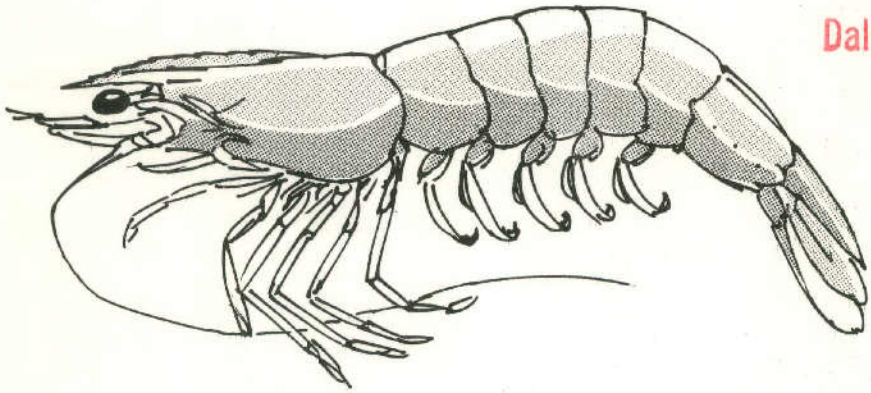
TEXAS SHRIMP FISHERY MANAGEMENT PLAN

Fishery Management Plan Series
Number 2



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TEXAS SHRIMP FISHERY MANAGEMENT PLAN

by

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INTRODUCTION

The Texas Legislature has historically managed the shrimp fishery in Texas primarily to maximize the ex-vessel (dockside) value of shrimp landed in Texas. The result has been that since the 1950's, Texas has led all other Gulf states in ex-vessel value of shrimp landed commercially for food. Average annual reported landings of shrimp sold as food in Texas were 87 million pounds (whole weight, heads-on; used throughout the Plan) with an average ex-vessel value of $186 million from 1983 through 1987. The impact of the shrimp fishery on the Texas economy is about $580 million annually, based on an economic multiplier of 3.12. The fishery employs about 20,000 fishermen using 7,000 vessels and boats, and depends primarily on three species: brown shrimp (Penaeus aztecus), white shrimp (P. setiferus), and pink shrimp (P. duorarum). However, this Plan is concerned with the harvest of shrimp in general and any reference to shrimp pertains to all shrimp except where a particular species is indicated.

Shrimp have one of the highest ex-vessel values of any seafood product in the United States. Average annual ex-vessel value of the United States shrimp fishery was $541 million from 1983 through 1987. The Gulf of Mexico is the most important shrimp producing area of the United States with average annual landings worth $458 million.

The complex nature of the Texas shrimp fishery makes management difficult. Shrimp are both estuarine- and Gulf-dependent, and several harvesting fleets in the fishery have evolved with diverse economic goals and objectives. These fleets include the commercial food and bait fisheries in the bays, a food fishery in the Gulf of Mexico and a recreational fishery for food and bait. A further complication is the fishery's direct impact on finfish, and other animals that are part of the by-catch, especially endangered species like sea turtles.

Further adding to the complexity of the shrimp fishery is the fact that all three species of shrimp important to the Texas fishery occur in waters under the jurisdiction of five Gulf states and the governments of the United States and Mexico. The overlap of federal and state jurisdiction has led to joint management of the fishery by Texas and the U. S. Department of Commerce through the Gulf of Mexico Fishery Management Council's Fishery Management Plan for the Shrimp Fishery of the Gulf of Mexico United States Waters (1981). There are no formal shrimp management programs between the United States and Mexico.

In 1985, the Sixty-ninth Texas Legislature delegated to the Texas Parks and Wildlife Commission authority to regulate the shrimp fishery in Texas bays and the Texas Territorial Sea (Figure 1). However, the Legislature mandated that before existing regulations are changed the Texas Parks and Wildlife Department prepare a Shrimp Fishery Management Plan and economic impact analysis in accordance with Chapter 77 of the Parks and Wildlife Code.

This document is the Texas Shrimp Fishery Management Plan. It was prepared by Texas Parks and Wildlife Department staff. However, the Plan is the culmination of a process that was designed to maximize public

participation. In particular, the Plan was prepared based on information from the Texas Coastal and Marine Council and its Shrimp Advisory Committee, the Joint Interim Committee on the Texas Shrimp and Oyster Industry, bills introduced to the Legislature but not enacted and meetings with representatives from Professional Involvement of Seafood Concerned Enterprises (PISCES), United Shrimpers Association (USA), Texas Shrimp Association (TSA), Center for Environmental Education (CEE), and the Marine Advisory Service of the Texas A & M University Sea Grant Program. Comments were also incorporated from those who attended seven public hearings held across the coast in July-August 1986 (over 10,000 personal invitations were mailed to individuals, county judges, state representatives, commercial and recreational organizations, marine extension agents and other parties with a special interest in the Texas Shrimp Industry) 24 statewide public hearings and finally, all those who wrote, called or otherwise contacted the Texas Parks and Wildlife Department to offer their comments.

The goal of the Shrimp Fishery Management Plan is to provide a management strategy for the shrimp fishery in Texas. The plan will allow the Texas Parks and Wildlife Commission to regulate by proclamation the catching, possession, purchase, and first sale of shrimp as described in Section 77.007 of the Texas Parks and Wildlife Code. In determining the need for a proclamation the Legislature requires the Commission to consider:

(1) measures to prevent overfishing while achieving, on a continuing basis, the optimum yield for the fishery;

(2) measures based on the best scientific information available;

(3) measures to manage shrimp throughout their range;

(4) measures, where practicable, that will promote efficiency in utilizing shrimp resources, except that economic allocation may not be the sole purpose of the measures;

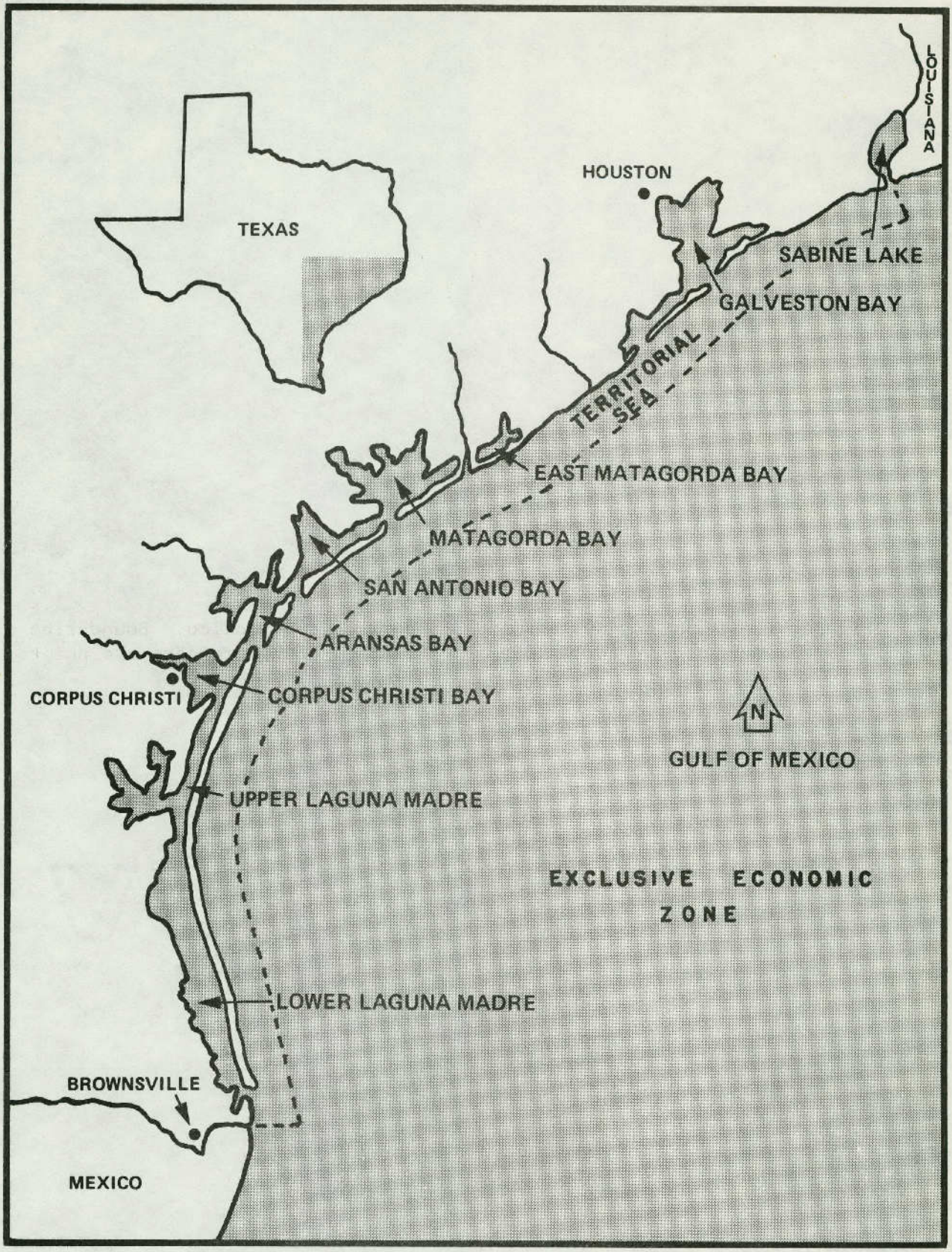
(5) measures, where practicable, that will minimize cost and avoid unnecessary duplication in their administration; and

(6) measures which will enhance enforcement.

A proclamation issued by the Commission may limit the quantity and size of shrimp that may be caught, possessed, sold, or purchased and may prescribe the times, places, conditions, and means and manner of catching shrimp. However, measures dealing with sale and purchase may only be implemented at first sale or exchange transaction.

Through the six measures identified in Section 77.007 and listed above, the Legislature provided policy for the Texas Parks and Wildlife Department to follow in managing shrimp. Economic considerations are an integral part of the measures listed, but they are not the only factors to be considered. In particular, the Department is instructed to manage

Figure 1. Texas bay systems and adjacent Gulf of Mexico. Boundaries for Territorial Sea and Exclusive Economic Zone are not to scale.


LOUISIANA
HOUSTON
TEXAS
SABINE LAKE
GALVESTON BAY
TERRITORIAL SEA
EAST MATAGORDA BAY
MATAGORDA BAY
SAN ANTONIO BAY
ARANSAS BAY
CORPUS CHRISTI
CORPUS CHRISTI BAY
N
GULF OF MEXICO
UPPER LAGUNA MADRE
EXCLUSIVE ECONOMIC ZONE
LOWER LAGUNA MADRE
BROWNSVILLE
MEXICO

shrimp scientifically to achieve optimum yield and promote efficiency while minimizing the costs of administration and ensuring adequate enforcement. It is clear that the statute directs the Department to recognize that shrimp are to be treated similarly to other publicly-owned natural resources managed by the state and country, like oil, gas, or timber.

The Legislature has directed the Department to manage the fishery to achieve optimum yield for the shrimping industry. For purposes of this plan, optimum yield is defined as the amount of shrimp that the fishery will produce on a continuing basis to achieve the maximum economic benefits to the shrimping industry and the State as modified by any relevant, social or ecological factors. Stated simply, this fishery needs to be managed by the State in a way that does not differ significantly from the way it would be managed by a privately owned firm. This approach is consistent with that taken by the State in its management of other natural resources and the United States government in managing its natural resources, including fisheries.

The Legislature also clearly indicated that management measures beyond those concerned with economics be considered. Not only is optimum yield to be a management objective, but overfishing was also to be prevented. Overfishing, environmental factors, and other events can cause depletion. Depletion is defined as the process, regardless of cause, that reduces the population abundance and composition to a depleted state. For purposes of this plan, shrimp are considered depleted when the population abundance and composition are not sufficient to maintain a harvest equal to the optimum yield. In other words, if shrimp are in a state that prevents the achievement of management goals, they are by definition depleted. The prevention of overfishing will ensure that depletion caused by controllable factors will not occur.

Descriptions of the biology, life history, fishery and management practices are presented in the Plan. Finally, the Plan suggests management structures to achieve optimum yield. Available and applicable biologic, economic, legal and sociologic information essential to the management of shrimp in Texas upon which this Plan is based are contained in a separate document that is a compilation of source materials. The source document is part of the files of the Texas Parks and Wildlife Department, and is available upon request.

DISTRIBUTION

Penaeid shrimp occur along the entire Texas coast. Brown shrimp have been reported from Massachusetts to Key West, Florida on the Atlantic coast and from extreme northwest Florida along the Gulf coast to the northwestern coast of Yucatan, Mexico. White shrimp range from Fire Island, New York to Saint Lucie Inlet in east Florida, are absent around the southernmost portion of Florida and the Florida west coast, and reappear from northwest Florida throughout the Gulf to the Gulf of Campeche in Mexico. The range for pink shrimp extends from lower Chesapeake Bay southward around the Florida Keys and throughout the Gulf

and the coastal waters of Mexico to Isla Mujeres. Shrimp in the Gulf occur in the ocean and in estuaries. Sub-adults are generally found in the estuary. As shrimp approach sexual maturity they migrate to the Gulf. Data indicate that tagged sub-adults from Texas generally remain in the western Gulf.

LIFE HISTORY

As described briefly above, the life cycles of brown, white and pink shrimp are similar. Adults spawn in the Gulf. Fertile eggs hatch into free-swimming larvae, and the larvae develop through a series of molts. Upon reaching the postlarvae stage the shrimp enter an estuary and become bottom feeders.

Within the estuary juvenile shrimp feed mainly at the marsh-water interface or in submerged grass beds. These areas apparently offer a concentrated food supply of detritus, algae and microfauna and provide some protection from predators. Growth and survival in the estuary are largely dependent upon local salinities and temperatures. As shrimp grow larger, they move to deeper waters and feed on bottom organisms. At a variable size, approximately 2.7 to 4.7 inches, they emigrate to the Gulf. This emigration is a function of size, tide and temperature. Growth continues in the Gulf, but slows as shrimp approach their maximum size. Spawning probably occurs before the shrimp are 12 months old.

Major differences in the life cycles of the brown, white, and pink shrimp occur as shifts in the time and space at which various life stages reach their maximum abundance.

Seabobs (Xiphopenaeus kroyeri), royal red shrimp (Hymenopenaeus robustus), rock shrimp (Sicyonia brevirostris), and Trachypenaeus sp. are shrimp species landed in Texas that are not estuarine-dependent, apparently completing their life cycles within the open waters of the Gulf. Together they make up less than 1% of the annual value landed in Texas. Seabobs occur primarily within the Texas Territorial Sea.

Brown Shrimp

Brown shrimp reach sexual maturity at about 5.5 inches. They usually spawn in Gulf waters greater than about 90 feet from August through November. Each female may release from about 200,000 to 1 million eggs per spawn and multiple spawns in a season may occur. Principal postlarval recruitment to the bays peaks from March to mid-April with additional lower peaks during June through September. At about 3 to 4 inches, brown shrimp emigrate from the bays to the Gulf. This movement is generally associated with a full moon and high tidal flows from May through August. Brown shrimp are most abundant in the bays during April through June and have usually entered the Gulf by November. Growth rates of brown shrimp range from about 0.02 inches per day during winter to as much as 0.13 inches per day during April through June.

White Shrimp

White shrimp reach sexual maturity at about 5.3 inches for females and about 6.1 inches for males. They usually spawn in Gulf waters less than 72 feet deep from May through August. Each female white shrimp may release from about 200,000 to 1 million eggs in a spawn and multiple spawns in a season may occur. Larval development usually takes from about 10 to 21 days at which time the shrimp normally have entered the bays. Postlarval recruitment to the bays usually occurs uniformly from May through October. At about 3 to 5 inches, white shrimp emigrate to the shallow Gulf from August through November. Offshore, shrimp exhibit a southerly migration during fall and winter and a northerly movement during spring, probably due to prevailing water currents. Growth rates of white shrimp range from about 0.02 to 0.08 inches per day during warm months, with slower rates during cold months.

Pink Shrimp

Pink shrimp reach sexual maturity at about 2.6 inches for males and about 3.6 inches for females. Time, duration, and area where spawning takes place are generally unknown. However, postlarval recruitment generally peaks during August through September. At about 3.5 inches, pink shrimp emigrate from the bays. Some shrimp may overwinter in the bays, residing there up to 9 months. Offshore movements and growth rates of pink shrimp are not well defined.

Seabobs

Seabob females reach sexual maturity at about 2.4 inches. They usually spawn along gulf beaches from July to December and development takes place in offshore waters. Adults are most often found in mud, silt, or sand and silt substrates. Seabobs are most common from the beach line to depths less than 30 feet. Migration toward gulf beaches occurs in response to advancing cold fronts during the fall and early winter. Little is known of larval development, diet, or growth rates.

MORTALITY

Natural mortality for larval, postlarval, and juvenile shrimp is unknown. Mortality rates have generally not been determined for shrimp in Texas bays. The best estimates for monthly natural mortality rates for offshore waters are approximately 25% for all three species. Weekly total mortality rate estimates range from 24 to 71% for brown shrimp, 13 to 44% for white shrimp and 7 to 79% for pink shrimp. These rates have been estimated for sub-adult and adult shrimp in the Gulf based on mark-recapture studies.

ABUNDANCE

Brown shrimp abundance has been generally stable since the early 1980's, white shrimp abundance has been generally declining and pink shrimp abundance has fluctuated with no apparent trend. The relative abundance

of juvenile and sub-adult shrimp has been monitored since 1978 in bays by the Texas Parks and Wildlife Department using bag seines pulled in water less than 3 feet deep and since 1982 by trawls in waters greater than 3 feet deep.

Coastwide brown shrimp relative abundance as measured by bag seines increased from about 100 per acre in 1978 to about 200 per acre in 1981 and has not exhibited a trend since 1981 (Figure 2). Brown shrimp in trawls has not exhibited a trend (Figure 3). White shrimp in bag seines fluctuated in those same years between about 100 per acre in 1985 and 500 per acre in 1982 (Figure 2). White shrimp in trawls declined from 47 per hour in 1982 to 17 per hour in 1987 (Figure 3). Pink shrimp in bag seines fluctuated from 1 to 10 per acre from 1978 through 1987 with peaks during 1981 and 1982 (Figure 2). Pink shrimp in trawls was less than 3 per hour during all years (Figure 3).

STATUS OF STOCKS

As pointed out above, the shrimp stocks in Texas appear to be replacing themselves with about the same or an increasing number of recruits each year. However, the proportion of the population that become adults each year is decreasing. This is especially evident for white shrimp. A decrease in mean length of white shrimp through time has been reported off Texas. Further, since 1982 the average number of white shrimp caught in bay trawls has declined. A spawner-recruit relationship for white shrimp has been defined and caution is advised since their current harvest rate appears to be at or nearing a dangerous level. The spawner-recruit relationship for brown shrimp is not as clear as for white shrimp. The average number of brown shrimp caught in Texas Parks and Wildlife Department bag seines and bay trawls fluctuates yearly and no significant trend since at least 1981 is evident.

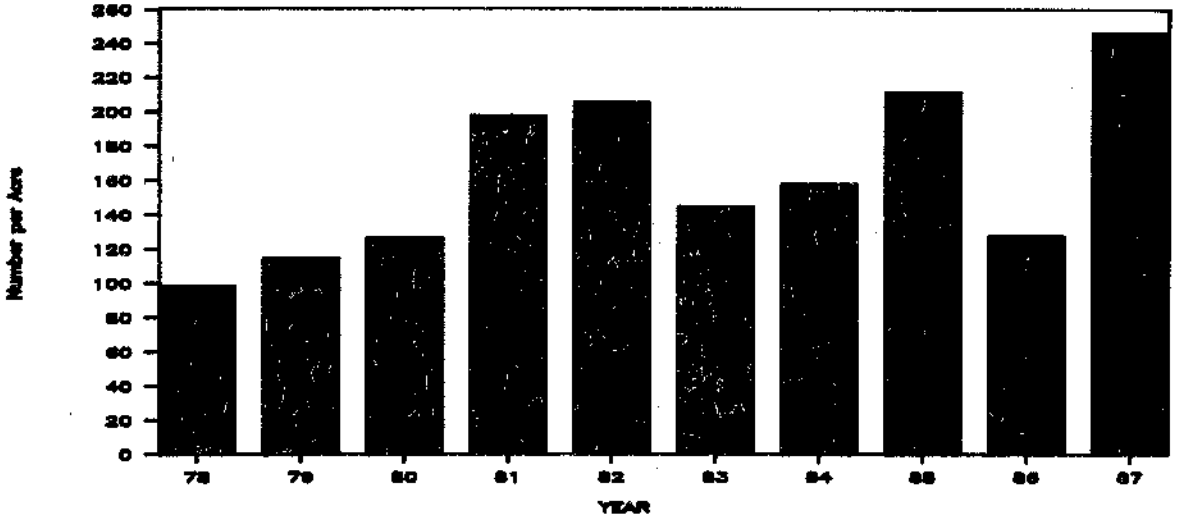
SUSTAINABLE HARVEST

Texas landings during the last 10 years averaged 109% of the minimum estimated maximum sustainable harvest for brown shrimp, 233% of the minimum estimated maximum sustainable harvest for white shrimp and 250% of the minimum estimated maximum sustainable harvest for pink shrimp. Estimates for the maximum sustainable harvest for Texas range from 53 million pounds to 65 million pounds for brown shrimp, 9 to 11 million pounds for white shrimp and 1.2 to 1.6 million pounds for pink shrimp. These estimates are based on the gulf-wide estimates of 116 to 142 million pounds for brown shrimp, 59 to 71 million pounds for white shrimp and 24 to 32 million pounds for pink shrimp annually. Texas has historically accounted for 46% of the gulfwide landings for brown shrimp, 16% for white shrimp and 0.05% for pink shrimp.

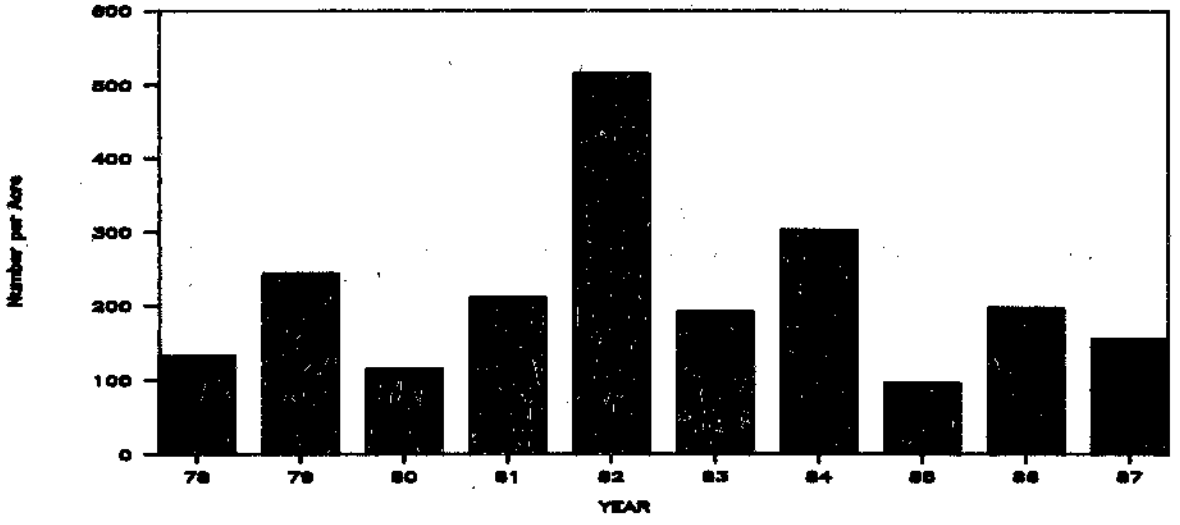
The maximum sustainable weight of shrimp is not being harvested each year partly because Texas fishery resources have traditionally been regarded as common property where access is unlimited (an open-access fishery). In an open-access system, fisheries tend to become overcapitalized (more boats that are needed to harvest the available resource) and

Figure 2. Relative abundance (number per acre) of three penaeid shrimp species caught in water less than 3 feet deep with Texas Parks and Wildlife Department bag seines, 1978 through 1987.

Brown Shrimp



White Shrimp



Pink Shrimp

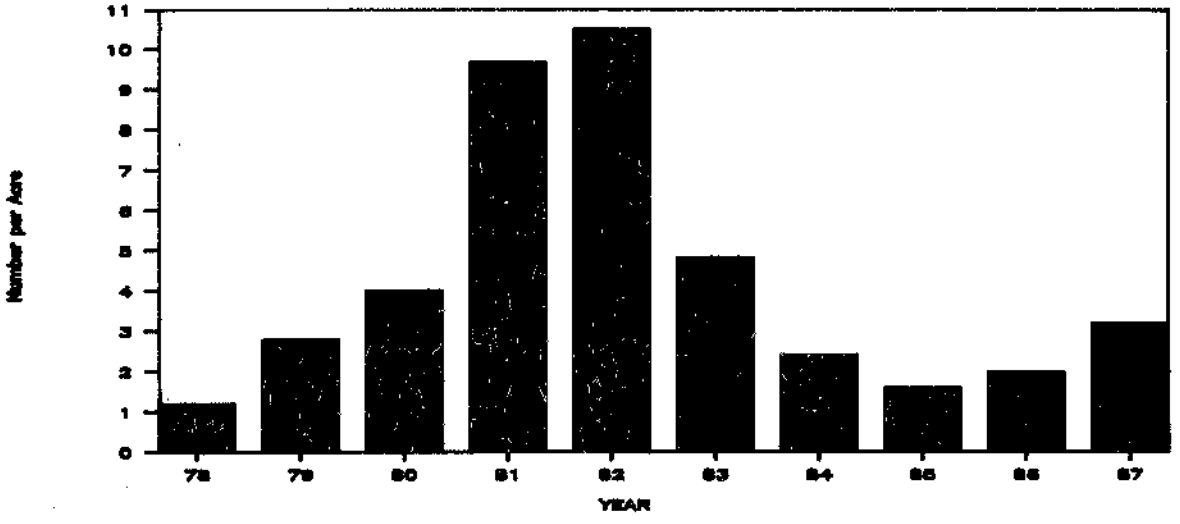
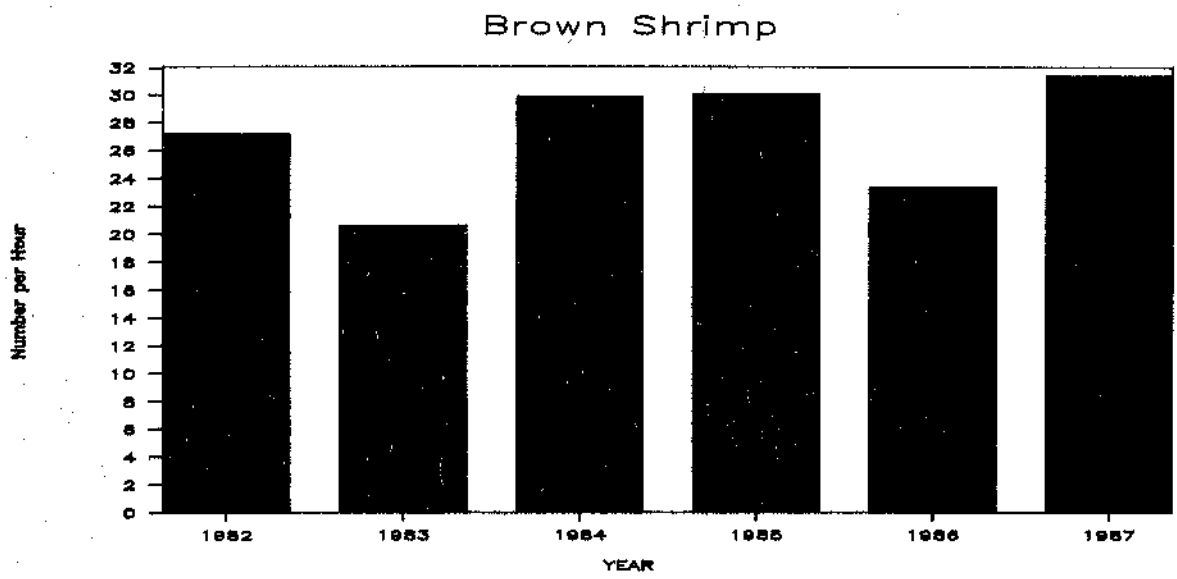
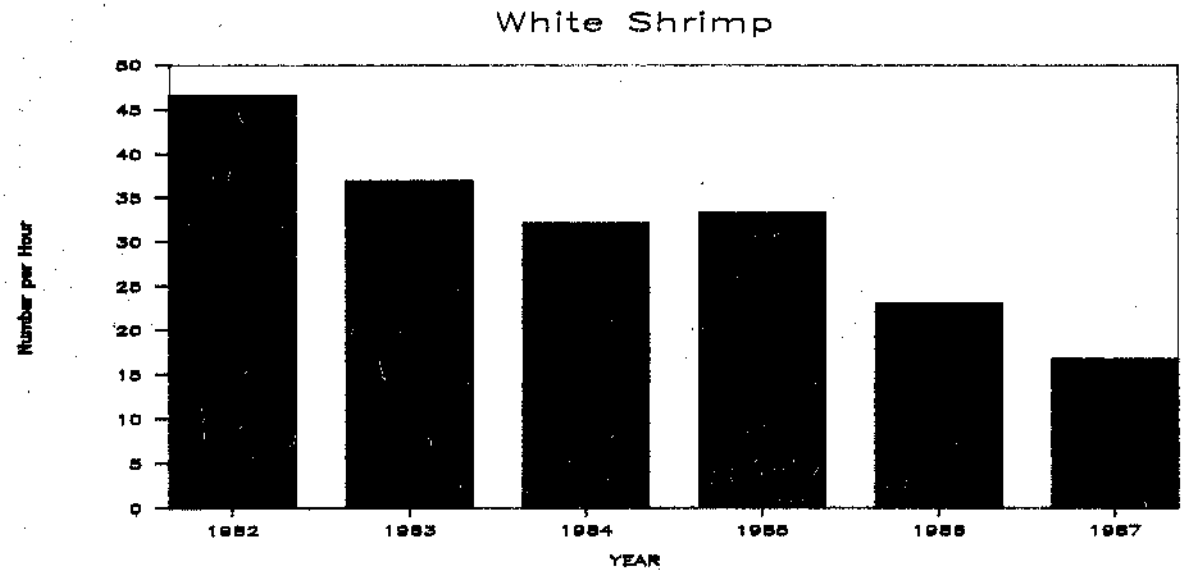
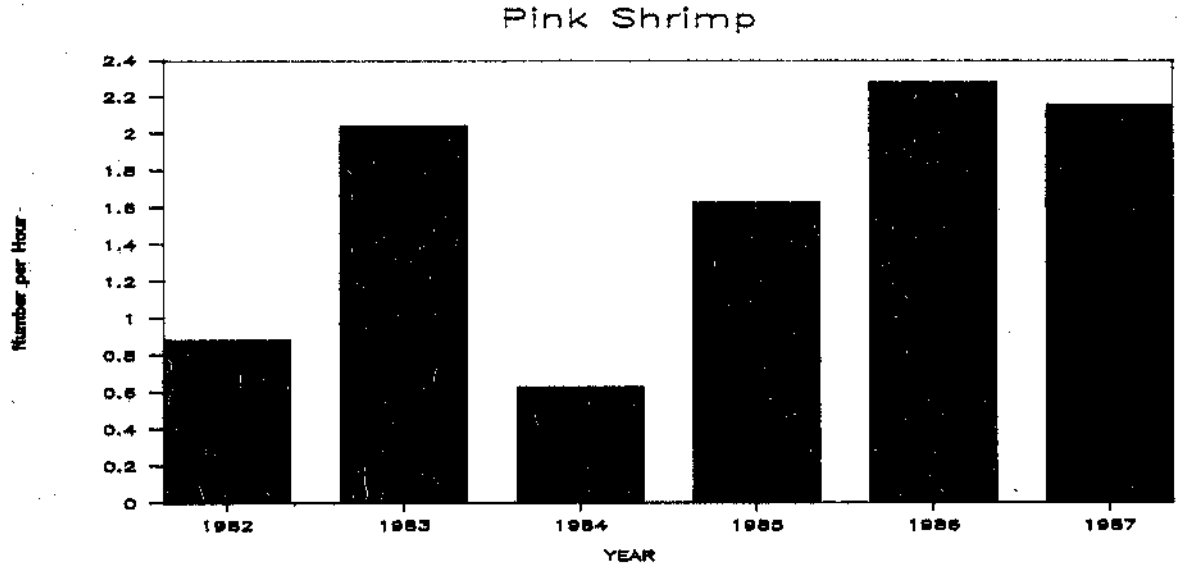


Figure 3. Relative abundance (number per hour) of three penaeid shrimp species caught in water 3 feet deep or greater with Texas Parks and Wildlife Department bay trawls, 1982 through 1987.


Brown Shrimp
Number per Hour
32
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
1982
1983
1984
1985
1986
1987
YEAR


White Shrimp
Number per Hour
50
45
40
35
30
25
20
15
10
5
0
1982
1983
1984
1985
1986
1987
YEAR


Pink Shrimp
Number per Hour
2.4
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
1982
1983
1984
1985
1986
1987
YEAR

eventually overfished, thus risking depletion of the resource. This "problem" has often been cited as justifying the active role of government in fisheries management. It is argued that government action is necessary to prevent the potential problems related to overfishing. However, the main goal of government has often been to simply conserve the resource without concern for the economic costs to the fishery. Various techniques have been and are being utilized as conservation measures in fisheries management: bag and possession limits, landings quotas, time and seasonal fishing restrictions, area closures, and gear restrictions. Regardless of the methods employed to conserve, the problem of open access remains.

In the last 10 years the number of boats working Texas waters has reached all time highs. Landings since 1980 have been sold for record amounts, but Texas Parks and Wildlife Department resource monitoring data indicate that brown shrimp abundance has been stable and white shrimp abundance has been declining. It is important, then, to change the economic situation of the fishermen so that it is advantageous for them to harvest in an economically efficient manner throughout the long term. In other words, the fishery should be managed to achieve optimum yield.

UTILIZATION

The Texas shrimp fishery is diverse and complex. It is primarily a trawl fishery that is divided into commercial and recreational (noncommercial) segments. Each segment harvests shrimp from both the bays and Gulf to sell, use for food, or use for bait. Each segment requires different licenses. If boats are used commercially, they must be licensed based on where the fishing occurs and the purpose for which the shrimp are sold. The Commercial Gulf Shrimp Boat and Commercial Bay Shrimp Boat licenses authorize the capture of shrimp for food during specified seasons in Gulf and bay waters. The Commercial Bait Shrimp Boat License authorizes the harvest of shrimp for bait. Some boats have all three commercial licenses. Noncommercial shrimp fishermen are required to have a special license (Individual Bait-shrimp Trawl Tag) in addition to a General Fishing license and Saltwater Sportfishing Stamp if they use a trawl; this authorizes the taking of both food and bait shrimp for noncommercial use.

The types of gear used to harvest shrimp have changed with improvements in technology. Prior to 1917 shrimp were harvested commercially in shallow inshore areas with haul seines. Introduction of the trawl completely revolutionized the shrimp industry. The shrimp trawl was adaptable for use in deeper waters, operated with fewer people, and was a much more efficient type of gear. Until the 1940's, shrimp were caught from vessels with single "otter" trawls usually within 6 miles of shore. White shrimp were the main shrimp caught and marketed until the early 1950's. The fishery was conducted predominantly during the day.

In the early 1950's, the markets for brown shrimp and pink shrimp increased as the discovery of new fishing grounds off Texas stimulated

the harvest of these species. This fishery was conducted predominantly during night.

In the late 1950's and early 1960's double-rig trawling evolved. Two smaller nets were towed by each vessel instead of a single large net. The double-rigged vessels were more efficient and were used mostly on the brown shrimp and pink shrimp grounds. A more recent development in the offshore Gulf fleet has been the twin-trawl rig where four 30 to 55 ft trawls are pulled instead of two.

The number of cast nets, push nets, and minnow seines being used in the fishery is unknown. Seasonal and geographical use of gears generally occurs in accordance with statutes regulating times and places of harvest.

Commercial Fishery

Despite increasing effort and continuing technological development, reported commercial landings 2 (shrimp brought to the dock and sold in Texas) of shrimp in Texas have remained stable during the past 26 years. The number of boats and value of shrimp have increased dramatically while landings per license have generally decreased. Reported commercial landings of shrimp sold as food ranged from 55 million pounds during 1962 to 103 million pounds during 1967 and value ranged from $26 million during 1964 to $229 million during 1986 (Figure 4).

From 1962 through 1987, landings of brown shrimp and pink shrimp from the bays and Gulf averaged 62 million pounds (Figure 5). Value during the same period increased from $19 million in 1964 to over $167 million in 1986. Total white shrimp landings fluctuated around an average of 18 million pounds over the same period. Since 1982 white shrimp landings have been over 19 million pounds each year. The value of white shrimp increased from $5 million in the early 1960's to over $60 million in 1986.

The number of commercial shrimp boat licenses (bay and gulf) generally increased through the early 1980's (Figure 6). The landings per license have decreased while value per license has increased (Figure 7).

Bay Fishery

The bay shrimp fishery consists of shrimp used as food and shrimp used as bait. Participation in both segments of the industry has increased. The bay fishery occurs in all major bay systems in Texas.

The bay fishery primarily consists of boats less than 55 feet long which return daily to dock. Most boats are owned and registered by residents of the 18 coastal counties. They typically shrimp in the bay system located in the county where registered. However, movement of fishermen between adjacent bay systems is common.

Figure 4. Annual Texas landings (pounds) and ex-vessel value of penaeid shrimp during 1962 through 1987.

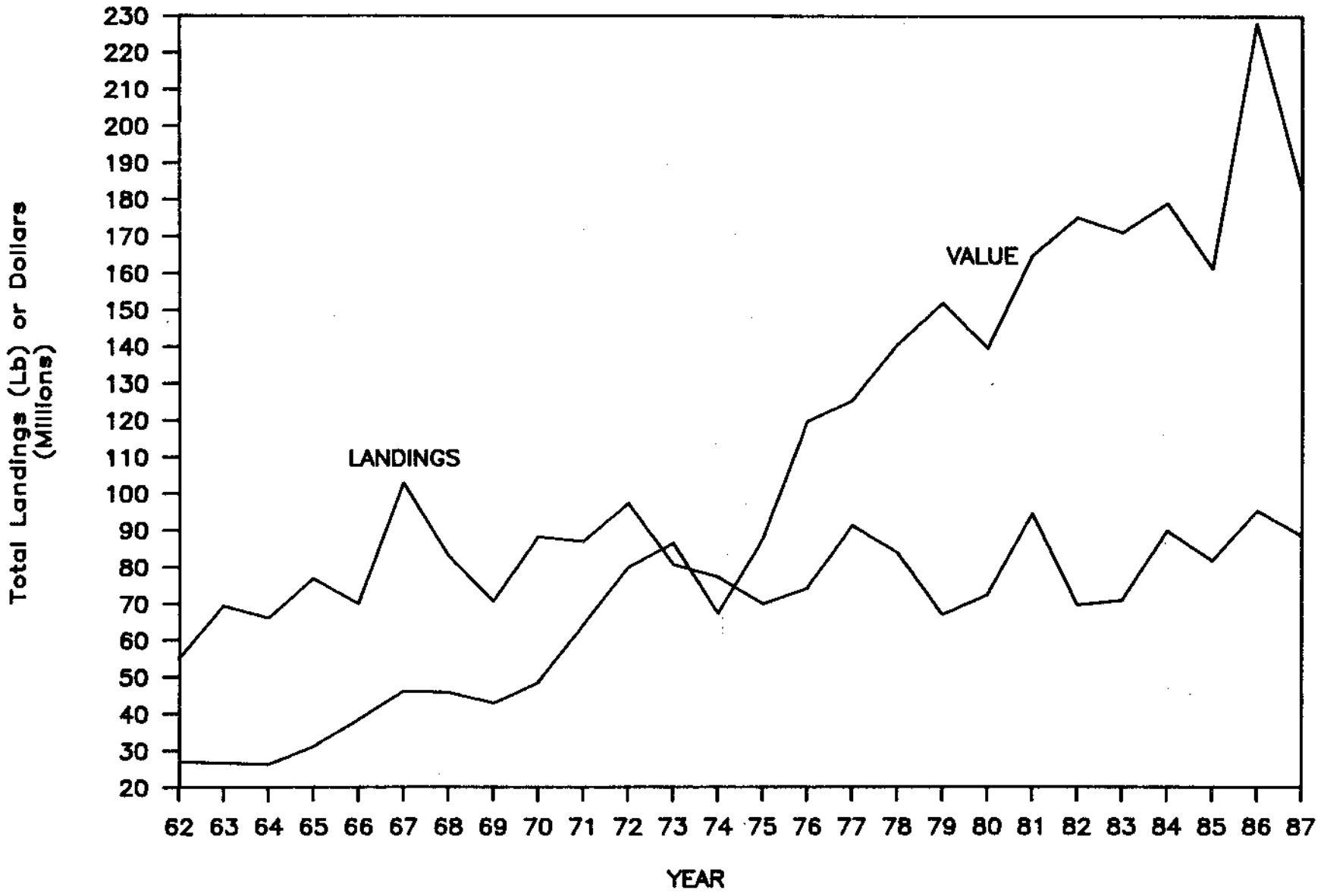
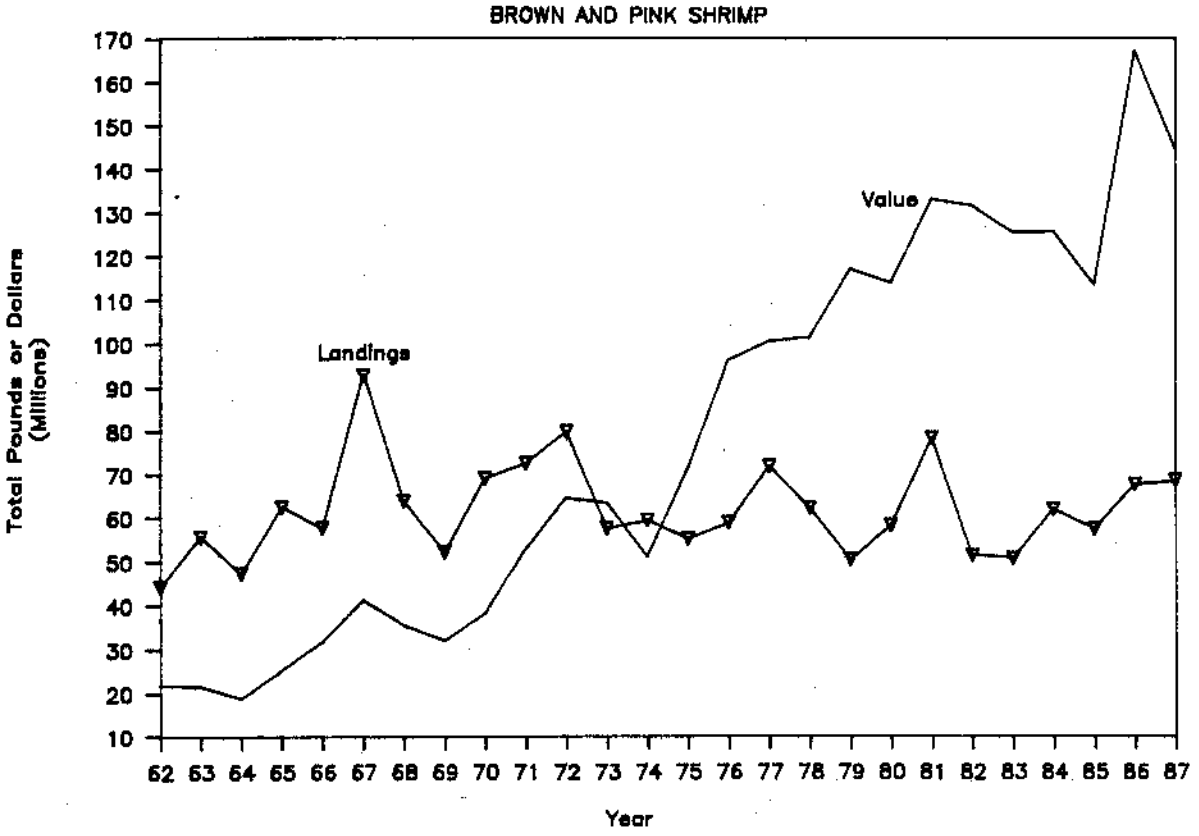

Total Landings (Lb) or Dollars (Millions)
230
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
LANDINGS
VALUE
62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87
YEAR

Figure 5. Annual Texas landings (pounds) and ex-vessel value of penaeid shrimp from Texas bays and the Gulf of Mexico combined during 1962 through 1987.


BROWN AND PINK SHRIMP
Total Pounds or Dollars (Millions)
Value
Landings
Year

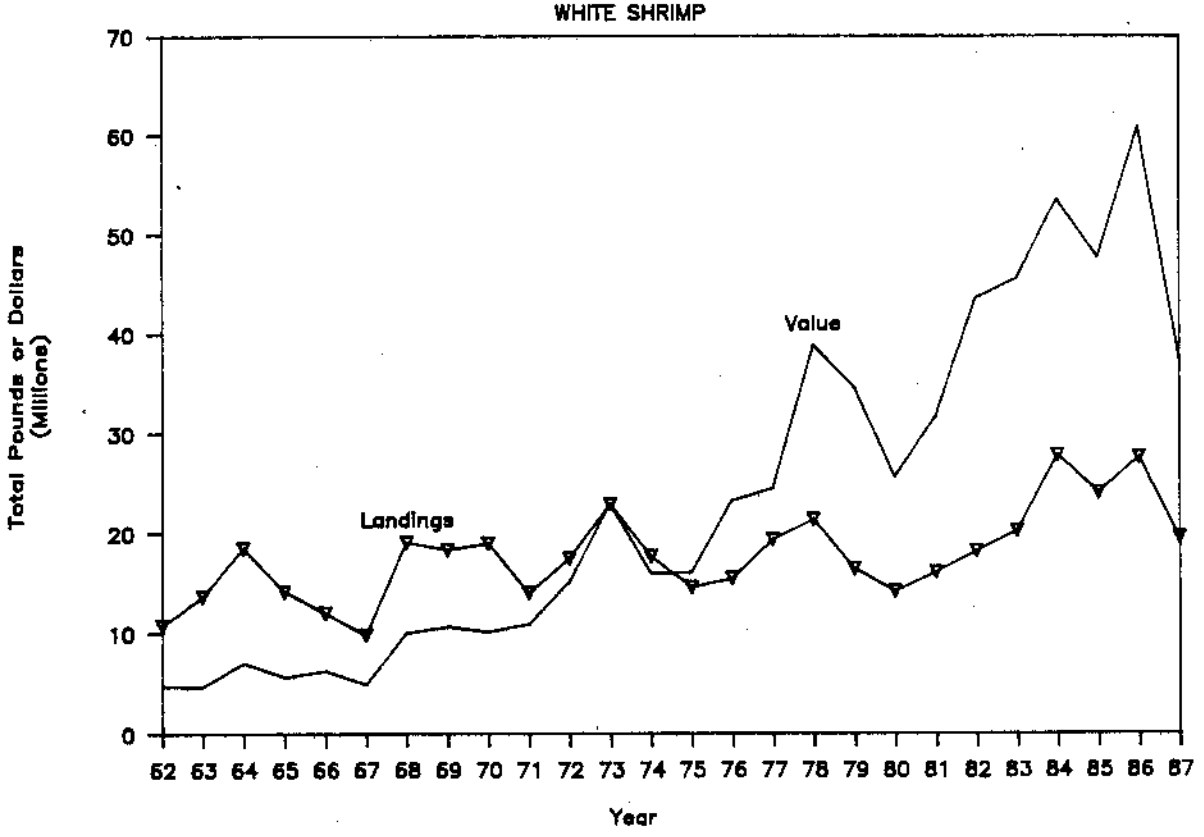

WHITE SHRIMP
Total Pounds or Dollars (Millions)
Value
Landings
Year

Figure 6. Number of Texas shrimp boat licenses sold by year.

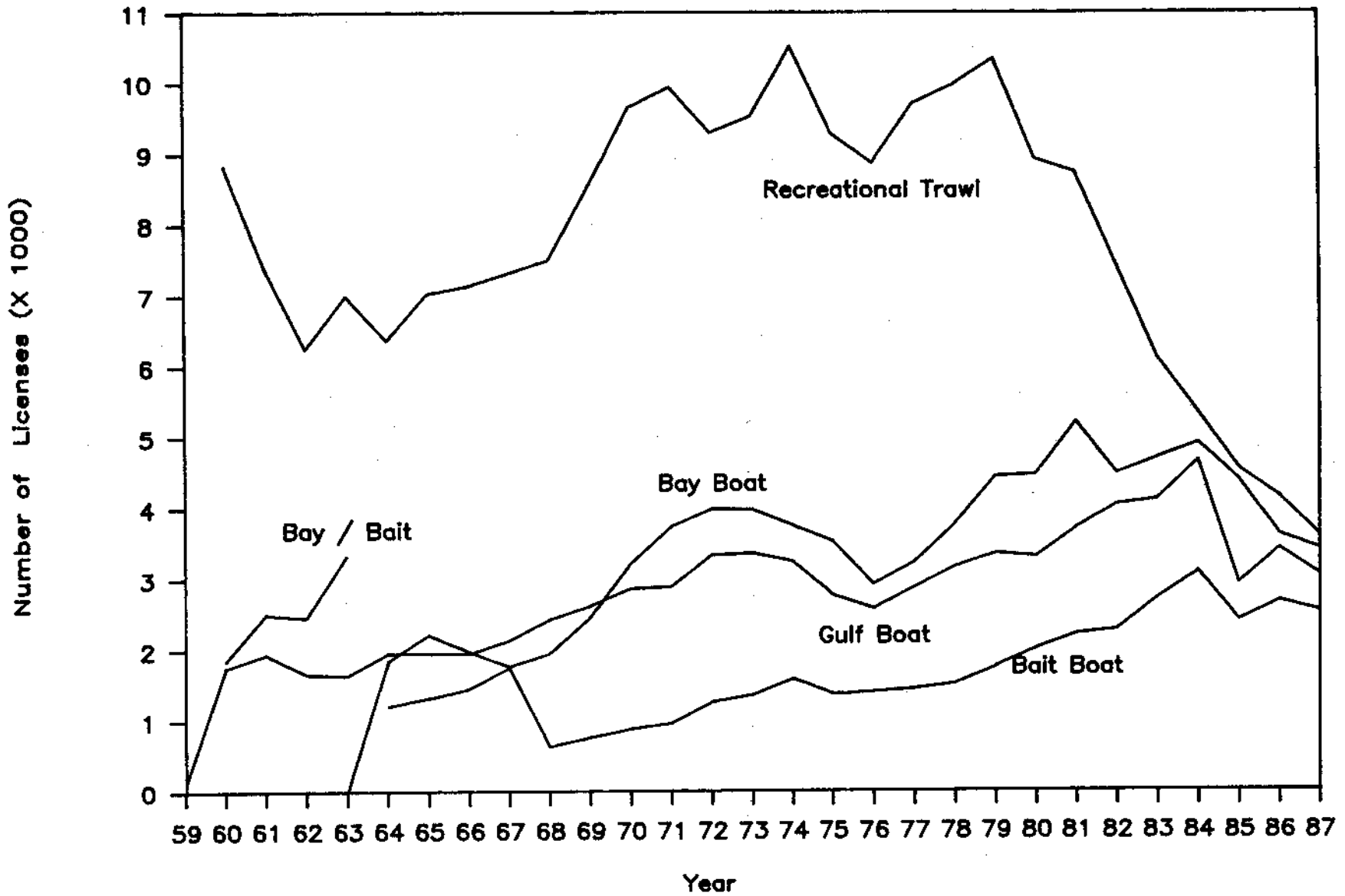
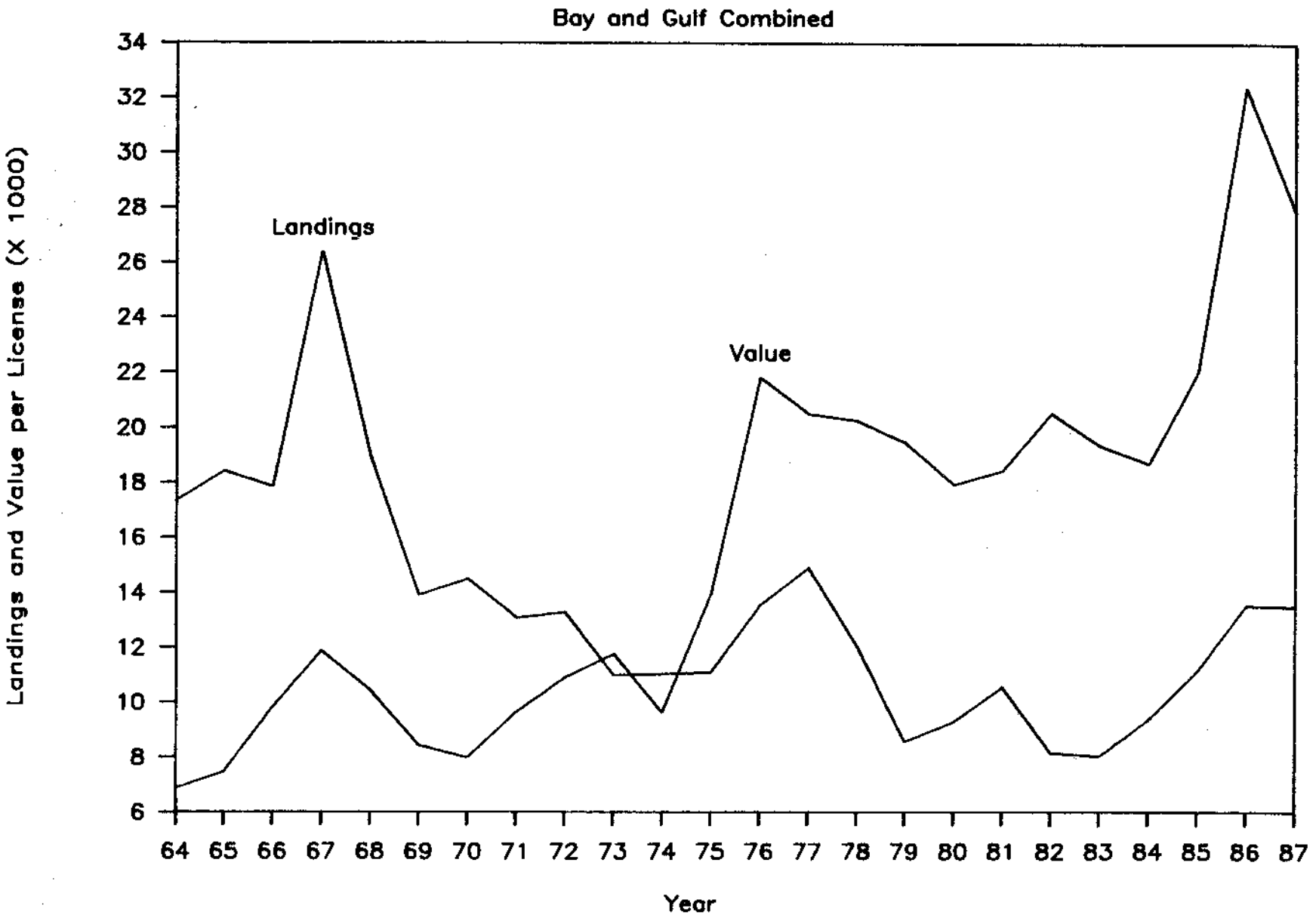

Number of Licenses (X 1000)
0
1
2
3
4
5
6
7
8
9
10
11
59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87
Year
Recreational Trawl
Bay Boat
Bay / Bait
Gulf Boat
Bait Boat

Figure 7. Landings (pounds) and value per license for Texas bays and the Gulf of Mexico combined during 1964 through 1987.


Bay and Gulf Combined
Landings
Value
Landings and Value per License (X 1000)
34
32
30
28
26
24
22
20
18
16
14
12
10
8
6
64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87
Year

Although the size of the shrimping fleet in the bays fluctuates yearly, the total number of bay boat licenses increased from about 1,800 in 1964 to about 5,000 in 1981 then declined to about 3,500 in 1987 (Figure 6). The number of bait licenses decreased from about 1,900 in 1964 to about 600 in 1968 then increased to about 3,000 in 1984 with a slight decline in the following years.

Shrimp Used as Food: Landings in Texas bays have increased in weight, value and number. Landings by weight have increased dramatically for brown shrimp and to a lesser extent for white shrimp. Annual average catch per license for brown shrimp has been increasing while average catch per license for white shrimp has been decreasing. Bay landings comprise approximately 16% (by weight) and 34% (by number) of the total shrimp landings in Texas. Brown shrimp and pink shrimp landings from Texas bays increased substantially during the last 20 years (Figure 8). Landings per license have also increased (Figure 9). From 1962 through 1987 landings averaged 4.9 million pounds of brown shrimp and pink shrimp, and ranged from 0.4 million pounds in 1968 to 13.7 million pounds in 1987. These shrimp had an average value of $3.3 million, ranging from $76,000 in 1968 to $13.7 million in 1987 (Figure 8).

Number of brown shrimp harvested each year from Texas bays has steadily increased from the late 1960's through the 1980's (Figure 8). An estimated annual average of 283 million brown shrimp were harvested from Texas bays by commercial food shrimpers from 1966 through 1986. Yearly estimates ranged from 26 million in 1968 to 672 million in 1984.

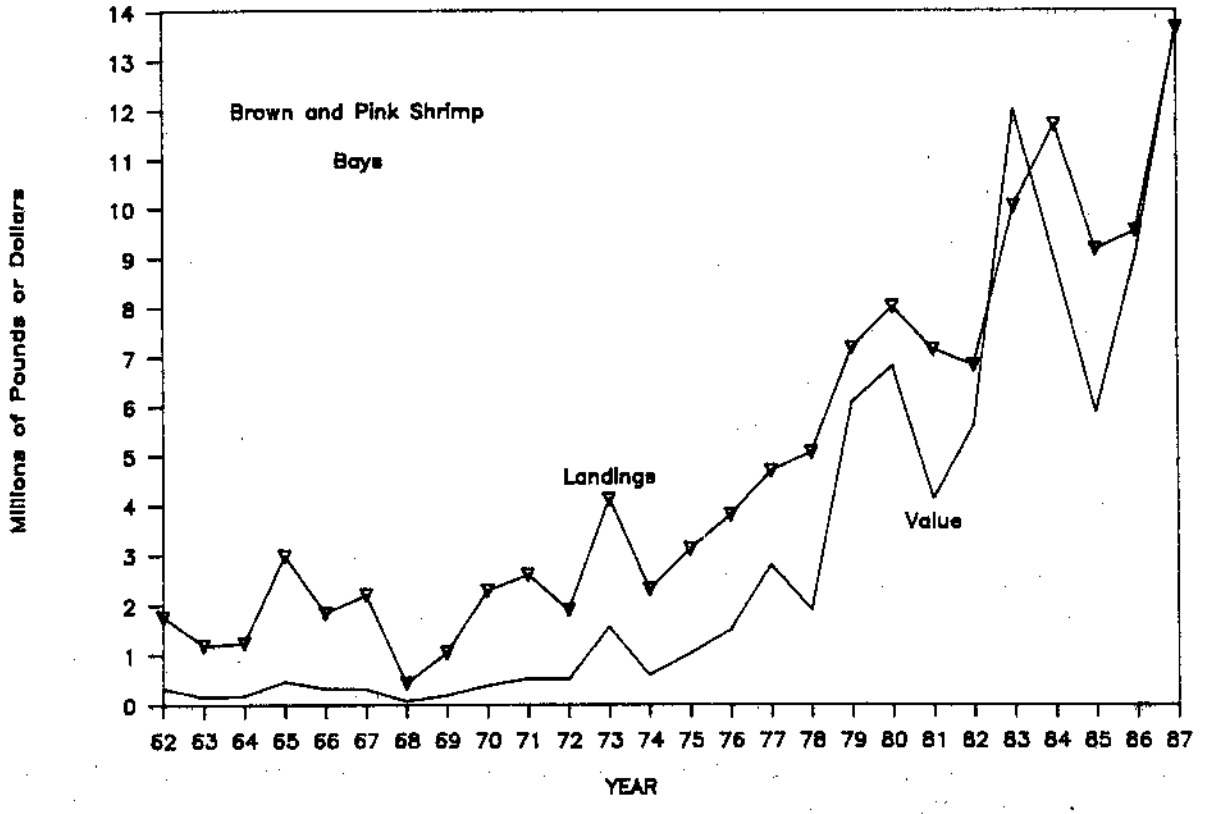
Brown shrimp and pink shrimp comprise 40% (by weight) and 48% (by number) of the average total shrimp landings in the bays. Most are harvested from May to July. The commercial bay food shrimp industry occurs in all major bay systems along the Texas coast except the Laguna Madre. Almost 52% of brown shrimp and pink shrimp are harvested from the Galveston and Matagorda Bay systems (Figure 10).

White shrimp landings from the bays have fluctuated but have generally increased (Figure 11). Landings per license have generally decreased (Figure 9). From 1962 through 1987 landings averaged 7.5 million pounds and ranged from 3.5 million pounds in 1967 to 11.2 million pounds in 1986. These shrimp had an annual average value of $7.0 million and ranged from $1.4 million in 1967 to $16.2 million in 1986 (Figure 11).

The number of white shrimp harvested from the bays has increased over the last 20 years and currently exceeds the number harvested from the Gulf. The average number landed each year during 1966-1986 was about 303 million (Figure 11). Yearly estimates ranged from 107 million in 1967 to 542 million in 1986.

White shrimp comprise almost 60% (by weight) and 52% (by number) of the average total shrimp landings in the bays. Most are harvested from August through November. Approximately 68% of the white shrimp are harvested from the Galveston and Matagorda Bay systems (Figure 10).

Figure 8. Annual Texas landings (pounds), ex-vessel value, and number of brown shrimp and pink shrimp from Texas bays during 1962 through 1987.


Brown and Pink Shrimp
Bays
Landings
Value
Millions of Pounds or Dollars
YEAR
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87

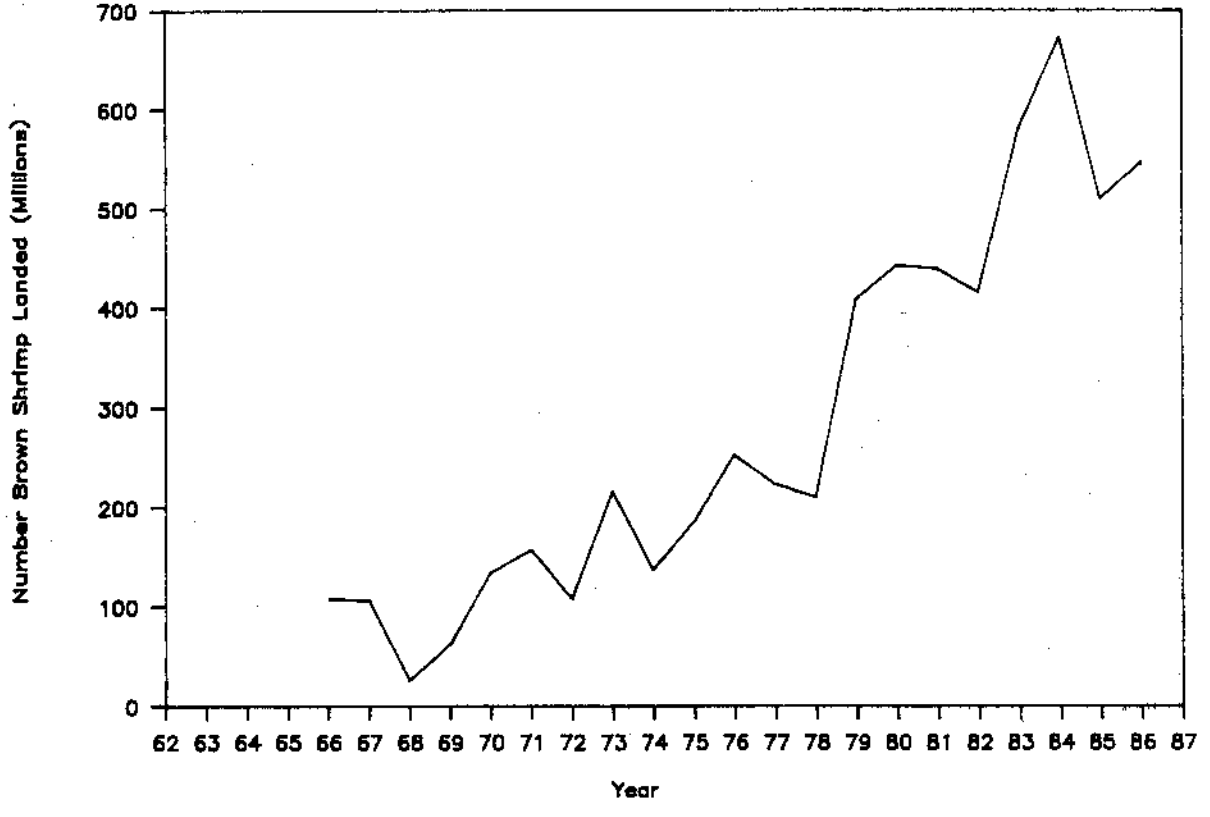
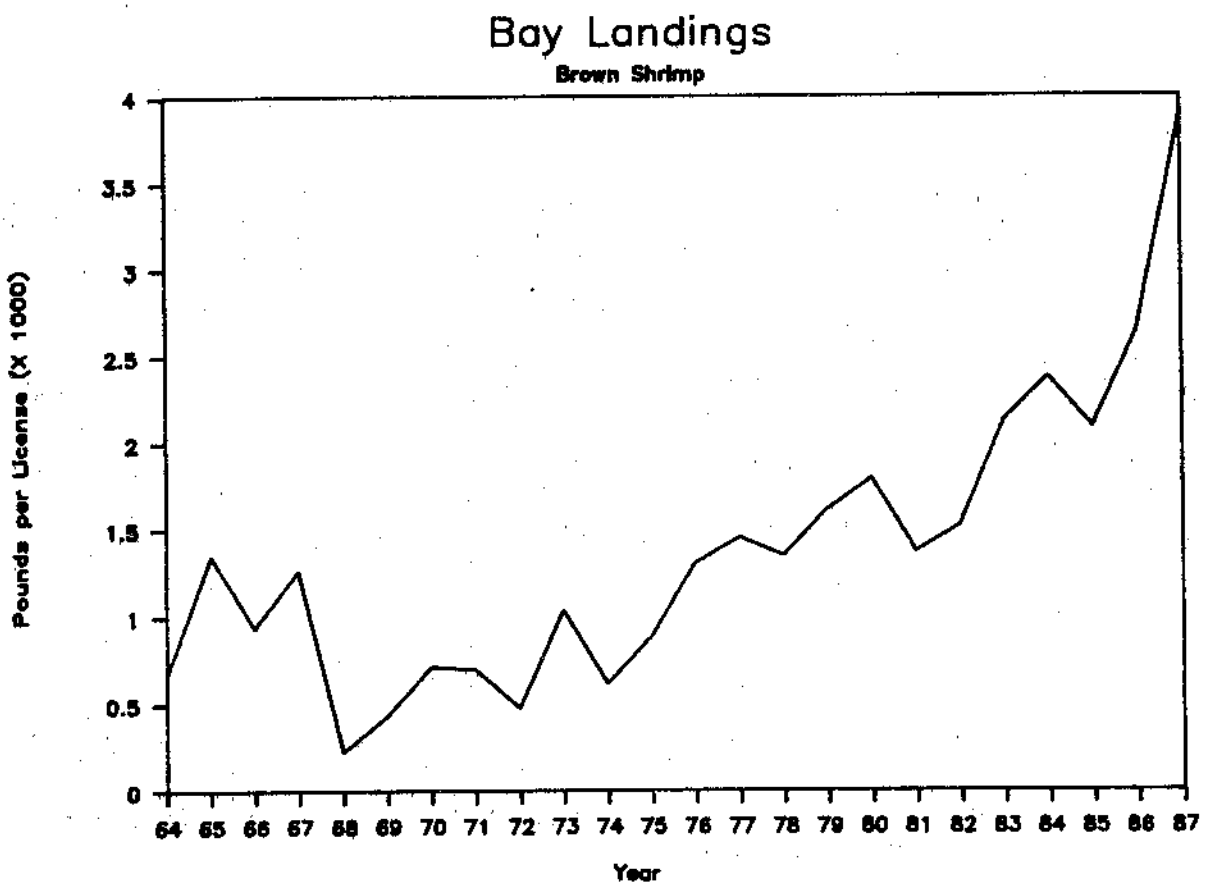

Number Brown Shrimp Landed (Millions)
Year
0
100
200
300
400
500
600
700
62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87

Figure 9. Landings (pounds) per license from Texas bays during 1964 through 1987.


Bay Landings
Brown Shrimp
Pounds per License (X 1000)
0
0.5
1
1.5
2
2.5
3
3.5
4
64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87
Year

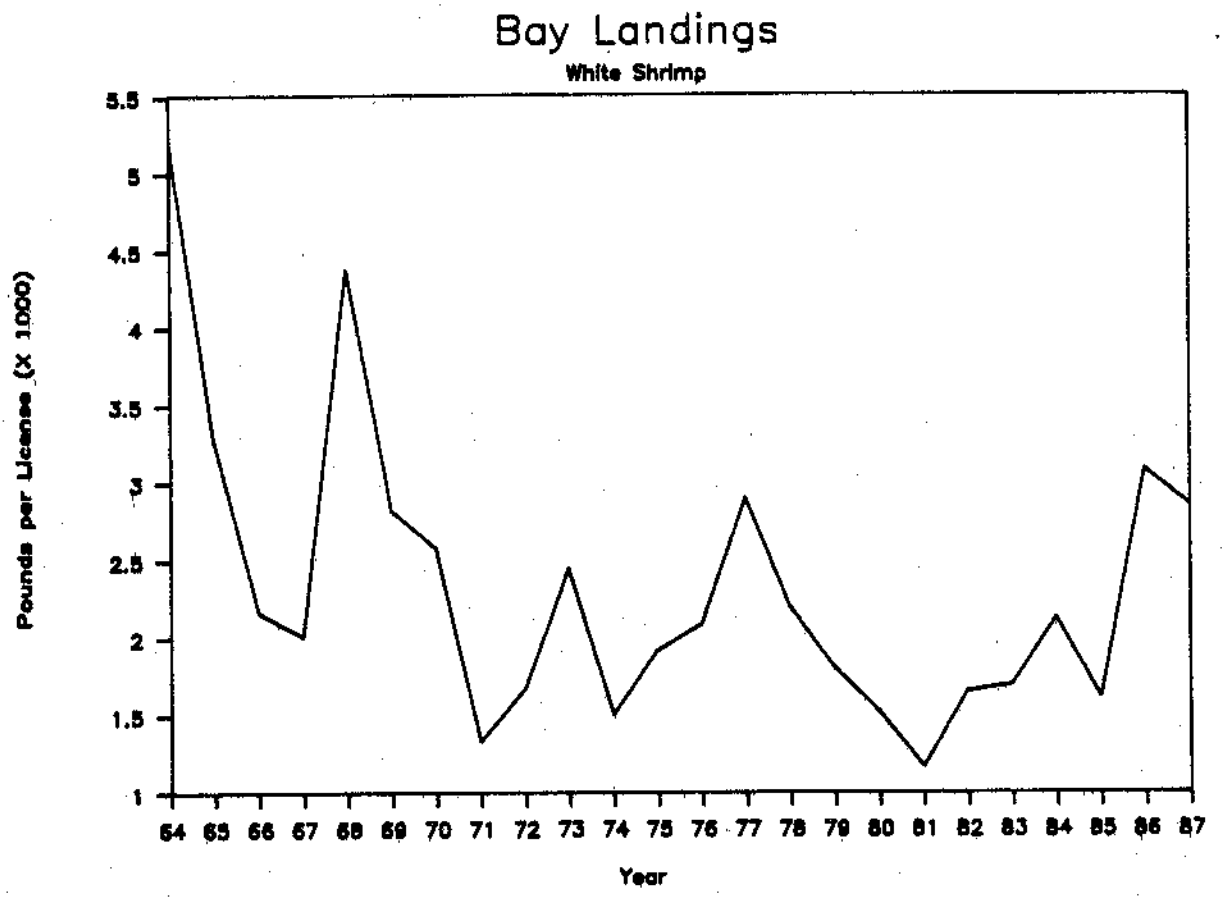
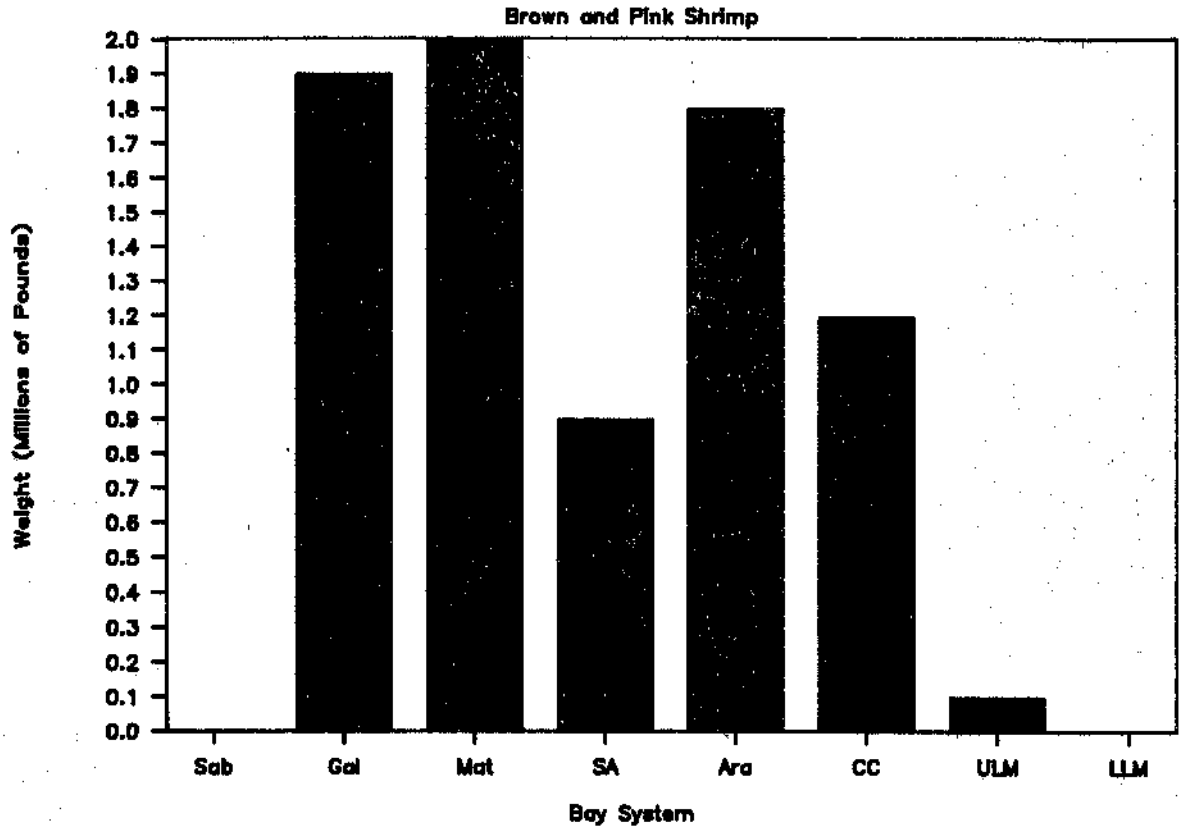

Bay Landings
White Shrimp
Pounds per License (X 1000)
1
1.5
2
2.5
3
3.5
4
4.5
5
5.5
64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87
Year

Figure 10. Average reported landings (1977-1986) of penaeid shrimp by Texas bay system.


Brown and Pink Shrimp
Weight (Millions of Pounds)
2.0
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
Sab
Gal
Mat
SA
Ara
CC
ULM
LLM
Bay System

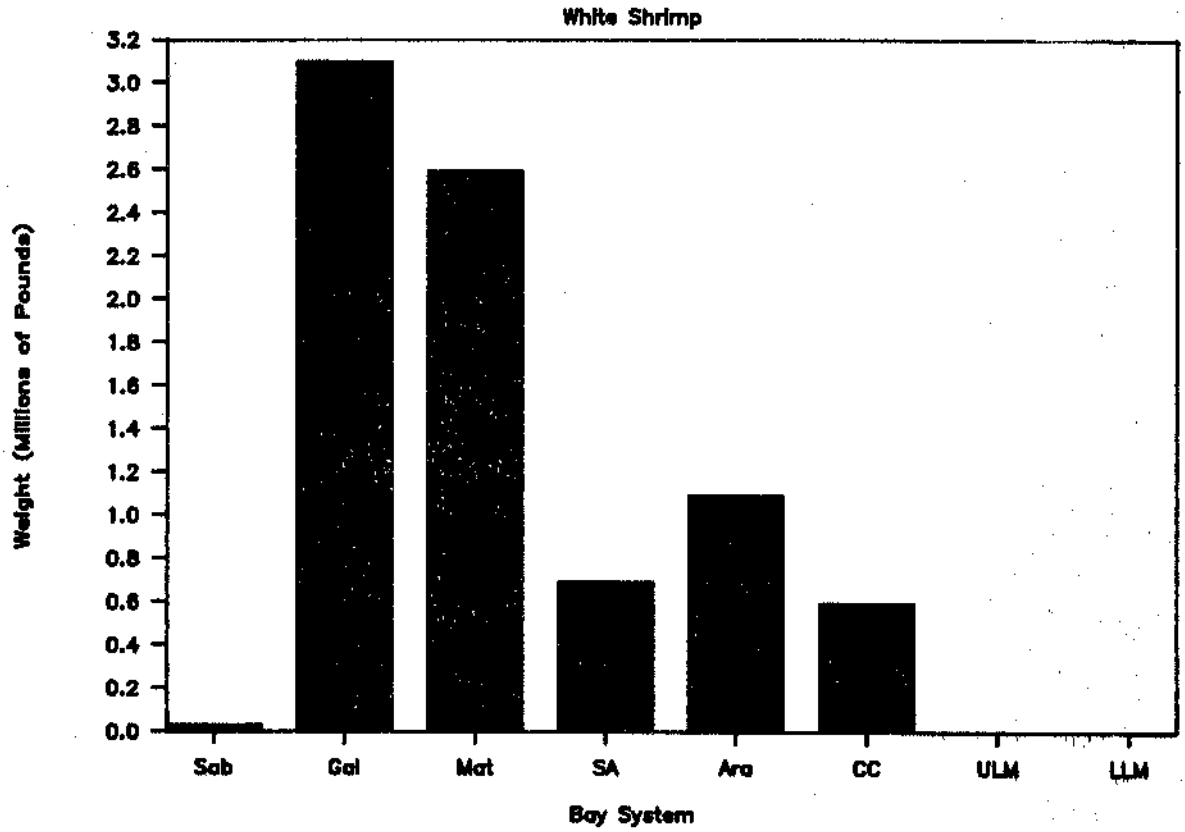
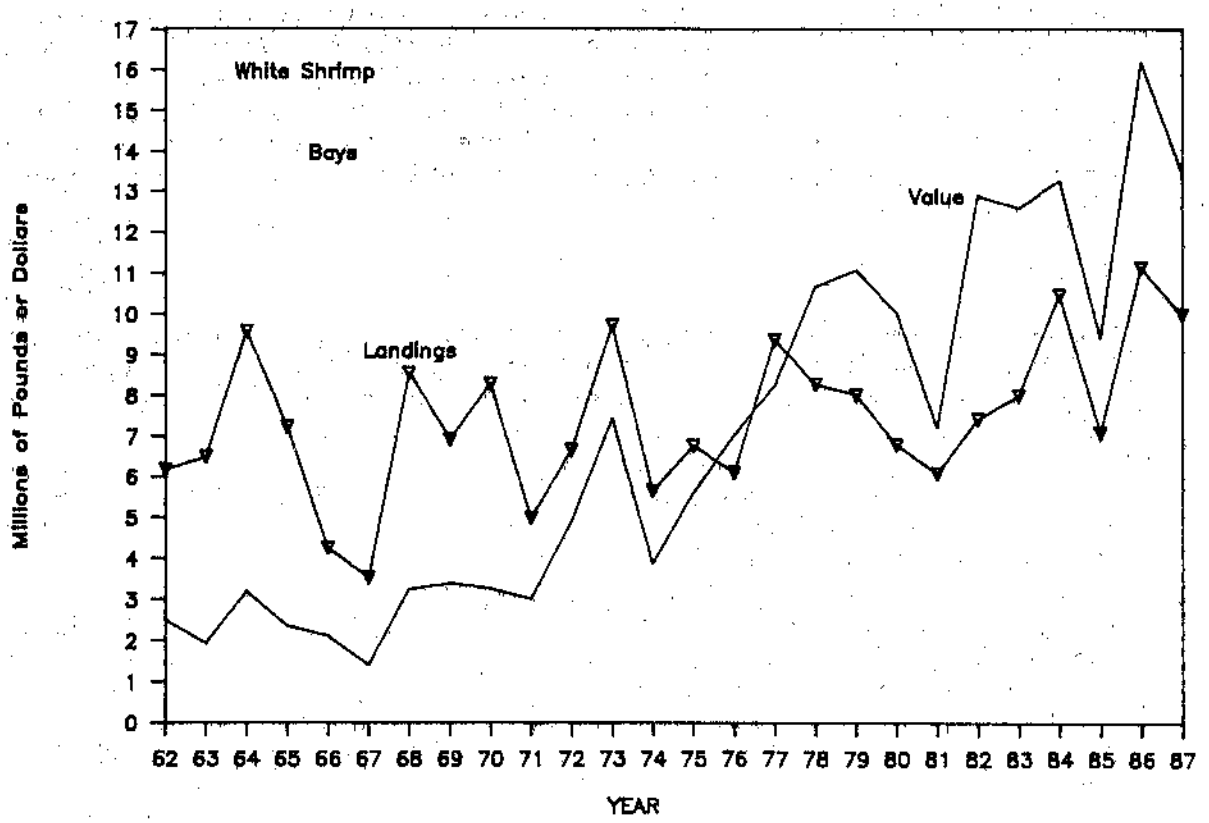
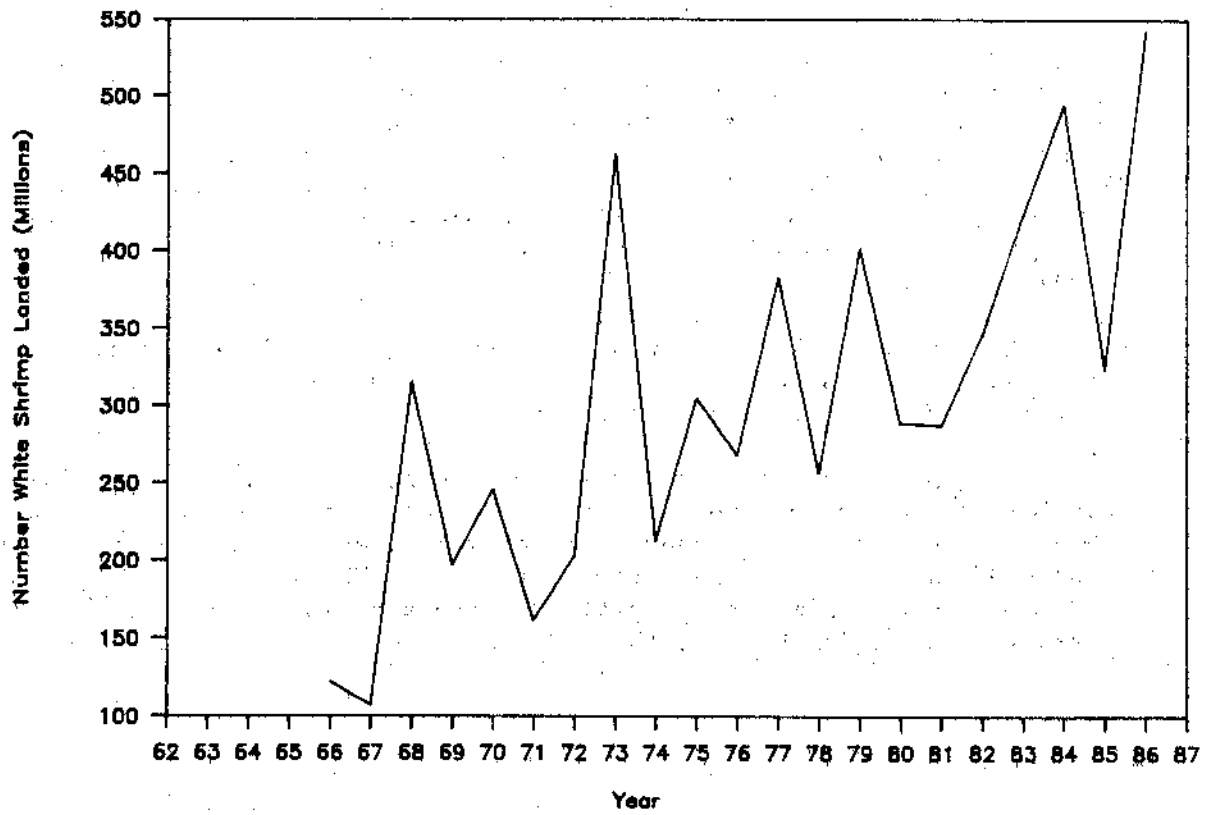

White Shrimp
Weight (Millions of Pounds)
3.2
3.0
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
Sab
Gal
Mat
SA
Ara
CC
ULM
LLM
Bay System

Figure 11. Annual Texas landings (pounds), ex-vessel value, and number of white shrimp from Texas bays during 1962 through 1987.


White Shrimp
Bays
Value
Landings
Millions of Pounds or Dollars
YEAR
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87


Number White Shrimp Landed (Millions)
Year
100
150
200
250
300
350
400
450
500
550
62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87

Shrimp Used as Bait: Shrimp harvested by commercial bait shrimpers averaged 1.6 million pounds valued at $5.9 million during 1977 through 1984. Commercial bait shrimping occurs in all bay systems and is generally restricted to areas defined by statute as bait bays and major bays. However, some fishermen are allowed to harvest shrimp in nursery areas under special statutory provisions which will expire on 31 August 1991.

Gulf Fishery

The Gulf shrimp industry consists of a brown and pink shrimp fishery and a white shrimp fishery. Participation in the industry has increased. Overall landings have increased slightly, value has increased substantially and landings per license have declined.

The fishery occurs in both the Texas Territorial Sea and the Exclusive Economic Zone. Gulf landings comprise approximately 84% (by weight) and 66% (by number) of total shrimp landings in Texas.

The gulf fishery is composed of both vessels and boats; vessels exceed 50 feet in length and have the capacity to stay at sea for extended periods, while boats range from 25 to 50 feet in length and usually return daily to the docks. Most licensed vessels and boats are concentrated in the Galveston, Freeport, Fulton to Corpus Christi and Brownsville/Port Isabel areas.

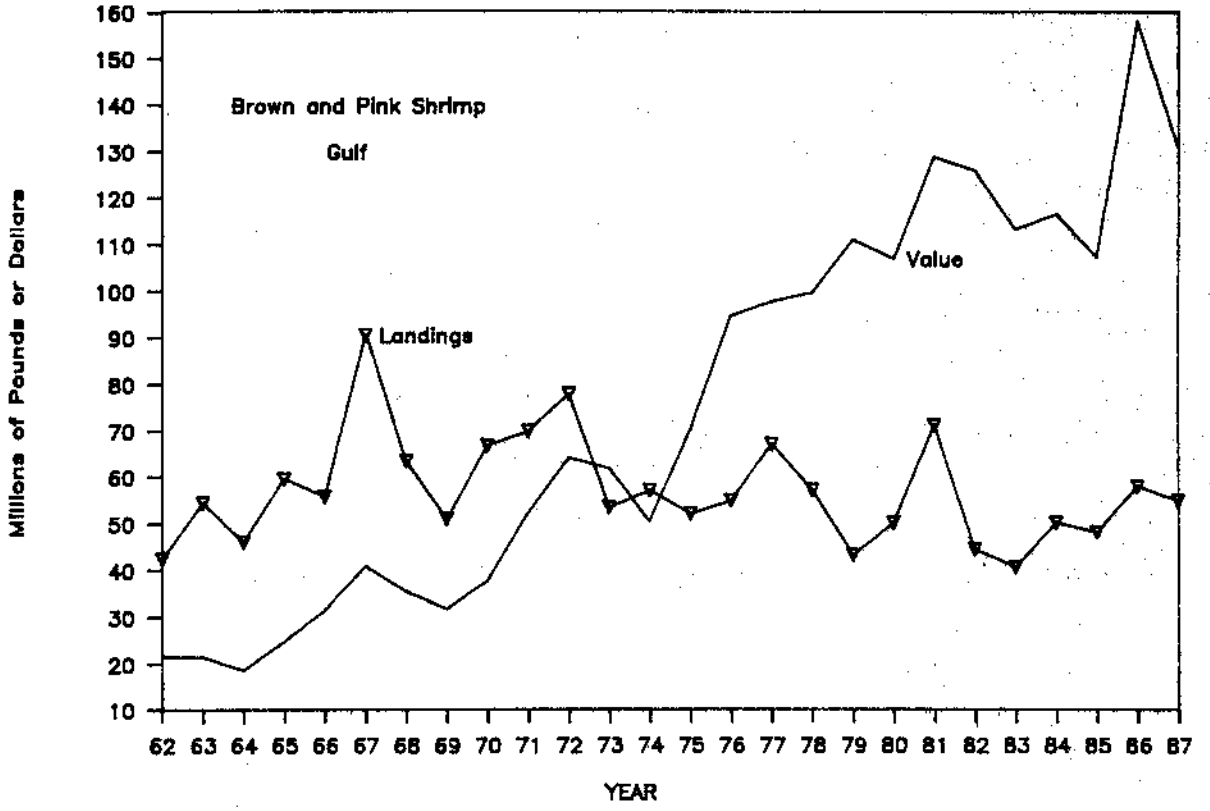
Although the size of the Texas gulf shrimp fleet fluctuates yearly, the total number of licenses in the fishery increased from about 1,600 in 1962 to over 4,600 in 1984, then declined to about 3,000 in 1987 (Figure 6). Non-resident vessels influence the annual variation in the size of the shrimp fleet operating off Texas.

Brown Shrimp and Pink Shrimp: Brown shrimp and pink shrimp landings increased substantially through the 1960's and then gradually decreased through 1987 while the value has increased steadily (Figure 12). Landings per license have declined (Figure 13). From 1962 through 1987, landings averaged 57 million pounds, ranging from 41 million pounds in 1983 to 91 million pounds in 1967. Average ex-vessel value from 1962 through 1987 was $75 million; the range was $19 million in 1964 to $158 million in 1986 (Figure 12).

An estimated 951 million brown shrimp were landed each year from Gulf waters from 1966 through 1986 (Figure 12). Yearly estimates ranged from 653 million in 1983 to 1.5 billion in 1967.

Traditionally, landings of brown shrimp and pink shrimp from the Gulf have been reported together, but about 95% of these are brown shrimp. Combined landings make up about 85% (by weight and number) of the average total Gulf catch of penaeid shrimp off Texas. The majority of brown shrimp and pink shrimp (by weight) are harvested in the Exclusive Economic Zone at depths less than 300 feet from July through December.

Figure 12. Annual Texas landings (pounds), ex-vessel value, and number of brown shrimp and pink shrimp from the Gulf of Mexico during 1962 through 1987.


Brown and Pink Shrimp
Gulf
Landings
Value
Millions of Pounds or Dollars
YEAR
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87

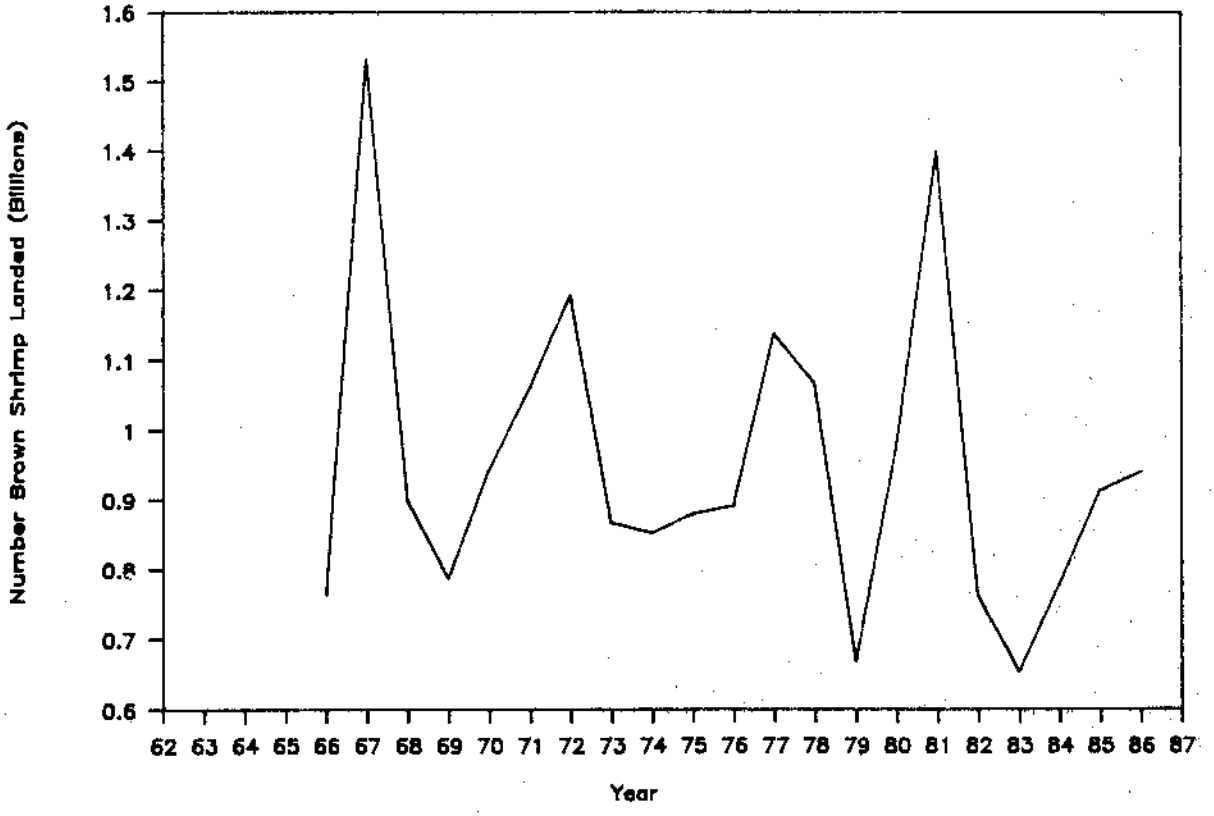
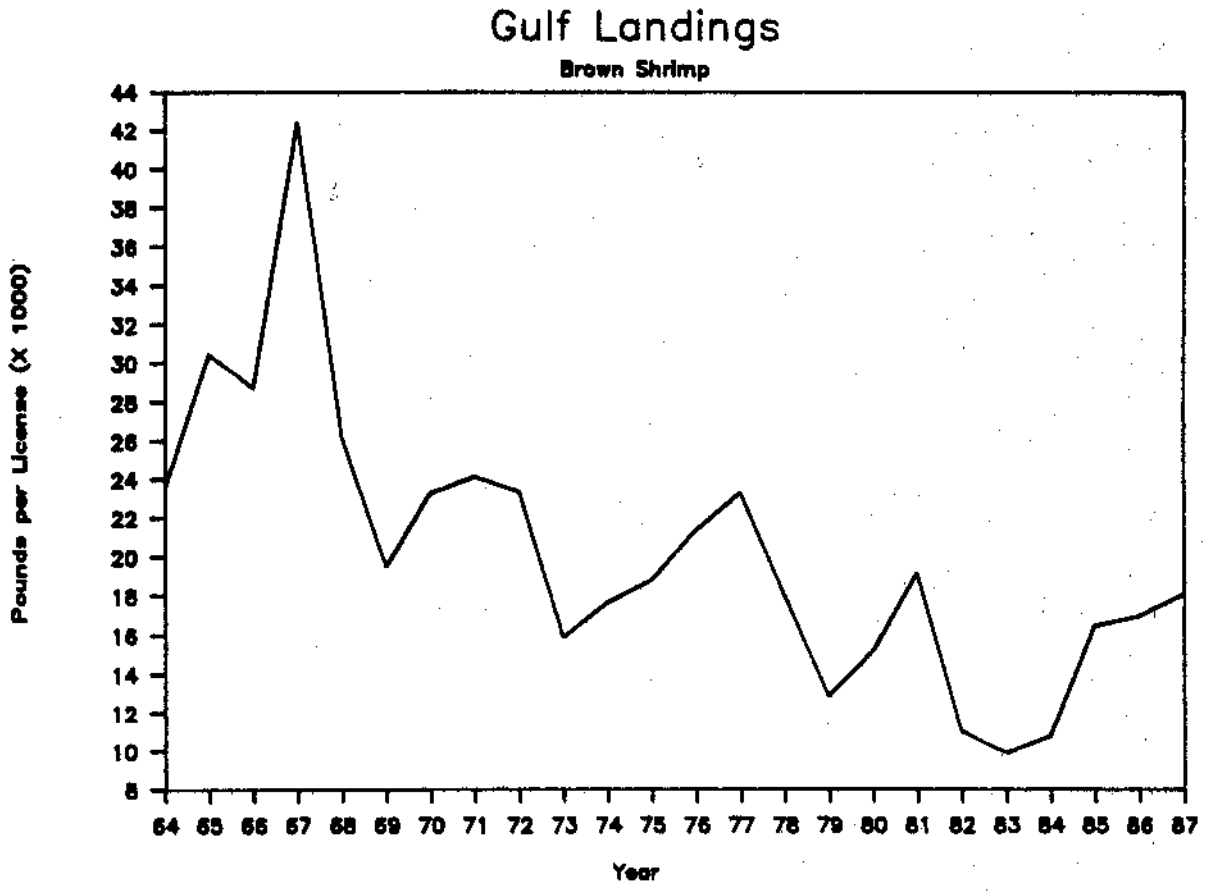
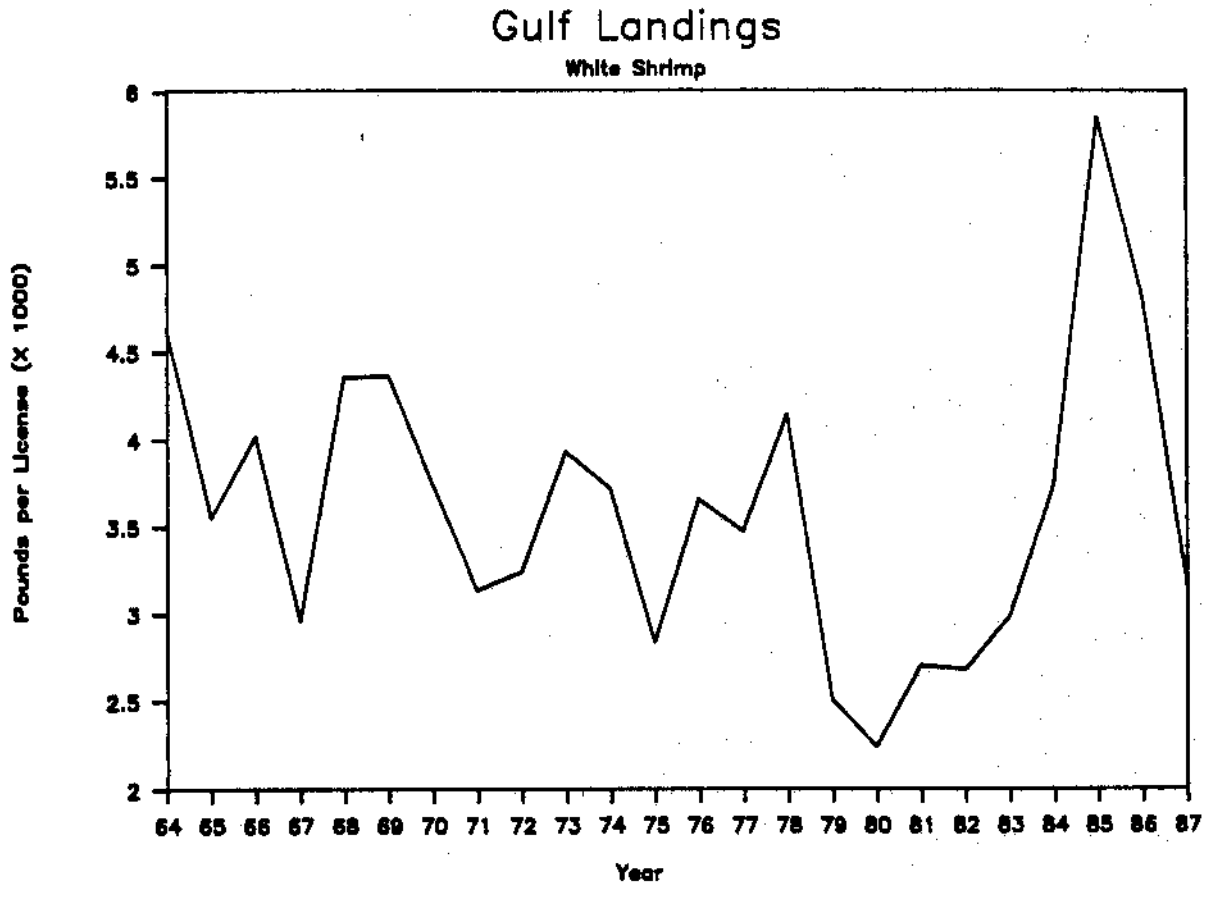

Number Brown Shrimp Landed (Billions)
Year
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87

Figure 13. Landings (pounds) per license from the Gulf of Mexico off Texas during 1964 through 1987.


Gulf Landings
Brown Shrimp
Pounds per License (X 1000)
44
42
40
38
36
34
32
30
28
26
24
22
20
18
16
14
12
10
8
64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87
Year


Gulf Landings
White Shrimp
Pounds per License (X 1000)
6
5.5
5
4.5
4
3.5
3
2.5
2
64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87
Year

White Shrimp: White shrimp landings have increased slightly while value has increased dramatically (Figure 14). Landings per license have fluctuated with no apparent trend (Figure 13). From 1962 through 1987, landings averaged 10 million pounds, ranging from 5 million pounds in 1962 to 17 million pounds in 1984. Average ex-vessel value from 1962 through 1987 was $17 million, ranging from $2 million in 1962 to $45 million in 1986 (Figure 14).

An estimated 178 million white shrimp were harvested each year from Gulf waters from 1966 through 1986. Yearly estimates ranged from 86 million in 1967 to 300 million in 1984 (Figure 14).

White shrimp are a comparatively shallow water shrimp with most of the Gulf harvest occurring at depths less than about 90 feet from September through December. White shrimp comprise about 15% (by weight and number) of the average total Gulf catch of penaeid shrimp off Texas.

Seabobs: Seabobs represent less than 1% of the total Texas Gulf shrimp landings. Average seabob landings from 1977 through 1986 were 309,000 pounds valued at $135,000. Landings ranged from 22,500 pounds worth $5600 in 1978 to 946,000 pounds worth $611,000 in 1986. Seabobs are harvested mainly from the territorial sea along the upper coast from December through February. Texas produces less than 4% of the gulfwide seabob catch.

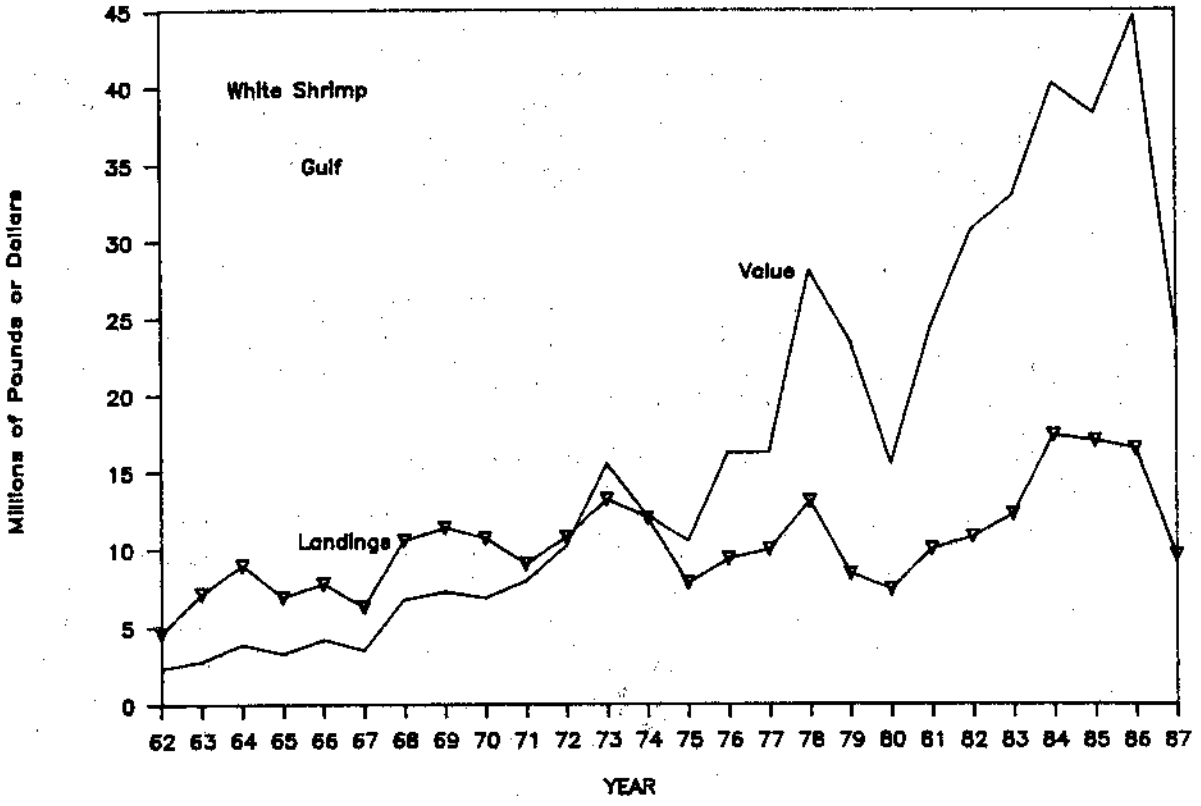
By-Catch

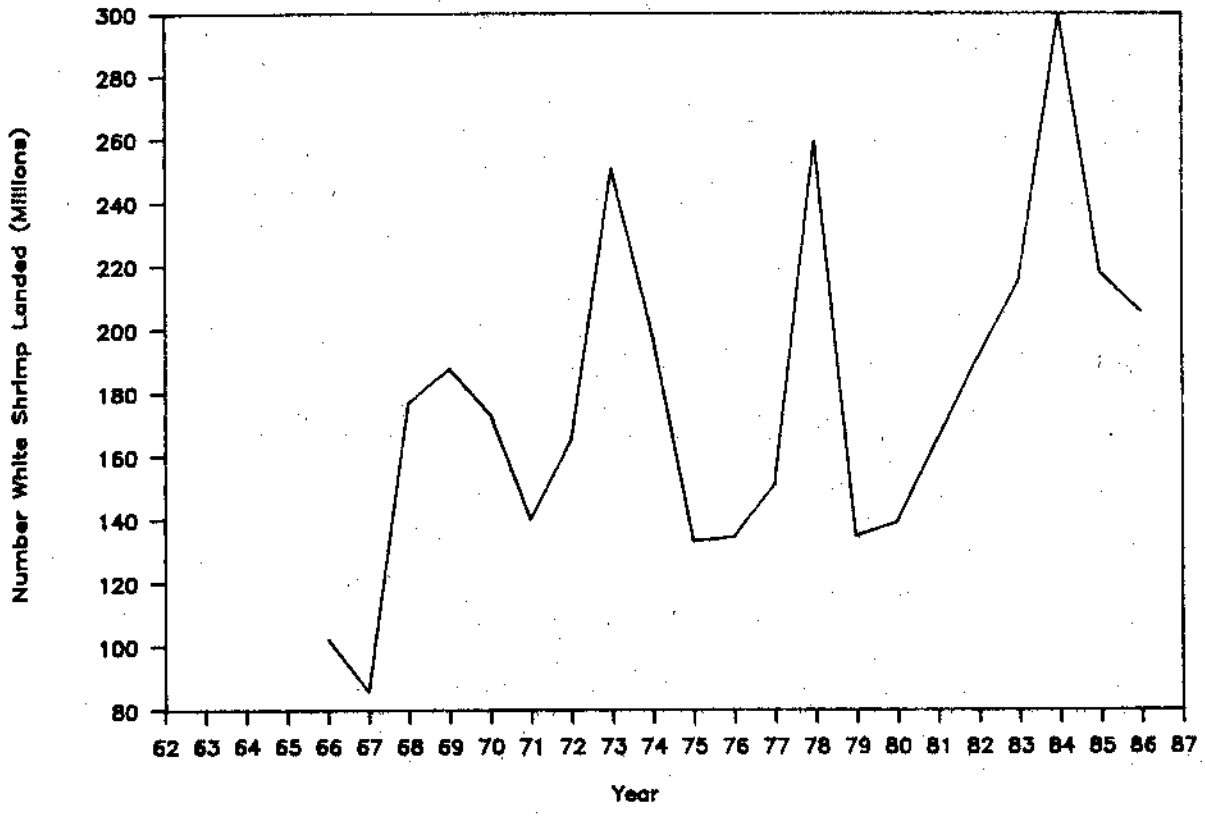
By-catch is defined as the incidental catch of non-target organisms captured during fishing activities. In shrimping, many finfish and invertebrates other than shrimp are captured. Most of the incidental catch is dead, others die as a result of handling and exposure and some are killed deliberately to make sorting more efficient before they are discarded. The by-catch includes small shrimp, crabs, non-commercial shrimp species, jellyfish, starfish, squids, mollusks, turtles, and various fishes. Blue crabs and some fishes in the catch are marketable, but the largest portion of the catch is usually discarded.

The by-catch in the bay fishery is generally unknown. However, a study of the flounder by-catch in the food and bait fisheries in Texas bays indicated more than 10 million juvenile southern flounder (average 7 inches) were caught and discarded during April through November 1978.

About 600 million pounds of organisms are discarded by the Gulf shrimp fleet off Texas each year. At certain times of the year small shrimp are discarded by the fishermen, but the majority of the by-catch consists of finfish and invertebrates other than shrimp. Crabs are a commonly occurring species but finfish often comprise 75 to 90% of a catch. Reported fish to shrimp ratios range from 4 to 12 pounds of fish per pound of shrimp. Using these ratios, the average amount of fish discarded over the last 10 years by the shrimp fishery off Texas ranged from about 328 to 977 million pounds per year.

Figure 14. Annual Texas landings (pounds), ex-vessel value, and number of white shrimp from the Gulf of Mexico during 1962 through 1987.


White Shrimp
Gulf
Value
Landings
Millions of Pounds or Dollars
YEAR
0
5
10
15
20
25
30
35
40
45
62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87


Number White Shrimp Landed (Millions)
Year
80
100
120
140
160
180
200
220
240
260
280
300
62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87

Attempts to utilize finfish by-catch in Texas have failed because large specimens are rarely caught and the species of fishes currently marketed as foodfish in Texas comprise less than 5% of the total catch. In recent years increasing quantities of trachypenaeids (a shrimp) have been landed.

Accidental capture of sea turtles is a problem that becomes increasingly important as nesting populations of the endangered Kemp's ridley continue to decline. The Turtle Excluder Device (TED) was developed by the National Marine Fisheries Service to eliminate capture of sea turtles and reduce the catch of other species.

RECREATIONAL FISHERY

Approximately 1.1% of the total shrimp harvest is taken by noncommercial shrimpers. Shrimp are harvested primarily from bays for personal use as food or bait. During 1980 over 121,000 noncommercial trawling trips were made, landing approximately 1.4 million pounds of shrimp that would have been valued at about $1.6 million in the commercial market if sale had been allowed.

ECONOMIC IMPACT

The average annual economic impact of the shrimp industry for the past 5 years is estimated to be $575 million. The economic impact from shrimp production can be estimated using economic multipliers similar to those used in other fisheries. Shrimp fishermen purchase goods and services to be able to collect shrimp. They also support families from income they earn through sale of shrimp. Wages are distributed into various sectors of the economy. The products and by-products of shrimping activity also generate income for various other sectors (i.e., restaurants, grocery stores, ship yards). Multipliers are a measure of the quantity of economic activity generated by purchases made by shrimp fishermen. The multiplier developed for fishery products in general, including shrimp, is 3.12. Using 3.12 as the economic multiplier for the Texas shrimp industry, economic impact for 1983 through 1987 reached a peak in 1986 at about $712 million (Table 1).

Table 1. Coastwide landings (whole weight), ex-vessel values and economic input for 1983-1987.

Year	Landings(lb)	Value ($)	Economic Input ($)
1983	71,076,800	171,113,200	533,873,180
1984	90,003,800	179,331,800	559,515,220
1985	81,634,400	161,217,800	502,999,540
1986	95,530,800	228,184,400	711,935,330
1987	88,379,300	182,303,200	568,785,980
Average	85,325,020	184,430,080	575,421,850

While recreational shrimping accounts for only a small portion of the Texas shrimp landings, it has a significant impact on the Texas economy. Based on the 1980 data, 120,000 noncommercial trawling trips were taken and the average cost per trip in Texas is $28.00; yielding a total of $3,360,000 spent annually by noncommercial shrimp trawlers. Using the coastal sportfishing economic multiplier, the total impact to the Texas economy is nearly $11 million dollars.

SHRIMP MANAGEMENT

Management Structure

The State Legislature has managed the shrimp fishery primarily through the Shrimp Conservation Act of 1959 (Chapter 77, Parks and Wildlife Code). However, the Texas Parks and Wildlife Department was granted regulatory authority in a number of counties via the Wildlife Conservation Act of 1983 (Chapter 61, Parks and Wildlife Code), and has additional authority in certain other counties via Title 7 (Local and Special Laws) of the Parks and Wildlife Code. In addition, through Chapter 79 (Parks and Wildlife Code, Extended Fishery Jurisdiction), the Texas Parks and Wildlife Department is authorized to cooperate with the Gulf of Mexico Fishery Management Council for the management of shrimp in waters of the Gulf of Mexico beyond state waters.

Management Regulations

Historical

The 1959 Shrimp Conservation Act established licenses (privilege tax) for each of the user groups including dealers (bait and food); set seasons, size limits, bag limits, possession limits, time limits and gear limits; established areas for fishing (major bays, bait bays, nursery areas, Gulf waters); established regulations concerning handling, loading, unloading, buying, selling, and processing of shrimp; and established penalties for violations.

Seasonal restrictions in the shrimp fishery are complicated (Figure 15) and do not effectively stop shrimping any timeduring the year except in parts of the Gulf during the Gulf Closed Season. Bait shrimping occurs year around during the day and night except during 15 August through 15 December, when only day shrimping is allowed in all areas except the Laguna Madre (where night shrimping continues). Shrimp caught as bait during this season are not supposed to be sold as food but once they reach the dock final disposition cannot be controlled.

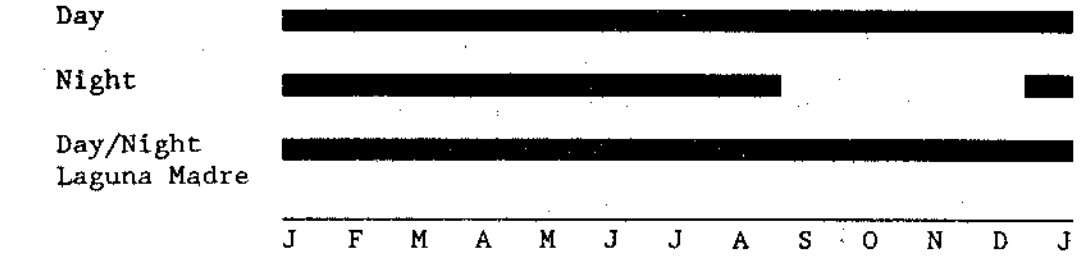
Under the 1959 Act, the Texas Parks and Wildlife Department is required to:

1) enforce shrimping regulations;

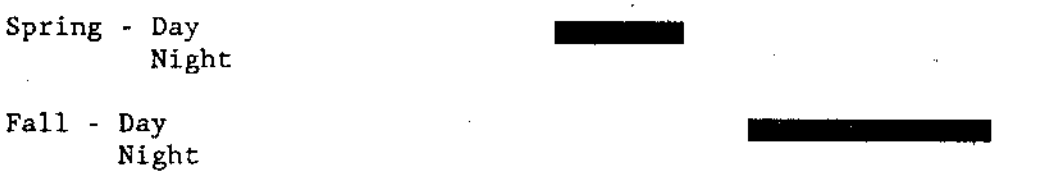
2) administer the sale of all licenses;

Figure 15. Summary of open shrimping seasons and associated regulations. Black bars indicate periods when shrimping is allowed.

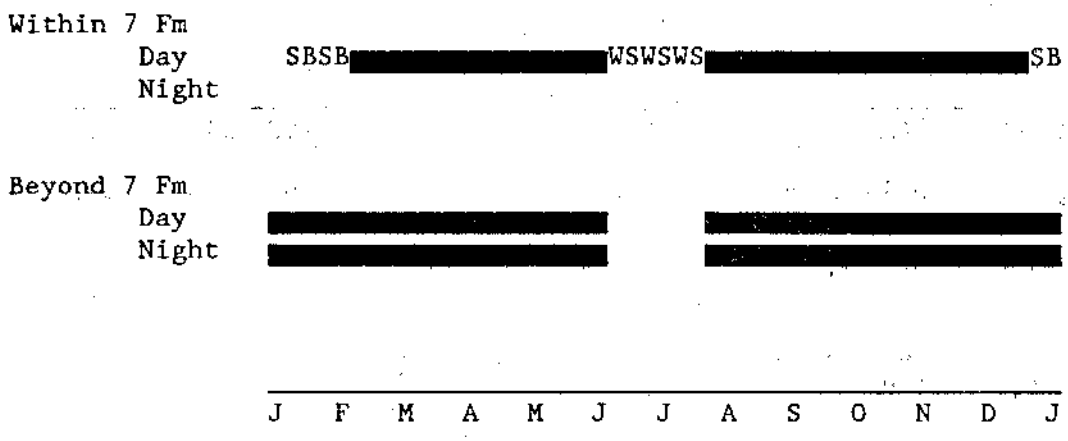
Bait Season	Location	Gear	Restrictions
Year-round	Major bays Bait bays Nursery areas	1 Trawl (54 ft) 1 Try Net (12 ft) 1 1/3" min. mesh	200 lbs/boat/day (November 15-August 15 50% must be alive)



Bay Season	Location	Gear	Restrictions
Spring	Major bays (May 15-Jul 15)	1 Trawl (54 ft) 1 Try Net (21 ft) 1 1/3" min. mesh	300 lbs/boat/day
Fall	Major bays (Aug 15-Dec 15)	1 Trawl (95 ft) 1 Try Net (21 ft) 1 3/4" min. mesh	None

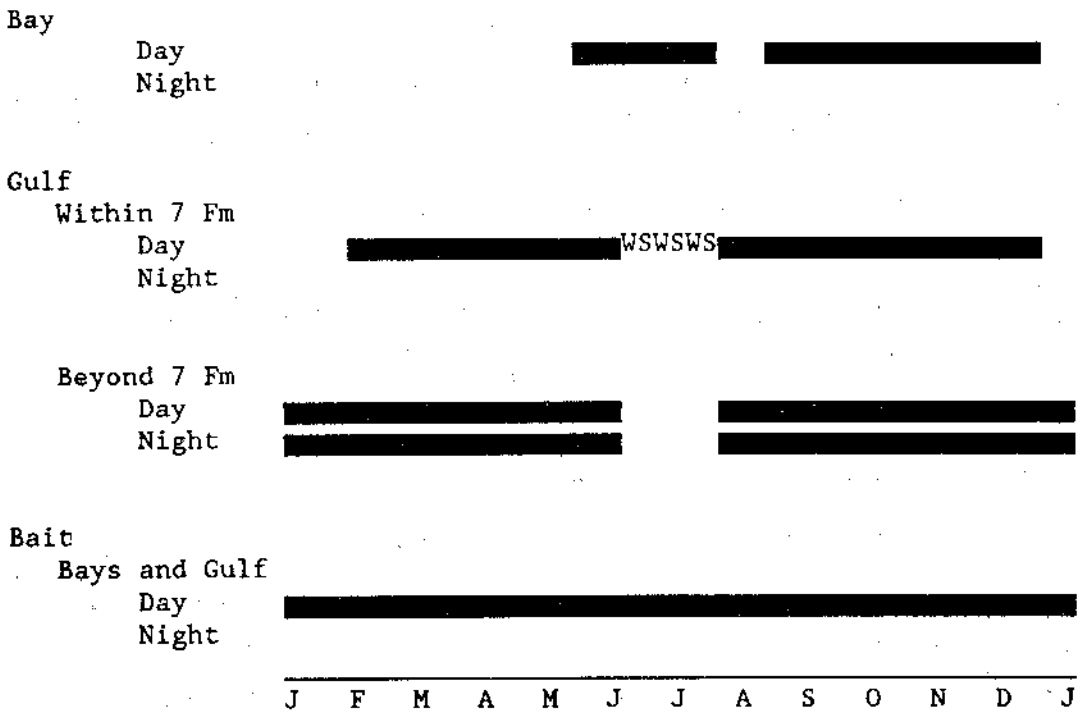


Gulf Season	Location	Gear[a]	Restrictions
Within 7 Fm[b]	Gulf within 7 fathoms Feb 2-Jun 1 Jul 16-Dec 15	No restrictions except 1 3/4" mesh	None
	Seabob season Dec 16-Feb 1	1 Trawl (25 ft) 1 1/3" mesh	90% Seabobs
	Gulf within 4 fathoms Feb 2-Dec 15	1 Trawl (54 ft) 1 Try Net (21 ft) 1 3/4" min. mesh	White shrimp only Jun 1-Jul 15
Beyond 7 Fm	Gulf beyond 7 fathoms Jul 16-May 31	No restrictions except 1 3/4" mesh	None



[a]Nets are measured from tip of door to tip of door. These Measurements are maximum size and include doors.
[b]Fathom = 6 ft.

Noncommercial Season	Location	Gear	Restrictions
Bay	Major bays Aug 15-Dec 15 May 15-Jul 15	Bait trawl Cast net Dip net Bait trap Minnow seine	15 lbs/day
Gulf	Outside waters Open seasons and depths	Bait trawl Cast net Dip net Bait trap Minnow seine Seine (400 ft)	100 lbs/day
Bait	Bait bays and Gulf Year-round	Bait trawl Cast net Dip net Bait trap Minnow seine	2 qt/person or 4 qt/boat



3) conduct continuous research and study of:

a) the supply, economic value, environment and breeding habits of the various species of shrimp;

b) factors affecting the increase or decrease in shrimp abundance;

c) the use of trawls, nets and other devices for the taking of shrimp;

d) industrial and other pollution of the water naturally frequented by shrimp; and

e) statistical information gathered by the Department on the marketing, harvesting, processing and catching of shrimp landed at points in the state;

4) publish a report on findings of fact for presentation to the Governor and Legislature before each regular session of the Legislature; and

5) permit vessels for fishing in nursery areas.

The Texas Parks and Wildlife Commission may:

1) based on sound biological data, change the 1 June through 15 July Gulf closed season to provide for an earlier, later or longer season not to exceed 60 days;

2) negotiate reciprocal agreements with another state with respect to the application of one state's shrimping regulations in its contiguous zone to citizens of the other state. (Note: This was an attempt to regulate shrimping beyond state waters and is now moot due to the passage of the Magnuson Fishery Conservation and Management Act of 1976).

Under Chapter 79 (Parks and Wildlife Code, Extended Fishery Jurisdiction) the Texas Parks and Wildlife Department is authorized to:

1) cooperate with the Gulf of Mexico Fishery Management Council in developing state management programs that are consistent with plans proposed by the Council and approved by the Secretary of Commerce, and

2) provide regulatory authority for shrimp if federal regulation in state waters is proposed and under no other circumstances.

Subchapter C of Chapter 61, Parks and Wildlife Code, defines the regulatory duties of the Texas Parks and Wildlife Commission and the Texas Parks and Wildlife Department. The Department shall conduct scientific studies and investigations of all species of wildlife

resources. These studies and investigations may be made periodically or continuously and the Commission shall make findings of fact based on the studies and investigations of the Department.

The Commission shall regulate by proclamation the periods of time, means, methods, manners, and places in which it is lawful to take or possess wildlife resources from the areas covered by this chapter (Title 7, Parks and Wildlife Code). If the Commission finds there is a danger of depletion or waste it shall amend or revoke its proclamations to prevent the depletion or waste. The Commission may amend or revoke its proclamations at any time it finds the facts warrant a change.

The Texas Parks and Wildlife Commission has regulatory authority for shrimp in Brazoria, Jackson and Willacy Counties and the inside waters of Cameron County. The Texas Parks and Wildlife Commission does not have Chapter 61 regulatory authority in Jefferson and Orange Counties, but special laws provide broad authority.

In Brazoria County, the Texas Parks and Wildlife Commission has essentially adopted rules similar to Chapter 77, Parks and Wildlife Code, with the exception that bait shrimp may be taken in nursery areas with cast nets, dip nets and 20-ft minnow seines. There is a 2 quart daily limit.

In Jackson County, shrimping is restricted to bait shrimp only, except during 15 August through 15 December, when 100 pounds per day may be taken for personal use. These restrictions do not apply to the waters of Carancahua Bay below Highway 35. These regulations were in the enabling legislation when Jackson County came under regulatory authority and have not been changed.

In Jefferson County, the use of trawls is prohibited south of the Intracoastal Waterway and west of the Port Arthur Causeway (Keith Lake area). Cast nets and 20-ft minnow seines may be used to take 2 quarts of bait shrimp per day. Fishing restrictions are consistent in all counties in the Laguna Madre.

Current

Current regulations are comprised of the statutes and regulatory mandates detailed in the previous section. The U.S. Government also regulates the shrimp fishery in Texas. During the gulf closed season for brown shrimp in state waters, a concurrent season in the Exclusive Economic Zone results in the suspension of the minimum size restriction for brown shrimp throughout the year. Through the Endangered Species Act the federal government has the authority to promulgate rules and has to date exercised this authority to protect sea turtles in both federal and state waters. Senate Bill 609 (Sixty-ninth Texas Legislature) provided the Texas Parks and Wildlife Department authority to regulate catching, possession, purchase and first sale of shrimp in Texas once a Shrimp Management Plan and Economic Impact Analysis was adopted by the Texas Parks and Wildlife Department.

Management Strategies

Historical

Through the Legislature, Texas has generally managed its shrimp fishery to harvest the larger, more valuable shrimp, to maintain different uses for shrimp and to prevent depletion. Laws have been implemented to meet these objectives, including the setting of size limits, seasonal and area closures, regulation of means and methods of harvesting shrimp, habitat protection, setting of bag and possession limits, requiring licenses of user groups and imposing penalties for noncompliance with regulations. Each of these objectives is further addressed through the Texas Parks and Wildlife Department's fishery independent and fishery dependent monitoring programs, assessment and evaluation of monitoring data and through communication of findings to user groups and related agencies.

Current Actions and Recommendations

1. Statutory Authority: Regulation of the shrimp fishery in Texas is extremely complicated. Primarily, the Texas Legislature has managed the shrimp fishery to prevent depletion and to maximize the ex-vessel value of shrimp landed. The result is a management system based on bag and possession limits, size limits, area and time closures and regulations governing the means and methods of taking shrimp. By transforming these statutes into proclamation form, the Texas Parks and Wildlife Commission could initiate a simplification and clarification process that would lead to an orderly transition from management by statute to management by regulation.

   Chapter 12, Parks and Wildlife Code gives the Department authority to administer laws relating to game, fish, oysters and other marine life in Texas waters. The Wildlife Conservation Act of 1983 (Chapter 61, Parks and Wildlife Code) gives regulatory authority to the Texas Parks and Wildlife Commission to provide a flexible mechanism to deal effectively with changing conditions to prevent depletion and waste of wildlife resources.

   In 1985, Chapter 77 of the Parks and Wildlife Code, directed the Department to conduct continuous research and study of:

   1. the supply, economic value, environment, and reproductive characteristics of the various economically important species of shrimp;

   2. factors affecting the increase or decrease in shrimp stocks in both an annual and long-term cycle;

   3. the use and effectiveness of trawls, nets, and other devices for the taking of shrimp;

4. industrial and other pollution of the water naturally frequented by shrimp;

5. statistical information gathered by the department on the marketing, harvesting, processing, and catching of shrimp landed at points in the state;

6. environmental parameters in the bay and estuary areas that may serve as limiting factors of shrimp population abundance;

7. other factors that, based on the best scientific information available, may affect the health and well-being of the economically important shrimp resources; and

8. alternative management measures for shrimp that may be considered for implementation in the management regime.

Section 77.007, Parks and Wildlife Code expanded the authority of the Department to regulate the catching, possession, purchase and sale of shrimp.

A proclamation of the Texas Parks and Wildlife Commission under this section prevails over:

1. any conflicting provision of this chapter to the extent of the conflict; and

2. a proclamation of the Commission issued under the Wildlife Conservation Act of 1983.

RECOMMENDATIONS: Implementation of Chapter 77 Parks and Wildlife Code may lead to fundamental changes in shrimp management by incorporating socioeconomic factors into the decision-making process. However, change should take place at a rate that minimizes disruption in the shrimp fishery and provides for an orderly transition from statutory authority to management by the Texas Parks and Wildlife Department. A process of clarifying and simplifying existing regulations should be a high priority under the proposed Shrimp Fishery Management Plan.

2. Joint Management: Shrimp that occur in Texas are part of a common stock that ranges throughout the Gulf of Mexico. As such, they fall under the jurisdiction of several states, federal agencies and the government of Mexico. Joint jurisdiction complicates the issue of managing shrimp resources throughout their range. The shrimp resources of Texas are managed by the Texas Parks and Wildlife Department (state waters out to nine nautical miles) and the U.S. Department of Commerce (Gulf waters from 9 to 200 nautical miles). The Texas Parks and Wildlife Commission has direct authority over state waters but Commission members and Department staff also serve as voting or advisory members on various committees of the Gulf of Mexico Fishery Management Council, Gulf States Marine Fisheries

Commission, MEXUS-Gulf work groups and other marine advisory councils.

RECOMMENDATIONS: The Texas Parks and Wildlife Department will continue to work with other groups to coordinate shrimp management. Upon adoption of this Plan the Texas Parks and Wildlife Department staff will work to incorporate management actions and recommendations based upon the Plan into Gulf of Mexico Fishery Management Council, MEXUS-Gulf and Gulf States Marine Fisheries Commission actions. This coordinated effort can provide for more effective management of the shrimp resources of Texas and the Gulf.

As the specifics of this Plan are to be developed by the adoption of rules and regulations by the Texas Parks and Wildlife Commission, and because it is vital to have the continued input of all individuals and groups interested in the shrimp resources of Texas, an advisory committee consisting of persons from the shrimp industry and individuals and groups interested in the shrimp resources of Texas shall be selected by the Chairman of the Texas Parks and Wildlife Commission for the purpose of advising, with the Texas Parks and Wildlife Department staff, on the preparation and formulation of each and every rule and regulation necessary to carry out the Shrimp Plan prior to the presentation of said rules and regulations to the Commission for its action.

3. Bag and Possession Limits: There are no possession limits in the shrimp fishery. Current statutes impose catch limits on bay, bait and noncommercial shrimp fishermen. Bay fishermen are limited to 300 lb per boat per day from 15 May through 15 July. Bait shrimpers are restricted to 200 lb per boat per day all year, and 50% of all bait shrimp must be kept alive from 15 November through 15 August. There are no bag limits for Gulf commercial shrimp fishermen. Noncommercial shrimpers are limited to 15 lb per person per day from 15 August through 15 December (except in Jackson County north of Highway 35 where the limit is 100 lb per person per day) and from 15 May through 15 July in the bays. The daily limit for noncommercial shrimpers in the Gulf is 100 lb per boat per day during the open season. Noncommercial shrimpers shrimping outside the above seasons are limited to 2 quarts per person per day or 4 quart per boat per day for bait.

RECOMMENDATIONS: If other management tools that reduce waste, enhance law enforcement and meet the goal of controlling harvest and allocating catch can be successfully implemented in the shrimp fishery, the use of bag limits should be reduced or eliminated. Management tools other than bag limits, that reduce waste of the resource and enhance law enforcement should be the primary management tools.

There is evidence that the bait shrimp license is being abused. The 50 percent live shrimp requirement for bait shrimp and the live box requirement were initially successful in reducing the number of

bait licenses sold but the bait shrimp license is not solely used to provide bait. A means other than the 50 percent live and live box requirements needs to be developed to provide for the legitimate needs for bait.

Restrictions on heading shrimp in inside waters should be eliminated in the absence of a bag or count limit. Heading in bays would allow more flexibility for fishermen to react to market situations. It could provide a higher quality product because headed shrimp deteriorate less than whole shrimp.

4. Size (Count) Limits: The only size restriction in effect occurs in major bays from 15 August through 31 October when the legal shrimp count is 50 whole shrimp per pound. Minimum shrimp size restrictions from outside waters have been exempted as long as the Gulf of Mexico Fishery Management Council's management plan is in effect and the taking of shrimp in at least part of the Exclusive Economic Zone is restricted during the Texas Gulf Closed Season. No size limits are imposed on bait or noncommercial shrimping.

RECOMMENDATION: If other management tools that reduce waste or enhance law enforcement can be successfully implemented, the use of size limits should be eliminated because they generally lead to waste of the resource.

5. Time Periods: The Legislature has regulated the time period within which the taking of shrimp is allowed by setting seasons and day/night restrictions. This has resulted in a complicated network of seasons.

Bait shrimp may be taken at any time of the day or night except during the Fall Open Season when bait shrimping is permitted only during the day. An exception in the Laguna Madre allows bait shrimping any time of the day or night year around.

Major bays are open during the day for food shrimp from 15 May through 15 July and from 15 August through 15 December.

Outside waters beyond the 7-fm depth contour are open year around, day and night, except during the flexible summer closed season from 1 June through 15 July. The closing and opening dates of the summer closed season may be changed by the Texas Parks and Wildlife Commission or Executive Director to provide for an earlier, later or longer season not to exceed 60 days. During this season, there is also an exception that allows the catch of white shrimp in outside waters less than 4 fm deep during the day.

Outside waters within the 7-fm depth contour are closed at night year around. Except for the summer closed season and the winter closed season (16 December through 1 February), waters within the 7-fm depth contour are open during the day . An exception during the winter closed season allows shrimping for seabobs in daylight

hours as long as restrictions on gear and composition of catch are met.

Noncommercial shrimpers in both inside and outside waters have the same season restrictions as commercial shrimpers.

RECOMMENDATIONS: Restricting the harvest of shrimp to specific time periods (including, but not limited to, certain times during the day, or certain months [periods] during the year), along with area closures (where an area can be a portion of a bay system or the Gulf of Mexico, a bay system, the Gulf of Mexico, or the entire state including Gulf waters) are the primary means for managing the Texas shrimp fishery, especially if bag limits are removed.

Exceptions to closed time periods should be eliminated unless it can be demonstrated that the value of the target species exceeds the loss in value of non-target species.

The time of day when seasons open and close should be standardized. Current inconsistencies cause confusion and are difficult to enforce.

6. Closed Areas: The Legislature regulates the shrimp fishery by designating areas where shrimp may be caught. No person may catch shrimp within natural or man-made passes leading from inside water to outside water. Commercial and noncommercial shrimping in inside waters, except bait shrimping, are restricted to major bays. Bait shrimping is restricted to bait bays and major bays but certain bait shrimp dealers have been authorized to fish in designated nursery areas under a "grandfather clause" that will expire in 1991. The Texas Territorial Sea is closed during the Gulf Closed Season except in water less than 4 fm deep where white shrimp may be taken. Outside waters up to 7 fm deep are closed at night year around and during the day from 16 December through 1 February.

RECOMMENDATIONS: Area closures, as well as specific time period restrictions, should be the primary management tools for managing the Texas shrimp fishery if they can successfully be used to reduce waste and enhance law enforcement. Areas closed to shrimping should continue to be based on the life history of shrimp, especially as it relates to growth. The boundaries of closed areas should be clearly identified to assist fishermen in recognizing closed areas, and to enhance law enforcement.

7. Means and Methods: The Legislature has regulated the taking of shrimp by imposing limits on the dimensions, mesh size, configuration and number of gear units allowed within each fishery.

The bait shrimp fishery is limited to one main trawl 32 to 34 ft along headrope, and one try net less than 12 ft along the headrope from the leading tip of each door. Beam trawls less than 25 ft

along the beam and try nets not exceeding 5 ft are also legal. Minimum mesh size is 6.5 inches over 5 stretched meshes.

For the Spring Open Season, one main net (otter trawl or beam trawl with the same restrictions as above) and one try net less than 21 ft or beam trawl less than 10 ft may be used. Minimum mesh size is 6.5 inches over 5 stretched meshes.

During the Fall Open Season, only one otter trawl and one try net may be used. The total width of the otter trawl and doors may not exceed 95 ft. The try net may not exceed 21 ft. A beam trawl used as a try net may not exceed 10 ft. Minimum mesh size is 8.75 inches over 5 stretched meshes from 15 August through 31 October and 6.5 inches over 5 stretched meshes from 1 November through 15 December.

There are no restrictions on the number or size of trawls in outside waters except when fishing for white shrimp within the 4-fm depth contour during the Gulf Closed Season (one main trawl, 32 to 34 ft, and one try net may be used; if a beam trawl is used it may not exceed 25 ft), or when fishing for seabobs during the closed winter season inside the 7-fm depth contour (one trawl not exceeding 25 ft in width with a 5 stretched meshes no smaller than 6.5 inches). Electro-trawls may have an applied voltage of no more than 3 volts.

A person may catch shrimp for personal use with an individual bait shrimp trawl (minimum mesh size 8.75 inches over 5 stretched meshes; not exceeding 20 ft in width), cast net, dip net, bait trap or minnow seine not larger than 20 ft in length.

During the open season in outside waters a seine not exceeding 400 ft in length with certain mesh restrictions may also be used.

RECOMMENDATIONS: If regulation of means and methods can successfully regulate the catch of individual fishermen, they should be used instead of bag limits and size limits. Regulations on means and methods should be standardized where practical and designed to reduce waste and enhance law enforcement.

8. Licenses: The Texas Parks and Wildlife Department has the responsibility of issuing licenses, established by the Legislature, for the privilege of catching, buying, selling, unloading, transporting or handling shrimp within the jurisdiction of the state. License documentation provides Texas Parks and Wildlife Department with a universe of fishery participants. The fees for non-resident fishermen are usually higher than those for resident fishermen. The Texas Parks and Wildlife Commission may increase fees from the minimum set by law.

A General Commercial Fisherman's License is required for residents or nonresidents who harvest edible aquatic products from the waters

of the state. For boats having a Commercial Shrimp Boat License, one license may be bought in the name of the boat to cover captain and crew.

A Bait Shrimp Dealer License is required of any person selling shrimp for fish bait in coastal counties.

Business licenses include 1) Wholesale Fish Dealer, 2) Wholesale Fish Truck Dealer, 3) Retail Fish Dealer, 4) Retail Fish Truck Dealer, 5) Shrimp House Operator, and 6) Shellfish Culture License.

Boat licenses include 1) Bait Shrimp Boat, 2) Bay Shrimp Boat and 3) Gulf Shrimp Boat.

For noncommercial shrimping, a person must have a General Fishing License, a Saltwater Stamp and, if a trawl is used, an Individual Bait-Shrimp Trawl Tag.

RECOMMENDATIONS: The licensing and fee system should be as simple as possible. It should be designed to produce revenue to pay for management and recover economic rent associated with the removal of the State's resources.

9. Penalties and Compliance: The Legislature sets penalties and fines for violations of fish and game laws. The Texas Parks and Wildlife Department has the authority to establish guidelines for recovering the value of illegally harvested or killed shrimp (Sections 12.302-12.307, Parks and Wildlife Code) and the Texas Parks and Wildlife Department also has the authority to revoke or suspend any license (Section 12.501, Parks and Wildlife Code).

RECOMMENDATIONS: Penalties for violating regulations should be increased, especially for violations of the recommended primary management tools of area closures, time periods, and means and methods. Higher penalties could include increased fines, higher classification of violations, reduction in the number of violations required for license revocation or suspension, and more consistent penalties for violations. The civil restitution and license revocation and suspension provisions of current law should be continued.

10. Allocation: Allocation is that element of fisheries management that is implemented after protection of spawning stock has been accomplished. Resource allocation can be accomplished directly (by quotas, limited entry, etc.) or indirectly through regulation of fishing means, methods, times, seasons, gear, etc. Historically, the Texas Legislature has allocated shrimp resources through indirect methods.

RECOMMENDATION: The necessary data should be obtained to assess the feasibility of implementing a limited entry program into the Texas shrimp fishery to achieve optimum yield.

11. Stocking: Shrimp hatchery technology exists but stocking of hatchery produced shrimp into public waters has not been done by the Texas Parks and Wildlife Department. Current law allows the raising of shrimp in the private waters of the state by holders of a Shellfish Culture License. Recent legislation provides that stocking of shrimp is not permitted in Texas public waters without prior notification and approval of the Texas Parks and Wildlife Department. Additionally, it is not legal to transplant shrimp, native or non-native, into Texas for culture or stocking without notification and approval of the Texas Parks and Wildlife Department.

RECOMMENDATIONS: Stocking in public waters to enhance natural populations should be used when necessary to supplement natural recruitment when sufficient research has demonstrated its efficacy.

12. Mariculture Development: Current state law allows the culture of shrimp in private waters of the state by holders of a Shellfish Culture License. Current statutes and Texas Parks and Wildlife Commission rules allow the take of limited quantities of wild brood stock and the importation of live shellfish (that are certified free of disease) by permit for culture purposes (Sections 51.009 and 51.010, Parks and Wildlife Code).

RECOMMENDATION: The Texas Parks and Wildlife Department should continue to monitor the development of mariculture techniques and the commercial production of penaeid shrimp.

13. Habitat Maintenance, Restoration, and Enhancement: Under Section 77.004, Parks and Wildlife Code, the Texas Parks and Wildlife Department is required to conduct continuous research and study of environmental parameters and other factors that affect shrimp population abundance. The Department is also required to study industrial and other pollution of the water naturally frequented by shrimp.

RECOMMENDATIONS: The long-term viability of the Texas shrimp fishery depends on maintenance and enhancement of shrimp habitat. The Texas Parks and Wildlife Department should continue to aggressively protect and enhance shrimp habitat and water quality via all available resource protection agencies and programs.

14. Fishery Independent Monitoring: The objectives are to develop long-term trend information on shrimp population abundance and stability in Texas bays and the Gulf of Mexico, and to monitor environmental factors which may influence shrimp availability. A comprehensive monitoring program provides information about most life history stages of the resource and is capable of detecting changes in population structure. To accomplish these objectives,

long-term trend information will be collected with 60-ft bag seines and 20-ft otter trawls in the bays and Gulf of Mexico.

RECOMMENDATIONS: The present monitoring program should be maintained or enhanced to meet Legislative mandates and to continue to determine trends in population abundance and stability, movement, growth, mortality and the impacts of environmental influences.

15. Fishery Dependent Monitoring: The objectives are to determine size, catch per unit effort, and value of shrimp landed by commercial and recreational fishermen from Texas bays and the Gulf of Mexico, and to determine monthly and annual purchases of edible seafood products by commercial dealers through Monthly Marine Products Reports. Daylight commercial landings and fishing activities are estimated from on-site surveys of seafood and bait dealers, boat access sites and commercial vessel docking structures. The landings and fishing activities of sport fishermen are monitored through on-site surveys of recreational boat access sites. The Department also has an agreement with the National Marine Fisheries Service to exchange landings and effort data on the shrimp fishery.

RECOMMENDATIONS: The present monitoring program should be enhanced to meet Legislative mandates and to continue to determine fishery harvest trends, economics and impacts of sociological influences.

16. Assessment and Evaluation: The Texas Parks and Wildlife Department is mandated by Sections 12.001, 61.051 and 77.006, Parks and Wildlife Code to assess annually and publish the status of shrimp populations and associated environmental variables. The Texas Parks and Wildlife Department is responsible for making management recommendations regarding the State's shrimp fishery within the bays, estuaries and Gulf waters out to nine nautical miles.

RECOMMENDATIONS: Continued assessment and evaluation are necessary to meet Legislative mandates and to address data needs reviewed in this Plan.

17. Communication and Education: The Texas Parks and Wildlife Department is required to report on findings of fishery research, assessments and evaluations and to make recommendations for further actions when studies indicate they are appropriate to accomplish the objectives of this plan (Sections 12.0011, 12.002 and 77.004-77.006, Parks and Wildlife Code).

RECOMMENDATIONS: The Texas Parks and Wildlife Department should continue to maintain a high level of interdepartmental, industrial and interagency communication to more fully benefit from the free flow of information concerning penaeid shrimp research, adverse environmental conditions and changes in economic and societal goals.

The Texas Parks and Wildlife Department will periodically update the data and information contained within the Shrimp Fishery Management Plan.

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