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Synopsis of the Northern Gulf of Mexico Industrial and Foodfish Industries

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ABSTRACT—A synoptic overview of the industrial groundfish and croaker foodfish industries in the northern Gulf of Mexico is presented. Their histories, fishing grounds, vessels, gear, tactics, and product processing are described for the period 1952 through 1973. The fishing grounds with major species and their contribution to the fishery are discussed.

INTRODUCTION

This paper describes the industrial bottomfish and croaker foodfish fisheries of the north central Gulf of Mexico. These grounds are defined as the inshore area (out to 50 fathoms) between Pensacola Bay, Fla., and Galveston Bay, Tex. Historical and present aspects of these fisheries are considered and the techniques and tactics utilized by both fishermen and processors are discussed.

Although both fisheries exploit the same stocks, basic differences in species utilization and fishing tactics exist. The industrial bottomfish fishery produces petfood principally and to a lesser extent, bait, animal food, and fishmeal, while the foodfish fishery catches croaker for the fresh-fish market. Fishing grounds, vessels, gear, and tactics are similar but not identical between the fisheries. The industrial fishery utilizes most species and size groups, but the croaker foodfish fleet utilizes only croaker exceeding 9½ inches in length.

The northern Gulf of Mexico fauna is highly diversified with over 200 species of fish and invertebrates found on the grounds. Sciaenids—croaker, *Micropogon undulatus*; spot, *Leiostomus xanthurus*; and sea trout, *Cynoscion nothus* and *C. arenarius*—are the most important finfish in both the commercial and sport fisheries and contribute to the major portion of the industrial bottomfish and foodfish fleet catches. They also represent a major segment of the finfish discards of the shrimp fleet. Other finfish caught by the industrial fishery fleet are also utilized for petfood with the exception of sharks, skates, rays, and small catfish. Significant quantities of shrimp (*Penaeus* spp.) are also taken seasonally and substantiate the fleet income. Less desirable species may be discarded at sea in order to maintain an acceptable species composition for petfood formulation.

Croaker constitute over half of the industrial bottomfish landings and most of these croaker weigh less than ⅓ lb and are shorter than 9½ inches in length.

Croaker used by the foodfish fishery are larger than 9½ inches and are graded into three sizes: small (½ lb); medium (¾ lb); and large (1 lb). Croaker larger than 1 lb are also taken on handlines by snapper boats fishing near offshore oil rigs. In addition, a limited number of foodfish croaker are harvested seasonally from Big Lagoon, Ala.

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THE INDUSTRIAL BOTTOMFISH FISHERY

Historical Aspects

Haskell (1961) and Roithmayr (1965 a,b) have described the historical aspects of the industrial bottomfish fishery including vessels, operational methods, fishing season and area, species composition, fishing effort, catch rates, and abundance. Thompson (1966) determined the proximate chemical composition of 17 major finfish species contributing to this fishery. This information is used by the petfood industry to meet oil and protein content specification requirements for the finished product.

Bullis and Carpenter (1968) discussed the latent production of industrial bottomfish in the Gulf of Mexico, suggesting both effort and landings could be increased considerably. In fact, landings of industrial bottomfish from the northern Gulf of Mexico have increased dramatically since 1953 (Fig. 1). This increase can, in part, be attributed to the abundance and availability of sciaenid stocks inhabiting the "fertile crescent" around the Mississippi River Delta. The ready availability and abundance of these fish stimulated interest in their utilization during the early 1950's that led, in 1952, to the establishment of a pilot petfood canning plant in Pascagoula. This plant processed finfish landed incidentally to shrimp fishing operations. Fishermen were paid $22/ton—insufficient to ensure a dependable supply to the plant and many fishermen often went shrimping during periods of shrimp availability, leaving

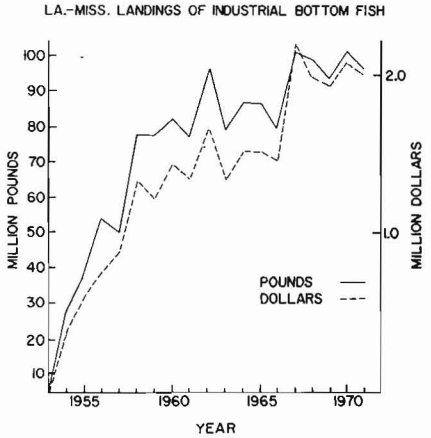

Figure 1.—Total pounds landed and dollar value of industrial groundfish from Louisiana and Mississippi for 1953-71.

Figure 2.—A contemporary Gulf of Mexico industrial bottomfish trawler.

the plant without a dependable, steady supply of finfish. Because of this, the plant began operating its own fleet in addition to contracting with independent vessels, and increased the ex-vessel price to $35/ton. The success experienced by the Pascagoula plant soon stimulated the establishment of petfood plants in Biloxi, Miss., and Golden Meadow, La.

Six million pounds of industrial bottomfish were landed from the northern Gulf of Mexico in 1952. Landings steadily increased until a plateau of about 75 million pounds was reached in 1958. Landings then fluctuated yearly but remained near this level until 1967 when production rose to about 100 million pounds (Fig. 1). This increase was due to increased Louisiana landings of industrial groundfish that doubled between 1966 and 1968, and the increased consumer demand for processed products.

Vessels and Gear

As product demand increased, processing plants needed a dependable source of fish in large quantities. Because the then-available shrimp trawlers had insufficient space for holding and refrigerating large catches, the petfood industry began to acquire vessels designed specifically to catch and hold large quantities of bottomfish.

At the inception of the fishery in 1952, the average fleet vessel was about 50 ft long with a 165-hp engine, had a hold capacity of 30 tons, and pulled a single 65-ft trawl. Gradually larger vessels ranging in length from 60 to 90 ft with a carrying capacity of from 63 to 125 tons were added to the fleet. Today, only two

Table 1.—Summary of vessel characteristics of the Mississippi industrial bottomfish fleet fishing in the northern Gulf of Mexico, 1973. This table does not represent the entire fleet; two vessels exceeding 90 feet and several vessels less than 70 feet have recently entered the fisheries.

Vessel	Tons		Length (ft)	Width (ft)	Horse-power	Winch cap. (fathoms)	Size cable (in)	Drums per winch	Winches per boat
	Gross	Capacity							
1	139	100	75	25	365	200	5/8	3	1
2	298	300	121	—	1,000	200	7/8	2	2
3	82	100	80	22	480	150	9/16	2	1
4	126	164	90	—	725	250	5/8	2	1
5	100	150	97	—	400	—	5/8	1	2
6	—	105	100	—	450	200	5/8	3	1
7	—	72	87	—	342	125	5/8	3	1
8	150	135	85	24	520	300	5/8	3	1
9	169	140	80	22	335	200	5/8	3	1
10	170	155	105	24	660	200	5/8	3	1
11	120	100	108	—	450	200	5/8	3	1

Table 2.—Summary of net characteristics of the Mississippi industrial bottomfish fleet fishing in the northern Gulf of Mexico, 1973.

Design	Length in feet		No. mud rollers	Number floats	Mesh size in inches				Meshes wing	Thread size			Loop chain link/ft	Length of leg lines (ft)	Door information		
	Head-rope	Foot rope			Wing body	Throat	Bag	Liner		Wing body	Throat	Bag			Construc. (ft)	Length (ft)	Height (ft)
2-S BN[1]	75	89	30	25	3	2	—	1¼	125	30	30	96	15	10	Wood	10	60
2-S BN	00	120	50	6	3	2	2	2¼	125	30	24	90	15	20	Steel	15	72
4-S BN	75	85	29	25	3	—	—	—	—	—	—	—	15	15	Wood	11	50
2-S FN[2]	85	100	33	24	3	1⅞	—	1¼	125	24	30	96	16	20	Wood	12	60
2-S BMFN[3]	82	90	30	33	3	3	3	1	—	30	30	96	15	20	Wood	12	72
2-S BMFN	93	111	46	23	3	1½	—	1¼	110	30	24	96	15	10	Wood	12	60
2-S BMFN	52	81	32	19	3	1	2	1	—	28	18	120	18	12	Wood	10	50
2-S BMFN	80	98	39	30	2	2	—	1½	200	21	36	96	17	14	Wood	12	60
2-S BMFN	75	89	30	25	3	2	2½	1¼	—	30	21	96	15	10	Wood	10	60
2-S BMFN	90	113	45	72	3	1½	2¼	1⅜	100	30	18	96	14	—	Steel	12	60
2-S BMFN	95	115	38	32	3	1½	2¼	1¼	190	30	30	72	15	14	Wood	12	60

[1]2-S BN = 2-Seam Balloon Net.
[2]2-S FN = 2-Seam Fish Net.
[3]2-S BMFN = 2-Seam Balloon Modified Fish Net.

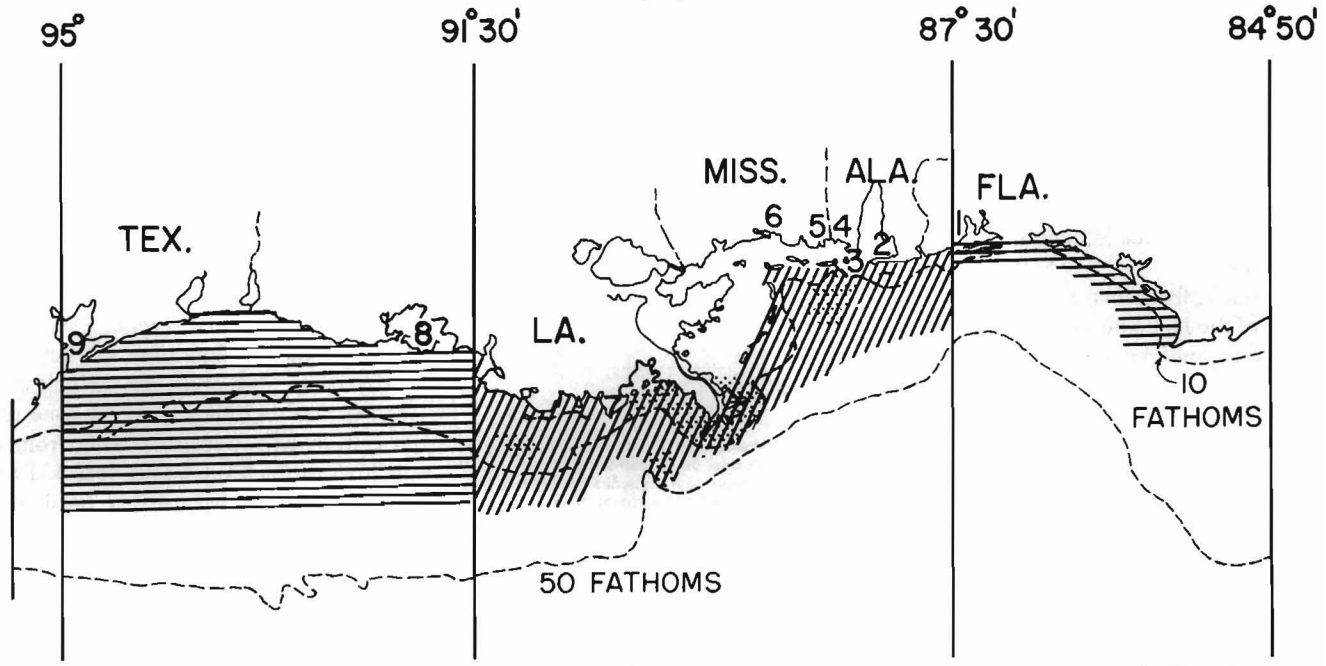

Figure 3.—Historical and traditional fishing grounds for industrial bottomfish and foodfish croaker in the northern Gulf of Mexico. Horizontal lines indicate historical grounds for industrial bottomfish while diagonal lines show the present area fished by industrial bottomfish fleet, and the stippled area is that fished by the foodfish croaker fleet. Specific locations referred to in the text are: (1) Pensacola Bay, Fla.; (2) Big Lagoon, Ala.; (3) Dauphin Islands, Ala.; (4) Bayou La Batre, Ala.; (5) Pascagoula, Miss.; (6) Biloxi, Miss.; (7) Golden Meadow, La.; (8) Marsh Island, La.; (9) Galveston, Tex.

boats still operate from the original industrial bottomfish fleet. A typical modern industrial fish trawler operating in the northern Gulf of Mexico is shown in Figure 2.

Industrial bottomfish trawlers are constructed of steel and all but two, the *Alaska* and *Falcon,* are double-rigged. Length of the vessel, horsepower, and size of towed net are variable, but generally the larger trawlers fish the largest nets. Winch capacity limits fishing depths to about 40 fathoms. All trawlers in this fleet utilize a brine-tank refrigeration system using an ammonia-cooled condenser.

At the onset of this fishery, approximately 50 boats comprised the fleet, some operating full time and some being transient. Presently, 21 boats operate full time—16 out of Pascagoula and Biloxi (Table 1 lists 11 boats of this fleet) and 5 out of Golden Meadow. Little information was available to the authors on the boats or fishing tactics of the Golden Meadow fleet. Their fishing operations are generally known to be similar to those employed by the Mississippi fleet; however, they do not venture as far offshore as the Pascagoula and the Biloxi fleets and their major effort is expended west of the Mississippi River Delta.

Important boat and gear characteristics are listed in Tables 1 and 2 for 11 of the 21 industrial bottomfish boats now operating in the fishery. Two of these boats, the *Alaska* and the *Falcon,* are converted menhaden purse seiners and have been in the fleet almost from the inception of the fishery.

Trawls used in this fishery are constructed from a single basic design, differing only in the size and arrangement of certain components. Legline length is variable, ranging between 10 and 40 ft. Mesh size is fairly uniform with 3-inch webbing in the body and wing and 1¼- to 2-inch mesh in the throat and bag. Bag liners are used with larger mesh sizes. Wing depth ranges between 48 and 200 meshes.

Trawl door size is somewhat dependent on vessel and trawl size. Doors range from 10 ft × 50 inches to 15 ft × 72 inches, with 12 ft × 60-inch doors most commonly used. Doors are generally constructed of wood, but some larger doors are constructed of steel. Steel and some large wooden doors have aluminum flotation tanks on their upper edge to provide stability.

Fishing Grounds

The shallow waters of the northern Gulf of Mexico seaward to 50 fathoms between Pensacola Bay, Fla., and Galveston, Tex., include some of the most productive fishing grounds known (Fig. 3). This area produces a wide variety and quantity of shellfish and finfish such as brown and white shrimp, (*Penaeus aztecus* and *P. setiferus*), oyster (*Crassostrea virginica*), blue crab (*Callinectes sapidus*), menhaden (*Brevoortia* spp.), and the sciaenid fishes. These marine resources support many valuable commercial and sport fisheries.

The Mississippi River exerts a major influence on the northern Gulf of Mexico industrial groundfish grounds (Gunter, 1967). The river annually deposits large quantities of sediment at its mouth, creating a soft mud bottom with a fairly steep slope. Eastward and westward from the Delta, bottom composition changes from soft mud near the river mouth to firmer mud, sand, and shell bottom.

Bottom topography east and west of the Mississippi River mouth is somewhat altered from that off the Delta because of an increased shelf area and a decreased rate of mud deposition. There, the bottom has a gentle slope with mud lumps and some "live" coral areas.

The historical industrial bottomfish fishing grounds for the northern Gulf of Mexico between 1959 and 1963 were

described in detail by Roithmayr (1965 a,b) and the present fishing grounds generally encompass the same area. The primary industrial bottomfish grounds in the northern Gulf extend seaward to about 35 fathoms but most catches are made in waters shallower than 20 fathoms. Occassionally, fishing may be conducted in depths of 40 to 50 fathoms.

Initially, fishermen seldom ventured west of the Delta because required production could be obtained near their home ports east of the Delta. During 1959-63, about 60 to 85 percent of the fishing effort and landings occurred east of the Mississippi River Delta while data from 1969-72 indicate that both effort and catch are now about equally divided between the areas east and west of the Delta (Fig. 4). This shift does not necessarily reflect geographical changes in the sciaenid population density. In all probability, this is due to the inability of the eastern grounds to meet the increased demand witnessed since 1963.

Industrial groundfish catches east of the Delta are now made primarily off the islands between Mobile Bay and North Pass of the Mississippi River. Those west of the Delta are made offshore of Grand Isle to Marsh Island, La.

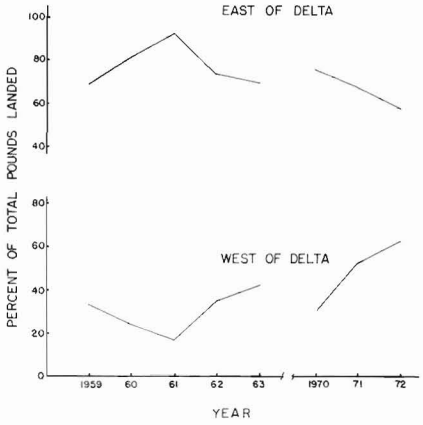

Figure 4.—Percent total production east and west of the Mississippi Delta 1959-63 (Roithmayr, 1965) and from fishing boat logbooks for 1970-72 (logbooks represent 10-15 percent of the total fleet effort).

Tactics

Fishing tactics have evolved from single rigged, small wooden vessels (average size 50 ft long with a carrying capacity of about 30 tons) to large steel trawlers (up to 130 ft long with a carrying capacity of 400 tons) designed specifically for this fishery towing two nets (Table 1).

Vessels now use outriggers that are dropped from their upright, stowed position, soon after leaving port. Each outrigger is used to tow a single trawl. The fishing trawls, prepared for operation as the vessel departs port, remain on deck until the vessel arrives at the fishing location. Brine tanks used to refrigerate the catch are filled about one-third immediately upon departure and chilling started. Additional seawater is then added and chilled as needed.

All vessels use a small trawl (approximately a 16-ft headrope) called a trynet to locate commercial concentrations of fish and to monitor the fishing activity. This is set from a separate winch and is handled independently off the stern of the fishing vessel. These small trawls use doors ranging in size from 2 ft × 18 inches to 2 ft × 24 inches. Once set, the trynet is hauled back each half hour and the catch evaluated to determine whether to: (1) continue fishing, (2) change direction of tow, (3) move to more fertile grounds, or (4) set the large fishing trawls. Appraisal criteria of the trynet catch includes species composition; number, condition, color, and ratio of croaker; and presence of undesirable species.

Significant catches of industrial bottomfish in the trynet will initiate fishing operations. When fishing two nets, the doors are hung from the end of each outrigger with the net strung out on the surface. A single winch is used for each net, which has a 30- to 50-fathom bridle extending from the tow warp to the doors. As the doors are dropped into the water the nets spread, assuming their fishing configuration as they are carried to the bottom. Single-net fishing, on the other hand, is done off the stern with one door hung from a gallows on each side of the vessel. Two winches and tow warps are used; the bridle is absent. The net is laid out behind the boat and when the doors are dropped it assumes its fishing attitude. Maintaining tension on the towing cable is very important during setting to ensure that the trawl is properly spread. Warp length is approximately four times the bottom depth unless fishing in shallow water (5 fathoms or less) where the scope ratio is increased to five or six times the depth. When fishing in 2 or 3 fathoms, the fishermen lets out only enough warp to submerge the entire bridle.

Trawling time is quite variable, depending upon density and availability of

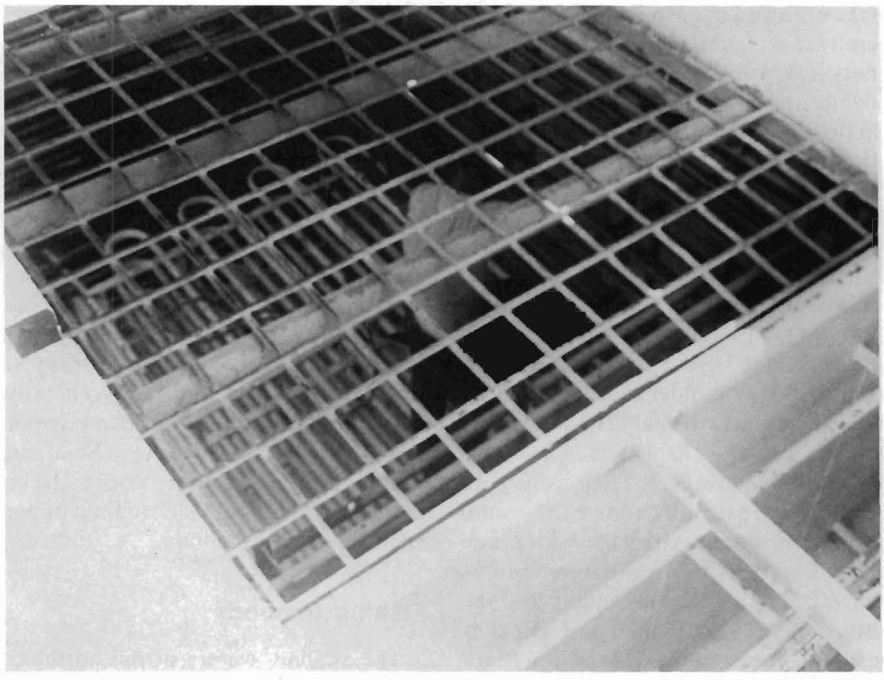

Figure 5.—Grid array used over hatches on the industrial bottomfish trawlers to prevent large specimens from entering the brine tanks.

finfish on the grounds. Towing time ranges between 10 min and 5 h but averages about 3 h per tow. Longer tows ordinarily produce catches of inferior quality because of the abrasions caused by other fish, the webbing, and water pressure. When catch rates are high, fishing is conducted both day and night unless sea conditions limit operation. Non-fishing time is restricted to search and repair functions. If fish are scattered and catch rates low, many vessels stop fishing overnight and continue at daybreak.

After a tow has been completed, the trawl is swung over a sorting grid above the hatch and the catch emptied directly into the chilled brine maintained between 28° and 30°F (Fig. 5). This process immediately raises the brine temperature; however, the solution stabilizes downward to 28°-30°F in about 15 min. Large fish will not enter the fishhold because of the sorting grids and of these, undesirable species are discarded and edible fish saved for future sale.

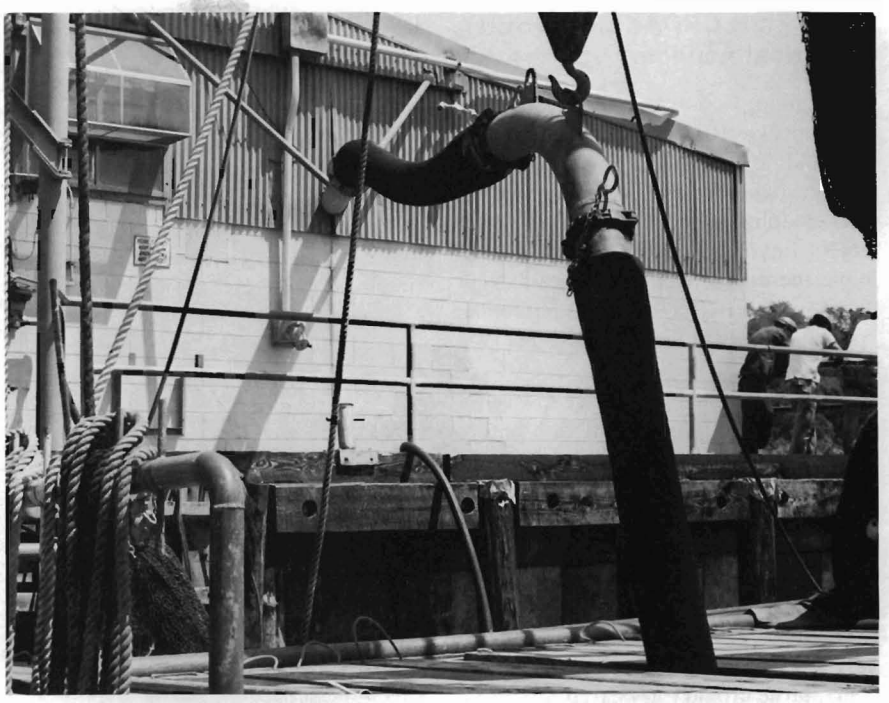

Figure 6.—Suction hose used to offload industrial bottomfish catches at the processing plant.

Trip duration has changed since the early years of the fishery when a trip lasted from 1 to 3 days and the vessels fished reasonably close to the plant sites. Today, trips average about 7 days and range from 3 to 10 days, depending on catch rates and vessel capacity. Running time to the grounds used to vary from 1 to 6 h, but can now take up to 24 h. Fishing time averages about 14 h per day but is variable depending on bottom type, density of stock, and incidence of repairs. Processors request that vessels do not remain at sea longer than 7 days to prevent reduced catch quality.

Gear damage on the grounds due to bottom type or obstructions is relatively light because of the regularity and texture of the bottom. There is, however, a serious threat to trawls from sharks and large jacks (*Caranx hippos*), particularly close to the Mississippi River mouth. Large schools of sharks abound in that area and at times tear large holes in the trawl body or codend. Fishermen have reported that large schooling jacks, (a species that does not have the extensive dentition of sharks) can also do considerable damage to a net through repeated strikes that weaken the net twine.

Trawl damage and subsequent catch loss is costly and large concentrations of sharks can force vessels to leave a high-production area. This has stimulated the development of several techniques to reduce both severity and incidence of trawl damage by fish. Mesh sizes larger than 3 inches have been used, but fish gilling attracts sharks and increases the incidence of damage. Electrical shocking units placed on the bag were successful in discouraging sharks but their usefulness was overridden by the risk of loss and high cost. Stainless steel chaffing bag covers, which slip directly over the trawl, have had some success against sharks, but with prolonged use they abrade the twine and weaken the bag. Regardless, these chaffing bags have been more successful than any other shark deterrent and are used by many fishermen.

Processing

Vessels are offloaded with a hydraulic fish pump (Fig. 6) that transfers fish and chilled brine from the hold onto a conveyor belt leading into the plant. Fish are transported into the plant, but the brine solution is recycled back into the hold and is repeatedly removed with fish by the hydraulic fish pump unit. Offloading time is variable, depending on species composition, size of fish, and weight of catch. Offloading 100 tons of fish will take from 6 to 8 h unless the belt must be repeatedly stopped to remove edible or undesirable species. Edible fish, crustaceans, trash, and all undesirable animals (i.e., those difficult to grind or harmful to grinders) are removed from the belt as the catch moves into the processing area. Edible items are returned to the boat to be sold or eaten by the trawler crew, and the undesirable species discarded. Usable fish continue into the petfood processing area.

Processing, generally similar throughout the industry, includes grinding, mixing, cooking, fortifying, canning, sterilizing, labeling, and casing. Whole raw fish are ground and mixed with meal or other animal protein. Vitamins, minerals, and other products are added according to specified formulation. The product is then cooked, canned, sterilized in retorts, cooled, labeled, and readied for distribution.

Some handling differences occur depending on plant and degree of automation. For example, one plant initially handles the catch on the deck, whereas the other plants do not handle the catch until it has entered the processing area. Sterilization techniques also differ among processors, some requiring considerably more manual effort in placing and removing cans in the retorts.

FOODFISH CROAKER FISHERY
Historical Aspects

Declining croaker catches in the Chesapeake Bay area (Joseph, 1972) resulted in a ready market for large Gulf croaker and stimulated in 1967 the establishment of a foodfish fishery in Bayou La Batre, Ala. Landings have increased significantly each year from 1967 to 1971, with 10 million lb valued at $1 million landed in 1971 (Fig. 7).

A foodfish fishery for croaker was not initiated in the Gulf of Mexico before 1967 because quantities of large croaker, capable of sustaining a fishery, were unavailable though croaker exceeding 1 lb were known to be present in the inshore and offshore waters of Texas, Louisiana, Mississippi, and Alabama. Those few taken were generally sold in local fresh-fish markets. In 1967, large croaker appeared in sizable quantities in 5 fathoms and deeper around the mouth of the Mississippi River, and a portion of the local shrimp fishing fleet began fishing for them on a regular basis.

Their "sudden" appearance, in sufficiently large quantities to establish a fishery, has not been adequately explained. It has been suggested that the croaker population, prior to exploitation by the industrial bottomfish fishery, was stunted due to overpopulation. Initiation of the industrial bottomfish fishery and its subsequent landing eliminated overpopulation, thereby allowing croakers to grow to their "normal" size. In addition, the presence of offshore oil platforms on these grounds may provide "refuge" for these fish, thereby reducing exploitation and allowing them to grow to a larger size. This view is not shared by all fishermen. Some industrial groundfish fishermen have advocated that lack of a market for large croaker is the primary reason that

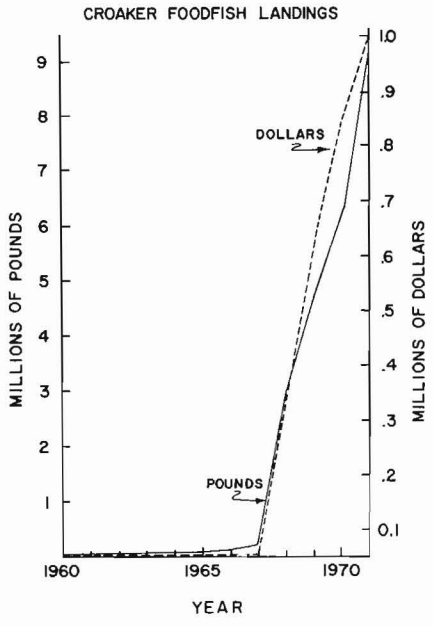

Figure 7.—Total pounds and dollar value of foodfish croaker landed through 1971.

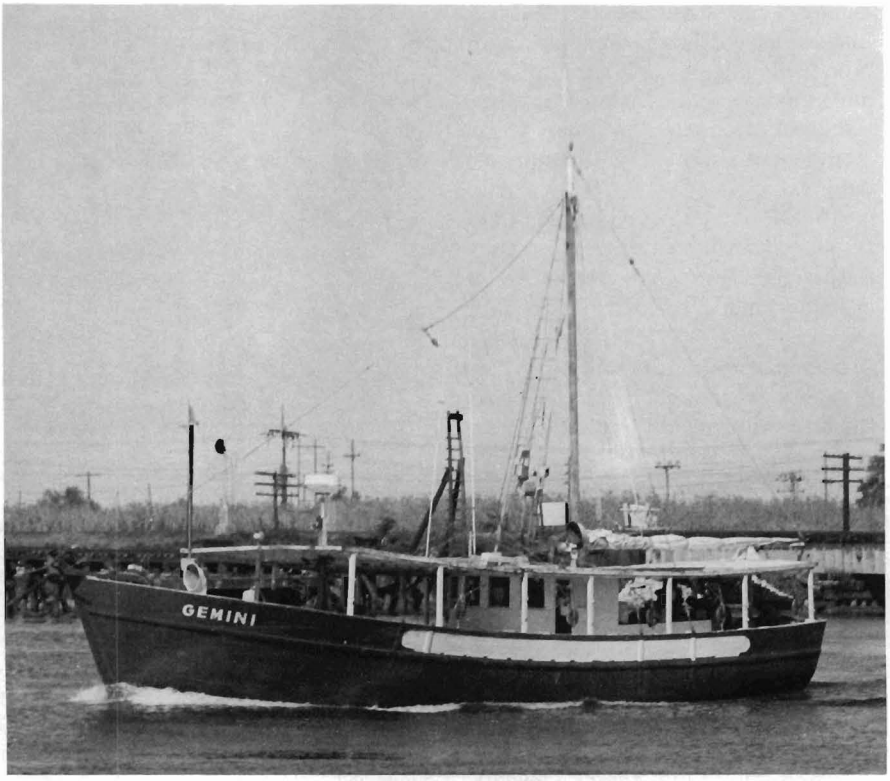

Figure 8.—Conventional handline snapper fishing boat.

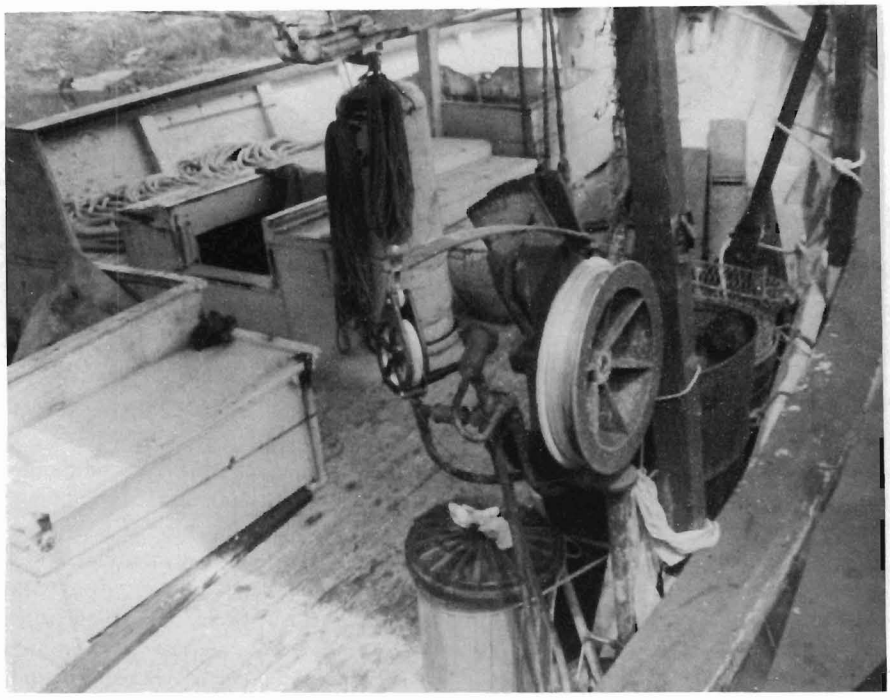

Figure 9.—Snapper boat handlines and reel.

few were landed prior to 1967. They state that prior to the establishment of the foodfish fishery, large croaker catches could be made off the mouth of the Mississippi River; however, industrial products processors discouraged the catching of these large croaker. Despite these theories, the origins of the sudden rise in foodfish croaker populations remain obscure at this time.

Some 10-20 thousand lb of foodfish croaker are also taken annually by trammel nets in Big Lagoon, Ala. This operation is independent of the trawl fishery, the catch being sold directly to outside markets by the producer. Limited numbers of large croaker are also taken on handlines by snapper boats fishing offshore oil platforms around the river mouth but principally west of Southwest Pass. A typical snapper handliner is shown in Figure 8. Standard snapper reels baited with squid or cut fish are used in this activity (Fig 9).

Approximately 75 percent of the foodfish croaker landed are taken by trawlers who fish primarily for croaker, whereas the remaining 25 percent is taken by shrimpers who occasionally trawl for croaker. This distribution of effort into either shrimp or croaker is a matter of degree and is, in part, influenced by the availability and/or price of either resource.

Vessels and Gear

Vessel and gear characteristics for the foodfish trawler are given in Tables 3 and 4. Initially, the local foodfish croaker fleet was comprised of large shrimp boats, but vessel modifications were required as catches increased. These modifications were primarily directed toward handling larger, more efficient trawls and increasing the holding capacity. A typical foodfish trawler operating in this fishery is shown in Figure 10.

All but one of the primary trawlers in this fleet are constructed of steel, the other of wood. Refrigerated ice, rather than brine, is used to maintain better catch quality. Vessel length, horsepower, and net size are less variable than in the industrial fleet and all are equipped for double-rigged trawling.

Trawls used by the foodfish fleet are of one basic design. These are generally smaller than those used in the industrial fishery (though rigged the same)

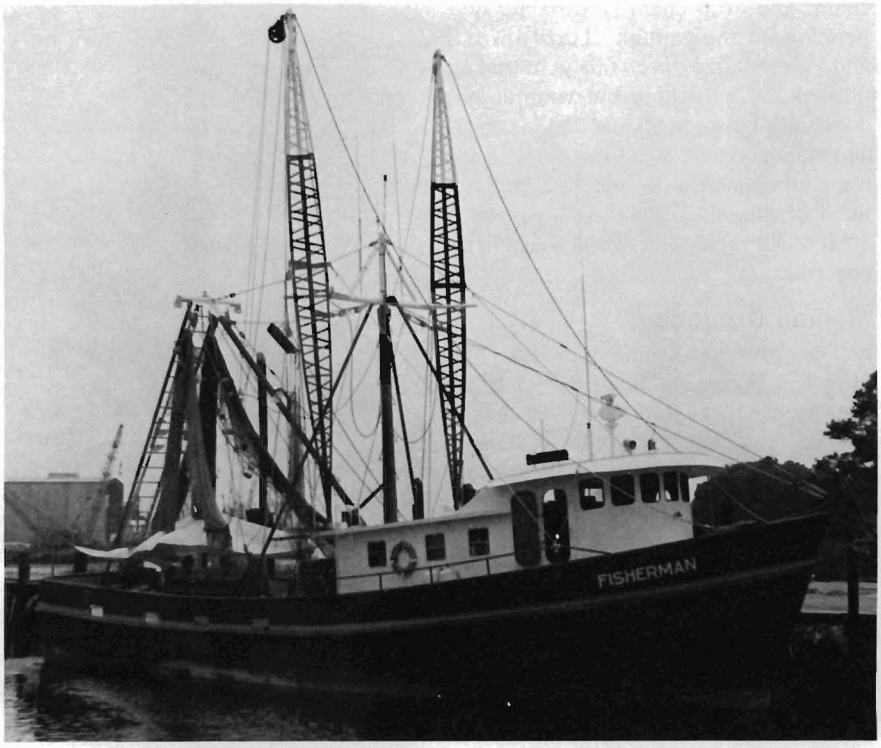

Figure 10.—Contemporary northern Gulf foodfish trawler.

Table 3.—Summary of vessel characteristics of the foodfish croaker fleet fishing in the northern Gulf of Mexico. This table represents the principal croaker foodfishing vessels.

Vessel	Type construction	Tonnage		Length (ft)	Width (ft)	Horsepower	Winch capacity (fathoms)	Size cable (in)	Drums per winch
		Gross	Capacity						
1	Steel	137	93	83	29	320	200	5/8	3
2	Steel	114	101	75	21	320	200	5/8	2
3	Steel	77	52	65	20	340	200	3/8	—
4	Steel	135	93	85	20	425	—	5/8	—
5	Steel	118	81	75	21	420	200	5/8	3
6	Steel	115	78	80	22	375	200	5/8	3
7	Steel	119	81	83	24	320	245	5/8	3
8	Steel	119	85	85	24	320	200	5/8	3
9	Steel	115	78	75	22	340	225	5/8	3
10	Steel	114	67	72	22	345	200	5/8	3
11	Wood	79	53	70	20	240	200	5/8	3
12	Steel	136	92	86	24	425	1,000	5/8	3

Table 4.—Summary of net characteristics of foodfish croaker fleet fishing in the northern Gulf of Mexico, 1973.

Length (ft)					Mesh size in inches								Chain arrangement					
Headrope	Footrope	No. of rollers	Floats		Wing body	Throat	Bag	Meshes in wing	Wing	Body	Throat	Bag	ft. between loops	Links/ loop	Texas drop	Leg line (ft)	Door information	
			No.	Type													Length (ft)	Height (ft)
65	75	35	12	Plastic	2	1½	1⅛	150	18	21	30	54	7	20	—	12	10	40
65	75	38	7	"	2	1½	1½	150	21	21	21	54	7	—	8"	12	10	44
52	62	26	4	"	1⅞	1⅝	2	100	18	18	—	54	3	—	—	12	9	40
65	75	38	4	"	2	1½	1½	125	18	21	21	54	4	—	—	12	11	44
65	70	30	5	"	2	1½	1½	135	21	21	21	54	4	15	—	10	10	44
65	75	35	8	"	2	1½	1½	100	21	30	30	54	4	18	—	10	11	44
62	72	35	8	"	2	1½	1½	80	21	30	30	54	4	16	—	16	10	44
60	70	20	10	"	2	1½	1⅞	200	18	30	18	54	10.5	16	—	15	10	44
62	72	22	5	"	2	1½	1⅝	165	21	30	30	54	4	15	—	10	10	44
71	81	24	5	"	2	1½	1⅞	125	18	21	21	60	9	17	—	12	10	44
50	60	25	6	"	2	1½	1⅞	100	18	30	30	54	6	16	—	12	9	40
65	70	33	18	Sponge	2	1½	1½	100	21	30	30	54	1	14	—	6	12	44

and range in headrope length from 40 to 71 ft (Table 4). Size used is somewhat dependent upon vessel size and horsepower. The variation between the number and type of floats and mud rollers used is shown in Table 4. Placement of floats, mud rollers, tickler chain, and drop chain is variable, depending on the captain. Trawl thread and mesh size are fairly uniform throughout the fishery but wing depth does vary between 80 and 200 meshes, depending on how high from the bottom the captain wants the net to fish. The most commonly used trawl doors are 10 ft × 44 inches, of wood and chain construction.

Fishing Grounds

The present fishing grounds are shown in Figure 3. The primary fishing area for trawl-caught foodfish croaker is around Southwest Pass off the Mississippi River Delta, with limited fishing conducted between Southwest Pass and North Pass in depths of 5 to 40 fm and in the area between Southwest Pass and Marsh Island in depths to about 20 fm. As mentioned, the handline fishery is located near offshore oil platforms in depths of 20 to 39 fm, and the fish are generally larger than the "large" trawl-caught croaker. Handlined croaker average about 2 lb in weight and 18 inches in length, whereas the large trawl-caught croaker weigh 1 lb and are about 15 inches long.

Tactics

Major differences between industrial bottomfish and croaker foodfish fishing lie in the size of fish harvested and the shipboard processing techniques employed. The foodfish industry requires only croaker larger than 9½ inches that have been held on ice for short periods. Croaker between 9 and 10 inches are least desirable though improved mincing techniques may allow using this size croaker in such products as fish blocks, etc.

A similar but smaller trynet than that used in the industrial fishery is used to locate commercial concentrations of foodfish-sized croaker and to monitor availability and density of croaker. Trynet operation in both foodfish and industrial bottomfish fisheries is similar. Fishing operations with the large trawls are as described in the section titled Industrial Bottomfish Fishery.

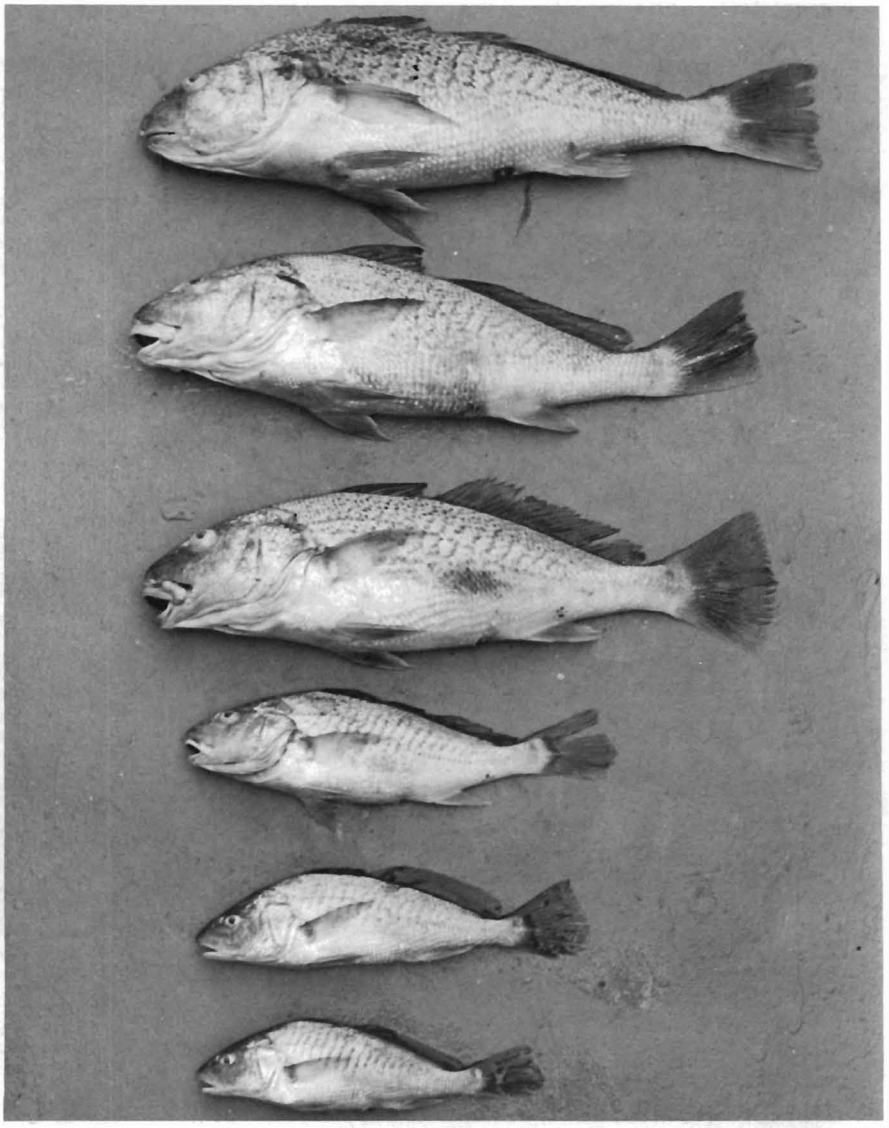

Figure 11.—Foodfish croaker taken in the northern Gulf of Mexico on the National Marine Fisheries Service RV *Oregon II*. Lower two fish are small foodfish, middle two fish are medium foodfish, and upper two are large foodfish.

Drag time varies from 20 min to 3 h, depending upon the concentration of available food-sized croaker. Trawling is conducted only between sunrise and sunset because fishermen believe that fishing in the same area continuously for 24 h unsettles the bottom and drives the fish from the area.

After the bag is brought aboard and emptied on deck, the catch is sorted for foodfish croaker, other foodfish species, and shrimp. Usable croaker are rough-sorted into large-, medium-, and small-sized groups and put into the hold and iced (Fig. 11). Large foodfish-sized croaker weigh over 1 lb and are longer than 12 inches; medium-sized croaker are between ¾ and 1 lb and are longer than 10 inches; small-sized croaker are between ½- and ¾-lb and are longer than 9 inches. Marketable fish and shrimp are put into the hold in separate bins and iced. The remainder of the catch is discarded and the net reset.

Trip time ranges between 3 and 12 days depending on availability and density of foodfish-sized croaker and/or weather. An average trip lasts about 6.7 days, with 5 days of fishing, and the remainder spent traveling. Fishing time per day is about 13 h minus search and repair time. This fishery experiences the same problem with sharks and large jacks as discussed in the section titled Industrial Bottomfish Fishery.

Processing

Processing operations are generally similar throughout the trawl-caught foodfish croaker industry. Croaker are offloaded separately from other edible fish using either a large bucket or a suction pump which removes both ice and finfish from the hold. Except for minor differences, both systems utilize a conveyor belt to transport the catch into the plant; however, when the suction pump is used the catch is deposited directly onto a conveyor belt, but when a bucket system is employed the catch is first dumped into a water tank hopper and then automatically carried onto the conveyor belt (Fig. 12).

The catch entering the plant is hand-separated into the three foodfish-sized groups (Fig. 13). The sorted fish are then boxed in the round and iced for transport to the fresh-fish markets in Chesapeake Bay and New York.

Croaker are offloaded from snapper boats with a suction pump, but hand-sorting into size groups is obviously unnecessary. These croaker are boxed, iced, and transported to Bayou La Batre for shipment to the northeastern markets.

Figure 12.—Conveyor belt used in offloading vessels.

FINFISH DISTRIBUTION ON THE NORTHERN GULF OF MEXICO FISHING GROUNDS

Finfish distribution on the northern Gulf grounds is variable and somewhat dependent on bottom type, water temperature, and season, as evidenced by changes in catch rates and species composition. Croaker, the largest component of the commercial catch, prefer a mud bottom and are generally not found in depths exceeding 60 fathoms. Few croaker or other sciaenid fishes are caught over a sand/dead-shell bottom.

The depth at which quantities of fish are found is dependent, in part, on water temperature and season. Heavy concentrations of fish occur in shallow, warm water (inside 10 fathoms) during the summer months, but in fall and winter croaker and spot move offshore to about 40 fathoms (Franks et al., 1972). This offshore migration is partially in response to the cooling of the shallow inshore waters during the colder winter months.

Croaker and other finfish are not evenly (i.e., non-randomly) distributed

Figure 13.—Hand sorting and grading foodfish croaker.

on the fishing grounds. This is demonstrated by the often-encountered high variability in catch rates between simultaneously-towed nets. Enormous croaker schools are occasionally encountered where fish extend from the surface to the bottom. Fishermen, locating these concentrations by the large mud roils that are created, have reported catches of from 10 to 20 tons of croaker in 10-15 min of fishing. Because croaker tend to be concentrated in large schools whose general distribution is uneven, "staying in fish" becomes quite difficult and distribution and density must be continuously monitored to optimize vessel operations. Losing the schools results in costly search time with a subsequent increase in operational expense. Thus, the trynet is used to reduce this expense.

SPECIES COMPOSITION

A list of species taken on the northern Gulf of Mexico bottomfish grounds has been published by Roithmayr (1965 a). Only 10-20 species represent major components of this fishery (Table 5). The total species composition on the grounds remains constant, though temporal and spatial changes in species ranking are detected from trawl samples. Studies are presently underway by the National Marine Fisheries Service to gain an understanding of these fluctuations and the mechanisms responsible for them.

Species composition differs seasonally inshore-offshore and east and west of the Mississippi River Delta (Moore, Brusher, and Trent, 1970). Those species exerting a distinct influence on the finfish biomass are listed in Table 5. Sciaenids strongly dominate species composition, and at times, catches are almost exclusively one or more of the following seven species: croaker (*Micropogon undulatus*), spot (*Leiostomus xanthurus*), silvereel (*Trichiurus lepturus*), catfish (*Arius felis*), longspine porgy (*Stenotomus caprinus*), bumper (*Chloroscombrus chrysurus*), or butterfish (*Peprilus burti*). Often these seven species can account for as much as 95-98 percent of the total weight of the catch.

Brown, white, and pink shrimp (*Penaeus aztecus*, *P. setiferus*, and *P. duorarum*) are at times taken in quantities that represent a significant dollar value to the fisherman. Seasonally, large quantities of pompano (*Trachinotus carolinus*) and bulldozer lobster (*Scyllaridae*) are taken with the industrial finfish catches, and are sold on the local fresh-fish market or consumed by the fishermen.

Table 5.—List of the finfish species contributing a significant portion of the catch taken on the industrial and foodfish croaker grounds of the northern Gulf of Mexico.

Family	Scientific name	Common name
Sciaenidae	*Cynoscion aurenarius*	Sand seatrout
	Cynoscion nothus	Silver seatrout
	Larimus fasciatus	Banded croaker
	Leiostomus xanthurus	Spot
	Menticirrhus americanus	Southern kingfish
	Micropogon undulatus	Croaker
	Stellifer lanceolatus	Star drum
Carangidae	*Chloroscombrus chrysurus*	Bumper
	Trachurus lathami	Rough scad
	Vomer setapinnis	Atlantic moonfish
Ariidae	*Arius felis*	Sea catfish
Sparidae	*Stenotomus caprinus*	Longspine porgy
Stromateidae	*Peprilus burti*	Gulf butterfish
Trichiuridae	*Trichiurus lepturus*	Atlantic cutlassfish (Silvereel)
Clupeidae	*Harengula pensacolae*	Scaled sardine
	Sardinella anchovia	Spanish sardine
Synodontidae	*Synodus foetens*	Lizardfish
Triglidae	*Prionotus* sp.	Searobin

SUMMARY

The finfish resource of the northern Gulf of Mexico, dominated by sciaenids (croaker, spot, seatrout), supports two major trawl fisheries. One, initiated in 1952 to produce petfood, has undergone significant changes in vessels, gear, and fishing tactics. The second, begun in 1967, produces croaker for human consumption. Both fisheries use steel (one wood vessel exists in the industrial fishery) trawlers ranging from 65 to 121 ft and equipped for double-rigging trawling. Fishing gear is very similar in both fisheries and each uses the small "trynet" as a monitoring tool.

Major differences between the two fisheries (aside from the marketed product) lie in the species utilized, size of croaker required, and the processing and holding technology used at sea. The industrial fishery uses most finfish taken and requires croaker less than 8 inches in length. The catch is held at sea in chilled brine. Conversely, the foodfish fishery uses only croaker and those must exceed 9 inches. Catches are held in refrigerated ice. Both fisheries sort out and save edible finfish and shrimp for separate onshore sale.

Foodfish croaker are graded as small, medium, and large with preference for fish over 1 lb. The fishery is supplemented by handlined croaker, exceeding 1 lb and often much heavier, taken by commercial red snapper vessels near offshore oil platforms.

Fishing grounds extend from Pensacola, Fla., to Galveston, Tex. The primary grounds are located around the mouth of the Mississippi River and within 50 miles east of North Pass and 100 miles west of Southwest Pass. Fishes are generally found inshore (shallower than 12 fathoms) during the warm summer months and further offshore (30 to 40 fathoms) during the colder winter months.

Finfish stocks, particularly croaker, are distributed non-randomly on the grounds. At times they form excessively large schools from which fishermen report making catches up to 20 tons in about 10 to 15 min. Sciaenids such as croaker, trout, and spot are so dominant in the resource that they often make up as much as 98 percent of the catch. In 1972 the combined landings from these two fisheries exceeded 100 million pounds.

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[1]Reference to trade names does not imply endorsement of the National Marine Fisheries Service, NOAA.

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LITERATURE CITED

Bullis, H. R., Jr., and J. S. Carpenter. 1968. Latent fishery resources of the central west Atlantic region. *In* D. W. Gilbert (editor), The future of the fishing industry of the United States, p. 61-64. Univ. Wash. Publ. Fish., New Ser., Vol. IV, Seattle.

Franks, J. S., J. Y. Christmas, W. L. Siler, R. Combs, R. Waller, and C. Burns. 1972 A study of nektonic and benthic faunas of the shallow Gulf of Mexico off the State of Mississippi as related to some physical, chemical and geological factors. Gulf Res. Rep. 4:1-148.

Gunter, G. 1967. Some relationships of estuaries to the fisheries of the Gulf of Mexico. *In* G. H. Lauff (editor), Estuaries, p. 621-638. Am. Assoc. Adv. Sci., Publ. 83, Wash., D.C.

Haskell, W. A. 1961. Gulf of Mexico trawl fishery for industrial species. Commer. Fish. Rev. 23(2):1-6.

Joseph, E. B. 1972. The status of the sciaenid stocks of the middle Atlantic coast. Chesapeake Sci. 13(2):87-100.

Moore, D., H. A. Brusher, and L. Trent. 1970. Relative abundance, seasonal distribution, and species composition of demersal fishes off Louisiana and Texas, 1962-1964. Contrib. Mar. Sci., Univ. Tex. 15:45-70.

Roithmayr, C. M. 1965a. Industrial bottomfish fishery of the northern Gulf of Mexico, 1959-63. U.S. Fish Wildl. Serv., Spec. Sci. Rep. Fish. 518, 23 p.

_____. 1965b. Review of industrial bottomfish fishery in northern Gulf of Mexico, 1959-62. Commer. Fish. Rev. 27(1):1-6.

Thompson, M. H. 1966. Proximate composition of Gulf of Mexico industrial fish. U.S. Fish Wildl. Serv., Fish. Ind. Res. 3(2):29-67.

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