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COMPOSITION OF THE ICHTHYOFAUNA INHABITING THE 110-METER BATHYMETRIC CONTOUR OF THE GULF OF MEXICO, MISSISSIPPI RIVER TO THE RIO GRANDE[1]

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ABSTRACT: The ichthyofauna inhabiting the 110-m bathymetric contour from the Mississippi River to the Rio Grande was very diverse in comparison to the inshore fauna, although the number of species collected decreased off south Texas. A total of 69 species were identified, although only 3662 specimens were examined. Dominant taxa were the families Sparidae, Lutjanidae, Triglidae, Serranidae and Synodontidae with *Stenotomus caprinus, Pristipomoides aquilonaris, Prionotus paralatus, Serranus atrobranchus,* and *Synodus foetens* being the most abundant species. Faunal composition was very similar along the entire 110-m contour except for large changes in abundance of *Stenotomus caprinus, Pristipomoides aquilonaris,* and *Serranus atrobranchus.* Abundance of *Stenotomus caprinus* decreased greatly off south Texas whereas the converse was true for *Pristipomoides aquilonaris* and *Serranus atrobranchus.* The composition of the ichthyofauna at a depth of 110-m is similar to that found on the brown shrimp grounds of the northern Gulf of Mexico.

The continental shelf of the northwestern Gulf of Mexico supports a large, diverse ichthyofauna. However, the fish communities are poorly known despite the many studies conducted in this area including Gunter (1938, 1941, 1945, 1958), Baughman (1950 a, b), Hildebrand (1954), Springer and Bullis (1956), Hoese (1958), McFarland (1963), Miller (1965), Bullis and Carpenter (1968), Hoese et al. (1968), Moore, Brusher and Trent (1970), and Bright and Cashman (1974). Knowledge is especially lacking about the fauna that typically inhabits water deeper than about 27 m. This depth approximately represents the transition between two dominant and distinct fish communities found on soft bottom in the northern Gulf: an inshore (3-27 m) white shrimp grounds fauna and an offshore (27-90 m) brown shrimp grounds fauna (Hildebrand, 1954; Chittenden and McEachran, 1976). Little is known about the brown shrimp grounds fish community, because only a few studies (Hildebrand, 1954; Springer and Bullis, 1956; Moore et al., 1970; Franks et al., 1972; and Chittenden and McEachran, 1976) have been conducted in water deeper than 27 m. Furthermore, the bathymetric limits of this community are not clear. The fish fauna inhabiting water deeper than 90 m has been described only in Springer and Bullis' (1956) data report, and little is known about the fauna found at 90 m.

This paper documents the

[1] Technical Article 12737 from the Texas Agricultural Experiment Station.

ichthyofauna of the 110-m bathymetric contour of the northern Gulf from the Mississippi River to the Rio Grande and discusses the distribution of the brown shrimp community. Analysis presented herein is based on trawl surveys conducted during 1962-1964 by the U. S. Bureau of Commercial Fisheries. Moore et al. (1970) briefly described some findings of those surveys.

MATERIALS AND METHODS

Sampling stations, procedures in the field, and methods of processing the catch are described in detail by Moore et al. (1970). Briefly, samples were collected monthly January 1962-December 1964 from the Mississippi River to the Rio Grande using 14-m wide flat trawls equipped with rollers. The nets had 6-cm stretched mesh and were towed at a speed of three knots for about one hour during day or night whenever the vessel arrived on station. Each catch was emptied on deck, and a subsample of 1.8 kg in 1962 or 3.5 kg thereafter was taken to determine the average weight and relative abundance of each species.

Original data sheets describing the number and weight of each species in each subsample were made available by the National Marine Fisheries Service. Identifications were revised to correspond with subsequent changes in nomenclature and generally follow Bailey et al. (1970). In the present analysis, the weights and numbers of each species were pooled over time in the following categories: 1) south Texas (Fig. 1, stations W-7, W-18, W-19, W-30), 2) north Texas — Louisiana (stations W-6, E-6, E-7, E-18, E-19, E-30), and 3) overall data based upon all stations occupied at 110 m. Data summarization in each of these categories (Table 1) includes relative biomass and relative abundance expressed as the percentages that each taxon constituted of the total weight and total numbers, respectively.

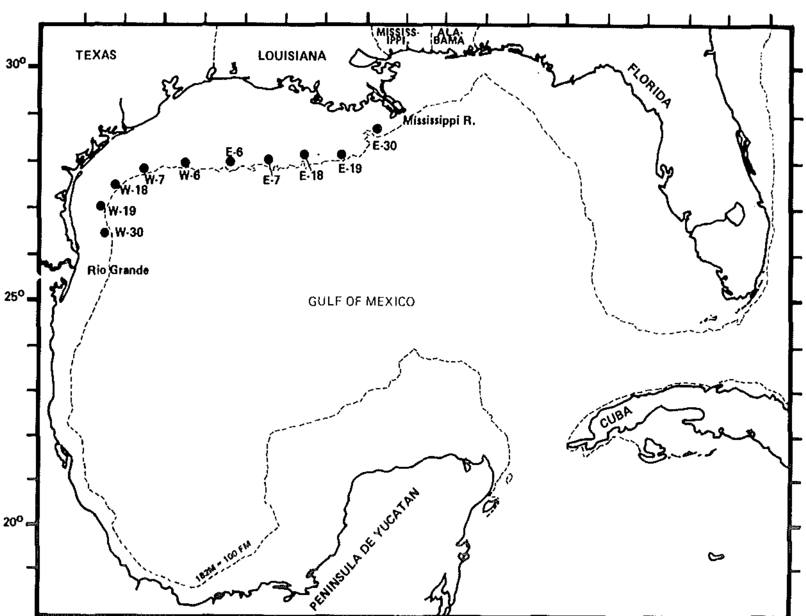

Figure 1. — The Gulf of Mexico showing locations sampled. station designations correspond to those of Moore et al. (1970).

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RESULTS AND DISCUSSION

Data presented in this paper are based on only 3662 fishes collected in 109 tows, so that the average subsample included only about 34 fish. Therefore, biases due to non-random sampling from the complete catch could have caused large errors in the percentage compositions. However, the compositions reported herein do agree with findings of studies in shallower water.

Species Diversity

The ichthyofauna at 110 m is very diverse, although the number of species collected decreased off south Texas. Overall, at least 67 species representing 31 families were identified in only 3662 specimens examined (Table 1). In contrast, Chittenden and McEachran (1976) found only 83 species among 14,894 specimens collected on the brown shrimp grounds and only 63 species in 11,703 specimens captured on the white shrimp grounds. Within the south Texas area, only 45 species representing 23 families were identified in contrast to 64 species representing 30 families in the north Texas — Louisiana area.

Species diversity in the northern Gulf, in general, apparently tends to increase with depth proceeding from the estuaries toward the edge of the continental shelf. Expressed as Shannon-Wiener's H' (Krebs, 1972), the overall species diversity at 110 m was 2.616; and H' values were 2.542 off south Texas and 2.518 in the north Texas - Louisiana area. These values are higher than the mean H' observed by Chittenden and McEachran (1976) on the brown shrimp grounds (2.251) or on the white shrimp grounds (1.825), and they are much higher than H' values that Bechtel and Copeland (1970) observed in Texas estuaries. This apparent trend with depth may simply reflect an increase in environmental stability and habitat diversity as Chittenden and McEachran (1976) suggested in comparing diversity on the white and brown shrimp grounds.

Composition of the Fauna

Percentage compositions were very similar for both biomass and numbers. Overall, 15 families made up about 97% of the biomass and 95% of the numbers of fishes (Table 1). The Sparidae (25%), Lutjanidae (20%), Triglidae (13%), Synodontidae (8%), and Serranidae (7%) constituted about 73% of the biomass. The Sparidae (30%), Triglidae (18%), Lutjanidae (12%), and Serranidae (11%) represented about 71% of the numbers of fishes. *Stenotomus caprinus,* the dominant species, made up about 25-30% of the catch by biomass or numbers and was followed in importance by *Pristipomoides aquilonaris* (12-20%) and *Prionotus paralatus* (8-12%). Only *Synodus foetens* and *Serranus atrobranchus* also made up 5% or more of the catch by biomass or numbers. A rich variety of less important families made up 1-4% of the catch. These families included the Ogcocephalidae, Gadidae, Carangidae, Sciaenidae, Mullidae, Labridae, Stromateidae, Scorpaenidae and Bothidae. Species represented in this last category included *Halieutichthys aculeatus, Urophycis floridanus, Centropristis philadelphica, Trachurus lathami, Cynoscion arenarius, Mullus auratus, Upeneus parvus, Hemipteronotus novacula, Peprilus burti, Prionotus rubio, Prionotus stearnsi,* and *Trichopsetta ventralis.*

Faunal composition was very similar along the entire 110-m bathymetric contour from the Mississippi River delta to the Rio Grande except for large changes in the abundance of *Stenotomus caprinus, Pristipomoides aquilonaris,* and *Serranus atrobranchus,* and changes in composition within the family Triglidae. *Stenotomus caprinus* made up

Table 1. - Percentage compositions of the fish fauna collected a depth of 110m. Weight is in grams.

	All Stations		Off South Texas		Off North Texas-Louisiana	
Taxon	*By Weight*	*By Number*	*By Weight*	*By Number*	*By Weight*	*By Number*
Rajidae	.29	.11	.10	.10	.35	.12
Raja olseni	.08	.03	0	0	.11	.04
Raja texana	.18	.05	.10	.10	.20	.04
Raja sp.	.03	.03	0	0	.04	.04
Congridae	.04	.14	.07	.10	.03	.16
Neoconger mucronatus	.01	.03	.07	.10	.01	.04
Neoconger sp.	.03	.08	.0	0	.02	.08
Uroconger syringinus	0	.03	0	0	0	.04
Synodontidae	8.37	2.87	6.18	2.44	9.18	3.03
Synodus foetens	8.37	2.87	6.18	2.44	9.18	3.03
Ariidae	.19	.08	0	0	.26	.11
Arius felis	.19	.08	0	0	.26	.11
Batrachoididae	.14	.38	.18	.49	.13	.34
Porichthys porosissimus	.14	.38	.18	.49	.13	.34
Antennariidae	.04	.03	0	0	.06	.04
Antennarius radiosus	.04	.03	0	0	.06	.04
Ogcocephalidae	.73	3.17	.50	3.12	.82	3.19
Halieutichthys aculeatus	.33	2.43	.36	2.44	.32	2.43
Ogcocephalus sp.	.40	.74	.14	.68	.50	.76
Gadidae	2.96	1.61	4.65	2.64	2.35	1.22
Urophycis cirratus	.89	.49	.83	.59	.91	.46
U. floridanus	1.41	.76	2.29	1.37	1.09	.53
U. sp.	.66	.36	1.53	.68	.35	.23
Ophidiidae	.28	.25	.56	.39	.18	.19
Lepophidium sp.	.28	.25	.56	.39	.18	.19
Macrouridae	.28	.93	0	0	.39	1.29
Nezumia bairdi	.28	.93	0	0	.39	1.29
Serranidae	6.74	11.03	9.44	18.86	5.72	8.00
Centropristis philadelphica	3.51	2.27	2.45	1.57	3.89	2.54
Centropristis sp.	.04	.03	0	0	.05	.04
Diplectrum bivittatum	.01	.03	0	0	.01	.04
Diplectrum formosum	.08	.05	.30	.20	0	0
Epinephelus flavolimbatus	.02	.03	0	0	.03	.04
Pikea mexicana	.09	.16	.03	.10	.11	.19
Serranus atrobranchus	2.99	8.46	6.66	16.99	1.63	5.15
Priacanthidae	.28	.11	0	0	.38	.15
Priacanthus arenatus	.28	.11	0	0	.38	.15
Branchiostegidae	.87	.46	1.09	.59	.78	.42
Caulolatilis cyanops	.38	.16	.16	.10	.46	.19
Caulolatilis sp.	.49	.30	.93	.49	.32	.23

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Table 1. - (cont.)

Taxon	All Stations By Weight	All Stations By Number	Off South Texas By Weight	Off South Texas By Number	Off North Texas-Louisiana By Weight	Off North Texas-Louisiana By Number
Carangidae	1.64	1.48	.75	.49	1.97	1.86
Chloroscombrus chrysurus	.28	.19	0	0	.38	.27
Trachurus lathami	1.31	1.26	.75	.49	1.52	1.55
Vomer setapinnis	.05	.03	0	0	.07	.04
Lutjanidae	19.89	11.93	33.51	20.04	14.84	8.79
Lutjanus campechanus	.25	.14	.42	.20	.18	.11
Ocyurus chrysurus	.05	.03	0	0	.07	.04
Pristipomoides aquilonaris	19.59	11.76	33.09	19.84	14.59	8.64
Sparidae	25.15	30.11	10.98	12.21	30.39	37.06
Stenotomus caprinus	25.15	30.11	10.98	12.21	30.39	37.06
Pomadasyidae	.02	.03	.09	.10	0	0
Orthopristis chrysoptera	.02	.03	.09	.10	0	0
Sciaenidae	4.00	1.74	5.35	3.23	3.54	1.18
Cynoscion arenarius	2.57	.68	3.10	1.07	2.41	.53
Cynoscion nothus	.24	.08	.33	.20	.21	.04
Equetus acuminatus	.13	.14	.36	.39	.04	.04
Equetus umbrosus	.11	.05	.42	.20	0	0
Equetus sp.	.18	.16	.52	.39	.06	.08
Leiostomus xanthurus	.14	.08	0	0	.19	.11
Menticirrhus americanus	.13	.05	0	0	.18	.08
Micropogon undulatus	.50	.50	.62	.98	.45	.30
Mullidae	2.06	2.89	2.71	2.93	1.83	2.88
Mullus auratus	1.09	1.01	1.64	1.56	.89	.80
Upeneus parvus	.97	1.88	1.07	1.37	.94	2.08
Labridae	1.11	.49	1.28	.79	1.05	.38
Hemipteronotus novacula	1.11	.49	1.28	.79	1.05	.38
Percophididae	.03	.03	0	0	.04	.04
Bembrops gobiodes	.03	.03	0	0	.04	.04
Uranoscopidae	.12	.11	.15	.20	.11	.08
Kathetostoma albigutta	.12	.11	.15	.20	.11	.08
Trichiuridae	.18	.08	0	0	.24	.11
Trichiurus lepturus	.18	.08	0	0	.24	.11
Stromateidae	2.36	1.31	1.88	1.37	2.54	1.29
Peprilus paru	.66	.22	0	0	.90	.30
Peprilus burti	1.70	1.09	1.88	1.37	1.64	.99
Scorpaenidae	.99	1.64	.76	1.28	1.07	1.79
Scorpaena calcarata	.18	.33	.10	.20	.20	.38
Scorpaena sp.	.19	.36	.22	.59	.18	.27
Pontinus longispinis	.60	.90	.44	.49	.66	1.06
Pontinus sp.	.02	.05	0	0	.03	.08

Table 1. - (cont.)

Taxon	All Stations		Off South Texas		Off North Texas-Louisiana	
	By Weight	*By Number*	*By Weight*	*By Number*	*By Weight*	*By Number*
Triglidae	13.43	18.33	13.55	19.93	13.40	17.70
Bellator militaris	.29	.38	.80	.98	.10	.15
Peristedion miniatum	.31	.52	0	0	.43	.72
Peristedion sp.	.24	.44	0	0	.33	.61
Prionotus martis	.01	.03	.03	.10	0	0
Prionotus paralatus	8.20	11.85	12.44	18.26	6.63	9.36
Prionotus salmonicolor	.01	.03	.05	.10	0	0
Prionotus rubio	3.98	3.28	.18	.29	5.39	4.43
Prionotus stearnsi	.39	1.80	.05	.20	.52	2.43
Bothidae	4.03	5.49	4.96	6.57	3.70	5.09
Ancylopsetta dilecta	.80	.60	.97	.68	.73	.57
Ancylopsetta quadrocellata	.14	.05	0	0	.19	.08
Cyclopsetta chittendeni	.90	.30	1.34	.39	.74	.27
Etropus crossotus	.13	.25	.29	.59	.06	.11
Syacium gunteri	.29	.60	.49	1.00	.22	.46
Trichopsetta ventralis	1.77	3.69	1.87	3.91	1.76	3.60
Soleidae	.03	.08	.07	.20	.01	.04
Achirus lineatus	.03	.08	.07	.20	.01	.04
Cynoglossidae	.05	.11	0	0	.06	.15
Symphurus diomedianus	.02	.03	0	0	.02	.04
Symphurus plagiusa	.03	.08	0	0	.04	.11
Balistidae	.06	.08	0	0	.08	.12
Balistes capriscus	.03	.03	0	0	.04	.04
Monacanthus hispidus	.03	.05	0	0	.04	.08
Tetraodontidae	.28	.25	.39	.40	.23	.19
Lagocephalus laevigatus	.21	.14	.26	.20	.18	.11
Sphoeroides dorsalis	.07	.11	.13	.20	.05	.08
Unidentified	3.37	2.65	.93	1.66	4.27	3.03
Totals	**100**	**100**	**100**	**100**	**100**	**100**

only about 11-12% of the biomass and numbers off south Texas in contrast to about 30-37% in the north Texas - Louisiana area. The change in abundance of this species proceeding westerly may be real, because Hildebrand (1954) reported similar observations in 33-40 m: *S. caprinus* was very abundant off central Texas but uncommon 160 km to the west. *Pristipomoides aquilonaris* and *Serranus atrobranchus* greatly increased in biomass and numbers proceeding westerly and apparently replaced *Stenotomus caprinus* off south Texas. *Pristipomoides aquilonaris* constituted 20-33% of the fauna off south Texas but only 9-15% in the north Texas - Louisiana area. Similarly, *Serranus atrobranches* made up 7-17% of the fauna off south Texas but only 2-5% off north Texas -

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Louisiana. The family Triglidae was uniformly important at 110-m, although species compositions changed. *Prionotus paralatus* constituted only about 7-9% of the biomass and numbers in the north Texas - Louisiana area but 12-18% off south Texas. *P. rubio* and *P. stearnsi* were unimportant off south Texas, but they apparently replaced *P. paralatus* in the north Texas - Louisiana area. The reasons for these apparent changes in abundance within the Triglidae — if real — are not clear. Hildebrand (1954) also found *P. rubio* most abundant towards Louisiana; however, he found this species important throughout the northern and western Gulf, in contrast to our findings. Furthermore, in contrast to our findings and Chittenden and McEachran (1976), Hildebrand did not find *P. paralatus* important at any location.

The fish community typical of the brown shrimp grounds extends from about 27 m to at least 110 m. The ichthyofauna and the percentage compositions reported herein are very similar to the fauna that Chittenden and McEachran (1976) reported typical of the brown shrimp grounds. *Stenotomus caprinus,* the dominant species, made up 39% by number of the fishes on the brown shrimp grounds and 37% at 110 m in the north Texas - Louisiana area which is geographically closest to the locations where Chittenden and McEachran collected. *Serranus atrobranchus* constituted 2-3% of the fauna in these two areas, and the Triglidae made up 17-18%. *Pristipomoides aquilonaris* made up 9% by number of the fishes at 110 m in the north Texas - Louisiana area but only 1% on the brown shrimp grounds. However, this species might occur primarily on the outer continental shelf and upper slope. Compton (unpublished MS) found *Pristipomoides aquilonaris* abundant at 145-275 m in contrast to Hildebrand (1954) who captured only 76 specimens in water primarily about 18-44 m deep.

Bathymetric limits on the outer shelf are not clear for the fish community typical of the brown shrimp grounds, because the fauna found deeper than 110 m has not been described. However, Chittenden and McEachran (1976) noted that only a narrow portion of the shelf lies between 110-182 m and suggested that this area may simply be a transition zone for the fish faunas of the brown shrimp grounds and the continental slope. The apparent bathymetric changes in abundance of *Pristipomoides aquilonaris,* a dominant species, agree with that view; but additional study is desirable.

The geographic distribution of the brown shrimp community within the Gulf of Mexico is reasonably clear in broad outline: this community, or its dominant species, basically occupies (Hildebrand, 1954, 1955; Chittenden and McEachran, 1976) the terrigenous sediments of Springer and Bullis' (1954) western Gulf zone which is located from about northwestern Florida to the Campeche Bank off Mexico (Springer and Bullis, 1954; Lynch, 1954). The distribution of *Stenotomus caprinus,* the dominant species of the brown shrimp grounds, conforms to this pattern (Caldwell 1955). Other genera typical of offshore waters also seem to show similar sediment-associated distribution of their species including *Syacium gunteri* and *S. papillosum* (Hildebrand, 1955; Topp and Hoff, 1972); *Centropristis ocyurus* and *C. philadelphica* (Miller, 1959); and *Gymnachirus* spp (Dawson, 1964).

The distribution of the brown shrimp grounds community is reasonably clear in broad outline, but little is really known about specific factors that determine the abundance of its component species and the relative importance of these factors. Evidently, species compositions are not constant throughout the brown shrimp grounds, because important species such as *Stenotomus caprinus, Pristipomoides aquilonaris, Serranus atrobranchus, Prionotus rubio,* and *Prionotus paralatus,* and undoubtedly others, show geographic variation in abundance. The abundance of a species per unit time, area etc. can be mathematically expressed in terms of sources of variation that influence abundance (Chittenden and McEachran 1976). Important abiotic factors include temperature, topography, substrate composition, time of day, salinity, and their interactions and depth (Miller 1965; Dawson 1967; Gunter 1967; Struhsaker 1969; Moore et al. 1970; Chittenden and McEachran 1976). Further progress in delineating fish communities and in clarifying their distribution and the distributions of their component species depends on the application of standard statistical analyses, such as multiple regression, to: 1) identify factors that are important determinants of distribution and abundance, and 2) assess how important each of these factors is. Unfortunately, the existing literature has not done so.

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