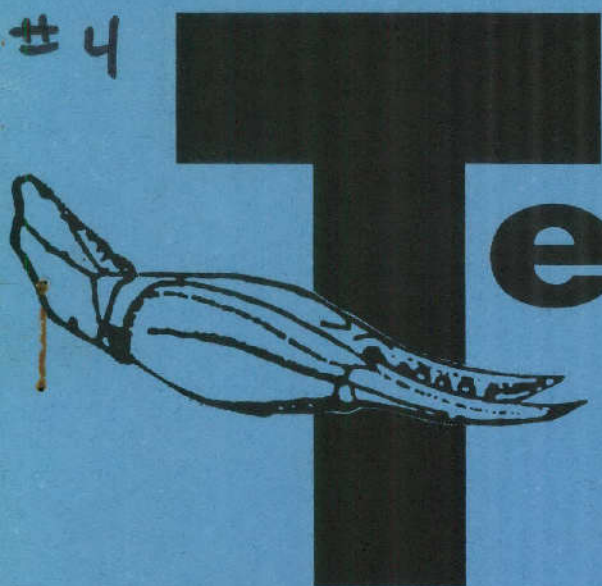


P 437.7  
F 539  
#4

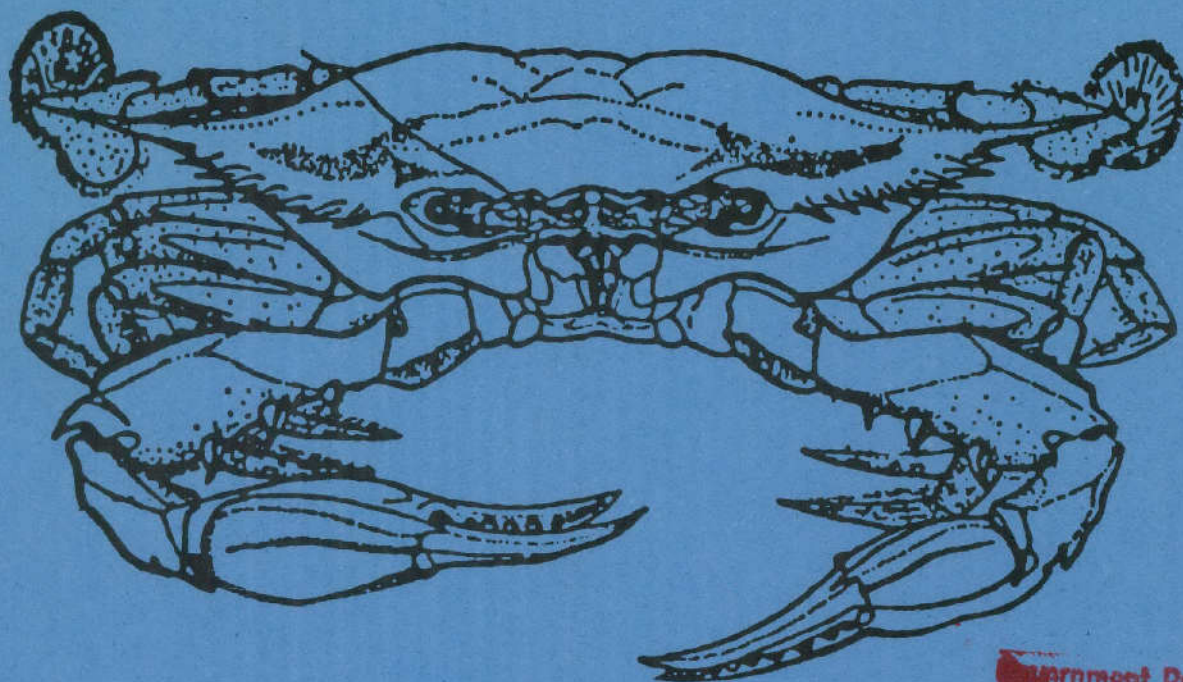


# exas

# BLUE CRAB

## Fishery Management Plan

Fishery Management  
Plan Series Number 4



Texas Parks & Wildlife Department  
4200 Smith School Road  
Austin, Texas 78744  
**1992**

Government Publications  
Texas State Documents

MAR 29 1993

Dallas Public Library



**FISHERY MANAGEMENT PLAN FOR THE BLUE CRAB FISHERY  
IN TEXAS WATERS**

by

Terry J. Cody

Tom Wagner

C. E. Bryan

Lawrence W. McEachron

Ralph Rayburn

Brenda Bowling

and

Jerry M. Mambretti

**Texas Parks and Wildlife Department  
Coastal Fisheries Branch  
4200 Smith School Road  
Austin, Texas 78744**



## INTRODUCTION

Annual Texas crab landings, predominantly blue crab (Callinectes sapidus), ranged from 7.0 to 11.7 million pounds (whole weight) with ex-vessel values of \$1.9 to \$4.8 million from 1977 through 1990. The annual impact on the Texas economy is about \$12 million. The fishery employs about 300-400 fishermen, most of whom are part-time fishermen. Fishermen use about 150-200 traps each. Stone crabs (Menippe adina) are landed in Texas but comprise less than 3% of the annual crab landings. The lesser blue crab (C. similis), common in Texas bays and Gulf water, does not attain a large enough size to be commercially important.

From 1985 through 1990, average annual ex-vessel value of the U. S. blue crab fishery was \$71 million. Reported landings of hard blue crab from the Gulf of Mexico exceeded 45 million pounds in 1990; these landings comprised about 23% of the U. S. production. Actual blue crab commercial landings are greater than reported because sales to the general public and restaurants are not included in mandatory reporting systems throughout the Gulf.

Harvesting sectors of the Texas crab fishery include the commercial hard crab and bait fishery, a small soft-shell crab industry and a recreational fishery. The Texas Parks and Wildlife Department (TPWD) monitors the blue crab population and harvesting activities. The Texas Department of Health (TDH) oversees licensing, construction, and operation of all crab processing plants in the state. The Texas Department of Health also regulates harvest areas for the purpose of protecting human health.

Blue crab occur in waters under jurisdiction of five Gulf states and the governments of the United States and Mexico. The Interjurisdictional Fisheries Act of 1986 (Title III, Public Law 99-659) was established by Congress to: (1) promote and encourage state activities in support of the management of interjurisdictional fishery resources and (2) promote and encourage management of interjurisdictional fishery resources throughout their range. In 1990 the Gulf States Marine Fisheries Commission (GSMFC) completed a regional management plan for the blue crab fishery of the Gulf of Mexico in U. S. waters. The present document was prepared by the TPWD staff and relies heavily on information presented in the GSMFC's Regional Management Plan for the Blue Crab Fishery.

The goal of the Texas Blue Crab Fishery Management Plan is to provide a management strategy for the crab fishery in Texas, provide management recommendations and identify research needs. Proclamations issued by the TPWC may regulate the quantity and size of blue crabs that may be caught or possessed and may prescribe the means, methods, manners, and places where wildlife resources may be taken or possessed and for the safe use of crab traps. In determining the need for management, the TPWC shall prevent depletion and waste while providing an ample supply of wildlife resources on a statewide basis to insure reasonable and equitable enjoyment of the privileges of ownership and pursuit of wildlife resources.

Included in the objectives of the Department's 6 year plan are the development of long range management plans which determine optimum yield for penaeid shrimp, Eastern oyster, blue crab, red drum, spotted seatrout, southern flounder and black drum. Plans for penaeid shrimp and Eastern oyster have been completed and approved. The stated goal is to provide maximum economic benefits to the fishermen while protecting the resource. For purposes of these plans, optimum yield is defined as the amount of organisms the fishery will produce on a continuing basis to achieve the maximum economic benefits to the industry and the State, as modified by any relevant social or ecological factors. Stated simply, these fisheries need to be managed by the State in a way that does not differ significantly from the way they should be managed by a competent privately owned firm. This approach is consistent with that taken by the State in its management of other natural resources and the U. S. government in managing its fisheries and other natural resources.

Not only is optimum yield to be a management objective, but depletion and waste are to be prevented. Overfishing, environmental factors, and other events can cause depletion. "Depletion" is defined in the Wildlife Conservation Act of 1983 as the reduction of a species below its immediate recuperative potential by any deleterious cause. For purposes of this plan, crabs are considered depleted when the population abundance and composition are not sufficient to sustain optimum yield. In other words, if crabs are in a condition 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 and fishery as well as current management practices are presented in the Plan. Finally, the Plan suggests management strategies to achieve optimum yield. Biological, economic, legal and sociologic information essential to management of blue crab in Texas, and upon which this Plan is based, are a compilation of source materials including *The Blue Crab Fishery of the Gulf of Mexico United States: A Regional Management Plan* prepared by the Blue Crab Technical Task Force of the Gulf States Marine Fisheries Commission, scientific publications and reports, and data files of TPWD and NMFS.

#### DISTRIBUTION

Blue crab occur along the entire Texas coast (Figure 1). They have been reported from Nova Scotia to northern Argentina. Blue crabs in the Gulf of Mexico inhabit all coastal habitats from fresh water to shallow Gulf water. They are most common in tidal marsh estuaries with soft mud substrates and waters of low to moderate salinity (<20 ppt). Tagging data reveal egg-bearing females in Texas bays move to higher salinity waters or offshore to spawn.

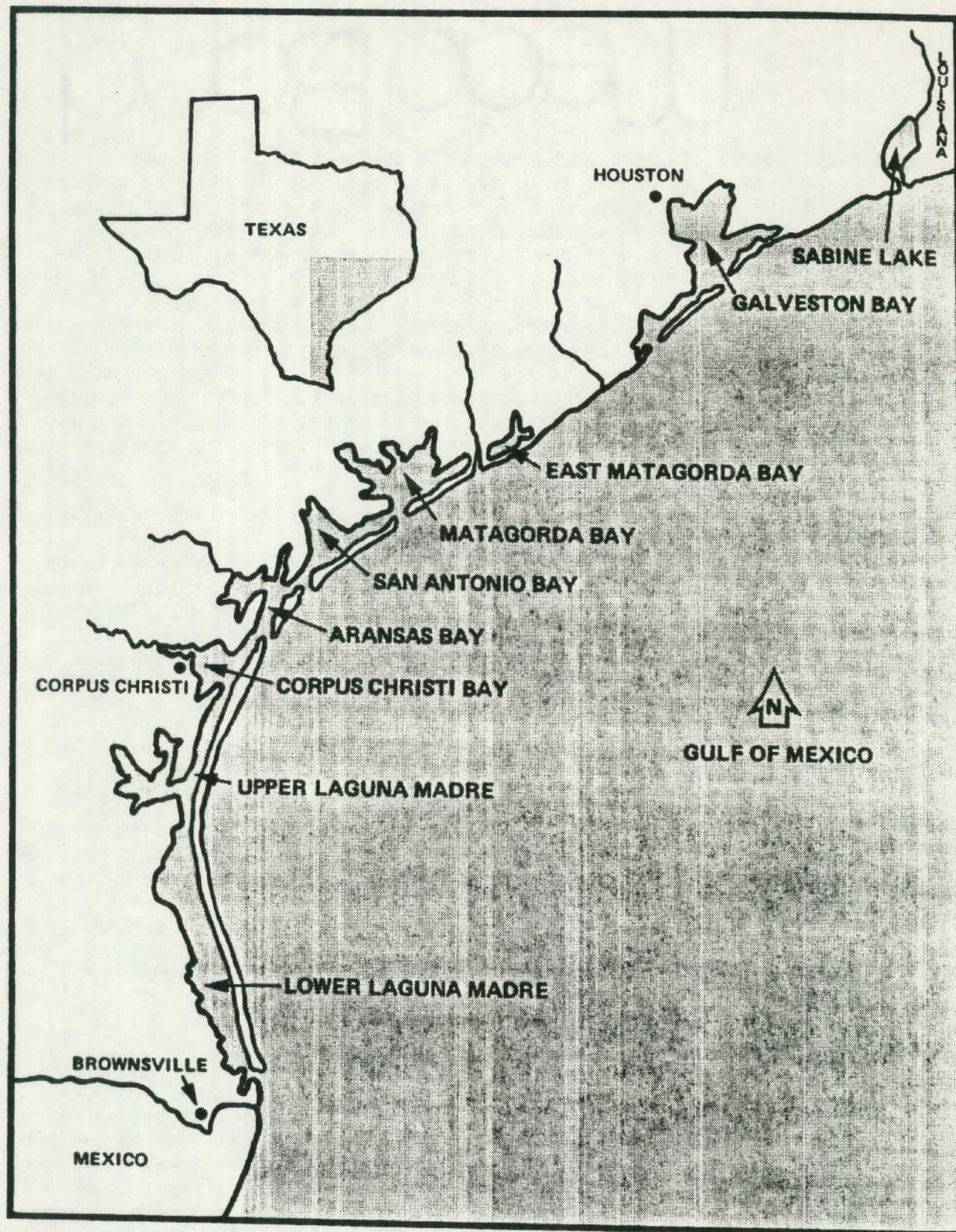


Figure 1. Texas bay systems and adjacent Gulf of Mexico.

### LIFE HISTORY

Egg-bearing females (sponge crabs) spawn in the Gulf or in high salinity bay waters (>20 ppt). Eggs hatch into free-swimming zoeae and develop through a series of molts into megalopae. Upon reaching the megalopal stage, blue crabs move into the bay systems year around and become bottom feeders. Peak movement is highest when offshore waters are entering passes during January-March, May-June and October.

In the estuary, juvenile crabs feed mainly at the marsh-water interface or in submerged grass beds, concentrating in areas of low to intermediate salinity. These areas offer a concentrated food supply of detritus, algae and microfauna and provide some protection from predators. Salinity, bottom type and food availability all influence the distribution of juvenile crabs. Growth is strongly affected by temperature, with molting rate increasing as temperature increases, but decreasing with age. Growth is about 0.6-0.7 inches per month.

As blue crabs mature, movement is out of nursery areas into other parts of the bay. Once maturation occurs, segregation by sex and salinity begins. Male blue crabs usually remain in upper, less saline portions of the bays whereas female blue crabs begin moving toward more saline areas. Most blue crabs are sexually mature at about 5 inches. The male crab mates with the female immediately after the female molts. Spawning usually occurs from spring through fall. In south Texas spawning may occur year around during mild winters. Females carry up to 2 million eggs per eggmass (sponge) and a second sponge may occur later in the year.

### MORTALITY

Death of blue crabs is due either to natural causes or by man. Estimates of mortality rates are not available. Natural mortality for larval, juvenile and adult crabs has not been determined in Texas or elsewhere in the Gulf. Chemical pollution, agricultural and industrial runoff, low dissolved oxygen, extreme temperatures and salinities, and red tide (Ptychodiscus brevis) have all been shown to cause blue crab mortalities. Fishing mortality occurs in the crab and shrimp fisheries. Most crabs probably die within one to one and one-half years after reaching maturity.

### ABUNDANCE

Relative abundance of juvenile and adult crabs in bays has been periodically monitored since 1962 by the TPWD using bag seines, marsh nets and bar seines. Since 1978 bag seines have been pulled routinely along shorelines to capture the smallest sizes. As crabs grow larger and move to deeper water abundance is monitored by trawl. A coastwide trawling program in water greater than three feet was established in Texas bays during 1982 and in Gulf waters during 1985.

Blue crab abundance generally has been stable since the early 1980's. Small crabs are most abundant along shorelines and in bay waters during March through July; abundance remains low the rest of the year (Figure 2).

Coastwide relative abundance of juvenile blue crab along shorelines, as measured by bag seine catch rates, fluctuated from a low of 20 per acre in 1978 to a high of about 46 per acre in 1985. Catch rates have averaged 30 per acre since 1985 (Figure 3). Mean sizes have decreased more than 0.4 inches since the late 1970's (Figure 3).

Coastwide trawl catch rates from bay waters ranged from 15 per hour during 1984 to 22 per hour in 1988 (Figure 4). Catch rates averaged 19 per hour for 1986-1990. Mean carapace width of juvenile crabs in TPWD samples decreased about 0.6 inches through the 1980's (Figure 4). In nearshore gulf water coastwide catch rates of blue crab are less than 5 per hour and have fluctuated since 1985 (Figure 5). Mean size in the gulf has declined more than 1.6 inches since 1985 (Figure 5).

#### STATUS OF STOCKS

The various blue crab stages monitored by the TPWD appear to be replacing themselves with about the same number of recruits on a coastwide basis but mean size has steadily declined in all three gears. These conditions are the first indication of a possible growth overfishing situation where yield from a given group of organisms declines because they have not had the opportunity to achieve their full growth potential. Growth overfishing is usually easier to detect and correct than recruitment overfishing which occurs when the adult stock is reduced to a level where there is a significant decline in average recruitment.

A spawner-recruit relationship is the relationship between number of reproducing adults and resulting number of young recruited to the fishery. Studies are inconclusive as to whether a spawner-recruit relationship for blue crab exists. However, recent studies in Chesapeake Bay revealed significant correlation between juvenile abundance and commercial hard crab landings in Virginia, indicating a stock-recruit function. The researchers emphasized abundance surveys covering broad spatial and temporal ranges are needed to determine the relationships because juvenile abundance is highly dependent on environmental conditions. The TPWD sampling program meets these criteria and staff will investigate spawner-recruit relationships in Texas.

Blue crab stocks are usually considered "density-independent", meaning larval survival is believed to be more dependent on environmental conditions, food availability, and abundance of predators than on parental or larval abundance. A density-independent theory suggests factors other than spawning stock (i.e. environmental, physical and socio-economic factors) control recruitment of crabs into the fishery.

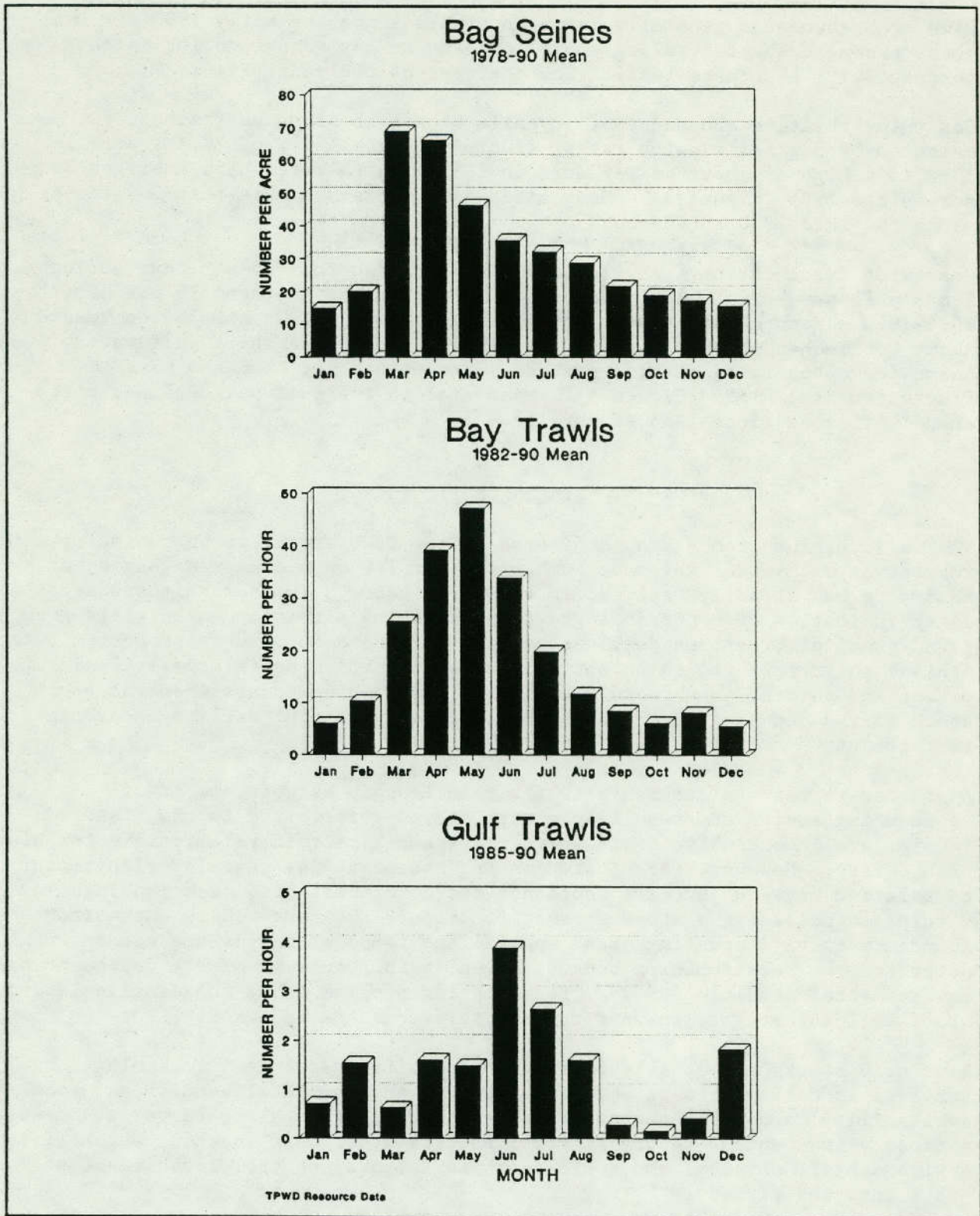
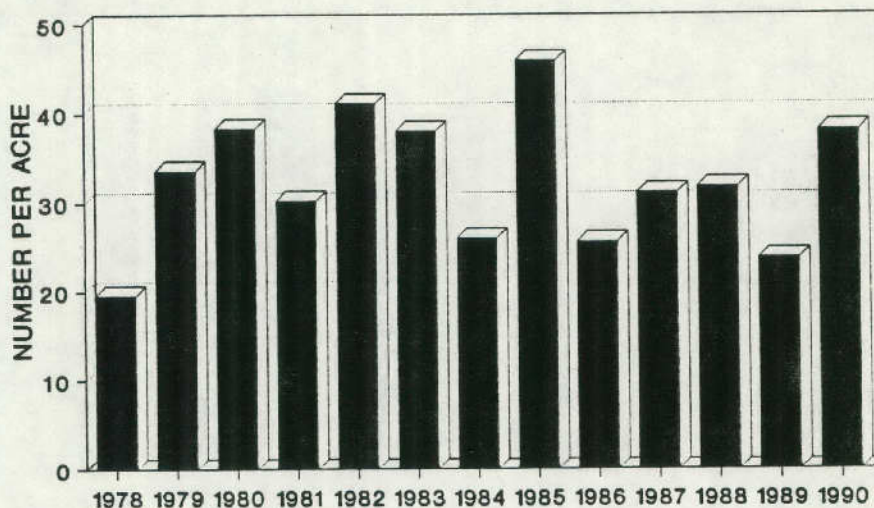
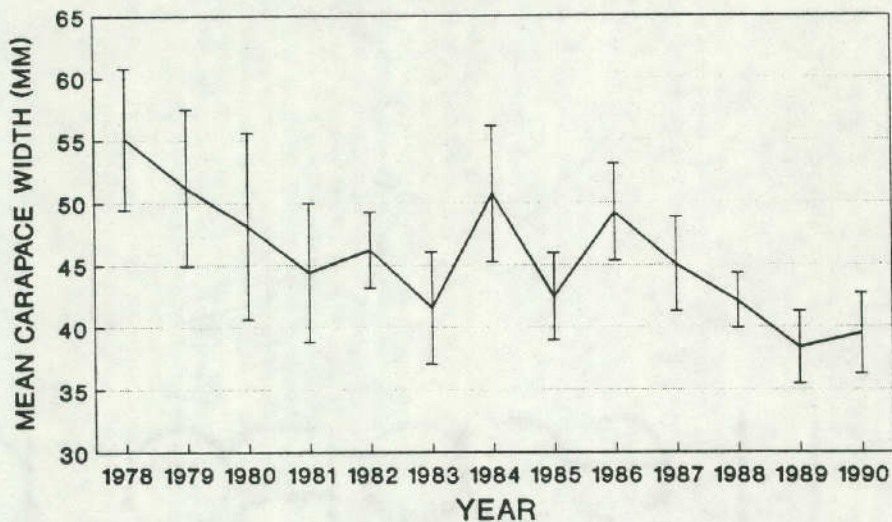


Figure 2. Monthly relative abundance of blue crabs in TPWD bag seines (1987-1990), bay trawls (1982-1990) and gulf trawls (1985-1990).

### Bag Seines Coastwide



### Bag Seines Coastwide



TPWD Resource Data

Figure 3. Relative abundance (number per acre) and mean size ( $\pm 1$  SE) of blue crab juveniles caught along shorelines with TPWD bag seines, 1978 through 1990.

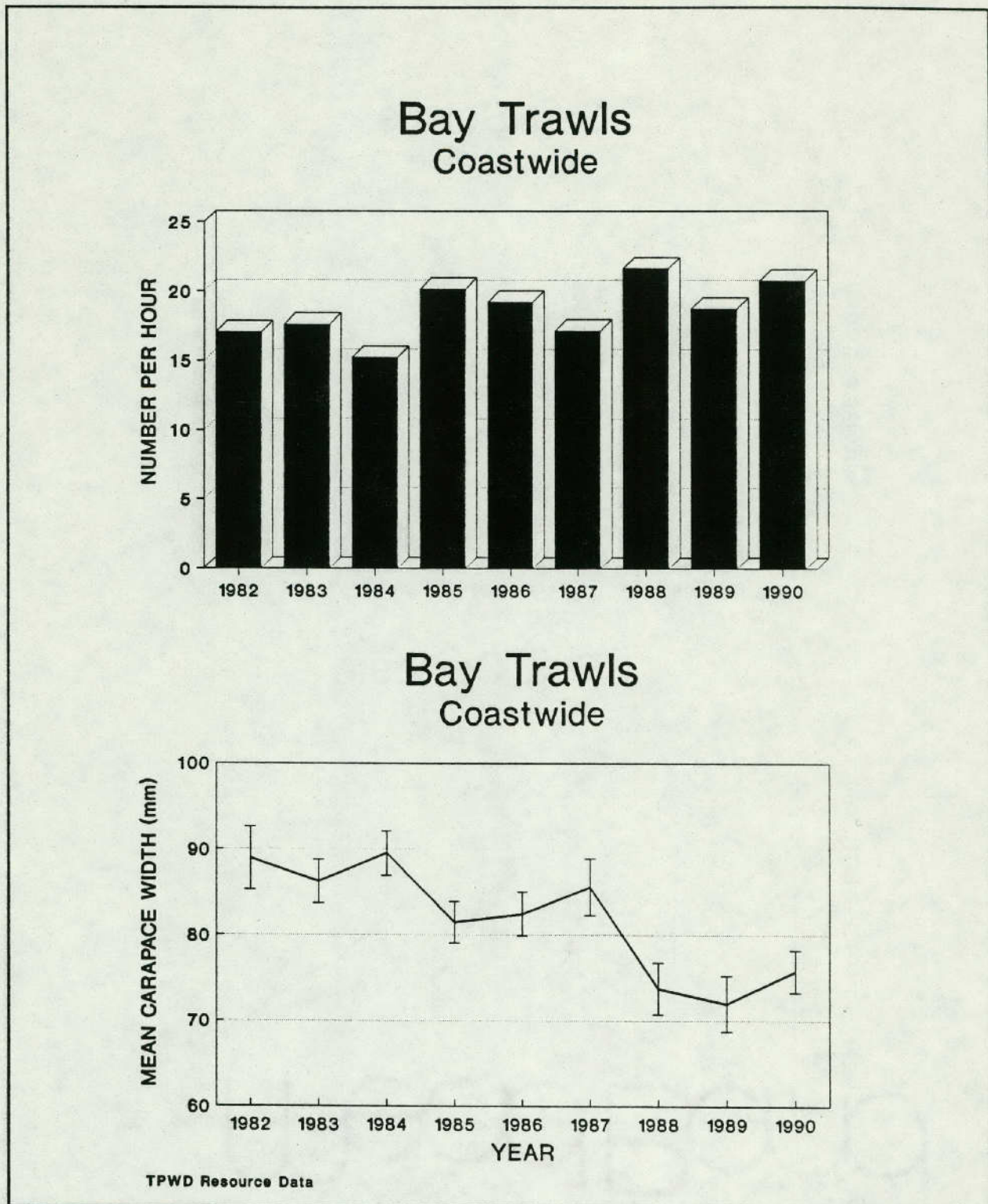


Figure 4. Relative abundance (number per hour) and mean size ( $\pm 1$  SE) of blue crabs caught in bay waters greater than 3 feet deep with TPWD trawls, 1982 through 1990.

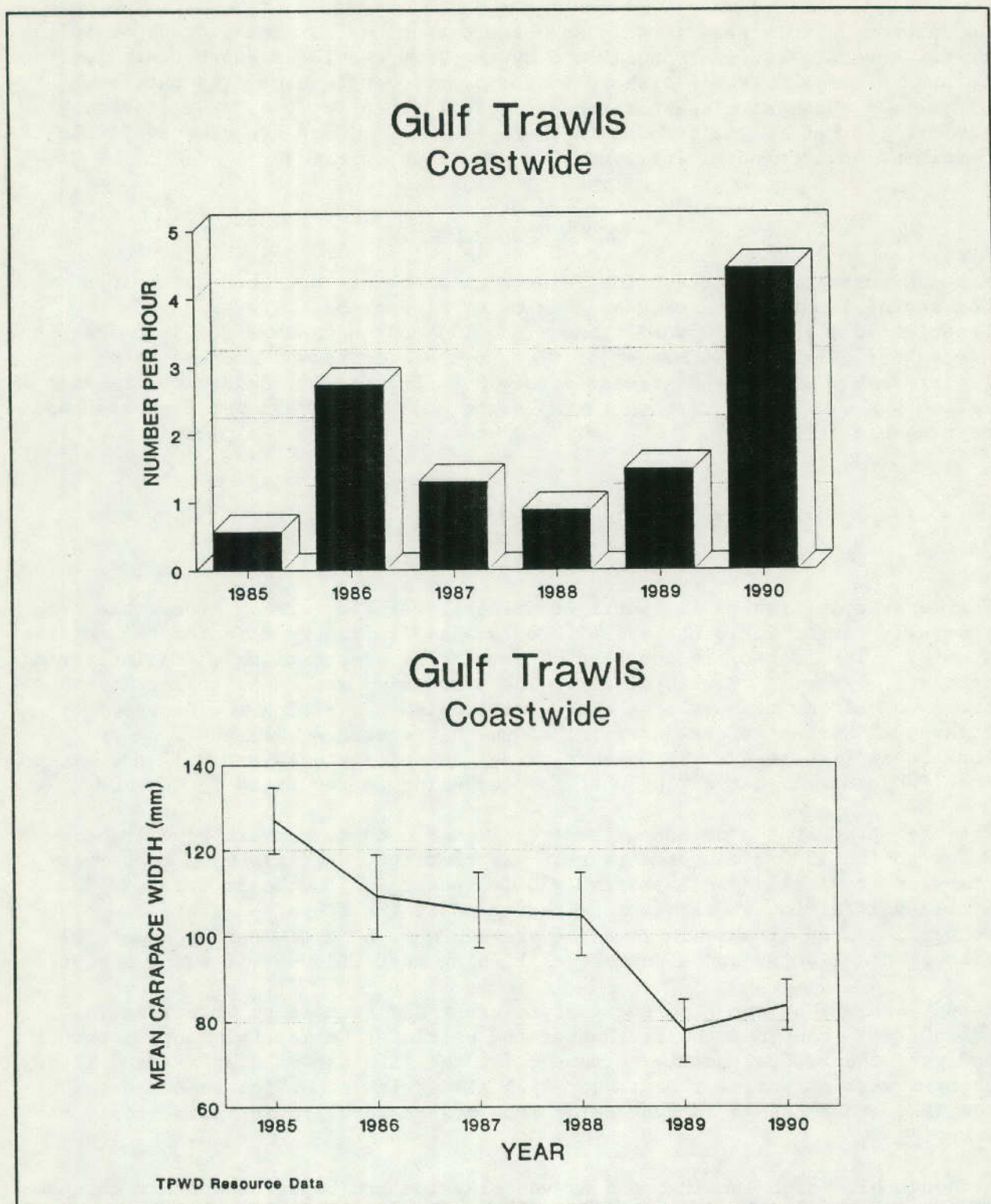


Figure 5. Relative abundance (number per hour) and mean size ( $\pm 1$  SE) of blue crabs caught in gulf waters within 9 nautical miles of shore with TPWD trawls, 1985 through 1990.

No spawner-recruit relationship has been determined for Texas or other Gulf states but data routinely collected by the TPWD should be appropriate for future analysis. TPWD's fishery-independent juvenile blue crab data may ultimately document a spawner-recruit relationship for the Texas fishery similar to that recently found in Chesapeake Bay. Data are also available to determine environmental influences on abundance of crabs.

### SUSTAINABLE HARVEST

Maximum sustainable harvest for Texas blue crabs has not been determined. Commercial landings and ex-vessel value of blue crabs in Texas have experienced a general upward trend since 1969 but both have declined sharply since 1987 (Figure 6). Number of fishermen has increased whereas catch per fisherman has steadily decreased since 1979 (Figure 7). Reduction in catch reflects a decline in catch per trap since number of traps per fisherman has been stable (Figure 8).

### UTILIZATION

#### Commercial Fishery

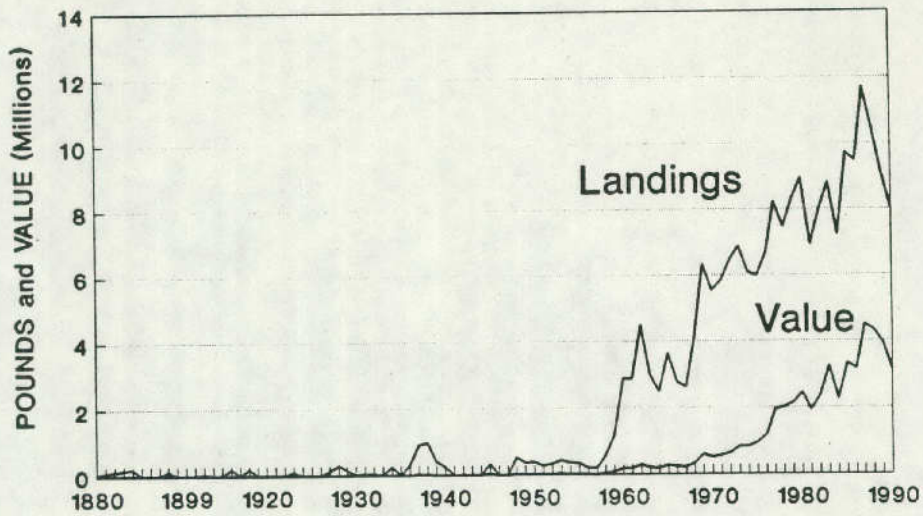
The Texas crab fishery is comprised primarily of blue crab. Stone crabs are generally caught incidentally, with only a small fishery directed toward this species. The fishery is composed of commercial, recreational, and incidental catch (i.e. shrimp trawl bycatch). The processing sector is an important component of the fishery that often complicates harvesting and management strategy. Market prices determine how much processors will buy from an individual fishermen. The "basket trade" out-of-state is not well documented. The TPWD controls harvesting whereas processing is regulated by the TDH.

The crab trap is the dominant commercial gear used to harvest blue crabs. Prior to the 1940's the primary gear was trotline. Vessels used to harvest crabs are typically small skiffs (<20 ft) powered by outboard motors. Thus, little initial investment is required to enter the fishery. There is no commercial crab license in Texas; fishermen must hold a General Commercial Fisherman's License and a Commercial Fishing Boat License (if using a boat).

Recent actions by the 72nd Legislature created a commercial Crab Trap Tag (\$1.50/tag), combined the Freshwater and Saltwater Commercial Boat Licenses, and gave the TPWC authority to manage for the safe use of crab traps. These changes were effective 1 September 1991 along with a new fee schedule set by the TPWC and a change in buoy color from orange to white for commercial crab traps.

Although blue crab landings and ex-vessel value are reported monthly through the Monthly Marine Products Report (MMPR), the TPWD historically has relied on National Marine Fisheries Service (NMFS) estimates for commercial fishing effort. The new legislation mentioned previously (September 1991) should

## Blue Crab Landings Total



## Since 1960

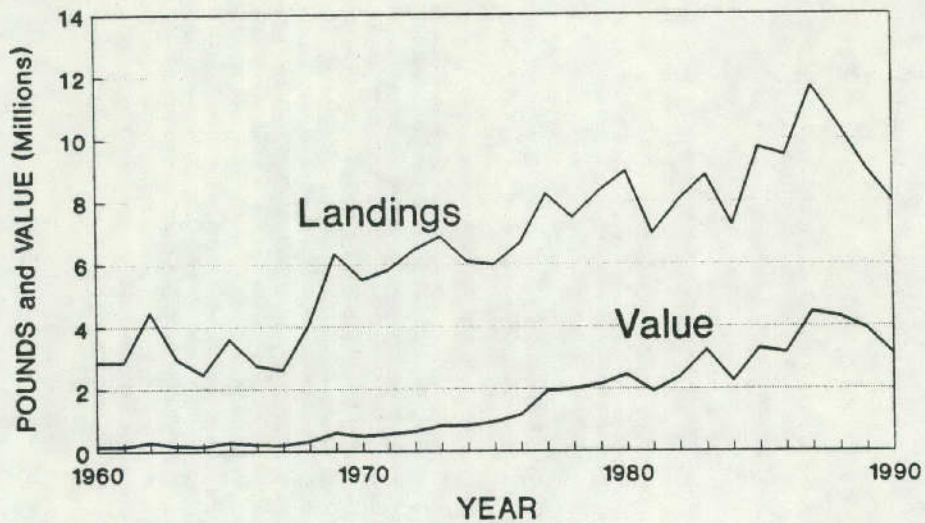


Figure 6. Annual Texas landings (pounds) and ex-vessel value in the Texas blue crab fishery, 1880 through 1990.

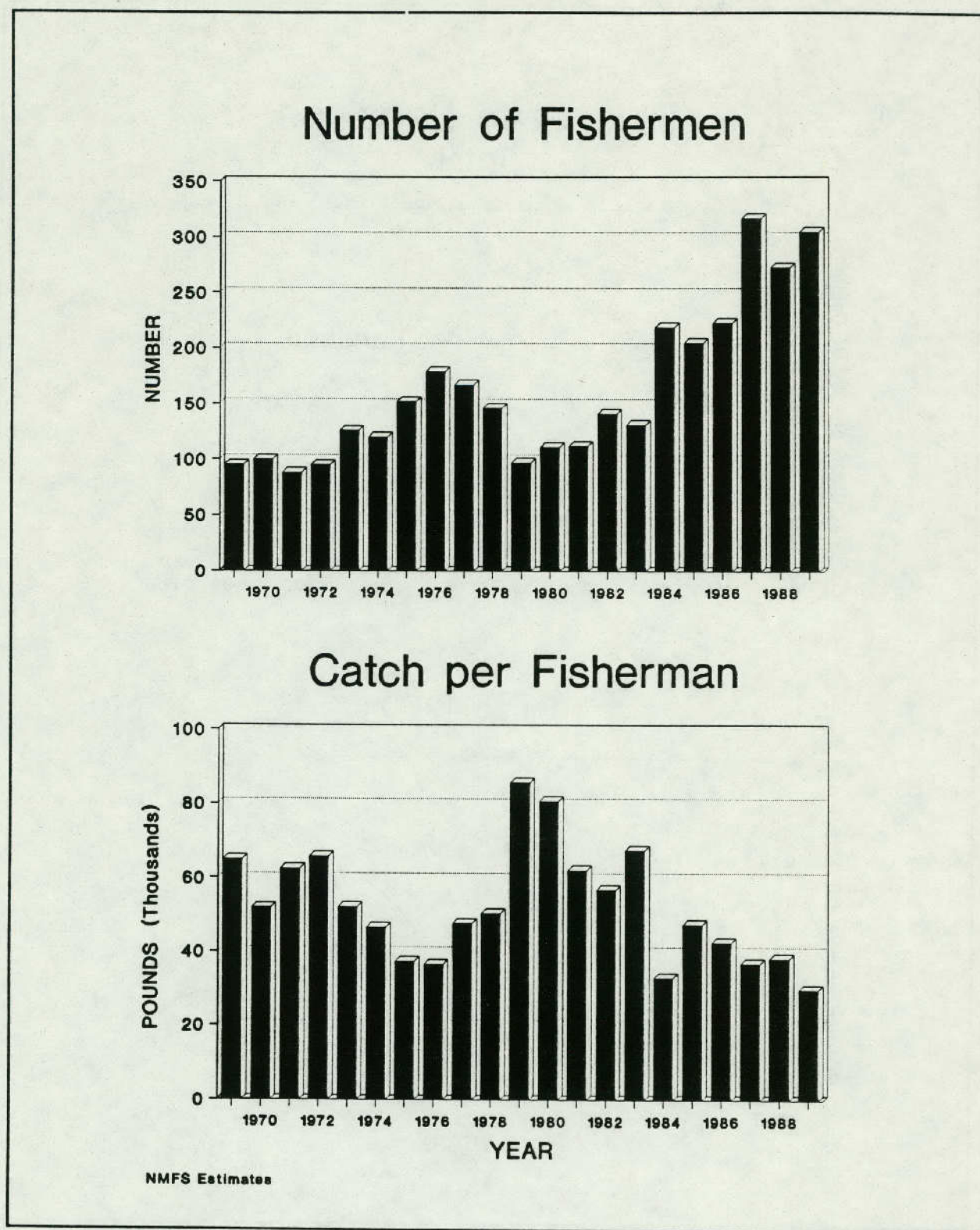


Figure 7. Annual estimates of the number of fishermen and catch per fisherman during 1969 through 1989 (National Marine Fisheries Service data).

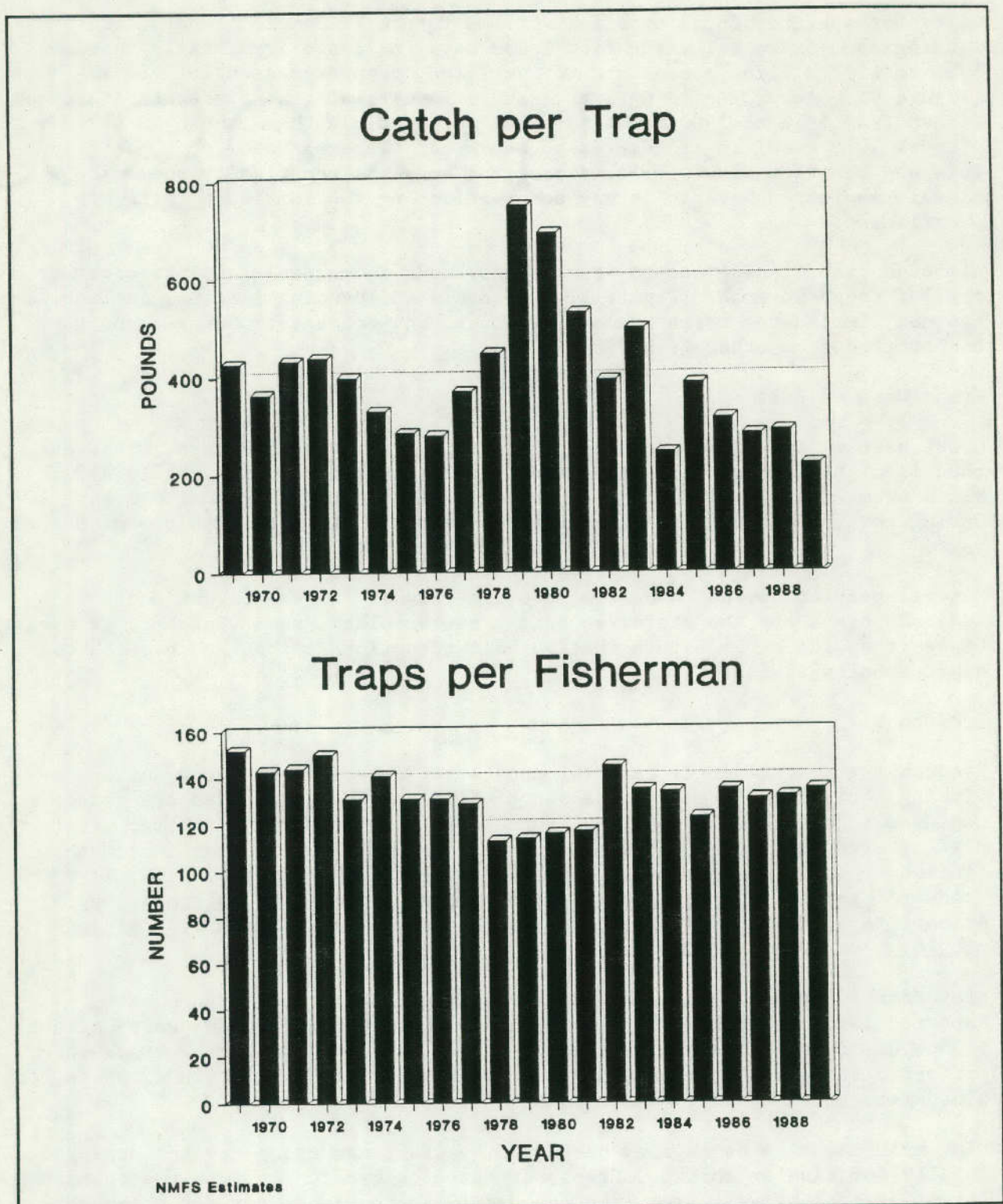


Figure 8. Annual estimates of catch per trap and the number of traps per fisherman during 1969 through 1989 (National Marine Fisheries Service data).

allow for a better focus on effort in the future. Commercial hard crab landings and ex-vessel value from Texas bays increased irregularly through 1987 to 11.7 million pounds and \$4.5 million, then decreased in 1988-90 (Figure 9). According to NMFS estimates, numbers of crab fishermen and traps fished from 1979 to 1989 have increased more rapidly than landings (Figure 10), resulting in decreased catch per fisherman and catch per trap. This and the fact crab size is decreasing suggests the fishery should be closely monitored because it may be experiencing the initial effects of overfishing.

Although crab fishing occurs year around, most commercial landings occur from April through November (Figure 11). Factors influencing landings include, but are not limited to, market demand, weather, environmental changes, and competition from other fisheries.

#### Crabs Used As Bait

Crabs have minimal importance as bait for recreational fishermen, with less than 1% of sport-boat fishermen reporting crabs used as bait from 1983-90. Black drum (Pogonias cromis) is the species most often caught with crabs. During the "black drum run" from February-March crabs are often the preferred bait.

Several studies on the commercial trotline fishery in the Laguna Madre indicate crabs are the preferred bait type for black drum. Catch rates are higher than for other natural baits, bait retention is good and bycatch of other species is low.

#### Bycatch

Bycatch is the incidental catch of non-target organisms captured during fishing activities. Several species of finfish, and stone crab are often captured in crab traps. Entrance funnels leading into the crab trap limit size of organisms susceptible to capture to about 6 to 8 inches in length. Finfish typically caught include pinfish (Lagodon rhomboides), Atlantic croaker (Micropogonias undulatus), black drum, flounder (Paralichthys sp.), Atlantic spadefish (Chaetodipterus faber) and spotted seatrout (Cynoscion nebulosus).

Stone crabs are a commercially important component of crab trap bycatch. Reported landings in 1990 were more than 53,000 pounds of claws worth almost \$135,000. Stone crabs are targeted by some fishermen by setting traps in preferred stone crab habitat, but most are taken incidentally in traps set for blue crab.

Blue crab may also be legally harvested by fishermen using devices deployed legally for fish or shrimp. Crabs harvested as bycatch in trawls accounted for 6% of crab harvest from 1948 through 1978, the last year for which data were available.

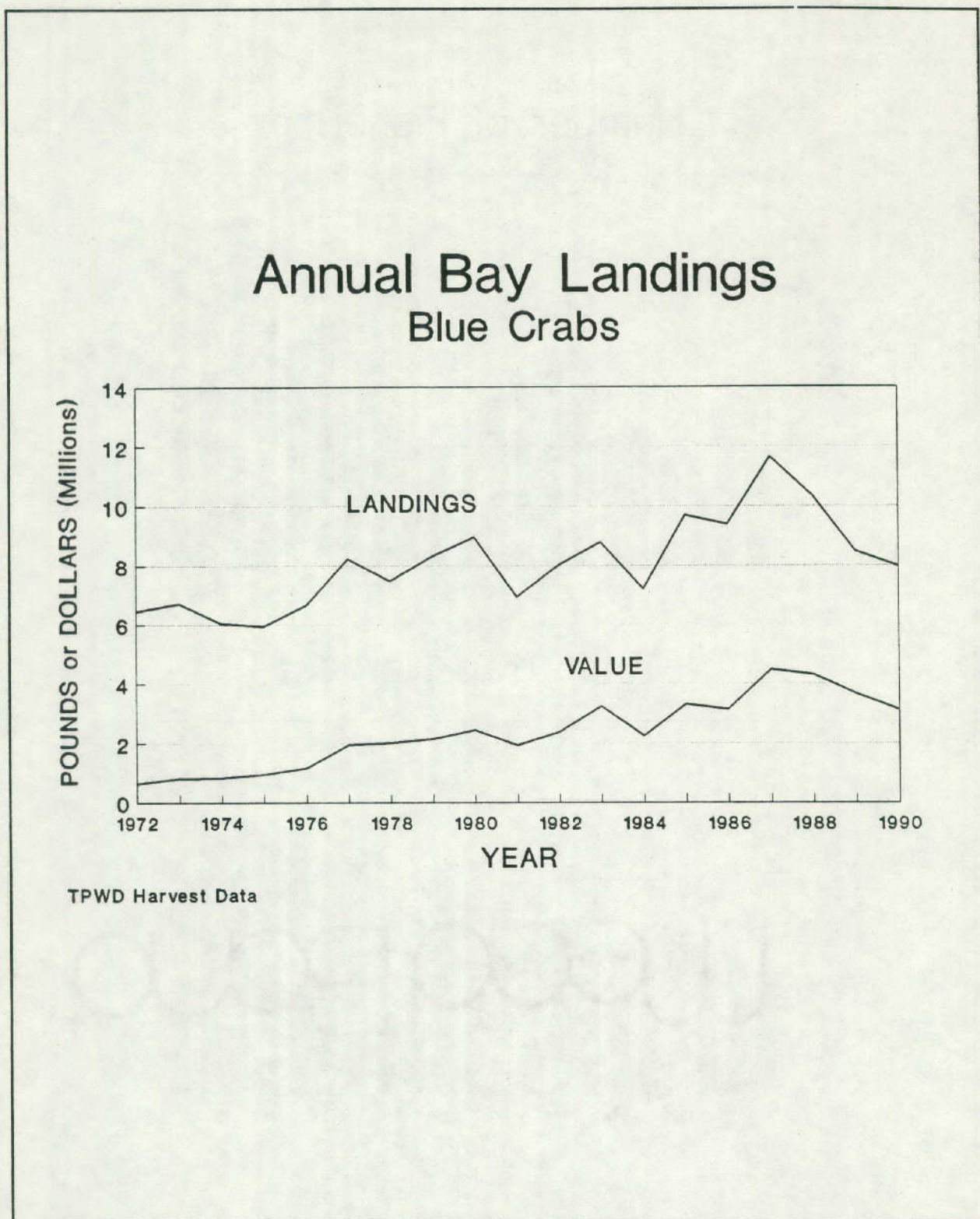


Figure 9. Annual Texas landings (pounds) and ex-vessel value of blue crabs from Texas bays during 1972 through 1990.

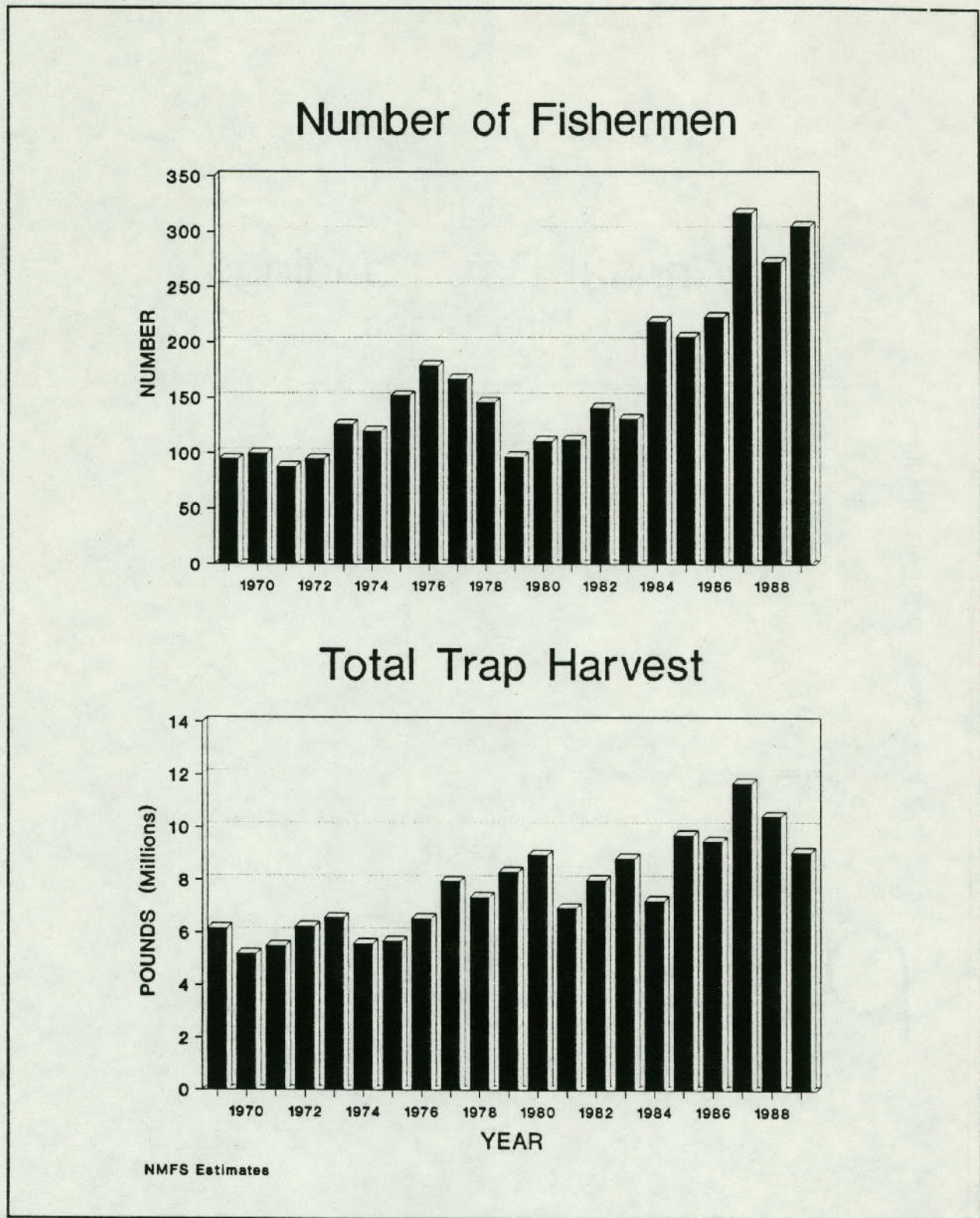
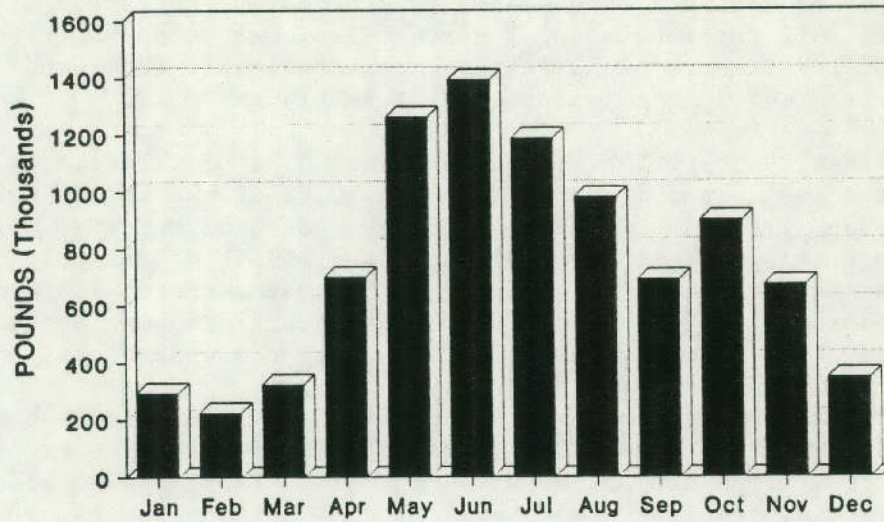
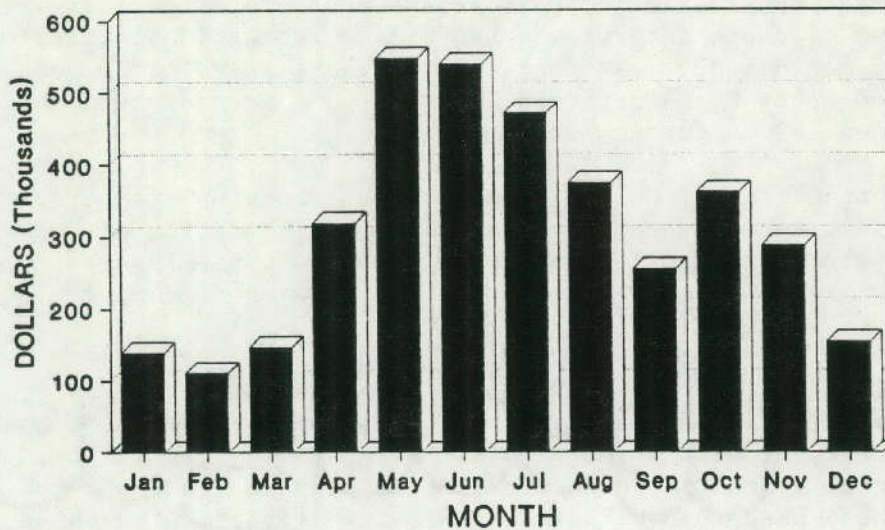


Figure 10. Number of fishermen and total trap harvest (pounds) during 1969 through 1989 (NMFS estimates).

## Bay Landings 1988-90 Mean



## Bay Value 1988-90 Mean



TPWD Harvest Data

Figure 11. Monthly blue crab landings (pounds and dollars) from Texas bays (1988-1990).

### RECREATIONAL FISHERY

Data on recreational catch of crabs are sparse. The sport fishery is thought to contribute significantly to total fishing pressure, but estimates of the impact of recreational fishing on the resource vary widely. Crab traps and hand lines are the most utilized gears. Historically, recreational catches were high. In 1968 the recreational harvest from Galveston Bay was estimated at about 6% of the commercial harvest. Recent estimates from other Gulf states range from <4% in Mississippi to 20% in Alabama.

From May 1990-May 1991 sport crabbing comprised 0.3% of all fishing activities at Texas boat access sites (ramps and docks), 0.8% of the interviews on lighted piers and 1.7% of the activity during wade/bank surveys. Overall, 0.7% of sport fishing trips targeted blue crabs; 99.1% of all trips were made by finfishermen. Percent of all trips from boat access sites for blue crabs has remained 0.3% since 1989. Most sport crabbing activity from boats, lighted piers or wade/bank areas was along the upper Texas coast.

Over 68% of all trips for crabs were successful (at least one crab retained) from May 1990-May 1991. TPWD surveys reveal 91% of boat crab trips, 77% of lighted pier crab trips and 53% of wade/bank crab trips were successful. Fishermen targeting crabs were more successful than finfishermen who landed crabs during their fishing trip (26 per trip vs 11). Catch rates were highest along the upper Texas coast.

A recent survey of outdoor recreational activities in Louisiana revealed <1% considered recreational crabbing their most preferred outdoor activity. Slightly over 5% considered it their second most preferred activity. Less than one-third of those interviewed had made a recreational crabbing trip during the 12 month study. Recreational crabbers travelled a mean distance of 17.6 miles and spent \$6.24 per trip compared to a mean distance of 70 miles and expenses of \$42.06 for saltwater anglers.

Recreational crab trap fishermen were exempted from the crab trap tag requirement instituted by the Legislature. Quantification of recreational crab traps would require direct observation of buoy markings.

### ECONOMIC IMPACT

Total average annual economic impact (with multiplier) of the commercial blue crab fishery for the past 6 years is estimated to be \$12 million. Economic impact from crab production can be estimated using an economic multiplier similar to those used in other fisheries. Crab fishermen purchase goods and services to harvest crabs. They also support families from income earned from the sale of crabs. Wages are distributed into various sectors of the economy. Products and by-products of crabbing activity also generate income for various other sectors (e.g., processing plants, restaurants, grocery stores).

Multipliers are a measure of the quantity of economic activity stimulated by purchases of crab fishermen. The economic impact for 1985 through 1990 reached a peak in 1987 at about \$14 million when the multiplier (3.12) is used.

Table 1. Coastwide landings (whole weight), ex-vessel values and economic impact for 1985-1990.

<u>Year</u>	<u>Landings (lb)</u>	<u>Value (\$)</u>	<u>Economic impact (\$)</u>
1985	9,722,000	3,310,000	10,327,000
1986	9,482,000	3,170,000	9,890,000
1987	11,688,000	4,474,000	13,959,000
1988	10,428,000	4,326,000	13,497,000
1989	9,066,000	3,946,000	12,312,000
1990	8,005,000	3,132,000	9,772,000
Average	9,732,000	3,726,000	11,626,000

#### CRAB MANAGEMENT

##### Management Structure

Chapter 12, Parks and Wildlife Code, gives the TPWD authority to administer laws relating to game, fish, oysters and other marine life in Texas waters. The Texas Parks and Wildlife Commission was granted regulatory authority in all 18 coastal counties via the Wildlife Conservation Act of 1983 (Chapter 61, Parks and Wildlife Code), and has additional authority in certain other areas via Chapter 66, Parks and Wildlife Code.

Chapter 436 Subchapter C of the Texas Health and Safety Code grants the Texas Department of Health the authority to regulate the crab processing industry in Texas. Chapter 436 Subchapter A of the Texas Health and Safety Code grants the Texas Department of Health the authority to declare a harvest area of any aquatic life prohibited for the purpose of protecting human health.

## Management Regulations

### Historical

Subchapter C of Chapter 61, Parks and Wildlife Code, defines the regulatory duties of the TPWC and the TPWD. The TPWD 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 finding 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 Chapter 61. 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.

In Jefferson County, the governing body of the city of Port Arthur may designate or otherwise regulate by ordinance the location and placement of traps in the waters of Lake Sabine within the corporate limits of the city.

The Texas Department of Health has an area of Lavaca Bay near Point Comfort closed to the taking of blue crabs because of mercury contamination.

### Current

Current regulations are comprised of the statutes and regulatory mandates detailed in the previous section (Table 2). The Gulf States Marine Fisheries Commission published a regional management plan for the Gulf of Mexico blue crab fishery in 1990 which contains management measures which are not binding. Authority for enactment and enforcement of blue crab fishery regulations resides with the TPWC.

## Management Strategies

### Historical

Management regulations have been implemented to prevent over-harvest of the recruitment stock through the setting of a minimum size limit, area restrictions for trap placement in Aransas County, regulation of means and methods of harvesting crabs, habitat protection, protection of egg-bearing females and imposition of penalties for noncompliance with regulations. Each of these objectives is further addressed through the TPWD'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: The TPWC has managed the crab fishery with the goal of preventing depletion and providing for a sustainable population. To achieve these goals minimum size limits, protection of egg-bearing females and regulations governing the means and methods of taking crabs have been implemented.

Chapter 12, Parks and Wildlife Code provides 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 TPWC to provide a flexible mechanism to deal effectively with changing conditions to prevent depletion and waste of wildlife resources.

RECOMMENDATIONS: Blue crab management should remain with the Texas Parks and Wildlife Commission so that resources can be managed on a timely basis.

2. Joint Management: Texas blue crab populations are part of a common stock that ranges throughout the Gulf of Mexico. As such, they fall under the jurisdiction of several states and agencies. Blue crab resources of Texas are managed by the TPWD (state waters out to nine nautical miles) and the Texas Department of Health. The TPWC has direct authority over state waters but Department staff also serve as voting or advisory members on various committees and work groups of the Gulf States Marine Fisheries Commission which is an interstate compact for the Gulf states. Texas also shares jurisdiction of Sabine Lake with Louisiana and the Rio Grande River with Mexico.

RECOMMENDATIONS: The TPWD should continue to work with other entities to coordinate blue crab management. Upon adoption of this Plan the TPWD staff should work to incorporate management actions and recommendations based upon the Plan into Gulf States Marine Fisheries Commission initiatives. This coordinated effort can provide for more effective management of the blue crab resources of Texas and the Gulf.

Because it is vital to have continued input of all individuals and groups interested in the crab resources of Texas, a crab advisory committee consisting of persons from the blue crab industry and individuals and groups interested in the blue crab resources of Texas shall be selected by the Chairman of the Texas Parks and Wildlife Commission for the purpose of advising Department staff on implementation of the Blue Crab Plan. In appointing members of the committee, the Chairman is encouraged to develop a balance among various interests including, to the extent practicable, representatives of commercial crab harvesting, recreational crab harvesting, crab processing, recreational finfish fishing and non-consumptive uses. The Chairman may also consider appointing a member of the Law Enforcement Division with field experience in enforcing crabfishing regulations to serve as an ex officio member or advisor to

the committee. Public hearings will be used by TPWD to provide additional input in the process. As specifics of this Plan are developed by the adoption of rules and regulations by the Texas Parks and Wildlife Commission, the advisory committee will assist the TPWD staff in the preparation and formulation of each rule and regulation prior to presentation to the Commission for its action.

3. Size Limits: There is a five inch minimum size limit in blue crab carapace width measured from tip of spine to tip of spine. Not more than five percent by number of undersized crabs may be possessed if placed in a separate container at the time of taking. All crabs less than the minimum size not retained must be returned to the waters from which taken.

RECOMMENDATIONS: Size limits are an effective management measure to accomplish the objectives of this plan. The establishment of a larger minimum size for the crab fishery should be reviewed to determine if there is the potential to increase the optimum yield of the crab fishery; however, before considering any change in the current size limit, biological, economic and social factors should be evaluated for both the commercial and the recreational aspects of the fishery.

4. Time Restrictions: There are currently no time or seasonal restrictions for blue crab fishing in Texas. However, traps must be removed from the water when not being actively fished and a gear tag must be re-dated every 30 days.

RECOMMENDATIONS: Restriction of crab trap tending to daylight hours only should be considered in Texas to facilitate law enforcement and reduce crab and crab trap theft.

5. Closed Areas: Crab trap fishing is currently restricted by the TPWC only in portions of waters in Aransas County. Laws passed by the Legislature were adopted by the Commission when Aransas County came under regulatory authority. Placement of traps within 200 feet of marked navigable channels in Aransas County was restricted on the basis of safety. Crab fishing is also currently restricted by the Texas Department of Health in a portion of Lavaca Bay near Point Comfort due to mercury contamination.

RECOMMENDATIONS: The Commission has the authority to regulate the means, methods, manners, and places where crabs may be taken based on biological considerations, as well as the placement of crab traps based on safety of persons engaged in fishing, boating, and other water activities. Regulations should be reviewed based on this authority and their enforceability to evaluate spacing and marking of crab traps, prohibition of crab traps in certain areas at certain times, and authorized seizure of abandoned traps or traps in unauthorized areas. The Aransas County regulation (Sect. 65.78) appears to be successful and similar rules should be considered coastwide.

6. Means and Methods: Taking of crabs is currently limited to the methods in Table 2. Crab traps are the most frequently used method of taking crabs; therefore, traps and floats that mark them are regulated.

A trap identification system (e.g. trap tags issued by the Department) was recently established by the 72nd Texas Legislature. This system will provide more precise effort data, help insure trap accountability, reduce trap theft, reduce fishing by lost or abandoned traps, and facilitate law enforcement.

RECOMMENDATIONS: Regulations on means and methods should be standardized where practical and designed to reduce waste and enhance law enforcement.

Effort should be made to find a suitable replacement for plastic and styrofoam floats to reduce the amount of non-degradable plastic left in bays from abandoned or lost floats and decrease the hazards associated with traps with no visible markers.

To reduce sub-legal catch, increase or maintain legal catch, reduce culling time, and reduce fishing by lost or abandoned traps, escape vents or biodegradable panels should be considered for use on all traps.

TPWD should study the use of various fishing practices (e.g. culling and salt boxes) to quantify the effect of crab mortality on the fishery and develop regulations, if necessary, to protect the crab resources.

TPWD should assess the feasibility of combining the crab trap tag and the gear tag.

7. Bag and Possession Limits: There are no bag or possession limits in the blue crab fishery.

RECOMMENDATIONS: Bag and possession limits are management tools that could be used in the fishery since crabs can be released alive, but are not recommended at this time.

8. Licenses: The TPWD has the responsibility of issuing licenses, established by the Legislature, for the privilege of catching, buying, selling, unloading, transporting or handling blue crabs within jurisdiction of the State. License documentation provides TPWD with a universe of fishery participants. Fees for non-resident fishermen are usually higher than those for resident fishermen. The TPWC may increase fees from the minimum set by law.

The only licenses required to commercially harvest blue crabs in Texas are a General Commercial Fisherman's resident or non-resident license, a Commercial Fishing Boat License, and a crab trap tag.

The 72nd Legislature approved a crab trap tag (\$1.50) for individual crab traps. Data available from the sale of this tag can be used to determine number of commercial crabbers within the state and to document fishing effort and distribution of fishery participants. The legislation also stipulated the fee can not be changed until a crab management plan has been adopted and a crab advisory committee established.

**RECOMMENDATIONS:** The licensing and fee system should be as simple as possible. It should be designed to produce revenue to pay for management, recovery of economic rent associated with removal of the State's resources, and provide catch and effort data necessary for effective management.

The statutory system of trap tags should be reviewed to determine if gear tags, fishermen licenses, or a combination of both systems would be the most effective means to achieve the objectives of this plan. Such a method should be instituted to allow for determination of the number of commercial crabbers within the state and to document fishing effort and distribution of resource users.

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

**RECOMMENDATIONS:** Consideration should be given for increasing penalties for violating regulations, especially for violations of the recommended primary management tools. 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. 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 among user groups can be accomplished directly (by quotas, bag limits, limited entry, etc.) or indirectly through regulation of fishing means, methods, times, seasons, gear, etc. Historically, the TPWC has allocated blue crab resources through indirect methods.

**RECOMMENDATION:** The necessary data should be obtained to assess the current allocation of the blue crab resources among user groups. The feasibility of implementing access limitation into the commercial Texas blue crab fishery should be considered to achieve the objectives of this Plan.

11. Shedding Technology Development: Current laws allow the shedding of soft-shell blue crabs in private waters of the state, but problems associated with soft crab shedding (peeler availability, legality of harvesting gears and economic conditions) have prevented large-scale efforts to shed soft crabs in Texas. For nearly a decade, size limits

were liberalized to allow for the development of a soft-shell crab industry and for the use of small crabs as bait. This liberalization made the 5-inch minimum size limit effectively unenforceable. During this period no significant soft-shell crab industry developed. Also, there are alternatives to using small crabs for bait, e.g. parts of legal sized crabs can be used. Considering the increased fishing pressure and decreasing size of crabs, the exception allowing the unlimited take of undersize crabs (for bait or shedding purposes) was eliminated effective 1 September 1990.

**RECOMMENDATIONS:** The TPWD should monitor development of shedding technology and production in the soft-shell crab industry and determine impacts of current regulations on the soft-shell crab industry.

12. Mariculture Development: Current state law allows culture of blue crabs in private waters of the state, but problems associated with blue crab culture, such as cannibalism, have prevented large-scale efforts to raise crabs in captivity. In order to engage in aquaculture, an Aquaculture (Fish Farmer's) License is required from the Texas Department of Agriculture.

**RECOMMENDATIONS:** The TPWD should continue to monitor development of mariculture techniques and commercial production of cultured blue crabs.

13. Habitat Maintenance, Restoration, and Enhancement: The TPWD is required to conduct continuous research and study of environmental parameters and other factors that affect finfish, shrimp and oyster populations. The Department is also required to study industrial and other pollution of water naturally frequented by finfish, shrimp and oysters. Crabs are included in all studies since they are often associated with fish, shrimp and oysters.

**RECOMMENDATIONS:** The long-term viability of the Texas blue crab fishery depends on maintenance and enhancement of crab habitat. The TPWD should continue to aggressively protect and enhance blue crab 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 blue crab population abundance and stability in Texas bays and the Gulf of Mexico, and to monitor environmental factors which may influence crab 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 continue to be collected.

**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, total landings and value of blue crabs 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 MMPRs. 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 blue crab 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 TPWD's Six-Year Plan requires the collection of samples to assess annually the status of marine resources and associated environmental variables. The TPWD is responsible for making management recommendations regarding the State's blue crab 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 TPWD 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.

RECOMMENDATIONS: The TPWD should continue to maintain a high level of interdepartmental, industrial and interagency communication to more fully benefit from the free flow of information concerning blue crab research, adverse environmental conditions and changes in economic and societal goals. The TPWD will periodically update the data and information contained within the Blue Crab Fishery Management Plan.

18. Plan Implementation and Reporting: Upon its adoption, the Texas Blue Crab Fishery Management Plan will be utilized to guide the Commission and the Department in the management of the blue crab fishery resources of Texas. The Blue Crab Advisory Committee will be a key element providing advice to the Department staff in the management program.

RECOMMENDATIONS: An initial task of the Blue Crab Advisory Committee should be to determine a schedule for study, discussion, and action, if required, on each of the recommendations made in this plan. The Advisory Committee should present an annual report to the Regulatory Committee of the Texas Parks and Wildlife Commission to report on the progress being made on the review and implementation of the recommendations.





