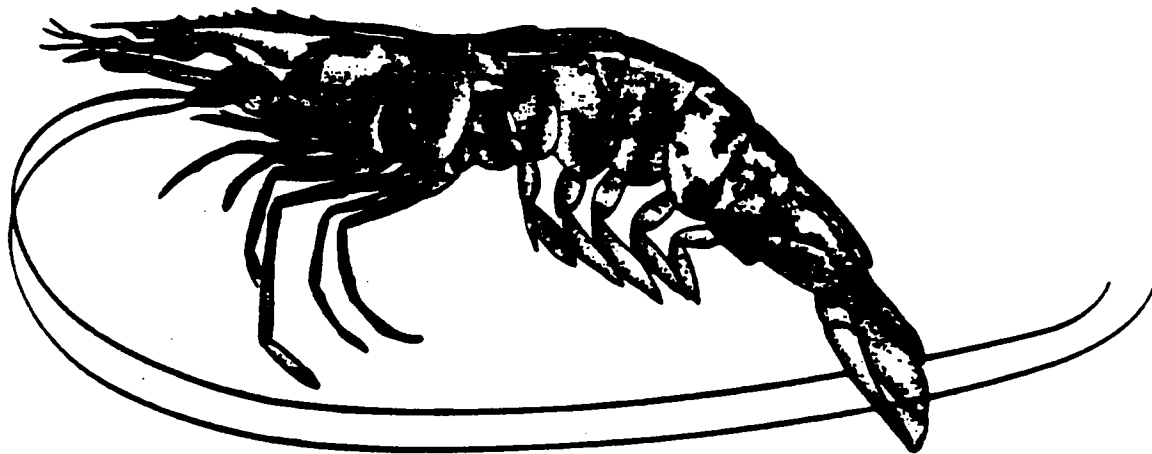


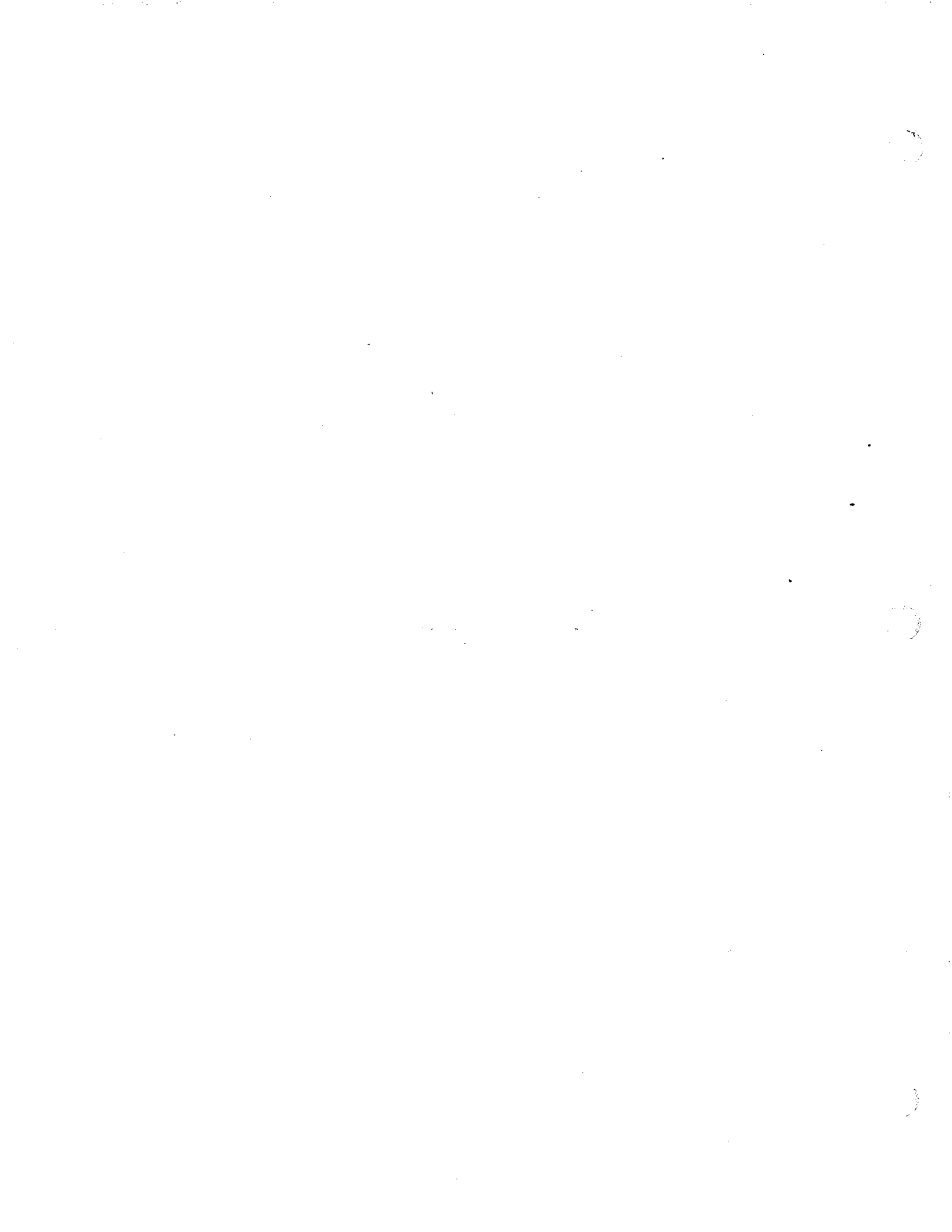
**FISHERY MANAGEMENT PLAN
FOR THE
SHRIMP FISHERY
OF THE
GULF OF MEXICO,
UNITED STATES WATERS**

(INCLUDES AMENDMENTS 1 AND 2)



REVISED NOVEMBER 1981

**GULF OF MEXICO FISHERY MANAGEMENT COUNCIL
TAMPA, FLORIDA**



DRAFT UPDATE
OF
FISHERY MANAGEMENT PLAN
FOR
SHRIMP
GULF OF MEXICO

NOVEMBER, 1981

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2.0 INTRODUCTION

The Magnuson Fishery Conservation and Management Act (Public Law 94-265) provides for exclusive United States management authority over the fishery resources within a fishery conservation zone extending from the seaward boundary to the United States territorial sea (three nautical miles for the Gulf of Mexico states of Louisiana, Mississippi, and Alabama and nine nautical miles for Texas and the west and northwest coasts of Florida) to a point 200 miles from shore. Responsibility for developing a shrimp fishery management plan for the Gulf of Mexico is vested in the Gulf of Mexico Fishery Management Council; and implementation and enforcement of any regulations pertinent to the management of fisheries within the fishery conservation zone are the responsibility of the Secretary of Commerce and Secretary of the Department wherein the U.S. Coast Guard is located.

Successful implementation of the plan will require unity of purpose between federal regulations and those of the five Gulf states (Florida, Alabama, Mississippi, Louisiana, and Texas). Authority for implementing state regulations is vested in the Florida Department of Natural Resources, the Alabama Department of Conservation and Natural Resources, the Mississippi Marine Conservation Commission, the Louisiana Wildlife and Fisheries Commission, and the Texas Parks and Wildlife Commission.

The fishery addressed is composed of six species, occurring in the area of jurisdiction of the Gulf of Mexico Fishery Management Council as well as in the territorial seas adjacent thereto and the associated bays, inlets, wetlands, and upland areas as appropriate. Species include brown shrimp (*Penaeus aztecus* Ives), white shrimp (*Penaeus setiferus* Linnaeus), pink shrimp (*Penaeus duorarum* Burkenroad), and royal red shrimp (*Hymenopenaeus robustus* Smith¹), plus seabobs (*Xiphopenaeus kroyeri* Heller) and rock shrimp (*Sicyonia brevirostris* Stimpson), which are incidental bycatch. The management unit is to be equal to the fishery throughout its range; however, federal implementation will occur only in the fishery conservation zone.

Biological aspects of the shrimp species have been reviewed, and the maximum probable catch is estimated at: (see Sec. 4.7.1.1)

Brown shrimp	--	132 million pounds (tails) per year
White shrimp	--	64 million pounds (tails) per year
Pink shrimp	--	20 million pounds (tails) per year
Royal red shrimp	--	0.392 million pounds (tails) per year

Each year's take of brown, white, and pink shrimp will be heavily influenced by water salinity and temperature during critical periods of estuarine shrimp growth. Maximum sustainable yield (MSY) estimates for the seabobs and rock shrimp cannot be made with any authority because they are caught incidentally by fishermen trawling for the other species.

Seabobs and rock shrimp are caught incidental to the three main species of penaeid shrimp. MSY estimates are weakened because of lack of data.

None of the stocks appear to be biologically overfished.

Major concern for future stocks is related to concern for adequate habitat, particularly for the estuarine-dependent brown, white, and pink shrimp, which account for most of the annual shrimp harvest.

¹ The genus *Hymenopenaeus* is the same as *Pleoticus* according to Isabel Farfante.

The effects of shrimping on sea turtles and incidentally caught finfish are considered in the plan.

The fishery is the most valuable and probably the most diverse in the nation. Harvesters include (1) a large commercial fleet fishing the inshore, nearshore Gulf, and open Gulf waters, (2) an undetermined (but large) number of recreational shrimpers mainly fishing the inshore and nearshore Gulf waters, and (3) a substantial number of bait shrimpers mainly fishing the inshore waters. Processed products include frozen, canned, fresh, and breaded shrimp as well as a host of specialty items. Present management regimes differ in the fishery over the allowable size of shrimp at first harvest as size is related to whom can harvest and process the shrimp.

Unfortunately, socioeconomic data are insufficient for this complex fishery to evaluate fully the relative needs of various user groups for shrimp of different sizes. Care has therefore been taken in making recommendations to reduce the waste of current culling practices so that one user group will not be favored over another. No recommendations are made on limiting fishing effort because the resource is not biologically overfished. There is insufficient socioeconomic data to suggest methods or reasons, consistent with MFCMA, to limit entry at this time.

During a period of public review of the Draft Fishery Management Plan and Environmental Impact Statement, 21 public hearings were held and written comments were received by mail. Public comments and responses are contained in the Final Environmental Impact Statement.

The plan is to be reviewed annually so that management measures can be evaluated for their fairness and effectiveness and so that other methods of optimizing yield can be assessed.

Problems in the Fishery (See Section 8.3)

The Council has identified the following problems associated with the fishery and the present management regime and has prepared the plan objectives to address and alleviate them. In a free access fishery, a management regime to maximize protein yield and economic return to the fisherman is of importance.

- 1) Conflict among user groups as to area and size at which shrimp are to be harvested.
- 2) Discard of shrimp through the wasteful practice of culling.
- 3) The continuing decline in the quality and quantity of estuarine and associated inland habitats.
- 4) Lack of comprehensive, coordinated and easily ascertainable management authorities over shrimp resources throughout their ranges.
- 5) Conflicts with other fisheries such as the stone crab fishery in southern Florida, the groundfish fishery of the north central Gulf, and the Gulf's reef fish fishery.
- 6) Incidental capture of sea turtles.
- 7) Loss of gear and trawling grounds due to man-made underwater obstructions.
- 8) Partial lack of basic data needed for management.

2.1 Goal and Objectives

GOAL:

To manage the shrimp fishery of the United States waters of the Gulf of Mexico in order to attain the greatest overall benefit to the nation with particular reference to food production and recreational opportunities on the basis of the maximum sustainable yield as modified by relevant economic, social or ecological factors.

OBJECTIVES:

1. Optimize the yield from shrimp recruited to the fishery.
2. Encourage habitat protection measures to prevent undue loss of shrimp habitat.
3. Coordinate the development of shrimp management measures by the GMFMC with shrimp management programs of the several states, where feasible.
4. Promote consistency with the Endangered Species Act and the Marine Mammal Protection Act.
5. Minimize the incidental capture of finfish by shrimpers, when appropriate.
6. Minimize conflicts between shrimp and stone crab fishermen.
7. Minimize adverse effects of underwater obstructions to shrimp trawling.
8. Provide for a statistical reporting system.

2.2 Management Measures Considered and Adopted (See Sec. 8.5.1.1)

In order to obtain the above objectives, the Council has adopted the following management measures:

- Measure 1: Establish a cooperative permanent closure with the State of Florida and the U.S. Department of Commerce of the area delineated in Table 8.3-1 to protect small pink shrimp until they have generally reached a size range larger than 69 tails to the pound.
- Measure 2: Establish a cooperative closure of the territorial sea of Texas and the adjacent U.S. FCZ with the State of Texas and the U.S. Department of Commerce during the time when a substantial portion of the brown shrimp in these waters weigh less than a count of 65 tails to the pound (39 heads-on shrimp to the pound).
- Measure 3: Recommend that all Gulf states consider establishing shrimp management sanctuaries in important segments of nursery grounds under their sole jurisdiction.
- Measure 4: The Gulf of Mexico Fishery Management Council has established an internal committee to review and assess the status of Gulf fishery habitats, with particular attention to those factors which might further stimulate "the downward trends in quality and quantity of fish habitats." (Atlantic States Marine Fisheries Commission, et al., 1977.)
- Measure 5: The Gulf states are encouraged to adopt flexible management procedures which would provide regulation by administrative agencies of the shrimp resources in inland waters and territorial seas.

Measure 6: The Gulf states are encouraged to adopt reciprocal internal management decisions flexible enough to allow joint management of shrimp with other states and with the Department of Commerce.

Measure 7: Develop and implement an educational program to inform shrimpers of the current status of sea turtle populations and of proper methods of resuscitation and return to sea of incidentally captured sea turtles.

Measure 8: Encourage research on and development of shrimping gear in order to reduce the incidental catch without decreasing the overall efficiency of shrimping or excessively increasing the cost of gear.

Measure 9: Consistent with the Stone Crab Management Plan, establish a seasonal closure of a portion of the Dry Tortugas shrimp grounds in order to avoid gear conflicts with stone crab fishermen.

Measure 10: The Gulf of Mexico Fishery Management Council will attempt to reduce, where feasible, the loss of offshore trawlable bottom by establishing within GMFMC, a committee to monitor and review construction of offshore reefs, with attention to the needs of the reef fish and shrimp user groups.

Measure 11: All statistical reporting requirements will be mandatory.

2.3 Operational Definitions of Terms Used

Acceptable Biological Catch (ABC) is a seasonally determined catch that may differ from MSY for biological reasons. It may be lower or higher than MSY in some years for species with fluctuating recruitment. It may be set lower than MSY in order to rebuild overfished stocks.

Annual Crop is a species which is harvested essentially as a 0-year class (less than one year of age).

Boats are crafts that displace less than five gross tons.

Catch Per Unit of Effort (CPUE) is the total number or weight of fish harvested by a defined unit of fishing effort.

Commercial Shrimpers are shrimpers who sell any portion of their catch.

Culling is the practice of discarding those shrimp caught which are smaller than a size the fisherman wishes to retain.

Determination for Total Allowable Level of Foreign Fishing (TALFF). The foreign allowable catch is determined by deducting the expected domestic annual harvest from the optimum yield.

Detritus is considered as decaying plant material and its associated community of microscopic plants and animals.

Domestic Annual Fishing Capacity (DAFC) is the total potential physical fishing capacity of the fleet, modified by logistic factors. The components of the concept are:

- a. An inventory of total potential physical capacity, defined in terms of appropriate vessel and gear characteristics (that is, size, horsepower, hold capacity, gear design, etc.).

- b. Logistic factors determining total annual fishing capacity, (that is, variations in vessel and gear performance, trip length between fishing locations and landing points, weather constraints, etc.).

Domestic Annual Processing Capacity (DAPC) is the amount that can be processed if supplies are available.

Equilibrium Yield (EY) is the annual or seasonal harvest that maintains the resource at approximately the same level of abundance (apart from the effects of environmental variation) in succeeding seasons or years.

Estuarine Dependent Species are those organisms that must complete a portion of their life cycle within an estuary.

Expected Domestic Annual Harvest (EDAH) is the total expected catch of the U.S. shrimp fleet.

Fishery Conservation Zone (FCZ) is the area of federal jurisdiction, beginning at the outer limit of the states' territorial seas and extending 200 miles from shore.

Fishing Effort is the total fishing gear in use for a specified period of time.

Fishing Mortality includes all deaths to the exploited populations associated with the harvesting practices.

Growth Overfishing is a level of effort which prevents the exploited population from providing its maximum yield but does not impair the reproductive capacity of the stock.

Incidental Catch refers to the catch of species other than the target species (bycatch).

Inland Waters (Inside waters) are areas of state jurisdiction and include all bays and lagoons inland from the baseline from which the territorial sea is measured.

Maximum Economic Efficiency (MEE) is that level of fishing effort at which the value to society of the last unit of shrimp produced is equal to the cost to society of producing that unit.

Maximum Economic Yield (MEY) is the level of harvest from the common property resource that maximizes the stream of generated net incomes over time.

Maximum Sustainable Yield (MSY) is an average over a reasonable length of time of the largest catch which can be taken continuously from a stock, under current environmental conditions.

Natural Mortality includes deaths from all causes except capture by man.

Omnivore is an animal which eats whatever dead or alive animal or plant material is available.

Optimum Yield (OY) with respect to the yield from a fishery, means the amount of fish:

- (a) which will provide the greatest overall benefit to the nation, with particular reference to food production and recreational opportunities; and
- (b) which is prescribed as such on the basis of the maximum sustainable yield from such fishing, as modified by any relevant economic, social, or ecological factor.

Recreational Shrimpers are shrimpers who do not sell their catch.

Recruitment Overfishing is used to denote that level of fishing effort which reduces the spawning stock size to the point where there is a reduction in the amount of young recruited to the fishery.

Spawner-Recruit Relationship is the quantifiable relationship between the number of reproducing adults and the resulting number of young recruited to the fishery.

Stock is a group of fish manageable as a unit.

Target Species are the species at which the fishery is directed.

Territorial Sea is the area of state jurisdiction extending from the baseline to three nautical miles seaward for Alabama, Mississippi, and Louisiana, and to nine nautical miles for Texas and the Florida west and northwest coasts.

Total Allowable Level of Foreign Fishing (TALFF) is any surplus in the optimum yield above the expected domestic annual harvest.

Unit Fishing Effort is a measure of harvesting pressure which has been adjusted to account for differences in the ability of boats and vessels of different types to harvest the resource.

Vessels are crafts with displacement greater than or equal to five gross tons.

Year-class is the fish spawned in a given year.

Yield is the amount of a species harvested by man.

3.0 DESCRIPTION OF FISHERY

3.1 Area and Stocks Involved

The fishery being addressed is comprised of the species listed below and occurs in the area of jurisdiction of the Gulf of Mexico Fishery Management Council as well as in the area of jurisdiction of the various Gulf states including their territorial seas, associated bays, inlets, wetlands, and upland areas as appropriate.

Consideration of this large area is necessary because of the migratory natures of the exploited species and fishermen, the critical role of estuaries in the life cycles of the dominant shrimp species, and the impacts upland alterations may have on the quality of shrimp habitat.

Shrimp species within the fishery are:

Brown shrimp (Penaeus aztecus Ives)
White shrimp (Penaeus setiferus Linnaeus)
Pink shrimp (Penaeus duorarum Burkenroad)
Royal red shrimp (Hymenopenaeus robustus Smith)
Seabobs (Xiphopenaeus kroyeri Heller) INCIDENTAL BYCATCH
Rock shrimp (Sicyonia brevirostris Stimpson) INCIDENTAL BYCATCH

In addition to these shrimp species, shrimpers also catch sea turtles and other shellfish and finfish. The sea turtle catch is of concern to the development of this plan because all the sea turtles which occur in the Gulf are listed as either endangered or threatened under the U.S. Endangered Species Act which prohibits capture of endangered species. Though primary responsibility for protection of these sea turtle species lies with the National Marine Fisheries Service and the U.S. Fish and Wildlife Service, the plan contains appropriate suggestions to minimize the impact on sea turtle populations. The incidental catch of other shellfish and finfish is also of concern because much of this catch is discarded at sea. Since much of the discarded catch is dead or dies as a result of being caught, this operation largely represents a direct conversion of national resources into food for scavengers. Many of these resources can be used by other national interests. Primary responsibility for managing these resources lies with the GMFMC, NMFS, and the Gulf states. Management plans are currently being prepared by GMFMC for two major bycatch groups--groundfish and reef fish--in which appropriate measures are suggested to reduce this bycatch. In addition, the groundfish management plan contains a thorough treatment of current efforts to develop markets for these discarded species.

Brown shrimp range along the north Atlantic and Gulf of Mexico coasts from Martha's Vineyard, Massachusetts, to the northwestern coast of Yucatan. The range is not continuous but is marked by an apparent absence of brown shrimp along Florida's west coast between the Sanibel and the Apalachicola shrimping grounds (Perez Farfante, 1969). In the U.S. Gulf of Mexico, catches are high along the Texas, Louisiana, and Mississippi coasts.

Mark-recapture experiments indicate a mixing of brown shrimp populations along the north central and northwestern Gulf coast. A southward drift of brown shrimp off the Texas coast towards Mexico has been proposed (Gunter, 1962). There is some speculation that the Mississippi River may act as a barrier to east-west migration.

Brown shrimp are caught out to at least 50 fathoms, though most come from less than 30 fathoms. The season begins in May, peaks in June and July, and gradually declines to an April low.

White shrimp range along the Atlantic coast from Fire Island, New York, to Saint Lucie Inlet, Florida, and along the Gulf coast from the mouth of the Ochlockonee River, Florida, to Campeche. In the Gulf there are two centers of abundance: one along the Louisiana coast and one in the Campeche area (Perez Farfante, 1969).

There appears to be a general mixing of white shrimp west of the Mississippi River to at least the northeast coast of Mexico, with an observed northward migration along the Mexico-Texas shore to at least Aransas Pass, Texas, during the spring (Lindner and Anderson, 1956). A reciprocal southward movement in the fall and winter has been proposed (Gunter, 1962). It has been suggested that again the Mississippi River may act as a barrier in east-west migration (Lindner and Anderson, 1956; Perez Farfante, 1969).

White shrimp are a comparatively shallow-water shrimp, with most of the catch coming from less than 15 fathoms. Annual catch has two peaks: the major one in late summer-early fall, with an October high; the minor one is the "Easter fishery" on over-wintered shrimp which peaks in May. Largest U.S. catches occur west of the Mississippi River to the Freeport, Texas, area, though catch is considerable along the entire north central and western Gulf.

Pink shrimp range along the Atlantic from lower Chesapeake Bay south to around the Florida Keys and up and around the Gulf coast to Isla Mujeres, Mexico. They are also found in the Bermuda Islands and the northern coast of Yucatan. Major concentrations are off southwest Florida and in the south-eastern part of Golfo de Campeche (Perez Farfante, 1969).

The two major pink shrimp grounds in the United States are the Tortugas and Sanibel grounds in southwestern Florida. There is little movement of shrimp between these grounds, and they are derived from largely different estuarine areas (Castello and Allen, 1965).

Pink shrimp catch comes mainly from less than 25 fathoms, with a peak catch at 11 to 15 fathoms. Because of continuous recruitment in southeastern Florida, the catch exhibits a broad peak October through May. U.S. catch is mainly restricted to Florida and is greatest in southwestern Florida.

Royal red shrimp are deepwater shrimp occurring as far north as Cape Hatteras, North Carolina, to as far south as the coast of the Guianas, and primarily in depths of 140 to 300 fathoms. Concentrations of royal red are known to exist in three geographical areas: (1) east of St. Augustine, Florida, in the western Atlantic; (2) south-southeast of the Dry Tortugas in the Florida Straits; and (3) southeast of the Mississippi River Delta in the Gulf of Mexico (Roe, 1969).

Seabobs are caught most often in shallow waters at six to seven fathoms or less and almost never in estuaries (Renfro and Cook, 1963). U.S. catch is highest along the Louisiana coast in October through December.

Rock shrimp occur along the Atlantic coast from Virginia to the Florida Keys and up along the Gulf coast to Cabo Catoche, Mexico (Cobb, et al., 1973; Hildebrand, 1954). Major concentrations occur at Cabo Catoche, Mexico, and in the Cape Canaveral, Florida, area (Christmas and Etzold, 1977). Major Gulf catch (1971-1975) comes from the Panhandle area of Florida at depths of 10 to 22 fathoms (Christmas and Etzold, 1977).

3.2 History of Exploitation

3.2.1 Domestic Fishery

3.2.1.1 Description of User Groups

The shrimp fishery of the Gulf can be divided into four general categories of users -- harvesters (directly involved in the taking of shrimp), processors, marketers, and consumers.

The actual taking of shrimp is done by recreational fishermen, commercial belt shrimpers, and commercial (food) shrimpers. The commercial shrimp user category includes employees as well as owners of vessels and may be divided into smaller boat operations, which are restricted to inland bay and shallow offshore activities, and the offshore vessels, which range from the territorial seas out to the limits of the FCZ and into foreign waters.

The structure of the shrimp fishery includes a large number of harvesters, the boatyard and gear industry, and the suppliers of ice and fuel (essential inputs for shrimping operations).

Processors include the shrimper as a first level processor, if he heads the shrimp. Fish houses may perform one or all processing activities such as heading, peeling, grading, packing in ice, and freezing, cooking, or drying. The non-shrimper processors handle the shrimp between the fish house and the purchaser. The three basic types of processors are: (1) producers of "green" (fresh) or frozen shrimp; in 1974 they accounted for 86.25 million pounds valued at \$152.6 million, or 59 percent of the total value of shrimp produced in the Gulf that year; (2) "breeders," who in 1974 produced 52.66 million pounds of breaded shrimp (including imports) valued at \$75.7 million, or 29 percent of the total value of shrimp processed in the Gulf region (Florida and Texas accounted for 91 percent of the breaded shrimp); (3) canners, who generally use small- to medium-sized shrimp; such canning plants are located primarily in south Louisiana and Mississippi, with the greatest concentration found in the Orleans area. They accounted for \$13.1 million worth of canned shrimp represented by 1.9 million standard cases, or seven percent of the total value of all shrimp processed in the Gulf region. In addition, there is a wide array of specialty items such as dried shrimp, gumbo, etc.

Restaurants are also an important processing entity. It is estimated that more shrimp are consumed in restaurants than used in homes. The role of restaurants as processors ranges from minimal, limited to the actual cooking process, to the handling of shrimp in raw and unpeeled form.

Marketing of shrimp involves every stage of the industry; there also are groups which engage solely in marketing, with their processing function limited to possible repackaging. Transportation of shrimp is usually handled by trucks operated by the wholesale marketing entities.

Consumers are given a choice of several different ways to purchase shrimp, ranging from heads-on to stove-ready status.

3.2.1.2 General Description of Fishery Effort

Prior to the introduction of the otter trawl in 1917, most shrimp were commercially harvested in shallow inshore areas with haul seines. White shrimp were the main shrimp caught and marketed until the early 1950s. Quantities of seabobs and brown shrimp were used for dried products. During these years, fishing efforts were concentrated in areas where white shrimp were abundant. From 1917 to the late 1940s, most shrimp were caught from vessels rigged with single otter trawls which operated within about six miles of shore. However, vessels occasionally went out about ten miles and, in some instances off Louisiana, out fifty miles. Wing or butterfly nets were also used in Louisiana passes. By the early 1950s, increased markets for brown and pink shrimp and the discovery of new fishing grounds initiated a period of rapid expansion of the shrimp industry. As a result, some vessels began to move farther offshore because of the increasing difficulty of making profitable catches on traditional fishing grounds. By the early 1960s, U.S. shrimp vessels were fishing off the coasts of Mexico

and South America. A major change in gear methodology took place in the late 1950's with the introduction of double-rig trawling. Two small trawls were pulled instead of a single large net, resulting in a substantial increase in catch efficiency and a reduction of handling problems. Double-rig trawls were used by most vessels fishing for pink and brown shrimp. More recently the twin-trawl has become popular in the offshore Gulf shrimp fleet because of its efficiency (Figure 3.2-11). With this arrangement four small trawls are towed instead of two from a single vessel. The inshore shrimp fishery is primarily confined to the territorial waters of each of the Gulf states. There are numerous small boats rigged with single otter trawls which harvest shrimp commercially from the bays and marshes. Some of the boats may fish in the Gulf during favorable weather conditions, especially for white shrimp.

Fishing efforts for royal red shrimp occur intermittently when shrimping along the coast is poor. Royal red shrimp are harvested from vessels using a single trawl. The deep-water habitat of the species necessitates the use of heavier winches and cables than are used to catch shallow-water shrimp species and, in general, the use of larger vessels.

The live-bait shrimp fishery is generally limited to bays and the shallow inshore waters of the Gulf. Bait shrimp catches on the Florida west coast consist primarily of pink shrimp, which are harvested in shallow grass beds from boats equipped with single or double side-frame trawls. The bait shrimp fishery in the remaining Gulf states is usually dependent upon white and brown shrimp, which are harvested with boats rigged with a single otter trawl. Mortality of the live shrimp is minimized by trawling for short durations during the cooler early morning hours and then rapidly sorting the catch. The limited capacity of live-holding facilities aboard the boat and the perishability of live shrimp probably restrict bait shrimping operations to areas near the dealer where the catch is sold. The dealer in turn, however, may transport live shrimp considerable distances, i.e., 200 or more miles.

Recreational shrimping efforts are generally concentrated in shallow inshore waters, though few individuals may occasionally venture into the territorial sea during favorable weather conditions. It is unlikely, however, that any recreational shrimpers operate in the fishery conservation zone. The boats used in the recreational shrimp fishery are usually outboard or inboard pleasure craft rigged to tow a single otter trawl ranging from about 16 to 40 feet in width. Although most of the recreational catch is harvested with otter trawls, other gear such as cast nets, wing nets, channel nets, and dip nets may account for a substantial amount of the harvest in localized areas.

The actual amount of fishing effort applied in the shrimp fishery and a more descriptive analysis of the gear employed are discussed in detail in several other sections of the management plan. For example, see Sections 3.2.1.4, 3.5.2.1, 3.5.2.4, 3.5.3.2, 4.7 and 5.0. Fishing effort in the shrimp fishery from a physical standpoint increases through more vessels entering the fishery and through more technologically efficient harvesting techniques. More units of effort due these two factors occur due to industry responses to high profit levels and returns on investment. Because of the open access characteristic of the shrimp fishery and some periods of rapidly rising product prices, fishing effort sometimes reaches levels beyond that which yields satisfactory economic returns during certain time periods. The reasons for this occurrence in a fishery and its relation to periodically poor financial years in the shrimp fishery are discussed in detail in Sections 3.5.2.3 and 5.1.2.

3.2.1.3 Catch Trends

Trends in the shrimp fishery discussed here are based on two data sets. The first is the reported commercial catch by species (U.S. Department of Commerce, 1959-1975). The second is the reported commercial landings by state (U.S. Department of Commerce, 1880-1975). These two data sets are not identical. The catch is the amount of shrimp caught in a specific inshore or offshore area. Landings are the total catch, whose origin may not be known, delivered at a port and sold commercially.

3.2.1.3.1 Commercial Catch Trends by Species

Annual Catch Patterns

The average annual reported commercial catch of shrimp (\pm one standard deviation) by species in the U.S. Gulf area:

Brown shrimp ¹	66.5	\pm 16.6	million pounds (tails)
White shrimp ¹	36.9	\pm 7.2	million pounds (tails)
Pink shrimp ¹	13.0	\pm 1.8	million pounds (tails)
Royal Red shrimp *	.83	\pm .091	million pounds (tails)
Seebob shrimp **	1.4	\pm 1.6	million pounds (tails)
Rock shrimp ***	.331	\pm .358	million pounds (tails)

¹ 1963-1977

* 1959-1975

** 1959-1975

*** 1971-1976

The most recent information, 1977, indicates that brown, white and pink shrimp account for 97 percent of the total catch. This reflects essentially no change from the average total catch of 98 percent for the 1959-1975 period.

Shrimpers, processors, consumers, and resource managers recognize the historical annual variation in annual catches of the dominant species (brown, white, pink). The vulnerability of shrimp during the critical estuarine growth phase to environmental perturbations is the basic cause of catch variation (Section 4.1). Griffin and others (1976) calculated a yield function for shrimp using the level of discharge from the Mississippi. Discharge was useful because of its impact on salinity and temperature while the shrimp are in the nursery ground. Two recent incidences of environmentally induced problems with shrimp production resulted in the Small Business Administration (SBA) declaring areas of Louisiana and Texas to have suffered economic disasters. Tropical storms in coastal areas of Texas during 1979 caused heavy rains which SBA found to adversely affect the shrimp catch. Heavy spring rainfalls in Louisiana during 1980 were judged by SBA to have severely impaired brown shrimp catch. Both of these natural events caused unacceptable variation, in the eyes of SBA, in earning potential of small businesses. The variation in catch of the three minor species is more related to the market conditions and the supply of other shrimp than to variation in their abundance. This is particularly evident for seebob shrimp. Primarily a fall-early winter fishery off Louisiana, catch has fallen only once between 1969-1975 compared to the white shrimp fishery decline in catch during five of those years (Fig. 3.2-1 and Fig. 3.2-2).

Catch for a given year appears to be independent of the preceding year's catch. The absence of any defined spawner-recruit relationship suggests that the shrimp catch can fluctuate widely from year to year. The critical determinant is estuarine environmental conditions which vary annually, often times radically. No apparent or significant linear trends in annual catches of brown, white, or pink shrimp (Fig. 3.2-1 and Table 4.7-1) have yet been determined.

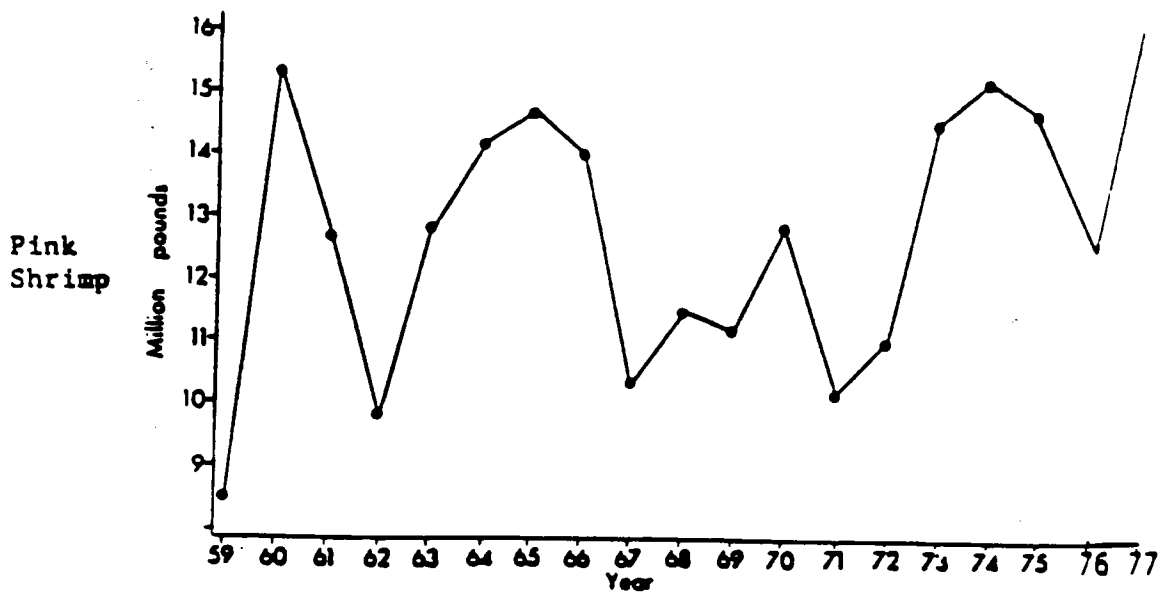
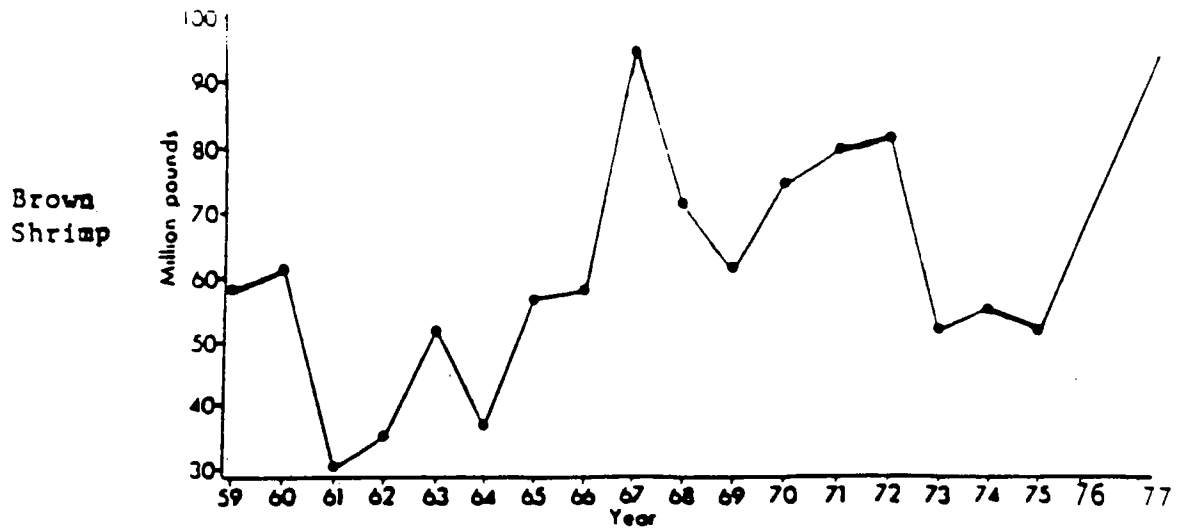


Figure 3.2-1. Annual reported commercial catch of brown, white, and pink shrimp from the US Gulf of Mexico (US Dept. Com., Gulf Coast Shrimp Data, 1959-1977). Weight is in pounds of tails.

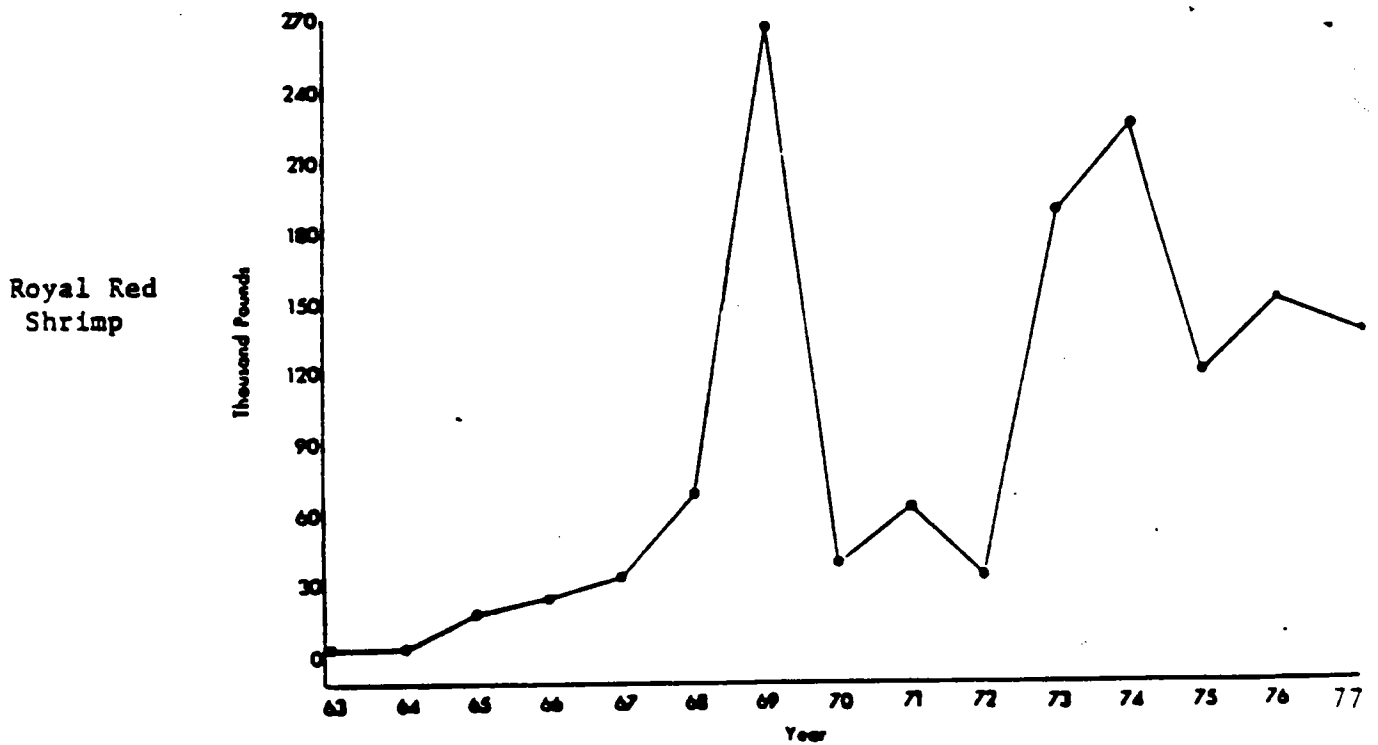
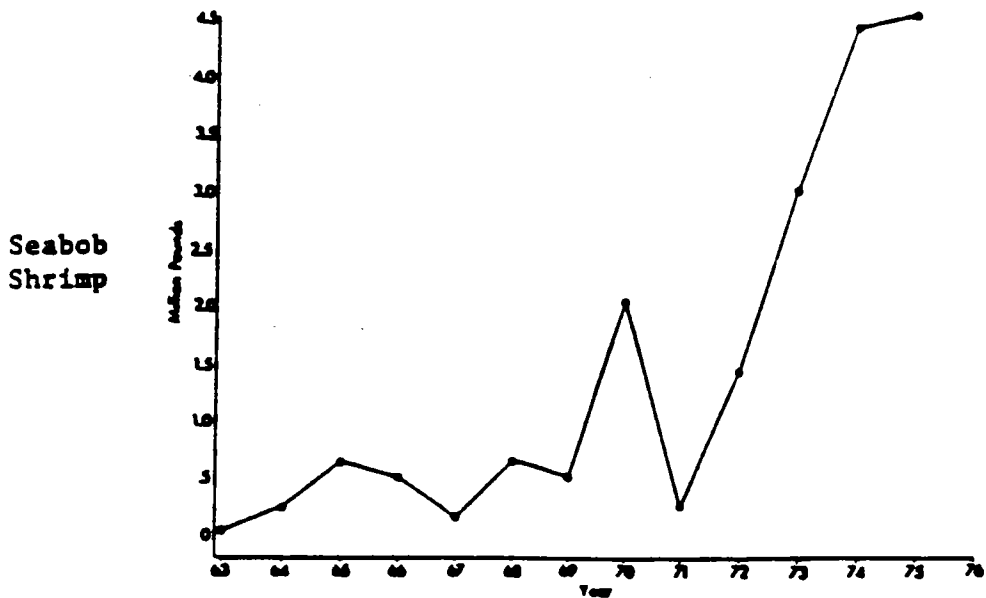


Figure 3.2-2. Annual reported commercial catch of seabob (1963-1975) and royal red shrimp (1963-1977) from the U.S. Gulf of Mexico (U.S. Dept. Com., Gulf Coast Shrimp Data, 1963-1975). Weight is in pounds of tails.

Annual catch of minor species has increased with time (Table 4.7-3). As effort increased to harvest major species, the catch of minor species increased (Table 4.7-1). Annual catch of royal red shrimp ranged between 4,600 and 270,000 pounds of tails with an average increase of 14,000 \pm 5,000 pounds of tails per year (1963-1976).

The acceptability of seabob shrimp in Louisiana by the canning industry was in part responsible for the catch increase over the 1963-1975 period (Fig. 3.2-2). The seabob catch results in part from incidental catch during white shrimping activities (Table 4.7-5), though a targeted fishery develops when price is high and other shrimp are in short supply (P. Juneau, personal communication, 1978).

The reported catch of rock shrimp is relatively recent, with the first report occurring in 1971. Catch for the 1971-76 period is listed in Table 4.7-3. Rock shrimp are mostly caught incidentally with other species, especially pink shrimp (Table 4.7-9), however, a small directed fishery does exist.

Area Distribution of the Catch

The reported commercial catch of shrimp is classified by NMFS into 21 areas along the U.S. Gulf coast (Fig. 3.2-3).

The average annual commercial catch by area is compared for brown, white, and pink shrimp in Fig. 3.2-4 and for royal red, seabob, and rock shrimp in Fig. 3.2-5.

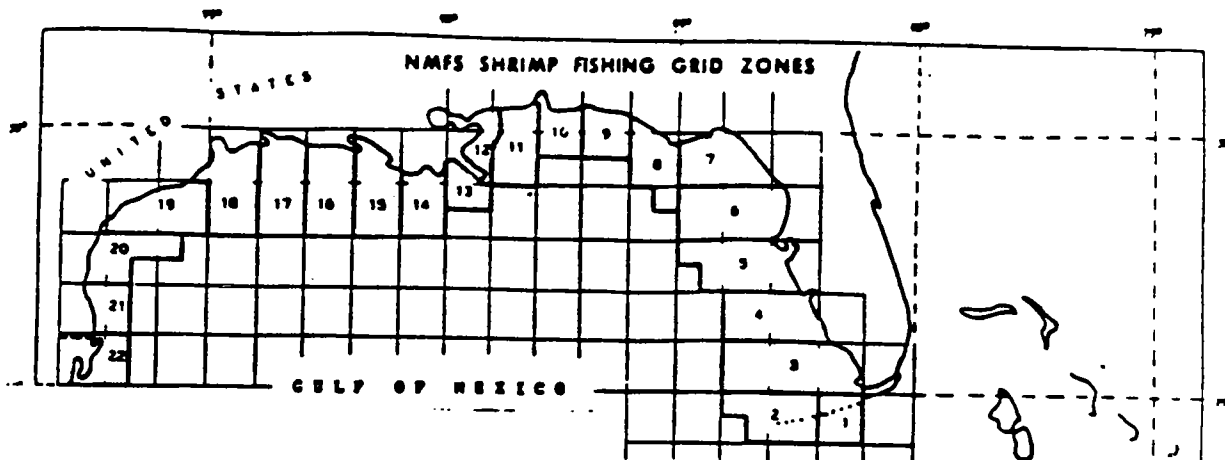
Brown and white shrimp exhibit a similar broad peak in catch from the Apalachee to Brownsville areas. Pink shrimp catch is substantial in the Key West to Apalachee Bay areas. There is little overlap of dominant pink areas with brown or white shrimp.

Brown shrimp catch normally exceeds two million pounds of tails annually in each of the NMFS grid areas in the Biloxi to Brownsville areas. The Freeport area normally has the largest catch, averaging 12 million pounds of tails annually. White shrimp catch normally exceeds four million pounds of tails annually in the Barataria, Terrebonne, and Atchafalaya areas. Catches from the Rockefeller through Freeport areas are also normally high, averaging about 2.5 million pounds of tails annually. Pink shrimp harvest is concentrated in the Dry Tortugas areas with an annual catch of nine million pounds of tails.

There are two main areas for the royal red shrimp catch. One is off the Dry Tortugas areas; the other is off the mouth of the Mississippi River and is reported for the Biloxi and Barataria areas. Catch is highest from January through June and in September and occurs at depths of 100 to 300 fathoms. Seabob catch is normally highest in waters associated with the Louisiana coast, peak catch normally occurring in the Atchafalaya area at 0.5 million pounds annually. Rock shrimp catch (1971 to 1975) is mainly limited to waters associated with Florida. Annual catch is highest in the Panama City and Apalachee areas.

Month, Depth, and Size Patterns in Catch of Brown, White and Pink Shrimp

Brown and white shrimp exhibit distinct annual cycles in their abundance and size at different depths in the shrimping grounds of the U.S. Gulf. Although pink shrimp have an expected size-depth relationship (Section 4.1), their seasonal and size patterns in reported commercial catch are not as dramatic as those of brown and white shrimp; pink shrimp have a more or less continual recruitment in the Dry Tortugas area and Florida has practiced area closures to protect undersized pink shrimp. Pink shrimp catch (Fig. 3.2-8) exhibits a peak from October through May at 11 to 15 fathoms. Seasonal patterns in size or depth of catch are not pronounced because of the fairly continual recruitment of pink shrimp in the Dry Tortugas area and closure of the Tortugas shrimp bed by Florida to protect undersized shrimp.



Area code index to prominent city, bay, or federal game reserve associated with the area:

1. Key West
2. Dry Tortugas
3. Everglades
4. Naples
5. Tampa
6. Tarpon Springs
7. Apalachee
8. Panama City
9. Fort Walton
10. Mobile
11. Biloxi
12. Chandeleur
13. Barataria
14. Terrebonne
15. Atchafalaya
16. Rockerfeller
17. Calcasieu
18. Galveston
19. Freeport
20. Corpus Christi
21. Brownsville

Figure 3.2-3. National Marine Fishery Service Shrimp Fishery Grid Zones in the US Gulf of Mexico (US Department of Commerce, Gulf Coast Shrimp Data, 1959-1975).

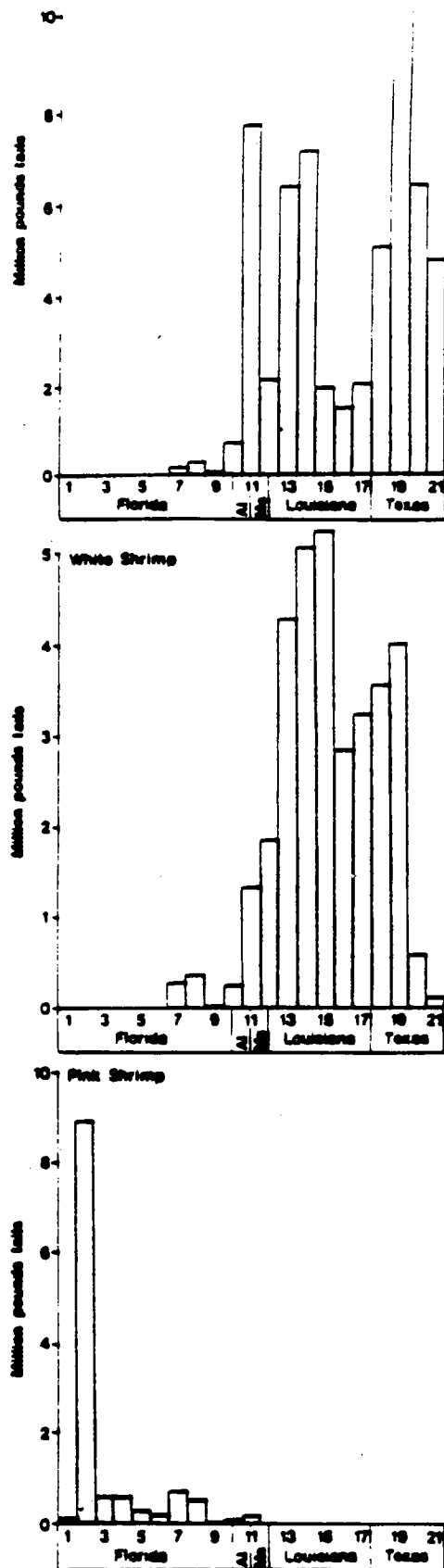


Figure 3.2-4. Average reported commercial catch of brown, white, and pink shrimp along the US Gulf Coast (US Dept. Com., Gulf Coast Shrimp Data, 1959-1975). Catch is represented as averages reported for the 21 NMFS statistical reporting zones along the US Gulf Coast (Fig. 3.2-3).

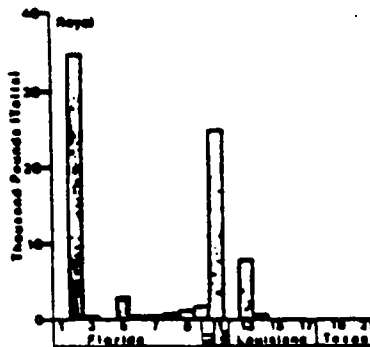
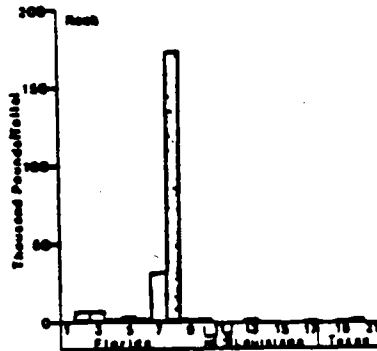
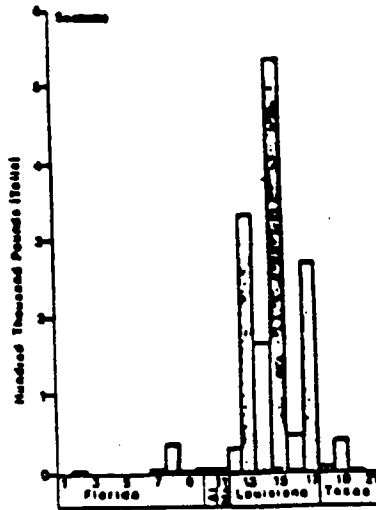


Figure 3.2-5. Average reported commercial catch of scabed (1963-1975), rock (1971-1975), and royal red shrimp (1963-1975) along the US Gulf Coast (US Dept. Com., Gulf Coast Shrimp Data, 1963-1975). Averages are for the 21 NOAA statistical reporting zones (Fig. 3.2-3).

As shown in Fig. 3.2-6, the fishery on 0-year class brown shrimp normally starts in inland waters in May on shrimp of a count greater than 67 tails to the pound. The inshore catch peaks in June at an average catch of 6.6 million pounds of tails. Although it consists mainly of smaller size shrimp, this inshore catch is popular among recreational and small boat commercial shrimpers whose gear does not normally allow them to fish the open waters of the Gulf.

The offshore fishery for brown shrimp peaks in July and August at depths of 11 to 20 fathoms. The dominant size class in the reported commercial catch is 31 to 40 tails to the pound. The actual average size shrimp caught may be much smaller since a considerable number of undersized shrimp are discarded off the Texas coast (Baxter, 1973; Sections 4.7 and 8.3) and the primary brown shrimp catch during this time also occurs off the Texas coast.

The September brown shrimp catch is dominated by 26 to 30 tails-to-the-pound shrimp at 16 to 20 fathoms. The catch becomes further restricted to deeper waters and larger shrimp in October to December. The January to April pattern is relatively constant, with greatest catch in open Gulf waters of 21 to 40 fathoms and of shrimp of a count less than 21 tails to the pound.

The size-depth-month patterns in white shrimp catch are not as simple as those of brown shrimp, but they do reflect the annual nature of the white shrimp's life cycle. The fishery on the 0-year class white shrimp, spawned in the spring and summer, essentially begins in August and September (Fig. 3.2-7). The white shrimp catch in internal waters contains much larger size shrimp than does the brown shrimp catch. This size difference reflects the rapid growth rate of white shrimp and their tendency to leave the estuaries at a larger size than brown shrimp. Catch remains comparatively high from August to November, though it is essentially limited to water shoreward of 11 fathoms. The comparative increase in shrimp catch in the 68 tails and over count group in October through December reflects a decline in the growth rate of white shrimp as well as a migration of shrimp to deeper waters. Both of these phenomena are associated with cold fronts advancing during these months and the accompanying decline in temperature.

Catch declines from December through February. The decline reflects, in part, adverse weather conditions for shrimping but also the dwindling supplies and comparatively small size of white shrimp during this period.

In March through June with the spring warming of the estuaries and shallow Gulf, the overwintered white shrimp are believed to exhibit an increase in their growth rates. This increase is reflected in the commercial catch: peak size classes of white shrimp shift from those greater than 67 tails to the pound to 31 to 40 tails to the pound in March, to shrimp 15 to 20 tails to the pound in June and July. The May and June inshore catch of white shrimp reflects the reentry of overwintering white shrimp into the estuaries for a period of pre-spawning growth.

Catch by Size, State, and Species for Brown, White and Pink Shrimp

Different harvesting strategies have developed among the several Gulf states. These differences largely relate to the evolution of the dominant fisheries at different times (Section 3.2.1.2). The Louisiana-Mississippi fishery developed comparatively early on inshore and nearshore Gulf concentrations of white, brown, and seabob shrimp. The brown shrimp fishery in Texas and the pink shrimp fishery in Florida developed in the 1950s on offshore concentrations of shrimp in comparatively deep water. In large part local management still reflects the needs of the historical fisheries in these areas for shrimp of certain sizes or of their gear restrictions limiting the depth of harvest.

Tables 3.2-1 and 3.2-2 compare estimates of the average commercial (1963 to 1976) catch of brown, white, and pink shrimp in the various reported size categories in terms of pounds and estimated number (see Table 3.2-2 for method in which number of shrimp were estimated).

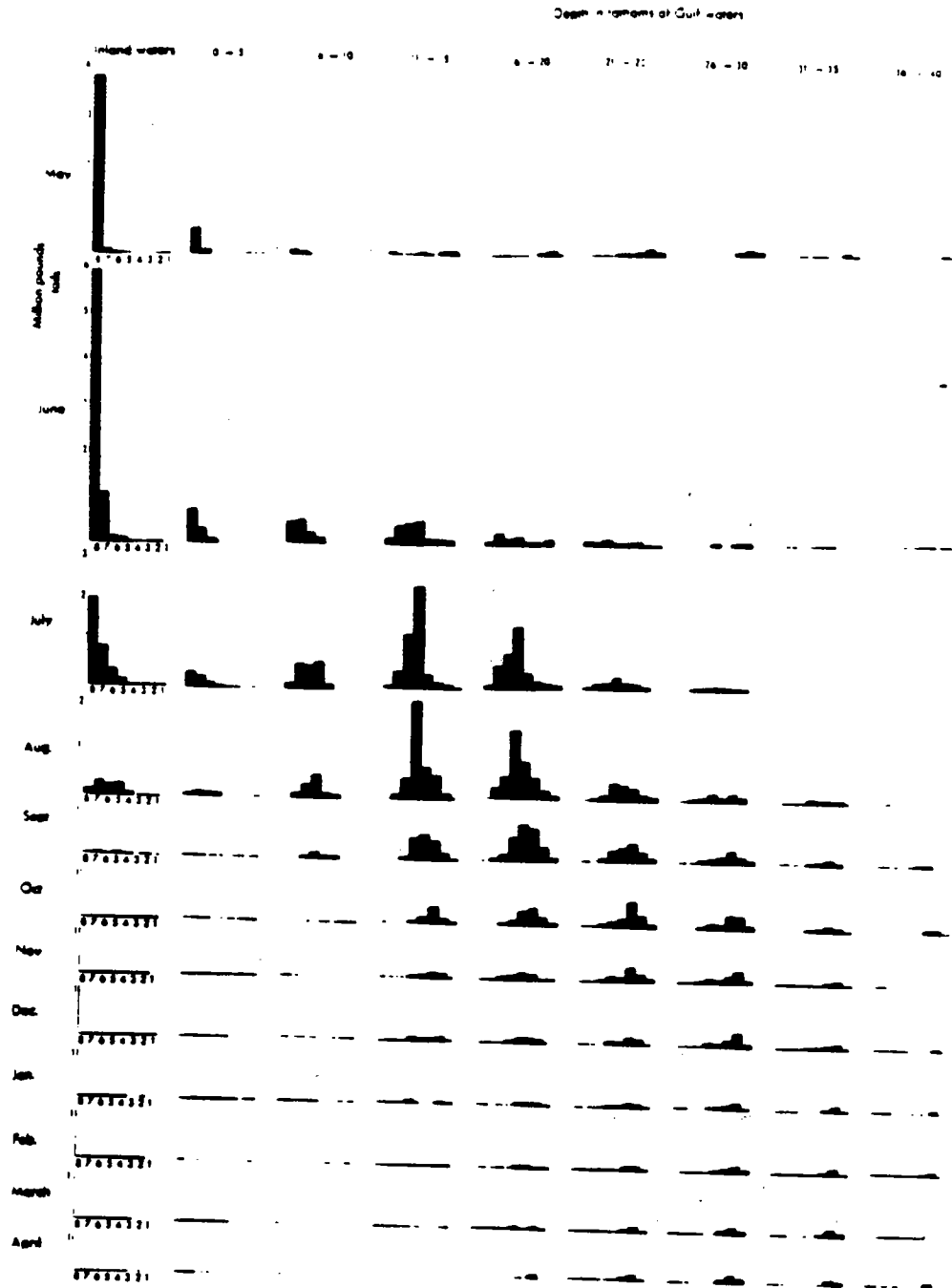


Figure 3.2-6. Brown shrimp average catch in the US Gulf by size, class, depth, month (US Dept. Com., Gulf Coast Shrimp Data, 1959-75). Code to size of shrimp: 1 = under 15 tails per pound; 2 = 15-20 tails per pound; 3 = 21-25 tails per pound; 4 = 26-30 tails per pound; 5 = 31-40 tails per pound; 6 = 41-50 tails per pound; 7 = 51-67 tails per pound; 8 = 68 and over tails per pound.

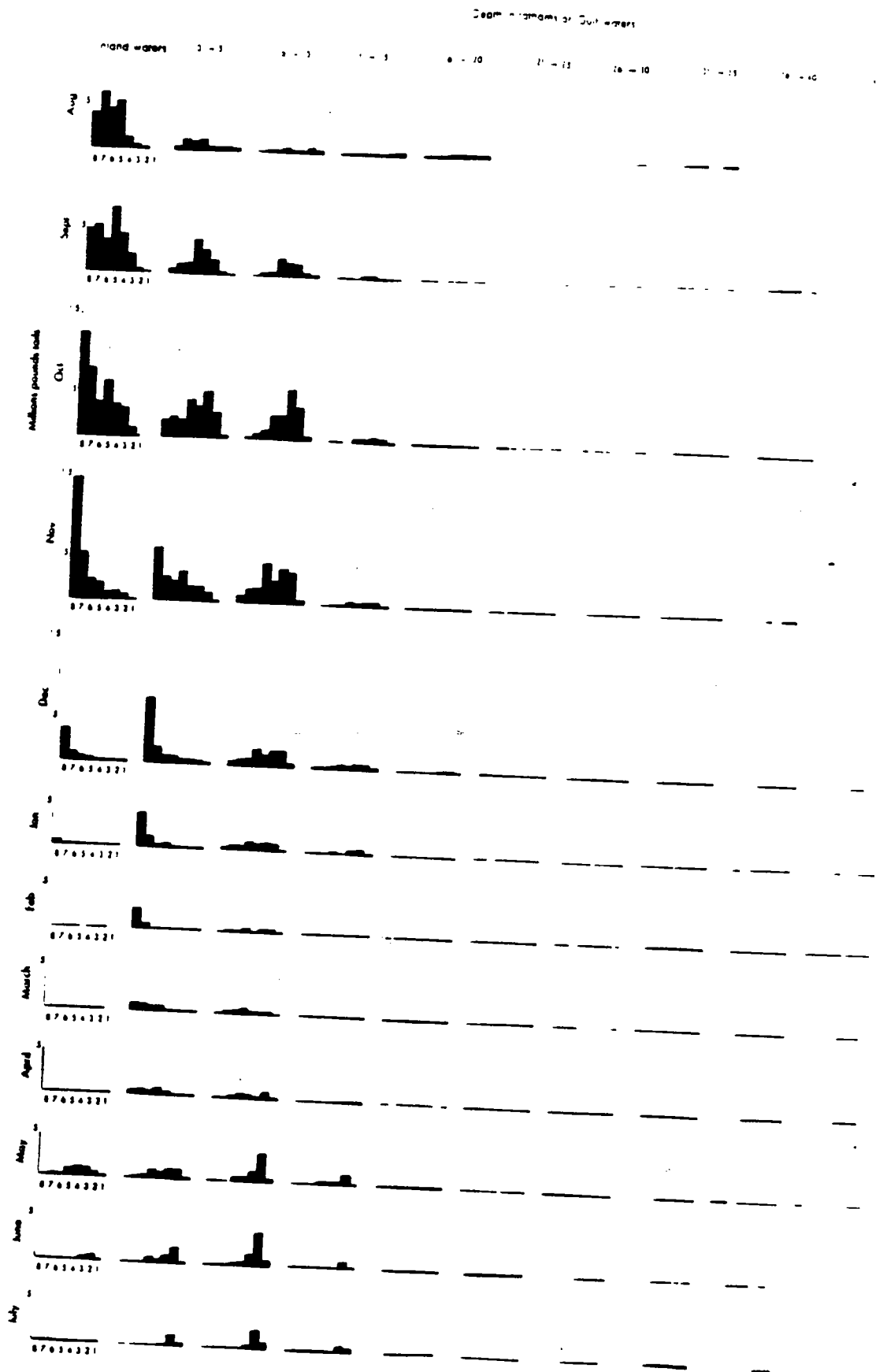


Figure 3.2-7. White shrimp average catch in the US Gulf by size, class, depth, month (US Dept. Com., Gulf Coast Shrimp Data, 1959-1975). Code to size of shrimp: 1 = under 15 tails per pound; 2 = 15-20 tails per pound; 3 = 21-25 tails per pound; 4 = 26-30 tails per pound; 5 = 31-40 tails per pound.

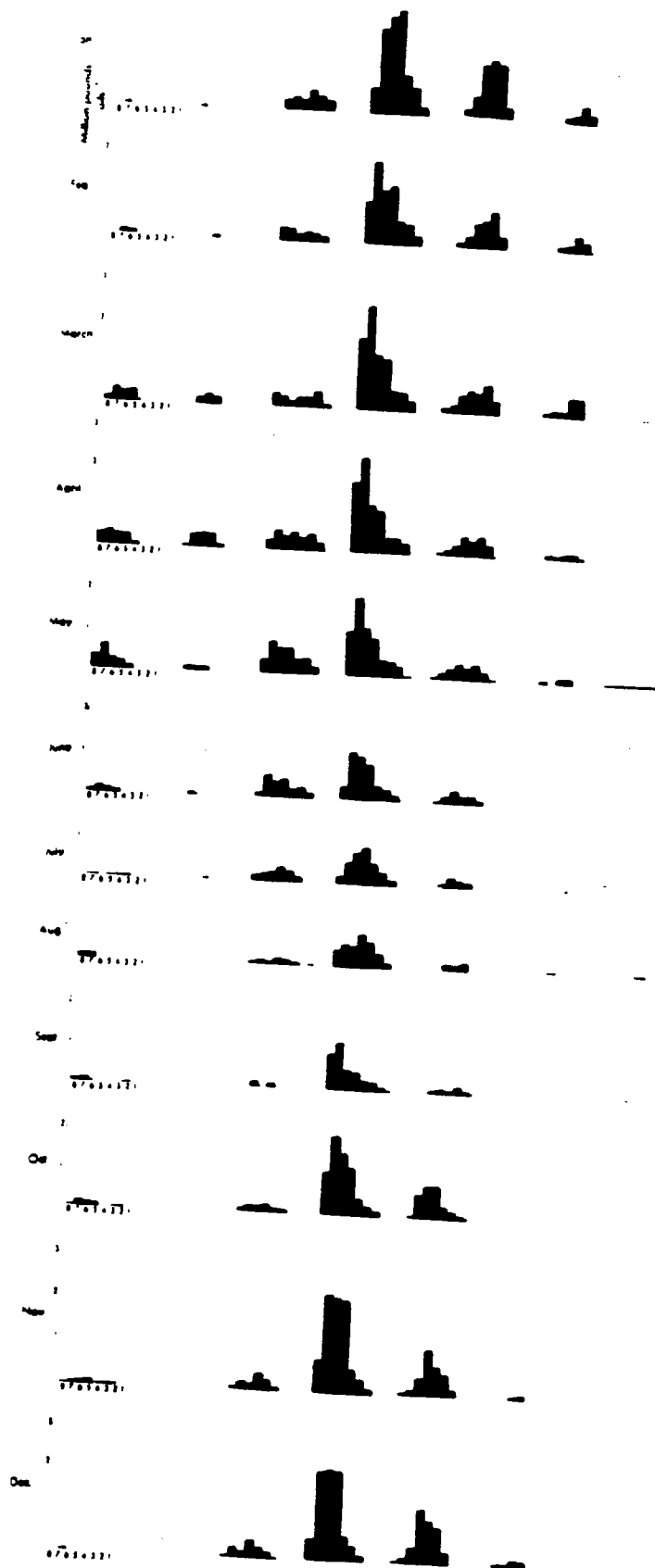


Figure 3.2-8. Pink shrimp average catch in the US Gulf by size class, depth, month (US Dept. Com., Gulf Coast Shrimp Data, 1959-1975). Code to size of shrimp: 1 = under 15 tails per pound; 2 = 15-20 tails per pound; 3 = 21-25 tails per pound; 4 = 26-30 tails per pound; 5 = 31-40 tails per pound; 6 = 41-50 tails per pound; 7 = 51-67 tails per pound; 8 = 68 and over tails per pound.

Catch from the states of Mississippi and Alabama were combined due to similarities in the minimum size of harvest and overlapping areas in the reported catch statistics.

The brown shrimp catch off the Texas coast accounts for 46 percent of the total poundage and 25 percent of the number of brown shrimp caught commercially in the U.S. Gulf of Mexico. The catch associated with Louisiana accounts for 40 percent of the poundage but 64 percent of the number of commercially caught brown shrimp. The apparent discrepancy lies in the fact that Louisiana is estimated to harvest a tremendous number of shrimp in the smallest commercial size category, some 54 percent of average total catch of brown shrimp in the Gulf. Much of these shrimp are utilized in the Louisiana canning industry. Conversely, the reported catch of brown shrimp off Texas, peaks at a larger size, 31 to 40 tails to the pound of shrimp. There are no shrimp canneries in Texas and much of this product is utilized by the fresh-frozen industry. The introduction of several peeling machines has recently allowed utilization of smaller shrimp, however. The Mississippi-Alabama and Florida catches of brown shrimp exhibit a peak catch at 51 to 67 tails to the pound size category.

Louisiana has by far the largest catch of white shrimp, accounting for some 82 percent by number and 77 percent by weight of the average reported catch. As with brown shrimp, the peak in catch occurs in the smallest commercial size group, though there is a comparatively better mix of larger size shrimp than with brown shrimp. The Texas white shrimp catch peaks at a size similar to the brown shrimp catch, or 31 to 40 tails to the pound. Though the Florida white shrimp catch peaks at the same size class as its brown shrimp catch, the Mississippi-Alabama catch of white shrimp peaks at a larger size, 15 to 20 tails to the pound in terms of weight, and 31 to 40 tails to the pound in terms of number.

Florida accounts for 98 percent of the pounds and numbers of pink shrimp caught in the reported commercial fishery of the U.S. Gulf of Mexico. Pounds and numbers both peak at a size of 51 to 67 tails to the pound.

Although the previously mentioned difference in harvesting strategies has resulted in larger shrimp being harvested in Texas vis-a-vis Louisiana-Mississippi, there has been a trend toward landing more small shrimp. Callowet, et al. (1979) report that for brown and white shrimp in both Louisiana and Texas there was a significant trend toward increased proportions of small shrimp in the 1959 to 1976 catches. Louisiana catches contain greater proportions of small shrimp than Texas catches. It is important to note that the proportion of Louisiana inshore catch in the 68 count and smaller category increased markedly during 1963 to 1976 with the major change occurring between 1973 to 1976 (Sass, 1979). Sass reports the major change to be in the size composition of the white shrimp catch.

3.2.1.3.2 Landing Trends by State

The historical pattern of landings among states during 1880-1975 is evident in Figure 3.2-9. Landings data differ from the catch data used in the preceding section. Landings are reported in heads-on units and are attributed to the state where off-loaded regardless of catch location. Due to the lengthy historical period portrayed, the data may not have been collected consistently; however, the data are suitable for reflecting long run trends and accurately depict in recent time the frequent fluctuation in landings.

Before about 1920, Louisiana and Mississippi were the dominant shrimp producing states in the Gulf. Between 1920 and 1948 the fisheries off Texas and Alabama began to rival that of Mississippi. At the same time, Louisiana's landings far exceeded any of the other states. During these early years the fishery was mainly an inshore and shallow water fishery predominantly of white shrimp, with minor catches of seabob and brown shrimp used mainly as dried shrimp. After World War II, the fishery began to expand. Sudden increases of landings in Texas and Florida were due to the discovery of concentrations of offshore populations of brown and pink shrimp, respectively, and the successful development

Table 3.2-1. Average weight of catch of brown, white, and pink shrimp by size and state¹ in thousand pounds of tails (US Dept. Comm., 1963-1975).

Shrimp	State	Size (Tails per Pound)										Total		
		70 & over	31-37	21-30	11-20	12-20	21-25	12-20	Under 12					
Brown	FLA	37	84	50	64	18	4	2						259
	ALA-MISS	1724	2223	1288	1313	786	674	467						8744
	LA	13598	2612	1675	2636	1254	1550	1974						25771
	TX	1222	2707	3708	8224	4224	2124	2288						29303
	CALF	16682	2286	6361	12939	6484	7462	3949	1876					64159
White	FLA	189	154	81	104	64	34	22						649
	ALA-MISS	74	133	164	268	228	365	379						1604
	LA	2226	3646	2187	2212	2212	2640	2593						26794
	TX	512	307	429	1212	722	722	822						3188
	CALF	8882	4328	2922	5356	3269	3812	3673	683					32237
Pink	FLA	1135	3199	2164	2786	1611	1245	567						12514
	ALA-MISS	16	79	61	46	33	16	5						247
	LA	1	3	3	3	1	1							12
	TX													6
	CALF	1132	3281	2228	2838	1436	1263	553	28					12779
Species Combined	25026	15087	11331	21133	11189	12537	10175	1787					109175	

¹ Florida - statistical area 1-9. ALA-MISS - statistical area 10-11. Louisiana - statistical area 12-17. Texas - statistical area 18-21. See Fig. 3.2-3 for location of statistical areas.

Table 3.2-2. Estimated average number¹ of brown, white, and pink shrimp by size and state² in thousands of shrimp (US Dept. of Comm., 1963-1975).

Shrimp	State	Size (Tails per Pound)							Total	
		68 & over	51-67	41-50	31-40	26-30	21-25	15-20		Under 15
Brown	FLA	2536	4954	2253	2270	513	99	31	---	12456
	ALA-MISS	151742	131134	50618	53699	21942	15513	8174	912	461734
	LA	2109355	154116	73920	93597	35159	35640	34554	6496	2622837
	TX	89259	225252	154594	307264	123920	120292	61364	6043	1000976
	CULF	2433582	425153	209385	459330	181536	171645	104123	13451	4078203
White	FLA	12848	9089	3669	3709	1782	789	384	8	32278
	ALA-MISS	6361	7034	7461	9236	6148	7939	6636	389	51984
	LA	620918	213132	99228	134204	61933	60721	45371	6446	1264753
	TX	32298	34624	22282	43020	21638	18240	11886	1690	108689
	CULF	675405	266689	132941	190189	91501	87489	64277	8533	1517204
Pink	FLA	77200	188731	98487	98920	39497	28445	9570	343	541393
	ALA-MISS	1392	4658	2765	1628	640	371	90	11	11555
	LA	241	197	122	122	31	14	7	---	734
	TX	1	18	23	115	29	19	18	1	224
	CULF	78334	193604	101397	100785	40197	29049	9685	335	553906
Species Combined	CULF	3187821	885446	523723	750284	313232	288383	178085	22339	6149313

¹The number of shrimp caught in each size category was estimated in the following manner:

If size equals	Then number equals
shrimp	Pounds times
Under 15	12.5
15-20	17.5
21-25	23
26-30	28
31-40	35.5
41-50	45.5
51-67	59
68 and over in Fla or Tx	68
68 and over brown or pink shrimp Miss-Ala	88
68 and over brown or pink shrimp in La	161
68 and over white shrimp in La or Miss-Ala	86

²Florida - statistical area 1-9, ALA-MISS - statistical area 10-11, Louisiana - statistical area 12-17, Texas - statistical area 18-21. See Fig. 3.2-3 for location of statistical area.

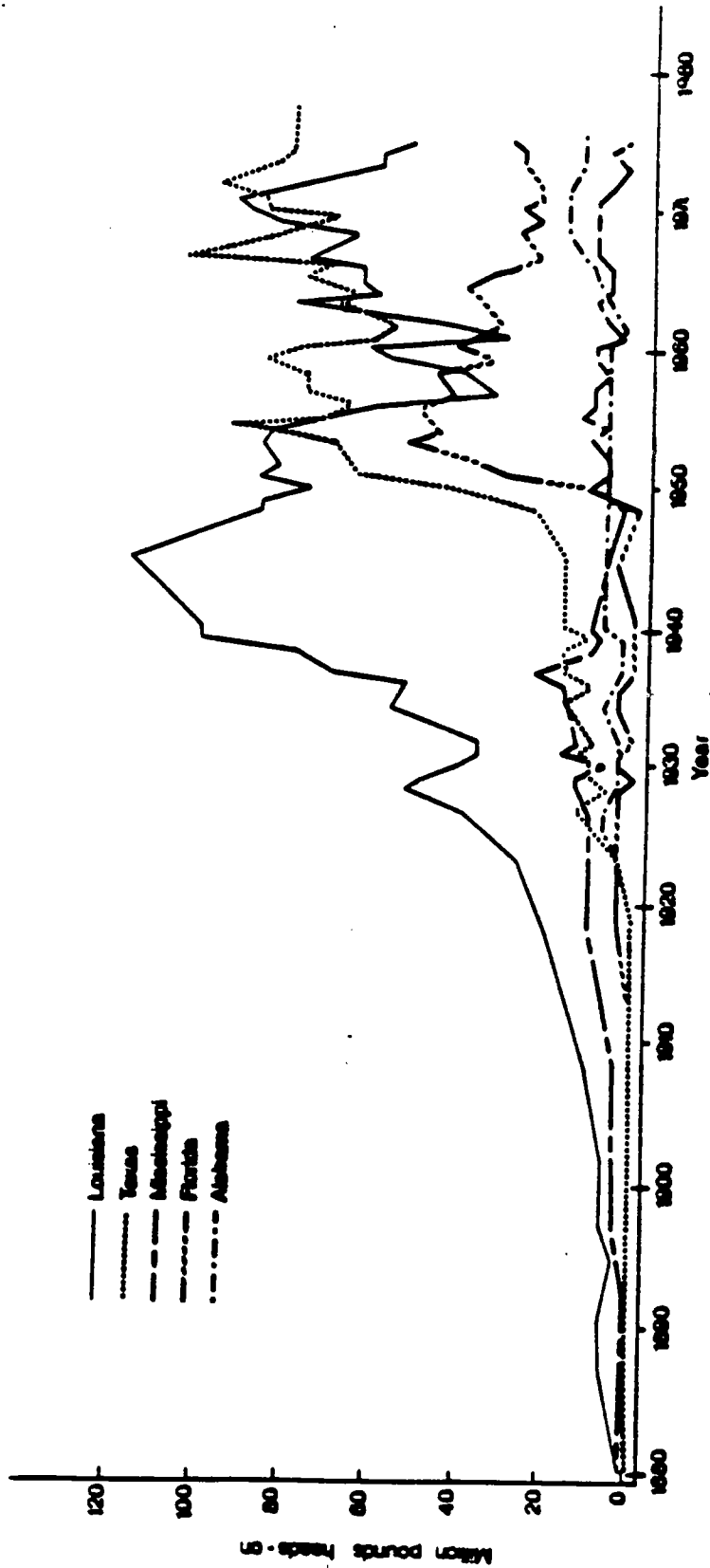


Figure 3.2-9. Annual reported commercial landings of shrimp (heads-on) by Gulf state (US Dept. Com., 1880-1975). Note that landings data are for heads-on shrimp off-loaded within a state regardless of where they were caught. This graph is not directly comparable with catch data used in this report.

of markets for these species. The gradual decline in landings from Florida (west coast) after 1954 may reflect a change in landing patterns of shrimp caught in Central and South America. The dramatic decline in landings in Louisiana from 1945 to about 1961 may reflect a salinity-induced shift in estuarine production of the state from predominantly white shrimp to a mixture of brown and white shrimp. However, data are insufficient to support this hypothesis.

The period from the mid-1950s to 1979 clearly depicts two important features of shrimp landings. First a mature fishery is evident from the standpoint that landings overall are neither increasing nor decreasing over time. The maturity is also visible from the fact that no trend in the share of landings has developed since the mid-1950s. Florida landings may have decreased slightly but Louisiana and Texas have maintained their respective relationships. Figure 3.2-9 also reveals that major fluctuations in landings are common. Peaks and valleys occur frequently and are large in magnitude. Since 1955 the annual landings have reversed the trend set in the preceding year on the average about 50 percent. This is interpreted to mean that landings following a good (bad) year are equally likely to increase or decrease. Shrimp businesses are often financially stressed by the variation in landings. The figure (3.2-9) indicates that shrimp harvesters cannot assure themselves of a stable catch by journeying to adjoining states. Generally, poor (or successful) seasons occur simultaneously in the states.

3.2.1.4 Description of Vessels and Gears Employed

Early Gulf coast shrimp trawlers were generally shallow-draft open skiffs ranging in length from 15 to 25 feet and powered by inboard gasoline engines. These early designs were gradually replaced in the 1920's by trawlers constructed with decks and pilot houses (Christmas and Etzold, 1977). The introduction of the diesel engine in the 1930s was considered a major advancement over gasoline engines in terms of safety, reliability, and reduced maintenance. The limited holding facilities and range of these early trawlers confined shrimping operations to areas relatively near the major shrimping ports. As a result, many coastal areas of the Gulf were inaccessible to the small trawlers (Johnson and Lindner, 1934, cited in Christmas and Etzold, 1977).

Until the late 1940s, commercial shrimp landings in the Gulf of Mexico consisted primarily of white shrimp (Idyll, 1963). By the early 1950s, however, increasing quantities of brown and pink shrimp were being caught and sold in response to a growing public acceptance of these unfamiliarly pigmented species (Idyll, 1963). The strong demand for shrimp and the opening of new fishing grounds off Florida, Alabama, Texas, and Mexico initiated a period of rapid growth in the size of the shrimp fleet. The expansion of offshore fishing grounds dictated the need for larger vessels with greater horsepower capable of remaining at sea for extended periods. Innovations in design and construction, such as steel hulls and onboard freezer units, were incorporated into the newer offshore trawlers of the late 1940s (Christmas and Etzold, 1977).

Captiva (1966) stated that the modern trends in the design and construction of shrimp trawlers were: (1) the increasing use of all-welded steel construction instead of wood; (2) more powerful engines, (3) onboard installation of sorting, packaging, and freezing equipment; (4) more comfortable crew accommodations; (5) development of multipurpose vessels which may be rapidly rigged with a variety of fishing gears; (6) modern hydraulic equipment; (7) increased use of modern electronic equipment; and (8) increased use of newer hull materials such as aluminum and fiberglass-reinforced plastics.

The shrimp boat design most commonly seen in the offshore waters of the Gulf of Mexico is believed to be a derivation of Greek designs used in the sponge fishery on the Florida west coast (Idyll, 1963). The "Florida-type" vessels are characterized by the forward placement of the wheelhouse and engine room. Current construction trends are toward larger offshore Florida-type vessels ranging from 75 to 80 feet or more in length (Christmas and Etzold, 1977).

The "Biloxi-type" vessel design, with the wheelhouse and engine room aft, is used primarily for shrimping in the inshore waters of the Gulf region (Idyll, 1963). These vessels range from 30 to 45 feet in length and are less common than the Florida-type designs (Idyll, 1963).

The boats used in inshore shrimp fisheries are made of wood or fiberglass and range in length from 16 to 50 feet. Most of the boats use gasoline-powered inboard or outboard motors for propulsion, and some may be equipped with powered winches to retrieve nets. The smaller boats are rigged in a variety of ways and are primarily confined to sheltered inshore waters. The larger boats may occasionally fish offshore if weather conditions are suitable. The "mosquito" fleet of Louisiana is made up of numerous small boats, generally operated by one person, that shrimp commercially in the inshore bays and marshes. These boats are typically shallow-draft, open skiffs.

Deep-water trawling for royal red shrimp in the Mississippi and Tortugas grounds has been steadily increasing in the past few years. Royal reds are fished by wood, steel, and aluminum vessels ranging in length from 56 to 86 feet. Most of the vessels are double-rigged and are capable of shrimping in both the shallow and deep water of the Gulf. Smaller vessels and boats usually do not have the winch capacity or sufficient stability in rough seas to fish for royal reds (Kilma and Ford, 1970).

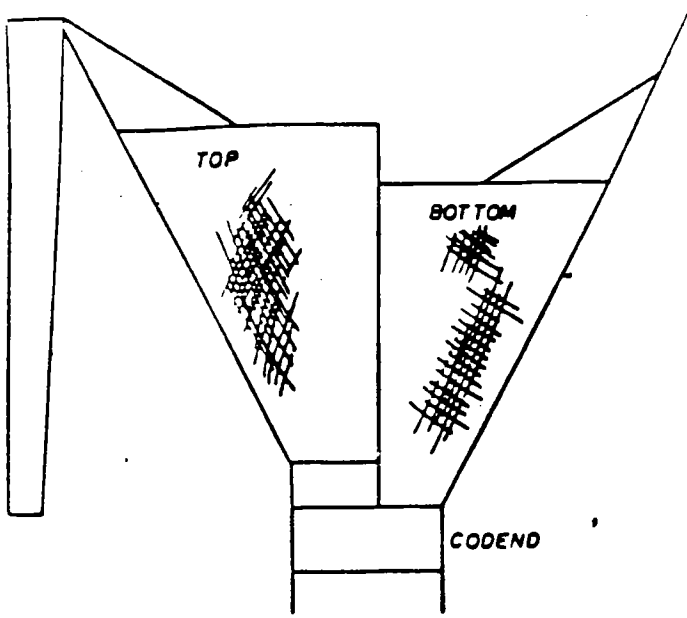
Although the otter trawl is the most common of the gears used in the Gulf shrimp fisheries, other kinds of gear are also used. The star trawl was developed for shallow-water shrimping in the Gulf of Mexico (Marinovich and Whiteleather, 1968, cited in Kilma and Ford, 1970). Sideframe trawls, used almost exclusively to harvest belt shrimp on the Florida west coast from Cedar Key to Naples (Woodburn, et al., 1957; Saloman, 1965), are virtually unknown in the other Gulf states. Researchers are conducting experiments with the electric trawl, beam trawl, separator trawl, and excluder panel. Other gear types used by both commercial and recreational shrimp fishermen include haul seines, cast nets, channel nets, wing nets, and push nets.

The haul seine was the primary gear used to harvest shrimp until the introduction of the otter trawl in Beaufort, North Carolina, between 1912 and 1917 (Christmas and Etzold, 1977). Tullian (1920) reports that the otter trawl was introduced into the Louisiana shrimp fisheries in 1917. The use of the otter trawl spread rapidly among shrimp fishermen in Louisiana because of the increase in catch per man-hour possible over haul seines.

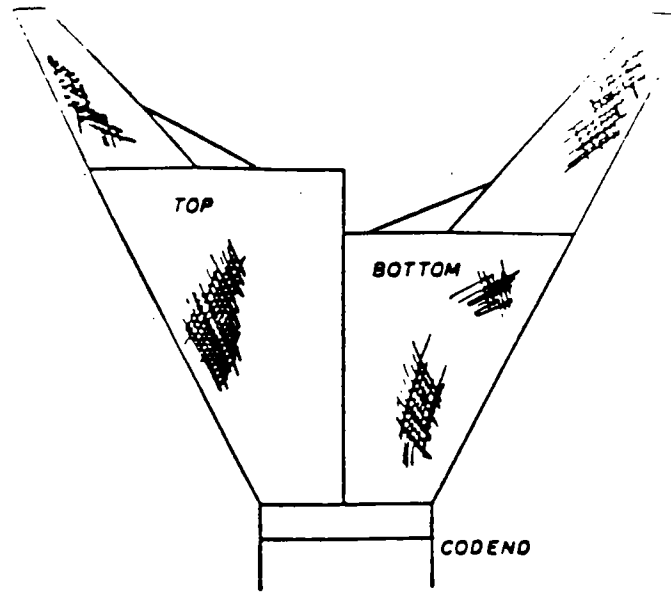
An otter trawl consists of a heavy mesh bag with wings on each side designed to funnel the shrimp into the codend or tail. A pair of otter boards or trawl doors positioned at the end of each wing hold the mouth of the net open by exerting a downward and outward force at towing speed.

The two basic otter trawl designs used by the Gulf shrimp fleet are the flat and the semi-balloon trawls (Kilma and Ford 1970). The mouth of the flat trawl is rectangular in shape, whereas the mouth of the semi-balloon design forms a pronounced arch when in operation. The basic design of each trawl type is shown in Figure 3.2-10. The semi-balloon designs tend to maintain an efficient shape under repeated towing strains; flat nets require periodic rerigging and rehanging to maintain maximum efficiency (Christmas and Etzold, 1977). The two-seam semi-balloon trawl (Figure 3.2-10) was introduced in the Gulf of Mexico in 1947 (Marinovich and Whiteleather, 1968, cited in Christmas and Etzold, 1977). The two-seam design was followed by the development of the four-seam semi-balloon trawl, which has "a shorter jib with wings on either side between the top and bottom bellies," whereas the "top and bottom bellies were joined directly together" in the two-seam design (Christmas and Etzold, 1977). The four-seam trawl maintains an efficient shape under towing strains and therefore creates less resistance in the water than the two-seam trawl.

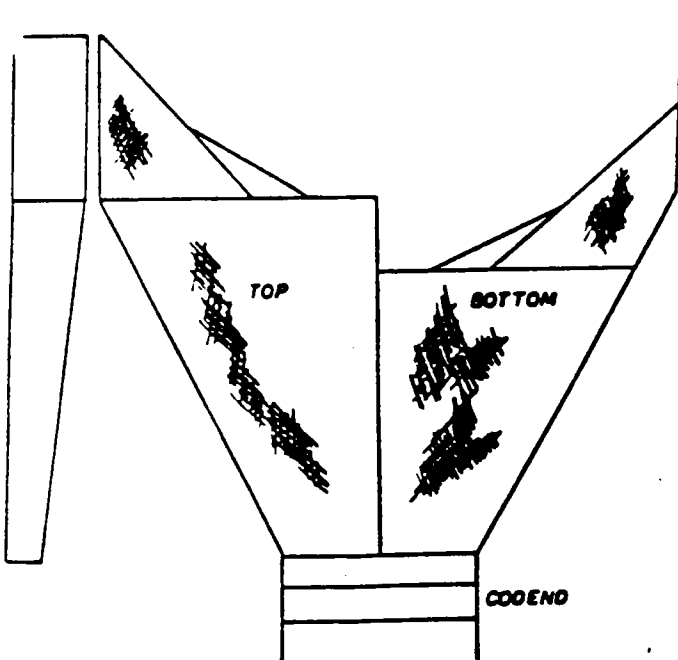
About 90 percent of the fishermen in the royal red fishery use 55 to 75-foot flat otter trawls, and the remainder use semi-balloon trawls ranging in width from 45 to 60 feet (Kilma and Ford, 1970).



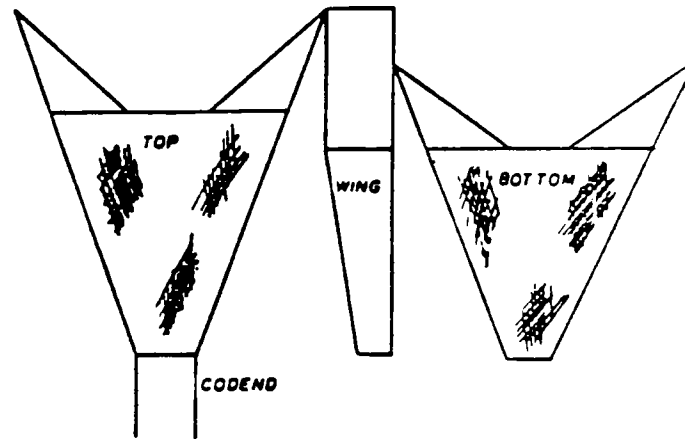
Gulf flat net



Two-seam semi-balloon trawl



Gulf four-seam semi-balloon trawl



Star net

Figure 3.2-10. Diagrams of the four basic designs of otter trawls used by the Gulf of Mexico shrimp fleet (after Christmas and Etzold 1977).

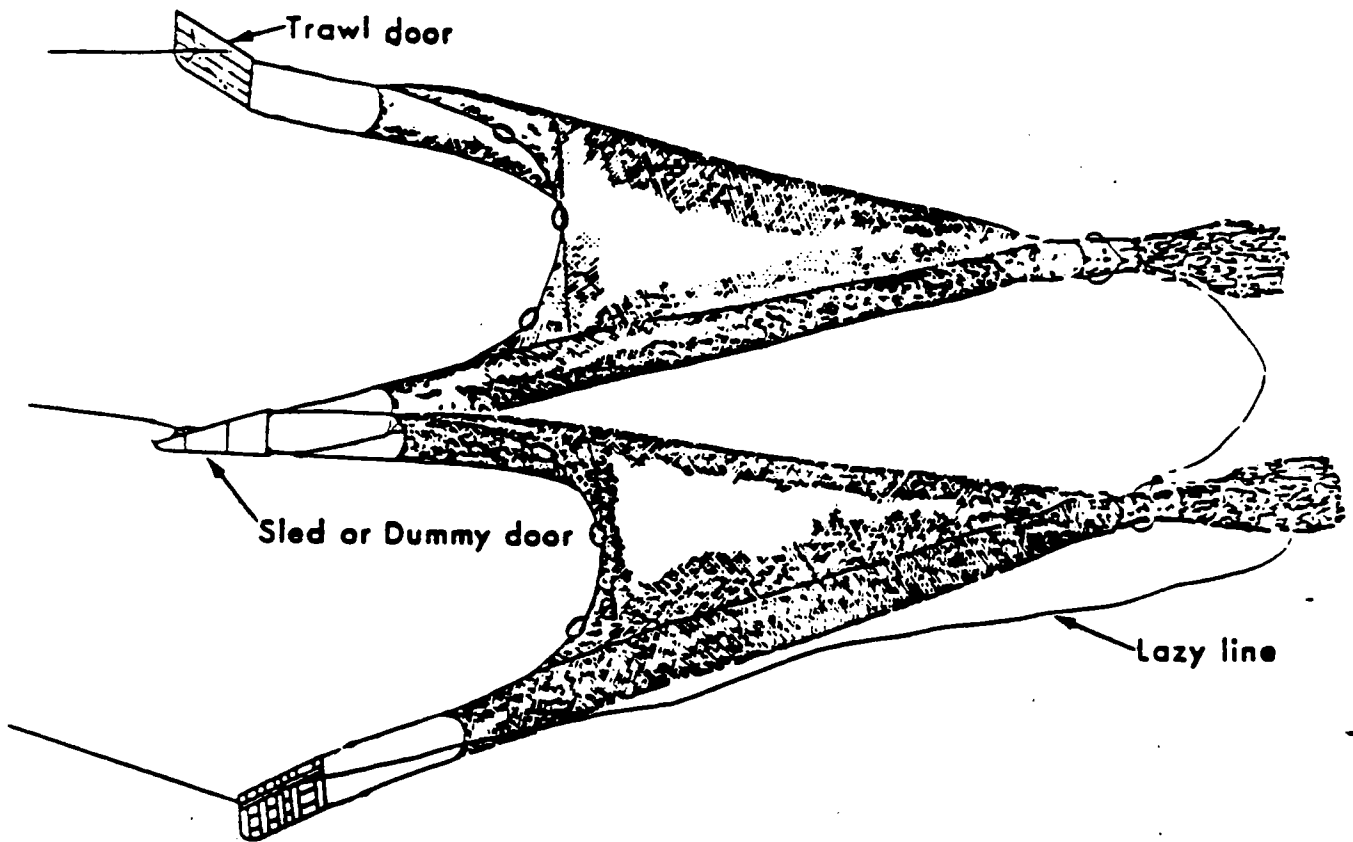


Figure 3.2-11. Diagram of the twin-trawl rig (after Harrington et al. 1972).

Try nets are small otter trawls about 12 to 15 feet in width which are used to test areas for shrimp concentrations. These nets are towed during regular trawling operations and lifted periodically to allow the fishermen to assess the amount of shrimp and other fish and shellfish being caught. These amounts in turn determine the length of time the large trawls will remain set.

Until the late 1950's, most shrimp vessels pulled single otter trawls ranging from 80 to 100 feet in width (Idyll, 1963). Double-rig trawling was introduced into the shrimp fleet during the late 1950's. The single large trawl was replaced by two smaller trawls, each 40 to 50 feet in width, which were towed simultaneously from stoutly constructed outriggers located on the port and starboard sides of the vessels. The port trawl was towed about 150 feet in back of the starboard trawl to prevent fouling. The advantages of double-rig trawling are (1) increased catch per unit of effort, (2) fewer handling problems with the small nets, (3) lower initial gear costs, (4) a reduction in costs associated with damage or loss of the nets, and (5) greater crew safety (Idyll, 1963).

The haul seine consists of a large rectangular panel of webbing ranging up to 1,000 feet in length and 20 feet in depth. It was mainly used before 1917. At that time mesh size ranged from 0.5- to 1.5-inch bar and a large crew was required to set and fish the net. Typically, a corkline buoyed the top of the net and a leadline was attached to the bottom edge. Haul seines were frequently constructed with bags or pockets where the captured shrimp were forced to congregate. Although the haul seine is no longer used to harvest commercial quantities of shrimp, it is still licensed in some states.

Cast nets are used mostly by sportsmen along tidal creeks, bayous, and weirs where shrimp congregate seasonally. Cast nets are circular, usually ranging from six to 12 feet in diameter, with a leadline sewn around the periphery of the net. A cord line passes through a metal or plastic thimble in the center of the net and radiates out to several smaller cords which are attached at even intervals to the leadline. Cast nets are usually constructed of nylon webbing with a 0.25- to 0.75- inch mesh. The nets are thrown in a circular pattern and allowed to sink to the bottom. The cord line is pulled in, causing the leadline to be drawn to the center of the net where the shrimp are trapped.

Channel nets are stationary nets which resemble otter trawls and catch emigrating shrimp in narrow cuts and bayous in areas with large tidal amplitude. The mouth of the net is held open with anchors or poles instead of trawl doors. The contents of the net are periodically dumped into a small skiff or a box located onshore.

Butterfly or wing nets are bags constructed of nylon webbing which are hung on a rectangular frame and attached to the side of a boat. Boats equipped for "butterfly" shrimp fishing anchor themselves heading into the current and lower the nets into the water perpendicular to the gunwales. The tidal currents are then allowed to sweep emigrating shrimp into the mouth of the net. The net can be checked without raising the frame by lifting the codend on board with a lazy line and emptying the contents into a sorting box. The net is then put overboard to resume fishing while the catch is sorted.

Push nets, which are occasionally used to catch shrimp in shallow-water areas of Florida and Texas, are small mesh bags hung on rectangular frames. The operation of a push net usually involves an individual wading and pushing the net before him in shallow water.

Table 3.2-3. Estimates of Foreign Catch (in tails) of Shrimp (1971-1976) in Waters Now Considered as Within the US Fishery Conservation Zone of the Gulf of Mexico (Data from Charles Fuss, NMFS, personal communication 1978).

Bordering state	Year	Foreign country involved: Estimated catch			Total estimated foreign catch
		Cuba	Mexico	Panama	
- - - - - Pounds - - - - -					
Florida	1971	57,440	0	0	57,440
	1972	10,240	0	0	10,240
	1973	20,480	0	0	20,480
	1974	75,000	0	0	75,000
	1975	135,000	105,000	0	240,000
	1976	0	0	0	0
6-year average		49,693	17,500		67,193
Texas	1971	0	2,783,300	0	2,783,300
	1972	0	83,820	0	83,820
	1973	1,710,000	0	0	1,710,000
	1974	1,110,000	90,000	0	1,200,000
	1975	1,665,000	225,000	0	1,890,000
	1976	722,750	0	126,000	848,750
6-year average		867,958	530,353	21,000	1,419,311

Table 3.2-4. Estimates of Monthly Foreign Effort and Catch Directed Toward Shrimp (1971-1976) in Waters Now Considered as Within the US Fishery Conservation Zone of the Gulf of Mexico (Data from Charles Fusa, NMFS, personal communication 1978). Weight is tail weight.

Bordering states	Year	Principal fishing months	Estimated # vessels	Estimated fishing days per vessel	Estimated number of vessel days	Estimated catch per vessel day	Estimated total catch (pounds)	
----- Mexico -----								
Florida	1971	--	--	--	--	--	--	
	1972	--	--	--	--	--	--	
	1973	--	--	--	--	--	--	
	1974	--	--	--	--	--	--	
	1975	July	7	30	210	500	105,000	
	1976	--	--	--	--	--	--	
Texas	1971	June	128	16	2,048	195		
		July	145	16	5,320	418		
		August	11	16	176	435	2,783,300	
	1972	June	7	16	112	435		
		July	5	16	80	[439]	83,820	
	1973	--	--	--	--	--	--	
	1974	July	3	30	90	500		
		October	3	30	90	500	90,000	
	1975	July	8	30	240	500		
		August	7	30	210	500	225,000	
1976	--	--	--	--	--	--		
----- Cuba -----								
Florida	1971	January	10	16	160	215		
		February	6	16	96	240	57,440	
	1972	February	2	16	32	320	10,240	
		February	4	16	64	320	20,480	
	1974	January	1	30	30	500		
		November	4	30	120	500	75,000	
	1975	February	3	30	90	500		
		August	6	30	180	500	135,000	
1976	--	--	--	--	--	--		
Texas	1971	September	7	2	14	--	--	
		--	--	--	--	--	--	
	1973	April	3	30	90	500		
		May	5	30	150	500		
		June	15	30	450	500		
		July	59	30	1,770	500		
		August	32	30	960	500	1,710,000	
		1974	April	3	30	90	500	
			May	10	30	300	500	
			June	16	30	480	500	
	1975	July	35	30	1,050	500		
		August	10	30	300	500	1,110,000	
		June	25	30	750	500		
July		46	30	1,380	500			
1976	August	40	30	1,200	500	1,665,000		
	June	25	25	625	350			
	July	31	25	775	350			
August	19	25	[475]	350	[656,250]			
----- Panama -----								
Florida	1971	--	--	--	--	--	--	
	1972	--	--	--	--	--	--	
	1973	--	--	--	--	--	--	
	1974	--	--	--	--	--	--	
	1975	--	--	--	--	--	--	
	1976	--	--	--	--	--	--	
Texas	1971	--	--	--	--	--	--	
	1972	--	--	--	--	--	--	
	1973	--	--	--	--	--	--	
	1974	--	--	--	--	--	--	
	1975	--	--	--	--	--	--	
	1976	January	1	30	30	350		
September		5	60	300	350			
October		1	30	30	350	126,000		

3.2.2 History of Foreign Exploitation

3.2.2.1--3.2.2.3 General Description of User Groups, Fishing Effort, Vessels and Gear Employed

Foreign shrimp fishing in the U.S. Gulf of Mexico has been virtually nonexistent in 1977-1978 (Charles Fuss, NMFS, personal communication, 1978) as a result of the passage of the MFCMA. Prior to 1971, Mexican vessels had been shrimping in U.S. waters for many years; Cubans entered the fishery in 1971, and some Panamanian boats shrimped off Texas in 1976 (Table 3.2-3). Annual harvest for the years 1971-1976 ranged from zero to 2.8 million pounds in resources in inland waters and in tails off Florida. Mexican harvest off Texas ranged from zero to 2,783,000 pounds in tails. Cuban boat activities off Texas were concentrated in the months of June, July, and August, the peak brown shrimp season (Table 3.2-4). It is estimated that 30 boats worked 29 days per month and harvested 408,000 pounds in tails per month. Mexican boats, present in the same waters during the same period, in 1971 totaled 345 and took an estimated 2.3 million pounds. The catch fell sharply in ensuing years. Cuban boat activities off Florida occurred mainly during the winter months; from one to ten vessels were involved, and the take was as high as 135,000 pounds in tails annually. Seven Mexican vessels took 105,000 pounds of shrimp tails off Florida in July 1975 (Charles Fuss, NMFS, personal communication, 1978). Foreign vessels are of the same configuration as the U.S. offshore fleet and utilize similar gear.

3.2.3 Fishing in Foreign Waters

The United States and Mexico signed a treaty in November, 1976, concerning U.S. shrimping activity in Mexico's portion of the Gulf of Mexico affected by the 200-mile extended jurisdiction. A three and one-half year phaseout period was negotiated, and all U.S. shrimp fishing within Mexico's 200-mile offshore fishing zone was terminated by January, 1980.

Historical U.S. Shrimping Activity in the Gulf of Mexico

The shrimp grounds in the Gulf of Mexico begin with Area 1 off the southwestern tip of Florida and extend to Area 40 just off Quintana Roo; these areas and depth zones in ten-fathom increments are shown in Figure 3.2-12. Areas 1 to 21 off the U.S. coast, and Areas 22 to 40, off Mexico's coast, conform to those used by the National Marine Fisheries Service (NMFS) in collecting and reporting shrimp landings data.

Landings from Mexican waters decreased from around 18 to 10 million pounds for the period 1962-1974 with the average for the last five years being 9.6 million pounds (Table 3.2.5). The decrease in landings came from regions 31 to 40 off the Yucatan Peninsula where catch dropped from 12 million pounds to four million pounds. Landings from Areas 22 to 30 remained fairly constant at five to six million pounds. During 1970-1974, 90 percent of U.S. shrimp landings came from U.S. waters and 10 percent from Mexican waters. Within the last five years almost two-thirds of the landings from Mexican waters came from Areas 22 to 30 on the Texas side of the Gulf.

Total value of catch (nominal dollars) from Mexican waters (Areas 22-40) remained fairly constant at \$13 million. Areas 22 to 30 have become relatively more valuable to Gulf shrimpers in the U.S. than Areas 31 to 40. While Mexican vessels began to fish in U.S. waters in the early 1970s, their catch and associated value was negligible.

Days fished in Mexican waters decreased from around 30,000 to 16,000 between 1962 and 1974. Most noticeable in this shift was between 1965 and 1966 when days fished dropped in Areas 31 to 40 of Mexican waters. Days fished in Areas 22 to 30 of Mexican waters remained nearly constant at about 10,000 days for the 13-year period.

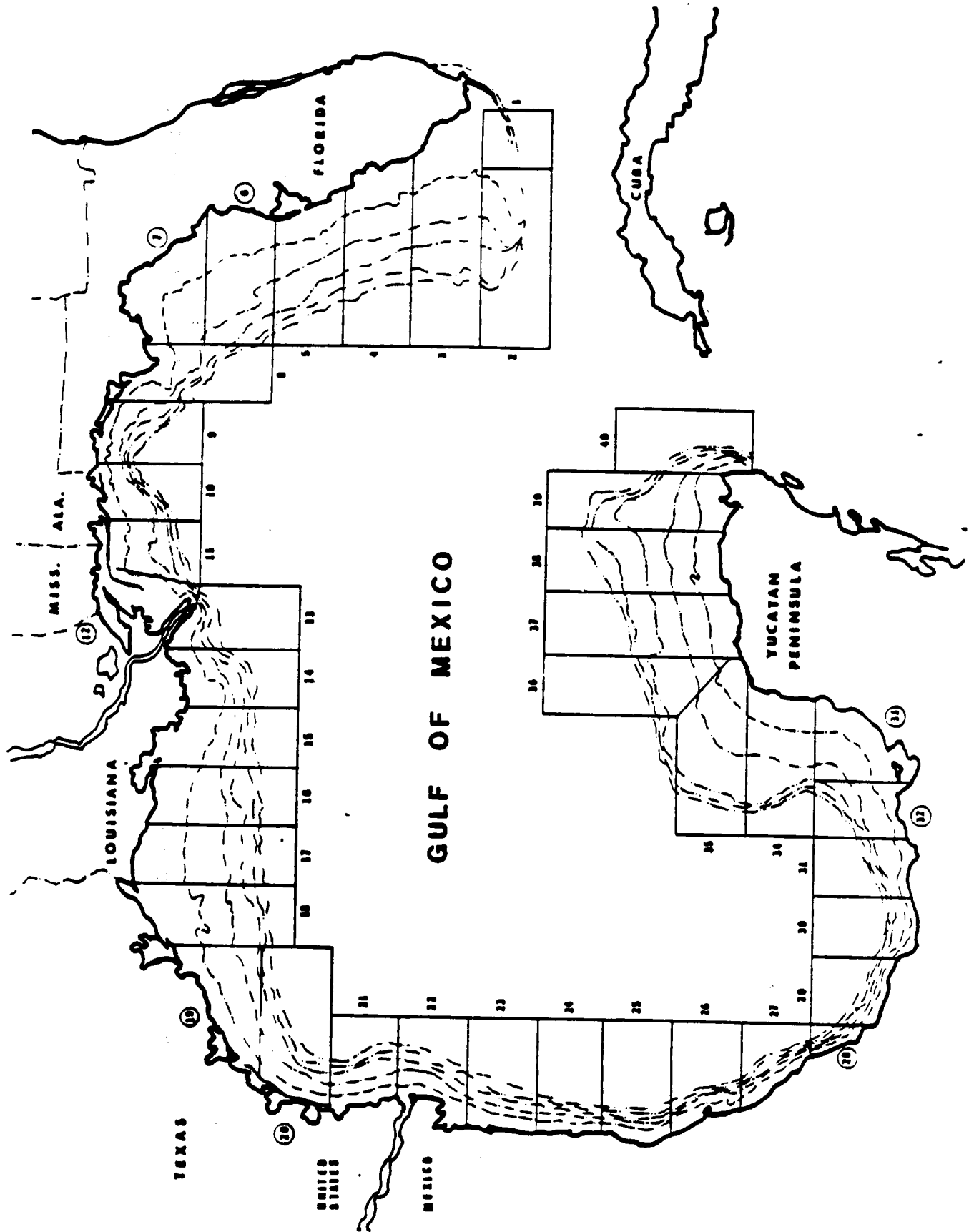


Figure 3.2-12 Gulf of Mexico with ten-fathom depth lines.

Distribution of Landings from Mexican Water

Landings data for the period 1970 to 1974 indicate that more than 99 percent of the catch from Mexican waters was landed in Florida and Texas (Table 3.2.6). For the five Gulf states an average of 85.0 million pounds (90 percent) of the shrimp landed during the 1970-1974 period came from U.S. waters whereas 9.5 million pounds (10 percent) came from Mexican waters. Eighty-nine percent of Florida landings (and revenue) came from U.S. waters and 11 percent from Mexican waters. Texas was somewhat more dependent on Mexican waters since 17 percent of its landings and 19 percent of its revenue came from Mexican waters.

Table 3.2.5. Total landing and value by U.S. vessels and days fished from statistical reporting areas in Mexican waters of the Gulf of Mexico, 1962-1974.

Year	Landings			Value			Days Fished		
	22-30	31-40	22-40	22-30	31-40	22-40	22-30	31-40	22-40
	----million pounds----			-----million \$-----			------(1000)-----		
1962	5.9	13.9	19.8	5.0	10.7	15.7	11.5	26.5	38.0
1963	3.3	10.7	14.0	2.5	7.7	10.2	5.9	20.4	26.3
1964	5.2	12.3	17.4	3.9	7.5	11.4	8.9	22.1	31.0
1965	5.0	11.4	16.3	3.7	8.0	11.7	7.8	20.1	27.9
1966	6.1	4.1	10.1	5.6	3.5	9.1	10.3	7.2	17.5
1967	5.0	5.0	10.0	4.6	4.5	9.1	7.1	7.5	14.6
1968	8.1	6.3	14.4	8.0	5.9	13.9	11.8	11.1	23.0
1969	4.1	4.2	8.3	4.5	4.4	8.9	9.2	7.6	16.8
1970	5.2	3.9	9.1	4.9	4.2	9.1	7.7	7.8	15.5
1971	6.3	2.7	9.1	8.3	3.1	11.5	10.5	4.3	14.8
1972	8.3	3.4	11.7	11.6	4.4	16.0	12.3	4.5	16.8
1973	5.7	4.4	10.1	11.1	7.7	18.8	10.5	7.2	17.7
1974	4.8	3.4	8.2	8.1	4.3	12.4	10.3	4.7	15.0
1970-1975									
Average	6.1	3.6	9.6	8.8	4.7	13.6	10.3	5.7	16.0
Percent of Total Gulf	6.4	3.7	10.1	7.5	4.0	11.5	6.7	3.7	10.4

Source: Griffin and Beattie (1978).

Most of the catch taken from Mexican waters and brought to Texas was landed in the ports of Brownsville and Port Isabel. For these two ports, located across the Rio Grande River from Mexico, 58 percent of the landings come from U.S. waters and 42 percent from Mexican waters. Thus, vessels operating out of Brownsville and Port Isabel were very dependent on Mexican waters.

Based on a Griffin and Beattie (1978) article, Table 3.2.7 shows the number of Florida and Texas vessels that were estimated to be directly affected by the 200-mile extended jurisdiction by Mexico before the phase-in of the fishing moratorium was begun. The average number of Texas vessels that fished in Mexican waters for the period 1971-1974 was 565; for Florida, the average was 85. Of the 565 Texas vessels, 464 fished in Areas 22 to 30, 207 fished in Areas 31 to 38 and 59 fished in Areas 39 to 40. The Florida vessels were more dependent on Areas 39 to 40 where 80 of the 85 vessels fished. Only nine of the Florida vessels fished in Areas 31 to 38 and only one fished in Areas 22 to 30.

Economic Consequence of Mexican Extended Jurisdiction

Griffin and Beattie (1978) relied on economic theory and statistical models to estimate the economic consequences of extended Mexican jurisdiction. The nature and extent of the economic losses estimated were highly dependent on assumptions made with respect to shrimp prices, costs, length of adjustment period and alternative uses of shrimp vessels.

Slightly more than 10 percent, 30,600 units, of the total effort (real days fished) expended by U.S. shrimpers on the Gulf shrimp fishery occurred in Mexican waters during the 1970-1974 period (Griffin and Beattie, 1978). In their analysis, Griffin and Beattie (1978), assumed that these 30,600 units of effort (E_m in Figure 3.2-13) would be diverted to U.S. waters when Mexico's extended jurisdiction went into full effect in 1980. Assuming that the U.S. Gulf of Mexico fishery was in open-access equilibrium where total value product (TVP) equals total cost (TC), a temporary disruption of that equilibrium was expected.

Present Value of Negative Rent Stream

When the 30,600 units of effort exerted in Mexican waters were diverted to U.S. waters over a three and one-half year period ending in 1980, the industry as a whole was estimated to incur negative rents temporarily. Since rent is zero at equilibrium in an open-access common property resource, rent (r) was temporarily negative due to the excess effort. The term rent refers to "excess profits." Excess profit may be defined as a return over and above the normal profit return to labor and capital used in the fishery.

The expected increase in effort ($E^m = 30,600$) resulted in an increase in total value product of shrimp from \$147.6 million to \$156.4 million and in total cost (TC) from \$147.6 million to \$161.4 million (Griffin and Beattie, 1978). At 291,400 units of effort, rent accruing to the fishery would be a negative \$5.1 million per year.

Assuming the industry was no longer in equilibrium after being removed from Mexican waters, it moved toward the equilibrium effort level of 260,800 units if cost-price relationships did not change. The magnitude of the real cost to the industry can be represented by the annual stream of net loss over that period of time until equilibrium is reached. Table 3.2.8 shows the present value of the stream of losses for alternative adjustment periods ranging from one to seven years, and prices per pound of shrimp landed ranging from \$1.70 to \$3.00 assuming a ten percent discount rate over time. Adjustment was assumed to take place in equal increments of effort each year until equilibrium was reestablished (i.e., at 260,800 unit of effort).

At a price of \$1.70 (see Table 3.2-8 for other price and time scenarios) per pound of shrimp landed, and a three-year adjustment period, the present value of the stream of net losses was estimated to be \$8.6 million. Assuming the same price and discount rate but five years to adjust the net

Table 3.2-6. Total pounds and value (and percentages) of shrimp landed in the five Gulf states, Florida, Texas and Brownsville/Port Isabel by areas of the Gulf of Mexico, average over the five years, 1970-1974.

Area	Five Gulf States		Florida		Texas		Brownsville & Port Isabel	
	Pounds (mil)	Dollars (mil)	Pounds (mil)	Dollars (mil)	Pounds (mil)	Dollars (mil)	Pounds (mil)	Dollars (mil)
U.S.:								
1-21	85.0 (90)	103.6 (89)	13.5 (89)	15.1 (89)	38.2 (83)	49.5 (84)	9.9 (58)	12.6 (54)
Mexico:								
22-30	6.0 (6)	8.7 (7)	*	*	5.9 (13)	6.8 (12)	6.0 (34)	8.6 (37)
31-40	3.6 (4)	4.7 (4)	1.7 (11)	1.9 (11)	1.9 (4)	2.8 (5)	1.4 (8)	2.1 (9)
Total Gulf:								
1-40	94.5 (100)	117.0 (100)	15.2 (100)	16.9 (100)	46.0 (100)	59.1 (100)	17.3 (100)	23.3 (100)

* Less than 100,000

Source: Griffin and Beattie (1978), p. 17.

Table 3.2-7. Number of vessels from Texas and Florida fishing in the Gulf of Mexico by areas, 1971-1974.

Year	Texas Vessels				Florida Vessels			
	Total*	22-30	31-38	39-40	Total*	22-30	31-38	39-40
1971	570	460	158	78	75	4	11	72
1972	632	528	193	74	90	0	7	86
1973	615	480	323	53	96	0	14	86
1974	444	393	153	30	79	1	5	77
Average	565	465	207	59	85	1	9	80

*Exclusive of duplication

Source: Griffin and Beattie (1978).

present value of the stream of losses was estimated to be \$12.1 million. Obviously, the longer the adjustment period, the larger the loss.

Also presented in Table 3.2.8 are estimates of the present value of the negative rent stream assuming alternative shrimp prices. Since a change in product price shifts TVP and thus the equilibrium effort level, the estimates presented assume that costs of production shifted simultaneously so that the same (260,800) equilibrium effort level was maintained. Given this assumption, the present value of the stream of losses was estimated to be \$12.8 million assuming a \$2.50 shrimp price and three years to adjust. At the same shrimp price but assuming a five-year adjustment period, the present value of the loss stream was estimated to be \$18.0 million.

Table 3.2-8. Present value of U.S. cost due to Mexico's extended jurisdiction in the Gulf of Mexico for alternative adjustment periods and product prices (assuming equilibrium effort at 260,800 units and a ten percent discount rate.)

Years to adjust	Exvessel Price Per Pound			
	\$1.70	\$2.00	\$2.50	\$3.00
	-----million dollars-----			
1	4.6	5.5	6.9	8.3
3	8.6	10.1	12.8	15.4
5	12.1	14.3	18.0	21.8
7	15.2	18.0	22.7	27.4

Source: Griffin and Beattie (1978)

3.3 History of Management

3.3.1. Management Institutions, Policies, Jurisdiction

Inland water management of the Gulf shrimp fishery is based on the laws and regulations of the five states affected. All the states have restrictions on the size of shrimp which may be taken; all have exclusive state authority for the determination of shrimping seasons; all require licensing of or permits for various types of shrimp dealers and vessels; all provide for restricted waters to some degree; all have penalties for violations of laws and regulations; Florida, Alabama, Mississippi, and Louisiana have some administrative authority to negotiate reciprocal shrimp agreements with other states while Texas has none. All Gulf states have agencies concerned with wetlands management; shrimp habitat protection in nursery areas comes within their purview as advisory or rule-making bodies. Florida, Louisiana, Mississippi, and Alabama have federally approved Coastal Zone Management Programs which would embrace all the laws and regulations of the governing bodies, both local and state, affecting the state-controlled shrimp fishery and nursery areas. The five states all have reporting requirements, but the type of information asked for and the diligence with which it is sought vary. Louisiana, Mississippi, and Alabama are authorized to collect taxes based on volume from shrimpers and/or processors. None of the states have a limited entry law.

Alabama: The Department of Conservation and Natural Resources is responsible for shrimp fishery management. Its powers include determination of open and closed seasons, regulation of time, place, and method of taking seafood, and authority to require submission of statistical information from shrimpers and processors. Direct supervision of seafoods is handled by the Department's Division of Marine Resources, headed by a director named by the Commissioner of Conservation and Natural Resources. A thirteen-member advisory board meets at least twice each year to review regulations proposed by the Commissioner and to establish policy on proposed legislation. The advisory board can revise or repeal regulations proposed by the Commissioner, or it can adopt its own regulations by a two-thirds vote and the consent of the Governor. All seafood in state-owned waters is declared to be state property. Wetlands management in Alabama is under the jurisdiction of the Coastal Area Board (appointed by the Governor). Its area of authority begins at the ten-foot contour line and is concerned with habitat protection. A fourteen-member advisory committee of experts in all fields of coastal usage advises the Coastal Area Board. Alabama has entered into reciprocal shrimp agreements with Louisiana, Mississippi, and Florida.

Texas: Overall control of the Texas shrimp fishery is either vested in the six-member Parks and Wildlife Commission appointed by the Governor or controlled by the legislature. The Commission establishes rules and regulations in some coastal counties and may adjust the closed Gulf season; enforcement is handled by the Texas Parks and Wildlife Department. The Texas Shrimp Conservation Act is applicable all along the Texas coast because the Commission has adopted it as a regulatory policy. State jurisdiction extends seaward three leagues (nine nautical miles) from the coastline. The state distinguishes between inside waters--all bays, passes, rivers, or other bodies of water landward from the Gulf--and outside waters, extending from the shoreline seaward to the extent of Texas jurisdiction. The Texas Coastal Coordination Act requires the Texas Natural Resources Council to study problems and issues in connection with coastal natural resources and to submit a biennial study with recommendations for action on identified problems. The Council is also to recommend research and data acquisition priorities. Texas has no reciprocal shrimp agreement with the other Gulf states; legislative approval of any such agreement would be required. The Commission is empowered to coordinate any Texas shrimp management plans with those drafted for the federal fishery zone.

Louisiana: The Wildlife and Fisheries Commission has exclusive control over the shrimp fishery and the shrimp industry. Rules and regulations are promulgated by the seven-member Commission. Its members are named by the Governor to serve overlapping terms and represent various segments of fish- and wildlife-related industries and sportsmen's groups. Administration is handled by the Department

of Wildlife and Fisheries. The Department's Office of Coastal and Marine Resources is responsible for enforcing regulations and monitoring the shrimp fishery. A severance tax, payable by the first purchaser and collected by the Department, is levied on shrimp taken from Louisiana waters. Data reporting is required from shrimp processing plants and wholesale dealers. The Department has a limited degree of authority to enter into reciprocal agreements with other states. Louisiana's jurisdiction extends seaward three nautical miles from the coastline. The state differentiates between inside waters, including the large bays, and outside waters. Shrimping seasons are set for inside waters; there is no closed season for outside waters. Regulations proposed by the Commission are subject both to review by the Joint Senate and House Natural Resources Committee and to the Administrative Procedures Act which requires public notice through publication in the Louisiana State Register prior to their adoption by the Commission. The State Department of Transportation and Development is in the process of developing a Coastal Zone Management Program covering coastal marshes and estuaries and extending to Louisiana's seaward boundary. The vast Louisiana shrimp nursery grounds are included in the territorial limits to be covered by the program.

Mississippi: The policy making body of the Mississippi Department of Wildlife Conservation is a five-member Commission on Wildlife Conservation. Executive authority is vested in the Director of Wildlife who is elected by the Commission for a four-year term. A Bureau of Marine Resources is supervised by a director experienced in marine conservation; this Bureau aids the Commission in "formulating policies, discussing problems and considering other matters." The Commission determines seasons, restricted waters, and size of shrimp to be taken. The Commission is authorized to require such reporting as may be needed to meet the needs of any research project, and persons receiving such questionnaires are required to respond factually. Fines are imposed for failure to respond or for falsifying data. A severance tax is imposed on all shrimp processed, transported in or from the state, or caught within state waters. The state has a broadly-worded statute covering reciprocal agreements. The Bureau of Marine Resources is authorized to study "plans, proposals, reports, and recommendations" for development and utilization of coastal and offshore lands, waters, and marine resources.

Florida: The Florida Department of Natural Resources is the state's shrimp fishery regulating agency. It is empowered to adopt rules and regulations governing "method, manner, and equipment" used in taking shrimp and to define areas where shrimp may be caught. Its Division of Marine Resources is charged to "preserve, manage, and protect" fishery resources and to regulate vessels and fishermen "within or without" the boundaries of the state. However, the legislature has adopted numerous local laws (general bills of local application) which regulate shrimping in the particular counties. Special county acts govern shrimping seasons in Apalachicola Bay, St. Vincent Sound, and the area from Cape San Blas to Cape St. George. By legislative act, some nursery areas are permanently closed to all except bait shrimping. Florida has uniform rule-making procedures for all administrative agencies; these procedures require prior notice, an economic impact statement, and an opportunity for "substantially affected" persons to challenge proposed rules on the grounds of invalid exercise of the agency's legal authority. Proposed rules are also to be reviewed by a legislative Administrative Procedures Committee. Florida has no statute specifically taxing the taking or handling of shrimp. The Department of Natural Resources is authorized to enter into reciprocal agreements with other states, giving shrimpers based in such states the same "rights and privileges" that residents of states in which they are fishing have.

3.3.1.1 Regulatory Measures Employed to Regulate the Fishery

The following is summarized from Craig, et al. (1978).

Legal Size of Shrimp; Catch Limits

Texas: In 1981, Texas amended its shrimp regulations to eliminate its minimum size restriction of 39 whole shrimp to the pound on Gulf shrimp so long as there is a Shrimp FMP in place which provides for a closed season in the FCZ which corresponds to the Texas closed Gulf season. Commercial shrimpers are not limited as to amount of shrimp taken in outside waters; 300 pounds per day limit in spring open season for inside waters; no limit on fall catch in major bays; however, August 15 to October 31, minimum count of 50 whole is required; no count restriction November 1 to December 15. Recreational shrimpers may take 100 pounds per day in outside waters, 15 pounds per day from major bays in spring, and 15 pounds per day in fall open season. Commercial bait shrimpers are limited to 200 pounds per day.

Louisiana: Inside waters size limit is 68 whole shrimp to the pound; limit not applicable in outside waters or to any species taken during spring inside waters open season, nor to brown shrimp taken after November 20. There are no catch limits on commercial shrimpers; unlicensed recreational shrimpers are limited to 100 pounds per boat per day. Bait shrimp are excluded from size requirements.

Mississippi: Size limit is 68 whole shrimp to the pound. Bait shrimpers are limited to a maximum of 20 pounds of dead shrimp. In addition, bays are not opened to live bait shrimping until such time as the shrimp are determined by sample catch to be 95 whole shrimp to the pound or larger. No catch limits otherwise.

Alabama: Size limit is 68 whole shrimp to the pound. Bait shrimp are excepted. There are no catch limits for commercial including bait shrimpers. Recreational boats are limited to 25 pounds per boat in areas open to commercial shrimpers and 15 pounds per boat in bait shrimping areas.

Florida: Statewide size limit for shrimp taken in state waters is 47 to the pound, heads on, and 70 tails to the pound; in three Panhandle counties local size limit is 55 to the pound, heads on, in open inside bays and sounds. No catch limits.

Licensing of Vessels and Fishermen

Texas: Commercial Gulf shrimp boat, bay shrimp boat, bait shrimp boat, and sport shrimp trawl must be licensed; "John Doe" licenses are also required for the captain and each crewman of commercial vessel and a personal license for each recreational shrimper.

Louisiana: Commercial boat license based on length; no license needed for recreational boats; license required for all gear except noncommercial 16 feet and under in length.

Mississippi: Vessel license is based on length; bait shrimp boats and interstate vessels pay additional annual fees. No shrimp gear license required.

Alabama: Vessel license for Alabama residents and non-resident shrimpers required unless there is reciprocal agreement with state of their residence; gear license is based on length of trawl.

Florida: Vessels are registered according to size; permits are required for trawling but no charge is assessed. Alien and nonresident commercial fishermen are required to obtain license.

Season

Texas: Inside waters in major bays are open May 15 to July 15 and August 15 to December 15. Outside waters are normally closed June 1 to July 15, subject to 15-day alteration in opening and closing. White shrimp may be caught during the closed season at zero to four fathoms during the day.

Outside waters are also closed December 16 to February 1. During the closed season seabobs may be harvested during the day, but catch can contain no more than ten percent of other species. Zero to seven fathoms at night closed year round.

Louisiana: For inside waters, the spring season opens no later than May 25 and continues for at least 50 days or until technical data indicate a closure is needed to protect newly recruited white shrimp; however, at least one zone must have a 50 day-open season. Fall season opens the third Monday in August and closes December 21. Commission may set special seasons. No closed season in outside waters.

Mississippi: The season opens first Wednesday in June, dependent on shrimp size of sample catch, and usually runs from the second or third week of June until December 1 unless declared otherwise.

Alabama: Closed from late April to mid-June, depending on samples.

Florida: Season varies according to area.

Restricted Waters

Texas: All passes to and from outside waters are closed to trawling. Shrimping in inside waters is limited to major bays and belt bays as defined by law. Other inside waters are classified as nursery areas and no shrimping is allowed.

Louisiana: State and federal wildlife refuges, Bayou Judge Perez, and sanctuaries in Lake Pontchartrain and Lake Catherine are restricted waters.

Mississippi: Commercial shrimping is forbidden within one-half mile of mainland from Mississippi-Alabama line west to Bayou Caddy, off Gulf Island National Seashore, and in all bayous with the exception of two pipeline ditches in Hancock County. (Shrimping within the one-half mile sanctuary is limited to licensed live-belt dealers.)

Alabama: All rivers, streams, bayous, creeks, and portions of bays designated as nursery areas are restricted. No shrimping is allowed within 200 yards of the beach off Dauphin Island and Mobile Point from May 5 to September 15.

Florida: Portions of Santa Rosa Sound, Tortugas shrimp bed in Florida waters, and that portion of the Tortugas shrimp bed in the FCZ are closed to Florida residents. Other areas are subject to local seasonal restrictions. Certain areas designated as state parks or recreational areas are closed to commercial fishing.

3.3.1.2 Consistency Requirements of Coastal Zone Management Act

Consistency provisions of the Coastal Zone Management Act require a Council, in preparation of a fishery management plan, to address and consider the extent of fishing within state waters, on the premise that good management principles "require that the FMP address an individual stock of fish as a unit throughout its range, including its presence within state waters." Councils should "make every effort to coordinate their FMP development activities with the state coastal zone agencies."

3.3.2 Management and Regulation of Foreign Fishery

The present extent of the U.S. fishery conservation zone in the Gulf of Mexico is defined on the basis of two treaties on maritime boundaries, one with Mexico and the other with Cuba. Both treaties are now pending Senate advice and consent to ratification. In the meantime, the maritime boundaries specified in the treaties are being applied provisionally.

Access to the FCZ for foreign shrimp fishermen must be predicated on an available surplus of shrimp in excess of the U.S. harvesting capacity, as well as a Governing International Fishery Agreement (GIFA) with their home country. Likewise, for U.S. shrimp fishermen to gain access to the zones of exclusive fisheries jurisdiction of Mexico or Cuba, there must be a surplus over the harvesting capacity of the domestic fishermen involved. Cuba has a GIFA with the United States effective September 26, 1977. However, the MFOA does not permit allocations to the fishermen of either country unless a shrimp surplus is determined.

The current U.S.-Mexico Fisheries Agreement as discussed in Section 3.2.3 allows for no access to shrimp by U.S. fishermen in Mexico's fishery zone. The United States continues to negotiate with Mexico in an effort to obtain some form of shrimp access. U.S. fishermen have no access to fish or shrimp in the Cuban fishery zone. The U.S.-Cuba Convention for the Conservation of Shrimp was terminated on April 28, 1978, after being in force twenty years.

3.4 History of Research

Other than the work of Percy Vlosca and various annual reports by the Gulf states, little was recorded about Gulf shrimp until the 1930's. During the 1930's, the various Gulf states and the U.S. Bureau of Commercial Fisheries initiated a series of intensive studies on the life history of white shrimp (Lindner and Anderson, 1956). These mark-recapture and associated studies provided the basis for our knowledge of Gulf shrimp as well as providing a model for subsequent studies and an initial group of fishery scientists knowledgeable about Gulf shrimp and their environment.

The history of research since that time is too extensive and diverse to summarize in this section. Indeed, this entire plan attempts to summarize only that portion of the research which is directly relevant to the mandates of MFOA.

No articles were encountered which would indicate studies on U.S. Gulf shrimp had been supported by foreign countries.

3.5 Socioeconomic Characterization

3.5.1 Output of the Subject Domestic Reported Commercial Fishery

Measured by the value of shrimp at dockside, the shrimp fishery is the most valuable of all domestic fisheries, averaging 23 percent of the value of all fish and shellfish landed in the United States for the period 1964 through 1979. Translated into dollars, the 1979 fish and shellfish landings were worth \$2,233,679,000. Shrimp accounted for \$471,573,000; salmon, \$412,776,000; and tuna, \$158,387,000. The Gulf of Mexico commercial shrimp fishery in 1979 accounted for 80 percent of the dockside value of the U.S. shrimp landings and in terms of pounds of shrimp, the relative Gulf contribution is 61 percent of the U.S. shrimp landings.

3.5.1.1 Exvessel Value of the Catch

Exvessel value of Gulf of Mexico shrimp landings increased over six-fold between the late 1950's and the late 1970's (Table 3.5.1 and Figure 3.5.1). Although the overall trend in volume was upward for the twenty-two year period, most of the increase in value of landings was due to increases in exvessel prices. Since 1964 total value of shrimp landings only decreased in 1974. Between 1964 and 1970 total value increased steadily while after 1970 total value of shrimp landings increased dramatically. The overall trend in prices has been upward since 1967 causing most of the increase in total value. Prices generally moved in opposite direction than volume landed, causing the total value trend to be much smoother. Price movements changed direction in twelve of the twenty-two years, declining two years in a row only in 1958 and 1959 while increasing three years in a row during two periods.

Texas, with an average of 46 percent of the value of all Gulf of Mexico shrimp landings, has consistently had the largest exvessel value of all the Gulf states. Louisiana accounts for 28 percent of the average annual value of the landings. Florida ranks third at 15 percent of the total value. Value of shrimp landings increased in all states between 1958 and 1977 (Table 3.5.2). Average annual rate of increase in value of landings ranged from 5.2 percent for the Florida west coast to 16.6 percent for Alabama. Texas and Louisiana, the two most important states, averaged over nine percent per year.

Table 3.5-1. Total volume and value of U.S. Gulf of Mexico shrimp commercial landings, 1958-1980

Year	Heads-on	dollars	Dollars per pound
	pounds		
	----- 000 -----	-----	
1958	173,354	63,871	.37
1959	193,503	50,348	.26
1960	205,725	57,631	.28
1961	133,795	43,650	.33
1962	141,726	60,557	.43
1963	203,116	63,539	.31
1964	179,032	62,695	.35
1965	195,237	70,907	.36
1966	179,230	82,973	.46
1967	225,731	90,575	.40
1968	204,024	95,829	.47
1969	200,429	101,062	.50
1970	230,474	108,186	.47
1971	227,376	136,274	.60
1972	228,941	164,101	.72
1973	182,206	171,854	.94
1974	186,211	138,042	.74
1975	170,084	178,227	1.05
1976	210,078	275,222	1.31
1977	265,903	296,785	1.12
1978	248,327	319,590	1.29
1979	206,564	377,642	1.82
1980	204,914	295,212	1.44

Source: Fishery Statistics of the United States and Fisheries of the United States.



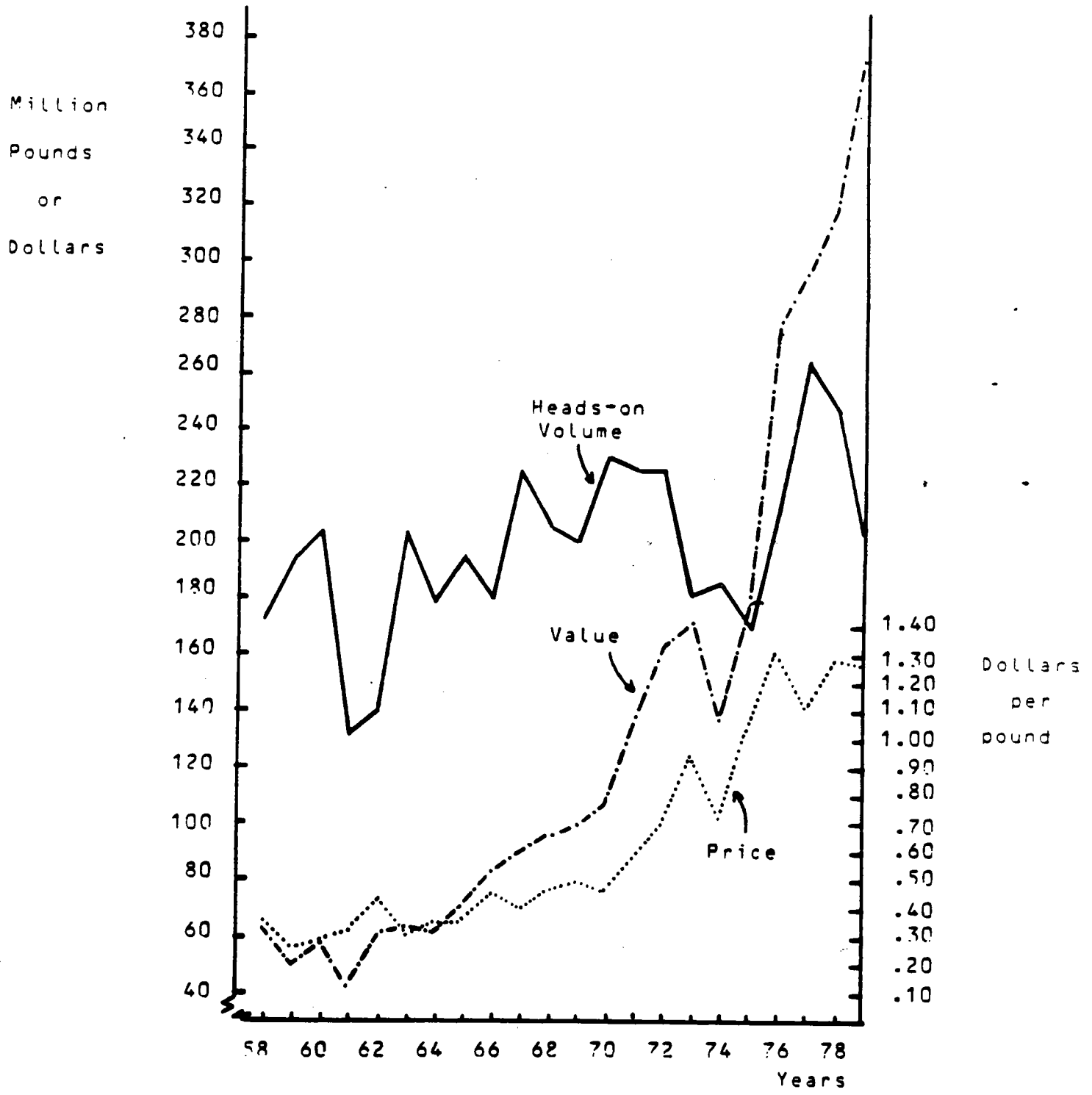


Figure 3.5.1.--Total volume and value of Gulf of Mexico shrimp landings and average ex-vessel prices, 1958-79

Area Distribution of the Value of the Catch

Figure 3.5-2 compares the average value distribution of the combined brown, white and pink shrimp catches from 1959 to 1975. Area 19 (the Freeport, Texas, grid) has the highest ex-vessel value. It has accounted for an average of 19 percent of the total value. Waters adjacent to Texas provide 42 percent of the average shrimp catch value. The value of the catch off Louisiana accounts for 36 percent of the total value; Florida, 11 percent; and Alabama and Mississippi each six percent.

A comparison of the value of landings (Table 3.5-2) and the average percent of the value of catch (Fig. 3.5-2) indicates some apparent differences, for example, Texas and Florida have larger percentage values in landings (see above) than are accounted for in percentage value of catch, whereas Mississippi and Louisiana have smaller values in landings than expected from the reported value of the catch. These differences reflect the mobility of much of the Gulf fleet. For example, until recently many vessels from Florida and Texas, because of their proximity, had shrimped off Mexico and landed a portion of their catch in the United States. Some vessels from Florida often migrate north in the spring and summer to fish off Mississippi and Louisiana and then Texas. Vessels from Louisiana frequent the shallow waters off Galveston, Texas, fishing for white and brown shrimp. Texas boats may fish off Louisiana during the Texas closed season in June and part of July. Alabama's Bayou La Batre vessels have the capability to "roam" the Gulf in search of shrimp, though they are larger than the average sized vessel in the northern Gulf.

Harvesting regimes exert a substantial influence on exvessel value. Texas regulations, for example, result in much greater landings of larger-sized shrimp than do those of Louisiana. A 1958-1975 study showed Texas prices for brown shrimp to be 1.6 times that of Louisiana brown shrimp, and 1.2 times that of white shrimp (Cellouet and Patella, 1978).

Although there have been variations in the relative importance of the exvessel value of brown, white, and pink shrimp, the brown shrimp is the most valuable, accounting for 52 percent of the total value of all species from 1958 to 1967 and for 56 percent of the total value from 1968 to 1977. White shrimp are the second most valuable species. The relative position of white shrimp increased from 25 percent of the total value in the 1958-1967 period to 30 percent of the total value during the 1968-1977 period. The percentage of total value of Gulf shrimp catch attributable to pink shrimp has fallen from 21 percent in the 1958-1967 period to 13 percent for 1968-1977.

Approximately 57 percent of the annual value of the brown shrimp catch is from Texas, 28 percent from Louisiana, and the remaining 15 percent from Mississippi, Alabama, and Florida (Fig. 3.5-3).

Louisiana waters furnish 61 percent of the value of the white shrimp harvest, Texas 30 percent, Mississippi five percent, Alabama three percent, and Florida one percent (Fig. 3.5-4).

The Florida catch accounts for 97 percent of the total pink shrimp value (Fig. 3.5-5). The Dry Tortugas area accounts for 70 percent of this value. Seabob are concentrated in the Atchafalaya River area of Louisiana (Fig. 3.5-6). These waters furnish 92 percent of the value of the catch. Texas adds four percent and the remainder comes from areas east of the mouth of the Mississippi (Fig. 3.5-6). Florida accounts for 98 percent of the rock shrimp exvessel value (Fig. 3.5-7). The royal red fishery is concentrated in two areas (Fig. 3.5-8): the Dry Tortugas catch is 45 percent of the total value, while the catch off the Mississippi Delta is 42 percent of the value.

Price Structure and Sensitivity by Size Distribution of the Catch

The price per pound of shrimp varies in direct proportion to size. There are significant price differences between size groups of shrimp. Price differentials play a key role in the substitution of

Table 3.5-2. Exvessel value of shrimp landings by state

Year	Florida West Coast	Alabama	Mississippi	Louisiana	Texas
-----1,000 dollars-----					
1958	16,312	1,984	2,377	13,533	29,665
1959	9,752	1,991	2,345	13,067	23,193
1960	12,155	2,090	2,899	15,881	24,606
1961	11,094	1,154	1,281	8,913	21,208
1962	14,556	1,647	2,220	14,985	27,149
1963	12,256	2,419	2,484	19,789	26,591
1964	13,322	2,630	1,805	18,794	26,144
1965	13,905	3,654	2,523	19,584	31,241
1966	12,427	4,920	2,751	24,390	38,485
1967	10,476	6,049	3,122	24,573	46,355
1968	12,695	7,964	3,677	25,623	45,870
1969	12,021	8,788	4,011	33,358	42,884
1970	13,108	8,040	3,810	34,614	48,614
1971	12,985	11,451	4,362	43,285	64,191
1972	17,309	14,661	4,966	47,066	80,099
1973	22,601	14,165	3,698	44,511	86,879
1974	21,445	13,490	3,225	32,203	67,679
1975	27,799	17,843	3,825	40,968	87,902
1976	36,842	30,393	8,418	79,688	119,881
1977	39,971	33,487	10,113	87,183	125,620
-----percent-----					
Average Annual change for 1958- 1977	5.2	16.6	6.5	9.5	9.1

Source: Fishery Statistics of the United States.

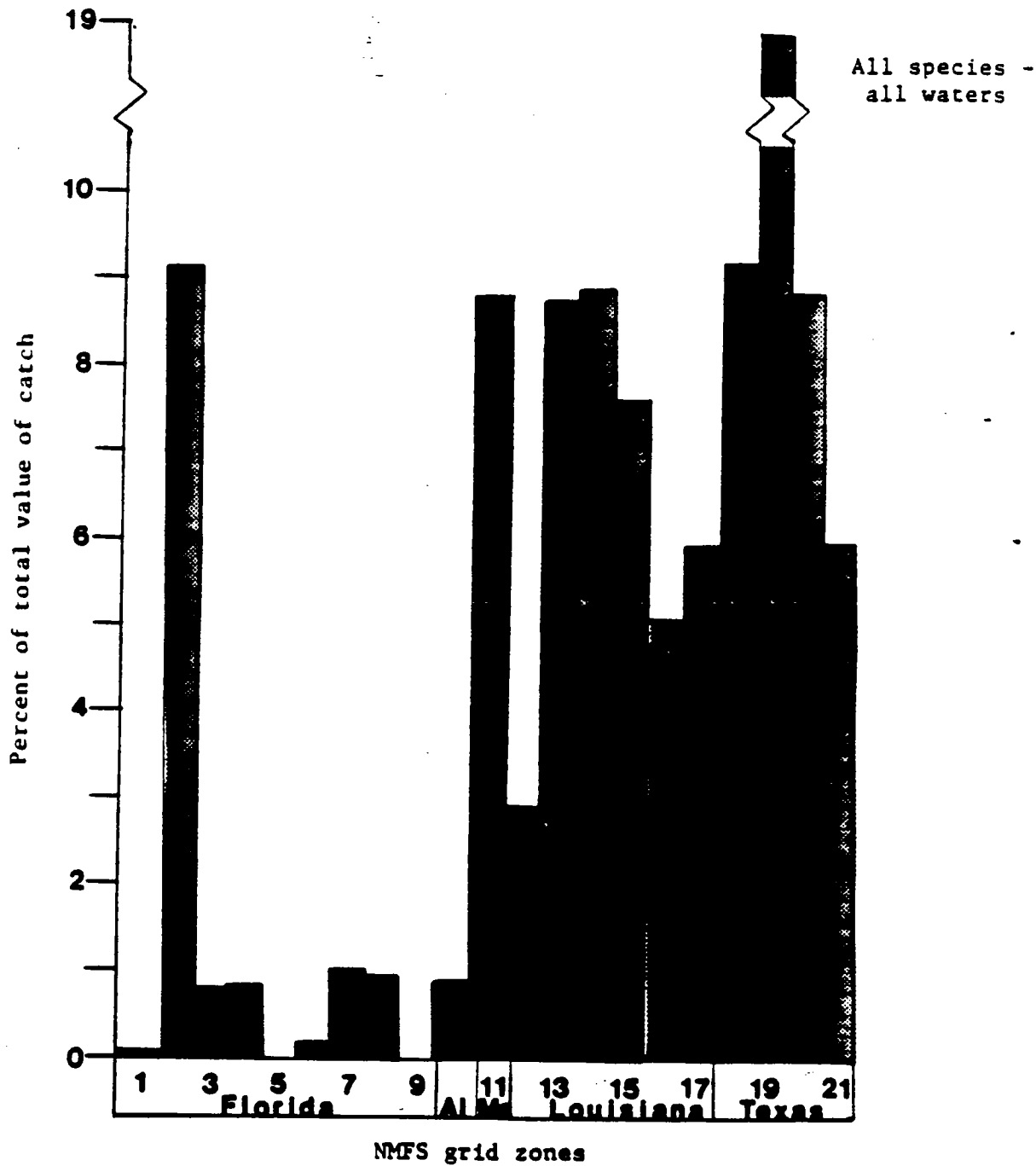


Figure 3.5-2. Average percent of total value of the Gulf catch for all species 1959-1975 by area (US Dept. Com., 1959-1975).

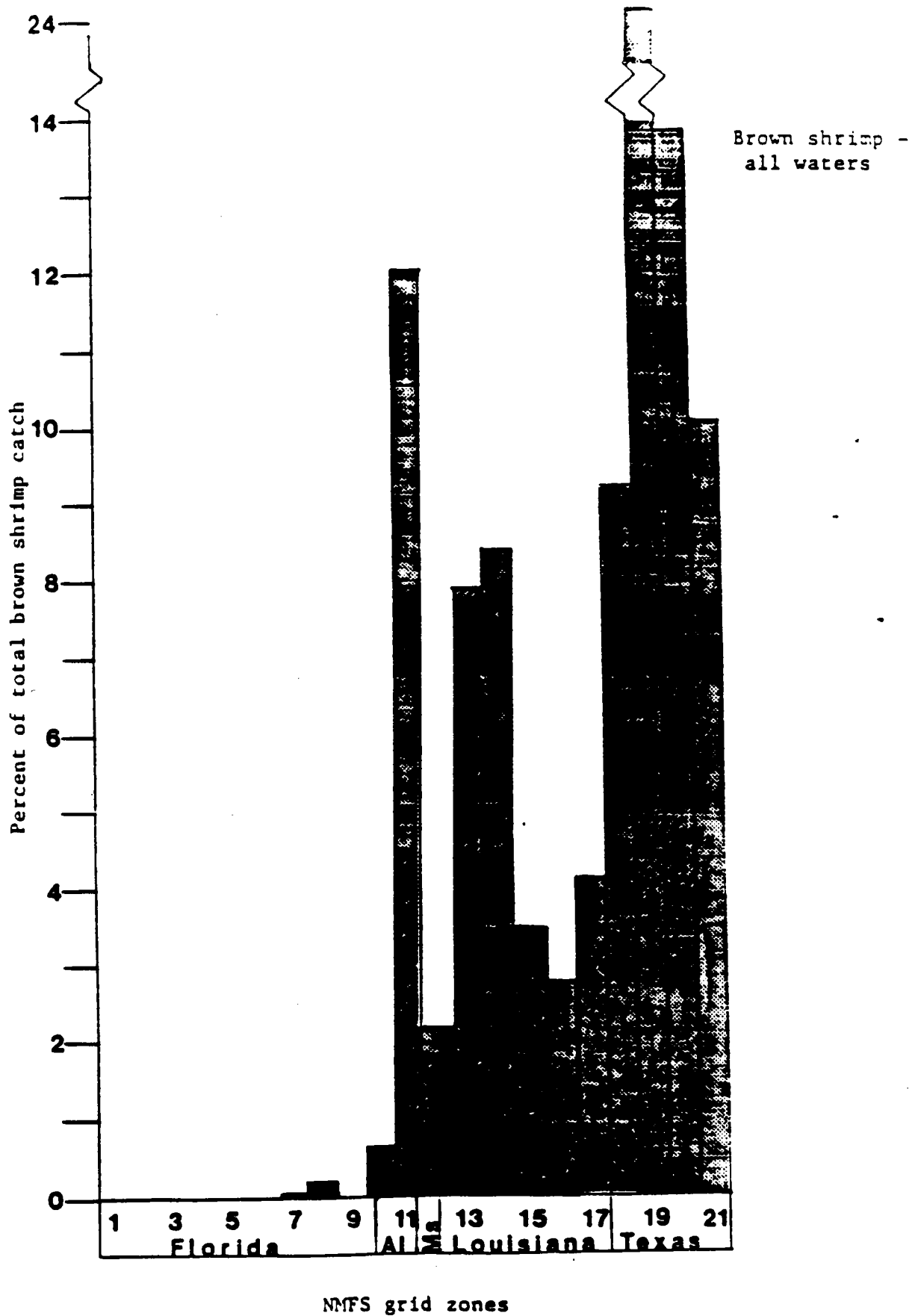


Figure 3.5-3. Average percent of the total value of the brown shrimp catch 1959-1975 by area (US Dept. Com., 1959-1975).

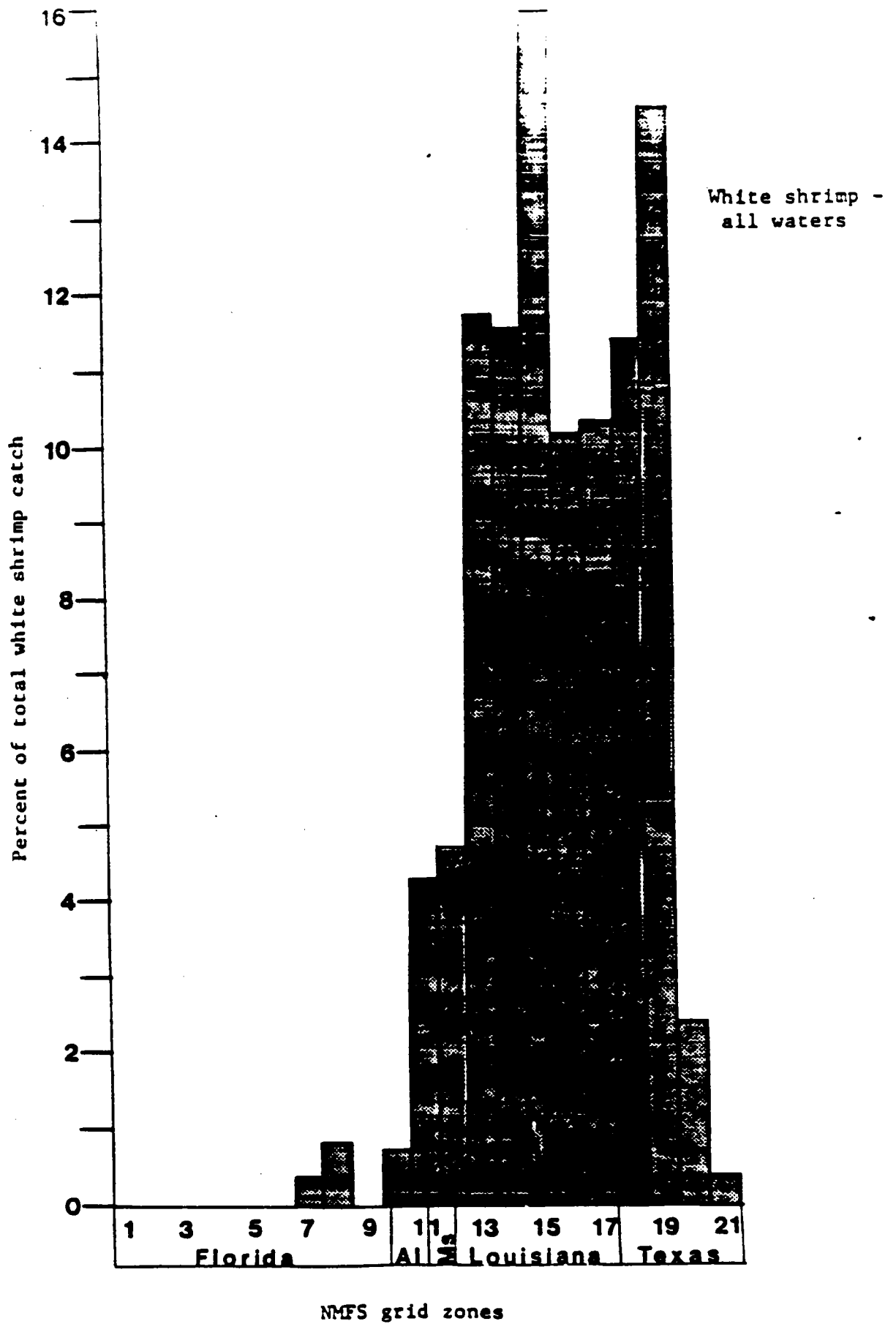


Figure 3.5-4. Average percent of the total value of the white shrimp catch 1959-1975 by area (US Dept. Com., 1959-1975).

certain sizes for others into various products such as breaded shrimp, fresh-frozen, and specialty items. This price structure appears to be partially sensitive to changes in the size distribution of the catch (Toews and Johnson, 1978).

Larger shrimp are consumed primarily through restaurants, while mediums are sold to breeders, fresh seafood retailers, canners and other processors. Small shrimp are often processed into canned, dried or specialty products.

A more recent study (Chui, 1980) also indicates an existence of separate markets by size of Gulf shrimp; large (under 30 count), medium (30 to 50 count), and small (over 50 count). Exvessel demand for shrimp was concluded to vary significantly by size of shrimp. Demand is higher for the larger sizes of shrimp and with the exception of small shrimp, the larger the size the greater the price response to changes in supply. Price responsiveness was, however, shown to be small within regions of the Gulf: eastern, northern and western Gulf.

3.5.1.2 Wholesale Value of the Product

Total value of processed shrimp products more than doubled between 1971 and 1977, increasing from \$253.7 million to \$528.9 million (Table 3.5-3). Texas has consistently been the leading state, with Florida's west coast second. In percentage terms, Alabama has had the largest growth rate while the Texas growth rate was the smallest.

Frozen raw headless is by far the most important processed product form accounting for 55.9 percent of processed shrimp products in 1976 (Figure 3.5-9). Breaded shrimp ranks second with 21.0 percent. Percentage production by states by product type is shown in Figure 3.5-10.

Wholesale price of processed products depends on exvessel prices, decrease or increase in product weight through processing, costs of marketing and processing and demand for the processed product. With the exception of exvessel prices, none of these parameters are reported on a consistent and continuous basis in published statistics. Wholesale prices computed by dividing volume of processed product into value of processed products are an estimate of value per unit of product as it leaves the processors establishment.

Wholesale prices increased for all processed products between 1958 and 1978 with the largest percentage increase for raw headless at 7.5 percent annually (Table 3.5-4). Annual wholesale prices vary widely because of exvessel prices, processing costs and demand shifts. Exvessel price variations are probably the most important factor determining variation in wholesale prices. Breaded raw products have consistently been the lowest valued products per pound since 1961. Required pounds of heads-on shrimp per pound of processed product are: 1.58 pounds, raw headless; 2.04 pounds, raw peeled, 1.0 pounds, breaded raw; 3.13 pounds, peeled and cooked; 3.21 pounds, canned; and 7.69 pounds, dried (based on conversion factors in Fishery Statistics of the United States). Multiplying these factors by the exvessel price gives the cost of raw product per unit of processed product and is referred to as the raw product equivalent price. This component is the largest part of the wholesale price. Wholesale price variation is then expected to vary directly with exvessel prices and the amount of variation is directly related to the conversion factor. Percentage of wholesale price variation is greatest for products utilizing a high ratio of shrimp to processed product.

The difference between the raw product equivalent price and the wholesale price is the marketing margin. This imputed marketing margin covers transportation, processing costs and profits to processors. Marketing margins were imputed for raw headless, breaded raw, and cooked and raw peeled processed shrimp products (Table 3.5-5). These margins were estimated by subtracting the imputed raw product equivalent prices from the wholesale prices. The raw product equivalent prices were estimated by multiplying the conversion factors discussed above by average exvessel Gulf of Mexico shrimp prices reported in Table 3.5-1.

Table 3.5-3. Wholesale values of processed shrimp for Gulf of Mexico states

State	1971	1972	1973	1974	1975	1976	1977
-----millions of dollars-----							
Florida, W.C.	70.2	70.9	80.0	69.5	83.3	133.2	150.9
Alabama	11.6	23.2	30.7	20.3	28.9	59.0	68.3
Mississippi	12.7	13.7	15.7	16.9	15.7	26.9	40.0
Louisiana	65.7	64.8	76.9	72.4	64.1	95.6	125.4
Texas	<u>93.6</u>	<u>110.2</u>	<u>120.6</u>	<u>80.7</u>	<u>67.7</u>	<u>141.4</u>	<u>144.2</u>
Gulf Total	253.7	282.6	330.0	259.9	259.8	456.1	528.9

Numbers do not add due to rounding. Totals are correct.

Source: National Marine Fisheries Service, Processed Fishery Products Annual Summary (Washington, D.C.: Dept. of Commerce, various years).

Marketing margins for shrimp increased from \$.18 per pound of processed product in 1958 to \$.20 per pound in 1978. The increase was fairly slow through 1972 at which time the margin was \$.30. Substantial increases took place between 1973 and 1974 and between 1976 and 1977. A comparison of exvessel price movements from year to year with changes in marketing margins shows no overall negative or positive relationship. Marketing margins for breaded shrimp also increased over time but not as consistently nor as substantially. Marketing margins for breaded raw shrimp increased from \$.30 per pound in 1958 to a high of \$1.10 in 1977.

Marketing margins for peeled shrimp generally increased until the late 1960's but then declined throughout the 1970's. The negative imputed margins during the late 1970's may reflect the margin estimation procedure for this product. Raw product price equivalents may have been over stated if smaller than average size shrimp were used in the processed product or if lower valued imported shrimp were used for this processed product.

3.5.1.3 Domestic Marketing Channels

The marketing of shrimp from the vessels to consumer may be handled through a variety of channels with as many as 11 components (Figure 3.5-11). The usual participation is more limited, however, involving fishermen, wholesalers, processors, transporters, and retailers. Other seafood products are usually also handled by members of the shrimp marketing system.

Since shrimp may range from five to more than 200 tails per pound, size is the principal factor influencing market channels and use. Larger size shrimp usually go to restaurants; those in the 30 to 65 per pound range go principally to breeders, fresh seafood retailers, canners, and other processors. Smaller shrimp are used by canners, driers, and specialty producers. In recent years there has been a growing trend to use the full range of shrimp sizes for breaded, peeled, and stove-ready products.

Variation in use of marketing channels depends on many factors: shrimp size, processed form, location of processor, degree of industry concentration, source of raw shrimp, amount of imported shrimp used, and amount of foreign labor involved in processing. Area differences prevent extrapolation of the Alvarez, et al. (1976) study of Florida's marketing channels to the entire Gulf coast (Christmas and Etzold, 1977). A telephone survey of shrimp processors and middlemen in each of the Gulf states was conducted in the drafting of this plan. The survey revealed a general pattern of marketing channels, shown in Fig. 3.5-11. The bold lines in the figure indicate major channels.

Dealers

The dealer is the first middleman to take possession of the shrimp. He normally operates docking facilities with allied provisions for service and storage. His relationship with the fisherman is that of purchaser of shrimp and, on occasion, purveyor of fuel, ice, and supplies. But he may also offer financial services ranging from credit extension to maintenance of records for boats based at his dock. In this relationship there is usually an understanding that the shrimper's catch will be handled by the dealer; such a relationship may have a corollary price impact.

Louisiana dealers surveyed reported purchasing shrimp on a regular basis from 80 to 120 craft, with the median about 110. Dealers may also get shrimp from other craft on a part-time basis; some operate craft of their own.

Among the dealer's functions are processing of shrimp for the market--heading, grading, packing, refrigerating, and storing. Some, especially in Louisiana, have operations for handling of heads-on shrimp for drying. The drying operations reduce loss of shrimp due to spoilage and permit the utilization of shrimp in periods of peak landings.

Table 3.5-4. Wholesale prices of Gulf of Mexico shrimp processed products, 1958-1978

Year	Raw ^a Headless	Raw ^a Peeled	Breeder ^a	Cooked ^a and Peeled	Canned ^b	Dried ^a
1958	.76	1.06	.67	1.89	10.38	1.41
1959	.59	.82	.62	1.54	8.89	.90
1960	.61	.98	.63	1.64	8.29	1.12
1961	.76	1.09	.75	1.63	9.09	1.78
1962	.92	1.24	.81	1.93	10.43	1.61
1963	.72	1.18	.71	1.77	8.59	.84
1964	.82	1.16	.80	1.67	8.63	1.99
1965	.83	1.16	.80	1.67	9.63	1.99
1966	.96	1.32	.90	1.97	10.66	2.02
1967	.88	1.37	.85	1.92	10.21	1.65
1968	1.03	1.55	.94	2.39	10.92	1.90
1969	1.09	1.75	1.00	2.04	10.29	1.74
1970	1.04	1.45	.99	1.57	10.51	no data
1971	1.28	1.69	1.07	2.51	11.14	1.87
1972	1.44	1.90	1.24	1.95	13.28	2.42
1973	2.42	2.25	1.48	3.44	18.91	3.87
1974	1.74	1.80	1.44	3.11	16.25	2.72
1975	2.35	1.77	1.61	3.36	16.74	4.92
1976	2.79	2.67	2.02	3.82	19.74	3.81
1977	2.81	2.41	2.22	3.43	22.66	3.88
1978	3.24	2.32	2.15	3.08	21.92	4.00
	----- percent -----					
Average annual increase	7.5	5.0	5.7	4.1	4.0	6.7

a Price per pound of finished product.

b Price per standard case of canned shrimp.

Source: Computed from Fishery Statistics of the United States and Current Fishery Statistics.

Table 3.5-5. Imputed marketing margins for selected Gulf of Mexico processed shrimp products, 1958-1978

Year	Raw Headless	Breaded Raw	Peeled	
			Raw	Cooked
----- dollars per pound -----				
1958	.18	.30	.31	.73
1959	.18	.32	.29	.73
1960	.17	.35	.41	.76
1961	.24	.42	.42	.60
1962	.24	.38	.36	.58
1963	.24	.40	.55	.80
1964	.25	.36	.41	.51
1965	.26	.44	.42	.54
1966	.23	.44	.38	.53
1967	.25	.45	.55	.67
1968	.29	.47	.59	.92
1969	.30	.50	.73	.47
1970	.30	.52	.49	.10
1971	.32	.47	.47	.63
1972	.30	.52	.43	-.31
1973	.93	.54	.33	.50
1974	.57	.70	.29	.79
1975	.69	.56	-.37	.07
1976	.72	.71	0	-.28
1977	1.04	1.10	.13	-.08
1978	1.20	.86	-.31	-.96

Source: Estimated by multiplying conversion factors reported in text by average annual exvessel prices and then subtracting this value from wholesale prices.

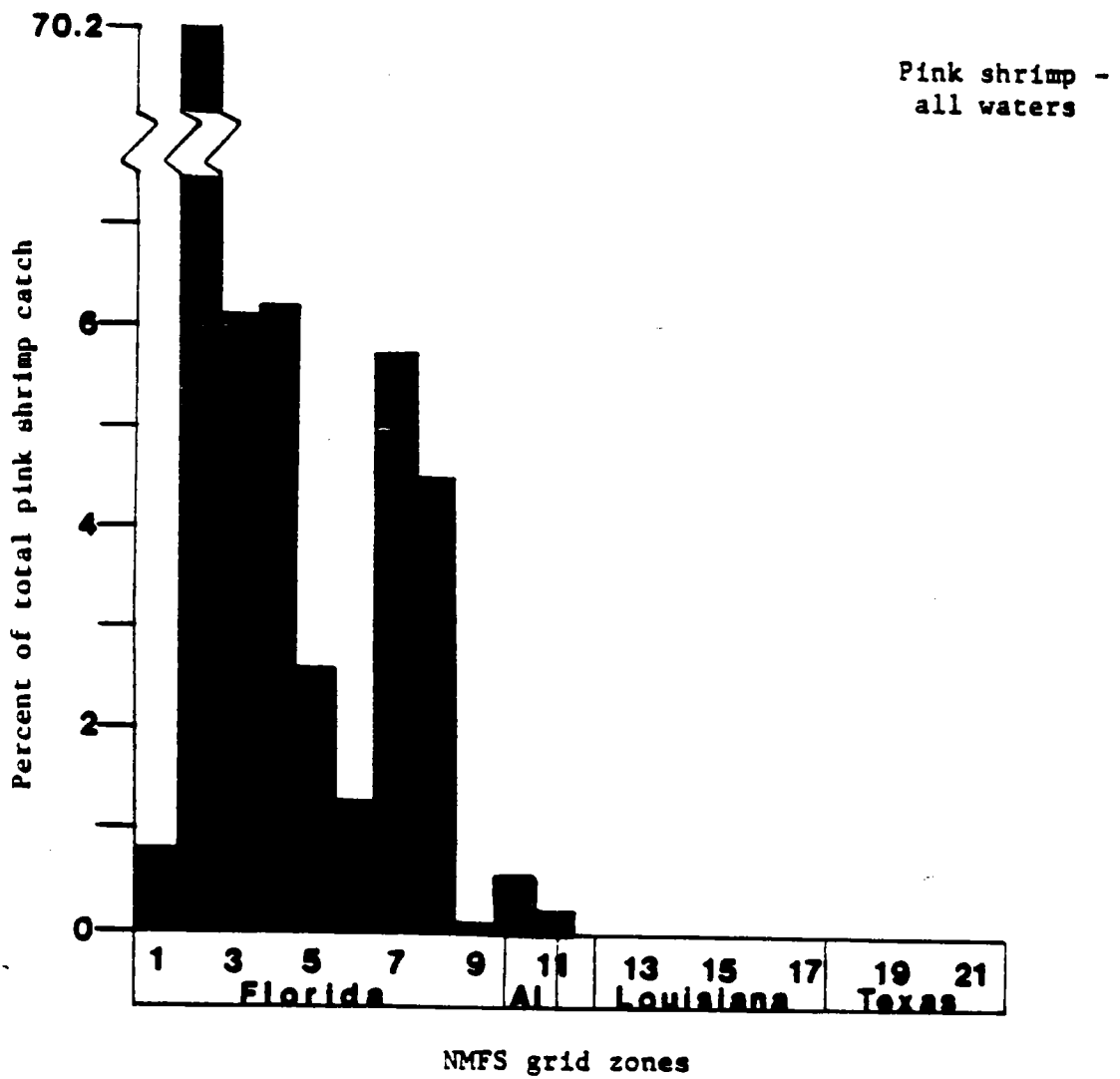


Figure 3.5-5. Average percent of the total value of the pink shrimp catch 1959-1975 by area (US Dept. Com., 1959-1975).

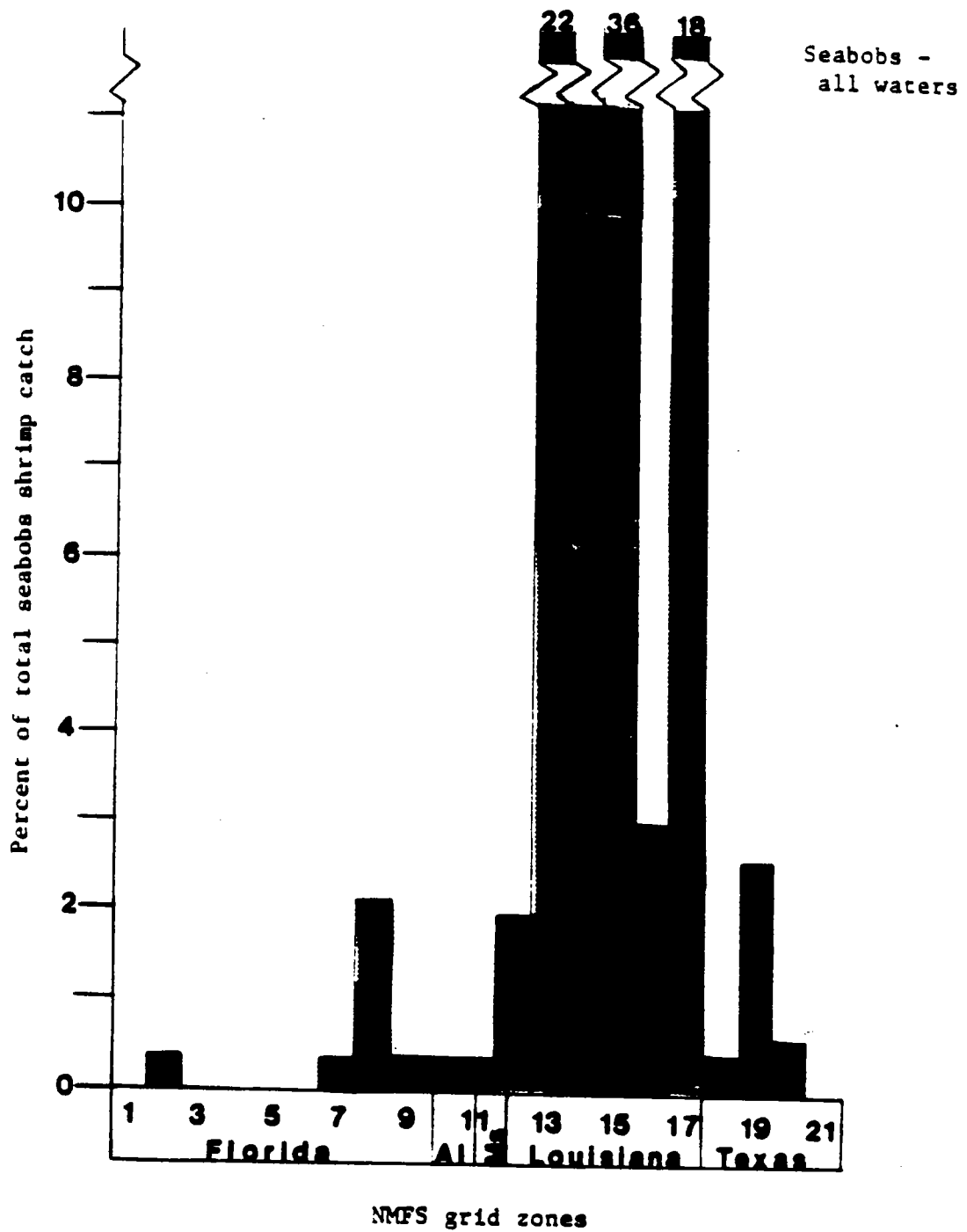


Figure 3.5-6. Average percent of the total value of the seabob shrimp catch 1963-1975 by area (US Dept. Com., 1963-1975).

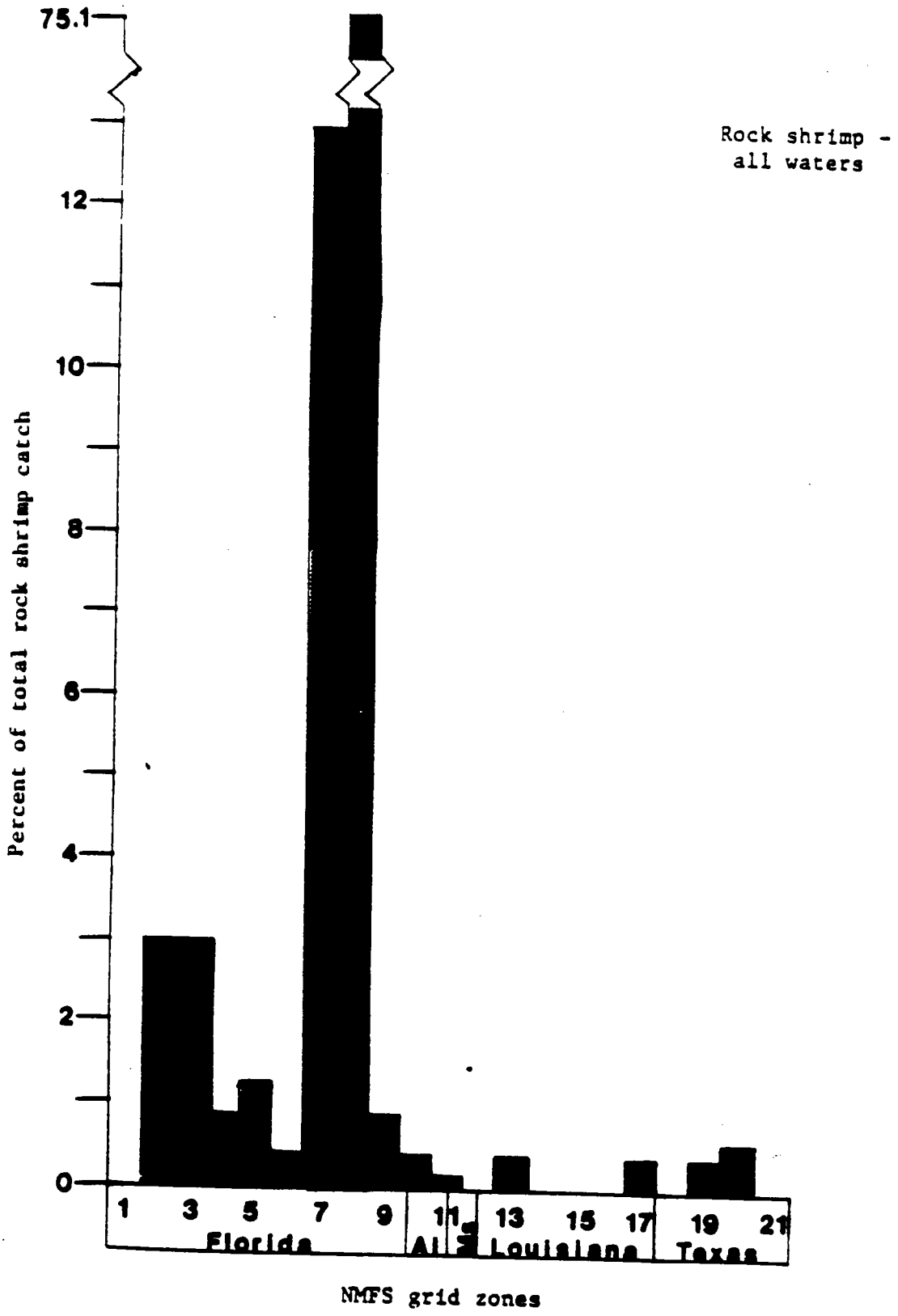


Figure 3.5-7. Average percent of the total value of the rock shrimp catch 1963-1975 by area (US Dept. Com., 1963-1975).

