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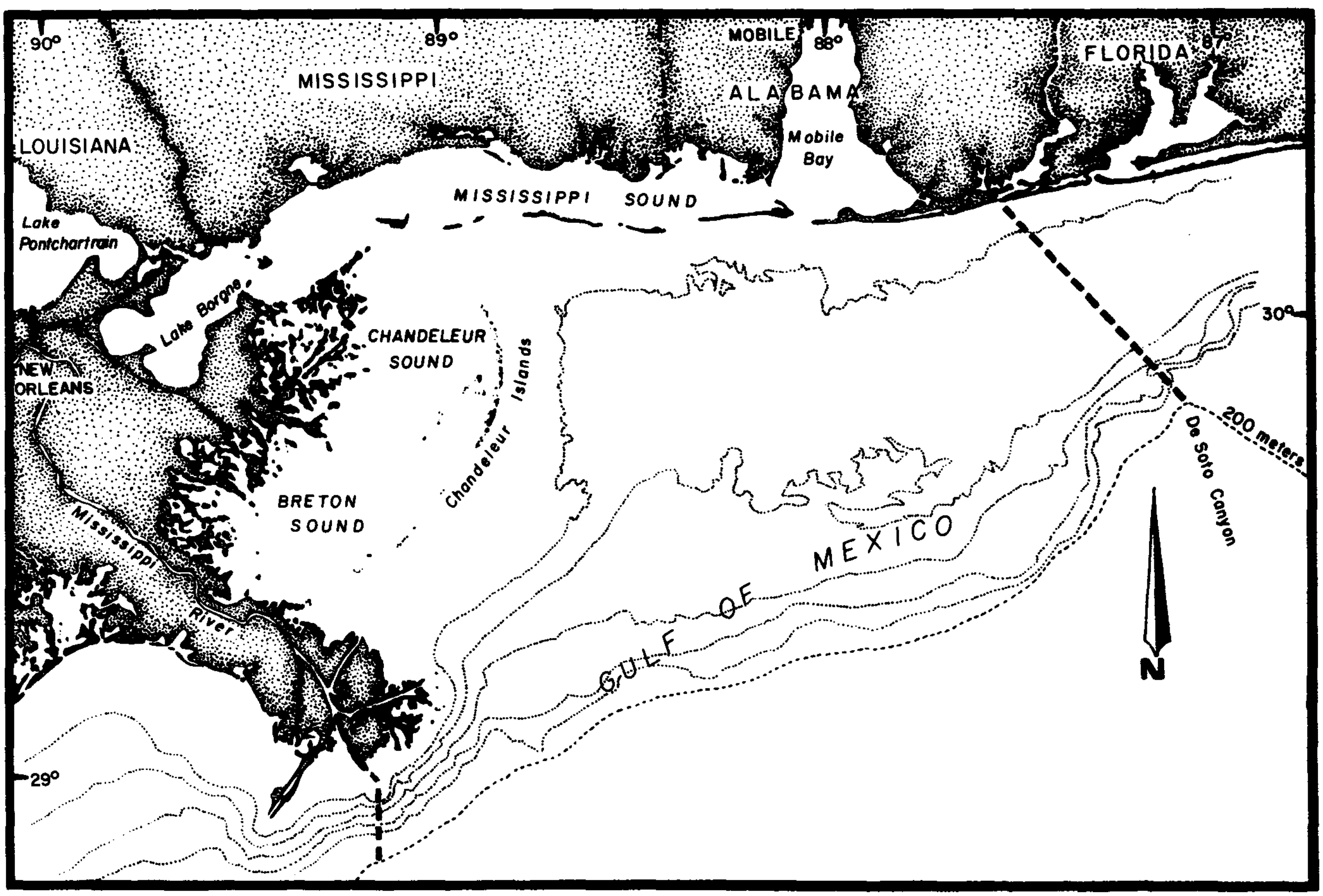
TUSCALOOSA TREND REGIONAL DATA SEARCH AND SYNTHESIS STUDY



VOLUME II SUPPLEMENTAL REPORTS

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Regional Office
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TUSCALOOSA TREND REGIONAL DATA SEARCH AND SYNTHESIS STUDY

FINAL REPORT
VOLUME II SUPPLEMENTAL REPORTS

Prepared under Contract No. 14-12-0001-30048

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BENTHIC MACROINFAUNA FROM BRETON-CHANDELEUR SOUND AREA

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DISTRIBUTION OF FISHES AND PENAEID SHRIMP OF COMMERCIAL AND RECREATIONAL IMPORTANCE ON THE CONTINENTAL SHELF OFF MISSISSIPPI AND ALABAMA

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June 1985

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TUSCALOOSA TREND REGIONAL DATA SEARCH AND SYNTHESIS STUDY

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VOLUME II SUPPLEMENTAL REPORTS

APPENDIX A

BENTHIC MACROINFAUNA FROM BRETON-CHANDELEUR SOUND AREA

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BENTHIC MACROINFAUNA FROM BRETON-CHANDELEUR SOUND AREA

1.0 INTRODUCTION

During the literature and data search of biological resources within the Tuscaloosa Trend study area, several comprehensive studies were found which characterize benthic macroinfauna communities within Mississippi Sound, Mobile Bay, and the nearshore waters adjacent to the barrier islands of Mississippi and Alabama. Also, a previous study by the Bureau of Land Management (MAFLA) identified several benthic communities from six stations samples on the continental shelf (MAFLA Transect VI) within the Tuscaloosa Trend study area (Dames and Moore, 1979). However, a large data gap exists for the macroinfaunal communities of the Breton-Chandeleur Sound areas (Figure 1). These highly productive areas off southeast Louisiana are major spawning, nursery, and harvest grounds for commercially important fish and shellfish species, many of which feed upon the benthic invertebrates during various life stages. Two sets of archived benthic macroinfauna samples that were collected from Breton-Chandeleur Sounds, but not completely analyzed, at Tulane University, Belle Chase Annex were release by Dr. Alfred Smalley (Biology Department) for analysis. Re-analysis of these samples should contribute substantially to the knowledge of benthic standing crop and productivity in this area. One set consists of macroinfauna samples collected in 1970-71 for impact analysis of an oil spill (see Figure 2). Another archive set consists of macroinfauna samples collected near an offshore dredged material disposal site (ODMDS) located along the Mississippi River-Gulf Outlet channel in Breton Sound in 1980-81.

Chevron Benthos

A sampling program was initiated in 1970 to determine the impact of an oil spill on the adjacent marine environment at Chevron Production Platform C, Main Pass Block 41, located 11 miles east of the Mississippi River Delta. Samples for sediment, water, and tissue hydrocarbons and macroinfauna analysis were collected at 165 stations. Macroinfaunal samples were collected at shallow depth stations using a 38 cm diameter diver-held suction sampler that sampled an area of 0.3 m^2. Stations over 30 m deep were sampled using a Shipek sampler to obtain a 0.04 m^2 by 10 cm deep sample. All samples were washed through a 1.2 mm sieve. Fifty-one additional stations were re-sampled about a year later to assess continued impacts. With the exception of crustaceans, organisms within these samples were identified only to major taxon levels. A thorough investigation of the polychaetes, ophiuroids and miscellaneous phyla has never been completed. These samples have been archived at Tulane University under the custodial care of Dr. Alfred Smalley, Department of Biology.

Forty-nine samples were selected for re-examination of representative stations of the Chevron macroinfauna samples and results compared with the existing macroinfauna data for Mississippi Sound and adjacent continental shelf. Initially, samples were to include 37 Shipek stations collected on the shelf at depths greater than 30 m. However, upon examination of archived material, no polychaete fractions were present. Analysis of these samples would result in a bias of data; therefore, only suction core samples would be analyzed. The samples were selected based on their physical condition, i.e.,

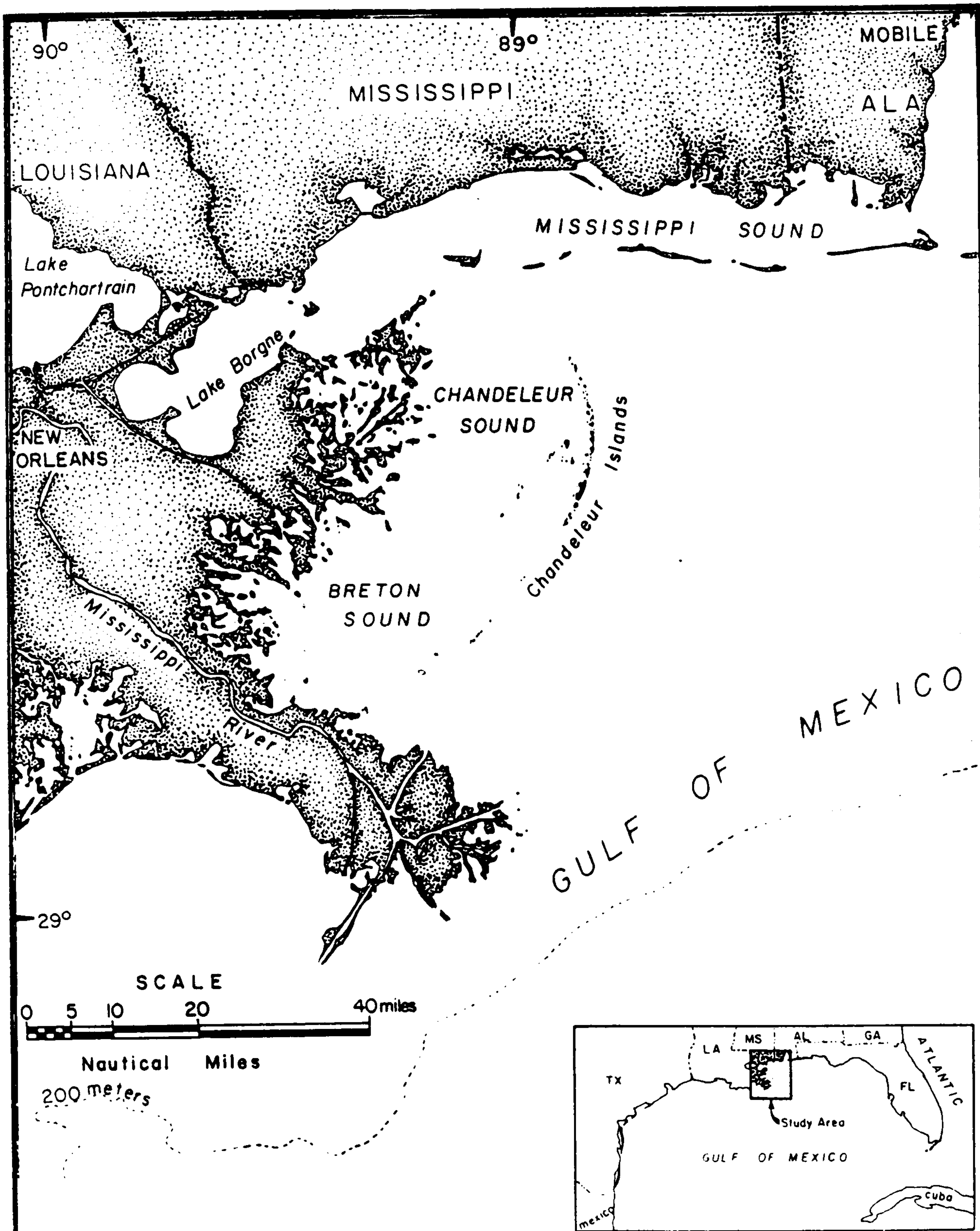
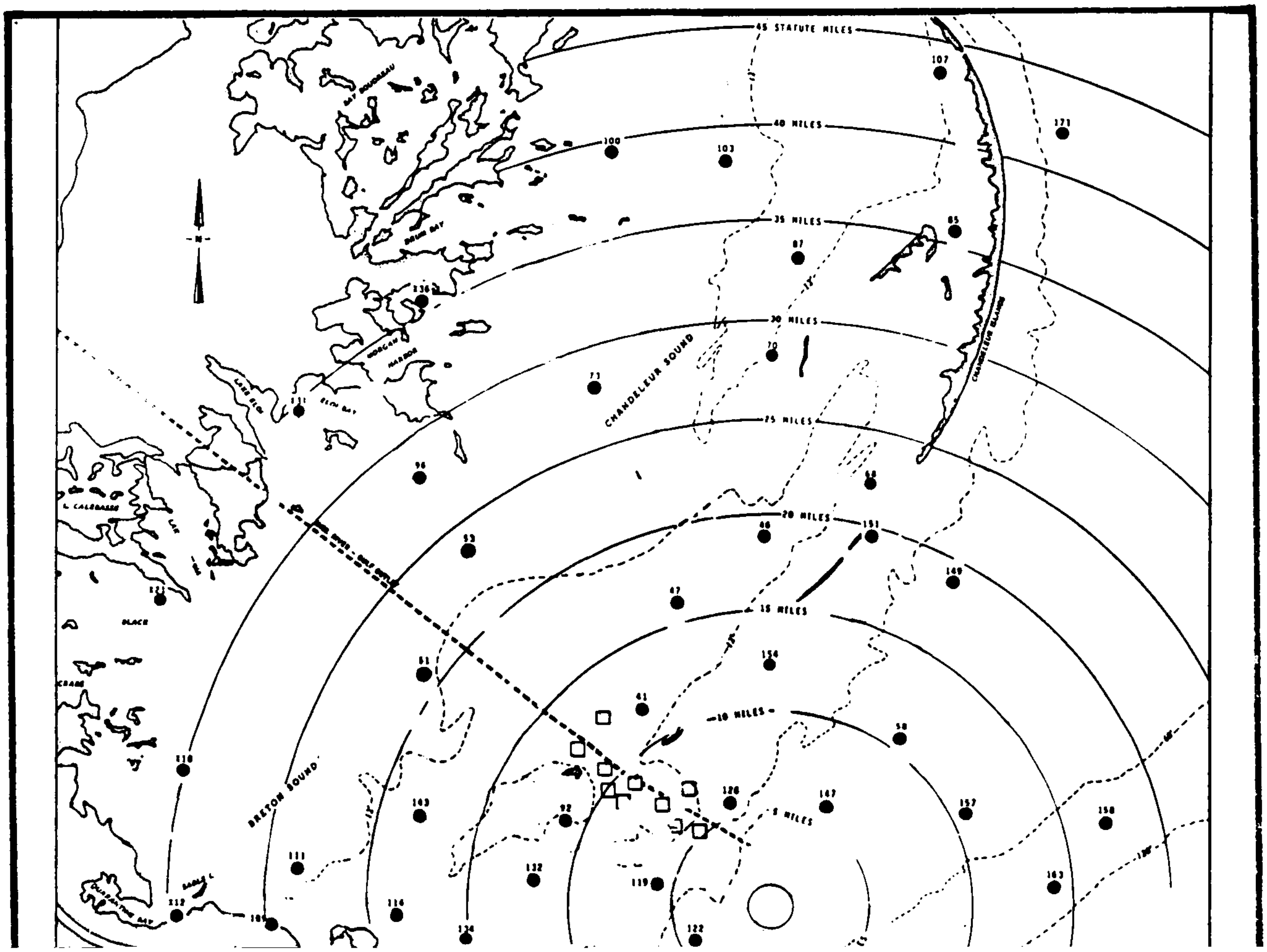


Figure 1. Breton-Chandeleur Sound study area within coastal southeast Louisiana.


45 STATUTE MILES
40 MILES
35 MILES
30 MILES
25 MILES
20 MILES
15 MILES
10 MILES
5 MILES
N
CHANDELEUR SOUND
BRETON SOUND
CHANDELEUR ISLANDS
MORGAN HARBOR

community structure parameters (e.g., species composition, species diversity indices, biomass measurements) during initial data reduction, followed by pattern and classification analysis for delineation of species assemblages. Since species are distributed along environmental gradients, there are generally no distinct boundaries between communities. However, the relationships between habitats and species assemblages reflect the interactions of physical and biological factors and express the major ecological trends.

Community Structure

Various types of numerical indices were chosen for analysis and interpretation of the macroinfaunal data base. Selection was based primarily on their ability to provide a meaningful summary of data, as well as their use in the characterization of benthic communities.

Infaunal abundance, often related to the productivity of the benthos, was reported as the total number of individuals per station and as the mean number and standard deviation of individuals per square meter. Species richness was reported as both the total number of taxa represented in a given station collection and by Margalef's Index, D (Margalef, 1958). This is estimated as $D = S-1/\log_e N$, where S is the number of taxa, and N is the number of individuals in the sample.

Species diversity, which is often related to the ecological stability and environmental "quality" of the benthos, was estimated by the Shannon-Weaver Index (Shannon and Weaver, 1963). The following formula has been applied, using log base e:

$$H' = -\sum_{i=1}^{s} p_i(\log_e p_i)$$

where, s - is the number of species in the sample

i - is the i'th species in the sample, and

p_i - is the number of individuals of the i'th species divided by the total number of individuals of all species in the sample.

Species diversity within a given community is dependent on both the number of taxa present (species richness) and the distribution of all individuals among those species (equitability or evenness). In order to quantify and compare the equitability in the fauna to the species diversity for a given area, Pielou's Index J' (Pielou, 1966) was calculated as $J' = H'/\log_e S$, where H' is the Shannon-Weaver Index of diversity (as calculated above), and S is the number of taxa (or species richness) in the sample.

Faunal Similarities

Numerical classification analysis (Boesch, 1977) was performed on the faunal data to examine within and between station differences by site and to compare faunal composition at each station. Classification analysis of both station collections (normal analysis) and species (inverse analysis) were performed using the Czekanowski quantitative index of faunal similarity (Field and MacFarlane, 1968). This index considers both the number of species in common and the difference in number of individuals between stations. Although it is weighted towards the occurrence of dominant (i.e., abundant) species, preliminary selection of species based on their percent abundance by station and percent frequency of occurrence for the study area can reduce the weighted bias.

The value of the similarity index is 1.0 when the two samples are identical and 0 when no species are in common. Hierarchical clustering of similarity values is achieved using the group-average sorting strategy (Lance and Williams, 1967) and displayed in the form of dendrograms (cluster graphs).

Both similarity classification and cluster analysis were performed with the aid of a "Package of Computer Programs for Benthic Community Analysis" (Bloom et al., 1977) as modified for use in Vittor & Associates' benthic data management program. Species used in these analyses are selected according to their percent abundance (generally those taxa which composed 1-5% or greater of the individuals collected at any given station during any given sampling period) and percent frequency (those taxa which occurred in 50% or greater of the station collections for a given study area) in the sampling. Total densities for each of the selected species at a given station collection were log-transformed $[x=\ln(x+1)]$ for the analysis.

3.0 RESULTS

3.1 BOTTOM HABITAT CHARACTERIZATION

It is extremely unfortunate that samples for sediment composition were not taken during either 1970 or 1971 Chevron sampling program (Dr. Alfred Smalley, Biology Department, Tulane Univesity, personal communication). It becomes difficult to compare faunal assemblages associated with benthic habitats; therefore, general assumptions of habitat descriptions will come from previous works of Parker (1956, 1960), and comparisons with the results of the MR-GO survey and Mississippi Sound and adjacent areas study (Shaw et al., 1982).

The MR-GO survey does not cover as large a geographic area as the Chevron survey; however, several habitat types were depicted based on sediment composition and station depth (Table 1). These were composed of shallow depth (3-6 m) sandy stations, moderate depth (7-11 m) muddy sand stations, and intermediate depth (6-7 m) muddy station. Since mean percentages of sand, silt, and clay were available for each station, sediment descriptors were used based on the mean percent composition of sand:

Sand	>90% sand
Muddy Sand	50-90% sand
Sandy Mud	20-50% sand
Mud	<20% sand

Table 1. Station depth and sediment grain size composition at Mississippi River-Gulf Outlet ODMDS survey. (After EPA, 1982).

Station	Depth (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Fines (%)
November-December 1980						
1	4	10.4 (5.5 - 19.1)	83.8 (74.2 - 87.7)	2.3 (0.8 - 3.2)	3.6 (1.8 - 4.6)	5.8 (2.5 - 6.8)
2	3	5.8 (3.4 - 11.0)	87.6 (82.1 - 91.9)	2.6 (1.7 - 3.2)	4.0 (2.6 - 5.9)	6.6 (4.3 - 9.1)
3	6	0.4 (0.2 - 0.7)	89.9 (78.3 - 97.2)	6.2 (0.5 - 15.6)	3.5 (1.7 - 5.5)	9.7 (2.6 - 21.1)
4	4	0.5 (0.1 - 1.0)	96.7 (94.8 - 97.8)	0.5 (0.2 - 1.3)	2.4 (1.6 - 3.4)	2.8 (2.1 - 4.7)
5	8	0.1 (0.0 - 0.1)	83.5 (78.1 - 88.0)	13.0 (9.8 - 17.2)	3.5 (2.0 - 4.6)	16.4 (11.9 - 21.8)
6	6	0.2 (0.0 - 0.7)	93.8 (91.7 - 94.9)	3.6 (2.7 - 5.3)	2.4 (2.2 - 3.0)	6.0 (5.0 - 7.6)
7	8	1.6 (0.8 - 3.7)	86.4 (80.5 - 93.9)	6.1 (1.2 - 10.5)	5.8 (3.4 - 7.7)	12.0 (5.3 - 18.2)
8	6	0.0 (0.0 - 0.0)	97.8 (96.9 - 98.3)	1.1 (0.3 - 2.0)	1.1 (0.0 - 2.2)	2.2 (1.7 - 3.2)
9	6	2.6 (0.2 - 5.0)	15.6 (11.1 - 19.4)	53.6 (50.3 - 58.2)	28.1 (25.9 - 29.7)	81.7 (76.8 - 87.0)
10	5	0.4 (0.1 - 0.6)	96.9 (95.9 - 97.7)	0.6 (0.4 - 0.8)	2.1 (1.5 - 3.0)	2.7 (2.2 - 3.5)
May-June 1981						
1	6	11.0 (5.2 - 21.0)	78.9 (69.4 - 85.2)	3.4 (1.6 - 7.5)	6.7 (5.5 - 7.6)	10.1 (7.8 - 15.1)
2	7	1.6 (0.3 - 2.4)	44.7 (33.1 - 51.7)	24.6 (17.2 - 30.4)	29.1 (21.5 - 35.3)	53.7 (46.5 - 65.7)
3	7	1.8 (0.2 - 3.4)	84.9 (70.2 - 91.0)	4.7 (1.8 - 11.5)	8.7 (6.9 - 15.2)	13.3 (8.6 - 26.7)
4	4	0.6 (0.1 - 1.4)	96.4 (95.3 - 97.0)	0.8 (0.4 - 2.0)	2.2 (0.0 - 3.8)	3.0 (2.0 - 4.6)
5	11	0.0 (0.0 - 0.1)	72.8 (61.4 - 84.2)	18.0 (9.7 - 28.0)	9.2 (6.1 - 14.3)	27.2 (15.8 - 38.5)
6	7	0.1 (0.0 - 0.4)	83.2 (78.6 - 86.7)	12.5 (10.1 - 15.9)	4.3 (2.8 - 5.4)	16.7 (12.9 - 21.3)
7	7	1.6 (0.7 - 3.2)	74.7 (60.3 - 83.2)	10.9 (8.8 - 16.6)	12.8 (6.8 - 19.9)	23.7 (15.7 - 36.5)
8	6	1.5 (0.5 - 2.6)	94.9 (93.8 - 96.1)	1.0 (0.7 - 1.8)	2.7 (1.8 - 3.4)	3.7 (2.4 - 5.1)
9	7	2.2 (0.2 - 6.8)	17.4 (12.0 - 26.6)	48.4 (32.6 - 56.0)	32.0 (23.7 - 38.2)	80.4 (69.7 - 87.8)
10	6	1.0 (0.2 - 3.6)	96.0 (93.1 - 98.1)	1.0 (0.6 - 1.6)	2.0 (0.0 - 3.1)	3.0 (1.6 - 3.9)

Notes: Values listed are mean (range) for seven replicate box cores or grabs at each station; fines = silt plus clay (<0.0625 mm)

3.2 MISSISSIPPI RIVER-GULF OUTLET (MR-GO)

3.2.1 FAUNAL COMPOSITION, ABUNDANCE, AND COMMUNITY STRUCTURE

A total of 12,067 individuals and 247 taxa were collected at the MR-GO (ODMDS) site during December 1980 (Table 2). Annelids were the most dominant major taxon, represented by 115 taxa and accounted for almost 65% of the macroinfaunal abundance. Mediomastus spp., Poecilochaetus spp., Magelona sp. H, Polygordius spp., Travisia hobsonae, Carazziella hobsonae, Lumbrineris spp., and Cossura soyeri accounted for 51% of the annelid fraction.

Arthropods ranked second in dominance at the study site, represented by 58 taxa and 17% of the macroinfaunal abundance. The amphipod Eudevenopus honduranus was the most abundant arthropod, but only one of five arthropods among the twenty most abundant species. The others include decapods Pinnixa chaetopterana and Callianassa biformis and amphipods Corophium tuberculatum and Protohaustorius sp. A.

The miscellaneous taxa represented by rhynchocoels, sipunculids, and cephalochordates ranked third in total abundance (10.3%), but fourth in total taxa (4.4%). The cephalochordate Branchiostoma sp. is the second most abundant taxon, while rhynchocoels contribute over 3% of the total number of individuals.

Molluscs ranked fourth in dominance (5.4%), but contributed 57 taxa--almost equalling the arthropods. The pelecypod Mulinia lateralis and gastropod Nassarius acutus accounted for 40% of the mollusc population in the study area.

Echinoderms contributed only six taxa and comprised 2.4% of the total macroinfaunal abundance and were represented by the ophiuroid Hemipholis elongata.

During June 1981, sampling at MR-GO (ODMDS) sites yielded a total of 18,438 individuals and 161 taxa (Table 3)--greater than 50% increase in number of individuals and 35% decrease in total taxa when compared to December 1980 collections. Annelids remained dominant with almost 67% of the total individuals and 47% of the total taxa. Mediomastus spp. still was most abundant, followed by Spiophanes bombyx and Apoprionospio pygmaea.

Molluscs increased to nearly 20% of the total individuals and were represented by 38 taxa, equal to the total number of arthropod taxa, but less than the 57 taxa reported for December. The fifteen-fold increase in Mulinia lateralis exemplifies the ephemeral nature of this pelecypod.

Arthropod populations during June 1981 were one-half the totals compared with December 1980 and contributed only 7.8% of the total individuals. They were represented dominantly by three amphipods Acanthohaustorius sp. A, Protohaustorius sp. A, and Eudevenopsis honduranus; one cumacean Oxyurostylis smithi; and one decapod Ogyrides alphaerostris. Echinoderms and miscellaneous taxa were also represented by lower numbers of individuals and taxa during June 1981 when compared to December 1980.

Table 2. Taxonomic listing of phyla and numerically dominant taxa from EPA Mississippi River-Gulf Outlet (741GO) 1980 survey sites.

Phylum	Phylum Total	% of Grand Total	No. Taxa in Phylum	% Total No. of Taxa
Annelida	7809	64.7	115	46.6
Mollusca	656	5.4	57	23.1
Arthropoda	2073	17.2	58	23.5
Echinodermata	286	2.4	6	2.4
Miscellaneous	1243	10.3	11	4.4
Total	12067		247	

NUMERICAL DOMINANTS

Taxon	No. Individuals	% Total	Cum. %	f*
Mediomastus (LPIL) (P)	4419	36.62	36.62	9
Branchiostoma (LPIL) (C)	768	6.36	42.98	9
Eudevenopus honduranus (A)	676	5.60	48.58	8
Poecilochaetus (LPIL) (P)	476	3.94	52.52	4
Rhynchocoela (LPIL)(R)	396	3.28	55.80	10
Magelona sp. H (P)	331	2.74	58.54	6
Polygordius (LPIL) (P)	248	2.06	60.60	3
Hemipholis elongata (E)	234	1.94	62.54	7
Travisia hobsonae (P)	223	1.85	64.39	4
Carazziella hobsonae (P)	202	1.67	66.06	2
Lumbrineris (LPIL) (P)	189	1.57	67.63	9
Pinnixa chaetopterana (A)	179	1.48	69.11	7
Mulinia lateralis (M)	156	1.29	70.40	2
Cossura soyeri (P)	143	1.19	71.59	3
Aglaophamus verrilli (P)	119	0.99	72.58	8
Callianassa biformis (A)	118	0.98	73.53	3
Prionospio (LPIL) (P)	114	0.94	74.50	4
Corphium tuberculatum (A)	113	0.94	75.44	5
Nassarius acutus (M)	110	0.91	76.35	8
Protohaustorius sp. A (A)	105	0.87	77.22	5

(A) = Arthropoda, (C) = Cephalochordata, (E) = Echinodermata,

(M) = Mollusca, (P) = Polychaeta, (R) = Rhynchocoela

*frequency of occurrence (maximum = 10)

Table 3. Taxonomic listing of phyla and numerically dominant taxa from EPA Mississippi River-Gulf Outlet (750 GO) 1981 survey site.

Phylum	Phylum Total	% of Grand Total	No. Taxa in Phylum	% Total No. of Taxa
Annelida	12692	68.8	75	46.6
Mollusca	3645	19.8	38	23.6
Arthropoda	1143	7.8	38	23.6
Echinodermata	71	0.4	4	2.5
Miscellaneous	587	3.2	6	3.7
Total	18438		161	

NUMERICAL DOMINANTS

Taxon	No. Individuals	% Total	Cum. %	f*
Mediomastus (LPIL) (P)	8234	44.66	44.66	10
Mulinia lateralis (M)	2605	14.13	58.79	10
Spiophanes bombyx (P)	1603	8.69	67.49	9
Acanthohaustorius sp. A (A)	345	1.87	69.35	2
Rhynchocoela (LPIL) (R)	256	1.39	70.74	10
Apoprionospio pygmaea (P)	242	1.31	72.05	5
Branchiostoma (LPIL) (C)	238	1.29	73.34	5
Lumbrineris (LPIL) (P)	235	1.27	74.61	5
Magelona sp. H (P)	194	1.05	75.66	4
Eudevenopus honduranus (A)	181	0.98	76.64	4
Ogyrides alphaerostris (A)	167	0.90	77.54	4
Oxyurostylis smithi (A)	148	0.80	78.34	6
Mediomastus ambiseta (P)	130	0.70	79.04	2
Protohaustorius sp. A (A)	126	0.68	79.72	2
Cossura soyeri (P)	114	0.62	80.34	1
Tellina (LPIL) (M)	114	0.62	80.96	3
Aglaophamus verrilli (P)	101	0.55	81.51	5
Chaetozone sp. B (P)	96	0.52	82.03	2
Travisia hobsonae (P)	81	0.44	82.47	3
Paraprionospio pinnata (P)	78	0.42	82.89	7

(A) = Arthropoda, (C) = Cephalochordata, (M) = Mollusca,

(P) = Polychaeta, (R) = Rhynchocoela

*frequency of occurrence (maximum = 10)

The community structure parameters for the ten MR-GO site stations collected in December 1980 and June 1981 are summarized in Table 4. Table 5 depicts percent composition of major taxa groups by station for each survey. Seasonal values of macroinfauna density and taxa are graphically compared in Figures 3 and 4, respectively. The number of taxa per station ranged from 20 to 93 at stations 4 and 1, respectively, with a mean of 59 taxa for the site. The number of individuals (and density as number of individuals $\cdot m^{-2}$) per station ranged from 199 (663 individuals $\cdot m^{-2}$) to 2886 (9620 individuals $\cdot m^{-2}$) at stations 4 and 2, respectively, with a mean of 1207 individuals (3862 individuals $\cdot m^{-2}$) for the site.

Species diversity (H', base e) ranged from 1.63 to 2.83 at stations 4 and 8, respectively. Species evenness (J') ranged from 0.47 at station 1 to 0.79 at station 8, while species richness ranged from 3.59 to 11.63 at stations 4 and 1, respectively.

Annelids comprised the greatest mean percentage of individuals (53.6%) followed by arthropods (27.1%), miscellaneous taxa (10.6%), molluscs (6.9%) and echinoderms (1.8%) (see Table 5). Wet weight biomass measurements reflect large variability between stations, due primarily to the presence of large individuals of molluscs and their shell weights.

Comparison of community structure parameters computed for the macroinfauna collected during June 1981 (Table 4, Figures 3 and 4) reflects a general decrease in total taxa (mean of 40 taxa per station), but an increase in total individuals (mean of 1844 individuals per station). This results in lower species diversity, evenness, and richness values when compared with species indices values for December 1980. The increase of individuals and decrease of taxa for annelids and molluscs contributed to the shift in community structure (Table 5). Even though the mean number of individuals increased from December to June, mean wet weight biomass measurements decreased by nearly 50% over the same period, perhaps reflecting the small size of individuals from spring recruitment.

3.2.2 NUMERICAL CLASSIFICATION ANALYSIS

Both normal (station) and inverse (taxon) classification analysis using Czekanowski's index of similarity and group-average sorting were performed in the MR-GO data sets. Taxa included in the analysis were selected on the basis of those contributing at least 1% of the total abundance at any given station, and/or any taxa relating distinct spatial distribution. Count data for the 29 taxa selected for analysis (15 polychaetes, 6 amphipods, 3 decapods, 2 molluscs, 1 rhynchocoel, 1 echinoderm, and 1 cephalochordate) are included in a matrix of station and species groups adjoining the resultant dendrograms from classification analysis (Figure 5). Numerically, these taxa account for 75% of the fauna collected during both MR-GO surveys.

Numerical classification of the 20 stations was interpreted at a four group level. Group A contains stations 4 and 10 from both seasons; Group B contains stations 5, 7, and 9 from both seasons, station 6 (December) and outlier station 2 (June); Group C contains stations 1, 3, and 8 from both seasons and station 2 (December); and Group D is represented by outlier station 6 (June). Sediment composition of each station was used to characterize habitats by group: sand (Group A), mud to muddy sand (Group B), muddy sand to

Table 4. General community structure parameters for EPA Mississippi River-Gulf Outlet survey sites, 1980-1981. Five replicates per station.

MR-GO (741) 1980	Total Taxa	Total Indiv.	Mean Density (ind./m^2)	Species Diversity (H_e')	Species Evenness (J')	Species Richness (D)	Biomass (Wet Wt.) (gm^{-2})
St. 1	93	2727	9090±4232	2.14	0.47	11.63	215.4790
2	65	2886	9620±3724	2.36	0.56	8.03	251.1016
3	62	715	2383± 716	2.54	0.62	9.28	21.228
4	20	199	663± 210	1.63	0.55	3.59	1.3174
5	62	1430	4767±1050	2.47	0.60	8.40	33.1724
6	65	1060	1927± 830	2.83	0.68	9.19	21.1169
7	65	717	2390±1247	2.57	0.62	9.73	147.1032
8	36	318	1060± 300	2.82	0.79	6.07	37.2175
9	66	1060	3533± 447	2.78	0.66	9.33	431.9496
10	52	955	3183±1159	2.02	0.51	7.43	20.0342
Mean	59	1207	3862±1392	2.42	0.61	8.27	117.9615
MR-GO (750) 1981							
St. 1	52	906	3624± 1355	2.18	0.55	7.49	196.7769
2	33	2631	10524± 4374	1.13	0.32	4.06	44.8808
3	50	3578	11927±12672	1.62	0.41	5.99	103.9778
4	29	376	1504± 619	2.26	0.67	4.72	54.942
5	26	1405	4683± 1288	1.97	0.60	3.45	19.7882
6	31	626	2087± 591	2.31	0.67	4.66	52.6670
7	63	4681	15603±15001	1.16	0.28	7.34	232.5949
8	43	813	3252± 2713	2.60	0.69	6.27	27.462
9	33	2651	8837± 4761	1.86	0.53	4.06	49.9082
10	36	771	3084± 1463	2.36	0.66	5.26	2.1056
Mean	40	1844	6513± 4484	1.95	0.54	5.33	78.5103

Table 5. Percent composition of major taxa groups by station. Percentages reflect mean values for each station at EPA Mississippi River-Gulf Outlet survey sites, 1980-1981.

MR-GO (741) 1980	Annelida	Arthropoda	Mollusca	Echinodermata	Miscellaneous
St. 1	75.4	3.2	3.6	3.0	14.8
2	78.6	4.1	2.6	4.9	9.8
3	46.5	18.7	3.2	0.4	31.2
4	3.0	85.0	3.0	5.0	4.0
5	67.0	27.3	4.0	0.2	1.5
6	55.8	32.6	7.0	0.5	4.1
7	69.6	11.4	14.8	1.3	2.9
8	47.8	17.0	14.5	0.3	20.4
9	67.4	4.1	12.6	2.7	13.2
10	24.4	68.0	3.8	0.1	3.7
Mean	53.6	27.1	6.9	1.8	10.6
MR-GO (750) 1981					
1	74.3	5.5	10.5	0.0	9.7
2	92.1	0.5	4.0	1.8	1.6
3	26.3	0.1	68.8	0.0	4.8
4	29.2	67.0	3.2	0.3	0.3
5	79.8	14.0	5.8	0.0	0.4
6	70.5	0.6	27.6	0.2	1.1
7	93.0	3.3	1.7	<0.1	1.9
8	55.2	11.3	26.3	0.2	7.0
9	75.8	4.5	14.6	0.7	4.4
10	21.9	72.5	4.7	0.0	0.9
Mean	61.8	17.9	16.7	0.3	3.2

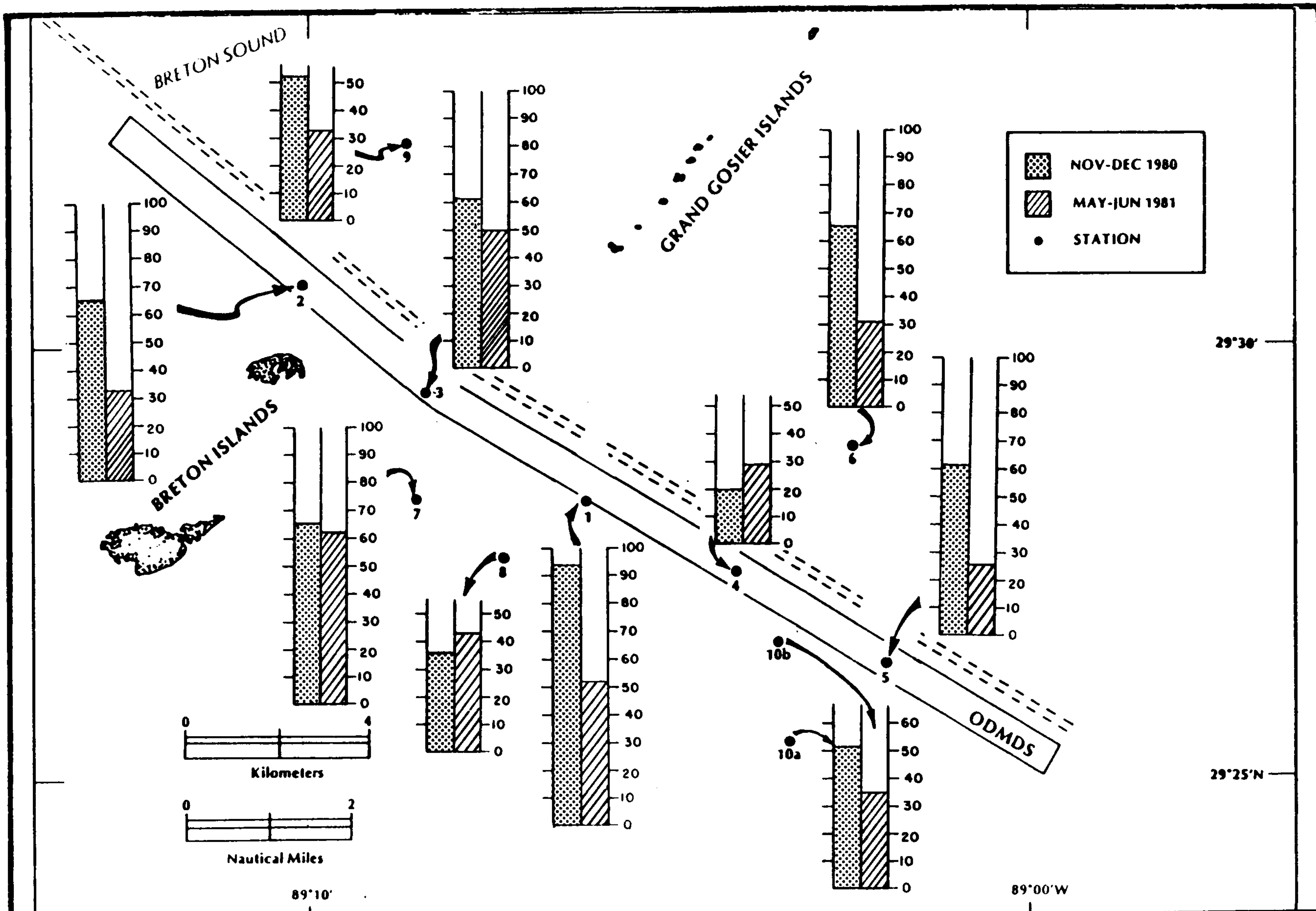


Figure 3. Number of macroinfauna taxa collected at each Mississippi River-Gulf Outlet station during 1980-81.

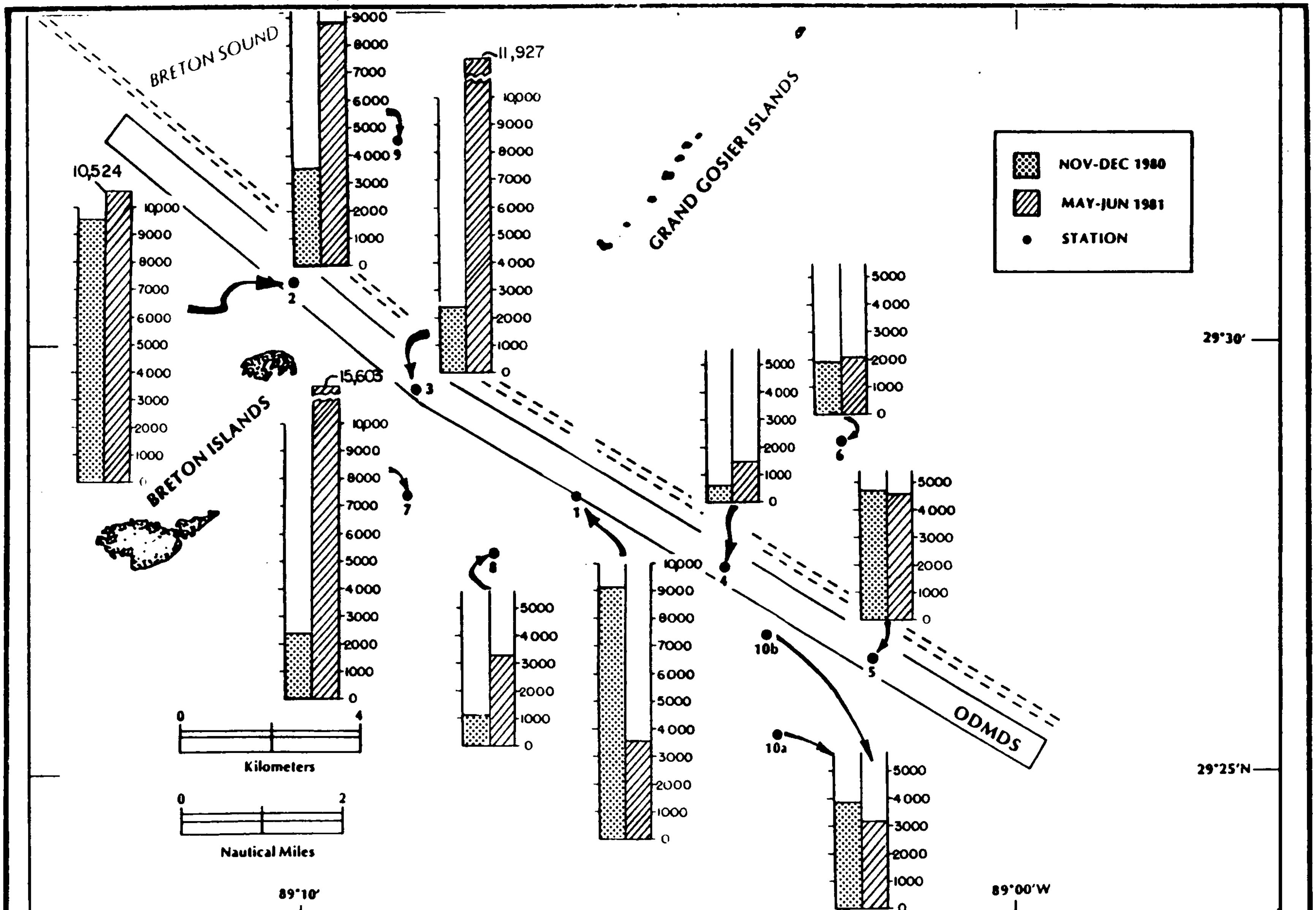


Figure 4. Density (number of individuals per m^2) of macroinfauna collected at each Mississippi River- Gulf Outlet station during 1980-81.

sand (Group C), and muddy sand (Group D). This characterization is based on mean percentage of sand at each station where sand is presented in greater amounts than 90%, muddy sand is 50-90% sand, sandy mud is 20-40% sand, and mud is less than 20% sand.

Classification of 29 taxa at 20 stations is interpreted at a five group level (Figure 5), where grouping taxa is based on their overall distribution patterns. The relationship of taxa or taxa groups to habitats delineated by the classification of station groups is presented as a data matrix in a two-way contingency table. By further simplifying measures of frequency occurrence and degree of restriction of taxa to habitats (station groups) through the use of nodal analysis, species group constancy, fidelity, and abundance are assessed. Nodal diagrams are presented in Figure 6 and discussed below.

The spatial distribution of stations is determined primarily by the occurrence and abundance of several taxa groups, either as distinct spatial peaks, or relatively constant numbers (i.e., ubiquitous occurrence throughout the area). The division of major groups is shown at 25% similarity. Species Group 1 (Branchiostoma (LPIL) to Prionospio (LPIL) are best represented in Station Group C by the high fidelity and abundance values (Figure 6). These taxa are predominantly sand-dwelling animals found primarily in high-energy tidal inlet habitats.

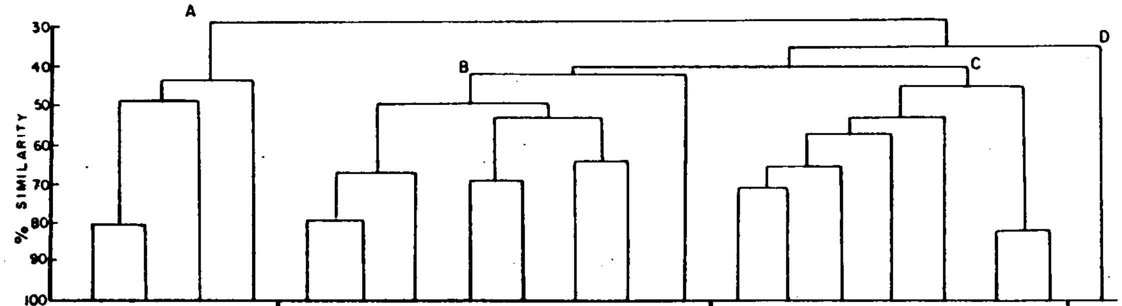
Species Group 2 is further divided into Groups 2a and 2b at 45% similarity. Species Group 2a (Callianassa biformis to Aglaophamus verrilli) appears associated with mud and muddy sand habitats as reflected by moderate and high fidelity values for station Groups B and D, respectively. Species Group 2b (Mulinia lateralis, Spiophanes bombyx, Mediomastus spp., Rhynchocoela) contains numerically dominant taxa that are well distributed throughout the study site as shown by high constancy for all station groups. These taxa appear less responsive to sediment composition than the Group 2a taxa. The irruptive seasonal occurrence of Mulinia lateralis in June reflects the spring and early summer recruitment period.

Species Group 3 is composed only of amphipods (Eudevenopus honduranus, Protohaustorius sp. A, Acanthohaustorius sp. A, and Corophium tuberculatum) found predominantly in the sand habitat of Station Group A. These taxa show the highest constancy, fidelity, and abundance for this habitat (Figure 6).

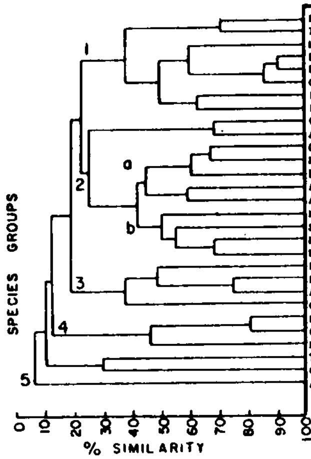
Species Group 4 contains the polychaetes Ninoe sp. B, Cossura soyeri, and Mediomastus ambiseta. These taxa have a high fidelity for Station Group 2; however, they appear restricted to the mud habitat found at station 9 (Figure 5).

Species Group 5 contains outlier taxa Tellina, Chaetozone sp. B, and Acanthohaustorius intermedius. The moderate and high fidelity values for Station Groups A and D, respectively, reflect the abundance of Acanthohaustorius intermedia in sand habitats, while Tellina and Chaetozone sp. B are more abundant in muddy sand habitats (Figure 5).

STATION GROUPS



E.P.A. MISS. RIVER - GULF OUTLET



Species	A: 81.06 10	A: 81.06 4	A: 80.12 10	A: 80.12 4	B: 81.06 9	B: 80.12 9	B: 80.12 7	B: 81.06 7	B: 81.06 5	B: 80.12 6	B: 80.12 5	B: 81.06 2	C: 81.06 8	C: 81.06 3	C: 81.06 1	C: 80.12 3	C: 80.12 8	C: 80.12 2	C: 80.12 1	D: 81.06 6
BRANCHIOSTOMA (LPIL)	0	0	5	1	0	0	1	1	2	1	1	0	37	129	69	204	52	183	320	0
TRAVISIA HOBSONAE	0	0	0	0	0	0	0	0	0	0	0	0	54	15	12	129	19	73	2	0
HEMIPHOLIS ELONGATA	0	0	0	0	10	1	5	1	0	5	1	26	1	0	0	1	0	139	82	0
POLYGORDIUS (LPIL)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	175	72	0
POECILOCHAETUS (LPIL)	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	327	147	0
CARAZZIELLA HOBSONAE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	154	48	0
PINNIXA CHAETOPTERANA	0	0	0	0	0	8	3	0	0	0	34	0	0	0	0	14	5	57	58	0
PRIONOSPIO (LPIL)	0	1	0	0	0	0	0	44	0	0	58	0	0	0	0	0	3	8	43	0
CALLIANASSA BIFORMIS	0	0	0	0	0	0	5	0	0	4	109	0	0	0	0	0	0	0	0	0
AMPELISCA AGASSIZI	0	0	0	0	0	0	0	0	0	29	68	0	0	0	0	1	0	0	0	1
OGYRIDES ALPHAEROSTRIS	0	0	1	0	15	2	15	46	102	3	73	0	4	0	0	1	0	0	0	0
MAGELONA SP.H	0	0	0	0	44	41	131	58	34	12	101	0	0	58	0	43	0	0	3	0
LUMBRINERIS (LPIL)	0	0	21	1	229	28	16	1	1	63	46	0	2	2	0	4	1	0	9	0
APOPRIONOSPIO PYGMAEA	3	0	0	0	0	0	0	3	52	2	7	0	14	0	0	2	2	0	0	170
AGLAOPHAMUS VERRILLI	1	0	0	0	0	1	1	0	21	16	62	0	11	46	0	33	1	1	6	22
MULINIA LATERALIS	6	1	0	0	236	75	81	2	3	0	0	6	157	2185	4	0	0	0	0	5
SPIOPHANES BOMBYX	110	38	2	0	0	0	0	176	344	15	0	3	235	460	179	6	0	5	5	58
MEDIOMASTUS (LPIL)	23	43	109	0	1377	267	241	3608	513	347	607	2041	66	97	391	68	42	1276	1462	75
RHYNCHOCOELA (LPIL)	6	1	23	6	115	138	19	63	4	30	19	28	10	9	18	18	8	80	55	2
EUDEVENOPUS HONDURANUS	96	65	495	0	0	1	0	0	0	143	7	0	19	0	1	4	20	1	5	0
PROTOHAUSTORIUS SP.A	87	39	35	67	0	0	0	0	0	0	1	0	0	0	0	0	1	0	1	0
ACANTHOHAUSTORIUS SP.A	234	111	0	87	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0
COROPHIUM TUBERCULATUM	50	6	0	0	0	1	2	0	0	16	0	0	0	0	0	86	0	8	0	0
NINOE SP.A	0	0	0	0	14	73	0	0	0	0	0	0	0	0	0	0	0	1	0	0
COSSURA SOYERI	0	0	0	0	114	140	0	0	0	0	0	0	0	0	0	0	0	2	1	0
MEDIOMASTUS AMBISETA	0	0	0	0	22	3	0	0	0	0	0	108	0	0	0	0	0	0	0	0
TELLINA (LPIL)	0	0	0	0	0	0	0	0	0	0	4	6	0	11	0	0	0	0	0	97
CHAETOZONE SP.B	0	0	0	0	0	0	0	83	0	0	0	0	0	0	0	0	0	0	0	13
ACANTHOHAUSTORIUS INTERM	0	0	82	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0

Figure 5. Results of normal (station) and inverse (species) classification analysis of Mississippi River- Gulf Outlet 1980-81 macroinfauna data.

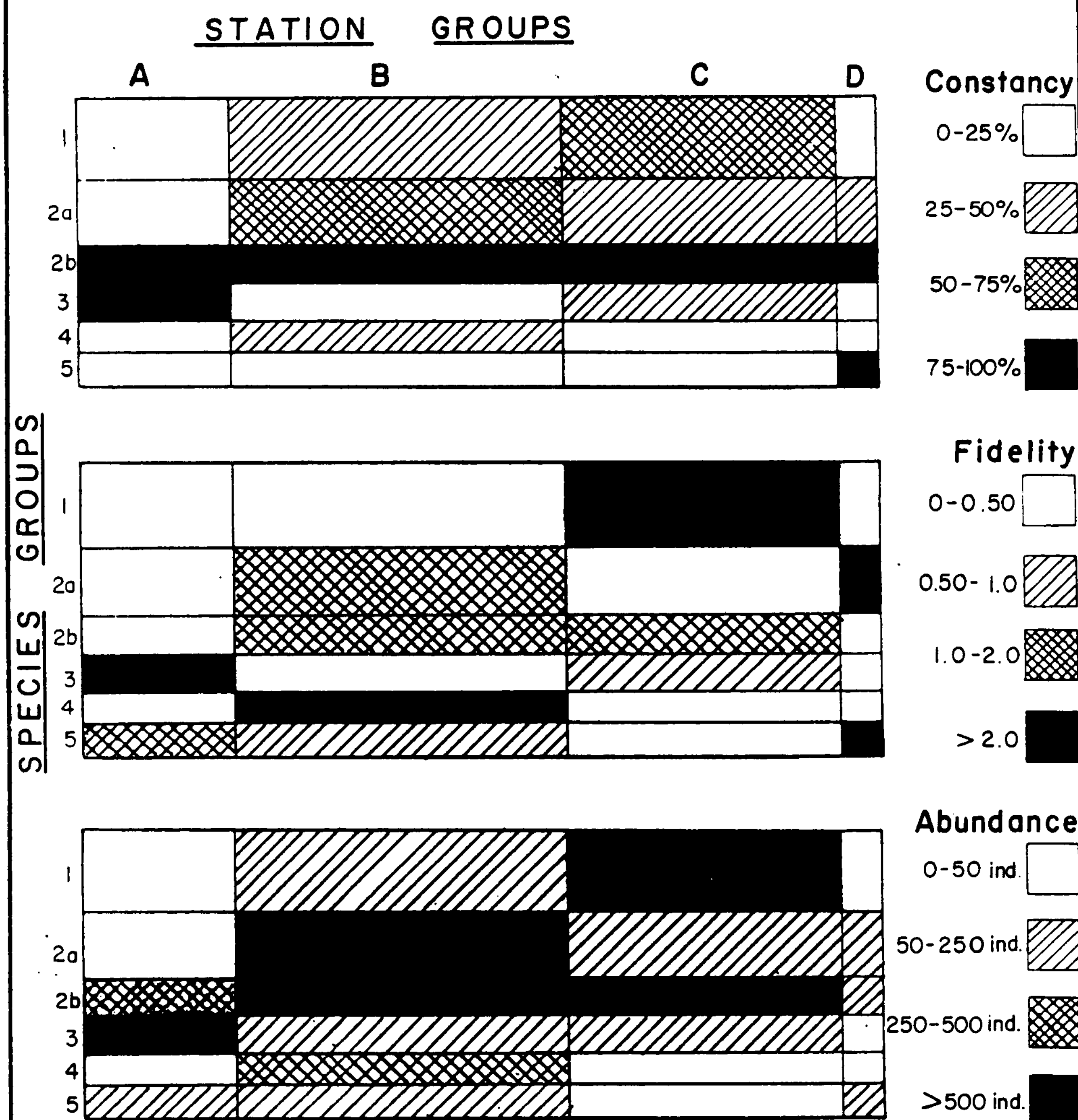


Figure 6. Nodal analysis of groups based on results of numerical classification analysis of MR-GO 1980-81 macroinfauna data.

3.3 CHEVRON BENTHOS

3.3.1 FAUNAL COMPOSITION, ABUNDANCE, AND COMMUNITY STRUCTURE

The total number of individuals and total number of taxa for each of the five major taxa groups collected during the Chevron 1970-1971 surveys are presented in Table 6. Molluscs comprised the greatest percentage of total individuals (60.7%), and were represented by 102 taxa. Mulinia lateralis, Abra aequalis, Nassarius acutus, and Tellina versicolor accounted for 92% of the mollusc population; M. lateralis contributed to almost 45% of the total macroinfauna.

Annelids ranked second in dominance with 26.8% of the total abundance, yet contributed 164 taxa. Mediomastus spp., Myriochele oculata, Spiophanes bombyx, Magelona sp. H, and Cirriformia sp. C accounted for 67% of the polychaete population in the study area.

Arthropods ranked third in both number of taxa (97) and percent of total individuals (8.9%). The cumacean Oxyurostylis smithi was the most abundant arthropod and occurred in greater frequency (at most stations) than any other species. Amphipods Melita nitida and Dulichiella appendiculata occurred only once, but were second and third most abundant arthropods collected.

The miscellaneous taxa represented by sipunculids, rhynchocoels, phoronids, coelenterates, and cephalochordates ranked fourth in total abundance (2.2%) and total taxa (15). Rhynchocoela and Actiniaria were not identified to species, but comprised 58% of the miscellaneous taxa reported.

Echinoderms contributed 13 taxa and less than 2% of the total individuals. Most of the individuals were represented by ophiuroids Micropholis atra and Amphiodia trychna; both comprised 64% of total echinoderms.

The community structure parameters for the Chevron 1970 and 1971 surveys are presented in Table 7. The 37 samples collected in 1970 yielded an average of 42 taxa and 618 individuals per station with a mean density of 2059 individuals$\cdot m^{-2}$. By comparison, the 1971 collection of 12 samples (six of which were different from previously sampled stations) averaged 46 taxa, 2616 individuals with a mean density of 8718 individuals$\cdot m^{-2}$.

The number of taxa ranged from 12 at station 166 in 1970 to 71 at station 158 in 1971. Mean density (number of individuals$\cdot m^{-2}$) ranged from 203 at station 166 in 1970 to 49,102 at station 126 in 1971.

Species diversity indices (H', base e) were highly variable during both sampling periods. Diversity values ranged from 0.77 to 3.78 in 1970 and from 0.36 to 3.59 in 1971. Species evenness (J') ranged from 0.12 in 1971 to 0.96 in 1970, and species richness (D) ranged from 1.96 in 1971 to 12.73 in 1970. Means of measured indices are similar for stations evaluated each year; species diversity (H') = 2.48 (1970), 2.24 (1971); species evenness (J') = 0.67 (1970), 0.60 (1971); and species diversity (D) = 6.95 (1970), 6.87 (1971).

Extreme ranges of index values in Table 7 are explained by closer examination of the data from a couple of stations. Low species diversity, evenness, and richness values at station 167 in 1971 relate directly to the

Table 6. Taxonomic listing of phyla and numerically dominant taxa from Chevron-Mississippi Delta 1970-1971 survey sites.

Phylum	Phylum Total	% of Grand Total	No. Taxa in Phylum	% Total No. of Taxa
Annelida	14,546	26.8	164	41.9
Mollusca	32,949	60.7	102	26.1
Arthropoda	4,866	8.9	97	24.8
Echinodermata	761	1.4	13	3.3
Miscellaneous	1,183	2.2	15	3.9
Total	54,305		391	

NUMERICAL DOMINANTS

Taxon	No. Individuals	% Total	Cum. %	f*
Mulinia lateralis (M)	24300	44.75	44.75	33
Mediomastus (LPIL) (P)	4439	8.17	52.92	24
Abra aequalis (M)	3577	6.58	59.50	27
Myriochele oculata (P)	2804	5.16	64.66	31
Oxyurostylis smithi (A)	1746	3.21	67.87	37
Spiophanes bombyx (P)	1383	2.54	70.41	26
Nassarius acutus (M)	1238	2.28	72.69	36
Tellina versicolor (M)	1071	1.97	74.66	35
Melita nitida (A)	704	1.29	75.95	1
Magelona sp. H (P)	654	1.20	77.15	21
Cirriformia sp. C (P)	566	1.04	78.19	1
Paraprionospio pinnata (P)	472	0.87	79.06	29
Mysidopsis bigelowi (A)	448	0.82	79.88	24
Dulichiella appendiculata (A)	380	0.70	80.67	1
Spiochaetopterus oculatus (P)	377	0.69	81.36	18
Owenia sp. A (P)	365	0.67	82.03	26
Rhynchocoela (LPIL) (R)	355	0.65	82.68	44
Solen viridis (M)	346	0.64	83.32	23
Actiniaria (LPIL) (C)	336	0.62	83.94	21
Lumbrineris verrilli (P)	302	0.55	84.49	23
Periploma (LPIL) (M)	284	0.52	85.01	4
Micropholis atra (E)	257	0.47	85.48	15
Amphiodia trychna (E)	229	0.42	85.90	8
Nuculana concentrica (M)	224	0.41	86.31	16

(A) = Arthropoda, (C) = Coelenterata, (E) = Echinodermata,

(M) = Mollusca, (P) = Polychaeta, (R) = Rhynchocoela

*frequency of occurrence (maximum = 49)

Table 7. General community structure parameters for Chevron sites, 1970-1971. One replicate ($0.3m^2$) per station.

COMMUNITY STRUCTURE PARAMETERS

CHEVRON 1970	Total Taxa	Total Indiv.	Mean Density (ind./m^2)	Species Diversity (H_e')	Species Evenness (J')	Species Richness (D)
St. 12	30	262	873	2.64	0.78	5.21
31	25	38	126	3.10	0.96	6.60
36	30	182	606	2.52	0.74	5.57
41	65	1625	5416	2.97	0.71	8.66
46	57	319	1063	3.25	0.81	9.71
47	29	960	3200	1.22	0.36	4.08
51	58	339	1130	3.18	0.78	9.78
53	54	738	2460	2.31	0.56	8.03
58	46	432	1410	2.73	0.71	7.44
68	20	74	247	2.47	0.82	4.42
70	33	154	513	2.71	0.78	6.35
87	46	390	1300	2.69	0.70	7.54
92	54	692	2306	2.57	0.64	8.10
96	38	221	737	2.90	0.80	6.85
100	51	841	2803	1.95	0.50	7.42
103	49	1813	6043	1.03	0.27	6.40
107	57	422	1407	2.70	0.67	9.26
109	48	300	1000	3.02	0.78	8.24
111	63	464	1547	3.42	0.83	10.10
114	37	415	1383	2.54	0.70	5.97
119	42	202	673	2.98	0.80	7.72
122	48	1482	4940	1.76	0.45	6.44
132	61	504	1680	3.13	0.76	9.64
134	18	170	567	2.10	0.73	3.31
136	43	2833	9442	0.80	0.21	5.28
143	52	1514	5046	2.25	0.57	6.97
149	52	791	2636	2.33	0.59	7.64
151	54	986	3286	2.59	0.65	7.69
154	24	102	340	2.70	0.85	4.97
157	48	166	553	3.28	0.85	9.20
158	71	244	813	3.78	0.89	12.73
161	27	1100	3666	0.77	0.23	3.71
163	35	88	293	3.34	0.94	7.60
164	20	78	260	2.40	0.80	4.36
166	12	61	203	1.80	0.72	2.68
167	22	1513	5043	1.05	0.34	2.87
171	51	340	1133	2.67	0.68	8.58
Mean	42	618	2059	2.48	0.67	6.95

CHEVRON 1971	Total Taxa	Total Indiv.	Mean Density (ind./m^2)	Species Diversity (H_e')	Species Evenness (J')	Species Richness (D)
St. 18	29	313	1043	1.98	0.58	4.87
21	46	1920	6399	1.73	0.45	5.95
36	46	542	1806	2.78	0.73	7.15
51	56	271	903	3.59	0.89	9.82
58	70	601	2003	2.94	0.69	10.78
73	68	1136	3786	1.69	0.40	9.52
85	68	466	1553	3.52	0.83	10.90
126	47	14732	49102	0.87	0.23	4.80
147	68	1405	4683	2.55	0.60	9.24
164	25	99	330	2.71	0.84	5.22
166	14	62	207	2.21	0.84	3.15
167	19	9862	32870	0.36	0.12	1.96
Mean	46	2616	8718	2.24	0.60	6.87

occurrence of a large population of Mulinia lateralis (9032 individuals) with few other taxa or individuals present. Conversely, high species diversity, evenness, and richness values at station 158 in 1970 relate to a small number of individuals represented by a large number of taxa.

Annelids comprised the greatest mean percent composition of individuals by station (Table 8) during both 1970 and 1971 sampling periods, respectively (37.5%, 47.7%), followed by molluscs (33.4%, 34.6%), arthropods (19.2%, 12.3%), miscellaneous taxa (6.6%, 3.8%), and echinoderms (3.3%, 2.1%). These figures seem to contradict the percentages presented for the annelids and molluscs in Table 6. However, upon closer examination of individual station data the discrepancy is explained by the few occurrences of Mulinia lateralis in extremely large numbers, thereby contributing significantly to the molluscan numerical counts in the combined surveys. (Refer to stations 103, 122, 136, 161, and 167 in 1970 and stations 21, 126, and 167 in 1971 on Tables 7 and 8 as examples of dominant mollusc populations.)

3.3.2 NUMERICAL CLASSIFICATION ANALYSIS

Both normal (station) and inverse (taxon) classification analysis using Czekanowski's index of similarity and group-average sorting were performed on the Chevron 1970-1971 data sets. As presented for the MR-GO data sets, taxa included in the analysis were selected on the basis of those contributing at least 1% of the total abundance at any given station, and/or any taxa relating distinct spatial distribution. Count data for 30 taxa selected for analysis (ten molluscs, nine polychaetes, five amphipods, two echinoderms, one actiniarian, one cumacean, one mysid, and one sipunculid) are included in a matrix of station and species groups adjoining the resultant dendrograms from classification analysis (Figure 7). Numerically, these taxa account for 87% of the fauna collected.

Numerical classification of the 49 stations is interpreted at a six group level. Group A contains four samples from two stations west of the Mississippi River Delta, three stations in south Breton Sound (near Delta) and one station east of the Delta approximately 30m depth. Group B contains two stations, one east of the Delta and the other in Chandeleur/ Breton Sound. Group C contains twelve stations located in the proximity of south Chandeleur Islands and Breton Island at tidal inlets and adjacent offshore areas. Group D contains twenty-two stations located throughout Chandeleur and Breton Sounds; one station located outside the Sound is considered an outlier. Group E contains two stations located in an inlet and offshore of Chandeleur Sound, similar to Group C. Group F contains outlier stations 31, 163, and 164.

Classification of 30 taxa at 49 stations is interpreted at a seven group level (Figure 7). A nodal analysis conducted on this two-way contingency table assessed species group constancy, fidelity, and abundance with station groups. Nodal diagrams are presented in Figure 8 and discussed below with respect to species groups.

The division of major species groups is at a 25% similarity. Species Group 1 (Amphiodia trychna to Anadara transerva) shows high fidelity and abundance for Station Group D (Figure 7). Species Group 2 (Micropholis atra to Spiochaetopterus oculatus) also has high fidelity and abundance values for

Table 8. Percent composition of major taxa groups by station at Chevron sites, 1970-1971.

CHEVRON 1970	Annelida	Arthropoda	Mollusca	Echinodermata	Miscellaneous
			PERCENT COMPOSITION		
St. 12	80.9	6.9	12.2	----	----
31	28.9	26.3	26.3	2.6	15.8
36	35.2	5.5	52.2	5.5	1.7
41	7.4	30.8	49.4	11.7	0.7
46	48.9	12.9	32.6	1.6	4.1
47	0.1	88.7	7.3	3.8	----
51	48.9	19.2	20.1	1.5	10.3
53	56.7	8.9	17.1	12.2	4.2
58	52.9	22.7	14.9	1.9	7.6
68	59.5	17.6	13.5	8.1	1.4
70	55.8	7.8	31.7	2.0	2.6
87	46.4	6.4	34.7	11.0	1.3
92	32.6	20.5	20.9	1.3	24.6
96	39.4	13.1	21.7	24.4	1.4
100	68.4	8.6	20.3	0.1	2.6
103	9.5	3.9	86.1	0.1	0.3
107	64.4	8.5	21.8	0.2	5.0
109	51.3	10.3	19.7	1.3	17.3
111	23.5	19.0	41.6	13.4	3.0
114	39.5	37.8	20.2	----	2.4
119	43.1	20.3	20.8	7.4	8.4
122	17.3	4.0	74.6	0.3	3.8
132	35.5	9.5	39.7	5.2	10.1
134	61.2	----	31.8	----	7.1
136	3.9	1.9	88.8	0.1	5.2
143	58.8	2.6	35.4	0.4	1.8
149	31.5	55.0	12.9	----	1.3
151	29.7	51.1	17.8	0.3	1.0
154	7.8	52.9	32.4	1.0	5.9
157	57.2	20.5	9.6	----	12.6
158	58.2	13.5	9.4	0.8	18.0
161	4.6	2.4	92.5	----	0.4
163	39.8	21.6	22.7	4.5	11.4
164	37.2	7.7	29.5	----	25.6
166	18.0	16.4	49.2	----	16.4
167	21.7	0.6	77.1	0.1	0.5
171	11.8	53.5	26.5	0.9	7.4
Mean	37.5	19.2	33.4	3.3	6.6

CHEVRON 1971	Annelida	Arthropoda	Mollusca	Echinodermata	Miscellaneous
St. 18	63.3	3.5	21.0	10.9	1.3
21	31.8	1.3	63.1	3.0	0.8
36	58.1	7.2	30.3	3.1	1.3
51	46.5	7.4	36.2	6.3	3.6
58	49.0	37.4	7.6	0.8	5.2
73	72.2	2.6	24.5	----	0.7
85	59.2	17.8	13.3	1.1	8.6
126	29.3	1.0	69.3	0.1	0.3
147	70.3	22.8	1.0	0.1	5.8
164	58.6	30.3	8.1	----	3.0
166	27.4	16.1	41.4	----	14.6
167	1.2	0.3	98.3	0.1	0.1
Mean	47.2	12.3	34.6	2.1	3.8

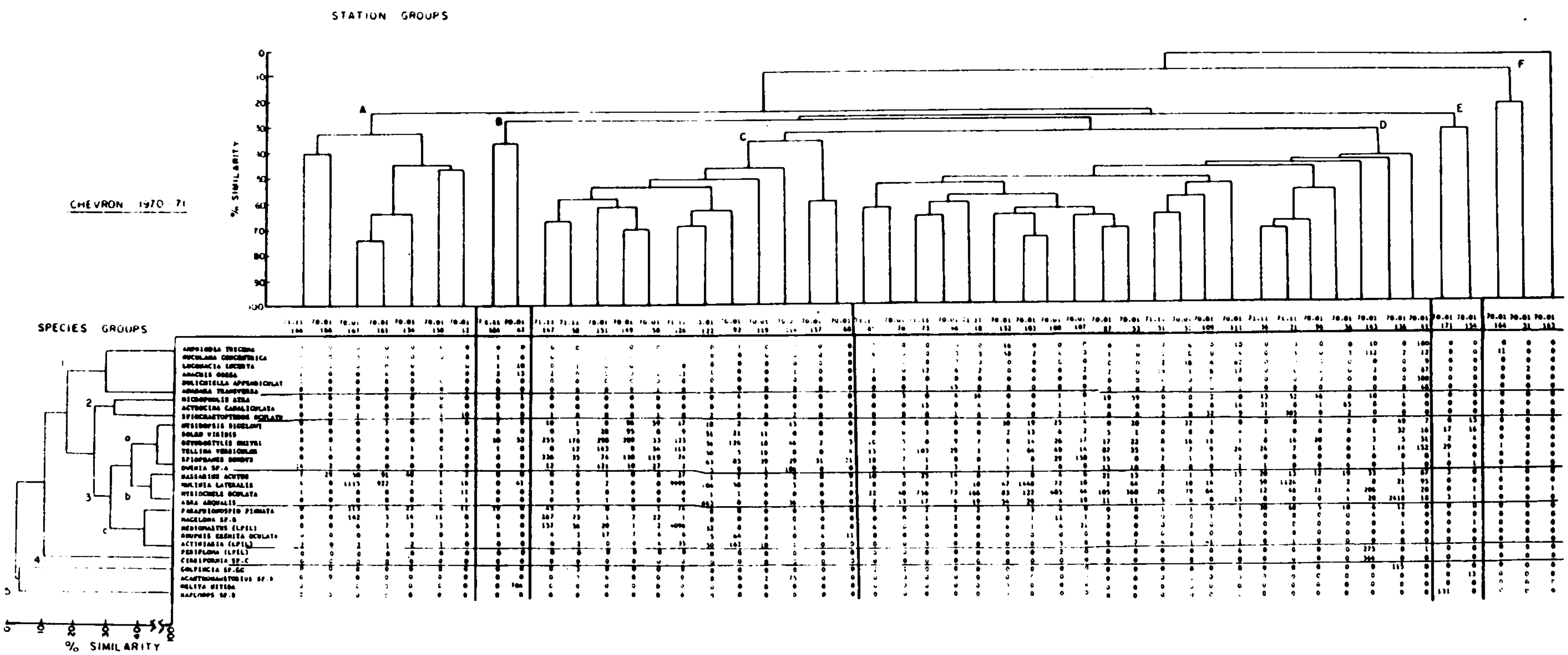


Figure 7. Results of normal (stations) and inverse (species) classification analysis of Chevron 1970-71 macroinfauna data.

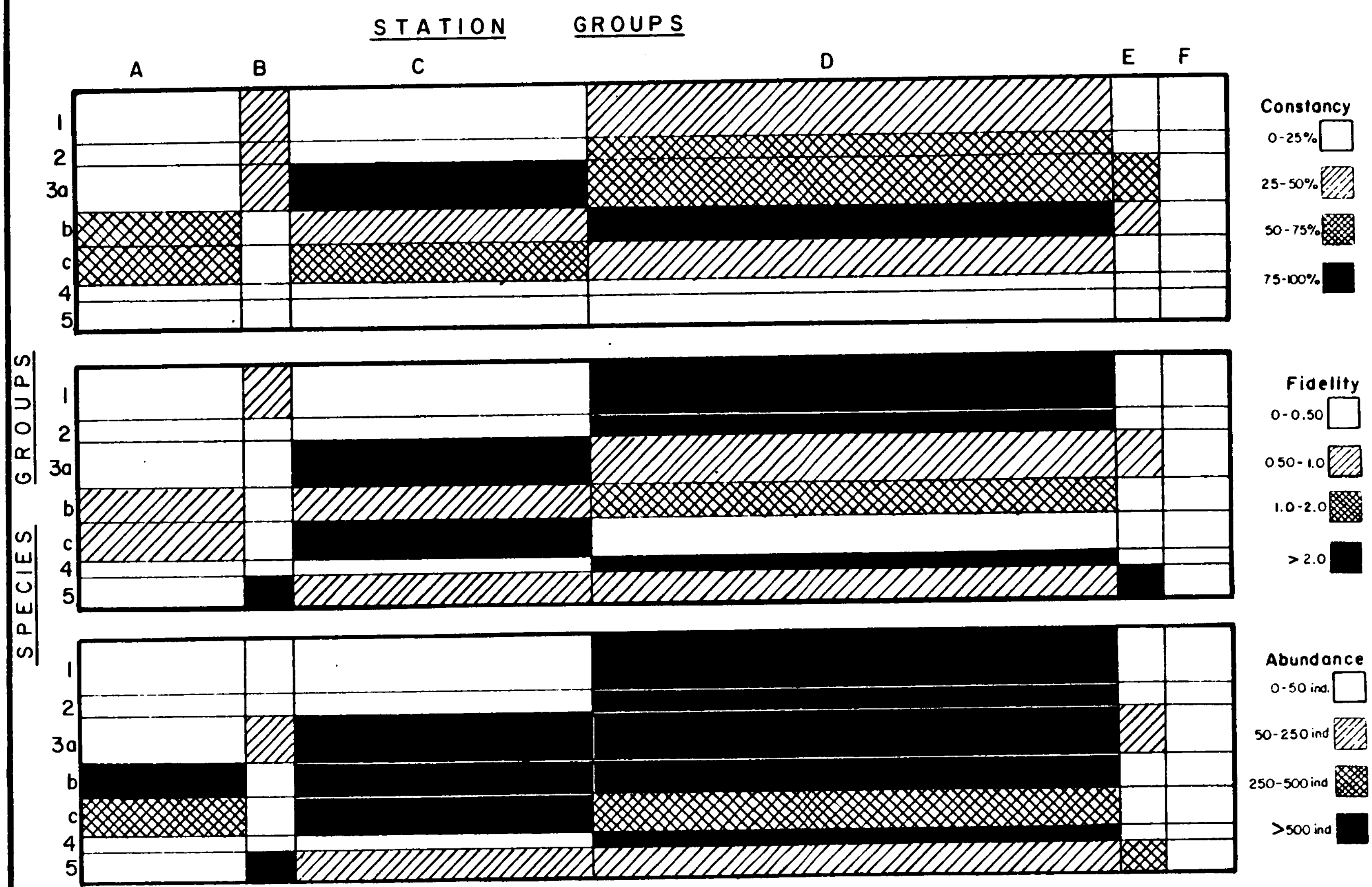


Figure 8. Nodal analysis of groups based on results of numerical classification analysis of Chevron 1970-71 macroinfauna data.

Group D. These two species groups best represent the infauna in Breton and Chandeleur Sounds.

Species Group 3 is represented by the numerically dominant and ubiquitous taxa that are distributed throughout the study area. Group 3 also has a high fidelity for Group C stations--those located predominantly seaward of the tidal inlets into Breton and Chandeleur Sounds. Species Group 3 was further divided into Groups 3a, 3b, and 3c at 45% similarity to identify any trends in the ubiquitous fauna. Species Group 3a (Mysidopsis bigelowi to Owenia sp. A) represents taxa found in Station Groups C, D, and E. Species Group 3b (Nassarius acutus, Mulinia lateralis, Myriochele oculata, and Abra aequalis) are widely distributed throughout Station Groups A, C, and D, and are known to irrupt seasonally in their populations. Group 3c (Paraprionospio pinnata, Magelona sp. H, Mediomastus spp.) are generally distributed along the inner shelf areas, as depicted by their fidelity for Station Groups A and C (Figure 8).

Species Group 4 (Periploma and Cirriformia sp. C) was present only at station 143 (Group D), but represented extremely high numbers of individuals.

Species Group 5 is comprised of outlier species which were collected one time in large numbers at single stations, i.e., Golfingia sp. GG (115 individuals) at station 136, Acanthohaustorius sp. B (75 specimens) at station 114, Melita nitida (704 individuals) at station 47, and Haploops sp. B (131 individuals) at station 171.

By rearranging the stations listed in Table 7 into their respective classified groups, the composite mean community structure parameters become useful for characterization of the major communities (Table 9). The inner shelf station Group A is represented by the lowest species indices, but is the second most abundant with an average density of 5530 individuals$\cdot m^{-2}$. Both station Groups C (tidal inlet/inner shelf) and D (sound stations) contain a large number of taxa, with Group C having the greatest average density (6104 individuals$\cdot m^{-2}$). Stations Groups B, E, and F are considered outliers and merged for sake of simplicity. Groups B, E, and F have the highest mean species diversity value (2.59) which is reflected in high species evenness (0.77) and low density value (812 individuals$\cdot m^{-2}$).

Since neither sediment composition nor depth measurements are available for the Chevron study site, additional analyses, i.e., multidiscriminant, were not performed on the data. Comparisons with the MR-GO macroinfauna data provide a synoptic overview of the infaunal assemblages associated with proposed habitats within the Chevron survey site.

4.0 DISCUSSION

Upon initial review of MR-GO and Chevron benthic data, several features make comparing results difficult. First, differences in surface sample size ($0.06\ m^2$ vs. $0.3\ m^2$) result in possible under- and/or over-estimates of population densities, although mean station densities are within one-half an order of magnitude between surveys and seasons. This may be due to replication at the MR-GO site, thus equalizing total areas sampled, i.e., $5 \times 0.06\ m^2$.

Table 9. Mean community structure parameters for station groups resulting from classification of Chevron station data.

STATION GROUPS	Total Taxa	Total Indiv.	Mean Density (ind./m^2)	Species Diversity (H_e')	Species Evenness (J')	Species Richness (D)
A	24	1659	5530	1.83	0.47	4.45
B,E,F	30	244	812	2.59	0.77	5.92
C	49	1832	6104	2.46	0.64	7.45
D	51	787	2571	2.55	0.64	7.91

Second, samples were collected with entirely different devices, a box corer and a diver-manned suction corer. Whereas, a box corer is considered a quantitative sampler with a known surface area and a computed volume, a suction corer can only provide semi-quantitative samples. The amount of surface area and depth of penetration is controlled by a diver where bias or inconsistency in sampling methodology is possible.

Third, differences in sieve size (0.5 mm vs. 1.2 mm) will definitely effect the "type" of faunal organisms collected, or not collected as the case may be. The larger, deeper burrowing bivalve molluscs and crustaceans collected with a suction corer and retained on a 1.2 mm sieve (Chevron data) may reflect a slightly different or incomplete assemblage when compared to the MR-GO fauna retained on a 0.5 mm sieve (i.e., predominately polychaetes).

Results of the 1980-1981 MR-GO survey depict the seasonal variability of macroinfauna populations found in the nearshore coastal waters of the northern Gulf of Mexico. The temporal pattern (i.e., significantly greater densities in June as compared to December) was not unexpected, as most of the numerically important taxa collected in the study are known to have late winter to late spring periods of recruitment (Johnson, 1980; Shaw et al., 1982).

When compared with benthic studies conducted in the area (TechCon, 1980; Shaw et al., 1982), the assemblage of taxa inhabiting tidal inlets are similar to those found for the MR-GO survey. These include the polychaetes *Polygordius* spp., *Poecilochaetus* sp., *Carazziella hobsonae*; cephalochordate *Branchiostoma* sp.; and amphipods *Eudevenopsis honduranus*, *Protohaustorius* sp. A, *Acanthohaustorius* sp. A at the predominantly sand habitats. Polychaetes *Ninoe* sp. B, *Cossura soyeri*, and *Mediomastus ambiseta* have been found to occur in a muddy substrate adjacent to a navigation channel at the mouth of Mobile Bay (TechCon, 1980). Taxa commonly found in areas similar to the MR-GO site include the ubiquitous bivalve *Mulinia lateralis*, ophiuroid *Hemipholis elongata*, polychaetes *Mediomastus californiensis*, *Spiophanes bombyx*, and predaceous rhynchocoels (TechCon, 1980; Shaw et al., 1982). The tidal inlet communities are composed of euryhaline species which are generally suspension and deposit feeders adapted to the physical stresses of currents (e.g., movement of sediment) and salinity fluctuations.

The MR-GO and Chevron surveys are represented by few comparable dominant taxa. These include the molluscs *Mulinia lateralis*, *Abra aequalis*, *Nuculana concentrica* and polychaetes *Mediomastus* sp., *Spiophanes bombyx*, *Paraprionospio pinnata*, *Magelona* sp. H. These species are generally found within open sounds, tidal inlets, and inner shelf (5-20 m) habitats of the Tuscaloosa Trend study area.

Results of the Chevron survey show similarities with macrofauna assemblages described by Parker (1956) for the Mississippi Delta and by Shaw et al. (1982) for Mississippi Sound and offshore coastal waters. Taxa from comparable inner shelf and tidal inlet assemblages include the polychaetes *Owenia* sp. A, *Spiophanes bombyx*, *Magelona* sp. H, *Paraprionospio pinnata*, *Mediomastus* spp.; molluscs *Mulinia lateralis*, *Tellina versicolor*; and cumacean *Oxyurostylis smithi*. Open Sound assemblages include comparable taxa such as the polychaetes *Myriochele oculata*, *Mediomastus* spp., and molluscs *Abra aequalis*, *Acteocina canaliculata*, *Nuculana concentrica*, *Anachis obesa*, and *Nassarius acutus*.

The infauna assemblages evaluated for the MR-GO and Chevron sites were incorporated during the formulation of proposed assemblages presented in Tables 6.8 and 6.20 of the Tuscaloosa Trend study area report.

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ATTACHMENT I - TAXONOMIC LISTING FOR MISSISSIPPI RIVER-GULF OUTLET SAMPLES

TAXONOMIC LISTING

FOR IEC GULF OUTLET SAMPLES (1980 & 1981) 01/16/85

==

ANNELIDA
- OLIGOCHAETA
  - OLIGOCHAETA (LPIL)
- POLYCHAETA
  - POLYCHAETA (LPIL)
  - AMPHARETIDAE
    - AMPHARETIDAE (LPIL)
    - MELINNA MACULATA
    - SABELLIDES SP.A
  - AMPHINOMIDAE
    - PARAMPHINOME SP.B
  - ARABELLIDAE
    - DRILONEREIS (LPIL)
  - CAPITELLIDAE
    - CAPITELLIDAE (LPIL)
    - MEDIOMASTUS (LPIL)
    - MEDIOMASTUS AMBISETA
    - MEDIOMASTUS CALIFORNIENSIS
    - NOTOMASTUS (LPIL)
    - NOTOMASTUS DAUERI
    - NOTOMASTUS HEMIPODUS
    - NOTOMASTUS LOBATUS
  - CHRYSOPETALIDAE
    - PALEANOTUS HETEROSETA
  - CIRRATULIDAE
    - CAULLERIELLA (LPIL)
    - CHAETOZONE SP.B
    - CHAETOZONE SP.D
    - CIRRATULIDAE (LPIL)
    - CIRRIFORMIA (LPIL)
    - CIRRIFORMIA SP.C
  - COSSURIDAE
    - COSSURA (LPIL)
    - COSSURA DELTA
    - COSSURA SOYERI
  - FLABELLIGERIDAE
    - FLABELLIGERIDAE (LPIL)
    - PIROMIS ROBERTI
  - GLYCERIDAE
    - GLYCERA (LPIL)
    - GLYCERA AMERICANA
    - GLYCERA DIBRANCHIATA
  - GONIADIDAE
    - GLYCINDE SOLITARIA
    - GONIADA LITTOREA
    - GONIADIDAE (LPIL)
  - HESIONIDAE
    - HESIONIDAE (LPIL)
    - HESIONIDAE GENUS C

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PODARKE OBSCURA
PODARKEOPSIS LEVIFUSCINA
LUMBRINERIDAE
LUMBRINERIDAE (LPIL)
LUMBRINERIS (LPIL)
LUMBRINERIS VERRILLI
NINOE SP.B
MAGELONIDAE
MAGELONA (LPIL)
MAGELONA CF. RIOJAI
MAGELONA PETTIBONEAE
MAGELONA SP.B
MAGELONA SP.H
MALDANIDAE
ASYCHIS ELONGATUS
CLYMENELLA TORQUATA
MALDANIDAE (LPIL)
NEPHTYIDAE
AGLAOPHAMUS (LPIL)
AGLAOPHAMUS VERRILLI
NEPHTYIDAE (LPIL)
NEPHTYS (LPIL)
NEPHTYS PICTA
NEPHTYS SIMONI
NEPHTYS SP.D
NEPHTYS SP.F
NEREIDAE
NEREIDAE (LPIL)
NEREIS (LPIL)
NEREIS FALSA
NEREIS MICROMMA
ONUPHIDAE
DIOPATRA (LPIL)
DIOPATRA CUPREA
DIOPATRA TRIDENTATA
MOOREONUPHIS NEBULOSA
ONUPHIDAE (LPIL)
OPHELIIDAE
ARMANDIA AGILIS
ARMANDIA MACULATA
OPHELIIDAE (LPIL)
TRAVISIA (LPIL)
TRAVISIA HOBSONAE
ORBINIIDAE
LEITOSCOLOPLOS (LPIL)
LEITOSCOLOPLOS FRAGILIS
ORBINIIDAE (LPIL)
SCOLOPLOS RUBRA

SCOLOPLOS SP.A

SCOLOPLOS TEXANA
OWENIIDAE
MYRIOCHELE OCULATA
OWENIA SP.A
PARAONIDAE
ARICIDEA SP.E
CIRROPHORUS (LPIL)
PARAONIDAE (LPIL)
PHYLLODOCIDAE
ETEONE (LPIL)
ETEONE HETEROPODA
ETEONE LACTEA
PHYLLODOCIDAE (LPIL)
PILARGIDAE
ANCISTROSYLLIS (LPIL)
ANCISTROSYLLIS HARTMANAE
ANCISTROSYLLIS JONESI
ANCISTROSYLLIS PAPILLOSA
CABIRA INCERTA
SIGAMBRA TENTACULATA
POECILOCHAETIDAE
POECILOCHAETUS (LPIL)
POLYGORDIIDAE
POLYGORDIUS (LPIL)
POLYNOIDAE
LEPIDASTHENIA VARIUS
MALMGRENIELLA SP.A
MALMGRENIELLA SP.B
POLYNOIDAE (LPIL)
POLYODONTIDAE
POLYODONTES (LPIL)
POLYODONTES LUPINUS
SABELLIDAE
SABELLIDAE (LPIL)
SERPULIDAE
HYDROIDES (LPIL)
HYDROIDES SP.B
HYDROIDES UNCINATA
SERPULIDAE (LPIL)
SIGALIONIDAE
SIGALION SP.A
SIGALIONIDAE (LPIL)
STHENELAIS (LPIL)
STHENELAIS SP.A
THALENESSA (LPIL)
THALENESSA SP.A
SPIONIDAE
APOPRIONOSPIO PYGMAEA

CARAZZIELLA HOBSONAE

==

DISPIO UNCINATA
MALACOCEROS (LPIL)
PARAPRIONOSPIO PINNATA
POLYDORA LIGNI
POLYDORA SOCIALIS
POLYDORA SP.A
PRIONOSPIO (LPIL)
PRIONOSPIO CRISTATA
PRIONOSPIO SP.E
SCOLELEPIS TEXANA
SPIONIDAE (LPIL)
SPIOPHANES BOMBYX
SPIOPHANES CF. MISSIONENSIS

SYLLIDAE
SYLLIDAE (LPIL)
TYPOSYLLIS ARMILLARIS
TYPOSYLLIS CF. LUTEA

TEREBELLIDAE
LOIMIA SP.A
PISTA (LPIL)
TEREBELLIDAE (LPIL)

ARTHROPODA (CRUSTACEA)
CRUSTACEA (LPIL)

AMPHIPODA

AMPELISCIDAE
AMPELISCA (LPIL)
AMPELISCA AGASSIZI
AMPELISCA BICARINATA
AMPELISCA CF. VERRILLI
AMPELISCA SP.A
AMPELISCA SP.C

ARIGISSIDAE
ARGISSA HAMATIPES

CAPRELLIDAE
CAPRELLIDAE (LPIL)

COROPHIIDAE
COROPHIUM LACUSTRE
COROPHIUM TUBERCULATUM
ERICHTHONIUS BRASILIENSIS

HAUSTORIIDAE
ACANTHOHAUSTORIUS INTERMEDIUS
ACANTHOHAUSTORIUS SP.A
HAUSTORIIDAE (LPIL)
PROTOHAUSTORIUS SP.A

ISCHYROCERIDAE
CERAPUS SP.A

LILJEBORGIIDAE
LISTRIELLA (LPIL)

LISTRIELLA BARNARDI

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LISTRIELLA SP.A
LISTRIELLA SP.B
MELITIDAE
MELITA (LPIL)
OEDICEROTIDAE
MONOCULODES NYEI
MONOCULODES SP.A
SYNCHELIDIUM AMERICANUM
PHOTIDAE
MICROPROTOPUS RANEYI
PHOTIS MACROMANUS
PHOXOCEPHALIDAE
METHARPINA FLORIDANA
RHEPOXYNIUS EPISTOMUS
PLATYISCHNOPIDAE
EUDEVENOPUS HONDURANUS
PLATYISCHNOPIDAE (LPIL)
CUMACEA
BODOTRIIDAE
CYCLASPIS SP.A
DIASTYLIDAE
OXYUROSTYLIS SMITHI
DECAPODA (NATANTIA)
DECAPODA NATANTIA (LPIL)
ALPHEIDAE
AUTOMATE EVERMANNI
OGYRIDAE
OGYRIDES ALPHAEROSTRIS
OGYRIDES HAYI
PENAEIDAE
PENAEIDAE (LPIL)
TRACHYPENAEUS (LPIL)
TRACHYPENAEUS CONSTRICTUS
TRACHYPENAEUS SIMILIS
PROCESSIDAE
PROCESSA HEMPHILLI
DECAPODA (REPTANTIA)
ANOMURA (LPIL)
ALBUNEIDAE
ALBUNEA PARETII
BRACHYURA
BRACHYURA (LPIL)
CALAPPIDAE
HEPATUS EPHELITICUS
CALLIANASSIDAE
CALLIANASSA (LPIL)
CALLIANASSA BIFORMIS
DIOGENIDAE

DIOGENIDAE(LPIL)

LEUCOSIIDAE
ILIACANTHA (LPIL)
PAGURIDAE
PAGURIDAE (LPIL)
PINNOTHERIDAE
PINNIXA (LPIL)
PINNIXA CHAETOPTERANA
PINNIXA PEARSEI
PORCELLANIDAE
EUCERAMUS PRAELONGUS
PORTUNIDAE
OVALIPES FLORIDANUS
PORTUNUS (LPIL)
UPOGEBIIDAE
UPOGEBIA AFFINIS
XANTHIDAE
HEXAPANOPEUS (LPIL)
HEXAPANOPEUS ANGUSTIFRONS
MICROPANOPE (LPIL)
XANTHIDAE (LPIL)
ISOPODA
IDOTEIDAE
EDOTEA TRILOBA
SPHAEROMIDAE
ANCINUS DEPRESSUS
MYSIDACEA
MYSIDAE
BOWMANIELLA (LPIL)
BOWMANIELLA BRASILIENSIS
BOWMANIELLA FLORIDANA
MYSIDAE (LPIL)
MYSIDOPSIS (LPIL)
OSTRACODA
OSTRACODA (LPIL)
STOMATOPODA
STOMATOPODA (LPIL)
CEPHALOCHORDATA
LEPTOCARDII
BRANCHIOSTOMIDAE
BRANCHIOSTOMA (LPIL)
CNIDARIA
ACTINIARIA
ACTINIARIA (LPIL)
ACTINIARIA (LPIL)
ECHINODERMATA
ASTERIODEA
LUIDIIDAE
LUIDIA CLATHRATA

ECHINOIDEA
ECHINOIDEA (LPIL)

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OPHIUROIDEA
OPHIUROIDEA (LPIL)
AMPHIURIDAE
AMPHIOPLUS CONIORTODES
MICROPHOLIS ATRA
OPHIOPHRAGMUS (LPIL)
OPHIACTIDAE
HEMIPHOLIS ELONGATA
ECHIURA
ECHIURA (LPIL)
HEMICHORDATA
BALANOGLOSSUS AURANTIACUS
MOLLUSCA
GASTROPODA
GASTROPODA (LPIL)
ACTEOCINIDAE
ACTEOCINA CANALICULATA
ACTEONIDAE
RICTAXIS PUNCTOSTRIATUS
BUCCINIDAE
BUCCINIDAE (LPIL)
CANTHARUS CANCELLARIUS
CAECIDAE
CAECIDAE (LPIL)
COLUMBELLIDAE
ANACHIS OBESA
MITRELLA LUNATA
CREPIDULIDAE
CREPIDULA (LPIL)
EPITONIIDAE
EPITONIUM CF. HUMPHREYSI
MELANELLIDAE
MELANELLIDAE (LPIL)
MELONGENIDAE
BUSYCON CONTRARIUM
MURICIDAE
THAIS HAEMASTOMA
NASSARIIDAE
NASSARIUS (LPIL)
NASSARIUS ACUTUS
NATICIDAE
NATICA PUSILLA
POLINICES DUPLICATUS
SINUM PERSPECTIVUM
OLIVIDAE
OLIVA SAYANA
OLIVELLA (LPIL)
OLIVELLA DEALBATA

PYRAMIDELLIDAE
TURBONILLA (LPIL)

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TURRIDAE
KURTZIELLA (LPIL)
KURTZIELLA CF. CERINA
VITRINELLIDAE
VITRINELLIDAE (LPIL)
PELECYPODA
PELECYPODA (LPIL)
ARCIDAE
ANADARA (LPIL)
ANADARA TRANSVERSA
ARCIDAE (LPIL)
BARBATIA CANDIDA
CARDIIDAE
CARDIIDAE (LPIL)
TRACHYCARDIUM (LPIL)
CORBULIDAE
CORBULA (LPIL)
CORBULA BARRATTIANA
CORBULA CONTRACTA
CORBULA DIETZIANA
CRASSATELLIDAE
CRASSINELLA (LPIL)
CRASSINELLA MARTINICENSIS
CUSPIDARIIDAE
CUSPIDARIIDAE (LPIL)
GASTROCHAENIDAE
GASTROCHAENA (LPIL)
GASTROCHAENA HIANS
LASAEIDAE
LASAEIDAE (LPIL)
LUCINIDAE
LINGA AMIANTUS
LUCINIDAE (LPIL)
LYONSIIDAE
LYONSIA HYALINA
MACTRIDAE
MULINIA (LPIL)
MULINIA LATERALIS
PANDORIDAE
PANDORA TRILINEATA
PERIPLOMATIDAE
PERIPLOMA FRAGILE
PERIPLOMA MARGARITACEUM
SEMELIDAE
ABRA AEQUALIS
SEMELIDAE (LPIL)
SOLECURTIDAE
TAGELUS DIVISUS

SOLENIDAE
ENSIS MINOR

TELLINIDAE
MACOMA (LPIL)
TELLINA (LPIL)
TELLINA AEQUISTRIATA
TELLINA ALTERNATA
TELLINA IRIS
TELLINA VERSICOLOR
TELLINIDAE (LPIL)
UNGULINIDAE
DIPLODONTA PUNCTATA
VENERIDAE
CHIONE (LPIL)
CHIONE CANCELLATA
CYCLINELLA TENUIS
DOSINIA (LPIL)
GEMMA GEMMA
MERCENARIA CAMPECHIENSIS
VENERIDAE (LPIL)
PHORONIDA
PHORONIS (LPIL)
PLATYHELMINTHES
TURBELLARIA
TURBELLARIA (LPIL)
RHYNCHOCOELA
RHYNCHOCOELA (LPIL)
SIPUNCULA
ASPIDOSIPHONIDAE
ASPIDOSIPHON (LPIL)
ASPIDOSIPHON ALBUS
GOLFINGIIDAE
GOLFINGIA TRICHOCEPHALA
PHASCOLION STROMBI

ATTACHMENT II - TAXONOMIC LISTING FOR CHEVRON SAMPLES

TAXONOMIC LISTING

FOR CHEVRON SAMPLES COLLECTED 1970 & 1971 01/08/85

==

ANNELIDA
- OLIGOCHAETA
  - OLIGOCHAETA (LPIL)
- POLYCHAETA
  - AMPHARETIDAE
    - AMPHARETE SP.A
    - AMPHARETIDAE (LPIL)
    - MELINNA MACULATA
    - SABELLIDES SP.A
  - AMPHINOMIDAE
    - PARAMPHINOME SP.B
  - ARABELLIDAE
    - ARABELLIDAE (LPIL)
    - DRILONEREIS LONGA
    - DRILONEREIS SP.G
  - CAPITELLIDAE
    - CAPITELLA CAPITATA
    - CAPITELLIDAE (LPIL)
    - MEDIOMASTUS (LPIL)
    - MEDIOMASTUS AMBISETA
    - NOTOMASTUS (LPIL)
    - NOTOMASTUS LOBATUS
    - NOTOMASTUS SP.E
  - CHAETOPTERIDAE
    - CHAETOPTERUS VARIOPEDATUS
    - SPIOCHAETOPTERUS OCULATUS
  - CHRYSOPETALIDAE
    - PALEANOTUS HETEROSETA
  - CIRRATULIDAE
    - CHAETOZONE (LPIL)
    - CHAETOZONE SP.D
    - CIRRATULIDAE (LPIL)
    - CIRRIFORMIA SP.A
    - CIRRIFORMIA SP.C
    - THARYX CF. ANNULOSUS
  - COSSURIDAE
    - COSSURA DELTA
    - COSSURA SOYERI
    - COSSURIDAE (LPIL)
  - DORVILLEIDAE
    - SCHISTOMERINGOS CF. RUDOLPHI
  - EULEPETHIDAE
    - GRUBEULEPIS SP.C
  - EUNICIDAE
    - MARPHYSA SANGUINEA
    - MARPHYSA SP.B
  - FLABELLIGERIDAE
    - FLABELLIGERIDAE (LPIL)

    - PIROMIS ROBERTI

GLYCERIDAE
- GLYCERA (LPIL)
- GLYCERA AMERICANA
- GLYCERA SP.E
- GLYCERA SP.K

GONIADIDAE
- GLYCINDE SOLITARIA
- GONIADA (LPIL)
- GONIADA LITTOREA
- GONIADIDAE (LPIL)
- OPHIOGLYCERA SP.A

HESIONIDAE
- HESIONIDAE (LPIL)
- PODARKEOPSIS LEVIFUSCINA

LUMBRINERIDAE
- LUMBRINERIDAE (LPIL)
- LUMBRINERIS (LPIL)
- LUMBRINERIS ERNESTI
- LUMBRINERIS JANUARII
- LUMBRINERIS SP.B
- LUMBRINERIS SP.D
- LUMBRINERIS SP.E
- LUMBRINERIS VERRILLI
- NINOE SP.B

MAGELONIDAE
- MAGELONA (LPIL)
- MAGELONA CF. RIOJAI
- MAGELONA SP.G
- MAGELONA SP.H
- MAGELONA SP.I
- MAGELONA SP.L

MALDANIDAE
- ASYCHIS ELONGATUS
- CLYMENELLA TORQUATA
- MALDANE SP.A
- MALDANIDAE (LPIL)

NEPHTYIDAE
- AGLAOPHAMUS VERRILLI
- NEPHTYIDAE (LPIL)
- NEPHTYS (LPIL)
- NEPHTYS INCISA
- NEPHTYS PICTA
- NEPHTYS SIMONI
- NEPHTYS SP.D

NEREIDAE
- CERATOCEPHALE OCULATA
- NEREIDAE (LPIL)
- NEREIS (LPIL)
- NEREIS LAMELLOSA

NEREIS MICROMMA
NEREIS SUCCINEA
ONUPHIDAE
DIOPATRA (LPIL)
DIOPATRA CUPREA
DIOPATRA NEOTRIDENS
DIOPATRA TRIDENTATA
KINBERGONUPHIS SP.A
MOOREONUPHIS CF. NEBULOSA
MOOREONUPHIS SP.A
MOOREONUPHIS SP.B
ONUPHIDAE (LPIL)
ONUPHIS EREMITA OCULATA
OPHELIIDAE
ARMANDIA AGILIS
ARMANDIA MACULATA
ORBINIIDAE
LEITOSCOLOPLOS (LPIL)
LEITOSCOLOPLOS FRAGILIS
NAINEREIS SP.A
ORBINIIDAE (LPIL)
SCOLOPLOS (LPIL)
SCOLOPLOS RUBRA
SCOLOPLOS SP.B
OWENIIDAE
MYRIOCHELE OCULATA
MYRIOWENIA SP.A
OWENIA SP.A
PARAONIDAE
ARICIDEA (LPIL)
ARICIDEA FRAGILIS
ARICIDEA SP.C
ARICIDEA SP.K
CIRROPHORUS (LPIL)
PARAONIDAE (LPIL)
PECTINARIIDAE
PECTINARIA (LPIL)
PECTINARIA GOULDII
PECTINARIIDAE (LPIL)
PHYLLODOCIDAE
PARANAITIS GARDINERI
PHYLLODOCE ARENAE
PHYLLODOCIDAE (LPIL)
PILARGIDAE
ANCISTROSYLLIS JONESI
ANCISTROSYLLIS SP.B
CABIRA INCERTA
PILARGIS SP.B

SIGAMBRA (LPIL)

SIGAMBRA BASSI
SIGAMBRA TENTACULATA
SIGAMBRA WASSI
POECILOCHAETIDAE
POECILOCHAETUS (LPIL)
POLYNOIDAE
HALOSYDNELLA SP.A
LEPIDASTHENIA VARIUS
LEPIDONOTUS SUBLEVIS
MALMGRENIELLA SP.A
POLYNOIDAE (LPIL)
POLYODONTIDAE
EUPANTHALIS SP.A
POLYODONTES SP.A
SABELLIDAE
CHONE (LPIL)
MEGALOMMA PIGMENTUM
SABELLIDAE (LPIL)
SERPULIDAE
HYDROIDES SP.D
HYDROIDES UNCINATA
POMATOCEROS AMERICANUS
SERPULIDAE (LPIL)
SIGALIONIDAE
FIMBRIOSTHENELAIS (LPIL)
FIMBRIOSTHENELAIS SP.A
SIGALIONIDAE (LPIL)
STHENELAIS SP.A
THALENESSA SP.A
SPIONIDAE
APOPRIONOSPIO PYGMAEA
CARAZZIELLA HOBSONAE
CARAZZIELLA SP.A
DISPIO UNCINATA
MALACOCEROS VANDERHORSTI
MICROSPIO PIGMENTATA
PARAPRIONOSPIO (LPIL)
PARAPRIONOSPIO PINNATA
POLYDORA LIGNI
POLYDORA SOCIALIS
PRIONOSPIO (LPIL)
PRIONOSPIO CRISTATA
SCOLELEPIS TEXANA
SPIONIDAE (LPIL)
SPIOPHANES BOMBYX
SPIOPHANES CF. MISSIONENSIS
STERNASPIDAE
STERNASPIS SCUTATA

SYLLIDAE
AUTOLYTUS SP.A

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BRANCHIOSYLLIS EXILIS
TEREBELLIDAE
AMAEANA (LPIL)
HAUCHIELLA SP.A
LOIMIA SP.A
TEREBELLIDAE (LPIL)
TRICHOBRANCHIDAE
TEREBELLIDES STROEMI
ARTHROPODA (CRUSTACEA)
AMPHIPODA
AMPHIPODA (LPIL)
AMPELISCIADE
HAPLOOPS SP.B
AMPELISCIDAE
AMPELISCA (LPIL)
AMPELISCA AGASSIZI
AMPELISCA BICARINATA
AMPELISCA SP.A
AMPELISCA SP.C
AORIDAE
LEMBOS BRUNNEOMACULATUS
LEPTOCHEIRUS SP.A
UNCIOLA SERRATA
ATYLIDAE
ATYLUS UROCARINATUS
BATEIDAE
BATEA CATHERINENSIS
CAPRELLIDAE
CAPRELLA CF. EQUILIBRA
LUCONACIA INCERTA
COROPHIIDAE
CERAPUS (LPIL)
CERAPUS SP.C
COROPHIUM (LPIL)
COROPHIUM TUBERCULATUM
ERICHTHONIUS (LPIL)
ERICHTHONIUS BRASILIENSIS
GAMMARIDAE
GAMMARIDAE (LPIL)
HAUSTORIIDAE
ACANTHOHAUSTORIUS SP.B
HAUSTORIIDAE (LPIL)
PSEUDOHAUSTORIUS AMERICANUS
PSEUDOHAUSTORIUS CAROLINENSIS
MELITIDAE
DULICHIELLA APPENDICULATA
MELITA FRESNELLI
MELITA NITIDA

OEDICEROTIDAE
MONOCULODES (LPIL)

MONOCULODES INTERMEDIUS
PHOTIDAE
PHOTIS MACROMANUS
PLATYISCHNOPIDAE
EUDEVENOPUS HONDURANUS
CUMACEA
CUMACEA (LPIL)
DIASTYLIDAE
OXYUROSTYLIS SMITHI
LEUCONIDAE
EUDORELLA MONODON
DECAPODA (NATANTIA)
DECAPODA NATANTIA (LPIL)
ALPHEIDAE
ALPHEIDAE (LPIL)
ALPHEOPSIS (LPIL)
ALPHEUS (LPIL)
ALPHEUS HETEROCHAELIS
AUTOMATE EVERMANNI
HIPPOLYTIDAE
LATREUTES PARVULUS
LAUTRETES PARVULUS
OGYRIDAE
OGYRIDES ALPHAEROSTRIS
PALAEMONIDAE
PERICLIMENES LONGICAUDATUS
PASIPHAEIDAE
LEPTOCHELA SERRATORBITA
PENAEIDAE
PENAEIDAE (LPIL)
TRACHYPENAEUS CONSTRICTUS
TRACHYPENAEUS SIMILIS
PROCESSIDAE
PROCESSA (LPIL)
PROCESSA HEMPHILLI
DECAPODA (REPTANTIA)
ALBUNEIDAE
ALBUNEA PARETII
BRACHYURA
BRACHYURA (LPIL)
CALAPPIDAE
HEPATUS PUNDIBUNDUS
CALLIANASSIDAE
CALLIANASSA (LPIL)
CALLIANASSA BIFORMIS
CALLIANASSIDAE (LPIL)
DIOGENIDAE
ISOCHELES WURDEMANNI
GONEPLACIDAE
CHASMOCARCINUS MISSISSIPPIENSI

==

SPEOCARCINUS LOBATUS
MAJIDAE
METOPORHAPHIS CALCARATA
PAGURIDAE
PAGURIDAE (LPIL)
PAGURUS ANNULIPES
PAGURUS LONGICARPUS
PAGURUS POLLICARIS
PARTHENOPIDAE
HETEROCRYPTA GRANULATA
PINNOTHERIDAE
PINNIXA (LPIL)
PINNIXA CHAETOPTERANA
PINNIXA SAYANA
PORCELLANIDAE
EUCERAMUS PRAELONGUS
POLYONYX GIBBESI
PORTUNIDAE
CALLINECTES (LPIL)
CALLINECTES SAPIDUS
CALLINECTES SIMILIS
OVALIPES (LPIL)
OVALIPES FLORIDANUS
OVALIPES STEPHENSONI
PORTUNIDAE (LPIL)
UPOGEBIIDAE
UPOGEBIA AFFINIS
XANTHIDAE
HEXAPANOPEUS ANGUSTIFRONS
MENIPPE MERCENARIA
RHITHROPANOPEUS HARRISII
XANTHIDAE (LPIL)
ISOPODA
ISOPODA (LPIL)
IDOTEIDAE
EDOTEA TRILOBA
SYNIDOTEA SP.B
SPHAEROMIDAE
ANCINUS DEPRESSUS
MYSIDACEA
MYSIDACEA (LPIL)
MYSIDAE
BOWMANIELLA PORTORICENSIS
MYSIDOPSIS (LPIL)
MYSIDOPSIS BAHIA
MYSIDOPSIS BIGELOWI
STOMATOPODA
LYSIOSQUILLIDAE
LYSIOSQUILLA SP.A

SQUILLIDAE
SQUILLA EMPUSA
TANAIDACEA
TANAIDACEA (LPIL)
APSEUDIDAE
APSEUDES SP.B
KALLIAPSEUDIDAE
KALLIAPSEUDES SP.A
KALLIAPSEUDES SP.B
CEPHALOCHORDATA
LEPTOCARDII
BRANCHIOSTOMIDAE
BRANCHIOSTOMA (LPIL)
BRANCHIOSTOMA FLORIDAE
CNIDARIA
ACTINIARIA
ACTINIARIA (LPIL)
ACTINIARIA (LPIL)
ANTHOZOA (PENNATULACEA)
RENILLIDAE
RENILLA MULLERI
ECHINODERMATA
ASTERIODEA
LUIDIIDAE
LUIDIA CLATHRATA
ASTEROIDEA
ASTEROIDEA (LPIL)
ECHINOIDEA
MELLITIDAE
MELLITA QUINQUIESPERFORATA
HOLOTHUROIDEA
CAUDINIDAE
PARACAUDINIDA CHILENSIS OBESAC
PHYLLOPHORIDAE
THYONE PAWSONI
OPHIUROIDEA
OPHIUROIDEA (LPIL)
AMPHIURIDAE
AMPHIODIA SP.A
AMPHIODIA TRYCHNA
AMPHIOPLUS (LPIL)
AMPHIPHOLIS (LPIL)
MICROPHOLIS ATRA
MICROPHOLIS GRACILLIMA
OPHIACTIDAE
HEMIPHOLIS ELONGATA
HEMICHORDATA
BALANOGLOSSUS AURANTIACUS
MOLLUSCA
GASTROPODA
GASTROPODA (LPIL)

==

ACTEOCINIDAE
- ACTEOCINA CANALICULATA

ACTEONIDAE
- ACTEON PUNCTOSTRIATUS

ATYIDAE
- HAMINOEA (LPIL)

BUCCINIDAE
- CANTHARUS CANCELLARIUS

CAECIDAE
- CAECUM JOHNSONI

COLUMBELLIDAE
- ANACHIS OBESA
- COLUMBELLIDAE (LPIL)
- MITRELLA LUNATA

CREPIDULA
- CREPIDULA (LPIL)
- CREPIDULA PLANA

CYLICHNIDAE
- CYLICHNA ALBA
- CYLICHNELLA BIDENTATA

EPITONIIDAE
- EPITONIUM ALBIDUM

MELONGENIDAE
- BUSYCON CONTRARIUM

MURICIDAE
- THAIS HAEMASTOMA FLORIDANA
- THAIS HAEMOSTOMA

NASSARIIDAE
- NASSARIUS ACUTUS

NATICIDAE
- NATICA PUSILLA
- POLINICES (LPIL)
- POLINICES DUPLICATUS
- SINUM PERSPECTIVUM

OLIVIDAE
- OLIVA SAYANA
- OLIVELLA MUTICA

PYRAMIDELLIDAE
- ODOSTOMIA GIBBOSA
- ODOSTOMIA TERES
- TURBONILLA (LPIL)
- TURBONILLA HEMPHILLI
- TURBONILLA PORTORICANA
- TURBONILLA SP.C
- TURBONILLA SP.G

TEREBRIDAE
- TEREBRA DISLOCATA

TURRIDAE
- KURTZIELLA CF. CERINA

==

KURTZIELLA LIMONITELLA
VITRINELLIDAE
CYCLOSTREMISCUS (LPIL)
CYCLOSTREMISCUS PENTAGONUS
CYCLOSTREMISCUS SP.A
EPISCYNIA INORNATA
SOLARIORBIS INFRACARINATA
NUDIBRANCHIA
NUDIBRANCHIA (LPIL)
PELECYPODA
PELECYPODA (LPIL)
ARCIDAE
ANADARA (LPIL)
ANADARA FLORIDANA
ANADARA OVALIS
ANADARA TRANSVERSA
NOETIA PONDEROSA
CARDIIDAE
CARDIUM (LPIL)
CORBULIDAE
CORBULA (LPIL)
CORBULA CONTRACTA
CORBULA DIETZIANA
CORBULA OPERCULATA
VARICORBULA OPERCULATA
CRASSATELLIDAE
CRASSINELLA LUNULATA
CUSPIDARIIDAE
CARDIOMYA ORNATISSIMA
LASAEIDAE
ERYCINA (LPIL)
ERYCINA SP.B
LASAEIDAE (LPIL)
LUCINIDAE
LINGA AMIANTUS
LUCINA AMIANTUS
PARVILUCINA MULTILINEATA
LYONSIIDAE
LYONSIA (LPIL)
LYONSIA HYALINA FLORIDANA
MACTRIDAE
MACTRA FRAGILIS
MULINIA LATERALIS
MYTILIDAE
BRANCHIDONTES EXUSTUS
MUSCULUS LATERALIS
NUCULANIDAE
NUCULANA ACUTA
NUCULANA CONCENTRICA

==

NUCULIDAE
- NUCULA PROXIMA

OSTREIDAE
- CRASSOSTREA VIRGINICA
- OSTREA EQUESTRIS

PANDORIDAE
- PANDORA TRILINEATA

PECTINIDAE
- CHLAMYS BENEDICTI

PERIPLOMATIDAE
- PERIPLOMA (LPIL)
- PERIPLOMA MARGARITACEUM

PETRICOLIDAE
- PETRICOLA PHOLADIFORMES

PHOLADIDAE
- DIPLOTHYRA SMITHII

SEMELIDAE
- ABRA AEQUALIS
- ABRA LIOICA

SOLECURTIDAE
- TAGELUS DIVISUS

SOLENIDAE
- ENSIS MINOR
- SOLEN VIRIDIS

TELLINIDAE
- MACOMA MITCHELLI
- MACOMA PULLEYI
- MACOMA TENTA
- STRIGILLA MIRABILIS
- TELLIDORA CRISTATA
- TELLINA (LPIL)
- TELLINA AEQUISTRIATA
- TELLINA ALTERNATA
- TELLINA IRIS
- TELLINA TEXANA
- TELLINA VERSICOLOR
- TELLINIDAE (LPIL)

UNGULINIDAE
- DIPLODONTA (LPIL)
- DIPLODONTA SP.A

VENERIDAE
- AGRIOPOMA TEXASIANA
- CHIONE CANCELLATA
- DOSINIA DISCUS
- MERCENARIA CAMPECHIENSIS
- VENERIDAE (LPIL)

SCAPHOPODA

DENTALIIDAE
- DENTALIUM TEXASIANUM

===

PHORONIDA
PHORONIS (LPIL)
PLATYHELMINTHES
TURBELLARIA
TURBELLARIA (LPIL)
RHYNCHOCOELA
RHYNCHOCOELA (LPIL)
SIPUNCULA
SIPUNCULA (LPIL)
ASPIDOSIPHONIDAE
ASPIDOSIPHON ALBUS
ASPIDOSIPHON MUELLERI
GOLFINGIIDAE
GOLFINGIA SP.66
GOLFINGIA TRICHOCEPHALA
PHASCOLION STROMBI

TUSCALOOSA TREND REGIONAL DATA SEARCH AND SYNTHESIS STUDY

FINAL REPORT
VOLUME II SUPPLEMENTAL REPORTS

APPENDIX B

DISTRIBUTION OF FISHES AND PENAEID SHRIMP OF COMMERCIAL AND RECREATIONAL IMPORTANCE ON THE CONTINENTAL SHELF OFF MISSISSIPPI AND ALABAMA

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June 1985

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INTRODUCTION

The Tuscaloosa Trend study area includes the continental shelf seaward of the barrier islands, and the study would not be complete without addressing the biology of this shelf region, giving particular attention to those species of commercial and recreational importance. During the past four decades many trawl studies have been carried out in this area, most of which are unpublished. However, the basic collecting data are available and can be used to provide a reasonably detailed account of the seasonal compositions and densities and, by implication, the seasonal dynamics of the various species. It is the purpose of the present study to bring together and analyze the most reliable trawl data available for the continental shelf from the Mississippi River Delta tothe Alabama-Florida border and to supplement this with information from other sources in order to provide state-of-the-art insight into the seasonal dynamics of key shrimp and fish species.

Doubt has been cast upon the validity of taxonomic identifications in many of the earlier collections for two reasons. During the early years new species were being described and older ones redefined. In addition, on some of the cruises identifications were made on shipboard by unknown and possibly incompetent personnel. In order to circumvent these problems it has been necessary to utilize only the most recent data and to avoid, wherever possible, identifications not known to have been made by competent taxonomists. A further safeguard is to base the analyses upon those species which are most readily recognized and least subject to taxonomic confusion. These are the procedures followed in the present study. Whereas, there may be occasional taxonomic errors in the total species list, high reliance may be placed upon the identifications of species employed in the actual analyses.

FISHES

A large data base was assembled to provide information concerning species composition and seasonal density patterns of the fishes of the continental shelf seaward of the barrier islands from the Mississippi River Delta to the Alabama-Florida border. This comprehensive data base was constructed from six separate data sets which are listed below.

1. GCRL - Monthly transects across the shelf by personnel of the Gulf Coast Research Laboratory of Ocean Springs, MS.

2. MBT - Monthly transects across the shelf by personnel of the National Marine Fisheries Service laboratory in Galveston, TX and referred to in the published paper by Moore, Brusher and Trent (1970).

3. DD - Collections made throughout the area during the spring season by personnel of the Oceanography Department of Texas A&M University under the supervision of Darnell and Defenbaugh (see Defenbaugh, 1976).

4. MAFLA - Seasonal collections made at scattered localities during the BLM-sponsored MAFLA study.

5. McCAFFREY - Random collections made during all seasons by McCaffrey for a Ph.D dissertation at Florida State University (see McCaffrey, 1981).

6. PASCAGOULA - Random collections made throughout the area during all seasons by personnel of the National Marine Fisheries Service laboratory in Pascagoula, MS. The data are from cruises of the FRS OREGON II during the years 1975-1982.

For all data sets the taxonomy was updated, and equations were applied so that each trawl collection is expressed as 60 minutes of trawling effort by a standard trawl of 45 foot headrope length and trawl doors of dimensions 84 inches by 40 inches towed at a rate of 3 knots. Station representation throughout the area is considered adequate for all seasons except for two problems. Stations tend to be scarce east of Perdido Bay in the area less than 40 m deep and along the entire shelf edge at depths greater than 120 m. Thus, the distribution patterns and limits in the east and in deeper waters have had to be defined in a less objective way than elsewhere. Despite these limitations, the information presented herein is considered to be by far the most critical inspection of the composition and distribution of the shelf ichthyofauna of this section of the continental shelf ever presented.

TOTAL FISH CATCH

Although the primary focus will be upon species and groups of commercial and recreational importance, preliminary attention will be given to the composition and distribution of the entire trawlable ichthyofauna. The combined data base includes 201,585 fishes representing 250 taxa. In Table 1 these are listed in phylogenetic order with the number of individuals given for each taxon. Since several field collections were often combined as a single station, rare species may appear as a fraction of a single individual.

In Table 2 the fish taxa are listed in order of numerical abundance together with their percentage of the total catch. The two most abundant species (*Stenotomus caprinus* and *Micropogonias undulatus*) made up about 36 percent of the total catch, and these were also the two most abundant species encountered on the northwestern Gulf shelf (Darnell et al., 1983). The four most abundant species made up over 50 percent of the entire catch.

In Figure 1 the seasonal abundance of the combined catch is displayed. In the winter two general areas of abundance are noted where the catch rate exceeded 1,000 fishes per hour of trawling effort. The first is a broad area, basically between 20 and 40 m from Perdido Bay to the Chandeleur Islands. This appears to be the wintering grounds for fishes from the nursery grounds of Mobile Bay, Mississippi Sound, and the Biloxi marshes of Louisiana. The second area lies in waters of all depths just east of the Mississippi River Delta outlets. This appears to be the wintering grounds for the fishes whose nursery is the delta marshes. In spring the patterns are broken into a series of high density areas with no clear-cut definition. This probably relates to the fact that many species spawn in late winter and spring and the catch of juveniles plus adults confounds the analysis. During summer high densities stretched southward from Mobile Bay and eastward from Breton Sound, converging in an area of extremely high density in an area south of Pascagoula, MS in the depth range of 30-50 m. Here, catch density exceeded 10,000 fishes per hour of trawling. This pattern appears to represent the swarms of young which are migrating from the nurseries added to the older individuals which have remained on the shelf. These migrations likely stem from Mobile Bay and the Pascagoula marshes to the north and the Louisiana marshes via the Gulf Outlet

Table 1. Listing of the fish taxa in the comprehensive fish data base by family, giving both the scientific and common names and providing the number of individuals of each taxon in the total catch.

Taxon		Abundance
Scientific name	Common name	(Number)
Carcharhinidae	REQUIEM SHARKS	
Carcharhinus acronotus	blacknose shark	3.1
Mustelus canis	smooth dogfish	6.2
Mustelus sp.		3.1
Rhizoprionodon terraenovae	Atlantic sharpnose shark	14.5
Sphyrnidae	HAMMERHEAD SHARKS	
Sphyrna tiburo	bonnethead	5.9
Squatinidae	ANGEL SHARKS	
Squatina dumerili	Atlantic angel shark	16.0
Rhinobatidae	GUITARFISHES	
Rhinobatos lentiginosus	Atlantic guitarfish	.1
Torpedinidae	ELECTRIC RAYS	
Narcine brasiliensis	lesser electric ray	89.3
Rajidae	SKATES	
Breviraja sp.		15.5
Raja eglanteria	clearnose skate	29.3
Raja garmani	rosette skate	38.8
Raja texana	roundel skate	247.1
Dasyatidae	STINGRAYS	
Dasyatis americana	southern stingray	19.6
Dasyatis sabina	Atlantic stingray	22.6
Dasyatis sayi	bluntnose stingray	7.5
Myliobatidae	EAGLE RAYS	
Rhinoptera bonasus	cownose ray	8.2
Anguillidae	FRESHWATER EELS	
Anguilla rostrata	American eel	.8

Moringuidae	SPAGHETTI EELS	
Moringua sp.		12.9
Muraenidae	MORAYS	
Gymnothorax nigromarginatus	blackedge moray	226.5
Nettastomidae	DUCKBILL EELS	
Hoplunnis diomedianus	blacktail pike-conger	64.6
Hoplunnis macrurus	freckled pike-conger	18.4
Hoplunnis tenuis	spotted pike-conger	124.7
Congridae	CONGER EELS	
Ariosoma balearicum	bandtooth conger	42.7
Hildebrandia flava	yellow conger	163.5
Paraconger caudilimbatus	margintail conger	25.8
Uroconger syringinus	threadtail conger	6.1
Ophichthidae	SNAKE EELS	
Ophichthus gomesi	shrimp eel	1.4
Ophichthus ocellatus	palespotted eel	7.4
Clupeidae	HERRINGS	
Alosa chrysochloris	skipjack herring	1.0
Brevoortia patronus	gulf menhaden	92.9
Etrumeus teres	round herring	105.8
Harengula jaguana	scaled sardine	1,039.0
Opisthonema oglinum	Atlantic thread herring	25.3
Sardinella aurita	Spanish sardine	17.4
Engraulidae	ANCHOVIES	
Anchoa hepsetus	striped anchovy	3,974.9
Anchoa lyolepis	dusky anchovy	231.1
Anchoa mitchilli	bay anchovy	675.0
Argentinidae	ARGENTINES	
Argentina striata	striated argentine	28.4
Glossanodon pygmaeus	pygmy argentine	6.1
Synodontidae	LIZARDFISHES	
Saurida brasiliensis	largescale lizardfish	18,216.0
Saurida normani	shortjaw lizardfish	65.8
Synodus foetens	inshore lizardfish	3,948.6
Synodus intermedius	sand diver	92.8
Synodus poeyi	offshore lizardfish	481.8
Trachinocephalus myops	snakefish	649.8

Chlorophthalmidae	GREENEYES	
Chlorophthalmus agassizi	shortnose greeneye	25.8
Myctophidae	LANTERNFISHES	
Myctophidae (undet.)		2.8
Diaphus dumerili		9.2
Ariidae	SEA CATFISHES	
Arius felis	hardhead catfish	4,519.8
Bagre marinus	gafftopsail catfish	139.9
Batrachoididae	TOADFISHES	
Porichthys plectrodon	Atlantic midshipman	588.1
Lophiidae	GOOSEFISHES	
Lophiidae (undet.)		.2
Lophius americanus	goosefish	12.1
Antennariidae	FROGFISHES	
Antennarius radiosus	singlespot frogfish	548.9
Ogcocephalidae	BATFISHES	
Dibranchus atlanticus	offshore batfish	39.6
Halieutichthys aculeatus	pancake batfish	2,460.4
Ogcocephalus corniger		25.8
Ogcocephalus parvus	roughback batfish	220.5
Ogcocephalus radiatus	polka-dot batfish	24.3
Ogcocephalus sp.		96.6
Zalieutes mcgintyi	tricorn batfish	1,551.4
Bregmacerotidae	CODLETS	
Bregmaceros atlanticus	antenna codlet	27.2
Gadidae	CODFISHES	
Merluccius albidus		25.8
Physiculus fulvus		242.9
Steindachneria argentea	luminous hake	2,069.4
Urophycis cirrata	gulf hake	263.2
Urophycis earlli	Carolina hake	144.7
Urophycis floridana	southern hake	766.6
Urophycis regia	spotted hake	293.3
Macrouridae	GRENADIERS	
Hymenocephalus cavernosus		39.6

Ophidiidae	CUSK-EELS	
Ophidiidae (undet.)		3.1
Brotula barbata	bearded brotula	136.9
Brotula sp.		29.8
Lepophidium graellsi	blackedge cusk-eel	335.6
Lepophidium jeannae	mottled cusk-eel	15.7
Lepophidium profundorum	offshore cusk-eel	73.0
Lepophidium sp.		79.4
Neobythites gilli		385.9
Ophidion grayi	blotched cusk-eel	9.4
Ophidion holbrooki	bank cusk-eel	37.6
Ophidion marginatum	striped cusk-eel	103.5
Ophidion welshi	crested cusk-eel	28.6
Ophidion sp.		8.9
Otophidium omostigmum	polka-dot cusk-eel	2.8
Exocoetidae	FLYINGFISHES	
Hemirhamphus brasiliensis	ballyhoo	3.0
Holocentridae	SQUIRRELFISHES	
Ostichthys trachypoma	bigeye soldierfish	3.7
Caproidae	BOARFISHES	
Antigonia capros	deepbody boarfish	1.9
Centriscidae	SNIPEFISHES	
Macrorhamphosus scolopax	longspine snipefish	90.5
Syngnathidae	PIPEFISHES	
Hippocampus erectus	lined seahorse	35.1
Hippocampus zosterae	dwarf seahorse	.4
Percichthyidae	TEMPERATE BASSES	
Synagrops bellus	blackmouth bass	168.9
Synagrops spinosa		55.5
Serranidae	SEA BASSES	
Centropristis ocyurus	bank sea bass	1,031.2
Centropristis philadelphica	rock sea bass	5,882.0
Diplectrum bivittatum	dwarf sand perch	3,424.9
Diplectrum formosum	sand perch	150.7
Epinephelus flavolimbatus	yellowedge grouper	3.1
Epinephelus niveatus	snowy grouper	21.6
Gonioplectrus hispanus	Spanish flag	36.4
Hemanthias leptus	longtail bass	.2
Hemanthias vivanus	red barbier	51.7
Liopropoma sp.		104.2

Serranidae (continued)		
Serraniculus pumilio	pygmy sea bass	36.4
Serranus atrobranchus	blackear bass	2,543.2
Serranus notospilus	saddle bass	1,756.0
Grammistidae	SOAPFISHES	
Rypticus bistrispinus	freckled soapfish	40.0
Priacanthidae	BIGEYES	
Priacanthus arenatus	bigeye	13.0
Pristigenys alta	short bigeye	27.9
Apogonidae	CARDINALFISHES	
Apogon aurolineatus	bridle cardinalfish	285.4
Apogon pseudomaculatus	twospot cardinalfish	6.1
Malacanthidae	TILEFISHES	
Caulolatilus intermedius	anchor tilefish	90.4
Caulolatilus microps	blueline tilefish	38.4
Pomatomidae	BLUEFISHES	
Pomatomus saltatrix	bluefish	.5
Rachycentridae	COBIAS	
Rachycentron canadum	cobia	9.4
Echeneidae	REMORAS	
Echeneis naucrates	sharksucker	11.2
Carangidae	JACKS	
Caranx crysos	blue runner	86.4
Chloroscombrus chrysurus	Atlantic bumper	1,140.7
Decapterus punctatus	round scad	120.2
Hemicaranx amblyrhynchus	bluntnose jack	40.0
Oligoplites saurus	leatherjacket	76.6
Selar crumenophthalmus	bigeye scad	32.9
Selene setapinnis	Atlantic moonfish	74.6
Selene vomer	lookdown	35.4
Seriola dumerili	greater amberjack	19.9
Trachurus lathami	rough scad	1,064.3
Lutjanidae	SNAPPERS	
Lutjanus campechanus	red snapper	1,131.8
Lutjanus synagris	lane snapper	37.6
Pristipomoides aquilonaris	wenchman	923.0
Rhomboplites aurorubens	vermilion snapper	9.2

Gerreidae	MOJARRAS	
Diapterus plumieri	striped mojarra	15.5
Eucinostomus argenteus	spotfin mojarra	3.9
Eucinostomus gula	silver jenny	1,106.9
Eucinostomus sp.		22.3
Haemulidae	GRUNTS	
Orthopristis chrysoptera	pigfish	131.8
Sparidae	PORGIES	
Archosargus probatocephalus	sheepshead	12.6
Calamus leucosteus	whitebone porgy	3,342.3
Lagodon rhomboides	pinfish	1,296.2
Pagrus pagrus	red porgy	7.9
Stenotomus caprinus	longspine porgy	39,533.3
Sciaenidae	DRUMS	
Bairdiella chrysoura	silver perch	2.6
Cynoscion arenarius	sand seatrout	3,005.0
Cynoscion nothus	silver seatrout	523.8
Cynoscion sp.		98.6
Equetus acuminatus	high-hat	41.8
Equetus lanceolatus	jackknife-fish	52.9
Equetus umbrosus	cubbyu	33.5
Equetus sp.		1.4
Larimus fasciatus	banded drum	515.5
Leiostomus xanthurus	spot	5,994.3
Menticirrhus americanus	southern kingfish	549.5
Micropogonias undulatus	Atlantic croaker	32,102.5
Pogonias cromis	black drum	17.8
Sciaenops ocellatus	red drum	21.6
Stellifer lanceolatus	star drum	347.4
Mullidae	GOATFISHES	
Mullus auratus	red goatfish	38.8
Upeneus parvus	dwarf goatfish	17.3
Ephippidae	SPADEFISHES	
Chaetodipterus faber	Atlantic spadefish	299.6
Labridae	WRASSES	
Decodon puellaris	red hogfish	1.8
Hemipteronotus novacula	pearly razorfish	222.1
Mugilidae	MULLETS	
Mugil cephalus	striped mullet	.2

Sphyraenidae	BARRACUDAS	
Sphyraena guachancho	guaguanche	22.7
Polynemidae	THREADFINS	
Polydactylus octonemus	Atlantic threadfin	.2
Opistognathidae	JAWFISHES	
Opistognathidae (undet.)		5.5
Percophidae	FLATHEADS	
Bembrops anatirostris	duckbill flathead	866.5
Uranoscopidae	STARGAZERS	
Astroscopus y-graecum	southern stargazer	.1
Gnathagnus egregius	freckled stargazer	12.9
Kathetostoma albigutta	lancer stargazer	43.7
Uranoscopus sp.		.1
Callionymidae	DRAGONETS	
Callionymus agassizi	spotfin dragonet	57.2
Gobiidae	GOBIES	
Bollmannia communis	ragged goby	924.6
Gobiosoma sp.		51.7
Trichiuridae	CUTLASSFISHES	
Trichiurus lepturus	Atlantic cutlassfish	511.0
Scombridae	MACKERELS	
Scomber japonicus	chub mackerel	9.0
Scomberomorus maculatus	Spanish mackerel	4.3
Stromateidae	BUTTERFISHES	
Hyperoglyphe perciformis	barrelfish	25.8
Peprilus alepidotus	harvestfish	144.8
Peprilus burti	gulf butterfish	12,931.3
Peprilus sp.		140.1
Scorpaenidae	SCORPIONFISHES	
Neomerinthe hemingwayi	spinycheek scorpionfish	53.6
Pontinus castor	longsnout scorpionfish	.1
Pontinus longispinis	longspine scorpionfish	2,395.0
Pontinus rathbuni	highfin scorpionfish	1.8

Scorpaenidae (continued)

Scorpaena agassizi	longfin scorpionfish	100.5
Scorpaena brasiliensis	barbfish	21.9
Scorpaena calcarata	smoothhead scorpionfish	642.3
Scorpaena dispar	hunchback scorpionfish	3.7
Triglidae	**SEAROBINS**	
Triglidae (undet.)		33.9
Bellator egretta	streamer searobin	29.6
Bellator militaris	horned searobin	297.8
Peristedion gracile	slender searobin	259.6
Peristedion miniatum	armored searobin	25.8
Prionotus alatus	spiny searobin	147.3
Prionotus martis	barred searobin	47.0
Prionotus ophryas	bandtail searobin	492.9
Prionotus paralatus	Mexican searobin	749.0
Prionotus roseus	bluespotted searobin	406.1
Prionotus rubio	blackfin searobin	4,961.3
Prionotus salmonicolor	blackwing searobin	1,347.6
Prionotus scitulus	leopard searobin	167.0
Prionotus stearnsi	shortwing searobin	437.3
Prionotus tribulus	bighead searobin	493.8
Prionotus sp.		240.4
Bothidae	**LEFTEYE FLOUNDERS**	
Bothidae (undet.)		37.0
Ancylopsetta dilecta	three-eye flounder	38.0
Ancylopsetta quadrocellata	ocellated flounder	109.9
Bothus sp.		3.1
Citharichthys cornutus	horned whiff	504.3
Citharichthys dinoceros		6.1
Citharichthys gymnorhinus	anglefin whiff	2.3
Citharichthys macrops	spotted whiff	98.9
Citharichthys spilopterus	bay whiff	282.5
Citharichthys sp.		18.9
Cyclopsetta chittendeni	Mexican flounder	362.2
Cyclopsetta fimbriata	spotfin flounder	4.6
Engyophrys senta	spiny flounder	33.9
Etropus crossotus	fringed flounder	1,535.0
Etropus microstomus	smallmouth flounder	1,719.0
Etropus rimosus	gray flounder	397.0
Monolene sessilicauda	deepwater flounder	1,211.3
Monolene sp.		2.4
Paralichthys albigutta	gulf flounder	.1
Paralichthys lethostigma	southern flounder	58.9
Paralichthys squamilentus	broad flounder	49.5
Syacium gunteri	shoal flounder	1,809.1
Syacium micrurum	channel flounder	575.9
Syacium papillosum	dusky flounder	2,490.9
Syacium sp.		206.9
Trichopsetta ventralis	sash flounder	422.0

Pleuronectidae	RIGHTEYE FLOUNDERS	
Poecilopsetta beanii		168.0
Soleidae	SOLES	
Gymnachirus melas	naked sole	17.5
Gymnachirus texae	fringed sole	98.8
Gymnachirus sp.		33.4
Trinectes maculatus	hogchoker	18.5
Cynoglossidae	TONGUEFISHES	
Symphurus civitatus	offshore tonguefish	336.1
Symphurus diomedianus	spottedfin tonguefish	102.1
Symphurus plagiusa	blackcheek tonguefish	217.4
Symphurus pusillus	northern tonguefish	13.3
Symphurus sp.		33.4
Triacanthodidae	SPIKEFISHES	
Parahollardia lineata	jambeau	24.0
Balistidae	LEATHERJACKETS	
Aluterus schoepfi	orange filefish	58.9
Aluterus scriptus	scrawled filefish	8.4
Balistes capriscus	gray triggerfish	379.1
Monacanthus hispidus	planehead filefish	279.8
Ostraciidae	BOXFISHES	
Lactophrys quadricornis	scrawled cowfish	6.0
Tetraodontidae	PUFFERS	
Lagocephalus laevigatus	smooth puffer	26.2
Sphoeroides dorsalis	marbled puffer	16.2
Sphoeroides nephelus	southern puffer	45.5
Sphoeroides parvus	least puffer	723.3
Sphoeroides sp.		18.5
Diodontidae	PORCUPINEFISHES	
Chilomycterus schoepfi	striped burrfish	10.2

Table 2. Listing of the fish taxa in the comprehensive fish data base in order of numerical abundance and giving both the number of individuals and percent of the total catch.

Rank	Taxon	Abundance	
		Number	Percent
1.	Stenotomus caprinus	39,533.3	19.76
2.	Micropogonias undulatus	32,102.5	16.05
3.	Saurida brasiliensis	18,216.0	9.11
4.	Peprilus burti	12,931.3	6.46
5.	Leiostomus xanthurus	5,994.3	3.00
6.	Centropristis philadelphica	5,882.0	2.94
7.	Prionotus rubio	4,961.3	2.48
8.	Arius felis	4,519.8	2.26
9.	Anchoa hepsetus	3,974.9	1.99
10.	Synodus foetens	3,948.6	1.97
11.	Diplectrum bivittatum	3,424.9	1.71
12.	Calamus leucosteus	3,342.3	1.67
13.	Cynoscion arenarius	3,005.0	1.50
14.	Serranus atrobranchus	2,543.2	1.27
15.	Syacium papillosum	2,490.9	1.25
16.	Halieutichthys aculeatus	2,460.4	1.23
17.	Pontinus longispinis	2,395.0	1.20
18.	Steindachneria argentea	2,069.4	1.03
19.	Syacium gunteri	1,809.1	0.90
20.	Serranus notospilus	1,756.0	0.88
21.	Etropus microstomus	1,719.0	0.86
22.	Zalieutes mcgintyi	1.551.5	0.78
23.	Etropus crossotus	1.535.0	0.77
24.	Prionotus salmonicolor	1.347.6	0.67
25.	Lagodon rhomboides	1.296.2	0.65
26.	Monolene sessilicauda	1,211.3	0.61
27.	Chloroscombrus chrysurus	1,140.7	0.57
28.	Lutjanus campechanus	1,131.8	0.57
29.	Eucinostomus gula	1,106.9	0.55
30.	Trachurus lathami	1,064.3	0.53
31.	Harengula jaguana	1,039.0	0.52
32.	Centropristis ocyurus	1,031.2	0.52
33.	Bollmannia communis	924.6	0.46
34.	Pristipomoides aquilonaris	923.0	0.46
35.	Bembrops anatirostris	866.5	0.43
36.	Urophycis floridana	766.6	0.38
37.	Prionotus paralatus	749.0	0.37
38.	Sphoeroides parvus	723.2	0.36
39.	Anchoa mitchilli	675.0	0.34
40.	Trachinocephalus myops	649.8	0.32
41.	Scorpaena calcarata	642.3	0.32
42.	Porichthys plectrodon	588.1	0.29
43.	Syacium micrurum	575.9	0.29
44.	Menticirrhus americanus	549.5	0.27
45.	Antennarius radiosus	548.9	0.27

46.	Cynoscion nothus	523.8	0.26
47.	Larimus fasciatus	515.5	0.26
48.	Trichiurus lepturus	511.0	0.26
49.	Citharichthys cornutus	504.3	0.25
50.	Prionotus tribulus	493.8	0.25
51.	Prionotus ophryas	492.9	0.25
52.	Synodus poeyi	481.8	0.24
53.	Prionotus stearnsi	437.3	0.22
54.	Trichopsetta ventralis	422.0	0.21
55.	Prionotus roseus	406.1	0.20
56.	Etropus rimosus	397.0	0.20
57.	Neobythites gillii	385.9	0.19
58.	Balistes capriscus	379.1	0.19
59.	Cyclopsetta chittendeni	362.2	0.18
60.	Stellifer lanceolatus	347.4	0.17
61.	Symphurus civitatus	336.1	0.17
62.	Lepophidium graellsi	335.6	0.17
63.	Chaetodipterus faber	299.6	0.15
64.	Bellator militaris	297.8	0.15
65.	Urophycis regia	293.3	0.15
66.	Apogon aurolineatus	285.4	0.14
67.	Citharichthys spilopterus	282.5	0.14
68.	Monacanthus hispidus	279.8	0.14
69.	Urophycis cirrata	263.2	0.13
70.	Peristedion gracile	259.6	0.13
71.	Raja texana	247.1	0.12
72.	Physiculus fulvus	242.9	0.12
73.	Prionotus sp.	240.4	0.12
74.	Anchoa lyolepis	231.1	0.12
75.	Gymnothorax nigromarginatus	226.5	0.11
76.	Hemipteronotus novacula	222.1	0.11
77.	Ogcocephalus parvus	220.5	0.11
78.	Symphurus plagiusa	217.4	0.11
79.	Syacium sp.	206.9	0.10
80.	Synagrops bellus	168.9	0.08
81.	Poecilopsetta beanii	168.0	0.08
82.	Prionotus scitulus	167.0	0.08
83.	Hildebrandia flava	163.5	0.08
84.	Diplectrum formosum	150.7	0.08
85.	Prionotus alatus	147.3	0.07
86.	Peprilus alepidotus	144.8	0.07
87.	Urophycis earlli	144.7	0.07
88.	Peprilus sp.	140.1	0.07
89.	Bagre marinus	139.9	0.07
90.	Brotula barbata	136.9	0.07
91.	Orthopristis chrysoptera	131.8	0.07
92.	Hoplunnis tenuis	124.7	0.06
93.	Decapterus punctatus	120.2	0.06
94.	Ancylopsetta quadrocellata	109.9	0.05
95.	Etrumeus teres	105.8	0.05
96.	Liopropoma sp.	104.2	0.05
97.	Ophidion marginatum	103.5	0.05
98.	Symphurus diomedianus	102.1	0.05
99.	Scorpaena agassizi	100.5	0.05

100.	Citharichthys macrops	98.9	0.05
101.	Gymnachirus texae	98.8	0.05
102.	Cynoscion sp.	98.6	0.05
103.	Ogcocephalus sp.	96.6	0.05
104.	Brevoortia patronus	92.9	0.05
105.	Synodus intermedius	92.8	0.05
106.	Macrorhamphosus scolopax	90.5	0.05
107.	Caulolatilus intermedius	90.4	0.05
108.	Narcine brasiliensis	89.3	0.04
109.	Caranx crysos	86.4	0.04
110.	Lepophidium sp.	79.4	0.04
111.	Oligoplites saurus	76.6	0.04
112.	Selene setapinnis	74.6	0.04
113.	Lepophidium profundorum	73.0	0.04
114.	Saurida normani	65.8	0.03
115.	Hoplunnis diomedianus	64.6	0.03
116.	Paralichthys lethostigma	58.9	0.03
117.	Aluterus schoepfi	58.9	0.03
118.	Callionymus agassizi	57.2	0.03
119.	Synagrops spinosa	55.5	0.03
120.	Neomerinthe hemingwayi	53.6	0.03
121.	Equetus lanceolatus	52.9	0.03
122.	Gobiosoma sp.	51.7	0.03
123.	Hemanthias vivanus	51.7	0.03
124.	Paralichthys squamilentus	49.5	0.02
125.	Prionotus martis	47.0	0.02
126.	Sphoeroides nephelus	45.5	0.02
127.	Kathetostoma albigutta	43.7	0.02
128.	Ariosoma balearicum	42.7	0.02
129.	Equetus acuminatus	41.8	0.02
130.	Hemicaranx amblyrhynchus	40.0	0.02
131.	Rypticus bistrispinus	40.0	0.02
132.	Dibranchus atlanticus	39.6	0.02
133.	Hymenocephalus cavernosus	39.6	0.02
134.	Mullus auratus	38.8	0.02
135.	Raja garmani	38.8	0.02
136.	Caulolatilus microps	38.4	0.02
137.	Ancylopsetta dilecta	38.0	0.02
138.	Lutjanus synagris	37.6	0.02
139.	Ophidion holbrooki	37.6	0.02
140.	Bothidae (undet.)	37.0	0.02
141.	Gonioplectrus hispanus	36.4	0.02
142.	Serraniculus pumilio	36.4	0.02
143.	Selene vomer	35.4	0.02
144.	Hippocampus erectus	35.1	0.02
145.	Triglidae (undet.)	33.9	0.02
146.	Engyophrys senta	33.9	0.02
147.	Equetus umbrosus	33.5	0.02
148.	Symphurus sp.	33.4	0.02
149.	Selar crumenophthalmus	32.9	0.02
150.	Brotula sp.	29.8	0.01
151.	Bellator egretta	29.6	0.01
152.	Raja eglanteria	29.3	0.01
153.	Ophidion welshi	28.6	0.01

154.	Argentina striata	28.4	0.01
155.	Pristigenys alta	27.9	0.01
156.	Bregmaceros atlanticus	27.2	0.01
157.	Lagocephalus laevigatus	26.2	0.01
158.	Hyperoglyphe perciformes	25.8	0.01
159.	Merluccius albidus	25.8	0.01
160.	Ogcocephalus corniger	25.8	0.01
161.	Paraconger caudilimbatus	25.8	0.01
162.	Peristedion miniatum	25.8	0.01
163.	Chlorophthalmus agassizi	25.8	0.01
164.	Opisthonema oglinum	25.3	0.01
165.	Ogcocephalus radiatus	24.3	0.01
166.	Parahollardia lineata	24.0	0.01
167.	Sphyraena guachancho	22.7	0.01
168.	Dasyatis sabina	22.6	0.01
169.	Eucinostomus sp.	22.3	0.01
170.	Scorpaena brasiliensis	21.9	0.01
171.	Epinephelus niveatus	21.6	0.01
172.	Sciaenops ocellatus	21.6	0.01
173.	Gymnachirus sp.	20.0	0.01
174.	Seriola dumerili	19.9	0.01
175.	Dasyatis americana	19.6	0.01
176.	Citharichthys sp.	18.9	0.009
177.	Sphoeroides sp.	18.5	0.009
178.	Trinectes maculatus	18.5	0.009
179.	Hoplunnis macrurus	18.4	0.009
180.	Pogonias cromis	17.8	0.009
181.	Gymnachirus melas	17.5	0.009
182.	Sardinella aurita	17.4	0.009
183.	Upeneus parvus	17.3	0.009
184.	Sphoeroides dorsalis	16.2	0.008
185.	Squatina dumerili	16.0	0.008
186.	Lepophidium jeannae	15.7	0.008
187.	Breviraja sp.	15.5	0.008
188.	Diapterus plumieri	15.5	0.008
189.	Rhizoprionodon terraenovae	14.5	0.007
190.	Symphurus pusillus	13.4	0.007
191.	Priacanthus arenatus	13.0	0.007
192.	Gnathagnus egregius	12.9	0.006
193.	Moringua sp.	12.9	0.006
194.	Archosargus probatocephalus	12.6	0.006
195.	Lophius americanus	12.1	0.006
196.	Echeneis naucrates	11.2	0.006
197.	Chilomycterus schoepfi	10.2	0.005
198.	Ophidion grayi	9.4	0.005
199.	Rachycentron canadum	9.4	0.005
200.	Rhomboplites aurorubens	9.2	0.005
201.	Diaphus dumerili	9.2	0.005
202.	Scomber japonicus	9.0	0.004
203.	Ophidion sp.	8.9	0.004
204.	Aluterus scriptus	8.4	0.004
205.	Rhinoptera bonasus	8.2	0.004
206.	Pagrus pagrus	7.9	0.004
207.	Dasyatis sayi	7.5	0.004

208.	Ophichthus ocellatus	7.4	0.004
209.	Mustelus canis	6.2	0.003
210.	Apogon pseudomaculatus	6.1	0.003
211.	Citharichthys dinoceros	6.1	0.003
212.	Glossanodon pygmaeus	6.1	0.003
213.	Uroconger syringinus	6.1	0.003
214.	Lactophrys quadricornis	6.0	0.003
215.	Sphyrna tiburo	5.8	0.003
216.	Opistognathidae (undet.)	5.5	0.003
217.	Cyclopsetta fimbriata	4.6	0.002
218.	Scomberomorus maculatus	4.3	0.002
219.	Eucinostomus argenteus	3.9	0.002
220.	Ostichthys trachypoma	3.7	0.002
221.	Scorpaena dispar	3.7	0.002
222.	Bothus sp.	3.1	0.002
223.	Carcharhinus acronotus	3.1	0.002
224.	Mustelus sp.	3.1	0.002
225.	Ophidiidae (undet.)	3.1	0.002
226.	Epinephelus flavolimbatus	3.1	0.002
227.	Hemiramphus brasiliensis	3.1	0.002
228.	Citharichthys gymnorhinus	2.8	0.001
229.	Otophidium omostigmum	2.8	0.001
230.	Myctophidae (undet.)	2.8	0.001
231.	Bairdiella chrysoura	2.6	0.001
232.	Monolene sp.	2.4	0.001
233.	Antigonia capros	1.9	0.0009
234.	Decodon puellaris	1.8	0.0009
235.	Pontinus rathbuni	1.8	0.0009
236.	Ophichthus gomesi	1.4	0.0007
237.	Equetus sp.	1.4	0.0006
238.	Alosa chrysochloris	1.0	0.0005
239.	Anguilla rostrata	0.8	0.0004
240.	Pomatomus saltatrix	0.5	0.0003
241.	Hippocampus zosterae	0.4	0.0002
242.	Mugil cephalus	0.2	0.0001
243.	Hemanthias leptus	0.2	0.0001
244.	Lophiomus sp.	0.2	0.0001
245.	Polydactylus octonemus	0.2	0.0001
246.	Rhinobatos lentiginosus	0.2	0.0001
247.	Uranoscopus sp.	0.1	0.0001
248.	Pontinus castor	0.1	0.0001
249.	Paralichthys albigutta	0.1	0.0001
250.	Astroscopus y-graecum	0.1	0.0001

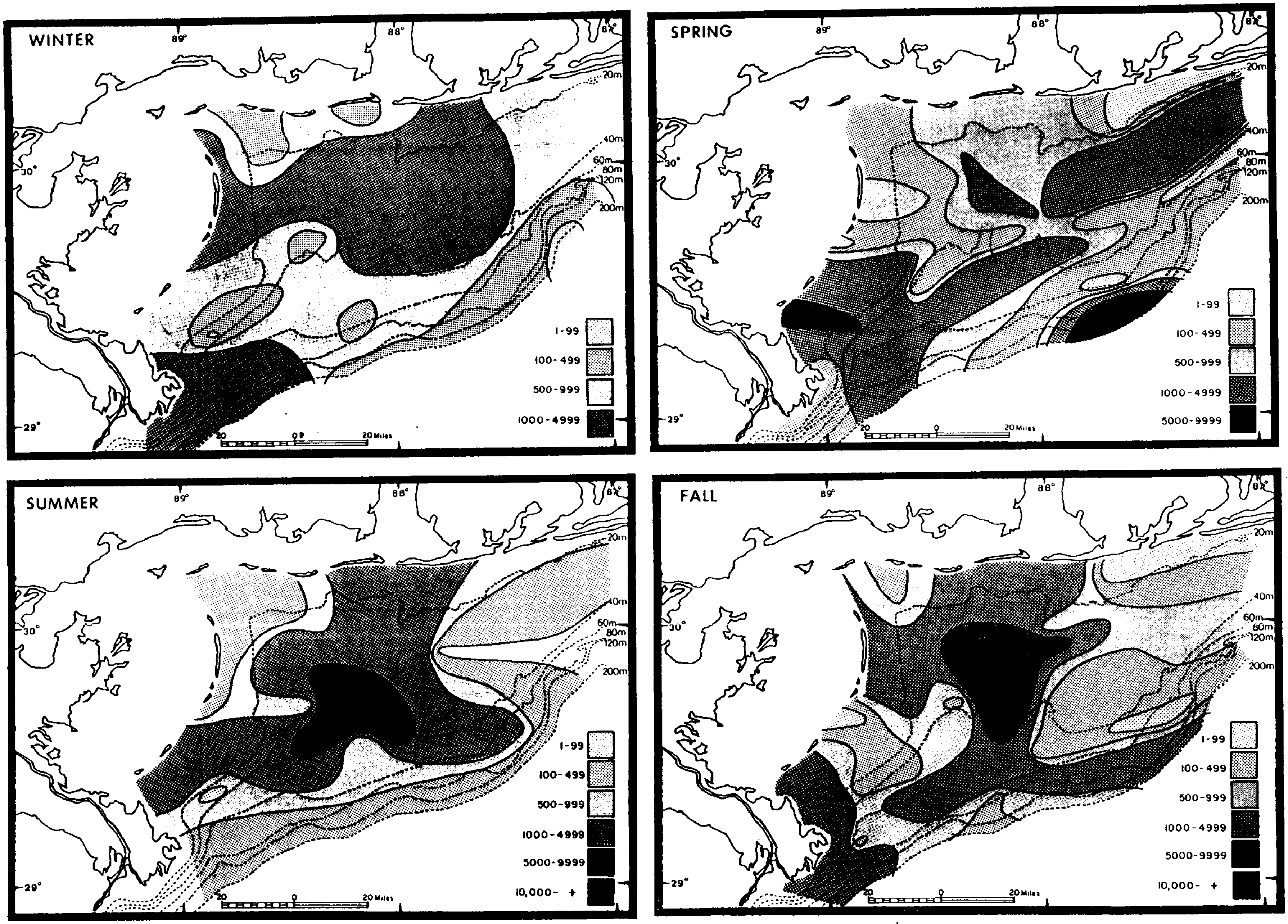

Figure 1. Seasonal abundance of the combined catch for all species considered in the synthesis of fish and shrimp collection data. Number of individuals captured per hour trawling.

Canal to the west. During fall the pattern has shifted slightly. The high density area still extends southward from Mobile Bay with some flow from Cat Island Channel and around the Chandeleur Islands. The flow from Breton Sound appears to remain close to the delta marshes. The area of very high density is still observed south of Pascagoula in the 30-50 m depth range. However, during the fall there appears to be an expansion of the high density area in the depth ranges beyond 50 m. These seasonal patterns for the combined catch will be examined in terms of the individual component species and groups of commercial and recreational importance.

SHARKS

At least 26 species of sharks are known from the northern Gulf of Mexico (Hoese, et al., 1977). Some are basically offshore species which may occasionally stray onto the continental shelf, and others are quite rare or poorly known. Fifteen species are considered to be fairly common in shelf waters of the north central Gulf, and these include the following:

Odontaspididae	SAND TIGERS
Odontaspis taurus	sand tiger
Carcharhinidae	REQUIEM SHARKS
Carcharhinus acronotus	blacknose shark
Carcharhinus brevipinna	spinner shark
Carcharhinus falciformis	silky shark
Carcharhinus isodon	finetooth shark
Carcharhinus leucas	bull shark
Carcharhinus limbatus	blacktip shark
Galeocerdo cuvieri	tiger shark
Mustelus canis	smooth dogfish
Negaprion brevirostris	lemon shark
Rhizoprionodon terraenovae	Atlantic sharpnose shark
Sphyrnidae	HAMMERHEAD SHARKS
Sphyrna lewini	scalloped hammerhead
Sphyrna mokarran	great hammerhead
Sphyrna tiburo	bonnethead
Squatinidae	ANGEL SHARKS
Squatina dumerili	Atlantic angel shark

The life histories of most shark species are not well documented, but some appear to move into shallower waters during the spring and summer and to retreat into deeper waters of the shelf during the cooler months. The bull shark enters rivers and fresher estuaries during the summer, and the bonnethead may be found in saltier bays and sounds. During the summer the young of several species appear inshore in such habitats as marsh channels (lemon shark) and surf zone (finetooth shark and Atlantic sharpnose shark). All of the sharks on the above list may be expected to occur throughout much of the continental shelf beyond the barrier islands. They may be taken by anglers fishing from piers and jetties or from around oil rigs and snapper banks in deeper water. Some are excellent game fish, and properly prepared, the flesh is quite edible.

Sharks are rarely taken in trawls, and most trawl fishermen consider sharks to be nuisances. In the present data base only 49 specimens were recorded representing six taxa. Together they constituted only 0.024 percent of the total fish catch. Included were the following:

Carcharhinidae	REQUIEM SHARKS	
Carcharhinus acronotus	blacknose shark	3
Mustelus canis	smooth dogfish	6
Mustelus sp.		3
Rhizoprionodon terraenovae	Atlantic sharpnose shark	15
Sphyrnidae	HAMMERHEAD SHARKS	
Sphyrna tiburo	bonnethead	6
Squatinidae	ANGEL SHARKS	
Squatina dumerili	Atlantic angel shark	16

Of the 21 station occurrences of these sharks, nine were in the winter, one in the spring, three in the summer, and eight in the fall. As a group, they were more than four times as abundant in the fall and winter than in the spring and summer. All but one of the occurrences was east of Mobile Bay. Most appeared in the shallower portion of the shelf (9-91 m), but the Atlantic angel shark appeared only in the depth range of 73 to 186 m.

Clupeidae - HERRINGS

Of the herrings, only the menhaden (Brevoortia spp.) are of commercial interest in the area. Three species are potentially present, the finescale menhaden (B. gunteri), gulf menhaden (B. patronus), and yellowfin menhaden (B. smithi). In the trawl collections only the gulf menhaden was taken, and this was relatively rare (93 specimens or 0.05 percent of the total fish catch). This species appeared at seven stations, five in the winter and two in the fall. All were taken in very shallow waters (9-16 m). These occurred along the coast and barrier islands from off Perdido Bay to Ship Island, with a single occurrence just east of the Mississippi River delta in the winter. Even though large populations of menhaden inhabit the area seasonally, they are pelagic and rarely appear in trawl collections.

Ariidae - SEA CATFISHES

The sea catfishes are represented on the north central Gulf shelf by two species, the hardhead catfish (Arius felis) and the gafftopsail catfish (Bagre marinus). The hardhead catfish is of some recreational and commercial interest and will be addressed here. A total of 4,520 specimens of this species was taken, representing 2.26 percent of the total catch. This was the eighth most abundant species taken. Only 4.2 percent of the specimens were collected during the summer, but between 31.6 and 32.5 percent of the individuals appeared at each of the other seasons.

The seasonal distribution patterns of the hardhead catfish are shown in Figure 2. At no season did the species appear in waters deeper than 37 m, and it was never abundant deeper than about 20 m. No specimens were actually

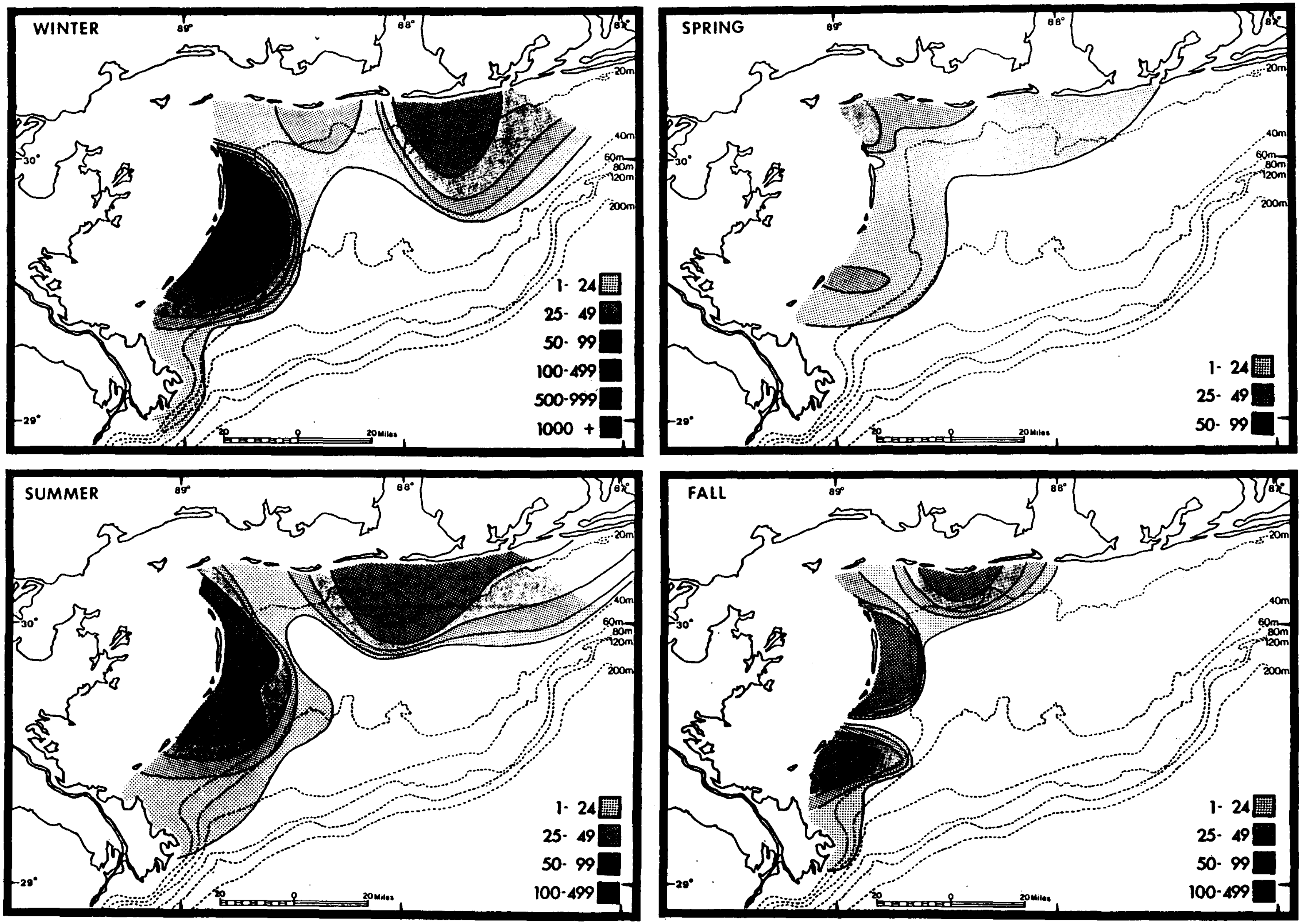

Figure 2. Seasonal distribution patterns of Arius felis on the outer continental shelf of the Tuscaloosa Trend study area. Number of individuals captured per hour trawling.

collected east of Perdido Bay, but few stations were made in shallow water of this area, and the distribution of the species in this portion of the shelf is not known.

The life history of the hardhead catfish in Mississippi Sound and adjacent areas has recently been discussed in detail by Benson (1982). He noted that during the period May-August the adults move into rivers and bays to spawn, and this apparently accounts for the relative scarcity of the species on the shelf during the summer months. Adults move out in the fall and overwinter on the shelf. Here they tend to concentrate around the passes and barrier islands.

Serranidae - SEA BASSES

Thirteen taxa of sea basses appeared in the fish data base, and together they included 15,041.6 specimens or 7.46 percent of the total catch. Four species were among the twenty most abundant, and these included the rock sea bass (Centropristis philadelphica), dwarf sand perch (Diplectrum bivittatum), blackear bass (Serranus atrobranchus), and saddle bass (Serranus notospilus).

The seasonal patterns of distribution for the sea bass family (all taxa combined) are presented in Figure 3. The family was present throughout the shelf at all seasons. During the winter there was a major area of concentration south of Mobile Bay in the depth range of 30-40 m where concentrations exceeded 2,500 fishes per hour of trawling. During the spring no areas of heavy concentration appeared, but the densest areas (i.e., with greater than 100 fishes per hour) tended to occur in waters deeper than 30 m. The summer was marked by the reappearance of the very dense area off Mobile Bay at a depth of 30-40 m, and densities exceeding 100 fish per hour were noted in the area west of Perdido Bay to the Chandeleur Islands in the depth range of 25-70 m. The fall pattern was almost the mirror image of that observed during the summer. An area of very high density was observed in very deep water (60-200 m) south of Perdido Bay, and fairly dense areas occurred across the mid-shelf east of Pascagoula and in deeper water west of Pascagoula. These strange and complex seasonal patterns result from the fact that several species are included, each with its own specific time and area of concentration.

Among the serranids the species of greatest commercial importance are the groupers. Only two species appeared in the collections, the yellowedge grouper (Epinephelus flavolimbatus) and the snowy grouper (E. niveatus). The former was represented by 3.1 individuals (0.002 percent of the total catch), and the latter included 21.6 individuals (0.01 percent of the catch). The yellowedge grouper occurred at a single station in winter at a depth of 77 m south of Horn Island, and the snowy grouper appeared at two stations in the spring and fall at 51 and 62 m south of Petit Bois and Horn Islands. The jewfish (E. itajara) and the red grouper (E. morio) which also occur in the area did not appear in the trawl collections.

Malacanthidae - TILEFISHES

Four species of tilefish likely occur on outer portions of the continental shelf in the north central Gulf of Mexico. These included the anchor

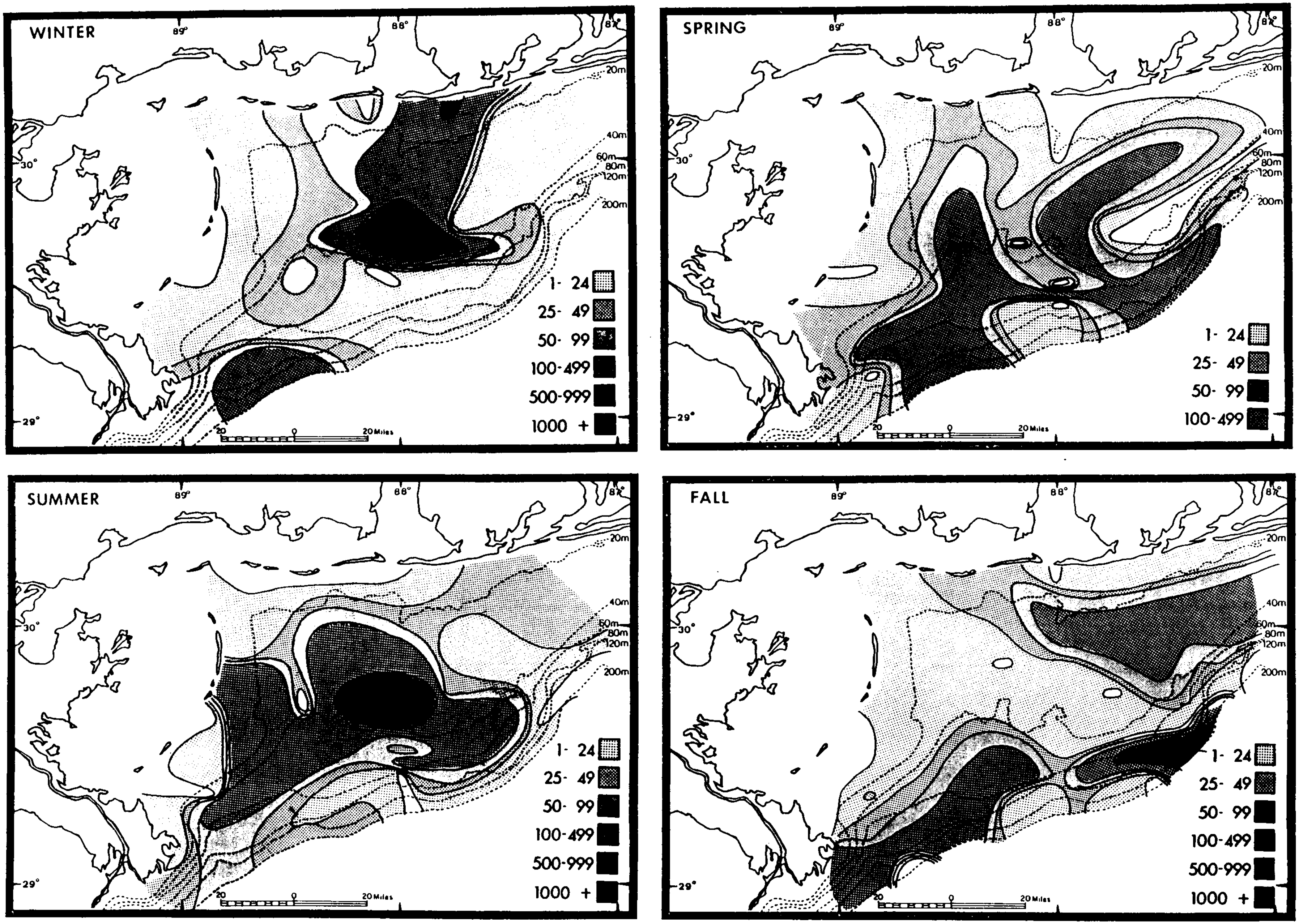

Figure 3. Seasonal distribution patterns of the family Serranidae on the outer continental shelf of the Tuscaloosa Trend study area. Number of individuals captured per hour trawling.

tilefish (Caulolatilus intermedius), blueline tilefish (C. microps), tilefish (Lopholatilus chamaeleonticeps), and sand tilefish (Malacanthus plumieri). Only two of these species appeared in the present data base, the anchor tilefish and the blueline tilefish. The anchor tilefish appeared at five stations, one each in the winter and summer and three in the fall. A total of 90.4 fish was taken in the depth range of 40-113 m. All occurred west of Mobile Bay, and most were taken near the Mississippi River Delta. The blueline tilefish occurred at seven stations, four in the spring and one each at the other seasons. A total of 38.4 fish was included in collections in the depth range of 55-183 m. Most were taken from the outer shelf below Horn Island and Mobile Bay, but six individuals appeared in a single sample from the estern edge of the DeSoto Canyon at a depth of 183 m. In no case did the two species co-occur in a given sample.

Pomatomidae - BLUEFISHES

The bluefish (Pomatomus saltatrix) breeds on the outer shelf, and young often use bays and sounds as nursery areas. This is a prized game fish and its flesh is considered excellent. This fast-swimming nektonic species seldom appears in trawl collections, and in the present data base it was represented by 0.5 specimens. It occurred at three stations, one in the winter and two in the summer. In the winter it occurred at the west end of Horn Island at a depth of nine meters, and in the summer it occurred on the mid-shelf below Petit Bois Island at depths of 55 and 73 m.

Rachycentridae - COBIAS

The life history of the cobia (Rachycentron canadum) is similar to that of the bluefish. It breeds on the outer shelf and uses the sounds as nursery areas. As in the case of the bluefish, the cobia appeared at one winter and two summer stations. The winter occurrence was at a depth of 55 m south of Petit Bois Island, and the summer specimens were taken at 11 m off the Chandeleur Islands at at 37 m below Dauphin Island. A total of 9.3 fish was taken.

Carangidae - JACKS

Most carangids are rather fast-swimming nektonic species which are seldom abundant in trawl collections. Several species are excellent game fishes, and they are also fine food fishes. Most breed on the outer continental shelf, and the young move inshore during the warmer months. Ten species appeared in the present data base, and together they included 2,691 individuals constituting 1.3 percent of the total fish catch. The species of greatest interest to the fishermen are the blue runner (Caranx crysos), crevalle jack (C. hippos), horse-eye jack (C. latus), bluntnose jack (Hemicaranx amblyrhynchus), greater amberjack (Seriola dumerili), lesser amberjack (S. fasciata), and Florida pompano (Trachinotus carolinus). Of these species only the blue runner, bluntnose jack, and greater amberjack appeared in the fish data base. A total of 86.4 specimens of the blue runner was taken at two stations. In the spring it appeared at 18 m off the Chandeleur Islands, and in the fall it occurred at 15 m just east of the Mississippi Delta. In the fall 40 specimens of the bluntnose jack were taken at a single station at 29 m off Horn Island.

The greater amberjack appeared at two summer stations at 37 and 38 m south of Petit Bois Island and Mobile Bay.

Coryphaenidae - DOLPHINS

Dolphins are highly prized pelagic game and food fishes which inhabit waters of the outer shelf, although young have been reported in inshore waters. In the northern Gulf they appear during the warmer months, but the life history is not well known. Two species are likely present in the north central Gulf, the pompano dolphin (Coryphaena equisetis) which seldom exceeds a length of 75 cm, and the common dolphin (Coryphaena hippurus) which may exceed 1.5 m in length. Neither species appeared in the fish data base.

Lutjanidae - SNAPPERS

The snappers are carnivorous fishes which are common around rocks, reefs, wrecks, and oil rigs on the outer half of the continental shelf. Larger individuals are prized game and commercial fishes, and the red snapper, in particular, is highly sought after. They are bottom fishes and are sometimes encountered away from rocks and other structures. Hoese et al. (1977) recorded ten species from the northern Gulf shelf. Some of these are small and others are quite rare. Four species appeared in the present data base and these included the red snapper (Lutjanus campechanus), lane snapper (L. synagris), wenchman (Pristipomoides aquilonaris), and vermilion snapper (Rhomboplites aurorubens). Together they included 2,101.6 fishes or 1.0 percent of the total catch. The seasonal distribution patterns for all species of the family are given in Figure 4. During the winter the family occupied most of the water between 20 and 120 m in the area west of Perdido Bay. High density appeared between 30 and 40 m south of Mobile Bay. In the spring the pattern was broken up into smaller areas, all of low density. Much the same pattern occurred during the summer. In the fall two areas of moderately high density were noted, one between 40 and 60 m below Petit Bois Island, and the other on the outer shelf beyond 100 m south of Perdido Bay. These patterns reflect primarily the combined distribution of the red snapper and wenchman which constituted most of the snapper catch.

The seasonal distribution of the red snapper is given in Figure 5. The species varied dramatically in seasonal abundance with 80.7 percent being taken during the winter, 1.9 percent in the spring, 6.7 percent in the summer, and 10.7 percent in the fall. During the winter this species was taken from 20 to 60 m in the shelf area west of Perdido Bay, and it was concentrated in an area 30-50 m deep south of Mobile Bay. In the spring only a few red snappers were taken in the area west of Mobile Bay at depths of 9-91 m, and no areas of concentration were observed. During the summer there were a few individuals taken from Mobile Bay westward in depths of 7-91 m, and one small area of moderate concentration was noted off the Chandeleur Islands. In the fall the species were quite widespread from Mobile Bay, westward, and there were no areas of concentration.

The life history of the red snapper has recently been reviewed by Benson (1982). During the winter months adults are found in deeper waters of the outer shelf where they school around wrecks and reefs. During the warmer months they move to the mid-shelf where they spawn at depths of 16-37 m during

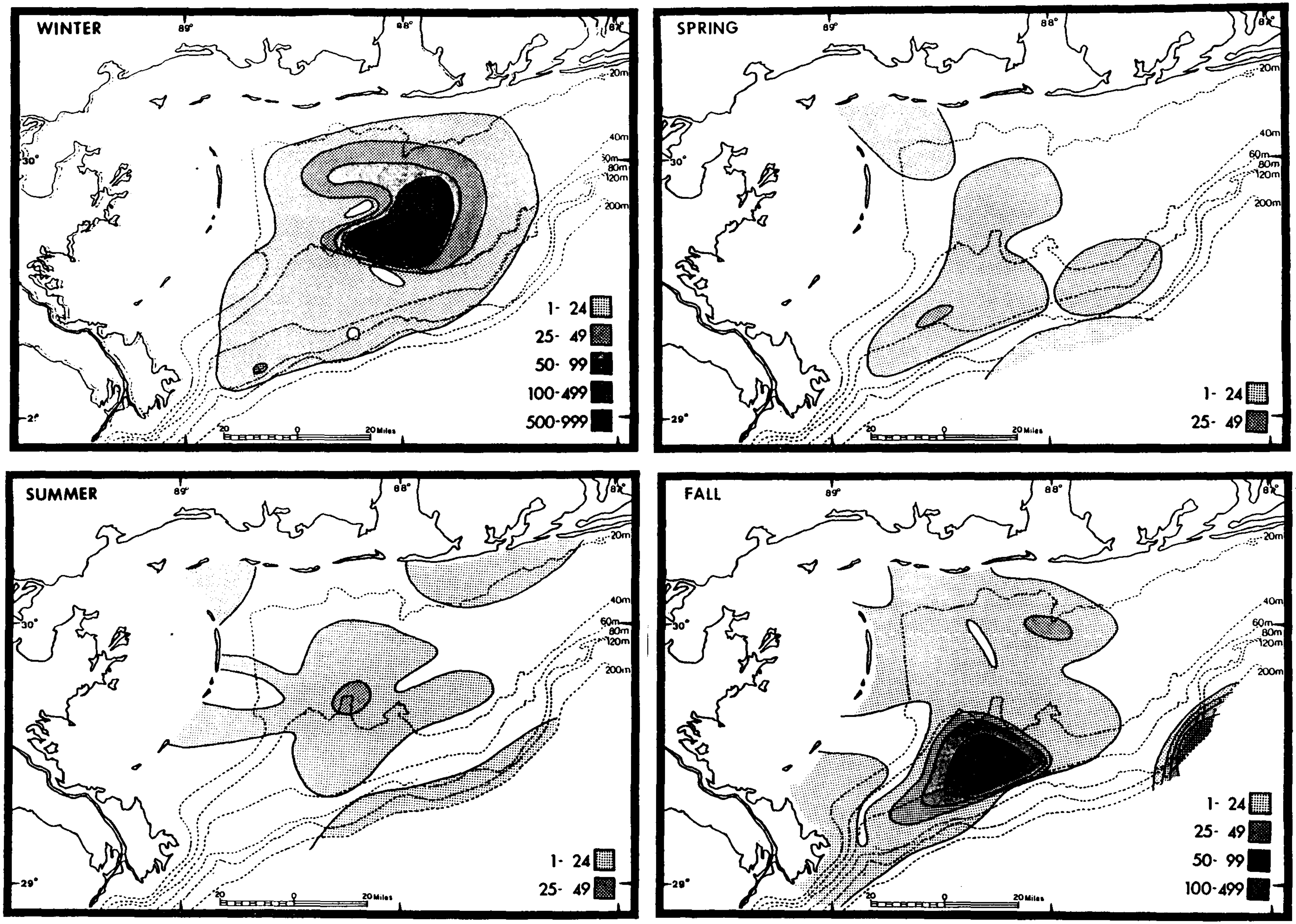

Figure 4. Seasonal distribution patterns of the family Lutjanidae on the outer continental shelf of the Tuscaloosa Trend study area. Number of individuals captured per hour trawling.

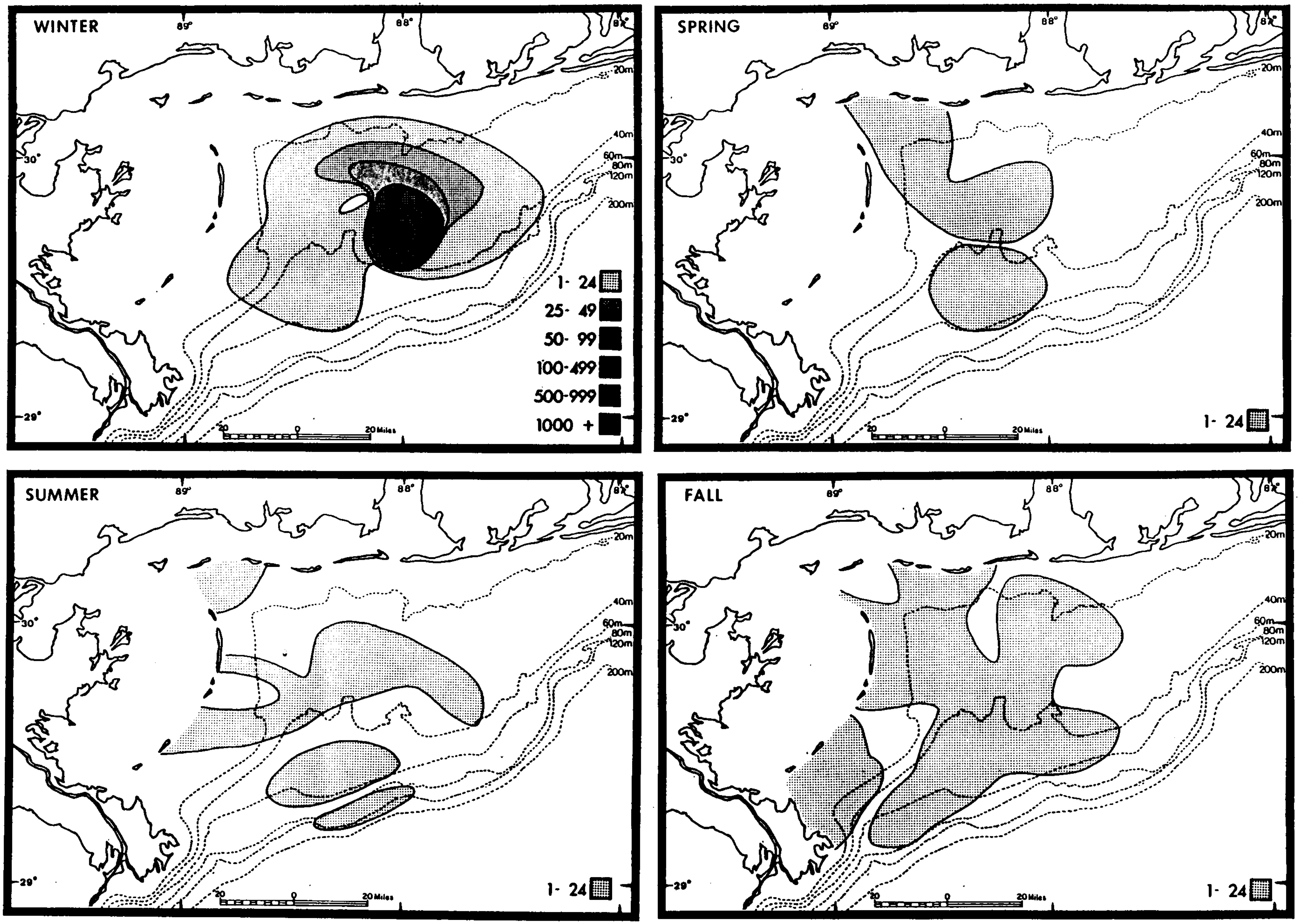

Figure 5. Seasonal distribution patterns of Lutjanus campechanus on the outer continental shelf of the Tuscaloosa Trend study area. Number of individuals captured per hour trawling.

the period of June to October. Young disperse from the spawning grounds into shallower waters, including bays and sounds, and move back onto the shelf during cooler months. Most of the individuals captured in the present study were probably young individuals in their first year of life. However, the literature does not provide an explanation for the very dense concentrations observed on the mid-shelf during the winter months. This phenomenon should be investigated.

The lane snapper occurred at two stations in the winter, one in the summer, and two in the fall, all within the depth range of 13-62 m and all west of Perdido Bay. The wenchman occurred at 18 stations (five in winter, three in spring, three in summer, and seven in fall). Although it was taken in the depth range of 18-183 m, it was most abundant in the range 50-91 m. Most specimens appeared in the area from south of Mobile Bay to the Mississippi River Delta, but the species did occur at two deepwater stations (over 90 m) directly south of Perdido Bay. The vermilion snapper was taken at a single station during the winter at a depth of 36 m south of the eastern edge of Mobile Bay.

Lobotidae - TRIPLETAILS

The tripletail (Lobotes surinamensis) is occasionally caught by anglers and commercial fishermen, and it is an edible fish. Cooler months are spent in shelf waters. During the warmer season they move into the shallows where spawning takes place May through August. The young are estuarine dependent. No specimens appeared in the present fish data base.

Sparidae - PORGIES

Five sparids appeared in the fish data base including the sheepshead (Archosargus probatocephalus), whitebone porgy (Calamus leucosteus), pinfish (Lagodon rhomboides), red porgy (Pagrus pagrus), and longspine porgy (Stenotomus caprinus). A total of 44,192.3 specimens was taken, and this constituted 21.9 percent of the catch in the fish data base. The longspine porgy alone was represented by 39,533.3 specimens or 19.8 percent of the catch, and this was the most abundant single species in the data base. The whitebone porgy was represented by 3,342.3 specimens or 1.67 percent of the total catch, and this was the twelfth most abundant species.

The only sparid considered to be of commercial or recreational importance which appeared in the data base was the sheepshead, of which only 12.6 specimens were taken. This species appeared at five winter stations and one spring station within the depth range of 9-37 m. As noted in Figure 6, the collection localities tended to be off the mouths of passes.

The life history of the sheepshead has been summarized by Benson (1982). Most of the life is spent in bays, sounds, and estuaries, where spawning takes place in the late winter, spring, and early summer. Overwintering takes place on the continental shelf which accounts for the greater frequency of winter captures in the fish data base.

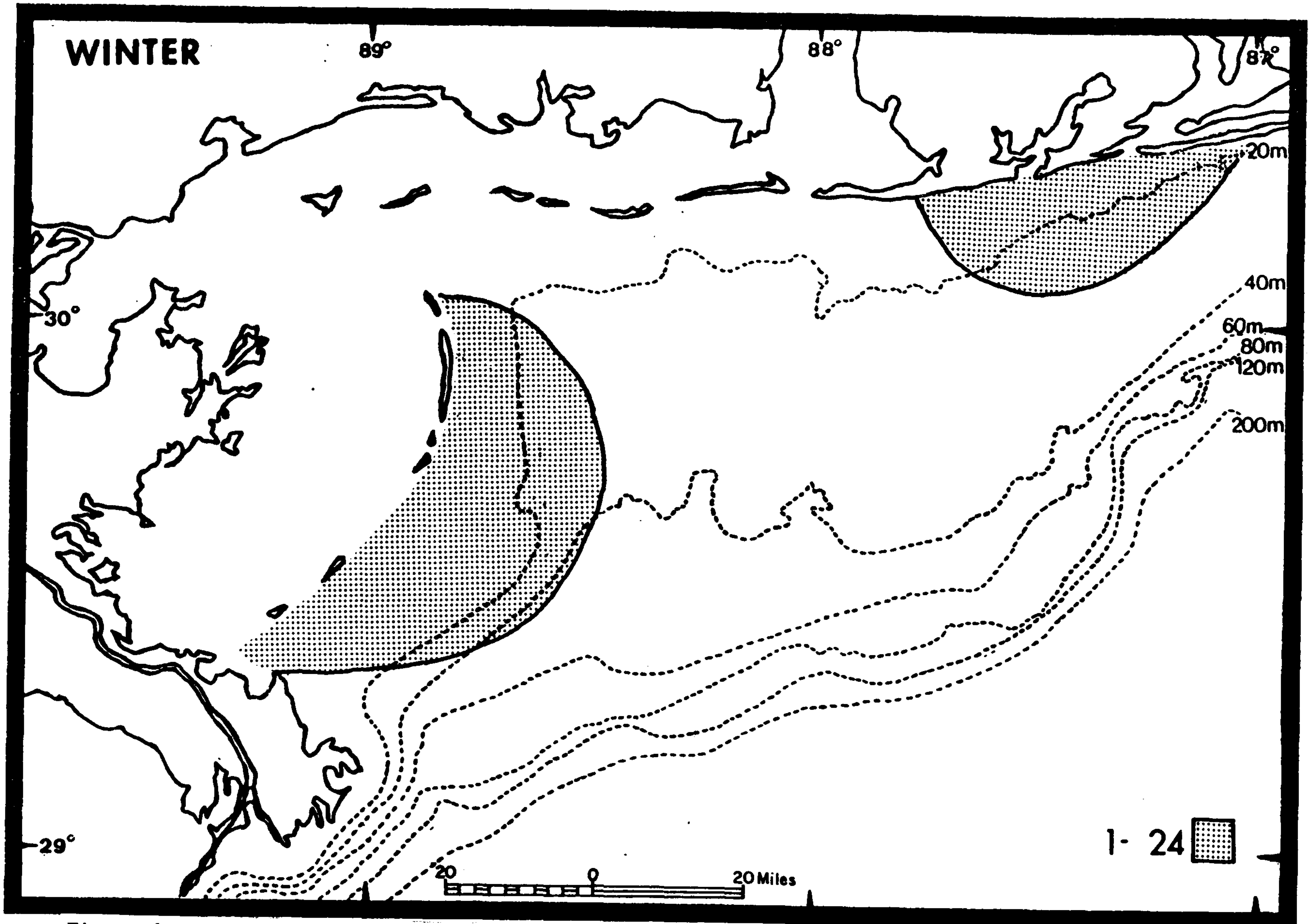

Figure 6. Seasonal distribution patterns of *Archosargus probatocephalus* on the outer continental shelf of the Tuscaloosa Trend study area (winter only). Number of individuals captured per hour trawling.

Sciaenidae - DRUMS

The drum family was represented in the collections by 43,308.2 specimens or 21.48 percent of the total catch. In abundance it was second only to the porgy family. Included were 15 taxa, the silver perch (Bairdiella chrysoura, sand seatrout (C. arenarius), silver seatrout (C. nothus), unidentified seatrout (Cynoscion sp.), high-hat (Equetus acuminatus), jackknife-fish (E. lanceolatus) cubbyu (E. umbrosus), unidentified equetids (Equetus sp.), banded drum (Larimus fasciatus), spot (Leiostomus xanthurus), southern kingfish (Menticirrhus americanus), Atlantic croaker (Micropogonias undulatus), black drum (Pogonias cromis), red drum (Sciaenops ocellatus), and star drum (Stellifer lanceolatus). Three of the species were quite abundant; the Atlantic croaker, spot, and sand seatrout which together made up 94.9 percent of the drum catch and 20.6 percent of the total fish catch.

Seasonal distribution patterns for the sciaenids (all species combined) are given in Figure 7. During the winter drums are common over most of the shelf area, although they are absent from the middle and outer shelf east of Mobile Bay. Two areas of very high concentration were evident, south of Pascagoula in the depth range 25-35 m, and just east of the outer reaches of the Mississippi River Delta (Southeast Pass) in depths to about 80 m. Densities of over 100 fishes per hour were common in waters of less than 30 m east of Mobile Bay, and west of the Bay they extended out to beyond 120 m for much of this area. In the spring drums were not taken east of Mobile Bay in waters shallower than 40 m, and they extended only to the level of Perdido Bay in deeper water. The only area of very high density occurred in waters beyond 60 m just east of the Mississippi River Delta. Areas of density greater than 100 fish per hour appeared at all depths, but such areas were disjunct and isolated. During the summer few specimens appeared at any depth east of Perdido Bay. However, an area of high density extended southward and slightly westward from the mouth of Mobile Bay out to a depth of about 100 m. The two highest density spots of this area were directly off the mouth of Mobile Bay and in the depth range of about 40-60 m. Another area of very high density appeared east of the Mississippi River Delta, especially in waters shallower than 20 m. The fall pattern was quite similar to that of the summer except that the dense area off Mobile Bay was greatly expanded, and in one collection at about 30 m a catch density of over 14,000 fishes per hour was recorded. The high densities off Mobile Bay and east of the Mississippi River Delta observed in the summer and fall seasons clearly represent the mass migrations of sciaenids from the nursery areas at these seasons. The relative scarcity of sciaenids east of Mobile Bay must reflect the relative scarcity of suitable inshore nursery grounds in this area.

The seatrouts were represented in the collections by the sand seatrout (Cynoscion areanarius), silver seatrout (C. nothus), and undetermined seatrouts (Cynoscion sp.). No specimens of the spotted seatrout (C. nebulosus) were taken. The sand seatrout was represented by 3,005.0 individuals or 1.50 percent of the total fish catch, and the seasonal changes in abundance of this species were marked. During the winter 48.2 percent of the total sand seatrout catch was made; 18.2 percent occurred in the spring, 11.9 percent in the summer, and 21.7 percent in the fall. The depth distribution of the species was 9-113 m. Seasonal distribution patterns of the sand seatrout are given in Figure 8. At no season did the species appear in shelf collections made east of Mobile Bay. During the winter sand seatrout was taken in low to moderate abundance in most of the shelf area west of Mobile Bay. Three areas of

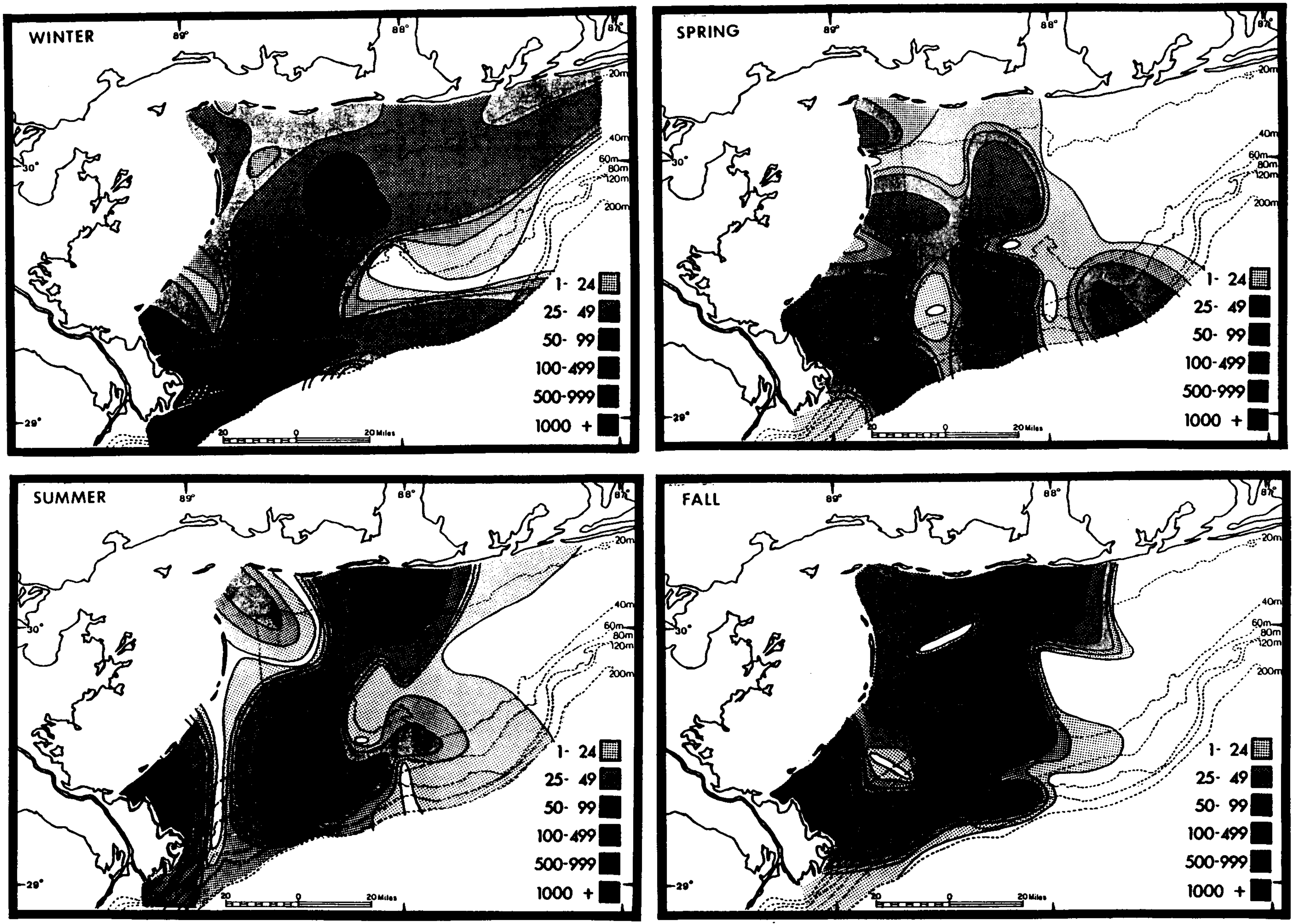

Figure 7. Seasonal distribution patterns of the family Sciaenidae on the outer continental shelf of the Tuscaloosa Trend study area. Number of individuals captured per hour trawling.

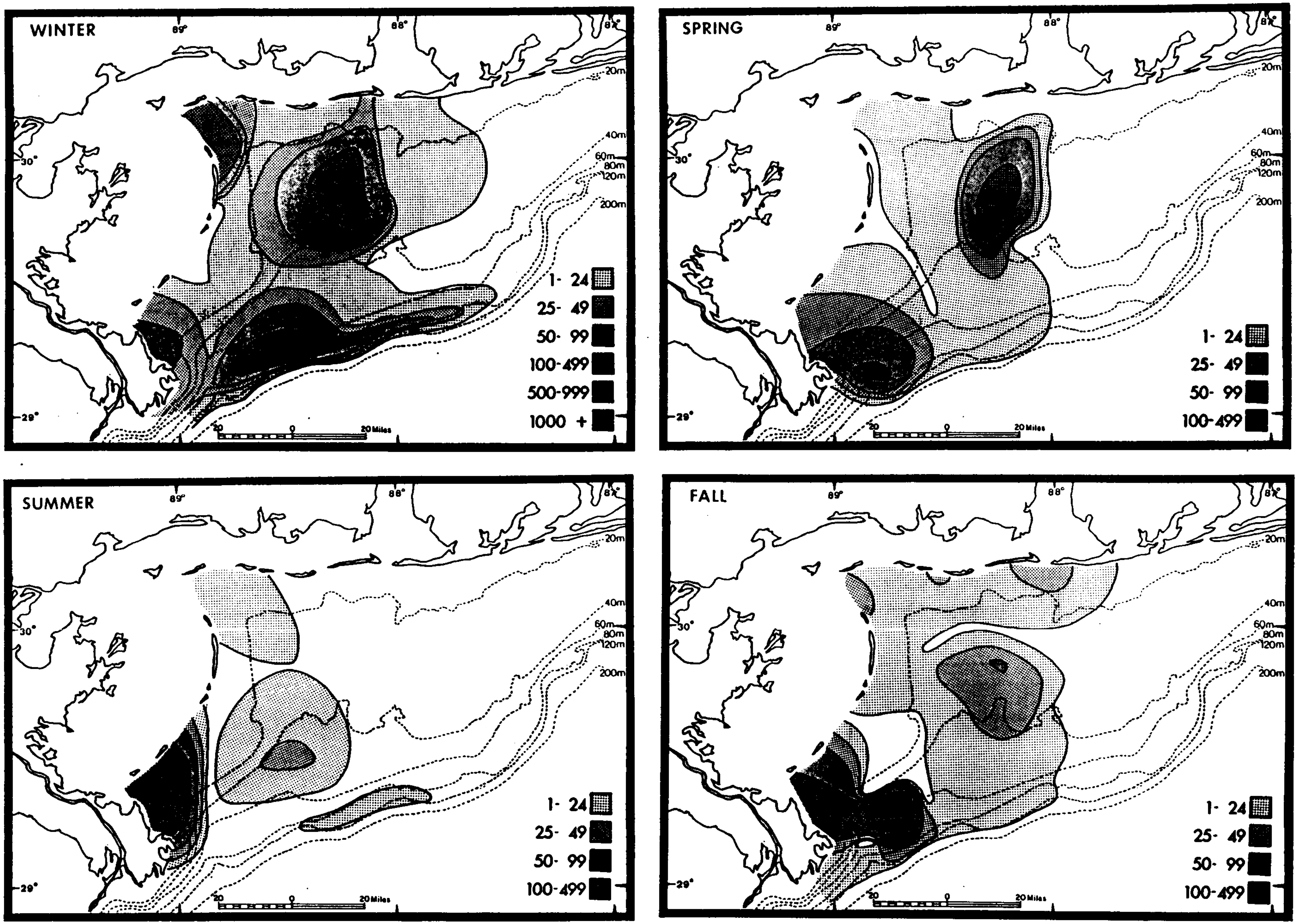

Figure 8. Seasonal distribution patterns of Cynoscion arenarius on the outer continental shelf of the Tuscaloosa Trend study area. Number of individuals captured per hour trawling.

moderate abundance were evident, in waters less than 20 m deep off Ship and Chandeleur Islands, between 20 and 40 m south of Pascagoula, and between 80 and 120 m east of the Mississippi River Delta. These are likely the over-wintering grounds for populations using the nursery grounds Biloxi marshes, Pascagoula marshes and Mobile Bay, and the terminal Mississippi Delta marshes, respectively. In the spring no individuals were taken east of 88° west .pa longitude (middle of Mobile Bay). Two small areas of moderate density appeared south of Pascagoula and east of the Mississippi Delta, and these probably represent older individuals, remnants of two of the moderate density concentrations observed during the winter. During the summer the distribution on the western half of the shelf had contracted considerably, and the only area of moderate density appeared between Breton Island and the Delta marshes. The fall season was marked by a great expansion of the species onto the shelf. Areas of intermediate density appeared at the mouths of passes (Mobile Bay, Petit Bois-Horn Island, Ship-Chandeleur Island, and Breton Island-Delta marshes. These denser areas clearly mark the passes through which young-of-the-year fishes were moving from the nursery areas to the over-wintering grounds on the shelf. An area of moderate density appeared in 30-40 m south of Pascagoula, and an area of somewhat higher concentration extended from Breton Sound and the Delta marshes southeastward toward deeper water.

Benson (1982) noted that spawning of the sand seatrout takes place offshore near passes and near inlets to estuaries from March to September with peak spawning in March-April or in August-September. Young move into bays and estuaries and seek deeper waters as they mature. Adults may also move into estuaries following spawning. In the fall most adults and juveniles move out onto the shelf. These facts are in good accord with the seasonal distribution patterns presented above.

As noted previously, the spotted seatrout (C. nebulosus) did not appear in the present shelf data base, nor was it present in the larger shelf data base for the northwestern Gulf Bio-Atlas (Darnell, et al., 1983). As noted by Benson (1982), all of the life history stages are passed in bays and estuaries, and even when temperatures drop in the winter they never stray onto the open shelf.

In the fish data base, 523.8 specimens of the silver seatrout (Cynoscion nothus) were taken representing 0.26 percent of the total fish catch. It was about one sixth as abundant as the sand seatrout. Its depth range extended from 9 to 113 m, although it was never abundant at depths beyond 20 m. The pattern of seasonal abundance was quite strange: winter - 64.9 percent; spring - 2.4 percent; summer - 25.9 percent; and fall - 6.8 percent. Seasonal distribution patterns are presented in Figure 9. During the winter specimens were taken off the mouths of passes (Perdido Bay, Mobile Bay, Chandeleur Island-Horn Island, and Breton Island-Mississippi Delta marshes). In the latter area it appeared in moderate density. An area of low density was also observed east of the Delta marshes and extended to a depth of over 100 m. In the spring the silver seatrout appeared only in an area between 20 and 40 m south of Pascagoula. In summer it was moderately abundant on the shallows east of the Mississippi River Delta, and it was also taken from mid-shelf south of the Ocean Springs-Pascagoula area. By fall it was beginning to reappear off the passes (Mobile Bay, Petit Bois-Horn Island), and it was also taken at one locality on the mid-shelf.

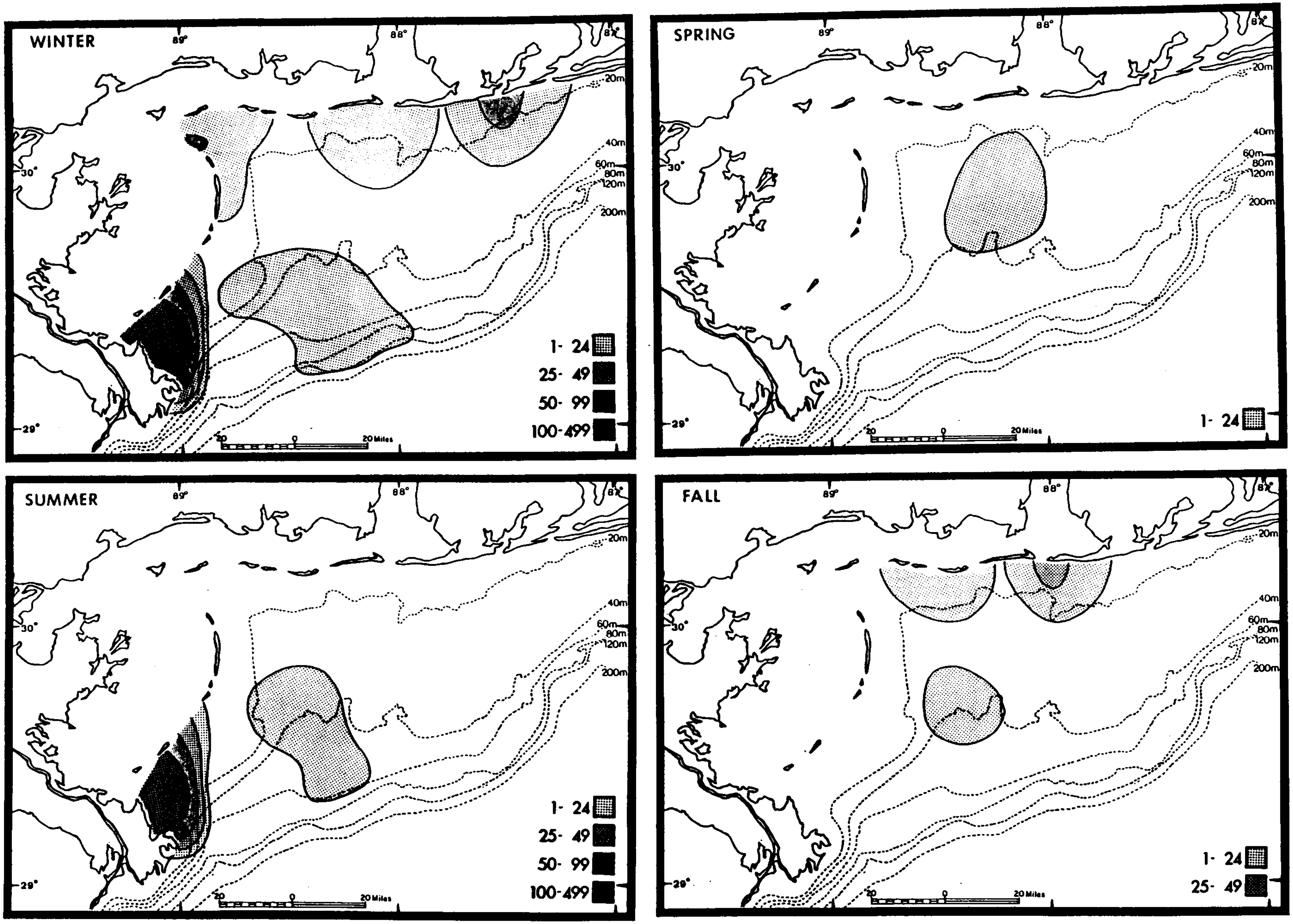

Figure 9. Seasonal distribution patterns of Cynoscion nothus on the outer continental shelf of the Tuscaloosa Trend study area. Number of individuals captured per hour trawling.

Ginsburg (1931) suggested that the silver seatrout tends to be found in deeper waters than the sand seatrout, a myth that has persisted in the literature. For example, Hoese et al. (1977) stated, ". . .between eight and twelve fathoms it gradually replaces C. arenarius, and it is the only Cynoscion normally found outside of twelve fathoms." This does not accord with the facts of the present study or with data presented for the northwestern Gulf by Darnell et al. (1982) and by Chittenden and Moore (1977). The life history of the silver seatrout is not well-known. It apparently spawns in the fall. The literature suggests that it moves into the nearshore waters during the colder months, but the present data suggest just the opposite. It seems to move onto the shelf in the fall and winter, and with the exception of a few, probably older individuals, it seems to spend the colder weather near the mouths of passes.

The spot (Leiostomus xanthurus) was the fifth most abundant species taken and was represented by 5,994.3 specimens or 3.0 percent of the total fish catch. Its seasonal abundance on the shelf was as follows: winter - 33.9 percent; spring - 11.6 percent; summer - 8.5 percent; and fall - 46.0 percent. Seasonal distribution patterns are presented in Figure 10. During the winter the spot was widespread over the shelf west of Perdido Bay, and an area of very dense concentration (greater than 1,000 fish per hour) appeared southwest of Mobile Bay in the 30-40 m depth range. Small areas of moderate concentration were seen at the north end of the Chandeleur Islands and in deeper water (beyond 60 m) east of the Mississippi River Delta. In the spring no specimens were taken east of Mobile Bay, and two small areas of moderate density appeared south of Pascagoula at around 30 m and 50 m. During the summer a moderately dense area appeared south of Mobile Bay extending to a depth of 30-40 m, and this probably represented young individuals migrating out onto the shelf. In the fall this area had developed very high density between 20 and 40 m, and moderate density extended out beyond 80 m.

According to Benson (1982), spawning takes place offshore during the winter (probably from late December through March on the north central Gulf shelf). Young move into the estuarine nursery areas, and some may remain there through the first winter of life. Sexual maturity appears during the second year, and these individuals move onto the shelf in late summer and fall prior to the winter spawning. These facts accord well with data presented in the present study.

Three species of kingfish are known from the northern Gulf coast, the southern kingfish (Menticirrhus americanus), gulf kingfish (M. littoralis), and northern kingfish (M. saxatilis). The latter two species are found close inshore, and only the southern kingfish appeared in the present data base. In the present study 549.5 specimens of the southern kingfish were taken, representing 0.27 percent of the total fish catch. The seasonal distribution of the species was as follows: winter - 42.8 percent; spring - 23.2 percent; summer - 13.6 percent; and fall - 20.3 percent. It was taken from the depth range of 4-37 m, and it was never abundant at depths greater than 15 m. The seasonal distribution patterns of the southern kingfish are given in Figure 11. At all seasons this species was taken primarily just off passes. The highest densities and most widespread distribution were observed during the winter months. Three areas of distribution at this time included the Mobile Bay-Perdido Bay, Chandeleur Island-Horn Island, and Mississippi Delta-Breton Island areas. In the spring the only specimens were taken from the Chandeleur Island-Horn Island area. In the summer they occurred off Horn Island and

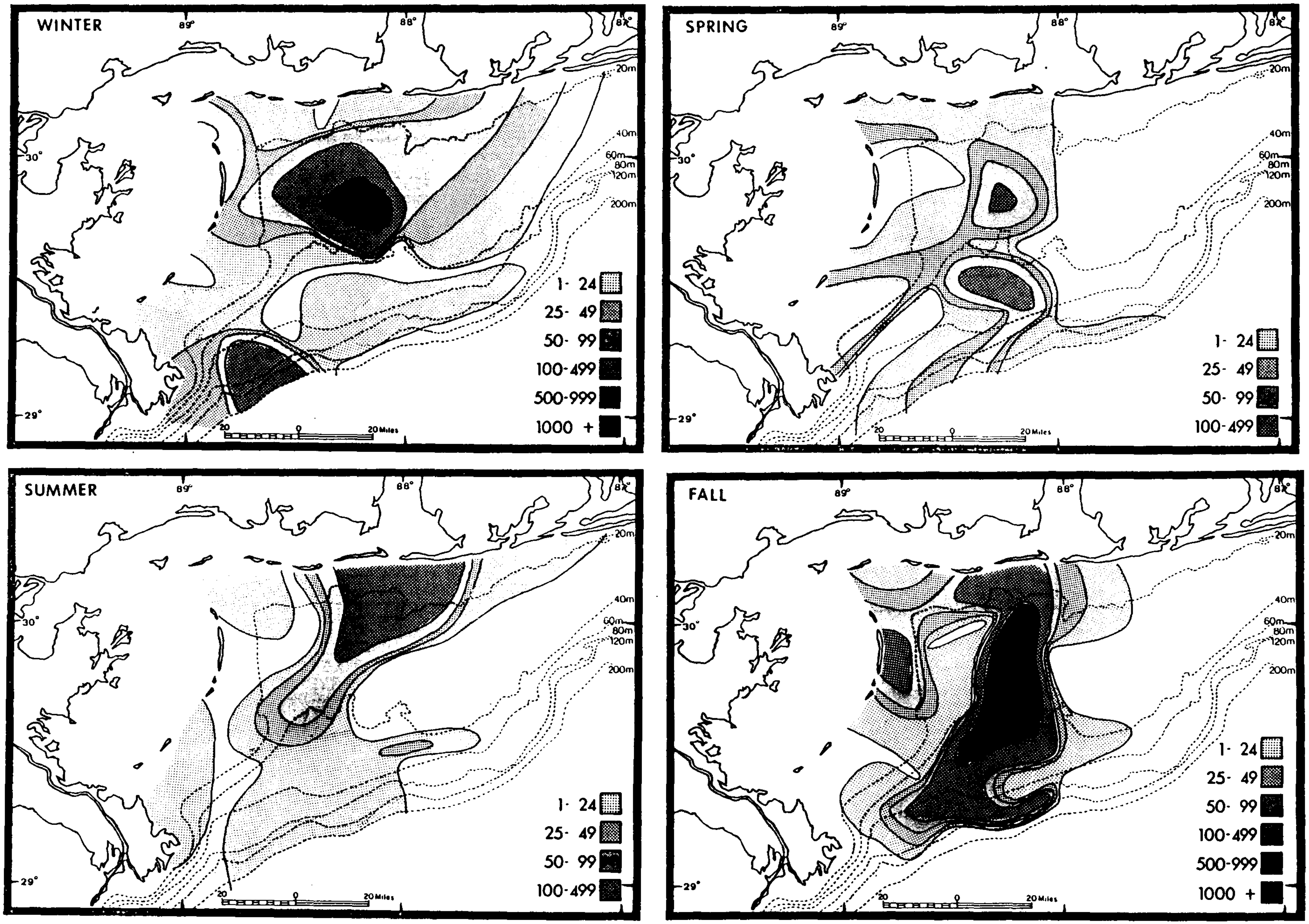

Figure 10. Seasonal distribution patterns of Leiostomus xanthurus on the outer continental shelf of the Tuscaloosa Trend study area. Number of individuals captured per hour trawling.

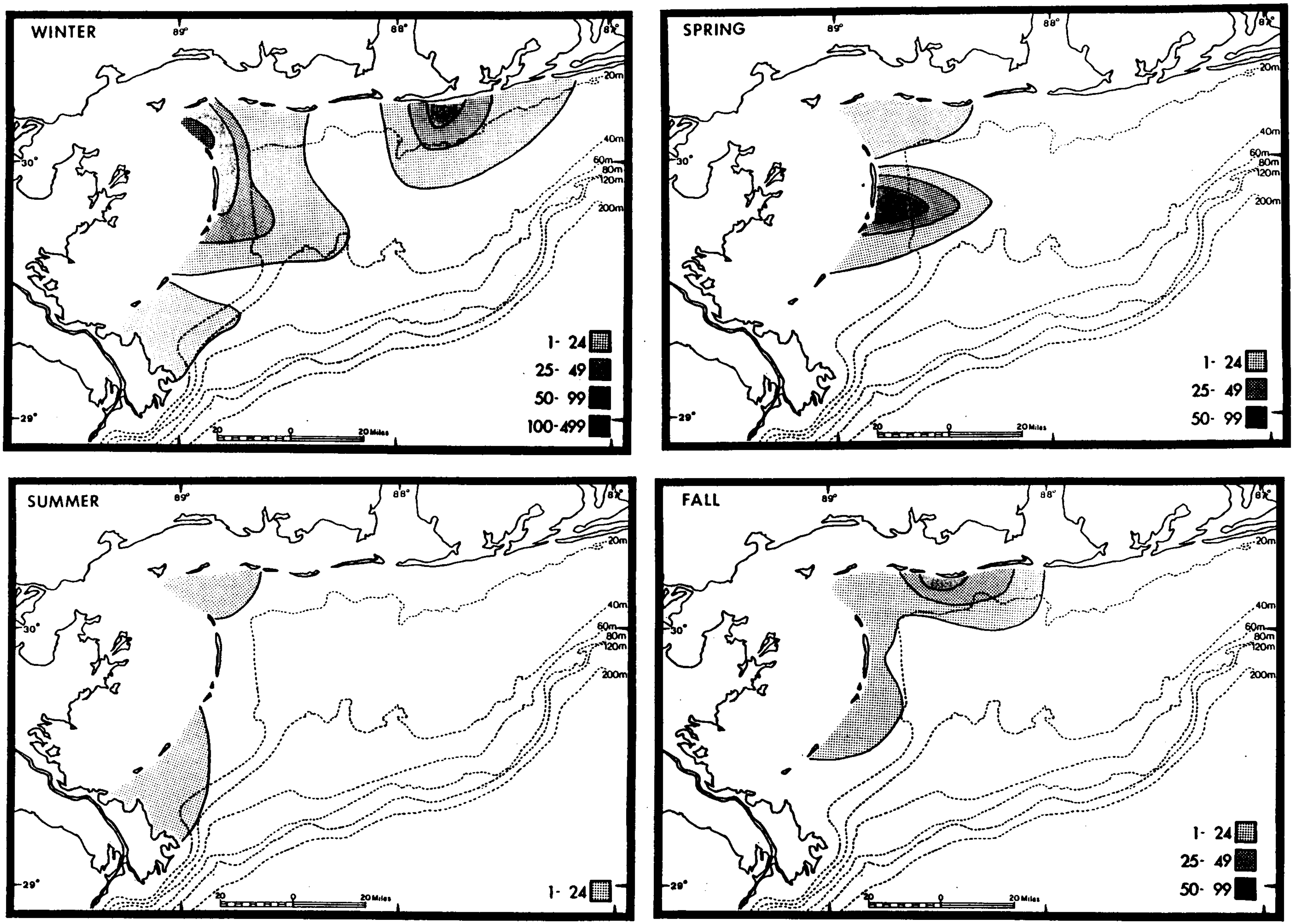

Figure 11. Seasonal distribution patterns of Menticirrhus americanus on the outer continental shelf of the Tuscaloosa Trend study area. Number of individuals captured per hour trawling.

Breton Island. In the fall the distribution was continuous from Mobile Bay to Breton Island, primarily at depths of less than 20 m, and one area of concentration was noted just off the Horn Island-Dauphin Island area.

Most of the life history of the southern kingfish is passed in the bays and sounds, but the adults may appear outside the barrier islands, especially during the colder months. Spawning on the northern Gulf coast apparently occurs from April to October.

The Atlantic croaker (Micropogonias undulatus) was represented by 32,102.5 specimens or 16.05 percent of the fish data base. It was the second most abundant species taken. Its seasonal distribution pattern was as follows: winter - 15.4 percent; spring - 13.0 percent, summer - 12.8 percent; and fall - 58.9 percent. The fall figure is inflated due to the fact that a single collection on the shelf during this season yielded over 12,000 individuals per hour, over five times larger than any other collection, and over a third of the entire year's catch. This point will be discussed below. The seasonal distribution patterns of the Atlantic croaker are presented in Figure 12. During the winter the Atlantic croaker was present over most of the shelf area except in the deeper water east of Mobile Bay. One area of very high concentration appeared at depths greater than 60 m off the Mississippi River Delta. However, areas of moderately high density extended south of Perdido Bay and south of Petit Bois and Horn Islands, the latter area extending from about 20 m to the outer edge of the shelf. By spring the pattern had changed dramatically. Virtually no individuals were collected east of Horn Island in less than 40 m of water, although the species did appear in one small area at depths greater than 40 m. One area of very dense concentration was observed at depths beyond 60 m off the Mississippi River Delta, and areas of moderate density appeared at 40-100 m south of Horn Island and in shallow ater off Breton and the Chandeleur Islands. The summer pattern was marked by the appearance of individuals in shallow waters as far east as Perdido Bay and very heavy concentrations off the mouth of Mobile Bay and betwen 40 and 60 m south of Horn Island. An area of moderate density included both these concentrations and extended from Mobile Bay and Horn Island on the north to a depth of 80 m. Another area of moderate density appeared in less than 20 m off Breton Island. The fall pattern was much like that of the summer. The very dense area off Mobile Bay now extended out to a depth of 40 m, and another very dense area appeared in shallow water between Breton Island and the Delta marshes.

The life history of the Atlantic croaker in the north central Gulf has recently been summarized by Benson (1982). Spawning takes place on the continental shelf in the fall and winter with peak spawning in the month of November. Spawning may occur between 15 and 81 m, but most individuals appear to spawn at about 20 m. Young move into the bays and estuaries and remain in the inside waters throughout the first year of life. During the late summer and fall of their second year they move out onto the shelf to spawn. Older juveniles and adults tend to school, especially just before spawning. Adults tend to remain on the shelf but their distribution and movements are poorly known.

In the present study Atlantic croakers were taken on the shelf at depths from 7 to 92 m but they likely extend deeper, especially off the Mississippi River Delta. The density patterns observed in the summer and fall clearly reflect the exodus of young fishes from the nursery areas, and they point up the importance of Mobile Bay and the Pascagoula marshes in this connection.

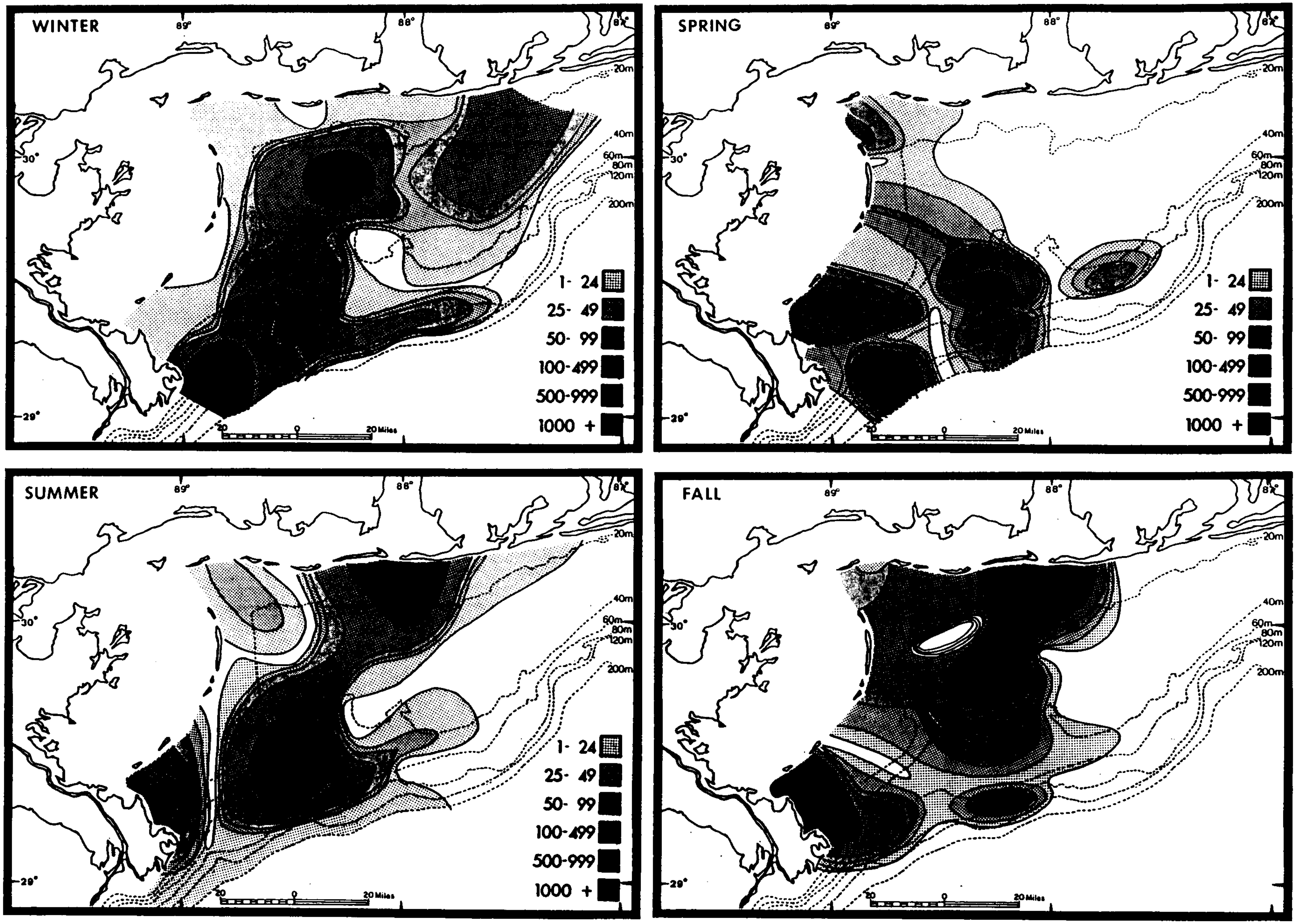

Figure 12. Seasonal distribution patterns of Micropogonias undulatus on the outer continental shelf of the Tuscaloosa Trend study area. Number of individuals captured per hour trawling.

The very dense collection of croakers (over 12,000 per hour) in the fall at a depth of 35 m southwest of Mobile Bay must represent a prespawning aggregation. This collection was made in mid-October. The winter and spring patterns must represent the post-spawning adults, and it would appear that these tend to move eastward and seaward between winter and spring. By summer they may have reversed this movement, and the heavy concentrations observed between 40 and 60 m at this season may represent the over-wintering adults moving back toward the spawning grounds.

The black drum (Pogonias cromis) was taken at only seven stations and only 17.8 individuals were represented. Six of the occurrences were in the winter and one in the fall. The collection sites of the black drum (all seasons combined) are presented in Figure 13. Most specimens were taken near the shore or off the barrier islands at less than 20 m depth, but the species did appear in a single collection in the winter at a depth of 73 m.

The black drum is primarily a bay species and Benson (1982) noted that adult migration is restricted largely to spring and fall movement through the passes between the estuarine and nearshore marine environments. Spawning occurs from February to April. These facts accord well with the essentially winter observance of a few black drums in the nearshore shelf environment. The one deepwater record is clearly an anomaly.

The red drum (Sciaenops ocellata) appeared in the collections at only three stations and a total of 21.6 individuals was taken. As shown in Figure 14, these were all just outside the barrier islands at depths of 11-18 m. All occurred during the winter months. Benson (1982) noted that spawning occurs in fall and winter with a peak during September-November. Most red drum reside in the inside waters during the summer but move into the Gulf in late fall. Post-spawning individuals tend to spend much time on the shelf and some inhabit the surf zone. On the shelf they tend to form schools, and Hoese and Moore (1977) pointed out that larger individuals may remain far offshore. The present data do not suggest that the red drum is present on the shelf at any season except winter, and they do not suggest that the species is found at depths greater than 20 m. In the much larger data base for the northwestern Gulf shelf the red drum was not even represented. It is, of course, possible that large red drum are present on the shelf but are too mobile to be captured by trawls.

Mugilidae - MULLETS

Although several species of mullets have been reported from the north central Gulf area, only the striped mullet (Mugil cephalus) is of commercial interest. In the fish data base this species was represented by 0.2 specimens taken at a single station in the fall at a depth of 37 m south of Petit Bois Island. On the continental shelf this fish is rarely taken in bottom trawls.

The striped mullet spawns from October to May in surface waters near the outer edge of the continental shelf. Young gradually enter the bays and estuaries where they spend most of the first two years of life. In the fall of their second year they move in large schools to the continental shelf. Apparently some of the post-spawning individuals reenter the estuaries with the onset of warm weather in the spring and summer.

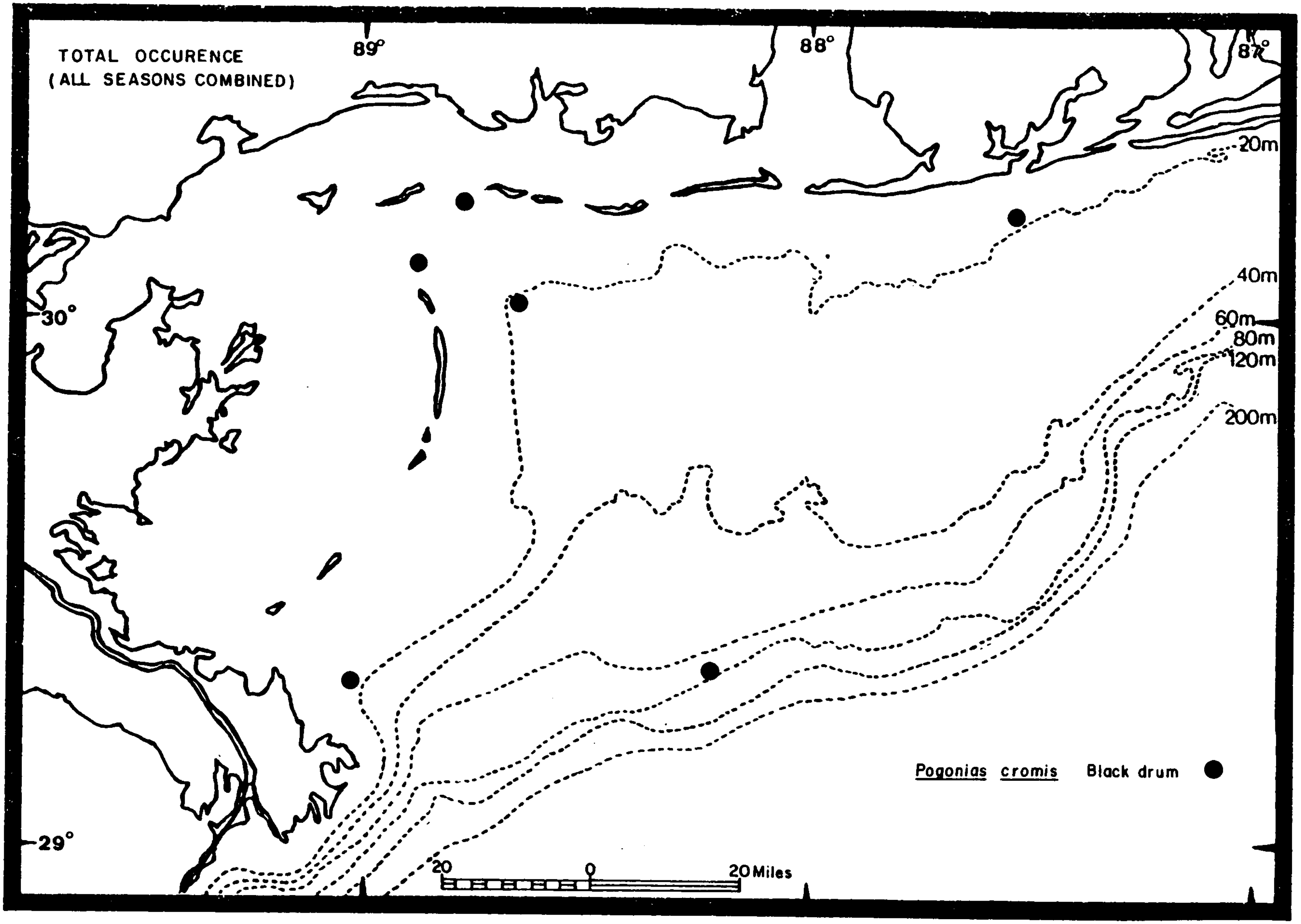

Figure 13. Seasonal distribution patterns of *Pogonias cromis* on the outer continental shelf of the Tuscaloosa Trend study area. Number of individuals captured per hour trawling.

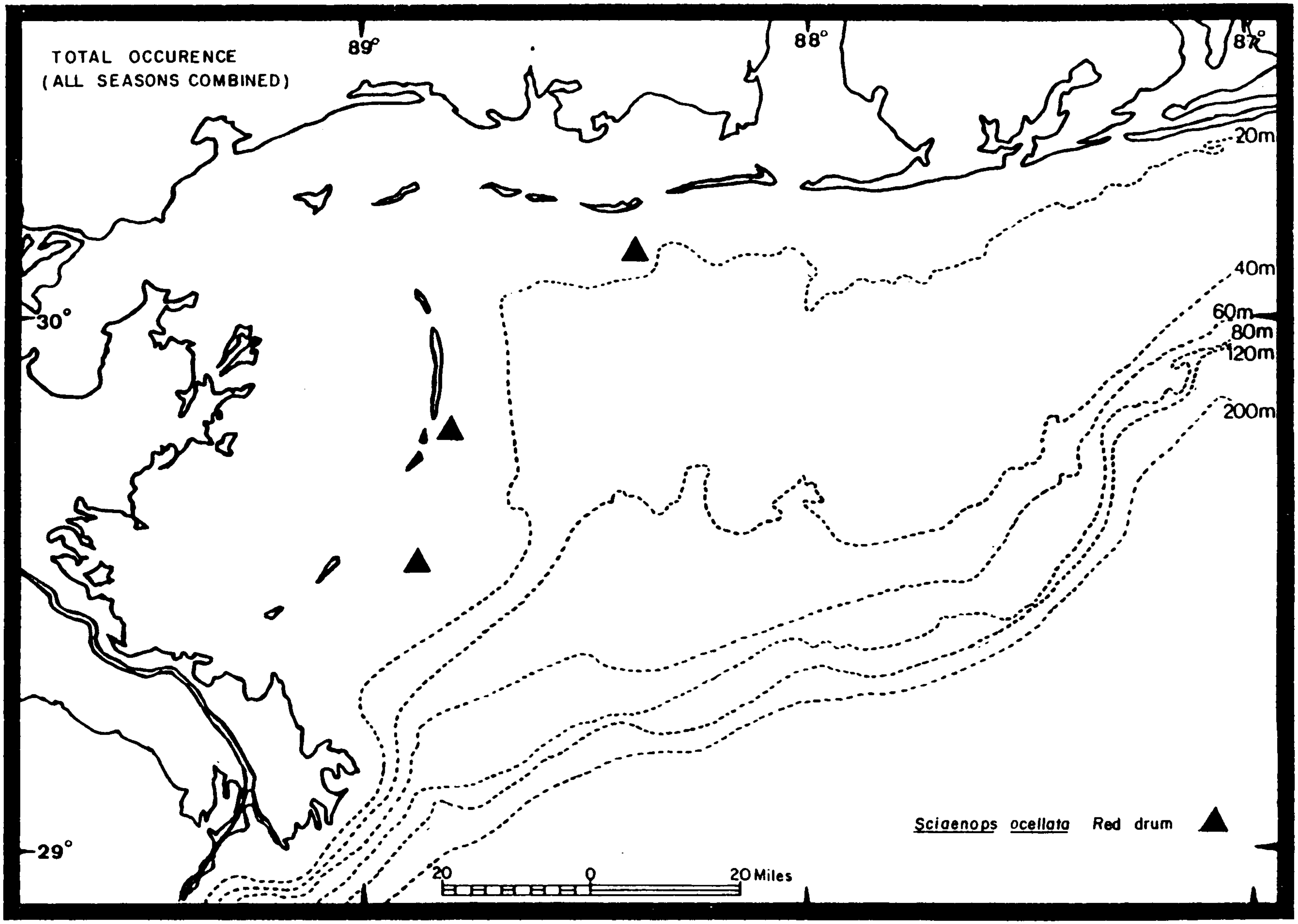

Figure 14. Seasonal distribution patterns of Sciaenops ocellata on the outer continental shelf of the Tuscaloosa Trend study area. Number of individuals captured per hour trawling.

Scombridae - MACKERELS

The family Scombridae includes the mackerels, tunas, and their relatives. The following list gives those species known or presumed to occur on or near the continental shelf of the north central Gulf of Mexico.

Mackerels	
Auxis thazard	frigate mackerel
Scomber japonicus	chub mackerel
Scomberomorus cavalla	king mackerel
Scomberomorus maculatus	Spanish mackerel
Scomberomorus regalis	cero
Tunas	
Euthynnus alletteratus	little tunny
Euthynnus pelamis	skipjack tuna
Thunnus albacares	yellowfin tuna
Thunnus atlanticus	blackfin tuna
Thunnus thynnus	bluefin tuna

Mackerels inhabit the continental shelf primarily during the warmer months, and the Spanish mackerel is more widespread over the shallow shelf than the other species. In the present study two species of mackerels were taken, the chub mackerel and the Spanish mackerel. Nine specimens of chub mackerel occurred at three stations in the winter, spring, and fall. These were widely distributed in the depth range of 18-99 m. All occurrences of this species were west of Mobile Bay. The Spanish mackerel appeared at five stations, one in the spring, two in the summer, and two in the fall. A total of 4.3 specimens was taken in the depth range of 9-24 m. All specimens were captured near Horn and the Chandeleur Islands.

The Spanish mackerel is a highly migratory species which is abundant in the north central Gulf primarily during the summer, although some individuals appear to remain in the area throughout the year. Spawning takes place May through September at depths of 12 to possibly 200 m. Young may be found on the shelf or in sounds and bays, but the species is not estuarine dependent.

Tuna fishes are not normally considered shelf species, but the little tunny (Euthynnus alletteratus) is widespread on the northern Gulf shelf in the warmer months. It is sometimes called the bonito or false albacore. It is a good game fish and is taken frequently by anglers. No specimens of this or any other tuna species appeared in the fish data base.

A few words will be said concerning the larger tunas of the area. According to Iwamoto (1965), commercially exploitable stocks of tunas are found in the northern Gulf of Mexico. These include the skipjack tuna (Euthynnus pelamis), yellowfin tuna (Thunnus albacares), blackfin tuna (Thunnus atlanticus), and bluefin tuna (Thunnus thynnus). The area of principal sightings by personnel of the exploratory vessel M/V OREGON and longline catches lies in the water above the 183 to 1,830 m depth contours. Although tuna schools were encountered in the northern Gulf at all seasons, they appeared to be more abundant during the summer and fall months. Tuna schools were located most frequently east and southeast of the mouth of the Mississippi River, but this may simply reflect the fact that more observations have been made in this area.

Istiophoridae - BILLFISHES

The three primary billfishes of the northern Gulf coast are the sailfish (Istiophorus platypterus), blue marlin (Makaira nigricans), and white marlin (Tetrapterus albidus), although two additional species may be present. All these species are highly migratory and appear on the northern Gulf coast only during the warmer months (primarily June through September). The life histories of all species are poorly known. Although no specimens of billfish appeared in the fish data base, information concerning the local distribution of these three species has been obtained from the National Marine Fisheries Service (Lopez and Pristas, 1982). This information is plotted in Figure 15. Although not as extensive as one might desire, the data are revealing. These three species appear to be concentrated over the outer portion of the continental shelf (beyond a depth of 60 m) and the upper slope. From this figure and other data (on hand, but not presented here), it appears that the billfishes concentrate along the lateral edges of DeSoto Canyon (avoiding waters directly over the canyon itself) and that they are relatively less dense around the mouth of the Mississppi River where the waters tend to be more turbid and offer less visibility for these highly predatory sight-feeders. The data also suggest that the sailfish occupies waters somewhat shallower than do the two species of marlin.

Stromateidae - BUTTERFISHES

The stromateids were represented in the fish data base by 13,242.0 specimens or 6.57 percent of the total fish catch. Four taxa were present: Barrelfish (Hyperoglyphe perciformis), harvestfish (Peprilus alepidotus), gulf butterfish (P. burti), and unidentified peprilids (Peprilus sp.). Only the harvestfish and Gulf butterfish are of commercial interest.

The harvestfish (Peprilus alepidotus) was represented by 144.8 individuals or 0.07 percent of the total fish catch. It occurred at 16 stations, ten of which were in the winter, two in spring, one in summer, and three in fall. Seasonally, the catch was as follows: winter - 30.4 percent; spring - 0.5 percent; summer - 0.01 percent; and fall - 69.0 percent. No individuals appeared at any season east of the center of Mobile Bay, but west of this point they were widespread and occurred in the depth range 9-91 m. However, most of the stations of occurrence and most of the individuals appeared in depths of less than 30 m. These occurred primarily south of Mobile Bay and around Horn Island and the Chandeleur Islands.

According to Horn (1970), in the northern Gulf of Mexico the harvestfish spawns in the spring, probably a few miles offshore. After hatching, the young probably move inshore. Juveniles occur in the bays and estuaries during the summer, and subadults pass back to the shelf in the fall. Since these are primarily pelagic, they seldom appear in abundance in trawl collections.

The Gulf butterfish (Peprilus burti) was represented in the fish data base by 12,931.3 individuals representing 6.46 percent of the entire fish catch. This was the fourth most abundant species taken. Its pattern of seasonal abundance was the reverse of most estuarine dependent species and is given as follows: winter - 3.3 percent; spring - 66.3 percent; summer - 27.4 percent; and fall - 3.0 percent. This species was taken in the depth range of 7-99 m. Seasonal distribution patterns of the Gulf butterfish are presented

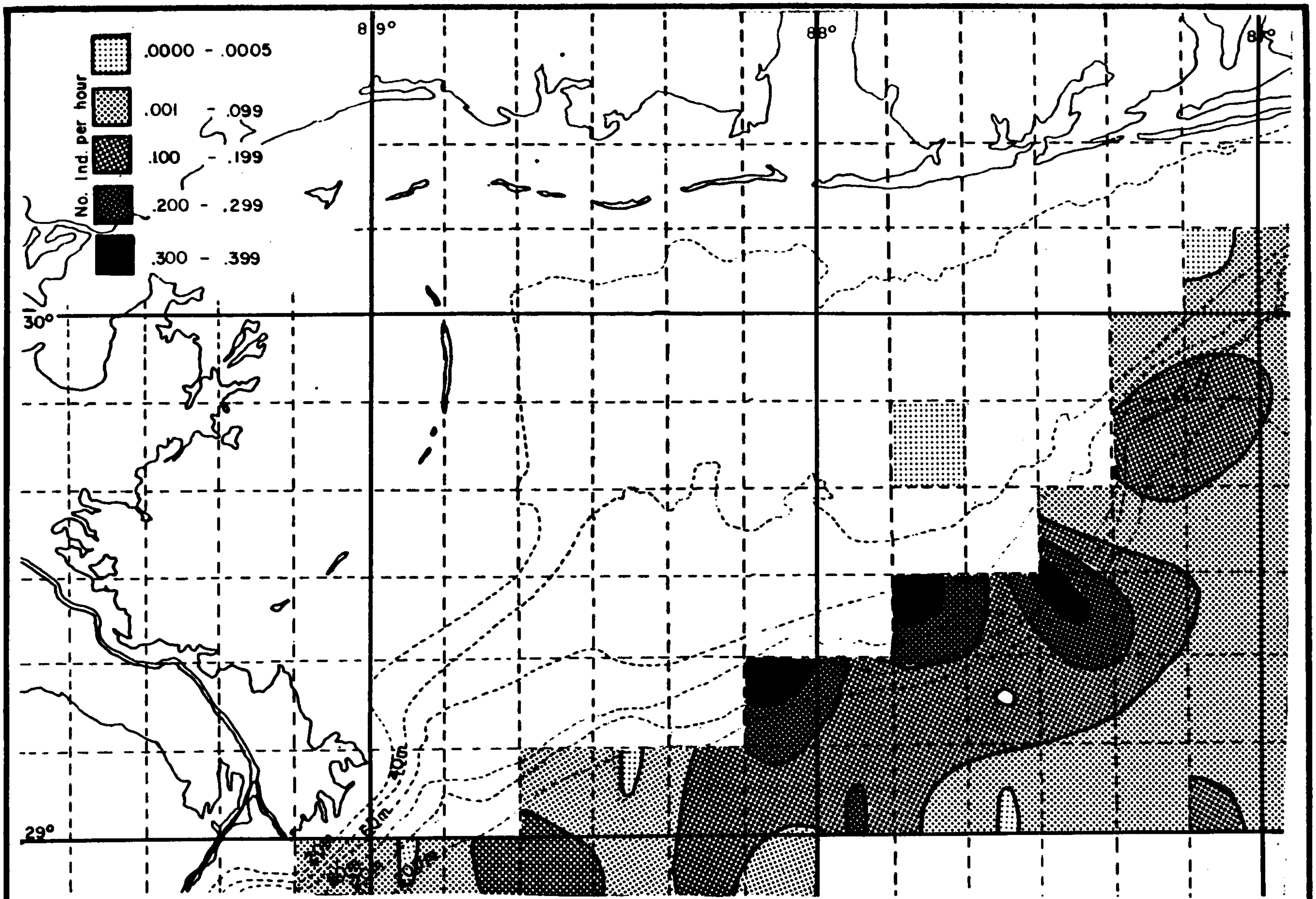

Figure 15. Numbers of billfishes raised per hour trolling in the north-central Gulf of Mexico in 1982 (plotted by ten-minute squares).

in Figure 16. This fish was rare east of Mobile Bay, but it was widespread on the western portion of the shelf. In the winter few individuals were taken at depths greater than 60 m. Three areas of moderate density were noted: below Horn Island and below Mobile Bay in the depth range of 15-30 m and further south off Mobile Bay in the depth range of 35-55 m. In the spring a large area of heavy density (greater than 1,000 fish per hour) extended from the Breton Sound area to a depth of about 60 m, and an area of intermediate density extended from Ship and Horn Islands to a depth of about 30 m. In the summer a very dense area appeared at depths of 20-40 m south of the barrier islands from Horn Island to the western edge of Mobile Bay. An area of moderate density extended eastward from the Mississippi River Delta marshes to a depth of greater than 60 m. In the fall an area of moderate to heavy density appeared south of Mobile Bay in the 20-40 m range, and a small moderately dense area appeared south of this at a depth of greater than 80 m.

Murphy (1981) found that off Texas the Gulf butterfish exhibits two spawning periods. One spawning takes place in the spring (February to early May), and the second spawning occurs in the fall (September through November). Adults spawn in the water column over the outer continental shelf and thereafter remain pelagic and disappear from the demersal catch of the shelf. Young move to the inshore portion of the shelf, and as they mature they gradually move offshore toward the outer shelf. Thus, there appears to be two seasonal cohorts which sequentially occupy the various benthic habitats from onshore to offshore. The species is not estuarine dependent.

To what extent these considerations apply to populations east of the Mississippi River is not clear. As in the case on the northwestern Gulf shelf (Darnell, et al., 1983), the density distribution patterns shift remarkably from one season to the next, and without further information they defy rational interpretation.

Bothidae - LEFTEYE FLOUNDERS

Flounders of the genus _Paralichthys_ are of commercial interest, and three species are found in the area: the Gulf flounder (_Paralichthys albigutta_); southern flounder (_P. lethostigma_); and broad flounder (_P. squamilentus_). All three species appeared in the fish data base and together they included 108.5 individuals, comprising 0.05 percent of the total fish catch.

The Gulf flounder (_Paralichthys albigutta_) occurred at a single station in the spring at the west end of Horn Island at a depth of 9 m. Hoese et al. (1977) noted that in Texas the young are found in bays during the spring and summer and migrate to the Gulf with the onset of colder weather. Benson (1982) stated that in the northern Gulf of Mexico this flounder is relatively common on the continental shelf out to a depth of 50 m, but this was not borne out by the trawl-catch data of the present study. The species was also somewhat rare on the northwestern Gulf shelf (Darnell et al., 1983).

The southern flounder (_Paralichthys lethostigma_) was not abundant in the collections. It was represented by 58.9 individuals or 0.03 percent of the total fish catch. It was captured at depths of 7-99 m at stations west of Mobile Bay. The seasonal distribution of the catch was as follows: winter - 27.0 percent; spring - 17.7 percent; summer - 22.7 percent; and fall - 32.6 percent. This flounder appeared at 24 stations whose depth distribution was

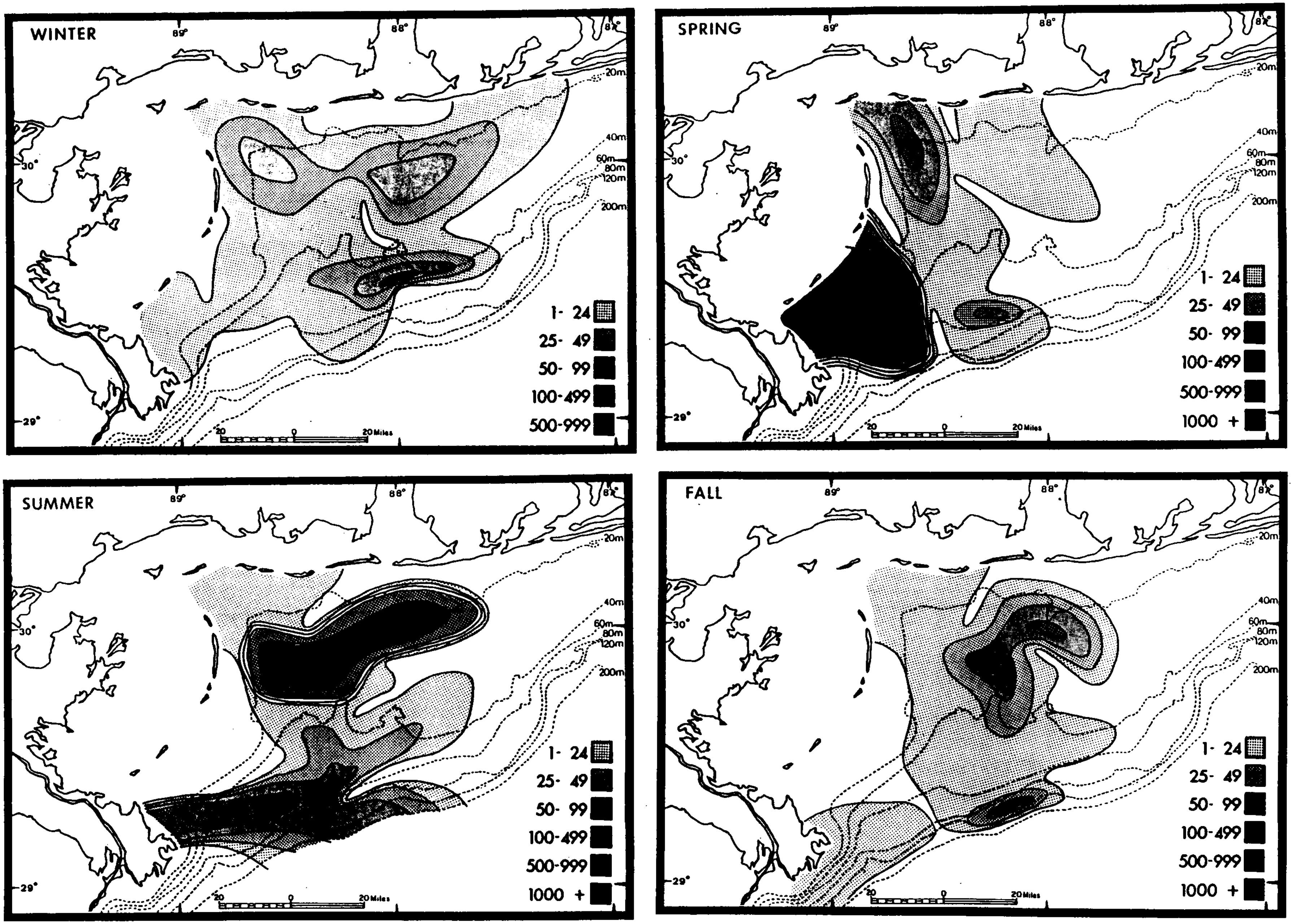

Figure 16. Seasonal distribution patterns of Peprilus burti on the outer continental shelf of the Tuscaloosa Trend study area. Number of individuals captured per hour trawling.

as follows: 0-19 m - 9 stations; 20-39 m - 8 stations; 40-59 m - 3 stations; 60-79 m - 1 station; 80-99 m - 3 stations. The species was more widespread and it was also more abundant in the nearshore shelf waters, but it did occur toward the outer shelf.

Benson (1982) stated that on the northern Gulf coast the southern flounder spawns on the inner and central continental shelf from September to April with peak spawning from November to January. The young then make their way to the bays and estuaries. In October-November there is a heavy migration of adults and older juveniles from the estuaries to the offshore waters where they overwinter. Most individuals achieve sexual maturity in their fourth or fifth year of life, and some attain the age of ten years. There probably is a resident shelf population of older individuals.

The broad flounder (Paralichthys squamilentus) was represented in the data base by 49.5 individuals or 0.02 percent of the total catch. This is a deeper water species which was taken at ten stations in the depth range of 55-205 m. A total of 84.5 percent of the specimens was taken in the fall and 12.5 percent occurred in the spring. Most of the captures were made in deep water directly south of Pascagoula and Mobile Bay, but the species did occur at a depth of 205 m on the eastern edge of the DeSoto Canyon.

On the northwestern Gulf shelf the broad flounder appeared at a single deepwater station off Louisiana (Darnell et al., 1983). Hoese et al. (1977) noted that this is a deepwater species occurring at depths of 60-120 fathoms but that the young occur inshore during the warmer months. Little is known of the life history.

SHRIMP

The shrimp catch was included in most, but not all, of the data sets employed in the fish study. No shrimp were recorded in the McCaffrey data set and these stations had to be made up, as possible, from various collections made by vessels in the service of the National Marine Fisheries Service operating out of Pascagoula, MS. In addition, the Moore, Brusher, and Trent data set included only fishes, but the Lyons and Baxter data set contained the shrimp data for the same stations and these were substituted. Thus, the comprehensive shrimp data base was constructed from the five data sets listed below.

1. GCRL - Monthly transects across the shelf by personnel of the Gulf Coast Research Laboratory of Ocean Springs, MS.

2. LB - Monthly transects across the shelf by personnel of the National Marine Fisheries Service laboratory in Galveston, TX and referred to in the published paper by Lyon and Baxter (1974.

3. DD - Collections made throughout the area by personnel of the Oceanography Department of Texas A&M University under the supervision of Darnell and Defenbaugh (see Defenbaugh, 1976).

4. MAFLA - Seasonal collections made at scattered localities during the BLM-sponsored MAFLA study.

5. PASCAGOULA - Random collections made throughout the area during all seasons by personnel of the National Marine Fisheries Service laboratory in Pascagoula, MS. The data are primarily from cruises of the FRS OREGON II during the years 1974-1982. However, four stations were included from a cruise of the old M/V OREGON made in January, 1957 since more recent stations could not be found for the particular localities. All three species of the genus Penaeus were clearly recognizable and their importance understood at that time.

The data for all the shrimp data sets were standardized in exactly the same manner as the fish data sets, and in the combined shrimp data base all the catch data are expressed as catch-per-hour-of-effort of the standard trawl.

Penaeidae - EDIBLE SHRIMP

In the present context the shrimp catch includes the three species of commercial importance: the brown shrimp (Penaeus aztecus); pink shrimp (P. duorarum); and white shrimp (P. setiferus). The combined shrimp data base includes a total of 3,509.87 shrimp. The composition and distribution of each of the three species is discussed below.

The brown shrimp (Penaeus aztecus) was represented in the catch by 2,607.68 individuals or 74.30 percent of the total shrimp catch. Its depth range extended from 3 to 110 m. Seasonally, the brown shrimp appeared as follows: winter - 8.1 percent; spring - 26.9 percent; summer - 32.9 percent; and fall - 32.2 percent. The seasonal distribution patterns of this shrimp are presented in Figure 17. During the winter the brown shrimp was distributed throughout most of the shelf west of Mobile Bay except in very deep water. No areas of significant concentration were apparent. In the spring the overall distribution pattern was much the same except that areas of intermediate density (greater than 100 individuals per hour) were evident in less than 20 m of water off Petit Bois Island and off the eastern flank of the Mississippi River Delta. These nearshore density areas appear to mark the movement of maturing shrimp from the nursery areas to the shelf in late spring. In the summer, areas of intermediate density appeared at 20-30 m off Dauphin Island and Mobile Bay in the north and at 40-50 m east of Breton Island further south. These appear to be the remnants of the two emigrating groups observed in the spring. In the fall the brown shrimp appeared to be more widespread, even east of Mobile Bay. A single area of moderate density appeared east of the Mississippi River Delta at 20-70 m, and this could represent a concentration of brown shrimp which move onto the shelf at that season. South of Petit Bois Island an area of low-intermediate density (greater than 50 shrimp per hour) appears to be the remnant of the two areas of intermediate density observed during the summer.

The life history of the brown shrimp in the north central Gulf has recently been summarized by Benson (1982). He pointed out that adults spawn on the shelf at 30-120 m from about November to April. The young then move into the estuaries where they grow rapidly. A major migration back out to the shelf takes place during the period of May to July. Although not mentioned by Benson (ibid.), movement of young from the estuaries probably takes place until at least November with a peak in the fall months. It is also clear that some larger individuals overwinter in the bays and sounds and participate in the spring emigration to the shelf. All these facts accord fairly well with

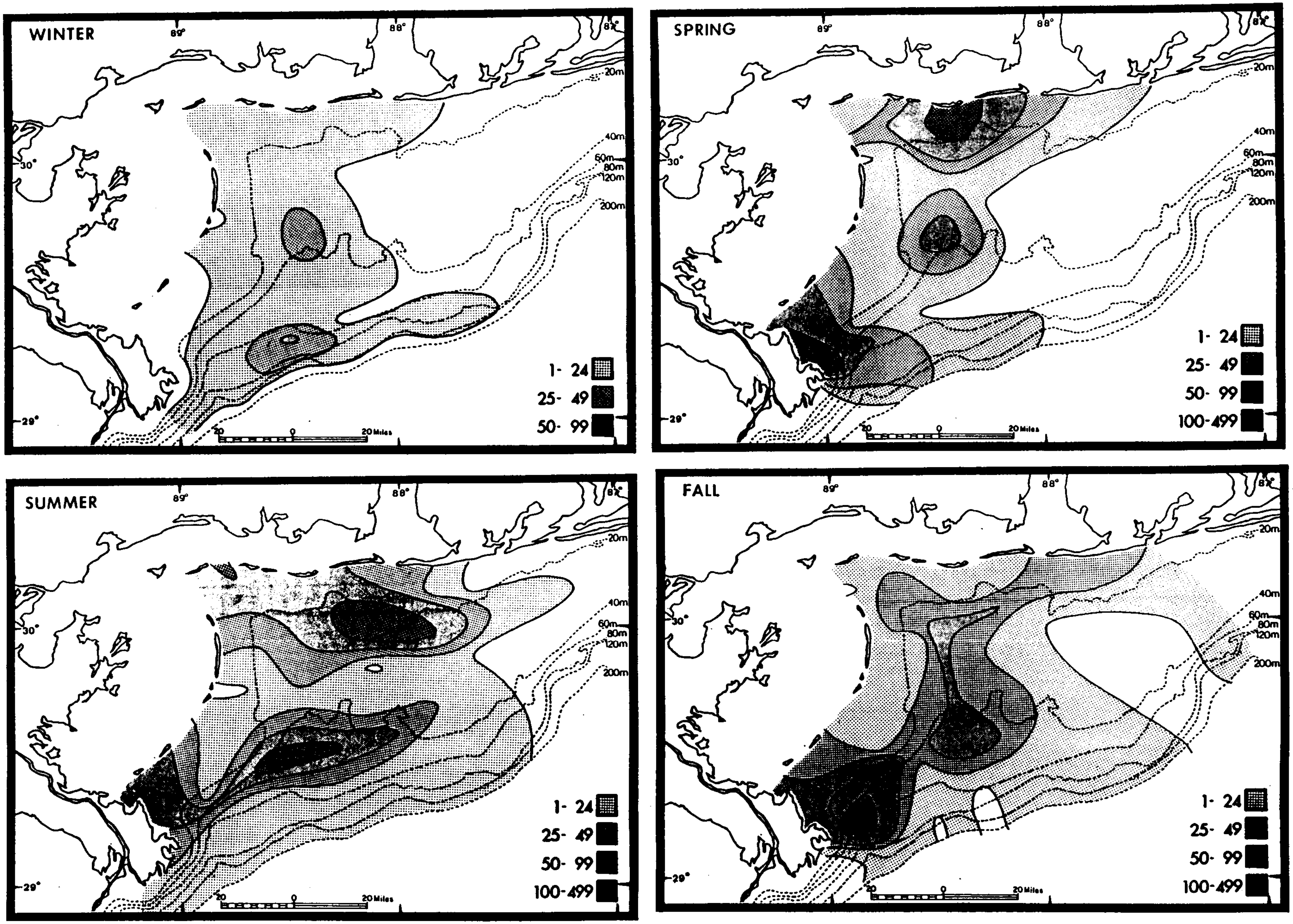

Figure 17. Seasonal distribution patterns of Penaeus aztecus on the outer continental shelf of the Tuscaloosa Trend study area. Number of individuals captured per hour trawling.

the seasonal patterns observed in the present study except that the winter populations on the shelf are much lower than might be anticipated. No winter breeding aggregations were observed. The distribution patterns would be more in accord with the assumption of late summer and fall spawning by this species.

The pink shrimp (Penaeus duorarum) was represented in the collections by 622.09 specimens or 17.72 percent of the total shrimp catch. The depth range of capture was 7-51 m. The species appeared at 34 stations; nine each in winter, spring, and summer, and seven in the fall. The seasonal distribution of abundance was as follows: winter - 12.7 percent; spring - 44.6 percent; summer - 38.1 percent; and fall - 4.6 percent. Seasonal distribution patterns are presented in Figure 18. In general, the pink shrimp was rare to absent east of Perdido Bay, and west of that point it was widely distributed across the inner half of the shelf during most seasons. At no season was the density greater than 80 individuals per hour of trawling effort, and densities greater than 50 per hour occurred only during spring and summer. In the spring they appeared off the mouth of Mobile Bay and the pass between the Chandeleur Islands and Breton Island. In the summer they appeared at nearly the same spots. During fall and winter the densities were lower and the distribution patterns were more restricted.

On the north central Gulf shelf the pink shrimp spawns in the depth range of 8-34 m from March to October. Young enter the bays and estuaries where they remain and grow until the following spring. Darnell and Williams (1956) reported that during a year of high salinity they were taken in Lake Pontchartrain in one-fourth of all trawl collections from November through May. The migration to the continental shelf takes place between June and November. Since the species is primarily nocturnal, daytime trawl collections often do not reveal its true abundance in an area.

The data presented in the present study substantiates the movement of pink shrimp onto the shelf in the spring and summer months. They further indicate that this species utilizes only the inner half of the shelf, and they suggest that this population (west of Perdido Bay) is isolated from other pink shrimp populations of the Florida shelf.

The white shrimp (Penaeus setiferus) was surprisingly rare in the collections. Only 280.10 individuals were taken, representing 8.0 percent of the total shrimp catch. It occurred at depths of 9-54 m. Seasonally, it occurred as follows: winter - 46.6 percent; spring - 8.0 percent; summer - 6.3 percent; and fall - 39.1 percent. The seasonal distribution of the white shrimp is presented in Figure 19. No specimens were taken east of Perdido Bay and few appeared east of Mobile Bay. During the winter this shrimp appeared in low density in relatively shallow water from Perdido Bay to the Mississippi River Delta. The only area of density greater than 50 per hour occurred near the Delta. Spring and summer were characterized by low density and restricted distribution patterns. In the fall the distribution was much like that of the winter. The species was continuously distributed in shallow water from Mobile Bay to the Mississippi Delta, and the only areas of slightly increased density were off the mouths of passes (in this case, between Horn and Petit Bois Islands and off the Chandeleur Islands).

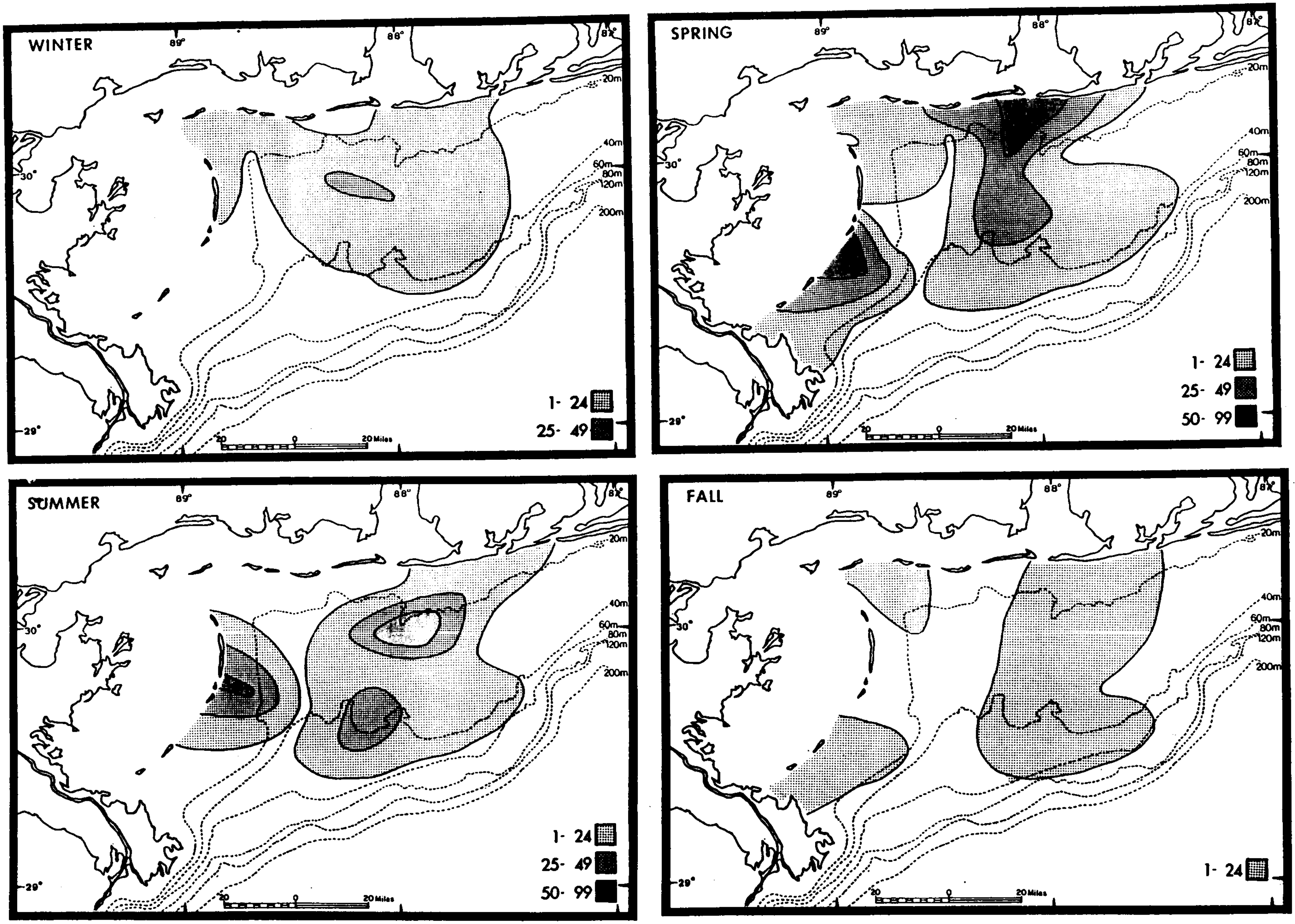

Figure 18. Seasonal distribution patterns of Penaeus duorarum on the outer continental shelf of the Tuscaloosa Trend study area. Number of individuals captured per hour trawling.

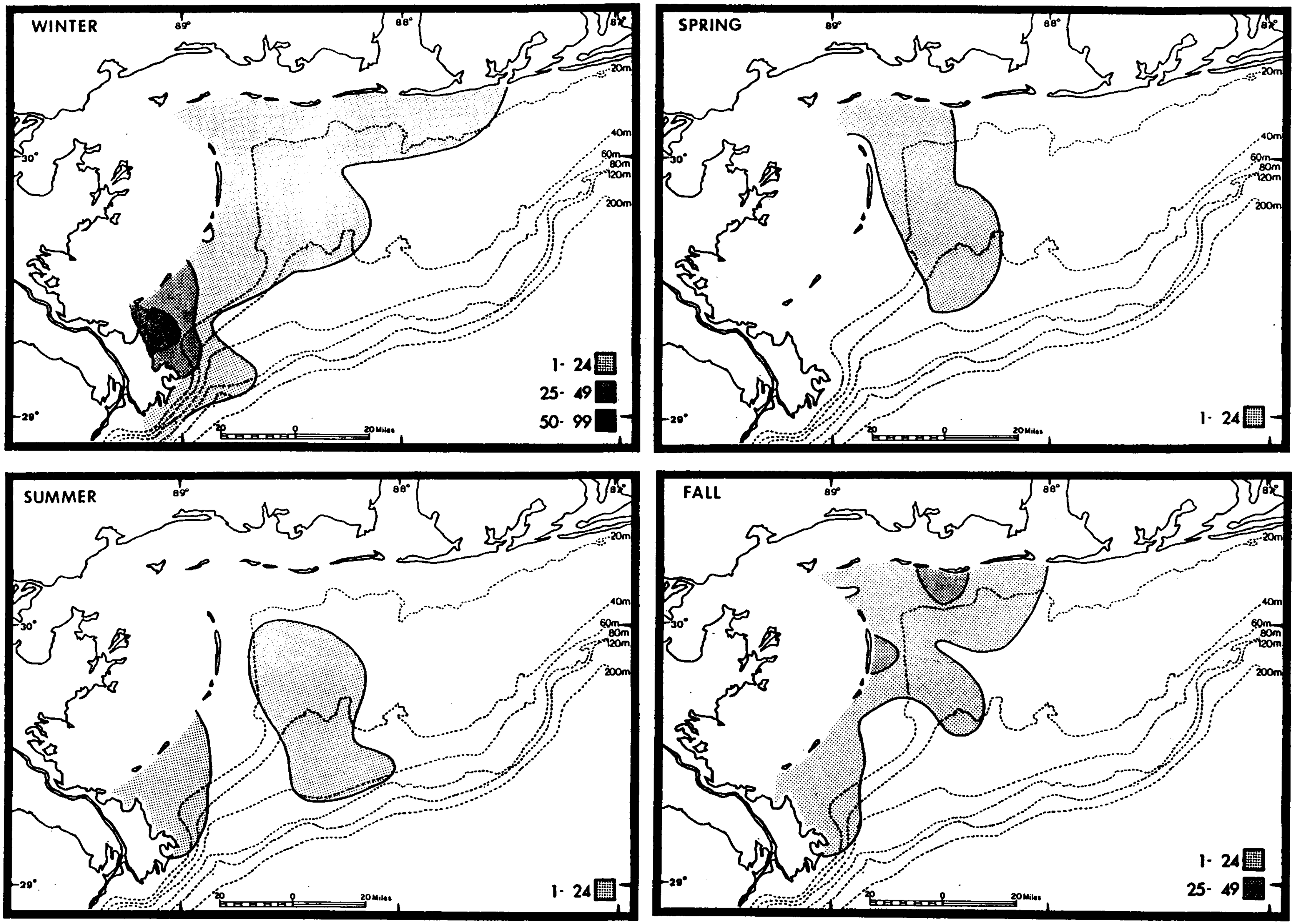

Figure 19. Seasonal distribution patterns of Penaeus setiferus on the outer continental shelf of the Tuscaloosa Trend study area. Number of individuals captured per hour trawling.

Benson (1982) noted that adult white shrimp spawn on the shelf at depths from 8 to 34 m from March to October. Postlarvae enter the bays and estuaries where they remain and grow until they are ready to migrate. The migration to the shelf takes place between June and November. In the writer's experience most of this migration occurs during the fall months.

Data in the present study support the conclusions that the white shrimp utilizes the shelf primarily during the fall and winter months, that its greatest populations are found off the mouths of passes, and that the species are most abundant at depths of less than 20 m. Over 85 percent of the white shrimp catch on the shelf occurred during the fall and winter months. Most of the individuals were taken west of Mobile Bay.

Another penaeid shrimp of commercial interest in the northern Gulf is the royal red shrimp (Pleoticus robustus). This species did not appear in the shrimp data base, but Bullis (1956) summarized information about its distribution in the area. It is an upper slope species with a maximum depth range of 274-732 m and is concentrated on trawlable bottoms southeast of the mouth of the Mississippi River, extending essentially to DeSoto Canyon. Three-hour trawl drags in this area produced catches of 90-120 pounds. This deepwater species is not known from the continental shelf of the area at depths of less than 200 m.

SUMMARY AND SYNTHESIS

The fish and shrimp species of commercial and recreational importance represent a very diverse assemblage in terms of life history and habitat relations. Each has developed its own particular formula for success in a very dynamic ecological system. For all the species more knowledge would be useful, but it is already possible to sketch out, in broad outline, how the system works and how the various species fit into the picture.

Estuarine dependent species

A portion of the species which utilize the continental shelf habitats is estuarine dependent, and summary data for this group is presented in Table 3. Two groups of estuarine dependent species are recognized--cold weather and warm weather spawners. Except for Penaeus aztecus, all the cold weather spawners are most abundant on the shelf during the fall and winter months (i.e., during their spawning seasons). Why P. aztecus deviates is not clear, but this species could be, in part at least, a fall spawner. Three of the warm weather spawners (Arius felis, Cynoscion arenarius, and Penaeus setiferus) are most abundant on the shelf during the fall and winter (i.e., during the non-spawning season). One species (Menticirrhus americanus) is most abundant on the shelf in the winter and about the same during the spring and fall. The pink shrimp (Penaeus duorarum) is most abundant on the shelf during the spring and summer months (i.e., during much of its spawning season).

The seasonal distribution maps clearly point to the fact that in order to enter the shelf the estuarine dependent species utilize the various passes and that different passes appear to be more important for different species. Two areas seem to stand out in this connection: the mouth of Mobile Bay and the Petit Bois-Dauphin Island channel, on the one hand; and the passes between the Chandeleur Islands and the Mississippi Delta marshes, on the other. Once on

Table 3. Estuarine dependent species of commercial and recreational importance collected on the continental shelf, giving numerical abundance in the fish or shrimp data base, percent abundance by season, and spawning season. For species with less than 50 individuals, seasonal percentage is not given.

Species	Number of individs.	Percent abundance on the shelf				Spawning season
		W	Sp	Su	F	
Cold weather spawners						
Brevoortia patronus	92.9	96.9	0.0	0.0	3.1	October-March
Archosargus probatocephalus	12.6	--	--	--	--	February-June
Leiostomus xanthurus	5,994.3	33.9	11.6	8.5	46.0	December-March
Micropogonias undulatus	32,102.5	15.4	13.0	12.8	58.9	October-April
Pogonias cromis	17.8	--	--	--	--	February-April
Sciaenops ocellatus	21.6	--	--	--	--	September-November
Mugil cephalus	0.2	--	--	--	--	October-May
Paralichthys albigutta	0.1	--	--	--	--	November-February
Paralichthys lethostigma	58.9	27.0	17.7	22.7	32.6	September-April
Penaeus aztecus	2,607.7	8.1	26.9	32.9	32.2	November-April
Warm weather spawners						
Arius felis	4,519.8	31.6	4.2	31.7	32.5	May-August
Cynoscion arenarius	3,005.0	48.2	18.2	11.9	21.7	March-September
Menticirrhus americanus	549.5	42.8	23.2	13.6	20.3	April-October
Penaeus duorarum	622.1	12.7	44.6	38.1	4.6	May-November
Penaeus setiferus	280.1	46.6	8.0	6.3	39.1	March-October

the continental shelf, many of the estuarine dependent species appear to remain, or at least display, highest densities near the passes and in less than 20 m of water. This group includes the following species: Arius felis; Archosargus probatocephalus; Menticirrhus americanus; Pogonias cromis; Sciaenops ocellatus; and Penaeus setiferus. Two species (Brevoortia patronus and Mugil cephalus) become pelagic and disappear from the bottom fishery almost as soon as they arrive at the shelf. Of the remaining estuarine-dependent species, Leiostomus xanthurus, Micropogonias undulatus, and to some extent, Penaeus aztecus and Cynoscion arenarius, develop dense populations beyond the 20 m depth. There appears to be a major area of cold weather concentration of most of these species at a depth of 20-40 m southeast of Mobile Bay. Some of the species which travel seaward near the eastern flank of the Mississippi Delta marshes appear to concentrate in cold weather in waters deeper than 60 m.

Non-estuarine dependent species which are resident on the shelf

The second group of species resides on the continental shelf, and although some species may make use of bays, sounds, and estuaries, such areas are not critical to the life history. Summary data for this group is given in Table 4. Those species which occur only on the outer half of the shelf are of potential commercial and recreational importance, but they are under-utilized at present. Of those which occur on the inner half of the shelf, only four species appeared in any abundance in the fish data base (Lutjanus campechanus, Cynoscion nothus, Peprilus alepidotus, and Peprilus burti). Most sharks, as well as Pomatomus saltatrix and Rachycentron canadum, are generally too mobile to be caught by trawls and are obviously much more abundant on the shelf than present data would indicate. Groupers (Epinephelus itajara and E. morio) and one of the snappers (Lutjanus synagris) tend to remain around wrecks and reef structures of the middle and outer shelf where they are less vulnerable to capture by trawls. In the winter months Lutjanus campechanus shows a remarkable concentration at a depth of 30-40 m off Mobile Bay. Since spawning in this species occurs in the warmer months, it is suggested that the winter concentration is a reflection of the concentration in the same area by the demersal fishes and shrimp which make up its food supply. On the continental shelf the distribution of Cynoscion nothus appears to differ in no significant way from that of C. arenarius except that the latter species is more abundant and extends to waters of greater depth. The two stromateids (Peprilus alepidotus and P. burti) are, in part, pelagic. The life histories must be seasonally quite different. P. alepidotus was most abundant in the fall and winter, whereas P. burti was most abundant in spring and summer.

Non-estuarine dependent species which are basically summer residents

A group of highly carnivorous species moves into the shelf area during the warmer months (Table 5). These include the carangids, coryphaenids, scombrids, tunas, and billfishes. Some move in from deeper Gulf waters, and others are along-shelf migrators. Some appear to remain around the outer edge of the shelf, whereas others range broadly over the inner shelf and may even penetrate Mississippi Sound and larger bays. Most appear to be spring or summer spawners and the young must make extensive use of the shelf and related coastal waters. These species are excellent swimmers and are only rarely taken in trawl collections. Most are of interest to sport fishermen.

Table 4. Non-estuarine dependent species of commercial and recreational importance which are resident on the shelf, giving numerical abundance in the fish data base, percent abundance by season, and spawning season (where known). For species with less than 50 individuals, seasonal percentage is not given.

Species	Number of individs.	Percent abundance on the shelf				Spawning season
		W	Sp	Su	F	
Species which occur on the inner half of the shelf						
Carcharhinus acronotus	3.1	--	--	--	--	
Mustelus canis	6.2	--	--	--	--	
Rhizoprionodon terraenovae	14.5	--	--	--	--	July-August
Sphyrna tiburo	5.9	--	--	--	--	
Other shark species	--	--	--	--	--	
Epinephelus itajara	--	--	--	--	--	
Epinephelus morio	--	--	--	--	--	
Pomatomus saltatrix	0.5	--	--	--	--	August-April
Rachycentron canadum	9.4	--	--	--	--	April-August
Lutjanus campechanus	1,131.8	80.7	1.9	6.7	10.7	June-October
Lutjanus synagris	--	--	--	--	--	March-September
Cynoscion nothus	523.8	64.9	2.4	25.9	6.8	"Fall"
Peprilus alepidotus	144.8	30.4	0.5	0.0	69.0	"Spring"
Peprilus burti	12,931.3	3.3	66.3	27.4	3.0	Feb.-May, Sept.-Nov.
Species which occur only on the outer shelf						
Squatina dumerili	16.0	--	--	--	--	
Caulolatilus intermedius	90.4	71.6	0.0	3.4	25.0	
Caulolatilus microps	38.4	--	--	--	--	
Lopholatilus chamaeleonticeps	--	--	--	--	--	
Malacanthus plumieri	--	--	--	--	--	
Paralichthys squamilentus	49.5	1.3	12.5	1.6	84.5	

Table 5. Non-estuarine dependent species of commercial and recreational importance which are basically summer residents only, giving numerical abundance in the fish data base, spawning season (where known), and portion of the shelf primarily used.

Species	Number of individs.	Spawning season	Portion of shelf used		Comments
			Inner	Outer	
<u>Carangids</u>					
Caranx crysos	86.4	Spring	x	x	
Caranx hippos	--	Spring-Summer	x	x	
Caranx latus	--	Summer	x	x	
Hemicaranx amblyrhynchus	40.0			x	
Seriola dumerili	19.9	Summer		x	
Seriola fasciata	--			x	
Trachinotus carolinus	--	Summer-Fall	x	x	
<u>Coryphaenids</u>					
Coryphaena equisetus	--			x	Shelf edge, rare
Coryphaena hippurus	--	Spring		x	
<u>Scombrids</u>					
Auxis thazard	--			x	Rare
Scomber japonicus	9.0			x	
Scomberomorus cavalla	--	Summer		x	
Scomberomorus maculatus	4.3	Summer	x	x	
Scomberomorus regalis	--			x	Rare
<u>Tunas</u>					
Euthynnus alletteratus	--	Summer	x	x	
Euthynnus pelamis	--	Summer		x	Shelf edge, rare

Table 5. (continued).

Species	Number of individs.	Spawning season	Portion of shelf used		Comments
			Inner	Outer	
<u>Tunas</u> (continued)					
Thunnus albacares	--			x	shelf edge
Thunnus atlanticus	--			x	shelf edge
Thunnus thynnus	--			x	shelf edge
<u>Billfishes</u>					
Istiophorus platypterus	--	Summer		x	
Makaira nigricans	--	Summer		x	shelf edge
Tetrapterus albidus	--	Summer		x	shelf edge

Ecosystem considerations

The migration of estuarine dependent fishes and shrimp from the estuaries, bays, and sound primarily during late summer and fall represents a major flow of biologically bound energy to the continental shelf area. The times and places of this flow have been documented above. Once on the shelf, this energy is divided among the pelagic and demersal species where they represent two somewhat interrelated food webs. However, it is probably no accident that the greatest utilization of the shelf by estuarine dependent species is during the colder months (when the bulk of the predators is absent) and that most estuarine dependent species spawn during the colder months. There is a reverse movement of energy back into the estuary and related waters when the larvae and juveniles migrate to the nursery areas, and considering the organic matter which accompanies the young in the bottom waters, this shoreward movement of energy cannot be negligible. This interrelatedness of the inside and outside waters strongly argues that any serious modeling effort should include both inside and outside waters in the same model or in two interconnected models. By the same token, both demersal and pelagic food webs should be integrated into the models.

Management recommendations

To provide for the continuance of spawning stocks of the estuarine dependent species, special protection should be afforded the migratory routes, particularly the passes. Protection should also be afforded the major aggregation areas off the passes. Protection should also be afforded the major aggregation areas off the passes, in waters of less than 20 m depth, in the winter aggregation area between 20 and 40 m southwest of Mobile Bay, and east and south of the Mississippi River Delta.

Research should be carried out to provide the basis for understanding of the dynamics of the system in a more quantitative way. This would involve numerical estimates of abundance of the various species in relation to time, elucidation of migratory pathways in greater detail, food web studies (building upon the works of Rogers, 1977, and including the pelagic portions and larval life), and casting this information in the framework of descriptive mathematical models. Since the life histories of the estuarine dependent species is intimately controlled by hydrographic conditions (associated with larval transport), the hydrography of the passes and nearshore waters cannot be ignored.

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TUSCALOOSA TREND REGIONAL DATA SEARCH AND SYNTHESIS STUDY

FINAL REPORT
VOLUME II SUPPLEMENTAL REPORTS

APPENDIX C

QUANTITATIVE CHARACTERIZATION OF DEMERSAL FINFISH AND SHELLFISH POPULATIONS AND COMMUNITIES IN THE TUSCALOOSA TREND REGION

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APPENDIX C

QUANTITATIVE CHARACTERIZATION OF DEMERSAL FINFISH AND SHELLFISH POPULATIONS AND COMMUNITIES IN THE TUSCALOOSA TREND REGION

1.0 SUMMARY OF RESULTS

1.1 INTRODUCTION

Section 1.0 presents a synthesis and summary of the results of the fisheries data analysis conducted as part of the Tuscaloosa Trend Regional Data Search and Synthesis Study. The analyses upon which this synthesis is based are discussed in detail in Section 2.0 of this appendix. Results of the analysis of the SEAMAP groundfish survey data from the spring seasons of 1982 and 1983 are first summarized in Section 1.3.1. The detailed analyses upon which this synthesis is based are presented in Sections 2.5.1 and 2.5.2. The SEAMAP surveys provided data for characterization of demersal nekton communities over much of the Tuscaloosa Trend study area, including the eastern region where data from the larger Fishery Independent survey database were generally lacking. The SEAMAP surveys also included stations from major estuarine habitats lying adjacent to the Tuscaloosa Trend study area that were outside the range of the Fishery Independent surveys.

The drawbacks to the SEAMAP survey database were its lack of seasonal and long term temporal coverage. To address seasonal and long term trends in community structure in the Tuscaloosa Trend study area, subsets of the large NMFS Fishery Independent groundfish survey database were analyzed. Data for four seasons from fall of 1974 to spring 1975 were used to assess seasonal trends, while data for the fall seasons for the period 1973 to 1983 were analyzed to assess long term trends in demersal nekton stocks. Summaries of the results of these seasonal and long term analyses are presented in Sections 1.3.2 and 1.3.3, respectively, while detailed presentations of the analysis results are presented in Sections 2.5.3 and 2.5.4, respectively.

Once this context was established, an analysis of NMFS Gulf Coast Shrimp Data (GCSD) for the period 1960 to 1982 was conducted for brown, white, pink and seabob shrimp, and the results are summarized in Section 1.3.4. A detailed discussion of these analysis results is presented in Section 2.5.5.

1.2 ANALYTIC APPROACH

The first step in the quantitative analysis of the finfish and shellfish populations and communities in the Tuscaloosa Trend region was the identification, acquisition and computerization of the relevant biological and environmental data sets. Long-term time series data for finfish and shellfish taxonomic counts and associated environmental variables, Ekman transport, river discharge, tides, winds, and precipitation were acquired for the estuarine and OCS areas from state and federal sources (see Section 2.3). These data were integrated into the project database in analytically compatible formats to allow the development of quantitative relationships between population levels, community structure and environmental processes.

The quantitative approach to defining the relationships of population and community distributions to environmental processes employed an overall analytic framework which utilized both univariate and multivariate statistical techniques. In this approach, population, community and habitat-level analysis and synthesis activities provided the context within which major biotic and habitat gradients in the study area and homogeneous subregions of the study area were identified and major processes influencing populations and communities were elucidated. The approach to this analysis is presented in greater detail in Section 2.4.

For each of the three major community analyses, habitats (station groups) and assemblages (taxa groups) are defined and the relationship of each assemblage to each habitat is identified. Nekton communities are composed of the several assemblages represented in each habitat type.

1.3 RESULTS

1.3.1 1982 and 1983 Southeastern Area Monitoring and Assessment Program (SEAMAP) Survey Data

The results of the pattern analyses conducted separately for the 1982 and 1983 SEAMAP trawl data revealed very similar trends in the distributions of finfish and shellfish taxa over much of the Tuscaloosa Trend ecosystem during fall in 1982 and 1983. The similarity of the separate analyses indicates that recurring trends in community structure were occurring over the study area. Differences in community structure during the two years was at least partly due to the different geographic distribution of stations (Figure 1). During 1983, the SEAMAP study area extended further east on the Florida shelf. Although the easternmost of these stations were located outside the defined borders of the Tuscaloosa Trend ecosystem, data from these stations were included to show the transitional nature of the study area and to better describe the communities from the eastern region of the study area itself. Other year to year differences could be attributable to differences in hydrographic conditions, either prior to or at the time of sampling. Other potential sources of variability included changes in taxa distributions during the sampling period, which was approximately 1 month during each year. Many nekton taxa are migratory, either along coast or normal to the coast, with the late spring-early summer being one of especially intensive activity. Year to year differences would be exaggerated if the cruise tracks (i.e., order of sampling of stations in different geographical areas) differed during the two years. Finally, there is the random variability within a sampling station due to a myriad of factors.

Trends in community structure were primarily related to the distributions of hydrographic conditions, depth, and, as inferred from sediment maps of the area, seafloor composition. Diversity indices were positively correlated with depth and salinity and negatively correlated with temperature, indicating that the deeper, more hydrographically stable offshore habitats supported a more diverse demersal nekton community. However, on the shelf itself, trends in community parameters were much less distinct. Regardless, there were distinct and recurring trends in

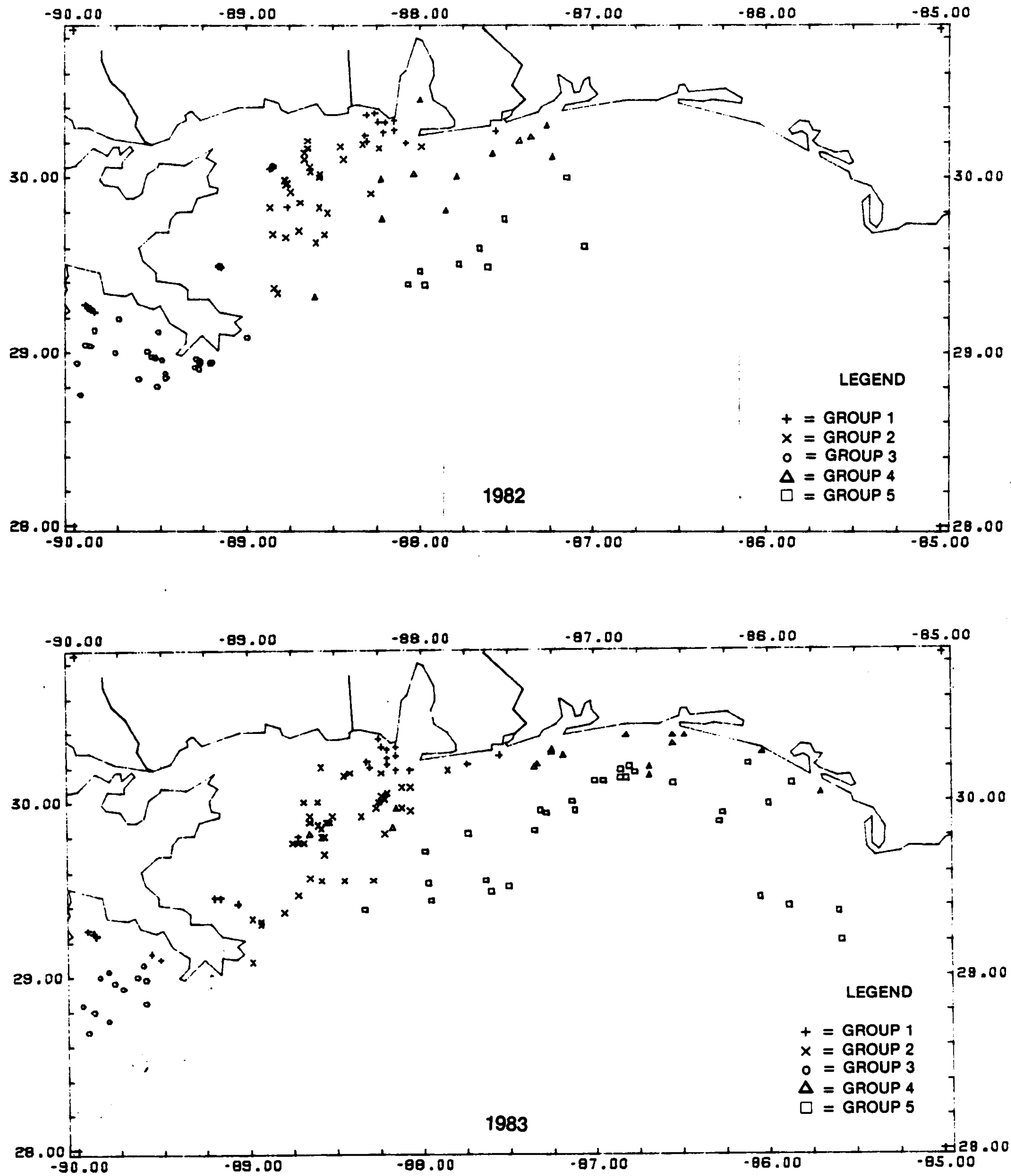

Figure 1. Map of the SEAMAP groundfish study area showing the membership of the stations to the five groups resulting from a synthesis of the community analyses of the spring 1982 and spring 1983 SEAMAP groundfish surveys.

community composition revealed in the pattern analyses of these data, which are summarized and discussed below.

The integration and synthesis of the results from the pattern analyses of the 1982 and 1983 SEAMAP data, which are discussed in detail in Sections 2.5.1 and 2.5.2, respectively, yielded five sample or station groups (habitats) and eight taxa groups (communities). Figure 1 depicts the geographical distribution of the five station groups (habitats) across the study area during 1982 and 1983, while summary statistics for each are presented in Table 1. The eight taxa groups are presented in Table 2, and the distributions of these taxa groups across the five station groups are presented in Table 3.

The five station groups included one widespread shallow water group (Group 1), two intermediate depth groups located east of the delta (Groups 2 and 4), one group encompassing stations at all but the shallowest depths west of the delta (Group 3), and one middepth to deep water group located east of the delta.

Sample Group 1 encompassed the shallow water, low salinity habitat located near the confluence of Mississippi Sound and Mobile Bay, and near the Mississippi River Delta (Figure 1 and Table 1). It included all of the very shallow water stations (less than 9 m depth) located both east and west of the Mississippi River outfall. This was the only one of the five groups found on both sides of the Mississippi River delta. The samples from this habitat were characterized by lowest means for total number of taxa and all community parameters (Table 1). However, mean numbers of individuals were intermediate among the five groups.

A habitat characterized by high salinity waters overlying muddy sediments in the central portion of the study area east of the Mississippi River Delta was represented by Sample Group 2. Stations in Group 2 were generally intermediate in depth, but the range was large (Table 1). They were generally located offshore of those in Group 1 and inshore of those in Group 5 (Figure 1). Group 2 stations had the second highest mean number of individuals and the highest mean number of taxa (Table 1). They also had the highest means for diversity and evenness, but these means were only marginally higher than those of Group 5.

Sample Group 3 encompassed a somewhat similar habitat west of the Mississippi River Delta. However, with the exception of the very shallow depths (less than 9 m (meters)), Group 3 stations were distributed across the entire extent of the SEAMAP study area (out to 90 m) west of the Mississippi River outfall. Station Groups 1 and 3 were the only ones represented west of the Mississippi River delta, and no station in Group 3 was found east of the delta (Figure 1). Therefore, many of the taxa characteristic of Group 3 showed similarly restricted geographical distributions. The fact that Group 3 stations included some out to 90 m depths may indicate that finer textured sediments may extend to deeper waters west of the outfall (as compared to those east of the delta). Samples from Group 3 stations had the highest mean number of individuals, and, next to the samples in Group 1, the lowest taxa richness (Table 1). Evenness and diversity were very similar to those of Groups 2, 4, and 5.

Sample Groups 4 and 5 more or less delineated middepth and deep water habitats, respectively, located mainly in the eastern portion of the study

Table 1. Summary statistics of environmental and community parameters for five station groups identified from a synthesis of analyses of samples collected in and around the Tuscaloosa Trend study area during the spring 1982 and 1983 SEAMAP groundfish surveys.

Parameter	Mean	Standard Deviation	Minimum	Maximum
GROUP=1				
Depth (m)	6.841	3.534	2.000	16.000
Bottom Dissolved Oxygen (ppm)	5.587	1.573	1.400	8.900
Bottom Salinity (ppt)	23.723	8.485	5.300	35.500
Bottom Temperature (oC)	27.500	2.421	21.500	31.700
Total Taxa	9.621	6.604	1.000	28.000
Total Count	510.195	841.161	1.000	4611.000
Diversity (J')	0.912	0.651	0.000	2.332
Evenness (H')	0.505	0.237	0.078	1.000
Richness (D)	1.700	0.985	0.000	4.904
GROUP=2				
Depth (m)	22.690	9.643	9.000	60.000
Bottom Dissolved Oxygen (ppm)	4.841	1.123	2.700	7.900
Bottom Salinity (ppt)	34.821	1.370	31.000	38.000
Bottom Temperature (oC)	22.255	2.345	18.810	27.800
Total Taxa	25.407	6.985	5.000	40.000
Total Count	957.512	1092.215	47.000	5845.000
Diversity (J')	1.980	0.456	0.879	2.845
Evenness (H')	0.626	0.142	0.293	0.916
Richness (D)	3.802	0.951	1.022	5.960
GROUP=3				
Depth (m)	42.750	18.744	10.000	90.000
Bottom Dissolved Oxygen (ppm)	5.053	1.239	1.800	7.400
Bottom Salinity (ppt)	35.912	0.820	33.000	37.724
Bottom Temperature (oC)	20.700	2.176	16.660	25.600
Total Taxa	19.892	6.463	1.000	33.000
Total Count	1238.811	1544.324	3.000	8673.000
Diversity (J')	1.822	0.548	0.000	2.699
Evenness (H')	0.627	0.117	0.373	0.808
Richness (D)	2.841	0.982	0.000	5.059
GROUP=4				
Depth (m)	22.286	8.944	9.000	42.000
Bottom Dissolved Oxygen (ppm)	6.804	1.530	4.400	9.300
Bottom Salinity (ppt)	35.351	0.721	33.006	37.000
Bottom Temperature (oC)	22.040	1.336	20.580	25.690
Total Taxa	18.276	7.309	7.000	30.000
Total Count	400.414	533.148	21.000	2085.000
Diversity (J')	1.798	0.533	0.551	2.729
Evenness (H')	0.645	0.186	0.194	0.884
Richness (D)	3.218	1.046	1.255	5.059
GROUP=5				
Depth (m)	49.667	17.409	22.000	90.000
Bottom Dissolved Oxygen (ppm)	6.582	1.516	4.500	9.200
Bottom Salinity (ppt)	36.042	0.579	35.000	38.000
Bottom Temperature (oC)	20.392	1.086	17.610	23.000
Total Taxa	20.718	9.179	4.000	45.000
Total Count	267.282	215.299	5.000	1005.000
Diversity (J')	1.931	0.589	0.723	3.023
Evenness (H')	0.661	0.168	0.246	0.961
Richness (D)	3.720	1.457	1.864	7.616

Table 2. Eight taxa groups resulting from a synthesis of community analyses of samples collected in and around the Tuscaloosa Trend study area during the spring 1982 and 1983 SEAMAP groundfish surveys.

Group 1. Taxa Most Characteristic of the Shallow Water, Low Salinity Habitat

Scientific Name	Common Name
Anchoa mitchilli	bay anchovy
Anchoa nasuta	longnose anchovy
Arius felis	hardhead catfish
Chloroscombrus chrysurus	Atlantic bumper
Larimus fasciatus	banded drum
Menticirrhus americanus	southern kingfish
Micropogonias undulatus	croaker
Stellifer lanceolatus	star drum
Polydactylus octonemus	Atlantic threadfin
Trinectes maculatus	hogchoker

Group 2. Taxa Represented in Low Salinity Waters and in High Salinity Waters Overlying Muddy Sediments

Scientific Name	Common Name
Lolliguncula brevis	squid
Penaeus setiferus	white shrimp
Penaeus aztecus	brown shrimp
Callinectes sapidus	blue crab
Callinectes similis	crab
Anchoa hepsetus	striped anchovy
Cynoscion arenarius	sand seatrout
Leiostomus xanthurus	spot
Citharichthys spilopterus	bay whiff
Trichiurus lepturus	Atlantic cutlassfish
Peprilus burti	gulf butterfish
Symphurus plagiusa	blackcheek tonguefish

Group 3. Taxa Widespread in High Salinity Waters Overlying Muddy Sediments

Scientific Name	Common Name
Sicyonia dorsalis	rock shrimp
Squilla LPIL	mantis shrimp
Trachypenaeus LPIL	hardback shrimp
Calappa sulcata	crab
Porichthys plectrodon	Atlantic midshipman
Brotula barbata	bearded brotula
Lepophidium graellsi	blackedge cusk-eel
Ophidion welshi	crested cusk-eel
Cynoscion nothus	silver seatrout
Prionotus rubio	blackfin searobin
Etropus crossotus	fringed flounder

Group 4. Taxa Most Characteristic of High Salinity Waters Overlying Muddy Sediments East of the Mississippi River Outfall

Scientific Name	Common Name
Portunus gibbesii	portunid crab
Saurida brasiliensis	largescale lizardfish
Urophycis cirratus	gulf hake
Urophycis floridanus	southern hake
Serranus atrobranchus	blackear bass
Prionotus tribulus	bighead searobin
Sphoeroides parvus	least puffer

Group 5. Taxa Most Characteristic of High Salinity Waters Overlying Muddy Sediments West of the Mississippi River Outfall

Scientific Name	Common Name
Parapenaeus	shrimp
Hoplunnis macrurus	silver conger
Antennarius radiosus	singlespot frogfish
Steindachneria argentea	luminous hake
Gunterichthys longipenis	gold brotula
Nezumia bairdi	grenadier
Bollmania communis	ragged goby

Group 6. Taxa Represented in High Salinity Waters Overlying Muddy and Sandy Sediments

Scientific Name	Common Name
Penaeus duorarum	pink shrimp
Solenocera	shrimp
Ovalipes guadulpensis	portunid crab
Portunus spinicarpus	portunid crab
Etrumeus teres	round herring
Synodus foetens	inshore lizardfish
Halieutichthys aculeatus	pancake batfish
Lepophidium jeannae	mottled cusk-eel
Ophidion grayi	blotched cusk-eel
Centropristis philadelphicus	rock sea bass
Diplectrum bivittatum	dwarf sand perch
Lutjanus campechanus	red snapper
Prionotus roseus	bluespotted searobin
Syacium gunteri	shoal flounder
Stenotomus caprinus	longspine porgy

Group 7. Taxa Most Characteristic of Nearshore High Salinity Waters Overlying Sandy Sediments

Scientific Name	Common Name
Doryteuthis plei	squid
Loligo pealeii	squid
Sicyonia brevirostris	rock shrimp
Raja eglanteria	cleannose skate
Centropristis ocyurus	bank sea bass
Haemulon aurolineatum	tomtate
Orthopristis chrysoptera	pigfish
Prionotus carolinus	northern searobin
Prionotus martis	barred searobin
Prionotus scitulus	leopard searobin
Sphoeroides spengleri	bandtail puffer

Group 8. Taxa Most Characteristic of Offshore High Salinity Waters Overlying Sandy Sediments

Scientific Name	Common Name
Synodus intermedius	sand diver
Synodus poeyi	offshore lizardfish
Trachinocephalus myops	snakefish
Urophycis regius	spotted hake
Ophidion holbrooki	bank cusk-eel
Lagodon rhomboides	pinfish
Neomerinthe hemingwayi	spinycheek scorpionfish
Scorpaena calcarata	smoothhead scorpionfish
Bellator militaris	horned searobin
Prionotus salmonicolor	blackwing searobin
Syacium papillosum	dusky flounder
Monacanthus hispidus	planehead filefish

Table 3. A coincidence table displaying the relationship of the eight taxa groups to the five station groups resulting from a synthesis of community analyses of samples collected in and around the Tuscaloosa Trend study are during the spring 1982 and 1983 SEAMAP groundfish surveys.

	STATION GROUPS				
TAXA GROUPS	Group 1 Low salinity Muddy sediments	Group 2 Muddy sediments east of delta offshore	Group 3 Muddy sediments west of delta offshore	Group 4 Nearshore high salinity sandy sediments	Group 5 Offshore high salinity sandy sediments
Group 1	P				
Group 2	P	P	P		
Group 3		P	P		
Group 4		P			
Group 5			P		
Group 6		S	S	P	P
Group 7				P	
Group 8					P

P = PRIMARY ASSOCIATION

S = SECONDARY ASSOCIATION

area, and characterized by high salinity waters overlying sandy sediments (Figure 1 and Table 1). The Group 5 stations extended across the deepest portions of the SEAMAP study area east of the delta (Figure 1), lying offshore of stations in both Group 2 (central region at middepths) and Group 4 (eastern region at middepths). Group 4 stations were much more restricted to the eastern portion of the study area. The distribution of Group 5 stations (Figure 1) may be another indication that coarser textured sediments extend to greater depths east of the Mississippi River delta. Based on total numbers of taxa and community parameters (Table 1) there was little difference in Group 4 and Group 5 samples. Means for all these parameters were marginally higher for Group 5, which had the lowest mean number of individuals of any of the five groups. Compared to those in Group 2, which encompassed a somewhat similar depth range further east, the Group 4 samples yielded lower values for numbers of individuals, numbers of taxa, diversity and richness (Table 1). Going west to east offshore (Groups 2-5), there was a consistent increase in mean numbers of individuals.

The eight taxa groups identified in the SEAMAP data (Table 2) showed very well defined distributions across the five stations groups (Table 3). As is evident in Table 3, the two offshore station groups located on muddy sediments in the western and central regions of the study area (Groups 2 and 3), were each characterized by five taxa groups, while the two offshore station groups, located mainly in the eastern and central portions of the study area overlying sandy sediments (Groups 4 and 5), and the inshore station group (Group 1) were each characterized by only two taxa groups.

Taxa Group 1 included those taxa most characteristic of, and generally restricted to, the shallow water, low salinity habitat during the spring represented by Sample Group 1. Anchoa mitchilli, Arius felis, Micropogonias undulatus, and Polydactylus octonemus were among the taxa most representative of this group. Several of these taxa (e.g., Anchoa mitchilli) are more or less restricted to estuaries, while several others (e.g., Micropogonias undulatus) are estuarine dependent, and migrate offshore later in the summer. Along with the taxa in Taxa Group 2 (Table 2), they characterized estuarine and very shallow offshore waters during the SEAMAP spring cruises (Table 3).

The taxa in Group 2 were also well represented in the shallow water, low salinity habitat of Sample Group 1, but were also prominent in the habitat characterized by high salinity waters overlying muddy sediments (Sample Groups 2 and 3), located both east and west of the Mississippi River delta. Some of the taxa most characteristic of this group included Cynoscion arenarius, Trichiurus lepturus, Symphurus plagiusa, Callinectes sapidus, Callinectes similis and Penaeus aztecus. This group included a number of taxa that are estuarine dependent, but migrate offshore as adults. Based on their distributions in the spring SEAMAP data (Table 3), it appears that substantial offshore stocks remained from the previous fall or migration from the estuaries occurred earlier in the spring (i.e., prior to the SEAMAP cruises). Along with the taxa in Groups 3 and 6, those in Group 2 (Table 2) were common to both Station Groups 2 (east of delta) and Station Group 3 (west of delta).

The taxa in Group 3 were widespread in high salinity waters overlying muddy sediments both east and west of the delta (Station Groups 2 and 3 in Figure 1). Group 3 included the only taxa that were both widespread over, and restricted to, these muddy bottom offshore habitats (Table 3). Porichthys plectrodon, Prionotus rubio, Squilla LPIL, and Trachypenaeus LPIL were among the taxa most representative of this group.

Group 4 taxa were most characteristic of the high salinity waters overlying muddy sediments east of the Mississippi River Delta (Sample Group 2), and were more or less restricted to this habitat (Table 3). Sphoeroides parvus and Portunus gibbesii were most characteristic of this group. Along with the taxa in Group 5, the Group 4 taxa differentiated the communities at stations overlying muddy sediment located east and west of the Mississippi River delta.

The taxa most characteristic of, and more or less restricted to, high salinity waters overlying muddy sediments west of the Mississippi River Delta comprised Group 5 (Tables 2 and 3). Some of the taxa most characteristic of this group included Hoplunnis macrurus, Gunterichthys longipenis and Bollmania communis. The Group 5 taxa contributed strongly to the differentiation of the stations in Station Group 3 from all other station groups identified (Table 3).

Group 6 taxa were widespread in high salinity waters overlying muddy and sandy sediments (Sample Groups 2, 3, 4, and 5). As such they characterized most of the study area at depths of between 10 and 90 m. Centropristis philadelphicus, Stenotomus caprinus, Penaeus duorarum and Solenocera LPIL were among the taxa most representative of this group (Table 2).

The taxa in Group 7 were most characteristic of, and restricted to, nearshore high salinity waters overlying sandy sediments (Sample Group 4). Along with the widely distributed taxa in Group 6, these taxa characterized the Station Group 4 habitat (Table 3). Some of the taxa most characteristic of this group included Orthopristis chrysoptera, Prionotus martis, Prionotus scitulus, Sicyonia brevirostris and Loligo pealeii (Table 2).

Taxa Group 8 included those taxa most characteristic of, and restricted to, offshore high salinity waters overlying sandy sediments (Sample Group 5). Along with the widely distributed taxa in Group 6, these taxa characterized the Station Group 5 habitat (Table 3). Some of the taxa most characteristic of this group included Synodus intermedius, Trachinocephalus myops, Bellator militaris and Syacium papillosum (Table 2).

1.3.2 NMFS Fishery Independent Survey Seasonal Data

Results of the pattern analyses conducted on the NMFS Fishery Independent survey seasonal data for fall 1974 through summer 1975 revealed trends in the distributions of finfish and shellfish taxa that were primarily related to geography depth, hydrographic conditions and sediment composition, with seasonal trends for the most part being secondary to these other responses. Some taxa groups showed specific habitat responses, and contributed strongly to defining station groups. For several groups, relatively distinct seasonal changes in distributions over the study area were observed, indicating migration during the life histories of these

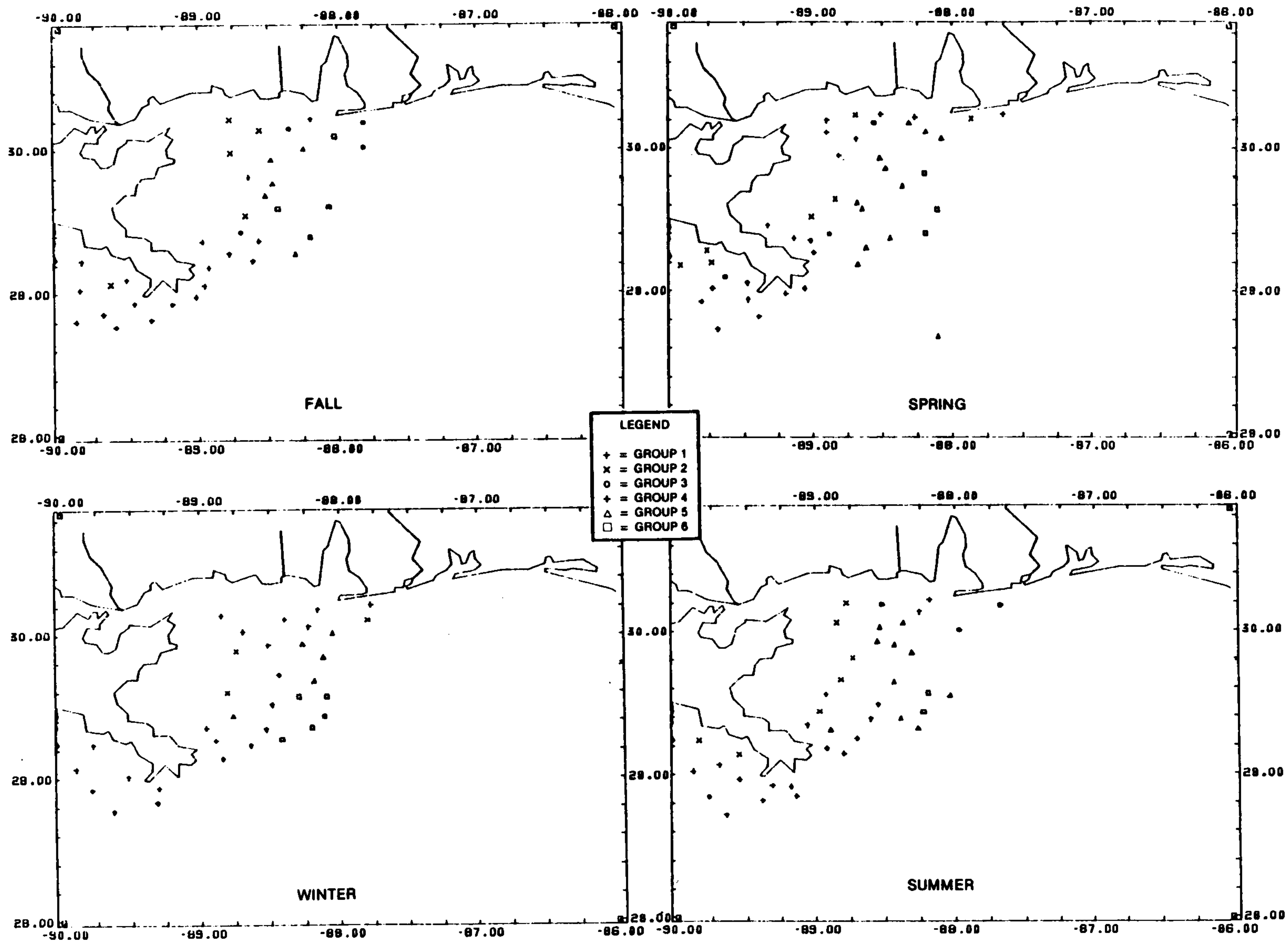

Figure 2. Map of the NMFS Fishery Independent groundfish survey area showing the membership of the stations to the six station groups resulting from a synthesis of the community analyses of the fall 1974 to summer 1975 NMFS Fishery Independent groundfish survey data.

Table 4. Summary statistics of environmental and community parameters for six station groups identified from a synthesis of analyses of three replicate samples collected at 154 stations in and around the Tuscaloosa Trend study area during the fall 1974 to summer 1975 NMFS Fishery Independent groundfish surveys.

Parameter	Mean	Standard Deviation	Minimum	Maximum
GROUP=1				
Depth (fm)	10.217	5.767	3.000	29.000
Bottom Temperature (°F)	71.483	5.252	61.000	81.000
Total Taxa	13.108	5.256	4.000	24.000
Total Count	897.133	988.098	67.000	4349.000
Diversity (J')	1.452	0.523	0.379	2.627
Evenness (H')	0.573	0.148	0.259	0.838
Richness (D)	1.991	0.946	0.585	4.571
GROUP=2				
Depth (fm)	7.227	1.878	3.667	11.000
Bottom Temperature (°F)	75.667	5.723	64.000	81.000
Total Taxa	10.030	4.662	2.333	17.333
Total Count	435.500	699.341	3.667	3300.333
Diversity (J')	1.242	0.487	0.466	2.089
Evenness (H')	0.591	0.183	0.271	0.946
Richness (D)	1.734	0.651	0.541	2.902
GROUP=3				
Depth (fm)	9.967	3.680	6.667	18.000
Bottom Temperature (°F)	72.979	3.416	67.000	79.000
Total Taxa	10.433	4.478	5.333	19.667
Total Count	138.433	109.467	21.333	323.667
Diversity (J')	1.342	0.344	0.574	1.654
Evenness (H')	0.612	0.128	0.409	0.792
Richness (D)	2.100	0.600	1.402	3.444
GROUP=4				
Depth (fm)	31.852	10.796	5.333	48.000
Bottom Temperature (°F)	67.857	2.869	64.000	77.000
Total Taxa	11.764	3.502	3.333	19.333
Total Count	559.870	277.299	219.333	1446.333
Diversity (J')	1.332	0.484	0.117	2.271
Evenness (H')	0.539	0.160	0.083	0.769
Richness (D)	1.787	0.639	0.414	3.324
GROUP=5				
Depth (fm)	21.042	10.881	8.000	50.000
Bottom Temperature (°F)	71.913	3.266	64.333	76.000
Total Taxa	17.927	4.414	8.333	25.333
Total Count	681.417	641.768	135.333	3426.667
Diversity (J')	1.834	0.380	0.858	2.550
Evenness (H')	0.641	0.096	0.405	0.837
Richness (D)	2.804	0.696	1.362	4.103
GROUP=6				
Depth (fm)	25.622	7.355	12.000	41.667
Bottom Temperature (°F)	71.417	2.173	68.000	74.000
Total Taxa	17.678	5.249	8.667	24.667
Total Count	439.344	523.555	89.667	2245.333
Diversity (J')	1.892	0.369	1.218	2.401
Evenness (H')	0.683	0.084	0.535	0.791
Richness (D)	2.930	0.739	1.858	4.247

Table 5. Relative composition of demersal nekton taxa at Station Group 1 stations based on the results of analysis of samples collected in and around the Tuscaloosa Trend study area during the fall 1974 to summer 1975 NMFS Fishery Independent groundfish surveys.

TAXON NAME	MEAN PERCENT COMPOSITION	CUMULATIVE PERCENT COMPOSITION	POOLED PERCENT COMPOSITION	FREQ. OF OCCURRENCE	CUMULATIVE ABUNDANCE	MEAN DENSITY (# / HA)	INDEX OF DISPERSION
Micropogonias undulatus	37.232	37.232	51.129	0.917	55043.	646.76	1573.97
Cynoscion arenarius	5.042	42.273	6.380	0.658	61911.	80.70	1601.88
Trichiurus lepturus	6.696	48.969	5.980	0.608	68349.	75.65	569.67
Cynoscion nothus	2.882	51.851	5.507	0.525	74278.	69.67	805.37
Penaeus aztecus	4.871	56.722	3.798	0.567	78367.	48.05	356.00
Anchoa hepsetus	1.246	57.968	3.645	0.267	82291.	46.11	2046.14
Leiostomus xanthurus	2.093	60.062	3.011	0.483	85533.	38.09	228.79
Prionotus rubio	2.425	62.487	2.004	0.442	87690.	25.34	112.71
Arius felis	4.620	67.107	1.772	0.475	89598.	22.42	102.61
Penaeus setiferus	2.681	69.788	1.461	0.667	91171.	18.48	49.44
Trachypenaeus	3.418	73.205	1.195	0.292	92458.	15.12	65.96
Polychaeta	0.618	73.824	0.929	0.008	93458.	11.75	1000.00
Anchoa mitchilli	2.138	75.962	0.864	0.158	94388.	10.93	88.76
Larimus fasciatus	0.839	76.801	0.845	0.358	95298.	10.69	75.93
Stellifer lanceolatus	1.592	78.393	0.844	0.167	96207.	10.68	97.95
Cynoscion	1.880	80.273	0.746	0.150	97010.	9.44	78.51
Lolliguncula brevis	1.613	81.886	0.649	0.292	97709.	8.21	42.53
Luidia	1.687	83.573	0.623	0.067	98380.	7.88	130.49
Harengula jaguana	0.918	84.491	0.606	0.208	99032.	7.66	77.37
Callinectes similis	1.005	85.496	0.587	0.350	99664.	7.43	36.30
Asteroidea	1.428	86.923	0.504	0.042	100207.	6.38	170.17
Peprilus burti	0.332	87.255	0.418	0.233	100657.	5.29	135.66
Prionotus tribulus	0.815	88.070	0.379	0.217	101065.	4.79	30.16
Callinectes sapidus	0.617	88.688	0.357	0.158	101449.	4.51	65.31
Renilla mulleri	0.693	89.381	0.340	0.092	101815.	4.30	47.70
Loligo	0.387	89.768	0.319	0.083	102158.	4.03	177.88
Chloroscombrus chrysurus	0.835	90.602	0.306	0.183	102487.	3.87	38.70
Cyclopsetta chittendeni	0.128	90.730	0.297	0.083	102807.	3.76	240.25
Menticirrhus americanus	0.609	91.339	0.296	0.250	103126.	3.75	25.67
Polydactylus octonemus	0.162	91.501	0.272	0.117	103419.	3.44	52.48
Lagodon rhomboides	0.319	91.820	0.266	0.192	103705.	3.36	19.08
Squilla	0.637	92.457	0.255	0.167	103980.	3.23	24.87
Stenotomus caprinus	0.265	92.723	0.254	0.067	104253.	3.21	69.86
Syacium papillosum	0.582	93.305	0.223	0.150	104493.	2.82	54.03
Etropus crossotus	0.595	93.900	0.217	0.258	104727.	2.75	16.50
Porichthys porosissimus	0.321	94.221	0.178	0.133	104919.	2.26	27.78
Centropristis philadelphicus	0.567	94.788	0.177	0.042	105110.	2.24	167.93
Prionotus	0.462	95.249	0.157	0.042	105279.	1.99	53.67
Synodus foetens	0.284	95.533	0.143	0.233	105433.	1.81	11.63
Sphoeroides parvus	0.430	95.962	0.138	0.125	105582.	1.75	13.03
Prionotus salmonicolor	0.087	96.049	0.112	0.042	105703.	1.42	96.93
Citharichthys spilopterus	0.249	96.298	0.111	0.167	105823.	1.41	9.85
Trinectes maculatus	0.035	96.333	0.097	0.033	105927.	1.22	44.62
Trachurus lathami	0.070	96.403	0.095	0.017	106029.	1.20	96.13
Cephalopoda	0.218	96.621	0.082	0.008	106117.	1.03	88.00
Polinices duplicatus	0.101	96.722	0.081	0.025	106204.	1.02	65.33
Sicyonia brevirostris	0.202	96.924	0.078	0.058	106288.	0.99	20.35
Diplectrum bivittatum	0.204	97.128	0.077	0.092	106371.	0.98	10.98
Opisthonema oglinum	0.168	97.296	0.073	0.075	106450.	0.93	19.19
Brevoortia patronus	0.183	97.478	0.072	0.067	106527.	0.90	26.24
Chaetodipterus faber	0.138	97.617	0.072	0.117	106604.	0.90	6.52
Selene setapinnis	0.181	97.798	0.059	0.108	106668.	0.75	10.14
Lepophidium	0.113	97.911	0.046	0.108	106717.	0.58	5.37
Archosargus probatocephalus	0.074	97.985	0.043	0.033	106763.	0.54	24.82
Urophycis floridanus	0.108	98.093	0.035	0.075	106801.	0.45	5.73
Orthopristis chrysoptera	0.079	98.173	0.031	0.017	106834.	0.39	31.04
Paralichthys lethostigma	0.038	98.211	0.030	0.142	106866.	0.38	3.32
Hydrozoa	0.037	98.248	0.027	0.033	106895.	0.34	11.61
Lutjanus campechanus	0.066	98.314	0.027	0.067	106924.	0.34	6.33
Portunus	0.019	98.334	0.027	0.017	106953.	0.34	20.65
Gorgoniidae	0.320	98.654	0.027	0.017	106982.	0.34	14.53
Brotula	0.092	98.745	0.026	0.025	107010.	0.33	12.80
Penaeus duorarum	0.071	98.816	0.026	0.108	107038.	0.33	2.57
Sphoeroides	0.080	98.896	0.025	0.042	107065.	0.32	8.55
Portunus gibbesii	0.059	98.955	0.025	0.050	107092.	0.32	5.71
Etropus	0.096	99.051	0.025	0.042	107119.	0.32	11.91
Parapenaeus	0.031	99.082	0.024	0.033	107145.	0.31	7.93
Bothidae	0.015	99.098	0.023	0.008	107170.	0.29	25.00
Eucinostomus gula	0.019	99.117	0.023	0.025	107195.	0.29	9.51
Symphurus plagiusa	0.042	99.158	0.020	0.042	107217.	0.26	7.15

Table 5. Continued.

TAXON NAME	MEAN PERCENT COMPOSITION	CUMULATIVE PERCENT COMPOSITION	POOLED PERCENT COMPOSITION	FREQ. OF OCCURRENCE	CUMULATIVE ABUNDANCE	MEAN DENSITY (# / HA)	INDEX OF DISPERSION
Lepophidium brevibarbe	0.017	99.175	0.020	0.017	107239.	0.26	18.33
Steindachneria argentea	0.007	99.182	0.020	0.017	107261.	0.26	15.40
Peprilus paru	0.037	99.219	0.020	0.042	107282.	0.25	4.77
Holothuroidea	0.004	99.223	0.020	0.008	107303.	0.25	21.00
Bagre marinus	0.037	99.260	0.018	0.050	107322.	0.22	4.46
Ophidion welshi	0.051	99.311	0.017	0.042	107340.	0.21	4.78
Halieutichthys aculeatus	0.042	99.352	0.017	0.050	107358.	0.21	4.78
Lolliguncula	0.018	99.371	0.016	0.025	107375.	0.20	11.78
Chilomycterus schoepfi	0.036	99.407	0.015	0.050	107391.	0.19	3.90
Squilla empusa	0.029	99.436	0.015	0.025	107407.	0.19	5.79
Loligo pealeii	0.036	99.473	0.014	0.050	107422.	0.18	3.57
Bairdiella chrysura	0.017	99.490	0.014	0.025	107437.	0.18	6.66
Balistes capriscus	0.004	99.495	0.011	0.017	107449.	0.14	10.15
Rhinoptera bonasus	0.062	99.557	0.010	0.050	107460.	0.13	2.57
Libinia emarginata	0.010	99.567	0.010	0.033	107471.	0.13	7.52
Narcine brasiliensis	0.017	99.584	0.009	0.050	107481.	0.12	3.95
Anthozoa	0.018	99.602	0.009	0.017	107491.	0.12	5.76
Caranx fusus	0.011	99.614	0.008	0.025	107500.	0.11	3.85
Sicyonia dorsalis	0.016	99.630	0.007	0.025	107508.	0.09	2.96
Pogonias chromis	0.016	99.645	0.007	0.033	107515.	0.08	2.10
Paguridae	0.020	99.665	0.006	0.017	107521.	0.07	2.97
Brotula barbata	0.007	99.672	0.006	0.008	107527.	0.07	6.00
Scomberomorus maculatus	0.011	99.683	0.006	0.025	107533.	0.07	2.30
Prionotus ophryas	0.004	99.687	0.006	0.008	107539.	0.07	6.00
Diplectrum radiale	0.004	99.691	0.006	0.008	107545.	0.07	6.00
Gorgonocephalus	0.016	99.707	0.006	0.008	107551.	0.07	6.00
Gobionellus hastatus	0.001	99.708	0.005	0.008	107556.	0.06	5.00
Citharichthys macrops	0.012	99.720	0.005	0.017	107561.	0.06	3.39
Ancylopsetta quadrocellata	0.009	99.729	0.005	0.008	107566.	0.06	5.00
Ogcocephalus	0.003	99.732	0.005	0.008	107571.	0.06	5.00
Caranx hippos	0.008	99.740	0.005	0.017	107576.	0.06	3.39
Congrina flava	0.005	99.745	0.004	0.008	107580.	0.05	4.00
Scorpaena calcarata	0.025	99.770	0.004	0.025	107584.	0.05	1.48
Hoplunnis	0.005	99.775	0.004	0.008	107588.	0.05	4.00
Calappa sulcata	0.007	99.782	0.004	0.008	107592.	0.05	4.00
Prionotus scitulus	0.026	99.808	0.004	0.008	107596.	0.05	4.00
Gymnura micrura	0.001	99.809	0.004	0.008	107600.	0.05	4.00
Etrumeus teres	0.006	99.815	0.003	0.017	107603.	0.04	1.66
Sphyraena guachancho	0.012	99.828	0.003	0.017	107606.	0.04	1.66
Syacium	0.044	99.871	0.003	0.017	107609.	0.04	1.66
Bollmannia	0.002	99.873	0.003	0.008	107612.	0.04	3.00
Ovalipes	0.005	99.878	0.003	0.008	107615.	0.04	3.00
Antennarius radiosus	0.010	99.887	0.003	0.017	107618.	0.04	1.66
Sciaenops ocellata	0.007	99.895	0.003	0.017	107621.	0.04	1.66
Rhizoprionodon terraenovae	0.015	99.910	0.003	0.025	107624.	0.04	0.98
Libinia	0.008	99.918	0.003	0.008	107627.	0.04	3.00
Etropus microstomus	0.004	99.923	0.002	0.008	107629.	0.02	2.00
Dasyatis sayi	0.005	99.927	0.002	0.008	107631.	0.02	2.00
Sphyrna tiburo	0.003	99.930	0.002	0.008	107633.	0.02	2.00
Busycon	0.009	99.939	0.002	0.017	107635.	0.02	0.99
Echinoidea	0.007	99.946	0.002	0.008	107637.	0.02	2.00
Syacium gunteri	0.004	99.951	0.002	0.008	107639.	0.02	2.00
Ophichthus	0.005	99.956	0.002	0.017	107641.	0.02	0.99
Dasyatus americana	0.006	99.962	0.002	0.017	107643.	0.02	0.99
Mugil curema	0.003	99.965	0.001	0.008	107644.	0.01	1.00
Ogcocephalus parvus	0.003	99.968	0.001	0.008	107645.	0.01	1.00
Decapterus punctatus	0.007	99.975	0.001	0.008	107646.	0.01	1.00
Congridae	0.000	99.975	0.001	0.008	107647.	0.01	1.00
Dasyatis sabina	0.001	99.976	0.001	0.008	107648.	0.01	1.00
Majidae	0.005	99.981	0.001	0.008	107649.	0.01	1.00
Raja texana	0.002	99.983	0.001	0.008	107650.	0.01	1.00
Monacanthus hispidus	0.005	99.988	0.001	0.008	107651.	0.01	1.00
Raja eglanteria	0.001	99.989	0.001	0.008	107652.	0.01	1.00
Leucosiidae	0.005	99.993	0.001	0.008	107653.	0.01	1.00
Trachinotus carolinus	0.000	99.993	0.001	0.008	107654.	0.01	1.00
Ophidion holbrooki	0.002	99.995	0.001	0.008	107655.	0.01	1.00
Callinectes	0.005	100.000	0.001	0.008	107656.	0.01	1.00
Ophiuroidea	0.000	100.000	0.000	0.008	107656.	0.00	*****

SAMPLE SUMMARY: SAMPLES = 120 TOTAL TAXA = 138 TOTAL DENSITY = 1264.96

Table 6. Relative composition of demersal nekton taxa at Station Group 2 stations based on the results of analysis of samples collected in and around the Tuscaloosa Trend study area during the fall 1974 to summer 1975 NMFS Fishery Independent groundfish surveys.

TAXON NAME	MEAN PERCENT COMPOSITION	CUMULATIVE PERCENT COMPOSITION	POOLED PERCENT COMPOSITION	FREQ. OF OCCURRENCE	CUMULATIVE ABUNDANCE	MEAN DENSITY (# / HA)	INDEX OF DISPERSION
Micropogonias undulatus	9.886	9.886	19.720	0.379	5668.	121.09	967.86
Selene setapinnis	2.028	11.915	14.417	0.136	9812.	88.53	4113.61
Cynoscion nothus	1.789	13.704	14.160	0.182	13882.	86.95	3741.29
Arius felis	25.038	38.742	13.715	0.864	17824.	84.22	157.86
Luidia	6.439	45.180	5.448	0.182	19390.	33.46	314.99
Chloroscombrus chrysurus	9.949	55.129	4.338	0.530	20637.	26.64	93.11
Anchoa hepsetus	4.855	59.984	4.290	0.333	21870.	26.34	181.98
Astropecten	2.634	62.618	3.316	0.045	22823.	20.36	467.47
Asteroidea	5.914	68.532	2.519	0.227	23547.	15.47	227.50
Harengula jaguana	1.830	70.362	1.124	0.288	23870.	6.90	70.19
Penaeus aztecus	1.755	72.117	1.079	0.364	24180.	6.62	32.88
Cynoscion arenarius	0.501	72.618	1.058	0.212	24484.	6.49	134.34
Loligo	1.688	74.305	1.033	0.152	24781.	6.34	44.33
Menticirrhus americanus	0.889	75.194	0.978	0.227	25062.	6.00	52.04
Anchoa mitchilli	1.023	76.217	0.950	0.061	25335.	5.83	125.71
Squilla	1.264	77.481	0.912	0.121	25597.	5.60	67.45
Opisthonema oglinum	2.961	80.442	0.751	0.288	25813.	4.61	38.35
Etropus crossotus	0.666	81.108	0.703	0.227	26015.	4.32	34.45
Leiostomus xanthurus	0.654	81.762	0.661	0.212	26205.	4.06	35.90
Lolliguncula	1.764	83.526	0.574	0.197	26370.	3.52	18.67
Decapoda	0.742	84.268	0.546	0.061	26527.	3.35	45.35
Prionotus	0.596	84.864	0.546	0.061	26684.	3.35	60.40
Lagodon rhomboides	0.617	85.481	0.470	0.091	26819.	2.88	49.12
Lolliguncula brevis	0.771	86.252	0.438	0.136	26945.	2.69	28.39
Cynoscion	0.381	86.633	0.431	0.076	27069.	2.65	57.62
Anchoa	0.456	87.090	0.411	0.061	27187.	2.52	38.44
Archosargus probatocephalus	2.127	89.217	0.379	0.152	27296.	2.33	17.56
Prionotus rubio	1.181	90.398	0.313	0.227	27386.	1.92	11.30
Peprilus burti	0.366	90.764	0.299	0.152	27472.	1.84	18.77
Penaeus setiferus	0.156	90.920	0.275	0.106	27551.	1.69	19.29
Decapterus punctatus	0.294	91.214	0.264	0.076	27627.	1.62	43.16
Renilla mulleri	0.577	91.791	0.264	0.091	27703.	1.62	17.32
Trachypenaeus	0.293	92.084	0.250	0.106	27775.	1.54	15.34
Loligo pealeii	0.285	92.369	0.177	0.091	27826.	1.09	15.08
Lutjanus campechanus	0.543	92.913	0.164	0.045	27873.	1.00	22.03
Portunus	0.058	92.971	0.160	0.015	27919.	0.98	46.00
Callinectes sapidus	0.684	93.654	0.146	0.227	27961.	0.90	4.04
Diplectrum bivittatum	0.175	93.829	0.139	0.121	28001.	0.85	10.81
Etropus	0.110	93.939	0.136	0.045	28040.	0.83	19.84
Trichiurus lepturus	0.241	94.180	0.136	0.106	28079.	0.83	12.91
Synodus foetens	0.175	94.355	0.136	0.152	28118.	0.83	7.91
Polydactylus octonemus	0.228	94.583	0.118	0.030	28152.	0.73	16.80
Squilla empusa	0.215	94.798	0.115	0.061	28185.	0.70	13.62
Aurelia	0.318	95.116	0.104	0.015	28215.	0.64	30.00
Syacium papillosum	0.081	95.197	0.094	0.106	28242.	0.58	5.56
Scyphozoa	0.206	95.404	0.094	0.091	28269.	0.58	7.75
Balistes capriscus	0.473	95.877	0.094	0.045	28296.	0.58	23.16
Penaeus duorarum	0.078	95.955	0.087	0.076	28321.	0.53	8.19
Sphyraena guachancho	0.087	96.042	0.083	0.061	28345.	0.51	7.33
Narcine brasiliensis	0.096	96.138	0.077	0.106	28367.	0.47	4.18
Stenotomus caprinus	0.076	96.214	0.077	0.061	28389.	0.47	7.14
Prionotus tribulus	0.078	96.293	0.073	0.106	28410.	0.45	4.56
Sphoeroides parvus	0.118	96.411	0.073	0.106	28431.	0.45	3.88
Callinectes similis	0.082	96.493	0.063	0.091	28449.	0.38	4.24
Centropristis philadelphicus	0.322	96.815	0.063	0.091	28467.	0.38	4.24
Lutjanus synagris	0.064	96.879	0.059	0.045	28484.	0.36	13.30
Eucinostomus gula	0.095	96.974	0.056	0.091	28500.	0.34	3.56
Scomberomorus cavalla	0.039	97.014	0.052	0.030	28515.	0.32	8.23
Chilomycterus schoepfi	0.070	97.083	0.052	0.091	28530.	0.32	2.95
Syacium gunteri	0.030	97.113	0.052	0.030	28545.	0.32	8.23
Portunus gibbesii	0.073	97.186	0.049	0.076	28559.	0.30	5.15
Hydrozoa	0.093	97.278	0.045	0.045	28572.	0.28	5.19
Paralichthys lethostigma	0.061	97.339	0.042	0.076	28584.	0.26	4.55
Renilla	0.083	97.422	0.038	0.045	28595.	0.23	7.49
Symphurus plagiusa	0.044	97.466	0.031	0.076	28604.	0.19	2.23
Brotula	0.049	97.515	0.031	0.015	28613.	0.19	9.00
Rhizoprionodon terraenovae	0.085	97.600	0.031	0.091	28622.	0.19	1.55
Prionotus salmonicolor	0.223	97.823	0.031	0.061	28631.	0.19	3.36
Rhinoptera bonasus	1.593	99.416	0.024	0.091	28638.	0.15	1.20
Calappa	0.009	99.425	0.024	0.015	28545.	0.15	7.00
Larimus fasciatus	0.034	99.459	0.024	0.015	28652.	0.15	7.00
Citharichthys spilopterus	0.027	99.486	0.021	0.045	28658.	0.13	2.28

Table 6. Continued.

TAXON NAME	MEAN PERCENT COMPOSITION	CUMULATIVE PERCENT COMPOSITION	POOLED PERCENT COMPOSITION	FREQ. OF OCCURRENCE	CUMULATIVE ABUNDANCE	MEAN DENSITY (# / HA)	INDEX OF DISPERSION
Caranx fusus	0.029	99.515	0.021	0.061	28664.	0.13	1.94
Orthopristis chrysoptera	0.033	99.548	0.021	0.030	28670.	0.13	4.31
Dasyatus americana	0.019	99.567	0.021	0.045	28676.	0.13	2.28
Sardinella aurita	0.057	99.624	0.021	0.030	28682.	0.13	2.95
Rhinobatos lentiginosus	0.019	99.643	0.021	0.061	28688.	0.13	1.94
Bothidae	0.015	99.658	0.017	0.015	28693.	0.11	5.00
Portunus spinicarpus	0.010	99.668	0.010	0.015	28696.	0.06	3.00
Etrumeus teres	0.013	99.681	0.010	0.015	28699.	0.06	3.00
Ophidiidae	0.008	99.689	0.010	0.015	28702.	0.06	3.00
Monacanthus hispidus	0.007	99.696	0.010	0.015	28705.	0.06	3.00
Halieutichthys aculeatus	0.015	99.711	0.010	0.015	28708.	0.06	3.00
Calappa sulcata	0.008	99.719	0.010	0.015	28711.	0.06	3.00
Sphoeroides	0.007	99.726	0.010	0.015	28714.	0.06	3.00
Porichthys porosissimus	0.019	99.745	0.007	0.030	28716.	0.04	0.98
Mugil cephalus	0.014	99.759	0.007	0.030	28718.	0.04	0.98
Prionotus roseus	0.010	99.769	0.007	0.015	28720.	0.04	2.00
Calappa flammea	0.005	99.774	0.007	0.015	28722.	0.04	2.00
Callinectes	0.022	99.796	0.007	0.015	28724.	0.04	2.00
Citharichthys macrops	0.002	99.798	0.003	0.015	28725.	0.02	1.00
Ovalipes	0.005	99.803	0.003	0.015	28726.	0.02	1.00
Cyclopsetta chittendeni	0.016	99.819	0.003	0.015	28727.	0.02	1.00
Bagre marinus	0.007	99.826	0.003	0.015	28728.	0.02	1.00
Lagocephalus laevigatus	0.015	99.841	0.003	0.015	28729.	0.02	1.00
Acanthostracion quadricornis	0.010	99.851	0.003	0.015	28730.	0.02	1.00
Sicyonia brevirostris	0.002	99.854	0.003	0.015	28731.	0.02	1.00
Antennarius radiosus	0.005	99.859	0.003	0.015	28732.	0.02	1.00
Chaetodipterus faber	0.009	99.868	0.003	0.030	28733.	0.02	1.00
Mycteroperca phenax	0.015	99.883	0.003	0.015	28734.	0.02	1.00
Raja eglanteria	0.005	99.888	0.003	0.015	28735.	0.02	1.00
Pomatomus saltatrix	0.004	99.892	0.003	0.015	28736.	0.02	1.00
Carcharhinus maculipinnis	0.069	99.961	0.003	0.015	28737.	0.02	1.00
Rachycentron canadum	0.005	99.967	0.003	0.015	28738.	0.02	1.00
Ogcocephalus nasutus	0.009	99.975	0.003	0.015	28739.	0.02	1.00
Pogonias chromis	0.002	99.977	0.003	0.015	28740.	0.02	1.00
Echeneis naucrates	0.008	99.985	0.003	0.015	28741.	0.02	1.00
Diplectrum formosum	0.011	99.995	0.003	0.015	28742.	0.02	1.00
Majidae	0.005	100.000	0.003	0.015	28743.	0.02	1.00
Sargassum	0.000	100.000	0.000	0.045	28743.	0.00	*****
Portunus spinimanus	0.000	100.000	0.000	0.015	28743.	0.00	*****

SAMPLE SUMMARY: SAMPLES = 66 TOTAL TAXA = 111 TOTAL DENSITY = 614.05

Table 7. Relative composition of demersal nekton taxa at Station Group 3 stations based on the results of analysis of samples collected in and around the Tuscaloosa Trend study area during the fall 1974 to summer 1975 NMFS Fishery Independent groundfish surveys.

TAXON NAME	MEAN PERCENT COMPOSITION	CUMULATIVE PERCENT COMPOSITION	POOLED PERCENT COMPOSITION	FREQ. OF OCCURRENCE	CUMULATIVE ABUNDANCE	MEAN DENSITY (# / HA)	INDEX OF DISPERSION
Chloroscombrus chrysurus	15.200	15.200	17.457	0.567	725.	34.07	128.71
Stenotomus caprinus	5.124	20.323	13.629	0.300	1291.	26.60	428.35
Anchoa hepsetus	3.744	24.067	11.052	0.167	1750.	21.57	309.58
Loligo pealeii	8.569	32.635	7.272	0.267	2052.	14.19	66.21
Loligo	4.163	36.798	6.236	0.200	2311.	12.17	46.18
Scyphozoa	5.191	41.989	6.212	0.067	2569.	12.13	219.83
Arius felis	4.488	46.478	4.093	0.433	2739.	7.99	28.46
Decapoda	3.192	49.670	3.684	0.067	2892.	7.19	92.88
Syacium papillosum	7.666	57.335	3.299	0.667	3029.	6.44	7.52
Harengula jaguana	1.722	59.057	3.227	0.200	3163.	6.30	80.86
Synodus foetens	4.476	63.533	3.034	0.767	3289.	5.92	10.70
Lolliguncula	2.608	66.141	2.649	0.167	3399.	5.17	64.43
Trachinocephalus myops	2.227	68.368	1.397	0.133	3457.	2.73	26.15
Anchoa	1.323	69.692	1.397	0.100	3515.	2.73	18.58
Asteroidea	1.960	71.651	1.228	0.133	3566.	2.40	19.03
Lolliguncula brevis	1.070	72.721	1.108	0.200	3612.	2.16	21.58
Etropus crossotus	1.052	73.773	0.915	0.400	3650.	1.79	4.73
Ophiuroidea	4.201	77.974	0.891	0.067	3687.	1.74	21.90
Diplectrum bivittatum	1.307	79.281	0.819	0.267	3721.	1.60	8.81
Cynoscion	0.546	79.827	0.722	0.033	3751.	1.41	30.00
Callinectes sapidus	2.077	81.905	0.698	0.400	3780.	1.36	2.32
Trachurus lathami	0.444	82.349	0.530	0.133	3802.	1.03	7.24
Penaeus aztecus	0.580	82.928	0.482	0.133	3822.	0.94	8.93
Prionotus rubio	0.316	83.245	0.433	0.233	3840.	0.85	3.06
Peprilus burti	0.459	83.703	0.433	0.133	3858.	0.85	7.54
Calappa	1.870	85.574	0.409	0.133	3875.	0.80	6.05
Sphoeroides parvus	0.416	85.989	0.361	0.167	3890.	0.70	3.28
Micropogonias undulatus	0.180	86.169	0.361	0.167	3905.	0.70	4.93
Mellitidae	0.668	86.837	0.337	0.067	3919.	0.66	9.12
Trichiurus lepturus	0.143	86.980	0.313	0.033	3932.	0.61	13.00
Prionotus tribulus	0.301	87.282	0.265	0.133	3943.	0.52	3.66
Scomberomorus cavalla	0.066	87.348	0.241	0.033	3953.	0.47	10.00
Aluterus schoepfi	0.358	87.706	0.241	0.133	3963.	0.47	3.38
Sphyraena guachancho	0.155	87.861	0.241	0.100	3973.	0.47	4.41
Diplectrum radiale	0.409	88.271	0.193	0.133	3981.	0.38	3.34
Rhizoprionodon terraenovae	0.136	88.406	0.169	0.100	3988.	0.33	2.57
Sardinella aurita	0.104	88.510	0.169	0.067	3995.	0.33	5.23
Opisthonema oglinum	0.097	88.607	0.169	0.100	4002.	0.33	2.86
Portunus	0.175	88.782	0.169	0.067	4009.	0.33	5.23
Centropristis philadelphicus	0.157	88.939	0.169	0.067	4016.	0.33	5.23
Eucinostomus gula	1.241	90.181	0.169	0.100	4023.	0.33	2.86
Cynoscion arenarius	0.183	90.364	0.144	0.067	4029.	0.28	4.28
Portunus gibbesii	0.242	90.606	0.144	0.067	4035.	0.28	4.28
Chaetodipterus faber	0.040	90.646	0.144	0.033	4041.	0.28	6.00
Squilla	0.227	90.872	0.120	0.100	4046.	0.23	2.10
Diplectrum formosum	0.605	91.477	0.120	0.133	4051.	0.23	1.28
Prionotus scitulus	0.115	91.592	0.120	0.100	4056.	0.23	2.10
Lutjanus campechanus	0.213	91.805	0.120	0.100	4061.	0.23	1.69
Prionotus salmonicolor	0.109	91.914	0.120	0.100	4066.	0.23	1.69
Sphoeroides	0.096	92.010	0.096	0.067	4070.	0.19	1.93
Citharichthys spilopterus	0.603	92.614	0.096	0.133	4074.	0.19	0.90
Penaeus duorarum	0.082	92.695	0.096	0.067	4078.	0.19	2.45
Selene setapinnis	0.053	92.748	0.096	0.033	4082.	0.19	4.00
Aurelia	0.417	93.165	0.072	0.033	4085.	0.14	3.00
Caranx fusus	0.101	93.265	0.072	0.067	4088.	0.14	1.62
Citharichthys macrops	0.494	93.759	0.072	0.067	4091.	0.14	1.62
Sphyrna tiburo	0.135	93.895	0.072	0.067	4094.	0.14	1.62
Paralichthys lethostigma	0.226	94.120	0.072	0.100	4097.	0.14	0.93
Portunus spinimanus	0.056	94.176	0.072	0.100	4100.	0.14	0.93
Sphyrna lewini	0.033	94.209	0.072	0.033	4103.	0.14	3.00
Echeneis naucrates	0.061	94.270	0.072	0.067	4106.	0.14	1.62
Ovalipes guadulpensis	0.069	94.340	0.072	0.067	4109.	0.14	1.62
Callinectes similis	0.174	94.514	0.072	0.100	4112.	0.14	0.93
Citharichthys cornutus	0.278	94.792	0.048	0.033	4114.	0.09	2.00
Luidia	0.333	95.125	0.048	0.067	4116.	0.09	2.00
Narcine brasiliensis	0.050	95.175	0.048	0.067	4118.	0.09	0.97
Ancylopsetta quadrocellata	0.046	95.221	0.048	0.067	4120.	0.09	0.97
Persephona aquilonaris	0.039	95.260	0.048	0.033	4122.	0.09	2.00
Etrumeus teres	0.011	95.271	0.048	0.033	4124.	0.09	2.00
Sicyonia dorsalis	0.061	95.332	0.048	0.033	4126.	0.09	2.00
Ovalipes	0.011	95.343	0.048	0.067	4128.	0.09	2.00
Prionotus	0.075	95.418	0.048	0.033	4130.	0.09	2.00

Table 7. Continued.

TAXON NAME	MEAN PERCENT COMPOSITION	CUMULATIVE PERCENT COMPOSITION	POOLED PERCENT COMPOSITION	FREQ. OF OCCURRENCE	CUMULATIVE ABUNDANCE	MEAN DENSITY (# / HA)	INDEX OF DISPERSION
Penaeus setiferus	0.013	95.431	0.048	0.033	4132.	0.09	2.00
Monacanthus hispidus	0.110	95.540	0.048	0.067	4134.	0.09	0.97
Lutjanus synagris	0.021	95.562	0.024	0.033	4135.	0.05	1.00
Ophidion holbrooki	0.005	95.567	0.024	0.033	4136.	0.05	1.00
Hepatus ephelitious	0.031	95.598	0.024	0.033	4137.	0.05	1.00
Anthozoa	0.025	95.623	0.024	0.033	4138.	0.05	1.00
Dasyatus americana	0.012	95.635	0.024	0.033	4139.	0.05	1.00
Rachycentron canadum	0.025	95.660	0.024	0.033	4140.	0.05	1.00
Anchoa lyolepis	0.101	95.761	0.024	0.033	4141.	0.05	1.00
Mugil cephalus	3.333	99.094	0.024	0.033	4142.	0.05	1.00
Calappa flammea	0.025	99.119	0.024	0.033	4143.	0.05	1.00
Halieutichthys aculeatus	0.167	99.286	0.024	0.033	4144.	0.05	1.00
Arenaeus cribrarius	0.005	99.291	0.024	0.033	4145.	0.05	1.00
Caranx hippos	0.025	99.316	0.024	0.033	4146.	0.05	1.00
Chilomycterus schoepfi	0.020	99.336	0.024	0.033	4147.	0.05	1.00
Sicyonia brevirostris	0.417	99.753	0.024	0.033	4148.	0.05	1.00
Encope	0.139	99.892	0.024	0.033	4149.	0.05	1.00
Etropus microstomus	0.044	99.936	0.024	0.033	4150.	0.05	1.00
Symphurus	0.025	99.961	0.024	0.033	4151.	0.05	1.00
Raja eglanteria	0.013	99.975	0.024	0.033	4152.	0.05	1.00
Orthopristis chrysoptera	0.025	100.000	0.024	0.033	4153.	0.05	1.00
Sargassum	0.000	100.000	0.000	0.033	4153.	0.00	******

SAMPLE SUMMARY: SAMPLES = 30 TOTAL TAXA = 94 TOTAL DENSITY = 195.19

Table 8. Relative composition of demersal nekton taxa at Station Group 4 stations based on the results of analysis of samples collected in and around the Tuscaloosa Trend study area during the fall 1974 to summer 1975 NMFS Fishery Independent groundfish surveys.

TAXON NAME	MEAN PERCENT COMPOSITION	CUMULATIVE PERCENT COMPOSITION	POOLED PERCENT COMPOSITION	FREQ. OF OCCURRENCE	CUMULATIVE ABUNDANCE	MEAN DENSITY (# / HA)	INDEX OF DISPERSION
Micropogonias undulatus	43.758	43.758	48.484	0.916	29081.	383.22	372.61
Trichiurus lepturus	8.821	52.580	8.551	0.589	34210.	67.59	363.69
Steindachneria argentea	4.998	57.578	8.159	0.308	39104.	64.49	455.87
Cynoscion arenarius	7.223	64.800	6.224	0.776	42837.	49.19	107.50
Penaeus aztecus	5.983	70.784	4.641	0.860	45621.	36.69	57.78
Leiostomus xanthurus	4.223	75.006	4.160	0.364	48116.	32.88	291.45
Trachypenaeus	3.183	78.189	2.694	0.421	49732.	21.29	78.44
Parapenaeus	2.575	80.764	1.861	0.150	50848.	14.71	114.12
Scyphozoa	1.830	82.595	1.621	0.065	51820.	12.81	467.53
Cynoscion nothus	1.794	84.388	1.464	0.449	52698.	11.57	26.27
Prionotus rubio	1.882	86.271	1.412	0.570	53545.	11.16	27.98
Portunus spinicarpus	1.502	87.773	1.124	0.168	54219.	8.88	127.96
Solenocera	0.985	88.758	0.920	0.299	54771.	7.27	48.46
Xiphopeneus	0.837	89.595	0.820	0.075	55263.	6.48	95.70
Centropristis philadelphicus	0.868	90.463	0.734	0.542	55703.	5.80	8.97
Halieutichthys aculeatus	0.702	91.164	0.717	0.187	56133.	5.67	41.79
Serranus atrobranchus	0.963	92.127	0.660	0.327	56529.	5.22	22.78
Callinectes similis	0.632	92.759	0.477	0.234	56815.	3.77	37.84
Lepophidium	0.575	93.334	0.452	0.336	57086.	3.57	9.80
Lepophidium brevibarbe	0.429	93.763	0.333	0.047	57286.	2.64	60.41
Porichthys porosissimus	0.437	94.201	0.330	0.262	57484.	2.61	9.37
Stenotomus caprinus	0.340	94.540	0.298	0.187	57663.	2.36	13.27
Synodus foetens	0.380	94.921	0.257	0.234	57817.	2.03	10.87
Peprilus burti	0.386	95.307	0.252	0.178	57968.	1.99	19.40
Loligo pealeii	0.279	95.586	0.242	0.047	58113.	1.91	95.22
Cyclopsetta chittendeni	0.341	95.927	0.213	0.215	58241.	1.69	9.91
Squilla	0.248	96.174	0.192	0.103	58356.	1.52	32.58
Decapterus punctatus	0.142	96.316	0.155	0.047	58449.	1.23	50.76
Xiphopeneus kroyeri	0.064	96.380	0.135	0.019	58530.	1.07	43.41
Congrina flava	0.133	96.513	0.130	0.112	58608.	1.03	7.29
Cynoscion	0.376	96.890	0.128	0.019	58685.	1.01	38.30
Lagodon rhomboides	0.235	97.125	0.127	0.093	58761.	1.00	14.58
Syacium papillosum	0.192	97.317	0.122	0.140	58834.	0.96	7.04
Larimus fasciatus	0.133	97.450	0.107	0.065	58898.	0.84	13.09
Paralichthys lethostigma	0.091	97.541	0.085	0.262	58949.	0.67	2.23
Diplectrum bivittatum	0.052	97.593	0.085	0.019	59000.	0.67	45.30
Citharichthys spilopterus	0.099	97.693	0.080	0.075	59048.	0.63	5.94
Rhizoprionodon terraenovae	0.113	97.806	0.077	0.112	59094.	0.61	14.53
Lutjanus campechanus	0.063	97.869	0.068	0.131	59135.	0.54	3.68
Penaeus setiferus	0.111	97.980	0.067	0.103	59175.	0.53	4.72
Selene setapinnis	0.080	98.061	0.060	0.103	59211.	0.47	4.82
Renilla	0.099	98.160	0.058	0.037	59246.	0.46	11.87
Prionotus stearnsi	0.059	98.219	0.055	0.019	59279.	0.43	29.21
Anasimus latus	0.054	98.273	0.055	0.056	59312.	0.43	7.67
Lolliguncula	0.071	98.343	0.053	0.084	59344.	0.42	5.44
Conger oceanicus	0.082	98.426	0.053	0.065	59376.	0.42	6.01
Plesionika	0.044	98.470	0.050	0.009	59406.	0.40	30.00
Chaetodipterus faber	0.051	98.521	0.050	0.056	59436.	0.40	5.10
Trachurus lathami	0.065	98.586	0.047	0.075	59464.	0.37	5.00
Hoplunnis	0.068	98.654	0.045	0.056	59491.	0.36	5.32
Brotula barbata	0.037	98.691	0.043	0.075	59517.	0.34	3.71
Portunus gibbesii	0.058	98.749	0.043	0.028	59543.	0.34	11.95
Loligo	0.055	98.804	0.038	0.056	59566.	0.30	4.74
Brotula	0.047	98.851	0.038	0.065	59589.	0.30	4.57
Urophycis floridanus	0.040	98.890	0.038	0.028	59612.	0.30	7.64
Raninoides louisianensis	0.076	98.967	0.037	0.047	59634.	0.29	5.48
Etrumeus teres	0.281	99.248	0.037	0.037	59656.	0.29	7.78
Arius felis	0.034	99.282	0.032	0.019	59675.	0.25	9.65
Diplectrum radiale	0.016	99.298	0.032	0.019	59694.	0.25	11.56
Hoplunnis macrurus	0.014	99.312	0.032	0.028	59713.	0.25	15.28
Callinectes sapidus	0.055	99.367	0.032	0.037	59732.	0.25	5.40
Calappa sulcata	0.031	99.398	0.027	0.037	59748.	0.21	5.02
Sicyonia dorsalis	0.030	99.428	0.025	0.019	59763.	0.20	10.15
Anadara	0.103	99.531	0.023	0.009	59777.	0.18	14.00
Pristipomoides aquilonaris	0.014	99.544	0.018	0.028	59788.	0.14	3.66
Peprilus paru	0.020	99.564	0.018	0.028	59799.	0.14	4.76
Antennarius radiosus	0.024	99.588	0.017	0.028	59809.	0.13	4.15
Gymnachirus texae	0.023	99.611	0.017	0.037	59819.	0.13	3.54
Congrina	0.021	99.632	0.015	0.056	59828.	0.12	1.82
Renilla mulleri	0.015	99.647	0.015	0.019	59837.	0.12	4.96
Synodus	0.008	99.655	0.015	0.009	59846.	0.12	9.00
Anchoa hepsetus	0.014	99.669	0.013	0.009	59854.	0.11	8.00

Table 8. Continued.

TAXON NAME	MEAN PERCENT COMPOSITION	CUMULATIVE PERCENT COMPOSITION	POOLED PERCENT COMPOSITION	FREQ. OF OCCURRENCE	CUMULATIVE ABUNDANCE	MEAN DENSITY (# / HA)	INDEX OF DISPERSION
Chloroscombrus chrysurus	0.008	99.677	0.013	0.019	59862.	0.11	3.96
Bollmannia communis	0.020	99.696	0.012	0.037	59869.	0.09	2.10
Sicyonia brevirostris	0.041	99.738	0.012	0.009	59876.	0.09	7.00
Asteroidea	0.007	99.745	0.012	0.009	59883.	0.09	7.00
Sphoeroides	0.010	99.755	0.010	0.019	59889.	0.08	2.97
Portunus	0.010	99.765	0.008	0.009	59894.	0.07	5.00
Symphurus diomedianus	0.017	99.781	0.008	0.009	59899.	0.07	5.00
Symphurus	0.009	99.790	0.008	0.009	59904.	0.07	5.00
Eucinostomus gula	0.007	99.798	0.007	0.009	59908.	0.05	4.00
Lolliguncula brevis	0.007	99.805	0.007	0.009	59912.	0.05	4.00
Squilla empusa	0.008	99.814	0.007	0.009	59916.	0.05	4.00
Lagocephalus laevigatus	0.010	99.824	0.007	0.009	59920.	0.05	4.00
Saurida brasiliensis	0.009	99.832	0.007	0.019	59924.	0.05	2.49
Portunus sayi	0.010	99.842	0.007	0.009	59928.	0.05	4.00
Conger	0.006	99.848	0.005	0.009	59931.	0.04	3.00
Congridae	0.009	99.856	0.005	0.009	59934.	0.04	3.00
Prionotus roseus	0.006	99.863	0.005	0.009	59937.	0.04	3.00
Laemonema	0.005	99.868	0.005	0.009	59940.	0.04	3.00
Anchoa	0.002	99.870	0.005	0.009	59943.	0.04	3.00
Rangia	0.022	99.892	0.005	0.009	59946.	0.04	3.00
Gobiidae	0.003	99.895	0.003	0.009	59948.	0.03	2.00
Anthozoa	0.007	99.902	0.003	0.009	59950.	0.03	2.00
Natantia	0.005	99.907	0.003	0.009	59952.	0.03	2.00
Prionotus ophryas	0.005	99.913	0.003	0.009	59954.	0.03	2.00
Astropecten	0.007	99.919	0.003	0.009	59956.	0.03	2.00
Parapandalus longicauda	0.005	99.925	0.003	0.009	59958.	0.03	2.00
Tonna galea	0.008	99.933	0.003	0.009	59960.	0.03	2.00
Calappa	0.007	99.939	0.003	0.009	59962.	0.03	2.00
Lopholatilis chamaeleonticeps	0.006	99.946	0.003	0.009	59964.	0.03	2.00
Penaeus duorarum	0.004	99.950	0.002	0.009	59965.	0.01	1.00
Caranx fusus	0.005	99.956	0.002	0.009	59966.	0.01	1.00
Luidia	0.003	99.958	0.002	0.009	59967.	0.01	1.00
Upeneus parvus	0.002	99.960	0.002	0.009	59968.	0.01	1.00
Calappa springeri	0.004	99.965	0.002	0.009	59969.	0.01	1.00
Prionotus tribulus	0.003	99.967	0.002	0.009	59970.	0.01	1.00
Prionotus salmonicolor	0.003	99.970	0.002	0.009	59971.	0.01	1.00
Triglidae	0.002	99.972	0.002	0.009	59972.	0.01	1.00
Syacium	0.002	99.974	0.002	0.009	59973.	0.01	1.00
Carcharhinus falciformis	0.001	99.975	0.002	0.009	59974.	0.01	1.00
Caulolatilus cyanops	0.003	99.979	0.002	0.009	59975.	0.01	1.00
Symphurus plagiusa	0.003	99.981	0.002	0.009	59976.	0.01	1.00
Hepatus epheliticus	0.002	99.983	0.002	0.009	59977.	0.01	1.00
Anchoa mitchilli	0.004	99.987	0.002	0.009	59978.	0.01	1.00
Etropus crossotus	0.004	99.991	0.002	0.009	59979.	0.01	1.00
Ogcocephalus	0.003	99.994	0.002	0.009	59980.	0.01	1.00
Neobythites gillii	0.006	100.000	0.002	0.009	59981.	0.01	1.00

SAMPLE SUMMARY: SAMPLES = 107 TOTAL TAXA = 118 TOTAL DENSITY = 790.40

Table 9. Relative composition of demersal nekton taxa at Station Group 5 stations based on the results of analysis of samples collected in and around the Tuscaloosa Trend study area during the fall 1974 to summer 1975 NMFS Fishery Independent groundfish surveys.

TAXON NAME	MEAN PERCENT COMPOSITION	CUMULATIVE PERCENT COMPOSITION	POOLED PERCENT COMPOSITION	FREQ. OF OCCURRENCE	CUMULATIVE ABUNDANCE	MEAN DENSITY (# / HA)	INDEX OF DISPERSION
Micropogonias undulatus	10.862	10.862	21.903	0.604	14328.	210.44	3169.21
Stenotomus caprinus	17.769	28.631	18.226	0.833	26251.	175.12	355.93
Peprilus burti	5.418	34.049	6.676	0.490	30618.	64.14	605.00
Trachurus lathami	6.035	40.084	4.690	0.448	33686.	45.06	292.59
Ophiuroidea	0.952	41.036	2.944	0.031	35612.	28.29	1827.38
Prionotus rubio	2.243	43.279	2.207	0.625	37056.	21.21	57.83
Leiostomus xanthurus	1.484	44.763	2.081	0.406	38417.	19.99	128.06
Synodus foetens	2.832	47.595	2.061	0.823	39765.	19.80	104.17
Anchoa hepsetus	3.229	50.824	1.977	0.292	41058.	18.99	160.83
Loligo	5.094	55.918	1.934	0.323	42323.	18.58	45.38
Syacium papillosum	2.471	58.389	1.851	0.625	43534.	17.79	48.13
Penaeus aztecus	3.220	61.609	1.851	0.719	44745.	17.79	45.55
Trichiurus lepturus	2.304	63.913	1.623	0.313	45807.	15.60	129.05
Serranus atrobranchus	1.392	65.305	1.599	0.240	46853.	15.36	167.68
Centropristis philadelphicus	1.830	67.136	1.599	0.573	47899.	15.36	74.23
Cynoscion arenarius	0.661	67.797	1.578	0.417	48931.	15.16	428.25
Portunus spinicarpus	1.074	68.871	1.367	0.167	49825.	13.13	143.71
Trachypenaeus	2.131	71.002	1.348	0.313	50707.	12.95	64.64
Lagodon rhomboides	1.608	72.610	1.281	0.323	51545.	12.31	68.62
Chloroscombrus chrysurus	1.659	74.269	1.085	0.156	52255.	10.43	118.12
Harengula jaguana	1.298	75.567	1.064	0.198	52951.	10.22	117.49
Etropus crossotus	1.254	76.821	1.050	0.510	53638.	10.09	50.22
Diplectrum bivittatum	0.855	77.676	1.003	0.146	54294.	9.64	88.92
Larimus fasciatus	0.143	77.819	0.998	0.083	54947.	9.59	522.41
Halieutichthys aculeatus	0.886	78.705	0.945	0.292	55565.	9.08	94.67
Luidia	1.399	80.103	0.887	0.083	56145.	8.52	309.81
Mellitidae	0.531	80.634	0.781	0.052	56656.	7.51	130.96
Anchoa	1.091	81.725	0.780	0.052	57166.	7.49	117.82
Decapterus punctatus	0.634	82.360	0.708	0.115	57629.	6.80	205.35
Penaeus duorarum	0.694	83.053	0.572	0.240	58003.	5.49	36.37
Scorpaena calcarata	0.425	83.478	0.567	0.156	58374.	5.45	75.15
Callinectes similis	1.467	84.946	0.566	0.292	58744.	5.43	40.48
Sicyonia brevirostris	0.523	85.469	0.552	0.240	59105.	5.30	76.46
Etrumeus teres	1.520	86.989	0.534	0.219	59454.	5.13	79.33
Squilla	0.540	87.529	0.530	0.333	59801.	5.10	22.33
Sphoeroides parvus	0.546	88.075	0.512	0.198	60136.	4.92	34.50
Diplectrum radiale	0.689	88.764	0.511	0.313	60470.	4.91	23.22
Echinoidea	0.679	89.443	0.474	0.115	60780.	4.55	55.43
Lutjanus campechanus	0.382	89.825	0.399	0.323	61041.	3.83	34.06
Opisthonema oglinum	0.349	90.175	0.326	0.042	61254.	3.13	128.29
Eucinostomus gula	0.738	90.913	0.318	0.229	61462.	3.06	24.34
Prionotus	0.216	91.129	0.307	0.042	61663.	2.95	68.22
Clypeaster	0.586	91.715	0.295	0.083	61856.	2.83	47.82
Pristipomoides aquilonaris	0.177	91.892	0.281	0.104	62040.	2.70	111.42
Sicyonia dorsalis	0.254	92.146	0.278	0.156	62222.	2.67	28.21
Anchoa lyolepis	0.831	92.977	0.277	0.083	62403.	2.66	42.83
Lepophidium	0.371	93.348	0.252	0.240	62568.	2.42	11.12
Cynoscion nothus	0.203	93.550	0.231	0.115	62719.	2.22	42.45
Loligo pealeii	0.444	93.995	0.222	0.073	62864.	2.13	36.55
Syacium gunteri	0.241	94.236	0.217	0.125	63006.	2.09	34.07
Cyclopsetta chittendeni	0.308	94.544	0.211	0.250	63144.	2.03	9.68
Bellator militaris	0.178	94.723	0.190	0.073	63268.	1.82	41.69
Asteroidea	0.452	95.175	0.182	0.104	63387.	1.75	84.20
Cynoscion	0.368	95.543	0.174	0.052	63501.	1.67	32.75
Prionotus tribulus	0.142	95.685	0.173	0.146	63614.	1.66	29.67
Sphyraena guachancho	0.251	95.937	0.156	0.094	63716.	1.50	18.80
Citharichthys spilopterus	0.254	96.191	0.138	0.115	63806.	1.32	13.65
Trichopsetta ventralis	0.088	96.279	0.136	0.052	63895.	1.31	37.59
Portunus gibbesii	0.103	96.382	0.135	0.073	63983.	1.29	32.74
Prionotus salmonicolor	0.192	96.574	0.115	0.135	64058.	1.10	10.41
Encope michelini	0.220	96.794	0.110	0.031	64130.	1.06	28.29
Arius felis	0.237	97.031	0.104	0.094	64198.	1.00	18.04
Lolliguncula brevis	0.291	97.322	0.092	0.052	64258.	0.88	21.16
Callinectes sapidus	0.115	97.438	0.090	0.167	64317.	0.87	7.21
Porichthys porosissimus	0.159	97.597	0.089	0.135	64375.	0.85	5.66
Prionotus paralatus	0.056	97.652	0.083	0.063	64429.	0.79	14.85
Prionotus roseus	0.056	97.708	0.081	0.031	64482.	0.78	28.14
Syacium	0.070	97.778	0.076	0.021	64532.	0.73	30.56
Saurida brasiliensis	0.265	98.043	0.076	0.115	64582.	0.73	11.40
Chaetodipterus faber	0.025	98.068	0.075	0.052	64631.	0.72	27.22
Symphurus plagiusa	0.028	98.096	0.073	0.052	64679.	0.70	27.71
Calappa	0.129	98.225	0.064	0.167	64721.	0.62	3.22

Table 9. Continued.

TAXON NAME	MEAN PERCENT COMPOSITION	CUMULATIVE PERCENT COMPOSITION	POOLED PERCENT COMPOSITION	FREQ. OF OCCURRENCE	CUMULATIVE ABUNDANCE	MEAN DENSITY (# / HA)	INDEX OF DISPERSION
Calappa sulcata	0.078	98.303	0.054	0.083	64756.	0.51	6.42
Upeneus parvus	0.073	98.376	0.047	0.063	64787.	0.46	10.14
Polydactylus octonemus	0.033	98.409	0.043	0.063	64815.	0.41	6.85
Selar crumenophthalmus	0.066	98.474	0.043	0.073	64843.	0.41	5.84
Calappa springeri	0.034	98.509	0.041	0.021	64870.	0.40	14.87
Lolliguncula	0.052	98.561	0.037	0.042	64894.	0.35	6.23
Trichopsetta	0.017	98.578	0.037	0.010	64918.	0.35	24.00
Eucinostomus argenteus	0.046	98.623	0.037	0.031	64942.	0.35	10.95
Lutjanus synagris	0.093	98.717	0.035	0.073	64965.	0.34	8.24
Polynemus virginicus	0.012	98.728	0.032	0.010	64986.	0.31	21.00
Selene setapinnis	0.063	98.791	0.032	0.083	65007.	0.31	3.77
Renilla mulleri	0.033	98.824	0.029	0.010	65026.	0.28	19.00
Menticirrhus americanus	0.024	98.848	0.026	0.042	65043.	0.25	6.18
Spatangoida	0.094	98.942	0.023	0.031	65058.	0.22	5.30
Scorpaena brasiliensis	0.032	98.974	0.021	0.021	65072.	0.21	12.12
Prionotus ophryas	0.023	98.997	0.021	0.073	65086.	0.21	3.17
Ogcocephalus	0.010	99.007	0.021	0.021	65100.	0.21	7.07
Paralichthys lethostigma	0.050	99.056	0.020	0.115	65113.	0.19	1.34
Lopholatilis chamaeleonticeps	0.009	99.066	0.018	0.010	65125.	0.18	12.00
Penaeus setiferus	0.025	99.091	0.018	0.052	65137.	0.18	3.24
Raninoides louisianensis	0.015	99.106	0.017	0.021	65148.	0.16	6.59
Prionotus stearnsi	0.031	99.138	0.017	0.052	65159.	0.16	2.73
Zalieutes mcgintyi	0.032	99.170	0.017	0.010	65170.	0.16	11.00
Sardinella aurita	0.013	99.183	0.017	0.042	65181.	0.16	4.94
Brotula	0.011	99.194	0.015	0.052	65191.	0.15	3.13
Lepophidium brevibarbe	0.036	99.230	0.015	0.031	65201.	0.15	5.35
Sphoeroides	0.024	99.254	0.015	0.031	65211.	0.15	4.54
Raja texana	0.009	99.263	0.012	0.042	65219.	0.12	3.45
Gymnachirus	0.006	99.269	0.012	0.010	65227.	0.12	8.00
Anthozoa	0.006	99.276	0.012	0.010	65235.	0.12	8.00
Anasimus	0.006	99.282	0.012	0.010	65243.	0.12	8.00
Gymnachirus texae	0.018	99.300	0.012	0.031	65251.	0.12	3.71
Ophidiidae	0.019	99.319	0.012	0.021	65259.	0.12	4.21
Renilla	0.172	99.491	0.011	0.021	65266.	0.10	4.11
Urophycis regius	0.007	99.498	0.009	0.010	65272.	0.09	6.00
Solenocera	0.030	99.528	0.009	0.021	65278.	0.09	3.31
Balistes capriscus	0.034	99.562	0.009	0.031	65284.	0.09	2.97
Hoplunnis macrurus	0.007	99.569	0.008	0.021	65289.	0.07	2.57
Rhomboplites aurorubens	0.003	99.572	0.008	0.010	65294.	0.07	5.00
Holothuroidea	0.019	99.592	0.008	0.010	65299.	0.07	5.00
Portunus spinimanus	0.013	99.605	0.008	0.031	65304.	0.07	2.17
Lagocephalus laevigatus	0.022	99.627	0.008	0.042	65309.	0.07	1.36
Goniaster americanus	0.002	99.629	0.008	0.010	65314.	0.07	5.00
Orthopristis chrysoptera	0.005	99.634	0.006	0.010	65318.	0.06	4.00
Ophidion welshi	0.004	99.638	0.006	0.010	65322.	0.06	4.00
Symphurus diomedianus	0.004	99.642	0.006	0.010	65326.	0.06	4.00
Rhizoprionodon terraenovae	0.036	99.677	0.006	0.021	65330.	0.06	1.98
Ovalipes guadulpensis	0.005	99.682	0.006	0.021	65334.	0.06	2.48
Natantia	0.004	99.686	0.006	0.010	65338.	0.06	4.00
Anasimus latus	0.004	99.690	0.006	0.010	65342.	0.06	4.00
Hepatus epheliticus	0.004	99.693	0.006	0.010	65346.	0.06	4.00
Squilla empusa	0.014	99.707	0.006	0.010	65350.	0.06	4.00
Aluterus schoepfi	0.019	99.726	0.006	0.021	65354.	0.06	1.98
Gymnothorax nigromarginatus	0.017	99.743	0.005	0.031	65357.	0.04	0.98
Ogcocephalus vespertilio	0.007	99.750	0.005	0.010	65360.	0.04	3.00
Synodus poeyi	0.012	99.761	0.005	0.010	65363.	0.04	3.00
Prionaster	0.002	99.763	0.005	0.010	65366.	0.04	3.00
Bollmannia communis	0.006	99.769	0.005	0.021	65369.	0.04	1.65
Saurida	0.021	99.790	0.005	0.010	65372.	0.04	3.00
Lopholatilis	0.007	99.797	0.005	0.010	65375.	0.04	3.00
Engyophrys senta	0.006	99.802	0.005	0.010	65378.	0.04	3.00
Peprilus paru	0.008	99.811	0.005	0.010	65381.	0.04	3.00
Paralichthys squamilentus	0.027	99.838	0.003	0.010	65383.	0.03	2.00
Sphyrna tiburo	0.018	99.856	0.003	0.021	65385.	0.03	0.99
Synodus	0.013	99.869	0.003	0.010	65387.	0.03	2.00
Scomber japonicus	0.007	99.876	0.003	0.021	65389.	0.03	0.99
Carcharhinus porosus	0.002	99.878	0.003	0.021	65391.	0.03	0.99
Haemulon aurolineatum	0.007	99.885	0.003	0.010	65393.	0.03	2.00
Calamus pennatula	0.010	99.895	0.003	0.010	65395.	0.03	2.00
Raja eglanteria	0.003	99.898	0.003	0.010	65397.	0.03	2.00
Parapenaeus	0.003	99.901	0.002	0.010	65398.	0.01	1.00
Libinia	0.006	99.907	0.002	0.010	65399.	0.01	1.00

Table 9. Continued.

TAXON NAME	MEAN PERCENT COMPOSITION	CUMULATIVE PERCENT COMPOSITION	POOLED PERCENT COMPOSITION	FREQ. OF OCCURRENCE	CUMULATIVE ABUNDANCE	MEAN DENSITY (# / HA)	INDEX OF DISPERSION
Astropecten	0.003	99.910	0.002	0.010	65400.	0.01	1.00
Caranx fusus	0.002	99.912	0.002	0.010	65401.	0.01	1.00
Scyllaridae	0.005	99.917	0.002	0.010	65402.	0.01	1.00
Equetus	0.005	99.922	0.002	0.010	65403.	0.01	1.00
Scomberomorus maculatus	0.014	99.936	0.002	0.010	65404.	0.01	1.00
Carcharhinus acronotus	0.001	99.937	0.002	0.010	65405.	0.01	1.00
Sphyrna lewini	0.003	99.939	0.002	0.010	65406.	0.01	1.00
Hoplunnis	0.006	99.945	0.002	0.010	65407.	0.01	1.00
Mellita	0.005	99.950	0.002	0.010	65408.	0.01	1.00
Serranus	0.003	99.953	0.002	0.010	65409.	0.01	1.00
Paguridae	0.005	99.958	0.002	0.010	65410.	0.01	1.00
Cyclopsetta fimbriata	0.006	99.964	0.002	0.010	65411.	0.01	1.00
Urophycis	0.008	99.972	0.002	0.010	65412.	0.01	1.00
Ogcocephalus parvus	0.005	99.977	0.002	0.010	65413.	0.01	1.00
Congridae	0.008	99.985	0.002	0.010	65414.	0.01	1.00
Monacanthus hispidus	0.010	99.995	0.002	0.010	65415.	0.01	1.00
Grammistidae	0.005	100.000	0.002	0.010	65416.	0.01	1.00
Balistes	0.000	100.000	0.000	0.010	65416.	0.00	******
Bellator	0.000	100.000	0.000	0.010	65416.	0.00	******

SAMPLE SUMMARY: SAMPLES = 96 TOTAL TAXA = 163 TOTAL DENSITY = 960.80

Table 10. Relative composition of demersal nekton taxa at Station Group 6 stations based on the results of analysis of samples collected in and around the Tuscaloosa Trend study area during the fall 1974 to summer 1975 NMFS Fishery Independent groundfish surveys.

TAXON NAME	MEAN PERCENT COMPOSITION	CUMULATIVE PERCENT COMPOSITION	POOLED PERCENT COMPOSITION	FREQ. OF OCCURRENCE	CUMULATIVE ABUNDANCE	MEAN DENSITY (# / HA)	INDEX OF DISPERSION
Stenotomus caprinus	22.133	22.133	19.735	0.841	3880.	124.34	99.42
Asteroidea	2.946	25.079	19.501	0.205	7714.	122.86	2725.82
Syacium papillosum	8.150	33.229	5.666	0.909	8828.	35.70	52.35
Eucinostomus gula	6.311	39.540	4.720	0.682	9756.	29.74	52.50
Prionotus salmonicolor	4.535	44.074	3.688	0.523	10481.	23.23	40.91
Prionotus rubio	3.381	47.455	3.459	0.500	11161.	21.79	51.07
Scorpaena calcarata	3.257	50.712	3.418	0.614	11833.	21.53	46.28
Sicyonia brevirostris	2.348	53.060	3.184	0.477	12459.	20.06	127.16
Synodus foetens	6.124	59.184	2.981	0.932	13045.	18.78	24.11
Diplectrum bivittatum	2.260	61.444	2.579	0.273	13552.	16.25	83.57
Anchoa hepsetus	2.008	63.453	2.538	0.045	14051.	15.99	492.90
Trichiurus lepturus	2.775	66.228	2.452	0.114	14533.	15.45	174.88
Micropogonias undulatus	2.310	68.538	2.385	0.477	15002.	15.03	53.98
Trachurus lathami	1.969	70.507	2.116	0.318	15418.	13.33	182.05
Ophiuroidea	2.039	72.546	2.096	0.091	15830.	13.20	387.95
Bellator militaris	1.229	73.775	1.368	0.477	16099.	8.62	31.53
Loligo	3.132	76.907	1.287	0.250	16352.	8.11	34.81
Penaeus aztecus	1.034	77.940	1.185	0.432	16585.	7.47	48.83
Loligo pealeii	1.986	79.926	1.002	0.227	16782.	6.31	42.97
Decapterus punctatus	0.987	80.913	0.905	0.159	16960.	5.70	40.01
Leiostomus xanthurus	0.806	81.719	0.860	0.159	17129.	5.42	36.72
Lagodon rhomboides	1.122	82.840	0.844	0.432	17295.	5.32	12.28
Peprilus burti	0.781	83.621	0.763	0.318	17445.	4.81	31.62
Portunus spinicarpus	0.744	84.365	0.651	0.409	17573.	4.10	8.68
Sphoeroides parvus	0.618	84.983	0.636	0.295	17698.	4.01	15.81
Centropristis philadelphicus	0.772	85.755	0.621	0.295	17820.	3.91	17.34
Syacium gunteri	0.580	86.336	0.615	0.136	17941.	3.88	30.84
Prionotus roseus	0.454	86.789	0.590	0.250	18057.	3.72	17.41
Penaeus duorarum	0.493	87.282	0.570	0.386	18169.	3.59	10.88
Lepophidium	0.337	87.619	0.488	0.273	18265.	3.08	14.46
Solenocera	0.566	88.185	0.443	0.091	18352.	2.79	35.91
Calappa sulcata	0.075	88.260	0.336	0.114	18418.	2.12	16.20
Mellitidae	0.883	89.143	0.310	0.114	18479.	1.95	32.38
Xiphopeneus kroyeri	0.377	89.520	0.310	0.023	18540.	1.95	61.00
Echinoidea	1.553	91.073	0.310	0.159	18601.	1.95	15.98
Lutjanus campechanus	0.402	91.475	0.310	0.205	18662.	1.95	11.11
Halieutichthys aculeatus	0.864	92.339	0.280	0.341	18717.	1.76	4.28
Saurida brasiliensis	0.576	92.915	0.280	0.295	18772.	1.76	4.69
Centropristis ocyurus	0.213	93.128	0.249	0.091	18821.	1.57	26.15
Scorpaena	0.484	93.612	0.239	0.068	18868.	1.51	29.97
Bellator	0.179	93.791	0.198	0.091	18907.	1.25	17.64
Selar crumenophthalmus	0.360	94.152	0.188	0.182	18944.	1.19	5.47
Trachinocephalus myops	0.414	94.565	0.168	0.205	18977.	1.06	4.41
Lutjanus synagris	0.106	94.672	0.158	0.114	19008.	0.99	16.54
Harengula jaguana	0.157	94.828	0.158	0.114	19039.	0.99	20.31
Serranus atrobranchus	0.231	95.059	0.158	0.114	19070.	0.99	8.88
Luidia	0.015	95.074	0.142	0.023	19098.	0.90	28.00
Squilla empusa	0.168	95.243	0.132	0.068	19124.	0.83	8.68
Selene setapinnis	0.160	95.403	0.127	0.068	19149.	0.80	11.74
Prionotus	0.157	95.560	0.127	0.068	19174.	0.80	9.69
Calappa springeri	0.143	95.703	0.127	0.091	19199.	0.80	6.50
Rissola marginata	0.111	95.813	0.117	0.068	19222.	0.74	8.85
Prionotus paralatus	0.139	95.952	0.112	0.091	19244.	0.70	12.05
Porichthys porosissimus	0.090	96.042	0.107	0.135	19265.	0.67	3.56
Prionotus ophryas	0.170	96.212	0.102	0.182	19285.	0.64	3.12
Cyclopsetta chittendeni	0.133	96.345	0.102	0.205	19305.	0.64	3.42
Equetus acuminatus	0.083	96.428	0.092	0.068	19323.	0.58	8.79
Cynoscion	0.122	96.550	0.086	0.068	19340.	0.54	7.97
Calappa	0.082	96.632	0.081	0.114	19356.	0.51	3.59
Scorpaena brasiliensis	0.197	96.829	0.081	0.023	19372.	0.51	16.00
Scyllarides nodifer	0.186	97.015	0.061	0.136	19384.	0.38	3.47
Etrumeus teres	0.198	97.213	0.061	0.114	19396.	0.38	3.81
Balistes capriscus	0.106	97.319	0.056	0.091	19407.	0.35	4.12
Sphoeroides	0.085	97.404	0.051	0.091	19417.	0.32	3.45
Pristipomoides aquilonaris	0.066	97.470	0.051	0.068	19427.	0.32	4.47
Etropus crossotus	0.046	97.516	0.051	0.068	19437.	0.32	3.25
Chaetodipterus faber	0.057	97.573	0.051	0.114	19447.	0.32	2.22
Squilla	0.021	97.594	0.051	0.045	19457.	0.32	5.70
Clypeaster	0.065	97.660	0.046	0.068	19466.	0.29	3.77
Sphyraena guachancho	0.048	97.708	0.046	0.068	19475.	0.29	4.45
Anasimus latus	0.123	97.831	0.046	0.068	19484.	0.29	5.59
Callinectes similis	0.091	97.922	0.046	0.068	19493.	0.29	4.45

Table 10. Continued.

TAXON NAME	MEAN PERCENT COMPOSITION	CUMULATIVE PERCENT COMPOSITION	POOLED PERCENT COMPOSITION	FREQ. OF OCCURRENCE	CUMULATIVE ABUNDANCE	MEAN DENSITY (# / HA)	INDEX OF DISPERSION
Balistidae	0.092	98.014	0.041	0.045	19501.	0.26	4.93
Ophiopholus	0.641	98.655	0.041	0.045	19509.	0.26	4.93
Callinectes sapidus	0.020	98.675	0.036	0.045	19516.	0.22	3.49
Cyclopsetta fimbriata	0.019	98.694	0.031	0.023	19522.	0.19	6.00
Rhizoprionodon terraenovae	0.055	98.749	0.031	0.068	19528.	0.19	2.93
Chilomycterus schoepfi	0.055	98.805	0.031	0.091	19534.	0.19	1.91
Anchoviella eurystole	0.036	98.841	0.031	0.045	19540.	0.19	2.93
Cynoscion arenarius	0.034	98.875	0.031	0.023	19546.	0.19	6.00
Paralichthys lethostigma	0.034	98.909	0.031	0.091	19552.	0.19	1.57
Portunus gibbesii	0.053	98.962	0.031	0.023	19558.	0.19	6.00
Symphurus plagiusa	0.018	98.980	0.025	0.023	19563.	0.16	5.00
Monacanthus hispidus	0.018	98.998	0.025	0.023	19568.	0.16	5.00
Rhomboplites aurorubens	0.031	99.030	0.025	0.045	19573.	0.16	2.54
Sardinella aurita	0.024	99.054	0.020	0.045	19577.	0.13	1.95
Parthenope serrata	0.029	99.083	0.020	0.045	19581.	0.13	2.47
Gymnothorax nigromarginatus	0.025	99.108	0.020	0.045	19585.	0.13	2.47
Peprilus paru	0.024	99.132	0.020	0.023	19589.	0.13	4.00
Upeneus parvus	0.022	99.154	0.020	0.045	19593.	0.13	2.47
Diplectrum radiale	0.031	99.185	0.015	0.045	19596.	0.10	1.64
Lagocephalus laevigatus	0.034	99.219	0.015	0.068	19599.	0.10	0.95
Congrina flava	0.011	99.230	0.015	0.023	19602.	0.10	3.00
Urophycis floridanus	0.017	99.246	0.015	0.023	19605.	0.10	3.00
Sicyonia dorsalis	0.007	99.253	0.015	0.023	19608.	0.10	3.00
Gymnothorax	0.025	99.278	0.015	0.068	19611.	0.10	0.95
Anchoa lyolepis	0.009	99.287	0.015	0.023	19614.	0.10	3.00
Aluterus schoepfi	0.043	99.330	0.015	0.045	19617.	0.10	1.64
Cynoscion nothus	0.017	99.347	0.015	0.023	19620.	0.10	3.00
Stellifer lanceolatus	0.017	99.363	0.015	0.023	19623.	0.10	3.00
Pagurus	0.033	99.397	0.015	0.023	19626.	0.10	3.00
Astropecten	0.042	99.439	0.010	0.023	19628.	0.06	2.00
Acanthostracion quadricornis	0.012	99.451	0.010	0.023	19630.	0.06	2.00
Raja texana	0.019	99.470	0.010	0.045	19632.	0.06	0.98
Ogcocephalus nasutus	0.095	99.565	0.010	0.045	19634.	0.06	0.98
Ogcocephalus	0.084	99.649	0.010	0.045	19636.	0.06	0.98
Scyllaridae	0.037	99.686	0.010	0.045	19638.	0.06	0.98
Ophidiidae	0.018	99.704	0.010	0.023	19640.	0.06	2.00
Scyllarus	0.021	99.725	0.010	0.023	19642.	0.06	2.00
Remora remora	0.027	99.752	0.010	0.045	19644.	0.06	0.98
Engyophrys senta	0.003	99.755	0.005	0.023	19645.	0.03	1.00
Trachypenaeus	0.010	99.766	0.005	0.023	19646.	0.03	1.00
Anthozoa	0.008	99.774	0.005	0.023	19647.	0.03	1.00
Urophycis	0.014	99.788	0.005	0.023	19648.	0.03	1.00
Gymnothorax moringa	0.012	99.800	0.005	0.023	19649.	0.03	1.00
Urophycis regius	0.009	99.809	0.005	0.023	19650.	0.03	1.00
Carcharhinus acronotus	0.016	99.825	0.005	0.023	19651.	0.03	1.00
Portunus spinimanus	0.014	99.840	0.005	0.023	19652.	0.03	1.00
Kathetostoma albigutta	0.012	99.851	0.005	0.023	19653.	0.03	1.00
Synodus poeyi	0.028	99.879	0.005	0.023	19654.	0.03	1.00
Rachycentron canadum	0.016	99.895	0.005	0.023	19655.	0.03	1.00
Diplectrum formosum	0.058	99.953	0.005	0.023	19656.	0.03	1.00
Echeneis naucrates	0.012	99.966	0.005	0.023	19657.	0.03	1.00
Mustelus canis	0.005	99.971	0.005	0.023	19658.	0.03	1.00
Porifera	0.008	99.979	0.005	0.023	19659.	0.03	1.00
Priacanthus arenatus	0.009	99.988	0.005	0.023	19660.	0.03	1.00
Prionotus stearnsi	0.012	100.000	0.005	0.023	19661.	0.03	1.00

SAMPLE SUMMARY: SAMPLES = 44 TOTAL TAXA = 127 TOTAL DENSITY = 630.05

Table 11. Six taxa groups resulting from a synthesis of community analyses of three replicate samples collected at 154 stations in and around the Tuscaloosa Trend study area during the fall 1974 to summer 1975 NMFS Fishery Independent groundfish surveys.

Group 1. Taxa Most Characteristic of the Shallow Water Habitat

Scientific Name	Common Name
Lolliguncula brevis	short squid
Penaeus setiferus	white shrimp
Narcine brasiliensis	lesser electric ray
Brevoortia patronus	gulf menhaden
Opisthonema oglinum	Atlantic thread herring
Anchoa hepsetus	striped anchovy
Anchoa mitchelli	bay anchovy
Arius felis	hardhead catfish
Bagre marinus	gafftopsail catfish
Chloroscombrus chrysurus	Atlantic bumper
Archosargus probatocephalus	sheepshead
Larimus fasciatus	banded drum
Merticirrhus americanus	southern kingfish
Stellifer lanceolatus	star drum
Chaetodipterus faber	Atlantic spadefish
Polydactylus octonemus	Atlantic threadfin
Symphurus plagiusa	blackcheek tonguefish

Group 2. Taxa Most Characteristic of Deep Waters Overlying Muddy Sediments in the Western Portion of the Study Area and in the Vicinity of the Mississippi River Delta

Scientific Name	Common Name
Parapenaeus	shrimp
Solenocera	shrimp
Trachypenaeus	shrimp
Xiphopeneus	seabob
Congrina flava	yellow conger
Steindachneria argentea	luminous hake

Group 3. Taxa Widespread Across the Study Area, but Most Numerically Prominent in Waters Overlying Muddy Sediments

Scientific Name	Common Name
Penaeus aztecus	brown shrimp
Callinectes similis	lesser blue crab
Rhizoprionodon terraenovae	Atlantic sharpnose shark
Porichthys porosissimus	Atlantic midshipman
Selene setapinnis	Atlantic moonfish
Cynoscion arenarius	sand seatrout
Cynoscion nothus	silver seatrout
Leiostomus xanthurus	spot
Micropogonias undulatus	croaker
Trichiurus lepturus	Atlantic cutlassfish
Prionotus rubio	blackfin searobin
Citharichthys spilopterus	bay whiff
Paralichthys lethostigma	southern flounder

Group 4. Taxa Widespread Across the Study Area, but Most Numerically Prominent in Waters Overlying Sandy Sediments

Scientific Name	Common Name
Harengula jaguana	scaled sardine
Synodus foetens	inshore lizardfish
Halieutichthys aculeatus	pancake batfish
Centropristis philadelphicus	rock sea bass
Logodon rhomboides	pigfish
Peprilus burti	gulf butterfish
Cyclopsetta chittendeni	Mexican flounder
Etropus crossotus	fringed flounder
Syacium papillosum	dusky flounder

Group 5. Taxa Widespread in Waters Overlying Sandy Sediments

Scientific Name	Common Name
Loligo pealii	squid
Penaeus duorarum	pink shrimp
Sicyonia dorsalis	rock shrimp
Etrumeus teres	round herring
Saurida brasiliensis	largescale lizardfish
Diplectrum bivittatum	dwarf sand perch
Diplectrum radiale	sand perch
Decapterus punctatus	round scad
Trachurus lathami	rough scad
Lutjanus campechanus	red snapper
Lutjanus synagris	lane snapper
Pristipomoides aquilonaris	wenchman
Eucinostamus gula	silver jerry
Stenotomus caprinus	longspine porgy
Sphyraena guachancho	guaguanche
Syacium gunteri	shoal flounder
Lagocephalus laevigatus	smooth puffer
Sphoeroides parvus	least puffer

Group 6. Taxa Most Characteristic off Mid-Depth to Deep Waters Overlying Sandy Sediments

Scientific Name	Common Name
Scyllarides nodifer	lobster
Portunus spinicarpus	portunid crab
Trachinocephalus myops	snakefish
Scorpaena calcarata	smoothhead scorpionfish
Bellator militaris	horned searobin
Prionotus ophyrus	bandtail searobin
Prionotus roseus	bluespotted searobin

Table 12. A coincidence table displaying the relationship of the six taxa groups to the six station groups resulting from a synthesis of community analyses of three replicate samples collected at 154 stations in and around the Tuscaloosa Trend study area during the fall 1974 to summer 1975 NMFS Fishery Independent groundfish surveys.

	STATION GROUPS					
	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
TAXA GROUPS	Nearshore waters primarily collected in winter and spring	Nearshore waters primarily collected in spring and summer	Nearshore waters overlying sandy sediments	Deep waters overlying muddy sediments	Mid-depth to deep waters overlying sandy sediments collected in spring and summer	Mid-depth to deep waters overlying sandy sediments collected in fall and winter
Group 1	P	S	S			
Group 2				P		
Group 3	P	P	S	P	S	S
Group 4	S	S	S	S	P	P
Group 5			S		P	P
Group 6					S	P

P = PRIMARY ASSOCIATION

S = SECONDARY ASSOCIATION

demersal nekton taxa. The taxa groups that exhibited seasonal trends also exhibited clear cut spatial distributions.

The integration and synthesis of the analysis results yielded six station groups (habitats) and six taxa groups (communities). The stations in these six groups are shown, by season, in Figure 2. Table 4 presents summary statistics for the six station groups while Tables 5-10 show the relative composition over all stations in each of the six station groups. The six taxa groups are presented in Table 11, and the distributions of these taxa groups across the six station groups are presented in Table 12.

The six station groups (Figure 2 and Tables 4 and 12) included three shallow water to middepth groups (Groups 1-3) and three middepth to deep water groups (Groups 4-6). All groups except the shallowest (Group 2) encompassed a wide range of depths. Inspection of Table 12 reveals that seasonal trends primarily differentiate stations in Group 1 from those in Group 2 and, similarly, those in Group 5 from those in Group 6. For each pair of groups, the same taxa groups characterized both members. Groups 1 and 2 were differentiated on the basis of seasonal trends of Taxa Group 1 taxa, and Group 5 and 6 differed mainly on the basis of seasonal trends of the Taxa Group 6 taxa. This suggests that it may be appropriate to consider combining Groups 1 and 2 and Groups 5 and 6 and characterize the seasonal data on the basis of four groups. The results at least point out the secondary role of season as a factor in the distribution of demersal nekton communities on the Tuscaloosa Trend Shelf OCS.

Station Group 1 was largely comprised of nearshore and some middepth stations (range of 3-29 fm (fathoms)) located across the study area (Figure 2 and Table 4). The majority of the stations in this group were collected in winter and spring, but this group also included some fall and summer collections, indicating that the seasonal trends were secondary to other sources of variation. Of the three nearshore station groups, (Groups 1-3), this group supported the most diverse community, and also had the highest mean number of individuals (Table 4). Compared to the stations from deeper waters in Groups 5 and 6, Group 1 stations had substantially lower numbers of taxa, lower diversity and richness, and higher numbers of individuals (Table 4).

Station Group 2 defined a nearshore habitat comprised of stations located in shallow waters across the study area; with many of the stations being located near Chandeleur and Breton Sounds (Figure 2). The stations in this group tended to harbor lower total numbers of taxa and individuals compared to the Group 1 stations (Table 4). This group included five fall, 3 winter, six spring and six summer collections.

The nearshore habitat located in shallow waters overlying sandy sediments in the eastern and central portion of the study area formed Station Group 3 (Figure 2). These stations were characterized by relatively low total numbers of taxa and the lowest mean number of individuals, and were collected during fall, spring, and summer (Table 4).

Station Group 4 defined a habitat characterized by deep waters overlying muddy sediments in the western portion of the study area and in the vicinity of the Mississippi River Delta (Figure 2). This group was well represented during all four seasons. Of the three middepth to deep water groups (Groups 4-6), Group 4 has lowest mean values for total number of taxa and community parameters (Table 4). These values were more similar to those of the three more nearshore groups (Groups 1-3).

Station Group 5 defined a habitat characterized by middepth to deep waters overlying sandy sediments in the eastern portion of the study area (Figure 2). It was well represented during all seasons, but more so during spring and summer. Values for total numbers of taxa and community parameters were the highest of all groups and very similar to each other (Table 4). Station Group 6 defined a habitat similar to Station Group 5, but included more collections from the fall and winter and fewer from the spring and summer. As mentioned above, mean numbers of taxa and means for community parameters were similar to those of Group 5 and higher than those for any of the other groups (Table 4).

Taxa Group 1 included those taxa most characteristic of the nearshore waters across the study area in winter and spring stations (Station Groups 1-3 and especially Group 1 in Table 12). However, as seen in Table 12, they were also characteristic, to a lesser degree, of the other two groups of shallow water stations (Groups 1 and 2). The lower relative importance of these taxa in the collections from the Group 2 stations, which represented a seasonal trend in the distributions of these taxa, was primarily responsible for the differentiation of the Station Group 1 and Group 2 stations. Some of the taxa most representative of this group were Penaeus setiferus, Menticirrhus americanus, Larimus fasciatus, and Arius felis (Table 11). These trends are consistent with the life history of white shrimp, which migrates to the shelf from the estuaries in fall and winter, and is predominantly found over muddy sediments. Many of the other taxa in Taxa Group 1 have similar estuarine-dependent life histories.

The taxa in Group 2 were virtually restricted to the middepth to deep water stations overlying muddy sediments in the western portion of the study area, and in the vicinity of the Mississippi River Delta (Table 12), with Parapenaeus LPIL, Solenocera LPIL, Trachypenaeus LPIL, and Steindachneria argentea most characteristic of this group (Table 11). Of all the taxa groups identified, this one had the most restricted habitat preferences, and was primarily responsible for the unique character of the community at the Group 4 stations (Figure 2).

The taxa comprising Group 3 were widespread across the study area, but were relatively most abundant in shallow to deep waters overlying muddy sediments (Station Groups 1, 2 and 4 and especially Station Group 1 in Table 12). Some of the taxa most representative of this group include Penaeus aztecus, Cynoscion arenarius, Cynoscion nothus, Micropogonias undulatus and Trichiurus lepturus (Table 11). Many of these Group 3 taxa are estuarine dependent, and their preferences for muddy substrates is well known. Young brown shrimp (Penaeus aztecus) migrate from Gulf Coast estuaries in late spring and early summer, moving to deeper waters as the year progresses (see Section 2.5.5). In winter they were found as deep as the deepest Fishery Independent survey stations (50-60 fm or about 100 m) These migration patterns explain their widespread distributions.

Group 4 taxa were also widespread across the study area, but were relatively most abundant in waters overlying sandy sediments. They were especially well represented at the middepth to deep water stations overlying study sediments in the eastern portion of the study area during all seasons (Groups 5 and 6 in Table 12). Synodus foetens, Centropristis philadelphicus, Peprilus burti and Syacium papillosum were most characteristic of this group (Table 11).

Taxa Groups 5 and 6 essentially defined the unique character of Station Groups 5 and 6 (Table 12). The taxa in Group 5 were widespread in waters overlying sandy sediments (Station Groups 3, 5 and 6 in Table 12), with Penaeus duorarum, Lutjanus campechanus, Eucinostomus gula, Stenotomus caprinus and Trachurus lathami most representative of the group (Table 11). As was the case with the Group 4 taxa, those in Group 5 were especially well represented at the middepth to deep water stations overlying sandy sediments in the eastern portion of the study area during all seasons (Groups 5 and 6 in Table 12).

The Group 6 taxa were more or less restricted to middepth to deep water stations overlying sandy sediments (Station Groups 5 and 6), and were best represented during fall and winter (i.e., in Station Group 6). The distributions of those taxa differ from those of the Group 5 taxa mainly by their absence from the shallow water, sandy habitat (Station Group 3) and their lesser relative importance at the middepth to deep water stations The lower relative importance of these on sandy bottoms in spring and summer (Group 5). taxa in the collections from the Group 5 stations, which represented a seasonal trend in their distributions, was primarily responsible for the differentiation of the Group 5 and Group 6 stations (Table 12). Some of the taxa most characteristic of this group were Bellator militaris, Prionotus roseus, and Scorpaena calcarata (Table 11).

1.3.3 NMFS Fishery Independent Survey Fall Data, 1973-1983

The results of the analysis of the subset of fall Fishery Independent data over the period 1973-1983 indicated that recurring trends in the distributions of taxa groups in the Tuscaloosa Trend study area did occur. Major patterns in the 10 year data set were primarily related to depth and geographical location, both probably being strongly related to trends in hydrography and sediment texture. Temporal trends were of secondary importance, but were still evident for several taxa and station groups.

Since this analysis included data collected over a number of years, defining habitats (i.e., station groups) on a geographic basis is not as meaningful as in the seasonal analysis. Therefore, the station groups discussed herein are those eight groups defined in the TWINSPAN analysis (see Figure 17 of Section 2.5.4.3), and are shown in Table 13 (as well as Table 36 of Section 2.5.4.3). For consistency with the other summary sections, the roman numeral identification of the TWINSPAN station groups (in Table 13) have been changed to arabic numerals (e.g., Group IA1 = Group 1, Group IIB2 = Group 8, etc.). Summary statistics for these eight groups are shown in Table 14. Table 15 shows the eight taxa groups defined on the basis of the community analyses, while Table 16 shows the relationship of the taxa groups to the station groups.

The dominant trend in the distribution of demersal nekton communities over the Tuscaloosa Trend study area as revealed by TWINSPAN station groupings (Table 13) was spatial, and involved segregation of the majority of the stations in the west and central regions (Groups 1-4) from the

Table 13. Distribution of stations (by region and depth) in each of eight TWINSPAN groups resulting from analyses of 90 selected demersal nekton collected in three replicate samples at 150 stations in three regions of the Tuscaloosa Trend study area during fall NMFS Fishery Independent surveys from 1973 to 1983.

STATION GROUP 1

DEPTH	73	74	75	76	77	78	79	80	82	83
	YEAR									
0-10			W	W	E/W	C/W				
10-20					W					
20-30										
30-40										
40-50										
>50										

STATION GROUP 2

DEPTH	73	74	75	76	77	78	79	80	82	83
	YEAR									
0-10	C/W	C/W	E	C			C/W	C/W	E/C/W	E/W
10-20	W	W	W	W	C	C/W	W	W	C/W	W
20-30	W	C/W	W	C/W	W	W	C/W	W		W
30-40			W	W			W			
40-50				W						
>50										

STATION GROUP 3

DEPTH	73	74	75	76	77	78	79	80	82	83
	YEAR									
0-10										
10-20							C			C
20-30			C		C	C			C/W	C
30-40	C/W	C		C	C/W	W		C/W	C/W	C/W
40-50	E/C/W	W	W				W	W	W	E/W
>50										

STATION GROUP 4

DEPTH	73	74	75	76	77	78	79	80	82	83
	YEAR									
0-10										
10-20										
20-30										
30-40		W	C			C	C	C		
40-50		E/C		C	C/W	W	E	C	E/C	C
>50			W						W	W

STATION GROUP 5

DEPTH	73	74	75	76	77	78	79	80	82	83
	YEAR									
0-10										
10-20										
20-30			E							
30-40			E	E		E	E	E	E	
40-50				E	E	C	C	E		
>50										

STATION GROUP 6

DEPTH	73	74	75	76	77	78	79	80	82	83
	YEAR									
0-10										
10-20		E	E							E
20-30	E	E		E	E	E			E	E
30-40	E	E			E					E
40-50										
>50										

STATION GROUP 7

DEPTH	73	74	75	76	77	78	79	80	82	83
	YEAR									
0-10		E	C	E	C	E	E	E		C
10-20	C	C	C	E/C	E	E		E/C	E	
20-30	C						E	E		
30-40										
40-50										
>50										

STATION GROUP 8

DEPTH	73	74	75	76	77	78	79	80	82	83
	YEAR									
0-10	E									
10-20	E									
20-30										
30-40										
40-50										
>50										

Table 14. Summary statistics of environmental and community parameters for eight station groups identified from a synthesis of analyses of three replicate samples collected at 150 stations in three regions of the Tuscaloosa Trend study area during fall NMFS Fishery Independent surveys from 1973 to 1983.

Parameter	Mean	Standard Deviation	Minimum	Maximum
GROUP=1				
Depth (fm)	7.905	2.052	6.000	12.333
Bottom Temperature (°F)	73.250	7.676	62.000	79.000
Total Taxa	9.238	5.269	4.000	17.667
Total Count	1181.333	1898.943	196.333	5464.333
Diversity (J')	0.954	0.792	0.126	1.906
Evenness (H')	0.403	0.270	0.083	0.691
Richness (D)	1.316	0.832	0.469	2.669
GROUP=2				
Depth (fm)	17.070	9.447	7.000	44.000
Bottom Temperature (°F)	73.649	3.200	65.000	79.000
Total Taxa	16.217	5.084	5.000	28.333
Total Count	751.798	1289.116	119.667	8682.333
Diversity (J')	1.754	0.521	0.315	2.701
Evenness (H')	0.633	0.143	0.196	0.841
Richness (D)	2.540	0.942	0.446	4.624
GROUP=3				
Depth (fm)	34.780	8.717	15.000	46.000
Bottom Temperature (°F)	73.214	4.117	65.000	77.000
Total Taxa	19.661	4.442	13.000	29.667
Total Count	577.565	431.569	122.333	1954.333
Diversity (J')	2.095	0.347	1.320	2.719
Evenness (H')	0.710	0.090	0.505	0.828
Richness (D)	3.104	0.866	1.788	4.781
GROUP=4				
Depth (fm)	43.772	6.479	33.000	55.333
Bottom Temperature (°F)	67.111	4.343	63.000	75.000
Total Taxa	16.930	4.608	9.000	26.667
Total Count	440.158	235.369	99.333	886.000
Diversity (J')	1.802	0.324	1.146	2.344
Evenness (H')	0.653	0.103	0.363	0.842
Richness (D)	2.777	0.660	1.559	4.081
GROUP=5				
Depth (fm)	38.556	6.491	25.000	48.000
Bottom Temperature (°F)	68.143	4.180	64.000	75.000
Total Taxa	13.278	3.905	7.000	19.000
Total Count	1159.208	1256.050	234.333	3978.333
Diversity (J')	1.450	0.595	0.488	2.149
Evenness (H')	0.559	0.191	0.255	0.744
Richness (D)	2.110	0.666	1.043	2.988
GROUP=6				
Depth (fm)	24.556	6.309	17.000	36.000
Bottom Temperature (°F)	74.167	1.772	71.000	76.000
Total Taxa	16.467	6.857	5.667	26.000
Total Count	308.778	298.056	21.333	802.000
Diversity (J')	1.998	0.478	0.917	2.546
Evenness (H')	0.751	0.104	0.521	0.874
Richness (D)	3.019	1.086	1.337	4.686
GROUP=7				
Depth (fm)	13.857	6.376	6.667	270667
Bottom Temperature (°F)	72.909	4.036	66.000	81.000
Total Taxa	14.571	5.436	7.000	30.000
Total Count	245.921	273.955	16.667	1107.667
Diversity (J')	1.744	0.407	1.225	2.782
Evenness (H')	0.673	0.122	0.430	0.865
Richness (D)	2.737	0.863	1.237	5.282
GROUP=8				
Depth (fm)	11.500	6.835	6.667	16.333
Bottom Temperature (°F)	75.000	2.828	73.000	77.000
Total Taxa	6.333	3.300	4.000	8.667
Total Count	32.167	19.092	18.667	45.667
Diversity (J')	1.146	0.754	0.613	1.680
Evenness (H')	0.639	0.277	0.442	0.835
Richness (D)	1.677	1.181	0.842	2.512

Table 15. Eight taxa groups resulting from a synthesis of community analyses of three replicate samples collected at 150 stations in three regions of the Tuscaloosa Trend study area during fall NMFS Fishery Independent surveys from 1973 to 1983.

Group 1. Taxa Most Characteristic of the Shallow Water Habitat in the Western Region

Scientific Name	Common Name
Penaeus setiferus	white shrimp
Brevoortia patronus	gulf menhaden
Harengula jaguana	scaled sardine
Opisthonema oglinum	Atlantic thread herring
Arius felis	hardhead catfish
Bagre marinus	gafftopsail catfish
Chloroscombrus chrysurus	Atlantic bumper
Selene setapinnis	Atlantic moonfish
Larimus fasciatus	banded drum
Menticirrhus americanus	southern kingfish
Stellifer lanceolatus	star drum
Polydactylus octonemus	Atlantic threadfin

Group 2. Taxa Most Characteristic of Mid Depth to Deep Waters Overlying Muddy Sediments in the Western Portion of the Study Area and in the Vicinity of the Mississippi River Delta

Scientific Name	Common Name
Parapenaeus	shrimp
Solenocera	shrimp
Trachypenaeus	shrimp
Congrina flava	yellow conger
Steindachneria argentea	luminous hake
Antennarius radiosus	singlespot frogfish
Lepophidium graellsi	blackedge cusk-eel
Serranus atrobranchus	blackear bass
Bollmannia communis	ragged goby

Group 3. Taxa Widespread Across the Study Area, but Most Numerically Prominent in Waters Overlying Muddy Sediments

Scientific Name	Common Name
Penaeus aztecus	brown shrimp
Squilla	mantis shrimp
Callinectes similis	lesser blue crab
Porichthys porosissimus	Atlantic midshipman
Cynoscion arenarius	sand seatrout
Cynoscion nothus	silver seatrout
Leiostomus xanthurus	spot
Micropogonias undulatus	croaker
Chaetodipterus faber	Atlantic spadefish
Trichiurus lepturus	Atlantic cutlassfish
Peprilus paru	harvestfish
Citharichthys spilopterus	bay whiff
Paralichthys lethostigma	southern flounder

Group 4. Taxa Widespread Across the Study Area, but Most Numerically Prominent in Waters Overlying Sandy Sediments

Scientific Name	Common Name
Loliguncula brevis	short squid
Loligo pealeii	squid
Synodus foetens	inshore lizardfish
Diplectrum bivittatum	dwarf sand perch
Stenotomus caprinus	longspine porgy
Syacium papillosum	dusky flounder

Group 5. Taxa Most Characteristic of the Shallow Water Habita in the Eastern and to Some Extent Central Region

Scientific Name	Common Name
Penaeus duorarum	pink shrimp
Callinectes sapidus	blue crab
Portunus gibbesii	portunid crab
Anchoa hepsetus	striped anchovy
Diplectrum formosum	sand perch
Lutjanus campechanus	red snapper
Eucinostomus gula	silver jenny
Etropus crossotus	fringed flounder
Aluterus schoepfi	orange filefish
Ballistes capriscus	gray triggerfish
Sphoeroides parvus	least puffer

Group 6. Taxa Most Characteristic of Mid-Depth Waters Overlying Sandy Sediments

Scientific Name	Common Name
Sicyonia brevirostris	rock shrimp
Trachinocephalus myops	snakefish
Ophidion holbroki	bank cusk-eel
Centropristis ocyurus	bank sea bass
Scorpaena calcarata	smoothhead scorpionfis
Bellator militaris	horned searobin
Prionotus ophyrus	bandtail searobin
Prionotus roseus	bluespotted searobin
Prionotus salmonicolor	blackwing searobin
Monacanthus hispidus	planehead filefish

Group 7. Taxa Favoring the Deepest Stations in the Study Area

Scientific Name	Common Name
Portunus spinicarpus	portunid crab
Saurida brasiliensis	largescale lizardfish
Urophycis floridanus	southern hake
Centropristis philadephicus	rock sea bass
Serranus atrobranchus	blackear bass
Pristipomoides aquilonaris	wenchman
Stenotomus caprinus	longspine porgy
Peprilus burti	gulf butterfish
Prionotus paralatus	Mexican searobin
Prionotus stearnsi	shortwing searobin
Cyclopsetta chittendeni	Mexican flounder

Group 8. Taxa with Widespread Distributions Showing No Strong Preferences

Scientific Name	Common Name
Calappa sulcata	crab
Rhizoprionodon terraenovae	Atlantic sharpnose sha
Halieutichthys aculeatus	pancake batfish
Lagodon rhomboides	pinfish
Sphyraena guachancho	guaguanche
Trachurus lathami	rough scad
Paralichthys lethostigma	southern flounder

Table 16. A coincidence table displaying the relationship of the eight taxa groups to the eight station groups resulting from a synthesis of community analyses of three replicate samples collected at 150 stations in three regions of the Tuscaloosa Trend study area during fall NMFS Fishery Independent surveys from 1973 to 1983.

	STATION GROUPS							
	Group 1 Nearshore mainly Western 1975-1978	Group 2 Nearshore to Middepth Western and Central most years	Group 3 Middepth to Deep Western and Central most years	Group 4 Deep Western and Central most years	Group 5 Deep Eastern and some Central mid years	Group 6 Middepth Eastern distinct periodicity	Group 7 Nearshore Eastern most years	Group 8 Nearshore Eastern 1973 only
TAXA GROUPS								
Group 1	S	P						
Group 2			P	S				
Group 3	S	P	P	S	S	S	S	
Group 4		S	S	P	P	P	P	S
Group 5		S					P	S
Group 6					S	P	S	
Group 7		S	S	P	P	S	S	
Group 8		S	S	S	S	S	S	

P = PRIMARY ASSOCIATION

S = SECONDARY ASSOCIATION

majority of those in the eastern region (Groups 5-8). Within these two major groups, the stations were ordered with the shallowest stations (Groups 1 and 8) at the ends of the TWINSPAN display and the deepest stations (Groups 4 and 5) near the center of the display. Thus, even though they were located at opposite ends of Table 13, Group 4 and 5 stations were somewhat similar to each other.

Groups 1 and 2 (Table 13) comprised the majority of the shallow to middepth stations from the western and central regions of the study area, along with a few deep water stations from the western region and a few shallow depth stations from the eastern region. Collectively these stations represented the white shrimp ground habitat in the Tuscaloosa Trend study area. Group 1 and 2 stations were characterized mainly by taxa in Taxa Groups 1, 3 and 5, with occasional representation by taxa in Taxa Groups 4 and 8 (Tables 15 and 16).

Station Group 1 consisted of seven shallow stations collected during the period 1975-1978, with the 0-10 fm zone in the western region being represented during all four years. These stations were taxonomically similar to those of Group 2 except they were more depauperate and had higher mean number of individuals (Table 14). This indicates that during these four years, inshore stocks of many taxa in the western region of the Tuscaloosa Trend study area may have been abnormally low. Group 1 stations had the second lowest mean number of taxa and the lowest means for community parameters (Table 14). Only Taxa Groups 1 and 3 were represented at these depauperate Group 1 stations (Table 16).

Although dominated by stations from the western region, Station Group 2 included a number of stations from the central and eastern regions (Table 13). Many of these stations were characterized by taxa in Taxa Group 5 (which were most prominently represented at the shallow and sandy Group 5 stations in Tables 13 and 16) as well as taxa characteristic mainly of the western portion of the study area (Taxa Groups 1 and 3 in Tables 15 and 16). These stations generally showed higher numbers of taxa than the other Group 2 stations (Table 14) since they included taxa characteristic of both sandy and muddy bottoms. Their presence at Station Group 2 stations indicated that during some years, taxa which were characteristic of the shallow shelf in the western region also occupy the shallow shelf in the central and eastern regions. Several other taxa groups which were more characteristic of other station groups (i.e., Groups 4, 7, and 8 in Table 15) were also represented at the Station Group 1 stations (Table 16). Station Group 2 stations had mean numbers of taxa and means for community parameters that were higher than those of Group 1 but lower than those of Groups 3 and 4, which were generally found offshore of the Group 2 stations (Table 13).

Station Groups 3 and 4 included the vast majority of the stations collected in the central and western regions at depths greater than 30 fm as well as the majority of stations in the 40-50 fm depth range from the eastern region (Table 13). The major spatial difference in Station Groups 3 and 4 was the presence of a number of stations, mainly from the central region at depths of less than 30 fm, in Group 3. Taxonomically, the two groups were very similar, with the same taxa groups being represented in each (Table 16). The two groups differed by the lower relative importance of taxa from Taxa Groups 2 and 3 at Group 4 stations, as well as the lower relative importance of some of the Group 7 taxa at Group 3 stations (Tables 15 and 16). The stronger affinity of the Group 3 taxa to the stations in Station Group 3 (as compared to those in Station Group 4) was probably due to the inclusion of a number of stations of less than 30 fm depth and more stations in the 30 to 40 fm depth range in Station Group 3.

In addition to Taxa Groups 2, 3 and 7, Taxa Groups 4 and 8 made minor contributions to Station Group 3 stations (Tables 15 and 16). Means for number of taxa and community parameters were very high for stations in Station Groups 3 and 4, with those for Group 3 being the highest of any of the eight station groups (Table 14). Mean numbers of individuals were intermediate for both station groups.

Ecologically, these trends may represent subtle sediment responses in the central and western regions or they may involve changes in depth distributions of taxa in response to changes in hydrographic conditions from year to year. Group 4 taxa (Table 15), which were relatively more important at stations in Station Group 4, generally preferred sandier substrates. Since the same stations were not sampled each year, and the same strata were not sampled at the same time each year, trends over time could be attributable to differences in sampling location and time within the fall season. Alternately or coincidentally, these trends could be attributable to year to year hydrographic variability that influences the depth distribution of demersal nekton on the Tuscaloosa Trend shelf.

In this regard, it is interesting to note that all of the stations of greater than 50 fm depths are located in Group 4, while Group 3 includes the majority of stations from 40-50 fm depths in the western region. Since the taxa most representative of the deepest stations in the study area (Taxa Group 6) were relatively less important at the stations in Station Group 3, the trends in Table 13 could represent onshore-offshore migration patterns of this group. Thus, for years represented in Station Group 4, the deep water taxa attained maximum shelf intrusion, while during those years represented in Group 3, there was maximum offshore excursions by the widespread taxa in Taxa Group 3 (Table 15).

Station Groups 5 and 6 included most of the stations collected in the eastern region at depths greater than 20 fm, while Groups 7 and 8 included the majority of the stations collected in the eastern region at depths less than 20 fm, along with several stations located at similar depths from the central region (Table 13). The major difference in Station Groups 5 and 6 was depth. Only one station located in less than 30 fm of water was included in this group, while only four stations greater than 30 fm depth were included in Group 6 (Table 13). Temporal and spatial trends embodied in these two station groups were primarily due to the general absence of Group 6 taxa (including Scorpaena calcarata, Bellator militaris, Prionotus salmonicolor and Trachinocephalus myops) at Group 5 stations, and the lower relative importance of Group 7 taxa (including Serranus atrobranchus, Centropristis philadelphicus and Stenotomus caprinus) at stations in Station Group 6 (Tables 15 and 16). Note that taxa in Taxa Group 7 were also important in differentiating Station Groups 3 and 4 (Table 16), and it appears that the migrations of this deep water taxa group were responsible for changes in community structure in the deep waters of all regions of the study area. Note also that the stations from the eastern region from depths greater than 40 fm that were not included in Station Group 5 were included in Station Groups 3 and 4, which included stations from mainly the western and central regions. Since Group 5 stations included those from only the middle of the study period, indications are that Group 7 taxa were less well represented at 30-50 fm depths in the study area during the early and later years.

The patterns of distribution of the Group 6 taxa are extremely interesting, especially since the stations in Station Group 6 were the preferred habitat of these taxa (Tables 15 and 16). The distinct periodicity of the occurrence of stations in Group 6 (Table 13) may indicate migration of Group 6 taxa into and out of the Tuscaloosa Trend study area over time. Station Group 5 had one of the highest mean number of individuals, over three times as high as that for Group 6 (Table 14). Mean numbers of taxa and means for all community parameters were, on the other hand, lower for Station Group 5, and were only marginally higher than those for the relatively depauperate Station Groups 1 and 8. Means for Station Group 6 were, on the other hand, among the highest, being exceeded only by those for Station Group 3 (Table 14).

The final two groups of stations (Groups 7 and 8) represented mainly shallow to middepth stations from the eastern and, to a lesser degree, central regions of the study area. In general, stations in these two groups were characterized by relatively few taxa and individuals compared to stations at similar depths from the western region. Those from Group 8 were the most depauperate, and also had the lowest mean number of individuals of any station group (Table 14). Taxa Groups 4 and 5 were best represented at these stations, with the Group 5 taxa being most characteristic (Table 16). Taxa Groups 6 and 8 were also represented at stations in Station Group 7 (Table 16). Station Group 8 included two very depauperate stations collected from 1973, a year of atypical hydrographic conditions along the northern Gulf coast. Because taxa in Taxa Group 4 (Table 15) were widespread in distribution, they probably contributed little to the segregation of the Group 7 and 8 stations from those of Groups 3-6 (Table 16). In contrast, Taxa Group 5 taxa (Table 15) were major components of the community at only the Station Group 7 stations (Table 16), indicating that trends in these Group 5 taxa were mainly responsible for the spatial and temporal patterns exhibited by the Group 7 stations (Table 13). The majority of the stations from the central region included in this group were from the years 1973-1976, with the eastern region being poorly represented during these years. Most of the stations from the eastern region in Group 7 were from the period 1976-1981. Therefore, it appears that the taxa most representative of Group 7 exhibited changes in distributions within the study area from year to year.

Eight taxa groups were identified from the community analyses of the annual Fishery Independent data set (Table 15). Most groups were identified as distinct ecological entities in both the TWINSPAN and factor analyses (see Figure 17 and Table 37 in Sections 2.5.4.3 and 2.5.4.4, respectively), and the majority were also defined in the seasonal analysis (see Table 11).

Taxa Group 1 represents one major component of the white shrimp grounds fauna, and includes the white shrimp itself as well as many other muddy bottom, shallow depth restricted taxa (Table 15). The majority of these taxa are estuarine dependent. These taxa were only occasionally found beyond 30 fm depths. They showed a distinct preference for the muddy bottoms of the western region and, to a lesser extent, the central region of the study area. They characterized Station Group 2 and were also represented at Station Group 1 (Table 16). They were included in Taxa Group IA2 and Factor 5 of the TWINSPAN and factor analyses, respectively (see Figure 17 and Table 37 in Sections 2.5.4.3 and 2.5.4.4). This group was essentially equivalent to Group 1 of the seasonal analysis (see Table 11).

Complimenting this shallow water, muddy bottom group are those taxa in Taxa Group 2 that were more or less restricted to middepth and deep muddy bottom stations in the western region of the study area (Groups 3 and 4 in Table 16). They defined Taxa Group IA1 and Factor 6 of the corresponding community analyses (see Figure 17 and Table 37 in Sections 2.5.4.3 and 2.5.4.4, respectively), and most were included in Group 2 of the seasonal analysis (see Table 11). Notable in its absence from Taxa Group 2 in the annual analysis was the seabob. While other analyses conducted in this study confirmed the seabob's preference for the shelf west of the Mississippi River Delta, the seabob was rare in the subset of samples selected for the annual analyses, probably because few of the Fishery Independent survey stations were located in waters of less than 5 fm depths. These middepth to deep water taxa in Group 2 included three other species of shrimp (Table 15) which uniquely characterized the brown shrimp ground habitat.

Taxa Group 3 (Table 15) was essentially the same as Group 3 in the seasonal analysis (see Table 11). Group 3 taxa were distributed over muddy bottoms in the western and central regions of the study area at all depths, and were also represented at most stations on sandy bottoms (Station Groups 5-7 in Table 16). This group included a number of taxa of commercial importance (Table 15), many of which are estuarine dependent. They form the second major component of both the nearshore and offshore muddy bottom habitats. Some of the more widespread taxa (including the brown shrimp and croaker) were also found in relatively lower numbers at middepth and deep sandy bottom stations. They characterized TWINSPAN Group IA2 and Factor 2 in the corresponding community analyses (see Figure 17 and Table 37 of Sections 2.5.4.3 and 2.5.4.4, respectively).

As Taxa Groups 1 to 3 characterized the muddy bottom habitats in the western and central regions of the study area, Taxa Groups 4 to 6 characterized the several sandy bottom habitats (Table 16). The taxa groups defined in this annual analysis for sandy bottom habitats were somewhat different from those defined in the seasonal analysis (see Table 11). In general, taxa in Taxa Groups 1 to 3 did not show as much habitat fidelity as those defining the muddy bottom communities, and many fewer taxa characterized these sandy bottom communities.

Group 4 taxa were generally widespread across the study area, but were most numerically prominent in waters overlying sandy sediments. Group 4 of the seasonal analyses (see Table 11) showed the same trends, but the taxa were somewhat different, with the inshore lizardfish and the dusky flounder common to both groups. The group was not particularly well defined in either the TWINSPAN or factor analyses due to the widespread distributions of its members (see Figure 17 and Table 37 in Sections 2.5.4.3 and 2.5.4.4, respectively).

Group 5 taxa were most characteristic of the shallow water habitat in the eastern region and parts of the central region of the study area (Table 16). A similar group was not defined in the seasonal analyses (see Table 11). Instead, one group characteristic of the shallow water environment in the entire study area was identified (equivalent to Group 1 in Table 15). Group 5 taxa were best represented at stations in Station Group 7, but were also represented at stations in Station Groups 2 and 8 (Table 16). The taxa in Taxa Group 5 characterized Factor 4 and TWINSPAN Groups IB2 and IIA1 in the corresponding community analyses (see Figure 17 and Table 37 in Sections 2.5.4.3 and 2.5.4.4, respectively). The pink shrimp and the portunid crab most characterized Group 5 (Table 15), which also included several other taxa known to prefer sandy bottoms.

Group 6 taxa were most characteristic of the middepth stations on sandy bottoms in the eastern region of the study area. They were of greatest relative importance at the Group 6 stations (Table 16) and the dynamics of these taxa may be responsible for the temporal trends exhibited by the Group 6 stations. Taxa Group 6 taxa were also represented at stations in Station Groups 5 and 7 (Table 16). Of all the sandy bottom taxa, those in Group 6 showed the most restricted distributions. These taxa characterized TWINSPAN Group IIB2 and Factor 1 in the corresponding community analyses (see Figure 17 and Table 37 in Sections 2.5.4.3 and 2.5.4.4, respectively). Most of these same taxa were included in Group 6 in the seasonal analysis (see Table 11), among them the snakefish, the bank cusk-eel, the bank sea bass, the smoothhead scorpionfish and a number of searobins. They apparently appeared in the study area at several fairly well defined time periods (Table 13), indicating migration in and out of the Tuscaloosa Trend ecosystem. They were found almost exclusively in the eastern region of the study area, and were not generally found outside the 10 to 40 fm depth range.

Taxa Group 7 (Table 15) was not defined in the seasonal analysis (see Table 11), but in the annual analysis these taxa clearly characterized the deepest stations across the study area (Station Groups 4 and 5 in Table 16). However, they were not restricted to these stations and were generally represented in all station groups except Groups 1 and 8 (Table 16). In the seasonal analyses, many of these taxa were characterized as occurring widely over the study area but preferring sandy bottoms, while others were characterized as being widespread over sandy bottoms (see Table 11). These taxa most characterized Factor 3 and TWINSPAN Taxa Group IB1 of the community analyses (see Figure 17 and Table 37 in Sections 2.5.4.3 and 2.5.4.4, respectively). Results indicated that the dynamics of the Group 7 taxa contributed strongly to the differentiation of the Group 3 and 4 stations, as well as the Group 5 and 6 stations (Tables 13 and 16).

The final taxa group (Group 8 in Table 15) included taxa that were widespread over the study area and showed no strong preference for any particular habitat. This group was not well defined in the TWINSPAN or factor analyses since they did not show distinct trends. Taxa in Group 8 included the Atlantic sharpnose shark, the pancake batfish, the pinfish, the rough scad and the southern flounder.

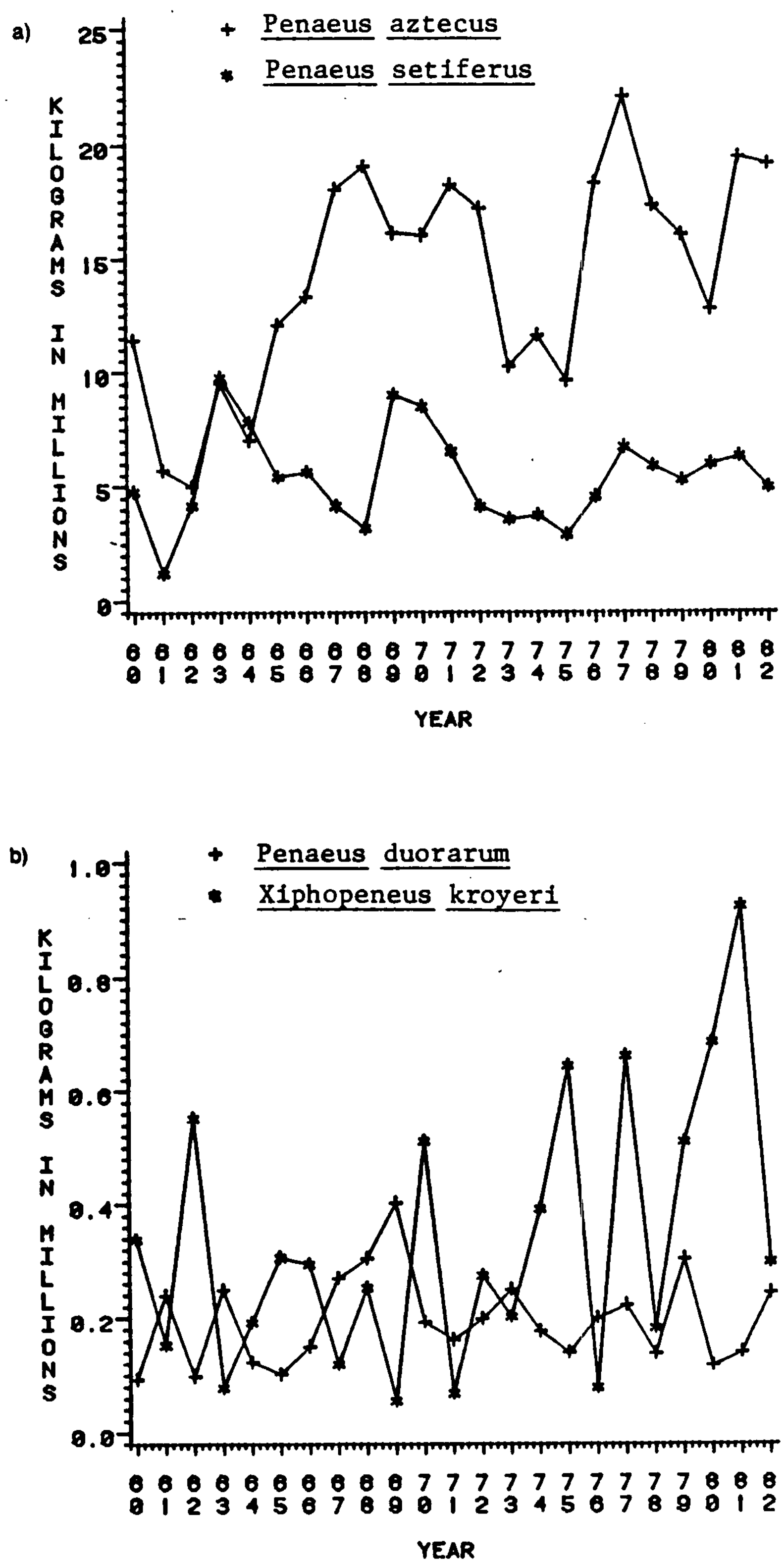

Figure 3. Total annual catch (kg, heads on) of a) white and brown shrimp and b) pink shrimp and seabobs in NMFS statistical subareas 9-13, which encompass the Tuscaloosa Trend study area.

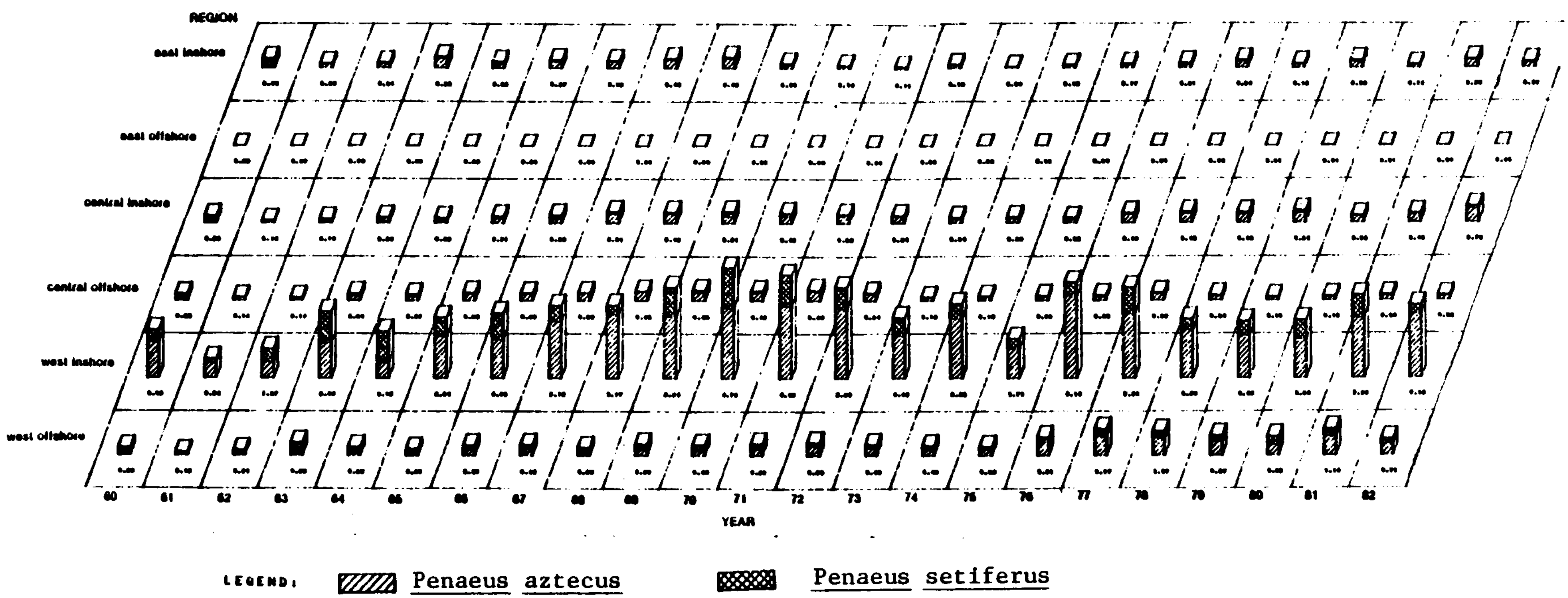

Figure 4. Mean annual inshore and offshore catch/unit water surface area (kg, heads on, per ha) of brown and white shrimp by region for the Tuscaloosa Trend study area based on Gulf Coast Shrimp Data for the period 1960-1982.

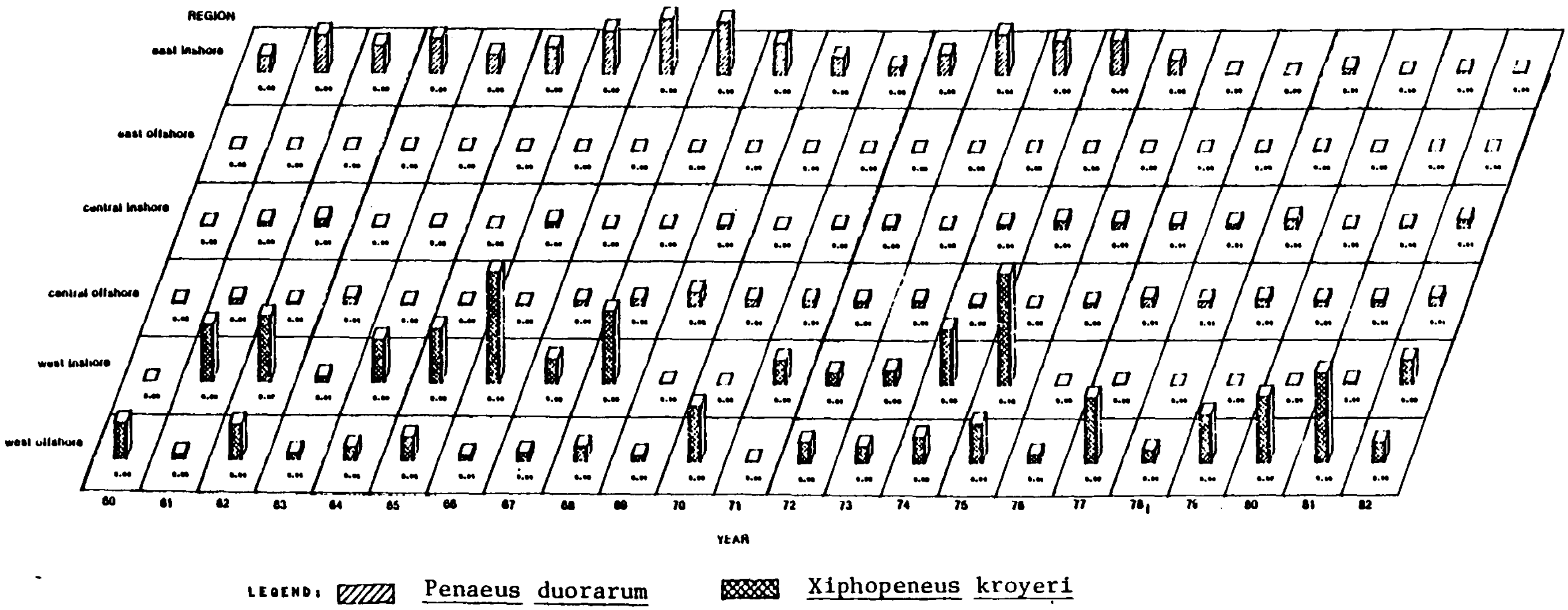

Figure 5. Mean annual inshore and offshore catch/unit water surface area (kg, heads on, per ha) of pink and seabob shrimp by region for the Tuscaloosa Trend study area based on Gulf Coast Shrimp Data for the period 1960-1982.

Table 17. Total annual catch (kg, heads on) and relative proportion of total catch of brown, white, pink and seabob shrimp in NMFS statistical subareas 9-13, which encompass the Tuscaloosa Trend study area, based on Gulf Coast Shrimp Data for the period 1960 to 1982.

	P.AZTECUS		P.DUORARUM		P.SETIFERUS		X.KROYERI		
YEAR	KILOGRAMS	PCT	KILOGRAMS	PCT	KILOGRAMS	PCT	KILOGRAMS	PCT	TOTAL
1960	11414868	0.69	93284	0.01	4758754	0.29	333307	0.02	16600213
1961	5716102	0.78	238787	0.03	1208024	0.17	151195	0.02	7314108
1962	4964745	0.51	97468	0.01	4173296	0.43	544443	0.06	9779953
1963	9512967	0.49	248701	0.01	9761667	0.50	77801	0.00	19601136
1964	6976258	0.46	122376	0.01	7791164	0.52	189486	0.01	15079284
1965	12052935	0.67	101519	0.01	5405583	0.30	301987	0.02	17862024
1966	13314715	0.69	150331	0.01	5634860	0.29	290140	0.01	19390045
1967	17990102	0.80	269617	0.01	4142907	0.18	117352	0.01	22519978
1968	19013203	0.84	304395	0.01	3172221	0.14	248600	0.01	22738419
1969	16066630	0.63	401266	0.02	8982801	0.35	54742	0.00	25505439
1970	15972307	0.64	191961	0.01	8465348	0.34	503549	0.02	25133164
1971	18176707	0.73	160775	0.01	6503217	0.26	67989	0.00	24908688
1972	17130178	0.79	198211	0.01	4115652	0.19	270179	0.01	21714220
1973	10208575	0.72	248605	0.02	3555463	0.25	199052	0.01	14211695
1974	11584577	0.73	175188	0.01	3727489	0.23	385362	0.02	15872615
1975	9585173	0.72	139443	0.01	2873608	0.22	634052	0.05	13232276
1976	18236378	0.79	199423	0.01	4531385	0.20	77434	0.00	23044620
1977	22042462	0.74	222054	0.01	6674103	0.23	651267	0.02	29589885
1978	17253247	0.74	137179	0.01	5854189	0.25	179097	0.01	23423712
1979	15991575	0.73	302886	0.01	5230002	0.24	502352	0.02	22026815
1980	12719736	0.65	116095	0.01	5964252	0.31	675455	0.03	19475538
1981	19414822	0.73	139798	0.01	6281149	0.23	910831	0.03	26746600
1982	19098684	0.78	242842	0.01	4924067	0.20	294172	0.01	24559765
TOTALS	324436945	0.70	4502204	0.01	123731200	0.27	7659844	0.01	460330193

In summary, eight taxa groups were identified in the annual analysis. Groups 1-3 showed well-defined depth preferences within the muddy bottoms of the western region and, to some extent, central region of the study Groups 4-6 favored portions of the eastern region, Group 7 characterized area. the deep water stations over the entire study area, and Group 8 showed no particular trends. The dynamics of these taxa groups indicated that trends over time were occurring in the study area.

1.3.4 Gulf Coast Shrimp Data (GCSD)

1.3.4.1 Introduction

GCSD for four penaeid shrimp, brown (*Penaeus aztecus*), white (*P. setiferus*) pink (*P. duorarum*) and seabob (*Xiphopeneus kroyeri*), in NMFS GCSD statistical subareas 8-13 (which encompass the Tuscaloosa Trend study area) were analyzed for the period 1960-1982. Two variables, catch (C) and catch/unit water surface area (C/A), were analyzed. Results of preliminary analysis of GCSD, along with results of the analyses of the scientific trawl survey data, indicated that these data would best suit the needs of the Tuscaloosa Trend ecosystem study if the five GCSD statistical subareas were aggregated to three regions, representing a western region (statistical subarea 13), a central region (statistical subareas 11 and 12 combined) and an eastern region (statistical subareas 9 and 10). NMFS statistical subareas are shown in Figure 9 in Section 2.3.4.2. The western region lies adjacent to the west side of the Mississippi River delta, while the eastern region lies off Alabama and Florida. The central region extends from the birdfoot delta on the west to Mobile Bay on the east, and includes Mississippi Sound and Chandeleur Sounds. The eastern region differs from the other two by having sediments of coarser grained material (fine grained sand). Other manipulations made to the original data received from NMFS TIMS involved consolidation of the 5 fm GCSD depth zones into one inshore and four offshore zones, and aggregation of the eight size classes of shrimp into three size classes. A map showing the regions and depth strata used in the shrimp analysis is presented in Figure 10 of Section 2.3.4.3.

Analysis results are presented as main effect and two and three way interaction means for year, month, region, zone and size. Figure 3 and Table 17 show the trends in total C (in kilograms (kg), heads on) for the four species of penaeid shrimp over the 23 year period 1960-1982. Figures 4 and 5 show the distribution of C/A over the same period by region broken down into inshore and offshore zones. Section 2.5.5.2 contains a more detailed discussion and display of these results.

1.3.4.2 Comparison of Trends Among Species

Over the entire 23 year period (1960-1982), C in the three regions totalled approximately 285 million kg (heads off), or approximately 12 million kg per year. Of this total, about 70% was brown shrimp, and 28% white shrimp, with seabobs and pink shrimp making up the remaining two percent. *Penaeus aztecus* dominated C in all years except for the period 1962-1964, when C of brown and white shrimp were similar (Figure 3 and Table 17).

There were both similarities and differences in the trends for white and brown shrimp. Both species showed relatively high C during the period 1969-1970, while during the period 1973-1975, C of both species was relatively low. In 1967, 1968 and 1977, brown shrimp C was high while that for white shrimp was relatively low.

C of pink and seabob shrimp were consistently lower than those for brown and white shrimp. Seabob C was highly variable through time, with peak C occurring in 1981 (almost 1 million kg). Pink shrimp C was less variable, and appears to have declined in recent years relative to that of seabobs.

Offshore, C/A for all four species decreased with depth, but the decline was less steep for brown shrimp (Figures 4 and 5). Most white and pink shrimp were caught in waters of less than 40 m depth, while brown shrimp C/A was more evenly distributed out to 100 m depths. Seabobs showed the most restricted depth distribution, with few being caught at depths greater than 20 m.

Three of the penaeid species (all except pink shrimp) generally showed similar spatial trends over the study area, with highest densities (as measured by C/A), in the western region and lowest densities in the eastern region (Figures 4 and 5). The seabob demonstrated the weakest affinity for the two regions located east of the Mississippi River, and (therefore) showed the most restricted geographic distribution. It was caught in appreciable numbers only in the western region, where the vast majority of the C was made in inshore waters and especially in nearshore waters of less than 10 fm depths (Figure 5). Going west to east, the contribution of inshore areas to total seabob C increased. A lower relative amount of seabob C was reported from inshore waters compared to the three species of the genus Penaeus. This is consistent with the general feeling that seabobs are not estuarine dependent (Juneau 1977).

White and brown shrimp C/A showed spatial trends similar to those of the seabob (i.e., highest densities in the west and lowest densities in the east), but were generally more widely distributed over the study area (Figure 4). While white shrimp C/A was by far the highest on the shelf in the western region, C/A for brown shrimp was more similar in the western and central regions. For both species, inshore areas of the western region were very productive, with C/A in the inshore zones of the central and especially eastern regions being much lower. Even so, the vast majority of the white shrimp C in the eastern region occurred in the estuaries, with virtually no offshore C reported. This probably indicates that white shrimp migrate westward upon leaving the estuaries of the eastern region, taking up residence on the shallow shelf in the central region (Lindner and Anderson 1956). The data clearly indicated that brown shrimp C in the estuaries and shallow Gulf were dominated by the size class of smallest shrimp, while a substantial fraction of the white shrimp C in these zones consisted of larger shrimp. This is consistent with the general understanding that white shrimp remain in the estuaries longer than brown shrimp, and grow to larger sizes there (Burkenroad 1934, Gunter 1950).

1.3.4.3 Brown Shrimp

The brown shrimp life cycle was well represented in the GCSD. C/A in the estuaries increased dramatically in May and June as juvenile shrimp moved out of the nurseries and into open bay staging areas and the shallow Gulf shelf. There was a clear trend as the year progressed for higher C of larger brown shrimp further offshore. The data clearly indicated that the size class of smallest shrimp showed very sharp decreases in C/A with depth, a trend just the opposite of the trends observed for the two larger size classes (which were caught in greatest numbers at depths of 40-100 m). Regionally, peak C of brown shrimp occurred first in the west and one month later in the central and eastern regions. C/A also appeared to be substantially more evenly distributed over the year at greater depths, with inshore waters showing both highest and lowest monthly C/A over the year. This indicates that the nearshore zone (out to 10 fm) was not the preferred habitat, and was primarily an area through which brown shrimp must migrate to reach the more offshore brown shrimp grounds.

1.3.4.4 White Shrimp

Although the life cycle of the white shrimp was not quite as well defined as was that for brown shrimp, the salient features were still evident in the GCSD, including the characteristic bimodal seasonal distribution of C. Across the entire study area, white shrimp showed a major increase during fall and early winter (August to December) and a second smaller peak in late spring (May to June). This bimodal distribution is consistent with the general understanding that some white shrimp postlarvae may enter estuaries too late in the fall to reach sufficient size to join the offshore adult stocks the same fall or winter. These shrimp probably overwinter in the estuaries, or, during colder winters, in the shallow Gulf, reentering the estuaries in the spring to complete their growth. However, C in spring was dominated by larger shrimp, indicating they may have migrated as adults from the estuaries the previous fall. The extended period over which white shrimp of the smallest size class were caught in elevated numbers (August to January) may indicate that the period of postlarval recruitment of white shrimp is extensive, and that shrimp were migrating out of the estuaries over the entire fall period (Baxter and Renfro 1967, Moffett 1970, Gaidry and White 1973, Christmas et al. 1966). This was very different from the trends for brown shrimp, where one major cohort resulting from a winter to early spring postlarval recruitment determines the success of the population for the year. Seasonal patterns were much more well defined and predictable for brown shrimp.

Size-related trends with depth and season were much more poorly defined for white as compared to brown shrimp, consistent with existing knowledge of the autecology of the two species. Offshore, C/A of the several size classes of white shrimp showed little change with depth. Seasonal trends in C/A were similar across all depths, although there was indication that peak C in the 20-40 m zone lagged by several months that in the inshore and shallow (0-20 m) offshore zones.

As was the case for white shrimp, pink shrimp C exhibited a bimodal distribution through the year. The major peak in C generally occurs in

May (inshore) and June (0 - 20 m depths, offshore), with C declining to low values by midsummer. A second, modest increase in C occurs both inshore and offshore in the midfall to early winter period. The fall C was dominated by shrimp of the smallest size class, indicating an extended period of pink shrimp spawning. The fall cohort may be the result of spawning of young of the year shrimp (i.e., those entering the estuaries the previous winter and early spring).

From year to year, there did not appear to be much correspondence between inshore and offshore C. The major pattern over time was the decreasing importance of the eastern estuaries during the last five or six years, and the increasing importance of the central region (both inshore and offshore) during the 1970s.

1.3.4.5 Pink Shrimp

Pink shrimp also exhibited very low C/A in the eastern region offshore, but inshore C/A in this region was the highest of the three regions (Figure 5). Pink shrimp C was even lower offshore in the western region, with the central region being the only one yielding substantial offshore C of pink shrimp. However, very few pink shrimp were caught inshore in the central region. Therefore, it appears that pink shrimp maturing in the estuaries of western Florida and Alabama migrate into the area of siltier sediments in the central region upon leaving the estuaries. A similar trend was noted above for white shrimp. The apparent low abundances of pink shrimp on the sandy sediments of the eastern region may be due to the fact that they are composed of relatively fine-grained sands, quite unlike the coarse textured sands on the west Florida shelf, where pink shrimp dominate the penaeid C. While shrimp of the smallest size class dominated the estuarine C and decreased in relative importance with distance offshore, the two size classes of larger shrimp exhibited no changes in C/A with depth offshore.

1.3.4.6 Seabobs

Seasonal trends for seabob C were similar in the central and western regions, with first increases observed in late summer and peaks found during fall and early winter. Catch then declines throughout the remainder of winter and spring, being lowest in late spring to early summer. This basic seasonal pattern was exhibited in all depth zones in which seabobs were caught in relatively high numbers, while at 20-40 m depths, increases in C began later and elevated C extended into the spring, possibly indicating offshore migration with age. Over the years, seabob inshore C has declined relative to offshore C, especially during years of high offshore C (Figure 5).

1.4 CONCLUSIONS

Results of the community analyses reflected the complex ecological patterns in the Tuscaloosa Trend ecosystem. All analyses revealed the presence of taxa characteristic of the shallow water, muddy bottom, variable hydrography habitat in the estuaries and shallow shelf in the western and central regions of the study area (the white shrimp grounds).

Most of the characteristic taxa, which included the white shrimp, the Gulf menhaden, the bay anchovy, the hardhead catfish, the Atlantic bumper, the southern kingfish, and the star drum are estuarine dependent. The white shrimp grounds were also characterized by taxa that were widely distributed over the study area, but were most prominent in waters overlying muddy sediments. Most of these taxa, including the brown shrimp, the sand and silver seatrouts, the spot, the croaker, and the Atlantic cutlassfish. are estuarine dependent and are the characteristic taxa of the brown shrimp grounds, located offshore of the white shrimp grounds. In the immediate vicinity of the birdfoot delta and westward, a third muddy bottom assemblage was evident in all three analyses. However, these taxa were not found in shallow waters or on muddy bottoms east of the delta. They include several penaeid shrimp including Parapenaeus LPIL and the seabob, as well as the yellow conger, the luminous hake, and the singlespot frogfish. In addition to these three taxa groups, the SEAMAP analysis identified taxa that were widespread in high salinity waters overlying muddy bottoms both east and west of the delta during spring (including the shrimp, Trachypenaeus LPIL and Squilla LPIL, the bearded brotula, and the blackedge cusk-eel). There was great similarity in taxa at the stations from all but the shallowest depths in the western region, due perhaps to the large volume of freshwater discharged into this area from the Mississippi River.

The shallow water, sandy bottom habitat of the central and eastern regions off Alabama and westernmost Florida was not characterized by a distinct inshore community comparable to that of the white shrimp grounds. This habitat was characterized by widespread taxa and taxa characteristic of more offshore habitats that migrated inshore seasonally. A number of taxa found in the SEAMAP survey, including the cleannose skate, the tomtate and several species of searobins, may be representative of the higher salinity, inshore habitat of the Florida shelf east of the study area. The middepth and deep water habitats in the eastern region were characterized by three groups of taxa. Taxa in the first group were widely distributed over the study area, but preferred sandy sediments (the scaled sardine, the inshore lizardfish, the rock sea bass, and the Gulf butterfish). Taxa in the second group were widespread over sandy bottoms, and included the squid, Loligo pealii, the rock shrimp, the dwarf sand perch, the largescale lizardfish, the red snapper, the wenchman, the longspine porgy, and the least puffer. Taxa in the third group of taxa were restricted to middepth and deep water habitats on sandy bottoms. This group was best characterized by the horned, bandtail, bluespotted and blackwing searobins, the smoothhead scorpionfish, the snakefish and the bank cusk-eel. Nekton community structure was very similar at all deep water stations located east of the delta, due to the widespread distributions of many of these sandy bottom taxa.

2.0 DETAILED ANALYSIS METHODOLOGIES AND RESULTS

2.1 INTRODUCTION

The Gulf of Mexico supports the largest single commercial fishery in the U.S., accounting for 36% of the total volume and 26% of the total value (SEAMAP 1984). Within the Gulf, the Tuscaloosa Trend region (Figure 6) is among the most biologically productive areas (Gunter 1967). Many of the ecologically and commercially important finfish and shellfish species are estuarine dependent (Roithmeyer 1965). Populations of these species are strongly related to processes acting on the larval and juvenile life stages, especially those processes related to the transport to the estuaries and subsequent growth and survival in the estuaries. These demersal finfish and shellfish species exemplify the ecologic interrelationships of the outer continental shelf (OCS) and the adjacent coastal areas. The offshore distributions of many of these species are related to hydrographic conditions and sediment type.

Beyond approximately 50 to 100 m depths, the demersal communities are considerably different, with a higher proportion of species that are offshore residents during their entire life cycle. Much less is known about the relationships of these deep water species to environmental processes.

The ecological and commercial importance of many of the demersal finfish and shellfish species has fostered the development of long-term data bases by both state and federal agencies which generally encompass taxonomic count, biomass and environmental data for both estuarine and adjacent OCS areas. The analysis and synthesis of these data provides valuable information to fishery scientists and managers, and aids the development of the Tuscaloosa Trend ecosystem conceptual model by identifying the dominant ecological processes and higher-level taxonomic and trophic groupings for model compartmentalization.

2.2 OBJECTIVES

The objectives of the quantitative characterization of demersal finfish and shellfish communities in the Tuscaloosa Trend OCS region are:

(1) to create an integrated database that incorporates biotic and environmental data from federal and state sources;

(2) to characterize the spatial and temporal patterns in the structure of demersal finfish and shellfish assemblages;

(3) to identify homogeneous habitats of the study area for model discretization;

(4) to define the relationships of habitats to communities;

(5) to utilize this community context to identify functional taxa or trophic groupings for model compartmentalization;

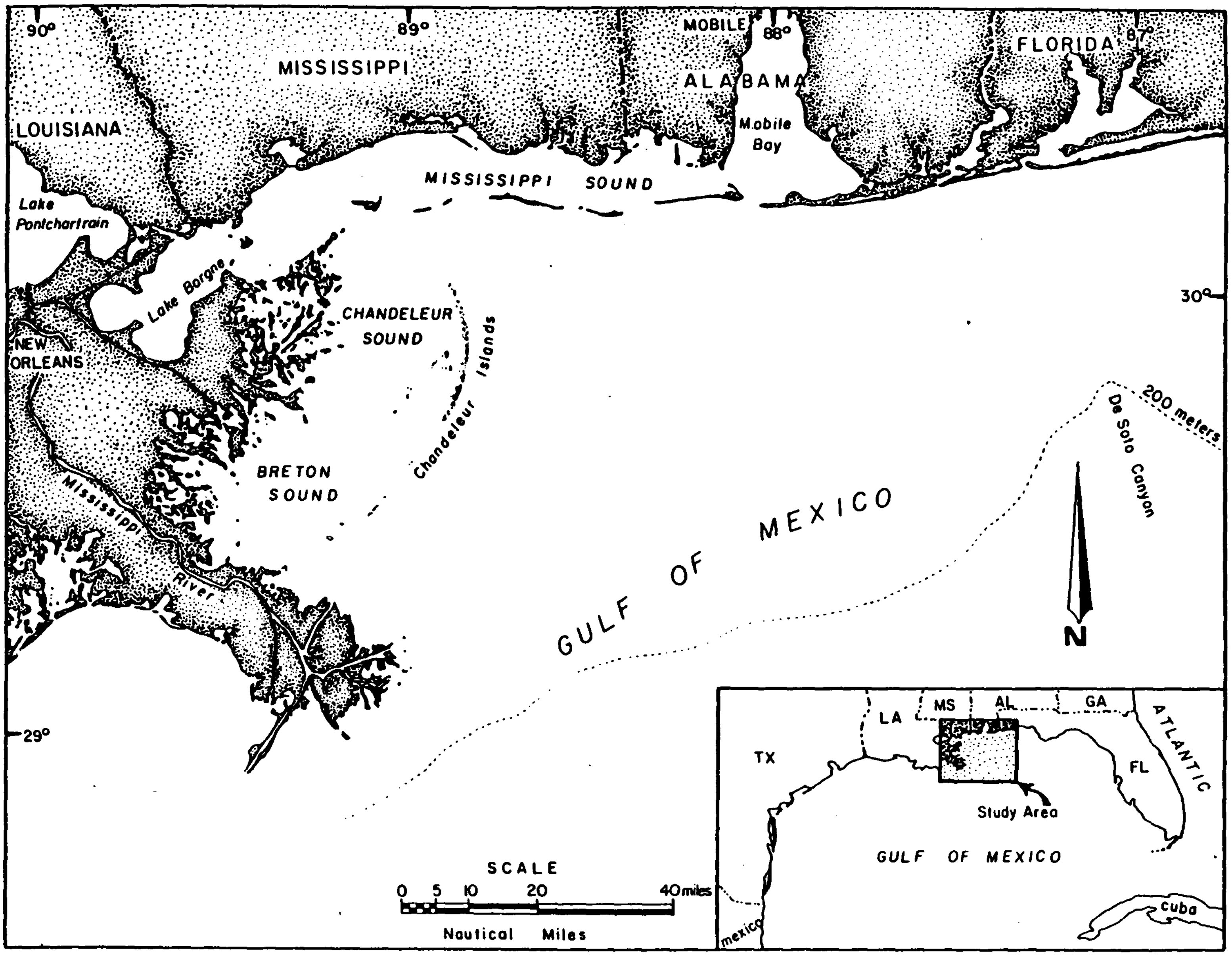

Figure 6. Map of the Tuscaloosa Trend study area.

(6) to define the relationships of communities and key taxa to physical and biological processes;

(7) to determine the degree of variability in those model compartments attributable to temporal, spatial and random variation; and

(8) to establish correlations between model compartments to identify important causal relationships.

2.3 DATABASE

2.3.1 Overview

The first step in the quantitative analysis of the finfish and shellfish communities in the Tuscaloosa Trend region was the identification, acquisition and computerization of the relevant biological and environmental data sets. Table 18 summarizes the federal and state databases utilized in the quantitative characterization of the demersal finfish and shellfish communities.

Because the ecological and economic importance of the commercial fishery in the northern Gulf valuable long-term time series of taxonomic count data for demersal nekton species has been archived by state agencies for estuarine and nearshore waters and by federal agencies for the adjacent OCS areas. Because of the importance of estuarine processes to the life cycles of many of the commercially important finfish and shellfish, long-term time series of data for Ekman transport, river discharge, tides, winds, and precipitation, was also acquired from federal sources for the same time periods encompassed by the taxonomic count data. The integration of these data into the project database allowed the development of quantitative relationships of community and population structure to environmental processes.

2.3.2 1982 and 1983 SEAMAP Survey Data

The SEAMAP program is a cooperative state/federal/university effort that was implemented in 1981 under the overall direction of the Gulf States Marine Fisheries Commission (GSMFC) to provide for the cost-effective collection, management, and dissemination of fishery-independent biological and environmental data in the Gulf of Mexico (SEAMAP, 1984). Participants in the SEAMAP program include the five Gulf states, GSMFC, NMFS-SEFC, the Gulf of Mexico Fishery Management Council, Sea Grant programs, universities and the Gulf and South Atlantic Fisheries Development Foundation. The SEAMAP program provides a framework for coordinating estuarine and offshore sampling times, vessels and methodologies and for cooperative regional planning for fishery research activities.

In the quantitative characterization of the finfish and shellfish communities in the Tuscaloosa Trend region, the SEAMAP shrimp and bottomfish trawl survey data and the associated environmental data were utilized (Table 18). The SEAMAP ichthyoplankton survey data were not available in time to permit analysis. Offshore trawl survey collections were made at night at randomly selected stations located inside 45 fm

Table 18. Data included in the Tuscaloosa Trend fisheries analysis database and their sources.

DATA SET	SOURCE	VARIABLES*	NUMBER OF STATIONS	TEMPORAL SPAN	FREQUENCY	PHYSICAL FORM
Federal Sources						
Fishery Independent Surveys for Groundfish	Dr. Walter R. Nelson/ Mr. Ken Savastano National Marine Fisheries Service	TC, B, LF, T, S, DO, TU, C XBT4	variable, 5-50 fathom depths	1972-1983	annually during fall, some seasonal coverage	magnetic tape
Southeastern Area Monitoring and Assessment Program (SEAMAP) A. Shrimp and Bottom Fish Survey B. Ichthyoplankton Survey C. Environmental Survey	Ms. Nikki Bane SEAMAP Coordinator Gulf States Marine Fisheries Commission	TC, B, LF, T, S, DO, TU, C XBT	variable, 1-50 fathom depths	1982-1983	annually during spring-summer	magnetic tape
Gulf Coast Shrimp Data	Mr. Darrell Tidwell National Marine Fisheries Service	TC, B, NT, DF	statistical area by 5-fathom depth zones	1960-1983	monthly	magnetic tape
River Discharge	U.S. Geological Survey Office of Water Data Coordination		12	1960-1983	monthly	magnetic tape
Precipitation and Winds	Mr. Warren Hatch National Climatic Data Center		4	1960-1983	monthly	magnetic tape
Tides	Ms. Janet Colt National Ocean Survey		1			magnetic tape
Ekman Transport	Dr. Andy Backun National Marine Fisheries Service Pacific Environmental Group		3° grids	1960-1983	monthly	magnetic tape
State Sources						
Louisiana Demersal Fisheries and Environmental Data	Mr. Harry E. Schafer, Jr. Dept. of Wildlife and Fisheries/Dr. Joan Browder National Marine Fisheries Service	TC, B, LF, T, S, DO, TU, NU	variable	1965-1983	monthly or semi-monthly	magnetic tape some hard copy
Mississippi Dermsal Fisheries and Environmental Data	Dr. Thomas McIlwain Gulf Coast Research Laboratory	TC, B, T, S, DO	11	1973-1983	monthly or semi-monthly	hard copy
Alabama Demersal Fisheries and Environmental Data	Mr. Walter Tatum/ Mr. Steve Heath Department of Conservation and Natural Resources	TC, B, T, S, DO	15-30	1977-1983	monthly or semi-monthly	hard copy

*TC = taxonomic count
B = biomass
LF = length/frequency
NT = number of trips
DF = days fished
T = temperature
S = salinity
DO = dissolved oxygen
TU = turbidity
NU = nutrients
C = chlorophyll
XBT = expendable bathythermograph

depths with a 40 ft shrimp trawl. Trawl stations (Figure 7) encompassed a 1 fm depth stratum with a maximum tow time of 30 minutes and a minimum tow time of 10 minutes. All tows were made perpendicular to the depth contours. Inshore waters were sampled by smaller state vessels employing a 16 foot trawl. In conjunction with the shrimp and bottomfish trawl survey, salinity, oxygen, and chlorophyll values and expendable bathythermograph temperature profiles were recorded at each station (SEAMAP, 1982).

2.3.3 NMFS Fishery Independent Survey Data

Kemmerer et al. (1982) have provided a summary of the Fishery Independent surveys for the period 1972 to 1981. These studies were initiated by the NMFS Pascagoula Laboratory in response to concerns expressed by the groundfish industry about declining stocks of commercially important demersal species in the northern Gulf of Mexico.

Since the inception of the Fishery Independent survey program in 1972, the Oregon II research vessel has served as the sampling platform for the surveys. A 12.2 m headrope length, four seam shrimp trawl, with 5 cm stretch nylon mesh in the wings and body and 3.8 cm stretch nylon mesh in the cod end is used as the standard sampling trawl. Three replicate 10 minute trawl tows are made at each sampling site at a speed of 2.5 knots, with the catch from each tow processed separately. The bottom area covered by the open net is 0.71 ha. The entire catch is always weighed, and when catches are small, the entire catch is processed. When catches are prohibitively large, a random subsample of each is processed, and extrapolations are made to the total catch based on ratios of weight of subsample to total weight. Each species of finfish and shellfish is counted and weighed as a group to the nearest 45 gm. Length-frequency data are usually taken for only the numerically dominant and/or commercially important taxa. Environmental data generally collected on these surveys include surface and bottom temperature and salinity, but more recently, surface and bottom dissolved oxygen and chlorophyll have been added.

Figure 8 (from Kemmerer et al. 1982) shows the Fishery Independent survey study area. The northern and southern boundaries of the survey area are the 5 and 50 fm depth contours, respectively. Therefore, all data were collected within the depth range of the Tuscaloosa Trend study area. One primary and two secondary areas have been identified. The primary area coincides with the region of maximum groundfish concentrations, and is sampled most intensively. A large portion of the Tuscaloosa Trend study area is located within this primary area. NMFS has subdivided the survey area into a series of 30 minute longitudinal sampling units, which are, in turn, each divided into five depth strata (5-10 fm, 11-20 fm, 21-30 fm, 31-40 fm, and 41-50 fm). Each of the longitude x depth strata is further divided into 10 minute square sampling blocks, and each block is subdivided into 16 two minute latitude x 2.5 minute longitude sampling sites. Within each longitude x depth stratum, sampling sites are randomly selected for each cruise. Table 19 (from Kemmerer et al. 1982) summarizes the 20 Oregon II Fishery Independent survey seasonal cruises conducted during the period 1972 to 1981; data for 1982 and 1983 were also available. Most of the effort has been concentrated in the autumn when population densities are generally greatest. We used these fall data for our analysis of long term trends. In the last several years, efforts have centered on spring and

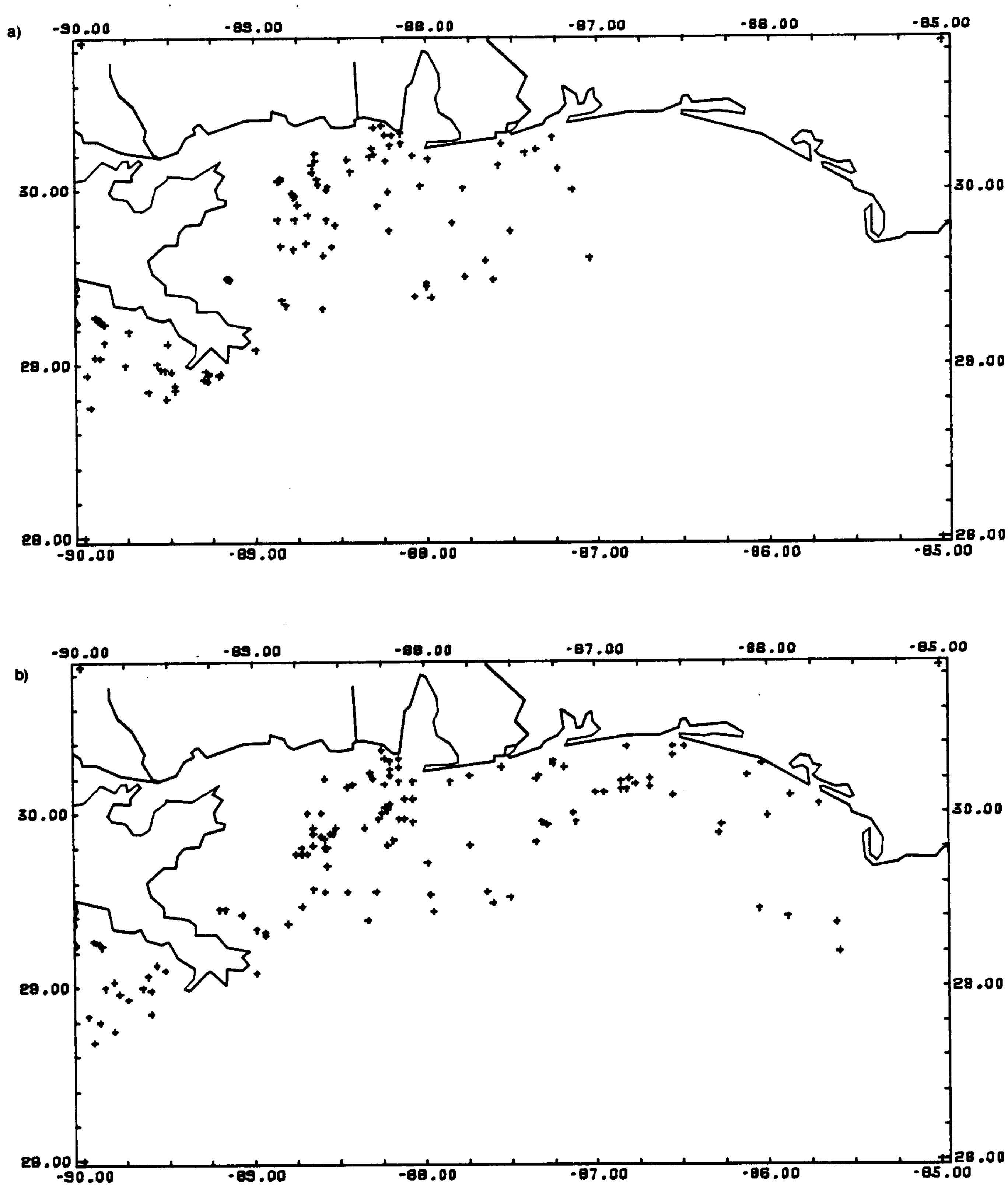

Figure 7. Map showing the locations of the SEAMAP sampling stations for a) 1982 and b) 1983.

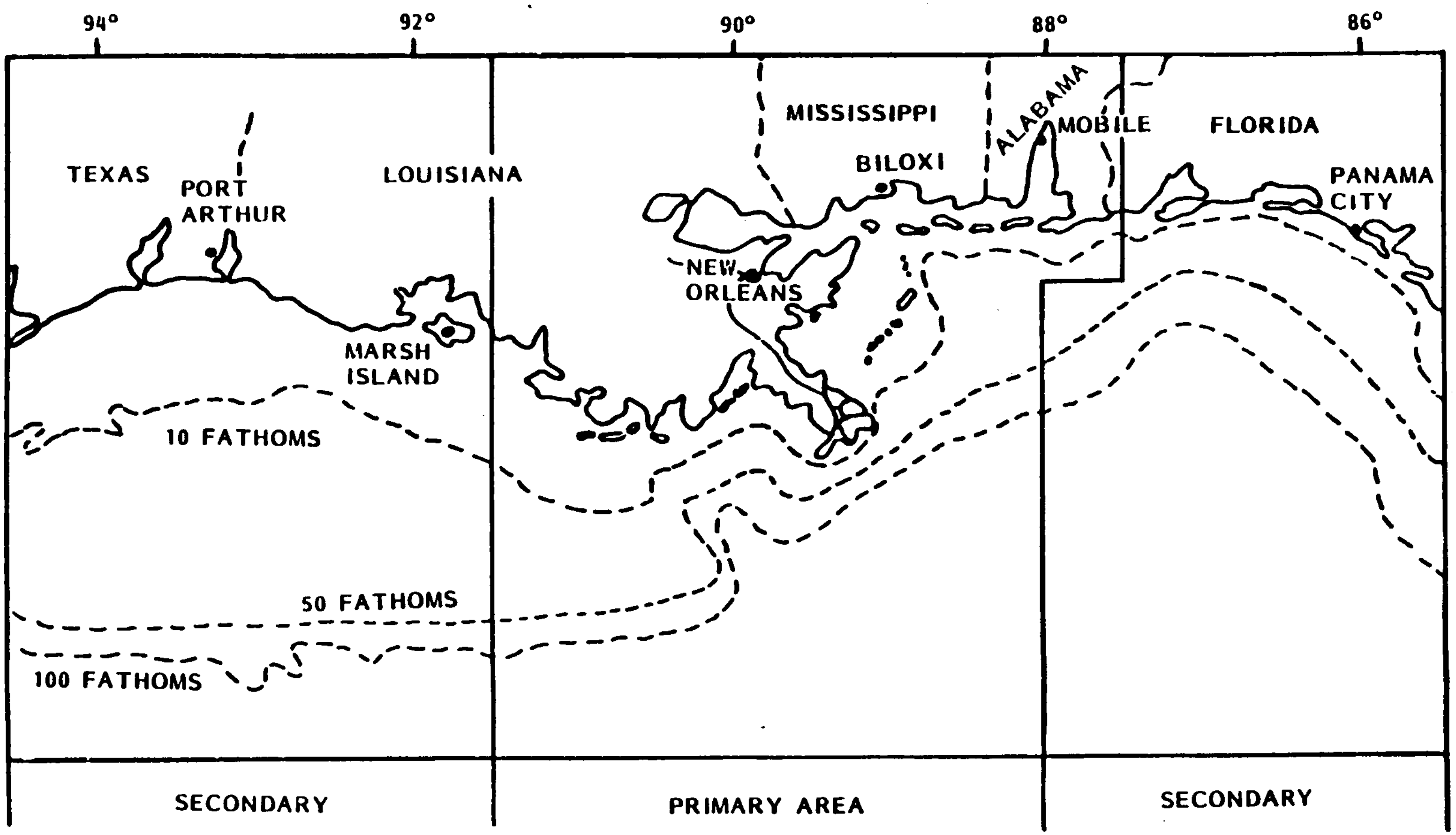

Figure 8. Sampling area for Fishery Independent Surveys for groundfish in the northern Gulf of Mexico.

Table 19. Summary of Fishery Independent groundfish survey cruises in the northern Gulf of Mexico, 1972-1981.

YEAR	SEASON			
	WINTER	SPRING	SUMMER	FALL
1972	0	0	0	2
1973	0	1	0	1
1974	0	0	2	1
1975	0	1	1	1
1976	1	0	1	1
1977	0	0	0	1
1978	0	0	0	1
1979	0	0	0	1
1980	0	1	0	1
1981	0	1	0	1
TOTALS	1	4	4	11

fall sampling. Only during 1974 and 1975 did cruises with enough spatial scope occur over 4 continuous seasons for use in our analyses.

2.3.4 GCSD

2.3.4.1 Introduction

Analysis of historical trends in commercial catch (C) and catch per area (C/A) of penaeid shrimp in the Tuscaloosa Trend study was based on GCSD, which is maintained by NMFS, Technical and Information Management Services (TIMS), Miami, Florida. GCSD are composed of two different files, the Shrimp Dealer Data and the Shrimp Trip Interview Data. Until several years ago, monthly and annual summaries of both the Dealer and Interview Data were published in NOAA/NMFS Current Fisheries Statistics. These published summaries, which were used in our analyses, are no longer issued. Data for the most recent years are available only from TIMS. GCSD monthly summaries are not equivalent to those published in Shrimp Landings, which include quantities landed within a reporting period regardless of when trips were completed or where fishing took place.

The Shrimp Dealer Data are obtained from records kept by shrimp dealers, and represent the best estimates of total C entering the commercial market. These data were the subject of the analyses herein reported. They include port of landing, type and identification of fishing craft, month of landing, number of trips, species and size composition and market value by species and marketing size. Shrimp size is expressed in number of shrimp (heads off) per pound or count. Eight sizes, ranging from 68 and over per pound (the category of smallest sized shrimp) to under 15 per pound (the category of largest sized shrimp), are reported. Damaged shrimp are reported as pieces.

GCSD include fishery information for brown shrimp (*P. aztecus*), pink shrimp (*P. duorarum*), white shrimp (*P. setiferus*), seabobs (*Xiphopeneus kroyeri*), royal reds (*Hymenopenaeus robustus*), rock shrimp (*Sicyonia brevirostris*) and *P. brasiliensis*. Of these seven taxa, the royal red is a deep water species, seldom being caught shallower than 200 m. Since it occurred in the Tuscaloosa Trend study area only rarely, it was not treated quantitatively in this analysis. Also, data for rock shrimp and *P. brasiliensis* were sporadic, and were also not addresses quantitatively. Data for the three *Penaeus* species and the seabob were analyzed in this study. Unlike the other three taxa, data for seabobs were not reported by size. In our study we converted the reported (heads off) weight to total (heads on weight) by multiplying the reported weight by the following conversion factors: brown, 1.61; pink, 1.60; white, 1.54; and, seabobs 1.53 (NOAA 1976).

2.3.4.2 GCSD Reporting System and Grid

NMFS has established a grid system for reporting penaeid shrimp C in the Gulf of Mexico. Within the U.S., twenty-one statistical subareas have been established (Figure 9). Statistical subareas 9-13 collectively encompass the entire Tuscaloosa Trend study area and its adjacent inland waters. Each statistical subarea is further subdivided into 5 fm depth zones for reporting purposes. Data are reported separately for inshore

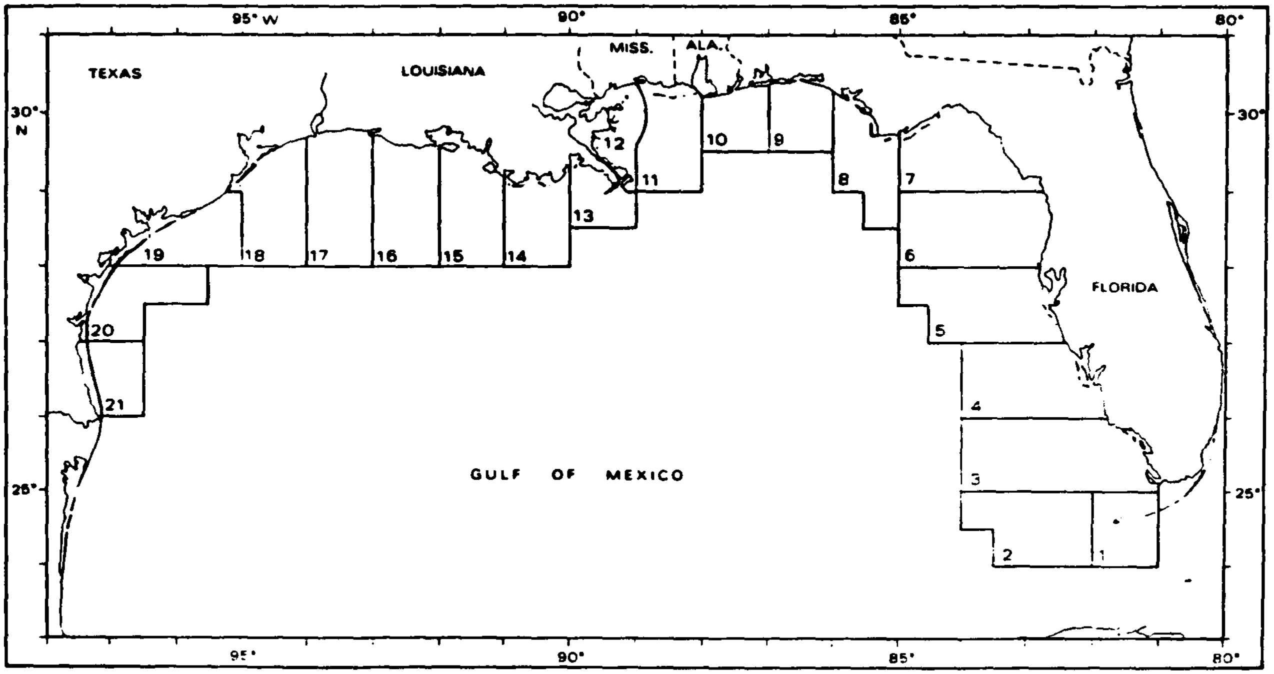

Figure 9. Map of Gulf of Mexico showing NMFS statistical subareas used to report Gulf Coast Shrimp Data.

and offshore waters. NMFS has established a code system for inland waters in each statistical subarea so C can be reported for individual estuarine systems. In the Tuscaloosa Trend Study area, waters for which C is reported include Pensacola Bay, Mobile Bay, Mississippi Sound, Lakes Borgne and Pontchartrain, Breton and Chandeleur Sounds, and inside waters from the Mississippi River to Bayou La Fourche. A major change occurred in the inland code system in 1976, involving some consolidation and switching of subarea affiliations for some inland waters. These changes, which involved subareas 9 and 10 as well as subareas 11 and 12, obviously complicate intepretation of C trends in inshore waters for the individual subareas over time.

Table 20 (modified from Patella 1975) shows the water surface area associated with each statistical subarea x 5 fm depth zone. Overall, the data indicate that the Tuscaloosa Trend study area is bathymetrically more complex than the more typical shelves bordering Texas and the west coast of the Florida peninsula.

Of the 21 statistical subareas in the Gulf of Mexico, subarea 9, which includes the eastern most portion of the Tuscaloosa Trend study area, encompasses the smallest offshore water surface area. Along with subareas 10 and 12, they constitute the three subareas with the smallest offshore water surface areas in the entire Gulf of Mexico. The small water surface areas occupied by 0-20 m depths of subareas 9 and 10 are attributable to the relatively narrow shallow shelf in the vicinity of DeSoto Canyon. This shallow zone decreases in width going east across subarea 10, being narrowest in subarea 9. Going east from the eastern boundary of subarea 9 (86 degrees W longitude), the shallow zone widens appreciably. Note that even though this zone occupies small water surface areas in subareas 9 and 10, the water surface area occupied by waters 20-40 m in depth is fairly expansive in each subarea. Water surface areas for depths greater than 40 m in subareas 9 and 10 are also strongly influenced by the slope of DeSoto Canyon.

Statistical subarea 11 includes the largest total water surface area and largest area 20-40 m deep of any of the five statistical subareas in the Tuscaloosa Trend study area (Table 20). Subarea 11 occupies the geographic center of the Tuscaloosa Trend OCS, and also includes most of Mississippi Sound. It lies along the eastern (and offshore) boundaries of subarea 12, which consists primarily of estuarine waters. Therefore the fishery dynamics of subarea 11 should be closely tied to those of the major estuaries located to the immediate east of the Mississippi River delta. The eastern boundary of subarea 11 (with subarea 10) lies in the vicinity of the transition from silty to sandy sediments on the OCS. Therefore, the fishery dynamics of subarea 11 might be expected to differ considerably from those of subareas 9 and 10 (located further east).

The most unique statistical subarea in the entire Gulf of Mexico is subarea 12 (Figure 9). Subarea 12 includes, for the most part, inshore areas such as Breton and Chandeleur Sounds and Lakes Borgne and Pontchartrain, and very little of the OCS itself. Subareas 11 and 13, which bound subarea 12 on the east and south, respectively, encompass the majority of the OCS waters adjacent to subarea 12. This is reflected in the small offshore area included in subarea 12 (Table 20, Figure 9), and especially in zones representing depths greater than 20 m. Subarea

Table 20. Water surface areas (ha) included in each five fathom depth cell in GCSD statistical subareas 9-13, which encompass the Tuscaloosa Trend study area.

AREA	DEPTH (FATHOMS) 0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	GT 50	TOTAL
9	4241	14895	155323	110036	94916	54867	34733	36902	40646	20137	354059	920755
10	18937	91696	164679	187285	113404	33235	33909	22831	21632	9057	134962	831627
11	59380	234504	169095	150633	137673	88465	75883	42500	24867	20646	318449	1322095
12	79271	16806	2561	1056	1130	301	113	45	0	0	0	101283
13	65661	74039	37173	37859	39688	37403	32835	22168	21711	30167	300852	699555
TOTAL	227490	431940	528832	486868	386811	214271	177473	124447	108855	80007	1108322	3875315

12 contains no water surface area at depths greater than 100 m. While the surface area of subarea 12 occupied by waters 0-20 m deep is low, it is similar to that of subarea 10 and considerably greater than that of subarea 9.

Statistical subarea 13 is the only one lying west of the Mississippi River delta (Figure 9). For this reason alone, the fishery dynamics of subarea 13 might be expected to be different from that of the subareas located east of the delta. Inland waters in subarea 13 include Barataria and Caminada Bays, Lake Salvador, Little Lake, and East Bay between Southwest and South Passes. Sediments in subarea 13 are predominantly silty, being more similar to those of subarea 11 than to subareas 9 and 10, located further east. As is evident from Figure 9, subarea 13 represents a transitional region. To the west of subarea 13, the OCS assumes the more typical bathymetry of much of the Louisiana and Texas OCS, while to the east, immediately adjacent to the birdfoot delta, the shelf is steeper and narrower than anywhere else in the Gulf. This is reflected in the relatively small water surface areas of 20-100 m depths in the study area compared to subareas outside the Tuscaloosa Trend study region.

The spatial and temporal resolution and boundaries of the GCSD are well suited to model conceptualization and quantification. The GCSD grid covers the entire Tuscaloosa Trend study area. The basic spatial reporting unit provides considerable detail on longshore and onshore/offshore trends. The monthly reporting intervals provide a reasonable time step for fishery geology modeling purposes. Because GCSD have been consistently reported since 1960, an extensive time series of this important component of the Gulf continental shelf ecosystem is available for analysis.

2.3.4.3 Data Processing and Reduction

Monthly summaries of the GCSD Dealer Data Files for the years 1960-1982 were obtained from NMFS/TIMS on magnetic tape. These summaries contained information equivalent to those presented in the previously published GCSD monthly summaries with several exceptions. First number of trips were not included. Number of trips on a year by area basis were subsequently acquired in hard copy form and were computerized. Second, inshore C was identified only to the level of statistical subarea, disallowing C in the individual inland water bodies, to be differentiated. Finally, the data received on tape included corrections to the Dealer Data File made subsequent to the publication of the summaries.

Inclusion of a large number of (5 fm) depth intervals and all 8 size classes of shrimp in the analysis would inevitably lead to excessive numbers of empty years x month x area x depth x size cells in the data matrix and considerable variability in values for individual spatial x size cells over time. As such, the original depth zones were consolidated into one inshore zone (all depths combined) and four offshore zones (0-20 m, 20-40 m, 40-100 m, and 100-200 m); similarly, the original eight size classes were consolidated into three size categories (0-20, 21-40 and 41 and more shrimp per pound heads off). These same depth and size consolidations were used in a similar analysis of GCSD along the Texas coast (Comiskey et al. 1982).

For the purposes of this fisheries analysis, an attempt was made to render the GCSD analysis consistent with those for the SEAMAP and Fisheries Independent Data. Analyses of these scientific trawl data revealed three more or less distinct regions in the Tuscaloosa Trend study area. These were (1) a western region located west of the Mississippi River delta, encompassing statistical subarea 13; (2) a central region, including statistical subareas 11 and 12, and encompassing the entire estuarine system from the Mississippi River delta to (but not including) Mobile Bay; and (3) an eastern region, including statistical subareas 9 and 10, and encompassing the inshore and offshore waters of western Florida and eastern Alabama. In addition to these geographical differences, several dominant depth trends recurred through the several analyses. These trends were accomodated by the depth zones used in the analysis.

Based on these facts and preliminary analyses using all five statistical subareas, it appeared beneficial to combine the five original subareas into three "homogeneous" subregions (i.e., eastern, central and western). This aggregation accomodated several other "problems" as well. First, some statistical subarea x depth zone cells were represented by very small water surface areas, even after the consolidation of depth zones. This was particularly true for the offshore zones in subarea 12 (which consist predominantly of estuaries). Catch reported for these spatially small cells was variable and obviously incorporated considerable spurious error. Also, while there was no water surface area given by Patella (1975) for depths greater than 100 m in subarea 12, there were a number of instances of reported C in these cells in the data received from TIMS. By combining subareas 11 and 12, these problems were resolved. Consolidation of subareas 11 and 12 into one central region appeared to be further justified on an ecological basis since subarea 12 constituted a very large portion of the estuaries adjacent to subarea 11 (those bordering the western portion of subarea 11). The preliminary analyses indicated that little information was lost in the aggregation to three regions, while interpretability of trends was greatly enhanced. Combining subareas 9 and 10 resulted in loss of some interesting longshore gradients, since subarea 10 was somewhat transitional between the very sandy area off westernmost Florida (subarea 9) and the silty bottoms off the Mississippi River delta and Mississippi Sound (subarea 11). These trends are noted in the text where appropriate. A final consideration pointing toward spatial aggregation involved the data for inland waters. Since the monthly summaries received from TIMS did not include codes for individual estuaries (i.e., they were reported at only the statistical subarea level), there was no way to accomodate the changes in reporting of inland C that occurred in 1976. Since these changes involved subareas 9 and 10 as well as subareas 11 and 12, aggregating both pairs of subareas was required to render the C data for inland waters interpretable.

Water surface areas in each region by consolidated depth zone cell are presented in Table 21 (in hectares) and are shown in Figure 10. Data for offshore areas were taken from Patella (1975), while those for inland waters were taken from the Cooperative Estuarine Inventories for Louisiana (Perret et al. 1971), Mississippi (Christmas 1973), Alabama (Crance 1971), and Florida (McNulty et al. 1972). In no two regions are the trends for water surface area with depth consistent, attesting to the complexity of the Tuscaloosa Trend Study area. This complexity is attributable to

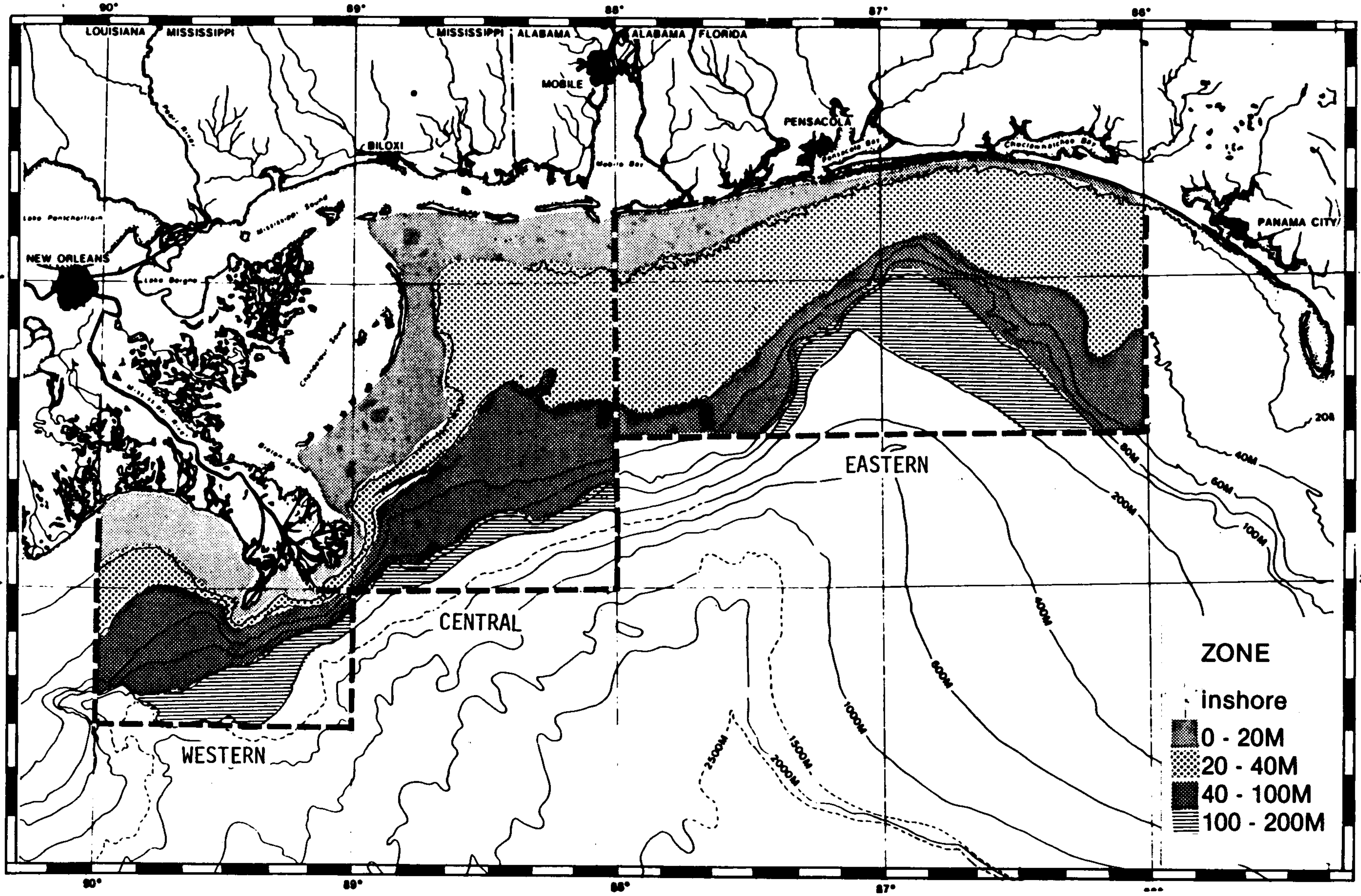

Figure 10. Map of the Tuscaloosa Trend study area showing the regions and depth strata used in the shrimp analysis.

Table 21. Water surface areas (ha) included in each region by depth zone cell used in the shrimp analysis.

REGION	INSHORE	0 - 20 M	20 - 40 M	40 - 100 M	100 - 200 M	TOTAL
WEST	121992	139700	75033	216805	300852	854382
CENTRAL	954053	389961	323345	467619	318449	2453427
EAST	219449	129679	617323	584912	489021	2040384
	-------	------	-------	-------	-------	-------
TOTAL	1295494	659340	1015701	1269336	1108322	5348193

the presence of the prograding Mississippi River delta in the study area. The central region contained the largest overall area but the eastern region contained the largest offshore area (Table 21). The central region contained by far the largest inshore area, being four times greater than that for the eastern region and almost eight times greater than for the western region. Most of the inland waters in the central region were included in GCSD statistical subarea 12, which is mainly composed of inland waters (Figure 9). The western region contained the smallest inshore and offshore areas. However, considering the entire study area (i.e., all three regions combined), the water surface areas for the three most offshore zones are very similar. While being the largest, the inland water surface area is only about 20% larger than that for the zones deeper than 20 m. On the other hand, the shallowest offshore zone (0-20 m) is only approximately 60% of the area of any of the other offshore zones, and about 50% of that for the inland zone. Total water surface area in the eastern and central regions were relatively more similar to each other than to the western region, which consisted of only one GCSD statistical subarea (subarea 13).

Results of the analyses of C and C/A for brown, white and pink shrimp as well as seabobs are presented as tables, graphs and bar charts displaying the most important main effects (i.e., year, month, region, depth and size) and two and three way interaction means. For the three species of Penaeus, these graphic displays included region x depth x size, month x depth x size, year by depth by size and year x region (including inshore and offshore x size. Size was not reported for seabobs and size was not included in any of the analyses. Graphic displays for seabobs included area x month x depth and year x area x depth. For those analyses involving region and/or depth zone as class variables, the trends for C and C/A would be different, depending on the water surface area included in each spatial cell (the values in Table 21).

The lack of consistency in water surface areas for the 15 region x depth zone cells in the Tuscaloosa Trend Study area indicates that relationships of C and C/A are not simple. The reader should note that all analyses which do not include statistical area or depth as class variables will result in identical trends for C and C/A, and the two variables are used interchangeably in those discussions.

2.3.5 State Estuarine Surveys

2.3.5.1 Overview

The states of Louisiana, Mississippi and Alabama have conducted spatially and temporally extensive biological and environmental sampling programs. These programs have primarily been designed to assess the stocks of commercially important finfish and shellfish species; however, many programs incorporate data on all species collected. The analysis of these valuable data provides the information needed to make management decisions such as the dates for the opening and closing of commercial fishing seasons in state waters.

Because of the importance of estuarine processes to the life cycles of many of the commercially important finfish and shellfish species on the OCS, these state estuarine data are essential for establishing quantitative relationships between community and population structure on the OCS and estuarine processes.

2.3.5.2 Louisiana Demersal Fisheries and Environmental Data

The Louisiana estuarine data integrated into the project database included taxonomic count, wet-weight biomass, length-frequency, turbidity, nutrients and near-bottom temperature, salinity, and dissolved oxygen measurements collected monthly or semi-monthly at a variable number of stations from 1965 to 1983 (Table 18). Trawl samples were collected with a 16 ft trawl where possible, with a 6 ft trawl utilized in very shallow waters. The program was primarily designed to assess penaeid shrimp populations, and only they were enumerated in the 6 ft trawl samples. However, all organisms were identified and enumerated in many of the 16 ft trawl samples.

The Louisiana estuarine data was recently computerized in analytically compatible formats by NMFS/SEFC (Savell et al. 1983) and the resulting integrated database is available on magnetic tape. The contacts for these data were Mr. Harry Schafer, Louisiana Department of Wildlife and Fisheries, Baton Rouge, Louisiana and Dr. Joan Browder, NMFS/SEFC, Miami, Florida. Because the data for 1981 to 1983 were not available, the Louisiana data were not integrated into the project database.

2.3.5.3 Mississippi Demersal Fisheries and Environmental Data

The estuarine data from Mississippi integrated into the project database included taxonomic count, wet weight biomass, and near-bottom temperature, salinity and dissolved oxygen measurements collected monthly or semi-monthly at a total of 11 selected stations for the period 1973 to 1983 (Table 18). Of the six trawl stations, the four most inshore stations were sampled with a 16 ft otter trawl 0.75 inch wing mesh, 0.25 inch cod end mesh) towed for 10 minutes. The two most offshore stations were sampled with a 36 ft otter trawl with the same mesh dimensions towed for 30 minutes. A beam plankton trawl was towed in a 50 m radius to sample larvae and postlarvae at three stations, and the remaining two stations were sampled with a 50 ft bag seine (0.25 inch bar mesh). All organisms were enumerated in the otter trawl and seine samples and larval and postlarval crabs, shrimp and finfish were enumerated in the beam plankton trawl samples (McIlwain, 1982; Mr. James Warren, Gulf Coast Research Laboratory, pers. comm.). The Mississippi data were obtained in hard copy form by contacting Dr. Thomas McIlwain, Gulf Coast Research Laboratory, Ocean Springs, MS.

2.3.5.4 Alabama Demersal Fisheries and Environmental Data

The Alabama estuarine data integrated into the project database included taxonomic count, wet-weight biomass, and near-bottom temperature, salinity and dissolved oxygen measurements collected monthly or semi-monthly at approximately 15 stations during the period 1977-1983 (Table 18). Trawl samples were collected with a 16 ft otter trawl (0.75 inch wing mesh, 0.25 inch cod end mesh) towed at approximately 3 knots for 10 minutes (Swingle, 1971). For the period 1977 to 1980, only the penaeid species were enumerated, thereafter, all organisms captured in the trawl samples were enumerated (Mr. Steve Heath, Alabama Department of Conservation and Natural Resources, pers. comm.). The Alabama data were obtained in hard copy form from Mr. Walter Tatum and Mr. Steve Heath, Alabama Department of Natural Resources, Dauphin Island, Alabama. These data have not yet been integrated into the project database.

2.3.6 Federal Environmental Data

Due to the importance of oceanographic and estuarine processes and environmental conditions the life cycles and survival of the estuarine dependent and commercially important species, time series of data for river discharge, precipitation and winds, tides, and Ekman transport were acquired for representative stations in the Tuscaloosa Trend study area for the time period 1960-1983 (Table 18).

River discharge data collected monthly at 12 stations located on the major sources of freshwater input in the study were acquired on magnetic tape from the U.S. Geologic Survey, Office of Water Data Coordination and from the U.S. Army Corps of Engineers, New Orleans and Vicksburg Districts. Precipitation and winds data were obtained for four coastal weather stations from Mr. Warren Hatch of the National Climatic Data Center, Asheville, North Carolina. Tide data for the period 1966 to 1983 collected at Dauphin Island, AL was obtained from Ms. Janet Colt and Mr. Steve Lyles at the National Ocean Survey, Rockville, Maryland. Ekman transport data for the study area was obtained from Dr. Andy Backun, NMFS, Pacific Environmental Group, Monterey, California.

2.4 ANALYTIC APPROACH

The overall approach to the analysis of the fishery data for the Tuscaloosa Trend study area centered on the use of multivariate pattern analysis techniques to provide the context within which major trends and sources of variation within and among suites of community and habitat variables could be quantified and mapped, and homogeneous subregions of the Tuscaloosa Trend study area could be identified. Within this context, taxa showing the most clear cut, consistent and ecologically meaningful trends were identified, resulting in a culling of those taxa that were either too rare or too sporadic in distribution to provide much information. The ultimate goal of the pattern analysis was to define communities, habitats (i.e., station groups) and the relationship of communities to station groups.

One of the most important data products in the initial stages of community analysis is the relative composition table. Both mean percent composition and pooled percent composition values are given in these tables. Taxa which have highly clumped distributions generally have higher pooled than mean percent composition values. The mean percent composition, by scaling each sample to a 0-100 (percent) basis before calculating an overall mean percent composition, reduces the influence of outliers (i.e., very high values) in one or several of the samples. Cumulative percent composition (based on mean percent composition), frequency of occurrence, cumulutive abundance, mean abundance (per ha), and an index of dispersion are also presented for each taxa. Relative composition tables were calculated for each of the initial community data sets used in this study, and the results were used to describe overall community composition and to eliminate rare taxa from subsequent multivariate community analysis.

The principal multivariate technique used in this study was Two-Way Indicator Species Analysis (TWINSPAN). TWINSPAN is an efficient way to display all taxonomic data in one reduced data matrix, with the samples and taxa oriented along gradients of community structure (Hill 1979). In a TWINSPAN display, the samples are ordered across the top, and the taxa are ordered down the side. The numbers 1 through 5 in the display represent categories of increasing relative percent composition of each taxon at each sample (i.e., 1 = 0-2%, 2 = 2-5%, 3 = 5-10%, 4 = 10-20% and 5 = >20%). No numerical entry (a dash) indicates that the taxon was not found in the sample. The groupings of samples and taxa result from hierarchical dichotomizations of the samples and taxa, and represent a progressive refinement of the relationships of sample groups (i.e., habitat types) to taxa groups (i.e., communities).

Within this context, taxa selection was conducted, and final TWINSPAN displays were generated for the selected taxa. These final displays are presented in this report. Tables of environmental variables and/or community parameters and tables of correlations of taxa with environmental variables were produced wherever possible, with stations and taxa ordered in the same way as in the corresponding TWINSPAN analyses. The algorithm used to calculate species diversity was the Shannon-Weiner H', while Pielou's Index J' was used to calculate evenness and Margalef's Richness Index D was used to calculate species richness. Maps depicting the distributions of station groups were also produced where appropriate. These data products substantially enhance the interpretation of the results of the analysis.

In addition to TWINSPAN, factor analysis was used in the analysis of the Fishery Independent groundfish survey annual data. Factor analysis identifies independent trends in community structure (i.e., the factors), with the loading of each taxon on each factor indicating the importance of the taxon to the community trend embodied in the factor. Factor analysis produces scores for each factor in each sample, indicating the importance of the community trend embodied in the factor to the community structure of the sample. These scores were then used as dependent variables and were correlated with important environmental variables thought to influence nekton community dynamics in the Tuscaloosa Trend study area.

The results of these pattern analyses were used, in concert, to identify nekton communities (taxa groups) and habitats (sample or station groups) and the relationship of taxa groups to station groups (i.e., communities to habitats). These relationships were expressed as taxa group by station group coincidence tables. This information was then used to discretize the study area into (internally) homogeneous subregions. Once the subregions were defined, community, population and habitat variables were statistically characterized within each subregion. A detailed analysis of population dynamics of commercially important penaeid shrimp was then conducted within this spatial context.

2.5 RESULTS

2.5.1 SEAMAP Survey Data, Spring 1982

2.5.1.1 Relative Composition and Abundance

The community composition over all samples combined from the fall 1982 SEAMAP survey is summarized in Table 22. A total of 81,429 individuals representing 225 taxa were identified from 128 trawl samples. A hierarchical master taxonomic list for these 84 taxa is shown in Table 23.

In general, the overall community tended to be numerically dominated by a relatively small number of taxa, with the vast majority of the taxa represented by only a few individuals each (Table 22). The nine most abundant taxa represented over 50% of the pooled percent composition, and the 32 most abundant taxa accounted for almost 80% of the cumulative mean percent composition. An examination of the frequency of occurrence values reveals that none of the taxa were widely distributed, with only Penaeus aztecus being collected in greater than 50% of the samples (frequency of occurrence = 0.578 in Table 22).

Trachypenaeus LPIL, Squilla LPIL, and Stenotomus caprinus each accounted for greater than 10% of the pooled percent composition. They had very clumped distributions (index of dispersion values of 725 to 1331), occurring on 48, 40 and 46% of the samples, respectively. Anchoa mitchilli accounted for 9.5% of the pooled percent composition, but occurred in only 26% of the samples (frequency of occurrence = 0.27). Callinectes similis and Prionotus rubio each accounted for greater than 3% of the pooled percent composition, and both occurred in 44% of the samples. Penaeus aztecus, Sicyonia brevirostris, Anchoa nasuta and Anchoa hepsetus each accounted for greater than 2% of the pooled percent composition. Anchoa nasuta had an especially clumped distribution, being found in only 6.3% of the samples. Other numerically prominent taxa include Parapenaeus LPIL, Micropogonias undulatus, Leiostomus xanthurus, Sicyonia dorsalis, Solenocera LPIL, Penaeus duorarum and Lolliguncula brevis, each accounting for greater than 1% of the pooled percent composition. Of these, Micropogonias undulatus and Lolliguncula brevis were found in greater than 40% of the samples, while Parapenaeus LPIL was found in only 6.3% of the samples. Other less numerically prominent taxa that occurred in greater than 30% of the samples included Sphoeroides parvus, Centropristis philadelphicus, Etropus crossotus, Cynoscion arenarius, Synodus foetens and Trichiurus lepturus.

2.5.1.2 Two-Way Indicator Species Analysis

An important application of the relative composition and abundance tables and other exploratory analysis techniques is in the selection of the taxa to be included in subsequent community analyses. Based on the results shown in Table 22, all taxa which occurred in two or fewer samples were removed from further consideration. This resulted in the removal of 75 taxa from the original list of 225 taxa, with the remaining 150 taxa subjected to further analysis. Two-Way Indicator Species Analyses (TWINSPAN) was then used to further reduce this suite of 150 taxa to a more workable level. The resulting ordered data matrix (whose values are one

Table 22. Overall relative composition of demersal nekton taxa collected in single replicate samples at 128 stations in and around the Tuscaloosa Trend study area during the spring 1982 SEAMAP groundfish survey.

TAXON NAME	MEAN PERCENT COMPOSITION	CUMULATIVE PERCENT COMPOSITION	POOLED PERCENT COMPOSITION	FREQ. OF OCCURRENCE	CUMULATIVE ABUNDANCE	INDEX OF DISPERSION
Trachypenaeus	9.963	9.963	20.538	0.477	16724.	1331.72
Squilla	5.772	15.735	15.244	0.398	29137.	1184.15
Stenotomus caprinus	9.446	25.181	11.417	0.461	38434.	724.59
Anchoa mitchilli	12.109	37.290	9.500	0.266	46170.	506.55
Callinectes similis	3.950	41.240	4.516	0.438	49847.	205.86
Prionotus rubio	1.668	42.908	3.581	0.438	52763.	334.85
Penaeus aztecus	3.296	46.204	2.809	0.578	55050.	124.75
Sicyonia brevirostris	2.256	48.460	2.212	0.320	56851.	249.30
Anchoa nasuta	2.290	50.750	2.198	0.063	58641.	940.36
Anchoa hepsetus	5.792	56.541	2.039	0.445	60301.	89.78
Parapenaeus	1.677	58.218	1.598	0.063	61602.	209.89
Micropogon undulatus	2.152	60.371	1.487	0.430	62813.	235.21
Leiostomus xanthurus	2.476	62.847	1.287	0.305	63861.	141.86
Sicyonia dorsalis	0.910	63.757	1.259	0.234	64886.	86.15
Solenocera	1.123	64.879	1.118	0.234	65796.	104.41
Penaeus duorarum	1.028	65.907	1.066	0.352	66664.	40.58
Lolliguncula brevis	4.243	70.150	1.038	0.445	67509.	29.62
Portunus gibbesii	0.607	70.757	0.939	0.242	68274.	82.21
Sphoeroides parvus	0.835	71.592	0.682	0.359	68829.	38.32
Bollmannia communis	0.405	71.998	0.672	0.156	69376.	45.15
Centropristis philadelphicus	0.894	72.891	0.651	0.336	69906.	20.19
Loligo pealeii	2.026	74.918	0.619	0.219	70410.	46.87
Etropus crossotus	0.540	75.458	0.601	0.352	70899.	22.64
Lepophidium graellsi	0.471	75.929	0.553	0.273	71349.	35.57
Syacium gunteri	0.581	76.509	0.491	0.227	71749.	75.06
Doryteuthis plei	0.702	77.211	0.484	0.047	72143.	125.18
Prionotus salmonicolor	0.534	77.745	0.465	0.102	72522.	99.43
Cynoscion arenarius	0.963	78.708	0.452	0.375	72890.	28.64
Syacium papillosum	0.470	79.179	0.404	0.125	73219.	104.08
Diplectrum bivittatum	0.515	79.694	0.399	0.234	73544.	18.12
Syacium	0.092	79.786	0.386	0.063	73858.	196.08
Ovalipes	0.103	79.889	0.370	0.016	74159.	298.99
Asteroidea	0.926	80.815	0.368	0.141	74459.	83.56
Portunus spinicarpus	0.402	81.217	0.321	0.109	74720.	59.80
Squilla empusa	0.258	81.475	0.321	0.070	74981.	127.80
Synodus foetens	0.426	81.901	0.306	0.336	75230.	11.60
Prionotus tribulus	0.353	82.254	0.302	0.203	75476.	25.39
Trichiurus lepturus	0.706	82.960	0.282	0.313	75706.	17.07
Steindachneria argentea	0.292	83.251	0.268	0.078	75924.	30.09
Luidia	0.666	83.917	0.264	0.055	76139.	73.18
Symphurus plagiusa	0.491	84.408	0.263	0.297	76353.	18.44
Aplysia	0.096	84.504	0.262	0.039	76566.	165.92
Mellita quinquiesperforata	1.953	86.458	0.237	0.023	76759.	181.23
Peprilus burti	0.956	87.413	0.228	0.133	76945.	45.62
Prionotus roseus	0.263	87.677	0.211	0.039	77117.	66.70
Anchoa	0.230	87.907	0.208	0.031	77286.	80.25
Lagodon rhomboides	0.227	88.133	0.199	0.070	77448.	49.59
Hoplunnis macrurus	0.188	88.321	0.195	0.164	77607.	10.95
Bellator militaris	0.185	88.505	0.184	0.070	77757.	28.11
Porichthys porosissimus	0.124	88.629	0.177	0.219	77901.	49.48
Scorpaena calcarata	0.145	88.775	0.174	0.094	78043.	30.41
Serranus atrobranchus	0.164	88.938	0.174	0.078	78185.	70.87
Halieutichthys aculeatus	0.185	89.123	0.169	0.133	78323.	33.34
Menticirrhus americanus	0.350	89.473	0.168	0.133	78460.	25.02
Callinectes sapidus	1.865	91.338	0.152	0.203	78584.	13.80
Centropristis ocyurus	0.219	91.558	0.138	0.070	78696.	40.31
Scyphozoa	0.199	91.756	0.126	0.039	78799.	39.06
Chloroscombrus chrysurus	1.880	93.637	0.120	0.203	78897.	9.49
Stellifer lanceolatus	0.123	93.759	0.118	0.039	78993.	74.06
Portunus	0.142	93.901	0.115	0.023	79087.	51.09
Saurida brasiliensis	0.123	94.024	0.115	0.133	79181.	33.33
Eucinostomus gula	0.043	94.068	0.114	0.039	79274.	36.28
Pristipomoides aquilonaris	0.089	94.157	0.096	0.078	79352.	14.87
Penaeus setiferus	0.128	94.285	0.093	0.188	79428.	7.01
Citharichthys spilopterus	0.124	94.409	0.091	0.164	79502.	12.17
Acetes americanus	0.091	94.500	0.087	0.016	79573.	63.39
Ophichthus gomesii	0.061	94.561	0.080	0.070	79638.	16.50
Harengula jaguana	0.138	94.698	0.076	0.102	79700.	12.65

Table 22. Continued.

TAXON NAME	MEAN PERCENT COMPOSITION	CUMULATIVE PERCENT COMPOSITION	POOLED PERCENT COMPOSITION	FREQ. OF OCCURRENCE	CUMULATIVE ABUNDANCE	INDEX OF DISPERSION
Arius felis	1.835	96.534	0.075	0.164	79761.	5.29
Macoma constricta	0.117	96.650	0.075	0.031	79822.	21.68
Brevoortia patronus	0.033	96.684	0.074	0.039	79882.	37.89
Lutjanus campechanus	0.183	96.867	0.074	0.070	79942.	12.50
Cynoscion nothus	0.138	97.005	0.064	0.070	79994.	20.79
Larimus fasciatus	0.103	97.108	0.056	0.109	80040.	5.16
Prionotus carolinus	0.100	97.207	0.054	0.047	80084.	18.02
Prionotus scitulus	0.067	97.275	0.054	0.039	80128.	19.54
Cyclopsetta chittendeni	0.047	97.322	0.053	0.094	80171.	4.79
Prionotus	0.029	97.351	0.053	0.016	80214.	23.31
Prionotus paralatus	0.083	97.434	0.050	0.039	80255.	16.76
Synodus poeyi	0.054	97.488	0.048	0.031	80294.	15.53
Cynoscion	0.044	97.531	0.045	0.039	80331.	10.09
Lepophidium	0.037	97.569	0.044	0.078	80367.	4.70
Trachinocephalus myops	0.056	97.625	0.044	0.047	80403.	17.75
Pagrus pagrus	0.049	97.673	0.044	0.031	80439.	20.49
Aequipecten	0.060	97.733	0.039	0.031	80471.	12.60
Antennarius radiosus	0.031	97.764	0.038	0.086	80502.	4.60
Peprilus paru	0.096	97.860	0.037	0.086	80532.	4.80
Mellitidae	0.091	97.951	0.036	0.055	80561.	7.04
Orthopristis chrysoptera	0.119	98.070	0.033	0.047	80588.	6.02
Urophycis regius	0.044	98.114	0.032	0.016	80614.	12.90
Calappa sulcata	0.025	98.140	0.031	0.094	80639.	3.23
Monacanthus hispidus	0.048	98.188	0.029	0.078	80663.	3.25
Ascidiacea	0.050	98.237	0.028	0.016	80686.	16.34
Luidia clathrata	0.041	98.278	0.028	0.016	80709.	11.61
Metapenaeopsis goodei	0.056	98.334	0.028	0.008	80732.	23.00
Serraniculus pumilio	0.031	98.365	0.026	0.031	80753.	5.74
Brotula barbata	0.009	98.374	0.026	0.047	80774.	7.56
Diplectrum formosum	0.021	98.394	0.026	0.016	80795.	19.08
Porifera	0.048	98.443	0.025	0.008	80815.	20.00
Hepatus epheliticus	0.028	98.471	0.025	0.078	80835.	2.36
Ogcocephalus	0.041	98.511	0.023	0.016	80854.	12.63
Scorpaena brasiliensis	0.037	98.548	0.020	0.016	80870.	9.07
Prionotus stearnsi	0.032	98.580	0.020	0.055	80886.	2.90
Urophycis floridanus	0.025	98.604	0.018	0.047	80901.	2.91
Caulolatilus intermedius	0.004	98.608	0.018	0.016	80916.	10.16
Sphoeroides dorsalis	0.021	98.630	0.017	0.031	80930.	5.79
Gymnachirus texae	0.021	98.650	0.017	0.031	80944.	4.07
Synodus intermedius	0.022	98.672	0.016	0.023	80957.	4.32
Anasimus latus	0.020	98.692	0.016	0.031	80970.	3.70
Lepophidium jeannae	0.029	98.720	0.016	0.031	80983.	3.54
Ophidion welshi	0.020	98.740	0.015	0.063	80995.	1.75
Scyllarus	0.019	98.759	0.015	0.016	81007.	6.62
Ophidion grayi	0.016	98.775	0.015	0.008	81019.	12.00
Ophidion holbrooki	0.017	98.792	0.015	0.016	81031.	6.62
Decapterus punctatus	0.077	98.869	0.015	0.039	81043.	2.59
Raja eglanteria	0.022	98.892	0.015	0.055	81055.	2.09
Anchoviella	0.012	98.903	0.015	0.023	81067.	4.10
Ficus papyratia	0.017	98.920	0.015	0.008	81079.	12.00
Urophycis cirratus	0.018	98.939	0.014	0.016	81090.	5.87
Congrina flava	0.009	98.947	0.014	0.039	81101.	2.75
Portunus spinimanus	0.015	98.963	0.014	0.031	81112.	6.05
Polydactylus octonemus	0.123	99.086	0.014	0.031	81123.	3.85
Trachurus lathami	0.023	99.109	0.012	0.031	81133.	2.94
Ophiuroidea	0.024	99.133	0.012	0.008	81143.	10.00
Scyllarides	0.023	99.156	0.012	0.023	81153.	6.57
Kathetostoma albigutta	0.022	99.178	0.011	0.023	81162.	3.85
Trinectes maculatus	0.090	99.268	0.011	0.023	81171.	5.64
Scomberomorus maculatus	0.056	99.324	0.010	0.055	81179.	1.20
Bairdiella chrysura	0.015	99.339	0.010	0.031	81187.	3.46
Sardinella anchovia	0.016	99.355	0.010	0.023	81195.	3.21
Dorosoma petenense	0.004	99.360	0.010	0.008	81203.	8.00
Upeneus parvus	0.010	99.370	0.010	0.023	81211.	2.71
Mullus auratus	0.009	99.378	0.009	0.016	81218.	5.27
Chilomycterus schoepfi	0.141	99.520	0.009	0.039	81225.	1.82
Echinoidea	0.017	99.537	0.009	0.008	81232.	7.00
Sphyraena borealis	0.004	99.540	0.009	0.008	81239.	7.00
Rhinoptera bonasus	0.031	99.572	0.007	0.023	81245.	2.98
Chaetodipterus faber	0.025	99.597	0.007	0.008	81251.	6.00

Table 22. Continued.

TAXON NAME	MEAN PERCENT COMPOSITION	CUMULATIVE PERCENT COMPOSITION	POOLED PERCENT COMPOSITION	FREQ. OF OCCURRENCE	CUMULATIVE ABUNDANCE	INDEX OF DISPERSION
Gymnothorax	0.015	99.611	0.007	0.008	81257.	6.00
Xiphopeneus kroyeri	0.002	99.613	0.006	0.008	81262.	5.00
Selene setapinnis	0.014	99.627	0.006	0.031	81267.	1.37
Bregmaceros atlanticus	0.006	99.632	0.006	0.031	81272.	1.37
Raninoides louisianensis	0.008	99.641	0.006	0.023	81277.	2.18
Prionotus ophryas	0.004	99.645	0.005	0.016	81281.	2.49
Caranx hippos	0.006	99.651	0.005	0.023	81285.	1.48
Anchoa lyolepis	0.006	99.657	0.005	0.016	81289.	2.49
Cantharus cancellarius	0.008	99.665	0.005	0.008	81293.	4.00
Anchoviella perfasciata	0.003	99.669	0.005	0.016	81297.	2.49
Otophidium omostigmum	0.012	99.680	0.005	0.016	81301.	2.49
Loligo pleii	0.021	99.701	0.005	0.008	81305.	4.00
Priacanthus arenatus	0.011	99.713	0.004	0.016	81308.	1.66
Ogcocephalus radiatus	0.001	99.713	0.004	0.008	81311.	3.00
Archosargus probatocephalus	0.007	99.720	0.004	0.023	81314.	0.98
Caridea	0.004	99.724	0.004	0.008	81317.	3.00
Balistes capriscus	0.004	99.729	0.004	0.016	81320.	1.66
Symphurus diomedianus	0.004	99.733	0.004	0.008	81323.	3.00
Caranx fusus	0.003	99.735	0.004	0.008	81326.	3.00
Gymnothorax saxicola	0.001	99.736	0.004	0.008	81329.	3.00
Rhomboplites aurorubens	0.002	99.738	0.004	0.008	81332.	3.00
Citharichthys macrops	0.004	99.742	0.004	0.016	81335.	1.66
Symphurus civitatus	0.006	99.747	0.004	0.008	81338.	3.00
Squilla chydaea	0.002	99.749	0.004	0.008	81341.	3.00
Monacanthus ciliatus	0.007	99.756	0.004	0.008	81344.	3.00
Equetus umbrosus	0.002	99.758	0.004	0.008	81347.	3.00
Clibanarius	0.001	99.759	0.002	0.008	81349.	2.00
Calappa flammea	0.004	99.764	0.002	0.016	81351.	0.99
Clypeaster	0.002	99.766	0.002	0.008	81353.	2.00
Muricidae	0.002	99.768	0.002	0.016	81355.	0.99
Barbatia candida	0.004	99.772	0.002	0.008	81357.	2.00
Bellator	0.004	99.776	0.002	0.008	81359.	2.00
Haemulon aurolineatum	0.002	99.777	0.002	0.008	81361.	2.00
Sphyrna lewini	0.009	99.787	0.002	0.016	81363.	0.99
Ogcocephalus nasutus	0.003	99.790	0.002	0.008	81365.	2.00
Scorpaena	0.005	99.795	0.002	0.008	81367.	2.00
Ancylopsetta quadrocellata	0.001	99.796	0.002	0.016	81369.	0.99
Parthenope	0.006	99.802	0.002	0.016	81371.	0.99
Gymnothorax ocellatus	0.006	99.808	0.002	0.008	81373.	2.00
Stenorhynchus seticornis	0.005	99.813	0.002	0.008	81375.	2.00
Podochela	0.003	99.816	0.002	0.008	81377.	2.00
Lagocephalus laevigatus	0.007	99.822	0.002	0.016	81379.	0.99
Aluterus heudeloti	0.002	99.824	0.002	0.008	81381.	2.00
Paralichthys lethostigma	0.001	99.825	0.002	0.016	81383.	0.99
Pagurus	0.003	99.828	0.002	0.016	81385.	0.99
Opisthonema oglinum	0.006	99.835	0.002	0.016	81387.	0.99
Rypticus maculatus	0.005	99.840	0.002	0.008	81389.	2.00
Fistularia tabacaria	0.001	99.841	0.001	0.008	81390.	1.00
Panulirus argus	0.002	99.843	0.001	0.008	81391.	1.00
Monacanthus	0.001	99.843	0.001	0.008	81392.	1.00
Busycon canaliculatum	0.002	99.845	0.001	0.008	81393.	1.00
Rachycentron canadum	0.001	99.846	0.001	0.008	81394.	1.00
Cyclopsetta fimbriata	0.002	99.848	0.001	0.008	81395.	1.00
Ogcocephalidae	0.002	99.851	0.001	0.008	81396.	1.00
Metoporhaphis calcarata	0.029	99.879	0.001	0.008	81397.	1.00
Gymnura micrura	0.011	99.890	0.001	0.008	81398.	1.00
Busycon spiratum	0.002	99.892	0.001	0.008	81399.	1.00
Pristigenys alta	0.002	99.895	0.001	0.008	81400.	1.00
Clibanarius vittatus	0.030	99.925	0.001	0.008	81401.	1.00
Scombridae	0.002	99.927	0.001	0.008	81402.	1.00
Persephona aquilonaris	0.002	99.929	0.001	0.008	81403.	1.00
Pitar cordatus	0.002	99.931	0.001	0.008	81404.	1.00
Cypselurus heterurus	0.002	99.934	0.001	0.008	81405.	1.00
Octopus vulgaris	0.007	99.941	0.001	0.008	81406.	1.00
Hemipteronotus novacula	0.002	99.943	0.001	0.008	81407.	1.00
Hippocampus	0.001	99.944	0.001	0.008	81408.	1.00
Selene vomer	0.012	99.956	0.001	0.008	81409.	1.00
Rhithropanopeus harrisii	0.003	99.959	0.001	0.008	81410.	1.00
Persephona mediterranea	0.002	99.962	0.001	0.008	81411.	1.00
Macrocoeloma	0.002	99.964	0.001	0.008	81412.	1.00

Table 22. Continued.

TAXON NAME	MEAN PERCENT COMPOSITION	CUMULATIVE PERCENT COMPOSITION	POOLED PERCENT COMPOSITION	FREQ. OF OCCURRENCE	CUMULATIVE ABUNDANCE	INDEX OF DISPERSION
Echiophis	0.002	99.966	0.001	0.008	81413.	1.00
Acanthostracion quadricornis	0.002	99.969	0.001	0.008	81414.	1.00
Ovalipes floridanus	0.003	99.972	0.001	0.008	81415.	1.00
Ovalipes guadulpensis	0.001	99.973	0.001	0.008	81416.	1.00
Scyllarides nodifer	0.001	99.974	0.001	0.008	81417.	1.00
Parthenope serrata	0.001	99.975	0.001	0.008	81418.	1.00
Libinia	0.001	99.976	0.001	0.008	81419.	1.00
Lutjanidae	0.011	99.987	0.001	0.008	81420.	1.00
Hoplunnis	0.001	99.988	0.001	0.008	81421.	1.00
Leiolambrus nitidus	0.002	99.990	0.001	0.008	81422.	1.00
Gastropsetta frontalis	0.002	99.993	0.001	0.008	81423.	1.00
Paguridae	0.001	99.994	0.001	0.008	81424.	1.00
Mustelus canis	0.002	99.995	0.001	0.008	81425.	1.00
Chondrichthyes	0.000	99.996	0.001	0.008	81426.	1.00
Cassis	0.002	99.998	0.001	0.008	81427.	1.00
Gorgoniidae	0.001	99.999	0.001	0.008	81428.	1.00
Dasyatis sabina	0.001	100.000	0.001	0.008	81429.	1.00

SAMPLE SUMMARY: SAMPLES = 128 TOTAL TAXA = 225

Table 23. Hierarchical list of demersal nekton taxa collected in single replicate samples at 128 stations in and around the Tuscaloosa Trend study area during the spring 1982 SEAMAP groundfish survey.

	Arthropoda	58
	Crustacea	61
	Decapoda	6175
	Penaeidae	617701
*	Metapenaeopsis goodei	6177010301
*	Parapenaeus	61770105
*	Penaeus aztecus	6177010101
*	Penaeus duorarum	6177010102
*	Penaeus setiferus	6177010103
*	Sicyonia	61770104
*	Sicyonia brevirostris	6177010401
*	Sicyonia dorsalis	6177010402
*	Sicyonia stimpsoni	6177010406
*	Solenocera	61770106
*	Solenocera vioscai	6177010602
*	Trachypenaeus	61770102
*	Xiphopeneus kroyeri	6177010701
	Sergestidae	617702
*	Acestes americanus	6177020101
	Albuneidae	618313
*	Albunea paretii	6183130201
*	Scyllaridae	618202
*	Scyllarides	61820202
*	Scyllarides nodifer	6182020202
*	Scyllarus	61820201
*	Paguridae	618306
*	Clibanarius	61830607
*	Clibanarius vittatus	6183060701
*	Pagurus	61830602
*	Goneplacidae	618905
	Portunidae	618901
*	Arenaeus cribrarius	6189010101
*	Callinectes danae	6189010303
*	Callinectes sapidus	6189010301
*	Callinectes similis	6189010302
*	Ovalipes	61890105
*	Ovalipes floridanus	6189010501
*	Ovalipes guadulpensis	61890105??
*	Ovalipes ocellatus	6189010502
*	Portunus	61890106
*	Portunus gibbesii	6189010601
*	Portunus sayi	6189010602
*	Portunus spinicarpus	6189010603
*	Portunus spinimanus	6189010604
	Xanthidae	618902
*	Menippe mercenaria	6189021301
*	Pilumnus dasypodus	6189021405
*	Rhithropanopeus harrisii	6189020901
	Dromiidae	618502
*	Dromidia antillensis	6185020301

Table 23. Continued.

*	Majidae	618701
*	Anasimus latus	6187012001
*	Libinia	61870109
*	Libinia emarginata	6187010902
*	Macrocoeloma	61870121
*	Metoporhaphis calcarata	6187011801
*	Podochela	61870119
*	Stenocionops spinosissima	6187012403
*	Stenorhynchus seticornis	6187011701
*	Parthenopidae	618702
*	Leiolambrus nitidus	6187020201
*	Parthenope	61870201
*	Parthenope serrata	6187020104
	Calappidae	618602
*	Calappa flammea	6186020101
*	Calappa sulcata	6186020102
*	Hepatus epheliticus	6186020201
	Leucosiidae	618603
*	Persephona aquilonaris	6186030103
*	Persephona mediterranea	6186030104
*	Persephona punctata	6186030101
	Raninidae	618604
*	Raninoides louisianensis	6186040201
*	Caridea	6179
	Palaemonidae	617911
*	Macrobrachium ohione	6179110201
	Stomatopoda	6191
	Squillidae	619101
*	Squilla	61910101
*	Squilla chydaea	6191010102
*	Squilla empusa	6191010101
	Palinura	6182
	Palinuridae	618201
*	Panulirus argus	6182010101
	Mollusca	5085
	Bivalvia	55
	Arcoida	5506
	Arcidae	550601
*	Barbatia candida	5506010502
	Mytiloida	5507
	Pinnidae	550702
*	Atrina serrata	5507020102
	Pterioida	5508
	Pectinidae	550905
*	Aequipecten	55090508
*	Aequipecten gibbus	55090508??
*	Amusium papyraceum	5509051101
	Veneroida	5515
	Tellinidae	551531
*	Macoma constricta	5515310121
	Veneridae	551547
*	Chione latilirata	5515471506
*	Pitar cordatus	5515471202

Table 23. Continued.

	Cephalopoda	57
	Theuthidida	5705
	Myopsida	5706
	Loliginidae	570601
*	Doryteuthis pleii	5706010301
*	Loligo pealeii	5706010102
*	Loligo pleii	5706010103
*	Lolliguncula brevis	5706010201
	Octopodida	5708
	Octopodidae	570801
*	Octopus vulgaris	5708010202
	Gastropoda	51
	Anaspidea	5124
	Aplysiidae	512402
*	Aplysia	51240202
	Mesogastropoda	5103
	Cassididae	510377
*	Cassis	51037702
	Cymatiidae	510378
*	Distorsio clathrata	5103780301
	Ficidae	510381
*	Ficus papyratia	51038101??
	Lamellariidae	510366
*	Lamellaria	51036601
	Naticidae	510376
*	Polinices duplicatus	5103760407
*	Sinum	51037605
	Tonnidae	510380
*	Tonna galea	5103800101
	Neogastropoda	5104
	Buccinidae	510504
*	Cantharus cancellarius	5105040401
*	Muricidae	510501
*	Thais haemastoma	5105010801
*	Opisthobranchia	5181
*	Nudibranchia	5127
	Stenoglossa	5105
	Melongenidae	510507
*	Busycon canaliculatum	5105070102
*	Busycon spiratum	5105070106
	Echinodermata	81
	Arbacioida	8147
	Arbaciidae	814701
*	Arbacia punctulata	8147010101
*	Asteroidea	8104
	Paxillosida	8106
	Astropectinidae	810601
*	Astropecten	81060105
	Spinulosida	8112
*	Clypeasteridae	815301
*	Clypeaster	81530101

Table 23. Continued.

*	Echinoidea	8136
	Clypeasteroida	8152
*	Mellitidae	815504
*	Mellita quinquiesperforata	8155040101
*	Holothuroidea	8170
*	Ophiuroidea	8120
	Stelleroidea	8101
	Platyasterida	8105
	Luidiidae	810501
*	Luidia	81050101
*	Luidia clathrata	8105010102
*	Porifera	36
	Cnidaria	37
*	Anthozoa	3740
	Pennatulacea	3752
	Renillidae	375303
*	Renilla mulleri	3753030101
*	Pennatulidae	375402
*	Scyphozoa	3730
	Semaeostomeae	3734
	Pelagiidae	373401
*	Chrysaora quinquecirrha	3734010203
	Ulmaridae	373403
*	Aurelia	37340302
*	Ectoprocta	78
	Chordata	8388
	Antennarioidei	8787
	Antennariidae	878702
*	Antennarius radiosus	8787020203
*	Ogcocephalidae	878704
*	Halieutichthys aculeatus	8787040301
*	Ogcocephalus	87870401
*	Ogcocephalus nasutus	8787040103
*	Ogcocephalus parvus	8787040105
*	Ogcocephalus radiatus	8787040106
*	Zalieutes mcgintyi	8787040401
	Aulostomoidei	8819
	Fistulariidae	881902
*	Fistularia tabacaria	8819020101

Table 23. Continued.

	Balistoidei	8860
	Balistidae	886002
*	Aluterus heudeloti	8860020102
*	Aluterus schoepfi	8860020101
*	Aluterus scriptus	8860020104
*	Balistes capriscus	8860020201
*	Canthidermis sufflamen	8860020502
*	Monacanthus	88600207
*	Monacanthus ciliatus	8860020701
*	Monacanthus hispidus	8860020703
*	Monacanthus setifer	8860020704
	Ostraciontidae	886003
*	Acanthostracion quadricornis	8860030201
	Batrachoidiformes	8783
	Batrachoididae	878301
*	Porichthys porosissimus	8783010106
*	Chondrichthyes	8701
	Exocoetoidei	8803
	Exocoetidae	880301
*	Cypselurus heterurus	8803010101
*	Hirundichthys rondeleti	8803010903
*	Parexocoetus brachypterus	8803011101
*	Prognichthys gibbifrons	8803011201
	Labroidei	8839
	Labridae	883901
*	Hemipteronotus novacula	8839010802
	Lophiodei	8786
	Lophiidae	878601
*	Lophius	87860101
	Myctophoidei	8762
	Synodontidae	876202
*	Saurida brasiliensis	8762020301
*	Synodus foetens	8762020101
*	Synodus intermedius	8762020102
*	Synodus poeyi	8762020104
*	Trachinocephalus	87620204
*	Trachinocephalus myops	8762020401
	Osteichthyes	8717
	Anguilliformes	8740
	Congridae	874112
*	Congrina flava	8741120302
*	Ophichthus gomesii	8741131001
*	Ophichthus ocellatus	8741131003
	Muraenesocidae	874108
*	Hoplunnis	87410801
*	Hoplunnis macrurus	8741080102
	Muraenidae	874105
*	Gymnothorax	87410504
*	Gymnothorax ocellatus	8741050405
*	Gymnothorax saxicola	8741050407
	Ophichthidae	874113
*	Echiophis	874113??
*	Myrophis punctatus	8741130802

Table 23. Continued.

	Clupeiformes	8745
	Clupeidae	874701
*	Brevoortia patronus	8747010403
*	Dorosoma petenense	8747010502
*	Etrumeus teres	8747010601
*	Harengula jaguana	8747010803
*	Opisthonema oglinum	8747010701
*	Sardinella anchovia	8747011003
	Engraulidae	874702
*	Anchoa	87470202
*	Anchoa hepsetus	8747020201
*	Anchoa lyolepis	8747020205
*	Anchoa mitchilli	8747020202
*	Anchoa nasuta	8747020206
*	Anchoviella	87470203
*	Anchoviella perfasciata	8747020304
	Gadiformes	8789
	Bregmacerotidae	879102
*	Bregmaceros atlanticus	8791020101
	Gadidae	879103
*	Urophycis cirratus	8791031005
*	Urophycis floridanus	8791031007
*	Urophycis regius	8791031002
*	Merlucciidae	879104
*	Steindachneria argentea	8791040201
	Moridae	879101
*	Physiculus fulvus	8791010301
	Ophidiidae	879201
*	Brotula barbata	8792010401
*	Lepophidium	87920105
*	Lepophidium brevibarbe	8792010502
*	Lepophidium graellsi	8792010504
*	Lepophidium jeannae	8792010505
*	Neobythites gillii	8792012001
*	Ophidion grayi	8792010602
*	Ophidion holbrooki	8792010603
*	Ophidion welshi	8792010605
*	Otophidium omostigmum	8792010701
	Perciformes	8834
	Callionymidae	884601
*	Callionymus agassizi	8846010101
	Carangidae	883528
*	Caranx	88352803
*	Caranx fusus	8835280302
*	Caranx hippos	8835280303
*	Caranx latus	8835280304
*	Chloroscombrus	88352804
*	Chloroscombrus chrysurus	8835280401
*	Decapterus punctatus	8835281202
*	Selar crumenophthalmus	8835280601
*	Selene setapinnis	88352807??
*	Selene vomer	8835280701
*	Trachurus lathami	8835280102

Table 23. Continued.

*	Gobiidae	884701
*	Bollmannia communis	8847011601
*	Gobionellus boleosoma	8847010501
*	Gobionellus hastatus	8847010502
*	Apogonidae	883518
*	Apogon maculatus	8835180107
	Branchiostegidae	883522
*	Caulolatilus intermedius	8835220103
	Chaetodonidae	883555
*	Chaetodon ocellatus	8835550101
	Coryphaenidae	883529
*	Coryphaena	88352901
	Echeneidae	883527
*	Echeneis naucrates	8835270201
	Ephippidae	883552
*	Chaetodipterus faber	8835520101
	Gerridae	883539
*	Eucinostomus argenteus	8835390101
*	Eucinostomus gula	8835390102
	Grammistidae	883503
*	Rypticus maculatus	8835030204
*	Lutjanidae	883536
*	Lutjanus campechanus	8835360107
*	Lutjanus synagris	8835360112
*	Pristipomoides aquilonaris	8835360701
*	Rhomboplites aurorubens	8835360501
	Mullidae	883545
*	Upeneus parvus	8835450402
	Pomadasyidae	883540
*	Haemulon aurolineatum	8835400101
*	Orthopristis chrysoptera	8835400201
	Priacanthidae	883517
*	Priacanthus arenatus	8835170101
*	Pristigenys alta	8835170201
	Rachycentridae	883526
*	Rachycentron canadum	8835260101
	Sciaenidae	883544
*	Bairdiella chrysura	8835440301
*	Cynoscion	88354401
*	Cynoscion arenarius	8835440106
*	Cynoscion nothus	8835440103
*	Equetus lanceolatus	8835441202
*	Equetus umbrosus	8835441206
*	Larimus fasciatus	8835440501
*	Leiostomus xanthurus	8835440401
*	Menticirrhus americanus	8835440601
*	Menticirrhus littoralis	8835440602
*	Micropogonias undulatus	8835440701
*	Stellifer lanceolatus	8835441001

Table 23. Continued.

	Serranidae	883502
*	Centropristis ocyurus	8835020304
*	Centropristis philadelphicus	8835020305
*	Diplectrum bivittatum	8835021005
*	Diplectrum formosum	8835021002
*	Epinephelus flavolimbatus	8835020405
*	Hemanthias leptus	8835021201
*	Serraniculus pumilio	8835022201
*	Serranus atrobranchus	8835022302
*	Serranus phoebe	8835022308
*	Serranus subligarius	8835022309
	Sparidae	883543
*	Archosargus probatocephalus	8835430301
*	Calamus leucosteus	8835430505
*	Calamus nodosus	8835430506
*	Lagodon rhomboides	8835430201
*	Pagrus pagrus	8835430601
*	Stenotomus caprinus	8835430102
*	Scombridae	885003
*	Scomberomorus maculatus	8850030502
*	Cynoglossidae	885802
*	Symphurus civitatus	8858020102
*	Symphurus diomedianus	8858020103
*	Symphurus plagiusa	8858020101
	Soleidae	885801
*	Achirus lineatus	8858010202
*	Gymnachirus texae	8858010303
*	Trinectes maculatus	8858010101
	Pleuronectoidei	8857
	Bothidae	885703
*	Ancylopsetta dilecta	8857030503
*	Ancylopsetta quadrocellata	8857030506
*	Bothus	88570306
*	Bothus ocellatus	8857030603
*	Citharichthys cornutus	8857030106
*	Citharichthys macrops	8857030109
*	Citharichthys spilopterus	8857030110
*	Cyclopsetta chittendeni	8857030801
*	Cyclopsetta fimbriata	8857030802
*	Etropus crossotus	8857030201
*	Gastropsetta frontalis	8857031001
*	Monolene sessilicauda	8857031204
*	Paralichthys lethostigma	8857030304
*	Syacium	88570313
*	Syacium gunteri	8857031301
*	Syacium micrurum	8857031302
*	Syacium papillosum	8857031303
*	Trichopsetta ventralis	8857031404
	Polynemoidei	8838
*	Polydactylus octonemus	8838010101

Table 23. Continued.

	Rajiformes	8713
	Dasyatidae	871305
*	Dasyatis sabina	8713050105
*	Gymnura micrura	8713050202
	Myliobatidae	871307
*	Rhinoptera bonasus	8713070301
	Rajidae	871304
*	Raja eglanteria	8713040113
*	Raja texana	8713040133
	Torpedinidae	871303
*	Narcine brasiliensis	8713030401
	Scombroidei	8850
	Trichiuridae	885002
*	Trichiurus lepturus	8850020201
	Scorpaenoidei	8826
	Scorpaenidae	882601
*	Neomerinthe hemingwayi	8826010402
*	Pontinus longispinis	8826010503
*	Scorpaena	88260106
*	Scorpaena brasiliensis	8826010605
*	Scorpaena calcarata	8826010606
*	Scorpaena plumieri	8826010614
*	Triglidae	882602
*	Bellator	88260202
*	Bellator militaris	8826020203
*	Peristedion	88260203
*	Peristedion miniatum	8826020307
*	Prionotus	88260201
*	Prionotus carolinus	8826020101
*	Prionotus martis	8826020111
*	Prionotus ophryas	8826020113
*	Prionotus paralatus	8826020114
*	Prionotus roseus	8826020117
*	Prionotus rubio	8826020118
*	Prionotus salmonicolor	8826020120
*	Prionotus scitulus	8826020103
*	Prionotus stearnsi	8826020121
*	Prionotus tribulus	8826020104
	Scyliorhinoidei	8708
	Carcharhinidae	870802
*	Mullus auratus	8835450201
*	Mustelus canis	8708020401
*	Rhizoprionodon terraenovae	8708020301
	Sphyrnidae	870803
*	Sphyrna lewini	8708030103
	Siluriformes	8777
	Ariidae	877718
*	Arius felis	8777180202
*	Bagre marinus	8777180101
	Sphyraenoidei	8837
	Sphyraenidae	883701
*	Sphyraena borealis	8837010102

	Stromateoidei	8851
	Stromateidae	885103
*	Peprilus burti	8851030104
*	Peprilus paru	8851030102
	Syngnathoidei	8820
	Syngnathidae	882002
*	Hippocampus	88200202
*	Syngnathus scovelli	8820020113
	Tetradontoidei	8861
	Diodontidae	886103
*	Chilomycterus schoepfi	8861030101
	Tetraodontidae	886101
*	Lagocephalus laevigatus	8861010101
*	Sphoeroides dorsalis	8861010205
*	Sphoeroides nephelus	8861010208
*	Sphoeroides parvus	8861010210
*	Sphoeroides spengleri	8861010211
	Trachinoidei	8840
	Opistognathidae	884002
*	Lonchopisthus lindneri	8840020102
	Uranoscopidae	884014
*	Astroscopus y-graecum	8840140102
*	Ascidiacea	8401
	Miscellaneous taxa	
*	Gorgoniidae	375105
	Sepiolidae	570402
*	Rossia	57040201

of the five categories of relative percent composition of each taxa counts in each sample) provided the context for assessing the ecological trends of these taxa, and the identification and exclusion of taxa that did not show meaningful trends. This initial TWINSPAN display is not presented in this report. Of the 150 numerically abundant taxa selected from the relative composition analysis, 84 taxa were ultimately selected for inclusion in the detailed community analysis.

After the suite of 84 taxa were selected, a final TWINSPAN analysis was conducted, resulting in the ordered two-way display shown as Figure 11. Table 24 presents values for environmental variables and community parameters in each sample, with the samples ordered and grouped in the same manner as in the corresponding TWINSPAN display (Figure 11). Table 25 presents the Pearson product-moment correlation coefficients of the density of each taxon and the values for the community indices in each sample with each environmental variable, with the taxa ordered and grouped in the same manner as in the corresponding TWINSPAN display. Figure 12 presents a map showing the affinities of the 128 samples to the most meaningful TWINSPAN sample groups in Figure 11. Examination of Figures 11 and 12 and Tables 24 and 25 in concert helps identify environmental trends most related to the ordering and grouping of the samples and taxa.

These results indicated that the ordering of samples across the top of the TWINSPAN display (Figure 11) were related to depth, hydrographic conditions and geography. The samples on the far right of the TWINSPAN display (Sample Group II in Figures 11 and 12 and Table 24) were generally collected at the shallowest depth stations (2 to 14 m), and were generally characterized by the lowest salinities (range from 6.4 to 35.5 ppt) and the highest temperatures (range from 23.0 to 31.7° C). Within Group II, there did not appear to be much difference in the depth, hydrographic conditions or geographical location of the samples in Groups IIA1 and IIB2 (Figure 12 and Table 24).

In general, the samples in Station Group II had lower total numbers of taxa and lower values for community parameters compared to those in Station Group I (Table 24). Most of those in Station Group IIB were very depauperate. Numbers of individuals were more variable than were values for community parameters within both Groups I and II, but Group II included a much larger number of samples with very few individuals (Table 24).

The samples in Sample Group I were, for the most part, collected in deeper waters (depth ranged from 9 to 90 m), and were generally characterized by higher salinities (salinity ranged from 31.0 to 37.7 ppt) and lower temperatures (temperature ranged from 17.6 to 27.8° C). Within Group I, samples in the two outside groups (Groups IA1 and IB2) included the majority of the samples from the deep water stations while those in Groups IA2 and IB1 were mainly collected from middepth stations. Of the deep water stations, those in Group IA1 were mainly collected east of the Mississippi River outfall, while those in Group IB2 were collected mainly west of the delta. Similarly, those in Group IA2 were collected mainly from the eastern and central regions of the study area, while those in Group IB1 were mainly collected from the western and central regions (Figures 11 and 12 and Table 24). Therefore, within Group I, the major trend (separating Group IA from Group IB) appear to be geographical, and within Groups IA and IB, the differences were most related to depth.

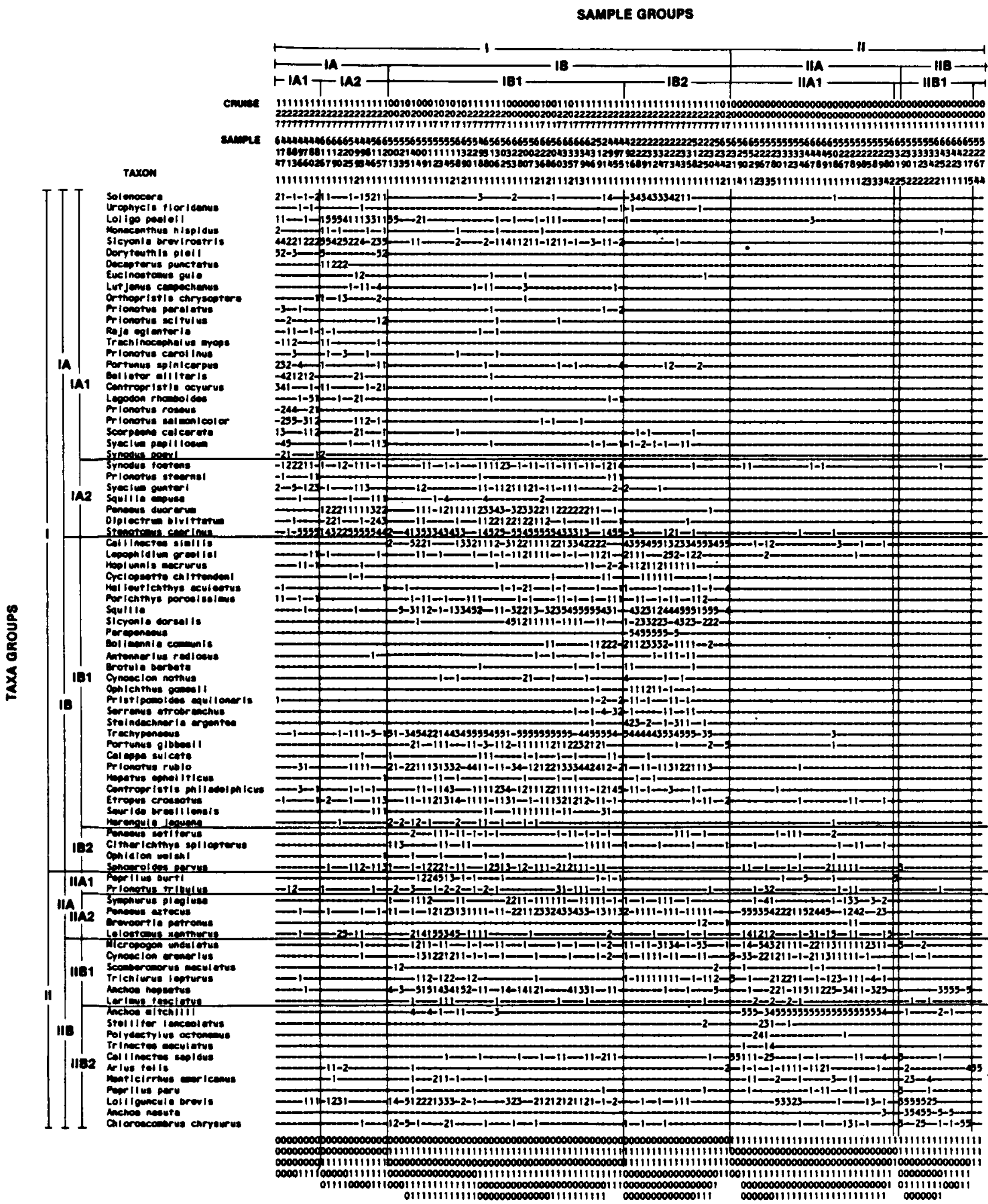

Figure 11. Ordered two-way display resulting from TWINSPAN analysis of relative abundances of 84 selected demersal nekton taxa collected in single replicate samples at 128 stations in and around the Tuscaloosa Trend study area during the spring 1982 SEAMAP groundfish survey.

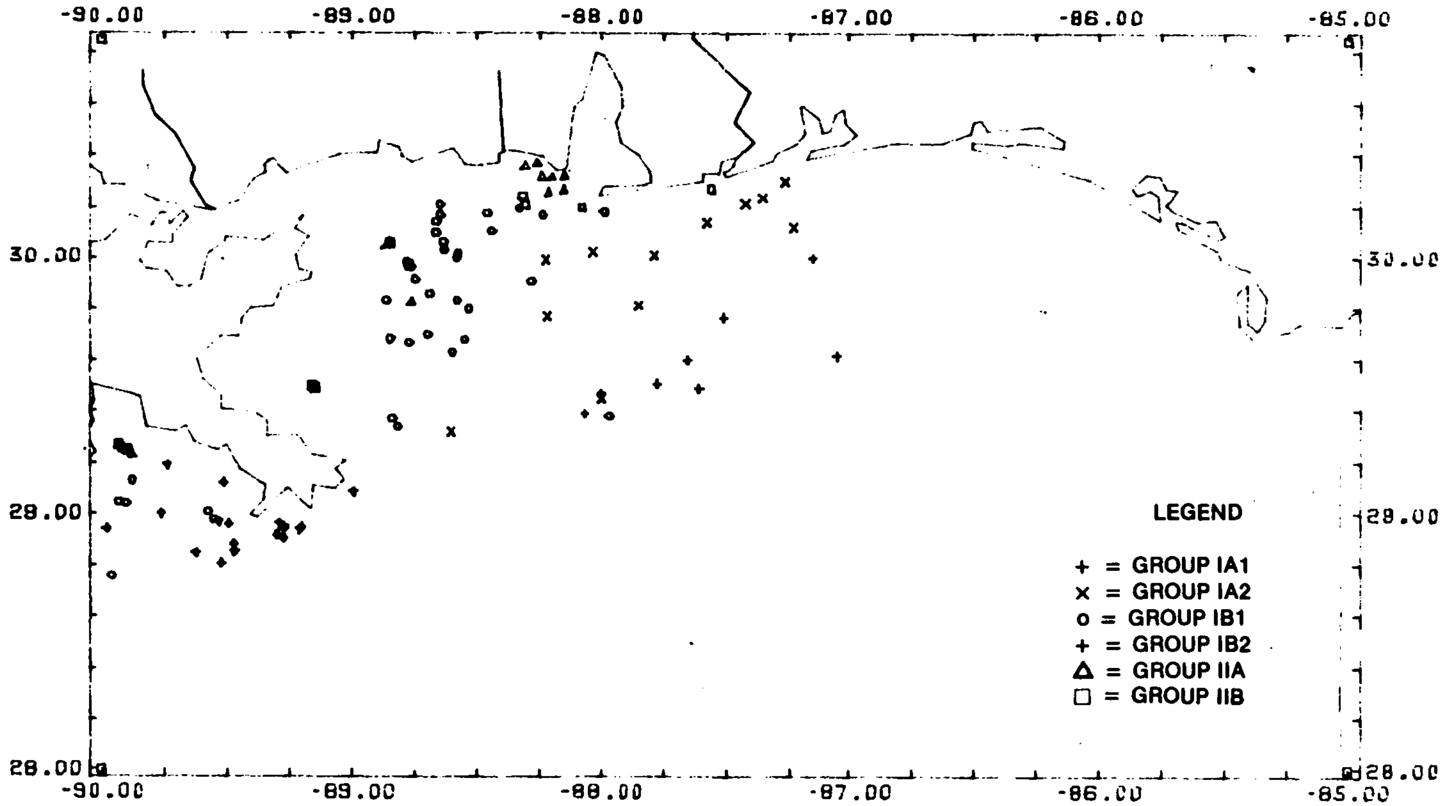

Figure 12. Map of the SEAMAP groundfish study area showing the membership of the samples to the six most meaningful groups resulting from TWINSPAN analysis of relative abundance of 84 selected demersal nekton taxa collected in single replicate samples at 128 stations in and around the Tuscaloosa Trend study area during the spring 1982 SEAMAP groundfish survey.

Table 24. Ordered table of environmental and community parameters for single replicate samples collected at 128 stations in and around the Tuscaloosa Trend study area during the spring 1982 SEAMAP groundfish survey.

Station Groups	Cruise	Site	Date	Latitude (DDMMSS)	Longitude (DDMMSS)	Depth (m)	Bottom Dissolved Oxygen (ppm)	Bottom Salinity (ppt)	Bottom Temperature (oC)	Total Taxa	Total Count	Diversity (J')	Evenness (H')	Richness (D)
I / IA / IA1	127	614 1	06JUN82	30 00 00	87 09 00	37	7.0	35.77	19.78	45	323	3.023	0.794	7.616
	127	477 1	07JUN82	29 29 24	87 36 30	64	6.4	36.06	19.00	29	392	2.691	0.799	4.689
	127	481 1	07JUN82	29 36 06	87 39 18	46	6.4	35.67	20.56	21	550	2.103	0.691	3.170
	127	483 1	08JUN82	29 46 06	87 30 36	38	6.5	35.19	21.11	18	547	2.140	0.740	2.697
	127	496 1	04JUN82	29 23 24	88 04 06	73	4.8	36.33	18.78	20	592	1.715	0.572	2.976
	127	476 1	05JUN82	29 28 06	87 59 59	50	4.8	36.22	20.00	15	526	1.119	0.413	2.235
	127	480 1	05JUN82	29 30 30	87 46 24	55	5.8	35.88	20.00	18	313	1.605	0.555	2.958
	127	482 1	05JUN82	29 36 54	87 02 54	40	5.8	35.63	21.11	21	428	1.159	0.381	3.301
IA2	127	616 1	06JUN82	30 07 12	87 14 06	26	6.8	35.34	22.06	30	859	1.304	0.383	4.293
	127	617 1	07JUN82	30 08 24	87 34 48	20	6.9	34.96	21.67	20	296	1.846	0.616	3.339
	127	619 1	07JUN82	30 12 48	87 25 30	16	6.8	35.28	22.78	12	106	1.523	0.613	2.359
	127	620 1	07JUN82	30 14 06	87 21 30	16	6.8	35.17	23.89	18	71	1.846	0.639	3.988
	127	622 1	07JUN82	30 18 00	87 16 00	11	7.4	35.10	25.56	14	85	2.115	0.801	2.926
	127	505 1	03JUN82	29 46 18	88 13 06	37	5.9	36.29	22.33	17	1437	0.551	0.194	2.201
	127	499 2	04JUN82	29 27 00	88 00 00					19	2085	1.013	0.344	2.355
	127	493 1	04JUN82	29 19 12	88 36 30	42	5.2	36.19	22.22	30	1868	1.338	0.393	3.850
	127	484 1	08JUN82	29 49 00	87 50 54	35	7.1	35.32	21.67	16	730	1.551	0.559	2.275
	127	516 1	02JUN82	29 59 24	88 13 30	27	4.4	35.36	20.94	17	424	1.790	0.632	2.645
	127	615 1	08JUN82	30 00 42	87 47 12	24	4.8	35.20	21.17	25	167	2.400	0.746	4.689
	127	627 1	08JUN82	30 01 24	88 02 06	24	6.5	35.60	21.44	25	534	2.087	0.648	3.821
IB / IB1	001	501 1	07JUN82	29 40 00	88 46 30	15	5.0	33.00	27.80	16	250	1.805	0.651	2.717
	001	503 1	07JUN82	29 41 00	88 51 00	11	5.1	31.00	26.50	11	99	1.343	0.560	2.176
	127	523 1	18JUN82	29 07 42	89 52 48	46	2.4	36.05	23.28	6	38	0.763	0.426	1.375
	001	515 1	07JUN82	29 59 00	88 47 00	11	3.1	33.00	26.90	7	54	1.382	0.710	1.504
	127	641 1	03JUN82	30 11 24	88 19 57	11	4.8	33.75	22.22	27	480	2.361	0.716	4.211
	001	504 1	08JUN82	29 42 00	88 42 00	18	3.6	34.00	26.00	27	554	2.151	0.653	4.116
	001	509 1	08JUN82	29 51 30	88 41 30	16	5.2	34.00	25.30	24	251	2.233	0.703	4.163
	001	511 1	09JUN82	29 55 00	88 45 00	13	4.8	34.00	24.00	22	301	1.832	0.593	3.680
	127	512 1	09JUN82	29 57 42	88 46 30	11	4.5	33.37	22.17	19	577	1.857	0.631	2.831
	001	513 1	09JUN82	29 58 00	88 46 00	13	4.6	32.00	25.80	26	285	2.213	0.679	4.423
	127	514 1	09JUN82	29 59 00	88 46 54	11	3.8	33.88	22.17	29	364	2.845	0.845	4.748
	001	515 2	09JUN82	29 59 00	88 47 00	11	5.8	34.00	25.00	17	120	2.547	0.899	3.342
	127	618 1	09JUN82	30 10 42	87 59 18	13	4.2	35.01	22.22	32	508	2.392	0.690	4.976
	001	639 2	10JUN82	30 10 00	88 39 00	13	6.6	35.00	24.50	15	181	1.719	0.635	2.693
	127	520 1	19JUN82	29 02 18	89 54 12	30	3.5	36.34	22.77	15	1160	1.578	0.583	1.984
	127	521 1	19JUN82	29 02 48	89 54 00	28	6.7	36.31	23.61	21	1824	1.528	0.502	2.664
	127	498 1	01JUN82	29 29 00	88 52 00					28	2318	1.406	0.422	3.485
	127	638 1	02JUN82	30 10 00	88 14 18	16	3.2	34.67	21.56	35	1233	2.133	0.600	4.777
	127	510 1	03JUN82	29 54 30	88 17 06	33	5.4	36.03	21.56	19	1150	1.308	0.444	2.554
	127	636 1	03JUN82	30 06 12	88 26 36	18	4.8	34.73	21.67	30	350	2.282	0.671	4.951
	127	502 1	04JUN82	29 40 48	88 33 00	31	6.5	36.16	21.67	24	527	1.862	0.586	3.670
	001	635 1	06JUN82	30 06 00	88 40 00	16	6.0	35.00	24.80	14	250	2.418	0.916	2.354
	001	623 1	07JUN82	30 00 00	88 35 00	24	5.4	32.00	23.90	19	307	1.990	0.676	3.143
	001	628 1	07JUN82	30 02 00	88 38 00	20	5.4	34.00	24.20	22	691	2.054	0.665	3.212
	001	500 1	08JUN82	29 38 00	88 36 00	22	4.8	35.00	25.00	27	151	2.738	0.831	5.182
	001	507 1	08JUN82	29 50 00	88 35 00	24	5.0	36.00	25.20	25	510	1.830	0.568	3.850
	001	623 2	09JUN82	30 00 00	88 35 00	24	6.2	34.00	25.50	27	412	1.917	0.582	4.318
	127	626 1	09JUN82	30 01 00	88 34 36	24	5.6	35.78	21.50	23	598	1.789	0.571	3.441
	001	628 2	10JUN82	30 02 00	88 38 00	22	6.4	35.00	25.00	22	519	1.949	0.631	3.359
	001	506 1	08JUN82	29 48 00	88 32 00	29	4.8	34.00	24.00	27	418	2.095	0.636	4.308
	127	640 1	09JUN82	30 10 30	88 27 36	9	4.7	34.49	22.22	31	719	2.394	0.697	4.561
	127	633 1	10JUN82	30 03 36	88 38 12	20	5.8	35.45	21.11	29	1528	1.998	0.593	3.819
	001	635 2	10JUN82	30 06 00	88 40 00	15	6.0	34.00	25.00	21	487	2.414	0.793	3.232
	127	637 1	10JUN82	30 08 24	88 40 00	15	5.5	32.73	21.11	27	1744	2.030	0.616	3.483
	127	639 3	10JUN82	30 10 00	88 39 00					19	1081	2.184	0.742	2.577
	127	644 1	10JUN82	30 12 36	88 39 00	13	5.3	35.00	21.67	27	934	2.327	0.706	3.801
	127	236 1	17JUN82	28 58 30	89 33 06	46	3.4	36.31	19.97	26	2402	1.628	0.500	3.212
	127	519 1	18JUN82	29 00 18	89 34 30	24	4.3	36.32	22.22	26	8673	1.629	0.500	2.757
	127	221 1	19JUN82	28 45 18	89 57 48	51	6.1	36.29	21.08	33	733	2.513	0.719	4.851
	127	494 1	02JUN82	29 20 18	88 49 18	44	5.5	36.30	23.33	28	352	2.570	0.771	4.605
	127	495 1	02JUN82	29 22 12	88 50 36	29	5.8	36.47	24.44	26	616	2.144	0.658	3.892
	127	475 1	04JUN82	29 23 12	87 58 12	82	4.7	36.33	17.61	23	202	2.378	0.759	4.144
IB2	127	491 1	14JUN82	29 05 12	88 59 54	27	5.5	36.32	22.16	21	262	2.119	0.696	3.592
	127	226 1	15JUN82	28 54 24	89 16 42	60	5.3	36.24	18.10	22	601	2.011	0.651	3.282
	127	228 1	15JUN82	28 56 18	89 12 48	44	4.8	36.24	19.20	22	383	2.288	0.740	3.531
	127	229 1	15JUN82	28 56 30	89 16 30	40	5.4	36.22	18.00	21	541	2.158	0.709	3.178
	127	231 1	15JUN82	28 56 54	89 12 18	34	5.5	36.31	18.30	24	598	2.317	0.729	3.602
	127	232 1	15JUN82	28 57 06	89 16 30	32	5.5	36.30	19.70	19	787	1.733	0.589	2.699
	127	234 1	15JUN82	28 57 48	89 17 36	26	4.5	36.27	21.11	22	314	2.279	0.737	3.653
	127	227 1	16JUN82	28 55 06	89 18 12	44	5.9	37.72	20.55	27	859	2.026	0.615	3.849
	127	223 1	17JUN82	28 50 42	89 37 30	80	5.4	36.25	17.40	31	376	2.699	0.786	5.059
	127	224 1	17JUN82	28 51 06	89 28 18	50	4.8	36.38	19.94	26	450	2.398	0.736	4.092
	127	233 1	17JUN82	28 57 36	89 29 30	33	3.3	36.39	19.44	14	2911	1.464	0.555	1.630
	127	235 1	17JUN82	28 58 06	89 31 48	46	3.1	36.30	19.17	22	3329	1.477	0.478	2.589
	127	518 1	18JUN82	29 00 00	89 45 42	46	4.3	36.39	18.38	23	1381	1.657	0.528	3.043
	127	222 1	17JUN82	28 48 24	89 31 12	90	4.5	36.09	16.66	14	796	1.255	0.476	1.946
	127	225 1	17JUN82	28 52 48	89 28 24	18	4.7	35.61	22.77	22	1997	1.891	0.612	2.763
	127	230 1	19JUN82	28 56 30	89 58 54	36	7.4	36.33	21.72	16	3561	1.566	0.565	1.834
	127	524 1	18JUN82	29 11 30	89 44 18	22	1.8	35.14	25.00	6	47	1.231	0.687	1.299
	001	634 2	03JUN82	30 04 00	88 51 00					1	3	0.000		0.000
	127	522 1	18JUN82	29 07 18	89 30 42	10	4.6	35.08	23.88	14	360	1.909	0.723	2.209
II / IIA / IIA1	001	631 1	03JUN82	30 03 18	88 51 24	5	5.2	27.60	29.00	1	1	0.000		
	001	529 4	07JUL82	29 16 18	89 55 58	2	6.9	23.80	31.70	1	4	0.000		0.000
	001	650 1	03JUN82	30 19 30	88 09 00					13	923	1.160	0.452	1.758
	001	652 1	03JUN82	30 22 18	88 15 42					1	1	0.000		
	001	652 1	03JUN82	30 22 18	88 15 42					12	642	1.688	0.679	1.702
	001	529 2	23JUN82	29 16 18	89 55 58	2	7.2	15.10	31.30	13	208	1.129	0.440	2.248
	001	526 3	29JUN82	29 14 42	89 53 52	7	4.6	29.50	29.80	6	32	0.995	0.556	1.443
	001	527 3	29JUN82	29 15 02	89 54 12	5	4.1	29.70	29.20	14	125	1.992	0.755	2.692
	001	528 5	13JUL82	29 15 32	89 54 54	4	5.8	23.40	30.60	16	66	2.305	0.831	3.580
	001	530 1	01JUN82	29 29 24	89 08 54	9	5.8	32.50	25.40	11	77	1.571	0.655	2.302
	001	531 1	01JUN82	29 29 45	89 09 12	7	5.4	32.90	25.40	11	334	0.760	0.317	1.721
	001	532 1	01JUN82	29 29 45	89 09 27	5	4.4	33.30	25.10	13	459	1.014	0.395	1.958
	001	533 1	01JUN82	29 29 48	89 09 36	4	5.7	32.40	25.40	10	404	0.489	0.212	1.500
	001	534 1	01JUN82	29 29 54	89 09 54	2	4.1	28.40	27.30	21	672	1.026	0.337	3.072
	001	646 1	03JUN82	30 15 30	88 12 48					6	8	1.733	0.967	2.404
	001	647 1	03JUN82	30 16 12	88 09 00					14	1485	1.074	0.407	1.780
	001	648 1	03JUN82	30 18 54	88 12 12					9	391	0.791	0.360	1.340
	001	649 1	03JUN82	30 19 00	88 14 30					10	422	0.776	0.337	1.489
	001	651 1	03JUN82	30 21 36	88 18 30					10	523	1.290	0.560	1.438
	001	508 1	09JUN82	29 50 00	88 46 00	13	4.2	34.00	23.00	19	210	2.203	0.748	3.366
	001	526 1	16JUN82	29 14 42	89 53 52	7	5.6	30.70	28.30	10	224	0.688	0.299	1.663
	001	527 1	16JUN82	29 15 02	89 54 12	5	4.4	21.60	30.30	10	1191	0.354	0.154	1.271
	001	528 1	16JUN82	29 15 32	89 54 54	4	8.5	6.40	30.20	17	428	1.365	0.482	2.641
	001	529 1	16JUN82	29 16 18	89 55 58	2	8.6	6.80	30.10	19	727	1.065	0.362	2.732
	001	528 2	23JUN82	29 15 32	89 54 54	4	6.5	15.10	31.10	12	350	0.470	0.189	1.878
	001	525 3	29JUN82	29 13 55	89 52 42	9	4.0	29.80	29.10	5	522	0.169	0.105	0.639
	001	528 3	29JUN82	29 15 32	89 54 54	4	4.8	30.30	29.30	6	13	1.411	0.787	1.949
	001	529 3	29JUN82	29 16 18	89 55 58	2	5.2	30.20	29.80	8	192	0.408	0.196	1.331
	001	528 4	07JUL82	29 15 32	89 54 54	4	5.0	27.30	31.00	16	189	1.904	0.687	2.862
	001	630 2	03JUN82	30 03 00	88 52 00					3	6	0.868	0.790	1.116
IIA2	001	631 2	08JUN82	30 03 18	88 51 24	5	6.2	30.20	28.20	2	2	0.693	1.000	1.443
IIB / IIB1	001	529 5	13JUL82	29 16 18	89 55 58	2	6.8	23.00	30.80	6	12	1.350	0.753	2.012
	001	530 2	08JUN82	29 29 24	89 08 54	9	5.0	27.90	29.40	5	79	0.638	0.396	0.915
	001	531 2	08JUN82	29 29 45	89 09 12	7	5.1	27.80	29.20	8	247	1.022	0.492	1.271
	001	532 2	08JUN82	29 29 45	89 09 27	5	4.9	27.50	29.50	4	26	0.672	0.485	0.921
	001	533 2	08JUN82	29 29 48	89 09 36	4	5.7	26.90	30.00	5	27	1.312	0.815	1.214
	001	534 2	08JUN82	29 29 54	89 09 54	2	5.1	25.30	29.90	6	350	0.567	0.317	0.854
	001	632 2	08JUN82	30 03 30	88 51 00	7	5.6	34.50	24.10	2	4	0.693	1.000	0.721
	001	645 1	03JUN82	30 14 24	88 19 00					10	1489	0.588	0.255	1.232
	001	632 1	03JUN82	30 03 30	88 51 00	7	5.1	28.50	28.60	1	1	0.000		
	001	642 1	08JUN82	30 11 54	88 04 54	14	4.2	32.00	24.00	4	325	0.744	0.536	0.519
	001	643 1	08JUN82	30 12 24	88 18 24	8	6.6	25.00	28.00	1	2	0.000		0.000
	001	621 1	08JUN82	30 16 06	87 33 42	11	6.4	30.00	28.00	1	1	0.000		
	001	527 5	13JUL82	29 15 02	89 54 12	5	5.2	28.50	30.30	3	6	1.011	0.921	1.116
IIB2	001	526 4	07JUL82	29 14 42	89 53 52	7	6.7	35.50	27.80	1	1	0.000		
	001	527 4	07JUL82	29 15 02	89 54 12	5	1.4	33.70	28.50	1	1	0.000		

Table 25. Ordered matrix of simple bivariate Pearson product moment correlation coefficients of densities of 84 selected demersal nekton taxa and community parameters with environmental variables collected at 128 stations in and around the Tuscaloosa Trend study area during the spring 1982 SEAMAP groundfish survey.

Taxa Groups	Taxa	Depth	Bottom Dissolved Oxygen	Bottom Salinity	Bottom Temperature
I / IA / IA1	Solenocera	0.24403	0.11194	0.15897	-0.26707
I / IA / IA1	Urophycis floridanus	0.55334	-0.07691	0.14050	-0.30750
I / IA / IA1	Loligo pealeii	-0.02554	0.18741	0.09685	-0.04369
I / IA / IA1	Monacanthus hispidus	0.07799	0.25268	0.12173	-0.18354
I / IA / IA1	Sicyonia brevirostris	0.12097	0.12390	0.13178	-0.15781
I / IA / IA1	Doryteuthis pleii	0.07414	0.17056	0.08622	-0.12997
I / IA / IA1	Decapterus punctatus	-0.05027	0.26889	0.09551	-0.05959
I / IA / IA1	Eucinostomus gula	0.10121	-0.01454	0.07472	-0.06060
I / IA / IA1	Lutjanus campechanus	0.06924	0.02126	0.10486	-0.09724
I / IA / IA1	Orthopristis chrysoptera	0.01595	0.14510	0.09715	-0.08343
I / IA / IA1	Prionotus paralatus	0.32352	0.07528	0.09491	-0.19367
I / IA / IA1	Prionotus scitulus	0.07342	0.12034	0.07641	-0.11478
I / IA / IA1	Raja eglanteria	0.13043	0.18450	0.10520	-0.15725
I / IA / IA1	Trachinocephalus myops	0.12109	0.12574	0.06626	-0.11391
I / IA / IA1	Prionotus carolinus	0.06973	0.12861	0.06726	-0.09762
I / IA / IA1	Portunus spinicarpus	0.45968	-0.03223	0.11716	-0.27980
I / IA / IA1	Bellator militaris	0.38446	0.08738	0.12994	-0.23684
I / IA / IA1	Centropristis ocyurus	0.24375	0.14779	0.09248	-0.17990
I / IA / IA1	Lagodon rhomboides	0.21672	0.03302	0.08714	-0.13304
I / IA / IA1	Prionotus roseus	0.18276	0.13546	0.08100	-0.14285
I / IA / IA1	Prionotus salmonicolor	0.19330	0.14415	0.09375	-0.15865
I / IA / IA1	Scorpaena calcarata	0.28863	0.06815	0.13540	-0.21681
I / IA / IA1	Syacium papillosum	0.21498	0.10185	0.09928	-0.17629
I / IA / IA1	Synodus poeyi	0.15661	0.15750	0.08251	-0.13405
I / IA / IA2	Synodus foetens	0.45300	0.05746	0.22037	-0.31716
I / IA / IA2	Prionotus stearnsi	0.28958	0.06443	0.12729	-0.15615
I / IA / IA2	Syacium gunteri	0.13215	0.14669	0.10268	-0.13453
I / IA / IA2	Squilla empusa	-0.02999	-0.18866	0.05086	-0.09351
I / IA / IA2	Penaeus duorarum	-0.00375	-0.06793	0.17311	-0.22296
I / IA / IA2	Diplectrum bivittatum	0.09621	-0.06214	0.20822	-0.24698
I / IA / IA2	Stenotomus caprinus	0.23986	0.04642	0.19462	-0.20010
I / IB / IB1	Callinectes similis	0.20688	-0.15931	0.22362	-0.32499
I / IB / IB1	Lepophidium graellsi	0.47106	-0.15520	0.20997	-0.36780
I / IB / IB1	Hoplunnis macrurus	0.41163	-0.25309	0.24301	-0.42393
I / IB / IB1	Cyclopsetta chittendeni	0.21857	0.11157	0.18930	-0.24347
I / IB / IB1	Halieutichthys aculeatus	0.01803	-0.08497	0.10572	-0.08506
I / IB / IB1	Porichthys porosissimus	0.04279	-0.06479	0.08831	-0.08883
I / IB / IB1	Squilla	0.15465	-0.17684	0.18195	-0.25083
I / IB / IB1	Sicyonia dorsalis	0.20853	-0.17632	0.19251	-0.30175
I / IB / IB1	Parapenaeus	0.23587	0.01520	0.16800	-0.29995
I / IB / IB1	Bollmannia communis	0.24129	-0.07081	0.22692	-0.31047
I / IB / IB1	Antennarius radiosus	0.34242	-0.14140	0.16005	-0.30798
I / IB / IB1	Brotula barbata	0.05404	-0.08540	0.08733	-0.11119
I / IB / IB1	Cynoscion nothus	0.04057	-0.01332	0.09510	-0.07265
I / IB / IB1	Ophichthus gomesii	0.11065	-0.05763	0.12586	-0.20923
I / IB / IB1	Pristipomoides aquilonaris	0.34668	-0.13925	0.14539	-0.25494
I / IB / IB1	Serranus atrobranchus	0.17955	0.05593	0.08947	-0.09853
I / IB / IB1	Steindachneria argentea	0.25132	-0.13760	0.17592	-0.28694
I / IB / IB1	Trachypenaeus	0.13269	-0.12748	0.19416	-0.20859
I / IB / IB1	Portunus gibbesii	0.00206	-0.08460	0.13486	-0.13401
I / IB / IB1	Calappa sulcata	0.08472	-0.04643	0.13766	-0.14761
I / IB / IB1	Prionotus rubio	0.07594	-0.08250	0.15107	-0.15605
I / IB / IB1	Hepatus epheliticus	-0.07610	-0.15660	0.09095	-0.16527
I / IB / IB1	Centropristis philadelphicus	0.37900	-0.01809	0.25102	-0.31909
I / IB / IB1	Etropus crossotus	-0.05080	-0.00981	0.16458	-0.22766
I / IB / IB1	Saurida brasiliensis	0.14672	0.06249	0.08992	-0.09511
I / IB / IB1	Harengula jaguana	-0.05937	-0.20096	0.06835	-0.00902
I / IB / IB2	Penaeus setiferus	-0.13665	-0.11841	0.08729	-0.11589
I / IB / IB2	Citharichthys spilopterus	0.04450	-0.17746	0.07190	-0.06102
I / IB / IB2	Ophidion welshi	-0.08620	-0.07773	0.05637	-0.08344
I / IB / IB2	Sphoeroides parvus	0.00009	-0.00965	0.10062	-0.15552
II / IIA / IIA1	Peprilus burti	-0.08140	-0.10266	0.02194	-0.00648
II / IIA / IIA1	Prionotus tribulus	-0.09682	-0.11286	0.06663	-0.14047
II / IIA / IIA2	Symphurus plagiusa	-0.13846	0.25808	-0.57205	0.19907
II / IIA / IIA2	Penaeus aztecus	-0.09533	0.12736	-0.12775	-0.05931
II / IIA / IIA2	Brevoortia patronus	0.02655	-0.03762	0.02442	-0.05498
II / IIA / IIA2	Leiostomus xanthurus	-0.09603	-0.11766	0.03684	-0.06587
II / IIB / IIB1	Micropogon undulatus	0.34761	-0.11435	0.08809	-0.20987
II / IIB / IIB1	Cynoscion arenarius	-0.00189	-0.13789	0.05695	-0.05439
II / IIB / IIB1	Scomberomorus maculatus	-0.05316	-0.20448	-0.00302	0.12153
II / IIB / IIB1	Trichiurus lepturus	0.00686	0.09198	0.05062	-0.02821
II / IIB / IIB1	Anchoa hepsetus	-0.15721	-0.14577	-0.07195	0.09211
II / IIB / IIB1	Larimus fasciatus	-0.21312	-0.08947	-0.10196	0.07416
II / IIB / IIB2	Anchoa mitchilli	-0.27750	0.03179	-0.49500	0.33308
II / IIB / IIB2	Stellifer lanceolatus	-0.03288	-0.05849	0.04440	-0.02081
II / IIB / IIB2	Polydactylus octonemus	-0.14993	0.05323	-0.30085	0.25537
II / IIB / IIB2	Trinectes maculatus	-0.10178	0.02413	-0.16391	0.16975
II / IIB / IIB2	Callinectes sapidus	-0.06809	0.04939	-0.17938	0.20554
II / IIB / IIB2	Arius felis	-0.26042	-0.01972	-0.04614	0.16056
II / IIB / IIB2	Menticirrhus americanus	-0.18324	-0.01092	-0.23598	0.16095
II / IIB / IIB2	Peprilus paru	-0.03847	0.08096	-0.14063	0.02624
II / IIB / IIB2	Lolliguncula brevis	-0.21304	-0.10875	-0.03296	0.13742
II / IIB / IIB2	Anchoa nasuta	-0.13578	-0.04658	-0.15278	0.17658
II / IIB / IIB2	Chloroscombrus chrysurus	-0.17933	0.03199	-0.39291	0.21908
	Total Taxa	0.46749	0.02185	0.41103	-0.65216
	Total Individuals	0.21687	-0.12788	0.20744	-0.31522
	Diversity	0.39233	0.00888	0.43412	-0.57345
	Richness	0.36913	0.04529	0.38278	-0.52788
	Evenness	0.05451	0.04821	0.26635	-0.16435

The taxa were ordered such that those most characteristic of the shallower depth, lower salinity and higher temperature stations (Sample Group II) were located along the bottom portion of the TWINSPAN display and ordered correlation table (Taxa Group II in Figure 11 and Table 25). Conversely, those taxa that were most characteristic of the deeper waters with higher salinities and lower temperatures (Sample Group I) were located along the middle to upper portions of the TWINSPAN display (Taxa Group I in Figure 11 and Table 25).

Total number of taxa, species diversity and species richness tended to show moderately strong positive relationships with depth and salinity, and moderately strong negative relationships with temperature (Table 25), indicating that the offshore communities tended to be more diverse than those inshore.

Although depth, hydrography and geography were obviously related to the ordering and grouping of samples (and therefore related to community composition), these factors alone did not adequately account for all of the trends evident in the TWINSPAN display, especially those in Sample Group I. The distributions of many demersal nekton species are also strongly related to the characteristics of the sea floor. Because no sediment data were collected during the SEAMAP program, sediment texture was inferred by overlaying a map of the SEAMAP station locations on a recent map of sediment texture in the study area.

The taxa in Taxa Group IA (Solenocera LPIL through Stenotomus caprinus in Figure 11 and Table 25) were virtually restricted to the moderate to deep water stations (Sample Groups IA and IB1). The taxa in Group IA1 were most characteristic of Sample Group IA, with occasional scattered occurrences in Sample Group IB. Some of the taxa most representative of this trend include Loligo pealeii and Sicyonia brevirostris. The taxa in Group IA2 tended to be more widely distributed than those in Group IA1, with many being well represented across Station Groups IA and IB1. Synodus foetens, Penaeus duorarum and Stenotomus caprinus were most indicative of this trend.

As a group, the taxa in Group IA tended to exhibit positive correlations with depth, dissolved oxygen, and salinity and negative correlations with temperature (Table 25). However, in many cases these correlations tended to be weak. Solenocera LPIL, Urophycis floridanus, Portunus spinicarpus, Bellator militaris, Scorpaena calcarata and Synodus foetens exhibited moderately strong positive relationships with depth, and moderate negative relationships with temperature.

The taxa in Group IB were virtually restricted to the stations in Sample Groups IB1 and IB2 (Figures 11 and 12). Some of the taxa most representative of this trend included Callinectes similis, Squilla LPIL, Trachypenaeus LPIL, and Prionotus rubio. Parapenaeus LPIL, Bollmania communis and Steindachneria argentea tended to be restricted in distribution to the moderately deep to deep water stations included in sample Group IB2, whereas Portunus gibbesii, Etropus crossotus, Saurida brasiliensis, Harengula jaguana and Sphoeroides parvus tended to be restricted to the shallow to moderately deep stations represented in Sample Group IB1 (Figure 11 and Table 24). Callinectes similis, Porichthys porosissimus, Squilla LPIL, Trachypenaeus and Prionotus rubio were widely distributed across Group IB stations (Figure 11).

The correlations of the densities of Group IB taxa with environmental variables were greatly similar to those for the Group IA taxa. Most taxa in both groups exhibited positive relationships with depth and salinity, and negative relationships with temperature (Table 25). However, the Group IB taxa generally exhibited stronger negative correlations with temperature and slightly stronger positive correlations with salinity, and also showed consistent but weak negative correlations with dissolved oxygen. These differences reflect the greater depths, lower dissolved oxygen concentrations, higher salinities, and lower temperatures of many of the stations represented by samples in Sample Group IB2 (Table 24). Callinectes similis, Lepophidium graellsi, Hoplunnis macrurus, and Centropristis philadelphicus exhibited moderately strong positive correlations with depth and salinity and moderately strong negative correlations with temperature. Antennarius radiosus and Pristipomoides aquilonaris showed moderately strong positive relationships with depth and negative relationships with temperature. The distributions of the four taxa in Taxa Group IB2 differed from those of the Group IB1 taxa by virtue of their presence at the shallow stations in Group IIA1 (Figures 11 and 12). The distributions of the taxa in Taxa Group IB1 seem to be transitional between those taxa most characteristic of the higher salinity, deep water habitat of Sample Group I and those taxa most characteristic of the lower salinity, shallow water habitat of Sample Group II (Figures 11 and 12). This transition was also evident in the correlations of these taxa with environmental variables, as three of the four taxa showed weak but negative correlations with depth (Table 25).

The taxa in Group IIA tended to be widespread across Sample Groups IB and IIA, but were virtually absent from Sample Groups IA and IIB (Figure 11). In addition, these taxa tended to be less well represented in samples from the deep water, high salinity habitat represented by Sample Group IB2. Peprilus burti, Penaeus aztecus and Leiostomus xanthurus were most representative of the trends in Taxa Group IIA. As with the taxa in Group IB2, the Group IIA taxa mark a transition from those taxa most characteristic of Sample Group I to those taxa most characteristic of Sample Group II. This trend was reflected in the correlations of the Group IIA taxa with environmental variables, with five of the six taxa exhibiting weak negative correlations with depth (Table 25). Symphurus plagiusa exhibited a strong negative correlation with salinity, and moderate positive correlations with dissolved oxygen and temperature.

Many of the taxa in Group IIB tended to be relatively widespread across the study area. However, they were most characteristic of the low salinity, shallow water stations represented by Sample Group II and were generally absent at the high salinity, moderately deep to deep water stations represented by Sample Group IA and (to some extent) Sample Group IB2 (Figures 11 and 12 and Table 24).

The taxa in Group IIB1 tended to be more widespread across the study area than those in Taxa Group IIB2. The Group IIB1 taxa were generally widespread across Sample Groups IB and IIA, but were virtually absent from the stations represented in Sample Groups IA and IIB. Some of the taxa most representative of this trend included Micropogonias undulatus, Cynoscion arenarius, and Anchoa hepsetus. Micropogonias undulatus was the only taxon in Group IIB that was well represented in the high salinity, moderately deep to deep water stations included in Sample Group IB2. Four of the six taxa in Taxa Group IIB1 were negatively correlated with depth, three taxa were negatively correlated with salinity, and three taxa were positively correlated with bottom temperature (Table 25). Micropogonias undulatus exhibited a moderately strong positive correlation with depth and a negative correlation with temperature, reflecting the occurrence of this taxon in the high salinity, deep water habitats of Sample Group IB2.

With the exception of Lolliguncula brevis, the taxa in Group IIB2 were virtually restricted to the shallow water, low salinity, high temperature habitats represented by Sample Group II (Figures 11 and 12 and Table 24). Anchoa mitchilli numerically dominated the community composition at all but five of the stations in Sample Group IIA, but was virtually absent from the stations represented in Sample Group IIB. Anchoa mitchilli (the bay anchovy) is a schooling pelagic species that is usually not collected by bottom trawl gear, except in shallow waters. Callinectes sapidus was well represented in Sample Group IIA, but occurred in only two samples in Group IIB.

Lolliguncula brevis was well represented at many of the samples in Groups IIA, IIB, and IB1. Anchoa nasuta (the longnose anchovy), which was shown to have a very clumped distribution in the relative composition analysis (see Table 22), was virtually restricted to the depauperate samples in Sample Group IIB (Figure 11). As was the case with the bay anchovy, this pelagic species is usually not collected by trawl gear in deeper waters. Chloroscombrus chrysurus was also well represented in the samples in Group IIB, and occurred intermittently across the study area. Along with Anchoa hepsetus (in Taxa Group IIB1, Figure 6) these three Group IIB2 taxa dominated the composition of the community at stations represented in Sample Group IIB1 (Figure 11).

The correlations of the taxa in Group IIB2 with environmental variables (Table 25) confirmed the shallow water association, with all of the taxa being negatively correlated with depth and all but one being negatively correlated with salinity and positively correlated with temperature.

2.5.2 SEAMAP Survey Data, Spring 1983

2.5.2.1 Relative Composition and Abundance

The community composition over all samples combined is summarized in Table 26. A total of 113,389 individuals representing 262 taxa were identified from 156 trawl samples. A hierarchical master taxonomic list for these 262 taxa is shown in Table 27.

As in the 1982 analysis (see Table 22), the community was numerically dominated by a relatively small number of taxa, and the vast majority of the taxa were represented by only a few individuals each (Table 26). Based on pooled percent composition, the top three taxa accounted for greater than 50% of all individuals collected. Based on mean percent composition, the 10 most abundant taxa accounted for greater than 50% of the total cumulative percent composition, and the 44 most abundant taxa accounted

Table 26. Overall relative composition of demersal nekton taxa in single replicate samples collected at 156 stations in and around the Tuscaloosa Trend study area during the spring 1983 SEAMAP groundfish survey.

TAXON NAME	MEAN PERCENT COMPOSITION	CUMULATIVE PERCENT COMPOSITION	POOLED PERCENT COMPOSITION	FREQ. OF OCCURRENCE	CUMULATIVE ABUNDANCE	INDEX OF DISPERSION
Trachypenaeus	12.578	12.578	30.462	0.385	34540.	2058.31
Anchoa mitchilli	10.602	23.181	16.374	0.282	53106.	2179.35
Stenotomus caprinus	6.521	29.702	5.479	0.468	59319.	325.18
Callinectes similis	2.219	31.922	4.011	0.295	63867.	1964.33
Micropogonias undulatus	3.242	35.163	3.322	0.378	67634.	487.63
Sicyonia brevirostris	3.773	38.936	2.411	0.455	70368.	124.51
Penaeus aztecus	2.900	41.835	2.166	0.532	72824.	111.44
Squilla	1.455	43.290	1.972	0.359	75060.	88.32
Loligo pealeii	5.426	48.716	1.860	0.462	77169.	76.15
Penaeus duorarum	2.405	51.121	1.813	0.391	79225.	72.82
Centropristis philadelphicus	2.661	53.783	1.376	0.551	80785.	86.28
Prionotus rubio	0.599	54.382	1.342	0.167	82307.	485.99
Halieutichthys aculeatus	0.866	55.248	1.226	0.301	83697.	131.59
Callinectes sapidus	1.391	56.639	1.223	0.231	85084.	353.73
Cynoscion arenarius	1.064	57.704	1.141	0.397	86378.	143.64
Portunidae	0.507	58.210	1.082	0.038	87605.	457.32
Anchoa hepsetus	3.335	61.545	1.066	0.288	88814.	118.61
Prionotus tribulus	1.305	62.850	0.934	0.340	89873.	88.58
Polydactylus octonemus	2.191	65.041	0.930	0.192	90928.	126.84
Etropus crossotus	1.039	66.080	0.916	0.506	91967.	33.01
Trichiurus lepturus	1.139	67.219	0.867	0.288	92950.	156.46
Anchoa	0.326	67.545	0.845	0.006	93908.	958.00
Lepophidium graellsi	0.586	68.131	0.817	0.269	94834.	117.67
Trachurus lathami	0.757	68.888	0.799	0.173	95740.	386.51
Sicyonia dorsalis	0.393	69.281	0.768	0.122	96611.	118.77
Symphurus plagiusa	0.410	69.691	0.728	0.346	97437.	236.68
Sphoeroides parvus	0.946	70.637	0.686	0.417	98215.	35.91
Diplectrum bivittatum	0.461	71.097	0.624	0.263	98923.	33.84
Syacium papillosum	1.479	72.576	0.619	0.321	99625.	37.33
Prionotus roseus	0.522	73.098	0.579	0.160	100282.	135.55
Prionotus salmonicolor	0.873	73.971	0.494	0.237	100842.	81.79
Urophycis floridanus	0.272	74.243	0.431	0.256	101331.	34.62
Etrumeus teres	1.078	75.321	0.421	0.128	101808.	125.05
Anchoa nasuta	0.685	76.006	0.414	0.058	102277.	110.58
Squilla empusa	0.234	76.239	0.413	0.064	102745.	71.95
Bollmannia communis	0.262	76.502	0.400	0.103	103199.	90.07
Antennarius radiosus	0.263	76.765	0.392	0.109	103643.	107.68
Lolliguncula brevis	0.456	77.221	0.374	0.115	104067.	41.76
Portunus spinicarpus	0.539	77.761	0.356	0.192	104471.	42.28
Syacium gunteri	0.168	77.929	0.327	0.128	104842.	58.71
Prionotus scitulus	1.541	79.470	0.326	0.192	105212.	35.25
Nezumia bairdii	0.250	79.720	0.315	0.032	105569.	98.59
Gunterichthys longipenis	0.181	79.901	0.307	0.051	105917.	132.53
Portunus gibbesii	0.399	80.300	0.281	0.224	106236.	19.65
Penaeus setiferus	0.311	80.611	0.262	0.282	106533.	13.71
Arius felis	1.198	81.809	0.231	0.128	106795.	43.25
Leiostomus xanthurus	0.455	82.264	0.225	0.224	107050.	24.58
Lagodon rhomboides	0.606	82.870	0.208	0.160	107286.	48.06
Solenocera	0.390	83.260	0.201	0.141	107514.	23.78
Harengula jaguana	1.313	84.573	0.195	0.179	107735.	44.85
Ophidion holbrooki	1.191	85.764	0.190	0.231	107950.	12.24
Decapterus punctatus	0.090	85.853	0.177	0.064	108151.	161.41
Hoplunnis macrurus	0.103	85.956	0.148	0.083	108319.	56.09
Haemulon aurolineatum	0.728	86.684	0.133	0.045	108470.	48.10
Synodus foetens	0.340	87.024	0.133	0.327	108621.	4.72
Steindachneria argentea	0.042	87.066	0.132	0.006	108771.	150.00
Ophidion welshi	0.119	87.185	0.124	0.173	108912.	13.97
Menticirrhus americanus	0.102	87.287	0.117	0.096	109045.	28.50
Diplectrum formosum	0.384	87.671	0.116	0.135	109176.	18.92
Scleractinia	0.224	87.895	0.109	0.019	109300.	84.33
Peprilus burti	0.245	88.140	0.105	0.173	109419.	9.59
Porifera	0.209	88.349	0.105	0.051	109538.	84.41
Bellator militaris	0.341	88.690	0.104	0.083	109656.	19.25
Lepophidium jeannae	0.192	88.882	0.104	0.071	109774.	19.11
Trachinocephalus myops	0.426	89.308	0.091	0.147	109877.	12.34
Citharichthys spilopterus	0.158	89.466	0.091	0.154	109980.	10.95
Prionotus martis	0.311	89.777	0.090	0.032	110082.	27.86
Neomerinthe hemingwayi	0.379	90.156	0.087	0.103	110181.	14.07
Peprilus paru	0.104	90.260	0.087	0.026	110280.	56.38
Orthopristis chrysoptera	0.258	90.518	0.086	0.096	110378.	16.76

Table 26. Continued.

TAXON NAME	MEAN PERCENT COMPOSITION	CUMULATIVE PERCENT COMPOSITION	POOLED PERCENT COMPOSITION	FREQ. OF OCCURRENCE	CUMULATIVE ABUNDANCE	INDEX OF DISPERSION
Ovalipes floridanus	0.150	90.668	0.083	0.058	110472.	16.89
Scorpaena calcarata	0.224	90.892	0.080	0.141	110563.	9.67
Porichthys porosissimus	0.194	91.086	0.077	0.179	110650.	10.93
Xanthidae	0.175	91.261	0.074	0.032	110734.	72.50
Urophycis regius	0.268	91.529	0.072	0.109	110816.	8.14
Squilla chydaea	0.074	91.603	0.072	0.032	110898.	33.54
Urophycis cirratus	0.056	91.658	0.069	0.083	110976.	9.20
Parapenaeus	0.058	91.717	0.068	0.019	111053.	48.79
Synodus intermedius	0.301	92.018	0.063	0.071	111124.	9.45
Hepatus epheliticus	0.025	92.043	0.061	0.051	111193.	47.44
Syacium	0.051	92.095	0.060	0.038	111261.	30.91
Lutjanus campechanus	0.102	92.197	0.056	0.103	111324.	9.77
Serranus atrobranchus	0.061	92.258	0.054	0.109	111385.	5.36
Cyclopsetta chittendeni	0.051	92.309	0.054	0.071	111446.	28.96
Chloroscombrus chrysurus	0.175	92.484	0.052	0.058	111505.	22.05
Portunus spinimanus	0.066	92.550	0.051	0.077	111563.	15.07
Hoplunnis	0.029	92.579	0.051	0.019	111621.	43.88
Rhomboplites aurorubens	0.127	92.706	0.050	0.032	111678.	30.02
Ophidion grayi	0.113	92.819	0.050	0.103	111735.	5.26
Saurida brasiliensis	0.085	92.904	0.049	0.147	111791.	4.35
Ogcocephalus	0.169	93.073	0.044	0.096	111841.	17.55
Soleracia	0.218	93.291	0.044	0.006	111891.	50.00
Haemulon plumieri	0.218	93.509	0.044	0.006	111941.	50.00
Prionotus stearnsi	0.084	93.593	0.042	0.083	111989.	5.06
Eucinostomus gula	0.047	93.640	0.041	0.038	112035.	11.47
Citharichthys	0.194	93.834	0.037	0.045	112077.	8.36
Larimus fasciatus	0.051	93.885	0.037	0.071	112119.	10.56
Ovalipes guadulpensis	0.121	94.006	0.035	0.109	112159.	2.91
Lepophidium	0.051	94.057	0.033	0.019	112196.	17.31
Ovalipes	0.078	94.134	0.033	0.038	112233.	12.85
Gymnothorax nigromarginatus	0.017	94.151	0.032	0.026	112269.	14.47
Calappa sulcata	0.014	94.165	0.029	0.090	112302.	4.94
Pagrus sedecim	0.128	94.293	0.027	0.026	112333.	13.66
Tagelus	0.009	94.302	0.027	0.006	112364.	31.00
Monacanthus hispidus	0.081	94.383	0.026	0.090	112394.	2.69
Lepophidium brevibarbe	0.004	94.387	0.026	0.006	112423.	29.00
Pristipomoides aquilonaris	0.035	94.423	0.024	0.045	112450.	6.35
Aequipecten	0.121	94.544	0.023	0.019	112476.	22.21
Prionotus carolinus	0.026	94.570	0.023	0.013	112502.	22.28
Asteroidea	0.116	94.686	0.022	0.051	112527.	7.53
Dasyatis sabina	0.650	95.336	0.022	0.019	112552.	14.37
Scorpaena brasiliensis	0.098	95.434	0.022	0.032	112577.	9.14
Mellitidae	0.057	95.491	0.022	0.038	112602.	10.19
Prionotus paralatus	0.048	95.539	0.020	0.051	112625.	5.50
Ophichthus gomesii	0.010	95.548	0.020	0.026	112648.	9.61
Lagocephalus laevigatus	0.012	95.561	0.019	0.026	112670.	9.10
Stellifer lanceolatus	0.060	95.620	0.019	0.038	112692.	4.80
Centropristis ocyurus	0.094	95.715	0.019	0.006	112713.	21.00
Phaeoptyx conklini	0.009	95.724	0.019	0.013	112734.	19.08
Scomberomorus maculatus	0.026	95.749	0.019	0.032	112755.	10.17
Holothuroidea	0.084	95.833	0.018	0.019	112775.	14.67
Apogonidae	0.029	95.862	0.017	0.006	112794.	19.00
Sphoeroides spengleri	0.169	96.031	0.016	0.045	112812.	4.58
Brevoortia patronus	1.925	97.956	0.016	0.032	112830.	6.59
Paralichthys lethostigma	0.034	97.990	0.016	0.032	112848.	6.71
Kathetostoma albigutta	0.054	98.044	0.015	0.071	112865.	1.61
Brotula barbata	0.009	98.053	0.015	0.058	112882.	3.74
Raja eglanteria	0.074	98.127	0.014	0.077	112898.	1.53
Ogcocephalus nasutus	0.003	98.130	0.014	0.026	112914.	7.32
Gymnachirus texae	0.017	98.148	0.012	0.019	112928.	7.82
Microspathodon chrysurus	0.037	98.185	0.012	0.019	112942.	5.23
Serranus phoebe	0.025	98.209	0.012	0.019	112956.	8.97
Archosargus probatocephalus	0.036	98.245	0.011	0.013	112969.	11.14
Citharichthys macrops	0.013	98.259	0.011	0.051	112982.	3.25
Synodus poeyi	0.047	98.305	0.011	0.038	112994.	2.94
Luidia	0.047	98.352	0.011	0.019	113006.	6.13
Nettastomatidae	0.031	98.383	0.011	0.026	113018.	4.12
Gymnothorax	0.033	98.417	0.010	0.058	113029.	1.67
Scyllarides nodifer	0.023	98.439	0.008	0.032	113038.	2.29
Equetus umbrosus	0.027	98.466	0.008	0.032	113047.	2.07
Metapenaeopsis goodei	0.020	98.486	0.008	0.019	113056.	3.18
Selene setapinnis	0.025	98.511	0.008	0.045	113065.	1.40

Table 26. Continued.

TAXON NAME	MEAN PERCENT COMPOSITION	CUMULATIVE PERCENT COMPOSITION	POOLED PERCENT COMPOSITION	FREQ. OF OCCURRENCE	CUMULATIVE ABUNDANCE	INDEX OF DISPERSION
Otophidium omostigmum	0.040	98.550	0.007	0.032	113073.	1.71
Gobionellus hastatus	0.008	98.558	0.006	0.026	113080.	2.69
Apogon pseudomaculatus	0.016	98.574	0.006	0.013	113087.	3.55
Sphoeroides dorsalis	0.041	98.616	0.006	0.032	113094.	1.54
Etrumeus	0.003	98.619	0.006	0.013	113101.	5.27
Porcellanidae	0.011	98.629	0.006	0.006	113108.	7.00
Acanthostracion quadricornis	0.016	98.646	0.006	0.038	113115.	1.25
Bairdiella chrysura	0.005	98.651	0.006	0.038	113122.	1.25
Libinia dubia	0.006	98.657	0.006	0.032	113129.	1.54
Paguridae	0.026	98.682	0.006	0.032	113136.	1.82
Aurelia	0.034	98.716	0.005	0.026	113142.	1.64
Selar crumenophthalmus	0.015	98.731	0.005	0.006	113148.	6.00
Dromidia antillensis	0.011	98.742	0.005	0.013	113154.	4.32
Aplysia	0.025	98.766	0.005	0.026	113160.	1.97
Pagrus pagrus	0.019	98.786	0.005	0.013	113166.	2.98
Gymnachirus melas	0.024	98.810	0.005	0.038	113172.	0.97
Ancylopsetta quadrocellata	0.024	98.834	0.005	0.038	113178.	0.97
Trinectes maculatus	0.002	98.836	0.004	0.019	113183.	2.18
Serraniculus pumilio	0.004	98.840	0.004	0.019	113188.	2.18
Upeneus parvus	0.015	98.855	0.004	0.019	113193.	2.18
Aluterus heudeloti	0.017	98.872	0.004	0.026	113198.	1.38
Eucinostomus argenteus	0.003	98.875	0.004	0.013	113202.	2.49
Calappa	0.007	98.883	0.004	0.019	113206.	1.48
Pectinidae	0.015	98.897	0.004	0.013	113210.	2.49
Bregmaceros atlanticus	0.004	98.901	0.004	0.026	113214.	0.98
Bregmaceros	0.007	98.908	0.004	0.013	113218.	1.99
Clypeaster	0.003	98.911	0.004	0.006	113222.	4.00
Prionotus ophryas	0.006	98.916	0.004	0.013	113226.	2.49
Narcine brasiliensis	0.011	98.927	0.004	0.026	113230.	0.98
Hemanthias vivanus	0.013	98.940	0.004	0.006	113234.	4.00
Rhinoptera bonasus	0.658	99.598	0.004	0.026	113238.	0.98
Calappa flammea	0.009	99.607	0.004	0.026	113242.	0.98
Chaetodon ocellatus	0.009	99.616	0.004	0.013	113246.	2.49
Hepatus	0.004	99.620	0.004	0.013	113250.	2.49
Symphurus diomedianus	0.007	99.628	0.004	0.026	113254.	0.98
Symphurus civitatus	0.001	99.628	0.003	0.013	113257.	1.66
Scorpaena dispar	0.007	99.636	0.003	0.006	113260.	3.00
Chaetodon sedentarius	0.005	99.640	0.003	0.006	113263.	3.00
Podochela sidneyi	0.022	99.662	0.003	0.006	113266.	3.00
Calamus bajonado	0.006	99.668	0.003	0.013	113269.	1.66
Cyclopsetta fimbriata	0.006	99.674	0.003	0.013	113272.	1.66
Chaetodipterus faber	0.015	99.690	0.003	0.019	113275.	0.99
Scyllarides	0.032	99.722	0.003	0.013	113278.	1.66
Syngnathus louisianae	0.006	99.728	0.003	0.019	113281.	0.99
Metoporhaphis calcarata	0.002	99.730	0.003	0.019	113284.	0.99
Gobiesox strumosus	0.000	99.731	0.003	0.006	113287.	3.00
Etropus	0.003	99.734	0.003	0.006	113290.	3.00
Xiphopeneus kroyeri	0.003	99.737	0.003	0.013	113293.	1.66
Caranx hippos	0.002	99.739	0.003	0.019	113296.	0.99
Astroscopus y-graecum	0.004	99.744	0.002	0.013	113298.	0.99
Ovalipes ocellatus	0.003	99.746	0.002	0.006	113300.	2.00
Dasyatis sayi	0.002	99.748	0.002	0.006	113302.	2.00
Cynoscion nothus	0.007	99.755	0.002	0.013	113304.	0.99
Raja texana	0.006	99.761	0.002	0.013	113306.	0.99
Prionotus	0.001	99.761	0.002	0.013	113308.	0.99
Scyllaridae	0.005	99.766	0.002	0.006	113310.	2.00
Congrina flava	0.003	99.769	0.002	0.013	113312.	0.99
Echinoidea	0.006	99.775	0.002	0.013	113314.	0.99
Caulolatilus intermedius	0.003	99.778	0.002	0.013	113316.	0.99
Lyropecten nodosus	0.006	99.784	0.002	0.013	113318.	0.99
Aluterus schoepfi	0.006	99.790	0.002	0.013	113320.	0.99
Ophiuroidea	0.006	99.796	0.002	0.013	113322.	0.99
Octopus	0.012	99.807	0.002	0.013	113324.	0.99
Canthigaster rostrata	0.003	99.811	0.002	0.006	113326.	2.00
Hypsoblennius hentzi	0.007	99.818	0.002	0.006	113328.	2.00
Gastropsetta frontalis	0.007	99.825	0.002	0.013	113330.	0.99
Sardinella anchovia	0.010	99.835	0.002	0.013	113332.	0.99
Porichthys pauciradiatus	0.000	99.836	0.002	0.006	113334.	2.00
Achirus lineatus	0.002	99.837	0.002	0.013	113336.	0.99
Rhizoprionodon terraenovae	0.003	99.840	0.002	0.013	113338.	0.99
Equetus lanceolatus	0.007	99.847	0.002	0.013	113340.	0.99
Scyllarus	0.013	99.861	0.002	0.013	113342.	0.99

Table 26. Continued.

TAXON NAME	MEAN PERCENT COMPOSITION	CUMULATIVE PERCENT COMPOSITION	POOLED PERCENT COMPOSITION	FREQ. OF OCCURRENCE	CUMULATIVE ABUNDANCE	INDEX OF DISPERSION
Ogcocephalus radiatus	0.000	99.861	0.001	0.006	113343.	1.00
Persephona punctata	0.001	99.862	0.001	0.006	113344.	1.00
Echiophis	0.006	99.868	0.001	0.006	113345.	1.00
Polinices duplicatus	0.001	99.869	0.001	0.006	113346.	1.00
Balistes capriscus	0.004	99.873	0.001	0.006	113347.	1.00
Caranx fusus	0.000	99.874	0.001	0.006	113348.	1.00
Chilomycterus schoepfi	0.003	99.877	0.001	0.006	113349.	1.00
Carapus bermudensis	0.004	99.881	0.001	0.006	113350.	1.00
Fasciolaria	0.004	99.885	0.001	0.006	113351.	1.00
Epinephelus flavolimbatus	0.005	99.890	0.001	0.006	113352.	1.00
Lutjanus griseus	0.002	99.891	0.001	0.006	113353.	1.00
Paralichthys squamilentus	0.001	99.892	0.001	0.006	113354.	1.00
Apogon aurolineatus	0.003	99.895	0.001	0.006	113355.	1.00
Anchoa lyolepis	0.001	99.896	0.001	0.006	113356.	1.00
Bothus robinsi	0.004	99.900	0.001	0.006	113357.	1.00
Dorosoma petenense	0.002	99.902	0.001	0.006	113358.	1.00
Mellita quinquiesperforata	0.001	99.904	0.001	0.006	113359.	1.00
Paralichthys albigutta	0.001	99.905	0.001	0.006	113360.	1.00
Ophichthus	0.003	99.908	0.001	0.006	113361.	1.00
Holacanthus bermudensis	0.003	99.911	0.001	0.006	113362.	1.00
Sphyraena guachancho	0.005	99.915	0.001	0.006	113363.	1.00
Microgobius thalassinus	0.008	99.923	0.001	0.006	113364.	1.00
Sphyrna lewini	0.000	99.923	0.001	0.006	113365.	1.00
Seriola zonata	0.006	99.929	0.001	0.006	113366.	1.00
Myctophum affine	0.001	99.930	0.001	0.006	113367.	1.00
Anchoviella perfasciata	0.003	99.933	0.001	0.006	113368.	1.00
Pecten	0.004	99.937	0.001	0.006	113369.	1.00
Equetus punctatus	0.000	99.937	0.001	0.006	113370.	1.00
Anthozoa	0.001	99.938	0.001	0.006	113371.	1.00
Calamus nodosus	0.004	99.942	0.001	0.006	113372.	1.00
Rypticus maculatus	0.004	99.947	0.001	0.006	113373.	1.00
Gobionellus oceanicus	0.001	99.948	0.001	0.006	113374.	1.00
Parexocoetus brachypterus	0.019	99.966	0.001	0.006	113375.	1.00
Dormitator maculatus	0.000	99.967	0.001	0.006	113376.	1.00
Stenorhynchus	0.001	99.968	0.001	0.006	113377.	1.00
Petrochirus diogenes	0.001	99.968	0.001	0.006	113378.	1.00
Octopus vulgaris	0.001	99.969	0.001	0.006	113379.	1.00
Ophichthus ocellatus	0.001	99.970	0.001	0.006	113380.	1.00
Alpheidae	0.003	99.974	0.001	0.006	113381.	1.00
Busycon contrarium	0.001	99.975	0.001	0.006	113382.	1.00
Aulostomus maculatus	0.005	99.980	0.001	0.006	113383.	1.00
Bothus	0.003	99.982	0.001	0.006	113384.	1.00
Calappa angusta	0.000	99.983	0.001	0.006	113385.	1.00
Xiphopeneus	0.001	99.984	0.001	0.006	113386.	1.00
Luidia clathrata	0.003	99.987	0.001	0.006	113387.	1.00
Fasciolaria tulipa	0.009	99.996	0.001	0.006	113388.	1.00
Priacanthus arenatus	0.004	100.000	0.001	0.006	113389.	1.00
Ectoprocta	0.000	100.000	0.000	0.006	113389.	******

SAMPLE SUMMARY: SAMPLES = 156 TOTAL TAXA = 262

Table 27. Hierarchical list of demersal nekton taxa collected in single replicate samples at 156 stations in and around the Tuscaloosa Trend study area during the spring 1983 SEAMAP groundfish survey.

	Arthropoda	58
	Crustacea	61
	Decapoda	6175
	Penaeidae	617701
*	Metapenaeopsis goodei	6177010301
*	Parapenaeus	61770105
*	Penaeus aztecus	6177010101
*	Penaeus duorarum	6177010102
*	Penaeus setiferus	6177010103
*	Sicyonia brevirostris	6177010401
*	Sicyonia dorsalis	6177010402
*	Solenocera	61770106
*	Trachypenaeus	61770102
*	Xiphopeneus	61770107
*	Xiphopeneus kroyeri	6177010701
*	Scyllaridae	618202
*	Scyllarides	61820202
*	Scyllarides nodifer	6182020202
*	Scyllarus	61820201
*	Paguridae	618306
*	Petrochirus diogenes	6183061201
*	Porcellanidae	618312
*	Portunidae	618901
*	Callinectes sapidus	6189010301
*	Callinectes similis	6189010302
*	Ovalipes	61890105
*	Ovalipes floridanus	6189010501
*	Ovalipes guadulpensis	61890105??
*	Ovalipes ocellatus	6189010502
*	Portunus gibbesii	6189010601
*	Portunus spinicarpus	6189010603
*	Portunus spinimanus	6189010604
*	Xanthidae	618902
	Dromiidae	618502
*	Dromidia antillensis	6185020301
	Majidae	618701
*	Libinia dubia	6187010901
*	Metoporhaphis calcarata	6187011801
*	Podochela sidneyi	6187011902
*	Stenorhynchus	61870117
	Calappidae	618602
*	Calappa	61860201
*	Calappa angusta	6186020105
*	Calappa flammea	6186020101
*	Calappa sulcata	6186020102
*	Hepatus	61860202
*	Hepatus epheliticus	6186020201
	Leucosiidae	618603
*	Persephona punctata	6186030101
*	Alpheidae	617914
	Palaemonidae	617911
*	Macrobrachium ohione	6179110201

Table 27. Continued.

	Stomatopoda	6191
	Squillidae	619101
*	Squilla	61910101
*	Squilla chydaea	6191010102
*	Squilla empusa	6191010101
	Mollusca	5085
	Bivalvia	55
	Pterioida	5508
*	Pectinidae	550905
*	Aequipecten	55090508
*	Lyropecten nodosus	5509051301
*	Pecten	55090504
	Veneroida	5515
	Sanguinolariidae	551533
*	Tagelus	55153302
	Cephalopoda	57
	Theuthidida	5705
	Myopsida	5706
	Loliginidae	570601
*	Loligo pealeii	5706010102
*	Lolliguncula brevis	5706010201
	Octopodida	5708
	Octopodidae	570801
*	Octopus vulgaris	5708010202
	Gastropoda	51
	Anaspidea	5124
	Aplysiidae	512402
*	Aplysia	51240202
	Mesogastropoda	5103
	Naticidae	510376
*	Polinices duplicatus	5103760407
	Stenoglossa	5105
	Fasciolariidae	510509
*	Fasciolaria	51050902
*	Fasciolaria tulipa	5105090202
	Melongenidae	510507
*	Busycon contrarium	5105070104
*	Volutidae	510513
*	Scaphella junonia	5105130201
	Echinodermata	81
*	Asteroidea	8104
	Spinulosida	8112
	Clypeasteridae	815301
*	Clypeaster	81530101
*	Echinoidea	8136
	Clypeasteroida	8152
*	Mellitidae	815504
*	Mellita quinquiesperforata	8155040101

Table 27. Continued.

*	Holothuroidea	8170
*	Ophiuroidea	8120
	Stelleroidea	8101
	Platyasterida	8105
	Luidiidae	810501
*	Luidia	81050101
*	Luidia clathrata	8105010102
*	Porifera	36
	Cnidaria	37
*	Anthozoa	3740
*	Scleractinia	3764
	Scyphozoa	3730
	Semaeostomeae	3734
	Ulmaridae	373403
*	Aurelia	37340302
*	Ectoprocta	78
	Chordata	8388
	Antennarioidei	8787
	Antennariidae	878702
*	Antennarius radiosus	8787020203
	Ogcocephalidae	878704
*	Halieutichthys aculeatus	8787040301
*	Ogcocephalus	87870401
*	Ogcocephalus nasutus	8787040103
*	Ogcocephalus radiatus	8787040106
	Aulostomoidei	8819
	Fistulariidae	881902
	Aulostomidae	881901
*	Aulostomus maculatus	8819010101
	Balistoidei	8860
	Balistidae	886002
*	Aluterus heudeloti	8860020102
*	Aluterus schoepfi	8860020101
*	Balistes capriscus	8860020201
*	Monacanthus hispidus	8860020703
	Ostraciontidae	886003
*	Acanthostracion quadricornis	8860030201
	Batrachoidiformes	8783
	Batrachoididae	878301
*	Porichthys pauciradiatus	8783010105
*	Porichthys porosissimus	8783010106

Table 27. Continued.

	Exocoetoidei	8803
	Exocoetidae	880301
*	Parexocoetus brachypterus	8803011101
	Myctophoidei	8762
	Myctophidae	876214
*	Myctophum affine	8762141501
	Synodontidae	876202
*	Saurida brasiliensis	8762020301
*	Synodus foetens	8762020101
*	Synodus intermedius	8762020102
*	Synodus poeyi	8762020104
*	Trachinocephalus myops	8762020401
	Osteichthyes	8717
	Anguilliformes	8740
	Congridae	874112
*	Congrina flava	8741120302
*	Ophichthus	87411310
*	Ophichthus gomesii	8741131001
*	Ophichthus ocellatus	8741131003
	Muraenesocidae	874108
*	Hoplunnis	87410801
*	Hoplunnis macrurus	8741080102
	Muraenidae	874105
*	Gymnothorax	87410504
*	Gymnothorax nigromarginatus	8741050404
*	Nettastomatidae	874110
	Ophichthidae	874113
*	Echiophis	874113??
	Clupeiformes	8745
	Clupeidae	874701
*	Brevoortia patronus	8747010403
*	Dorosoma cepedianum	8747010501
*	Dorosoma petenense	8747010502
*	Etrumeus	87470106
*	Etrumeus teres	8747010601
*	Harengula jaguana	8747010803
*	Sardinella anchovia	8747011003
	Engraulidae	874702
*	Anchoa	87470202
*	Anchoa hepsetus	8747020201
*	Anchoa lyolepis	8747020205
*	Anchoa mitchilli	8747020202
*	Anchoa nasuta	8747020206
*	Anchoviella perfasciata	8747020304
	Gadiformes	8789
	Bregmacerotidae	879102
*	Bregmaceros	87910201
*	Bregmaceros atlanticus	8791020101
	Carapidae	879202
*	Carapus bermudensis	8792020101
	Gadidae	879103
*	Urophycis cirratus	8791031005
*	Urophycis floridanus	8791031007
*	Urophycis regius	8791031002

Table 27. Continued.

	Macrouridae	879401
*	Nezumia bairdii	8794010802
	Merlucciidae	879104
*	Steindachneria argentea	8791040201
	Ophidiidae	879201
*	Brotula barbata	8792010401
*	Gunterichthys longipenis	8792012301
*	Lepophidium	87920105
*	Lepophidium brevibarbe	8792010502
*	Lepophidium graellsi	8792010504
*	Lepophidium jeannae	8792010505
*	Ophidion grayi	8792010602
*	Ophidion holbrooki	8792010603
*	Ophidion welshi	8792010605
*	Otophidium omostigmum	8792010701
	Gobiesociformes	8784
	Gobiesocidae	878401
*	Gobiesox strumosus	8784010102
	Perciformes	8834
	Blenniidae	884201
*	Hypsoblennius hentzi	8842010201
	Carangidae	883528
*	Caranx fusus	8835280302
*	Caranx hippos	8835280303
*	Chloroscombrus chrysurus	8835280401
*	Decapterus punctatus	8835281202
*	Selar crumenophthalmus	8835280601
*	Selene setapinnis	88352807??
*	Seriola zonata	8835280804
*	Trachurus lathami	8835280102
	Gobiidae	884701
*	Bollmannia communis	8847011601
*	Dormitator maculatus	8847013302
*	Gobionellus hastatus	8847010502
*	Gobionellus oceanicus	8847010503
*	Microgobius thalassinus	8847010702
*	Apogonidae	883518
*	Apogon aurolineatus	8835180104
*	Apogon pseudomaculatus	8835180110
*	Phaeoptyx conklini	8835180501
	Branchiostegidae	883522
*	Caulolatilus intermedius	8835220103
	Chaetodonidae	883555
*	Chaetodon ocellatus	8835550101
*	Chaetodon sedentarius	8835550107
*	Holacanthus bermudensis	8835550304
	Ephippidae	883552
*	Chaetodipterus faber	8835520101
	Gerridae	883539
*	Eucinostomus argenteus	8835390101
*	Eucinostomus gula	8835390102
	Grammistidae	883503
*	Rypticus maculatus	8835030204

Table 27. Continued.

	Lutjanidae	883536
*	Lutjanus campechanus	8835360107
*	Lutjanus griseus	8835360102
*	Pristipomoides aquilonaris	8835360701
*	Rhomboplites aurorubens	8835360501
	Mullidae	883545
*	Upeneus parvus	8835450402
	Pomacentridae	883562
*	Microspathodon chrysurus	8835620401
	Pomadasyidae	883540
*	Haemulon aurolineatum	8835400101
*	Haemulon plumieri	8835400102
*	Orthopristis chrysoptera	8835400201
	Priacanthidae	883517
*	Priacanthus arenatus	8835170101
	Sciaenidae	883544
*	Bairdiella chrysura	8835440301
*	Cynoscion arenarius	8835440106
*	Cynoscion nothus	8835440103
*	Equetus lanceolatus	8835441202
*	Equetus punctatus	8835441205
*	Equetus umbrosus	8835441206
*	Larimus fasciatus	8835440501
*	Leiostomus xanthurus	8835440401
*	Menticirrhus americanus	8835440601
*	Micropogonias undulatus	8835440701
*	Stellifer lanceolatus	8835441001
	Serranidae	883502
*	Centropristis ocyurus	8835020304
*	Centropristis philadelphicus	8835020305
*	Diplectrum bivittatum	8835021005
*	Diplectrum formosum	8835021002
*	Epinephelus flavolimbatus	8835020405
*	Hemanthias vivanus	8835021202
*	Serraniculus pumilio	8835022201
*	Serranus atrobranchus	8835022302
*	Serranus phoebe	8835022308
	Sparidae	883543
*	Archosargus probatocephalus	8835430301
*	Calamus bajonado	8835430502
*	Calamus nodosus	8835430506
*	Lagodon rhomboides	8835430201
*	Pagrus pagrus	8835430601
*	Pagrus sedecim	8835430602
*	Stenotomus caprinus	8835430102
	Scombridae	885003
*	Scomberomorus maculatus	8850030502
	Cynoglossidae	885802
*	Symphurus civitatus	8858020102
*	Symphurus diomedianus	8858020103
*	Symphurus plagiusa	8858020101
	Soleidae	885801
*	Achirus lineatus	8858010202
*	Gymnachirus melas	8858010301
*	Gymnachirus texae	8858010303
*	Trinectes maculatus	8858010101

Table 27. Continued.

	Pleuronectoidei	8857
	Bothidae	885703
*	Ancylopsetta quadrocellata	8857030506
*	Bothus	88570306
*	Bothus robinsi	8857030604
*	Citharichthys	88570301
*	Citharichthys macrops	8857030109
*	Citharichthys spilopterus	8857030110
*	Cyclopsetta chittendeni	8857030801
*	Cyclopsetta fimbriata	8857030802
*	Etropus	88570302
*	Etropus crossotus	8857030201
*	Gastropsetta frontalis	8857031001
*	Paralichthys albigutta	8857030302
*	Paralichthys lethostigma	8857030304
*	Paralichthys squamilentus	8857030306
*	Syacium	88570313
*	Syacium gunteri	8857031301
*	Syacium papillosum	8857031303
	Polynemoidei	8838
*	Polydactylus octonemus	8838010101
	Rajiformes	8713
	Dasyatidae	871305
*	Dasyatis sabina	8713050105
*	Dasyatis sayi	8713050106
	Myliobatidae	871307
*	Rhinoptera bonasus	8713070301
	Rajidae	871304
*	Raja eglanteria	8713040113
*	Raja texana	8713040133
	Torpedinidae	871303
*	Narcine brasiliensis	8713030401
	Scombroidei	8850
	Trichiuridae	885002
*	Trichiurus lepturus	8850020201
	Scorpaenoidei	8826
	Scorpaenidae	882601
*	Neomerinthe hemingwayi	8826010402
*	Scorpaena brasiliensis	8826010605
*	Scorpaena calcarata	8826010606
*	Scorpaena dispar	8826010607
	Triglidae	882602
*	Bellator militaris	8826020203
*	Prionotus	88260201
*	Prionotus carolinus	8826020101
*	Prionotus martis	8826020111
*	Prionotus ophryas	8826020113
*	Prionotus paralatus	8826020114
*	Prionotus roseus	8826020117
*	Prionotus rubio	8826020118
*	Prionotus salmonicolor	8826020120
*	Prionotus scitulus	8826020103
*	Prionotus stearnsi	8826020121
*	Prionotus tribulus	8826020104

Table 27. Continued.

	Scyliorhinoidei	8708
	Carcharhinidae	870802
*	Rhizoprionodon terraenovae	8708020301
	Sphyrnidae	870803
*	Sphyrna lewini	8708030103
	Siluriformes	8777
	Ariidae	877718
*	Arius felis	8777180202
	Sphyraenoidei	8837
	Sphyraenidae	883701
*	Sphyraena guachancho	8837010103
	Stromateoidei	8851
	Stromateidae	885103
*	Peprilus burti	8851030104
*	Peprilus paru	8851030102
	Syngnathoidei	8820
	Syngnathidae	882002
*	Syngnathus louisianae	8820020104
	Tetradontoidei	8861
	Diodontidae	886103
*	Chilomycterus schoepfi	8861030101
	Tetraodontidae	886101
*	Canthigaster rostrata	8861010401
*	Lagocephalus laevigatus	8861010101
*	Sphoeroides dorsalis	8861010205
*	Sphoeroides nephelus	8861010208
*	Sphoeroides parvus	8861010210
*	Sphoeroides spengleri	8861010211
	Trachinoidei	8840
	Uranoscopidae	884014
*	Astroscopus y-graecum	8840140102
*	Kathetostoma albigutta	8840140301
	Miscellaneous taxa	
	Paramuriceidae	375103
*	Scleracis	37510304

for 80% of the cumulative percent composition. None of the taxa in the community were widely distributed, as only Penaeus aztecus, Centropristis philadelphicus, and Etropus crossotus were collected in more than 50% of the samples. Trachypenaeus LPIL, Anchoa mitchilli, and Callinectes similis had very clumped distributions (indices of dispersion of 2058, 2179, and 1964, respectively).

As in the 1982 data, Trachypenaeus LPIL was the most abundant taxon, accounting for 30% of the pooled percent composition, followed by Anchoa mitchilli, which accounted for 16% of the pooled percent composition. Stenotomus caprinus, Callinectes similis, Micropogonias undulatus, Sicyonia brevirostris, Penaeus aztecus, and Squilla LPIL each accounted for 2% or greater of the pooled percent composition. Taxa found in greater than 40% but less than 50% of the samples included Callinectes similis, Sicyonia brevirostris, Loligo pealeii, and Sphoeroides parvus, while those collected in greater than 30% but less than 40% of the samples included Trachypenaeus LPIL, Micropogonias undulatus, Squilla LPIL, Penaeus duorarum, Halieutichthys aculeatus, Cynoscion arenarius, Prionotus tribulus, Symphurus plagiusa, Syacium papillosum and Synodus foetens. For the most part, the communities were very similar over the two fall seasons (Tables 22 and 26).

2.5.2.2 Two-Way Indicator Species Analysis

As in the 1982 SEAMAP analysis, the relative percent composition and abundance table and other exploratory techniques were utilized in the selection of the taxa to be included in subsequent community analyses. Based on the results shown in Table 26, all taxa which occurred in two or fewer samples were removed from further consideration. This resulted in the removal of 106 taxa from the original list of 262, with the remaining 156 taxa being subjected to further analysis. This suite of 156 taxa was reduced to a more workable level by utilizing the results of a preliminary TWINSPAN analysis (not presented) to exclude the taxa that were not showing ecologically meaningful trends. Of the 156 numerically abundant taxa selected from the relative composition analysis, 90 taxa were ultimately selected for inclusion in the detailed community analysis.

After the suite of 90 taxa were selected, a final TWINSPAN analysis was run (Figure 13). A map showing the affinities of the 156 samples to the six most meaningful TWINSPAN sample groups (in Figure 13) is presented in Figure 14. Table 28 presents values for environmental variables and community parameters in each sample, with the samples ordered and grouped in the same manner as in the corresponding TWINSPAN display (Figure 13). Table 29 presents the Pearson product-moment correlation coefficients of the density of each taxa and the values for community indices in each sample with environmental variables, with the taxa ordered and grouped in the same manner as in the corresponding TWINSPAN display (Figure 13). Examination of Figures 13 and 14 and Tables 28 and 29 in concert helps identify environmental trends most related to the ordering and grouping of the samples and taxa.

As in the analysis of the 1982 SEAMAP data discussed above (Figure 11), the ordering and grouping of the samples and taxa in the TWINSPAN display (Figure 13) appears to be most related to hydrography, depth and

Table 28. Ordered table of environmental and community parameters for single replicate samples collected at 156 stations in and around the Tuscaloosa Trend study area during the spring 1983 SEAMAP groundfish survey.

Station Group	Cruise	Site	Date	Latitude (DDMMSS)	Longitude (DDMMSS)	Depth (m)	Bottom Dissolved Oxygen (ppm)	Bottom Salinity (ppt)	Bottom Temperature (oC)	Total Taxa	Total Count	Diversity (H')	Evenness (J')	Richness (D)
I / IA / IA1	135	108 1	04JUN83	29 53 00	86 17 00	66	4.9	36.28	19.83	23	279	1.669	0.532	3.907
	135	111 1	09JUN83	29 26 00	87 57 00	64	8.5	36.18	19.20	20	139	1.858	0.620	3.850
	001	116 1	30JUN83	29 43 00	87 59 00	42	7.4	36.00	22.50	14	544	1.219	0.462	2.064
	001	114 1	30JUN83	29 32 00	87 58 00	48	6.6	36.00	21.00	19	1005	0.725	0.246	2.604
	001	115 1	30JUN83	29 33 00	87 30 00	55	7.4	36.00	21.00	27	665	1.621	0.492	4.000
	001	117 1	30JUN83	29 49 00	87 44 00	36	6.8	35.00	21.90	17	326	1.574	0.555	2.765
	135	129 1	09JUN83	29 23 00	88 20 00	55	7.2	36.95	19.00	15	111	1.097	0.405	2.973
	135	109 1	04JUN83	29 56 00	86 16 00	55	4.9	36.39	19.83	30	357	1.827	0.537	4.934
	001	113 1	29JUN83	29 31 00	87 30 00	70	7.1	36.00	20.50	4	5	1.332	0.961	1.864
	135	100 1	03JUN83	29 28 00	85 53 00	46	5.3	36.32	20.79	46	422	2.654	0.701	7.113
	135	101 1	05JUN83	29 59 00	86 00 00	31	5.1	35.71	20.93	38	216	2.903	0.798	6.883
	001	112 1	29JUN83	29 29 00	87 36 00	80	7.6	35.00	21.00	9	19	1.984	0.904	2.717
	001	118 1	30JUN83	29 50 00	87 21 00	46	7.0	35.00	21.80	12	87	1.203	0.484	2.463
	001	119 1	28JUN83	29 56 00	87 17 00	50	7.0	35.00	22.00	25	160	2.215	0.688	4.729
	001	120 1	29JUN83	29 57 00	87 19 00	32	7.2	35.00	23.00	11	192	0.869	0.362	1.902
	001	121 1	28JUN83	29 57 00	87 07 00	90	7.1	38.00	20.00	26	264	2.505	0.769	4.484
	135	176 1	05JUN83	30 06 00	85 52 00	26	5.2	35.88	20.41	26	190	2.199	0.675	4.765
	135	179 1	06JUN83	30 06 00	86 33 00	40	8.6	36.18	20.26	14	107	2.052	0.777	2.782
	135	180 1	03JUN83	30 07 00	86 57 00	42	5.0	36.29	19.48	18	160	2.030	0.702	3.350
	135	181 1	03JUN83	30 07 00	87 00 00	35	5.3	36.44	20.80	11	70	1.555	0.648	2.354
	135	182 1	07JUN83	30 08 00	86 49 00	51	9.1	36.23	19.96	27	225	2.377	0.721	4.801
	135	183 1	07JUN83	30 08 00	86 51 00	44	9.1	36.23	20.19	16	91	2.473	0.892	3.325
	135	185 1	07JUN83	30 10 00	86 46 00	37	9.0	36.21	21.14	8	35	1.748	0.840	1.969
	135	186 1	07JUN83	30 11 00	86 51 00	29	9.2	36.22	21.08	10	38	1.648	0.716	2.474
	135	187 1	07JUN83	30 12 00	86 48 00	27	8.8	36.31	21.21	10	34	1.606	0.697	2.552
	135	189 1	05JUN83	30 13 00	86 07 00	22	9.1	36.28	20.09	26	147	2.032	0.624	5.010
	135	195 1	02JUN83	30 00 00	87 08 00	38	5.2	36.19	19.34	32	143	2.866	0.827	6.246
	135	98 1	04JUN83	29 12 00	85 35 00	82	4.5	36.34	19.40	22	199	2.469	0.799	3.967
	135	99 1	04JUN83	29 22 00	85 36 00	40	5.0	36.38	20.16	21	95	2.492	0.819	4.392
	135	104 1	03JUN83	29 27 00	86 03 00	75	4.7	36.33	19.15	23	226	2.584	0.824	4.059
IA2	001	84 1	03JUL83	29 50 00	88 11 00	36	5.5	37.00	21.50	9	49	1.864	0.848	2.056
	001	146 1	02JUL83	29 49 00	88 39 00	24	6.8	36.00	22.50	10	296	0.845	0.367	1.582
	135	184 1	06JUN83	30 09 00	86 41 00	33	8.8	35.96	20.95	8	34	1.458	0.701	1.985
	135	188 1	06JUN83	30 12 00	86 41 00	26	8.7	35.97	21.34	13	46	2.235	0.872	3.134
	135	190 1	05JUN83	30 17 00	86 02 00	20	9.3	33.01	25.69	7	119	0.808	0.415	1.255
	135	197 1	01JUN83	30 15 00	87 20 00	22	6.8	34.93	20.63	28	495	1.877	0.563	4.352
	135	191 1	06JUN83	30 20 00	86 33 00	20	9.1	35.63	20.83	23	276	2.380	0.759	3.914
	135	192 1	06JUN83	30 23 00	86 29 00	16	9.3	35.27	21.23	28	348	2.293	0.688	4.614
	135	193 1	06JUN83	30 23 00	86 49 00	9	9.2	35.28	21.14	23	326	1.633	0.521	3.802
	135	194 1	06JUN83	30 25 00	86 33 00	11	9.1	35.03	22.38	21	109	2.260	0.742	4.263
	135	197 2	01JUN83	30 12 00	87 21 00	22	6.8	34.93	20.63	23	267	2.310	0.737	3.938
	135	199 1	02JUN83	30 16 00	87 11 00	20	5.3	35.70	20.58	8	24	1.839	0.884	2.203
	135	201 1	02JUN83	30 17 00	87 15 00	15	5.6	35.32	21.41	10	48	2.027	0.880	2.325
	135	202 1	01JUN83	30 18 00	87 15 00	13	5.8	34.50	22.16	8	21	1.790	0.861	2.299
	135	202 1	02JUN83	30 18 00	87 15 00	9	5.9	34.39	22.46	20	208	2.729	0.819	5.059
	001	158 1	03JUL83	29 58 00	88 09 00	34	6.4	35.00	24.00	18	87	2.415	0.820	4.031
	135	175 1	05JUN83	30 03 00	85 42 00	18	5.5	35.88	21.98	21	197	2.017	0.662	3.786
IB / IB1	001	160 1	03JUL83	29 58 00	88 07 00	30	6.9	34.00	25.70	19	565	2.058	0.699	2.841
	001	196 1	05JUL83	30 11 00	87 51 00	10	5.7	33.00	25.00	34	254	2.715	0.770	5.960
	001	209 1	04JUL83	30 02 00	88 14 00	20	4.7	34.00	23.50	24	146	2.571	0.809	4.615
	135	134 1	10JUN83	29 31 00	88 17 00	44	7.9	36.55	20.48	30	556	1.644	0.483	4.588
	135	147 1	10JUN83	29 49 00	88 13 00	33	6.2	36.42	18.94	32	582	2.255	0.651	4.869
	135	155 1	09JUN83	29 55 00	88 21 00	32	4.6	36.00	20.10	40	2183	1.769	0.480	5.073
	001	157 1	03JUL83	29 57 00	88 04 00	36	5.0	35.00	22.00	37	443	2.627	0.728	5.567
	135	159 1	08JUN83	29 58 00	88 16 00	30	4.4	36.00	20.50	31	4151	1.353	0.394	3.601
	135	204 1	08JUN83	30 00 00	88 15 00	28	4.4	35.00	21.00	34	2838	1.355	0.384	4.150
	001	206 1	04JUL83	30 00 00	88 15 00	32	4.8	34.00	23.50	26	547	2.314	0.710	3.965
	135	208 1	07JUN83	30 01 00	88 13 00	25	4.4	36.00	20.00	37	1631	1.786	0.495	4.867
	001	211 1	04JUL83	30 03 00	88 12 00	12	4.0	35.00	22.00	30	534	2.557	0.752	4.618
	001	214 1	05JUL83	30 05 00	88 04 00	22	6.8	35.00	21.00	30	1020	1.359	0.400	4.186
	135	215 1	07JUN83	30 05 00	88 07 00	20	4.3	35.00	20.70	34	790	2.137	0.606	4.946
	001	217 1	04JUL83	30 10 00	88 14 00	20	5.7	35.00	26.00	32	911	2.463	0.711	4.549
	001	126 1	01JUL83	29 19 00	88 56 00	40	5.6	35.00	22.00	29	770	2.105	0.625	4.213
	001	127 1	01JUL83	29 20 00	88 59 00	20	4.2	32.00	24.90	22	2288	2.102	0.680	2.715
	001	130 1	02JUL83	29 28 00	88 43 00	28	5.9	34.00	24.50	22	429	1.829	0.592	3.465
	001	136 1	01JUL83	29 33 00	88 27 00	48	6.0	35.00	21.00	26	559	1.989	0.611	3.952
	001	138 1	02JUL83	29 42 00	88 34 00	26	5.7	36.00	24.00	24	310	2.501	0.787	4.009
	135	140 1	08JUN83	29 46 00	88 43 00	18	4.0	35.79	19.10	17	314	1.607	0.567	2.783
	001	154 1	03JUL83	29 55 00	88 31 00	10	3.9	35.00	21.00	23	322	2.459	0.784	3.810
	001	156 1	02JUL83	29 55 00	88 19 00	22				19	133	2.412	0.819	3.681
	001	205 1	02JUL83	30 00 00	88 41 00	18	2.7	38.00	22.50	19	446	1.911	0.649	2.949
	001	207 1	03JUL83	30 00 00	88 36 00	22	6.1	34.00	24.50	24	329	2.268	0.714	3.968
	135	216 1	09JUN83	30 09 00	88 27 00	12	4.6	34.00	21.50	31	749	2.273	0.662	4.518
	001	218 1	04JUL83	30 10 00	88 25 00	16	3.3	32.00	25.00	25	843	1.567	0.487	3.562
	135	221 1	10JUN83	30 12 00	88 35 00	9	2.9	32.00	23.00	22	881	1.936	0.626	3.110
	135	139 1	08JUN83	29 46 00	88 45 00	13	3.6	35.00	22.00	10	98	1.821	0.791	1.963
	135	139 2	08JUN83	29 46 00	88 45 00	13	3.6	35.00	22.00	12	47	1.881	0.757	2.857
	135	142 1	08JUN83	29 46 00	88 49 00	13	3.2	33.96	21.04	5	50	1.270	0.789	1.022
	001	124 1	01JUL83	29 05 00	88 59 00	60	5.8	37.00	20.50	32	2310	2.296	0.663	4.003
	135	140 2	08JUN83	29 46 00	88 41 00	18	4.0	35.79	19.10	17	194	2.202	0.777	3.037
	135	141 1	08JUN83	29 46 00	88 41 00	18	3.6	35.00	21.00	23	1025	2.128	0.679	3.173
	135	151 1	09JUN83	29 53 00	88 39 00	20	3.7	35.00	20.10	28	831	1.476	0.443	4.016
	135	152 1	09JUN83	29 53 00	88 39 00	20	3.8	35.81	18.92	25	330	2.198	0.683	4.139
	135	174 1	10JUN83	30 12 00	88 40 00	11	3.3	12.00	22.00	29	2792	2.153	0.640	3.529
	135	135 1	07JUN83	29 33 00	88 35 00	31	4.4	35.84	19.04	31	327	2.011	0.819	5.181
	135	137 1	07JUN83	29 34 00	88 39 00	24	3.5	35.88	19.11	28	576	1.624	0.487	4.248
	135	145 1	09JUN83	29 48 00	88 34 00	26	4.0	35.00	20.20	25	5045	1.006	0.313	2.767
	135	144 1	08JUN83	29 48 00	88 35 00	26	4.1	36.02	18.88	37	1054	1.698	0.470	5.172
	135	144 2	08JUN83	29 48 00	88 35 00	26	4.1	36.02	18.88	24	3793	1.325	0.417	2.791
	135	148 1	09JUN83	29 51 00	88 35 00	26	4.1	36.00	20.00	21	2724	0.917	0.301	2.528
	135	149 1	09JUN83	29 52 00	88 36 00	24	3.7	36.48	18.81	35	1202	1.575	0.443	4.796
	135	149 2	09JUN83	29 52 00	88 36 00	24	3.7	36.48	18.81	34	1499	1.269	0.360	4.513
	135	150 1	09JUN83	29 55 00	88 32 00	28	4.8	36.00	20.10	20	5408	0.879	0.293	2.210
	135	151 2	09JUN83	29 53 00	88 39 00	20	3.7	35.00	20.10	28	774	1.615	0.485	4.059
	135	153 1	09JUN83	29 53 00	88 31 00	27	4.5	36.18	18.84	33	1231	1.172	0.393	4.497
	135	153 2	09JUN83	29 53 00	88 33 00	27	4.5	36.18	18.84	26	2056	1.297	0.398	3.277
	135	125 1	08JUN83	29 18 00	88 56 00	29	7.4	36.39	19.88	34	1090	2.351	0.667	4.713
	135	128 1	08JUN83	29 22 00	88 48 00	40	7.6	36.52	20.61	33	482	2.682	0.767	5.180
IB2	001	91 1	22JUN83	28 50 00	89 58 00	46	6.4	36.00	20.20	23	540	2.000	0.638	3.497
	001	161 1	23JUN83	29 00 00	89 39 00	20	5.4	35.00	25.60	19	503	1.203	0.429	2.898
	001	164 1	23JUN83	29 04 00	89 37 00	26	5.8	34.50	23.10	23	1912	2.462	0.785	2.912
	001	94 1	22JUN83	28 58 00	89 47 00	42	5.2	36.00	20.20	20	1016	2.420	0.808	2.744
	001	162 1	22JUN83	29 00 00	89 52 00	30	6.2	34.00	21.20	22	567	2.340	0.757	3.331
	001	163 1	22JUN83	29 02 00	89 49 00	35	6.0	35.00	21.30	26	487	2.221	0.682	4.040
	001	89 1	21JUN83	28 45 00	89 44 00	79	4.6	36.20	16.80	19	596	2.036	0.692	2.817
	001	90 1	22JUN83	28 48 00	89 54 00	50	5.9	35.80	19.40	18	871	1.530	0.529	2.511
	001	92 1	23JUN83	28 51 00	89 16 00	70	5.0	35.00	20.00	18	521	1.599	0.606	2.078
	001	93 1	22JUN83	28 56 00	89 44 00	52	5.8	36.10	19.60	19	2158	2.002	0.680	2.345
	001	88 1	21JUN83	28 41 00	89 56 00	78	7.1	36.00	18.60	18	1317	1.078	0.373	2.367
	001	95 1	21JUN83	28 59 00	89 36 00	48	5.8	36.00	22.60	21	987	2.340	0.768	2.901
II / IIA / IIA1	001	145 1	02JUL83	29 48 00	88 43 00	18	6.1	32.00	25.90	28	246	2.332	0.700	4.904
	003	170 2	22JUN83	29 25 00	89 04 00	9	3.9	21.30	26.10	14	52	1.843	0.698	3.290
	001	219 1	04JUL83	30 11 00	88 09 00	12	5.2	32.00	26.00	25	746	1.572	0.488	3.627
	002	167 2	14JUN83	29 14 00	89 53 00	10	5.9	15.50	27.60	17	752	1.741	0.614	2.416
	003	167 2	23JUN83	29 14 00	89 53 00	10	5.8	21.40	27.40	11	475	1.030	0.430	1.623
	003	168 2	23JUN83	29 15 00	89 54 00	6	5.7	11.70	27.60	15	415	1.592	0.588	2.322
	003	172 2	22JUN83	29 27 00	89 10 00	5	2.0	15.00	27.00	18	224	1.966	0.680	3.141
	135	220 1	09JUN83	30 11 00	88 04 00	13		26.00	21.00	22	1681	0.798	0.257	2.558
	135	223 1	10JUN83	30 13 00	88 12 00	9		27.00	21.50	19	997	1.980	0.672	2.607
	003	168 1	23JUN83	29 15 00	89 54 00	6	5.7	11.70	27.60	1	23	0.000		0.000
	003	170 1	22JUN83	29 25 00	89 04 00	9	3.9	21.30	26.10	1	4	0.000		0.000
	003	173 1	22JUN83	29 27 00	89 12 00	2	8.9	5.10	30.10	1	62	0.000		0.000
	135	220 1	01JUL83	30 11 00	88 04 00	12	6.4	28.00	26.00	2	6	0.451	0.650	0.558
	002	170 2	14JUN83	29 25 00	89 04 00	9	6.6	24.10	26.20	21	1551	0.874	0.287	2.722
	003	173 2	22JUN83	29 27 00	89 12 00	2	8.9	5.10	30.10	8	520	0.756	0.363	1.119
	135	198 1	09JUN83	30 13 00	87 44 00	10		31.00	22.00	26	777	1.543	0.478	3.756
	135	222 1	10JUN83	30 12 00	88 18 00	9		23.00	23.50	17	3995	0.480	0.169	1.929
	135	222 1	02JUL83	30 12 00	88 18 00	9	5.4	25.00	26.50	18	1883	1.297	0.449	2.254
	135	223 1	02JUL83	30 13 00	88 12 00	10	3.4	27.00	25.50	12	106	1.411	0.568	2.359
	003	167 1	23JUN83	29 14 00	89 53 00	10	5.8	21.40	27.40	1	122	0.000	.	0.000
	002	168 1	14JUN83	29 15 00	89 54 00	6	8.7	10.20	27.60	10	85	0.975	0.423	2.026
	002	169 2	14JUN83	29 16 00	89 56 00	2	7.8	7.40	27.90	12	327	1.269	0.511	1.900
	003	169 1	23JUN83	29 16 00	89 56 00	2	7.0	8.00	27.70	12	458	0.766	0.308	1.795
	002	171 2	14JUN83	29 27 00	89 10 00	5	5.6	19.30	26.90	12	1530	0.195	0.078	1.500
	002	173 1	14JUN83	29 27 00	89 12 00	2	6.9	7.60	26.80	11	1807	0.491	0.205	1.333
	135	224 1	09JUN83	30 14 00	88 19 00					14	281	1.670	0.633	2.306
	135	225 1	09JUN83	30 14 00	88 19 00					9	70	1.500	0.683	1.883
	135	226 1	09JUN83	30 15 00	88 12 00					11	108	1.703	0.710	2.136
	135	227 1	09JUN83	30 18 00	88 12 00					11	4611	0.223	0.093	1.185
	135	228 1	09JUN83	30 16 00	88 09 00					9	177	1.740	0.792	1.546
	135	229 1	09JUN83	30 19 00	88 14 00					9	1091	0.372	0.169	1.144
	135	230 1	09JUN83	30 19 00	88 09 00					9	2204	0.483	0.220	1.039
	135	231 1	09JUN83	30 22 00	88 15 00					11	206	1.650	0.688	1.877
	001	165 1	23JUN83	29 08 00	89 31 00	12	5.1	16.00	26.60	11	228	1.567	0.654	1.842
	001	166 1	23JUN83	29 08 00	89 34 00	14	4.8	32.00	25.30	9	828	0.476	0.217	1.191
	003	172 1	22JUN83	29 27 00	89 10 00	5	2.0	15.00	27.00	1	2	0.000		0.000
IIB / IIB1	135	200 1	06JUN83	30 16 00	87 33 00	9		12.00	21.50	12	242	1.017	0.409	2.004
	135	200 1	28JUN83	30 16 00	87 33 00	9	6.0	26.00	27.50	6	85	0.947	0.529	1.125
IIB2	002	168 1	14JUN83	29 15 00	89 54 00	6	8.7	10.20	27.60	1	1	0.000		
	002	170 1	14JUN83	29 25 00	89 04 00	9	6.6	24.10	26.20	1	2	0.000		0.000
	135	198 1	28JUN83	30 13 00	87 44 00	9	4.8	27.00	27.50	2	3	0.637	0.918	0.910

Table 29. Ordered matrix of simple bivariate Pearson product moment correlation coefficients of densities of 90 selected demersal nekton taxa and community parameters with environmental variables collected at 156 stations in and around the Tuscaloosa Trend study area during the spring 1983 SEAMAP groundfish survey.

TAXA GROUPS	Taxa	Depth	Bottom Dissolved Oxygen	Bottom Salinity	Bottom Temperature
I / IA / IA1	Lagodon rhomboides	0.05755	0.17068	0.09789	-0.10329
I / IA / IA1	Prionotus salmonicolor	0.14009	0.11319	0.08461	-0.05537
I / IA / IA1	Synodus foetens	0.25290	0.00427	0.21944	-0.20282
I / IA / IA1	Bellator militaris	0.41102	-0.05650	0.12506	-0.19365
I / IA / IA1	Monacanthus hispidus	0.18251	0.15645	0.13918	-0.10665
I / IA / IA1	Neomerinthe hemingwayi	0.12944	0.07387	0.12812	-0.14684
I / IA / IA1	Pristipomoides aquilonaris	0.28442	0.02897	0.09963	-0.15740
I / IA / IA1	Syacium papillosum	0.21314	-0.05117	0.19379	-0.22582
I / IA / IA1	Synodus intermedius	0.29424	0.13553	0.14039	-0.14977
I / IA / IA1	Synodus poeyi	0.33998	-0.02060	0.10100	-0.14565
I / IA / IA1	Trachinocephalus myops	0.36547	0.19612	0.14752	-0.14223
I / IA / IA1	Urophycis regius	0.39070	0.02002	0.15749	-0.21089
I / IA / IA1	Haemulon aurolineatum	-0.00283	0.05574	0.08112	-0.09140
I / IA / IA1	Ophidion holbrooki	0.18117	0.25091	0.16063	-0.13047
I / IA / IA1	Sphoeroides spengleri	0.09652	0.21727	0.09708	-0.10440
I / IA / IA1	Sicyonia brevirostris	0.05861	-0.08402	0.19561	-0.17948
I / IA / IA1	Loligo pealeii	0.08071	0.10516	0.20504	-0.11784
I / IA / IA1	Scorpaena calcarata	0.26606	0.06229	0.14262	-0.12334
I / IA / IA1	Diplectrum formosum	-0.10822	0.27553	0.10665	-0.08864
I / IA / IA1	Orthopristis chrysoptera	-0.06072	0.17589	0.09429	-0.10898
I / IA / IA1	Prionotus martis	-0.04295	0.29146	0.07945	-0.06939
I / IA / IA1	Prionotus scitulus	-0.00142	0.09277	0.13718	-0.12267
I / IA / IA1	Raja eglanteria	0.08177	0.15789	0.14582	-0.14618
I / IA / IA2	Portunus spinicarpus	0.37564	-0.13609	0.14924	-0.27473
I / IA / IA2	Solenocera	0.13744	0.02147	0.15162	-0.22261
I / IA / IA2	Centropristis philadelphicus	0.08049	-0.11601	0.15408	-0.05077
I / IA / IA2	Lepophidium jeannae	0.20770	0.00507	0.11650	-0.14776
I / IA / IA2	Decapterus punctatus	-0.00111	0.00043	0.03690	0.01837
I / IA / IA2	Prionotus stearnsi	0.28951	-0.09583	0.14111	-0.19222
I / IA / IA2	Stenotomus caprinus	0.19121	0.03212	0.18791	-0.14672
I / IA / IA2	Ophidion grayi	-0.06560	0.02596	0.12541	-0.12323
I / IA / IA2	Etrumeus teres	-0.02237	-0.00335	0.08661	-0.03996
I / IA / IA2	Trachurus lathami	0.13464	0.01832	0.07884	-0.06576
I / IA / IA2	Ovalipes guadulpensis	-0.06575	-0.09248	0.15640	-0.17739
I / IA / IA2	Lutjanus campechanus	0.12092	-0.05970	0.12039	-0.08747
I / IA / IA2	Porichthys porosissimus	0.11905	-0.05267	0.10233	-0.01142
I / IA / IA2	Prionotus roseus	0.06471	-0.00754	0.08144	-0.01193
I / IB / IB1	Penaeus duorarum	-0.09590	-0.35059	0.18879	-0.17986
I / IB / IB1	Portunus spinimanus	0.03051	-0.09849	0.08042	-0.05674
I / IB / IB1	Cyclopsetta chittendeni	0.12252	0.01554	0.06972	-0.02151
I / IB / IB1	Halieutichthys aculeatus	0.03728	-0.22276	0.14402	-0.23442
I / IB / IB1	Trachypenaeus	0.03134	-0.27363	0.17763	-0.27031
I / IB / IB1	Portunus gibbesii	-0.03748	-0.27761	0.16258	-0.24046
I / IB / IB1	Squilla empusa	0.02199	-0.14383	0.12452	-0.23956
I / IB / IB1	Ovalipes floridanus	-0.07285	-0.20695	0.08625	-0.09171
I / IB / IB1	Sicyonia dorsalis	0.01595	-0.08314	0.12594	-0.19724
I / IB / IB1	Parapenaeus	0.02736	0.09903	0.06436	-0.08628
I / IB / IB1	Calappa sulcata	0.01946	-0.17879	0.10201	-0.16047
I / IB / IB1	Brotula barbata	-0.03521	-0.15341	0.05333	0.05746
I / IB / IB1	Prionotus rubio	-0.07486	-0.18393	0.04478	-0.06814
I / IB / IB1	Saurida brasiliensis	0.13206	-0.08991	0.14343	-0.12300
I / IB / IB1	Serranus atrobranchus	0.19973	-0.05954	0.15500	-0.23110
I / IB / IB1	Syacium gunteri	0.00445	-0.16297	0.11812	-0.21813
I / IB / IB1	Urophycis cirratus	0.07300	-0.06428	0.14486	-0.23514
I / IB / IB1	Urophycis floridanus	0.00899	-0.23373	0.17613	-0.31355
I / IB / IB1	Antennarius radiosus	0.22273	-0.01175	0.09449	-0.11497
I / IB / IB1	Lepophidium graellsi	0.18272	-0.06574	0.12776	-0.12675
I / IB / IB1	Gunterichthys longipenis	0.17012	-0.02400	0.07689	-0.12414
I / IB / IB1	Nezumia bairdii	0.28589	-0.03341	0.08896	-0.16651
I / IB / IB1	Hoplunnis macrurus	0.17557	-0.00268	0.07859	-0.10562
I / IB / IB1	Squilla	0.09872	-0.22010	0.18389	-0.17025
I / IB / IB1	Bollmannia communis	0.18362	-0.00710	0.10484	-0.15531
I / IB / IB1	Diplectrum bivittatum	0.01244	-0.19972	0.18207	-0.14760
I / IB / IB2	Sphoeroides parvus	-0.02044	-0.14645	0.16650	-0.09840
I / IB / IB2	Lolliguncula brevis	-0.12188	-0.17534	0.05872	-0.08271
I / IB / IB2	Etropus crossotus	0.04749	-0.21858	0.19619	-0.17294
I / IB / IB2	Ophidion welshi	-0.05156	-0.12146	0.01855	-0.03698
I / IB / IB2	Prionotus tribulus	-0.13235	-0.24494	0.07324	-0.01872
II / IIA / IIA1	Callinectes similis	-0.08072	-0.10808	-0.06029	0.01451
II / IIA / IIA1	Symphurus plagiusa	-0.05108	-0.10152	-0.04100	-0.00594
II / IIA / IIA1	Penaeus setiferus	-0.12835	-0.19046	0.09544	0.09942
II / IIA / IIA1	Penaeus aztecus	-0.08313	-0.30370	0.05531	-0.02985
II / IIA / IIA1	Cynoscion arenarius	0.00131	-0.04541	0.04244	-0.00807
II / IIA / IIA1	Trichiurus lepturus	0.04238	-0.05016	-0.01777	0.07241
II / IIA / IIA1	Anchoa hepsetus	-0.14307	-0.05198	-0.06484	0.10651
II / IIA / IIA1	Citharichthys spilopterus	0.16679	-0.12123	0.01204	-0.04058
II / IIA / IIA2	Callinectes sapidus	-0.07126	-0.12366	0.02910	0.10775
II / IIB / IIB1	Arius felis	-0.16995	0.01559	-0.11758	0.10387
II / IIB / IIB1	Harengula jaguana	-0.04692	-0.10819	0.03717	0.07289
II / IIB / IIB2	Stellifer lanceolatus	-0.15565	0.02267	-0.10331	0.11000
II / IIB / IIB2	Chloroscombrus chrysurus	-0.07737	-0.09770	-0.01683	0.12540
II / IIB / IIB2	Peprilus burti	-0.05529	-0.10109	-0.04382	0.04830
II / IIB / IIB2	Anchoa mitchilli	-0.17357	0.07929	-0.21664	0.14031
II / IIB / IIB2	Anchoa nasuta	-0.16196	0.03547	-0.14012	0.17354
II / IIB / IIB2	Larimus fasciatus	-0.11550	-0.13863	-0.05484	0.02410
II / IIB / IIB2	Leiostomus xanthurus	0.05188	-0.00923	0.00731	0.03185
II / IIB / IIB2	Menticirrhus americanus	-0.15778	0.05559	-0.28112	0.17426
II / IIB / IIB2	Ophichthus gomesii	-0.10357	-0.01981	-0.06406	-0.00395
II / IIB / IIB2	Polydactylus octonemus	-0.16210	0.00096	-0.20291	0.23702
II / IIB / IIB2	Micropogonias undulatus	0.16490	-0.01844	-0.00022	-0.00121
	Total Taxa	0.29418	-0.27022	0.56658	-0.56609
	Total Individuals	-0.00959	-0.29451	0.10425	-0.18138
	Diversity	0.42098	-0.10588	0.65141	-0.55118
	Richness	0.33798	-0.12569	0.60598	-0.57451
	Evenness	0.25407	0.07678	0.35885	-0.20329

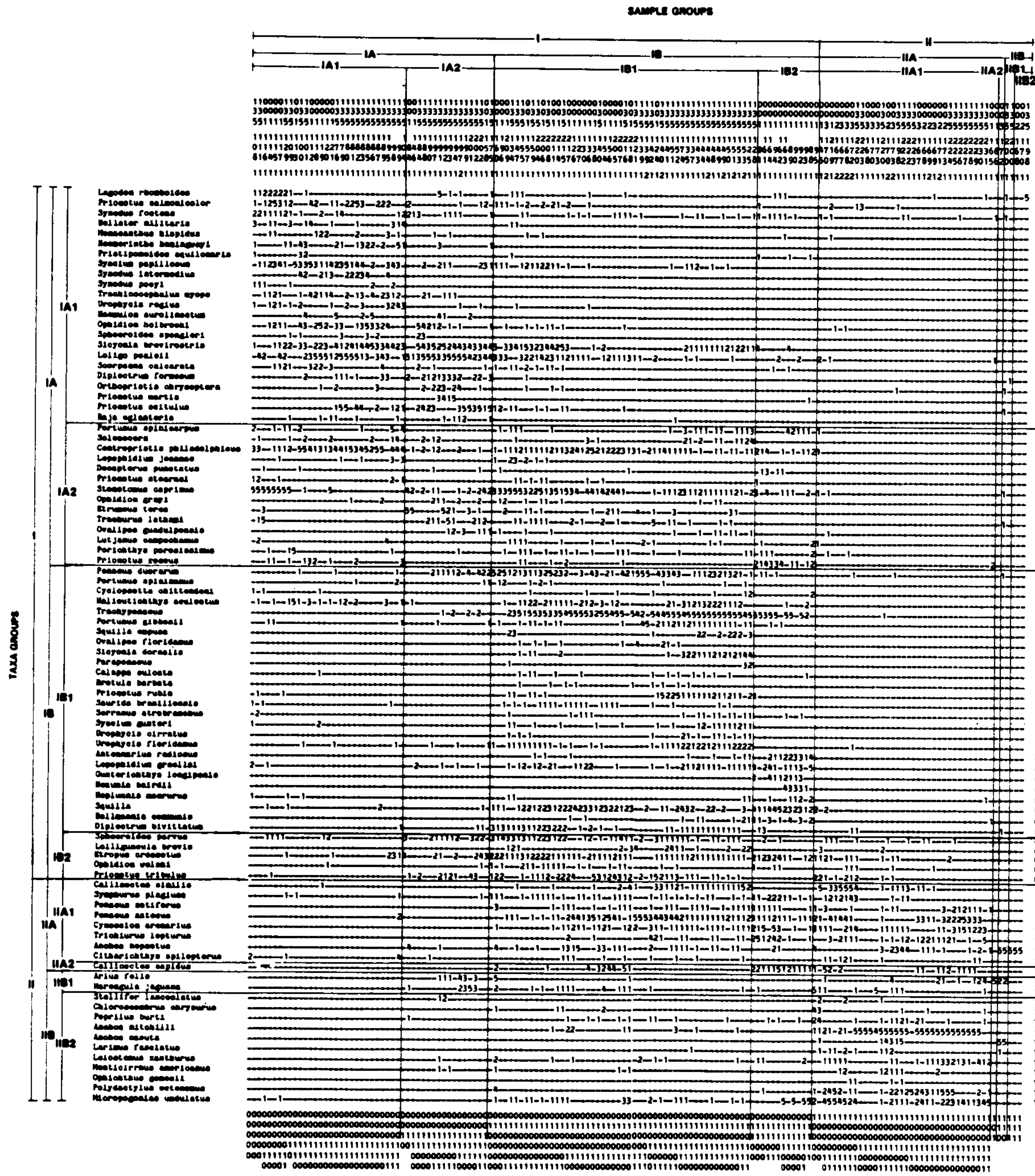

Figure 13. Ordered two-way display resulting from TWINSPAN analysis of relative abundances of 90 selected demersal nekton taxa collected in single replicate samples at 156 stations in and around the Tuscaloosa Trend study area during the spring 1983 SEAMAP groundfish survey.

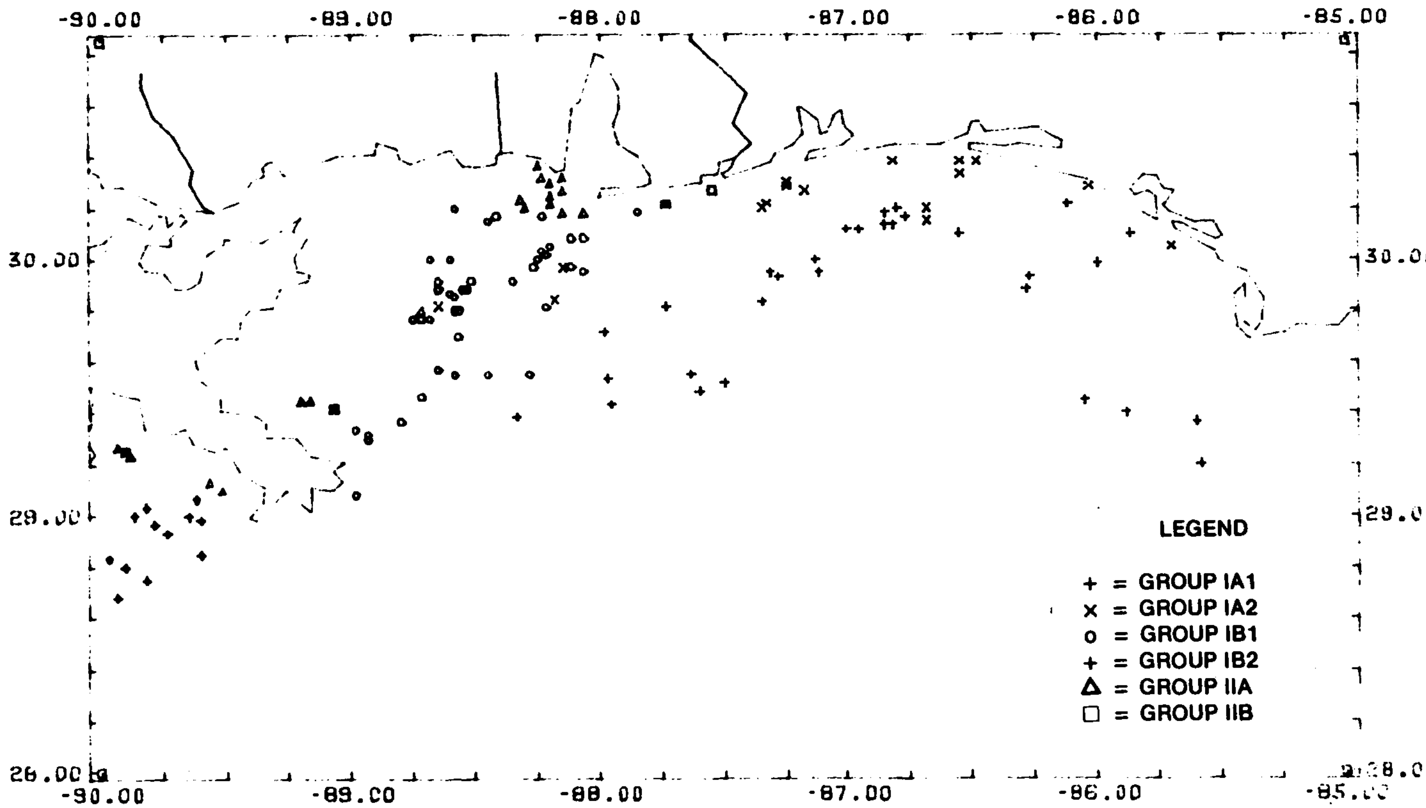

Figure 14. Map of the SEAMAP groundfish study area showing the membership of the samples to the six most meaningful groups resulting from TWINSPAN analysis of relative abundance of 90 selected demersal nekton taxa collected in single replicate samples at 156 stations in and around the Tuscaloosa Trend study area during the spring 1983 SEAMAP groundfish survey.

geography. Although not measured, it appears that sediment composition was important in determining the trends within areas that were otherwise similar. For interpretive purposes, sediment composition at the SEAMAP trawl stations was inferred in the same manner as for the 1982 collections (i.e., by overlaying a map of the station locations on a recent map of the sediment composition in the study area).

The overall ordering and grouping of the 1983 samples in Figure 13 was almost identical to that seen in Figure 11 for the 1982 samples. The samples on the far right of the TWINSPAN display (Sample Group II in Figure 13 and Table 28) were, for the most part, collected in the shallowest, most nearshore areas in the vicinity of the Mississippi Delta and near the confluence of Mississippi Sound and Mobile Bay (depth ranged from 2 to 16 m). They were generally characterized by lowest salinities (range of 5.3 ppt to 32 ppt) and highest temperatures (range of 21.5 to 30.1^{o} C). There did not appear to be any strong geographical differences in the stations represented in Groups IIB1 and IIB2. The samples in Group I were collected in deeper waters (range of 9 to 90 m) or from the nearshore areas off the Florida coast in the western portion of the study area, and were characterized by the highest salinities (range of 32 to 38 ppt) and lowest temperatures (range of 18.8 to 26.0^{o} C).

Sample Group IA encompassed the stations located on very sandy sediments in the eastern portion of the study area off the Alabama and Florida coasts (Figure 14), with the deep water, more offshore stations included in Station Group IA1 and the shallow water, more nearshore included in Group IA2 (Table 28). Sample Group IB included the stations located on the finer textured (muddier) sediments in moderate depth to deep waters in the western and central portions of the study area, with those stations located east of the Mississippi River outfall included in Group IB1 and those located west of the outfall in Group IB2. For the most part, those in Group IB2 were collected from stations in deeper waters than those in Group IB1. As in the results of the 1982 analysis, the main factor responsible for separating Group IA stations from those of Group IB appears to be geographical (east vs west), and within Groups IA or IB, the major differences appear to be depth related. Within each of the four groups in Sample Group I (Figure 13), there was considerable variability in numbers of taxa and community parameters, and no clear cut trends among Groups IA1-IB2 were apparent based on these parameters (Table 28).

Total number of taxa, species diversity and species richness were positively correlated with depth and salinity, and negatively correlated with temperature, again indicating that the offshore communities tended to be more diverse than those inshore (Table 29).

The taxa were ordered in Figure 13 such that those most characteristic of the shallower depth, lower salinity and higher temperature waters (Sample Group II) were located along the bottom portion of the TWINSPAN display and corresponding ordered correlation table (Taxa Group II in Figure 13 and Table 29). Conversely, those taxa (in Taxa Group I) that were most characteristic of middepth and deep waters with higher salinities and lower temperatures (Sample Group I) were located along the middle and upper portions of the TWINSPAN display and correlation table (Figure 13 and Table 29).

The majority of the taxa in Taxa Group IA1 (*Lagodon rhomboides* through *Raja eglanteria* in Figure 13 and Table 29) were most characteristic of the deeper water, high salinity, sandy habitat in the eastern portion of the study area (Sample Group IA1 in Figure 14). Some of the taxa in Group IA1 which were most characteristic of this trend include *Prionotus salmonicolor*, *Bellator militaris*, *Syacium papillosum*, *Synodus intermedius*, *Trachinocephalus myops*, and *Urophycis regius*. *Sicyonia brevirostris* and *Loligo pealeii* were widespread across all depths in this sandy habitat, and were also well represented in several of the samples from the moderate depth to deeper water, high salinity, muddy sediment habitat east of the Mississippi River Delta (Station Group IB1). *Diplectrum formosum*, *Orthopristis chrysoptera*, *Prionotus martis* and *Prionotus scitulus* were most characteristic of the shallow water, nearshore, sandy habitat encompassed in Sample Group IA2. The correlations of the Group IA1 taxa with environmental variables supported the deeper water association for these taxa, with the majority of these taxa exhibiting positive correlations with depth, dissolved oxygen, and salinity and negative correlations with temperature (Table 29).

The taxa in Group IA2 tended to be more widespread in distribution compared to those in Group IA1, with many of the taxa well represented in the high salinity, sandy and generally middepth habitat of Sample Group IA2, and in the high salinity, muddy sediment and generally middepth habitat east of the Mississippi River Delta (Sample Group IB1). Some of the taxa most characteristic of this trend included *Ophidion grayi*, *Etrumeus teres*, *Trachurus lathami*, and *Ovalipes guadulpensis*. *Centropristis philadelphicus*, *Stenotomus caprinus*, and *Prionotus roseus* showed these same trends, but were also represented in similar deep water habitats located both east and west of the Mississippi River outfall (Sample Groups IA1 and IB2). The correlations of the Group IA2 taxa with environmental variables were generally similar to, but somewhat weaker than those exhibited by the taxa in Group IA1 (Table 29).

The Group IB1 taxa were, for the most part, restricted to the high salinity, muddy sediment habitat located at middepths to deep waters the central and western portions of the study area (Sample Group IB). Many of the taxa in Group IB1 were restricted to the central portion of the study area (Sample Group IB1), with *Penaeus duorarum*, *Halieutichthys aculeatus*, *Portunus gibbesii*, *Sicyonia dorsalis*, *Prionotus rubio*, *Urophycis floridanus* and *Diplectrum bivittatum* most characteristic of this trend. *Trachypenaeus* LPIL, *Lepophidium graellsi*, and *Squilla* LPIL were well represented in the areas both east and west of the outfall, whereas *Gunterichthys longipenis*, *Nezumia bairdi*, *Hoplunnis macrurus*, and *Bollmania communis* were virtually restricted to the area west of the outfall (Sample Group IB2). The correlations of the Group IB1 taxa with environmental variables were generally weak, with the majority of the taxa exhibiting positive relationships with depth and salinity, and negative relationships with dissolved oxygen and temperature (Table 29).

The five taxa that comprised Taxa Group IB2 (*Sphoeroides parvus*, *Lolliguncula brevis*, *Etropus crossotus*, *Ophidion welshi*, and *Prionotus tribulus*) were the most widespread taxa in the study area, but were most relatively more abundant in the high salinity, muddy sediment middepth habitat east of the Mississippi River outfall (Sample Group IB1 in Figures

13 and 14 and Table 28). Lolliguncula brevis and Prionotus tribulus were not collected in the high salinity, muddy sediment habitat west of the Delta (Sample Group IB2). The correlations of Group IB2 taxa with environmental variables were generally very weak (Table 29), a reflection of their widespread distributions.

The taxa in Group IIA (Callinectes similis through Callinectes sapidus in Figure 13 and Table 29) were widespread across the muddy sediment habitats east and west of the Mississippi River outfall (Sample Group IB) and in the shallow water, low salinity habitats near the confluence of Mobile Bay and Mississippi Sound and near the Mississippi River Delta (Sample Group IIA). These taxa were virtually absent from the high salinity, sandy habitats in the central to eastern portions of the study area (Sample Group IA in Figures 13 and 14 and Table 28). Some of the taxa most representative of this trend include Callinectes similis, Penaeus aztecus, and Cynoscion arenarius. Callinectes similis was not collected in the fine-textured habitat west of the Mississippi River Delta (Sample Group IB2), whereas Callinectes sapidus occurred in all of these samples. The correlations of the Group IIA taxa with environmental variables were generally weak, due in large part to their widespread distributions (Table 29). However, the occurrence of these taxa in shallow depth, low salinity habitats was evident in the signs of the correlation coefficients, with most of the taxa exhibiting negative correlations with depth.

The Group IIB taxa (Arius felis through Micropogonias undulatus in Figure 13 and Table 29) were virtually restricted to the shallow depth, low salinity habitats located near the confluence of Mobile Bay and Mississippi Sound, and immediately east and west of the Mississippi River Delta. Some of the taxa most representative of this trend include Anchoa mitchilli, Leiostomus xanthurus, Polydactylus octonemus, and Micropogonias undulatus. The correlations of these taxa with environmental variables confirmed the shallow water, low salinity association, with virtually all of the taxa exhibiting negative correlations with depth and salinity and positive correlations with temperature (Table 29).

2.5.3 NMFS Fishery Independent Survey Seasonal Data

2.5.3.1 Introduction

The main purpose of this analysis was to evaluate seasonal trends in nekton community structure in the Tuscaloosa Trend study area. The Fishery Independent surveys included few samples from areas of the west Florida shelf that were included in the spatially extensive 1983 SEAMAP survey. in the As such, taxa characteristic of the sandy sediments of the eastern part of the study area (see Groups 4 and 5 in Tables 2 and 3) were not well represented in the Fishery Independent survey data. On the other hand, the seasonal data provided another dimension not seen in the analysis of the spring SEAMAP data or fall Fishery Independent survey data. Distributions of taxa in this seasonal analysis would be expected to be somewhat different from those seen in the spring and fall analyses, and the results should more closely define the life histories of the taxa in the Tuscaloosa Trend study area.

2.5.3.2 Relative Composition and Abundance

The community composition over all samples combined is summarized in Table 30. A total of 421,435 individuals representing 300 taxa were identified and enumerated in 763 seasonal trawl samples from 256 station selected for preliminary analysis. The community was numerically dominated by Micropogonias undulatus, which was collected in 69% of the samples (frequency of occurrence = 0.69) and accounted for 34% of the pooled percent composition; Stenotomus caprinus and Leiostomus xanthurus each accounted for greater than 5% of the pooled percent composition, with Leiostomus xanthurus exhibiting a very clumped distribution (index of dispersion = 5144.20). These two taxa were each found in about 1/3 of the samples. Based on mean percent composition (Table 30), the top eight most abundant taxa accounted for over 50% of the cumulative percent composition.

Trichiurus lepturus and Cynoscion arenarius were the next most abundant taxa, each accounting for greater than 4% of the pooled percent composition (Table 30). These two species were relatively widespread in distribution, with each occurring in greater than 40% of the samples. Penaeus aztecus and Cynoscion nothus each accounted for greater than 3% of the pooled percent composition. Penaeus aztecus was the second most widespread taxon, occurring in almost 60% of the samples collected. Arius felis, Anchoa hepsetus, Trachypenaeus LPIL, and Prionotus rubio each accounted for approximately 2% of the pooled percent composition, with Prionotus rubio occurring in 49% of the samples collected. Other taxa that were relatively widely distributed (frequency of occurrence >0.30) included Arius felis, Synodus foetens, Syacium papillosum and Centropristis philadelphicus.

There were substantial differences in community composition when these results were compared to those from the SEAMAP 1982 and 1983 fall analyses (compare Tables 22 and 26 with Table 30). Micropogonias undulatus was approximately an order of magnitude more abundant and Trachypenaeus LPIL about an order of magnitude less abundant in the Fishery Independent survey data. These differences may be attributable both to differences in the locations of sampling stations in the two studies and to seasonal effects. In the spring SEAMAP analysis, Micropogonias was more or less restricted to the inshore zone (Figures 11 and 13), while in this seasonal analysis, it was the most widely distributed taxa (Table 30). Another major difference in the results of the two studies derives from the inclusion of estuarine stations in the SEAMAP surveys. Taxa that spend the majority of their existence in or near the estuaries (e.g., Anchoa mitchilli) were less well represented in the Fishery Independent survey database which included few samples from stations located in less than 5 fm depths.

2.5.3.3 Two-Way Indicator Species Analysis

As part of the initial community characterization, various community indices were calculated and are discussed below in the context of the multivariate analysis of the community data. A hierarchical list of taxa found in the seasonal data set is presented as Table 31.

Based on the results of the relative composition analysis (Table 30), all taxa which did not occur in at least three samples were excluded

Table 30. Overall relative composition of demersal nekton taxa collected in three replicate samples at 154 stations in and around the Tuscaloosa Trend study area during the fall 1974 to summer 1975 NMFS Fishery Independent groundfish surveys.

Relative Composition Table for the Seasonal FID Data

TAXON NAME	MEAN PERCENT COMPOSITION	CUMULATIVE PERCENT COMPOSITION	POOLED PERCENT COMPOSITION	FREQ. OF OCCURRENCE	CUMULATIVE ABUNDANCE	MEAN DENSITY (# / HA)	INDEX OF DISPERSION
Micropogonias undulatus	23.195	23.195	33.969	0.689	143159.	264.55	1230.63
Stenotomus caprinus	6.104	29.299	5.805	0.328	167624.	45.21	320.64
Leiostomus xanthurus	2.222	31.521	5.040	0.336	188866.	39.25	5144.20
Trichiurus lepturus	4.863	36.384	4.833	0.402	209234.	37.64	372.51
Cynoscion arenarius	3.413	39.796	4.272	0.474	227238.	33.27	781.31
Penaeus aztecus	3.945	43.742	3.679	0.598	242741.	28.65	235.19
Cynoscion nothus	1.488	45.230	3.106	0.311	255829.	24.19	1549.27
Arius felis	5.129	50.359	2.393	0.308	265916.	18.64	148.04
Anchoa hepsetus	1.753	52.112	2.070	0.170	274639.	16.12	1036.04
Trachypenaeus	2.654	54.765	1.996	0.286	283051.	15.55	95.04
Prionotus rubio	2.068	56.833	1.979	0.491	291390.	15.41	82.38
Steindachneria argentea	1.160	57.993	1.656	0.089	298371.	12.90	437.81
Asteroidea	1.752	59.745	1.514	0.092	304753.	11.79	1710.53
Luidia	1.825	61.570	1.369	0.068	310522.	10.66	328.94
Peprilus burti	1.110	62.680	1.365	0.248	316273.	10.63	497.93
Trachurus lathami	1.495	64.174	1.297	0.160	321738.	10.10	295.71
Selene setapinnis	0.470	64.645	1.205	0.110	326817.	9.39	3366.51
Loligo	2.295	66.939	1.047	0.151	331231.	8.16	119.35
Chloroscombrus chrysurus	2.465	69.404	0.966	0.183	335300.	7.52	103.26
Syacium papillosum	1.897	71.301	0.948	0.338	339296.	7.38	46.25
Harengula jaguana	0.968	72.269	0.824	0.142	342770.	6.42	214.58
Synodus foetens	1.864	74.133	0.809	0.435	346178.	6.30	54.15
Serranus atrobranchus	0.719	74.851	0.711	0.159	349173.	5.53	151.26
Cynoscion	0.721	75.572	0.692	0.063	352091.	5.39	330.59
Centropristis philadelphicus	0.926	76.498	0.653	0.328	354841.	5.08	49.03
Ophiuroidea	0.483	76.981	0.651	0.017	357586.	5.07	1368.07
Penaeus setiferus	0.743	77.724	0.588	0.218	360064.	4.58	48.06
Diplectrum bivittatum	0.606	78.330	0.504	0.123	362190.	3.93	65.32
Portunus spinicarpus	0.512	78.842	0.502	0.104	364307.	3.91	110.80
Callinectes similis	0.687	79.529	0.497	0.231	366401.	3.87	36.15
Larimus fasciatus	0.273	79.802	0.475	0.115	368401.	3.70	211.78
Lagodon rhomboides	0.567	80.370	0.472	0.181	370389.	3.67	51.22
Sicyonia brevirostris	0.537	80.907	0.454	0.130	372303.	3.54	86.04
Parapenaeus	0.580	81.487	0.437	0.042	374145.	3.40	124.20
Etropus crossotus	0.640	82.127	0.427	0.235	375946.	3.33	33.81
Eucinostomus gula	0.848	82.974	0.407	0.143	377663.	3.17	54.52
Xiphopeneus	0.455	83.429	0.384	0.038	379280.	2.99	128.45
Squilla	0.547	83.976	0.379	0.194	380879.	2.95	29.14
Halieutichthys aculeatus	0.441	84.418	0.376	0.156	382465.	2.93	58.30
Anchoa mitchilli	0.586	85.004	0.366	0.058	384006.	2.85	85.95
Lolliguncula brevis	0.684	85.688	0.349	0.127	385477.	2.72	33.13
Prionotus salmonicolor	0.552	86.240	0.320	0.122	386827.	2.49	45.00
Scyphozoa	0.511	86.751	0.313	0.041	388148.	2.44	390.18
Lepophidium	0.392	87.142	0.296	0.193	389397.	2.31	14.84
Scorpaena calcarata	0.309	87.452	0.294	0.077	390638.	2.29	63.17
Stellifer lanceolatus	0.305	87.757	0.278	0.042	391811.	2.17	93.75
Loligo pealeii	0.796	88.552	0.263	0.094	392918.	2.05	51.06
Echinoidea	0.451	89.004	0.261	0.056	394019.	2.03	115.83
Solenocera	0.338	89.342	0.253	0.083	395087.	1.97	43.57
Polychaeta	0.097	89.439	0.237	0.001	396087.	1.85	1000.00
Etrumeus teres	0.401	89.840	0.236	0.063	397081.	1.84	149.13
Astropecten	0.243	90.083	0.232	0.009	398057.	1.80	463.31
Sphoeroides parvus	0.360	90.443	0.228	0.147	399019.	1.78	21.05
Cyclopsetta chittendeni	0.228	90.671	0.205	0.159	399882.	1.59	94.33
Decapterus punctatus	0.198	90.870	0.200	0.048	400723.	1.55	132.59
Menticirrhus americanus	0.304	91.174	0.197	0.094	401553.	1.53	34.45
Anchoa	0.262	91.435	0.188	0.024	402347.	1.47	93.29
Prionotus tribulus	0.269	91.705	0.180	0.097	403104.	1.40	29.63
Penaeus duorarum	0.217	91.921	0.171	0.121	403826.	1.33	24.86
Renilla mulleri	0.304	92.225	0.170	0.043	404543.	1.32	40.21
Porichthys porosissimus	0.212	92.437	0.156	0.144	405201.	1.22	13.77
Callinectes sapidus	0.322	92.759	0.156	0.135	405858.	1.21	41.12
Opisthonema oglinum	0.595	93.354	0.153	0.076	406504.	1.19	60.98
Lutjanus campechanus	0.230	93.584	0.153	0.142	407149.	1.19	21.53
Hydrozoa	0.181	93.765	0.151	0.017	407785.	1.18	401.21
Mellitidae	0.145	93.910	0.139	0.017	408372.	1.08	120.49
Prionotus	0.180	94.090	0.136	0.026	408944.	1.06	57.62
Lolliguncula	0.351	94.441	0.131	0.071	409496.	1.02	32.40
Bellator militaris	0.139	94.580	0.130	0.064	410044.	1.01	31.02
Diplectrum radiale	0.177	94.757	0.126	0.079	410577.	0.98	25.31

Table 30. Continued.

Relative Composition Table for the Seasonal FID Data

TAXON NAME	MEAN PERCENT COMPOSITION	CUMULATIVE PERCENT COMPOSITION	POOLED PERCENT COMPOSITION	FREQ. OF OCCURRENCE	CUMULATIVE ABUNDANCE	MEAN DENSITY (# / HA)	INDEX OF DISPERSION
Pristipomoides aquilonaris	0.170	94.927	0.115	0.045	411061.	0.89	70.81
Decapoda	0.323	95.249	0.114	0.017	411540.	0.89	62.75
Polydactylus octonemus	0.054	95.303	0.093	0.033	411931.	0.72	43.63
Citharichthys spilopterus	0.157	95.460	0.086	0.098	412293.	0.67	9.09
Lepophidium brevibarbe	0.106	95.566	0.085	0.030	412651.	0.66	41.20
Chaetodipterus faber	0.090	95.656	0.070	0.080	412944.	0.54	13.60
Syacium gunteri	0.070	95.726	0.068	0.033	413231.	0.53	31.46
Portunus spinimanus	0.063	95.789	0.066	0.028	413508.	0.51	52.69
Sicyonia dorsalis	0.056	95.845	0.061	0.041	413767.	0.48	23.20
Clypeaster	0.124	95.969	0.061	0.021	414024.	0.47	40.34
Portunus gibbesii	0.064	96.033	0.054	0.048	414251.	0.42	17.62
Saurida brasiliensis	0.172	96.205	0.052	0.067	414470.	0.40	8.32
Paralichthys lethostigma	0.087	96.292	0.049	0.155	414676.	0.38	2.46
Anchoa lyolepis	0.112	96.404	0.048	0.017	414879.	0.38	40.44
Ovalipes guadulpensis	0.128	96.532	0.048	0.008	415082.	0.38	176.25
Urophycis floridanus	0.098	96.630	0.047	0.046	415279.	0.36	9.92
Archosargus probatocephalus	0.216	96.847	0.047	0.030	415475.	0.36	17.79
Prionotus roseus	0.047	96.894	0.046	0.033	415667.	0.35	19.87
Sphyraena guachancho	0.060	96.954	0.043	0.041	415850.	0.34	13.61
Scorpaena brasiliensis	0.068	97.022	0.038	0.009	416012.	0.30	37.48
Upeneus parvus	0.066	97.088	0.036	0.031	416164.	0.28	20.41
Calappa sulcata	0.041	97.129	0.035	0.038	416313.	0.28	10.40
Congrina flava	0.030	97.160	0.030	0.029	416440.	0.23	7.24
Lutjanus synagris	0.045	97.205	0.030	0.038	416565.	0.23	10.27
Brevoortia patronus	0.055	97.259	0.030	0.026	416690.	0.23	18.38
Trachinocephalus myops	0.130	97.390	0.028	0.026	416809.	0.22	17.19
Cephalopoda	0.037	97.427	0.027	0.003	416923.	0.21	73.81
Symphurus plagiusa	0.025	97.452	0.027	0.038	417035.	0.21	14.53
Narcine brasiliensis	0.061	97.513	0.027	0.041	417147.	0.21	8.99
Prionotus paralatus	0.035	97.548	0.026	0.028	417258.	0.21	11.54
Sphoeroides	0.040	97.588	0.026	0.038	417366.	0.20	6.03
Brotula	0.040	97.628	0.025	0.026	417470.	0.19	8.36
Trinectes maculatus	0.005	97.634	0.025	0.005	417574.	0.19	45.04
Trichopsetta ventralis	0.021	97.655	0.024	0.014	417675.	0.19	33.82
Calappa	0.109	97.764	0.023	0.050	417774.	0.18	3.93
Renilla	0.078	97.841	0.022	0.014	417867.	0.17	16.00
Rhizoprionodon terraenovae	0.047	97.889	0.022	0.054	417959.	0.17	8.30
Selar crumenophthalmus	0.039	97.927	0.021	0.029	418049.	0.17	6.29
Portunus	0.019	97.947	0.021	0.012	418139.	0.17	30.83
Gorgoniidae	0.112	98.059	0.021	0.008	418227.	0.16	16.06
Polinices duplicatus	0.016	98.074	0.021	0.004	418314.	0.16	65.48
Bagre marinus	0.028	98.102	0.019	0.016	418395.	0.15	20.30
Balistes capriscus	0.065	98.167	0.019	0.033	418475.	0.15	10.81
Prionotus stearnsi	0.034	98.201	0.019	0.020	418554.	0.15	16.69
Etropus	0.029	98.231	0.019	0.013	418632.	0.14	15.48
Syacium	0.032	98.263	0.018	0.012	418708.	0.14	23.27
Scorpaena	0.047	98.309	0.018	0.008	418784.	0.14	24.30
Encope michelini	0.029	98.338	0.018	0.005	418860.	0.14	27.38
Hoplunnis	0.023	98.361	0.017	0.025	418933.	0.13	6.47
Prionotus ophryas	0.051	98.412	0.017	0.030	419005.	0.13	7.17
Calappa springeri	0.022	98.434	0.017	0.017	419077.	0.13	9.86
Saurida	0.054	98.488	0.016	0.009	419145.	0.13	22.76
Raninoides louisianensis	0.034	98.522	0.016	0.018	419212.	0.12	6.38
Bairdiella chrysura	0.020	98.542	0.015	0.013	419276.	0.12	11.90
Centropristis ocyurus	0.024	98.566	0.015	0.009	419338.	0.11	22.27
Anasimus latus	0.020	98.586	0.014	0.022	419399.	0.11	5.98
Citharichthys macrops	0.051	98.637	0.013	0.018	419455.	0.10	7.47
Aurelia	0.074	98.711	0.013	0.004	419508.	0.10	24.66
Peprilus paru	0.017	98.728	0.013	0.017	419561.	0.10	4.75
Gymnachirus texae	0.015	98.743	0.013	0.022	419614.	0.10	4.90
Ogcocephalus	0.029	98.772	0.012	0.024	419665.	0.09	4.98
Orthopristis chrysoptera	0.020	98.792	0.012	0.012	419714.	0.09	21.98
Chilomycterus schoepfi	0.020	98.812	0.011	0.029	419762.	0.09	3.07
Brotula barbata	0.010	98.822	0.011	0.017	419807.	0.08	4.41
Antennarius radiosus	0.014	98.836	0.011	0.018	419852.	0.08	5.57
Synodus poeyi	0.031	98.867	0.010	0.005	419895.	0.08	19.85
Caranx fusus	0.021	98.888	0.009	0.026	419934.	0.07	2.75
Bellator	0.010	98.898	0.009	0.007	419973.	0.07	18.10
Plesionika	0.008	98.906	0.009	0.003	420009.	0.07	25.99
Conger oceanicus	0.012	98.918	0.008	0.010	420042.	0.06	6.06
Monacanthus hispidus	0.028	98.946	0.008	0.024	420075.	0.06	2.66
Mellita	0.047	98.993	0.008	0.004	420107.	0.06	28.18

Table 30. Continued.

Relative Composition Table for the Seasonal FID Data

TAXON NAME	MEAN PERCENT COMPOSITION	CUMULATIVE PERCENT COMPOSITION	POOLED PERCENT COMPOSITION	FREQ. OF OCCURRENCE	CUMULATIVE ABUNDANCE	MEAN DENSITY (# / HA)	INDEX OF DISPERSION
Scomberomorus cavalla	0.009	99.002	0.008	0.005	420139.	0.06	8.53
Bollmannia communis	0.015	99.017	0.007	0.018	420170.	0.06	5.03
Sardinella aurita	0.016	99.033	0.007	0.017	420201.	0.06	3.87
Bothidae	0.004	99.036	0.007	0.003	420231.	0.06	21.66
Rhomboplites aurorubens	0.027	99.063	0.007	0.009	420261.	0.06	6.64
Eucinostomus argenteus	0.007	99.070	0.007	0.005	420291.	0.06	10.04
Aluterus schoepfi	0.035	99.105	0.007	0.020	420320.	0.05	2.62
Dasyatus americana	0.020	99.125	0.007	0.014	420349.	0.05	5.18
Ophidion welshi	0.011	99.136	0.007	0.012	420377.	0.05	4.18
Holothuroidea	0.004	99.140	0.007	0.004	420405.	0.05	16.77
Hoplunnis macrurus	0.005	99.145	0.006	0.009	420431.	0.05	11.83
Menticirrhus	0.019	99.164	0.006	0.005	420457.	0.05	9.44
Congridae	0.009	99.173	0.006	0.009	420482.	0.05	11.06
Trichopsetta	0.002	99.175	0.006	0.001	420506.	0.04	24.00
Scomberomorus maculatus	0.013	99.188	0.006	0.022	420530.	0.04	1.72
Prionotus scitulus	0.017	99.205	0.006	0.016	420554.	0.04	2.56
Lagocephalus laevigatus	0.016	99.222	0.006	0.022	420578.	0.04	1.80
Libinia emarginata	0.008	99.230	0.006	0.012	420602.	0.04	5.23
Anthozoa	0.007	99.237	0.005	0.009	420625.	0.04	5.59
Rissola marginata	0.006	99.243	0.005	0.004	420648.	0.04	9.16
Equetus acuminatus	0.006	99.249	0.005	0.007	420670.	0.04	7.80
Polynemus virginicus	0.001	99.250	0.005	0.001	420691.	0.04	21.00
Rhinoptera bonasus	0.158	99.408	0.005	0.020	420712.	0.04	1.93
Urophycis regius	0.005	99.413	0.005	0.007	420733.	0.04	6.03
Gymnothorax nigromarginatus	0.007	99.421	0.005	0.012	420753.	0.04	3.48
Diplectrum formosum	0.045	99.465	0.005	0.017	420772.	0.04	2.03
Symphurus diomedianus	0.007	99.472	0.005	0.009	420791.	0.04	3.40
Ogcocephalus nasutus	0.008	99.480	0.004	0.005	420809.	0.03	12.66
Raja texana	0.008	99.488	0.004	0.016	420827.	0.03	2.42
Ophidiidae	0.008	99.496	0.004	0.008	420845.	0.03	3.31
Calappa flammea	0.008	99.504	0.004	0.010	420861.	0.03	2.36
Spatangoida	0.012	99.516	0.004	0.004	420876.	0.03	5.39
Synodus	0.006	99.523	0.004	0.004	420891.	0.03	6.72
Congrina	0.006	99.528	0.004	0.012	420906.	0.03	2.05
Pogonius chromis	0.005	99.533	0.004	0.013	420921.	0.03	1.78
Lopholatilis chamaeleonticeps	0.002	99.536	0.003	0.003	420935.	0.03	10.57
Anadara	0.014	99.550	0.003	0.001	420949.	0.03	14.00
Scyllarides nodifer	0.012	99.562	0.003	0.010	420963.	0.03	3.27
Gymnothorax	0.004	99.567	0.003	0.008	420976.	0.02	5.30
Symphurus	0.003	99.570	0.003	0.004	420988.	0.02	5.16
Encope emarginata	0.011	99.582	0.003	0.003	421000.	0.02	6.66
Zalieutes mcgintyi	0.004	99.586	0.003	0.004	421012.	0.02	10.16
Prionotus alatus	0.007	99.593	0.003	0.003	421023.	0.02	6.63
Mugil cephalus	0.133	99.726	0.003	0.007	421034.	0.02	4.81
Pomatomus saltatrix	0.003	99.730	0.003	0.005	421045.	0.02	6.08
Ancylopsetta quadrocellata	0.006	99.736	0.003	0.009	421056.	0.02	2.81
Hepatus epheliticus	0.003	99.739	0.002	0.008	421066.	0.02	2.39
Raja eglanteria	0.014	99.753	0.002	0.010	421076.	0.02	1.39
Sphyrna tiburo	0.008	99.762	0.002	0.009	421086.	0.02	1.59
Caranx hippos	0.004	99.766	0.002	0.005	421095.	0.02	2.99
Natantia	0.003	99.769	0.002	0.004	421104.	0.02	3.21
Cyclopsetta fimbriata	0.004	99.773	0.002	0.005	421113.	0.02	4.33
Paguridae	0.006	99.779	0.002	0.007	421122.	0.02	2.32
Ophiopholus	0.037	99.816	0.002	0.003	421130.	0.01	5.00
Anasimus	0.001	99.816	0.002	0.001	421138.	0.01	8.00
Engyophrys senta	0.005	99.821	0.002	0.007	421146.	0.01	1.99
Balistidae	0.005	99.826	0.002	0.003	421154.	0.01	5.00
Gymnachirus	0.001	99.827	0.002	0.001	421162.	0.01	8.00
Rachycentron canadum	0.005	99.832	0.002	0.009	421169.	0.01	0.99
Rhinobatos lentiginosus	0.002	99.834	0.002	0.007	421176.	0.01	1.85
Sciaenops ocellata	0.003	99.837	0.002	0.008	421183.	0.01	1.28
Sicyonia	0.001	99.839	0.002	0.001	421190.	0.01	7.00
Libinia	0.004	99.843	0.002	0.004	421197.	0.01	2.71
Ovalipes	0.002	99.844	0.001	0.005	421203.	0.01	2.33
Scyllaridae	0.005	99.849	0.001	0.008	421209.	0.01	0.99
Majidae	0.002	99.851	0.001	0.005	421215.	0.01	1.99
Echeneis naucrates	0.005	99.856	0.001	0.007	421221.	0.01	1.33
Sinum perspectivum	0.002	99.858	0.001	0.003	421227.	0.01	4.33
Anchoviella eurystole	0.002	99.860	0.001	0.003	421233.	0.01	3.00
Gorgonocephalus	0.002	99.862	0.001	0.001	421239.	0.01	6.00
Paralichthys squamilentus	0.005	99.867	0.001	0.004	421245.	0.01	2.33
Sphyrna lewini	0.002	99.869	0.001	0.004	421250.	0.01	2.20

Table 30. Continued.

Relative Composition Table for the Seasonal FID Data

TAXON NAME	MEAN PERCENT COMPOSITION	CUMULATIVE PERCENT COMPOSITION	POOLED PERCENT COMPOSITION	FREQ. OF OCCURRENCE	CUMULATIVE ABUNDANCE	MEAN DENSITY (# / HA)	INDEX OF DISPERSION
Selene vomer	0.003	99.871	0.001	0.003	421255.	0.01	3.40
Achirus	0.007	99.878	0.001	0.003	421260.	0.01	3.40
Rypticus saponaceus	0.001	99.880	0.001	0.003	421265.	0.01	3.40
Dasyatis sayi	0.002	99.882	0.001	0.005	421270.	0.01	1.40
Goniaster americanus	0.000	99.882	0.001	0.001	421275.	0.01	5.00
Gobionellus hastatus	0.000	99.882	0.001	0.001	421280.	0.01	5.00
Portunus sayi	0.001	99.884	0.001	0.001	421284.	0.01	4.00
Gymnura micrura	0.000	99.884	0.001	0.001	421288.	0.01	4.00
Parthenope serrata	0.002	99.886	0.001	0.003	421292.	0.01	2.50
Remora remora	0.007	99.892	0.001	0.005	421296.	0.01	1.00
Plesionika martia	0.003	99.895	0.001	0.001	421300.	0.01	4.00
Etropus microstomus	0.004	99.899	0.001	0.004	421304.	0.01	1.50
Acquipecten gibbus	0.002	99.901	0.001	0.003	421308.	0.01	2.00
Ogcocephalus vespertilio	0.001	99.902	0.001	0.001	421311.	0.01	3.00
Prionaster	0.000	99.902	0.001	0.001	421314.	0.01	3.00
Conger	0.001	99.903	0.001	0.001	421317.	0.01	3.00
Urophycis	0.005	99.908	0.001	0.004	421320.	0.01	1.00
Lutjanus griseus	0.002	99.910	0.001	0.001	421323.	0.01	3.00
Laemonema	0.001	99.911	0.001	0.001	421326.	0.01	3.00
Hippocampus erectus	0.001	99.912	0.001	0.001	421329.	0.01	3.00
Carcharhinus acronotus	0.002	99.914	0.001	0.004	421332.	0.01	1.00
Citharichthys	0.001	99.915	0.001	0.003	421335.	0.01	1.66
Lopholatilis	0.001	99.916	0.001	0.001	421338.	0.01	3.00
Bollmannia	0.000	99.916	0.001	0.001	421341.	0.01	3.00
Scyllarus	0.002	99.918	0.001	0.003	421344.	0.01	1.66
Rangia	0.003	99.921	0.001	0.001	421347.	0.01	3.00
Penaeus	0.000	99.921	0.001	0.001	421350.	0.01	3.00
Callinectes	0.003	99.924	0.001	0.003	421353.	0.01	1.66
Acanthostracion quadricornis	0.002	99.925	0.001	0.003	421356.	0.01	1.66
Pagurus	0.002	99.927	0.001	0.001	421359.	0.01	3.00
Citharichthys cornutus	0.011	99.938	0.000	0.001	421361.	0.00	2.00
Priacanthus arenatus	0.001	99.940	0.000	0.003	421363.	0.00	1.00
Busycon	0.001	99.941	0.000	0.003	421365.	0.00	1.00
Petrochirus diogenes	0.001	99.942	0.000	0.001	421367.	0.00	2.00
Persephona aquilonaris	0.002	99.943	0.000	0.001	421369.	0.00	2.00
Gobiidae	0.000	99.944	0.000	0.001	421371.	0.00	2.00
Parapandalus longicauda	0.001	99.945	0.000	0.001	421373.	0.00	2.00
Haemulon aurolineatum	0.001	99.946	0.000	0.001	421375.	0.00	2.00
Ophidion holbrooki	0.000	99.946	0.000	0.003	421377.	0.00	1.00
Ogcocephalus parvus	0.001	99.947	0.000	0.003	421379.	0.00	1.00
Tonna galea	0.001	99.948	0.000	0.001	421381.	0.00	2.00
Sphoeroides spengleri	0.003	99.951	0.000	0.001	421383.	0.00	2.00
Scomber japonicus	0.001	99.952	0.000	0.003	421385.	0.00	1.00
Carcharhinus porosus	0.000	99.952	0.000	0.003	421387.	0.00	1.00
Triglidae	0.004	99.956	0.000	0.003	421389.	0.00	1.00
Cynoscion nebulosus	0.000	99.956	0.000	0.001	421391.	0.00	2.00
Steindachneria	0.001	99.958	0.000	0.001	421393.	0.00	2.00
Carcharhinidae	0.002	99.960	0.000	0.001	421395.	0.00	2.00
Caulolatilus	0.002	99.961	0.000	0.003	421397.	0.00	1.00
Calamus pennatula	0.001	99.963	0.000	0.001	421399.	0.00	2.00
Ophichthus	0.001	99.963	0.000	0.003	421401.	0.00	1.00
Gymnothorax moringa	0.002	99.966	0.000	0.003	421403.	0.00	1.00
Synagrops spinosa	0.001	99.967	0.000	0.001	421405.	0.00	2.00
Mycteroperca phenax	0.003	99.970	0.000	0.003	421407.	0.00	1.00
Carcharhinus falciformis	0.000	99.970	0.000	0.003	421409.	0.00	1.00
Pontinus macrolepis	0.001	99.971	0.000	0.001	421410.	0.00	1.00
Echinaster modestus	0.004	99.975	0.000	0.001	421411.	0.00	1.00
Gymnothorax ocellatus	0.000	99.975	0.000	0.001	421412.	0.00	1.00
Carcharhinus maculipinnis	0.006	99.981	0.000	0.001	421413.	0.00	1.00
Saurida normani	0.001	99.982	0.000	0.001	421414.	0.00	1.00
Serranus	0.000	99.982	0.000	0.001	421415.	0.00	1.00
Grammistidae	0.001	99.983	0.000	0.001	421416.	0.00	1.00
Mugil curema	0.001	99.983	0.000	0.001	421417.	0.00	1.00
Microgobius	0.000	99.983	0.000	0.001	421418.	0.00	1.00
Rhinoptera	0.002	99.985	0.000	0.001	421419.	0.00	1.00
Equetus	0.001	99.986	0.000	0.001	421420.	0.00	1.00
Busycon pyrum	0.001	99.987	0.000	0.001	421421.	0.00	1.00
Trachinotus carolinus	0.000	99.987	0.000	0.001	421422.	0.00	1.00
Caulolatilus cyanops	0.000	99.987	0.000	0.001	421423.	0.00	1.00
Sphoeroides dorsalis	0.001	99.988	0.000	0.001	421424.	0.00	1.00
Arenaeus cribrarius	0.000	99.988	0.000	0.001	421425.	0.00	1.00
Octopus vulgaris	0.001	99.989	0.000	0.001	421426.	0.00	1.00

Table 30. Continued.

Relative Composition Table for the Seasonal FID Data

TAXON NAME	MEAN PERCENT COMPOSITION	CUMULATIVE PERCENT COMPOSITION	POOLED PERCENT COMPOSITION	FREQ. OF OCCURRENCE	CUMULATIVE ABUNDANCE	MEAN DENSITY (# / HA)	INDEX OF DISPERSION
Kathetostoma albigutta	0.001	99.990	0.000	0.001	421427.	0.00	1.00
Porifera	0.000	99.990	0.000	0.001	421428.	0.00	1.00
Mustelus canis	0.000	99.990	0.000	0.003	421429.	0.00	1.00
Dasyatis sabina	0.000	99.991	0.000	0.001	421430.	0.00	1.00
Neobythites gillii	0.001	99.991	0.000	0.001	421431.	0.00	1.00
Encope	0.005	99.997	0.000	0.001	421432.	0.00	1.00
Parthenope	0.002	99.998	0.000	0.001	421433.	0.00	1.00
Leucosiidae	0.001	99.999	0.000	0.001	421434.	0.00	1.00
Equetus umbrosus	0.001	100.000	0.000	0.001	421435.	0.00	1.00
Sargassum	0.000	100.000	0.000	0.007	421435.	0.00	******
Balistes	0.000	100.000	0.000	0.001	421435.	0.00	******

SAMPLE SUMMARY: SAMPLES = 763 TOTAL TAXA = 297 TOTAL DENSITY = 778.80

Table 31. Hierarchical list of demersal nekton taxa collected in three replicate samples at 154 stations in and around the Tuscaloosa Trend study area during the fall 1974 to summer 1975 NMFS Fishery Independent groundfish surveys.

	Annelida	50
*	Polychaeta	5001
	Arthropoda	58
	Crustacea	61
*	Decapoda	6175
*	Natantia	61
	Penaeidae	617701
*	Parapenaeus	61770105
*	Penaeus	61770101
*	Penaeus aztecus	6177010101
*	Penaeus duorarum	6177010102
*	Penaeus setiferus	6177010103
*	Sicyonia	61770104
*	Sicyonia brevirostris	6177010401
*	Sicyonia dorsalis	6177010402
*	Solenocera	61770106
*	Trachypenaeus	61770102
*	Xiphopeneus	61770107
*	Scyllaridae	618202
*	Scyllarides nodifer	6182020202
*	Scyllarus	61820201
*	Paguridae	618306
*	Pagurus	61830602
*	Petrochirus diogenes	6183061201
	Portunidae	618901
*	Arenaeus cribrarius	6189010101
*	Callinectes	61890103
*	Callinectes sapidus	6189010301
*	Callinectes similis	6189010302
*	Ovalipes	61890105
*	Ovalipes guadulpensis	61890105??
*	Portunus	61890106
*	Portunus gibbesii	6189010601
*	Portunus sayi	6189010602
*	Portunus spinicarpus	6189010603
*	Portunus spinimanus	6189010604
*	Majidae	618701
*	Anasimus	61870120
*	Anasimus latus	6187012001
*	Libinia	61870109
*	Libinia emarginata	6187010902
	Parthenopidae	618702
*	Parthenope	61870201
*	Parthenope serrata	6187020104
	Calappidae	618602
*	Calappa	61860201
*	Calappa flammea	6186020101
*	Calappa springeri	61860201
*	Calappa sulcata	6186020102
*	Hepatus epheliticus	6186020201

Table 31. Continued.

*	Leucosiidae	618603
*	Persephona aquilonaris	6186030103
	Raninidae	618604
*	Raninoides louisianensis	6186040201
	Pandalidae	617918
*	Parapandalus longicauda	6179180401
*	Plesionika	61791805
*	Plesionika martia	61791805??
	Stomatopoda	6191
	Squillidae	619101
*	Squilla	61910101
	Mollusca	5085
	Bivalvia	55
	Arcoida	5506
	Arcidae	550601
*	Anadara	55060102
	Pterioida	5508
	Pectinidae	550905
*	Aequipecten gibbus	55090508??
	Veneroida	5515
	Mactridae	551525
*	Rangia	55152504
*	Cephalopoda	57
	Theuthidida	5705
	Myopsida	5706
	Loliginidae	570601
*	Loligo	57060101
*	Loligo pealeii	5706010102
*	Lolliguncula	57060102
*	Lolliguncula brevis	5706010201
	Octopodida	5708
	Octopodidae	570801
*	Octopus vulgaris	5708010202
	Gastropoda	51
	Mesogastropoda	5103
	Naticidae	510376
*	Polinices duplicatus	5103760407
*	Sinum perspectivum	5103760501
	Tonnidae	510380
*	Tonna galea	5103800101
	Stenoglossa	5105
	Melongenidae	510507
*	Busycon	51050701
*	Busycon pyrum	51050701??

Table 31. Continued.

	Echinodermata	81
*	Asteroidea	8104
	Paxillosida	8106
	Astropectinidae	810601
*	Astropecten	81060105
	Porcellanasteridae	810702
*	Prionaster	810702??
	Spinulosida	8112
	Clypeasteridae	815301
*	Clypeaster	81530101
	Echinasteridae	811404
*	Echinaster modestus	81140403??
	Valvatida	8109
	Goniasteridae	811104
*	Goniaster americanus	81110407??
*	Echinoidea	8136
	Clypeasteroida	8152
*	Mellitidae	815504
*	Encope	81550402
*	Encope emarginata	81550402??
*	Encope michelini	8155040202
*	Mellita	81550401
*	Spatangoida	8160
*	Holothuroidea	8170
*	Ophiuroidea	8120
	Ophiurida	8126
	Amphilepididae	812901
*	Ophiopholus	81290201
	Phrynophiurida	8125
	Gorgonocephalidae	812503
*	Gorgonocephalus	81250302
	Stelleroidea	8101
	Platyasterida	8105
	Luidiidae	810501
*	Luidia	81050101
*	Porifera	36
	Cnidaria	37
*	Anthozoa	3740
	Pennatulacea	3752
	Renillidae	375303
*	Renilla	37530301
*	Renilla mulleri	3753030101
*	Hydrozoa	3701
*	Scyphozoa	3730
	Semaeostomeae	3734
	Ulmaridae	373403
*	Aurelia	37340302

Table 31. Continued.

	Chordata	8388
	Antennarioidei	8787
	Antennariidae	878702
*	Antennarius radiosus	8787020203
	Ogcocephalidae	878704
*	Halieutichthys aculeatus	8787040301
*	Ogcocephalus	87870401
*	Ogcocephalus nasutus	8787040103
*	Ogcocephalus parvus	8787040105
*	Ogcocephalus vespertilio	8787040101
*	Zalieutes mcgintyi	8787040401
	Balistoidei	8860
*	Balistidae	886002
*	Aluterus schoepfi	8860020101
*	Balistes	88600202
*	Balistes capriscus	8860020201
*	Monacanthus hispidus	8860020703
	Ostraciontidae	886003
*	Acanthostracion quadricornis	8860030201
	Batrachoidiformes	8783
	Batrachoididae	878301
*	Porichthys porosissimus	8783010106
	Myctophoidei	8762
	Synodontidae	876202
*	Saurida	87620203
*	Saurida brasiliensis	8762020301
*	Saurida normani	8762020303
*	Synodus	87620201
*	Synodus foetens	8762020101
*	Synodus poeyi	8762020104
*	Trachinocephalus myops	8762020401
	Osteichthyes	8717
	Anguilliformes	8740
*	Congridae	874112
*	Conger	87411201
*	Conger oceanicus	8741120101
*	Congrina	87411203
*	Congrina flava	8741120302
*	Ophichthus	87411310
	Muraenesocidae	874108
*	Hoplunnis	87410801
*	Hoplunnis macrurus	8741080102
	Muraenidae	874105
*	Gymnothorax	87410504
*	Gymnothorax moringa	8741050403
*	Gymnothorax nigromarginatus	8741050404
*	Gymnothorax ocellatus	8741050405
	Clupeiformes	8745
	Clupeidae	874701
*	Brevoortia patronus	8747010403
*	Etrumeus teres	8747010601
*	Harengula jaguana	8747010803
*	Opisthonema oglinum	8747010701
*	Sardinella aurita	8747011001

Table 31. Continued.

	Engraulidae	874702
*	Anchoa	87470202
*	Anchoa hepsetus	8747020201
*	Anchoa lyolepis	8747020205
*	Anchoa mitchilli	8747020202
*	Anchoviella eurystole	8747020302
	Gadiformes	8789
	Gadidae	879103
*	Urophycis	87910310
*	Urophycis floridanus	8791031007
*	Urophycis regius	8791031002
	Merlucciidae	879104
*	Steindachneria	87910402
*	Steindachneria argentea	8791040201
	Moridae	879101
*	Laemonema	8791010202
*	Ophidiidae	879201
*	Brotula	87920104
*	Brotula barbata	8792010401
*	Lepophidium	87920105
*	Lepophidium brevibarbe	8792010502
*	Neobythites gillii	8792012001
*	Ophidion holbrooki	8792010603
*	Ophidion welshi	8792010605
*	Rissola marginata	8792010901
	Perciformes	8834
	Carangidae	883528
*	Caranx fusus	8835280302
*	Caranx hippos	8835280303
*	Chloroscombrus chrysurus	8835280401
*	Decapterus punctatus	8835281202
*	Selar crumenophthalmus	8835280601
*	Selene setapinnis	88352807??
*	Selene vomer	8835280701
*	Trachinotus carolinus	8835280901
*	Trachurus lathami	8835280102
*	Gobiidae	884701
*	Bollmannia	88470116
*	Bollmannia communis	8847011601
*	Gobionellus hastatus	8847010502
*	Microgobius	88470107
	Mugilidae	883601
*	Mugil cephalus	8836010101
*	Mugil curema	8836010102
	Apogonidae	883518
*	Synagrops spinosa	8835180603
	Branchiostegidae	883522
*	Caulolatilus	88352201
*	Caulolatilus cyanops	8835220102
*	Lopholatilis	88352202
*	Lopholatilis chamaeleonticeps	8835220201
	Echeneidae	883527
*	Echeneis naucrates	8835270201
*	Remora remora	8835270103

Table 31. Continued.

	Ephippidae	883552
*	Chaetodipterus faber	8835520101
	Gerridae	883539
*	Eucinostomus argenteus	8835390101
*	Eucinostomus gula	8835390102
*	Grammistidae	883503
*	Rypticus saponaceus	8835030207
	Lutjanidae	883536
*	Lutjanus campechanus	8835360107
*	Lutjanus griseus	8835360102
*	Lutjanus synagris	8835360112
*	Pristipomoides aquilonaris	8835360701
*	Rhomboplites aurorubens	8835360501
	Mullidae	883545
*	Upeneus parvus	8835450402
	Pomadasyidae	883540
*	Haemulon aurolineatum	8835400101
*	Orthopristis chrysoptera	8835400201
	Priacanthidae	883517
*	Priacanthus arenatus	8835170101
	Rachycentridae	883526
*	Rachycentron canadum	8835260101
	Sciaenidae	883544
*	Bairdiella chrysura	8835440301
*	Mycteroperca phenax	8835020505
*	Cynoscion	88354401
*	Cynoscion arenarius	8835440106
*	Cynoscion nebulosus	8835440102
*	Cynoscion nothus	8835440103
*	Equetus	88354412
*	Equetus acuminatus	8835441201
*	Equetus umbrosus	8835441206
*	Larimus fasciatus	8835440501
*	Leiostomus xanthurus	8835440401
*	Menticirrhus	88354406
*	Menticirrhus americanus	8835440601
*	Micropogonias undulatus	8835440701
*	Pogonias chromis	8835440801
*	Sciaenops ocellata	8835440901
*	Stellifer lanceolatus	8835441001
	Serranidae	883502
*	Centropristis ocyurus	8835020304
*	Centropristis philadelphicus	8835020305
*	Diplectrum bivittatum	8835021005
*	Diplectrum formosum	8835021002
*	Diplectrum radiale	8835021004
*	Serranus	88350223
*	Serranus atrobranchus	8835022302
	Sparidae	883543
*	Archosargus probatocephalus	8835430301
*	Calamus pennatula	8835430507
*	Lagodon rhomboides	8835430201
*	Stenotomus caprinus	8835430102

Table 31. Continued.

	Pomatomidae	883525
*	Pomatomus saltatrix	8835250101
	Scombridae	885003
*	Scomber japonicus	8850030301
*	Scomberomorus cavalla	8850030501
*	Scomberomorus maculatus	8850030502
	Cynoglossidae	885802
*	Symphurus	88580201
*	Symphurus diomedianus	8858020103
*	Symphurus plagiusa	8858020101
	Soleidae	885801
*	Achirus	88580102
*	Gymnachirus	88580103
*	Gymnachirus texae	8858010303
*	Trinectes maculatus	8858010101
	Pleuronectoidei	8857
*	Bothidae	885703
*	Ancylopsetta quadrocellata	8857030506
*	Citharichthys	88570301
*	Citharichthys cornutus	8857030106
*	Citharichthys macrops	8857030109
*	Citharichthys spilopterus	8857030110
*	Cyclopsetta chittendeni	8857030801
*	Cyclopsetta fimbriata	8857030802
*	Engyophrys senta	8857030901
*	Etropus	88570302
*	Etropus crossotus	8857030201
*	Etropus microstomus	8857030202
*	Paralichthys lethostigma	8857030304
*	Paralichthys squamilentus	8857030306
*	Syacium	88570313
*	Syacium gunteri	8857031301
*	Syacium papillosum	8857031303
*	Trichopsetta	88570314
*	Trichopsetta ventralis	8857031404
	Polynemoidei	8838
*	Polydactylus octonemus	8838010101
	Polynemidae	883801
*	Polynemus virginicus	8838010203
	Rajiformes	8713
	Dasyatidae	871305
*	Dasyatis sabina	8713050105
*	Dasyatis sayi	8713050106
*	Dasyatus americana	8713050103
*	Gymnura micrura	8713050202
	Myliobatidae	871307
*	Rhinoptera	87130703
*	Rhinoptera bonasus	8713070301
	Rajidae	871304
*	Raja eglanteria	8713040113
*	Raja texana	8713040133
	Rhinobatidae	871302
*	Rhinobatos lentiginosus	8713020101
	Torpedinidae	871303
*	Narcine brasiliensis	8713030401

Table 31. Continued.

	Scombroidei	8850
	Trichiuridae	885002
*	Trichiurus lepturus	8850020201
	Scorpaenoidei	8826
	Scorpaenidae	882601
*	Pontinus macrolepis	8826010504
*	Scorpaena	88260106
*	Scorpaena brasiliensis	8826010605
*	Scorpaena calcarata	8826010606
*	Triglidae	882602
*	Bellator	88260202
*	Bellator militaris	8826020203
*	Prionotus	88260201
*	Prionotus alatus	8826020105
*	Prionotus ophryas	8826020113
*	Prionotus paralatus	8826020114
*	Prionotus roseus	8826020117
*	Prionotus rubio	8826020118
*	Prionotus salmonicolor	8826020120
*	Prionotus scitulus	8826020103
*	Prionotus stearnsi	8826020121
*	Prionotus tribulus	8826020104
	Scyliorhinoidei	8708
*	Carcharhinidae	870802
*	Carcharhinus acronotus	8708020504
*	Carcharhinus falciformis	8708020506
*	Carcharhinus maculipinnis	8708020509
*	Carcharhinus porosus	8708020512
*	Mustelus canis	8708020401
*	Rhizoprionodon terraenovae	8708020301
	Sphyrnidae	870803
*	Sphyrna tiburo	8708030101
*	Sphyrna lewini	8708030103
	Siluriformes	8777
	Ariidae	877718
*	Arius felis	8777180202
*	Bagre marinus	8777180101
	Sphyraenoidei	8837
	Sphyraenidae	883701
*	Sphyraena guachancho	8837010103
	Stromateoidei	8851
	Stromateidae	885103
*	Peprilus burti	8851030104
*	Peprilus paru	8851030102
	Syngnathoidei	8820
	Syngnathidae	882002
*	Hippocampus erectus	8820020201
	Tetradontoidei	8861
	Diodontidae	886103
*	Chilomycterus schoepfi	8861030101
	Tetraodontidae	886101
*	Lagocephalus laevigatus	8861010101
*	Sphoeroides	88610102
*	Sphoeroides dorsalis	8861010205
*	Sphoeroides parvus	8861010210
*	Sphoeroides spengleri	8861010211

Table 31. Continued.

	Trachinoidei	8840
	Uranoscopidae	884014
*	Kathetostoma albigutta	8840140301
	Pheaophyta	15
	Phaeophyceae	1501
	Fucales	1510
	Sargassaceae	151004
*	Sargassum	15100401
	Miscellaneous taxa	
*	Gorgoniidae	375105

from further consideration. In addition, those taxa which represent higher levels of taxonomic identification (i.e., family, order, class or phylum level identifications) were also excluded. This process resulted in the selection of 175 taxa to be included in subsequent pattern analysis. These 175 taxa were subjected to initial TWINSPAN analysis of mean data at 256 stations (not presented). Based on the results of this initial analysis, a suite of 100 taxa that showed the most ecologically meaningful trends was selected for detailed community analysis and presentation.

The results of the initial TWINSPAN analysis were used in conjunction with maps depicting the station group locations by season to provide the basis for the elimination of 102 of the 256 stations. Some portions of the study area were more intensively sampled than others, and many of the excluded stations were located in these intensively sampled areas. The procedure involved removing redundancy in the data set while still retaining all of the important trends. This selection process yielded 154 stations that maintained adequate spatial and seasonal coverage. Therefore, the TWINSPAN analysis presented in this report consists of four seasons of data for 100 selected taxa at 154 stations that were each sampled on one occasion. The numbers of stations were evenly distributed over the four seasons. The locations of the stations in the analysis are presented, by season, in Figure 15.

The ordered two-way display resulting from this TWINSPAN analysis, which concisely displays the major trends in community structure, is presented in Figure 16. The stations in the two-way table are listed across the top, and the taxa are listed down the side. Table 32 presents the values for depth, near bottom temperature and community parameters for each station, with the stations ordered and grouped in the same manner as in the corresponding TWINSPAN display (Figure 16). Examination of Figure 16 and Table 32 in concert facilitates the identification of environmental trends most related to the ordering and grouping of stations and taxa.

These results showed that the station ordering across the top of the TWINSPAN display (Figure 16) was primarily related to hydrography (manifested in seasonal and geographical trends) and sediment composition (manifested through geographic location). The first dichotomy separated two groups of stations that differed mainly by geographic location. The stations on the left of the TWINSPAN display (Station Group I in Figure 16 and Table 32) were primarily located in the western and central portions of the study area with the addition of some of the very nearshore stations in the eastern portion of the study area. The stations on the right of the TWINSPAN display (Station Group II in Figure 16 and Table 32) were primarily located in the eastern portion of the study area with the addition of some central stations. The central portion of the study area marks a transition from the predominantly muddy sediments of the western portion of the study area to the predominantly sandy sediments of the eastern portion of the study area.

Similarly, the taxa were ordered such that those that were most characteristic of the western and central regions and the very nearshore habitat in all regions (Station Group I) were located along the upper portion of the TWINSPAN display (Taxa Group I in Figure 16), whereas those taxa that were most characteristic of the stations in the eastern portion

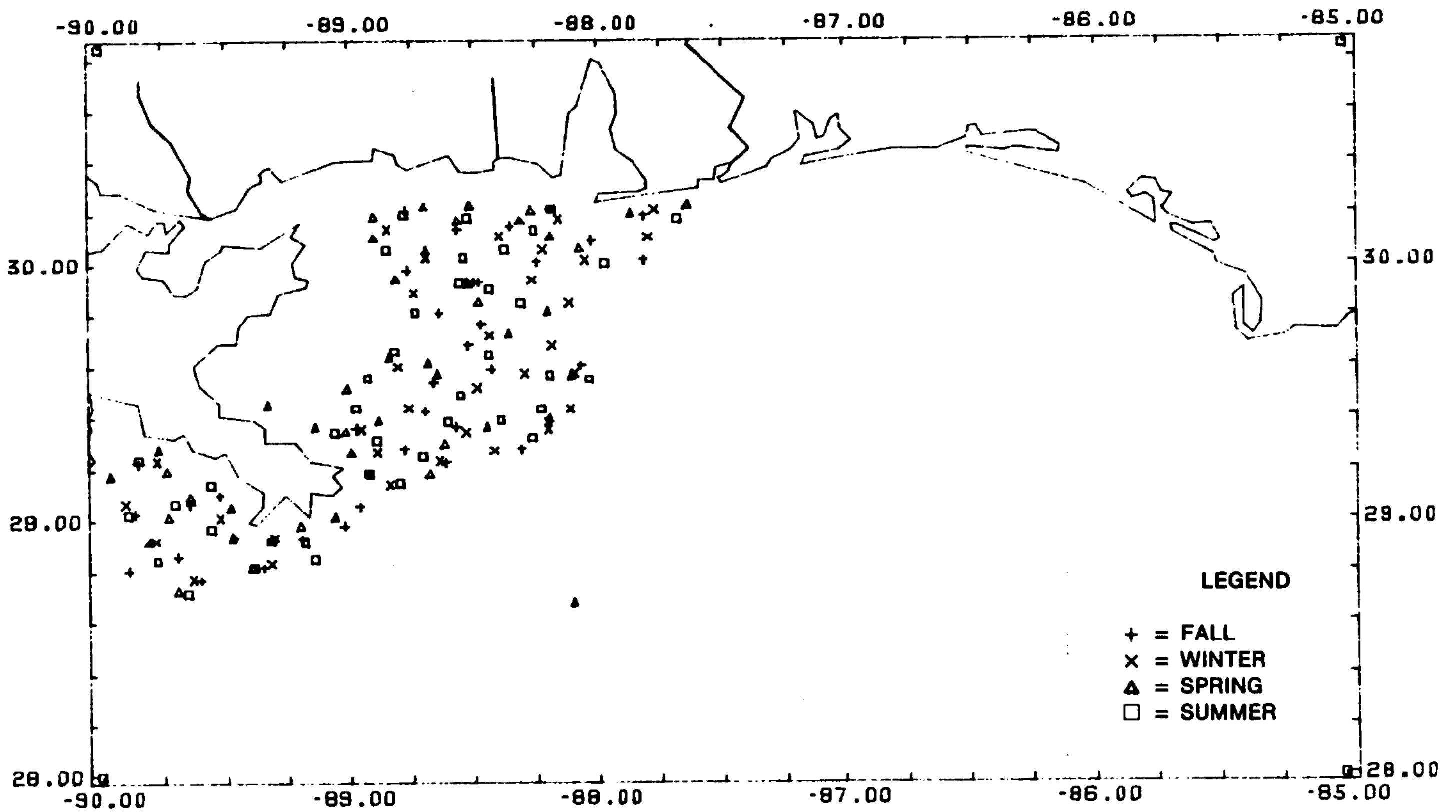

Figure 15. Map of the Tuscaloosa Trend study area showing the locations of the NMFS Fishery Independent groundfish survey stations for fall 1974 to summer 1975.

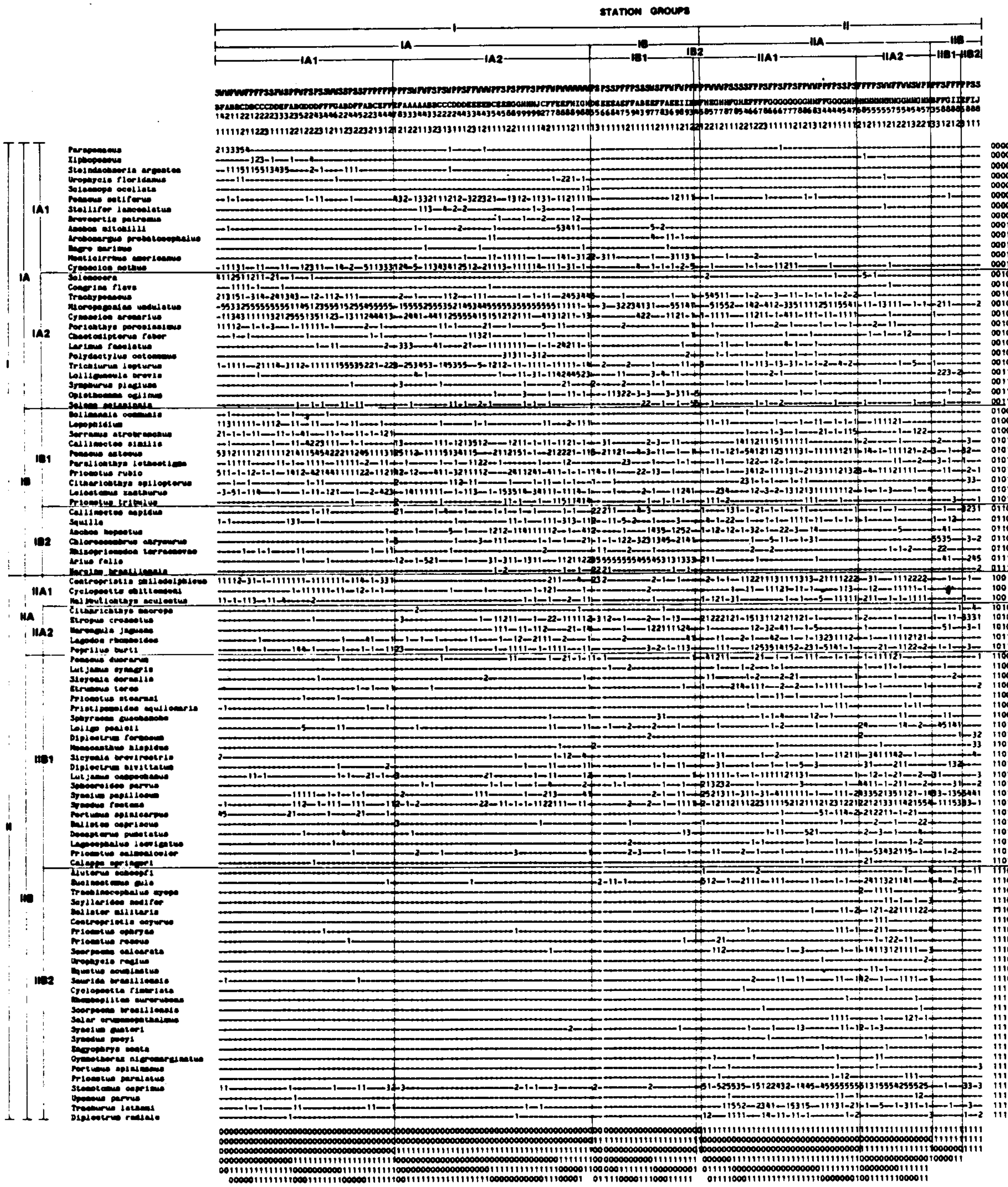

Figure 16. Ordered two-way display resulting from TWINSPAN analysis of mean relative abundances of 100 selected demersal nekton taxa collected in three replicate samples at 154 stations in and around the Tuscaloosa Trend study area during the fall 1974 to summer 1975 NMFS Fishery Independent groundfish surveys.

Table 32. Ordered table of means for environmental and community parameters in three replicate samples collected at 154 stations in and around the Tuscaloosa Trend study area during the fall 1974 to summer 1975 NMFS Fishery Independent groundfish surveys.

Station Group	Season	Cell	Group	Sample Number	Latitude (DDMMSS)	Longitude (DDMMSS)	Depth (fm)	Bottom Temperature (oC)	Total Taxa	Total Count	Diversity (H')	Evenness (J')	Richness (D)
IA1	Summer	B1	1	1	28 43 00	89 39 00	48	64.00	19	271	2.2711	0.767	3.324
IA1	Winter	F4	1	2	29 14 00	88 38 20	39	70.00	15	417	1.6000	0.599	2.207
IA1	Winter	A2	1	3	28 55 20	89 47 00	27		14	314	1.5977	0.604	2.276
IA1	Fall	B1	1	4	28 46 00	89 36 00	46		14	491	1.6233	0.625	2.048
IA1	Winter	B1	1	5	28 46 20	89 37 40	45		13	306	1.8255	0.713	2.177
IA1	Winter	C2	2	6	28 50 00	89 19 00	46		11	725	1.3955	0.576	1.603
IA1	Fall	D2	1	7	28 58 40	89 01 20	39		11	459	1.5266	0.648	1.584
IA1	Spring	B1	1	8	28 43 40	89 41 20	45	65.00	10	760	0.7633	0.336	1.318
IA1	Fall	C2	2	9	28 49 00	89 20 40	43		10	726	1.5822	0.725	1.337
IA1	Spring	C2	2	10	28 49 00	89 23 40	36	66.00	13	1125	1.3955	0.546	1.710
IA1	Summer	C2	3	11	28 49 00	89 23 20	41	64.00	4	1446	0.1177	0.083	0.460
IA1	Summer	D2	1	12	28 51 00	89 08 40	40	65.00	11	400	1.5233	0.639	1.710
IA1	Spring	D3	1	13	29 01 00	89 03 40	22	69.00	13	485	1.6488	0.652	1.859
IA1	Winter	E3	1	14	29 08 20	88 50 20	43		8	923	0.6233	0.303	0.988
IA1	Summer	F3	1	15	29 08 40	88 48 00	43	65.00	10	964	1.2466	0.548	1.351
IA1	Spring	A2	2	16	28 55 20	89 48 20	25	70.00	18	433	1.3755	0.479	2.741
IA1	Spring	B3	2	17	29 01 00	89 43 40	22	69.00	10	584	0.9033	0.362	1.475
IA1	Winter	G5	1	18	29 31 00	88 29 00	28	68.00	15	206	2.0788	0.769	2.563
IA1	Fall	D2	2	19	28 55 40	89 11 40	30		8	666	0.5977	0.294	1.026
IA1	Summer	D2	2	20	28 55 00	89 11 00	27	70.00	15	240	1.9788	0.734	2.560
IA1	Spring	D4	2	21	29 16 00	88 59 40	11		18	495	1.8299	0.638	2.698
IA1	Summer	F3	3	22	29 11 00	88 55 20	16	77.00	11	299	1.4500	0.607	1.752
IA1	Summer	F4	1	23	29 23 20	88 36 20	30	69.00	11	543	1.0966	0.455	1.650
IA1	Winter	F4	2	24	29 20 40	88 31 40	34	68.00	13	384	1.6866	0.657	2.025
IA1	Winter	G6	1	25	29 43 20	88 26 00	21	68.00	14	257	1.5822	0.599	2.348
IA1	Summer	A2	1	26	28 50 40	89 46 20	29	69.00	11	911	0.7677	0.324	1.419
IA1	Summer	B2	2	27	28 58 00	89 33 20	24	68.00	7	461	1.0722	0.580	0.994
IA1	Spring	D4	3	28	29 21 00	89 01 00	10	67.00	14	339	1.2711	0.488	2.173
IA1	Summer	F4	2	29	29 15 00	88 42 20	38	66.00	14	629	1.2033	0.460	2.116
IA1	Summer	F5	2	30	29 29 20	88 33 00	28	68.00	14	577	1.4388	0.537	2.208
IA1	Fall	A2	3	31	28 48 20	89 53 20	29		8	851	0.8811	0.441	0.992
IA1	Fall	B2	2	32	28 51 40	89 41 20	33		10	405	1.4300	0.644	1.749
IA1	Spring	C3	1	33	29 03 20	89 28 40	5		3	354	0.2300	0.229	0.414
IA1	Fall	E4	3	34	29 16 40	88 46 40	34		9	595	1.0511	0.467	1.324
IA1	Fall	F4	1	35	29 22 00	88 34 00	32		16	815	1.6577	0.603	2.203
IA1	Fall	F4	2	36	29 13 40	88 36 40	38		11	219	1.6077	0.677	1.859
IA2	Spring	E7	1	37	29 54 40	88 48 40	5		14	271	1.6144	0.603	2.405
IA2	Spring	F8	2	38	30 03 40	88 41 20	10	71.00	10	67	1.4055	0.623	2.104
IA2	Fall	A3	1	39	29 01 40	89 51 40	16	71.00	10	802	1.2722	0.562	1.305
IA2	Summer	A3	2	40	29 01 20	89 53 20	17	79.00	5	1097	0.9866	0.608	0.730
IA2	Winter	A3	2	41	29 04 00	89 54 00	14		12	256	1.7255	0.688	2.071
IA2	Fall	A4	1	42	29 13 40	89 51 00	6	68.00	6	1066	0.6355	0.368	0.683
IA2	Winter	A4	1	43	29 14 00	89 46 20	6	69.00	9	486	1.4600	0.668	1.347
IA2	Fall	B3	3	44	29 06 00	89 31 20	6		8	587	1.0422	0.511	1.046
IA2	Summer	B3	2	45	29 04 00	89 42 00	16	72.00	7	272	1.3299	0.671	1.128
IA2	Spring	C2	3	46	28 56 20	89 28 20	12	72.00	10	3321	0.8922	0.388	1.140
IA2	Summer	C2	1	47	28 55 20	89 19 00	14	75.67	9	335	1.6688	0.789	1.370
IA2	Winter	C2	3	48	28 56 00	89 18 20	18	69.00	9	2243	1.0877	0.487	1.152
IA2	Spring	D2	1	49	28 58 40	89 12 00	7		15	745	1.7611	0.651	2.155
IA2	Spring	D4	1	50	29 22 00	89 08 20	5		11	505	1.5322	0.637	1.759
IA2	Summer	D4	1	51	29 20 40	89 03 40	6	81.00	9	495	1.4955	0.670	1.285
IA2	Fall	E3	2	52	29 11 00	88 55 40	16		10	1116	1.0366	0.449	1.359
IA2	Fall	E3	3	53	29 03 20	88 57 40	29		9	433	1.3011	0.597	1.309
IA2	Winter	E4	1	54	29 21 20	88 57 20	11	66.00	10	373	0.8100	0.355	1.477
IA2	Winter	E4	2	55	29 16 00	88 53 20	26	69.00	9	493	0.6999	0.316	1.338
IA2	Winter	B3	1	56	29 00 40	89 31 20	7	69.00	12	468	0.9611	0.391	1.762
IA2	Spring	C5	1	57	29 27 20	89 19 40	3		15	4349	1.7933	0.659	2.170
IA2	Fall	E8	1	58	29 21 40	88 58 20	11		10	1629	0.8277	0.362	1.320
IA2	Summer	E8	1	59	29 33 20	88 55 40	6		12	602	1.3688	0.558	1.721
IA2	Spring	G8	2	60	30 06 20	88 54 00	7	75.00	15	2561	1.2666	0.473	1.748
IA2	Summer	G8	2	61	30 06 00	88 15 20	11	78.00	19	1195	1.5566	0.529	2.491
IA2	Spring	G9	1	62	30 12 40	88 16 00	5		13	1532	0.9066	0.353	1.578
IA2	Fall	H9	1	63	30 13 00	88 11 40	6	73.00	17	643	1.5988	0.563	2.532
IA2	Spring	H9	1	64	30 14 00	88 10 40	4		4	201	0.3799	0.259	0.585
IA2	Summer	H9	1	65	30 15 00	88 11 00	6	79.00	19	1027	1.3322	0.456	2.551
IA2	Spring	J9	1	66	30 14 00	87 38 20	4		17	3509	1.3266	0.461	2.070
IA2	Fall	C2	4	67	28 56 00	89 28 00	11		13	233	1.7944	0.712	2.302
IA2	Fall	F7	2	68	29 48 40	88 38 20	12		23	134	2.6277	0.838	4.571
IA2	Winter	F7	1	69	29 56 00	88 30 40	16	68.00	15	579	1.6100	0.598	2.154
IA2	Spring	G8	1	70	30 11 20	88 54 00	5		13	358	1.6033	0.625	2.191
IA2	Winter	H8	1	71	30 08 20	88 50 40	7		24	'422	2.3590	0.742	3.840
IA2	Winter	F8	1	72	30 01 40	88 41 20	10	61.00	23	391	2.4499	0.782	3.685
IA2	Winter	H8	2	73	30 10 40	88 09 20	8	64.00	18	253	1.9222	0.671	3.033
IA2	Winter	I9	1	74	30 12 40	87 46 20	7		14	290	1.0799	0.722	2.354
IA2	Winter	G8	1	75	30 06 40	88 23 40	10		24	307	2.3488	0.740	4.019
IA2	Winter	H8	1	76	30 03 40	88 13 20	12		22	291	2.3633	0.764	3.711
IB1	Spring	D5	1	77	29 31 00	89 00 40	5		16	511	1.4922	0.542	2.375
IB1	Summer	E5	3	78	29 26 20	88 58 20	8	81.00	6	40	1.3155	0.800	1.257
IB1	Spring	E6	1	79	29 38 20	88 50 20	7	72.00	11	587	0.7344	0.323	1.536
IB1	Summer	E6	1	80	29 39 40	88 49 00	6	80.00	10	471	0.9055	0.399	1.403
IB1	Summer	E8	1	81	30 03 40	88 51 00	6	79.00	7	215	0.6022	0.305	1.126
IB1	Spring	A4	1	82	29 17 00	89 46 00	4		4	89	0.9088	0.778	1.081
IB1	Fall	E7	1	83	29 50 40	88 46 00	7		14	167	1.6422	0.628	2.475
IB1	Fall	F5	2	84	29 32 20	88 39 40	11		9	96	1.0511	0.512	1.656
IB1	Spring	F9	1	85	30 13 40	88 41 40	5		4	217	0.6288	0.456	0.541
IB1	Summer	A4	1	86	29 19 20	89 50 40	7	80.33	6	20	1.3633	0.756	1.766
IB1	Summer	B3	1	87	29 08 20	89 31 20	6	79.00	5	159	0.4666	0.271	0.871
IB1	Summer	E9	1	88	30 11 40	88 46 40	6	79.00	15	112	2.0899	0.778	2.902
IB1	Winter	E7	1	89	29 53 20	88 44 20	9	64.00	14	227	1.8099	0.700	2.343
IB1	Summer	F7	2	90	29 48 40	88 44 00	9		10	225	1.6088	0.716	1.656
IB1	Fall	F8	1	91	30 08 20	88 33 40	8		15	488	1.5777	0.609	2.300
IB1	Spring	A3	1	92	29 10 40	89 57 40	7	76.00	5	184	0.6944	0.519	1.168
IB1	Winter	E6	1	93	29 36 00	88 48 20	8		13	631	1.1333	0.447	1.822
IB1	Fall	E9	1	94	30 12 40	88 46 20	8		17	1271	1.3677	0.475	2.359
IB1	Winter	I8	2	95	30 08 20	87 47 40	9	67.00	17	323	1.7988	0.627	2.831
IB1	Spring	I9	1	96	30 12 00	87 51 40	4		13	321	2.0788	0.809	2.130
IB1	Fall	B3	2	97	29 04 00	89 38 20	11		9	3300	1.2800	0.609	1.388
IB1	Spring	B4	2	98	29 11 40	89 44 00	8	75.00	2	4	0.7888	0.966	1.156
IB1	Spring	F5	1	99	29 34 20	88 38 40	10	72.00	13	135	1.5944	0.622	2.461
IB1	Spring	G8	2	100	30 09 00	88 04 20	12	75.00	17	356	2.3322	0.818	2.787
IB2	Winter	E5	2	101	29 26 20	88 45 40	14		17	200	1.7233	0.610	2.904
IIA1	Winter	G7	1	102	29 56 20	88 16 00	17		24	1005	2.3800	0.753	3.286
IIA1	Winter	H7	2	103	29 51 00	88 07 00	19		18	1024	1.5377	0.539	2.609
IIA1	Spring	H8	1	104	30 06 40	88 11 20	11	73.00	23	1362	1.7199	0.555	3.059
IIA1	Summer	F7	1	105	29 55 40	88 33 20	14	76.00	13	218	1.5800	0.610	2.188
IIA1	Summer	G8	1	106	30 03 40	88 22 20	16	76.00	8	322	0.8588	0.405	1.362
IIA1	Summer	H5	2	107	29 33 00	88 02 00	23	71.67	9	219	1.2266	0.549	1.560
IIA1	Summer	H4	2	108	29 18 40	88 53 40	17	74.00	20	279	2.0011	0.670	3.317
IIA1	Fall	F6	1	109	29 41 00	88 31 00	18	70.00	18	202	2.0033	0.692	3.395
IIA1	Spring	F6	2	110	29 37 00	88 41 00	9	71.00	17	129	1.7133	0.634	2.998
IIA1	Spring	F7	2	111	29 55 40	88 31 00	16	72.00	17	510	1.8522	0.656	2.587
IIA1	Summer	F8	3	112	30 01 40	88 32 20	14	76.00	16	277	1.8600	0.684	2.709
IIA1	Fall	G6	1	113	29 46 00	88 28 00	19		19	183	2.0900	0.714	3.420
IIA1	Spring	G6	1	114	29 44 00	88 21 20	21	73.00	21	145	2.5500	0.835	4.103
IIA1	Summer	G6	1	115	29 38 40	88 26 20	22	74.00	23	349	2.1744	0.690	3.806
IIA1	Fall	G7	1	116	29 54 00	88 28 40	16		17	3427	1.5655	0.546	2.385
IIA1	Spring	G7	1	117	29 51 20	88 20 40	17	71.00	20	1538	1.6311	0.544	2.647
IIA1	Summer	G7	2	118	-29 54 20	88 26 00	18	75.00	19	391	1.9166	0.650	3.258
IIA1	Fall	G8	1	119	30 00 40	88 14 40	16		20	1008	2.5033	0.837	2.760
IIA1	Spring	G8	2	120	30 10 20	88 18 40	8	72.00	20	915	1.7444	0.582	2.811
IIA1	Winter	H6	1	121	29 41 00	88 11 00	21		13	426	1.7899	0.699	1.981
IIA1	Winter	H8	3	122	30 01 00	88 03 00	12		25	711	2.0644	0.638	3.724
IIA1	Spring	F5	1	123	29 11 00	88 40 40	45	64.33	17	648	2.0566	0.726	2.494
IIA1	Spring	F4	2	124	29 18 00	88 37 00	36	68.00	14	607	1.5055	0.617	2.038
IIA1	Fall	G4	1	125	29 16 40	88 18 20	42	70.00	9	319	1.1477	0.523	1.548
IIA1	Spring	G4	1	126	29 22 00	88 26 40	34	71.00	23	515	2.0555	0.649	3.975
IIA1	Summer	G4	1	127	29 19 20	88 16 00	39	66.00	21	672	1.5388	0.510	3.107
IIA1	Summer	G5	1	128	29 23 40	88 23 20	30	69.00	21	1417	1.9799	0.653	2.713
IIA1	Spring	H6	1	129	29 40 40	88 06 00	50	68.00	16	1248	1.6744	0.608	2.113
IIA1	Summer	H7	1	130	29 51 00	88 18 40	19		25	787	2.2611	0.705	3.669
IIA2	Fall	H6	2	131	29 36 20	88 04 00	21		9	90	1.4544	0.668	1.905
IIA2	Fall	H8	1	132	30 05 40	88 01 20	13	72.00	25	387	2.3322	0.730	4.042
IIA2	Fall	H5	2	133	29 23 40	88 12 00	32		18	427	2.2688	0.791	2.801
IIA2	Spring	H5	1	134	29 34 00	88 06 20	22	74.00	24	208	2.4011	0.762	4.247
IIA2	Summer	H5	1	135	29 34 00	88 11 40	22	72.00	19	563	2.2566	0.782	2.829
IIA2	Winter	H5	1	136	29 34 20	88 05 40	25		19	488	2.1288	0.735	2.909
IIA2	Winter	H5	2	137	29 26 00	88 06 40	30		18	515	2.2244	0.765	2.786
IIA2	Fall	H7	1	138	29 51 00	88 06 20	19		24	2245	1.8533	0.583	3.053
IIA2	Fall	G5	2	139	29 35 20	88 25 40	23	73.33	23	337	1.9188	0.605	3.937
IIA2	Winter	G5	2	140	29 34 20	88 17 40	23		17	248	1.6699	0.590	3.002
IIA2	Winter	H4	1	141	29 21 20	88 12 00	34		20	219	1.9122	0.639	3.465
IIA2	Summer	H5	3	142	29 26 00	88 13 40	31	69.00	18	483	1.7344	0.609	2.740
IIA2	Winter	G4	2	143	29 16 20	88 25 00	42	68.00	10	110	1.5188	0.703	1.858
IIA2	Spring	H5	2	144	29 24 00	88 11 40	31	70.00	11	118	1.5088	0.753	2.160
IIA2	Spring	H7	1	145	29 49 00	88 12 00	20	73.00	11	201	1.2188	0.535	2.131
IIB1	Spring	B3	3	146	29 05 40	89 38 20	10	74.00	5	110	0.5744	0.453	1.802
IIB1	Fall	F5	3	147	29 29 40	88 41 40	18		7	35	1.0922	0.627	1.664
IIB1	Summer	F8	1	148	30 11 00	88 31 20	7	79.00	12	225	1.5711	0.643	1.974
IIB1	Fall	G8	2	149	30 09 00	88 21 00	8	73.00	14	324	1.1088	0.409	2.230
IIB1	Fall	I8	1	150	30 11 20	87 48 40	7	71.00	10	118	1.2377	0.542	1.901
IIB2	Fall	I8	2	151	30 01 00	87 48 40	13	72.50	8	80	1.6411	0.792	1.606
IIB2	Spring	E5	3	152	29 23 40	88 53 00	12	67.00	7	27	1.5422	0.775	1.925
IIB2	Spring	F8	1	153	30 10 20	88 33 40	7	75.00	15	149	1.6544	0.611	2.738
IIB2	Summer	I8	1	154	30 00 20	87 58 20	11		7	21	1.4033	0.722	2.121
IIB2	Summer	J8	1	155	30 10 40	87 40 40	7	72.33	20	295	1.5988	0.551	3.444

STATION GROUPS: I (IA: IA1, IA2; IB: IB1, IB2); II (IIA: IIA1, IIA2; IIB: IIB1, IIB2) of the study area were located along the bottom portion of the display (Taxa Group II in Figure 16).

The stations comprising Station Group IA1 in Figure 16 and Table 32 were primarily located in middepth to deep waters in the western region and directly off the Mississippi River Delta, with the addition of a few deep water stations located in the central region. Station Group IA1 included 8 fall, 8 winter, 8 spring and 11 summer stations, indicating a stable community structure over the year. Based on the values for community parameters (Table 32), the samples at these stations were not appreciably different from those in Groups IA2 and IB1.

Station Group IA2 (Figure 16) included 40 stations located in shallow to middepth waters across the entire study area. This group included 9 fall, 13 winter, 11 spring and 7 summer collections.

The 21 stations comprising Station Group IB1 (Figure 16) were generally located in shallow depths across the entire study area. Many of these stations were located near Chandeleur and Breton Sounds. They tended to have low total numbers of taxa and low total numbers of individuals, but they were not strikingly different from the samples in Groups IA1 and IA2 (Table 32). This group was dominated by spring and summer collections, and included 5 fall, 3 winter, 6 spring and 7 summer stations.

Station Group IB2 was comprised of 1 very depauperate sample collected from a shallow water station in the central portion of the study area during spring (Figure 16 and Table 32).

Station Group IIA1 was comprised of 32 stations primarily located in middepth waters in the central and eastern portions of the study area, with the addition of a few deep water stations and a few shallow water stations. Group IIA1 was dominated by spring and summer stations, and included 5 fall, 5 winter, 12 spring and 10 summer stations. Although there was considerable variability within the group, these stations and those in Group IIA2 generally had highest numbers of taxa and clearly had highest taxa richness (Table 32).

The 15 stations comprising Station Group IIA2 were generally located in middepth waters in the eastern portions of the study area, with the addition of some deep water stations. Compared to those in Group IIA1, the Group IIA2 stations covered a narrower depth range (Table 32). This group was dominated by fall and winter collections, and included 5 fall, 5 winter, 3 spring and 2 summer stations.

Station Group IIB1 included 6 stations located in shallow to middepth waters in the eastern region with the addition of 2 central stations and 1 western station. This group included 4 fall stations, 1 spring station and 1 summer station, and tended to harbor total numbers of taxa and total numbers of individuals that were lower than those of the Group IIA stations and similar to those of the Group I stations (Table 32).

Station Group IIB2 included 2 spring and 2 summer collections from stations located in shallow to middepth waters in the central and eastern portions of the study area (Figure 16). This group also harbored low total numbers of taxa and low total numbers of individuals (Table 32). As was the case with Group IIB1, Group IIB2 included no winter collections.

The taxa in Taxa Group IA exhibited three distinct distributions. Parapenaeus LPIL, Xiphopeneus LPIL and Steindachneria argentea from Taxa Group IA1 and Solenocera, Congrina flava and Trachypenaeus LPIL from Taxa Group IA2 were most characteristic of the deep water stations located in the western portion of the study area and directly off the Mississippi River Delta. These stations occupied the left-most portion of Station Group IA1 in Figure 16 and the upper-most portion of Table 32. With the exception of Cynoscion nothus the remaining taxa in Group IA1 were generally restricted to the low salinity, nearshore and middepth stations spread across the entire study area (those in Station Groups IA2 and IB1). The stations in Group IA2 were primarily sampled during fall, winter and spring, indicating that these taxa tended to be absent from this nearshore habitat during summer. In addition, the Group IA1 taxa were almost completely absent from the nearshore stations sampled during spring and summer in Station Group IB1, further indicating that those taxa tended to be absent from the nearshore habitat during the warmer months. Some of the taxa most characteristic of this trend were Penaeus setiferus, Stellifer lanceolatus and Menticirrhus americanus from Group IA1 and Larimus fasciatus from Group IA2.

The taxa in Group IA that showed the third distinct type of distribution were, with the exception of Cynoscion nothus, all included in Group IA2. In general, Group IA2 taxa were widely distributed across the study area, and include many of the most ubiquitous and numerically prominent taxa. The Group IA2 taxa were relatively most abundant in the muddy sediment habitat of the western and central regions of the study area (Station Group I), and were relatively much less abundant in the sandy sediment habitat located in the eastern portion of the study area (Station Group II). As with the taxa in Group IA1, the Group IA2 taxa also showed a tendency to be absent or less numerically prominent at the nearshore stations included in Station Group IB1, particularly those sampled during spring and summer. Some of the taxa most representative of Group IA2 include Micropogonias undulatus, Cynoscion arenarius, and Trichiurus lepturus.

The taxa in Group IB1 exhibited distributions very similar to those described above for Taxa Group IA2, but were slightly more prominent at the stations located on sandy sediments in the eastern portion of the study area (i.e., Station Group II). As with the taxa in Group IA, the Group IB1 taxa also showed a tendency to be less numerically prominent at the nearshore stations included in Station Group IB. Some of the taxa most representative of Taxa Group IB1 include Penaeus aztecus, Prionotus rubio, and Leiostomus xanthurus.

The taxa in Group IB2 were virtually absent from collections at deep water stations located in the western portion of the study area and directly off the Mississippi River Delta (Station Group IA1), but were well represented at the stations located in shallow to middepth waters across the study area (Station Groups IA2 and IB1) and at many of the stations in the eastern portion of the study area (Station Group II). Many of the Group IB2 taxa were among the few that were well represented at the generally depauperate, shallow water stations included in Station Group IB1. Arius felis was most characteristic of these stations. Other taxa representative of Group IB2 include Squilla LPIL, Anchoa hepsetus. and Chloroscombrus chrysurus.

The three taxa in Group IIA1 (Centropristis philadelphicus, Cyclopsetta chittendeni and Halieutichthys aculeatus were most characteristic of middepth to deep water stations overlying sandy sediments in the eastern region (Station Group IIA), but also occurred at many of the deep water stations overlying muddy sediments in the western portion of the study area and directly off the Mississippi River Delta (Station Group IA1).

The five taxa comprising Group IIA2 (Citharichthys macrops, Etropus crossotus, Harengula jaguana, Lagodon rhomboides, and Peprilus burti) were most characteristic of the stations located over sandy sediments in the eastern portion of the study area (Station Group II), but were also collected at many of the stations located over muddy sediments in shallow and middepth waters (Station Group IA2 and IB1).

The Group IIB1 taxa were relatively most abundant at the stations located over sandy sediments in the eastern region (Station Group II), with only scattered occurrences across the remainder of the study area. Some of the taxa most characteristic of Group IIB1 were Penaeus duorarum, Sicyonia brevirostris, Lutjanus campechanus, Sphoeroides parvus, Syacium papillosum, Synodus foetens, and Portunus spinicarpus.

With the exception of Eucinostomus gula, Stenotomus caprinus, Trachurus lathami, and Diplectrum radiale, the taxa in Group IIB2 were virtually restricted to collections at stations located in middepth to deep waters overlying sandy sediments in the eastern portion of the study area primarily during fall, winter and spring (Station Group IIA2). Some of the taxa most representative of this trend included Trachinocephalus myops, Scyllarides nodifer, Bellator militaris, Prionotus roseus, Scorpaena calcarata, and Saurida brasiliensis. Eucinostomus gula, Stenotomus caprinus, and Trachurus lathami were also well represented at the stations located in middepth to deep waters in the eastern portion of the study area that were primarily collected in spring and summer (Station Group IIA1), and Diplectrum radiale was virtually restricted to these stations.

2.5.4 NMFS Fishery Independent Survey Fall Data, 1973-1983

2.5.4.1 Introduction

To analyze community trends in the study area over time, data from the fall cruises from 1973-1980 and 1982-1983 were subset from the database.

Based on the results of the SEAMAP analysis and Fishery Independent seasonal analysis (see above), along with the distribution of stations in the database, the Tuscaloosa Trend study area was subdivided into three regions based on longitude. The eastern region included the area east of 88.5° longitude, and differed from the central and western regions by virtue of the sandy composition of its sediments. The central region extended from 88.5 to 90.0° longitude, while the western region consisted of the region west of the Mississippi River delta. Within each of the regions, 10 fm depth strata were identified, and three replicate samples collected at one "station" in each region by depth strata cell for each year were selected for analysis. In only three cases did three samples occur in any cell greater than 50 fm depth, and in an equal number of instances (but not the same cells) no samples were available from the 40-50 fm depths. The data set submitted for analysis included 150 stations, each with 3 replicate samples. The taxa that had been included in the final analysis of the SEAMAP and Fishery Independent data were those selected for inclusion in the initial analysis of the annual data. A number of these showed scattered or otherwise not meaningful in this initial analysis, and were eliminated from further consideration. Ninety (90) taxa were included in the final TWINSPAN analysis, and this number was further reduced to in the corresponding factor analysis.

5.5.4.2 Relative Composition and Abundance

The community composition over all samples combined is summarized in Table 33. A total of 318,186 individuals representing 374 taxa were identified from 548 samples. In general, the community tended to be dominated by a relatively small number of taxa. The 11 most abundant taxa accounted for greater than 50% of the cumulative mean percent composition, while the top four taxa accounted for almost 50% of the organisms collected. Most taxa exhibited restricted distributions, with only six taxa occurring in greater than 50% of the samples collected.

Micropogonias undulatus was the most abundant taxon, accounting for 18.7% of the pooled percent composition, with a mean density of 153 individuals per hectare. This taxon occurred in almost 60% of the samples collected (frequency of occurrence = 0.599). Leiostomus xanthurus was the second most abundant taxon, with a pooled percent composition of 12.2% and a mean density of 100 individuals per hectare. Leiostomus xanthurus occurred in 46% of the samples collected and had a very clumped distribution (index of dispersion = 5941). Stenotomus caprinus, Chloroscombrus chrysurus, and Peprilus burti each accounted for greater than 5% of the pooled percent composition. Of these three taxa, Stenotomus caprinus was the most widespread, occurring in greater than 50% of the samples collected. Portunus spinicarpus, Penaeus aztecus, Cynoscion arenarius, Trichiurus lepturus, and Arius felis each accounted for greater than 2% of the pooled percent composition. Penaeus aztecus was the most widespread taxon in the analysis, occurring in 63% of the samples collected, and was among the most evenly distributed (index of dispersion = 41). Other taxa occurring in greater than 45% of the samples included Cynoscion arenarius, Prionotus rubio, Centropristis philadelphicus and Synodus foetens. Table 34 is a hierarchical list of taxa represented in the annual data set.

2.5.4.3 Two-Way Indicator Species Analysis

The two-way ordered data matrix resulting from TWINSPAN is shown as Figure 17 and the corresponding ordered table of environmental variables and community parameters is shown as Table 35. Because the stations in each region by depth zone cell were chosen to be as close geographically as possible from year to year, maps displaying the TWINSPAN results over the 10 years were difficult to interpret. Instead, the stations in each TWINSPAN group are shown in matrix form in Table 36. The four groups

Table 33. Overall relative composition of demersal nekton taxa collected in three replicate samples at 150 stations in three regions of the Tuscaloosa Trend study area during fall NMFS Fishery Independent surveys from 1973 to 1983.

TAXON NAME	MEAN PERCENT COMPOSITION	CUMULATIVE PERCENT COMPOSITION	POOLED PERCENT COMPOSITION	FREQ. OF OCCURRENCE	CUMULATIVE ABUNDANCE	MEAN DENSITY (# / HA)	INDEX OF DISPERSION
Micropogonias undulatus	15.309	15.309	18.735	0.599	59612.	153.38	484.70
Leiostomus xanthurus	4.375	19.684	12.209	0.456	98459.	99.95	5941.44
Stenotomus caprinus	8.536	28.220	9.929	0.505	130051.	81.29	1999.21
Chloroscombrus chrysurus	4.261	32.481	8.621	0.272	157483.	70.58	3319.32
Peprilus burti	3.022	35.503	5.386	0.259	174619.	44.09	2545.36
Portunus spinicarpus	2.426	37.930	2.703	0.232	183218.	22.13	440.82
Penaeus aztecus	3.483	41.413	2.337	0.630	190655.	19.14	41.05
Cynoscion arenarius	2.153	43.566	2.257	0.484	197837.	18.48	68.28
Trichiurus lepturus	2.613	46.179	2.230	0.286	204934.	18.26	200.43
Arius felis	2.761	48.940	2.156	0.199	211795.	17.65	370.18
Prionotus rubio	2.164	51.104	1.861	0.586	217718.	15.24	52.51
Trachurus lathami	1.932	53.035	1.831	0.243	223543.	14.99	343.41
Penaeus setiferus	1.281	54.316	1.568	0.241	228531.	12.83	494.49
Centropristis philadelphicus	1.991	56.307	1.557	0.504	233486.	12.75	40.45
Serranus atrobranchus	1.813	58.120	1.429	0.303	238034.	11.70	140.86
Anchoa hepsetus	1.985	60.105	1.327	0.164	242256.	10.86	182.49
Sicyonia brevirostris	1.509	61.614	1.180	0.214	246012.	9.66	136.79
Cynoscion nothus	1.023	62.637	1.153	0.224	249682.	9.44	99.52
Squilla	1.650	64.287	1.117	0.318	253237.	9.15	49.08
Steindachneria argentea	1.254	65.540	1.107	0.068	256760.	9.06	268.55
Callinectes similis	1.445	66.985	1.036	0.319	260055.	8.48	84.04
Synodus foetens	2.119	69.104	0.939	0.536	263042.	7.69	31.70
Ophiuroidea	0.808	69.912	0.710	0.031	265301.	5.81	504.11
Lagodon rhomboides	0.756	70.668	0.647	0.299	267361.	5.30	76.33
Solenocera	0.891	71.559	0.647	0.146	269419.	5.30	57.96
Syacium papillosum	2.187	73.746	0.602	0.254	271335.	4.93	46.31
Trachypenaeus	0.883	74.630	0.547	0.192	273075.	4.48	37.55
Parapenaeus	0.543	75.173	0.503	0.062	274677.	4.12	104.98
Loligo pealeii	1.620	76.793	0.488	0.188	276230.	4.00	47.26
Halieutichthys aculeatus	0.624	77.417	0.488	0.210	277782.	3.99	55.04
Pristipomoides aquilonaris	0.650	78.066	0.484	0.162	279321.	3.96	128.07
Cynoscion	0.507	78.573	0.460	0.078	280785.	3.77	75.35
Scorpaena calcarata	0.554	79.127	0.451	0.126	282220.	3.69	79.57
Prionotus paralatus	0.407	79.534	0.431	0.088	283591.	3.53	157.94
Harengula jaguana	0.329	79.862	0.424	0.102	284939.	3.47	94.78
Diplectrum bivittatum	0.921	80.783	0.395	0.170	286195.	3.23	41.56
Eucinostomus gula	0.756	81.539	0.381	0.153	287407.	3.12	45.35
Portunus gibbesii	0.786	82.326	0.372	0.179	288590.	3.04	68.21
Lepophidium graellsi	0.421	82.746	0.356	0.139	289724.	2.92	46.86
Bellator militaris	0.374	83.121	0.329	0.082	290770.	2.69	65.45
Lolliguncula brevis	0.751	83.872	0.319	0.113	291786.	2.61	33.27
Saurida brasiliensis	0.564	84.436	0.319	0.115	292801.	2.61	62.75
Anasimus latus	0.310	84.746	0.318	0.086	293814.	2.61	285.49
Sphoeroides parvus	0.551	85.297	0.308	0.157	294795.	2.52	26.58
Brevoortia patronus	0.268	85.565	0.272	0.060	295661.	2.23	69.60
Etropus crossotus	0.454	86.019	0.247	0.137	296447.	2.02	30.80
Prionotus salmonicolor	0.327	86.346	0.229	0.122	297176.	1.88	38.58
Spatangidae	0.162	86.508	0.224	0.018	297889.	1.83	307.83
Porichthys porosissimus	0.262	86.769	0.217	0.193	298580.	1.78	12.60
Lutjanus campechanus	0.559	87.328	0.217	0.212	299269.	1.77	24.13
Asteroidea	0.709	88.037	0.197	0.086	299895.	1.61	84.38
Etrumeus teres	0.494	88.530	0.196	0.055	300518.	1.60	93.73
Anchoa mitchilli	0.239	88.770	0.194	0.015	301135.	1.59	125.28
Aurelia	0.421	89.191	0.187	0.089	301731.	1.53	41.28
Penaeus duorarum	0.348	89.539	0.181	0.089	302308.	1.48	25.44
Prionotus roseus	0.269	89.807	0.181	0.053	302885.	1.48	87.02
Cyclopsetta chittendeni	0.253	90.060	0.147	0.182	303353.	1.20	8.42
Lepophidium	0.199	90.259	0.145	0.095	303814.	1.19	17.87
Prionotus stearnsi	0.181	90.440	0.142	0.086	304267.	1.17	30.01
Syacium	0.337	90.776	0.140	0.080	304712.	1.14	29.94
Larimus fasciatus	0.104	90.881	0.136	0.068	305146.	1.12	26.49
Opisthonema oglinum	0.172	91.053	0.135	0.075	305574.	1.10	29.10
Peprilus paru	0.110	91.163	0.128	0.069	305982.	1.05	28.44
Myopsida	0.581	91.745	0.127	0.069	306385.	1.04	26.62
Lepophidium brevibarbe	0.154	91.898	0.114	0.047	306748.	0.93	24.75
Mellita	0.134	92.032	0.113	0.002	307109.	0.93	361.00
Chaetodipterus faber	0.131	92.163	0.110	0.139	307459.	0.90	12.41
Echinoidea	0.154	92.316	0.105	0.044	307793.	0.86	26.79
Scyphozoa	0.165	92.482	0.103	0.084	308122.	0.85	23.46
Loligo	0.579	93.061	0.103	0.060	308451.	0.85	21.61

Table 33. Continued.

TAXON NAME	MEAN PERCENT COMPOSITION	CUMULATIVE PERCENT COMPOSITION	POOLED PERCENT COMPOSITION	FREQ. OF OCCURRENCE	CUMULATIVE ABUNDANCE	MEAN DENSITY (# / HA)	INDEX OF DISPERSION
Aequipecten	0.239	93.299	0.103	0.007	308779.	0.84	227.27
Selene setapinnis	0.109	93.409	0.101	0.082	309101.	0.83	13.05
Upeneus parvus	0.105	93.513	0.096	0.036	309408.	0.79	78.65
Anchoa lyolepis	0.143	93.656	0.092	0.022	309700.	0.75	71.13
Syacium gunteri	0.149	93.805	0.083	0.064	309965.	0.68	12.93
Paralichthys lethostigma	0.109	93.914	0.077	0.181	310209.	0.63	4.27
Ophiolepididae	0.163	94.077	0.068	0.004	310424.	0.55	117.15
Luidia	0.152	94.229	0.061	0.046	310617.	0.50	73.83
Antennarius radiosus	0.066	94.295	0.058	0.053	310800.	0.47	18.53
Aequipecten gibbus	0.082	94.377	0.057	0.011	310981.	0.47	98.44
Prionotus	0.083	94.461	0.056	0.013	311159.	0.46	60.56
Trachinocephalus myops	0.288	94.748	0.054	0.047	311330.	0.44	16.75
Trichopsetta ventralis	0.055	94.803	0.052	0.036	311494.	0.42	25.06
Mellitidae	0.204	95.007	0.050	0.033	311652.	0.41	39.47
Sicyonia dorsalis	0.080	95.087	0.049	0.036	311808.	0.40	21.82
Congrina flava	0.059	95.146	0.048	0.055	311962.	0.40	7.90
Etropus	0.099	95.245	0.047	0.035	312113.	0.39	17.07
Urophycis floridanus	0.041	95.286	0.047	0.036	312262.	0.38	32.20
Caranx hippos	0.032	95.319	0.045	0.018	312406.	0.37	41.52
Citharichthys spilopterus	0.082	95.401	0.045	0.071	312548.	0.37	6.26
Ophidion holbrooki	0.070	95.471	0.044	0.029	312688.	0.36	34.71
Gymnachirus texae	0.045	95.516	0.040	0.058	312814.	0.32	6.48
Callinectes sapidus	0.076	95.592	0.038	0.060	312935.	0.31	7.70
Brotula barbata	0.052	95.644	0.037	0.058	313052.	0.30	7.86
Sphyraena guachancho	0.066	95.710	0.036	0.046	313167.	0.30	11.33
Doryteuthis pleii	0.336	96.047	0.035	0.005	313277.	0.28	59.00
Astropecten	0.142	96.188	0.034	0.038	313384.	0.28	10.62
Caranx fusus	0.061	96.250	0.033	0.047	313490.	0.27	7.56
Lepophidium jeannae	0.032	96.281	0.033	0.020	313595.	0.27	20.88
Bollmannia communis	0.033	96.315	0.032	0.036	313696.	0.26	8.44
Libinia emarginata	0.015	96.330	0.031	0.007	313795.	0.25	91.21
Calappa sulcata	0.050	96.380	0.030	0.075	313891.	0.25	5.29
Tellina	0.051	96.431	0.030	0.011	313987.	0.25	37.27
Diplectrum formosum	0.209	96.640	0.028	0.026	314077.	0.23	22.63
Polydactylus octonemus	0.050	96.691	0.028	0.026	314167.	0.23	8.21
Menticirrhus americanus	0.020	96.710	0.028	0.027	314255.	0.23	9.79
Mollusca	0.015	96.725	0.027	0.002	314341.	0.22	86.00
Plesionika	0.064	96.789	0.024	0.004	314418.	0.20	75.02
Prionotus alatus	0.034	96.823	0.024	0.011	314495.	0.20	32.74
Solenocera atlantidis	0.015	96.838	0.024	0.005	314571.	0.20	50.30
Porifera	0.103	96.941	0.024	0.015	314647.	0.20	48.19
Prionotus ophryas	0.049	96.990	0.023	0.029	314721.	0.19	9.48
Polychaeta	0.047	97.037	0.022	0.011	314792.	0.18	25.54
Symphurus plagiusa	0.061	97.098	0.022	0.053	314861.	0.18	3.92
Raninoides louisianensis	0.058	97.156	0.021	0.044	314929.	0.17	4.56
Decapoda	0.136	97.292	0.021	0.004	314996.	0.17	51.39
Centropristis ocyurus	0.128	97.421	0.021	0.026	315063.	0.17	8.77
Anchoa	0.035	97.456	0.020	0.011	315126.	0.16	25.63
Triglidae	0.023	97.479	0.020	0.009	315189.	0.16	18.95
Portunus spinimanus	0.033	97.512	0.019	0.024	315250.	0.16	11.24
Bagre marinus	0.019	97.531	0.019	0.029	315310.	0.15	5.80
Aluterus schoepfi	0.077	97.608	0.018	0.027	315368.	0.15	5.52
Turris	0.015	97.623	0.018	0.009	315425.	0.15	19.63
Selar crumenophthalmus	0.034	97.657	0.017	0.031	315480.	0.14	5.86
Monacanthus hispidus	0.101	97.758	0.017	0.038	315534.	0.14	4.72
Symphurus diomedianus	0.022	97.780	0.017	0.024	315588.	0.14	9.25
Loligo pleii	0.033	97.813	0.016	0.005	315639.	0.13	41.81
Scomber japonicus	0.014	97.827	0.016	0.004	315690.	0.13	45.34
Squilla chydaea	0.009	97.836	0.016	0.002	315740.	0.13	50.00
Prionotus scitulus	0.050	97.886	0.016	0.024	315790.	0.13	10.17
Ovalipes guadulpensis	0.137	98.022	0.016	0.009	315840.	0.13	22.07
Lutjanus synagris	0.025	98.047	0.015	0.029	315889.	0.13	4.47
Ophidion welshi	0.013	98.060	0.015	0.026	315936.	0.12	4.92
Rhizoprionodon terraenovae	0.062	98.122	0.014	0.053	315982.	0.12	2.70
Fusinus covei	0.008	98.130	0.014	0.004	316028.	0.12	30.32
Stellifer lanceolatus	0.014	98.144	0.014	0.011	316074.	0.12	12.33
Ogcocephalus	0.011	98.155	0.014	0.015	316119.	0.12	14.50
Bothidae	0.018	98.173	0.014	0.009	316164.	0.12	13.30
Scorpaenidae	0.054	98.227	0.014	0.005	316208.	0.11	14.86
Congrina	0.027	98.254	0.012	0.007	316247.	0.10	13.16
Hoplunnis macrurus	0.014	98.268	0.012	0.024	316284.	0.10	5.10
Anadara	0.015	98.283	0.011	0.009	316320.	0.09	16.52

Table 33. Continued.

TAXON NAME	MEAN PERCENT COMPOSITION	CUMULATIVE PERCENT COMPOSITION	POOLED PERCENT COMPOSITION	FREQ. OF OCCURRENCE	CUMULATIVE ABUNDANCE	MEAN DENSITY (# / HA)	INDEX OF DISPERSION
Fusinus	0.036	98.319	0.011	0.007	316356.	0.09	17.69
Synodus poeyi	0.150	98.469	0.011	0.018	316391.	0.09	6.78
Lagocephalus laevigatus	0.030	98.499	0.011	0.020	316426.	0.09	11.13
Xiphopeneus kroyeri	0.006	98.505	0.011	0.004	316461.	0.09	18.63
Hepatus epheliticus	0.010	98.515	0.011	0.020	316496.	0.09	13.36
Equetus acuminatus	0.024	98.540	0.011	0.013	316531.	0.09	6.83
Scomberomorus maculatus	0.016	98.555	0.011	0.020	316565.	0.09	5.18
Kathetostoma albigutta	0.011	98.566	0.011	0.026	316599.	0.09	4.12
Sphoeroides	0.065	98.632	0.010	0.011	316632.	0.08	11.20
Scorpaena brasiliensis	0.008	98.639	0.010	0.005	316664.	0.08	16.91
Archosargus probatocephalus	0.015	98.655	0.010	0.011	316696.	0.08	7.58
Equetus umbrosus	0.024	98.678	0.010	0.018	316727.	0.08	5.34
Saurida normani	0.030	98.709	0.009	0.004	316757.	0.08	18.25
Etropus microstomus	0.007	98.715	0.009	0.004	316787.	0.08	28.06
Parthenope serrata	0.039	98.754	0.009	0.024	316816.	0.07	3.51
Balistes capriscus	0.019	98.773	0.009	0.020	316844.	0.07	4.53
Stenorhynchus seticornis	0.023	98.796	0.009	0.009	316872.	0.07	13.83
Hoplunnis tenuis	0.006	98.802	0.008	0.009	316899.	0.07	6.52
Syacium micrurum	0.014	98.816	0.008	0.004	316926.	0.07	17.65
Scomberomorus cavalla	0.006	98.822	0.008	0.005	316951.	0.06	8.97
Diplectrum radiale	0.016	98.838	0.008	0.004	316976.	0.06	21.31
Congrina gracilior	0.005	98.843	0.007	0.002	316999.	0.06	23.00
Engyophrys senta	0.015	98.857	0.007	0.016	317021.	0.06	3.33
Symphurus	0.010	98.867	0.007	0.018	317043.	0.06	4.42
Raninoides	0.004	98.871	0.007	0.002	317064.	0.05	21.00
Peristedion gracile	0.005	98.877	0.007	0.007	317085.	0.05	9.26
Decapterus punctatus	0.109	98.986	0.007	0.016	317106.	0.05	4.21
Rhomboplites aurorubens	0.010	98.996	0.007	0.013	317127.	0.05	6.12
Sphoeroides dorsalis	0.004	99.000	0.006	0.004	317147.	0.05	10.38
Gymnachirus melas	0.005	99.005	0.006	0.007	317167.	0.05	7.78
Orthopristis chrysoptera	0.013	99.018	0.006	0.009	317186.	0.05	4.13
Urophycis cirratus	0.005	99.023	0.006	0.009	317205.	0.05	5.40
Prionotus tribulus	0.019	99.042	0.006	0.018	317224.	0.05	2.44
Petrochirus diogenes	0.015	99.057	0.006	0.009	317243.	0.05	9.51
Pagurus	0.007	99.064	0.006	0.004	317261.	0.05	14.44
Paraconger caudilimbatus	0.010	99.074	0.006	0.011	317279.	0.05	3.42
Hildebrandia flava	0.013	99.087	0.006	0.007	317297.	0.05	9.43
Calappa flammea	0.011	99.098	0.005	0.015	317314.	0.04	3.92
Lolliguncula	0.008	99.106	0.005	0.009	317331.	0.04	6.98
Mullus auratus	0.006	99.111	0.005	0.004	317348.	0.04	9.22
Scyllarides nodifer	0.005	99.116	0.005	0.018	317365.	0.04	2.97
Selene vomer	0.008	99.125	0.005	0.009	317382.	0.04	5.92
Pitar cordatus	0.005	99.130	0.005	0.007	317398.	0.04	5.86
Cnidaria	0.026	99.155	0.005	0.005	317414.	0.04	6.86
Natantia	0.011	99.167	0.005	0.004	317430.	0.04	12.49
Xiphopeneus	0.008	99.175	0.005	0.005	317445.	0.04	5.38
Raja texana	0.012	99.187	0.005	0.026	317460.	0.04	1.11
Caulolatilus intermedius	0.009	99.196	0.005	0.013	317475.	0.04	3.65
Synagrops spinosa	0.004	99.199	0.005	0.007	317490.	0.04	5.38
Uroconger syringinus	0.003	99.202	0.005	0.004	317505.	0.04	8.32
Zalieutes mcgintyi	0.003	99.206	0.004	0.002	317519.	0.04	14.00
Renilla	0.021	99.227	0.004	0.005	317532.	0.03	6.83
Myropsis quinquespinosa	0.006	99.233	0.004	0.005	317545.	0.03	9.46
Crassostrea virginica	0.010	99.243	0.004	0.002	317557.	0.03	12.00
Antennarius	0.001	99.244	0.004	0.002	317569.	0.03	12.00
Epinephelus flavolimbatus	0.004	99.247	0.004	0.009	317581.	0.03	4.65
Calappa	0.014	99.261	0.003	0.009	317592.	0.03	3.17
Raja eglanteria	0.005	99.266	0.003	0.011	317603.	0.03	2.26
Pecten	0.045	99.311	0.003	0.004	317614.	0.03	7.72
Ascidiacea	0.006	99.317	0.003	0.004	317625.	0.03	9.18
Ophidion grayi	0.012	99.328	0.003	0.009	317635.	0.03	3.19
Bivalvia	0.002	99.330	0.003	0.004	317645.	0.03	5.19
Citharichthys cornutus	0.002	99.333	0.003	0.004	317655.	0.03	5.19
Calappa springeri	0.007	99.340	0.003	0.004	317665.	0.03	5.79
Synagrops bella	0.002	99.342	0.003	0.002	317674.	0.02	9.00
Synodus	0.002	99.344	0.003	0.002	317683.	0.02	9.00
Elops saurus	0.001	99.345	0.003	0.002	317692.	0.02	9.00
Sciaenops ocellata	0.003	99.348	0.003	0.011	317701.	0.02	1.88
Caulolatilus cyanops	0.003	99.351	0.003	0.005	317710.	0.02	3.88
Rhinoptera bonasus	0.004	99.355	0.003	0.009	317719.	0.02	2.32
Sardinella aurita	0.054	99.409	0.003	0.005	317728.	0.02	4.55
Portunus	0.019	99.428	0.003	0.005	317737.	0.02	3.66

Table 33. Continued.

TAXON NAME	MEAN PERCENT COMPOSITION	CUMULATIVE PERCENT COMPOSITION	POOLED PERCENT COMPOSITION	FREQ. OF OCCURRENCE	CUMULATIVE ABUNDANCE	MEAN DENSITY (# / HA)	INDEX OF DISPERSION
Scyllarus	0.004	99.432	0.003	0.005	317745.	0.02	3.24
Ophidion	0.003	99.435	0.003	0.005	317753.	0.02	2.99
Leiolambrus nitidus	0.030	99.465	0.003	0.007	317761.	0.02	3.49
Equetus	0.003	99.468	0.003	0.004	317769.	0.02	6.25
Antennarius ocellatus	0.002	99.470	0.003	0.004	317777.	0.02	4.24
Sphyrna tiburo	0.004	99.473	0.003	0.009	317785.	0.02	1.99
Pomatomus saltatrix	0.002	99.475	0.002	0.009	317792.	0.02	1.85
Congridae	0.001	99.476	0.002	0.004	317799.	0.02	5.28
Hemanthias leptus	0.006	99.482	0.002	0.002	317806.	0.02	7.00
Citharichthys	0.004	99.486	0.002	0.002	317813.	0.02	7.00
Bairdiella chrysura	0.004	99.491	0.002	0.004	317820.	0.02	3.57
Gymnothorax nigromarginatus	0.013	99.503	0.002	0.007	317827.	0.02	2.13
Hoplunnis	0.003	99.507	0.002	0.004	317834.	0.02	3.57
Porcellana sayana	0.002	99.509	0.002	0.004	317840.	0.02	4.33
Rossia	0.002	99.511	0.002	0.005	317846.	0.02	2.99
Paguridae	0.003	99.514	0.002	0.007	317852.	0.02	1.99
Ophichthidae	0.001	99.515	0.002	0.004	317858.	0.02	4.33
Anthozoa	0.047	99.562	0.002	0.004	317864.	0.02	3.33
Chilomycterus schoepfi	0.005	99.567	0.002	0.005	317870.	0.02	2.99
Citharichthys macrops	0.005	99.572	0.002	0.009	317876.	0.02	1.32
Ogcocephalus nasutus	0.003	99.575	0.002	0.005	317882.	0.02	2.99
Echeneis naucrates	0.009	99.584	0.002	0.005	317888.	0.02	2.99
Rachycentron canadum	0.004	99.588	0.002	0.009	317894.	0.02	1.32
Eucinostomus argenteus	0.002	99.590	0.002	0.002	317900.	0.02	6.00
Paralichthys albigutta	0.001	99.591	0.002	0.004	317906.	0.02	4.33
Paralichthys squamilentus	0.003	99.594	0.002	0.005	317912.	0.02	2.99
Pontinus longispinis	0.002	99.596	0.002	0.002	317917.	0.01	5.00
Mustelus canis	0.001	99.598	0.002	0.007	317922.	0.01	1.39
Rypticus maculatus	0.001	99.599	0.002	0.007	317927.	0.01	1.39
Porcellana	0.004	99.602	0.002	0.004	317932.	0.01	3.40
Arca	0.001	99.604	0.002	0.002	317937.	0.01	5.00
Libinia	0.000	99.604	0.002	0.002	317942.	0.01	5.00
Ophidiidae	0.007	99.611	0.002	0.004	317947.	0.01	2.60
Porcellanidae	0.001	99.612	0.002	0.004	317952.	0.01	2.60
Cronius	0.001	99.613	0.002	0.002	317957.	0.01	5.00
Gymnothorax moringa	0.009	99.622	0.002	0.005	317962.	0.01	2.19
Opsanus beta	0.005	99.627	0.002	0.004	317967.	0.01	3.40
Seriola dumerili	0.003	99.630	0.002	0.004	317972.	0.01	2.60
Dasyatus americana	0.007	99.637	0.002	0.009	317977.	0.01	0.99
Conger oceanicus	0.001	99.638	0.001	0.002	317981.	0.01	4.00
Anadara baughmani	0.002	99.640	0.001	0.002	317985.	0.01	4.00
Libinia dubia	0.003	99.644	0.001	0.002	317989.	0.01	4.00
Conus	0.009	99.652	0.001	0.004	317993.	0.01	2.50
Amusium papyraceum	0.001	99.654	0.001	0.004	317997.	0.01	2.50
Persephona aquilonaris	0.004	99.658	0.001	0.005	318001.	0.01	1.50
Portunus sayi	0.002	99.660	0.001	0.002	318005.	0.01	4.00
Pagrus sedecim	0.002	99.662	0.001	0.004	318009.	0.01	2.50
Fistularia tabacaria	0.009	99.671	0.001	0.007	318013.	0.01	0.99
Carcharhinus acronotus	0.001	99.671	0.001	0.002	318016.	0.01	3.00
Lutjanus griseus	0.008	99.679	0.001	0.004	318019.	0.01	1.66
Serranus phoebe	0.002	99.681	0.001	0.004	318022.	0.01	1.66
Pagrus pagrus	0.002	99.684	0.001	0.002	318025.	0.01	3.00
Scorpaena	0.004	99.688	0.001	0.005	318028.	0.01	1.00
Neomerinthe hemingwayi	0.002	99.690	0.001	0.004	318031.	0.01	1.66
Ophichthus	0.001	99.691	0.001	0.002	318034.	0.01	3.00
Ogcocephalus radiatus	0.002	99.693	0.001	0.005	318037.	0.01	1.00
Gymnothorax saxicola	0.001	99.694	0.001	0.004	318040.	0.01	1.66
Galatheidae	0.002	99.696	0.001	0.002	318043.	0.01	3.00
Renilla mulleri	0.002	99.698	0.001	0.002	318046.	0.01	3.00
Nudibranchia	0.003	99.701	0.001	0.002	318049.	0.01	3.00
Parthenope	0.008	99.709	0.001	0.004	318052.	0.01	1.66
Tetraxanthus	0.001	99.710	0.001	0.004	318055.	0.01	1.66
Scaphella	0.001	99.711	0.001	0.002	318058.	0.01	3.00
Sicyonia	0.001	99.712	0.001	0.002	318061.	0.01	3.00
Microgobius gulosus	0.002	99.713	0.001	0.002	318064.	0.01	3.00
Hemipteronotus martinicensis	0.016	99.729	0.001	0.004	318066.	0.01	1.00
Mugil cephalus	0.003	99.731	0.001	0.002	318068.	0.01	2.00
Pogonias chromis	0.001	99.733	0.001	0.004	318070.	0.01	1.00
Sargassaceae	0.012	99.744	0.001	0.004	318072.	0.01	1.00
Trachinotus carolinus	0.000	99.745	0.001	0.004	318074.	0.01	1.00
Synodus synodus	0.041	99.785	0.001	0.002	318076.	0.01	2.00
Ovalipes	0.001	99.787	0.001	0.004	318078.	0.01	1.00

Table 33. Continued.

TAXON NAME	MEAN PERCENT COMPOSITION	CUMULATIVE PERCENT COMPOSITION	POOLED PERCENT COMPOSITION	FREQ. OF OCCURRENCE	CUMULATIVE ABUNDANCE	MEAN DENSITY (# / HA)	INDEX OF DISPERSION
Acanthostracion quadricornis	0.014	99.801	0.001	0.004	318080.	0.01	1.00
Turridae	0.001	99.802	0.001	0.002	318082.	0.01	2.00
Aluterus heudeloti	0.007	99.809	0.001	0.004	318084.	0.01	1.00
Clypeaster	0.008	99.817	0.001	0.004	318086.	0.01	1.00
Ophiolepis	0.001	99.818	0.001	0.002	318088.	0.01	2.00
Aequipecten glyptus	0.001	99.819	0.001	0.002	318090.	0.01	2.00
Grapsidae	0.002	99.821	0.001	0.004	318092.	0.01	1.00
Persephona crinita	0.001	99.822	0.001	0.002	318094.	0.01	2.00
Gymnothorax	0.002	99.824	0.001	0.002	318096.	0.01	2.00
Caridea	0.001	99.824	0.001	0.002	318098.	0.01	2.00
Scyllarus chacei	0.001	99.825	0.001	0.002	318100.	0.01	2.00
Bemprops anatirostris	0.002	99.827	0.001	0.004	318102.	0.01	1.00
Dactylopterus volitans	0.000	99.827	0.001	0.002	318104.	0.01	2.00
Neobythites gillii	0.001	99.828	0.001	0.002	318106.	0.01	2.00
Calamus nodosus	0.003	99.831	0.001	0.002	318108.	0.01	2.00
Hemipteronotus novacula	0.010	99.841	0.001	0.004	318110.	0.01	1.00
Calamus	0.001	99.842	0.001	0.002	318112.	0.01	2.00
Physiculus fulvus	0.002	99.844	0.001	0.002	318114.	0.01	2.00
Epinephelus niveatus	0.000	99.845	0.001	0.004	318116.	0.01	1.00
Epinnula magistralis	0.001	99.845	0.001	0.004	318118.	0.01	1.00
Pagrus	0.005	99.850	0.001	0.002	318120.	0.01	2.00
Eretmochelys imbricata	0.000	99.851	0.000	0.002	318121.	0.00	1.00
Gymnothorax ocellatus	0.000	99.851	0.000	0.002	318122.	0.00	1.00
Carcharhinus obscurus	0.000	99.851	0.000	0.002	318123.	0.00	1.00
Carcharhinus porosus	0.000	99.852	0.000	0.002	318124.	0.00	1.00
Saurida	0.001	99.852	0.000	0.002	318125.	0.00	1.00
Cypselurus heterurus	0.046	99.898	0.000	0.002	318126.	0.00	1.00
Menticirrhus saxatilis	0.001	99.899	0.000	0.002	318127.	0.00	1.00
Carcharhinus limbatus	0.000	99.899	0.000	0.002	318128.	0.00	1.00
Carcharhinus falciformis	0.002	99.901	0.000	0.002	318129.	0.00	1.00
Myliobatis	0.000	99.902	0.000	0.002	318130.	0.00	1.00
Ogcocephalus vespertilio	0.005	99.907	0.000	0.002	318131.	0.00	1.00
Priacanthus arenatus	0.013	99.920	0.000	0.002	318132.	0.00	1.00
Prionotus martis	0.001	99.921	0.000	0.002	318133.	0.00	1.00
Alectis crinitus	0.001	99.921	0.000	0.002	318134.	0.00	1.00
Poecilopsetta	0.001	99.922	0.000	0.002	318135.	0.00	1.00
Hippocampus	0.005	99.927	0.000	0.002	318136.	0.00	1.00
Diodon hystrix	0.005	99.932	0.000	0.002	318137.	0.00	1.00
Priacanthus cruentatus	0.001	99.933	0.000	0.002	318138.	0.00	1.00
Ophichthus ocellatus	0.000	99.934	0.000	0.002	318139.	0.00	1.00
Remora remora	0.001	99.934	0.000	0.002	318140.	0.00	1.00
Rypticus saponaceus	0.001	99.935	0.000	0.002	318141.	0.00	1.00
Reptilia	0.000	99.935	0.000	0.002	318142.	0.00	1.00
Mustelus	0.001	99.936	0.000	0.002	318143.	0.00	1.00
Kathetostoma	0.003	99.939	0.000	0.002	318144.	0.00	1.00
Decodon puellaris	0.004	99.943	0.000	0.002	318145.	0.00	1.00
Synodus intermedius	0.005	99.948	0.000	0.002	318146.	0.00	1.00
Scorpaena agassizi	0.000	99.948	0.000	0.002	318147.	0.00	1.00
Ogcocephalus parvus	0.000	99.948	0.000	0.002	318148.	0.00	1.00
Caulolatilus microps	0.000	99.949	0.000	0.002	318149.	0.00	1.00
Urophycis regius	0.002	99.950	0.000	0.002	318150.	0.00	1.00
Dasyatis sayi	0.000	99.950	0.000	0.002	318151.	0.00	1.00
Ophichthus gomesii	0.001	99.951	0.000	0.002	318152.	0.00	1.00
Ogcocephalidae	0.001	99.951	0.000	0.002	318153.	0.00	1.00
Chlorophyceae	0.003	99.955	0.000	0.002	318154.	0.00	1.00
Syngnathidae	0.005	99.960	0.000	0.002	318155.	0.00	1.00
Orthopristis	0.001	99.960	0.000	0.002	318156.	0.00	1.00
Ophichthus spinicauda	0.001	99.961	0.000	0.002	318157.	0.00	1.00
Squilla lijdingi	0.001	99.962	0.000	0.002	318158.	0.00	1.00
Encope	0.002	99.964	0.000	0.002	318159.	0.00	1.00
Atrina	0.001	99.965	0.000	0.002	318160.	0.00	1.00
Apogon maculatus	0.001	99.966	0.000	0.002	318161.	0.00	1.00
Gobiidae	0.001	99.968	0.000	0.002	318162.	0.00	1.00
Sicyonia stimpsoni	0.000	99.968	0.000	0.002	318163.	0.00	1.00
Octopodida	0.001	99.969	0.000	0.002	318164.	0.00	1.00
Majidae	0.000	99.969	0.000	0.002	318165.	0.00	1.00
Ancylopsetta quadrocellata	0.006	99.975	0.000	0.002	318166.	0.00	1.00
Dasyatis sabina	0.001	99.976	0.000	0.002	318167.	0.00	1.00
Gastropoda	0.001	99.977	0.000	0.002	318168.	0.00	1.00
Alpheidae	0.000	99.977	0.000	0.002	318169.	0.00	1.00
Busycon contrarium	0.001	99.978	0.000	0.002	318170.	0.00	1.00
Polinices duplicatus	0.001	99.979	0.000	0.002	318171.	0.00	1.00

Table 33. Continued.

TAXON NAME	MEAN PERCENT COMPOSITION	CUMULATIVE PERCENT COMPOSITION	POOLED PERCENT COMPOSITION	FREQ. OF OCCURRENCE	CUMULATIVE ABUNDANCE	MEAN DENSITY (# / HA)	INDEX OF DISPERSION
Myropsis	0.001	99.979	0.000	0.002	318172.	0.00	1.00
Cancellaria reticulata	0.001	99.980	0.000	0.002	318173.	0.00	1.00
Iliacantha liodactylus	0.001	99.981	0.000	0.002	318174.	0.00	1.00
Dromidia antillensis	0.000	99.981	0.000	0.002	318175.	0.00	1.00
Hydrozoa	0.005	99.986	0.000	0.002	318176.	0.00	1.00
Stenocionops	0.000	99.986	0.000	0.002	318177.	0.00	1.00
Nassariidae	0.001	99.987	0.000	0.002	318178.	0.00	1.00
Holothuroidea	0.001	99.988	0.000	0.002	318179.	0.00	1.00
Achirus lineatus	0.009	99.996	0.000	0.002	318180.	0.00	1.00
Octopus vulgaris	0.000	99.997	0.000	0.002	318181.	0.00	1.00
Murex	0.001	99.997	0.000	0.002	318182.	0.00	1.00
Murex pomum	0.001	99.998	0.000	0.002	318183.	0.00	1.00
Arenaeus cribrarius	0.001	99.999	0.000	0.002	318184.	0.00	1.00
Narcine brasiliensis	0.001	99.999	0.000	0.002	318185.	0.00	1.00
Astroscopus y-graecum	0.001	100.000	0.000	0.002	318186.	0.00	1.00
Psuedopriacanthus altus	0.000	100.000	0.000	0.002	318186.	0.00	******

SAMPLE SUMMARY: SAMPLES = 548 TOTAL TAXA = 374 TOTAL DENSITY = 818.69

Table 34. Hierarchical list of demersal nekton taxa collected in three replicate samples at 150 stations in three regions of the Tuscaloosa Trend study area during fall NMFS Fishery Independent surveys from 1973 to 1983.

	Annelida	50
*	Polychaeta	5001
	Arthropoda	58
	Crustacea	61
*	Decapoda	6175
*	Natantia	61
	Penaeidae	617701
*	Parapenaeus	61770105
*	Penaeus aztecus	6177010101
*	Penaeus duorarum	6177010102
*	Penaeus setiferus	6177010103
*	Sicyonia	61770104
*	Sicyonia brevirostris	6177010401
*	Sicyonia dorsalis	6177010402
*	Sicyonia stimpsoni	6177010406
*	Solenocera	61770106
*	Solenocera atlantidis	6177010601
*	Trachypenaeus	61770102
*	Xiphopeneus	61770107
*	Xiphopeneus kroyeri	6177010701
*	Galatheidae	618310
	Scyllaridae	618202
*	Scyllarides nodifer	6182020202
*	Scyllarus	61820201
*	Scyllarus chacei	6182020102
*	Paguridae	618306
*	Pagurus	61830602
*	Petrochirus diogenes	6183061201
*	Porcellanidae	618312
*	Porcellana	61831205
*	Porcellana sayana	6183120505
*	Grapsidae	618907
	Portunidae	618901
*	Arenaeus cribrarius	6189010101
*	Callinectes sapidus	6189010301
*	Callinectes similis	6189010302
*	Cronius	61890104
*	Ovalipes	61890105
*	Ovalipes guadulpensis	61890105??
*	Portunus	61890106
*	Portunus gibbesii	6189010601
*	Portunus sayi	6189010602
*	Portunus spinicarpus	6189010603
*	Portunus spinimanus	6189010604
	Xanthidae	618902
*	Tetraxanthus	61890211
	Dromiidae	618502
*	Dromidia antillensis	6185020301

Table 34. Continued.

*	Majidae	618701
*	Anasimus latus	6187012001
*	Libinia	61870109
*	Libinia dubia	6187010901
*	Libinia emarginata	6187010902
*	Stenocionops	61870124
*	Stenorhynchus seticornis	6187011701
	Parthenopidae	618702
*	Leiolambrus nitidus	6187020201
*	Parthenope	61870201
*	Parthenope serrata	6187020104
	Calappidae	618602
*	Calappa	61860201
*	Calappa flammea	6186020101
*	Calappa springeri	61860201
*	Calappa sulcata	6186020102
*	Hepatus epheliticus	6186020201
	Leucosiidae	618603
*	Iliacantha liodactylus	6186030301
*	Myropsis	61860302
*	Myropsis quinquespinosa	6186030201
*	Persephona aquilonaris	6186030103
*	Persephona crinita	6186030102
	Raninidae	618604
*	Raninoides	61860402
*	Raninoides louisianensis	6186040201
*	Caridea	6179
*	Alpheidae	617914
	Pandalidae	617918
*	Plesionika	61791805
	Stomatopoda	6191
	Squillidae	619101
*	Squilla	61910101
*	Squilla chydaea	6191010102
*	Squilla lijdingi	61910101??
*	Mollusca	5085
*	Bivalvia	55
	Arcoida	5506
	Arcidae	550601
*	Anadara	55060102
*	Anadara baughmani	5506010205
*	Arca	55060104
	Mytiloida	5507
	Pinnidae	550702
*	Atrina	55070201
	Pterioida	5508
	Ostreidae	551002
*	Crassostrea virginica	5510020102
	Pectinidae	550905
*	Aequipecten	55090508
*	Aequipecten gibbus	55090508??
*	Aequipecten glyptus	5509050803
*	Amusium papyraceum	5509051101
*	Pecten	55090504

Table 34. Continued.

	Veneroida	5515
	Tellinidae	551531
*	Tellina	55153102
	Veneridae	551547
*	Pitar cordatus	5515471202
	Cephalopoda	57
	Theuthidida	5705
*	Myopsida	5706
	Loliginidae	570601
*	Doryteuthis pleii	5706010301
*	Loligo	57060101
*	Loligo pealeii	5706010102
*	Loligo pleii	5706010103
*	Lolliguncula	57060102
*	Lolliguncula brevis	5706010201
	Octopodida	5708
	Octopodidae	570801
*	Octopus vulgaris	5708010202
*	Gastropoda	51
	Mesogastropoda	5103
	Naticidae	510376
*	Polinices duplicatus	5103760407
	Neogastropoda	5104
	Cancellariidae	510514
*	Cancellaria reticulata	5105140204
	Muricidae	510501
*	Murex	51050110
*	Murex pomum	5105011003
*	Nassariidae	510508
	Conidae	510603
*	Conus	51060301
*	Turridae	510602
*	Turris	510602??
*	Nudibranchia	5127
	Stenoglossa	5105
	Fasciolariidae	510509
*	Fusinus	51050905
*	Fusinus covei	5105090504
	Melongenidae	510507
*	Busycon contrarium	5105070104
	Volutidae	510513
*	Scaphella	51051302
	Echinodermata	81
*	Asteroidea	8104
	Paxillosida	8106
	Astropectinidae	810601
*	Astropecten	81060105
	Spinulosida	8112
	Clypeasteridae	815301
*	Clypeaster	81530101

Table 34. Continued.

*	Echinoidea	8136
	Clypeasteroida	8152
*	Mellitidae	815504
*	Encope	81550402
*	Mellita	81550401
	Spatangoida	8160
*	Spatangidae	816302
*	Holothuroidea	8170
*	Ophiolepididae	81????
*	Ophiuroidea	8120
	Ophiurida	8126
	Ophiacanthidae	812801
*	Ophiolepis	81280103
	Stelleroidea	8101
	Platyasterida	8105
	Luidiidae	810501
*	Luidia	81050101
*	Porifera	36
*	Cnidaria	37
*	Anthozoa	3740
	Pennatulacea	3752
	Renillidae	375303
*	Renilla	37530301
*	Renilla mulleri	3753030101
*	Hydrozoa	3701
*	Scyphozoa	3730
	Semaeostomeae	3734
	Ulmaridae	373403
*	Aurelia	37340302
	Chordata	8388
	Antennarioidei	8787
	Antennariidae	878702
*	Antennarius ocellatus	8787020202
*	Antennarius radiosus	8787020203
*	Ogcocephalidae	878704
*	Halieutichthys aculeatus	8787040301
*	Ogcocephalus	87870401
*	Ogcocephalus nasutus	8787040103
*	Ogcocephalus parvus	8787040105
*	Ogcocephalus radiatus	8787040106
*	Ogcocephalus vespertilio	8787040101
*	Zalieutes mcgintyi	8787040401
	Aulostomoidei	8819
	Fistulariidae	881902
*	Fistularia tabacaria	8819020101

Table 34. Continued.

	Balistoidei	8860
	Balistidae	886002
*	Aluterus heudeloti	8860020102
*	Aluterus schoepfi	8860020101
*	Balistes capriscus	8860020201
*	Monacanthus hispidus	8860020703
	Ostraciontidae	886003
*	Acanthostracion quadricornis	8860030201
	Batrachoidiformes	8783
	Batrachoididae	878301
*	Opsanus beta	8783010202
*	Porichthys porosissimus	8783010106
	Dactylopteriformes	8832
	Dactylopteridae	883201
*	Dactylopterus volitans	8832010101
	Elopiformes	8737
	Elopidae	873801
*	Elops saurus	8738010101
	Exocoetoidei	8803
	Exocoetidae	880301
*	Cypselurus heterurus	8803010101
	Labroidei	8839
	Labridae	883901
*	Decodon puellaris	88390105
*	Hemipteronotus martinicensis	8839010801
*	Hemipteronotus novacula	8839010802
	Myctophoidei	8762
	Synodontidae	876202
*	Saurida	87620203
*	Saurida brasiliensis	8762020301
*	Saurida normani	8762020303
*	Synodus	87620201
*	Synodus foetens	8762020101
*	Synodus intermedius	8762020102
*	Synodus poeyi	8762020104
*	Synodus synodus	8762020106
*	Trachinocephalus myops	8762020401
	Osteichthyes	8717
	Anguilliformes	8740
*	Congridae	874112
*	Conger oceanicus	8741120101
*	Congrina	87411203
*	Congrina flava	8741120302
*	Congrina gracilior	8741120303
*	Hildebrandia flava	8741121001
*	Ophichthus	87411310
*	Ophichthus gomesii	8741131001
*	Ophichthus ocellatus	8741131003
*	Ophichthus spinicauda	87411310??
*	Paraconger caudilimbatus	8741120501
*	Uroconger syringinus	8741120801
	Muraenesocidae	874108
*	Hoplunnis	87410801
*	Hoplunnis macrurus	8741080102
*	Hoplunnis tenuis	8741080103

Table 34. Continued.

	Muraenidae	874105
*	Gymnothorax	87410504
*	Gymnothorax moringa	8741050403
*	Gymnothorax nigromarginatus	8741050404
*	Gymnothorax ocellatus	8741050405
*	Gymnothorax saxicola	8741050407
*	Ophichthidae	874113
	Clupeiformes	8745
	Clupeidae	874701
*	Brevoortia patronus	8747010403
*	Etrumeus teres	8747010601
*	Harengula jaguana	8747010803
*	Opisthonema oglinum	8747010701
*	Sardinella aurita	8747011001
	Engraulidae	874702
*	Anchoa	87470202
*	Anchoa hepsetus	8747020201
*	Anchoa lyolepis	8747020205
*	Anchoa mitchilli	8747020202
	Gadiformes	8789
	Gadidae	879103
*	Urophycis cirratus	8791031005
*	Urophycis floridanus	8791031007
*	Urophycis regius	8791031002
	Macrouridae	879401
*	Scorpaena agassizi	8826010601
	Merlucciidae	879104
*	Steindachneria argentea	8791040201
	Moridae	879101
*	Physiculus fulvus	8791010301
*	Ophidiidae	879201
*	Brotula barbata	8792010401
*	Lepophidium	87920105
*	Lepophidium brevibarbe	8792010502
*	Lepophidium graellsi	8792010504
*	Lepophidium jeannae	8792010505
*	Neobythites gillii	8792012001
*	Ophidion	87920106
*	Ophidion grayi	8792010602
*	Ophidion holbrooki	8792010603
*	Ophidion welshi	8792010605
	Perciformes	8834
	Carangidae	883528
*	Alectis crinitus	8835280201
*	Caranx fusus	8835280302
*	Caranx hippos	8835280303
*	Chloroscombrus chrysurus	8835280401
*	Decapterus punctatus	8835281202
*	Selar crumenophthalmus	8835280601
*	Selene setapinnis	88352807??
*	Selene vomer	8835280701
*	Seriola dumerili	8835280801
*	Trachinotus carolinus	8835280901
*	Trachurus lathami	8835280102

Table 34. Continued.

	Gempylidae	885001
*	Epinnula magistralis	8850010102
*	Gobiidae	884701
*	Bollmannia communis	8847011601
*	Microgobius gulosus	8847010701
	Mugilidae	883601
*	Mugil cephalus	8836010101
	Apogonidae	883518
*	Apogon maculatus	8835180107
*	Synagrops bella	8835180601
*	Synagrops spinosa	8835180603
	Branchiostegidae	883522
*	Caulolatilus cyanops	8835220102
*	Caulolatilus intermedius	8835220103
*	Caulolatilus microps	8835220104
	Echeneidae	883527
*	Echeneis naucrates	8835270201
*	Remora remora	8835270103
	Ephippidae	883552
*	Chaetodipterus faber	8835520101
	Gerridae	883539
*	Eucinostomus argenteus	8835390101
*	Eucinostomus gula	8835390102
	Grammistidae	883503
*	Rypticus maculatus	8835030204
*	Rypticus saponaceus	8835030207
	Lutjanidae	883536
*	Lutjanus campechanus	8835360107
*	Lutjanus griseus	8835360102
*	Lutjanus synagris	8835360112
*	Pristipomoides aquilonaris	8835360701
*	Rhomboplites aurorubens	8835360501
	Mullidae	883545
*	Upeneus parvus	8835450402
	Pomadasyidae	883540
*	Orthopristis	88354002
*	Orthopristis chrysoptera	8835400201
	Priacanthidae	883517
*	Priacanthus arenatus	8835170101
*	Priacanthus cruentatus	8835170102
*	Psuedopriacanthus altus	883517????
	Rachycentridae	883526
*	Rachycentron canadum	8835260101
	Sciaenidae	883544
*	Bairdiella chrysura	8835440301
*	Cynoscion	88354401
*	Cynoscion arenarius	8835440106
*	Cynoscion nothus	8835440103
*	Equetus	88354412
*	Equetus acuminatus	8835441201
*	Equetus umbrosus	8835441206
*	Larimus fasciatus	8835440501
*	Leiostomus xanthurus	8835440401
*	Menticirrhus americanus	8835440601
*	Menticirrhus saxatilis	8835440603
*	Micropogonias undulatus	8835440701
*	Pogonias chromis	8835440801
*	Sciaenops ocellata	8835440901
*	Stellifer lanceolatus	8835441001

Table 34. Continued.

	Serranidae	883502
*	Centropristis ocyurus	8835020304
*	Centropristis philadelphicus	8835020305
*	Diplectrum bivittatum	8835021005
*	Diplectrum formosum	8835021002
*	Diplectrum radiale	8835021004
*	Epinephelus flavolimbatus	8835020405
*	Epinephelus niveatus	8835020411
*	Hemanthias leptus	8835021201
*	Serranus atrobranchus	8835022302
*	Serranus phoebe	8835022308
	Sparidae	883543
*	Archosargus probatocephalus	8835430301
*	Calamus	88354305
*	Calamus nodosus	8835430506
*	Lagodon rhomboides	8835430201
*	Pagrus	88354306
*	Pagrus pagrus	8835430601
*	Pagrus sedecim	8835430602
*	Stenotomus caprinus	8835430102
	Pomatomidae	883525
*	Pomatomus saltatrix	8835250101
	Scombridae	885003
*	Scomber japonicus	8850030301
*	Scomberomorus cavalla	8850030501
*	Scomberomorus maculatus	8850030502
	Cynoglossidae	885802
*	Symphurus	88580201
*	Symphurus diomedianus	8858020103
*	Symphurus plagiusa	8858020101
	Soleidae	885801
*	Achirus lineatus	8858010202
*	Gymnachirus melas	8858010301
*	Gymnachirus texae	8858010303
	Pleuronectiformes	8855
	Pleuronectidae	885704
*	Poecilopsetta	88570421
	Pleuronectoidei	8857
*	Bothidae	885703
*	Ancylopsetta quadrocellata	8857030506
*	Citharichthys	88570301
*	Citharichthys cornutus	8857030106
*	Citharichthys macrops	8857030109
*	Citharichthys spilopterus	8857030110
*	Cyclopsetta chittendeni	8857030801
*	Engyophrys senta	8857030901
*	Etropus	88570302
*	Etropus crossotus	8857030201
*	Etropus microstomus	8857030202
*	Paralichthys albigutta	8857030302
*	Paralichthys lethostigma	8857030304
*	Paralichthys squamilentus	8857030306
*	Syacium	88570313
*	Syacium gunteri	8857031301
*	Syacium micrurum	8857031302
*	Syacium papillosum	8857031303
*	Trichopsetta ventralis	8857031404

Table 34. Continued.

	Polynemoidei	8838
*	Polydactylus octonemus	8838010101
	Rajiformes	8713
	Dasyatidae	871305
*	Dasyatis sabina	8713050105
*	Dasyatis sayi	8713050106
*	Dasyatus americana	8713050103
	Myliobatidae	871307
*	Myliobatis	87130702
*	Rhinoptera bonasus	8713070301
	Rajidae	871304
*	Raja eglanteria	8713040113
*	Raja texana	8713040133
	Torpedinidae	871303
*	Narcine brasiliensis	8713030401
	Scombroidei	8850
	Trichiuridae	885002
*	Trichiurus lepturus	8850020201
	Scorpaenoidei	8826
*	Scorpaenidae	882601
*	Neomerinthe hemingwayi	8826010402
*	Pontinus longispinis	8826010503
*	Scorpaena	88260106
*	Scorpaena brasiliensis	8826010605
*	Scorpaena calcarata	8826010606
*	Triglidae	882602
*	Bellator militaris	8826020203
*	Peristedion gracile	8826020303
*	Prionotus	88260201
*	Prionotus alatus	8826020105
*	Prionotus martis	8826020111
*	Prionotus ophryas	8826020113
*	Prionotus paralatus	8826020114
*	Prionotus roseus	8826020117
*	Prionotus rubio	8826020118
*	Prionotus salmonicolor	8826020120
*	Prionotus scitulus	8826020103
*	Prionotus stearnsi	8826020121
*	Prionotus tribulus	8826020104
	Scyliorhinoidei	8708
	Carcharhinidae	870802
*	Carcharhinus acronotus	8708020504
*	Carcharhinus falciformis	8708020506
*	Carcharhinus limbatus	8708020507
*	Carcharhinus obscurus	8708020501
*	Carcharhinus porosus	8708020512
*	Mustelus	87080204
*	Mullus auratus	8835450201
*	Mustelus canis	8708020401
*	Rhizoprionodon terraenovae	8708020301
	Sphyrnidae	870803
*	Sphyrna tiburo	8708030101

Table 34. Continued.

	Siluriformes	8777
	Ariidae	877718
*	Arius felis	8777180202
*	Bagre marinus	8777180101
	Sphyraenoidei	8837
	Sphyraenidae	883701
*	Sphyraena guachancho	8837010103
	Stromateoidei	8851
	Stromateidae	885103
*	Peprilus burti	8851030104
*	Peprilus paru	8851030102
	Syngnathoidei	8820
*	Syngnathidae	882002
*	Hippocampus	88200202
	Tetradontoidei	8861
	Diodontidae	886103
*	Chilomycterus schoepfi	8861030101
*	Diodon hystrix	8861030201
	Tetraodontidae	886101
*	Lagocephalus laevigatus	8861010101
*	Sphoeroides	88610102
*	Sphoeroides dorsalis	8861010205
*	Sphoeroides parvus	8861010210
	Trachinoidei	8840
	Percophididae	884007
*	Bemprops anatirostris	8840070101
	Uranoscopidae	884014
*	Astroscopus y-graecum	8840140102
*	Kathetostoma	88401403
*	Kathetostoma albigutta	8840140301
*	Ascidiacea	8401
*	Reptilia	90
	Cheloniidae	900204
*	Eretmochelys imbricata	9002040301
	Chlorophyta	08
*	Chlorophyceae	0801
	Pheaophyta	15
	Phaeophyceae	1501
	Fucales	1510
*	Sargassaceae	151004
	Miscellaneous taxa	
	Sepiolidae	570402
*	Rossia	57040201

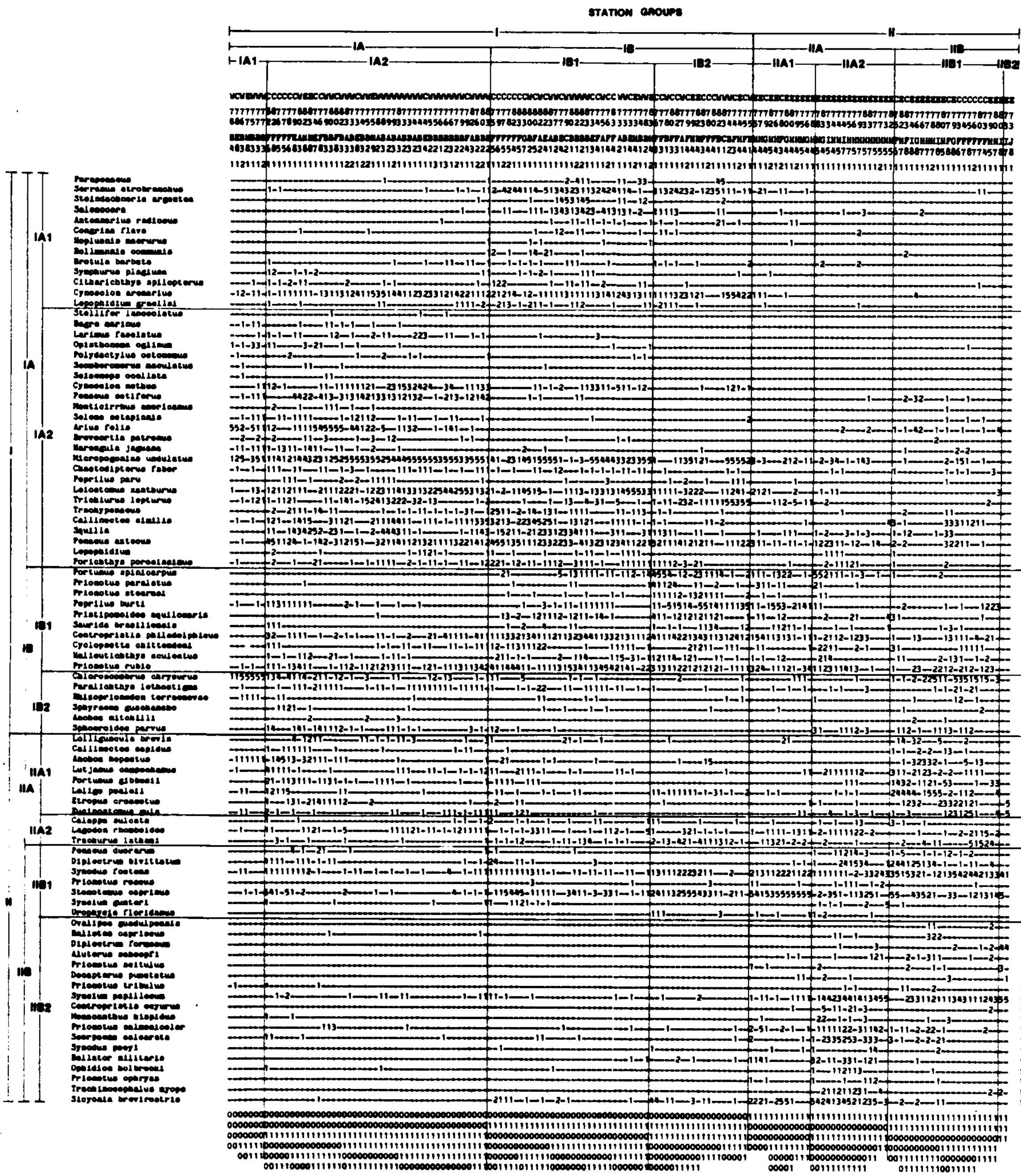

Figure 17. Ordered two-way display resulting from TWINSPAN analysis of mean relative abundances of 90 selected demersal nekton taxa collected in three replicate samples at 150 stations in three regions of the Tuscaloosa Trend study area during fall NMFS Fishery Independent surveys from 1973 to 1983.

Table 35. Ordered table of means for environmental and community parameters in three replicate samples collected at 150 stations in three regions of the Tuscaloosa Trend study area during fall NMFS Fishery Independent surveys from 1973 to 1983.

Station Groups	Year	Region	Cell	Group	Sample Number	Latitude (DDMMSS)	Longitude (DDMMSS)	Depth (fm)	Bottom Temperature (oC)	Total Taxa	Total Count	Diversity (J')	Evenness (H')	Richness (D)
	78	W	B4	1	1	29 13 20	89 43 00	7	79.00	4	196	0.314	0.246	0.601
	78	C	F8	1	2	30 02 00	88 45 40	7		7	206	0.826	0.406	1.186
	76	W	B3	2	3	29 11 20	89 43 20	8	62.00	18	565	1.906	0.665	2.669
IA1	77	E	H8	1	4	30 09 00	88 07 20	8		5	5464	0.126	0.083	0.469
	75	W	B3	1	5	29 03 40	89 32 00	6	77.00	12	665	1.537	0.644	1.633
	77	W	B3	1	6	29 06 00	89 41 40	12	75.00	14	674	1.821	0.691	2.027
	77	W	B3	2	7	29 05 40	89 34 00	7		5	496	0.197	0.087	0.626
	82	C	F5	1	8	29 43 20	88 34 00	15		26	246	2.447	0.758	4.626
	82	C	F8	1	9	30 04 20	88 41 00	7	73.00	23	310	2.235	0.713	3.842
	76	C	F5	1	10	29 29 00	88 36 00	24		23	300	2.185	0.699	3.923
	77	C	F5	1	11	29 31 20	88 38 40	16		12	184	1.219	0.490	2.131
	78	C	F6	1	12	29 46 40	88 34 40	15		16	120	2.002	0.737	3.268
	79	C	F8	1	13	30 06 20	88 44 40	7		26	317	2.674	0.821	4.376
	80	W	A3	1	14	29 04 40	89 44 20	17		22	147	2.459	0.797	4.214
	82	E	H8	1	15	30 09 00	88 04 20	7	75.00	21	263	2.404	0.793	3.653
	83	E	H8	1	16	30 10 00	88 01 20	7	76.00	20	1579	1.733	0.581	2.537
	74	C	F7	1	17	29 58 40	88 46 00	7		14	167	1.642	0.628	2.475
	74	C	F8	1	18	30 10 40	88 41 20	7	65.00	26	359	2.701	0.836	4.187
	79	W	B3	1	19	29 09 20	89 36 20	7		15	442	1.969	0.721	2.447
	80	W	B3	1	20	29 11 00	89 40 00	8	73.00	16	599	1.567	0.562	2.422
	80	C	F8	1	21	30 08 00	88 36 00	8		21	1252	1.433	0.478	2.755
	82	W	B3	1	22	29 11 20	89 41 40	7	70.00	18	661	1.955	0.671	2.646
	83	W	A3	2	23	29 01 20	89 53 20	16	74.33	18	158	1.704	0.675	2.652
	73	W	B3	2	24	29 10 40	89 43 20	8	77.00	14	1423	1.292	0.485	1.845
IA	73	C	F8	2	25	30 12 20	88 45 40	7	72.00	14	942	0.801	0.302	1.907
	74	W	B3	2	26	29 11 40	89 43 40	7		9	275	1.124	0.516	1.364
	75	W	B3	2	27	28 59 00	89 33 00	16		13	618	1.643	0.643	1.814
IA2	73	C	F9	1	28	30 12 20	88 09 00	7		15	1407	1.318	0.492	1.890
	78	W	A2	1	29	28 56 40	89 46 00	25		12	529	1.514	0.626	1.772
	78	W	A3	1	30	29 05 00	89 43 40	14	78.50	16	390	2.046	0.739	2.514
	79	W	A2	1	31	28 59 00	89 45 40	23		15	309	1.934	0.724	2.547
	82	W	A3	1	32	29 04 20	89 41 40	16		16	469	2.308	0.841	2.385
	83	W	A3	1	33	29 09 00	89 49 20	8	75.00	17	300	2.246	0.795	2.986
	73	W	B2	1	34	28 56 20	89 43 40	23	72.00	13	1069	1.514	0.602	1.629
	73	W	A2	1	35	29 05 20	89 42 20	14	72.00	21	427	2.197	0.726	3.251
	74	W	A2	1	36	28 58 00	89 47 00	23		11	905	1.153	0.476	1.504
	74	W	B3	1	37	29 03 00	89 44 00	16		11	498	1.122	0.468	1.610
	74	C	B4	1	38	29 21 20	88 53 00	22		13	531	1.682	0.650	2.045
	75	W	B2	1	39	28 54 20	89 32 20	16		13	444	1.718	0.672	1.968
	75	W	B2	3	40	28 58 00	89 38 20	27	79.00	14	642	1.532	0.575	2.062
	75	W	B1	1	41	28 46 00	89 41 00	44		5	8682	0.315	0.196	0.446
	76	W	B2	3	42	28 58 20	89 38 20	25	73.00	16	756	1.357	0.490	2.245
	76	W	B3	1	43	29 04 00	89 43 20	14		12	772	1.255	0.505	1.676
	76	W	B2	2	44	28 58 20	89 38 40	26	73.00	12	456	1.640	0.655	1.871
	77	W	B2	1	45	28 51 20	89 39 00	37		11	475	1.778	0.752	1.569
	79	C	F8	1	46	29 22 00	88 44 00	27		17	335	2.076	0.743	2.754
	82	W	B2	1	47	29 04 20	89 41 20	14	74.50	13	467	1.282	0.505	1.904
I	76	W	B2	2	48	28 53 00	89 44 00	30	71.00	15	782	1.463	0.552	2.049
	80	W	B2	1	49	28 59 20	89 41 00	25	76.00	21	439	2.347	0.777	3.254
	83	W	B2	1	50	28 58 40	89 40 40	26		23	797	2.454	0.737	4.115
	75	C	F5	1	51	29 25 20	88 43 20	24	76.00	18	277	2.260	0.782	3.086
	75	C	F8	1	52	29 16 00	88 11 20	15		21	235	2.238	0.736	3.680
	77	C	F5	2	53	29 29 20	88 34 00	27		20	122	2.279	0.764	3.950
	78	C	F5	2	54	29 27 00	88 33 20	28		24	440	2.487	0.786	3.837
	82	C	F5	1	55	29 15 40	88 42 00	34	77.00	17	286	2.269	0.818	2.847
	83	C	F5	1	56	29 31 00	88 34 20	24		21	224	2.251	0.746	3.642
	83	C	07	1	57	29 51 00	88 30 00	16	76.00	17	1060	1.534	0.544	2.091
	80	W	B2	1	58	28 53 00	89 38 40	36	74.00	23	795	2.324	0.742	3.345
	80	C	F5	1	59	29 26 20	88 35 40	26		23	858	2.162	0.695	3.207
	82	W	A2	1	60	28 54 40	89 47 40	36		20	391	2.228	0.749	3.215
	82	C	B4	1	61	29 20 00	88 48 30	26		21	316	1.997	0.659	3.395
	83	W	A1	1	62	28 48 00	89 45 40	37		23	374	2.011	0.639	3.837
	77	W	A2	1	63	28 50 40	89 40 00	38		15	399	2.090	0.768	2.404
	77	C	B4	1	64	29 13 00	88 49 20	38		14	287	1.783	0.689	2.272
	79	W	C2	1	65	28 49 00	89 21 40	44		14	602	1.320	0.505	1.984
	80	W	B1	1	66	28 44 00	89 48 40	46	75.00	30	523	2.541	0.753	4.781
IB1	82	W	B1	2	67	28 44 00	89 38 40	46	65.00	26	439	2.532	0.779	4.167
	82	W	B2	2	68	28 51 00	89 36 40	38	77.00	28	332	2.719	0.814	4.733
	83	W	B1	1	69	28 47 40	89 32 20	44	69.00	25	209	2.624	0.828	4.479
	73	C	[illegible]	1	70	29 08 20	88 50 20	48	76.00	18	513	1.964	0.681	2.794
	74	C	F4	1	71	29 22 00	88 34 00	32		16	815	1.657	0.603	2.203
	75	W	A1	1	72	28 45 40	89 48 00	45		15	352	2.248	0.824	2.449
	76	C	F4	2	73	29 16 40	88 40 40	36	65.00	16	818	2.122	0.771	2.194
	83	C	F4	1	74	29 18 40	88 35 40	34		21	335	2.287	0.764	3.405
IB	73	W	A2	1	75	28 48 40	89 46 00	38	75.00	17	1103	1.570	0.552	2.337
	73	W	B1	1	76	28 43 40	89 38 20	44	75.00	24	273	2.320	0.738	4.073
	73	C	B4	1	77	29 13 20	88 46 20	36	71.00	18	540	1.790	0.626	2.737
	73	E	H4	2	78	29 18 00	88 12 20	46	74.00	17	1954	1.598	0.572	2.071
	74	W	B1	1	79	28 46 00	89 36 00	46		14	491	1.623	0.625	2.048
	78	W	B2	1	80	28 56 20	89 33 20	33		13	831	2.068	0.806	1.788
	83	E	H4	2	81	29 21 20	88 08 20	43		23	959	2.047	0.656	3.225
	76	C	F3	1	82	29 09 20	88 38 00	45	64.00	27	647	2.392	0.711	4.081
	77	C	F3	1	83	29 10 20	88 36 00	48		23	542	1.196	0.363	3.535
	78	W	B1	1	84	28 43 20	89 43 40	46		20	644	1.936	0.648	3.173
	80	C	F3	1	85	29 09 20	88 41 00	44	63.00	20	719	1.595	0.536	2.854
	82	C	F3	1	86	29 08 00	88 41 00	45		19	601	2.046	0.696	2.838
	77	W	A1	1	87	28 44 00	89 46 40	45		18	210	2.033	0.708	3.158
	79	C	F4	2	88	29 13 40	88 41 20	36		15	99	2.283	0.842	3.132
	79	E	H6	1	89	29 21 20	88 03 20	47	68.00	16	228	1.807	0.664	2.698
	82	E	H6	1	90	29 16 40	88 10 00	47		17	866	1.928	0.676	2.488
	83	C	F3	1	91	29 09 00	88 43 40	42		20	237	2.344	0.797	3.609
IB2	78	C	F4	2	92	29 15 20	88 37 20	38		15	554	1.681	0.614	2.319
	80	C	F4	1	93	29 19 00	88 36 20	35		19	419	1.745	0.594	2.991
	82	W	B1	1	94	28 40 20	89 35 40	54	65.00	16	318	1.959	0.720	2.849
	83	W	C1	1	95	28 44 40	89 27 20	55	67.67	22	749	1.681	0.544	3.221
	74	W	B2	1	96	28 51 40	89 41 20	33		10	405	1.430	0.644	1.749
	74	C	F3	1	97	29 11 20	88 40 20	40		12	109	1.657	0.693	2.274
	74	E	H6	2	98	29 20 40	88 04 00	46		14	366	1.658	0.639	2.454
	75	C	F4	1	99	29 21 20	88 33 40	34		11	507	1.442	0.617	1.559
	75	W	B1	1	100	28 43 20	89 38 40	52	75.00	9	125	1.519	0.694	1.779
	75	E	H4	1	101	29 23 40	88 00 00	37	71.00	16	639	2.023	0.736	2.351
	77	E	H4	1	102	29 21 40	88 01 20	48		18	787	2.149	0.744	2.557
	79	C	G4	1	103	29 16 00	88 22 00	43		17	420	1.968	0.716	2.597
	82	E	H5	2	104	29 24 40	88 04 40	33	71.00	9	3590	0.618	0.261	1.173
	76	E	H4	1	105	29 18 20	88 16 40	42	65.00	9	3978	1.410	0.657	1.707
	78	C	F3	2	106	29 09 00	88 37 20	46	64.00	19	492	2.044	0.695	2.988
HA1	80	E	G4	1	107	29 18 20	88 18 00	36	64.00	14	234	1.761	0.678	2.530
	80	E	H4	1	108	29 22 20	88 03 00	45	75.00	12	1082	1.488	0.623	1.980
	79	E	H4	2	109	29 21 00	88 10 40	37		15	576	1.406	0.536	2.285
	75	E	H5	1	110	29 30 40	88 03 40	25		7	335	0.488	0.255	1.043
	76	E	G4	1	111	29 22 20	88 19 20	36	65.00	15	1076	1.454	0.540	2.028
	78	E	H4	1	112	29 21 40	88 11 20	35		9	701	0.595	0.269	1.281
	78	E	H5	1	113	29 33 40	88 03 40	25		21	802	2.111	0.700	2.945
HA	83	E	G4	1	114	29 21 20	88 15 40	33		22	154	2.414	0.779	4.238
	73	E	J5	1	115	29 26 00	87 48 20	36	74.00	21	83	2.546	0.833	4.686
	74	E	H8	1	116	29 23 40	88 08 40	33	76.00	21	310	2.539	0.837	3.466
	74	E	H5	1	117	29 31 00	88 01 40	23	74.00	19	303	2.079	0.703	3.139
	74	E	J7	1	118	29 51 00	87 56 20	17		23	754	2.352	0.756	3.328
	75	E	H7	1	119	29 55 20	88 01 40	18		22	796	2.173	0.708	3.210
	76	E	H5	1	120	29 29 00	88 04 20	25	71.00	14	268	1.859	0.700	2.666
	79	E	H7	1	121	29 48 20	88 03 20	17		26	246	2.267	0.693	4.543
	83	E	H5	1	122	29 34 40	88 02 40	22		9	33	1.760	0.874	2.469
	83	E	H7	1	123	29 56 40	88 04 20	17	75.00	17	50	2.428	0.867	4.104
	77	E	H5	1	124	29 26 00	88 03 20	32		11	635	1.516	0.598	1.823
	77	E	H5	2	125	29 31 00	88 02 00	24		7	39	1.644	0.869	1.782
	73	E	H5	1	126	29 29 00	88 01 20	23	75.00	6	38	0.917	0.521	1.337
	82	E	H5	1	127	29 31 20	88 09 00	23		6	21	1.364	0.829	1.541
H	75	C	F6	1	128	29 37 00	88 34 00	15		18	114	2.213	0.776	3.634
	82	E	H7	1	129	29 50 20	88 06 00	18		7	17	1.565	0.808	2.132
	83	C	F8	1	130	30 06 20	88 36 00	8	76.00	30	242	2.782	0.820	5.282
	74	E	I8	1	131	30 11 20	87 48 40	7	71.00	10	118	1.237	0.542	1.901
	76	E	G8	1	132	30 10 20	88 17 40	7	66.00	11	61	1.967	0.813	2.569
	76	E	H7	1	133	29 52 00	88 04 00	18		15	414	1.352	0.466	3.064
	77	E	H7	1	134	29 58 40	88 09 20	16	73.00	13	860	1.590	0.617	1.833
	78	E	H7	2	135	29 59 00	88 01 40	15		11	79	1.626	0.690	2.339
	78	E	I8	1	136	30 09 40	87 52 20	7	72.00	16	133	1.951	0.706	3.203
	80	E	H5	1	137	29 29 20	88 06 40	25		13	110	1.640	0.692	2.505
	77	C	F8	1	138	30 11 00	88 42 00	8		26	433	2.420	0.752	4.151
HB	79	E	G8	1	139	30 03 40	88 25 40	8		10	70	1.758	0.692	3.012
HB1	73	C	F6	1	140	29 48 40	88 35 40	14	73.00	12	53	1.844	0.746	2.800
	74	C	F7	1	141	29 58 40	88 34 20	14		11	192	1.765	0.697	2.431
	75	C	F8	1	142	30 10 00	88 31 20	7	76.00	17	1108	1.225	0.430	2.327
	76	C	F7	2	143	29 57 20	88 33 00	14		14	246	1.941	0.728	2.501
	80	C	F7	1	144	29 57 00	88 30 40	15	72.00	16	223	1.612	0.577	2.843
	73	C	F4	1	145	29 23 00	88 43 20	24	74.00	15	212	1.290	0.495	2.566
	79	E	H5	1	146	29 26 20	88 10 40	28	81.00	11	116	1.441	0.601	2.138
	80	E	H7	1	147	29 54 00	88 03 40	18		13	40	2.117	0.865	2.938
	80	E	I8	1	148	30 10 40	87 51 20	6	68.00	3	325	1.290	0.620	1.237
	73	E	J7	1	149	29 53 40	87 51 20	16	73.00	3	19	1.680	0.835	2.512
HB2	73	E	J8	1	150	30 10 40	87 41 40	7	77.00	1	46	0.613	0.442	0.842

Table 36. Distribution of stations (by region and depth) in each of eight TWINSPAN groups resulting from analyses of 90 selected demersal nekton collected in three replicate samples at 150 stations in three regions of the Tuscaloosa Trend study area during fall NMFS Fishery Independent surveys from 1973 to 1983.

STATION GROUP IA1

DEPTH	YEAR 73	74	75	76	77	78	79	80	82	83
0-10			W	W	E/W	C/W				
10-20					W					
20-30										
30-40										
40-50										
>50										

STATION GROUP IA2

DEPTH	YEAR 73	74	75	76	77	78	79	80	82	83
0-10	C/W	C/W	E	C			C/W	C/W	E/C/W	E/W
10-20	W	W	W	W	C	C/W	W	W	C/W	W
20-30	W	C/W	W	C/W	W	W	C/W	W		W
30-40			W	W			W			
40-50				W						
>50										

STATION GROUP IB1

DEPTH	YEAR 73	74	75	76	77	78	79	80	82	83
0-10										
10-20							C			C
20-30			C		C	C			C/W	C
30-40	C/W	C		C	C/W	W		C/W	C/W	C/W
40-50	E/C/W	W	W				W	W	W	E/W
>50										

STATION GROUP IB2

DEPTH	YEAR 73	74	75	76	77	78	79	80	82	83
0-10										
10-20										
20-30										
30-40		W	C			C	C	C		
40-50		E/C		C	C/W	W	E	C	E/C	C
>50			W						W	W

STATION GROUP IIA1

DEPTH	YEAR 73	74	75	76	77	78	79	80	82	83
0-10										
10-20										
20-30			E							
30-40			E	E		E	E	E	E	
40-50				E	E	C	C	E		
>50										

STATION GROUP IIA2

DEPTH	YEAR 73	74	75	76	77	78	79	80	82	83
0-10										
10-20		E	E							E
20-30	E	E		E	E	E			E	E
30-40	E	E			E					E
40-50										
>50										

STATION GROUP IIB1

DEPTH	YEAR 73	74	75	76	77	78	79	80	82	83
0-10		E	C	E	C	E	E	E		C
10-20	C	C	C	E/C	E	E		E/C	E	
20-30	C						E	E		
30-40										
40-50										
>50										

STATION GROUP IIB2

DEPTH	YEAR 73	74	75	76	77	78	79	80	82	83
0-10	E									
10-20	E									
20-30										
30-40										
40-50										
>50										

across the upper half of Table 36 represent the groups on the right side of the corresponding TWINSPAN display (Group I in Figure 17, while those across the bottom half of Table 36 represent the groups on the left side of the display (Group II in Figure 17). Even though they are at opposite ends of Table 36, Groups IA2 and IIA1 are similar to each other (i.e., both are at the center of Figure 17). Examination of Figure 17 and Tables 35 and 36 in concert helps identify environmental trends most related to the ordering and grouping of the samples and taxa.

The station ordering across the top of Figure 17 primarily represents responses of the taxa to geographical location and depth, with some secondary year to year trends also evident. Station Group I includes all the stations from the western region of the study area and the majority of those from the central region. Station Group II includes the vast majority of the stations from the eastern region, along with 11 stations from the central region of the study area. Within each of these two major TWINSPAN groups, those samples near the outside of the display (i.e., those in Groups IA and IIB) are generally from shallow stations, while those near the center of the display (i.e., those in Groups IB and IIA were from the deepest stations (Tables 35 and 36).

Within Station Group IA, Group IA1 includes seven shallow stations (depth range of 6.0 to 12.3 fm), most of which were collected from the western region. Table 36 shows that all these stations were collected during the period 1975 to 1978, indicating that a temporal trend may be embodied in this station group. These seven stations were very depauperate, with a range of mean number of taxa of 4.0 to 17.7 (Table 35). The inclusion of stations from the eastern and central regions during 1977 and 1978, respectively, may indicate that the processes responsible for this impoverished community structure were acting over a wide geographical area.

Group IA2 was the largest station group in the display, and includes the vast majority of the very shallow stations from the western and central regions that were not in the closely related Group I, as well as virtually all the stations from the western region in the 10-30 fm depth range. It also includes several samples from the 30-50 fm range, all of which were from the western region. Six stations from the central region at depths of 20-40 fm and three stations from the eastern region at 0-10 fm depths were also included in Group IA2. The community at the Group IA2 stations was more speciose than that at the related Group IA1 stations (Table 35), with only two of the 43 stations in Group IA2 with means of less than 10 taxa. The inclusion of several shallow eastern stations in group IA2, and the large number of years when shallow stations from several or all regions were included, is indicative of the longshore similarity in community structure in the shallow Gulf during many years.

Group IB includes the majority of the deep water stations from the central and western regions of the study area, with Groups IB1 and IB2 both including a number of stations from the 40-50 fm depth zone (Table 36). All the stations from the 30-40 fm depths in the central region were included in Group IB. The two groups differed in that Group IB1 included a number of stations shallower than 30 fm (the vast majority of which are from the central region), while Group IB2 included none from shallow depths. Also, Group IB2 includes all three stations which were greater than 50 fm in depth (all of which were from the western region). Although there was considerable overlap, the stations from Group IB1 appeared to be generally the most speciose of all those in Group I, with those in Group IB2 being similar in numbers of taxa to those in the shallower Group IA2. Therefore, it appears that within the muddy bottom habitats, the communities at middepth stations were more speciose than those located either shallower or deeper.

As is evident from Table 36, going from left to right in Group II (Figure 17), stations become shallower. Group IIA1 includes all the stations in Group II that were deeper than 30 fm. While this includes all but one of the stations in the eastern region in the 30-40 fm depth range, only five stations in the 40-50 fm range were included in Group II (2 from the central region and 3 from the eastern region). The majority of the stations in the 40-50 fm depth range from the eastern region were located in Group IB, along with the majority of the stations from the central and western regions. The stations in Group IIA1 were all collected from a well defined time period (Table 36), indicating that the same community was consistently represented at middepth stations from the eastern and central regions during the period 1975-1982, but not in earlier and later years.

Group IIA2 stations were all from the eastern region, and represent three distinct time periods (Table 36). No stations from the 40-50 fm range were included in Group IIA2, and the group can generally be categorized as a middepth group from the eastern region. Comparing the stations in Groups IIA1 and IIA2, it is apparent that at the depth of overlap (i.e., the 30-40 fm zone), the middepth portion of the eastern region was characterized by a community more characteristic of shallower depths during some years (i.e., 1973-74, 1977 and 1983), while during most years the community inhabiting these stations was more typical of a deeper water habitat.

Group IIB included most of the shallow samples from the eastern and central regions that were not included in Groups IA, or IIA1, and included no samples located at depths greater than 30 fm. Within Group IIB, Group IIB2 includes only two samples, those being from the 0-20 fm depths in the eastern region during the hydrologically atypical year of 1973. Within Group IIB1, there appeared to be a secondary temporal trend, with most of the stations from the early portion of the record (i.e., 1973-1976) being from the central region and the majority from the middle and latter portion of the record (i.e., 1977-1982) being from the eastern transect. This indicates that the community that characterizes these stations exhibited similar spatial trends over time.

Unlike some of the other TWINSPAN displays presented earlier in this report, the taxa in Figure 17 did not show a simple left to right gradient of station affinity going down the table. This is attributable to trends in distribution of several taxa groups, and especially those of Taxa Groups IA1 and IB1 (Figure 17).

The taxa at the top of the display (i.e., those in Taxa Group IA1 in Figure 17) were found almost exclusively at Station Group IB1 stations and, to a lesser extent, at Station Group IB2 stations, indicating that they were relatively restricted to the middepth to deep water stations of the central and especially the western regions of the study area (Table

36). This taxa group, which includes Parapenaeus LPIL, Steindachneria argentea, Solenocera LPIL, and Congrina flava, was essentially equivalent to Group 2 defined from the seasonal analysis (see Table 11). The presence of these Group IA1 taxa, along with the absence of a number of taxa in Taxa Group IA2 characteristic of only the nearshore stations in Station Group I, differentiated Station Group IB1 from Station Group IA (Figure 17). The taxa in Group IA1, which seldom occur in waters shallower than 15 fm, were the taxa that most differentiated Station Group IB1 from the rest of the stations, and were the most unique component of the brown shrimp grounds. These nearshore taxa in Taxa Group IA2 included several that are commercially important and many that are estuarine dependent and estuarine related. These include the star drum (Stellifer lanceolatus), the gafftopsail catfish (Bagre marinus), the banded drum (Larimus fasciatus), the Gulf menhaden (Brevoortia patronus), the white shrimp (Penaeus setiferus), the Atlantic threadfin (Polydactylus octonemus), the silver seatrout (Cynoscion nothus), and the hardhead catfish (Arius felis). These were essentially the same taxa that defined Group 1 resulting from a synthesis of the seasonal analysis data (see Table 11), and were the characteristic component of the white shrimp ground community. The clear differences in the distributions of these Group IA1 and IA2 taxa with depth is very impressive, and indicates that distinct depth-related communities exist in the western and central regions of the Tuscaloosa Trend study area.

In addition to the inshore restricted taxa, Taxa Group IA2 included a number of taxa that were distributed over the entirety of Station Group I, which essentially defined the the muddy bottom habitat of the western and central regions of the study area. These taxa included the brown shrimp (Penaeus aztecus), the croaker (Micropogonias undulatus), the lesser blue crab (Callinectes similis), the Atlantic cutlassfish (Trichiurus lepturus), the spot (Leiostomus xanthurus) and the silver seatrout (Cynoscion arenarius). Note that the distribution of the brown shrimp actually extended into the region defined by the Group II stations (Figure 17), with the croaker, spot or sand seatrout better differentiating the Group I stations from those of Group II. These widely distributed Group IA2 taxa are known to characterize both the white and brown shrimp grounds, and most of their members are estuarine dependent. In the analysis of the seasonal data, a similar group was distinguished (Group 3 in Table 11). A number of these widely distributed Group IA2 taxa occurred in decidedly lower densities at stations in Station Group IB2, which represented the deep water habitat in western and central regions of the study area, including all of the stations greater than 50 fm in depth (Table 36).

The taxa in Taxa Group IB1, were found in relatively greatest abundance at the deep water stations from the entire study area (Station Groups IB1, IB2 and IIA1 in Figure 17). While these taxa showed considerable "scatter" in their distributions, the importance of the deep water habitat is evident. These taxa include two subgroups. Taxa in the first subgroup (including the portunid crab (Portunus spinicarpus), several searobins (Prionotus paralatus and P. stearnsi), and the butterfish (Peprilus burti)) all showed a distinct preference for the deep water stations in Station Group IB2 and IIA1 over those in Station Group IB1. As such, these taxa were more prominent at the deepest, sandy stations from the eastern region of the study area as compared to the stations at similar depths from the western region.

The other suite of taxa in Taxa Group IB1, including the rock sea bass (Centropristis philadelphicus), the Mexican flounder (Cyclopsetta chittendeni), the pancake batfish (Halieutichthys aculeatus), and the blackfin searobin (Prionotus rubio), were more widely distributed over Station Groups IB1, IB2, and IIA1, but were somewhat less well represented at stations in Station Group IIA1. The importance of depth to the distribution of these taxa was not as evident in the seasonal analysis which only dealt with the distributions during a single year. In the seasonal analysis, these deep water taxa displayed what appeared to be mainly sediment related trends, and were characterized as either being widely distributed over the study area but preferring sandy bottoms, to being widely distributed over sandy bottoms (see Table 11). These deep water taxa constituted a second assemblage that characterizes the stations in Station Group IB (i.e., the brown shrimp grounds), but were generally more important in the central and eastern regions of the study area. Therefore, while the white shrimp grounds (Station Group IA) were characterized mainly by an inshore restricted taxa group and the generalists (both in Taxa Group IA2 in Figure 17), the brown shrimp grounds was characterized by the generalists, a middepth group that preferred the muddier sediments of the western region and portions of the central region (Taxa Group IA), and a deep water assemblage (Taxa Group IB1) consisting of taxa that appeared to show a wide range of sediment preferences but were generally more prominent in the eastern region. It is for this reason that the stations located at middepths in the western region and portions of the central region (Station Group IB in Figure 17) were the most speciose of all (Table 35).

The taxa in Taxa Group IB2 and especially those in Taxa Group IIA1 showed very unique distributions over the study area (Figure 17). They quite clearly preferred the shallow, sandy bottom stations from the eastern and central regions located in Station Group IIB1, as well as a number of stations from the central and eastern regions located to the far left of Station Group IA2 (Figure 17). Some shallow water sandy stations were included in Station Group IA2 because they contained a number of taxa characteristic of the white shrimp grounds, which were not present at the very sandy Group IIB stations. The location of these shallow stations from the central and eastern regions in Station Group IA2 was responsible for the bimodal distributions of several of the Taxa Group IB2 and IIA1 taxa, including the red snapper (Lutjanus campechanus), the silver jerry (Eucinostomus gula), the striped anchovy (Anchoa hepsetus), the least puffer (Sphoeroides parvus), the portunid crab (Portunus gibbesii), the fringed flounder (Etropus crossotus), and the squid (Loligo pealeii). In the seasonal analysis, these taxa were variously classified as being characteristic of the shallow water habitat, being widespread across the study area but preferring sandy bottoms, and being widespread over sandy bottoms (see Table 11). This long term analysis confirmed that these taxa did not generally occur in deep water habitats, and that they constituted a distinct, sandy bottom, inshore community.

Three taxa constituted Taxa Group IIA2 (Figure 17). All three of these taxa (Calappa sulcata, Lagodon rhomboides, and Trachurus lathami) were widely distributed over the study area. None of them showed much preference for any of the station groups, except they appeared to be in relatively greater abundance at some of the middepth to deeper water stations (Station Groups IB1, IB2 and IIA1).

The taxa in Taxa Group IIB1 included the pink shrimp (Penaeus duorarum), the dwarf sand perch (Diplectrum bivittatum), the inshore lizardfish (Synodus foetens), and the longspine porgy (Stenotomus caprinus). They were widely distributed over the study area, but showed a distinct preference for the sandy bottoms. This was evidenced by the increasing relative importance of these taxa on the right side of the TWINSPAN display (Figure 17). Besides their general preference for sandy bottoms, there was little similarity in the distributions of these taxa. The pink shrimp generally preferred shallow bottoms while the longspine porgy showed a greater preference for deep water stations. The inshore lizardfish also showed a distinct preference for the sandy inshore stations, and exhibited one of the best gradients in the entire suite of taxa (Figure 17). In the seasonal analysis, this taxon was characterized as being widespread over the study area but preferring sandy bottoms, while the pink shrimp and inshore lizardfish were widespread over, and relatively restricted to, the sandy bottoms. Compared to the community at the shallow water, muddy bottom stations, generally fewer taxa characterized the shallow water, sandy bottom habitat.

The final taxa group (Group IIB2 at the very bottom of Figure 17) included the only taxa that clearly characterize the middepth habitats in the eastern region, where sandy sediments predominate. The majority of these taxa were quite restricted to the stations in Station Group IIA2, which includes a number of stations from the 10-40 fm depths from only the eastern region (Station Group IIA2 in Table 36). It was noted earlier that the stations in Station Group IIA2 represented three somewhat distinct blocks of time (1973-1974, 1976-1978 and 1982-1983). Since the Taxa Group IIB2 taxa provided the unique character to the community at these stations, indications are that the taxa in Taxa Group IIB2 may have migrated into the Tuscaloosa Trend study area when conditions were favorable. When they were present, they contributed to the more speciose nature of these stations as compared to stations at similar depths in the western region where they were not present. These taxa included the smoothhead scorpionfish (Scorpaena calcarata), the horned searobin (Bellator militaris), the snakefish (Trachinocephalus myops), the bandtail searobin (Prionotus ophyrus), and the bluespotted searobin (P. roseus). These same taxa also formed a distinct assemblage in the seasonal (fall 1974-summer 1975) analysis (see Table 11). 1974 was one of the years when the group was best represented in the Tuscaloosa Trend study area (Table 36). The dusky flounder (Syacium papillosum) and the rock shrimp (Sicyonia brevirostris) also characterized these middepth stations, but were more widely distributed. The dusky flounder was especially characteristic of the inshore sandy stations of Station Group IIB, and was one of the few taxa that spans several depth zones in the sandy eastern region (Figure 17). The rock shrimp was also found at some of the deepest stations of Station Group IIA1, being (along with the longspine porgy) one of the few taxa that showed a distinct preference for the deep water sandy stations. It is for this reason that many of the deep water sandy Group IIA1 stations were less speciose than were the middepth stations from the eastern region (Station Group IIA2); however, the presence of some of the deep water taxa characteristic of Taxa Group IB1 at these Group IIA2 stations added considerably to the species richness in these habitats (Table 35). In general, there appeared to be less change in numbers of taxa with depth in the sandy habitat than was evident in the muddy habitat.

2.5.4.4 Factor Analysis

The factor pattern matrix resulting from the R-mode factor analysis of the individual replicate annual data set is presented in Table 37, along with final communalities for each taxon and variance explained by each factor. The suite of taxa from the final TWINSPAN analysis (Figure 17) were input to the factor analysis, and the taxa included in Table 37 are those with communalities (i.e., shared variance) greater than 0.20 and loadings of at least 0.30 on one of the factors. Seven factors were retained for rotation to simple structure. Factor scores were generated from the final factor solution, and entered into correlation analysis to relate taxa groups defined by the factors to environmental variables. The results of this correlation analysis are shown in Table 38.

Overall, the assemblages defined in the factor analysis (Table 37) were very similar to those found in the corresponding TWINSPAN analysis (Figure 17). Factor 1, which represented the strongest community trend in the data, was essentially equivalent to TWINSPAN Taxa Group IIB2 (Figure 17). These taxa, which included the rock shrimp (Sicyonia brevirostris), the snakefish (Tracinocephalus myops), the smoothhead scorpionfish (Scorpaena calcarata), the horned searobin (Bellator militaris), the bandtail searobin (Prionotus ophyrus), bluespotted searobin (Prionotus roseus), the bank seabass (Centropristis ocyurus), and the planehead filefish (Monacanthus hispidus), were, for the most part, restricted to middepth stations (10-40 m) in the sandy eastern portion of the study area (Station Group IIA2 in Table 36). Of these taxa, only the rock shrimp had a salient loading on another factor (Factor 3), demonstrating some adherence to the trends defined by Factor 3. The Factor 1 taxa appear to exhibit some long term trends, since they occurred in several blocks of time and space (Table 36). These taxa also formed a distinct group (Group 6) in the community analysis of the seasonal data (see Table 11). Factor 1 scores were significantly and negatively correlated with precipitation and estuarine water temperature in winter, and significantly and positively correlated with low tides in summer and fall at Pensacola (Table 38).

Factor 2 included those taxa that were widely distributed over the study area but were numerically most prominent in waters overlying muddy sediments. All of these taxa except the sand seatrout (Cynoscion arenarius) were included in Taxa Group IA2 in the corresponding TWINSPAN analysis (Figure 17). These included a number of the commercially most important nekton in the Gulf of Mexico, among them the croaker (Micropogonias undulatus), the silver seatrout (Cynoscion nothus), the spot (Leiostomus xanthurus), and both the brown and white shrimp (Penaeus aztecus and P. setiferus). As can be seen in Figure 17, the white shrimp showed a more inshore-restricted distribution than the other taxa, but not as restricted as some of the other taxa in Taxa Group IA2 of the TWINSPAN analysis (Figure 17). The affinity of the white shrimp to the nearshore habitat was shown by its salient loading on Factor 5 (Table 37).

Table 37. Factor pattern matrix resulting from R-mode factor analysis of 90 selected demersal nekton taxa collected in three replicate samples at 150 stations in three regions of the Tuscaloosa Trend study area during fall NMFS Fishery Independent surveys from 1973 to 1983.

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Communality
Scorpaena calcarata	0.87909	-0.07163	-0.01541	0.11344	-0.05590	-0.01514	0.00889	0.79446
Sicyonia brevirostris	0.70831	-0.14256	0.40625	-0.05680	-0.04133	-0.09826	-0.01406	0.70186
Bellator militaris	0.67633	0.02811	0.24881	-0.11337	-0.01091	-0.13683	-0.09655	0.56114
Ophidion holbrooki	0.61698	-0.04817	-0.04095	0.05666	-0.00348	0.05522	0.03943	0.39250
Prionotus ophryas	0.56642	-0.00949	0.04468	-0.01919	0.01548	-0.00272	0.01390	0.32373
Syacium papillosum	0.50958	-0.20574	-0.17695	0.02919	-0.16452	-0.14037	-0.08754	0.38860
Prionotus salmonicolor	0.50926	-0.07974	-0.02514	0.11143	-0.03546	-0.08735	-0.09903	0.29745
Trachinocephalus myops	0.38333	-0.12973	-0.11642	-0.01871	-0.08871	-0.01002	-0.03187	0.18666
Micropogonias undulatus	-0.10272	0.87825	-0.11212	0.04791	0.14348	-0.10792	-0.04598	0.83110
Cynoscion arenarius	-0.15918	0.72240	0.04357	-0.10778	0.16361	0.12430	-0.06986	0.60782
Leiostomus xanthurus	-0.10856	0.65019	0.03738	-0.07456	0.05769	0.02886	-0.29433	0.53228
Cynoscion nothus	-0.08071	0.59689	-0.19327	0.01150	0.05807	0.03231	0.11765	0.41853
Penaeus aztecus	-0.10886	0.55157	0.21143	0.08152	-0.15347	0.22346	-0.00169	0.44092
Penaeus setiferus	-0.09484	0.45230	-0.24614	0.16569	0.40921	-0.08039	0.04541	0.47758
Centropristis philadelphicus	-0.08274	0.22090	0.65270	0.09218	-0.21610	0.18038	-0.17847	0.60124
Prionotus paralatus	0.10332	-0.07325	0.57736	-0.08456	0.04548	-0.04382	-0.01271	0.36069
Prionotus rubio	0.05615	0.29605	0.56945	0.13943	-0.02355	0.11739	0.04800	0.45115
Portunus spinicarpus	0.17220	-0.05780	0.56864	-0.17755	-0.04804	0.12866	-0.03868	0.40822
Prionotus stearnsi	-0.10051	-0.07677	0.51857	-0.03544	-0.06678	-0.01346	0.06676	0.29526
Stenotomus caprinus	0.08394	-0.19546	0.50340	-0.08438	-0.23673	-0.13497	0.11507	0.39328
Serranus atrobranchus	-0.21711	0.06021	0.48437	-0.04393	-0.21026	0.32750	0.03214	0.43981
Pristipomoides aquilonaris	-0.07527	-0.07881	0.47480	-0.06321	-0.05531	0.19258	0.08446	0.28859
Synodus foetens	0.07336	-0.20790	0.31751	0.08841	-0.23306	-0.30421	-0.00117	0.30409
Penaeus duorarum	0.39703	-0.11888	-0.03170	0.61696	0.02326	0.01817	0.06161	0.55808
Portunus gibbesii	-0.03887	0.01065	-0.06205	0.61510	0.01726	-0.06467	-0.05638	0.39148
Sphoeroides parvus	0.23912	0.01022	-0.09691	0.57410	0.13386	-0.09685	-0.00874	0.42364
Etropus crossotus	-0.07095	-0.06107	-0.07271	0.55580	0.10838	-0.13588	-0.02720	0.35391
Trachypenaeus	-0.06560	0.12749	0.05349	0.49322	-0.14310	0.21744	-0.19653	0.37307
Diplectrum bivittatum	0.36856	-0.20002	-0.08796	0.44317	-0.11492	-0.08558	0.04524	0.40256
Squilla	-0.05189	0.24967	0.08574	0.42400	-0.02088	0.34536	-0.17184	0.40139
Callinectes similis	-0.17319	0.37106	-0.01348	0.39125	-0.03898	0.05028	-0.14152	0.34502
Bagre marinus	-0.03753	0.02680	-0.02088	-0.01853	0.64908	-0.00854	-0.01838	0.42463
Brevoortia patronus	-0.03960	0.14926	-0.04784	-0.04028	0.55651	0.01932	0.06056	0.34150
Arius felis	0.01152	0.03731	-0.24192	0.21779	0.52621	-0.09175	-0.06830	0.39746
Sciaenops ocellata	-0.02378	-0.02533	0.00852	-0.01415	0.50594	0.01229	-0.02193	0.25809
Selene setapinnis	-0.07518	0.16003	-0.11261	0.00257	0.42694	-0.11128	0.00750	0.23867
Chloroscombrus chrysurus	-0.14325	-0.16872	-0.18110	0.04449	0.33448	-0.16376	0.07059	0.22744
Steindachneria argentea	-0.02579	0.02236	0.00951	-0.03978	-0.04108	0.71508	0.09399	0.52469
Parapenaeus	-0.04045	0.01719	0.00956	-0.00214	-0.03637	0.66970	0.01222	0.45200
Solenocera	-0.10725	0.07048	0.26403	-0.04389	-0.11389	0.57989	-0.17795	0.46901
Congrina flava	-0.05900	0.01467	0.13314	-0.04870	-0.03004	0.33978	-0.19905	0.17977
Peprilus burti	-0.12515	-0.06828	0.28621	-0.10798	-0.08688	-0.07011	0.56051	0.44054
Trachurus lathami	-0.14177	-0.14739	0.30059	-0.05722	-0.14023	0.03017	0.55024	0.45879
Trichiurus lepturus	-0.11842	0.38047	-0.11909	-0.16014	0.16953	0.04914	0.49687	0.47664
Halieutichthys aculeatus	0.01357	0.06157	0.29027	0.03478	-0.05719	0.13720	-0.32334	0.21608
Lepophidium graellsi	-0.12949	0.19015	0.21116	0.18088	-0.18246	0.23027	-0.35192	0.34040
VARIANCE EXPLAINED	3.80812	3.48804	3.47242	2.49058	2.23377	2.21315	1.48573	

Table 38. Results of correlation analysis of environmental variables with factor scores resulting from analysis of 90 selected demersal nekton taxa collected in three replicate samples at 150 stations in three regions of the Tuscaloosa Trend study area during fall NMFS Fishery Independent surveys from 1973 to 1983.

FACTOR	REGION	YEAR	EKMAN TRANSPORT MERIDIONAL	EKMAN TRANSPORT ZONAL	PRECIPITATION	AIR TEMPERATURE	TIDES	MISSISSIPPI RIVER DISCHARGE	ESTUARINE TEMPERATURE	ESTUARINE SALINITY
Factor 1	East				- Winter				- Winter	
Factor 2	East			+ Winter + Spring		+ Summer	+ Summer + Fall			- Spring
	Central			+ Winter + Spring		+ Winter - L. Spring	+ Winter + Spring		+ Winter - L. Spring	- Spring
	West	-		+ Winter + Spring		+ Winter - L. Spring	+ Winter + Spring - Summer	+ Fall	+ Winter - L. Spring	- Spring
Factor 3	East	+	+ Winter - Spring			- Winter (Md) + L. Spring (D)	- Winter - Spring + Summer	- Fall (Sh) - Annual		+ Spring
	Central	+	+ Winter - Spring	- February - June		- Winter (Md) + L. Spring (D)	- Spring		- L. Winter - Spring	+ Spring
	West	+ (esp. Sh)	+ Winter - Spring	- February - June		- Winter (Md) + L. Spring (D)	- All Year		- L. Winter - Spring	+ Spring
Factor 4	East	+	+ Spring + Summer + Fall	- March		- Summer	+ Spring			+ E. Spring
	Central	+				- Fall	+ Spring	- Fall		+ L. Spring - Summer
	West	+			+ Winter + Spring	+ Summer	+ Spring	+ Summer		- Spring - Summer + Fall
Factor 5	East		- Summer (Md)		+ Winter (Md) + Spring (Md)	- Winter (D)	+ Spring + Summer - Winter		- March (Md)	
	Central	-	- February	- Spring	- Winter (Md) - Spring (Md)	+ April			+ Spring	- Fall
	West	- (Md)	- February	- Spring		+ April - Fall			- Fall	- Fall
Factor 6	East	-	+ Spring - Summer			+ Summer	- Summer		- Spring + Fall	+ L. Spring
	Central			+ Summer			- Fall - Winter	- Winter	- Winter	+ L. Spring - Summer
	West	+	+ February		+ Winter	+ March		- Fall	- Winter	
Factor 7	East			- Spring - Fall	+ Summer (Sh)	+ April - Fall	- Winter - Spring + Summer - Fall		- L. Winter + Spring (D)	+ Spring (D) + Summer (D)
	Central				+ Fall (Sh)	- L. Spring	- (Sh)	+ Fall (D)		- Fall
	West	- (D)		+ L. Winter			+ (Sh)	- Summer (D)	+ Spring	- Spring - Summer - Fall

(Sh) = Shallow
(Md) = Middepth
(D) = Deep

All entries indicate at least one significant correlation at α = 0.10

Factor 2 scores from the western region were the only ones showing strong negative correlations with year, indicating that stocks of the Factor 2 taxa (Table 37) declined in this region over the study period. Factor 2 scores showed a number of strong correlations with environmental variables, with some differences apparent from region to region. These strong relationships would be expected since the Factor 2 taxa (Table 37) are generally estuarine dependent. Scores in all three regions were positively correlated with wind and tide variables in winter and spring, including zonal Ekman transport, mean sea level, mean higher high water and low tide. The scores from the western and central regions were also positively correlated with air temperatures and estuarine water temperatures in winter and high tides in spring. Both were negatively correlated with estuarine salinities in spring and air and estuarine temperatures in late spring and summer. Scores in the western region were also positively correlated with Mississippi River discharge in fall and negatively correlated with mean lower low water in summer. Scores from the eastern region showed somewhat different trends, including negative correlations with estuarine salinities only in spring and air temperatures only in summer, and positive correlations with a number of tide variables during the the entire summer to winter period, and especially in fall.

Factor 5 included a large number of taxa that were included in TWINSPAN Taxa Group IA2 which showed very inshore restricted distributions, including the menhaden (Brevoortia patronus), the hardhead catfish (Arius felis), the gafftopsail catfish (Bagre marinus), the Atlantic bumper (Chloroscombrus chrysurus), and the Atlantic moonfish (Selene setipinnis), as well as the white shrimp (Penaeus setiferus). These taxa are the ones that most characterize the inshore white shrimp ground community in the northwest Gulf of Mexico, and formed a similar assemblage in the seasonal analysis (Group 1 in Table 11).

Factor 5 scores from the 21-40 fm depths in the western region and those for stations from all depths in the central region were negatively correlated with time, indicating that there were lower populations of the Factor 5 taxa (Table 37) in these areas during more recent years. In the western and central regions, correlations of scores with meridional Ekman transport in February and zonal transport in spring were negative, while in the eastern region, correlations of scores from 21-40 fm depth stations with meridional transport in summer were negative. Scores at 21-40 fm depths in the eastern and central regions showed exactly the opposite trends with respect to precipitation in winter and spring, with those for the central region being negative. Correlations with air temperature variables also differed across the study area. In the deepest parts of the eastern region, correlations of scores with winter temperatures were negative. In the western and central regions, correlations with air temperature in April were positive, and, in the western region, correlations with fall temperatures were negative. This indicates that Factor 5 taxa (Table 37) were relatively less abundant in the western region of the study area during those fall seasons when air temperatures (and presumably water temperatures) were lower. Correlations of scores with tide variables were not strong, with only those from the eastern region being significant (positive in spring and summer and negative in winter). Virtually no significant correlations were observed with discharge. Correlations with estuarine temperature variables were also not strong, except in the west, where correlations with spring temperatures were positive and those with fall temperatures were negative. In the eastern region, scores from the 20-40 fm depths were negatively correlated with estuarine temperature in March. Correlations with estuarine salinity variables were stronger, with those involving scores from the western and central regions in the fall being among the strongest and negative.

Eleven taxa showed salient loadings on Factor 3, nine of which had their highest loadings on this factor. Taxa showing the strongest affinity to Factor 3 included the rock seabass (Centropristis philadelphicus), several species of searobin (Prionotus paralatus, P. rubio, and P. stearnsi), the portunid crab (Portunus spinicarpus), the longspine porgy (Stenotomus caprinus), the wenchman (Pristipomoides aquilonaris) and the blackear bass (Serranus atrobranchus). The vast majority of these taxa were located in Taxa Group IB1 of the corresponding TWINSPAN analysis, with several others included in Taxa Group IIB1 (Figure 17). While many were widely distributed over the study area, they all exhibited an affinity for the deepest stations, and especially those in Station Group IB2 (Figure 17 and Table 36). Several characterized the deep zones in all regions, while several others (the portunid crab, the wenchman and several searobins) occurred in significantly lower numbers in the middepth to deep water stations in the western region (Station Group IB1 in Figure 17). This taxa group was not similarly identified in the seasonal analysis, with most of these taxa being characterized as either widespread over the study area but more prominent in the sandy sediments, or widespread over sandy sediments (see Table 11). These taxa were an important component of the deep water habitat in the study area. In the sandy region, this group was the main component of the deep water community. Along with the widespread taxa characteristic of Factor 2 and the Factor 6 taxa (see below), they characterized the communities at middepth to deep water stations over muddy bottoms.

The scores for the Factor 3 taxa with time were generally positive, with those for the shallow stations in the western region of the study area being the strongest. This indicates that Factor 3 taxa (Table37) generally increased in abundance over the study period and especially in the more inshore areas of the western region. Correlations with meridional Ekman transport in winter were generally positive, while those in summer were generally negative. In the western and central regions, correlations with zonal Ekman transport in February were negative, as were the correlations with this same variable in June. Virtually no significant correlations with precipitation variables were apparent. Correlations with air temperatures in winter were negative and strongest at the shallowest depths (20-30 fm). Scores for the deepest stations in spring were positively correlated with air temperatures in late spring. All of the strong correlations of Factor 3 scores with tide variables were negative. Strong correlations were seen in all seasons, but especially so in spring in the central region (where relationships were strongest) and winter and spring at the shallowest depths in the eastern region. Mississippi River discharge, and especially discharge in the fall was negatively correlated with scores from the eastern region at shallowest depths. Few significant correlations were seen with estuarine temperature variables, with the strongest being the negative correlations with estuarine temperature variables in spring. Similarly, most strong correlations with estuarine salinity variables involved salinities in spring, but were positive.

The taxa with salient loadings on Factor 4 were those in TWINSPAN Taxa Groups IB2 and IIA1 which showed bimodal distributions across the study area (Figure 17). They were characteristic of shallow inshore stations predominantly in the eastern and central regions, presumably with sandy sediments. Their bimodal distributions in Figure 17 resulted from the fact that some of the shallow samples from the central and eastern regions in which they were collected also included representatives of the inshore community characteristic of muddy bottoms predominantly in the western region. The pink shrimp (Penaeus duorarum) and the portunid crab, Portunus gibbesii, had the highest loadings on Factor 4. Other taxa with their highest loadings on this factor included the least puffer (Sphoeroides parvus), the fringed flounder (Etropus crossotus) and the shrimp, Trachypenaeus LPIL. These taxa were not identified as a discrete assemblage in the seasonal analysis, where they were included among the widely distributed taxa that occurred most prominently in waters overlying sandy bottoms or among those that occurred widely over sandy bottoms (Groups 4 and 5, respectively, in Table 11).

Factor 4 scores showed relatively strong positive correlations with time, with those from the western and central regions being particularly strong. This indicates that stocks of the Factor 4 taxa (Table 37) increased in the Tuscaloosa Trend study area during the study period. Scores from the eastern region, and especially those from shallow depths, showed the strongest correlations with Ekman transport variables, including positive correlations with meridional transport in the spring to fall period, and negative correlations with zonal transport in March. The only strong relationships to precipitation variables were in the western region in winter and spring, and they were positive. Correlations with temperature variables differed from region to region. Scores from the eastern and western regions were, respectively, negatively and positively related to air temperatures in summer, while, scores from the central region were negatively correlated with air temperatures in fall. Very few strong relationships of Factor 4 scores with tide variables were observed; however, correlations with spring tide variables were generally positive. Little relationship was seen with discharge from the Mississippi River either, but the correlations of scores from the western region with summer discharge were generally positive and those from the central region with fall discharge were generally negative. Correlations with estuarine salinity variables showed several major trends. Scores from the eastern and central regions were positively correlated with estuarine salinities from the shallow bay stations in early and late spring, respectively. Scores from the eastern and western regions, and especially those from 0-20 fm depths, were negatively correlated with salinities from deeper open bay stations during spring and summer. Over all depths in the western region, scores were positively correlated with open bay salinities in fall.

The four taxa with highest loadings on Factor 6 (the luminous hake, Steindachneria argentea), two shrimp (Parapenaeus LPIL and Solenocera LPIL), and the yellow conger (Congrina flava) formed a distinct assemblage in both the corresponding TWINSPAN analysis (Taxa Group IA1 in Figure 17) and in the Fishery Independent survey seasonal analysis (see Table 11), where they were characteristic of deep waters overlying muddy sediments mainly in the western region of the study area. These taxa, along with those with highest loadings on Factors 2 and 3, comprised the communities inhabiting deep waters over muddy bottoms. They showed some of the most restricted distributions of any taxa groups, and apparently occur only rarely east of the Mississippi River Delta.

Factor 6 scores showed different relationships to time, depending on location in the study area. Those from the eastern region were generally negative with respect to time, while those from the western region were generally positive. This indicates a shifting in the distributions of the Factor 6 taxa (Table 37) during the study period. Scores from the western region were positively correlated with meridional Ekman transport in February, while those from the eastern region were negatively correlated with meridional transport in spring and summer. Scores from the central region were positively related to zonal transport in summer. The only strong correlation with precipitation variables involved scores from the western region in winter, and it was positive. Scores from the western region were positively related to air temperature in March, while, in the eastern region, scores were positively related to air temperatures in summer. Correlations with tide variables were not strong. In the eastern region, scores were negatively correlated with summer tides, while in the central region, negative correlations were observed with tide variables in fall and winter. Scores in the western and central regions were negatively correlated with Mississippi River discharge in winter and fall, respectively. Correlations of scores from the central and western regions with winter estuarine temperatures were negative, while, in the eastern region, scores were negatively correlated with estuarine temperatures in spring and positively correlated with estuarine temperatures during the fall. Correlations of scores from the eastern and central regions with estuarine salinities during late spring were positive, while scores from the central region with estuarine salinities in summer were negative.

Factor 7 was a bipolar factor, with three taxa (the Gulf butterfish, Peprilus burti, the Atlantic cutlassfish, Trichiurus lepturus, and the rough scad, Trachurus lathami) having positive salient loadings, and two taxa (the pancake batfish, Halieutichthys aculeatus, and the blackedge cusk eel, Lepophidium graellsi) having negative loadings. This indicates that for the trends embodied in Factor 7, these two groups showed much the opposite relationships. The rough scad and the cutlassfish showed salient loadings on other factors, while the batfish and butterfish showed loadings on other factors that approached being salient (i.e., 0.30). Therefore, the trends embodied in Factor 7 were not particularly distinct. Based on the distribution of the taxa with the highest loading on Factor 7 (i.e., the butterfish), it appears that the taxa with positive and negative salient loadings on Factor 7 favor different groups of deep water stations in the study area (TWINSPAN Station Group IB1 versus Groups IB2 and IIA1 in Figure 17).

For the most part, Factor 7 scores were not significantly correlated with time, indicating no significant trends in the abundance of the Factor 7 taxa (Table 37) over the study period. The one exception was the significant negative correlation of the scores from the deep water stations in the western region (20-50 fm depths). This indicates that stocks of

Factor 7 taxa in the deep water habitat declined over the study period. Correlations with Ekman transport variables differed in the eastern and western regions. In the eastern region, scores were negatively correlated to zonal transport in spring and fall, while in the western region, scores were positively correlated with zonal transport in late winter. Correlations with precipitation variables were, for the most part, not strong, but those for the shallow stations in the eastern and central regions were positively correlated with precipitation in summer and fall, respectively. Correlations with temperature variables also differed across the study area. In the eastern region, scores were positively related to air temperature in April and negatively related to air temperature in fall. For the central region, correlations of scores with temperature variables in May and June were negative. As was the case for other types of variables, correlations of Factor 7 scores with tide variables were different in the several regions of the study area. In the eastern region, correlations with tide variables in winter and spring were generally negative, those with summer tide variables were generally positive, and those with tide variables in fall were strongly negative. In the central region at shallow depths, scores were negatively related to tide variables, and in the shallow depths of the western region, correlations of scores with tide variables from all seasons were positive. Few strong correlations were seen with Mississippi River discharge variables. Scores from the deepest stations in the western region were negatively correlated with discharge in summer, while those for the deepest stations from the central region were positively correlated with fall discharge. Estuarine temperatures in late winter and spring were positively correlated with Factor 7 scores from the deepest stations in the eastern region of the study area, and estuarine temperatures in spring were positively correlated with scores from the western region. Scores from the deepest stations in the eastern region of the study area were also positively correlated with estuarine salinities in spring and summer. In the western and central regions, scores were negatively correlated with estuarine salinities in fall, and those from the western region were negatively correlated with estuarine salinities during much of the year (all seasons except the winter).

The only taxa that were not represented in the factor analysis were those with widespread distributions that showed no strong preferences for any stations. The nature of factor analysis is to pick out distinct trends. If taxa do not show distinct trends, they do not load saliently on any of the factors or, as was the case with Penaeus setiferus, load saliently on several factors.

2.5.5 GCSD

2.5.5.1 Introduction

General Life Cycle

The life cycle of commercially important shrimp of the genus *Penaeus* has been the subject of numerous investigations. According to Kutkuhn (1966) spawning occurs in the nearshore Gulf, with individual females each producing up to a million microscopic eggs. Within hours these semibouyant eggs hatch into small, planktonic nauplii. Development proceeds rapidly through the protozoal and mysis stages as the developing larvae are transported landward toward the mouths of shallow estuaries. The time elapsing between hatching offshore and entry of the 7-15 mm postlarval shrimp to inshore waters varies from three to five weeks and is determined by spawning depths and prevailing wind and current conditions. Once in the estuary, postlarvae quickly transform into juveniles, and, over the next two to four months, approach or reach commercial size.

Estuarine areas are vital to penaeid shrimp (Kutkuhn 1966, Gunter 1967), providing the habitat required by the postlarvae and juveniles. Upon entry the estuaries, postlarval and/or juvenile shrimp drift or migrate to fertile and protected backwater nursery areas, including tidal creeks, bayous, marshes and shallow bays. The nursery and open bay areas occupied by young shrimp are determined in part by water salinity and temperature. Christmas et al. (1976) found that the preferred habitats of young penaeid shrimp in Mississippi Sound included areas along the margins of marshes, in submerged grass beds, and in nonvegetated areas where organic debris had accumulated. Small juveniles feed on detritus, while larger shrimp become more predaceous bottom feeders as they move to the deeper portions of the bay (Gulf of Mexico Fishery Management Council 1981).

The growth rates of young shrimp depend primarily on food availability and water temperature, and have been estimated at from 30-60 mm per month (Moffett 1970). When 50-75 mm in length, young shrimp move to the deeper waters of bays (staging areas) where they become vulnerable to fishing. Advanced juvenile and subadult shrimp, 75-125 mm in length, migrate back to the Gulf of Mexico, completing the life cycle.

Maturation of female brown shrimp occurs around 115-140 mm total length (Burkenroad 1939, Renfro 1964, and Moffett 1970), while female white shrimp are believed to reach sexual maturity at approximately 135 mm (Lindner and Bailey 1968, Moffett 1970, Gallaway and Reitsema 1981). Eldred et al. (1961) found ripe female pink shrimp of 92 mm length. According to Anderson (1970), female seabobs reach sexual maturity at 63 mm length. Major differences in the life cycle of brown, white and pink shrimp in the Gulf of Mexico are related to shifts in time and space, while the seabob shows a somewhat different overall pattern. Current knowledge on the life histories of each of these taxa is discussed below.

Brown Shrimp

Offshore in the northern Gulf, fishable stocks of brown shrimp reach maximum densities at depths of from 20 to 100 m (Comiskey et al. 1981) where most spawning occurs (Kutkuhn 1962, Gallaway and Reitsema 1981). The depth at which spawning occurs is important since it determines the distance the larvae and postlarvae must traverse to reach the estuaries. Spawning is believed to occur between depths of approximately 50 to 100 m throughout the year and between 20 to 50 m from March to December (Lindner and Anderson 1956, Renfro and Brusher 1965, Moffett 1970). Temple and Fisher (1967) reported greatest abundance of penaeid shrimp larvae off the Texas coast at depths of 30 to 90 m in late summer and fall, following the peak occurrence of brown shrimp adults at these depths. They also found that the breeding season tended to be protracted with depth, with penaeid larvae continually being produced at spawning depths greater than 50 m. Kutkuhn et al. (1969) found that during spring, when brown shrimp postlarvae are entering estuaries, early larval stages of penaeid shrimp are absent in waters closer than ten km (kilometers) from shore, but are present further offshore. Subrahmanyam (1971), who sampled penaeid shrimp larvae off Mississippi Sound out to 100 m depths, concluded that brown shrimp spawning occurred mainly at depths of around 36 m in fall and 72-90 m in winter. Angelovic (1976), who reported the results of the analyses of plankton samples collected monthly on the South Texas OCS study area from February 1962 to December 1965, found that during the fall to early winter period the spawning peak occurred later with depth. Greatest catches of *Penaeus* spp. larvae occurred at the 45.8 m depth station, and lowest catches were reported at the 109.7 m depth station, indicating that the outer limits of the brown shrimp spawning area were being approached.

Gunter (1950) proposed a February-March spawning period for brown shrimp in Texas, based on the abundance of juveniles in the estuaries. Baxter and Renfro (1967) found that postlarval brown shrimp were the only ones to enter Galveston Bay during the first four months of the year. Results from the Texas Park and Wildlife Department (TPWD) estuarine surveys (Moffett 1970) indicated that the first waves of brown shrimp postlarvae entered Texas coastal bays in March and April, and the success of these postlarvae generally determines the success of the brown shrimp year class. Subadults usually leave Texas estuaries in late May and early June.

Gaidry and White (1973) and White and Boudreaux (1977) report February and March as peak months of recruitment for brown shrimp postlarvae to Louisiana estuaries. A steady increase in postlarval densities occurred from late March through mid May, during which time peak density of juvenile brown shrimp also occurred. In early May, larger juvenile shrimp (65-75 mm) migrated from shallow nursery areas to the deep, open bay staging areas, prior to their migration to the Gulf at lengths of 90-100 mm. Once in the open bays, the shrimp are subject to exploitation, and there was an abrupt decline in the population following the opening of the bay shrimping season (15th-31st of May). There was strong indication that upon entering the shallow Gulf, young brown shrimp migrate longshore, possibly entering other estuaries in western Louisiana. Lowest bay populations of brown shrimp in Louisiana were found in late fall and early winter.

Christmas et al. (1966) found that during 1966, brown shrimp postlarvae began arriving in Mississippi Sound in February and continued through October. While peak recruitment occurred in March and April, a second wave of postlarvae was noted in September. Young adults comprised over half the bay catch in June. Christmas et al. (1976) reported peak recruitment of brown shrimp postlarvae to Mississippi waters from March to May, similar to that in Texas and Louisiana. According to Benson (1982) adult brown shrimp spawn offshore of Mississippi Sound from about November to April, with most postlarvae moving inshore to the estuaries from February to April. Migration of juveniles (60-70mm) from the shallow nursery areas to the deeper open bays and finally to the offshore areas extended from May to July. Loesch (1965) reported that young brown shrimp first appeared in Mobile Bay in late March and April, with some recruitment continuing into November. He did not observe two distinct (spring and fall) peaks in recruitment. Brown shrimp were most abundant in Mobile Bay during June-August. Ingle (1956) reported that young brown shrimp first entered Apalachicola Bay, Florida in April.

Some controversy exists as to when brown shrimp postlarvae that appear in great numbers in the late winter and early spring in Gulf estuaries are spawned. Temple and Fischer (1967) proposed a fall spawning period, with an overwintering of postlarvae in the nearshore Gulf. This hypothesis is supported by the work of Aldrich et al. (1968) who showed that postlarval brown shrimp burrow into the bottom at low temperatures (approximately 15^{o} C) and emerge when temperatures reached 18 to 21.5^{o} C. This question was addressed in the NMFS shrimp spawning site survey off Texas (Gallaway and Reitsema 1981). Results indicated that peak spawning of brown shrimp off Texas occurred in autumn at 46 m depth, but no overwintering brown shrimp postlarvae were found offshore. Even so, Gallaway and Reitsema (1981) still felt that the large size of the early (February to March) arriving postlarvae indicated that they were spawned the previous fall. They noted that Ekman transport is generally not favorable for transport of larvae to the estuaries of the northwest Gulf in the fall and early winter, with net transport being predominantly offshore.

Growth rates of brown shrimp have been estimated at from 0.5 mm per day in January and February to a maximum of 3.3 mm per day in late spring (St. Amant et al. 1966, Ford and St. Amant 1971) when temperatures are not limiting. Moffett (1970) reported that brown shrimp growth was usually slow in Texas bays in April and rapid in May. During colder springs, growth is retarded and the shrimp remain longer in the estuaries.

Brown shrimp do not penetrate as far into the estuaries as do white shrimp, nor do they remain in the estuaries for as long a period of time. Consequently at the time of the early summer egress, many brown shrimp are still relatively small (less than 100 mm or greater than 68 shrimp per pound, heads off). Trent (1967) found that brown shrimp emigrating from Galveston Bay to the Gulf averaged less than 100 mm (4 in) in length from mid May to July. This has considerable management implications. In the Gulf, brown shrimp tend to migrate offshore as they grow and as the summer passes to fall.

White Shrimp

White shrimp are much more restricted in depth distribution in the Gulf compared to brown shrimp, and are reported to spawn at depths of 4 to 17 fm during the spring to fall period (Lindner and Anderson 1956). The early spring spawning is probably attributable to females which have migrated from the estuaries the previous summer and fall and have overwintered as adults in the Gulf. These same shrimp are probably also part of the late spring-early summer spawning stock, being supplemented by relatively younger females recently arriving offshore from the estuaries. This latter group, which apparently results from a late summer or early fall spawning the previous year, are of insufficient size to join the adult stocks the same fall. They either remain in the estuaries during mild winters or are driven by low estuarine temperatures and/or salinities into the nearshore Gulf where they overwinter. These shrimp reenter the bays in spring to complete their juvenile development before migrating offshore in late spring. They probably remain part of the offshore spawning population for much of the rest of their lives. From midsummer to midfall, these adult stocks are supplemented by young of the year shrimp migrating out of the estuaries. These shrimp, contribute to the fall spawning stock, and also comprise the majority of the stock that overwinters in the open Gulf and spawns in spring. By October, white shrimp spawning appears to be completed, as evidenced by the decline in ripe ovaries and increased occurrence of spent females (Lindner and Anderson 1956).

Young white shrimp spend more time in the estuaries than do brown shrimp, and also penetrate them to a greater degree (Burkenroad 1934, Gunter 1950, Lindner and Anderson 1956). Because of their longer stay in the estuaries, they reach a large size there (115-140 mm) than do brown shrimp. Therefore, white shrimp are subject to much more intense inshore exploitation, and support an important sport and commercial estuarine fishery.

Anderson al. (1949) reported that larval development in white shrimp took two to three weeks, with transformation to the postlarval stage generally occurring inside the estuary. Ripe females have been collected inside bays and estuaries, indicating some spawning may occur there. On occasion, spawning has been noted very close to shore in the vicinity of inlets. Everything considered, white shrimp postlarvae are much less dependent on the vagarities of ocean currents for transport to the estuaries than are brown shrimp. Considerable evidence also indicates that individual females may spawn more than once during the season. Lindner and Bailey (1968) noted that the percent of spent females remains low throughout the summer and there is evidence of subsequent redevelopment of ovaries.

At depths within which white shrimp are assumed to spawn (7.6 m station), Temple and Fischer (1967) found the greatest abundance of _Penaeus_ sp. larvae from May to August. Kutkuhn et al. (1969) stated that penaeid larvae are found closer than ten kilometers from shore off Texas only during the summer, when white shrimp are spawning. In the nearshore zone (7.3-13.7 m) off the south Texas OCS area, Angelovic (1976) reported two peaks in abundance of penaeid larvae, one in spring and the other in early fall, with no larvae being found from April to October. Subrahmanyam

(1971) concluded that summer spawning of penaeid shrimp (presumable white shrimp) off Mississippi Sound occurred mainly at 18 m depths.

Baxter and Renfro (1967) found that by June advanced postlarval and early juvenile white shrimp had become abundant in Galveston Bay, with both brown and white shrimp being present through the summer. They reported that white shrimp postlarvae entered Texas estuaries from May through October, appearing in distinct waves. Results of the TPWD surveys conducted from 1960 to 1970 showed that white shrimp postlarvae often enter bays of the upper Texas coast in several waves from June through October. This suggests pulses in spawning activity or periods when conditions are favorable for survival of larvae offshore and/or for transport of larvae to the estuaries. Unlike the situation for brown shrimp, the first wave of white shrimp entering the estuaries is not always the largest or most successful (Moffett 1970). In both 1965 and 1966, white shrimp were scarce in summer and abundant in fall in Galveston Bay. Moffett (1966) noted that the large waves of small white shrimp that appeared in Galveston Bay late in the season in 1966 would contribute to the 1967 catch if conditions were suitable for survival and growth. Moffett (1969) noted that the large numbers of adult white shrimp caught in the spring of 1969 in Texas inshore waters reflected a large late-fall to winter wave of postlarvae the previous fall. Many of these shrimp spent the mild 1968-1969 winter inshore and apparently migrated to the open waters of Galveston Bay in April.

Gaidry and White (1973) found that most white shrimp postlarvae entered Louisiana estuarine waters from June to September. Smaller pulses occurred in early spring and late fall, indicating that spawning occurred in all seasons except winter. Juveniles first appeared in bay catches in June and July, with recruitment generally continuing through September. Largest inshore populations were generally found in April-May and August-September. The spring group migrates offshore in late summer to early fall as adults. Juveniles resulting from late (midsummer to early fall) arriving postlarvae are forced to migrate from the estuaries during cold spells in the fall and winter. They reenter the estuaries in the late winter and early spring at about 100 mm size to complete their growth, migrating offshore in late spring and summer. The populations of the inshore deep lakes and bays from July to December are mainly dependent on recruitment of shrimp from the nursery, while the spring population depends on immigration of stocks of juveniles that overwintered offshore. Highest densities of white shrimp in Gulf waters off Louisiana occurred during the November-January period.

White shrimp are most abundant in Mississippi Sound and Mobile Bay in the summer and fall (Benson 1982). Spawning apparently occurs in the open Gulf from March to October (GMFMC 1981). In Mississippi and Alabama, postlarvae recruitment to the estuaries extends from May through October (Christmas et al. 1966; Loesch 1965). Christmas (1966) observed white shrimp postlarvae in greatest numbers in Mississippi Sound in June and August, while Christmas et al. (1966) found highest numbers of white shrimp postlarvae in October. Loesch (1976) noted that white shrimp migration from Mobile Bay occurred in two stages. The first occurred in midsummer and involved migration of subadults from shallow estuaries to the open bay. The second stage occurred in midfall, and involved the offshore migration of this same group. He reported that larger shrimp (that apparently overwintered offshore) enter lower Mobile Bay during the late winter, and migrated offshore by the end of June. Christmas et al. (1976) reported that adult white shrimp comprised over half the penaeid catch in Mississippi estuarine waters during midfall to midwinter during some years. Christmas et al. (1973) reported two distinct size groups of white shrimp in Mississippi Sound in the spring. The larger shrimp were in the Sound in April, but were not collected during the previous December to March or after June. They apparently migrated from the Gulf into Mississippi Sound in early spring. Females from this group had fully developed gonads, and apparently migrated offshore to spawn by the end of June. The second size group were juveniles which appeared in May. Early juveniles were still apparent in November. Ingle (1956) reported continuous recruitment of white shrimp during the spring to fall period in the bays of the north Florida Gulf coast.

Growth rates of white shrimp have been estimated from 0.6 to 2.2 mm/day, with temperature being a critical factor. Lindner and Anderson (1956) found that growth decreased with size. Loesch (1965) reported that white shrimp in Mobile Bay grew 14 to 27 mm/month in winter and 18 to 30 mm/month in summer, with growth rates of up to 65 mm/month being possible in the very young. Occasionally, winter conditions can be severe, and white shrimp kills have been reported by Gunter (1941), Gunter and Hildebrand (1951), and Joyce (1965). In 1966, heavy mortality was experienced by young white shrimp that entered Galveston Bay as part of a late arriving postlarval wave (Moffett 1966). Chapman (1964) found few white shrimp in Galveston Bay in late February after large numbers had been found in mid January. Apparently, heavy mortality was experienced when temperatures dropped to about 4° C. Prerecruitment waves of white shrimp usually moved from back bays to primary bays during the first "norther" of the fall. At this time they first became vulnerable to the inshore fishery.

Lindner and Anderson (1956) reported that white shrimp on the Continental Shelf east of the Mississippi River to Mobile Bay tend to migrate westward toward the Mississippi River during summer and fall. It is unclear whether or not these shrimp migrate across the narrow shelf off the southern tip of the delta to the central and western Louisiana shelf, where the majority of the white shrimp production occurs.

Pink Shrimp

Because the pink shrimp is relatively uncommon in the central Gulf, its life history in the Tuscaloosa Trend study area is not well known. Most information on pink shrimp life history comes from the south Florida shelf, where pink shrimp dominate the commercial catch of penaeid shrimp. In this region, spawning (at depths of 25 to 50 m) and recruitment to the estuaries occur more or less continuously, with peaks of activity from spring through fall (Ingle et al. 1959). Further north in Florida (in the areas from Tampa Bay to Apalachicola Bay), most spawning appears to occurs in summer (Christmas and Etzold 1977). Spawning apparently occurs in the Gulf off Mississippi Sound from May to December at depths of between 4 and 52 m (GMFMC 1981), with most recruitment to the estuaries occurring over this same period. Pink shrimp are relatively uncommon in Mississippi estuaries (Christmas et al. 1976). In Mobile Bay, Loesch (1965) captured relatively few pink shrimp, and all these were taken from October to May. All of those collected in October and November were found at the lower end of the bay, probably indicating that they had been driven from the shallow estuaries by low temperatures and/or were migrating to the open Gulf. Christmas et al. (1973) reported the largest catch of pink shrimp in Mississippi Sound in October, with all of the larger catches occurring from August through October.

Seabobs

Very little is known regarding seabob ecology, with the only directed study being that of Juneau (1977) in Louisiana. It appears that seabobs differ from the *Penaeus* spp. by not being estuarine dependent, although they generally occur in inland waters. Juneau (1977) concluded that the seabob spawning season off Louisiana begins in July and August, and may extend to as long as December. Small non-gravid females were collected in relatively large numbers in the very nearshore Gulf between December and March. These shrimp probably represented the production that resulted from spawning during the previous summer and fall. The seabob is apparently quite restricted in depth distribution in the open Gulf, and may prefer soft clayey bottoms out to about six or seven fm (GMFMC 1981).

Factors Affecting Shrimp Populations

For many years it has been assumed that the critical phases in the penaeid shrimp life history involve transport of larvae and postlarvae to the estuaries and survival and growth of the postlarvae and juveniles in the estuaries. Numerous investigators have attempted to predict commercial shrimp catch from postlarvae and juvenile abundance either in Gulf estuaries or in the shallow Gulf in the vicinity of estuaries.

Based on the results of six years of sampling near the entrance to Galveston Bay, Berry and Baxter (1969) concluded that postlarval abundance was not a good indicator of subsequent commercial catch. While collections from March to April during the 1960-1966 period showed similar abundances of postlarvae, there were significant differences in commercial catch during these years. They concluded that the relative sizes of the shrimp stocks developing in Galveston Bay were better reflected by bait shrimp (juvenile) landings than by postlarval abundance. This indicates that conditions in the estuaries subsequent to the arrival of the postlarvae and early in the juvenile growth period had greater influence on the subsequent abundance of shrimp offshore. Moffett felt that favorable large scale water movements in the Gulf of Mexico in spring, resulting from onshore winds, can carry more than the usual number of postlarvae to the expanded nurseries. Gaidry and White (1973) noted that postlarval data alone has proven inconsistent in Louisiana's efforts to predict commercial shrimp catch. Therefore, Louisiana has relied heavily on juvenile indices.

Because of these and other similar results, most studies addressing the influence of environmental factors on shrimp production have concentrated on processes acting inside the estuaries. St. Amant et al. (1963) showed that populations of postlarval brown shrimp were quite responsive to hydrologic conditions that existed during and shortly after their arrival at Louisiana estuaries. St. Amant et al. (1963, 1965), and Ford and St. Amant (1971) all found increasing numbers of juveniles and maximum postlarval densities of brown shrimp in Louisiana estuaries when water temperature remained at or above 18^{o} C and 20^{o} C, respectively. Barrett and Gillespie (1973) found that unseasonally low temperatures in Louisiana estuarine waters, especially during the early weeks following spawning, were critical factors in the survival of recently arriving larval and postlarval brown shrimp. They suggested that the number of hours that temperature remained below 20^{o} C. after April 8 was important in determining brown shrimp production for the year. It appears that an average temperature of 20^{o} C is minimum for "normal" growth of brown shrimp (1 mm/day). As temperatures increase above 20^{o} C during the spring, accelerated growth could be expected. If temperature remained below 20^{o} C for less than 33 hours, other factors, such as rainfall, river discharge and availability of food became important. Berry and Baxter (1969), found a strong relationship between average April air temperature at Galveston and time of peak abundance of juvenile shrimp in Galveston Bay, indicating that in colder years, growth is slower and offshore migration is later. Moffett (1967) noted that a good brown shrimp season in Texas was likely if postlarval immigration was late, thereby avoiding the colder late winter to early spring period.

Salinities are also important in determining shrimp production by determining the size of the estuarine area where shrimp can survive and grow. St. Amant et al.(1963, 1965) found denser populations of juvenile brown shrimp and larger postlarvae at salinities above 15 ppt. Gaidry and White (1973) reported that above average abundance of brown shrimp in Louisiana estuaries during 1970-1972 resulted from abnormally high salinity levels in the estuaries during the spring of these three years. Upper to lower bay salinities of 15 and 20 ppt, respectively, appeared to be ideal for brown shrimp production (Barrett and Gillespie 1973). After April, salinity appears to be the dominant factor influencing brown shrimp distribution in Louisiana estuaries. Annual brown shrimp catch appeared to be related to the number of acres of estuarine surface water in coastal Louisiana above 10 ppt salinity in the spring. The large amount of freshwater which entered the estuaries in 1973 resulted in a drastic reduction in the amount of nursery area as compared to 1972. Moffett (1966) noted that reduced salinities in Texas estuaries resulting from increased runoff can act similar to temperature in moving juvenile shrimp from peripheral bays and nursery areas to the open bays where they can be exploited. Prolonged flooding of marshes during long-lasting periods of high spring tides and prevailing onshore winds along the upper Texas coast apparently increase brown shrimp production by increasing the amount of available nursery space (Moffett 1972). Turner (1977) found a strong linear correlation (r^2 = 0.69) between the area of intertidal land and yield of penaeid shrimp caught in inshore Louisiana waters. The percent of the total inshore catch that were brown shrimp was directly related to the percent of salt marsh in the estuaries.

Gunter and Edwards (1969) found no significant correlation between brown shrimp catch and rainfall in Texas. However, Moffett (1971) found brown shrimp landings in Texas for the 1962-1970 period to be inversely related to spring rainfall. Barrett and Gillespie (1973) and Barrett and Ralph (1976) concluded that good brown shrimp catches occurred in

Louisiana when salinities were average (due to low spring rainfall and river discharge), and water temperatures in the spring were mild. Higher than average salinities in Louisiana estuaries were related to increased production of both white and brown shrimp. However, as seen during the drought of the early 1950s, excessively high salinities in summer can apparently lead to reduced white shrimp production.

In an analysis of the relationship of commercial shrimp catch to environmental variables along the northeast Texas coast, Comiskey et al. (1982) found annual and spring river discharge as well as annual, spring and winter precipitation to be negatively related to brown shrimp catch on the Texas continental shelf, while the relationship with summer river discharge was positive. Lagged river discharge variables were also negatively related to brown shrimp catch. Both salinity and temperature variables for the February to April period were positively related to brown shrimp catch. March zonal Ekman transport was highly and positively correlated with brown shrimp catch, while other wind, tide and Ekman transport variables for the period February to April were also related. Catches in primary and secondary bays in spring were most closely related to offshore catch.

Annual river discharge and (one year) lagged annual river discharge as well as precipitation have been shown to be positively related to catch in Texas (Gunter and Edwards 1969, Comiskey et al. 1982). The strength of the 1973 white shrimp year class that yielded a record high 14.9 million pounds in Texas may have been positively related to the abundant rainfall during the late spring and summer (Moffett and McEachron, 1973). Gunter and Hildebrand (1954) had previously found a positive correlation between white shrimp production and rainfall in Texas but their work related mainly to the early 1950s when the effects of a severe and prolonged drought were obvious. Therefore, it appears that in Texas white shrimp catch shows trends much the opposite of those of brown shrimp with regard to variables that influence estuarine salinity. During 1973, a record catch of white shrimp was recorded in Texas, but brown shrimp catch was relatively poor due to excessive river discharge and runoff as well as abnormally low temperatures in April. Under "normal" conditions in Louisiana waters, white shrimp catch is positively related to estuarine salinity in the summer months.

Barrett and Ralph (1976) found that years of good brown shrimp catch in Louisiana were often not good years for white shrimp catch, and vice versa. They concluded that if river discharge and rainfall remained relatively low throughout the summer, white shrimp production in Louisiana should be well above average. The apparently different response of white shrimp in Louisiana and Texas to discharge and estuarine salinity may be related to different ambient salinities of the estuaries in the two states.

Temperature does not appear to be related to white shrimp catch in Texas (Comiskey et al. 1982). In this same study, BCF-NMFS postlarval catch/effort variables for the summer months were important predictor variables for catch and catch/effort of white shrimp, as was bay catch/effort. All were positively related to white shrimp catch offshore. Wind and tide variables during the early to midsummer period (June to August) were closely related to white shrimp catch, possibly by expanding the size of the estuarine nursery areas. As expected from the more nearshore location of their spawning grounds, Ekman transport variables were generally not strongly related to white shrimp catch (Comiskey et al. 1982).

Historical Trends

In the historical record there has been a notable change in trends in catch of the two major species, brown and white shrimp. Prior to the development of the otter trawl in 1917, shrimp were commercially harvested with haul seines (GMFMC 1981). This restricted the fishing to nearshore areas, resulting in the exploitation of mainly white shrimp. Until the late 1940s most trawling was done from relatively small vessels rigged with single trawls, fishing within approximately six miles of the coast. Lindner and Anderson (1956) stated that white shrimp made up 95 percent of the total catch off the Louisiana coast prior to WW II. During the 1950s, increased market demand and the discovery of new brown shrimp grounds further offshore resulted in a rapid expansion of the industry. A large decline in white shrimp harvest occurred after 1952, coincident with an increase in brown shrimp production. The decline in white shrimp catch was coincident with increasing estuarine salinities during the summer of 1952 to the spring of 1957, a period of prolonged drought. The subject of extended droughts and their influence on shrimp production was discussed in the works of Hildebrand and Gunter (1953), Gunter and Hildebrand (1954), Parker (1955), and Viosca (1958). Because young white shrimp generally display a greater propensity for less saline water than do other species, it was assumed that higher estuarine salinities accompanying the drought caused environmental stress and reduced habitat carrying capacity, resulting in a lower annual production of white shrimp.

Through the 1960s the Gulf coast shrimp fishery evolved into the most valuable fishery in the U.S., with dockside values in 1977 exceeding $355 million (GMFMC 1980).

2.5.5.2 Analysis Results

Brown Shrimp

Over all years and months, brown shrimp C and C/A was highest in the western region and lowest in the eastern region at all depths out to 200 m (Figures 18 and 19 and Table 39). However, C and C/A were very low at depths beyond 100 m. In the eastern and western regions, C/A was highest in the inshore waters, while in the central region, C/A was higher offshore out to 40 m. The estuarine waters in the western region appear to be particularly productive, while the offshore area in the eastern region held the smallest stocks. C/A was similar in the inshore waters of the central and eastern regions, a situation far different from that offshore. In offshore waters of the central and western regions, C/A was highest in the 20-40 m depth zone, but was relatively evenly distributed out to 100 m depths. In the eastern region where C was generally low, C/A decreased dramatically from inshore waters to 40 m depth, beyond which no brown shrimp were caught.

The data clearly indicated a trend for declining C/A of brown shrimp going west to east and offshore across the Tuscaloosa Trend study area

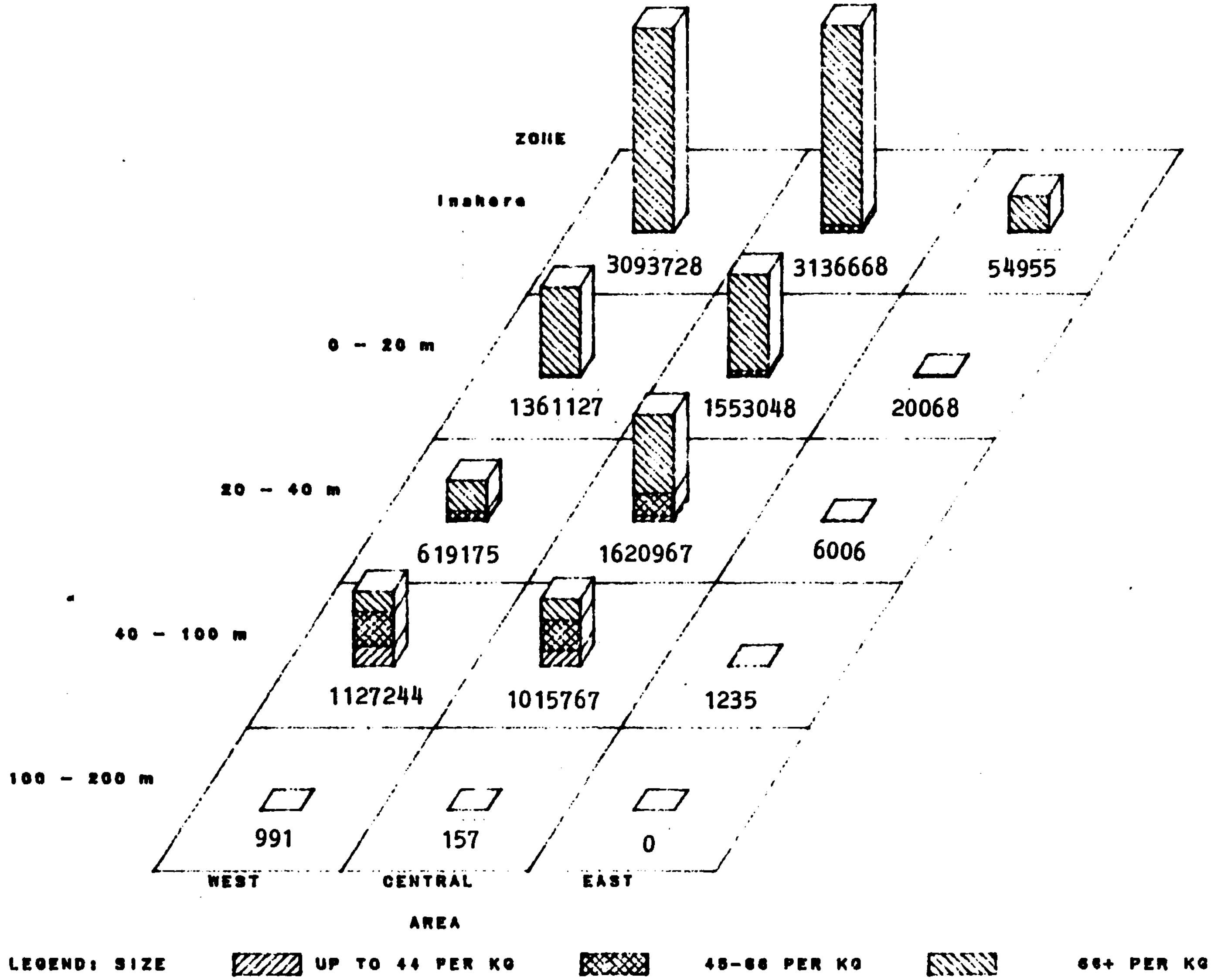

Figure 18. Region by depth by size means of brown shrimp catch (kg, heads on) for the Tuscaloosa Trend study area based on Gulf Coast Shrimp Data for the period 1960 to 1982.

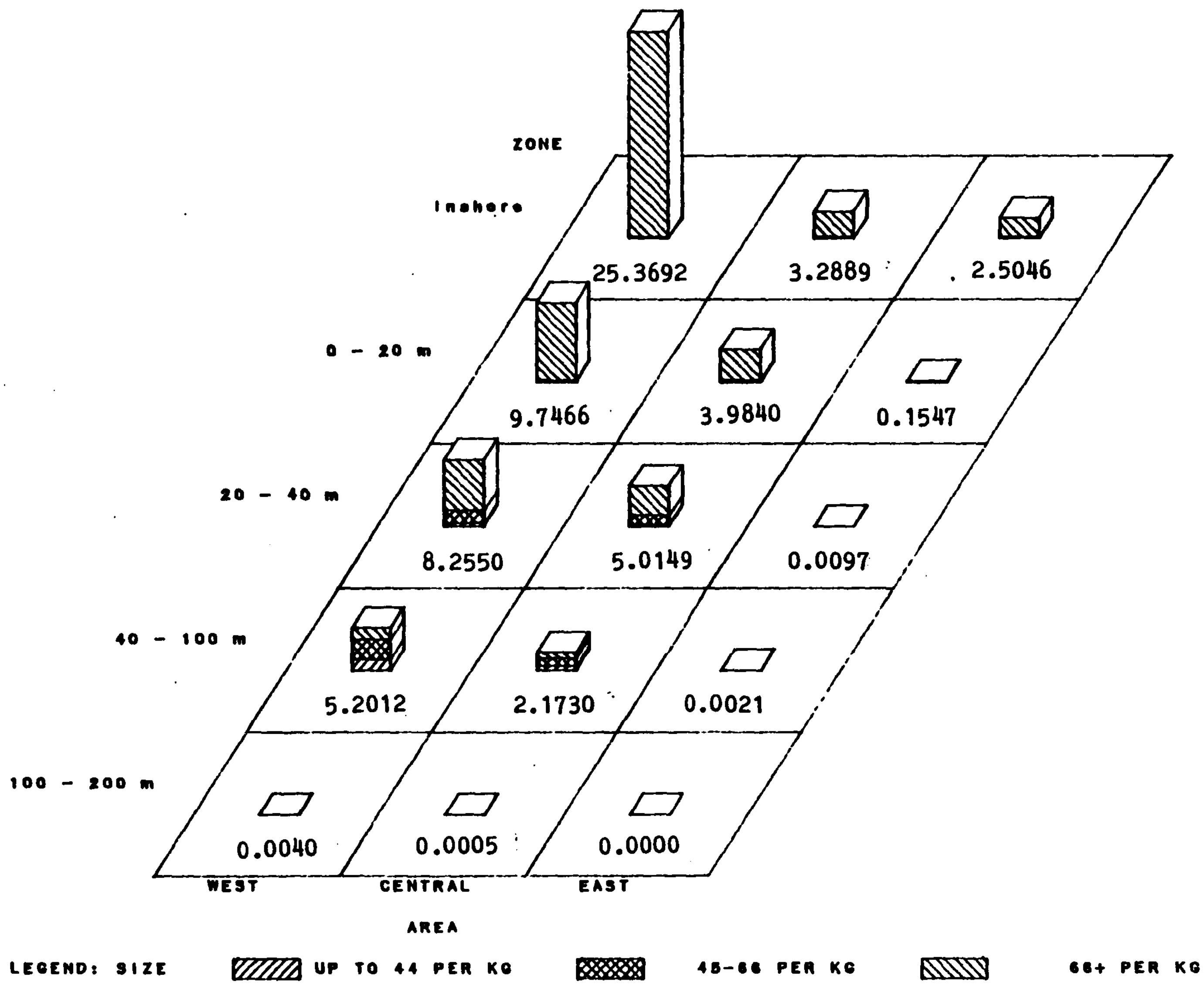

Figure 19. Region by depth by size means of brown shrimp catch/unit water surface area (kg, heads on, per ha)for the Tuscaloosa Trend study area based on Gulf Coast Shrimp Data for the period 1960 to 1982.

Table 39. Region by depth by size means of brown shrimp catch/unit water surface area (kg, heads on, per ha)for the Tuscaloosa Trend study area based on Gulf Coast Shrimp Data for the period 1960 to 1982.

P.AZTECUS		LT 44/KG	44-66/KG	GT 66/KG	TOTAL
WEST					
	Inshore	0.0026	0.0293	25.3373	25.3692
	0 - 20 m	0.0314	0.1443	9.5709	9.7466
	20 - 40 m	0.4035	1.5677	6.2838	8.2550
	40 - 100 m	1.3757	2.3906	1.4349	5.2012
	100 - 200 m	0.0013	0.0019	0.0008	0.0040
	REGION	0.3905	0.7728	6.0989	7.2622
CENTRAL					
	Inshore	0.0035	0.1045	3.1809	3.2889
	0 - 20 m	0.0343	0.1657	3.7840	3.9840
	20 - 40 m	0.2248	1.0758	3.7144	5.0149
	40 - 100 m	0.4757	0.9918	0.7055	2.1730
	100 - 200 m	0.0000	0.0000	0.0005	0.0005
	REGION	0.1271	0.3978	2.4624	2.9873
EAST					
	Inshore	0.0068	0.0835	2.4143	2.5046
	0 - 20 m	0.0181	0.0473	0.0893	0.1547
	20 - 40 m	0.0012	0.0023	0.0062	0.0097
	40 - 100 m	0.0005	0.0006	0.0010	0.0021
	100 - 200 m	0.0000	0.0000	0.0000	0.0000
	REGION	0.0024	0.0128	0.2676	0.2828
STUDY AREA MEANS					
	Inshore	0.0040	0.0939	5.1373	5.2351
	0 - 20 m	0.0305	0.1378	4.2829	4.4512
	20 - 40 m	0.1021	0.4597	1.6505	2.2122
	40 - 100 m	0.4104	0.7739	0.5055	1.6899
	100 - 200 m	0.0004	0.0005	0.0004	0.0012
		0.1216	0.3108	2.2060	2.6384

(Figure 19). Dramatic declines in both C and C/A were apparent from the central to the eastern regions. The boundary between these regions (see Figure 10) approximates the transition from silty to sandy bottoms in the Tuscaloosa Trend study area.

C/A for the three size classes of brown shrimp showed very different trends with depth out to 100 m (Figure 19). C/A of the size class of smallest shrimp was highest inshore, and decreased consistently with depth. Both size classes of larger shrimp showed just the opposite trend, with C/A increasing consistently from inshore waters out to 100 m depths. For both of these larger size classes, highest C/A was reported in the 40-100 m depth range. The data clearly indicated that the C in the estuaries and the shallow offshore zone (out to 20 m) was composed almost exclusively of shrimp under 100 mm length (equivalent to 86+ per kg., heads on), and the size class of largest shrimp was taken in only token quantities in waters less than 40 m.

Means of brown shrimp C and C/A by month, depth zone and size class are shown in Table 40 and are portrayed in Figure 20. Collectively, they embody the dominant trends in the brown shrimp life cycle. Over the 0-100 m depth range, peak C/A occurred later in the season at greater depths, indicating offshore migration over time. However, monthly trends for C/A inshore and in the shallow Gulf (0-20 m) were virtually identical. Catch of brown shrimp less than 100 mm increases dramatically in inland waters and the shallow offshore zone in May. At this time, the major cohort of brown shrimp resulting from postlarvae which had entered the estuaries in late winter and early spring were approaching adulthood, and were beginning to move offshore. Peaks in C/A occurred during June in the 0-20 and 20-40 m depth zones, during July in the 21-30 m zone and during September in the 40-100 m zone, indicating offshore migration over the entire late spring to early fall period. By October, the only appreciable C of brown shrimp were landed from the 40-100 m depth zone. Lowest C/A was reported in this zone in June, the month of peak C/A in the 0-20 m zone. C/A was clearly more evenly distributed over the year at greater depths (Figure 20). This indicates that the nearshore zone was not the preferred habitat of adult brown shrimp, and was primarily an area through which they must migrate to reach the more offshore and preferred grounds (i.e., 40-100 m depths). Of the four zones with substantial C/A, the inshore waters showed the greatest variability over the year, with both the lowest monthly mean (March) and the highest monthly mean (June).

All three regions showed generally similar seasonal trends, with highest C/A reported during late spring to midsummer (Figure 20). The patterns (but not absolute values) for the central and eastern regions were almost identical, lagging those of the western region by about one month. C/A increased abruptly in May in the western region, but not until June in the central and eastern regions. By September, C/A in the western region was considerably lower than in the previous months, while C/A in the central and eastern regions remained at relatively high levels. This might indicate migration of brown shrimp from the western to the eastern and central regions.

The distinctly different trends over the year in C/A of the different size classes of brown shrimp clearly showed the growth of shrimp populations (Figure 20). The size class of smallest shrimp showed the

Table 40. Month by depth by size means of brown shrimp catch/unit water surface area (kg, heads on, per ha)for the Tuscaloosa Trend study area based on Gulf Coast Shrimp Data for the period 1960 to 1982.

P.AZTECUS	LT 44/KG	44-66/KG	GT 66/KG	TOTAL
January				
Inshore	0.0005	0.0008	0.0008	0.0021
0 - 20 m	0.0021	0.0030	0.0027	0.0078
20 - 40 m	0.0097	0.0113	0.0065	0.0275
40 - 100 m	0.0398	0.0544	0.0143	0.1085
100 - 200 m	0.0000	0.0001	0.0000	0.0002
TOTAL	0.0117	0.0156	0.0052	0.0325
February				
Inshore	0.0000	0.0001	0.0006	0.0007
0 - 20 m	0.0016	0.0026	0.0019	0.0061
20 - 40 m	0.0039	0.0080	0.0045	0.0164
40 - 100 m	0.0469	0.0434	0.0107	0.1010
100 - 200 m	0.0001	0.0002	0.0000	0.0003
TOTAL	0.0121	0.0122	0.0038	0.0280
March				
Inshore	0.0000	0.0001	0.0004	0.0005
0 - 20 m	0.0006	0.0013	0.0003	0.0022
20 - 40 m	0.0036	0.0048	0.0039	0.0123
40 - 100 m	0.0610	0.0352	0.0054	0.1016
100 - 200 m	0.0001	0.0001	0.0000	0.0002
TOTAL	0.0153	0.0094	0.0022	0.0269
April				
Inshore	0.0000	0.0002	0.0011	0.0013
0 - 20 m	0.0010	0.0009	0.0051	0.0069
20 - 40 m	0.0040	0.0025	0.0030	0.0095
40 - 100 m	0.0563	0.0155	0.0050	0.0769
100 - 200 m	0.0001	0.0001	0.0000	0.0003
TOTAL	0.0143	0.0043	0.0027	0.0212
May				
Inshore	0.0000	0.0002	1.1266	1.1268
0 - 20 m	0.0027	0.0052	0.9126	0.9206
20 - 40 m	0.0044	0.0079	0.0626	0.0748
40 - 100 m	0.0342	0.0217	0.0145	0.0704
100 - 200 m	0.0000	0.0000	0.0002	0.0002
TOTAL	0.0093	0.0073	0.4008	0.4174

Table 40. Continued.

P.AZTECUS	LT 44/KG	44-66/KG	GT 66/KG	TOTAL
June				
Inshore	0.0005	0.0026	2.4466	2.4497
0 - 20 m	0.0053	0.0153	1.7825	1.8031
20 - 40 m	0.0109	0.0205	0.4784	0.5098
40 - 100 m	0.0101	0.0096	0.0287	0.0484
100 - 200 m	0.0000	0.0000	0.0001	0.0001
TOTAL	0.0052	0.0087	0.9101	0.9240
July				
Inshore	0.0004	0.0174	1.1333	1.1512
0 - 20 m	0.0028	0.0301	1.1664	1.1993
20 - 40 m	0.0080	0.0464	0.5531	0.6075
40 - 100 m	0.0109	0.0218	0.0900	0.1227
100 - 200 m	0.0000	0.0000	0.0000	0.0000
TOTAL	0.0045	0.0219	0.5447	0.5712
August				
Inshore	0.0015	0.0454	0.3219	0.3688
0 - 20 m	0.0047	0.0420	0.3308	0.3775
20 - 40 m	0.0156	0.1417	0.3909	0.5481
40 - 100 m	0.0208	0.0954	0.1294	0.2455
100 - 200 m	0.0000	0.0000	0.0000	0.0000
TOTAL	0.0089	0.0657	0.2237	0.2983
September				
Inshore	0.0004	0.0211	0.0708	0.0923
0 - 20 m	0.0022	0.0146	0.0281	0.0449
20 - 40 m	0.0167	0.1281	0.0694	0.2141
40 - 100 m	0.0290	0.1827	0.0753	0.2870
100 - 200 m	0.0000	0.0000	0.0000	0.0000
TOTAL	0.0104	0.0746	0.0517	0.1367
October				
Inshore	0.0003	0.0039	0.0233	0.0275
0 - 20 m	0.0025	0.0099	0.0212	0.0336
20 - 40 m	0.0089	0.0481	0.0280	0.0850
40 - 100 m	0.0245	0.1450	0.0430	0.2125
100 - 200 m	0.0000	0.0000	0.0000	0.0000
TOTAL	0.0079	0.0457	0.0238	0.0774

Table 40. Continued.

P.AZTECUS	LT 44/KG	44-66/KG	GT 66/KG	TOTAL
November				
Inshore	0.0002	0.0013	0.0094	0.0110
0 - 20 m	0.0023	0.0074	0.0217	0.0313
20 - 40 m	0.0069	0.0209	0.0285	0.0563
40 - 100 m	0.0304	0.0774	0.0511	0.1588
100 - 200 m	0.0000	0.0000	0.0000	0.0000
TOTAL	0.0088	0.0236	0.0225	0.0549
December				
Inshore	0.0002	0.0007	0.0025	0.0034
0 - 20 m	0.0027	0.0055	0.0096	0.0178
20 - 40 m	0.0096	0.0195	0.0217	0.0509
40 - 100 m	0.0467	0.0719	0.0379	0.1566
100 - 200 m	0.0000	0.0000	0.0000	0.0000
TOTAL	0.0133	0.0216	0.0149	0.0498

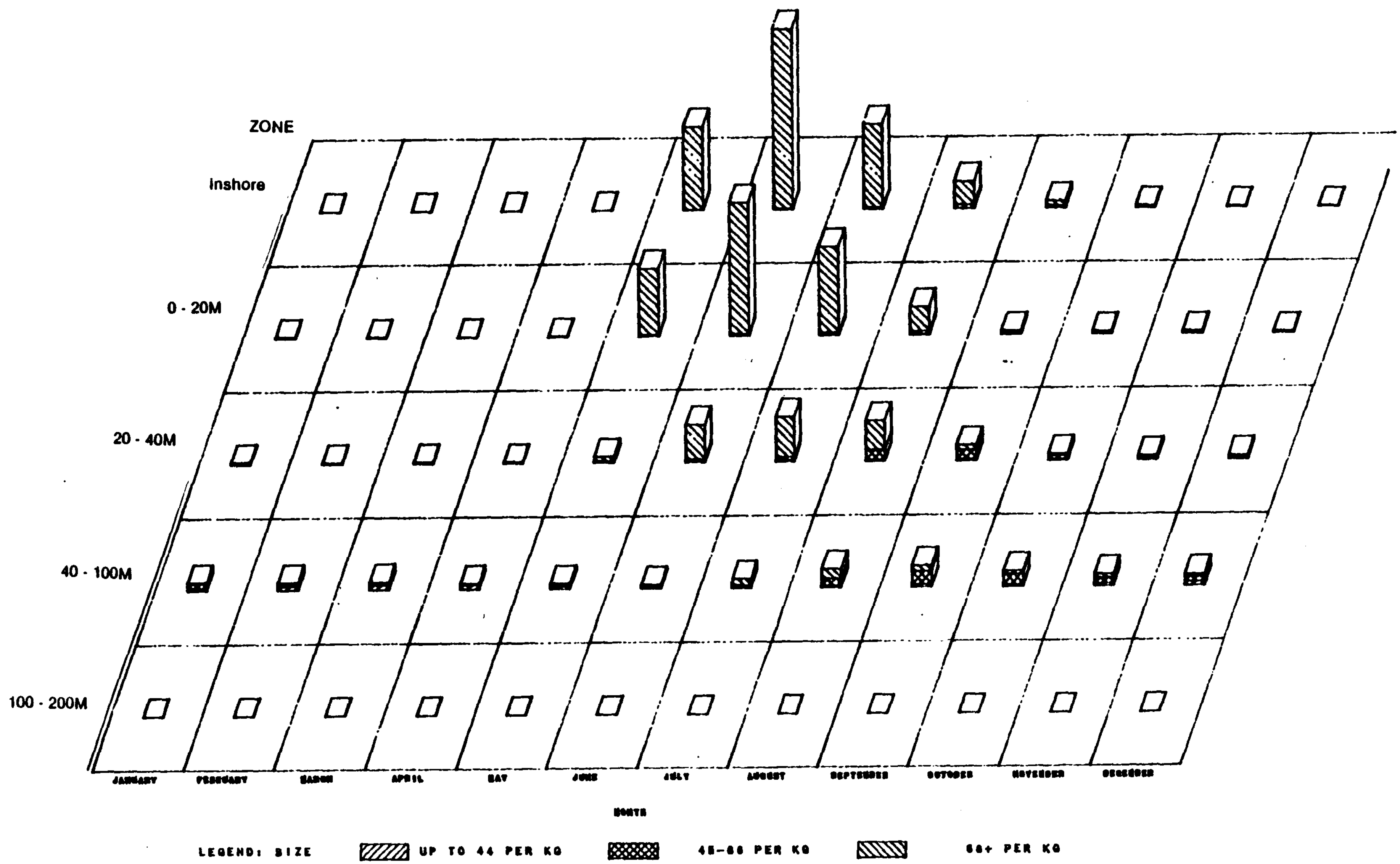

Figure 20. Month by depth by size means of brown shrimp catch/unit water surface area (kg, heads on, per ha)for the Tuscaloosa Trend study area based on Gulf Coast Shrimp Data for the period 1960 to 1982.

greatest variability in C/A over the year, with both the lowest (March) and highest (June) monthly means. The size class of largest shrimp showed the smallest range of monthly means over the year (Figure 20 and Table 40). Lowest C/A of the size class of largest shrimp occurred in June and July, months of peak C/A of the size class of smallest shrimp. For the intermediate size class, peaks in C/A occurred during the period August to October. For the size class of largest shrimp the winter and early spring period included those months with peak C/A. The results indicate that as the year progresses, there is a gradual change from smaller shrimp inshore to larger shrimp offshore.

Over the period 1960-1982, brown shrimp C and C/A in the central and western regions of the Tuscaloosa Trend study area generally showed similar trends, but years of peak C/A did not necessarily coincide (Figure 21 and Table 41). Lower C/A was reported for both regions during the 1973-1975 period, probably attributable to both poor year classes of brown shrimp and less fishing effort. Otherwise since the middle 1960s, C/A has remained relatively stable in both regions. However, there are some indications that the western region has become relatively more important in recent years. Peaks in C/A occurred there during the period 1976-1982, while for the central region, highest C/A occurred during the period 1967-1972. In the western region, offshore C generally increased in absolute terms as well as relative to the estuarine C through the 23 year period, although it was generally low during the overall poor years of the early 1970s (Figure 21). Inshore C in the western region was relatively highest from 1967 to 1972. In the central region, offshore C was highest from 1965 to 1972 and in 1977. In all these years relatively higher C was also reported inshore. While C was low both inshore and offshore during the poor years of 1973-1975, inshore C has been relatively high since 1975. Except for 1977, offshore C remained relatively low during this same period. The different trends in offshore C during this time in the central and western regions represented the greatest difference in brown shrimp C in the Tuscaloosa Trend study area. In the eastern region, where C/A was generally lower, C/A was relatively high in the early years (up to 1968) and during the last several years, with lower C/A reported during the period 1968-1976.

There has been some concern that in more recent years, brown shrimp reaching the market are becoming smaller in size. Overfishing of stocks of subadults could affect recruitment and could also represent a loss of potential C of larger, more valuable shrimp (later in the season). Results of these analysis indicated that there were two periods when the relative importance of size classes shifted (Figure 21). The first occurred during the period 1972-1975 when C/A of the size classes of smallest and intermediate sized shrimp were among the lowest recorded, and C/A of the size class largest shrimp was among the highest. This shift in the relative importance of the several size classes was probably attributable to less fishing pressure on the small stocks of subadults, permitting a larger percentage than usual to attain large size. The 1973-1974 period in general, and the winters and springs of both years, in particular, were characterized by abnormally high rainfall in the eastern U.S., causing high river flows and lowered estuarine salinities in the springtime. During 1975, the Gulf shrimp industry was crippled by high fuel costs, making shrimping relatively unprofitable, and substantially reducing effort. The

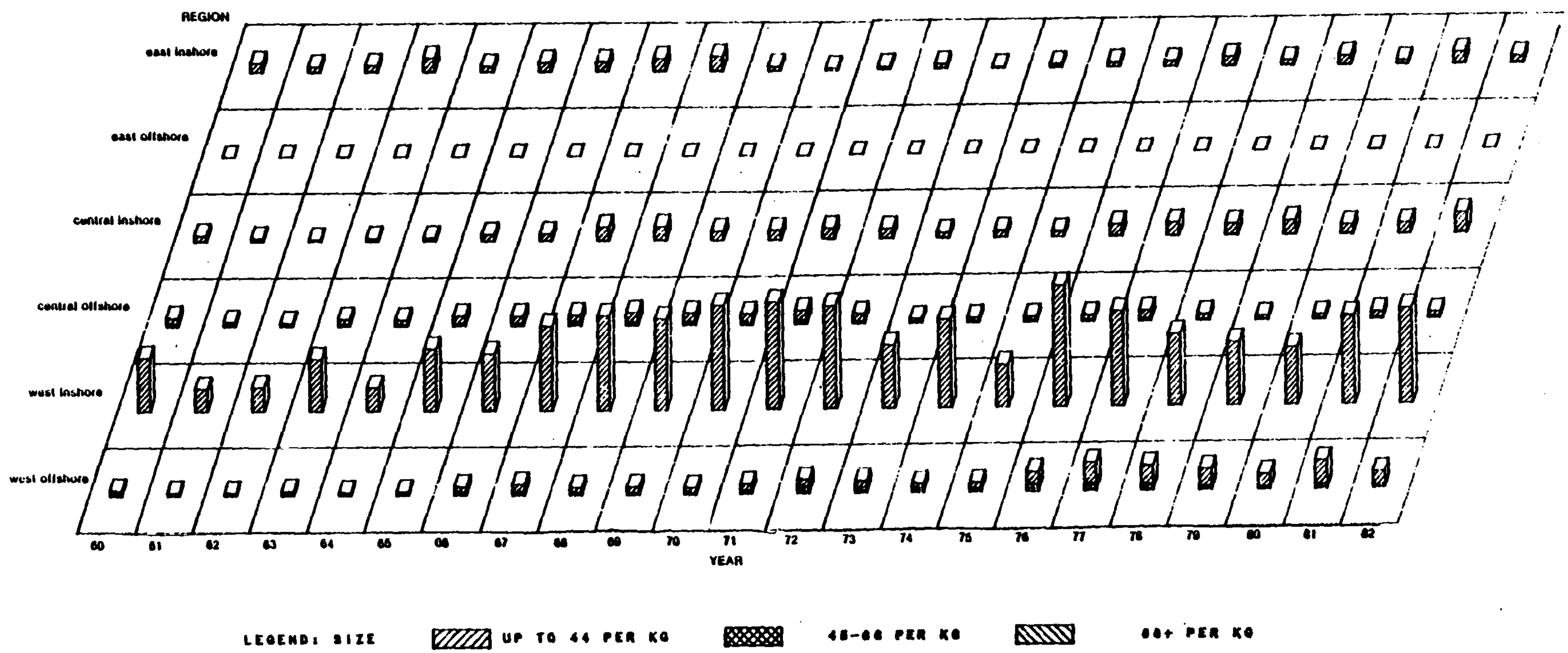

Figure 21. Year by region by size means of brown shrimp catch/unit water surface area (kg, heads on, per ha)for the Tuscaloosa Trend study area based on Gulf Coast Shrimp Data for the period 1960 to 1982.

Table 41. Year by region by size means of brown shrimp catch/unit water surface area (kg, heads on, per ha)for the Tuscaloosa Trend study area based on Gulf Coast Shrimp Data for the period 1960 to 1982.

P.AZTECUS	LT 44/KG	44-66/KG	GT 66/KG	TOTAL
1960				
West Offshore	0.5900	0.8068	0.5897	1.9865
West Inshore	0.0019	0.0007	18.8249	18.8274
Central Offshore	0.2077	0.9716	1.9894	3.1687
Central Inshore	0.0007	0.1265	2.1602	2.2874
East Offshore	0.0000	0.0000	0.0000	0.0000
East Inshore	0.0007	0.0284	3.3143	3.3433
TOTAL	0.1392	0.4066	1.5892	2.1350
1961				
West Offshore	0.3071	0.5274	0.2940	1.1285
West Inshore	0.0057	0.0257	7.9379	7.9693
Central Offshore	0.1239	0.3542	1.0660	1.5441
Central Inshore	0.0003	0.0485	1.1424	1.1913
East Offshore	0.0005	0.0011	0.0028	0.0044
East Inshore	0.0025	0.0953	1.9963	2.0941
TOTAL	0.0772	0.1851	0.8068	1.0691
1962				
West Offshore	0.1491	0.3199	0.6227	1.0917
West Inshore	0.0001	0.0119	8.4133	8.4252
Central Offshore	0.0939	0.2116	0.8815	1.1869
Central Inshore	0.0014	0.0355	0.7127	0.7496
East Offshore	0.0042	0.0164	0.0356	0.0561
East Inshore	0.0229	0.1707	2.2761	2.4697
TOTAL	0.0493	0.1223	0.7570	0.9286
1963				
West Offshore	0.1445	0.5071	0.9606	1.6122
West Inshore	0.0011	0.0000	18.2195	18.2206
Central Offshore	0.2242	0.4039	1.9753	2.6034
Central Inshore	0.0009	0.1054	1.0297	1.1361
East Offshore	0.0048	0.0072	0.0071	0.0191
East Inshore	0.0191	0.1254	4.8241	4.9686
TOTAL	0.0852	0.2091	1.4850	1.7793
1964				
West Offshore	0.2362	0.1183	0.8442	1.1987
West Inshore	0.0000	0.0000	8.3012	8.3012
Central Offshore	0.1825	0.3554	1.7723	2.3102
Central Inshore	0.0004	0.0132	1.2115	1.2251
East Offshore	0.0017	0.0015	0.0066	0.0098
East Inshore	0.0009	0.0066	1.9866	1.9941
TOTAL	0.0842	0.1190	1.1017	1.3048

Table 41. Continued.

P.AZTECUS		LT 44/KG	44-66/KG	GT 66/KG	TOTAL
1965					
	West Offshore	0.2663	0.5051	0.5644	1.3358
	West Inshore	0.0025	0.0030	21.6949	21.7003
	Central Offshore	0.3650	0.6130	2.5875	3.5655
	Central Inshore	0.0016	0.0375	2.4224	2.4614
	East Offshore	0.0005	0.0023	0.0033	0.0061
	East Inshore	0.0202	0.0355	3.2528	3.3085
	TOTAL	0.1401	0.2500	1.8643	2.2544
1966					
	West Offshore	0.3266	0.9378	1.8459	3.1103
	West Inshore	0.0000	0.0448	20.0465	20.0913
	Central Offshore	0.2923	0.7215	2.5557	3.5695
	Central Inshore	0.0012	0.0254	2.5448	2.5713
	East Offshore	0.0003	0.0010	0.0130	0.0142
	East Inshore	0.0020	0.1907	3.2669	3.4596
	TOTAL	0.1271	0.3444	2.0189	2.4904
1967					
	West Offshore	0.2861	0.9842	2.7320	4.0023
	West Inshore	0.0000	0.0170	29.5987	29.6157
	Central Offshore	0.4111	1.0925	2.3249	3.8285
	Central Inshore	0.0012	0.0838	4.8726	4.9576
	East Offshore	0.0000	0.0000	0.0042	0.0042
	East Inshore	0.0138	0.1087	4.3177	4.4403
	TOTAL	0.1552	0.4608	2.7488	3.3649
1968					
	West Offshore	0.3623	0.7926	1.7164	2.8714
	West Inshore	0.0000	0.0034	33.1504	33.1538
	Central Offshore	0.3462	1.0236	3.2817	4.6515
	Central Inshore	0.0029	0.0938	4.8980	4.9947
	East Offshore	0.0007	0.0004	0.0007	0.0018
	East Inshore	0.0057	0.1235	5.0169	5.1461
	TOTAL	0.1476	0.4175	2.9910	3.5562
1969					
	West Offshore	0.1873	0.6626	2.1941	3.0441
	West Inshore	0.0000	0.0000	31.9865	31.9865
	Central Offshore	0.2920	1.0759	2.8394	4.2073
	Central Inshore	0.0003	0.0238	3.4011	3.4251
	East Offshore	0.0000	0.0015	0.0034	0.0049
	East Inshore	0.0004	0.0106	1.6101	1.6210
	TOTAL	0.1076	0.3975	2.5000	3.0051

Table 41. Continued.

P.AZTECUS		LT 44/KG	44-66/KG	GT 66/KG	TOTAL
1970					
	West Offshore	0.4062	0.7090	1.4582	2.5734
	West Inshore	0.0001	0.0020	36.5195	36.5215
	Central Offshore	0.3087	0.9716	2.7359	4.0162
	Central Inshore	0.0001	0.0759	3.5027	3.5787
	East Offshore	0.0000	0.0006	0.0024	0.0030
	East Inshore	0.0001	0.0106	0.8836	0.8944
	TOTAL	0.1422	0.3837	2.4616	2.9875
1971					
	West Offshore	0.4498	0.6223	2.3945	3.4666
	West Inshore	0.0018	0.1456	37.2248	37.3722
	Central Offshore	0.3461	1.0233	3.4647	4.8341
	Central Inshore	0.0016	0.0605	3.7270	3.7891
	East Offshore	0.0009	0.0000	0.0006	0.0015
	East Inshore	0.0006	0.0060	0.9928	0.9994
	TOTAL	0.1593	0.3864	2.8541	3.3998
1972					
	West Offshore	0.7314	1.6748	2.6801	5.0864
	West Inshore	0.0186	0.1821	35.8095	36.0102
	Central Offshore	0.2339	0.6993	2.5824	3.5156
	Central Inshore	0.0008	0.0962	3.4331	3.5301
	East Offshore	0.0003	0.0043	0.0000	0.0046
	East Inshore	0.0194	0.1062	1.5630	1.6886
	TOTAL	0.1672	0.4525	2.5843	3.2040
1973					
	West Offshore	0.9117	1.0023	2.3274	4.2413
	West Inshore	0.0053	0.0365	22.1298	22.1715
	Central Offshore	0.1584	0.3339	1.0202	1.5126
	Central Inshore	0.0025	0.0792	2.0557	2.1374
	East Offshore	0.0008	0.0013	0.0015	0.0036
	East Inshore	0.0006	0.0096	0.3885	0.3987
	TOTAL	0.1701	0.2466	1.4926	1.9094
1974					
	West Offshore	0.7299	1.0598	1.4360	3.2257
	West Inshore	0.0000	0.0058	30.8904	30.8962
	Central Offshore	0.1533	0.3080	1.3727	1.8340
	Central Inshore	0.0002	0.0226	2.5051	2.5279
	East Offshore	0.0011	0.0018	0.0086	0.0114
	East Inshore	0.0020	0.0526	1.1967	1.2513
	TOTAL	0.1434	0.2384	1.7850	2.1668

Table 41. Continued.

P.AZTECUS		LT 44/KG	44-66/KG	GT 66/KG	TOTAL
1975					
	West Offshore	0.5645	0.8004	1.9685	3.3334
	West Inshore	0.0002	0.0036	14.9890	14.9928
	Central Offshore	0.1963	0.3568	1.4336	1.9867
	Central Inshore	0.0000	0.0298	2.0534	2.0832
	East Offshore	0.0000	0.0000	0.0000	0.0000
	East Inshore	0.0001	0.0026	1.6009	1.6036
	TOTAL	0.1323	0.2151	1.4453	1.7928
1976					
	West Offshore	0.9953	1.5206	4.4917	7.0076
	West Inshore	0.0022	0.0113	42.3090	42.3225
	Central Offshore	0.1541	0.5420	1.6072	2.3033
	Central Inshore	0.0012	0.1080	4.1898	4.2990
	East Offshore	0.0000	0.0002	0.0001	0.0004
	East Inshore	0.0010	0.0207	1.7636	1.7853
	TOTAL	0.1798	0.3806	2.8505	3.4109
1977					
	West Offshore	0.5548	1.9630	7.4698	9.9876
	West Inshore	0.0177	0.0730	33.1568	33.2474
	Central Offshore	0.0934	0.7667	2.7668	3.6270
	Central Inshore	0.0021	0.1588	4.5469	4.7078
	East Offshore	0.0000	0.0000	0.0200	0.0200
	East Inshore	0.0004	0.1908	3.0586	3.2498
	TOTAL	0.1030	0.5216	3.4983	4.1228
1978					
	West Offshore	0.5988	1.5887	6.6038	8.7914
	West Inshore	0.0028	0.0498	25.0402	25.0928
	Central Offshore	0.0711	0.3175	1.8631	2.2517
	Central Inshore	0.0026	0.1345	4.0073	4.1443
	East Offshore	0.0032	0.0021	0.0104	0.0157
	East Inshore	0.0142	0.1276	1.6846	1.8264
	TOTAL	0.1041	0.3377	2.7853	3.2271
1979					
	West Offshore	0.5364	0.8816	6.0108	7.4287
	West Inshore	0.0000	0.0035	22.0874	22.0909
	Central Offshore	0.0794	0.1498	1.1683	1.3975
	Central Inshore	0.0013	0.1085	5.0911	5.2009
	East Offshore	0.0051	0.0250	0.0319	0.0620
	East Inshore	0.0210	0.1006	3.0286	3.1502
	TOTAL	0.0986	0.1948	2.6977	2.9911

Table 41. Continued.

P.AZTECUS		LT 44/KG	44-66/KG	GT 66/KG	TOTAL
1980					
	West Offshore	0.3405	0.6436	4.4302	5.4143
	West Inshore	0.0000	0.0078	20.1248	20.1326
	Central Offshore	0.1136	0.3234	1.2702	1.7073
	Central Inshore	0.0456	0.3859	3.0294	3.4609
	East Offshore	0.0187	0.0316	0.0339	0.0842
	East Inshore	0.0013	0.1137	1.1966	1.3115
	TOTAL	0.0930	0.2632	2.0228	2.3791
1981					
	West Offshore	0.5136	1.1296	8.2214	9.8646
	West Inshore	0.0000	0.0324	31.0078	31.0402
	Central Offshore	0.1125	0.3112	2.0738	2.4974
	Central Inshore	0.0026	0.0854	3.8602	3.9482
	East Offshore	0.0000	0.0001	0.0015	0.0017
	East Inshore	0.0056	0.1267	3.9486	4.0809
	TOTAL	0.1026	0.2632	3.2656	3.6314
1982					
	West Offshore	0.2792	0.8645	4.7159	5.8596
	West Inshore	0.0000	0.0131	33.2950	33.3082
	Central Offshore	0.1724	0.5145	1.4893	2.1762
	Central Inshore	0.0100	0.4647	6.7626	7.2374
	East Offshore	0.0000	0.0010	0.0153	0.0163
	East Inshore	0.0016	0.1582	2.3601	2.5199
	TOTAL	0.0884	0.3527	3.1311	3.5722

1973-1975 period was preceeded by periods of low C/A for all size classes in the early 1960s and relatively high C/A for all size classes during the middle 1960s to 1972.

The second period when there appeared to be a major shift in the relative importance of the several size classes was 1977-1982. During this period there were several years of high C/A of the size class of smallest shrimp, with lower than average C/A of this size class reported only during 1980. Relatively high C/A was also reported for the intermediate size class during several recent years. C/A for the size class of largest shrimp has been consistently low during this six year period, approaching the low values reported during the early 1960s when less effort was expended in the more offshore waters where large brown shrimp reside.

The trends for the several size classes of brown shrimp by year and zone (Figure 22) elaborate on these trends. Trends in C/A with depth differed considerably between the two periods of generally poor C as well as the two periods of relatively higher C. During the early 1960s, C/A was relatively low at all depths and especially so in the 40-100 m zone. In the early 1970s, C in the 40-100 m depth zone was relatively good, especially for larger shrimp. The early period of relatively higher C (1962-1972) differed from the more recent period of relatively higher C in that more small shrimp were being harvested in the shallow Gulf (0-20 m depths), and less larger shrimp were being harvested from the deeper Gulf.

White Shrimp

White shrimp C and C/A decreased consistently going west to east across the Tuscaloosa Trend study area, with the trend being consistent across all depths zones (Figures 23 and 24, and Table 42). However, the relative importance of inshore and offshore C changed with region. In the western and central regions, inshore C/A was less than but similar to that in the shallowest Gulf (0-20 m). In the eastern region, where white shrimp C/A was generally low, C in the estuaries dominated total C. Offshore C/A was approximately two orders of magnitude lower in the eastern region compared to the central region, indicating that those white shrimp raised in the estuaries of the eastern region probably migrate to the central region once they move offshore.

C/A decreased consistently with depth across the entire study area. The vast majority of white shrimp were caught in waters less than 40 m deep. Substantial numbers of white shrimp of the largest and intermediate size classes were caught inshore (Figure 23). Such a trend was not apparent for brown shrimp (see Figure 19), but, was consistent with our understanding that white shrimp remain longer and grow larger in the estuaries than do brown shrimp. The size class of smallest shrimp dominated white shrimp C/A in both the estuaries and offshore (Figure 24). For offshore waters all three size classes showed consistently decreasing C/A with depth, with maximum C/A of all size classes in the 0-20 m depths. However, in the western region where C/A was highest, the two size classes of larger shrimp were relatively more important further offshore than in the central and eastern regions.

Although there were substantial differences from region to region, C/A of white shrimp showed similar seasonal patterns across the entire study

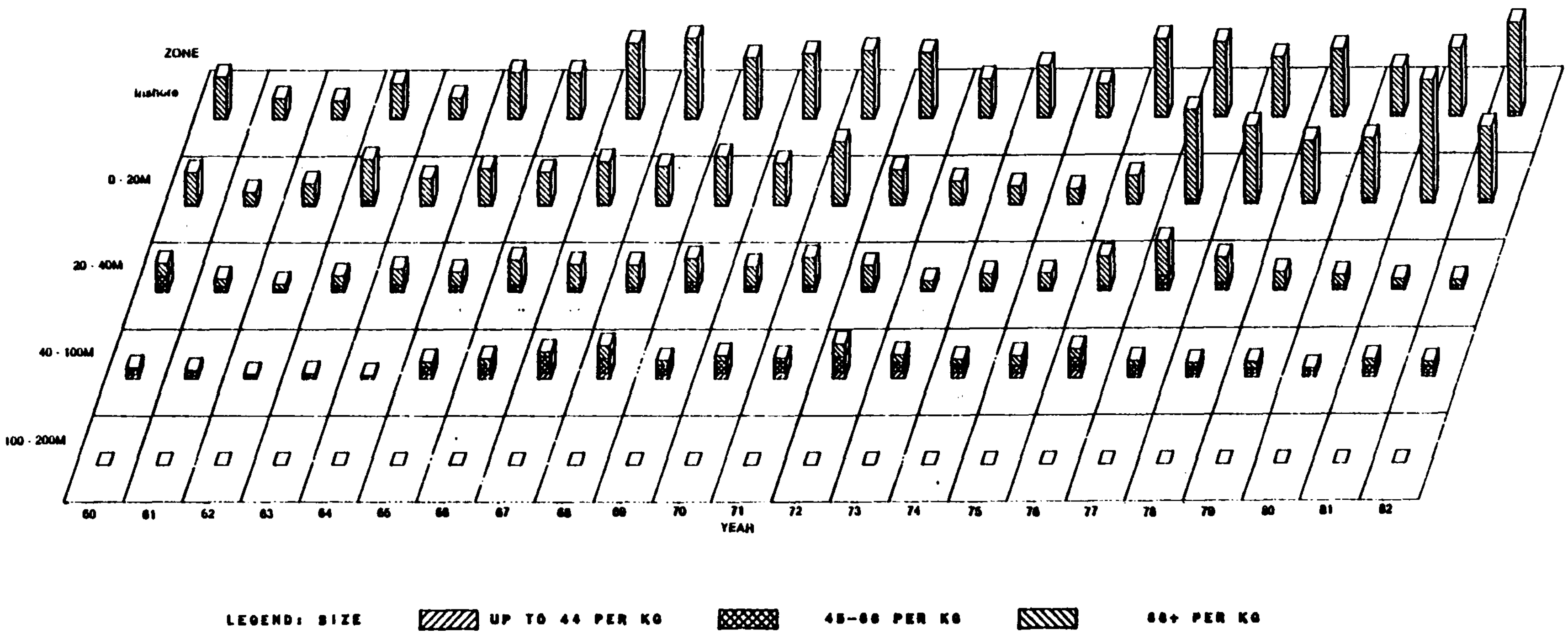

Figure 22. Year by depth by size means of brown shrimp catch/unit water surface area (kg, heads on, per ha)for the Tuscaloosa Trend study area based on Gulf Coast Shrimp Data for the period 1960 to 1982.

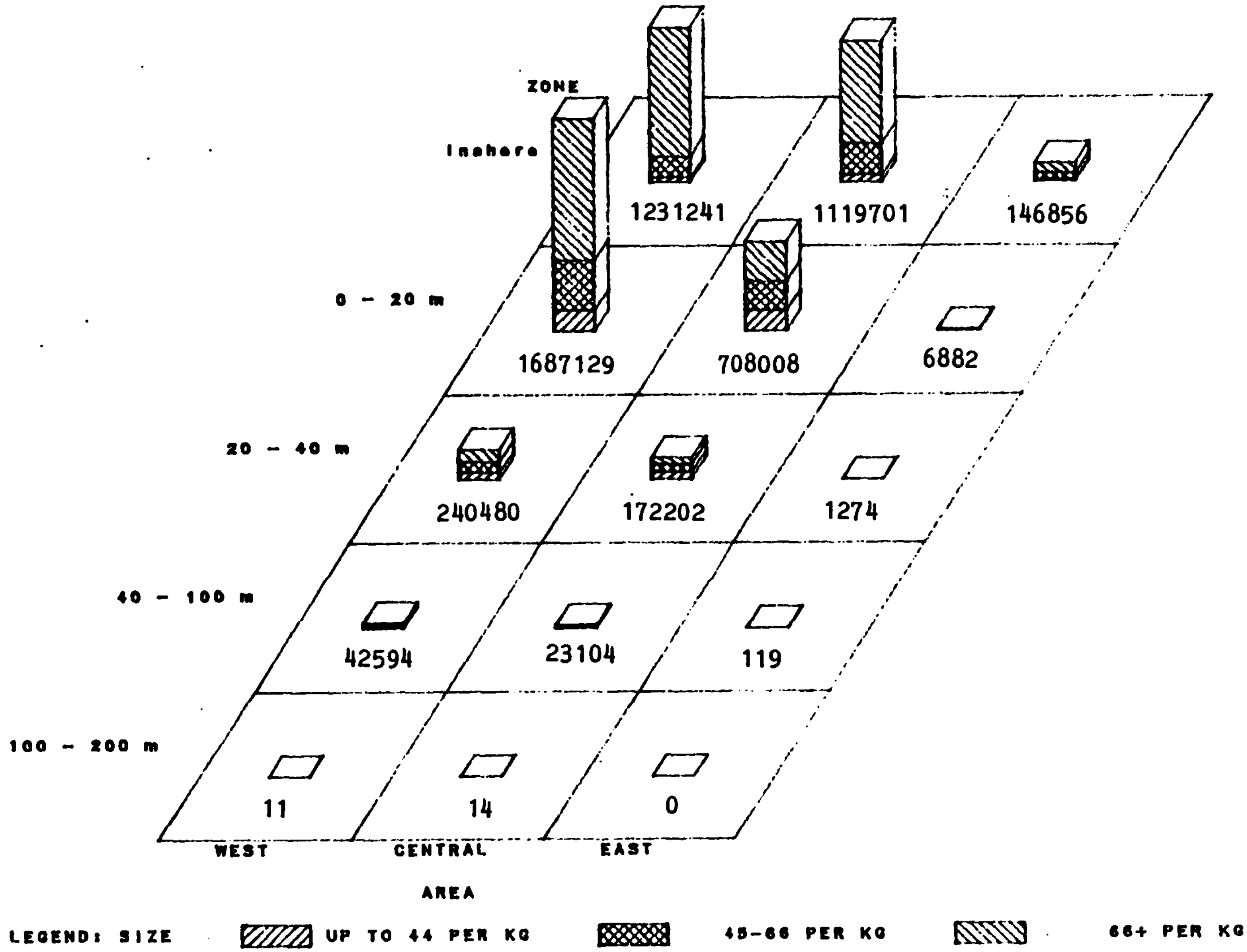

Figure 23. Region by depth by size means of white shrimp catch (kg, heads on) for the Tuscaloosa Trend study area based on Gulf Coast Shrimp Data for the period 1960 to 1982.

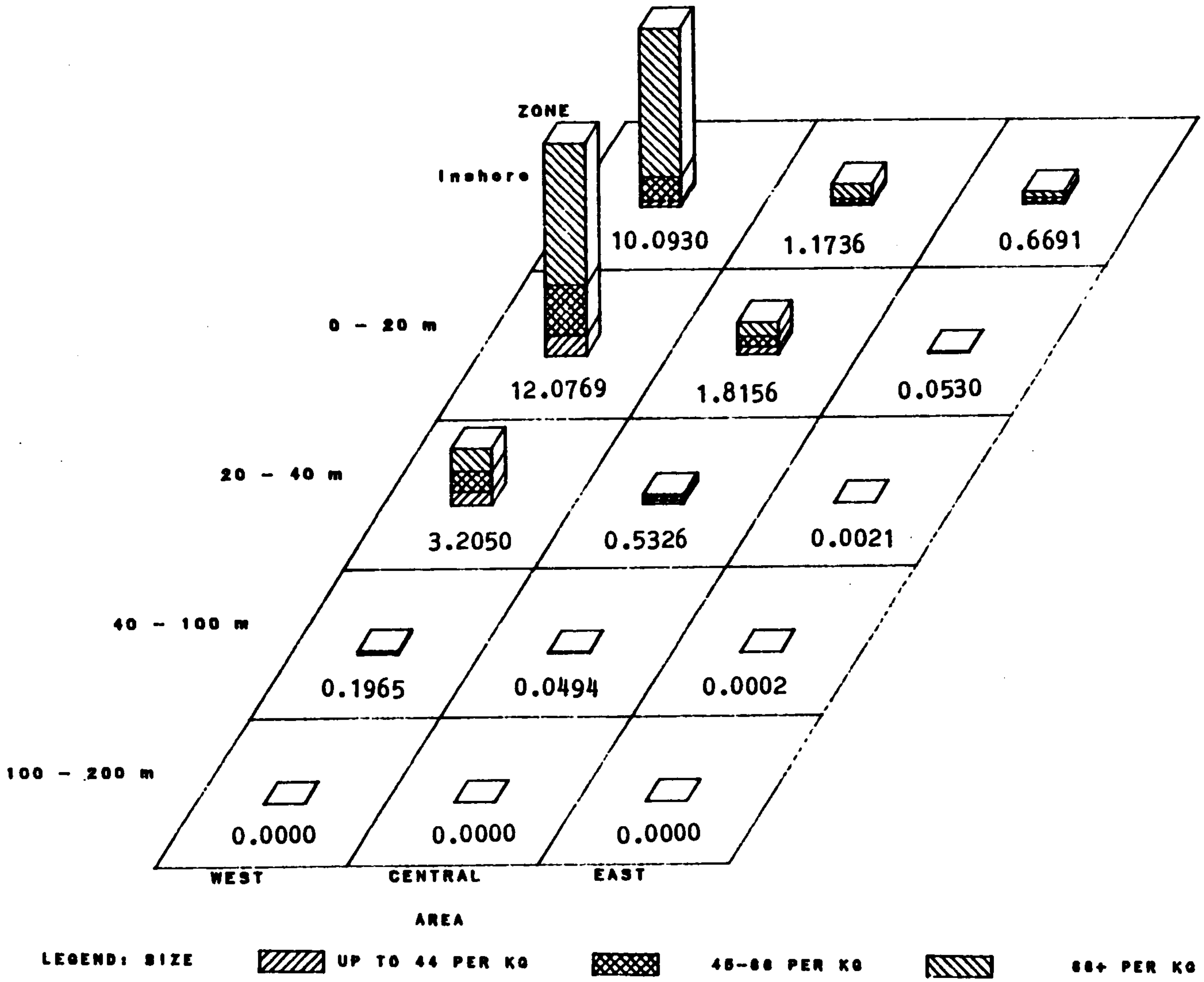

Figure 24. Region by depth by size means of white shrimp catch/unit water surface area (kg, heads on, per ha) for the Tuscaloosa Trend study area based on Gulf Coast Shrimp Data for the period 1960 to 1982.

Table 42. Region by depth by size means of white shrimp catch/unit water surface area (kg, heads on, per ha) for the Tuscaloosa Trend study area based on Gulf Coast Shrimp Data for the period 1960 to 1982.

P. SETIFERUS		LT 44/KG	44-66/KG	GT 66/KG	TOTAL
WEST					
	Inshore	0.2831	1.3925	8.4174	10.0930
	0 - 20 m	1.1674	2.8568	8.0527	12.0769
	20 - 40 m	0.7342	1.1615	1.3094	3.2050
	40 - 100 m	0.0659	0.0899	0.0406	0.1965
	100 - 200 m	0.0000	0.0000	0.0000	0.0000
	REGION	0.3125	0.7908	2.6439	3.7471
CENTRAL					
	Inshore	0.0595	0.2641	0.8500	1.1736
	0 - 20 m	0.4071	0.6003	0.8082	1.8156
	20 - 40 m	0.1836	0.1985	0.1504	0.5326
	40 - 100 m	0.0196	0.0177	0.0121	0.0494
	100 - 200 m	0.0000	0.0000	0.0000	0.0000
	REGION	0.1158	0.2277	0.4811	0.8246
EAST					
	Inshore	0.0541	0.2524	0.3626	0.6691
	0 - 20 m	0.0187	0.0164	0.0180	0.0530
	20 - 40 m	0.0005	0.0011	0.0005	0.0021
	40 - 100 m	0.0002	0.0000	0.0000	0.0002
	100 - 200 m	0.0000	0.0000	0.0000	0.0000
	REGION	0.0072	0.0285	0.0403	0.0760
STUDY AREA MEANS					
	Inshore	0.0796	0.3684	1.4800	1.9280
	0 - 20 m	0.4918	0.9634	2.1874	3.6426
	20 - 40 m	0.1130	0.1496	0.1449	0.4076
	40 - 100 m	0.0186	0.0219	0.0114	0.0519
	100 - 200 m	0.0000	0.0000	0.0000	0.0000
		0.1058	0.2416	0.6584	1.0059

area (Figure 25 and Table 43). These trends included a major increase in the summer to early winter period (August - December) and a second smaller peak in late spring (May - June). It is difficult to determine whether the spring peak was due to increased abundance of white shrimp in the study area or simply the result of increased effort directed at brown shrimp that were just entering the offshore fishery. Evidence was presented above (Section 2.5.5.1) that indicated some white shrimp postlarvae may enter Gulf coast estuaries too late in summer or fall to contribute to offshore stocks that same fall. These juvenile or subadults may overwinter in the nearshore Gulf, reentering the estuaries in late winter as temperatures rise. These shrimp then complete their growth in the estuaries during late winter and early spring, entering the offshore fishery in midspring. In this respect, it is interesting to note that the spring peaks mainly involve the size class of largest shrimp (Figure 25), while the initial summer C mainly involve the size class of smallest shrimp. C/A of the size class of largest shrimp in May and June was almost as great as in the fall. This would indicate either that the shrimp leaving the estuaries in the spring were larger than those leaving the estuaries in the summer or that the increased C was attributable to the adult stock which overwintered offshore.

During summer and fall, increases in C/A were first observed for the size class of smallest shrimp (August), and latest for the size class of largest shrimp (October). This trend clearly demonstrates the growth of white shrimp over the period (Figure 25). The rather extended period over which white shrimp of the smallest size class were caught in elevated numbers (August-January) is consistent with evidence that indicates that periods of postlarval recruitment of white shrimp are extensive, with white shrimp apparently migrating out of the estuaries over the entire fall period. Several studies have indicated that white shrimp postlarvae enter northern Gulf estuaries in several "waves" over the entire summer to early fall period. The more abbreviated period of peak C of brown shrimp of the smallest size class (see Figure 20) indicates that their postlarvae enter the estuaries over a much more abbreviated period of time, and the offshore brown shrimp production is based on a single or several closely spaced waves of postlarvae.

These general seasonal patterns appear to be relatively consistent across depths, with some minor exceptions (Figure 25). For example, C/A increased dramatically in August in the estuaries and shallow Gulf, but not until October in the 20-40 m depth zone. However, all strata showed peak C from October to December. The still elevated C in the nearshore zone in January and February was not accompanied by elevated C in the estuaries. Since most of the offshore C in winter was dominated by the size class of smallest shrimp, which was not caught in the estuaries at this time, it appears they were overwintering offshore.

Years of highest C/A of white shrimp in the western region included 1963-1964, 1969-1971, 1977 and 1980-1981 (Figure 26 and Table 44). The central region showed similar patterns during the 1960s, but generally did not display elevated C/A during the late 1970s. In general, years of high C/A inshore were also years of high C/A offshore in both the central and western regions (Figures 26 and 27). However, it appears that C/A in the offshore zones of the western region was of relatively greater importance

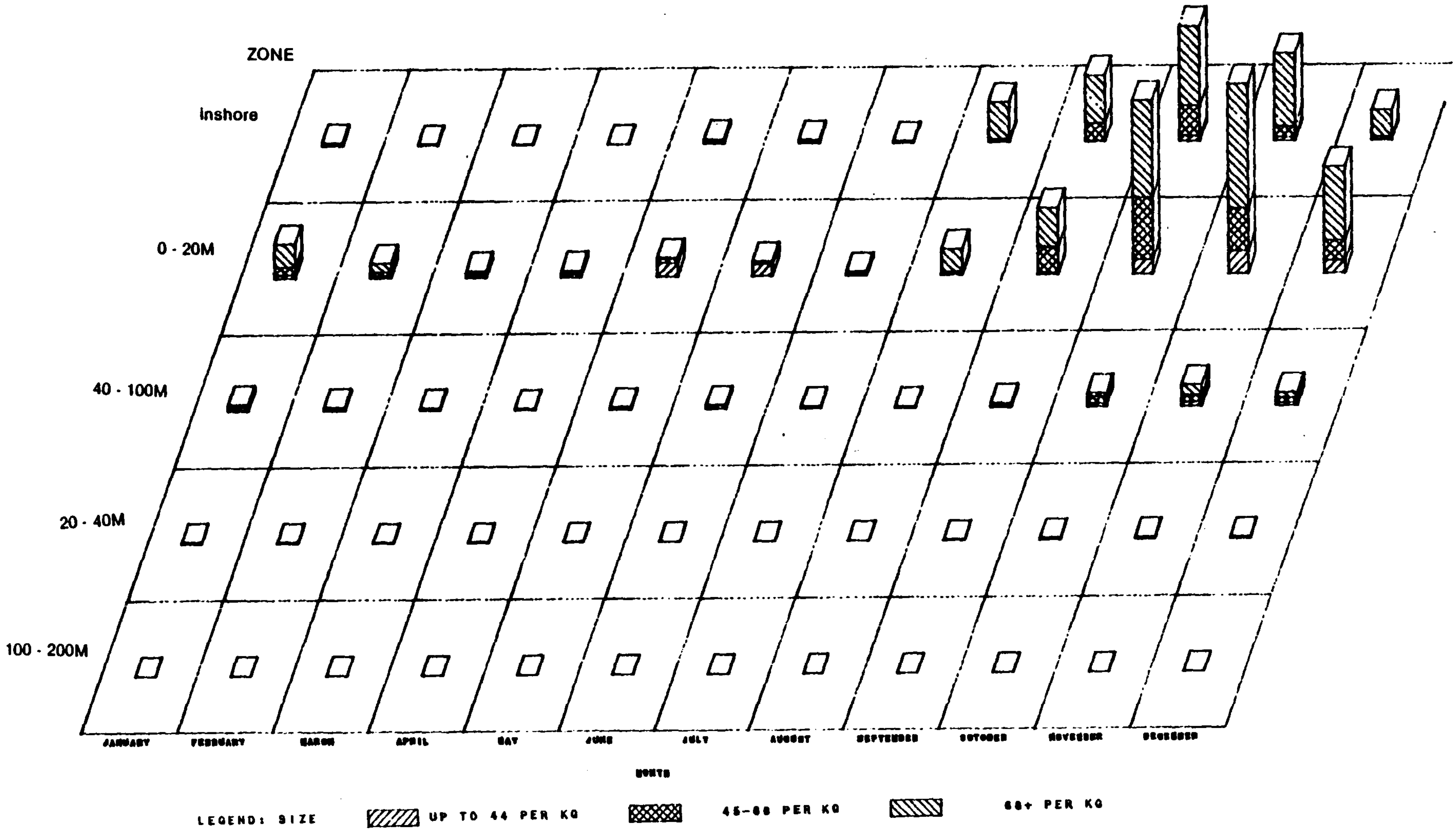

Figure 25. Month by depth by size means of white shrimp catch/unit water surface area (kg, heads on, per ha) for the Tuscaloosa Trend study area based on Gulf Coast Shrimp Data for the period 1960 to 1982.

Table 43. Month by depth by size means of white shrimp catch/unit water surface area (kg, heads on, per ha) for the Tuscaloosa Trend study area based on Gulf Coast Shrimp Data for the period 1960 to 1982.

P.SETIFERUS	LT 44/KG	44-66/KG	GT 66/KG	TOTAL
January				
Inshore	0.0003	0.0018	0.0118	0.0139
0 - 20 m	0.0174	0.0420	0.1307	0.1901
20 - 40 m	0.0065	0.0130	0.0172	0.0367
40 - 100 m	0.0024	0.0035	0.0028	0.0087
100 - 200 m	0.0000	0.0000	0.0000	0.0000
TOTAL	0.0040	0.0089	0.0229	0.0358
February				
Inshore	0.0001	0.0005	0.0025	0.0031
0 - 20 m	0.0113	0.0192	0.0498	0.0804
20 - 40 m	0.0042	0.0064	0.0061	0.0166
40 - 100 m	0.0020	0.0017	0.0009	0.0046
100 - 200 m	0.0000	0.0000	0.0000	0.0000
TOTAL	0.0027	0.0041	0.0081	0.0149
March				
Inshore	0.0001	0.0005	0.0007	0.0013
0 - 20 m	0.0081	0.0113	0.0144	0.0338
20 - 40 m	0.0041	0.0037	0.0032	0.0110
40 - 100 m	0.0015	0.0007	0.0003	0.0025
100 - 200 m	0.0000	0.0000	0.0000	0.0000
TOTAL	0.0022	0.0024	0.0026	0.0072
April				
Inshore	0.0003	0.0002	0.0002	0.0006
0 - 20 m	0.0162	0.0089	0.0091	0.0343
20 - 40 m	0.0028	0.0013	0.0007	0.0048
40 - 100 m	0.0010	0.0003	0.0000	0.0013
100 - 200 m	0.0000	0.0000	0.0000	0.0000
TOTAL	0.0028	0.0015	0.0013	0.0056
May				
Inshore	0.0063	0.0123	0.0036	0.0222
0 - 20 m	0.0736	0.0240	0.0060	0.1036
20 - 40 m	0.0106	0.0012	0.0002	0.0120
40 - 100 m	0.0019	0.0001	0.0000	0.0020
100 - 200 m	0.0000	0.0000	0.0000	0.0000
TOTAL	0.0131	0.0062	0.0016	0.0209

Table 43. Continued.

P.SETIFERUS	LT 44/KG	44-66/KG	GT 66/KG	TOTAL
June				
Inshore	0.0135	0.0045	0.0008	0.0188
0 - 20 m	0.0665	0.0115	0.0020	0.0799
20 - 40 m	0.0172	0.0018	0.0002	0.0192
40 - 100 m	0.0007	0.0001	0.0000	0.0008
100 - 200 m	0.0000	0.0000	0.0000	0.0000
TOTAL	0.0149	0.0029	0.0005	0.0183
July				
Inshore	0.0050	0.0013	0.0012	0.0075
0 - 20 m	0.0155	0.0025	0.0011	0.0191
20 - 40 m	0.0117	0.0008	0.0000	0.0126
40 - 100 m	0.0008	0.0000	0.0000	0.0008
100 - 200 m	0.0000	0.0000	0.0000	0.0000
TOTAL	0.0055	0.0008	0.0004	0.0068
August				
Inshore	0.0024	0.0108	0.2048	0.2181
0 - 20 m	0.0045	0.0141	0.1253	0.1438
20 - 40 m	0.0028	0.0017	0.0021	0.0065
40 - 100 m	0.0004	0.0001	0.0003	0.0008
100 - 200 m	0.0000	0.0000	0.0000	0.0000
TOTAL	0.0018	0.0047	0.0655	0.0720
September				
Inshore	0.0027	0.0969	0.2647	0.3642
0 - 20 m	0.0077	0.1440	0.2146	0.3663
20 - 40 m	0.0015	0.0123	0.0077	0.0214
40 - 100 m	0.0003	0.0020	0.0006	0.0030
100 - 200 m	0.0000	0.0000	0.0000	0.0000
TOTAL	0.0020	0.0440	0.0922	0.1382
October				
Inshore	0.0268	0.1663	0.4398	0.6328
0 - 20 m	0.0781	0.3422	0.5380	0.9584
20 - 40 m	0.0138	0.0423	0.0177	0.0738
40 - 100 m	0.0020	0.0043	0.0015	0.0079
100 - 200 m	0.0000	0.0000	0.0000	0.0000
TOTAL	0.0192	0.0915	0.1766	0.2873

Table 43. Continued.

P.SETIFERUS	LT 44/KG	44-66/KG	GT 66/KG	TOTAL
November				
Inshore	0.0185	0.0608	0.3994	0.4787
0 - 20 m	0.1253	0.2338	0.6878	1.0469
20 - 40 m	0.0226	0.0376	0.0595	0.1196
40 - 100 m	0.0041	0.0047	0.0023	0.0110
100 - 200 m	0.0000	0.0000	0.0000	0.0000
TOTAL	0.0252	0.0518	0.1934	0.2704
December				
Inshore	0.0039	0.0124	0.1504	0.1667
0 - 20 m	0.0675	0.1099	0.4085	0.5859
20 - 40 m	0.0152	0.0277	0.0304	0.0733
40 - 100 m	0.0015	0.0044	0.0026	0.0086
100 - 200 m	0.0000	0.0000	0.0000	0.0000
TOTAL	0.0125	0.0229	0.0932	0.1286

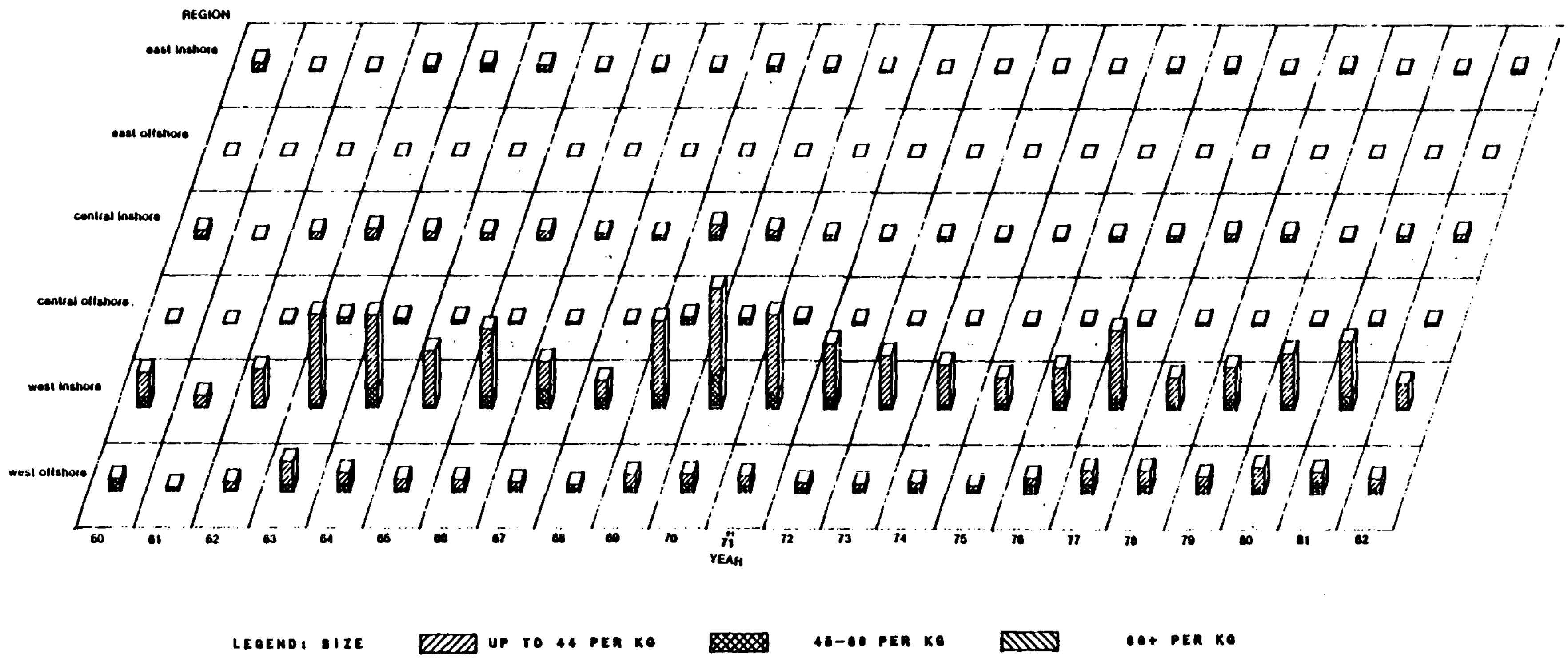

Figure 26. Year by region by size means of white shrimp catch/unit water surface area (kg, heads on per ha) for the Tuscaloosa Trend study area based on Gulf Coast Shrimp Data for the period 1960 to 1982.

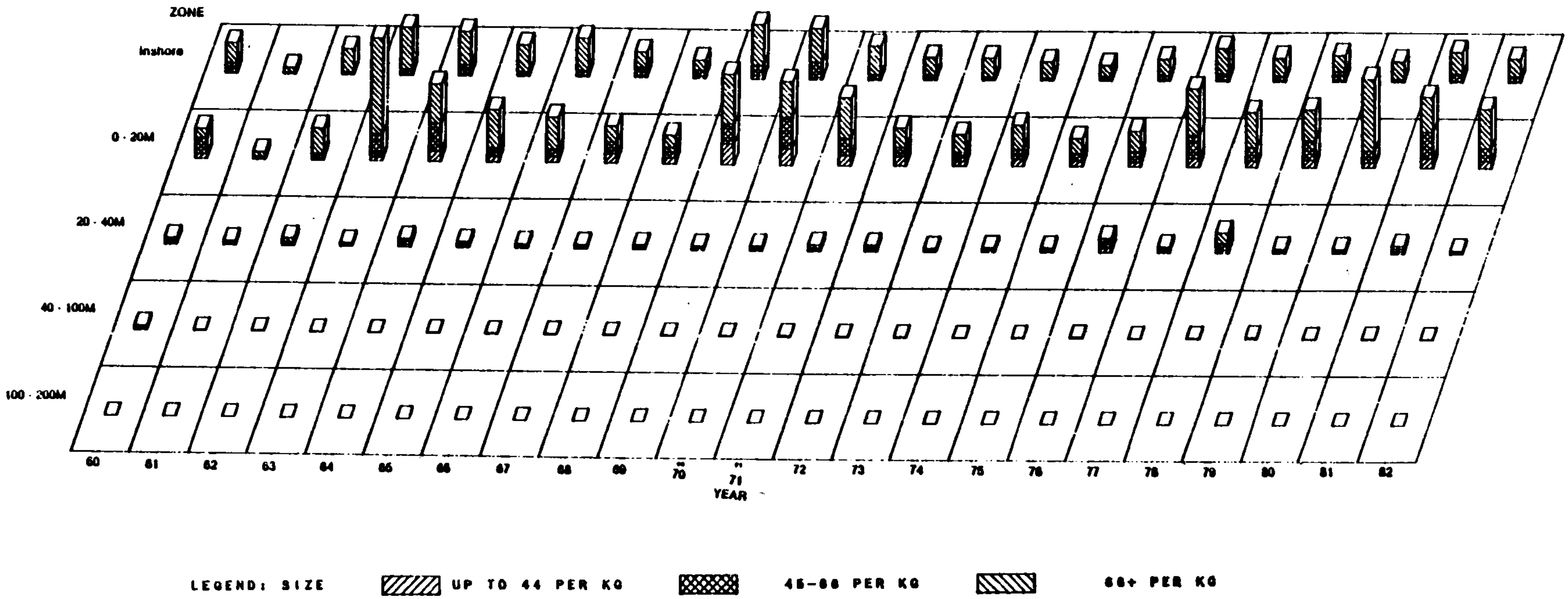

Figure 27. Year by depth by size means of white shrimp catch/unit water surface area (kg, heads on per ha) for the Tuscaloosa Trend study area based on Gulf Coast Shrimp Data for the period 1960 to 1982.

Table 44. Year by region by size means of white shrimp catch/unit water surface area (kg, heads on per ha)for the Tuscaloosa Trend study area based on Gulf Coast Shrimp Data for the period 1960 to 1982.

P. SETIFERUS		LT 44/KG	44-66/KG	GT 66/KG	TOTAL
1960					
	West Offshore	0.4734	1.1421	0.6348	2.2503
	West Inshore	0.0753	1.7344	4.3432	6.1528
	Central Offshore	0.1097	0.1650	0.0484	0.3232
	Central Inshore	0.0536	0.5503	1.0007	1.6046
	East Offshore	0.0000	0.0000	0.0000	0.0000
	East Inshore	0.0479	0.4189	1.1035	1.5704
	TOTAL	0.1088	0.3576	0.4234	0.8898
1961					
	West Offshore	0.0926	0.1585	0.4246	0.6757
	West Inshore	0.0094	0.1062	2.0056	2.1213
	Central Offshore	0.0166	0.0460	0.0230	0.0856
	Central Inshore	0.0025	0.0585	0.1841	0.2452
	East Offshore	0.0012	0.0061	0.0056	0.0130
	East Inshore	0.0090	0.1378	0.1657	0.3125
	TOTAL	0.0188	0.0552	0.1519	0.2259
1962					
	West Offshore	0.0661	0.3324	1.3329	1.7314
	West Inshore	0.0465	0.2151	6.4982	6.7598
	Central Offshore	0.0395	0.1248	0.2900	0.4542
	Central Inshore	0.0194	0.1302	1.2269	1.3765
	East Offshore	0.0008	0.0005	0.0004	0.0016
	East Inshore	0.0228	0.0665	0.2907	0.3801
	TOTAL	0.0258	0.1115	0.6429	0.7803
1963					
	West Offshore	0.1373	1.0854	4.1518	5.3744
	West Inshore	0.0404	0.5772	15.8201	16.4376
	Central Offshore	0.0651	0.2224	0.8478	1.1353
	Central Inshore	0.0206	0.3490	1.5967	1.9664
	East Offshore	0.0009	0.0004	0.0045	0.0059
	East Inshore	0.0734	0.2802	0.7002	1.0538
	TOTAL	0.0450	0.2981	1.4822	1.8252
1964					
	West Offshore	0.3552	1.0604	2.0282	3.4438
	West Inshore	0.3571	3.0650	12.8412	16.2632
	Central Offshore	0.2349	0.4590	0.2745	0.9684
	Central Inshore	0.0591	0.2736	1.2452	1.5779
	East Offshore	0.0027	0.0025	0.0003	0.0054
	East Inshore	0.2030	0.6816	0.5629	1.4475
	TOTAL	0.1424	0.4214	0.8929	1.4568

Table 44. Continued.

P.SETIFERUS		LT 44/KG	44-66/KG	GT 66/KG	TOTAL
1965					
	West Offshore	0.2426	0.3749	1.6658	2.2833
	West Inshore	0.1380	0.3650	9.5265	10.0295
	Central Offshore	0.1373	0.1393	0.4110	0.6876
	Central Inshore	0.0549	0.1473	1.0669	1.2691
	East Offshore	0.0048	0.0041	0.0024	0.0112
	East Inshore	0.0658	0.3767	0.6862	1.1287
	TOTAL	0.0890	0.1418	0.7799	1.0107
1966					
	West Offshore	0.2470	0.3175	1.7020	2.2665
	West Inshore	0.4195	1.6534	11.7551	13.8280
	Central Offshore	0.1066	0.1202	0.1979	0.4246
	Central Inshore	0.0404	0.1847	1.3892	1.6143
	East Offshore	0.0001	0.0005	0.0002	0.0008
	East Inshore	0.0269	0.1955	0.2781	0.5004
	TOTAL	0.0816	0.1560	0.8160	1.0536
1967					
	West Offshore	0.3811	0.4782	0.9310	1.7904
	West Inshore	0.8281	2.4237	4.9096	8.1614
	Central Offshore	0.1750	0.1788	0.0662	0.4200
	Central Inshore	0.0417	0.3461	0.7172	1.1050
	East Offshore	0.0000	0.0000	0.0000	0.0000
	East Inshore	0.0919	0.3598	0.2413	0.6930
	TOTAL	0.1313	0.2474	0.3959	0.7746
1968					
	West Offshore	0.2643	0.4368	0.6436	1.3447
	West Inshore	0.5916	1.2161	3.1275	4.9352
	Central Offshore	0.1157	0.1957	0.0833	0.3947
	Central Inshore	0.0843	0.2928	0.5036	0.8807
	East Offshore	0.0001	0.0000	0.0000	0.0001
	East Inshore	0.1346	0.3402	0.2230	0.6979
	TOTAL	0.1027	0.2086	0.2818	0.5931
1969					
	West Offshore	0.3504	0.5808	2.2603	3.1916
	West Inshore	0.4928	1.8934	12.9210	15.3072
	Central Offshore	0.5269	0.3515	0.4112	1.2896
	Central Inshore	0.2338	0.5952	1.9146	2.7436
	East Offshore	0.0001	0.0000	0.0004	0.0006
	East Inshore	0.1008	0.5148	0.4134	1.0290
	TOTAL	0.2528	0.3486	1.0782	1.6796

Table 44. Continued.

P.SETIFERUS		LT 44/KG	44-66/KG	GT 66/KG	TOTAL
1970					
	West Offshore	0.4580	1.0960	1.6586	3.2126
	West Inshore	0.5913	5.2068	15.1791	20.9772
	Central Offshore	0.3289	0.4900	0.3044	1.1233
	Central Inshore	0.1004	0.6679	1.0124	1.7807
	East Offshore	0.0014	0.0000	0.0000	0.0014
	East Inshore	0.0098	0.2829	0.4722	0.7649
	TOTAL	0.1872	0.5370	0.8587	1.5828
1971					
	West Offshore	0.3691	0.7515	1.8210	2.9416
	West Inshore	0.2977	2.3734	13.7497	16.4207
	Central Offshore	0.1983	0.2471	0.4844	0.9298
	Central Inshore	0.0440	0.1225	0.7485	0.9150
	East Offshore	0.0000	0.0003	0.0000	0.0003
	East Inshore	0.0233	0.1003	0.2321	0.3557
	TOTAL	0.1217	0.2524	0.8418	1.2159
1972					
	West Offshore	0.4100	0.4095	1.0008	1.8204
	West Inshore	0.4527	1.5774	9.4292	11.4593
	Central Offshore	0.2005	0.1512	0.1957	0.5474
	Central Inshore	0.0539	0.1251	0.3833	0.5623
	East Offshore	0.0003	0.0009	0.0007	0.0019
	East Inshore	0.0222	0.0432	0.0432	0.1086
	TOTAL	0.1333	0.1589	0.4774	0.7695
1973					
	West Offshore	0.2367	0.4307	0.9106	1.5779
	West Inshore	0.2171	0.6203	8.5735	9.4109
	Central Offshore	0.0735	0.1012	0.1470	0.3217
	Central Inshore	0.0460	0.0824	0.6047	0.7330
	East Offshore	0.0000	0.0000	0.0000	0.0000
	East Inshore	0.0369	0.0637	0.2190	0.3195
	TOTAL	0.0677	0.1188	0.4783	0.6648
1974					
	West Offshore	0.3731	0.4541	1.0850	1.9122
	West Inshore	0.1686	0.5410	7.0454	7.7550
	Central Offshore	0.1068	0.1317	0.2465	0.4849
	Central Inshore	0.0256	0.0520	0.5303	0.6080
	East Offshore	0.0000	0.0000	0.0002	0.0002
	East Inshore	0.0386	0.1046	0.1917	0.3349
	TOTAL	0.0910	0.1250	0.4809	0.6970

Table 44. Continued.

P.SETIFERUS		LT 44/KG	44-66/KG	GT 66/KG	TOTAL
1975					
	West Offshore	0.2446	0.2683	0.7766	1.2894
	West Inshore	0.2089	0.7270	4.5835	5.5193
	Central Offshore	0.1401	0.1379	0.1220	0.4000
	Central Inshore	0.0661	0.1141	0.4202	0.6004
	East Offshore	0.0001	0.0002	0.0000	0.0003
	East Inshore	0.0555	0.1373	0.1845	0.3772
	TOTAL	0.0916	0.1180	0.3276	0.5373
1976					
	West Offshore	0.5514	0.9289	1.2338	2.7141
	West Inshore	0.4073	1.0250	5.9281	7.3605
	Central Offshore	0.0857	0.1997	0.1549	0.4404
	Central Inshore	0.0580	0.1754	0.6269	0.8602
	East Offshore	0.0000	0.0000	0.0014	0.0014
	East Inshore	0.0370	0.1888	0.5137	0.7396
	TOTAL	0.1207	0.2456	0.4810	0.8473
1977					
	West Offshore	0.4012	1.1027	2.4988	4.0026
	West Inshore	0.3319	1.5132	11.9786	13.8237
	Central Offshore	0.1440	0.2578	0.2019	0.6037
	Central Inshore	0.0570	0.2812	0.6780	1.0162
	East Offshore	0.0000	0.0008	0.0003	0.0011
	East Inshore	0.0356	0.2962	0.4866	0.8184
	TOTAL	0.1145	0.3204	0.8130	1.2479
1978					
	West Offshore	0.4172	0.9489	2.6403	4.0064
	West Inshore	0.1903	0.5140	4.8845	5.5889
	Central Offshore	0.1264	0.2287	0.2283	0.5834
	Central Inshore	0.0717	0.3125	0.9406	1.3248
	East Offshore	0.0025	0.0020	0.0016	0.0061
	East Inshore	0.0342	0.1313	0.2376	0.4031
	TOTAL	0.1119	0.2676	0.7151	1.0946
1979					
	West Offshore	0.3158	1.0297	1.6388	2.9843
	West Inshore	0.2830	1.5056	5.5785	7.3672
	Central Offshore	0.1558	0.2005	0.1431	0.4994
	Central Inshore	0.0754	0.4942	0.6653	1.2350
	East Offshore	0.0078	0.0106	0.0035	0.0219
	East Inshore	0.0827	0.4399	0.2922	0.8148
	TOTAL	0.1129	0.3414	0.5236	0.9779

Table 44. Continued.

P.SETIFERUS		LT 44/KG	44-66/KG	GT 66/KG	TOTAL
1980					
	West Offshore	0.1783	0.5315	3.8516	4.5614
	West Inshore	0.1108	0.7768	9.0054	9.8930
	Central Offshore	0.0993	0.1519	0.2844	0.5356
	Central Inshore	0.0294	0.0662	0.4117	0.5072
	East Offshore	0.0124	0.0036	0.0106	0.0266
	East Inshore	0.0224	0.0720	0.2766	0.3710
	TOTAL	0.0651	0.1491	0.9009	1.1152
1981					
	West Offshore	0.4989	1.4264	1.9263	3.8516
	West Inshore	0.2317	2.1123	9.6719	12.0159
	Central Offshore	0.1431	0.2225	0.2171	0.5828
	Central Inshore	0.0503	0.3299	0.6837	1.0639
	East Offshore	0.0005	0.0024	0.0005	0.0034
	East Inshore	0.0340	0.2396	0.1796	0.4533
	TOTAL	0.1243	0.3754	0.6748	1.1744
1982					
	West Offshore	0.2362	0.5373	1.8734	2.6469
	West Inshore	0.0216	0.2845	4.2442	4.5504
	Central Offshore	0.1575	0.1796	0.2844	0.6215
	Central Inshore	0.0804	0.3244	0.9991	1.4039
	East Offshore	0.0001	0.0002	0.0010	0.0013
	East Inshore	0.0359	0.3332	0.3449	0.7140
	TOTAL	0.0928	0.2020	0.6258	0.9207

to total regional C in the later years (1976-1982) and relatively less important during the overall poor years of 1972-1975. Years of relatively high C/A in the eastern region, which occurred for the most part during the 1960s, generally coincided with years of high white shrimp C/A in the other regions. The period 1972-1975 were years of generally lower C/A, especially offshore in the western region (Figure 26).

From year to year, there did not appear to be any consistent changes in the relative importance of the different size classes of white shrimp to total C. Years of high C/A for the size class of smallest shrimp were also generally years of highest C/A of the intermediate size class, and often of the size of largest shrimp as well (e.g., 1964, 1969, and 1970).

Over the 23 year period 1960-1982, trends for inshore and offshore C were generally similar (Figure 26). Years of low C/A inshore (e.g., 1961, 1962, 1968-1969, 1972-1976) were also years of low C/A offshore, while years of high C inshore (1963, and 1969-1970) were also years of high C offshore. Beginning in 1977, this relationship appeared to change somewhat, with offshore C being relatively high thereafter and inshore C never increasing substantially over the lows of the 1972-1976 period.

Pink Shrimp

Mean C and C/A of pink shrimp by region and depth zone (Figures 28 and 29, and Table 45) reveals very interesting trends, especially with regard to inshore and offshore production. C/A in inshore waters decreased sharply from east to west across the Tuscaloosa Trend study area, with very few pink shrimp being caught in inshore waters west of the Mississippi River (i.e., the western region). While the most productive estuaries appeared to be in the eastern region, offshore C in the eastern region was only marginally higher than that in the western region, and very much lower than that in the central region. This may indicate that pink shrimp migrating from Florida and Alabama estuaries move westward into the central region of the Tuscaloosa Trend OCS. Such a pattern may indicate that pink shrimp prefer the silty sediments of the central region to the fine terrigenous sands off eastern Alabama and western Florida. Considering both inshore and offshore areas combined, C/A for the eastern and central regions were somewhat similar and considerably higher than that for the western region.

In offshore waters, C/A of pink shrimp decreased consistently with depth (Figure 29). C of pink shrimp have never been reported from depths beyond 100 m, and only rarely beyond 40 m. The estuarine pink shrimp C was made up almost exclusively of the smallest size class. The proportion of shrimp in the smallest size class to total C appears to decrease offshore out to 40 m depth. In contrast to the trends for brown shrimp, there was little indication that larger pink shrimp sought out the deeper portions of the depth range, with C/A of the two size classes of largest shrimp being generally higher at 0-20 m depth (Figure 29).

The relationship of size, season and depth zone are shown in Figure 30 and Table 46. C/A generally begins to increase slowly in inshore waters during the midwinter period, with more substantial increases occurring in March and April. C/A peaks in May (inshore) and June (0-20 m depths offshore) and then declines to low values in August. A second, modest

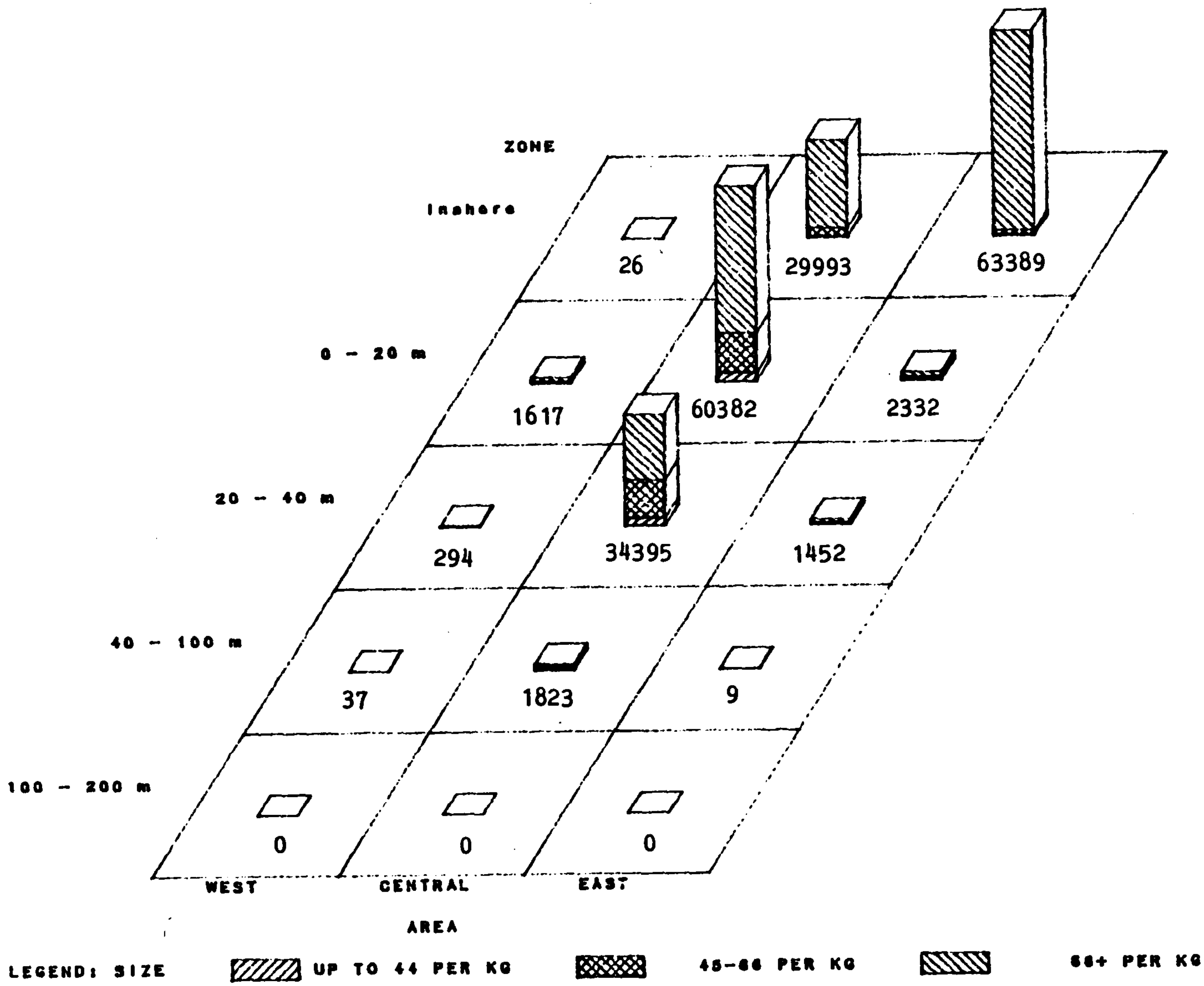

Figure 28. Region by depth by size means of pink shrimp catch (kg, heads on) for the Tuscaloosa Trend study area based on Gulf Coast Shrimp Data for the period 1960 to 1982.

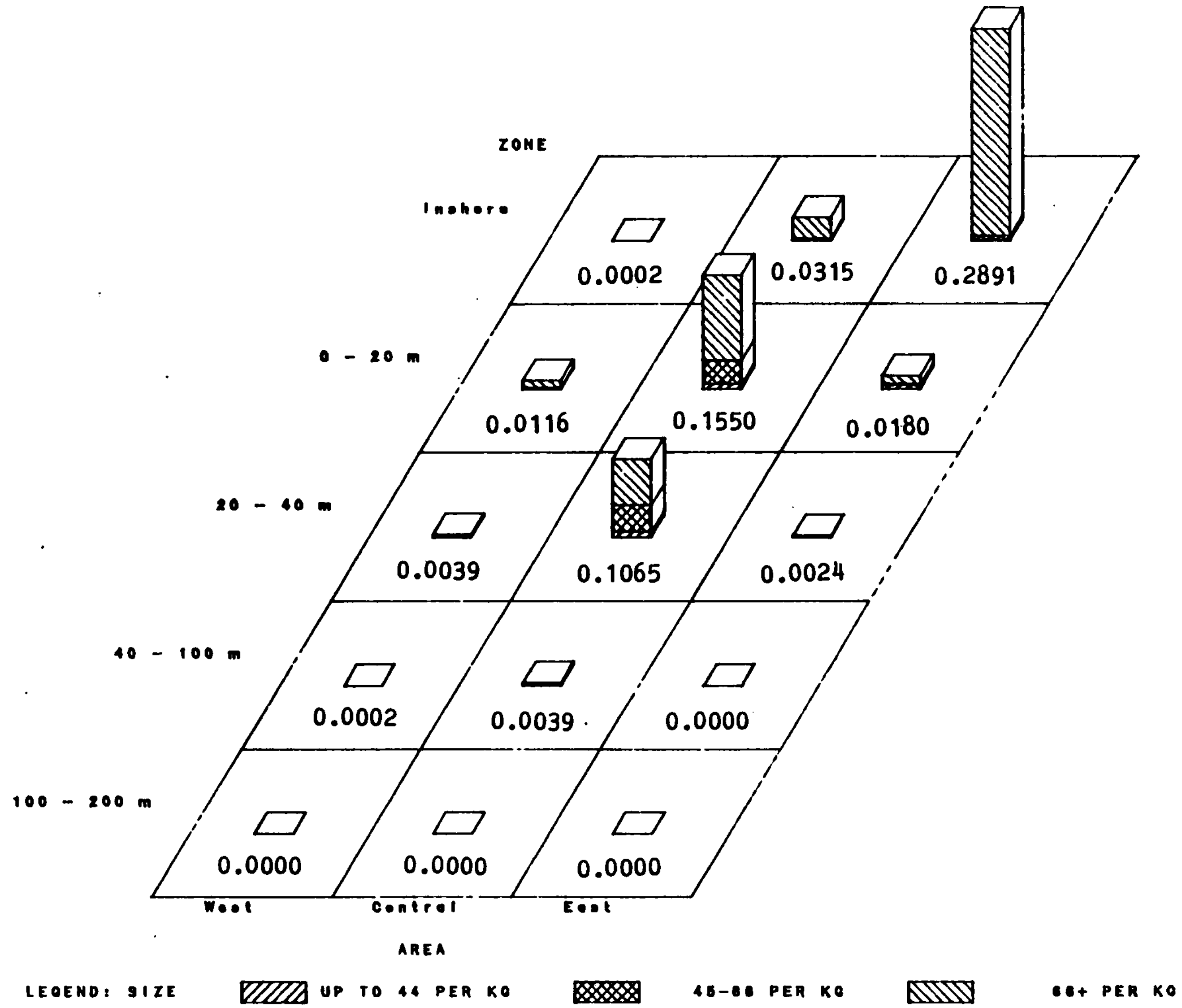

Figure 29. Region by depth by size means of pink shrimp catch/unit water surface area (kg, heads on, per ha) for the Tuscaloosa Trend study area based on Gulf Coast Shrimp Data for the period 1960 to 1982.

Table 45. Region by depth by size means of pink shrimp catch/unit water surface area (kg, heads on, per ha) for the Tuscaloosa Trend study area based on Gulf Coast Shrimp Data for the period 1960 to 1982.

P.DUORARUM		LT 44/KG	44-66/KG	GT 66/KG	TOTAL
WEST					
	Inshore	0.0000	0.0000	0.0002	0.0002
	0 - 20 m	0.0005	0.0011	0.0100	0.0116
	20 - 40 m	0.0000	0.0017	0.0022	0.0039
	40 - 100 m	0.0000	0.0001	0.0001	0.0002
	100 - 200 m	0.0000	0.0000	0.0000	0.0000
	REGION	0.0001	0.0004	0.0019	0.0023
CENTRAL					
	Inshore	0.0001	0.0028	0.0286	0.0315
	0 - 20 m	0.0065	0.0316	0.1169	0.1550
	20 - 40 m	0.0072	0.0367	0.0626	0.1065
	40 - 100 m	0.0005	0.0017	0.0017	0.0039
	100 - 200 m	0.0000	0.0000	0.0000	0.0000
	REGION	0.0021	0.0113	0.0383	0.0516
EAST					
	Inshore	0.0004	0.0061	0.2825	0.2891
	0 - 20 m	0.0049	0.0016	0.0115	0.0180
	20 - 40 m	0.0002	0.0007	0.0015	0.0024
	40 - 100 m	0.0000	0.0000	0.0000	0.0000
	100 - 200 m	0.0000	0.0000	0.0000	0.0000
	REGION	0.0004	0.0010	0.0316	0.0330
STUDY AREA MEANS					
	Inshore	0.0001	0.0031	0.0689	0.0722
	0 - 20 m	0.0049	0.0192	0.0735	0.0977
	20 - 40 m	0.0024	0.0122	0.0210	0.0356
	40 - 100 m	0.0002	0.0006	0.0006	0.0015
	100 - 200 m	0.0000	0.0000	0.0000	0.0000
		0.0011	0.0056	0.0299	0.0366

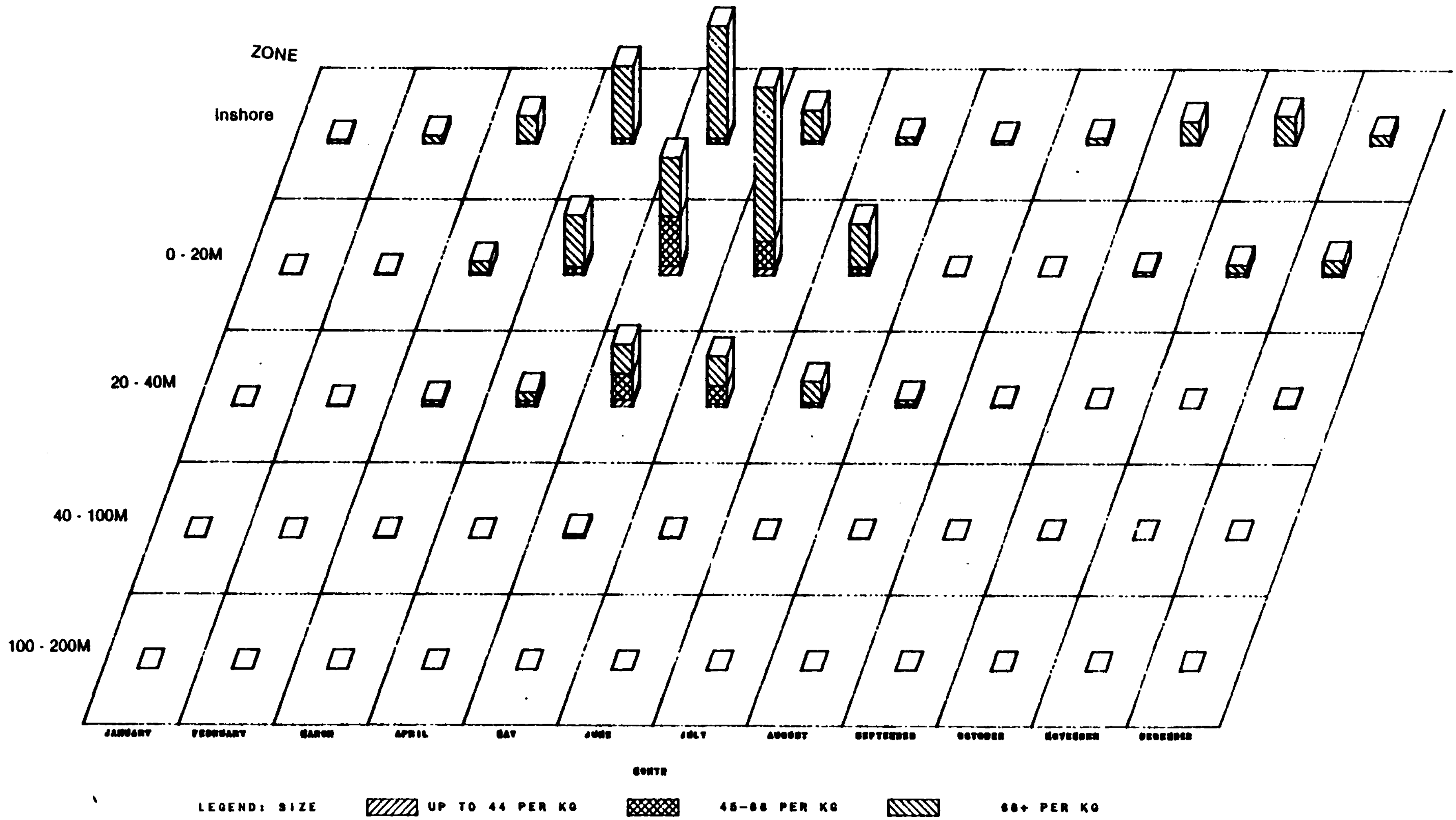

Figure 30. Month by depth by size means of pink shrimp catch/unit water surface area (kg, heads on, per ha) for the Tuscaloosa Trend study area based on Gulf Coast Shrimp Data for the period 1960 to 1982.

Table 46. Month by depth by size means of pink shrimp catch/unit water surface area (kg, heads on, per ha) for the Tuscaloosa Trend study area based on Gulf Coast Shrimp Data for the period 1960 to 1982.

P.DUORARUM	LT 44/KG	44-66/KG	GT 66/KG	TOTAL
January				
Inshore	0.0000	0.0000	0.0007	0.0007
0 - 20 m	0.0000	0.0000	0.0001	0.0001
20 - 40 m	0.0000	0.0000	0.0000	0.0001
40 - 100 m	0.0001	0.0000	0.0000	0.0001
100 - 200 m	0.0000	0.0000	0.0000	0.0000
TOTAL	0.0000	0.0000	0.0002	0.0002
February				
Inshore	0.0000	0.0000	0.0016	0.0016
0 - 20 m	0.0000	0.0000	0.0002	0.0002
20 - 40 m	0.0000	0.0001	0.0002	0.0002
40 - 100 m	0.0000	0.0000	0.0000	0.0000
100 - 200 m	0.0000	0.0000	0.0000	0.0000
TOTAL	0.0000	0.0000	0.0004	0.0005
March				
Inshore	0.0000	0.0003	0.0055	0.0058
0 - 20 m	0.0002	0.0002	0.0025	0.0028
20 - 40 m	0.0001	0.0002	0.0008	0.0011
40 - 100 m	0.0000	0.0001	0.0001	0.0002
100 - 200 m	0.0000	0.0000	0.0000	0.0000
TOTAL	0.0000	0.0002	0.0018	0.0020
April				
Inshore	0.0000	0.0010	0.0154	0.0163
0 - 20 m	0.0002	0.0014	0.0110	0.0126
20 - 40 m	0.0002	0.0009	0.0019	0.0030
40 - 100 m	0.0000	0.0000	0.0000	0.0000
100 - 200 m	0.0000	0.0000	0.0000	0.0000
TOTAL	0.0001	0.0006	0.0055	0.0061
May				
Inshore	0.0000	0.0010	0.0237	0.0247
0 - 20 m	0.0018	0.0105	0.0125	0.0248
20 - 40 m	0.0013	0.0056	0.0062	0.0131
40 - 100 m	0.0000	0.0004	0.0005	0.0008
100 - 200 m	0.0000	0.0000	0.0000	0.0000
TOTAL	0.0005	0.0027	0.0086	0.0117

Table 46. Continued.

P.DUORARUM	LT 44/KG	44-66/KG	GT 66/KG	TOTAL
June				
Inshore	0.0000	0.0005	0.0065	0.0070
0 - 20 m	0.0015	0.0056	0.0326	0.0397
20 - 40 m	0.0005	0.0038	0.0064	0.0107
40 - 100 m	0.0001	0.0001	0.0000	0.0002
100 - 200 m	0.0000	0.0000	0.0000	0.0000
TOTAL	0.0003	0.0015	0.0068	0.0087
July				
Inshore	0.0000	0.0001	0.0013	0.0013
0 - 20 m	0.0003	0.0013	0.0093	0.0109
20 - 40 m	0.0001	0.0008	0.0044	0.0053
40 - 100 m	0.0000	0.0000	0.0000	0.0000
100 - 200 m	0.0000	0.0000	0.0000	0.0000
TOTAL	0.0001	0.0003	0.0023	0.0027
August				
Inshore	0.0000	0.0000	0.0006	0.0006
0 - 20 m	0.0000	0.0000	0.0000	0.0000
20 - 40 m	0.0001	0.0005	0.0009	0.0014
40 - 100 m	0.0000	0.0001	0.0000	0.0001
100 - 200 m	0.0000	0.0000	0.0000	0.0000
TOTAL	0.0000	0.0001	0.0003	0.0004
September				
Inshore	0.0000	0.0000	0.0012	0.0012
0 - 20 m	0.0000	0.0000	0.0000	0.0000
20 - 40 m	0.0000	0.0003	0.0000	0.0003
40 - 100 m	0.0000	0.0000	0.0000	0.0000
100 - 200 m	0.0000	0.0000	0.0000	0.0000
TOTAL	0.0000	0.0001	0.0003	0.0004
October				
Inshore	0.0000	0.0003	0.0046	0.0049
0 - 20 m	0.0000	0.0000	0.0009	0.0009
20 - 40 m	0.0000	0.0000	0.0000	0.0000
40 - 100 m	0.0000	0.0001	0.0000	0.0001
100 - 200 m	0.0000	0.0000	0.0000	0.0000
TOTAL	0.0000	0.0001	0.0012	0.0013

Table 46. Continued.

P.DUORARUM	LT 44/KG	44-66/KG	GT 66/KG	TOTAL
November				
Inshore	0.0000	0.0000	0.0060	0.0060
0 - 20 m	0.0007	0.0000	0.0016	0.0024
20 - 40 m	0.0000	0.0000	0.0000	0.0000
40 - 100 m	0.0000	0.0000	0.0000	0.0000
100 - 200 m	0.0000	0.0000	0.0000	0.0000
TOTAL	0.0001	0.0000	0.0017	0.0018
December				
Inshore	0.0000	0.0000	0.0020	0.0020
0 - 20 m	0.0002	0.0002	0.0029	0.0033
20 - 40 m	0.0001	0.0001	0.0002	0.0003
40 - 100 m	0.0000	0.0000	0.0000	0.0000
100 - 200 m	0.0000	0.0000	0.0000	0.0000
TOTAL	0.0000	0.0000	0.0009	0.0010

increase in C/A generally occurs both inshore and offshore in the midfall to early winter period, with the peak occurring later and being of shorter duration further offshore. This fall C mainly involved the size class of smallest shrimp. While these results undoubtedly reflect increased densities of pink shrimp in the spring and early summer, the fall increase may be an artifact. Pink shrimp C/A in the Tuscaloosa Trend study area was generally low, and much of the C is probably due to effort directed at other species (i.e., brown shrimp in the spring and early summer and white shrimp in the fall to winter). This may be especially so for the fall peak. However, the fact that the fall peak involves the size class of smallest shrimp indicates that spawning must take place over a long period of time. If this were true, it would indicate that pink shrimp reach adulthood early enough in the year to spawn in early summer, with the fall peak in C being the result of this early summer spawning.

There were some indications of changes in the relative importance of the several size classes of pink shrimp over the typical year (Figure 30). C/A was highest for all three size classes in May, although the size class of smallest shrimp appeared in relatively larger numbers earlier in the year. The size classes of intermediate and large sized shrimp were best represented in May, when they made up almost half of the offshore C. By July, they were virtually unrepresented. As discussed above, the fall peak consists mainly of shrimp of the smallest size class.

In the central region, years of relatively high C included 1969, 1977, 1979 and 1982. These were years of relatively high C both inshore and offshore (Figure 31). For the eastern region, years of relatively high C generally occurred earlier in the record (1961, 1963, 1966-1968, and 1973-1975) and were dominated in all years by inshore C. This shift in relative importance of the eastern and central regions represented the greatest regional change over the 23 year period. It was attributable mainly to substantial decreases in inshore C in the eastern region since 1976 and, except for the period 1974 and 1975, to higher C offshore in the central region since the late 1960s. Inshore C has also been higher in the central region in the 1970s, but the trends were less consistent than for offshore C. C/A in the estuaries of the eastern region in 1980 was an order of magnitude lower than during some of the better earlier years.

Figure 31 and Table 47 indicate that there was an inverse relationship of pink shrimp C inshore and offshore, at least during some years. This was quite unlike the situation for brown and white shrimp, where inshore and offshore C were positively related. Prior to 1970, inshore and offshore pink shrimp C were positively related. However, in 1971-1972, 1977-1978 and 1980-1982, inshore production was relatively low while offshore production was relatively high. Figure 31 shows that during these years C/A in the estuaries of the eastern area was consistently low, while C/A in the estuaries of the central region was not. During the period 1973-1975, inshore production was relatively high while offshore production decreased through the period. C/A in the estuaries of the central region was at intermediate levels during these years, increasing slightly through the period (Figure 31). The offshore C in 1975 was the lowest of the 23 year period, and may have been at least partly due to greatly decreased effort during that year.

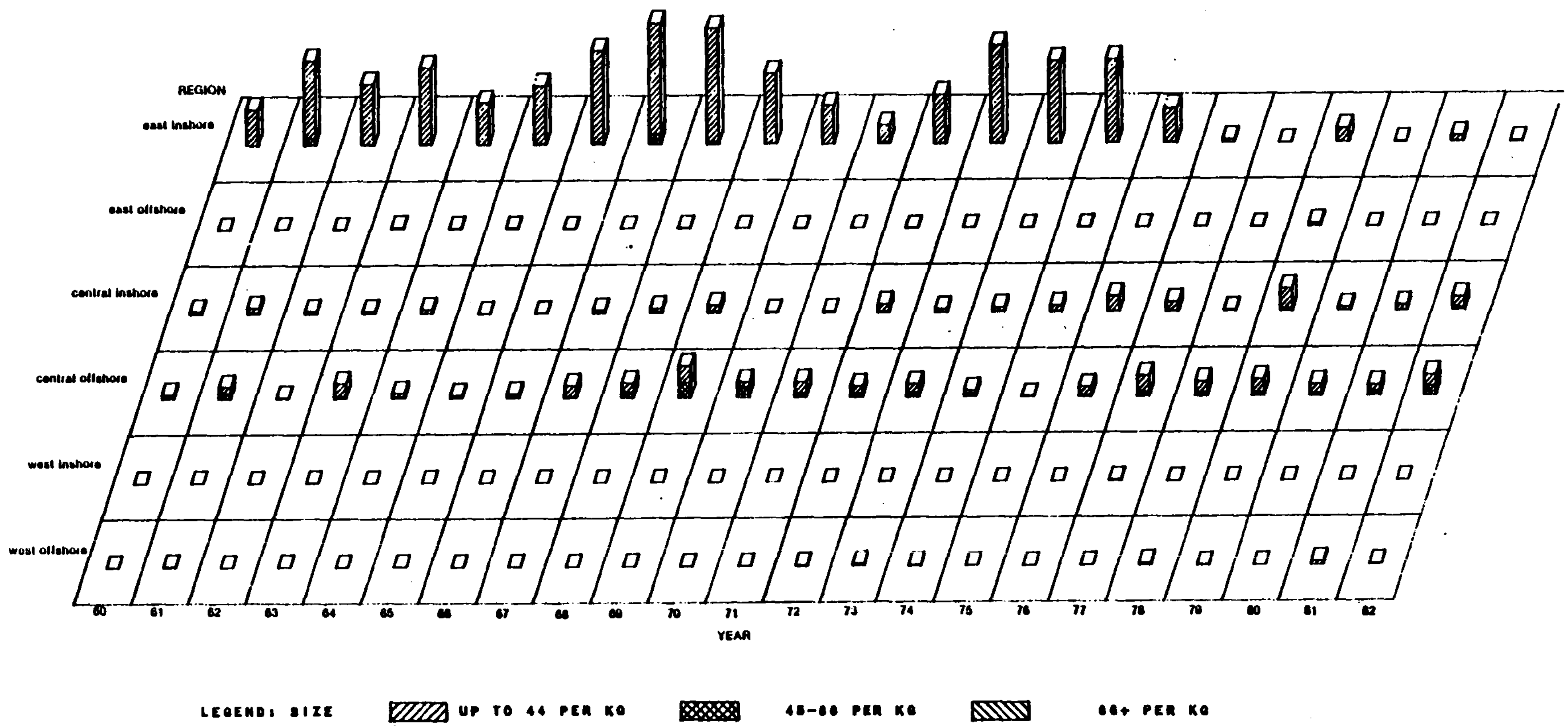

Figure 31. Year by region by size means of pink shrimp catch/unit water surface area (kg, heads on, per ha) for the Tuscaloosa Trend study area based on Gulf Coast Shrimp Data for the period 1960 to 1982.

Table 47. Year by region by size means of pink shrimp catch/unit water surface area (kg, heads on, per ha) for the Tuscaloosa Trend study area based on Gulf Coast Shrimp Data for the period 1960 to 1982.

P.DUORARUM		LT 44/KG	44-66/KG	GT 66/KG	TOTAL
1960					
	West Offshore	0.0000	0.0000	0.0000	0.0000
	West Inshore	0.0000	0.0000	0.0000	0.0000
	Central Offshore	0.0017	0.0071	0.0130	0.0219
	Central Inshore	0.0000	0.0020	0.0139	0.0158
	East Offshore	0.0000	0.0000	0.0003	0.0003
	East Inshore	0.0000	0.0000	0.2047	0.2047
	TOTAL	0.0005	0.0023	0.0146	0.0175
1961					
	West Offshore	0.0003	0.0023	0.0000	0.0025
	West Inshore	0.0000	0.0000	0.0000	0.0000
	Central Offshore	0.0016	0.0283	0.0378	0.0677
	Central Inshore	0.0001	0.0045	0.0277	0.0324
	East Offshore	0.0000	0.0000	0.0000	0.0000
	East Inshore	0.0022	0.0366	0.4385	0.4774
	TOTAL	0.0006	0.0105	0.0335	0.0447
1962					
	West Offshore	0.0000	0.0000	0.0000	0.0000
	West Inshore	0.0000	0.0000	0.0000	0.0000
	Central Offshore	0.0000	0.0009	0.0023	0.0032
	Central Inshore	0.0000	0.0000	0.0148	0.0148
	East Offshore	0.0000	0.0009	0.0005	0.0014
	East Inshore	0.0010	0.0017	0.3440	0.3467
	TOTAL	0.0001	0.0006	0.0176	0.0182
1963					
	West Offshore	0.0000	0.0000	0.0001	0.0001
	West Inshore	0.0000	0.0000	0.0000	0.0000
	Central Offshore	0.0009	0.0124	0.0722	0.0854
	Central Inshore	0.0000	0.0017	0.0084	0.0101
	East Offshore	0.0000	0.0000	0.0085	0.0085
	East Inshore	0.0000	0.0028	0.4333	0.4361
	TOTAL	0.0002	0.0039	0.0424	0.0465
1964					
	West Offshore	0.0000	0.0000	0.0009	0.0009
	West Inshore	0.0000	0.0000	0.0000	0.0000
	Central Offshore	0.0007	0.0040	0.0226	0.0274
	Central Inshore	0.0000	0.0006	0.0213	0.0219
	East Offshore	0.0000	0.0003	0.0041	0.0044
	East Inshore	0.0000	0.0000	0.2365	0.2365
	TOTAL	0.0002	0.0013	0.0214	0.0229

Table 47. Continued.

P.DUORARUM		LT 44/KG	44-66/KG	GT 66/KG	TOTAL
1980					
	West Offshore	0.0000	0.0000	0.0000	0.0000
	West Inshore	0.0000	0.0000	0.0000	0.0000
	Central Offshore	0.0052	0.0067	0.0509	0.0628
	Central Inshore	0.0000	0.0002	0.0197	0.0199
	East Offshore	0.0000	0.0000	0.0013	0.0013
	East Inshore	0.0000	0.0000	0.0030	0.0030
	TOTAL	0.0015	0.0019	0.0183	0.0217
1981					
	West Offshore	0.0000	0.0001	0.0186	0.0187
	West Inshore	0.0000	0.0000	0.0000	0.0000
	Central Offshore	0.0058	0.0174	0.0341	0.0573
	Central Inshore	0.0000	0.0018	0.0315	0.0333
	East Offshore	0.0000	0.0000	0.0006	0.0006
	East Inshore	0.0000	0.0009	0.0324	0.0333
	TOTAL	0.0016	0.0053	0.0193	0.0262
1982					
	West Offshore	0.0000	0.0001	0.0040	0.0041
	West Inshore	0.0000	0.0000	0.0000	0.0000
	Central Offshore	0.0162	0.0345	0.0617	0.1124
	Central Inshore	0.0001	0.0147	0.0592	0.0739
	East Offshore	0.0000	0.0000	0.0000	0.0000
	East Inshore	0.0001	0.0001	0.0046	0.0048
	TOTAL	0.0046	0.0123	0.0286	0.0455

Table 47. Continued.

P.DUORARUM		LT 44/KG	44-66/KG	GT 66/KG	TOTAL
1975					
	West Offshore	0.0000	0.0000	0.0000	0.0000
	West Inshore	0.0000	0.0000	0.0000	0.0000
	Central Offshore	0.0002	0.0001	0.0011	0.0015
	Central Inshore	0.0000	0.0035	0.0335	0.0370
	East Offshore	0.0000	0.0007	0.0007	0.0014
	East Inshore	0.0000	0.0020	0.4515	0.4535
	TOTAL	0.0001	0.0010	0.0251	0.0261
1976					
	West Offshore	0.0000	0.0000	0.0000	0.0000
	West Inshore	0.0000	0.0000	0.0000	0.0000
	Central Offshore	0.0001	0.0041	0.0469	0.0512
	Central Inshore	0.0000	0.0000	0.0860	0.0860
	East Offshore	0.0000	0.0000	0.0000	0.0000
	East Inshore	0.0000	0.0028	0.1836	0.1864
	TOTAL	0.0000	0.0013	0.0360	0.0373
1977					
	West Offshore	0.0000	0.0000	0.0000	0.0000
	West Inshore	0.0000	0.0000	0.0049	0.0049
	Central Offshore	0.0018	0.0179	0.0917	0.1115
	Central Inshore	0.0000	0.0013	0.0521	0.0534
	East Offshore	0.0000	0.0000	0.0000	0.0000
	East Inshore	0.0000	0.0000	0.0158	0.0158
	TOTAL	0.0005	0.0053	0.0358	0.0416
1978					
	West Offshore	0.0000	0.0010	0.0106	0.0115
	West Inshore	0.0000	0.0000	0.0000	0.0000
	Central Offshore	0.0023	0.0136	0.0650	0.0809
	Central Inshore	0.0000	0.0003	0.0055	0.0058
	East Offshore	0.0000	0.0006	0.0005	0.0011
	East Inshore	0.0000	0.0000	0.0001	0.0001
	TOTAL	0.0007	0.0042	0.0208	0.0257
1979					
	West Offshore	0.0003	0.0000	0.0013	0.0015
	West Inshore	0.0000	0.0000	0.0000	0.0000
	Central Offshore	0.0034	0.0125	0.0740	0.0899
	Central Inshore	0.0010	0.0127	0.1110	0.1247
	East Offshore	0.0074	0.0001	0.0101	0.0175
	East Inshore	0.0000	0.0000	0.0749	0.0749
	TOTAL	0.0037	0.0058	0.0472	0.0567

Table 47. Continued.

P.DUORARUM		LT 44/KG	44-66/KG	GT 66/KG	TOTAL
1965					
	West Offshore	0.0000	0.0000	0.0000	0.0000
	West Inshore	0.0000	0.0000	0.0000	0.0000
	Central Offshore	0.0006	0.0027	0.0126	0.0159
	Central Inshore	0.0000	0.0000	0.0010	0.0010
	East Offshore	0.0002	0.0006	0.0016	0.0023
	East Inshore	0.0000	0.0015	0.3293	0.3309
	TOTAL	0.0002	0.0010	0.0178	0.0190
1966					
	West Offshore	0.0000	0.0000	0.0000	0.0000
	West Inshore	0.0000	0.0000	0.0000	0.0000
	Central Offshore	0.0012	0.0023	0.0178	0.0213
	Central Inshore	0.0002	0.0000	0.0005	0.0006
	East Offshore	0.0000	0.0000	0.0007	0.0007
	East Inshore	0.0000	0.0116	0.5196	0.5311
	TOTAL	0.0004	0.0011	0.0266	0.0281
1967					
	West Offshore	0.0000	0.0003	0.0003	0.0006
	West Inshore	0.0000	0.0000	0.0000	0.0000
	Central Offshore	0.0002	0.0077	0.0607	0.0686
	Central Inshore	0.0000	0.0000	0.0171	0.0171
	East Offshore	0.0000	0.0000	0.0000	0.0000
	East Inshore	0.0019	0.0556	0.6273	0.6847
	TOTAL	0.0001	0.0045	0.0459	0.0505
1968					
	West Offshore	0.0000	0.0000	0.0000	0.0000
	West Inshore	0.0000	0.0000	0.0000	0.0000
	Central Offshore	0.0040	0.0281	0.0524	0.0845
	Central Inshore	0.0000	0.0060	0.0197	0.0258
	East Offshore	0.0013	0.0036	0.0002	0.0051
	East Inshore	0.0031	0.0133	0.6404	0.6568
	TOTAL	0.0017	0.0107	0.0446	0.0570
1969					
	West Offshore	0.0005	0.0000	0.0000	0.0005
	West Inshore	0.0000	0.0000	0.0000	0.0000
	Central Offshore	0.0015	0.0834	0.0953	0.1802
	Central Inshore	0.0003	0.0093	0.0360	0.0457
	East Offshore	0.0000	0.0000	0.0000	0.0000
	East Inshore	0.0000	0.0021	0.3966	0.3987
	TOTAL	0.0005	0.0251	0.0494	0.0751

Table 47. Continued.

P.DUORARUM	LT 44/KG	44-66/KG	GT 66/KG	TOTAL
1970				
West Offshore	0.0008	0.0006	0.0000	0.0014
West Inshore	0.0000	0.0000	0.0000	0.0000
Central Offshore	0.0162	0.0453	0.0282	0.0897
Central Inshore	0.0000	0.0018	0.0039	0.0057
East Offshore	0.0000	0.0007	0.0011	0.0018
East Inshore	0.0000	0.0001	0.2186	0.2187
TOTAL	0.0046	0.0133	0.0179	0.0359
1971				
West Offshore	0.0003	0.0003	0.0006	0.0012
West Inshore	0.0000	0.0000	0.0000	0.0000
Central Offshore	0.0063	0.0137	0.0663	0.0863
Central Inshore	0.0000	0.0020	0.0060	0.0080
East Offshore	0.0000	0.0000	0.0000	0.0000
East Inshore	0.0009	0.0054	0.0986	0.1048
TOTAL	0.0018	0.0045	0.0238	0.0301
1972				
West Offshore	0.0000	0.0003	0.0030	0.0034
West Inshore	0.0000	0.0000	0.0000	0.0000
Central Offshore	0.0038	0.0138	0.0429	0.0605
Central Inshore	0.0000	0.0008	0.0452	0.0460
East Offshore	0.0006	0.0005	0.0002	0.0014
East Inshore	0.0000	0.0009	0.2669	0.2678
TOTAL	0.0013	0.0043	0.0315	0.0371
1973				
West Offshore	0.0000	0.0038	0.0075	0.0114
West Inshore	0.0000	0.0000	0.0000	0.0000
Central Offshore	0.0009	0.0195	0.0497	0.0701
Central Inshore	0.0000	0.0004	0.0188	0.0192
East Offshore	0.0000	0.0000	0.0000	0.0000
East Inshore	0.0000	0.0027	0.5307	0.5334
TOTAL	0.0002	0.0062	0.0401	0.0465
1974				
West Offshore	0.0000	0.0008	0.0024	0.0032
West Inshore	0.0000	0.0000	0.0000	0.0000
Central Offshore	0.0037	0.0070	0.0226	0.0332
Central Inshore	0.0000	0.0010	0.0248	0.0258
East Offshore	0.0000	0.0000	0.0001	0.0001
East Inshore	0.0000	0.0013	0.4471	0.4485
TOTAL	0.0010	0.0023	0.0294	0.0328

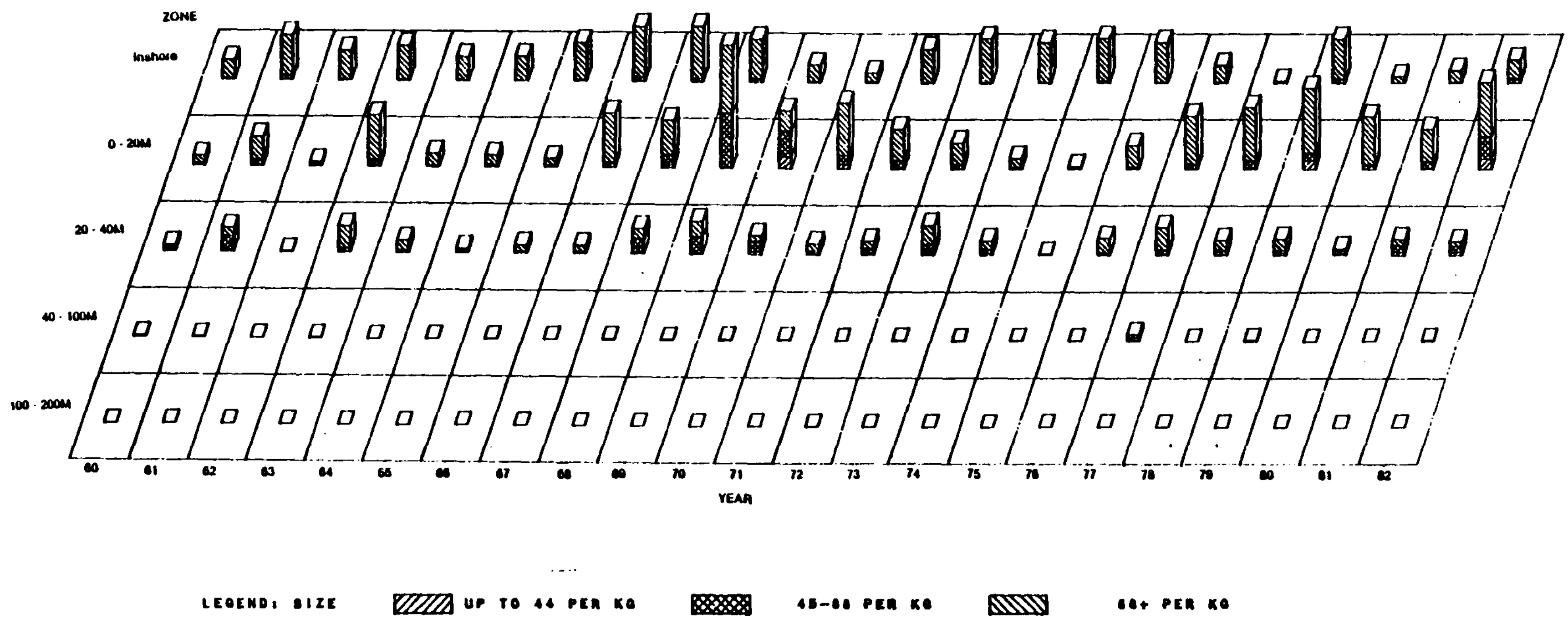

Figure 32. Year by depth by size means of pink shrimp catch/unit water surface area (kg, heads on, per ha) for the Tuscaloosa Trend study area based on Gulf Coast Shrimp Data for the period 1960 to 1982.

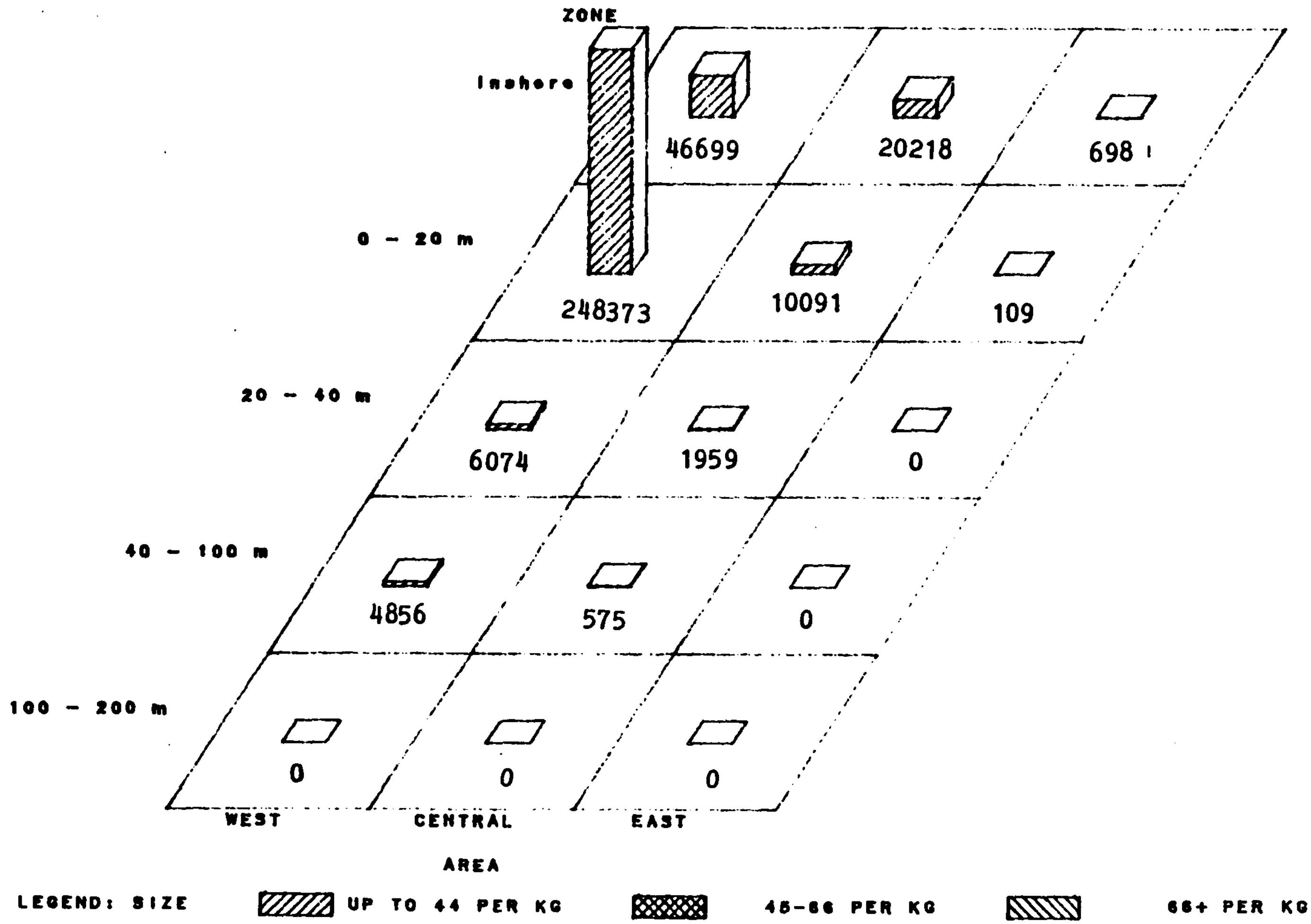

Figure 33. Region by depth means of seabob catch (kg, heads on) for the Tuscaloosa Trend study area based on Gulf Coast Shrimp Data for the period 1960 to 1982.

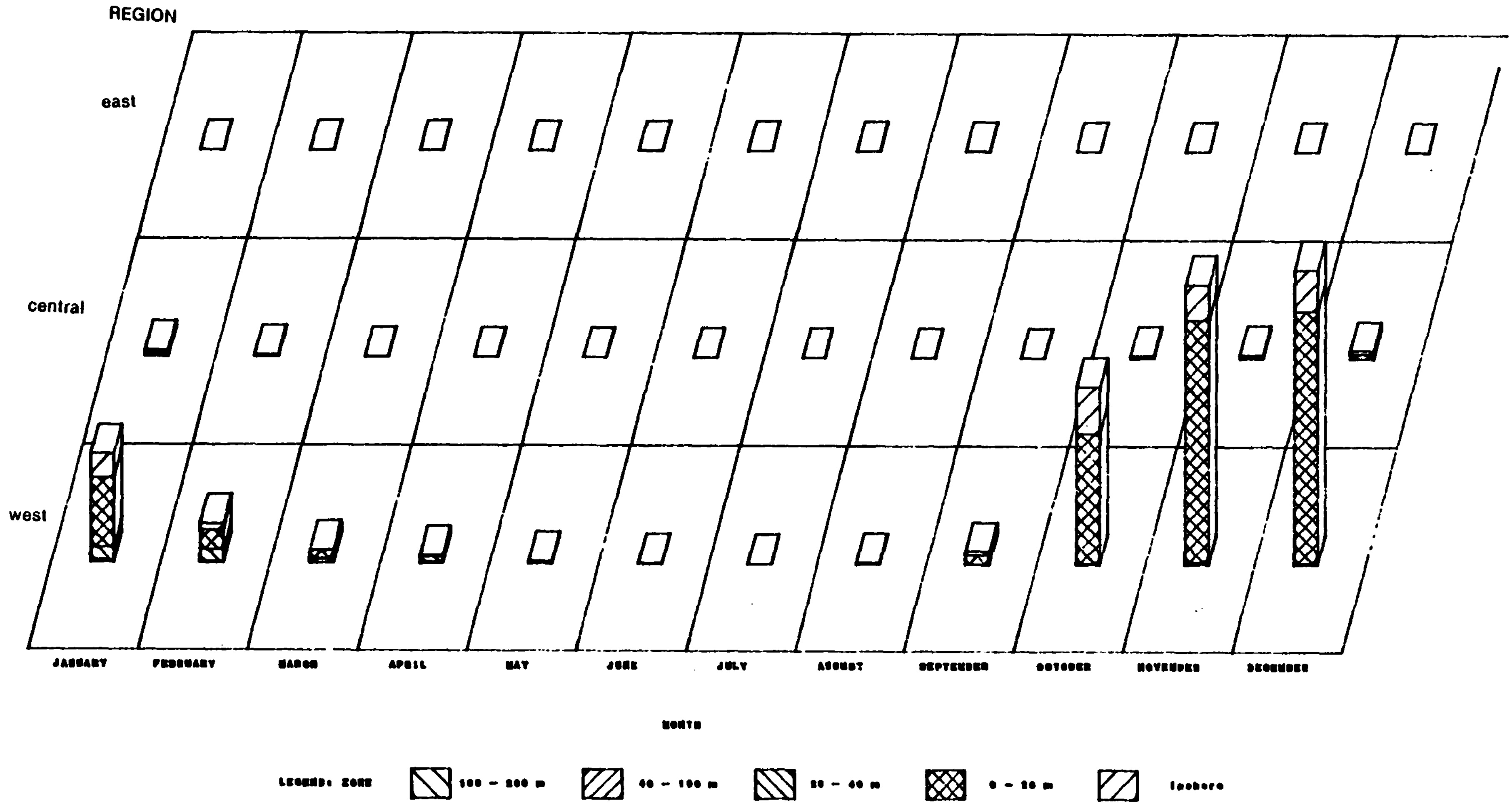

Figure 34. Month by region by depth means of seabob catch/unit water surface area (kg, heads on, per ha) for the Tuscaloosa Trend study area based on Gulf Coast Shrimp Data for the period 1960 to 1982.

Table 48. Region by depth means of seabob catch (kg, heads on) for the Tuscaloosa Trend study area based on Gulf Coast Shrimp Data for the period 1960 to 1982.

X.KROYERI		TOTAL CATCH IN KILOGRAMS
WEST		
	Inshore	46699
	0 - 20 m	248373
	20 - 40 m	6074
	40 - 100 m	4856
	100 - 200 m	0
	REGION TOTAL	306003
CENTRAL		
	Inshore	20218
	0 - 20 m	10091
	20 - 40 m	1959
	40 - 100 m	575
	100 - 200 m	0
	REGION TOTAL	32844
EAST		
	Inshore	698
	0 - 20 m	109
	20 - 40 m	0
	40 - 100 m	0
	100 - 200 m	0
	REGION TOTAL	807
	SPECIES TOTAL	339654

Table 49. Month by region by depth means of seabob catch/unit water surface area (kg, heads on, per ha) for the Tuscaloosa Trend study area based on Gulf Coast Shrimp Data for the period 1960 to 1982.

	January	February	March	April	May	June	July	August	September	October	November	December
WEST												
Inshore	0.0578	0.0144	0.0017	0.0000	0.0000	0.0000	0.0002	0.0000	0.0084	0.1105	0.0844	0.0979
0 - 20 m	0.1645	0.0475	0.0203	0.0017	0.0030	0.0006	0.0001	0.0022	0.0214	0.3082	0.5756	0.5981
20 - 40 m	0.0303	0.0265	0.0008	0.0122	0.0013	0.0000	0.0000	0.0000	0.0000	0.0026	0.0058	0.0000
40 - 100 m	0.0042	0.0030	0.0080	0.0029	0.0003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0035
100 - 200 m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
AREA MEAN	0.0389	0.0129	0.0057	0.0021	0.0007	0.0001	0.0000	0.0004	0.0047	0.0664	0.1067	0.1127
CENTRAL												
Inshore	0.0016	0.0002	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0004	0.0060	0.0042	0.0083
0 - 20 m	0.0071	0.0027	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.0001	0.0006	0.0040	0.0108
20 - 40 m	0.0046	0.0007	0.0000	0.0001	0.0000	0.0000	0.0003	0.0000	0.0000	0.0000	0.0002	0.0000
40 - 100 m	0.0000	0.0012	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
100 - 200 m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
AREA MEAN	0.0024	0.0009	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0002	0.0024	0.0023	0.0049
EAST												
Inshore	0.0000	0.0002	0.0002	0.0013	0.0009	0.0003	0.0000	0.0000	0.0000	0.0000	0.0001	0.0001
0 - 20 m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0004	0.0000	0.0000	0.0000	0.0004
20 - 40 m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
40 - 100 m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
100 - 200 m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
AREA MEAN	0.0000	0.0000	0.0000	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

No consistent trends in C/A were apparent among the three size classes of pink shrimp over the 23 year period. Years of high C/A for the different size classes appear to bear little relationship to one another. The years 1969 and 1970 were exceptional, with C/A of the size class of intermediate sized shrimp in offshore waters constituting half the total C (Figure 32). The size class of largest shrimp was most important in 1970, 1979 and 1982.

Seabobs

Figure 33 and Table 48 shows mean seabob C by region and depth (over all years and months), while Figure 34 and Table 49 present month by region by depth means of seabob C/A. Virtually all of the seabob harvest in the Tuscaloosa Trend study area was taken from the western region (i.e., west of the Mississippi River delta). C/A in the central region was very low considering the substantial C for Penaeus spp. Only a token number of seabobs have been reported from the eastern region, and all of those were from GCSD statistical subarea 10, which encompassed the western half of the eastern region (see Figures 9 and 10). Since the sediment composition in the eastern region is relatively sandy, the absence of seabobs on these bottoms is not surprising.

Going westward across the study area, seabob C/A in inshore waters constituted relatively less of the regional totals, although in absolute terms C/A in inshore waters increased dramatically from east to west. In the eastern region, highest C/A was reported in inshore waters, with no C reported beyond 20 m depths. In the central and western regions, C of seabobs were reported out to 100 m depths, but C/A in both regions decreased dramatically with depth. In the western region, C/A was by far the highest in the nearshore zone (0-20 m depths), while, in the central region, C/A in inshore waters and in the shallow (0-20 m) depths offshore were similar. The relatively small contribution of estuaries to total seabob production is consistent with the general feeling that they are not estuarine dependent. The estuarine contribution to total seabob C in any one month remains fairly consistent over the year.

Trends in seabob C/A in the central and western regions, where C has been reported during most months, were very similar over the year (Figure 34). Seabob C/A first increased in August and September, with substantially higher values reported during the fall and early winter (October to January). C/A then declined throughout the remainder of the winter and spring, reaching lowest values in the May-July period. Seasonal patterns in the eastern region, where C/A was generally much lower, were quite different from those in the central and western regions. C/A was relatively high in the eastern region when C/A was relatively low in the other regions (May) and was lowest when C/A in the central and western regions was highest (October).

In the western region, the same general seasonal pattern was exhibited at all depths at which seabobs were caught (inshore to 100 m depths offshore), with departures from this basic pattern becoming more noticeable as depth increases. While inshore waters and the 0-20 m depths offshore showed very similar seasonal patterns, C/A was consistently higher in the shallow Gulf, especially during months of high C. Catches in waters greater than 20 m in depth did not constitute a substantial fraction of the total seabob C until December, after which they increased through winter and early spring. The depth by month trends (Figure 34) appear to indicate an offshore migration with time. C/A in the 20-40 m depth zone remained near zero until January, when it increased sharply and remained relatively high through April. C/A was higher in 40-100 m depths in March and May compared to inshore waters, and higher in both the 20-40 m depths and the 40-100 m depths in April compared to the 0-20 m depths.

Over the 23 year period 1960-1982, seabob C/A showed inconsistent trends across the three regions, with only the means for the western region being substantial during all years (Figure 35 and Table 50). In this region, higher seabob C were reported in 1962, 1970, 1975, 1977 and 1979-1981, while 1971 was represented by the lowest C/A. Other years of relatively low C/A in the western region included 1963, 1967, 1969, 1976 and 1979. Since 1977, during years of relatively high C, virtually no seabobs were caught inshore, with the vast majority being harvested in the shallow Gulf in waters less than 20 m depth. Considering the years of higher C in the western region, only 1962 and 1975 showed substantial inshore C. In 1962, the best year for seabob C during the 1960s, C/A was relatively evenly distributed out to 100 m depths. C/A in the central region appears to be generally higher since 1978, with most years of low C/A occurring before 1970.

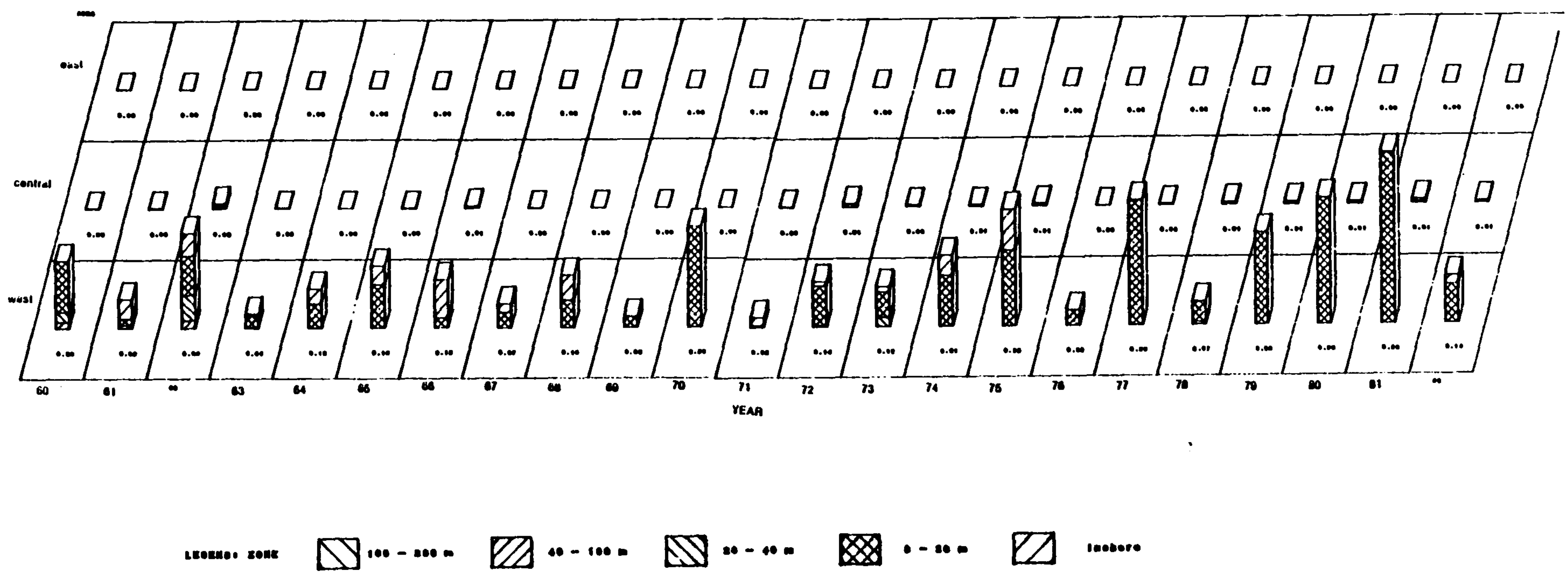

Figure 35. Year by region by depth means of seabob catch/unit water surface area (kg, heads on, per ha) for the Tuscaloosa Trend study area based on Gulf Coast Shrimp Data for the period 1960 to 1982.

Table 50. Year by region by depth means of seabob catch/unit water surface area (kg, heads on, per ha) for the Tuscaloosa Trend study area based on Gulf Coast Shrimp Data for the period 1960 to 1982.

	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971
WEST												
Inshore	0.0000	0.7103	0.8169	0.0733	0.5343	0.6790	1.3811	0.3077	0.9014	0.0145	0.0000	0.3000
0 - 20 m	1.8382	0.2303	1.4162	0.4154	0.8710	1.5404	0.3438	0.5521	0.9756	0.3730	3.5952	0.0563
20 - 40 m	0.3710	0.0993	0.8992	0.0025	0.0031	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
40 - 100 m	0.2110	0.0000	0.2779	0.0162	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
100 - 200 m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
AREA MEAN	1.0981	0.4197	1.4134	0.2349	0.6219	0.9906	0.7196	0.3811	0.8185	0.1791	1.6694	0.1478
CENTRAL												
Inshore	0.0000	0.0246	0.0848	0.0020	0.0023	0.0001	0.0746	0.0000	0.0000	0.0000	0.0008	0.0247
0 - 20 m	0.0000	0.0002	0.0095	0.0108	0.0005	0.0069	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
20 - 40 m	0.0091	0.0043	0.0670	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
40 - 100 m	0.0000	0.0000	0.0277	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
100 - 200 m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
AREA MEAN	0.0092	0.0783	0.3744	0.0194	0.0075	0.0087	0.2235	0.0000	0.0000	0.0000	0.0025	0.0739
EAST												
Inshore	0.0000	0.0000	0.0000	0.0044	0.0000	0.0054	0.0112	0.0123	0.0107	0.0039	0.0023	0.0000
0 - 20 m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
20 - 40 m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
40 - 100 m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
100 - 200 m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
AREA MEAN	0.0000	0.0000	0.0000	0.0020	0.0000	0.0024	0.0050	0.0055	0.0048	0.0017	0.0010	0.0000

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
WEST											
Inshore	0.1677	0.1967	0.7262	1.4562	0.0000	0.0092	0.0000	0.0000	0.0041	0.0325	0.3219
0 - 20 m	1.4161	0.9088	1.8037	2.7089	0.5414	4.4666	0.7415	3.2979	4.5258	6.0969	1.3801
20 - 40 m	0.0456	0.3214	0.0000	0.0000	0.0000	0.0000	0.0836	0.0000	0.0000	0.0000	0.0000
40 - 100 m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
100 - 200 m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
AREA MEAN	0.7369	0.5819	1.1320	1.8484	0.2514	2.0778	0.3651	1.5314	2.1032	2.8443	0.7714
CENTRAL											
Inshore	0.0051	0.0009	0.0366	0.0777	0.0018	0.0215	0.0617	0.0092	0.0020	0.0020	0.0457
0 - 20 m	0.1098	0.0575	0.0241	0.0095	0.0000	0.0146	0.0232	0.0813	0.1040	0.0899	0.0417
20 - 40 m	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0562	0.0000
40 - 100 m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
100 - 200 m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
AREA MEAN	0.1499	0.0730	0.1392	0.2444	0.0054	0.0821	0.2132	0.1270	0.1334	0.1731	0.1879
EAST											
Inshore	0.0034	0.0033	0.0021	0.0007	0.0004	0.0000	0.0000	0.0003	0.0010	0.0000	0.0103
0 - 20 m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0103	0.0086	0.0000	0.0000	0.0000
20 - 40 m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
40 - 100 m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
100 - 200 m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
AREA MEAN	0.0015	0.0015	0.0009	0.0003	0.0002	0.0000	0.0027	0.0024	0.0005	0.0000	0.0046

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The Department of the Interior Mission

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The Department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

The Minerals Management Service Mission

As a bureau of the Department of the Interior, the Minerals Management Service's (MMS) primary responsibilities are to manage the mineral resources located on the Nation's Outer Continental Shelf (OCS), collect revenue from the Federal OCS and onshore Federal and Indian lands, and distribute those revenues.

Moreover, in working to meet its responsibilities, the **Offshore Minerals Management Program** administers the OCS competitive leasing program and oversees the safe and environmentally sound exploration and production of our Nation's offshore natural gas, oil and other mineral resources. The MMS **Minerals Revenue Management** meets its responsibilities by ensuring the efficient, timely and accurate collection and disbursement of revenue from mineral leasing and production due to Indian tribes and allottees, States and the U.S. Treasury.

The MMS strives to fulfill its responsibilities through the general guiding principles of: (1) being responsive to the public's concerns and interests by maintaining a dialogue with all potentially affected parties and (2) carrying out its programs with an emphasis on working to enhance the quality of life for all Americans by lending MMS assistance and expertise to economic development and environmental protection.