Economics of Harvesting and Market Potential for the Texas Blue Crab Industry

Marine Fisheries

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ABSTRACT

Economics of Harvesting and Market Potential for the Texas Blue Crab Industry

Within the Gulf of Mexico region Texas ranks third in blue crab production. Beginning in 1975, two things occurred which directly affected the Texas blue crab industry. The first was an increase in involvement of Northeastern interests in the Gulf processing industry. The second was the influx of Indochinese pickers and crabbers into the Texas crab fishery. These developments resulted in increased production due to more efficient harvesting and processing and an increase in the export of whole crabs and crabmeat to East coast markets.

The first purpose of this study is to describe the Texas blue crab industry. The second major objective of the study is to identify market development opportunities within Texas and the surrounding region.

The blue crab harvesting sector is comprised of two basic groups, Indochinese and indigenous crabbers. Survey results indicated that the average crabber uses a fiberglass sport boat and 200 traps. According to the survey, returns above costs for a typical crabber are less than $4000. The major problem identified by crabbers is the low ex-vessel price in relation to the price for inputs.

The typical crab consumer was shown to be a middle-aged white

collar worker. He is usually from a small household and is in the middle income range. Demographic projections indicate that this socioeconomic group will be increasing in number resulting in a growing market for crab. The growing trend toward fast food and the resulting diversification of restaurant menus to include seafood offers another market development opportunity for the crab industry.

Currently crab consumption in Texas is estimated to be 4.5 million pounds of raw crabs. If demographic projections materialize this figure could double. In order to supply a growing market good reliable crabbers will need to be attracted into the industry. The lack of consistent crabbers was a problem before entry of the Vietnamese and could conceivably be a problem again if ex-vessel price does not increase significantly. If a larger regional market should develop, prices rise and greater interest develops in commercial harvest then the resource may come under greater pressure. This suggests that greater emphasis be placed upon more refined public management including licensing of commercial crabbers.

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INTRODUCTION

Background

Texas, primarily thought of in context with oil and agriculture, has vast coastal resources associated with its 624-mile coastline. These resources are used extensively in trade, energy, industrial development and recreational activities. The Texas coast is fringed by an almost continuous array of bays, inlets, lagoons and marshes. This estuarine area, where nutrient-rich freshwater is mixed with saltwater, is a biologically dynamic zone which supports lifecycle stages of many commercially important species of fish and shellfish. These species support another important industry in this area, that of commercial fishing. Though not considered a dominant user of coastal resources, the fishing industry employs thousands of Texas residents and, in 1981, contributed over $500 million to the Texas economy (Texas Coastal and Marine Council).

The shrimp fishery is the dominant component of the Texas commercial fishing industry, accounting for 95 percent of the total value of the industry. In 1981 this segment had a dockside value of approximately $165 million. The shrimp fishery is divided into two segments, bay and Gulf. While the Gulf segment has struggled through some recent record poor years and has felt the effects of the permanent closure of Mexican waters, it is the bay segment that is currently facing severe economic conditions. An increasing number of boats entering the fishery has resulted in average landings per boat which are well below historic levels. This factor, combined with sharply rising harvesting costs, has resulted in profit levels near or below the break-even point

for many boats (Texas Coastal and Marine Council). In the long run many of these vessels will be forced to leave the bay fishery or exit the fishing industry altogether.

Finfish, oyster and blue crab fisheries also are components of the Texas fishing industry and together they account for the remaining five percent of the industry's estimated dockside value. In 1981 this was $4.2, $2.0 and $1.9 million, respectively. The finfish component of the fishing industry has been diminished considerably by the 1981 legislation that prohibits the sale of redfish and speckled trout caught in Texas waters. This affected approximately 300 fulltime fishermen, many of whom entered the bay shrimp fishery (Tom Moore, personal communication). Landings of oyster meat declined over the early 1970's from 4.7 million pounds in 1970 to 1.4 million pounds in 1975. Landings have fluctuated between .95 and 3.9 million pounds since 1976. The overall trend in blue crab landings, however, has been upward since 1960. Presently, this fishery represents the only expanding fishery in Texas and the other Gulf states (Perkins).

Development of the Texas Blue Crab Industry

The first documented blue crab processing plant was built at Palacios in 1958. However, a previously built plant may have been in operation in Flour Bluff. The Palacios plant provided a market outlet for crabs, few of which had been landed in commercial quantities in the state previously, and attracted fishermen from other areas, mainly Florida and Mississippi. By 1961, three crab processing plants were operating in Texas. From 1958 to 1962 fishing effort was concentrated in Aransas-Copano and Matagorda bays. In 1963, due to declining catches,

most fulltime crab fishermen moved to other areas, mainly Galveston and San Antonio bays. The number of plants operating during 1965-1967 ranged from eight to ten. Most plants employed only a few workers and were closed for most of the winter (More 1969).

During the 22 year period from 1960 through 1981 Texas accounted for 8 to 22 percent of total Gulf landings. The Texas hardshell blue crab industry is currently the third largest in the Gulf, behind Louisiana and Florida, with average landings, since 1970, of 6.8 million pounds worth $1.3 million dockside. There are presently 10 processing plants operating in Texas, five of which have the capacity to process 10,000 pounds or more of raw crabs per day. Production is centered in Galveston, Matagorda, San Antonio and Aransas bay systems. Since 1977 the crab fishery has ranked second among Texas fisheries in number of pounds landed but only fourth in value (with the exception of 1978 when it ranked third).

Two things began to happen in 1975 which directly affected the Texas blue crab industry. The first was a significant increase in the involvement of Northeasterners in the Gulf processing industry in the form of partnerships or ownership of processing facilities. Presently three of the major plants in Texas are owned by northeastern companies. A large but unknown quantity of live and processed crabs has been diverted into this market. Additionally, increases in population and incomes in the Southeast have resulted in an increased demand for crabs and crabmeat in that region (Perkins).

A second factor affecting the blue crab industry has been the movement of Vietnamese refugees into the state. Approximately 16,000 Indochinese refugees settled along the Texas Gulf coast from 1975 to

1979 (TransCentury). Many of these refugees were former coastal villagers with highly developed fishing skills and were attracted to employment opportunities consistent with their skills and past experience as well as to the favorable coastal climate (Starr). Presently there are approximately 51,824 Indochinese (Vietnamese and Cambodian) refugees settled in Texas. While the primary resettlement of refugees is considerably reduced from initial levels, there is still significant secondary migration into the state from other regions of the United States (State of Texas Office, Washington D.C.). It is probable that some of these people may be entering the blue crab industry.

Prior to the arrival of the Vietnamese refugees, many processing plants found it difficult to locate sufficient personnel. Local residents were not interested in this type of work. Encouraged by successes in using Vietnamese for crab processing in Louisiana, Texas processors began employing Vietnamese pickers. The result has been a highly productive work force which has reduced the cost per pound of processed meat (Swartz and McIntosh).

The crab fishery is the easiest and least expensive fishery to enter. Because of the low investment required and its relatively unsophisticated technological nature it is also the least prestigious of Texas fisheries. Initial investment is estimated at approximately $5,000 to $8,000 for boat and motor, pots and related gear (Charles Moss, personal communication). A commercial crabbing license is not required in Texas. Because of this low investment cost and because they were discouraged by indigenous fishermen from entering into other existing fisheries, some Vietnamese entered the harvesting sector of the blue crab industry. In 1978 in Seadrift, Texas, there were 23

Vietnamese crabbers and 6 local crab fishermen. An estimated 2 million pounds of crabs were landed that year in Seadrift, with an estimated 79 percent or 1.3 million pounds landed by Vietnamese crabbers (Swartz and McIntosh). Vietnamese entry into the fishery has significantly increased the supply of raw crabs to several processors along the Texas coast (personal communication with Texas blue crab processors).

Problem Setting and Objectives of the Study

With conditions being as they are in the shrimp and finfish fisheries it would be beneficial to the fishing industry and the Texas economy as a whole to develop new or underutilized fisheries that would: (1) create alternative opportunities for fishermen presently engaged in the bay shrimp fishery, (2) create expanded employment opportunities for coastal residents, in particular the Indochinese, and (3) stimulate the economic growth of the Texas Gulf region. One of the existing fisheries presently thought to have potential for further development is the blue crab fishery. The growth of this industry, while not spectacular, has been steady. With the availability of an efficient work force to process crabs and a reliable source of raw crabs, it is conceivable that this industry could enter into and develop new market areas. Since the early 1970's the Texas crab fishery has depended heavily on its Northeastern market outlets.

Dependence on a distant market, such as the Northeast, can lead to several problems for a fishing industry. Coordination between production decisions and consumption decisions is harder to achieve due to untimely price and quantity information. This can adversely affect producer incomes if the market is over supplied and, if the coordina-

tion problem continues, can lead to price uncertainty. Landings of the same or a closely substitutable species by fisheries in the market region may also cause price uncertainty. This can have either a negative or positive effect on producer incomes. Finally, as distance from the producer to the market increases, control over the product in the marketing channel decreases, which can lead to untimely delivery or delivery of a poor quality product. This is especially important in marketing seafood, because of its high perishability.

Development of a regional market could eliminate or lessen the effects of these problems. Coordination would be improved because shorter distances and fewer handlers would result in more timely market information. Reduction in distance and number of handlers would mean increased product control for the processor and would also mean reduced freight cost. The result of these advantages could be eventual improvement in producer incomes. Of equal importance are the capabilities of the harvesting sector itself. New markets cannot be effectively developed unless this sector is capable of supplying the increased demand. At the present time little is known about the characteristics of the Texas blue crab harvesting sector.

The purpose of this study, then, is to describe the fishery as it exists today and to analyze its potential for further development. Specifically, the objectives of the study are to:

(1) Review and describe the blue crab industry in Texas.

(2) Determine the major characteristics of the harvesting sector of the blue crab industry.

(3) Identify and describe the marketing channels utilized by the industry.

(4) Identify major economic and marketing problems currently facing

the industry.

(5) Identify the socioeconomic and demographic characteristics of consumers of crabmeat and other shellfish and describe how these might affect development of a regional market for blue crab.

Literature Review

The literature on the blue crab and the blue crab fishing industry in the United States is not very specific to Texas. Life history studies are available for the Gulf and other regions which provide a basis for examining characteristics important to the Texas resource. The characteristics of the blue crab industries are also documented in literature from other states in the Gulf region.

Life History Studies

The life history of the blue crab is well documented for the Gulf region (Daugherty, More 1965 and 1969, Adkins, Perry) and is similar in all Gulf states.

The blue crab occurs along the entire Texas coast and spawns from March through September. Most spawning occurs in the Gulf of Mexico but may also occur in the lower bays. All zoael stages are completed in the Gulf before the crabs migrate to the bays. Peak abundance of megalops occurs during February-March, May-June, and October-November.

Peaks in abundance of juvenile crabs in bays occur during fall and winter although they are present throughout the year. Juveniles tend to congregate in areas where salinity is low and the bottom consists of mud, clay or sand. These areas are generally associated with tidal marshes, secondary bays, rivers and bayous.

Adult blue crabs can be found throughout a bay system. After mating the adult males tend to remain in low salinity (<10 ppt.) areas while mated females move to higher salinity (>20 ppt.) areas of the bay. Peaks in sponge crab (females bearing eggs) abundance occur during spring and summer in the bays.

The most prominant factor affecting crab abundance is generally accepted to be salinity. Declines in crab populations have been noted in association with drought conditions with corresponding increases occurring after those conditions cease (Hoese). Although not yet studied in detail, differences in size-to-weight ratios of Texas crabs may also be linked to differences in freshwater flow into bays and estuaries (Paul Hammerschmidt, personal communication). A reduction of freshwater flow due to damming of streams or a drought may result in crabs which yield a smaller quantity of meat. A 1960 study by Dunker et al. showed significant differences in yields of crabmeat from Chesapeake Bay crabs according to season and the area of capture. Varying yields may significantly affect the production costs of processing crabmeat.

Industry Studies

Although it is known that Vietnamese crab fishermen make up a significant proportion of crabbers in some areas, relatively little has been published on the characteristics of crabbers in the Gulf of Mexico region. A study by Pesson provides some insight about Louisiana fishermen of various types. Crab fishermen were found to be predominantly middle-aged, to have a low level of education and to live in rural areas.

Commercial crabbers were classified by Jaworski into three categories. The fulltime crabber derives all or most of his income from crabbing. The seasonal category is comprised of those crabbers who derive a significant share of their income from some other source. Casual crab fishermen are usually persons who are more fully engaged in the fishery but, because of the unreliable nature of the fishery, have taken jobs in industry. They may crab on days off, weekends and during vacations. Jaworski found that most of the crabbers in Barataria Estuary were seasonal fishermen whose main income earning activity was shrimping. They could also engage in catfishing, fur trapping or temporary employment to supplement their incomes. Most of the crabbers in that area were descendents of former swampdwellers.

Roberts and Thompson, in a study of the Lake Borgne and Pontchartrain crab fisheries, found 35 percent of the crabbers in that region to be parttime operators. This is higher than the 22 percent statewide average. They attributed this to the close proximity of the metropolitan area of New Orleans which offers a wide variety of employment opportunities. Overall, parttime crabbers in this area operate smaller boats and fish fewer traps than do fulltime crabbers. The average catch per trapday is lower for a parttime crabber than for a fulltime crab fisherman. With a high parttime crabber population, however, crabbing effort can expand rapidly within a calender year. If conditions are poor in other fisheries effort can rapidly be switched to crabbing or vice versa (Roberts and Thompson).

Roberts and Thompson surveyed crabbers in the Lake Borgne and Pontchartrain area to determine what market channels were being utilized. In isolated areas the crab processor is usually the sole pur-

chaser of crabs. Close to metropolitan areas, however marketing may be done to retailers, restaurants and the general public. The study found that 60 percent of the crabs harvested in 1980 were sold through channels not surveyed by seafood harvest statistical reporting systems. To the extent that seafood is marketed through other channels, published statistics will underestimate the catch and economic impact of the fishery. It was then estimated that the 1980 blue crab catch from Lakes Borgne and Pontchartrain was closer to 9.8 million pounds than the officially reported 1.5 million pounds.

A number of studies have been done to determine the effects of landings of blue crabs on dockside prices and to examine the impacts of landings in various geographical areas on prices in other areas. Prochaska, Cato and Kiethly made an analysis of dockside prices in the Florida blue crab fishery for the years 1957 to 1976. They found Florida landings to have a significantly negative effect on Florida ex-vessel price, while a positive relationship existed between per capita income levels and price. Per capita income was the most significant variable in determining the level of blue crab prices. Small dockside price changes occurred for given changes in quantities supplied, implying a highly elastic consumer demand exists for Florida blue crabs. Rhodes, using prices from the entire Gulf, also found disposable income to be highly significant in ex-vessel price determination. Both the Rhodes and Florida models looked at the effects of regional landings on dockside prices. Chesapeake region landings were found to have a significant negative effect on prices in the Florida model but not in the Rhodes model.

In a study completed in 1980, Landrum and Prochaska reviewed the

Florida blue crab industry. They looked specifically at trends in landings, prices and resource productivity. Tagatz, in analyzing fluctuations in yield in the St. Johns River (FL) fishery, concluded that the factors primarily responsible for determining the size of the 1961 and 1962 catches were market conditions, migrations and population size. Market conditions included changes in demand, the availability of outlets and price.

Blue crabs, unless sold in the live-whole form, require considerable processing. In a survey of Gulf of Mexico and South Atlantic regional processing plants conducted in the early 1960's, Lee et al. found that the lack of a steady supply of raw crabs, an inadequate labor force and difficulty marketing the picked product were problems common to the blue crab industry in both regions. Numerous machines have been developed to remove crabmeat by several methods, including centrifugation, vacuum, pressure and vibration These are reviewed in a study by Moody, Flick and Tinker. The industry has failed to adopt mechanization on a large scale due to the inefficiency or breakdown of machines, slow production, poor quality of the extracted meat or because the machine would not significantly reduce labor requirements. Moody et al. conclude that the problems common to the blue crab industry 20 years ago are still problems today.

Methodology

Available secondary data series on landings and effort were analyzed to provide a basic description of historical trends in the fishery.

A survey of blue crab fishermen was conducted to determine the

characteristics of the harvesting sector, including the number of crabbers, vessel types, costs incurred by crabbers, and whether or not the fishery is used as a supplementary means of income by other fishermen. The survey was conducted from late July to early August 1982 using a formal written questionnaire. It was administered to a random sample of crabbers at each of the processing plants.

Socioeconomic and demographic characteristics of crab consumers were analyzed with a frequency distribution procedure. The data employed were from the 1977-78 Individual Consumption Survey Data collected by the U.S. Department of Agriculture. Results were compared to present and projected demographic composition of Texas and the surrounding South Central region. The possible development of a regional market for blue crab products was analyzed subjectively.

Organization of Text

The remaining text is divided into four chapters. Chapter II reviews trends in the blue crab fishery on a regional scale, then examines trends in the Texas fishery over the past 21 years. Chapter III describes the results of the harvesting sector survey. The first section of Chapter IV briefly describes the harvesting and processing sectors of the blue crab industry. The subsequent three sections examine consumption of crab and other seafood products in the United States in relation to various socioeconomic and demographic variables. The last section of Chapter IV estimates current crab consumption in Texas and projects future consumption based on expected demographic trends. The concluding chapter summarizes the data and discusses the development potential of the Texas blue crab industry. Market development poten-

tial is examined based on comparison of results of the consumer profile analysis and the projected demographic characteristics of the Texas population. Possible problems which may arise in the harvesting sector are discussed. The study concludes with recommendations for further study.

REVIEW OF TRENDS IN THE BLUE CRAB FISHERY (1960-1981)

United States

From 1960 to 1981 hardshell blue crab landings in the United States varied from a low of 113.6 million pounds in 1968 to a high of 195.1 million pounds in 1981 (Figure 1). Since 1976 landings have shown a sharp, steady increase. Total value of landings showed some annual fluctuation during the 1960's but has increased steadily since 1970 (Figure 2). Average annual ex-vessel price has ranged from 5 cents per pound in the early 1960's to a high of 24 cents per pound in 1981 (Table 1).

Blue crab landings are reported for four major regions of the United States, the Middle Atlantic, Chesapeake Bay, South Atlantic and the Gulf of Mexico. A fifth region, made up of the New England states, reports landings of a few hundred pounds in Connecticut.

The Middle Atlantic region, which includes New York, New Jersey and Delaware, ranks fourth in total reported hardshell blue crab landings. Annual production over the past 22 years has been less than 10 million pounds (Figure 3). Most of the blue crabs landed in this region are taken from Delaware Bay. Over the past 12 years the average annual value of landings for this region has been less than one million dollars (Figure 4). Reported prices received in Middle Atlantic states are much higher than those of any other region (Figure 5). This may be due to the close proximity of major markets and/or that a larger, better quality blue crab is landed in this region.

The Chesapeake Bay region (Maryland and Virginia) is the major area of blue crab production in the United States, accounting for 38 to

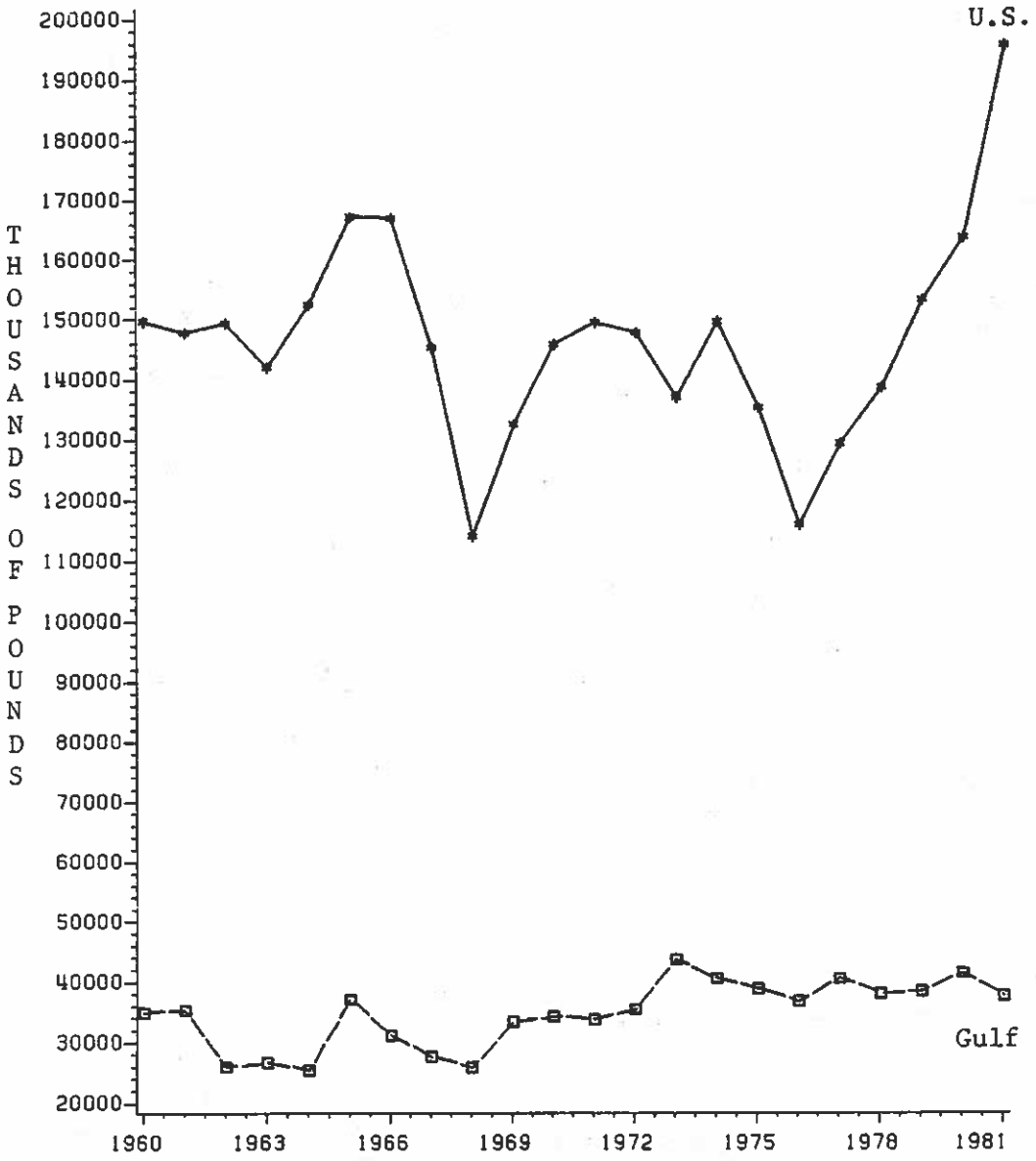

Figure 1. Total Annual Hardshell Blue Crab Landings for the United States and the Gulf of Mexico, 1960-1981.

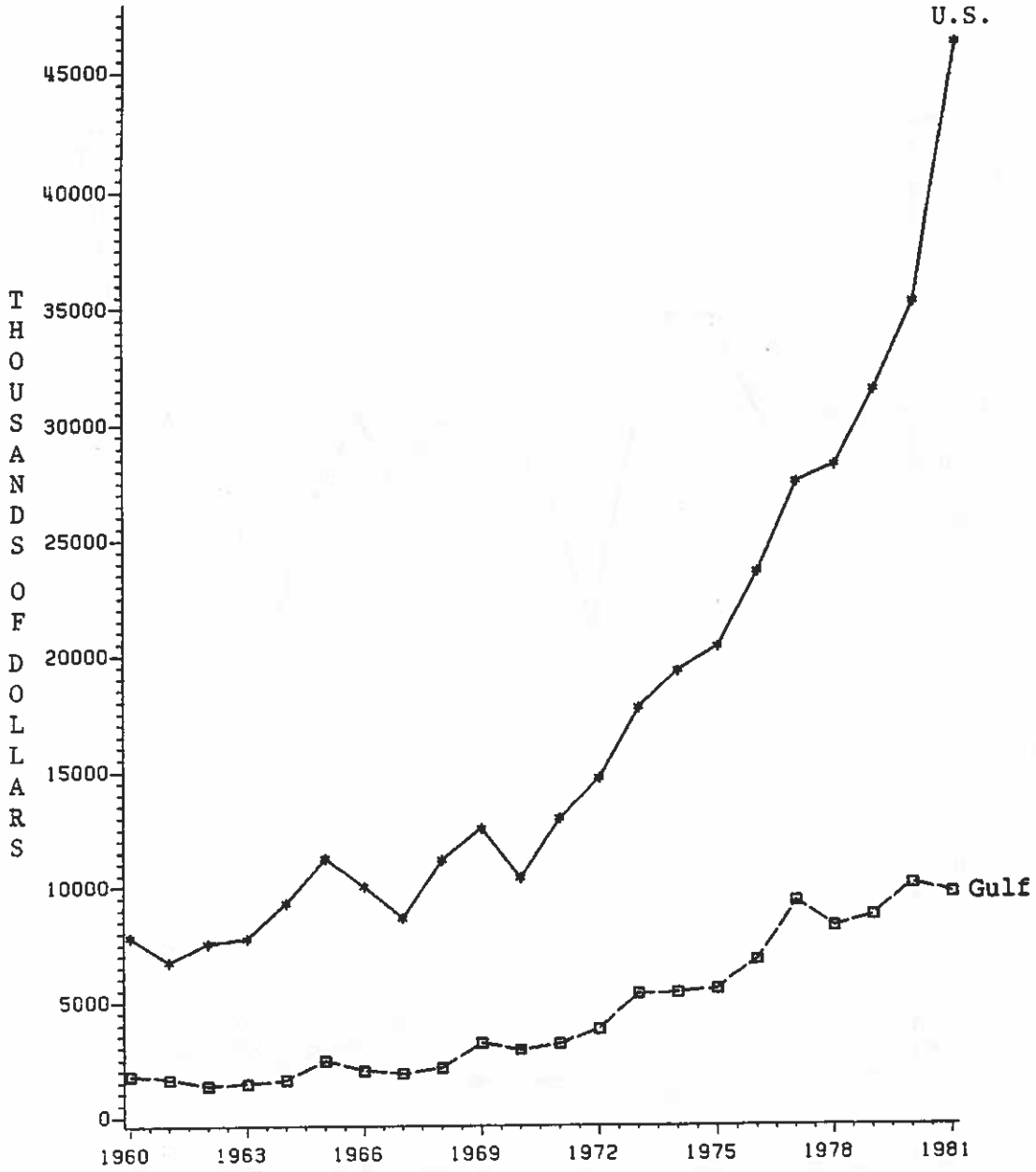

Figure 2. Total Annual Value of Hardshell Blue Crab Landings for the United States and the Gulf of Mexico, 1960-1981.

Table 1. Quantities, Dockside Value and Average Annual Ex-vessel Prices for Hardshell Blue Crab Landed in the United States, 1960-1981.

Year	Landings (Thousands of Pounds)	Value (Thousands of Dollars)	Average Annual Ex-Vessel Price (Dollars)
1960[a]	149,643	7,809	0.05
1961	147,648	6,736	0.05
1962	149,345	7,538	0.05
1963	141,743	7,719	0.06
1964	152,297	9,267	0.06
1965	166,996	11,236	0.07
1966	166,827	9,963	0.06
1967	145,027	8,603	0.06
1968	113,619	11,143	0.10
1969	132,255	12,459	0.09
1970	145,410	10,327	0.07
1971	149,081	12,921	0.09
1972	147,468	14,671	0.10
1973	136,516	17,661	0.13
1974	149,176	19,259	0.13
1975	134,742	20,310	0.15
1976	115,434	23,563	0.20
1977[b]	128,860	27,434	0.21
1978	138,230	28,180	0.20
1979	152,830	31,424	0.21
1980	163,206	35,167	0.22
1981	195,114	46,343	0.24

[a] Source: U.S. Dept. of Commerce, National Marine Fisheries Service. *Fisheries Statistics of the U.S., 1960-1976.* Natl. Fish. Stat. Prog., Washington, D.C.

[b] Source: U.S. Department of Commerce, National Marine Fisheries Service. Unpublished commercial fishing landings statistics, 1977-1981. Natl. Fish. Stat. Prog., Washington, D.C.

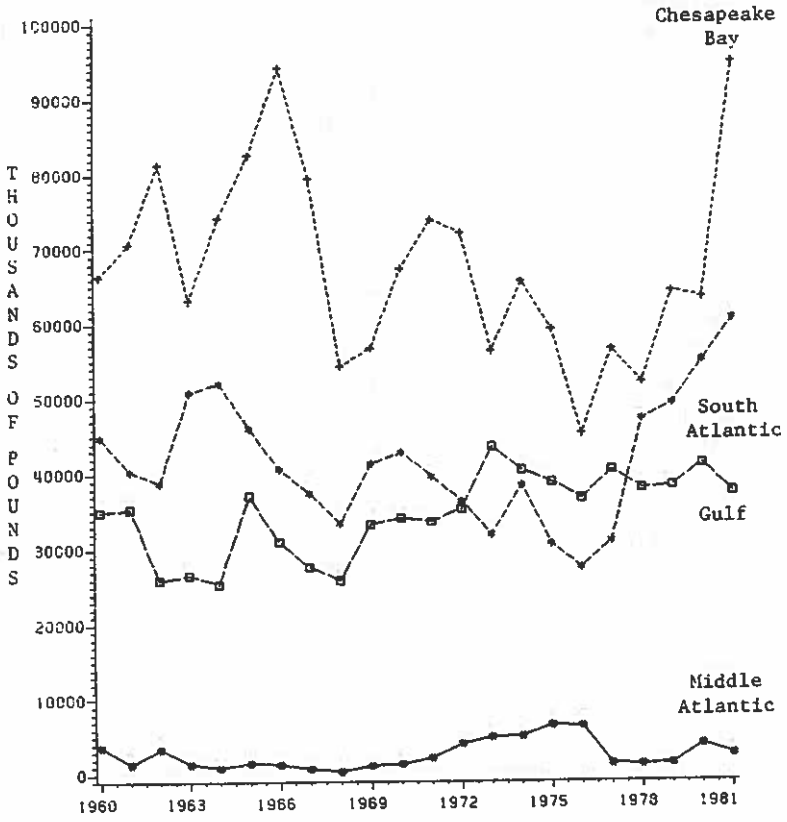

Figure 3. Total Annual Hardshell Blue Crab Landings by Region, 1960-1981.

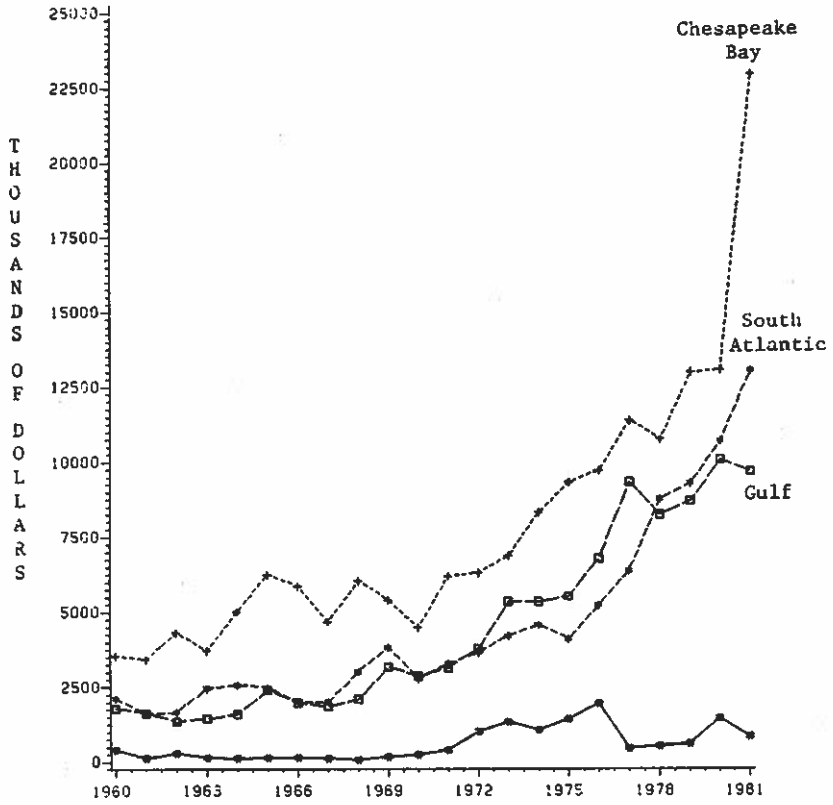

Figure 4. Total Annual Value of Hardshell Blue Crab Landings by Region, 1960-1981.

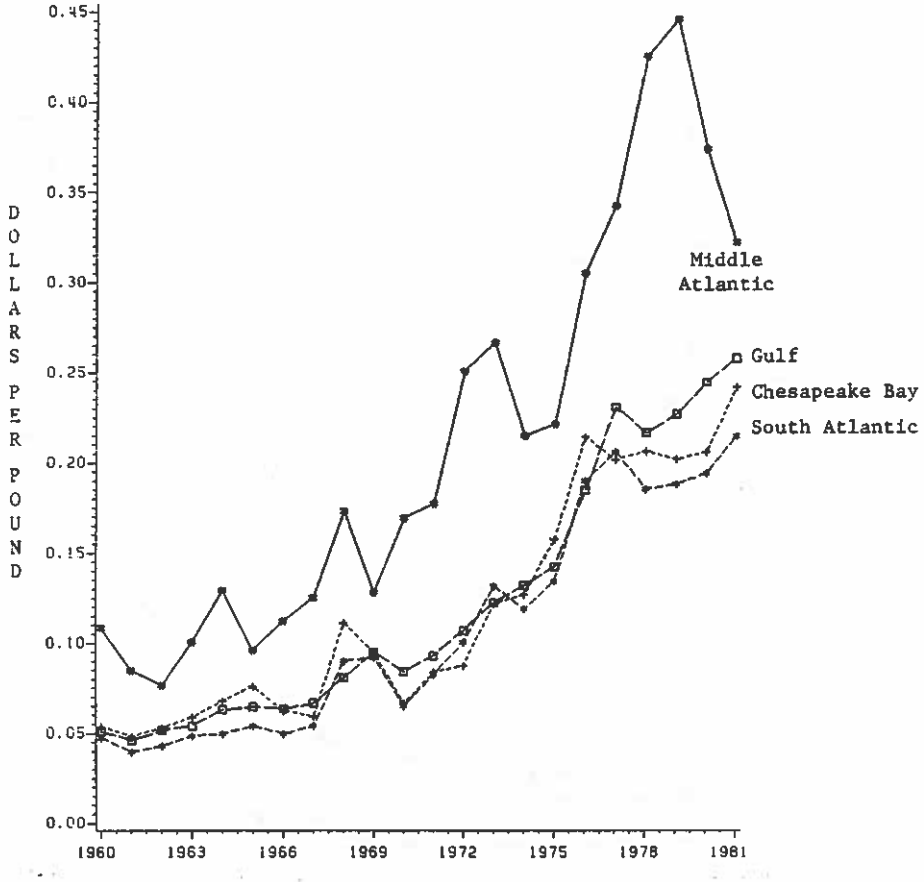

Figure 5. Average Annual Ex-vessel Price Paid for Hardshell Blue Crab by Region, 1960-1981.

56 percent of total U.S. production over the past 22 years (Appendix Table A-1). Since 1960 landings have ranged from a low of 45.2 million pounds in 1976 to a high of 94.7 million pounds in 1981 (Figure 3, page 18). On the average Virginia leads Maryland in crab production. From 1960 to 1976 several four-to-six year cycles occurred in the fishery; since 1977, however, there has been a general increase in landings for this region. Total value of landings has increased steadily as has annual average ex-vessel price. Since 1976 a divergence has occurred among prices paid in the various regions with Chesapeake Bay prices ranking third behind the Middle Atlantic and Gulf of Mexico regions (Figure 5, page 20).

The South Atlantic region, made up of North and South Carolina, Georgia and the east coast of Florida, ranked second in hardshell blue crab production until 1972, ranked third from 1972 to 1977, and has ranked second again since 1978 when a dramatic increase in landings occurred. Over the past 22 years landings in this region have ranged from a low of 27.4 million pounds in 1976 to a high of 60.5 million pounds in 1981 (Figure 3, page 18). Generally, North Carolina leads the South Atlantic region in blue crab production. Value of total landings has consistently increased over this same period. Average annual ex-vessel price paid in this region stayed fairly close to prices paid in the Chesapeake and Gulf regions until 1977. Since then, South Atlantic prices have been lower than all other regions. Rhodes found that Chesapeake Bay landings and prices had a significant effect on South Atlantic prices but not on those of any other region.

Gulf of Mexico

The Gulf of Mexico region includes the west coast of Florida, Alabama, Mississippi, Louisiana and Texas. Since 1960 reported landings in this region have varied from a low of 25.3 million pounds in 1964 to a high of 43.5 million pounds in 1973. Since 1970 the Gulf region has accounted for approximately 19 to 32 percent of total U.S. landings and ranked second to the Chesapeake Bay region in blue crab production from 1973 to 1978 (Figure 3, page 18).

Value of landings in this region has steadily increased, accounting for 21 to 34 percent of total U.S. value (Appendix Table A-1). Since 1977 the Gulf region has paid the second highest average annual ex-vessel price to blue crab fishermen (Figure 5, page 20).

The west coast of Florida led the Gulf region in hardshell blue crab production until 1971 when Louisiana took over the lead (Figure 6). Generally, landings in Louisiana increased during 1960 to 1972 but have shown a downward trend since then. The annual average reported landings for Louisiana during the period of 1970 to 1981 have been approximately 16 million pounds with an average value of $2.8 million. During this period Louisiana has accounted for 30 to 53 percent of Gulf landings (Appendix Table A-2). Actual landings, however, may be much higher. Roberts and Thompson found that 70 percent of the crabbers operating in the Lake Borgne and Lake Pontchartrain fisheries used unsurveyed market channels for 60 percent of the crabs harvested in 1980. This would make the actual catch 2.5 times that which is reported for this area.

Average yearly landings for the west coast of Florida from 1970 to

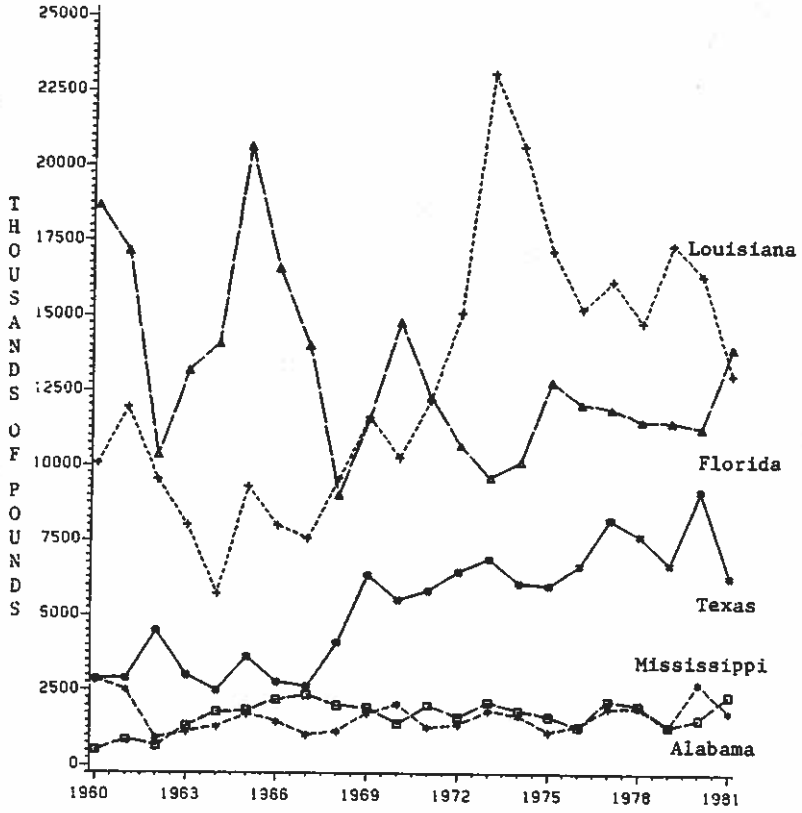

Figure 6. Total Annual Hardshell Blue Crab Landings in Each of the Five Gulf Region States, 1960-1981.

1981 have been 11.9 million pounds with an average value of $1.8 million. This area has contributed 22 to 44 percent of reported Gulf landings of hardshell blue crab over the past 12 years. The Florida west coast generally produces more than half the crabs landed in Florida (Prochaska et al.).

Mississippi and Alabama annually produce an average of 1.7 and 1.8 million pounds of hardshell blue crab, respectively. Production has been relatively stable in both states for the last 22 years. Value of catches in these states has increased more slowly than in other Gulf states (Figure 7); however, since 1979 Alabama has led the Gulf region in average annual ex-vessel price paid to crab fishermen (Figure 8).

Texas

Texas is the third largest producer of hardshell blue crab in the Gulf region with average annual landings since 1970 of 6.8 million pounds worth $1.3 million. In 1981 6.9 million pounds with a dockside value of $1.9 million were landed in Texas. This ranked the fishery second among Texas fisheries in number of pounds landed but fourth in dockside value behind shrimp, oysters and finfish (Table 2). Since 1977 the blue crab fishery has consistently ranked second among Texas fisheries in number of pounds landed due to increased crab and decreased finfish landings.

Since 1960 the overall trend in Texas blue crab landings has been upward. Landings more than doubled from approximately 4.1 million pounds in 1960 to 9.2 million pounds in 1980. The state has accounted for between 8 and 22 percent of Gulf landings (Appendix Table A-2). During that same time the number of reported traps went from 7,099 in

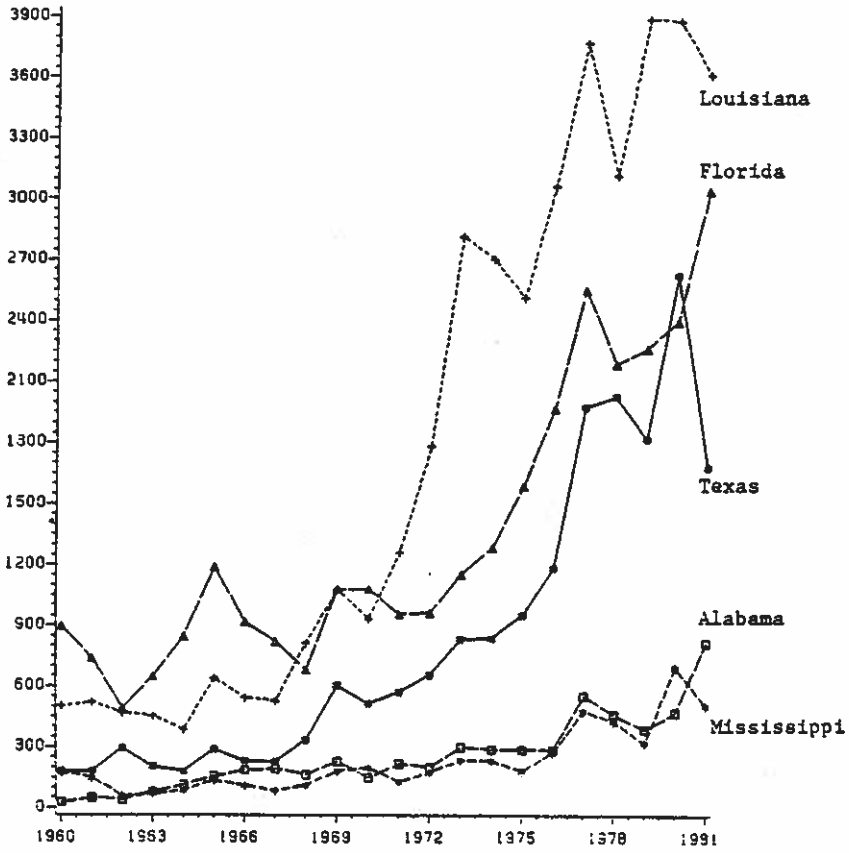

Figure 7. Total Annual Value of Hardshell Blue Crab Landings in Each of the Five Gulf Region States. 1960-1981.

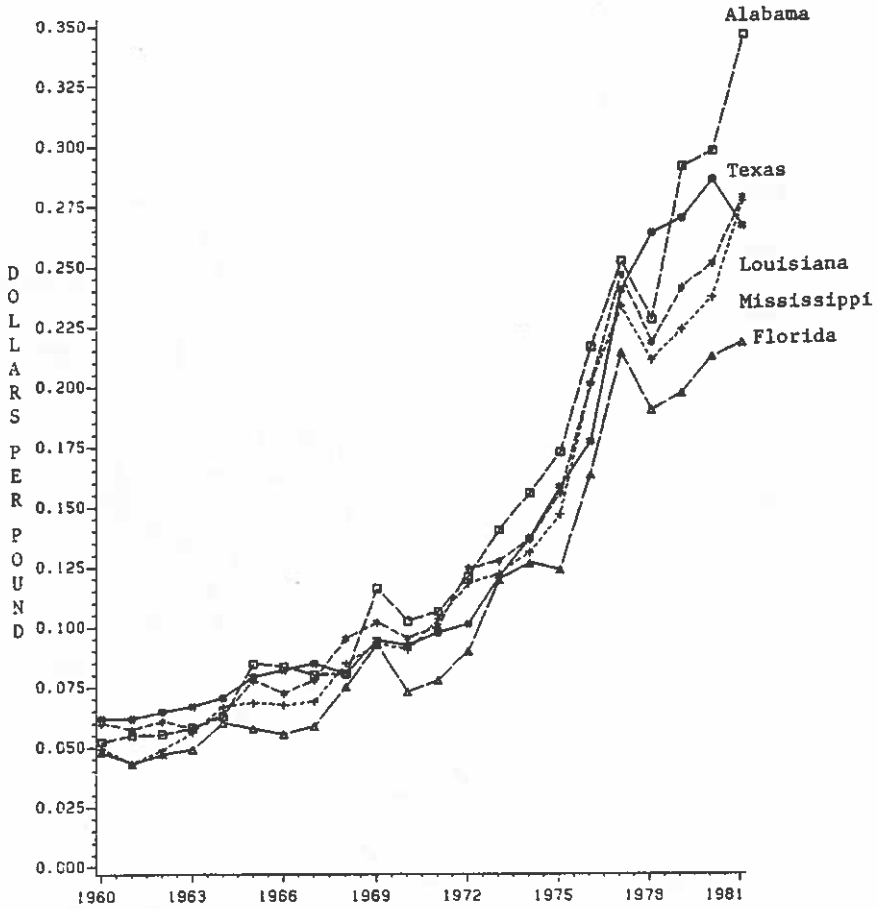

Figure 8. Average Annual Ex-vessel Price Paid for Hardshell Blue Crab in Each of the Five Gulf Region States, 1960-1981.

Table 2. Relative Position of the Hardshell Blue Crab Fishery Among the Major Texas Fisheries, 1970-1981.

	SHRIMP		OYSTERS		FINFISH		BLUE CRAB	
YEAR	Lbs.	$	Lbs.	$	Lbs.	$	Lbs.	$
	Millions							
1970	88.3	48.6	4.7	2.0	5.3	1.2	5.5	.5
1971	86.9	64.2	4.7	2.4	6.6	1.6	5.8	.6
1972	97.6	80.1	3.9	2.5	6.5	1.7	6.5	.7
1973	81.7	86.9	2.3	1.8	6.8	1.9	6.9	.8
1974	78.7	67.7	1.2	1.1	7.5	2.1	6.1	.8
1975	70.6	87.9	1.8	1.4	7.6	2.4	6.0	1.0
1976	74.8	119.9	3.9	3.2	8.1	2.9	6.7	1.2
1977	92.4	126.9	2.6	3.0	5.0	2.3	8.2	1.9
1978	84.2	141.1	1.9	2.2	5.2	2.7	7.5	2.0
1979	67.6	153.1	1.0	1.1	5.0	2.9	6.7	1.8
1980	74.1	140.1	3.2	4.6	7.1	5.3	9.2	2.6
1981	95.7	165.3	1.3	2.0	4.5	4.2	6.9	1.9

Source: Texas Parks and Wildlife Dept. *Texas Landings, Annual Summary, 1970-1981.*

1960 to a high of 23,375 in 1976 (Table 3).

Table 3. Estimated Number of Blue Crab Traps Fished in Texas, 1960-1981.

YEAR	NUMBER OF TRAPS	YEAR	NUMBER OF TRAPS
1960	7,099	1971	12,700
1961	7,200	1972	14,225
1962	9,220	1973	16,500
1963	9,668	1974	16,950
1964	8,680	1975	19,900
1965	8,200	1976	23,375
1966	8,460	1977	15,950
1967	11,100	1978	16,425
1968	12,820	1979	11.060
1969	14,440	1980	11,050
1970	14,300	1981	10,100

Source: Texas Parks and Wildlife Department.

The number has declined since 1976 due to the movement of crab fishermen into Louisiana (Jim Morgan, National Marine Fisheries Service). Since Texas does not require a commercial crab license or the registration of crab traps, however, the actual number in use could be much higher.

The value of landings has continued to move upward with the average annual ex-vessel price increasing from six cents per pound in 1960 to a high of 28 cents per pound in 1980. Texas has accounted for 27 to 53 percent of the annual value of Gulf hardshell blue crab landings (Table 26, Appendix I).

Monthly landings data for Texas show peak landings occur during May through July with increases in catches beginning to occur in March or April. A second, smaller peak occurs about September through October. More (1969) reported monthly catch per unit effort values ranging from 1.5 to 5.9 pounds per pot-day in Galveston Bay over the 1965 to

1967 period. Values were highest in June and November and lowest in January and August. It was also reported that fishing effort was highest in May through September and sporadic from December through February. Figures 9 through 12 depict monthly landings averaged over five year periods from 1962 through 1981.

Seasonality of catch is related to several factors. Crabs are more active during summer and early fall months, due to higher water temperatures, and are more easily trapped. More (1969) found that during the colder months most crabs migrate to deeper channels and possibly bury in the mud. In addition, because of favorable weather, crab fishermen are able to go out more regularly to run their trap lines during the summer. According to an industry participant (Davis, personal communication), demand for crabmeat and whole crabs usually drops off toward the end of the summer and processors generally buy fewer crabs during July and August because the East Coast market is being well supplied with Chesapeake and South Atlantic blue crabs. In the fall, when landings on the East Coast begin to decline due to colder weather, the demand for Texas crabs picks up again and the processors buy more crabs. This explains the second, smaller peak in landings which occurs in September-October.

No distinct pattern is evident in monthly prices averaged over five-year periods from 1962 to 1981 (Figures 13-16). During the 1962 to 1966 period average ex-vessel prices remained almost constant for the entire year despite an increase in average landings of 300,000 pounds from February to June. In the 1967 to 1971 period, when average landings increased by approximately 450,000 pounds to peak in June, prices fluctuated somewhat but were still relatively constant for the

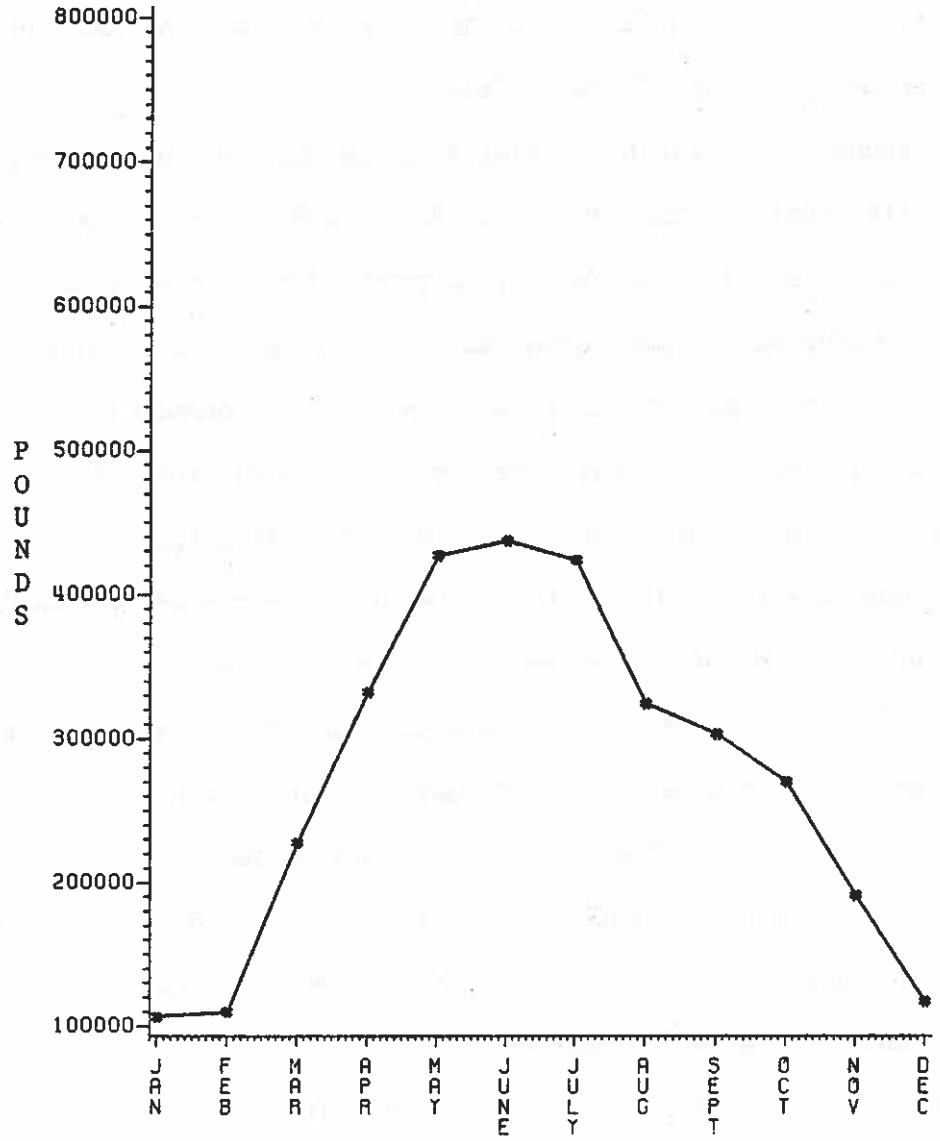

Figure 9. Average Monthly Landings of Hardshell Blue Crab in Texas, 1962-1966.

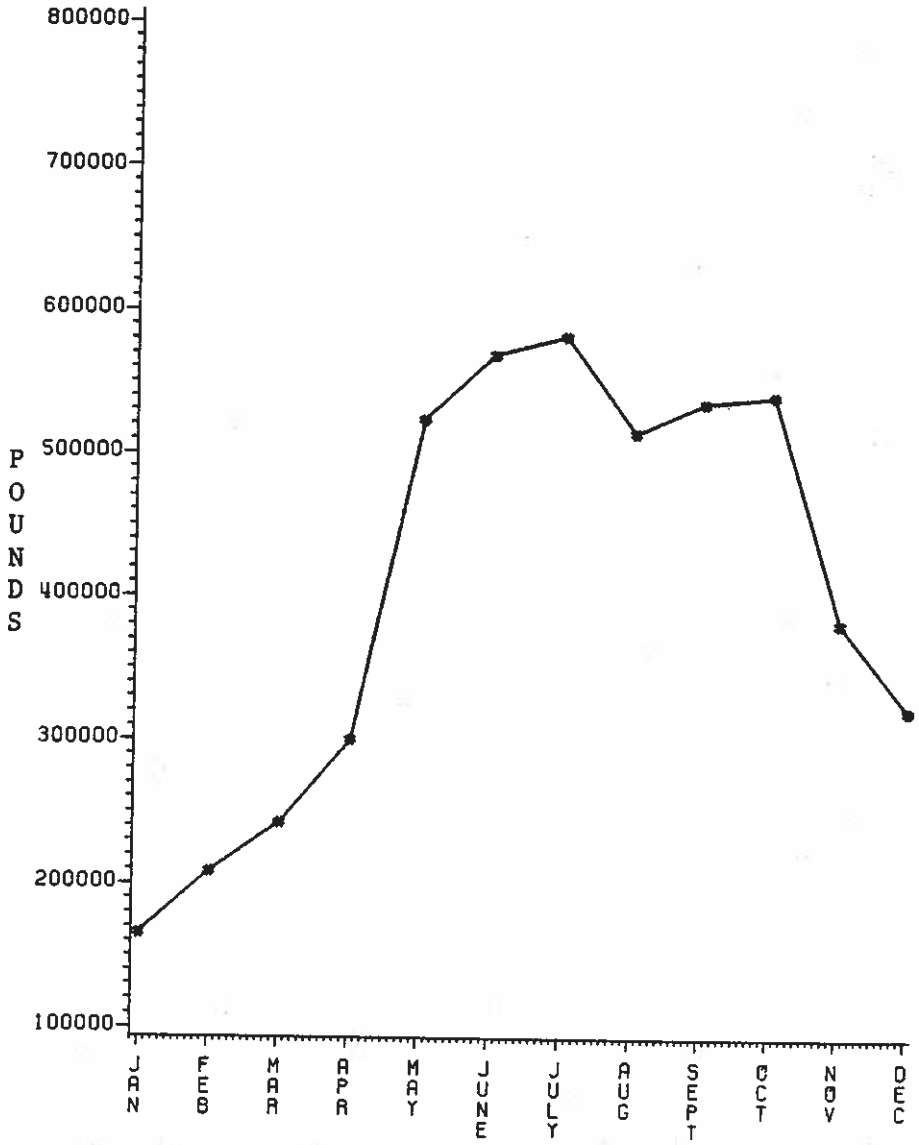

Figure 10. Average Monthly Landings of Hardshell Blue Crab in Texas, 1967-1971.

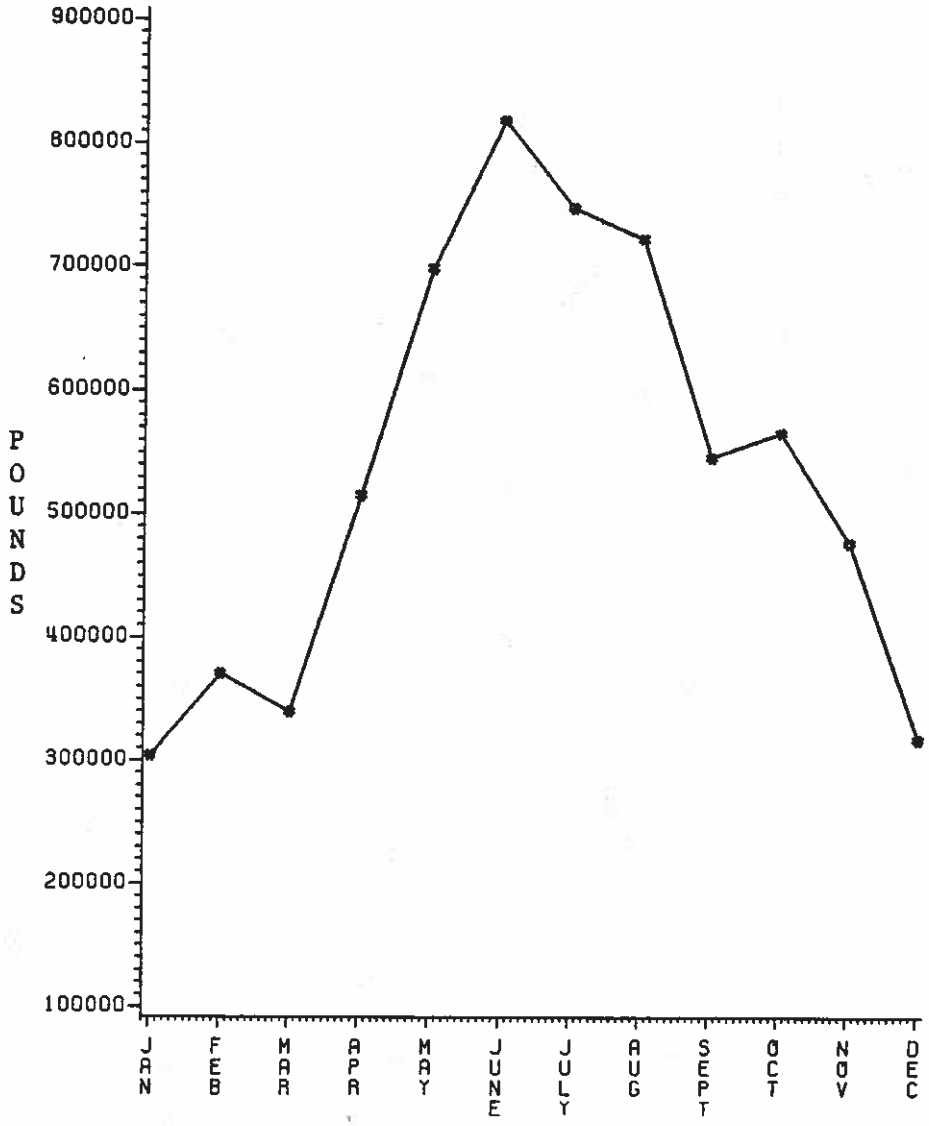

Figure 11. Average Monthly Landings of Hardshell Blue Crab in Texas, 1972-1976.

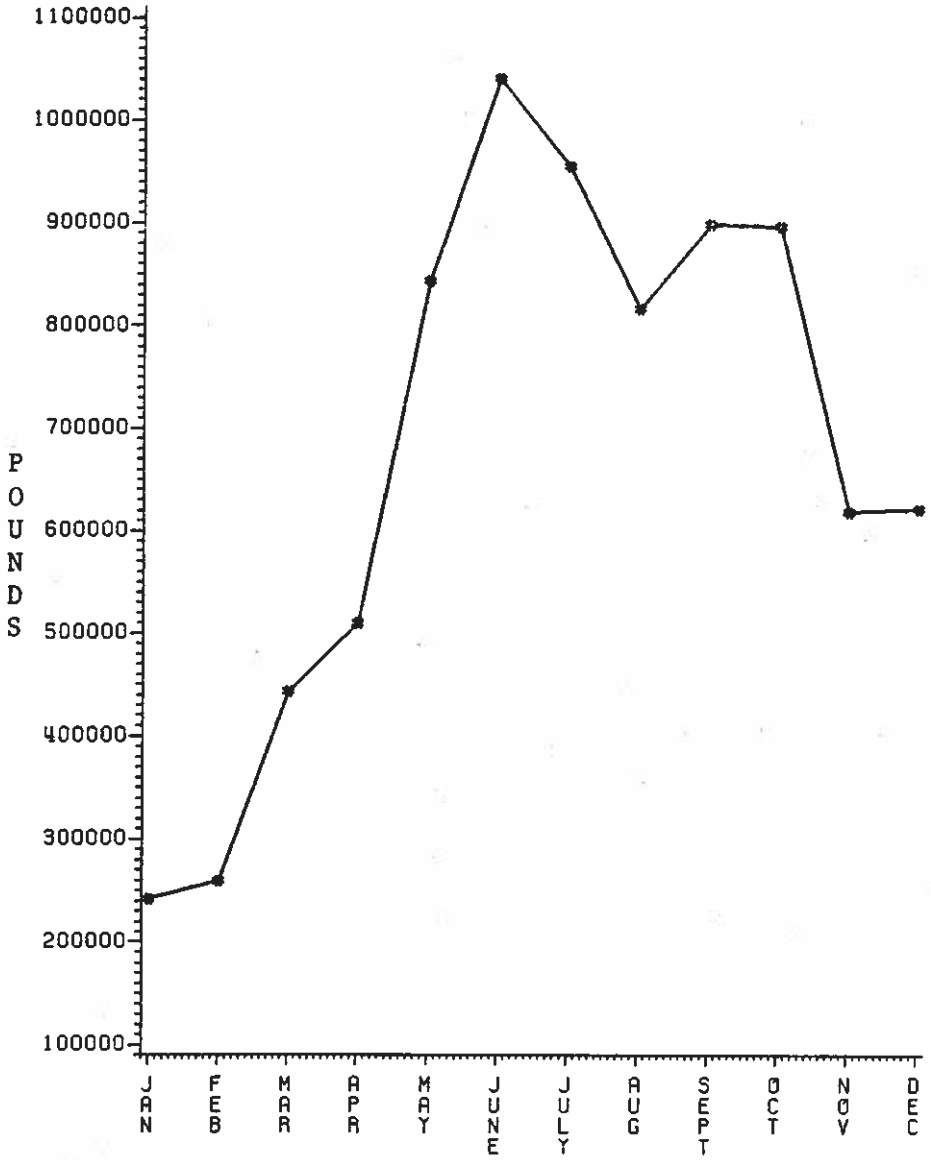

Figure 12. Average Monthly Landings of Hardshell Blue Crab in Texas, 1977-1981.

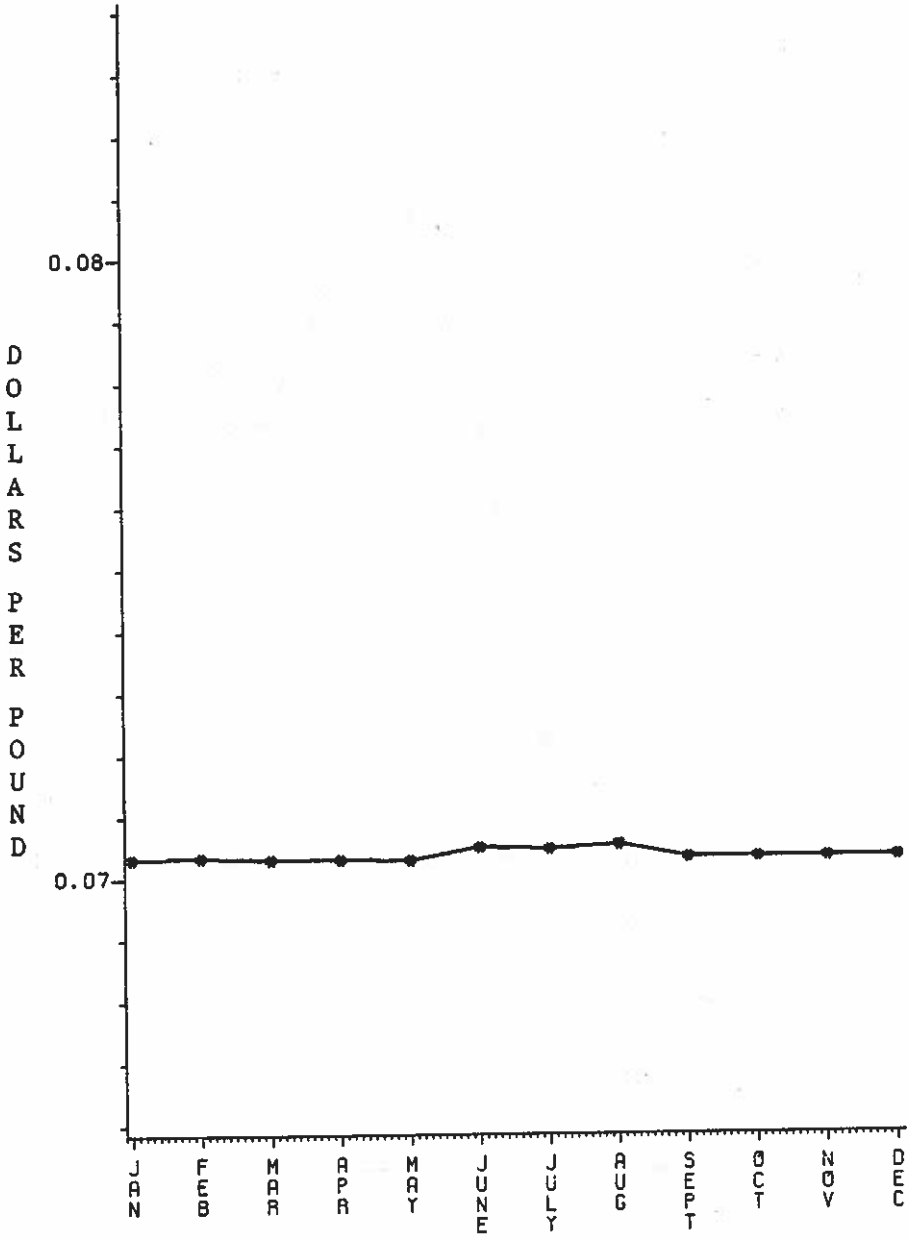

Figure 13. Average Monthly Ex-vessel Price Paid for Hardshell Blue Crab in Texas, 1962-1966.

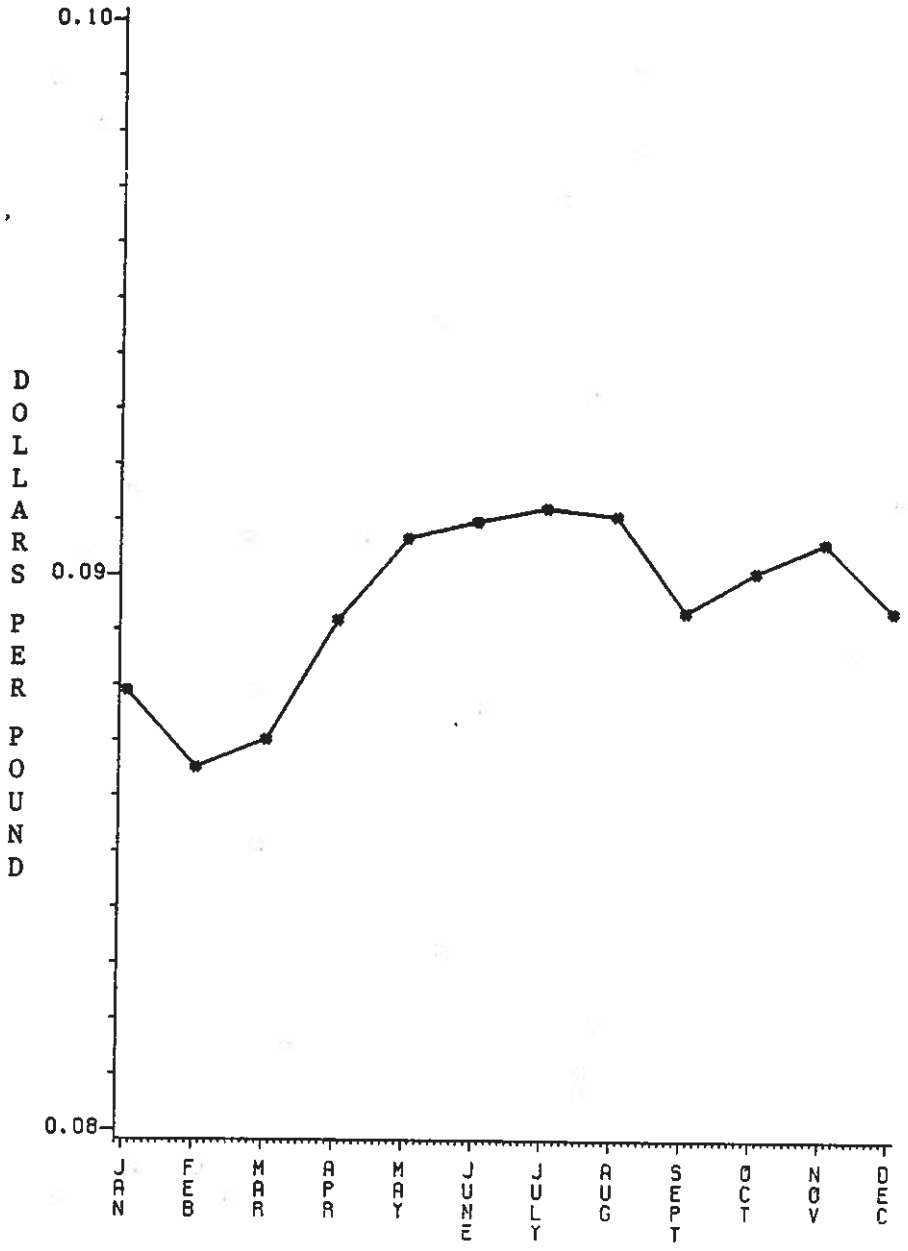

Figure 14. Average Monthly Ex-vessel Price Paid for Hardshell Blue Crab in Texas, 1967-1971.

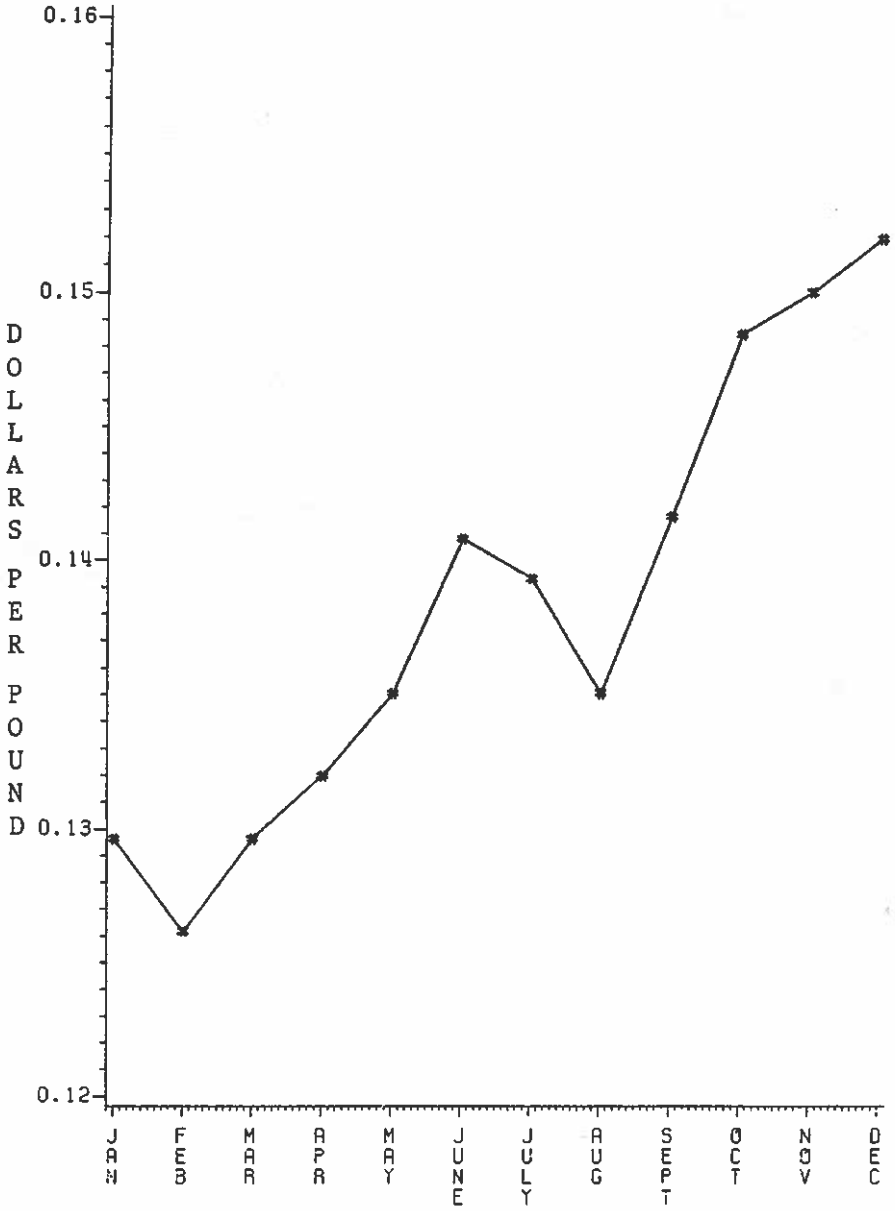

Figure 15. Average Monthly Ex-vessel Price Paid for Hardshell Blue Crab in Texas, 1972-1976.

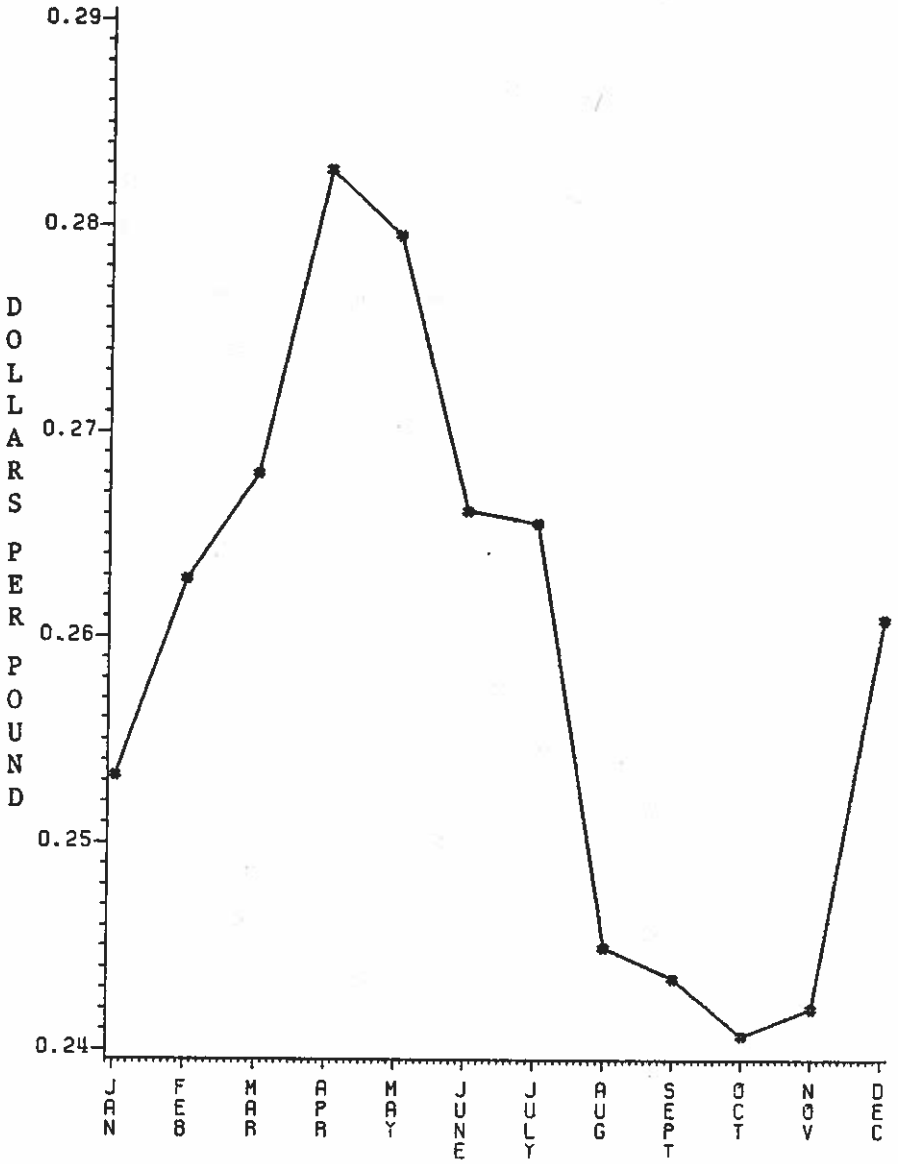

Figure 16. Average Monthly Ex-vessel Price Paid for Hardshell Blue Crab in Texas, 1977-1981.

12 months. Prices averaged for 1972 to 1976 went from slightly less than 13 cents per pound in February to slightly more than 15 cents per pound in December. A half-cent decline occurred from June to August, right after the peak of the season. The 1977 to 1981 period showed the greatest fluctuation in ex-vessel prices. The average price rose by about three cents per pound from January through April. Price declined from April through October, to slightly over 24 cents per pound, while landings peaked in June, declined until August, then rose slightly and leveled off in September and October. Price again rose to slightly more than 26 cents per pound in December after a decline of approximately 300,000 pounds in average landings.

The greatest crab productivity has always been in bay systems receiving high inflows of fresh water (More 1969). A higher level of fresh water inflow results in a higher overall level of productivity within a bay system. The extent of shallow-water areas is also an important factor. Historically, Sabine Lake, Galveston, Matagorda, San Antonio and Aransas Bay systems have been the major blue crab production areas in Texas. Productivity, however, has varied within each system through the years. Landings for 1962 to 1981 are listed in Table 4.

The Galveston Bay system (including Trinity Bay) led in blue crab production from 1964 to 1975. Fluctuations in landings during the early 1960's were attributed to crab migrations and varying abundance of crabs (More 1969). Since 1970, landings have ranged from 2.6 million pounds to a low of approximately 610,000 pounds in 1981. Since 1977, the Galveston Bay system has ranked third in production behind San Antonio and Aransas bays. The major processor in this area is Top

Table 4. Landings of Hardshell Blue Crab by Bay System, 1962-1981.

Year	Sabine Lake	Galveston	Matagorda	San Antonio	Aransas	Corpus Christi	Upper Laguna Madre	Lower Laguna Madre	Gulf
	Pounds								
1962	237,300	311,300	2,006,800	170,900	1,605,400	---	---	---	146,700
1963	104,500	977,500	728,400	984,900	125,200	45,300	---	---	16,400
1964	272,100	1,195,000	225,900	639,900	112,300	---	---	---	39,000
1965	509,200	1,817,900	401,300	693,000	39,600	113,700	---	---	47,500
1966	555,800	1,357,800	477,200	362,700	19.300	---	---	---	4,900
1967	775,700	1,047,900	360,800	276,100	155,600	---	---	---	8,700
1968	788,800	1,542,600	933,300	472,500	197,500	---	124,100	---	24,800
1969	825,600	1,705,700	891,000	1,484,000	724,200	152,500	528,500	---	31,200
1970	685,000	2,622,000	782,000	531,700	878,100	---	4,700	---	21,900
1971	1,918,000	2,160,800	394,300	582,800	591,800	100,500	200	---	61,200
1972	1,288,700	1,870,100	882,100	995,500	1,338,900	70,700	4,100	---	14,400
1973	1,358,200	2,040,000	1,129,600	859,000	1,272,700	41,100	1,000	11,600	167,900
1974	560,800	1,983,000	959,300	1,124,300	1,079,300	326,300	2,000	12,700	39,900
1975	620,900	1,863,500	897,700	1,593,100	892,500	125,700	8,900	3,500	39,700
1976	514,200	1,599,500	651,700	2,140,400	1,318,800	123,700	800	299,000	20,300
1977	226,100	1,845,000	535,400	2,181,600	2,244,600	102,800	126,800	975,200	11,100
1978	624,200	1,920,900	581,200	1,925,500	2,051,200	9,300	159,600	196,100	1,700
1979	163,301	1,953,742	876,881	2,681,111	2,436,246	50,498	26,911	122,279	517
1980	70,089	1,749,057	859,695	3,011,967	2,716,056	17,448	6,688	518,342	3,634
1981	72,600	610,200	451,600	3,211,100	1,777,300	7,700	---	815,087	6,400

Source: Texas Parks and Wildlife Department. *Texas Landings, Annual Summary, 1962-1981.*

Quality Seafood located in Oak Island. Two smaller plants are located in Port Bolivar.

Prior to 1969 landings in the San Antonio Bay system (including Mesquite and Espiritu Santo bays) ranged from 170,000 to 984,000 pounds. More attributed the fluctuating landings to lack of a permanent market in this area resulting in varying levels of fishing effort. In 1969 a record 1.5 million pounds was landed but production dropped to approximately one-third that level in the next two years. Landings picked up again in 1972 and by 1974 were more than one million pounds. This was the same year that Verlon Davis (now manager of Bo Brooks processing plant) began to buy crabs in this area. In 1976, when the Bo Brooks plant opened, the San Antonio bay system led the state in blue crab production. Since then, landings have continued to increase. This area was the leader in crab production from 1979 to 1981. A major contributing factor to the increased landings in this and other bay systems has been the movement of Vietnamese into the area and their entry into the blue crab fishery. According to Verlon Davis, the Vietnamese began fishing for blue crab in the San Antonio Bay system in about 1976.

More than 1.6 million pounds of crabs were landed in the Aransas Bay system (including Copano Bay) in 1962, but landings from 1963 to 1968 were less than 200,000 pounds per year. More attributed the decline to low crab abundance which made fishing unprofitable. With the exception of 1971 and 1975, production in this bay system has been more than one million pounds since 1972. From 1977 through 1980 annual landings exceeded two million pounds and the Aransas Bay system led the state in blue crab production in 1977 and 1978. Vietnamese fishermen

have also entered into the Aransas Bay fishery and have largely been responsible for growth of the fishery in this area. The first major crab processing plant, Texas Super Crab, opened in this area in July 1981.

More than two million pounds of crab were taken from Matagorda Bay (includes East Matagorda and Lavaca Bays) in 1962. Since then, however, then landings have been less than one million pounds with the exception of 1973 when approximately 1.1 million pounds were landed. From 1963 to 1972 production ranged from a low of 226,000/pounds to a high of 891,000 pounds. As with other bay systems, fluctuating effort and low abundance of crabs were said to be responsible (More 1969). With the exception of 1976-78, when landings were less than 700,000 pounds, production in this area from 1974-80 has averaged approximately 900,000 pounds. As was the case in most areas, production fell considerably in 1981. The major processor in this area is Collins Seafood which opened in 1967. This plant has also attracted Vietnamese fishermen and pickers, but catches have not increased dramatically as they have in the San Antonio and Aransas Bay systems.

Landings in Sabine Lake from 1971 through 1973 averaged approximately 1.5 million pounds. This is the only period when landings for this bay system have reached or exceeded one million pounds. Prior to 1971 landings ranged from approximately 105,000 to 826,000 pounds. Since 1973 production has shown an overall decline and in 1980 and 1981 was less than 100,000 pounds. According to one crab fisherman (personal communication) there are approximately 20 to 25 fishermen crabbing in Sabine Lake but not all of them sell their crabs to Texas processors. Some sell to buyers located in Louisiana. In the fall of

1982 Geneva's Wholesale Seafood opened in Port Arthur and began processing crabs from this area.

A small fishery existed in Corpus Christi and Nueces Bays in 1963, 1965 and 1969. Beginning in 1971 landings have been reported for every year and have ranged from a low of 7.7 thousand pounds in 1981 to 326,000 pounds in 1974.

A commercial crab fishery was not present in the upper Laguna Madre (including Baffin Bay) until 1968 and the lower and central Laguna Madre until 1973. According to crabbers in this area (personal communication) the bay will not sustain a fishery over the winter and crabs disappear from the bay system for long periods of time.

Gulf landings have comprised less than four percent of the total catch. Most of the crabs taken from Gulf waters are taken incidentally in shrimp trawls.

During the period from 1962 to 1973 average ex-vessel prices prices differed little among bay systems. The range of difference was only 0 to 4 cents per pound (Table 5). Crabs landed from the Gulf region almost always sold for the lowest price due to the poorer quality of trawl-caught crabs. From 1974 to 1981 prices among bays varied more with differences in average ex-vessel prices of up to 26 cents per pound.

Summary

The Chesapeake Bay region ranks first in blue crab production followed by the South Atlantic, Gulf of Mexico and the Middle Atlantic regions. The Gulf region accounts for approximately 20 to 30 percent of total U.S. landings. Louisiana is the leader in production in the

Table 5. Average Ex-vessel Prices Paid for Hardshell Blue Crabs According to Bay System, 1962-1981.

Year	Sabine Lake	Galveston	Matagorda	San Antonio	Aransas	Corpus Christi	Upper Laguna Madre	Lower Laguna Madre	Gulf	Range of Prices (Cents)
	Dollars									
1962	.07	.05	.07	.07	.07	---	---	---	.06	2
1963	.07	.07	.07	.07	.07	.07	---	---	.05	2
1964	.07	.07	.07	.07	.07	---	---	---	.06	1
1965	.08	.08	.08	.08	.08	.08	---	---	.07	1
1966	.09	.08	.08	.09	.08	---	---	---	.06	3
1967	.08	.09	.08	.09	.09	---	---	---	.07	1
1968	.08	.08	.08	.08	.08	---	.08	---	.08	0
1969	.09	.09	.10	.10	.09	.09	.10	---	.07	3
1970	.09	.09	.09	.09	.09	---	.09	---	.07	2
1971	.10	.10	.10	.09	.10	.10	.12	---	.08	4
1972	.10	.10	.10	.10	.10	.10	.10	---	.08	2
1973	.12	.13	.12	.12	.12	.11	.10	.11	.13	3
1974	.14	.14	.14	.14	.14	.14	.14	.14	.09	5
1975	.16	.15	.16	.16	.17	.17	.17	.17	.12	5
1976	.17	.17	.17	.18	.17	.17	.22	.24	.13	11
1977	.26	.24	.25	.23	.23	.25	.23	.25	.20	6
1978	.26	.27	.26	.26	.28	.23	.29	.26	.15	14
1979	.30	.25	.26	.27	.25	.22	.25	.25	.34	12
1980	.34	.28	.27	.27	.28	.45	.40	.25	.22	23
1981	.31	.31	.26	.25	.29	.50	---	.24	.30	20

Source: Calculated from data obtained from *Texas Landings, Annual Summary, 1962-1981*. Texas Parks and Wildlife Department.

Gulf of Mexico, followed by Florida, Texas, Alabama and Mississippi in that order.

The blue crab fishery currently ranks second among Texas fisheries. There has been a gradual upward trend in the fishery over the past 21 years. The peak season occurs from May through October when crabs are most active due to warm water temperatures. The greatest productivity is in bays receiving high inflows of fresh water. Historically Sabine Lake, Galveston and Trinity Bays, and the Matagorda, San Antonio and Aransas Bay systems have been leaders in blue crab production.

HARVESTING SECTOR SURVEY

Background

Little information has been published or is available on the harvesting sector of the Texas blue crab industry. Official estimates of the number of crab fishermen range from 105 to 650 (Texas Parks and Wildlife Department). In order to generate more detailed data on this sector, a survey was conducted in late July through August 1982. A three-page questionnaire (Appendix II) was personally administered to 41 crabbers at 9 crab processing plants along the Texas coast from Brownsville to Port Bolivar. This chapter will describe the results of the survey. It is divided into four sections which include: Crabbing vessels, gear and variable inputs; crabbing effort; marketing; and characteristics and problems of Texas blue crab fishermen.

In the following discussion the term Vietnamese crabber is used to refer to a crabber who is of Vietnamese or Cambodian origin and who immigrated to the U.S. during and after the Vietnam War. Indigenous crabber is any other crabber whether or not he is a native of Texas.

At the time of the survey there were 10 crab processing plants operating in Texas. An estimated 109 crab fishermen were delivering crabs to these plants. Table 6 shows the distribution of the crabbers and the percentage interviewed at each of the 10 plants. The names and locations of the 10 crab processing plants located in Texas are listed in Table 27 (Appendix II). The 41 crabbers who completed the survey represented 38 percent of the estimated total selling to processing plants. The 109 estimated crabbers, however, does not take into account those crab fishermen selling through channels other than pro-

Table 6. Blue Crab Processing Plants in Texas and the Number of Crab Fishermen Fishing and Interviewed at Each Plant.[a]

Processor	Total # of Crabbers	Total # of Vietnamese Crabbers	Total # of Indigenous Crabbers	Total Interviews		Vietnamese Interviews		Indigenous Interviews	
				Number	Percent	Number	Percent	Number	Percent
1	6	0	6	5	(83.3)	0	(0)	5	(83.3)
2	25	2	23	10	(40.0)	2	(100)	8	(34.8)
3	24	21	3	9	(37.5)	7	(33.3)	2	(66.7)
4	1	1	0	1	(10.0)	1	(100)	0	(0)
5	1	0	1	0	(0)	0	(0)	8	(0)
6	20	15	5	4	(20.0)	3	(20.0)	1	(20.0)
7[b]	15	--	--	2	(13.3)	0	---	2	---
8	9	0	9	5	(55.6)	0	(0)	5	(55.6)
9	2	0	2	2	(100)	0	---	2	(100)
10	6	0	6	3	(50.0)	0	---	3	(50.0)

[a] This information reflects the status of the industry in July 1982.

[b] This processor was unable to designate the numbers of Vietnamese and indigenous crabbers.

cessors. Although it is difficult to determine what their number is, it is known that there are crabbers selling directly to independent shippers, fish markets and restaurants, and who are shipping live crabs directly to East coast markets (personal communication with industry personnel).

Crabbing Vessels, Gear and Variable Inputs

The gear used by Texas blue crab fishermen is limited to crab traps. These are usually constructed of 18 gauge galvenized double-dip wire with vinyl covering (Charles Moss, personal communication). The average cost of a crab trap is approximately $10. Traps may be purchased from commercial trap builders or constructed by the crabbers themselves. Overall, trap investment ranged from $500 to $4,200 with a mean of $1,937. Investment for indigenous crabbers ranged from $500 to $4,200 compared with $1,000 to $2,000 for Vietnamese crabbers.

Estimates of boat values ranged from $900 for a 16-foot fiberglas boat to $32,000 for a 30-foot Chesapeake Bay-style crab boat. Table 7 shows estimated values for vessels by construction material and by functional design. Twelve of the crabbers interviewed either declined or were unable to answer the question. This was especially a problem with the Vietnamese sample.

Survey data indicate that most of the fiberglas and aluminum boats used by crabbers are in the 16- to 19- foot range while most wooden and fiberglas-on-wood boats are in the 24- foot or larger category. Most of the wooden and fiberglas-on-wood boats are in the central and lower Laguna Madre and in Galveston and Trinity Bays. These vessels are primarily designed as crab boats. The majority of the vessels used, how-

Table 7. Estimation of Value for Crabbing Vessels by Construction Material and by Functional Design.

Material	Number of Boats	Percent of Sample	Range of Values (Dollars)
Wood	8	19.5	1,100-32,000
Fiberglas	25	61.0	900-15,000
Aluminum	5	12.2	1,500-20,000
Fiberglas/ Wood	3	7.3	4,000-6,000
Engine Type	**Number of Boats**	**Percent of Sample**	**Range of Values (Dollars)**
Inboard	5	12.2	--------
Outboard	34	82.9	--------
Inboard/ Outboard	1	2.4	--------
Jet Boat Motor	1	2.4	--------
Vessel Design	**Number of Boats**	**Percent of Sample**	**Range of Values (Dollars)**
Crabbing	12	29.3	1,100-32,000
General Fishing	5	12.2	6,000-20,000
Non-Commercial	24	58.5	900-7,000

ever, are fiberglas (61.0 percent) and gasoline-outboard powered (82.9 percent) (Table 7, page 4 The majority of these vessels fell into the non-commercial category. All Vietnamese interviewed used this type of boat (Table 8).

Table 8. Types of Boats Used by Vietnamese and indigenous Crabbers.

	Crabbing	General Fishing	Non-Commercial
Indigenous	12	5	11
Vietnamese	0	0	13

The major variable inputs for crab fishermen are bait and fuel. Crabbers get bait from the processors or from independent dealers. Three of the crabbers reported that they caught their own. Independent dealers include bait dealers, fish markets, fish processing plants and fishermen. The processors and independent bait dealers obtain most of their bait by truckload from the East coast and, in some cases, from the Great Lakes region.

The cost of bait ranged from zero (bait was caught by the crabber or given to him) to 24 cents per pound. Obviously, some costs are incurred even if a crabber catches his own bait, however for the purpose of this study, a cost of zero was assigned to that bait. The mean price per pound was 16 cents. Forty percent of the respondents were paying 18 cents per pound.

Table 9 below lists the most common types of bait.

Table 9. Most Common Types of Bait Used in the Texas Blue Crab Fishery.

Menhaden	Gar
Mullet	Catfish
Carp	Shad
Sheepshead	Croaker
Kingfish	Shark
Stingray	Fish scraps

The amount of bait used per day ranged from 32 to 200 pounds. Fifty-one percent (21 crabbers) of the respondents used 200 pounds or less per day. Eight of those 21 crabbers said they averaged 200 pounds. The amount of bait used, however, varies by season. Less bait is used during the winter, when crabbing effort is reduced and crabs are less active, than during the summer.

All crabbers, with the exception of seven in the San Antonio Bay area, reported that they purchase fuel from an independent dealer. Processors either do not want to bother with selling fuel or lack facilities to do so. The responses as to the amount of fuel used ranged from 2 to 30 gallons per day.

Table 10 shows a budget for an average crabber operating in Texas. The typical boat is described as a fiberglas, non-commercial vessel, 16- to 19- feet in length with a gasoline powered outboard engine. The market value for this vessel is set at $7,000 and was calculated using survey data. Variable costs are calculated for 232 days of crabbing per year, which was the maximum estimated number of days that any crabber fished, and 200 traps. The amounts of fuel and bait used per day were determined using survey data. The percentage of trap replacement

Table 10. A Cost and Return Budget for a Typical Texas Crabber.

Boat and Gear			
Boat	Fiberglas, sport-type 16 to 19 feet in length		
Engine	Outboard/Gasoline		
Total Value of Boat and Engine	$7000		
Average Number of Traps	200		
Average Annual Catch	64,220 pounds		
Gross Returns ($0.28 x 64,220)			**$17,981**
Variable Costs			
Bait (150 pounds/day x $0.18/pound x 232)		$6264	
Boat Fuel (16 gallons/day x $1.06/gallon x 232)		3935	
Trap Replacement (75% replacement/year)		1500	
Boat and Engine Repair (10.8% x boat value)		756	
Oil		72	
Subtotal		$12,527	
Overhead Costs			
Depreciaton		$656	
Interest		371	
Licenses		15	
Dock Fees		240	
Subtotal		$1282	
Total Costs			**$13,809**
Net Return			4,072
Self Employment Tax (9.35%)			381
Returns Above Costs			**$3691**

is the same as was reported by Roberts and Thompson.

Boat and engine repairs were calculated as 10.8 percent of the boat value. This figure was arrived at by taking the ratio of repairs to boat value reported in the Roberts and Thompson study. In the same manner, oil purchase was divided by fuel purchase and that percentage (1.7) was then multiplied by the average fuel purchase of a Texas crabber to obtain oil expenditure.

Depreciation was calculated in the same manner as the Roberts and Thompson study. Salvage value was calculated as 25 percent of the present market value of the vessel and a useful life of eight years was assumed. The straight-line method was used.

Although the typical crabber has no outstanding debt on his boat, interest expense was calculated as an opportunity cost. The mean annual interest cost was calculated assuming the vessel was purchased three years ago and the loan was for the entire price of the vessel. An average annual interest rate of 10.6 percent (1979 average annual PCA interest rate) was used in the calculations.

Roberts and Thompson reported that small boats powered by gasoline engines are typically costly to insure and in many cases insurance is not available. Based on this, it is assumed that a typical crabber, with a 16- to 19- foot boat, does not have the boat insured.

Variable costs, those costs dependent upon crabbing activity, totaled $12,527. Fixed costs, which are independent of crabbing effort, came to $1,282 making total yearly costs $13,809.

Gross returns were calculated by first dividing the total annual value by the total annual catch of blue crab in Texas to get an average annual ex-vessel price. That price was then multiplied by 64,220

pounds, which is the estimated annual catch, based upon 1981 landings, per crabber. This figure was derived by dividing 1981 Texas landings by 109 crabbers. Thus, the estimated gross return to a crabber in 1982 was $17,981. After deducting total costs and self-employment tax his return above costs was $3,691.

Crabbing Effort

Sixty-one percent of the crabbers interviewed said they did not participate in any other fishery. This figure includes all the Vietnamese crabbers interviewed. Fourteen (50 percent) of the 28 indigenous crabbers said they formerly fished for redfish and speckled trout. No Vietnamese reported having participated in this fishery. The majority of former bay fishermen stated that if they were not successful in making a living in the crab fishery, they would exit the fishing industry totally. Sixteen crabbers did indicate that they participated in other fisheries. Four of these participated in the shrimp fishery, working as deckhands or occasionally shrimping when it was good. Other fisheries included oystering, bait fishing and fishing for black drum and flounder. The percent of household fishing income derived from fisheries other than crabbing ranged from 1 to 90 but was, in nearly all cases, 10 percent or less.

There was no evidence that crabbing is used as a supplementary source of income, by shrimp or any other type of fishermen, to any great extent. It was reported by crab processors and shrimp processing plant operators that shrimpers do not normally bring in crabs other than for their own consumption nor do they normally engage in the crab fishery when not shrimping. Warren, in a survey of bay shrimpers,

reported that 66 percent of those surveyed responded that they did not market fish, crabs or oysters. Responses indicated that shrimpers do not want to bother culling crabs, especially since the dockside price is so low. Secondly, crab processing plants don't want trawl-caught crabs because of their poor condition.

Table 11 gives information on the average number of days crabbed per season, number of traps set and estimated daily catches for indigenous and Vietnamese crabbers. Eighty-three percent of the sample reported fishing five to six days per week during the summer (May-August), weather permitting. However, at the time of the survey most processors were buying only five days per week. Because crabs must be kept live for shipping or until they are cooked for processing, this restricts crabbers to fishing only five days per week.

The range of days fished during the fall season (September-December) is 0 to 112. Approximately 67.5 percent of the crabbers surveyed fish five to six days per week if they are able. Weather was named as the primary factor limiting fall crabbing.

Crabbing during the winter is curtailed due to bad weather and the inactivity of crabs during cold weather. Sixty-one percent of the crabbers indicated that they crab only two to three days per week, on the average, during the winter. Five crabbers reported that they either entered other fisheries or took a non-fishery related job.

The average number of traps set, per crabber, remains about the same year round (Table 11). Only one Vietnamese crabber reported decreasing the number of traps he set in the fall and winter. Eight of the indigenous crabbers interviewed increase while four decrease their numbers of traps. Differences in the number of traps set over the year

Table 11. Average Number of Traps Set and Days Crabbed and Estimated Average Daily Catches for Indigenous and Vietnamese Crabbers.

Season	Indigenous	Vietnamese
	Average (Range) Number of Traps Set	
Summer	225 (50-400)	150 (100-200)
Fall	200 (0-400)	150 (100-200)
Winter/ Spring	200 (0-400)	150 (100-200)
	Average (Range) Number of Days Crabbed	
Summer	72 (32-112)	88 (80-96)
Fall	56 (0-112)	84 (72-96)
Winter/ Spring	56 (0-112)	60 (40-80)
	Estimated (Range) Average Daily Catch	
Summer	745 (50-1500)	600 (350-850)
Fall	875 (50-1800)	600 (350-850)
Winter/ Spring	1050 (50-2000)	175 (150-400)

range from 50 to 130. All but three counties, Chambers, Harris and Victoria, have a 300 trap per crabber limit.

The highest average catches (per day) were reported for Laguna Madre and Aransas Bay for the fall and winter seasons and for the Laguna Madre and Galveston and Trinity Bays for summer. These results are suspect, however, in regard to the Laguna Madre. Historically this bay system has had the lowest landings statewide. The fall season had the highest average reported catches, followed by summer and then winter/spring.

Processors who had both Vietnamese and indigenous crabbers delivering to their plants reported that the Vietnamese crabbers are more consistent than their indigenous counterparts. Although they are not conclusive, survey data show that there is less variability in the average number of traps set, days crabbed per season and average daily catch for Vietnamese versus indigenous crabbers.

Marketing

Convenience was stated by a majority of crabbers (63.4 percent) as the reason they sold to a specific processor. Price was given as the second reason, followed by services offered by the processor. These choice criteria were identical for indigenous and Vietnamese crabbers. Only 29 percent of the 41 crabbers surveyed said they had sold to more than one processor during the past year. The main reason given for selling to a different processor was receipt of a better price.

Table 12 lists the prices which were being paid by processors at the time of the survey. The price for females ranged from 14 to 20 cents per pound for all processors and from 20 to 42 cents per pound

Table 12. Ex-vessel Prices Paid by Texas Processors During the Survey Period.

Processor	Males	Culls	Females
	----------Cents Per Pound----------		
1	.20		.20
2	.34	.20	.15
3	.30		.14
4	.35		.18
5	.35		.15
6	.32	.22	.15
7	.42		.15
8	.40		.20

for males. Culls (small males which are not large enough for the whole-crab markets) were differentiated by two processors. Prices received for culls were 20 and 22 cents at these two plants.

Only 17 percent of the crabbers interviewed reported selling any of their catch directly to another handler besides a processor. The amount of catch sold to other outlets was, in all but two cases, less than five percent of the total catch and never exceeded 25 percent.

Demographic Characteristics and Major Problems of Crab Fishermen

Household sizes, for crabbers surveyed, ranged from one to six persons for indigenous crabbers and one to eight persons for Vietnamese crabbers. Seven Vietnamese households were in the six to eight person range compared with one indigenous household.

Ninety-two percent (12) of the Vietnamese sampled reported that they were the only member of their household engaged in crabbing. There were 11 indigenous households (42 percent) with two crabbers and one with three. Half (50 percent) the indigenous sample reported using a deckhand when crabbing compared with 31 percent of the Vietnamese surveyed. In 61 percent of these cases the deckhand was a member of the same household as the crabber. Payment of deckhands is on a straight wage or percentage basis or by the pound.

Seven (54 percent) Vietnamese households had one member working in a crab processing plant and two households had two members. Vietnamese pickers were employed in all but two plants. Six (23 percent) indigenous and one Vietnamese household had one member employed in a non-fishery related job.

Nineteen indigenous crabbers reported deriving all their income

from fishing. This represented 79 percent of those answering this question. Of those 19, 16 (84 percent) reported that their entire fishing income from crabbing. Twelve of the 13 Vietnamese surveyed reported that their entire fishing income was derived from crabbing operations.

The three most prevalent problems reported by crabbers are:

1) Loss of traps due to weather, shrimp boats or the cutting of lines,

2) Costs of inputs being too high in relation to the price received (by crabbers) for crabs, and

3) Theft of crabs from traps.

Approximately 54 percent of the Vietnamese sample mentioned loss of traps as the major problem compared to 5.7 percent of the indigenous sample. The major problem that indigenous crabbers feel they are facing is the high cost of inputs including bait, fuel, boats and motors, and traps. The ex-vessel price for crabs was not perceived to be too low by itself but was said to be too low in relation to the prices of inputs. Other problems identified by crabbers include competition with sport crabbers, poor crabbing in some bays, difficulty obtaining bait, preventing bait spoilage, and the pollution of bays.

Summary

The segment of the Texas blue crab harvesting sector that sells to established processors is comprised of approximately 109 crabbers. At the time the survey was undertaken approximately 42 percent of these crabbers were Vietnamese located along the central coast from Rockport to Palacios.

Crabbing activity is usually carried out five to six days per week during summer and fall but only two to three days per week during the winter. The average number of pots set per crabber is 200. The typical vessel used is a 16- to 19- foot, fiberglas sport boat powered by a gasoline outboard. Fuel and bait account for the largest share of the crabber's variable costs. Based on survey data and the assumptions stated earlier, the typical crabber receives returns above costs of less than $4,000. Whereas indigenous crabbers see the high cost of inputs as their major problem, Vietnamese consider loss of traps due to weather, sabotage and nets to be the major problem they are facing.

A number of bay fishermen appear to be entering the blue crab fishery. Many have the attitude that it is the last resort for remaining in the fishing industry as fishermen. The survey indicated that crabbing is not used as a supplementary fishery by other fishermen. A number of crabbers do participate in other fisheries but only on a very limited basis.

The ex-vessel price for crabs did differ across processors. The largest variation was in the price paid for males. In almost all cases, however, a crabber sold his catch to the most conveniently located processor, not the one paying the highest price. In addition to the problems mentioned earlier, other problems identified by crabbers include competition, poor markets and crabbing, bait spoilage and pollution.

PROCESSING, MARKETING AND CONSUMPTION

This chapter is divided into five sections. The first part briefly describes the processing sector and outlines the marketing channels utilized by the industry. The following three sections relate to consumption of crab and crab products in the U.S.. Previous studies describing demographic determinants of seafood consumption are reviewed. This is followed by a description of crab consumption according to various demographic determinants and an examination of away and at home consumption. The last section describes demographic characteristics of the Texas population and relates this to regional markets for crab and crab products.

Processing and Marketing Sectors

A typical processing scheme for a Texas crab plant is illustrated in Figure 17. Upon being unloaded from the boat the crabs are sorted. Large male crabs (usually greater than or equal to 6 inches) destined for the whole-crab market are separated, boxed and loaded onto trucks to be taken to the airport to be flown to markets in major east coast and central cities. The remainder of the crabs are put into large containers, usually with ice. These are taken to the plant (if the unloading facility is not located at the plant) and are stored in a cool place to await processing.

The crabs are cooked that afternoon or evening or, at the latest, the next day. Most plants steam cook the crabs, however some still use the boiling method. The crabs are then cooled, usually overnight. The next day they are backed and washed, then picked. In some cases the

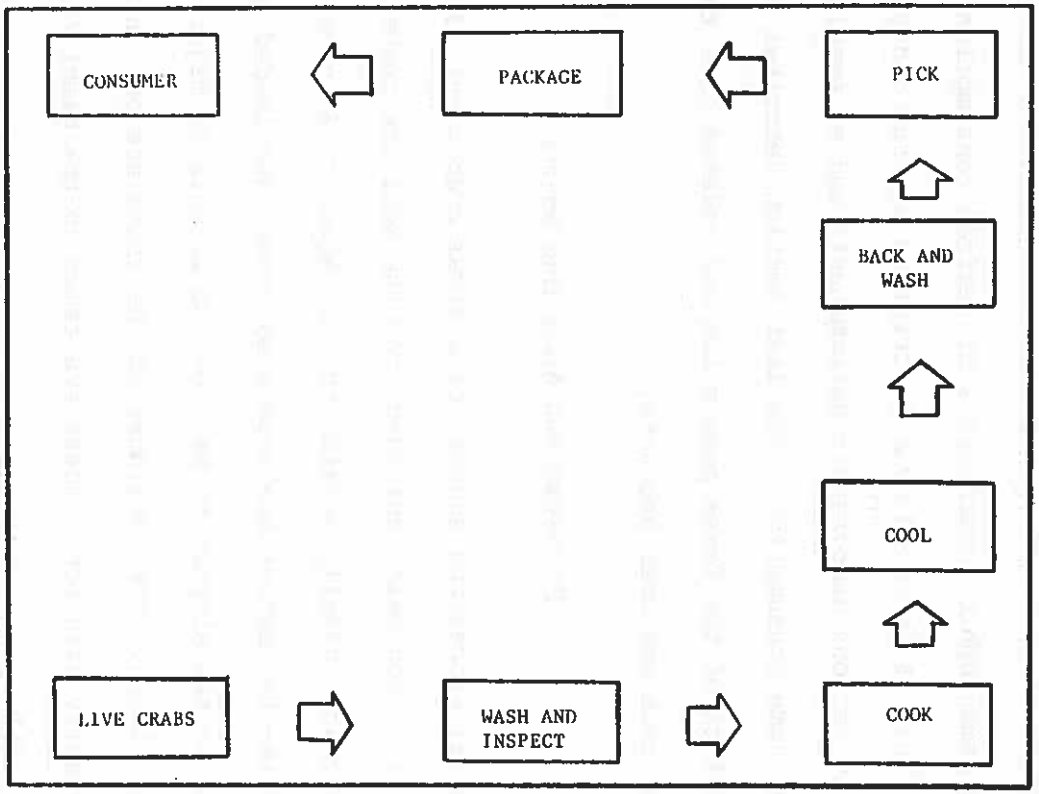

Figure 17. Processing Scheme for a Texas Blue Crab Processing Plant.

crabs are cooked, then cooled quickly and backed before being picked the next day.

The picking process is labor intensive. Crab plants on the Texas coast employ from one to fifty pickers depending on plant capacity and the time of the year. More pickers are employed during the summer and early fall when the peak of the season occurs. Before the Vietnamese refugees moved into the coastal regions of Texas many processors were facing a shortage of pickers. The majority of pickers presently employed in the industry are Vietnamese. Considerable effort has been expended, over the years, toward developing a crab-picking machine. However, as stated earlier, the machines developed thus far have either failed to reduce labor requirements to a significant degree or produce an unacceptable product.

Approximately 80 to 85 percent of the crab is waste. One hundred pounds of raw crabs will produce approximately 15 to 20 pounds of crab-meat. The average reported (by Texas Processors) cost of producing a pound of meat is $4.50 including the cost of the raw crabs. Four basic types of meat are picked from the blue crab. These include:

(a) white meat--picked from the body of the crab

(b) lump meat--two large, firm white chunks of meat which are the muscles supporting the swimming appendages

(c) flake meat--meat obtained from the walking legs, and

(d) brown meat--consists of claw meat and claw fingers.

The lump meat is the highest quality meat; the brown meat the lowest quality. Price per pound ranges from $4 to $12 (New York Green Sheet). The different types of white meats are mixed in different combinations and sold as backfin or special. The price of these products depends

upon their composition.

Most blue crabmeat is presently marketed as a fresh, refrigerated product having a shelf life of 6 to 10 days. Pasteurization, a process by which crabmeat is heated in hermetically sealed cans to a temperature of 190 degrees Fahrenheit for three minutes then cooled rapidly, is currently used by two Texas processors. This process can extend the shelf life of picked meat for up to 18 months if it is stored at temperatures between 32 and 38 degrees Fahrenheit. A variety of processed products are also produced by a few Texas processors. These include stuffed crab, stuffed Jalapeno peppers, stuffed shrimp, stuffed flounder, crab rolls and breaded claws. Production, however, is on a limited scale.

Marketing channels utilized by the Texas blue crab industry are shown in Figure 18. The most common channel is from crabber to processor. The processor then sells whole crabs and picked meat to seafood brokers and distributors and to food services, restaurants and other retail outlets. One major processor (locally owned) indicated that 70 percent (by weight) of that plant's output (whole crabs and crabmeat) was sold to wholesalers and the remaining 30 percent was sold to restaurants and other retail outlets. It was also reported that approximately 30 percent (by weight) of the landings consisted of males large enough for the whole-crab market. This is subject to variation, however, depending on the condition of the crab populations. As stated earlier, a restriction of freshwater flow into a bay can result in smaller crabs. The largest Texas processors, most of which are owned by east coast companies, sell the major percentage of their whole crabs in the east coast markets. However the percentage can vary from season

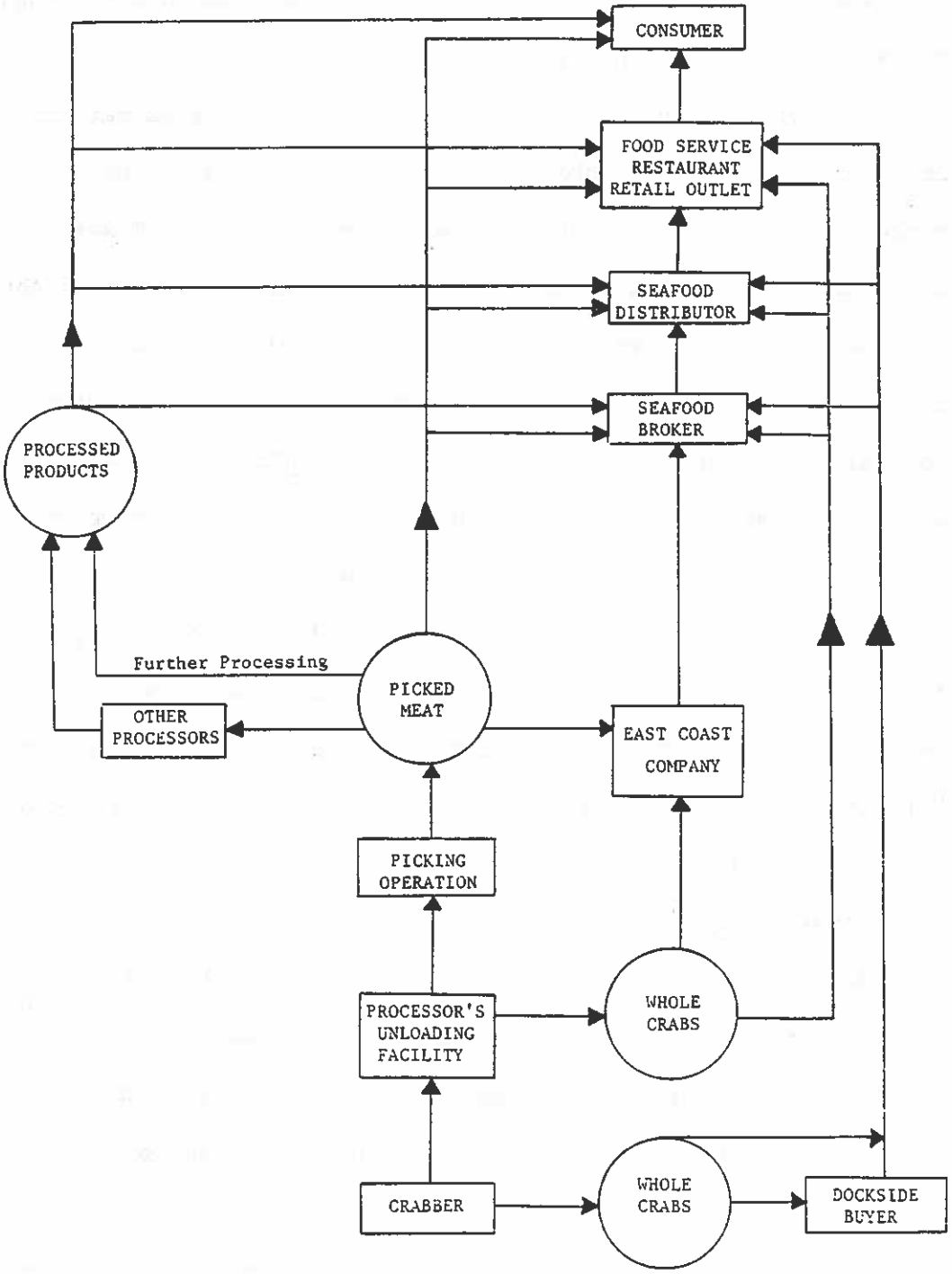

Figure 18. Marketing Channels for Blue Crab Caught By Texas Crabbers.

to season and year to year depending on the status of East coast blue crab fisheries. The major market area is Baltimore, Md. Other eastern market areas include Atlantic City, Washington, D.C. and Philadelphia. Whole crabs are also shipped to Chicago.

According to an industry participant, the Texas market for blue crab is approximately double what it was 10 years ago. Many of the processors are expanding their market areas in Texas. Texas processors are shipping whole crabs and crabmeat to Houston, Dallas, San Antonio, Beaumont, Galveston, Port Arthur, Corpus Christi, Brownsville, Austin and El Paso. The major crab processors also sell already picked meat to smaller processors who use it in the production of processed products. The smaller companies may have only one or two crabbers who cannot always supply enough crabs to meet the processor's needs.

There are two other channels, from crabber to consumer, in operation in Texas. A crabber may sell his crabs to a dockside buyer who then either sells them to a processor or sells only the small crabs to a processor and sells the large whole crabs directly to brokers, distributors and retail outlets. A crabber may also enter directly into the market channel and sell whole crabs to brokers, distributors and retailers. It is known that there are some crabbers and dockside buyers shipping crabs out of Texas, however, the numbers and the volume of their shipments are unknown. Because landings records are collected only from the processors, blue crab landings in Texas may be, and most problably are, significantly underestimated.

Although studies are still being done to determine the status of the blue crab resource off the Texas coast, it is felt by some industry personnel that there is potential for further development of the indus-

try. An important incentive for further development would be the growth of local and regional markets. The second part of this chapter examines present crab consumption according to various demographic variables and compares it to finfish and other shellfish consumption. From this analysis, then, some inferences about future crab consumption patterns in Texas and the surrounding region will be made.

Review of Previous Seafood Consumption Studies

Over the period of 21 years, from 1960 to 1981, annual per capita consumption of seafood has trended gradually upward from 10.3 pounds to 13.0 pounds, representing a 26.2 percent increase (Table 13). Over that same period poultry consumption increased by 82.6 percent from 34.4 pounds in 1960 to 62.8 pounds in 1981. Beef and other redmeat consumption reached a high of 170.1 per capita pounds in 1971 and has been declining since.

Seafood expenditure share, of total redmeat, seafood and poultry expenditures, showed a gradual upward trend from 1960 to 1981 while seafood consumption share remained at around five percent. This indicates that, relative to poultry and redmeat, consumers did not increase consumption of seafood over that period but, rather, they spent more on seafood due to a faster relative rise in seafood prices. The consumer price index for seafood rose 272 points, over that same period, compared to 82 points for poultry and 175 points for redmeat. This faster rise in seafood prices is an important factor to consider in seafood market development due to the substitution effect.

Shellfish consumption, which was 2.3 pounds per capita in 1960, reached a high of 3.3 pounds in 1981. This represents a 43.5 percent

Table 13. Per Capita Consumption and Consumer Price Indexes for Seafood, Poultry and Redmeat.

Year	Seafood[a]		Poultry		Redmeat[c]		Total Meat and Seafood		Seafood[d] Consumption Share	Seafood[e] Expenditure Share
	Per Capita Consumption	CPI[b]	Per Capita Consumption	CPI	Per Capita Consumption	CPI	Per Capita Consumption	CPI		
	(Lbs.)		(Lbs.)		(Lbs.)		(Lbs.)		(%)	(%)
1960	10.3	85.0	34.4	106.9	146.6	87.2	191.3	89.1	5.4	5.1
1961	10.7	86.9	37.7	96.5	145.2	88.3	193.6	89.3	5.5	5.4
1962	10.6	90.5	37.2	102.0	146.9	90.1	194.7	91.5	5.4	5.4
1963	10.7	90.3	38.0	100.4	152.0	88.7	200.7	90.1	5.3	5.3
1964	10.5	88.2	38.9	98.2	155.8	87.3	205.2	88.7	5.1	5.1
1965	10.8	90.8	41.1	101.2	148.3	93.9	200.2	94.5	5.4	5.2
1966	10.9	96.7	43.8	106.7	151.5	102.6	206.2	102.6	5.3	5.0
1967	10.6	100.0	45.3	100.0	158.5	100.0	214.4	100.0	4.9	4.9
1968	11.0	101.6	45.0	103.1	162.1	102.3	218.1	102.2	5.0	5.0
1969	11.2	107.2	47.1	109.0	161.4	111.4	219.7	110.8	5.1	4.9
1970	11.8	118.0	48.8	108.4	164.8	117.6	225.4	116.5	5.2	5.3
1971	11.5	130.2	49.0	109.0	170.1	116.7	230.6	116.9	5.0	5.6
1972	12.5	141.9	51.1	110.4	166.1	129.2	229.7	128.0	5.4	6.0
1973	12.8	162.8	49.3	154.8	153.9	161.1	216.0	160.4	5.9	6.0
1974	12.1	187.7	49.9	146.9	164.3	164.1	226.3	163.9	5.3	6.1
1975	12.2	203.3	49.0	162.4	156.4	177.9	217.6	178.0	5.6	6.4
1976	12.9	227.3	52.2	155.7	166.1	178.2	231.2	179.4	5.6	7.1
1977	12.7	251.6	53.6	156.7	165.2	174.2	231.5	178.4	5.5	7.7
1978	13.4	275.4	56.3	172.9	158.9	206.8	228.6	208.3	5.9	7.8
1979	13.0	302.3	60.9	181.5	157.7	241.9	231.6	239.3	5.6	7.1
1980	12.8	330.2	61.0	190.8	159.7	248.8	233.5	248.2	5.5	7.2
1981	13.0	357.7	62.8	198.6	157.1	257.8	232.9	285.5	5.6	7.0

[a] Excludes game fish.

[b] 1967=100

[c] Excludes game and edible offal.

[d] Seafood Consumption Share= (Pounds Seafood) / (Pounds Total Meat and Seafood).

[e] Seafood Expenditure Share= (Seafood CPI x Per Capita Consumption) / (Total CPI x Per Capita Consumption of Total Meat and Seafood).

Source: *Food Consumption, Prices and Expenditures*. U.S. Department of Agriculture, Economics and Statistics Service, Statistical Bulletin No. 656, February 1982.

increase. However, shellfish consumption as a percentage of total per capita seafood consumption has remained approximately the same, fluctuating between 21 and 26 percent (Table 14).

Many factors influence fish and shellfish consumption patterns. These include price and income and various socioeconomic and demographic variables. The latter two categories include region of residence, population density, household size, occupation, and educational level. The impact these factors have upon consumption patterns is likely to reflect, in part, differences in tastes and preferences of individuals, differences in cultural backgrounds, and differences due to varying infrastructures among households.

Several studies have been done to determine the effects that some of these factors have on seafood consumption and expenditure patterns. Purcell and Rauniker analyzed seafood expenditure patterns of 160 households in the Atlanta, area. The data covered the five-year period from 1958 to 1962. Results of their analysis showed that household expenditure for fish and shellfish increased as income and household size increased. In addition, fish and shellfish expenditure for non-white households was, on the average, about 36 percent greater than fish and shellfish expenditures for white households. Age was shown to have a significant effect on the quantities purchased and amount expended for fish and shellfish. The number of persons in the 6-18 age classification had the greatest effect on household quantities of seafood products purchased while the number of persons over 18 had an effect on the amount expended.

Nash, using data collected by the NMFS during 1969, investigated the patterns of seafood product purchases of 1,586 households according

Table 14. Per Capita Shellfish Consumption as a Percentage of Total Seafood Consumption, 1960-1981.

Year	Total Seafood Consumption[a]	Shellfish Consumption[b]	Shellfish Consumption as a Percentage of Total Seafood Consumption
	(Pounds)	(Pounds)	(%)
1960	10.3	2.3	22.3
1961	10.7	2.4	22.4
1962	10.6	2.3	21.7
1963	10.7	2.5	23.4
1964	10.5	2.6	24.8
1965	10.8	2.7	25.0
1966	10.9	2.6	23.9
1967	10.6	2.7	25.5
1968	11.0	2.7	24.5
1969	11.2	2.7	24.1
1970	11.8	2.9	24.6
1971	11.5	2.9	25.2
1972	12.5	2.9	23.2
1973	12.8	2.7	21.1
1974	12.1	3.0	24.8
1975	12.2	3.1	25.4
1976	12.9	3.0	23.3
1977	12.7	3.2	25.2
1978	13.4	3.1	23.1
1979	13.0	2.9	22.3
1980	12.8	3.0	23.4
1981	13.0	3.3	25.4

[a] Excludes game fish consumption.

[b] Includes fresh, frozen and canned.

Source: *Food Consumption, Prices and Expenditures.* U.S. Department of Agriculture, Economics and Statistics Service, Statistical Bulletin No. 656, February 1982.

to household income, household size, geographic region, and age, occupation and educational level of the household head. Study results showed per capita fish and shellfish consumption and expenditure for blacks were almost double that for whites. Households located in the New England, East South Central and West South Central regions consumed more fish and shellfish than households located in other regions of the country. North Central (East and West) region households had the lowest per capita consumption rates for seafood.

Long and Coale conducted a survey of 600 households in two Virginia metropolitan areas. The two communities were Norfolk, a coastal area where seafood is more readily available and the population somewhat more transient, and Roanoke, an inland community with a more permanent population and less availability of seafood in fresh form.

The researchers found that seafood purchases in Norfolk are more frequent than in Roanoke. Eating out was found to be a major component of seafood consumption, especially among younger age categories and higher income occupational groups. Supermarkets are the primary source of supply for seafood consumed at home. The survey also indicated that seafood increases in dietary importance as age increases. Finfish replaced shrimp as the favored seafood of survey respondents over the age of 45 years.

In comparing consumption of seafood products among occupational groups it was found that more than three-fourths of welfare, blue collar and military respondents had eaten seafood during the week prior to the survey. Finfish was mentioned most often as the seafood last consumed, followed by shrimp. Crab consumption was highest among military workers.

In two separate studies, Salathe, and Smallwood and Blaylock investigated the impacts of household size and income on seafood purchases. Salathe utilized data from the 1972-74 Bureau of Labor Statistics (BLS) Consumer Expenditure Survey while Smallwood and Blaylock used the 1977-78 USDA Nationwide Household Food Consumption Survey. Both studies showed household purchases of fish and shellfish to be quite responsive to the level of household income and to household size.

In a recent study, Capps investigated the nature and magnitude of the influence of price, household income and socioeconomic and demographic variates on aggregate seafood expenditure. The data base utilized was the 1972-74 BLS Consumer Expenditure Diary Survey.

Households located in the Northeast were shown to purchase significantly more seafood than those in the North Central, South or West regions. In addition, households located in the South and West spend significantly more on fish and shellfish than households in the North Central region. Expenditures are also significantly higher for households located in statistical metropolitan areas with populations of one million or more than in less densely populated areas. Education, occupation, seasonality and employment status of the female head were not proven statistically significant in affecting seafood expenditure. It was found, however, that blacks and married persons expend significantly more on fish and shellfish than do non-blacks and non-married persons. The price of fish and shellfish, household size and household income were shown to be statistically significant factors affecting household purchase of seafood products. Increases (decreases) in price, household size and household income lead to concommitant

increases (decreases) in household expenditure on seafood products.

Crab Consumption Relative to Shellfish and Finfish Consumption

In most of the above mentioned studies crab consumption was not separated out. In order to obtain specific estimates of crab consumption, an analysis was conducted which did separate crab consumers from other seafood consumers. The data base used for this analysis is the 1977-78 USDA Nationwide Food Consumption Survey for Individuals. The survey of individuals contains data for away-from-home as well as at home consumption. Including away-from-home consumption was felt to be important since a significant amount of seafood consumption occurs outside the home. However, in using the individual data, it was not possible to do any expenditure analysis because data on at home expenditures was not available.

The survey was conducted from April 1, 1977, through March 31, 1978. It includes information on food ingested by 30,739 individuals (selected from 14,035 households) over a three-day period as well as information on household and individual characteristics believed to be related to food consumption. Household characteristics include region and urbanization, household income, household size, and education, occupation and employment status of male and female heads of households. Individual characteristics include sex, race and age.

The number of people consuming some form of seafood in the three-day period is 7,004 or 22.8 percent of the overall sample. Those people who consumed only finfish number 5,858 or 19.1 percent of the total sample. With the addition of the 323 people who consumed fish and shellfish this number increases to 6,181 or 20.1 percent. Approxi-

mately 16 percent or 1,146 of those individuals who consumed seafood ate shellfish. This represents 3.7 percent of the total sample. Crab was eaten by 185 people. This number represents 0.6 percent of the overall sample, 2.6 percent of seafood consumers and 16.1 percent of shellfish consumers. In carrying out this analysis total shellfish (1,146) and finfish (only) consumers (5,858) are used for comparisons.

The Northeast region accounts for the largest percentage of shellfish and crab consumers followed by the West, South and North Central regions. The same order applies to finfish consumers (Table 15). The New England, Mid Atlantic, South Atlantic and Pacific subregions account for the highest percentages of seafood consumers within their respective regions. All are coastal subregions. The percentage of crab consumers is highest in the Mid Atlantic followed by the Pacific and South Atlantic subregions. The West South Central subregion, which includes Texas, Oklahoma, Louisiana and Arkansas, ranks seventh among nine subregions in seafood consumption and had only a 0.3 percent occurrence of crab consumption within the survey period. Both the South Atlantic and Pacific areas have large crab fisheries. The Chesapeake Bay and Florida blue crab fisheries are in the South Atlantic area while the Dungeness, tanner and king crab fisheries dominate the Pacific subregion. The Mid Atlantic subregion, on the other hand, is the location of the large New York City market.

The percentage of seafood consumers is lowest in non-metro areas and approximately equal in central city and suburban areas. Higher prices, nonavailability of seafood and/or the lack of familiarity with many seafood products may be reasons for lower consumption in non-metro areas. In addition, rural diets traditionally are oriented more toward

Table 15. Percent of Individuals Consuming Crab, Shellfish, Finfish and Seafood in the Three-day Survey Period, in Each of the Regions and Subregions, May 1977-April 1978.

Region and Subregion[a]	Total Sample		Crab		Shellfish		Fish		Seafood	
	N	(%)	N	(%)	N	(%)	N	(%)	N	(%)
Northeast	7204	23.4	74	1.0	364	5.1	1647	22.9	2011	27.9
New England	1745		6	0.3	98	5.6	433	24.8	531	20.4
Mid Atlantic	5459		68	1.2	266	4.9	1214	22.2	1480	27.1
North Central	7851	25.5	24	0.3	197	2.5	1313	16.7	1510	19.2
East North Central	5205		16	0.3	127	2.4	801	15.4	928	17.8
West North Central	2646		8	0.3	70	2.6	512	19.3	582	22.0
South	10739	34.9	52	0.5	355	3.3	1941	18.1	2296	21.4
South Atlantic	4624		36	0.8	159	3.4	1013	21.9	1172	25.3
East South Central	2543		6	0.2	76	3.0	353	13.9	429	16.9
West South Central	3572		10	0.3	120	3.4	575	16.1	695	19.5
West	4945	16.1	35	0.7	230	4.7	957	19.4	1187	24.0
Mountain	1420		4	0.3	37	2.6	263	18.5	300	21.1
Pacific	3525		31	0.9	193	5.5	694	19.7	887	25.2
U.S.	30739	100	185	0.6	1146	3.7	6181	20.1	7004	22.8

[a] Region and subregions identified in Appendix Table A-4.
Source: Calculated from data obtained from *USDA Nationwide Food Consumption Survey for Individuals, 1977-1978* data tapes.

redmeat and poultry. The differences in consumption among residential areas are least pronounced for finfish. This could be due to the greater availability of frozen fish and a greater familiarity of the consumer with the breaded "fish-stick" type product. The difference is greatest for crab consumption which may be expected. Crab tends to be a more regionalized seafood available mostly in coastal areas or in large cities at restaurants and fish markets. Its availability in less populated areas is limited. Table 16 shows the differences in consumption rates by urbanization category.

Little seasonal difference in shellfish and finfish consumption is evident (Table 16). Crab and total shellfish consumption is lowest during the winter when finfish consumption is highest. This may be due to a greater availability of finfish relative to shellfish during the winter, however, the differences are not great enough nor can it be said that this is not just a sampling occurrence.

Table 17 indicates that seafood consumption increases with age. Finfish consumption remains relatively stable at around 19 to 22 percent. Shellfish consumption, however, increases with age then falls off after the age of 60. Some reports suggest that shellfish is relatively high in cholesterol and sodium compared to finfish, redmeats and chicken (Dean). Thus, elderly people may reduce consumption of shellfish voluntarily or be encouraged to do so, for health reasons, by physicians. Relatively lower incomes among older, retired people could also provide a plausible explanation for this decline in consumption. The highest percentages of shellfish consumers occur in the 25 to 39 and 55 to 59 age groups. Crab consumers fall mostly in the 20 to 29, 30 to 39 and 50 to 59 age groups. However, the sample size for crab

Table 16. Percent of Individuals Consuming Crab, Shellfish and Finfish by Urbanization Category and by Season.

Urbanization Classification	Total Sample		Crab		Shellfish		Fish		Seafood	
	(N)	(%)	(N)	(%)	(N)	(%)	(N)	(%)	(N)	(%)
Central City	8729	28.4	62	0.7	360	4.1	1805	20.7	2165	20.9
Suburban	11204	36.4	89	0.8	504	4.5	2075	18.5	2579	23.0
Non-Metro	10806	35.2	34	0.3	282	2.6	1978	18.3	2260	20.9

Season	Total Sample		Crab		Shellfish		Fish		Seafood	
	(N)	(%)	(N)	(%)	(N)	(%)	(N)	(%)	(N)	(%)
Spring	8772	28.5	62	0.7	378	4.3	1741	19.8	2119	23.6
Summer	6569	21.4	42	0.6	242	3.7	1195	18.2	1437	21.9
Fall	7689	25.0	47	0.6	279	3.6	1357	17.6	1636	21.3
Winter	7709	25.1	34	0.4	247	3.2	1565	20.3	1812	23.6

Source: Calculated from data obtained from *USDA Nationwide Food Consumption Survey for Individuals, 1977-1978* data tapes.

Table 17. Percent of Individuals Consuming Crab, Shellfish, Finfish and Seafood by Age Classification.

Age	Total Sample		Crab		Shellfish		Fish		Seafood	
	N	(%)	N	(%)	N	(%)	N	(%)	N	(%)
1-4	2936	9.6	3	0.1	34	1.2	383	13.0	417	14.2
5-9	3390	11.0	10	0.3	61	1.8	660	19.5	721	21.3
10-14	3872	12.6	10	0.3	88	2.3	757	19.6	845	21.8
15-19	3505	11.4	9	0.3	120	3.4	662	18.9	782	22.3
20-24	2078	6.8	20	1.0	91	4.4	381	18.3	472	22.7
25-29	1983	6.5	19	1.0	121	6.1	370	18.7	491	24.8
30-34	1778	5.8	22	1.2	111	6.2	353	19.9	464	26.1
35-39	1486	4.8	17	1.1	89	6.0	276	18.6	365	24.6
40-44	1297	4.2	10	0.8	73	5.6	267	20.6	340	26.2
45-49	1295	4.2	6	0.5	70	5.4	287	22.2	357	27.6
50-54	1513	4.9	21	1.4	82	5.4	311	20.6	393	26.0
55-59	1363	4.4	15	1.1	87	6.4	288	21.1	375	27.5
60-64	1211	3.9	10	0.8	46	3.8	256	21.1	302	24.9
65-69	1144	3.7	6	0.5	36	3.1	255	22.3	291	25.4
>70	1888	6.1	9	0.5	37	2.0	340	18.0	377	20.0

Source: Calculated from data obtained from *USDA Nationwide Food Consumption Survey for Individuals, 1977-1978* data tapes.

consumers is too small to determine any definite patterns.

Table 18 shows crab, shellfish and finfish consumption categorized by occupational groups for males and females combined. Fish consumption is highest among craftsmen and foremen followed by the professional and technical group and managers, proprieters and officers. Between 17 and 25 percent of each occupational group represented in the sample consumed finfish. Shellfish consumption ranges from 2.2 to 5.7 percent and is highest among professional and technical workers followed by managers, proprieters and officers. These two groups also account for the highest percentages of crab consumers.

Finfish and total seafood consumption increase with increasing household income (Table 19). Shellfish and crab consumption, however, increase up to an income level of $35,000 then decline (except for the over $50,000 group). This may be due to changes in tastes and preferences among older age groups as is indicated in the Long and Coale study.

Increasing household size has little effect upon finfish consumption. However, as household size increases past two persons, shellfish and crab consumption declines (Table 20).

Fish consumption is slightly higher among blacks (Table 21). This group, however, has the lowest percentage of shellfish consumers. Crab consumption occurs predominantly among whites. Fish, shellfish and crab consumers are equally distributed between males and females (Table 21).

Away-From-Home and At-Home Consumption of Seafood

Overall, at home seafood consumption is about 2.5 times that of

Table 18. Percent of Individuals Consuming Crab, Shellfish, Finfish and Seafood by Occupation (Male and Female).

Occupation	Total Sample		Crab		Shellfish		Fish		Seafood	
	N	(%)	N	(%)	N	(%)	N	(%)	N	(%)
Professional and Technical	6912	23.9	74	1.1	397	5.7	1348	19.5	1745	25.2
Managers, Officers and Proprieters	4785	16.5	50	1.0	239	5.0	934	19.5	1173	24.5
Farmers	958	3.3	1	0.1	32	3.3	181	18.9	213	22.2
Clerical and Sales	5895	20.4	43	0.7	276	4.7	1105	18.7	1381	23.4
Craftsmen and Foremen	633	2.2	3	0.5	26	4.1	155	24.5	181	28.6
Operatives	7129	24.6	37	0.5	255	3.6	1269	17.8	452	17.2
Service Workers	2631	9.1	9	0.3	59	2.2	452	17.2	511	19.4

Source: Calculated from data obtained from *USDA Nationwide Food Consumption Survey for Individuals, 1977-1978* data tapes.

Table 19. Percent of Individuals Consuming Crab, Shellfish, Finfish and Seafood by Income Classification.

Income	Total Sample		Crab		Shellfish		Fish		Seafood	
	N	(%)	N	(%)	N	(%)	N	(%)	N	(%)
0-4999	3071	13.3	2	0.07	44	1.4	546	18.4	595	19.4
5000-9999	4572	19.7	11	0.2	108	2.4	814	17.8	922	20.2
10000-14999	4884	21.1	27	0.6	182	3.7	936	19.2	1118	22.9
15000-19999	4349	18.8	33	0.8	165	3.8	819	18.8	984	22.6
20000-24999	2793	12.1	20	0.7	142	5.1	530	19.0	672	24.1
25000-29999	1467	6.3	17	1.2	82	5.6	304	20.7	386	26.3
30000-34999	900	3.9	16	1.8	71	7.9	197	21.9	268	29.8
35000-39999	393	1.7	4	1.0	19	4.8	75	19.1	94	23.9
40000-44999	307	1.3	2	0.7	15	4.9	60	19.5	75	24.4
45000-49999	113	0.5	0	0.0	3	2.7	33	29.2	36	31.9
> 50000	324	1.4	10	3.1	37	11.4	75	23.1	112	34.6

Source: Calculated from data obtained from *USDA Nationwide Food Consumption Survey for Individuals, 1977-1978* data tapes.

Table 20. Percent of Individuals Consuming Crab, Shellfish, Finfish and Seafood by Household Size.

Household Size	Total Sample		Crab		Shellfish		Fish		Seafood	
	N	(%)	N	(%)	N	(%)	N	(%)	N	(%)
1	2577	8.4	18	0.7	124	4.8	487	18.9	611	23.7
2	5451	17.7	55	1.0	293	5.4	1051	19.3	1344	24.7
3-4	12119	39.4	70	0.6	455	3.8	2255	18.6	2710	22.4
5-7	9118	29.7	41	0.4	257	2.8	1756	19.3	2013	22.1
> 7	1474	4.8	1	0.07	17	1.2	309	21.0	326	22.1

Source: Calculated from data obtained from *USDA Nationwide Food Consumption Survey for Individuals, 1977-1978* data tapes.

Table 21. Percent of Individuals Consuming Crab, Shellfish, Finfish and Seafood by Race and Sex.

	Total Sample		Crab		Shellfish		Fish		Seafood	
Race	N	(%)	N	(%)	N	(%)	N	(%)	N	(%)
White	25431	82.9	172	0.7	1003	3.9	4655	18.3	5658	22.2
Black	4119	13.4	11	0.3	104	2.5	962	23.4	1066	25.9
Other	1126	3.7	2	0.2	38	3.4	228	20.2	266	23.6
Sex	N	(%)	N	(%)	N	(%)	N	(%)	N	(%)
Male	13830	45.0	77	0.6	507	3.7	2559	18.5	3066	22.2
Female	16909	55.0	108	0.6	639	3.8	3299	19.5	3938	23.3

Source: Calculated from data obtained from *USDA Nationwide Food Consumption Survey for Individuals, 1977-1978* data tapes.

away-from-home. Table 22 shows the number of people consuming finfish, shellfish, crab and total seafood at home and away-from-home. The mean amount (in pounds) and the range in amounts consumed are listed along with the coefficient of variation of the means.

Almost three times as many people consumed fish at home than away-from-home. However, the numbers consuming shellfish and crab away-from-home were 15 and 13 percent higher, respectively, than those indicating at home consumption. Generally, the mean amounts consumed are slightly larger for home consumption.

The major places of seafood purchases, in order of importance, are sit-down restaurants, school cafeterias, fast food restaurants, other people's homes and school a la carte meals. Eighty-six percent of the respondents who consumed seafood away-from-home utilized at least one of these five sources. There are, however, differences in utilization of these sources among finfish, shellfish and crab consumers (Table 23).

Sit-down restaurants increase in importance in consumption of finfish to consumption of crab. Approximately 77 percent of those people consuming crab away-from-home did so at a sit-down restaurant compared to 28 percent of finfish consumers. However, the opposite relationship exists for fast food restaurants. Only 1.1 percent of crab consumers ate at fast food restaurants compared to 14.4 percent of finfish consumers. The only other important source of crab is other people's homes (16 percent). This source ranked third in importance for shellfish and fourth for finfish. No crab was consumed at school, however, school cafeteria meals and a la carte meals are both important sources of finfish. Overall the most away-from-home sources were

Table 22. At-Home and Away-From-Home Consumption of Total Seafood, Finfish, Shellfish and Crab During the Three-day Survey Period, May 1977-April 1978.

Food Category	At-Home				Away-From-Home			
	N	Mean Amount Consumed (Lbs.)	Range (Lbs.)	C.V.	N	Mean Amount Consumed (Lbs.)	Range (Lbs.)	C.V.
Total Seafood	5203	0.30	.007-5.18	89.6	2107	0.28	0.0005-2.22	88.1
Finfish	4790	0.30	.007-5.18	87.3	1603	0.28	0.0006-2.19	81.9
Shellfish	469	0.24	.007-2.14	108.0	564	0.21	0.0005-1.50	97.3
Crab	86	0.33	.018-1.62	82.5	99	0.29	0.0007-1.39	83.7

Source: Calculated from data obtained from *USDA Nationwide Food Consumption Survey for Individuals, 1977-1978* data tapes.

Table 23. Away-From-Home Sources and Percent Useage by Crab, Other Shellfish, Fish and Total Seafood Consumers.

Away From Home Source	Crab	Other Shellfish	Fish	Total Seafood
	----------Percent----------			
Sit-down Restaurant	76.7	63.5	28.3	30.4
Fast Food Restaurant	1.1	13.5	14.4	14.3
Other Public Eating Establishment	3.3	5.0	1.8	1.9
Dining Room or Cafeteria at Work	0.0	2.5	5.1	4.9
Other Place at Work	0.0	1.5	2.5	2.7
Day Care Center	0.0	0.0	0.9	0.9
Summer Day Camp	0.0	0.2	0.1	0.2
Community Feeding Program for Seniors	0.0	0.0	0.9	0.9
Grocery or Other Food Store	0.0	0.2	0.6	0.6
Drugstore or Other Store	0.0	0.0	0.1	0.1
Someone Else's Home	15.6	8.3	10.7	10.2
School Cafeteria Meals	0.0	0.8	22.2	22.3
School a la Carte Meals	0.0	1.2	10.2	9.2
Other	3.3	3.1	2.1	3.5

Source: Calculated from data obtained from *USDA Nationwide Food Consumption Survey for Individuals, 1977-1978* data tapes.

listed for finfish, the fewest for crab.

Table 24 lists crab products, the number of persons consuming each product at- and away-from-home, and the mean and range of amounts consumed. Because the sample size is so small it is difficult to make any kind of prediction about crab consumption. However, Table 24 indicates that hardshell steamed crabs, crab cakes and crab soup are more likely to be consumed away from home than are canned crabmeat or crabmeat imperial. The other products have approximately an equal occurrence of at home and away-from-home consumption.

Texas Market and Consumption Potential

Historically the Texas blue crab industry has been dependent upon the East coast market. The proportion of Texas crabs shipped to this market is substantial and has increased since 1975 when East coast interests moved into the Texas processing industry. This dependence on a distant market has led to a certain degree of instability within the Texas industry. It is significantly affected by fluctuations in landings in the East coast fishery which results in price instability for Texas producers. In addition, coordination between production and consumption decisions is more difficult and loss of control of the crabs within the marketing channel, by the processor, has led to delivery and product quality problems. The development of a regional market would reduce the industry's dependence upon the East coast market and eliminate or reduce the impacts of these problems upon Texas producers. This section of the study examines demographic projections for the Texas as well as the U.S. population. Based upon these projections and the results of the previous section, estimations of potential market

Table 24. Amounts of Various Crab Products Consumed Away- and At-Home During the Three-day Survey Period, May 1977-April 1978.

Food Category	At-Home				Away-From-Home			
	N	Mean Amount Consumed (Lbs.)	Range (Lbs.)	C.V.	N	Mean Amount Consumed (Lbs.)	Range (Lbs.)	C.V.
Crabmeat (Not Further Specified)	20	0.17	0.04-0.56	74.8	28	0.18	0.04-0.60	82.9
Crab, Hardshell-Steamed	8	0.17	0.02-0.67	126.3	19	0.22	0.01-1.00	118.1
Crabmeat, Canned	13	0.24	0.06-0.89	96.5	3	0.30	---	---
Crab, Softshell-Fried	3	0.40	0.23-0.50	36.0	0	----	---	---
Crabmeat, Deviled	4	0.30	0.19-0.49	42.7	6	0.30	0.05-0.53	59.1
Crabmeat, Imperial	13	0.37	0.13-0.72	46.6	8	0.31	0.12-0.56	56.9
Crab Cakes	10	0.36	0.08-0.66	55.4	17	0.21	0.16-0.53	57.0
Crab Salad	9	0.56	0.09-0.99	53.6	6	0.44	0.28-0.85	47.7
Crab Soup (Not Further Specified)	7	0.71	0.27-1.62	66.2	14	0.73	0.41-0.81	29.6

[a] Consumption amounts are averages for one day.
Source: Calculated from data obtained from *USDA Nationwide Food Consumption Survey for Individuals, 1977-1978* data tapes.

demand for crab within Texas will be derived.

Demographic Characteristics

Presently Texas is the third most populous state in the U.S. with a population, in 1980, of 14,228,383. By the year 2000 it is expected to rank second with a population of around 22,000,000. According to a study by the Texas 2000 Commission, immigration accounted for 58.3 percent of the growth in population between 1970 and 1980 and is expected to continue to account for the largest percentage over the next 20 years. The magnitude of migration and the characteristics of immigrants will, of course, affect the demand for goods and services including crab and crab products. During the 1970's Louisiana provided more than 10 percent of the immigrants to Texas. The second largest contributor of people moving into Texas is the Northeast region. Residents of these areas traditionally consume more seafood than those of other areas. Louisiana and the Northeast are also sites of large blue crab fisheries, making this species a familiar and popular seafood and one which immigrants from these areas can be expected to continue consuming.

Analysis of seafood consumers showed that the typical crab consumer is white and lives in an urban area in a one or two member household. He/she tends to be middle-aged and a white collar worker with a yearly income of 20 to 35 thousand dollars. According to demographic projections, the number of consumers in Texas who may fit this description may be increasing over the next two decades.

In 1970 73.5 percent of the Texas population lived in urban areas. In 1980 the percentage had risen to 79.5 and the trend toward greater

urbanization is expected to continue. After a decade of growth in personal income and employment, Texas' per capita personal income ($9,513), in 1980, had risen slightly above the national average ($9,458) and it is expected to continue rising (Skrabanek). Related to this, the number of working women in the state is also expected to continue rising, thus increasing the number of two income households. According to the Texas 2000 report, a large majority of the immigrants are well-educated young couples or families in middle-income brackets and are likely to be upwardly mobile.

The U.S. economy, as a whole, has been gradually changing from largely a blue collar to a predominantly white collar economy. This trend is expected to continue into the future as the economy moves from an industrial toward a service orientation. White collar jobs are expected to expand approximately 25 percent, with growth being fastest in the professional and technical occupations. By 1990, more than half the U.S. labor force is expected to be white collar (Russel).

Consumption Potential

The previous analysis indicated that a person consumes 0.175 pounds of crabmeat per serving (average of at home and away-from-home consumption, Table 24). This figure is assumed to represent the average amount of crabmeat consumed during the three-day survey period. It is assumed, therefore, that survey respondents did not consume crab more than once during that period, which seems reasonable based upon the relatively low incidence of crab consumption overall. Assuming that 0.3 percent of the population consumes crab in any given three-day period, as was determined for the West South Central region, then the

population of Texas (14,228,000) will consume a total of 7,470 pounds of crabmeat in that period or 2,490 pounds per day. This translates into 12,450 pounds of raw crabs per day assuming a 20 percent recovery of meat. Extrapolating further, then, an estimated 908,850 pounds of crabmeat or an equivalent of 4,544,250 pounds of raw crabs are consumed yearly in Texas. This represents roughly 66 percent of the reported 1981 landings of blue crab in Texas.

In the previous discussion of Texas and U.S. demographic trends it was indicated that a significant number of people could be moving into Texas from regions with a higher incidence of seafood consumption. In addition, middle income, white collar households, which were shown to account for the largest percentage of crab consumers, are expected to increase in number. If these projections hold true the frequency of crab consumption in this region can be expected to approach that of the U.S. as a whole (0.6 percent, Table 15). The quantity of crab consumed within Texas, then, could conceivably double. These estimates, however, include all types of crab. Survey respondents ate a variety of processed crab products as well as canned and fresh crabmeat and steamed and fried whole crabs. Species were not designated. Thus, the estimated amount, of blue crabmeat and whole crabs consumed in Texas may be, and most probably is, considerably lower than these figures indicate. These estimates are, however, the best available at this time and are valuable in as much as they indicate the overall demand for crab within this region.

If the projected trends materialize, a growing market for blue crab will be available in this region for the Texas crab industry. If properly developed, this market could offer a viable alternative to the

East coast market. The existence of a large regional market would lead to more efficient pricing due to better coordination between production decisions of producers and the decisions of consumers. Price variability would also be diminished through reduction in the dependence on the East coast market which fluctuates in relation to East coast landings. Lastly, processors would have better control over the product in the marketing channels because time and distance of delivery would be reduced. This would mean that a better quality product could be assured which could lead to higher and more consistent prices.

Summary

Upon being unloaded, crabs are sorted by the processor and large male crabs are separated out for the whole-crab market. The remaining crabs are taken to the plant where they are picked. One hundred pounds of raw crabs yields 15 to 20 pounds of meat, most of which is sold as a fresh refrigerated product.

The most common market channel utilized by the Texas blue crab industry is from crabber to processor with the processor selling whole crabs and crabmeat to brokers, distributors and retail outlets. Two other channels exist; a crabber can sell crabs to a dockside buyer or he may enter the marketing channel directly. While the managers of processing plants owned by East coast interests indicated that they sell most of their whole crabs and crabmeat to East coast markets, they also reported that the percentage can change from season to season and year to year depending upon the landings in the East coast fisheries. The Texas market was reported to be about double its level ten years ago.

Analysis of crab consumers was done in order to make projections as to future market potential for blue crab in Texas. Although the sample size was too small to determine any definite trends in crab consumption, a few general patterns were suggested. Crab consumption, measured by percentage of population, is relatively low. During the three-day survey period only 0.6 percent of the entire sample consumed any type of crab or crab product. Data suggest that most crab consumers are white, and live in urban areas in one to two member households. Most are in the middle age groups and are white collar workers with yearly incomes of 20 to 35 thousand dollars. According to projected population demographics, this socioeconomic group will be increasing in number in the future.

Away-from-home consumption of crab was found to be slightly higher than at home consumption. Sit-down restaurants are the most important source of crab consumed away-from-home.

Yearly consumption of all species of crab in Texas was estimated to be approximately 900,000 pounds of crabmeat or approximately 4.5 million pounds of raw crabs. Taking into account projected demographic trends this figure could at least double over the next two decades, resulting in development of a larger market for blue crab in Texas and the surrounding region. This, then, could lead to greater price stability for Texas producers and potentially higher returns.

SUMMARY AND CONCLUSIONS

Summary

The Gulf of Mexico ranks second to the Chesapeake Bay region in blue crab production. Within this region, Texas ranks third in production, accounting for roughly 20 percent of total Gulf landings since 1970. Beginning in 1975 two things occurred which directly affected the Texas blue crab industry. The first was a significant increase in involvement of Northeastern interests in the Gulf processing industry. The second was the influx of Indochinese pickers and crabbers into the industry. These developments resulted in increased production due to more efficient harvesting and processing and an increase in the export of whole crabs and crabmeat to East coast markets.

There are currently 10 crab processing plants located along the Texas Gulf coast. At the time this study was undertaken there were approximately 109 crabbers operating out of these plants. Crabbers of Indochinese origin accounted for about 41 percent of these and were concentrated along the central coast.

A cost and return budget, based upon survey results, showed that a typical crabber earns less than $4,000 above costs. Bait and fuel account for roughly 74 percent of his total costs. The most common type of vessel used is a fiberglas sport boat, 16- to 19- feet in length, with a gasoline-outboard engine. Although the limit on the number of traps which can be fished is 300 in all but three counties, most crabbers reported they fished 200 traps year round.

No evidence was found that the crab fishery is used to a significant degree as a supplementary source of income by other fishermen.

Some crabbers reported that they participate in other fisheries at various times of the year but only on a small scale. Fifty percent of the indigenous crabbers interviewed were former bay fishermen.

The major problems perceived by crabbers are the high price of inputs relative to the price received for crabs and loss of traps. Other problems include competition with sport crabbers, poor crabbing, poor markets, difficulty obtaining and storing bait, and pollution of bays.

An undetermined amount of Texas-caught blue crab is shipped to east coast markets by processors, dockside buyers and crabbers. The major market is located in Baltimore. Within Texas, whole crabs and crabmeat are shipped to Houston, Dallas, San Antonio, Beaumont, Galveston, Port Arthur, Corpus Christi, Brownsville, Austin and El Paso. The Texas blue crab market, has been expanding gradually. Industry-wide efforts in this area have been limited, usually consisting of local advertising and product promotion. The large Texas processors, owned by east coast interests, are committed to supplying Northeast markets first and have shown limited interest in development of the Texas market. Other processors, however, have expressed an interest in developing larger markets and expanding processing capabilities to meet the growing market.

Several basic trends in crab consumption are suggested. The Northeast region was found to account for the largest percentage of all individuals who are shellfish and crab consumers. The West South Central subregion ranks seventh among nine subregions in crab consumption. Data suggested that the average crab consumer usually lives in an urban area in a small household. He/she tends to be middle-aged and in a

white collar occupation with a 20 to 35 thousand dollar income. According to demographic projections of the Texas population, this socioeconomic classification of people is predicted to increase in number over the next two decades. In addition, a significant number of people are predicted to move into Texas from regions exhibiting a higher frequency of seafood consumption.

Away-from-home consumption of crab was shown to be slightly higher than at home consumption. Sit-down restaurants are the predominant away-from-home source.

Based upon survey results, which indicate that 0.3 percent of the West South Central population consumes crab once in three days and that the average amount of crabmeat consumed per serving is 0.175 pounds, an estimate of current crab consumption was derived. In terms of raw crabs the amount, approximatey 4.5 million pounds, represents 66 percent of the 1981 level of Texas blue crab landings. Taking into account demographic projections for the U.S. and Texas, it is conceivable that this amount could double over the next two decades. These estimates, however, include all types of crab and, thus, consumption of blue crab, in Texas, is most probably considerably lower.

Discussion and Recommendations

Opportunities for Market Development

The significant increase in population and changing socioeconomic composition of the Texas population are likely to have an effect on the blue crab market. The magnitude and the characteristics of immigrants will, of course, affect the demand for goods and services including

crab and crab products. If significant numbers of people move in from areas such as the Northeast and South Atlantic, where seafood consumption is traditionally higher than in the West South Central region, then demand for all types of seafood, including crab, could increase significantly.

Traditionally, blue crab has been a luxury seafood item. Because of the high cost of processing and the large percentage of waste, crabmeat and crab products have carried a relatively high price. While away-from-home consumption of crab at sit-down restaurants will likely remain important, Texas processors may be wise to explore the possibilities of increasing at home consumption. The growing white collar segment, especially those households with two incomes, could be a large target market for convenience and microwave-ready crab products.

The growing trend toward fast food offers another market development opportunity. Increased competition among fast food restaurants is leading to a wider diversification of menus. Fish has become a popular fast food restaurant item and an increasing number of restaurants are adding more seafood items to their menus. This could offer another market opportunity for crab processors. Some processors have complained that they sometimes have a problem selling brown claw meat. Developing processed crab products in which brown meat could be mixed with other ingredients could offer a solution to this problem. Products of this type could be developed for both the home consumption and fast food markets.

Presently, most processors are not equipped to produce crab products other than picked meat. If they are, it is only on a small scale. However, a growing market for processed products, as well as whole

crabs, could lead to expansion of facilities or integration with other food processing companies.

Potential Problems

Two potential problems may exist which could have limiting effects on the development of the Texas blue crab industry. The first of these is a shortage of supply due to too few crabbers. In order to supply a growing market processors must be assured a steady supply of raw crabs. This was a problem until entry of the Vietnamese into the fishery. According to processors, their entry significantly increased landings leading to expansion of the industry in the latter 1970's. It can be argued, however, that not many additional Vietnamese may be entering the fishery in the future.

Vietnamese crabbers entered the industry with low opportunity costs. Discouraged by indigenous fishermen from entering other fisheries and lacking the skills needed for employment elsewhere, the blue crab industry offered a viable means of making a living and starting a new life in the U.S. It is doubtful, however, whether many new Vietnamese immigrants will choose to enter the fishery because of the low returns. The primary resettlement program is greatly reduced from what it was in the 1970's. Thus, any new Vietnamese moving into the area will probably be coming from some other region of the U.S., most likely the North. These people will be more proficient in English than when they arrived, and will likely have received training in some area other than fishing. Thus, it is unlikely that they will become crab fishermen. Secondly, it is unlikely that younger generations, now being educated in public schools, colleges and vocational schools, will choose

to enter the blue crab fishery. Proficient in English and having training in various fields, it is more likely that they will seek employment where the returns are much higher. In addition, despite discouragement from local fishermen, many Vietnamese families have pooled the resources of family members to buy larger boats and have entered the bay, and in a few cases the Gulf, shrimp fishery. Thus, upward mobility within the fishing industry has attracted some crabbers away from the blue crab industry.

The second potential problem is a decline in the resource due to poor management and/or destruction of the habitat areas in the coastal zone. Coastal wetlands, defined as lands in close proximity to coastal bays and characterized by near-surface water tables and/or inundated by water at least part of the year, are critical in the life cycle of the blue crab. Crabs develop from the megalops to adult stage in areas of low salinity typically associated with bayous, secondary bays and tidal marshes. In the past, the changes which occurred in these coastal wetlands were driven by nature. Increasingly, however, changes occurring in the coastal zone (including coastal wetlands) have been brought about by man's activities. The coastal zone has become the scene of intense and expanding human activity as increased population and per capita income have increased the demand for recreation, products of industry, agriculture and fisheries, and for suitable housing. Unfortunately, man's activities are often designed to change the natural system so that he can make better use of it. In many cases little effort is made to determine how these changes will affect the biological systems or the effects become evident only after the changes have occurred. Undesirable effects resulting from coastal zone development

include saltwater intrusion, pollution, and land and habitat loss. The result of these effects can be reduction in shellfish production leading to significantly reduced landings in the blue crab fishery.

Recommendations

Unless returns to crabbers are significantly increased it is conceivable that the industry may face supply problems in the future especially with increasing demand. Bait and fuel account for 74 percent of a crabber's costs and both are rising in cost. Trap loss also remains high. The ex-vessel price paid for crab is not keeping pace with the increasing costs of inputs. Though an increase in demand will eventually result in an increase in ex-vessel price, due to the shifting out of the demand curve, that increase may not be large enough to attract enough reliable new crabbers into the industry, especially if input prices rise significantly. Due to the high percentage of waste and the labor intensive picking process, the price processors are willing to pay for raw crabs will remain far below those paid for other seafood species. This suggests that efforts at market development must be combined with efforts to decrease production costs and the percentage of waste per crab so crabbers may retain more of the value of the raw product.

One area in which research effort could be focused is development of uses for crab waste other than animal feed. Alternatives include protein extraction, silage and composting. Possible uses of products include fertilizers, pharmaceuticals and food dye. Reduction of processing costs through improved technology is a second area needing further research. Development of a picking machine that will be efficient

and produce a good quality product would allow processors to reduce labor costs of producing picked meat and could result in higher prices to crabbers. And finally, development of consumer products that will utilize a larger percentage of the crab, such as ground carapace and minced meat extracted by machine, could also result in greater returns to processors and potentially be reflected in higher ex-vessel prices.

Another cause of low ex-vessel prices may be lower relative production costs in other producing regions. If costs are lower in the East coast fishery then, due to the Texas industry's dependence on that market, Texas producers are at a disadvantage because they have higher costs but the ex-vessel price they receive is largely determined by the East coast market. Development of a larger regional market could eliminate this problem because the ex-vessel price received by crabbers within this market would be based on production costs for the Texas fishery. As a result the East coast market would then have to pay this higher price in order to obtain Texas blue crabs.

A discussion of the development potential of the Texas blue crab industry is academic unless the continued survival of the resource can be assured. If the crab populations of the coastal zone are to remain healthy then there must be a balance in uses of the coastal zone to ensure that this resource has the habitat and conditions needed for survival. The future of the blue crab industry will depend upon a sound management system that will minimize the stresses and impacts upon the resource resulting from diversified uses of the coastal zone. This system must also extend to activities which, while not occurring directly in the coastal zone, effect it nevertheless. An example would be further damming of rivers which provide freshwater flow into coastal

bays.

In the past, low demand for blue crab has resulted in relatively low use of the crab resource. As a result there has not been much interest in or pressure for more refined management. This is evidenced by the fact that no commercial crab license is required. In the future, however, if a larger regional market should develop, prices rise and greater interest develops in commercial harvest then the resource may come under greater pressure. This suggests that greater emphasis be placed upon more refined public management. The first step could be the requirement of a crab license. Through licensing, management authorities could then determine the number of crabbers operating in Texas including those not selling to processing plants. Licensing would also allow for documentation of the number of traps being used in various bays. In the current situation, Texas landings may be significantly higher than published data indicate and conceivably the resource could already be utilized at its full potential.

Limitations of the Study

This study provides a baseline from which further studies of the Texas blue crab industry may proceed. It documents the industry as it presently exists, identifies several problem areas as well as opportunities, and suggests areas needing further research. There are, of course, limitations to the study. The description of the harvesting sector takes into account only those crabbers who sell to processors. As mentioned in Chapter III there are two other classifications of commercial crabbers, those who sell to a dockside buyer other than a processor and those crabbers who sell directly to brokers, wholesalers and

retail outlets. Because the state of Texas does not require a commercial crab license, determining the number and locations of crabbers who fall into these latter two categories has been impossible. The result has been large descrepancies among estimates of the number of crabbers with estimations ranging from 150 to 650. While this study determined that there were approximately 109 crabbers selling to processors in July 1982, it was unable to determine the total number of crabbers operating in the state of Texas. While it can be assumed that the gear used, costs incurred and effort expended by these crabbers are similar to those of crabbers interviewed, this has not been determined directly.

The analysis of per capita consumption of crab relative to consumption of other seafood was conducted using a survey of 30,739 individuals. However, only 185 of those people consumed crab in the three-day survey period. While this indicates that overall consumption of crab in the U.S. is low, it also means that estimates of the average amount of crab consumed per serving and comparison of at home versus away-from-home consumption of crab were based on a relatively small sample. In addition, it is recognized that while the analysis of per capita seafood consumption provides a definitive summary of crab consumption, it lacks statistical support and thus can be proven correct only by the consistency of results among related and additional studies.

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APPENDIX A

Appendix Table A-1. Hardshell Blue Crab Landings, Value of Landings and Percent of Total U.S. Landings by Region (1960-1981).

	Middle Atlantic Region				Chesapeake Bay Region			
Year	Landings (Thousand Pounds)	% of U.S. Landings	Value (Thousand Dollars)	% of U.S. Value	Landings (Thousand Pounds)	% of U.S. Landings	Value (Thousand Dollars)	% of U.S. Value
1960	3643	2.0	395	5.0	66338	44.0	3535	45.0
1961	1406	1.0	119	1.8	70634	47.8	3411	50.6
1962	3389	2.3	259	3.4	81332	54.5	4293	57.0
1963	1383	1.0	139	1.8	63072	44.5	3697	47.9
1964	882	0.6	114	1.2	74112	48.7	4994	53.9
1965	1451	0.9	139	1.2	82561	49.4	6239	55.5
1966	1255	0.8	141	1.4	94104	56.4	5852	58.7
1967	752	0.5	94	1.1	79412	54.8	4675	54.3
1968	358	0.3	62	0.6	54186	47.7	6010	53.9
1969	1132	0.9	145	1.2	56654	42.8	5374	43.1
1970	1359	0.9	230	2.2	67351	46.3	4475	43.3
1971	2117	1.4	375	2.9	73882	49.6	6171	47.8
1972	3989	2.7	999	6.8	72036	48.8	6288	42.9
1973	4945	3.6	1317	7.5	57285	41.2	6849	38.8
1974	4996	3.3	1074	5.6	65510	43.9	8308	43.1
1975	6437	4.8	1424	7.0	59083	43.8	9294	45.8
1976	6313	5.5	1926	8.2	45191	39.1	9683	41.1
1977	1252	1.0	429	1.6	56415	43.8	11356	41.4
1978	1231	0.9	524	1.9	52020	37.6	10724	38.1
1979	1304	0.9	582	1.9	64159	42.0	12934	41.2
1980	3877	2.4	1451	4.1	63300	38.8	13025	37.0
1981	2511	1.3	809	1.8	94740	48.6	22911	49.4

Appendix Table A-1 cont.

	South Atlantic Region				Gulf of Mexico Region			
Year	Landings (Thousand Pounds)	% of U.S. Landings	Value (Thousand Dollars)	% of U.S. Value	Landings (Thousand Pounds)	% of U.S. Landings	Value (Thousand Dollars)	% of U.S. Value
1960	44786	2.99	2115	27.1	34876	23.3	1764	22.6
1961	40350	27.3	1589	23.6	35258	23.9	1617	24.0
1962	38731	25.9	1657	22.0	25893	17.3	1329	27.6
1963	50769	35.8	2454	31.8	26519	18.7	1429	18.5
1964	52011	34.2	2570	27.7	25292	16.6	1589	17.1
1965	45976	27.5	2468	22.0	37008	22.2	2390	21.3
1966	40517	24.3	2006	20.1	30951	18.6	1964	29.7
1967	37335	25.7	2008	23.3	27528	19.0	1826	21.2
1968	33316	29.3	2994	26.9	25759	22.7	2077	28.6
1969	41280	31.2	3795	30.5	33189	25.1	3145	25.2
1970	42701	29.4	2772	26.8	33999	23.4	2850	27.6
1071	39551	26.5	3262	25.2	33531	22.5	3113	24.1
1972	36248	24.6	3631	24.7	35195	23.9	3753	25.6
1973	31813	23.3	4182	23.7	43473	31.8	5313	30.1
1974	38315	25.7	4553	23.6	40355	27.1	5324	27.7
1975	30502	22.6	4089	20.1	38720	28.7	5503	27.1
1976	27369	23.7	5199	22.1	36561	31.7	6755	28.7
1977	30839	23.9	6344	23.1	40354	31.3	9305	33.9
1978	47084	34.1	8729	31.0	37895	27.4	8203	29.1
1979	49186	32.2	9250	29.4	38181	25.0	8658	27.6
1980	54963	33.7	10650	30.3	41066	25.2	10041	28.6
1981	60461	31.0	12983	28.0	37402	19.2	9640	20.8

Appendix Table A-2. Hardshell Blue Crab Landings, Value of Landings and Percent of Gulf of Mexico Landings by State (1960-1981).

	WEST COAST OF FLORIDA				MISSISSIPPI				ALABAMA			
Year	Landings (Thousand Pounds)	% of Gulf Landings	Value (Thousand Dollars)	% of Gulf Landings	Landings (Thousand Pounds)	% of Gulf Landings	Value (Thousand Dollars)	% of Gulf Value	Landings (Thousand Pounds)	% of Gulf Landings	Value (Thousand Dollars)	% of Gulf Value
1960	18648	54	895	51	2812	8	169	10	499	1	26	1
1961	17130	49	736	46	2505	7	143	9	838	2	46	3
1962	10356	40	407	37	907	4	55	4	614	2	35	3
1963	13158	50	644	43	1112	4	66	5	1297	5	75	5
1964	14068	56	843	53	1286	5	82	5	1762	7	110	7
1965	20598	56	1185	5-	1692	5	131	6	1812	5	153	6
1966	16547	53	912	46	1457	5	105	5	2183	7	182	9
1967	13976	51	817	45	1015	4	79	3	2353	9	188	10
1968	9008	35	674	32	1136	4	108	5	1980	8	159	8
1969	11584	35	1074	34	1760	5	177	6	1920	6	223	7
1970	14785	44	1076	30	2027	6	193	7	1607	4	144	5
1971	12279	37	952	31	1259	4	126	4	1997	6	212	7
1972	10673	30	959	26	1362	4	169	5	1611	5	195	5
1973	9599	22	1147	22	1815	4	231	4	2098	5	294	6
1974	10134	25	1280	24	1667	4	227	4	1828	5	284	5
1975	12807	33	1585	29	1137	3	177	3	1640	4	283	5
1976	12048	33	1966	29	1335	4	268	4	1299	4	281	4
1977	11700	30	2547	27	1919	5	473	5	2174	5	548	6
1978	11500	30	2185	27	1940	5	423	5	2009	5	458	6
1979	11465	30	2259	26	1311	3	316	4	1316	3	383	4
1980	11263	27	2392	24	2748	7	690	7	1557	4	464	5
1981	13931	37	3037	32	1805	5	503	5	2347	6	813	8

Appendix Table A-2 cont.

	LOUISIANA				TEXAS			
Year	Landings (Thousand Pounds)	% of Gulf Landings	Value (Thousand Dollars)	% of Gulf Value	Landings (Thousand Pounds)	% of Gulf Landings	Value (Thousand Dollars)	% of Gulf Landings
1960	10050	29	497	28	2867	8	177	10
1961	11910	34	514	32	2875	8	178	11
1962	9523	37	463	35	4473	17	289	22
1963	7982	30	447	31	2980	11	199	14
1964	5692	23	379	24	2486	10	275	18
1965	9284	25	635	27	3622	10	286	12
1966	7986	26	537	27	2778	9	228	12
1967	7559	27	520	28	2625	10	222	12
1968	9551	37	807	39	4084	16	329	16
1969	13602	35	1072	34	6348	19	599	19
1970	10254	30	928	33	5525	16	509	18
1971	12186	36	1256	40	5810	17	567	18
1972	15083	43	1777	47	6464	18	653	17
1973	23080	53	2811	53	6881	16	830	16
1974	20640	41	2701	41	6088	15	832	16
1975	17144	44	2510	46	5992	16	948	17
1976	15211	42	3061	45	6668	18	1179	17
1977	16154	40	3765	40	8297	20	1972	21
1978	14772	39	3113	38	7674	20	2024	25
1979	17370	46	3885	45	6721	18	1815	21
1980	16342	40	3874	39	9156	22	2621	26
1981	13026	35	3609	37	6952	17	1929	17

Appendix Table A-3. Names and Locations of Blue Crab Processing Plants in Texas.

Processor	Location
Caribe Seafood	Brownsville
Texas Super Crab	Rockport
Bo Brooks of Texas	Seadrift
Raby's	Port O'Connor
Villereal Fish Market	Port O'Connor
Collins Seafood	Palacios
Crabco	Matagorda
Top Quality Seafood	Port Bolivar
Milt's Seafood	Port Bolivar
Gold Crab Co.	Port Bolivar

Appendix Table A-4. Regions and Subregions as Identified in the *USDA Individual Food Consumption Survey*.

Northeastern Region
New England - Maine, Vermont, New Hampshire, Massachusetts, Connecticut, Rhode Island
Middle Atlantic - New York, Pennsylvania, New Jersey
North Central Region
West North Central - North Dakota, South Dakota, Nebraska, Kansas, Minnesota, Iowa, Missouri
East South Central - Wisconsin, Michigan, Ohio, Indiana, Illinois
Southern Region
West South Central - Oklahoma, Texas, Arkansas, Louisiana
East South Central - Kentucky, Tennessee, Mississippi, Alabama
South Atlantic - West Virginia, Maryland, Delaware, Virginia, North Carolina, South Carolina, Georgia
Western Region
Pacific - Alaska, Washington, Oregon, California, Hawaii
Mountain - Montana, Idaho, Wyoming, Colorado, Utah, Nevada, Arizona, New Mexico

APPENDIX B

Date: _____
Professor: _____
Time: _____

TEXAS BLUE CRAB HARVESTING SECTOR SURVEY

Texas A&M University Sea Grant Program
Department of Agricultural Economics

Vessel and Gear

1. Please give a description of the vessel you use for crabbing.

   Construction material? (✓)

   wood _____
   steel _____
   fiberglass _____
   other (specify) _____ _____

   Overall length (feet)? _____.

   Fuel type? (✓)

   gasoline _____
   diesel _____

   Engine model? _____.

2. Is your vessel:

   _____ designed primarily as a crabbing vessel?
   _____ designed for use in another fishery?
   (please specity which fishery) _____.
   _____ not specifically designed for use as a commercial fishing vessel?

3. How many crab traps do you fish during:

   Summer (May-August)? _____.
   Fall (September-December)? _____.
   Winter/Spring (January-April)? _____.

4. Estimate the present market value of your crab boat $ _____ and gear $ _____.

Bait and Supplies

5. What kind of bait do you use? _____
   _____.

6. What is the average amount of bait you are now using per day (total for all pots)?
   _____.

7. What is the average price per pound you currently pay for bait? _____.

8. How much fuel do you use per day when you are crabbing? _____ gallons.

9. Do you purchase bait and fuel from a processor or an independent dealer?

Bait	Fuel
_____ processor	_____ processor
_____ independent dealer	_____ independent dealer

10. How many days per week would you estimate you crab during each of the seasons indicated below and what is your average catch per day?

Season	Number of Days Per Week Crabbing	Total Number of Days Crabbing	Average Pounds Caught Per Day
Summer (May-August)	_____	_____	_____
Fall (Sept-Dec)	_____	_____	_____
Winter/Spring (Jan-April)	_____	_____	_____

11. What other fisheries do you participate in during the year? (Please indicate the months during which you participate in each fishery).

Fishery	Months
_____	_____
_____	_____
_____	_____
_____	_____

12a. How many people are currently living in your household? _____.

b. What share of your total household income comes from fishing? _____.

c. How many people in your household:

harvest (fish for) crabs? _____.

work in a crab processing plant? _____.

work in a non-fishery related job? _____.

d. What share of your fishing income comes from crabbing? _____.

13a. Do you normally have a crewman when you are crabbing?

_____ yes

_____ no (go to question 14).

b. Is this crewman a member of your household? yes _____ no _____.

c. How are your earnings from crabbing split between you and your crewman?

_____.

Marketing

14. What is your home (hailing) port? _____.

15. Do you normally fish different bay systems during the year? (Please indicate which bay systems and the months of the year you fish there).

(✓) Months

_____ Sabine Lake _____.
_____ Galveston and Trinity Bays _____.
_____ Matagorda, East Matagorda and Lavaca Bays _____.
_____ San Antonio, Mesquite and Espiritu Santo Bays _____.
_____ Green Lake and Lower Guadalupe River _____.
_____ Aransas and Capano Bays _____.
_____ Corpus Christi and Neuces Bays _____.
_____ Upper Laguna Madre and Baffin Bay _____.
_____ Central and Lower Laguna Madre _____.
_____ Gulf _____.
_____ Other (specify)_____ _____.

16a. During the past year (1981) have you sold crabs to more than one processor?

_____ yes (go to 15b).
_____ no (go to questions 16).

b. Why did you sell to more than one processor?

(✓)

_____ to receive a better price.
_____ because you crabbed in different areas during the year.
_____ other (please specify) _____.

17. Of the choices listed below, which would you choose as the most important criteria in making your decision on where to sell your crabs?

Criteria	
convenience of the processor to your fishing area	_____
availability of docking facilities	_____
price paid for your crabs	_____
services offered by the processor	_____
other (specify) _____	_____

18. Approximately how many pounds of crabs did you land last year (1981)? ____ pounds.

19a. Do you sell any of your catch directly to consumers or to retail outlets?

_____ yes
_____ no

b. If yes, estimate what percent of your total crab catch _____%.

20. What do you feel are the main problems facing you as a crab fisherman?

_____.
_____.
_____.
_____.
_____.