

MEXUS-Gulf Demersal Fish Research, 1978-85

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Introduction

The MEXUS-Gulf concept was conceived to enhance an understanding of the fisheries and ecology of shared resources in the Gulf of Mexico. Discipline oriented working groups including the demersal fish group were established at the initial meeting of MEXUS-Gulf. Emphasis was first placed on fish stocks off the Yucatan Peninsula; however, in subsequent meetings research efforts were directed to stocks of deep-water species of snapper, grouper, and tilefish throughout the Gulf of Mexico.

Activities within the demersal fish working group have changed but overall goals remained constant. Defined goals were to: 1) Obtain data on distribution and abundance of deep-water snapper, grouper, and tilefish stocks; and 2) obtain data on biomass and faunal components of trawl caught species off the Yucatan Peninsula. These goals have been pursued by scientific personnel and vessels from Federal research organizations of Mexico (Secretaria de Pesca's Instituto Nacional de Pesca—INP) and the United States (National Marine Fisheries Service—NMFS). This report is presented in two parts, the first providing a faunal inventory of trawl-caught species off Mexico (Yucatan Peninsula to Tamaulipas) and the second addressing distribution and abundance of snapper, grouper, and tilefish in deep water.

Methods

Gulf of Mexico data pertaining to MEXUS-Gulf objectives were collected

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Table 1.—Cruises operating under MEXUS-Gulf auspices (demersal fish working group) from 1979 to 1983 from which faunal data was obtained.

Vessel	Date	Area	Operation
<i>Oregon II</i>	June 1979	Tampico to Texas	Trawls-shrimp tagging
<i>Oregon II</i>	Aug. 1979	Northern Yucatan	Trawls and longlines
<i>Oregon II</i>	Sept. 1979	Tampico to Texas	Trawls-shrimp tagging
<i>Oregon II</i>	May 1980	Southern Yucatan	Trawls-shrimp tagging
<i>Oregon II</i>	Sept. 1980	Northwestern Yucatan	Trawls and longlines
<i>Onjuku</i>	Aug. 1981	Veracruz to Carmen	Trawls and longlines
<i>Oregon II</i>	Aug. 1983	Offshore Texas	Trawls and longlines
<i>Oregon II</i> ¹	Oct. 1979	Tampa to Tortugas, Fla.	Longlines
<i>Oregon II</i> ²	Sept. 1984	Offshore Texas	Submersible-longlines

¹Areal coverage requested at MEXUS-Gulf meeting.

²Not under direct MEXUS-Gulf auspices.

aboard both INP and NMFS vessels. Cruises satisfying defined annual objectives are listed in Table 1, and cover the entire Gulf of Mexico. Efforts expended are shown in Figures 1 (trawling) and 2 (longlining). Trawling data was collected using a 12 m semiballoon shrimp trawl with 2.4 × 1.0 m wooden chain doors on the *Oregon II* and a 14 m western jib trawl with 2.1 × 0.9 m wooden chain doors on the MV *Onjuku*. Longline data was collected with standard 2-hour sets using 377 m of mainline fished with 100 number 6 and 7 Japanese circle tuna hooks on the *Oregon II*; and 960 m of mainline with 200 number 6 and 7 Japanese circle tuna hooks on the MV *Onjuku* (Guthertz et al.¹). Limited use was made of data obtained at several handline stations. Data collected included species identification to the lowest taxon, number of specimens

caught, aggregate weight of the species caught, and length frequency information on predefined species. Biological data was obtained on sex and maturation stage; scales and/or otoliths were collected for population data from grouper, snapper, and tilefish. Limited environmental and habitat information was collected to broadly define habitats utilized by defined species.

Longline catch rates were computed to establish indices of relative abundance throughout the entire Gulf of Mexico for snapper, grouper, and tilefish; sharks were generally weighed only after identification. Catch by area was standardized to a catch rate of kilograms per 100 hooks per hour for each bottom longline set. Data was then summarized and mean catch rates per 0.5° blocks computed. Standardized catch rates were also summarized by faunal zones (Fig. 3) and depth; a mean catch rate and its associated confidence interval was then computed for each unit (Table 2). Other species caught on the longlines were identified and their weights recorded.

Trawl catches were processed separ-

¹Guthertz, E. J., M. Contreras, A. J. Kemmerer, B. A. Rohr, W. R. Nelson, and V. Morano. 1982. A summary of Mexus-Golfo cooperative demersal fish research 1978-1982. Report submitted to Southeast Fisheries Center (NMFS) and Instituto Nacional de Pesca (INP). Memora de la VII Reunion Mexus-Golfo, Veracruz, 24-26 de Agosto, 1982, 11 p.

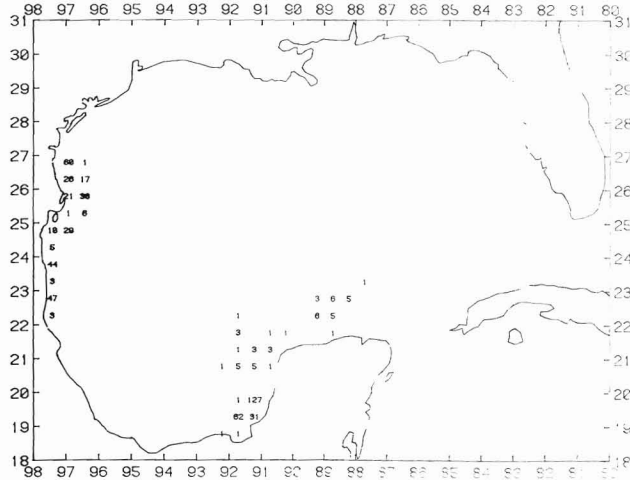


Figure 1.—Trawl stations on MEXUS-Gulf cooperative cruises between 1979 and 1983.

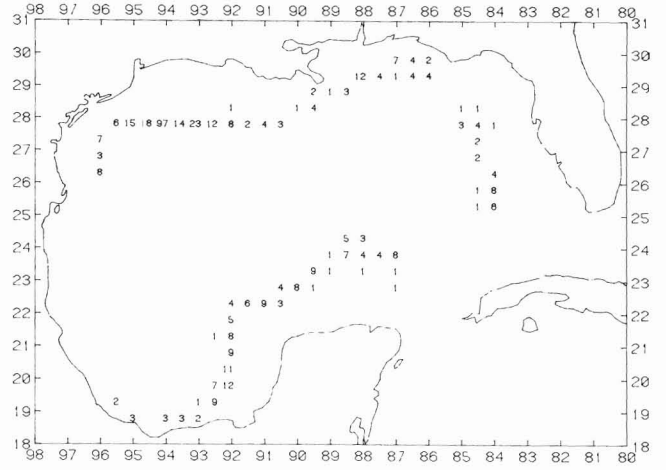


Figure 2.—Bottom longline effort as number of sets per 0.5 degree blocks in depths exceeding 90 m; data sets obtained on the *Oregon II* and *Onjuku* from 1968 to 1984.

ately with catches weighing less than 25 kg handled in their entirety. Larger catches were sampled, although the entire catch was weighed to the nearest 0.5 kg.

Selection of sample stations during shrimp tagging cruises was based on abundance of shrimp, and they were not randomized. All other trawl stations were randomly selected (Gutherz et al.¹).

Longline stations were selected randomly according to predetermined, area, depth strata, and day/night periods with sampling restricted to between 90 and 460 m. During cruises, modifications to the sampling schemes were required due to bottom conditions which precluded some sampling at predetermined stations.

Trawling Results

Trawling results have been compiled and are presented in Gutherz et al.¹ Faunal listing and biomass estimates are included for off the Yucatan Peninsula and Tamaulipas. Overall, the tomate, *Haemulon aurolineatum*, was the dominant trawl-caught finfish and the pink shrimp, *Penaeus duorarum*, was the dominant invertebrate (Table 3). The 20 dominant species taken at all trawling stations are listed in Table 3. Trawling data was separated into three distinct geographical areas which have unique

biological and geomorphic characteristics.

The northern Yucatan area features a limestone substrate upon which sponge and patch corals form a live bottom

habitat which is difficult to sample with trawls. Within this habitat night catches were about three times higher than day tows (203 vs. 71 kg/hour). Yellow goatfish, *Mulloidichthys martinicus*, and

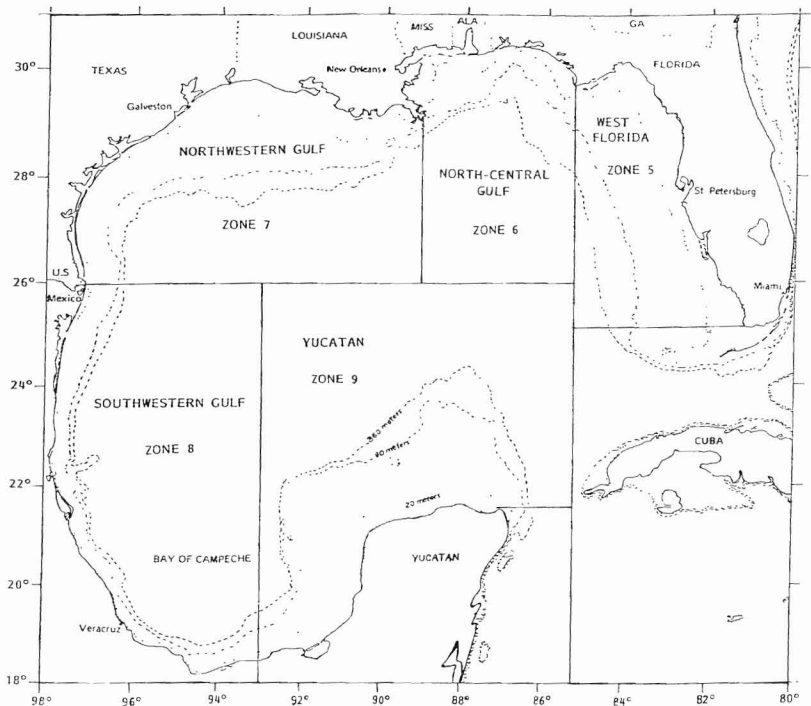


Figure 3.—Faunal zones used for summarization of Gulf of Mexico bottom longline data from 90 to 455 m.

Table 2.—Mean catch rate and confidence interval expressed as kg/100 hooks/hour for Gulf of Mexico faunal zones in depths exceeding 90 m.

Species	Faunal zones				
	5 N = 18 sets	6 N = 33 sets	7 N = 120 sets	8 N = 10 sets	9 N = 116 sets
<i>Epinephelus flavolimbatus</i>	0.00 ± 2.95	3.61 ± 2.8	2.01 ± 1.14	7.09 ± 3.96	4.14 ± 1.16
<i>Lutjanus campechanus</i>	0.34 ± 0.96	0.11 ± 0.71	0.13 ± 0.37	4.14 ± 1.28	1.44 ± 0.38
<i>Etelis oculatus</i>	0.00 ± 1.79	0.00 ± 1.32	0.02 ± 0.69	0.00 ± 2.40	0.08 ± 0.70
<i>Caulolatilus microps</i>	0.17 ± 0.37	0.00 ± 0.28	0.004 ± 0.14	0.00 ± 0.50	0.41 ± 0.15
<i>Epinephelus niveatus</i>	0.00 ± 1.16	0.00 ± 0.85	0.25 ± 0.45	0.23 ± 1.55	0.35 ± 0.46
<i>Lopholatilus chamaeleonticeps</i>	0.06 ± 3.13	2.45 ± 2.31	11.76 ± 1.21	0.50 ± 4.20	1.34 ± 1.23

Table 4.—Percent of bottom longline sets fished in the Gulf of Mexico by depth category, 1967-1982.

Area (faunal zones)	Depth (m)									
	90-180 m		182-271 m		273-362 m		364-455 m		Total	
	Per-cent	No. of sets	Per-cent	No. of sets	Per-cent	No. of sets	Per-cent	No. of sets	Per-cent	No. of sets
Western Florida (Zone 5)	2	6	2	6	1	4	1	2	5	18
North-central Gulf (Zone 6)	2	7	3	9	3	10	2	7	10	33
Northwestern Gulf (Zone 7)	3	10	6	20	23	70	6	21	37	121
Southwestern Gulf (Zone 8)	5	17	1	4	1	2	0	0	7	23
Yucatan (Zone 9)	23	74	9	30	5	16	4	13	41	133
Total	35	114	21	69	31	102	13	43	100	328

tomtate were the principal species caught. Day/night catch rates of yellow goatfish were similar, suggesting a relatively consistent diurnal behavior pattern, but nighttime catch rates of tomtate were about six times higher than day catches. Tomtates have been reported to leave reef sites during night hours to forage on the grass and sand flats off the reef. This behavior would make tomtates much more susceptible to trawls during night hours. Inshore (<36 m) and offshore (>36 m) differences in catch rates were also noted with tomtate; pluma, *Calamus pennatula*; and sand perch, *Diplectrum formosum*, caught most frequently inshore, and tomtate, yellow goatfish, and pinfish, *Lagodon rhomboides*, caught most frequently offshore. These five species accounted for between 31 and 43 percent of the total catch off the northern Yucatan Peninsula. Species obtained off the northern Yucatan Peninsula numbered 124 from the 28 trawl samples. This is fewer than identified from the other two areas but does not necessarily indicate a reduced species diversity. The difficulty in sampling the habitat is undoubtedly responsible for the reduced number of species

caught.

The western Yucatan area is composed of a limestone substrate with some sponge and patch coral in its northern portion and a sand/shell/mud substrate in the southern portion. Catch rates were generally low throughout the western Yucatan with day catches higher (53 vs. 34 kg/hour). Dominant day-caught species were all finfish, including gray angelfish, *Pomacanthus arcuatus*; lane snapper, *Lutjanus synagris*; and Campeche porgy, *Calamus campechanus*; dominant night-caught species included two crustaceans (pink shrimp and blue crab, *Callinectes* sp.) and one finfish (tomtate).

Inshore-offshore differences were also quite distinct with three species of crustaceans dominant inshore and three species of finfish dominant offshore. Inshore species included brown shrimp, *Penaeus aztecus*; blue crab, and mantis shrimp, *Squilla* sp.; offshore species included tomtate, dwarf goatfish, *Upeneus parvus*; and spotfin mojarra, *Eucinostomus argenteus*. Species diversity off the western Yucatan Peninsula is reflective of its two major habitats. Identified species numbered 193 taken on the 250

Table 3.—Twenty dominant species from 524 MEXUS-Gulf shrimp trawl stations (5,736 kg) as percent total weight of the catch. Samples were taken from the southwestern Gulf of Mexico and off the Yucatan Shelf in 15-73 m.

Common and scientific name	Percent weight
Finfishes	
Tomtate, <i>Haemulon aurolineatum</i>	5.1
Pinfish, <i>Lagodon rhomboides</i>	2.0
Inshore lizardfish, <i>Synodus foetens</i>	1.5
Longspine porgy, <i>Stenotomus caprinus</i>	1.5
Dusky flounder, <i>Syacium papillosum</i>	1.3
Bigeye, <i>Priacanthus arenatus</i>	1.3
Flounder, <i>Syacium</i> sp.	1.2
Hardhead catfish, <i>Arius felis</i>	1.2
Gray angelfish, <i>Pomacanthus arcuatus</i>	1.1
Yellow goatfish, <i>Mulloidichthys martinicus</i>	1.1
Other fishes	31.8
Subtotal	49.1
Crustaceans	
Pink shrimp, <i>Penaeus duorarum</i>	13.2
Blue crab, <i>Callinectes similis</i>	6.5
Mantis shrimp, <i>Squilla</i> sp.	5.6
Brown shrimp, <i>Penaeus aztecus</i>	4.6
Blue Crab, <i>Callinectes rathbunae</i>	2.0
<i>Trachypeneus</i> sp.	1.7
Rock shrimp, <i>Sicyonia brevirostris</i>	1.1
Other crustaceans	3.9
Subtotal	38.6
Other species	
Sponge, Porifera	3.8
Long-finned squid, <i>Loligo pealei</i>	1.8
Sea cucumber, Holothuroidea	1.5
Other species	5.2
Subtotal	12.3

stations sampled. Dominant species were taken on both the live bottom and sand/shell habitat.

The western Gulf (off Tamaulipas) is composed of primarily sand/shell/mud substrate. Samples were taken only at night; however, catch rates were generally quite low, averaging only 33 kg/hour. Major differences were encountered between inshore-offshore catches in terms of speciation. Inshore stations caught 140 species whereas offshore stations caught only 40. Dominant inshore species included pink, brown, and mantis shrimp, and dominant offshore species included brown shrimp, blackear bass, *Serranus atrobranchus*; and inshore lizardfish, *Synodus foetens*. Identified species in the western Gulf numbered 141 from the 246 stations sampled and represent a faunal component which is similar to that seen on the brown shrimp grounds off Texas in the northern Gulf of Mexico. Faunal components and their respective biomass caught off Mexico were reported by Gutherz et al.¹

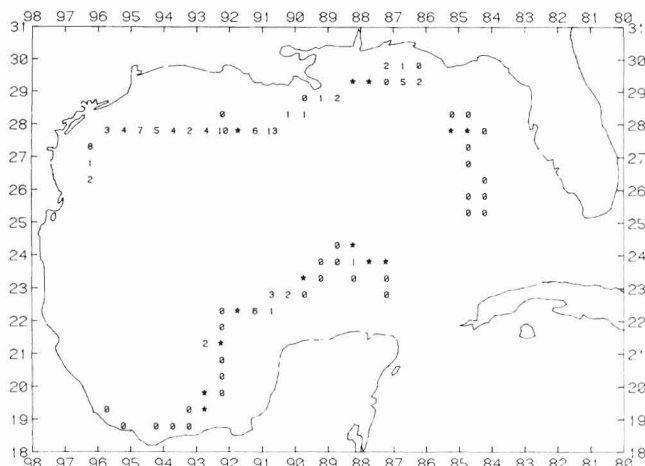


Figure 4.—Catch rate of golden tilefish expressed as kg/100 hooks/hour using bottom longlines in depths exceeding 90 m; data sets obtained on the *Oregon II* and *Onjuku* from 1968 to 1984. A star represents catches of less than 0.5 kg/100 hooks/hour.

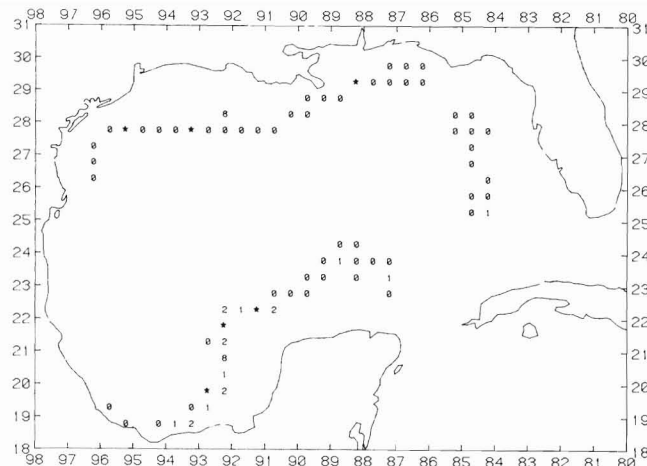


Figure 5.—Catch rate of snapper (primarily red snapper) expressed as kg/100 hooks/hour using bottom longlines in depths exceeding 90 m; data sets obtained on the *Oregon II* and *Onjuku* from 1968 to 1984. A star represents catches of less than 0.5 kg/100 hooks/hour.

Longlining Results

Considerable effort has been expended utilizing on- and off-bottom longlines in the Gulf of Mexico to evaluate the resource potential and status of snapper-grouper-tilefish stocks. Of the total effort devoted to this endeavor only a small portion was in response to MEXUS-Gulf requests. Data from all MEXUS-Gulf cooperative cruises has been shared jointly, with the United States taking the lead role in the analysis of distributional and relative abundance patterns for snapper-grouper-tilefish. Relative population levels of these species for each faunal zone (Table 2) was estimated using fishery independent catch rates to determine the mean catch rate and its associated confidence interval.

Longline efforts have been exerted throughout most of the Gulf of Mexico (Fig. 2). Notable for its lack of any data is the area from off Vera Cruz to the U.S.-Mexican border. Major effort has been expended off Texas and the Yucatan Peninsula (Fig. 2, Table 4). The U.S. Gulf of Mexico has fairly broad coverage in terms of number of sets made, but additional effort should be expended in the eastern Gulf of Mexico. In terms of depth coverage, the shallowest and in-

termediate depths were well sampled, but the deepest depths appear to be somewhat undersampled (Table 4).

Catch rates of snapper-grouper-tilefish stock throughout the Gulf of Mexico are variable (Tables 2, 5; Fig. 4-7). Tilefish, *Lopholatilus chamaeleonticeps*, were caught at the lowest rate throughout the Gulf of Mexico, except for faunal zones 6 and 7 (Tables 2, 5; Fig. 4). The broadest shelf in those depths at which tilefish are found is along the northern Gulf of Mexico

(Faunal zones 6 and 7). Tilefish are generally found on mud bottoms which have a consistency enabling the species to construct and maintain its burrow. Periodically the species is also found over irregular bottom contours in association with grouper, *Epinephelus* spp., and blueline tilefish, *Caulolatilus microps*. At a single site off the northern Yucatan Peninsula, three species (tilefish, blueline tilefish, and yellowedge grouper, *E. flavolimbatus*, were captured on the same set. At four sites off the northern Yucatan Peninsula, blueline tilefish and yellowedge grouper were captured together, and at a total of 28 sites tilefish and yellowedge grouper were captured together (21 in the northern Gulf of Mexico and 7 off the Yucatan Peninsula). These combined captures of grouper and tilefish suggest utilization of similar habitats or multiple habitats within close proximity to each other. Burrow utilization by specimens of these three species has been reported (Jones et al.²; Able et al., 1982; In press). Collection of these two or three species on the same set may

Table 5.—Percent composition of catch by family of deep-water reef fish taken on bottom longlines in depths of 90-455 m by faunal zone in the Gulf of Mexico (from Nelson, et al.: Table 9).

Family	Faunal zone					Mean %
	5	6	7	8	9	
Lutjanidae	10.7	1.2	1.0	28.7	17.4	12.7
Serranidae	35.7	21.2	16.7	41.5	39.3	30.8
Branchiostegidae	7.1	14.1	54.9	2.9	9.7	14.7
Sharks	35.7	46.5	19.6	16.0	25.8	31.9
Others	10.8	15.3	7.8	11.7	7.7	9.9
Total ²	100.0	100.0	100.0	100.0	100.0	100.0

¹Nelson, W. R., G. M. Russell, and E. J. Gutherz. 1982. Status of reef fish resource survey activities of the Southeast Fisheries Center. A special report for the Southeast Fisheries Center 1982 stock assessment workshop; on file at SEFC Mississippi Laboratories, Pascagoula Laboratory, Pascagoula, Miss., 46 p.

²Values may not add to exactly 100.0 due to rounding.

²Jones, R. S., W. R. Nelson, and E. J. Gutherz. 1986. Exploitation of burrow habitats by the yellow-edge grouper (*Epinephelus flavolimbatus*). Manuscr. with R. Jones, Univ. Tex. Mar. Sta., Port Aransas, Tex.

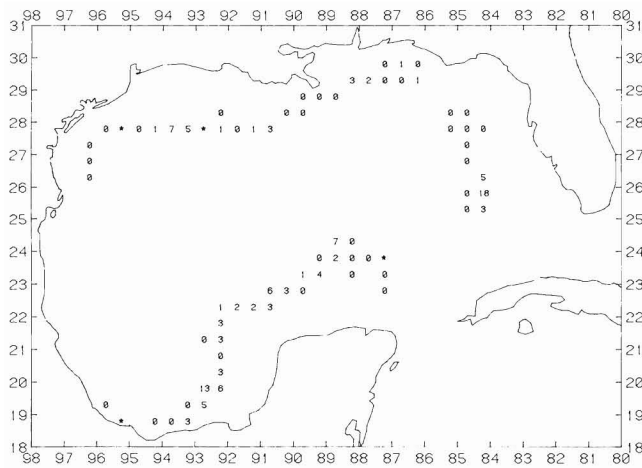


Figure 6.—Catch rate of grouper expressed as kg/100 hooks/hour using bottom longlines in depths exceeding 90 m; data sets obtained on the *Oregon II* and *Onjuku* from 1968 to 1984. A star represents catches of less than 0.5 kg/100 hooks/hour.

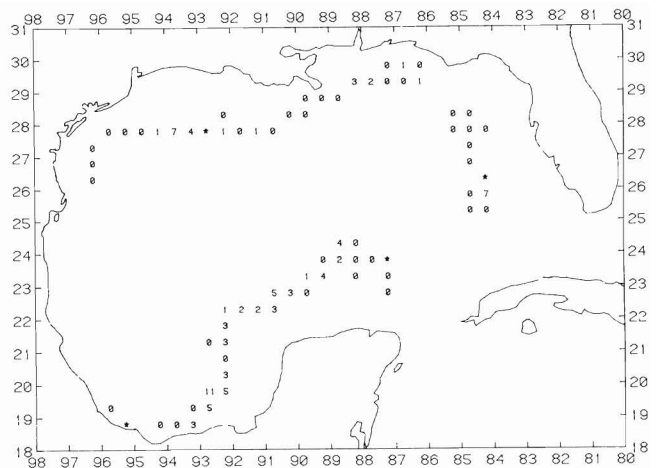


Figure 7.—Catch rate of yellowedge grouper expressed as kg/100 hooks/hour using bottom longlines on the *Oregon II* and *Onjuku* from 1968 to 1984. A star represents catches of less than 0.5 kg/100 hooks/hour.

also indicate occupation of the same burrow or burrows within close proximity to each other.

Species in the family Lutjanidae are most frequently caught in depths less than 90 m. The outer depths at which red snapper, *Lutjanus campechanus*, were generally caught was about 136 m. Species of snapper generally caught at greater depths are the blackfin snapper, *L. buccanella*; silk snapper, *L. vivanus*; and queen snapper, *Etelis oculatus*; however, these species were caught infrequently. Rates of capture were generally low for Lutjanidae throughout the Gulf of Mexico, with the highest rates off Mexico in faunal zones 8 and 9 (Tables 2, 5; Fig. 5).

Serranids (*Mycteroperca* and *Epinephelus*) were caught throughout the Gulf of Mexico. The primary species captured in depths greater than 90 m was the yellowedge grouper. Although caught throughout the Gulf of Mexico it was taken most frequently in faunal zones 8 and 9 (Tables 2, 5; Fig. 6, 7). The snowy grouper, *E. niveatus*, was the second most frequently caught deep-water serranid. Groupers caught in faunal zones 5 and 9 were generally caught on rough bottom which has topographic highs as opposed to the smoother substrate frequently found in faunal zones 6 and 7. Depth preference of groupers is inshore of tilefish and offshore of snapper species.

Within the Gulf of Mexico, shark species were more frequently caught than either snapper-grouper or tilefish. Species of shark caught were varied and consisted of both large and small species. Many of the large *Carcharhinus* species were exploited and utilized; however, other genera and species are frequently discarded.

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