

TEXAS MARINE RESOURCES

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A SUMMARY OF COASTAL ACTIVITIES

1974

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**A SUMMARY OF
COASTAL ACTIVITIES**

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FOREWORD

This report is a summary of the 202-page study "Marine Resources Activities in Texas" which was completed for the Sea Grant Program of Texas A&M University in August, 1969. As copies of the original study dwindled, a decision was made to develop a summary report for distribution.

Preparation of this summary was undertaken with the intent to include a substantial amount of statistical information and pertinent highlights of the original study. The summary identifies diverse organizations in Texas conducting activities related to the marine environment associated with the Gulf of Mexico. Also identified are specific projects and programs of ports, educational institutions, research institutes and Federal and State of Texas agencies. And where possible, fiscal information on individual projects and total annual budgets and expenditures for marine related activities has been provided.

The Industrial Economics Research Division is grateful for the assistance received from many individuals and organizations in compiling information for the original report. Special credit must be given to port representatives, educational institutions, research institutes, and Federal and State of Texas departments and agencies.

The study "Marine Resources Activities in Texas" was partially funded by the National Science Foundation's Sea Grant Program institutional grant GH-26 made to Texas A&M University.

**James R. Bradley, Head
Industrial Economics
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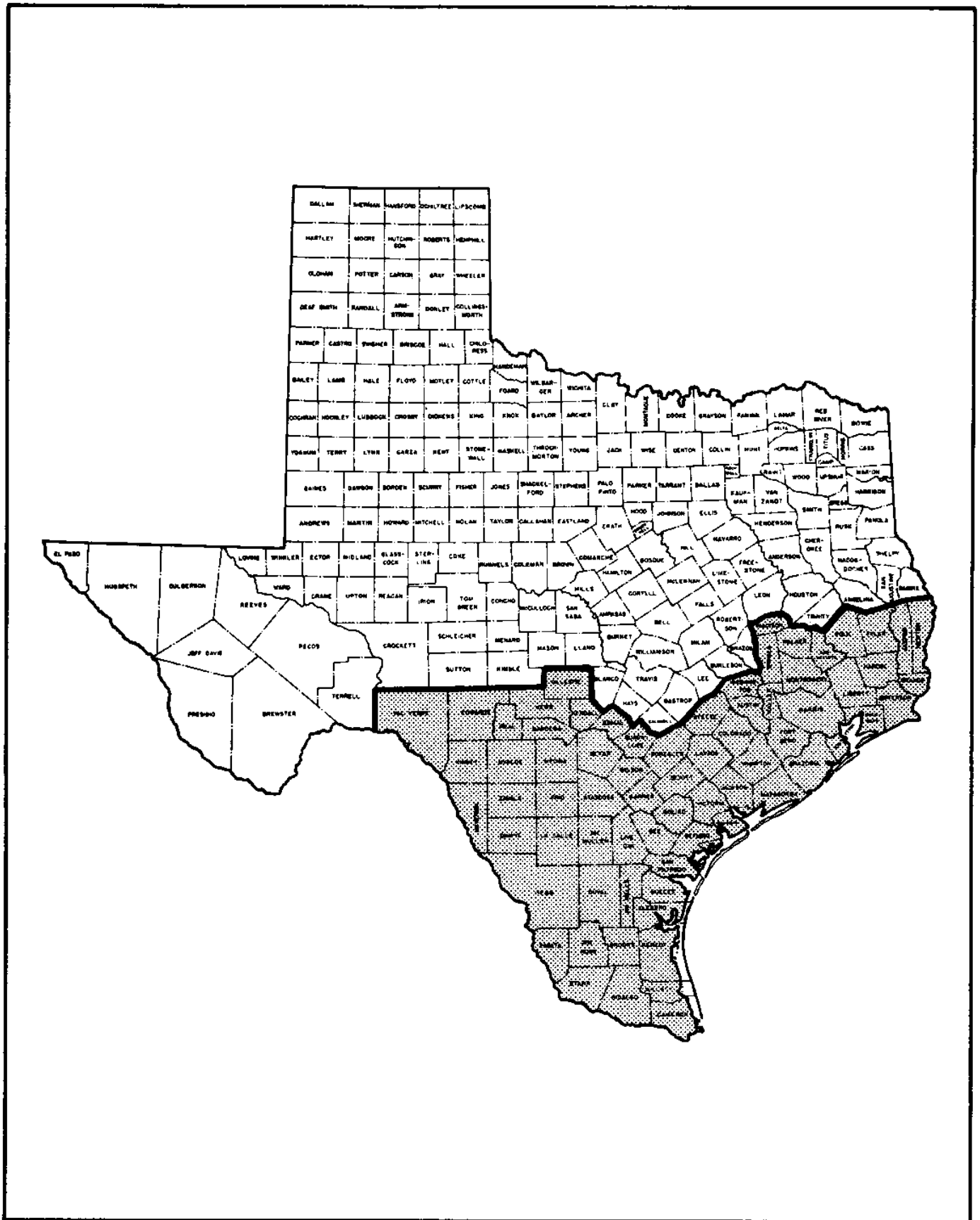


FIGURE 1 Orientation of the Study Area in Texas

1. INTRODUCTION

Purpose

This summary presents the findings of the 202-page study, "Marine Resources Activities in Texas," which was completed for the Sea Grant Program of Texas A&M University in August, 1969. The purpose of the survey was to prepare an inventory of agencies and organizations in Texas participating in activities related to the marine environment of the Gulf of Mexico. In addition to identifying these groups involved in marine related activities, every attempt was made to determine the level of marine related activity of each organization including specific projects, programs and direct expenditures for these efforts.

One of the major difficulties encountered in the study was that some Federal and most state agencies were unable to furnish information regarding expenditures solely for marine related activities in Texas. When such information was not available and total appropriations or budgets for the entire State of Texas were employed, these exceptions were so noted. Also, no attempt was made to evolve formulas or proportions to compute the pro rata share of total appropriations or budgets involved in the marine environment.

Sponsorship

Major financial support for this study was furnished by the National Science Foundation's Sea Grant Program of Texas A&M University which is directed by Dr. John C. Calhoun, Jr., Vice President of Programs, Texas A&M University. Additional financial aid was contributed from institutional funds from the Industrial Economics Research Division, Texas Engineering Experiment Station of Texas A&M University.

Study Area

The "study area" is defined as the 72-county area covering the coastal and southern portions of Texas. Selection and inclusion of these 72 counties in the study area was predicated on the general assumption that these counties had economies related, to some degree, to the Gulf of Mexico. It is recognized that some counties, due to access and proximity, interact to a substantially greater degree with the marine environment than do other counties included in the study area. The relative location of the study area is shown in Figure 1.

2. ECONOMIC CHARACTERISTICS

The 72-county study area is composed of several geographic regions. The regions are identified as the Gulf Coast Plain, South Texas Plain, Post Oak Belt, and the Edwards Plateau. Elevation in the area ranges from sea level in the Gulf Coast Plain to above 2,000 feet in the Edwards Plateau.

The study area contains 75,011 square miles. This is 27.1 percent of the state's total land area.

The Brazos, Colorado, Neches, Nueces, Rio Grande, Trinity, and Sabine Rivers flow through the study area. These major rivers enter ports along the Texas Gulf Coast. These deep water ports are Orange, Beaumont, Port Arthur, Houston, Texas City, Galveston, Freeport, Port Lavaca-Point Comfort, Corpus Christi, Port Isabel, and Brownsville. The location of these ports is shown in Figure 3 on page 5.

Major population centers are located within the eight Standard Metropolitan Statistical Areas (SMSA) designated in the 72-county study area. These SMSA's are Beaumont-Port Arthur-Orange, Galveston-Texas City, Houston, San Antonio, Laredo, Corpus Christi, McAllen-Pharr-Edinburg, and Brownsville-Harlingen-San Benito.

The total population of the area was 4,336,872 in 1962 and is projected to increase to 4,595,000 by 1970, which is a gain of 6.0 percent. Population growth and projected trends for the study area and Texas are presented in Table 1. These projections indicate that the region studied will increase by 2,821,628 people or 65.1 percent from 1962 to 2000.

Personal income is a measure of the purchasing power of persons. Total earnings, a major component of personal income, consists of the sum of wages and salaries, proprietors' income, and other labor income. The nonearnings portion of personal income consists of property income, transfer payments, and personal contributions for social insurance.

Total personal income for the area in 1962 was \$7,949,656,000. By 1970 this figure is expected to increase to \$12,110,400,000, an increase of 52.3 percent. By the year 2000, this figure is projected to

Table 1
POPULATION OF THE STUDY AREA AND TEXAS

Year	POPULATION		Study Area as Percentage of Texas
	Texas	Study Area	
1940	6,418,520	2,378,079	37.1
1950	7,712,137	3,163,418	41.0
1959	9,274,923	4,006,706	43.2
1962	9,988,070	4,336,872	43.4
1970	11,035,400	4,595,000	41.6
1980	12,775,200	5,307,800	41.5
1990	14,821,600	6,175,000	41.7
2000	17,175,400	7,158,500	41.7

SOURCE: *Preliminary Report on Economic Projections for Selected Geographic Areas*, United States Water Resources Council, Office of Business Economics, U. S. Department of Commerce, Washington, D. C., 1968.

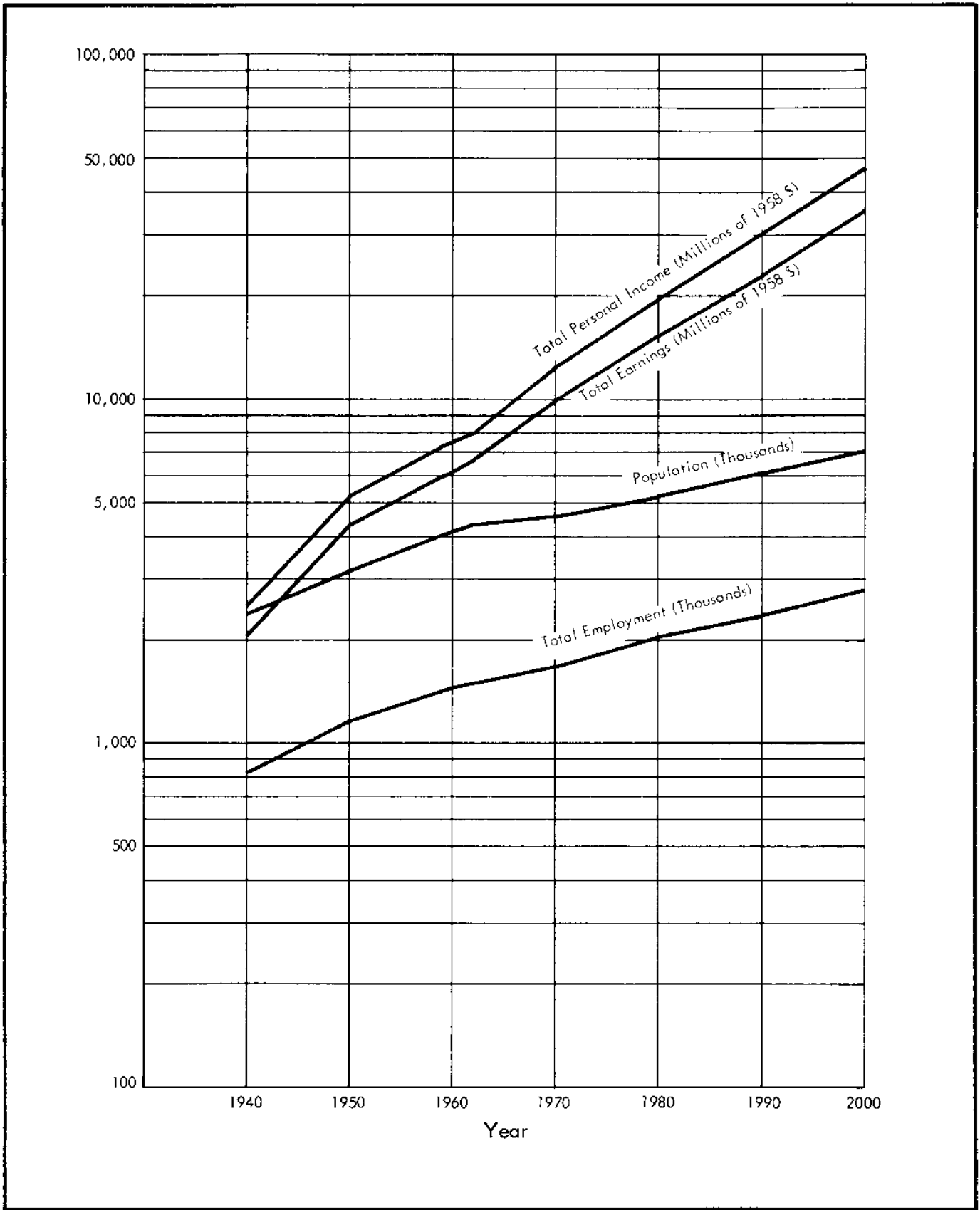


FIGURE 2 Actual and Projected Growth Trends for the Study Area

Table 2
TOTAL PERSONAL INCOME IN STUDY AREA AND TEXAS
(In Thousands of 1958 Dollars)

Year	TOTAL PERSONAL INCOME				Study Area As Percentage of Texas
	Texas	Percent Increase	Study Area	Percent Increase	
1940	\$ 6,036,318		\$ 2,494,448		41.3
1950	12,551,363	107.9	5,145,732	106.3	41.0
1959	17,593,100	40.1	7,217,373	40.3	41.0
1962	19,377,830	10.1	7,949,656	10.1	41.0
1970	29,105,600	50.2	12,110,400	52.3	41.6
1980	46,107,000	58.4	19,307,900	59.4	41.9
1990	69,696,700	51.1	29,202,300	51.2	41.9
2000	110,137,300	58.0	46,635,100	59.7	42.3

SOURCE: *Preliminary Report on Economic Projections for Selected Geographic Areas*, United States Water Resources Council, Office of Business Economics, U. S. Department of Commerce, Washington, D. C., 1968.

increase to \$46,635,100,000. This is a projected increase of 486 percent from 1962.

A presentation of total personal income for the study area and Texas from 1940 to 2000 is shown in Table 2.

Total employment in the 72-county study area is expected to increase from 1,421,774 persons in 1960 to 1,693,800 in 1970, a 19.1 percent rise. However, following national trends, the area's employment in agriculture has declined and is expected to continue this decline at least through the year 2000. In 1950, employment in agriculture was 160,521; in 1960, it had decreased to 115,628. This is a decrease of 28 percent. Over this same period, the nation's agricultural employment was reduced by 38 percent.

By 1970, the agricultural employment figure is estimated to decrease to 97,100. This will be 5.7 percent of the total employment in 1970.

Employment figures projected to the year 2000 are shown in Table 3. Comparison of the total employment in the study area and Texas from 1950 to 2000 is presented in Table 4.

Despite the decrease in employment, the study area's earnings from agriculture are increasing. Excluding the drought years from 1950 to 1959, agricultural earnings are expected to increase from \$329,290,000 in 1959 to \$822,700,000 in 2000. The 1959 figure represented five percent of total earnings in the study area and the large dollar increase by 2000 is deceptive since this figure will represent only 2.3 percent of the total earnings in the study area. Nonagricultural earnings constitute more than 95 percent.

The greatest growth in nonagricultural earnings will be in the field of services. Earnings are expected to increase from \$461,411,000 in 1950 to \$7,294,700,000 in 2000. Projections indicate that

Table 3
EMPLOYMENT BY INDUSTRY FOR THE STUDY AREA

INDUSTRY	1950	1960	1970	1980	1990	2000
TOTAL EMPLOYMENT	1,141,219	1,421,774	1,693,800	2,017,800	2,332,600	2,763,900
Agriculture, Forestry, and Fisheries	160,521	115,628	97,100	86,000	74,300	66,300
Mining	32,061	38,459	49,500	54,100	56,100	58,300
Contract Construction	98,290	106,601	130,200	152,600	173,400	201,600
Manufacturing	173,677	236,949	285,700	340,000	396,300	460,600
Transportation, Communication, and Public Utilities	95,614	107,178	112,500	121,700	129,200	132,000
Wholesale and Retail Trade	237,888	304,732	347,300	403,200	454,500	518,600
Finance, Insurance, and Real Estate	35,309	56,773	72,800	91,600	109,200	135,700
Services	214,189	313,064	428,800	572,400	714,300	934,100
Government	93,670	142,390	169,900	195,600	225,300	256,700

SOURCE: *Preliminary Report on Economic Projections for Selected Geographic Areas*, United States Water Resources Council, Office of Business Economics, U. S. Department of Commerce, Washington, D. C., 1968.

Table 4
TOTAL EMPLOYMENT OF THE STUDY AREA AND TEXAS

Year	TOTAL EMPLOYMENT		Study Area As Percentage of Texas
	Texas	Study Area	
1950	2,832,628	1,141,219	40.3
1960	3,443,400	1,421,774	41.3
1970	4,180,700	1,693,800	40.5
1980	4,973,000	2,017,800	40.6
1990	5,716,800	2,332,600	40.8
2000	6,753,100	2,763,900	40.9

SOURCE: *Preliminary Report on Economic Projections for Selected Geographic Areas*, United States Water Resource Council, Office of Business Economics, U. S. Department of Commerce, Washington, D. C., 1968.

33.8 percent of the total employment will be in the services field by 2000. Employment figures were presented in Table 3.

A breakdown of total earnings by industry source from 1950 to 2000 is presented in Table 5.

A graph showing the actual and projected growth trends for the 72-county study area is presented in Figure 2, page 2.

3. TEXAS PORTS

Development of the deep water ports along the 475-mile Texas coastline was one of the major factors accounting for the rapid economic growth of the area bounded by the Gulf of Mexico on the east and southeast and the geographical region known as the Coastal Plain on the west and northwest. The 14 deep water ports along the Texas Gulf Coast are: Beaumont, Brownsville, Corpus Christi, Freeport, Galveston, Houston, Orange, Port Aransas, Port Arthur, Port Isabel, Port Mansfield, Sabine Pass, Texas City, and Port Lavaca-Point Comfort.

Analysis of the ports of Port Mansfield, Sabine Pass, and Port Aransas will not be presented in detail because of the lack of activity and/or the lack of

Table 5
EARNINGS BY INDUSTRY SOURCE FOR THE STUDY AREA
(In Thousands of 1958 Dollars)

INDUSTRY	1950	1959	1962	1970	1980	1990	2000
TOTAL EARNINGS	\$4,252,412	\$5,985,060	\$6,508,973	\$9,691,700	\$15,091,400	\$22,789,700	\$35,613,600
Agriculture	455,574	329,290	346,234	450,100	561,900	663,600	822,700
Farms	441,415	311,601	325,755	421,700	525,800	602,900	N.A.
Agricultural Services, Forestry & Fisheries	14,159	17,689	20,479	28,400	36,100	60,700	N.A.
Nonagricultural	3,796,838	5,655,770	6,162,739	9,241,700	14,529,800	22,125,900	34,790,900
Mining	318,010	403,317	391,314	492,100	658,900	812,000	1,066,800
Contract Construction	334,461	378,994	461,539	669,300	1,022,500	1,515,700	2,340,900
Manufacturing	699,990	1,172,552	1,292,692	1,964,800	3,025,600	4,487,200	6,766,300
Transportation, Communications, & Public Utilities	393,048	530,275	536,391	739,200	1,016,000	1,353,100	1,593,800
Wholesale & Retail Trade	849,425	1,154,357	1,213,557	1,782,600	2,718,500	4,008,800	6,185,600
Finance, Insurance & Real Estate	178,020	296,819	318,979	480,900	765,300	1,146,700	1,817,000
Services	461,411	730,673	830,649	1,266,100	2,395,900	4,201,800	7,294,700
Government	561,743	988,783	1,117,618	1,846,700	2,927,100	4,600,600	7,365,800

N.A.—Not Available

SOURCE: *Preliminary Report on Economic Projections for Selected Geographic Areas*, United States Water Resources Council, Office of Business Economics, U. S. Department of Commerce, Washington, D. C., 1968.



FIGURE 3 Major Deep Water Ports in Texas

available data on these ports. The geographical location of the eleven ports is shown in Figure 3.

Related to this port development was the growing need for an intracoastal waterway, to provide a sheltered lateral canal connecting the main bays, sounds, estuaries and islands traversing the Gulf Coast and along the eastern seaboard. This coastal waterway system is examined in broad scope within this section from its historical inception through legislative processes to recent construction and improvements.

SEQUENCE OF PORT DEVELOPMENT

The Port of Galveston in 1832 recorded the earliest movement of waterborne traffic through a Texas port. Five years later, the Port of Galveston was made a port of entry, and the first wharf was constructed in 1838.

Establishment of the Port of Houston by a city ordinance in 1841 was the initial act which founded this largest of Texas sea ports. The Harris County Ship Channel Navigation District was formed in 1910, and the ship channel was completed four

years later which afforded the city of Houston a man-built waterway to the Gulf of Mexico 50 miles to the south. Before the Civil War, the Port of Orange was a ship building center. The establishment of the Port of Texas City in 1893 was closely followed by the opening of the Port of Port Arthur in 1895. In the 1900's, six major ports were created on the following dates: Port of Beaumont—1916; Port of Freeport—1925; Port of Corpus Christi—1926; Port of Port Isabel—1935; Port of Brownsville—1936; and Port of Port Lavaca-Point Comfort—1962.

SURVEY OF TEXAS PORTS

General characteristics of the ports on the Texas Gulf Coast are presented in Table 6. This table shows the port size, composition of the port authority, staff and the general characteristics of accommodations and services which are provided to include transit sheds, open docks, bunkers, and ship repairs.

Waterborne cargo is classified in two categories, one being dry cargo and the other liquid cargo. Dry

cargo includes grains, cotton and sulphur; while listed under liquid cargo are such items as petroleum and chemical products. The largest volume of cargo movement through Texas ports is liquid cargo.

The various types of seaborne cargo are presented in Figure 5 which shows 1967 cargo movement by category for the major ports along the Texas Gulf Coast. Extremes to be noted in the figure are that cargo movement through the Port of Galveston was approximately 95 percent dry cargo while 98 percent of the cargo movement through the Port of Texas City was primarily liquid.

To prepare a broader scope on the effects and trends developed within the movement of waterborne commerce along major ports, a compilation of tonnages moved within, along and through eight selected Texas ports was evaluated over a six year period. Trends established during these six years indicate that the Port of Houston has a rather steady cargo movement pattern averaging approximately 59 million short tons annually. The Port of Beaumont established a steady increase during the years of 1965 and 1966, but experienced a decrease in 1967. The port showing the largest increase in volume of cargo traffic has been the Port of Orange, which has increased by approximately 100 percent since 1965. Both the Ports of Brownsville and Corpus Christi have also shown steady increases in cargo tonnage during this same period of time. The trends established in this cargo movement from 1962 to 1967 are presented in Figure 4.

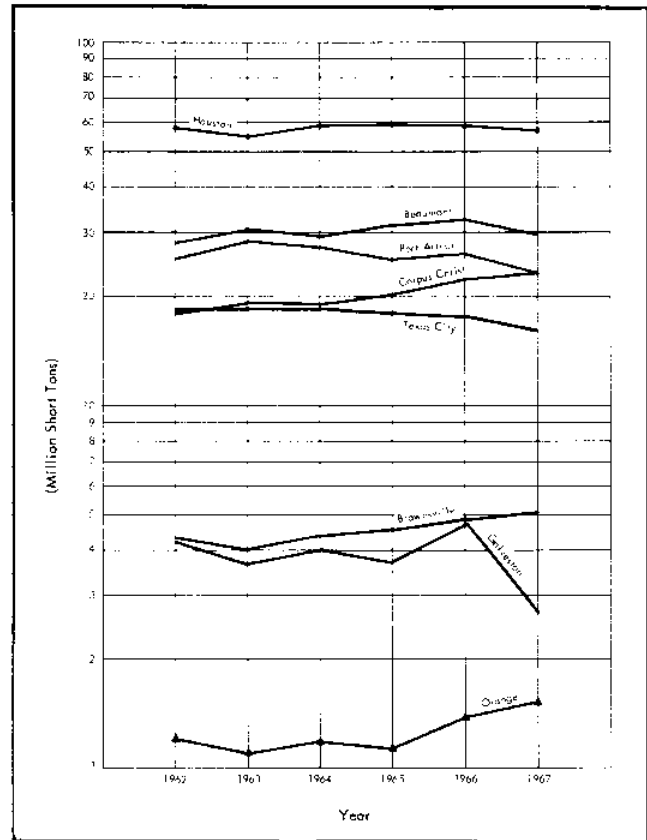


FIGURE 4 Comparative Trends in Waterborne Commerce at Major Ports in Texas

Table 6
GENERAL CHARACTERISTICS OF MAJOR PORTS ON THE TEXAS GULF COAST

Port	Size (Sq. Miles)	Governing Body (Commissioners)	Size of Staff	ACCOMMODATIONS			
				Transit Sheds (Sq. Feet)	Open Docks (Sq. Feet)	Bunkers Available	Ship Repairs
Beaumont	149.90	6	50	349,000	235,000	Yes	No
Brownsville	315.10	N.A.	7	100,000	N.A.	Yes	Yes
Corpus Christi	838.00	3	10	508,000	N.A.	Yes	Yes
Freeport	1,124.00	5	13	156,720	N.A.	Yes	Yes
Galveston	94.11	7	N.A.	4,484,952	979,100	Yes	Yes
Houston	1,747.00	5	26	1,616,004 (enclosed) 1,916,621 (open area)	N.A.	Yes	Yes
Orange	356.00	5	N.A.	285,350	41,400	Yes	Yes
Port Arthur	58.00	5	N.A.	108,000	360,000	Yes	Yes
Port Isabel	317.50	3	4	52,000	50,000	Yes	No
Texas City	960.00	Private	100	N.A.	40,000	Yes	Yes
Port Lavaca- Port Comfort	127.00	6	12	N.A.	15,000	Yes	No

N.A.—Not Available

SOURCE: Respective port authorities.

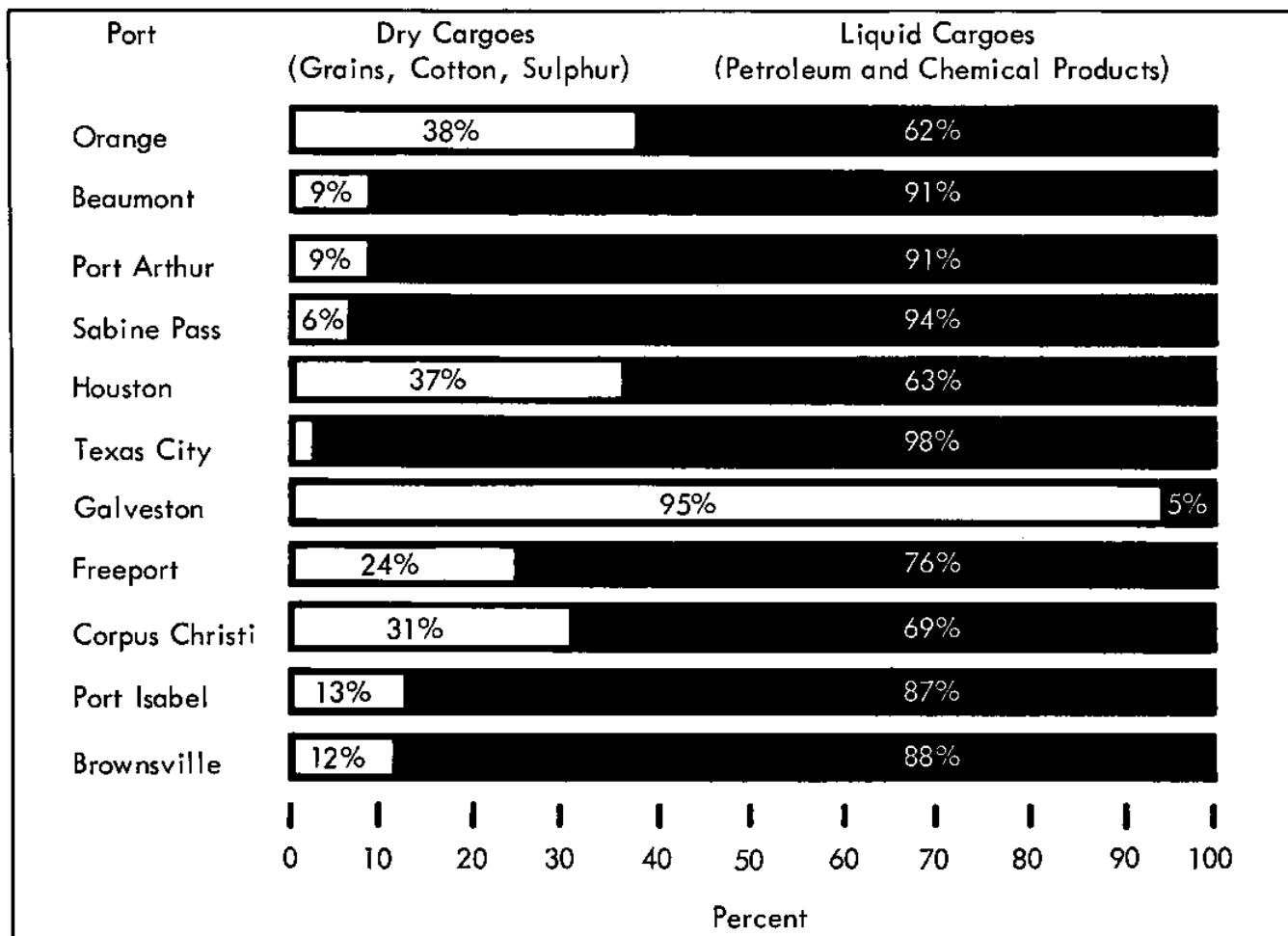


FIGURE 5 Types of Cargoes Handled by the Major Texas Ports in 1967

THE GULF INTRACOASTAL WATERWAY

Stretching along the coast of the Gulf of Mexico from northern Florida to the southern tip of Texas, is one of the principal arteries of the vast inland waterway systems of the United States—the Gulf Intracoastal Waterway. The 1,100-mile Gulf Intracoastal Waterway is a land-protected course across coastal Florida, Alabama, Mississippi, Louisiana and Texas which has its eastern origin at Carrabelle, Florida, and its southern terminus at Brownsville, Texas. For the purpose of this study, the scope of information will be restricted to the intracoastal waterway that extends from the port at Orange to the port at Brownsville, Texas.

As early as the beginning of the 19th Century, the Congress of the United States recognized the need for a sheltered lateral waterway connecting the many bays, sounds, estuaries and islands along the Gulf Coast. The development of the Gulf Intracoastal Waterway has been in segments; each segment built to fill the needs of a specific local area. The first survey was authorized in 1873 which selected a suitable route for an inland waterway connecting the Mississippi River to the Rio Grande. Subsequent surveys, however, led to congressional authorization in 1892 of a federal project channel

three and one-half feet deep by 200 feet wide in Galveston Bay.

The history of the remaining development of the intracoastal canal was carried on at the time of the extension of the nine-foot by 100-foot channel from Galveston Bay to Corpus Christi, which was completed in 1941. In 1949, the last link in the main channel in the Gulf Intracoastal Waterway from Florida to the Rio Grande was completed. In more recent years along with improvements to the main channel, many tributaries and connecting channels have been provided to keep pace with the rapid growth and expansion that has occurred.

Descriptive data on present channel dimension and distances along the Texas portion of the Intracoastal Waterway areas are presented in Table 7.

CARGO MOVEMENT THROUGH THE GULF INTRACOASTAL WATERWAY

Originally presented to Congress on the basis that the potential of 5 million short tons of commerce would move annually through the waterway, in 1962, the canal carried more than 12 times that amount. In the 25 years from 1937 to 1962, tonnage transported on the waterway increased from

Table 7
AUTHORIZED CHANNEL DIMENSIONS
AND DISTANCE MEASUREMENT OF THE
GULF INTRACOASTAL WATERWAY WEST
OF THE SABINE RIVER

Location	Channel Depth Width (Feet)		Location	Distance Miles From New Orleans
	Depth	Width		
Sabine River to Houston Ship Channel	16	150	Port Arthur	185
Houston Ship Channel to Corpus Christi	12	125	Beaumont	296
Corpus Christi to Brownsville	12	125	Galveston Freeport Houston Corpus Christi Brownsville	355 399 400 552 684

SOURCE: *Gulf Intracoastal Waterway*, U. S. Army, Corps of Engineers, December, 1964.

Table 8
MARINE RELATED ACTIVITIES AT
COLLEGES AND UNIVERSITIES IN TEXAS
1968-69

Institution	MARINE RELATED ACTIVITY	
	Number of Projects	1968-69 Project Expenditures
Del Mar College	1	\$ 110,800
Galveston Community College	1	*
James Connally Technical Institute	1	*
Lamar State College of Technology	N.A.	N.A.
Rice University	N.A.	N.A.
St. Mary's University	N.A.	N.A.
Southwest Texas State College	4	23,000
Texas A&I University	11	40,000
Texas A&M University	82	2,865,724
Texas Christian University	3	95,000
Texas Technological College	1	37,000
The University of Texas at Austin	39	1,026,402
University of Corpus Christi	N.A.	N.A.
University of Houston	29	713,498
University of St. Thomas	13	446,468
TOTAL	185	\$5,357,892

*Included in Texas A&M University's expenditures.
N.A.—Not Available

SOURCE: 1969 Marine Activities Questionnaire, Industrial Economics Research Division, Texas A&M University, College Station, Texas.

5.75 million tons to approximately 60.5 million tons. The 1962 traffic moved a distance of more than 8.75 billion ton miles as compared to approximately 581 million ton miles in 1937.

The greatest volume of tonnage on the waterway consists of petroleum products, including gasoline, fuel oil, jet fuel and others. These products are transported from Texas and Louisiana refineries to consumers and distributors throughout the nation. Other commodities that are shipped along the canal are chemicals, iron, steel, sugar, limestone, and other dry cargo products.

4. EDUCATIONAL INSTITUTIONS

In an effort to determine the level of marine related activities of the colleges and universities in Texas, a marine activities questionnaire was sent to 28 educational institutions in the state. Only those schools reporting an enrollment of 2,000 or more students were sent a questionnaire. A reply was received from 23 of these institutions, and 12 indicated that they had some level of activity. Through personal interviews and a search of published data, it was discovered that several institutions that were not sent the questionnaire and several replying that they had no activity, in fact, were engaged in marine related work. There were three such schools in this category. This results in a total of 15 institutions reporting involvement in marine activities. A list of these 15 colleges and universities is presented in Table 8. This table indicates which of these institutions had marine related research, the number of research projects, and the estimated total research expenditures during the 1968-69 school year. The 15 institutions having marine related activity spent an estimated \$5,357,892 on 185 projects during this same period of time.

As shown in Table 8, Texas A&M University and the University of Texas at Austin were respective leaders in the number of marine related projects and expenditures in Texas. Below is a partial listing of divisions at each school pursuing marine related activities:

Texas A&M University

- Oceanography Department
- Sea Grant Program
- Coastal and Ocean Engineering Division
- Chemurgic Research Laboratory
- Texas Maritime Academy
- Water Resources Institute

University of Texas at Austin

- Bureau of Economic Geology
- Center for Research in Water Resources
- College of Business Administration
- Environmental Health Engineering Laboratory
- Mechanical Engineering Department
- Institute of Marine Science

5. RESEARCH ORGANIZATIONS

Five non-profit research organizations operating in Texas expended \$787,000 in FY 1968 in support of marine related activities. The largest contributor to this total was Southwest Research Institute with a budget of \$450,000 for marine research.

A brief description of the five research organizations is as follows:

Gulf States Marine Fisheries Commission— New Orleans, Louisiana

The Gulf States Marine Fisheries Commission is a coordinating agency between groups representing the five states of Alabama, Florida, Louisiana, Mississippi, and Texas. The Commission coordinates the actions of each of the five states with regard to water pollution, utilization of fisheries, estuaries, and other problems, in order to recommend the most effective method of dealing with such problems. It also acts as a liaison between the states and the federal government in order to effect concerted action in this area.

Gulf Universities Research Corporation— Galveston, Texas

Gulf Universities Research Corporation (GURC) is a non-profit research organization composed of 16 universities and research institutes from Florida to Texas. Texas institutions comprise the majority of its members: Texas A&M University, Rice University, Southern Methodist University, Texas Christian University, Texas Technological College, University of Houston, University of Texas, Southwest Center for Advanced Studies, and Southwest Research Institute.

Organized in 1965, the corporation is devoted to the development of the Gulf of Mexico as an important natural resource and concentrates on research and development along the Gulf coastal margin. GURC headquarters are located in Galveston but the organization maintains a field station in Houston.

In addition to the academic and research members, GURC also has advisory membership. Currently 19 industrial groups serve in this capacity, many of which are Texas based. In addition to advisory members, representatives from state and federal agencies serve on the Board of Advisors.

Southwest Center For Advanced Studies— Dallas, Texas

Southwest Center for Advanced Studies (SCAS) is a non-profit, engineering and science research organization. Marine related research at the Center is conducted by the Geosciences and Marine Geophysics Divisions. The Geosciences Division is conducting paleomagnetic studies to determine the movements of the continents during many millions of years. This research is in support of the continental drift theory. During FY 1963 SCAS had \$615,835 in sponsored research and \$101,804 in center supported research. These figures increased to

\$5,335,723 in sponsored research and \$600,044 in center supported research during FY 1968. The value of facilities at the Center in FY 1968 were estimated to be \$9,413,123.

The Marine Biomedical Institute—Galveston, Texas

The Marine Biomedical Institute (MBI) was established in Galveston on February 1, 1969, as a result of a cooperative effort by the University of Texas Medical Branch and Texas A&M University. Both schools have allocated \$50,000 per year for two years, for a total of \$200,000, to develop the marine biomedical program. The marine biomedical program was developed as it became evident, both at the national and state level, that there is a need for a multidisciplinary approach to the biomedical problems encountered as man ventures farther into the environment of the sea. Associated with this approach is the quest for greater knowledge of fundamental biomechanisms in man through the study of simple marine organisms.

Southwest Research Institute—San Antonio, Texas

Southwest Research Institute (SwRI) was founded in 1947 as a non-profit research organization. Main offices and laboratories of SwRI are located on a campus of over 4,000 acres. Additional offices and laboratories are operated in Houston and Corpus Christi. The permanent staff is made up of 337 persons with professional training; 411 technical support personnel; and 256 persons engaged in administrative and other non-technical assignments. Among the professional staff, 50 have degrees at the doctorate level, and 287 have degrees beyond the baccalaureate.

Gross revenue for the fiscal year October 1, 1967-September 30, 1968 was \$16,055,216, compared with \$13,615,546 for the previous year or an increase of 17.9 percent.

During FY 1968-69, \$743,652 was expended for new laboratory equipment and for the improvement of existing facilities. Of particular importance to marine related research was the equipping of the Ocean Science and Engineering Laboratory in Corpus Christi. Marine research is developed through the Underwater Engineering Laboratory, Deep-Ocean Simulators, Naval Dynamics Division, Ocean Engineering Division, Shore Laboratory of the Ocean Science and Engineering Laboratory and cooperative programs with various Federal agencies.

6. MARINE RELATED INDUSTRIES

Throughout the historical development of the 72-county study area, particularly those counties bordering the coastal region, the importance of marine oriented industries have played a vital role. In the early years the economy was initially dependent upon a strategically important natural resource base; this base being the cotton, cattle and forest products which were the first commercially developed industries in the area. These industries later assumed even greater economic importance as port

facilities were developed, channels dredged and the total seaborne mode of transportation was improved. This industrial growth continued to flourish; attracting more people and offering broader horizons and tempting challenges to the early Texans. Knitted closely to this industrial development, and increasingly so in recent years, has been the most abundant but least exploited natural resource—the Gulf of Mexico.

In the last few decades the Gulf of Mexico has gained due recognition as a magnetic force for economical growth and expansion along the 1,081 miles of Texas coast line. The abundance and richness of nature's gifts deposited over many centuries combined with the ever increasing scope of man's education and technology have provided this area with as yet undetermined potentials for food, minerals, fresh water and other resources.

A compilation and inventory of marine related manufacturing and service firms was developed by city to determine the magnitude of their influence on the economy of the area. These data are shown in Table 9.

Although only selected portions of the study are presented in this summary, marine industries were classified according to exploration, extraction and refining of petroleum and other minerals, seafood harvesting and processing, manufacturing, tourism and recreation and service.

CLASSIFICATION AND IDENTIFICATION OF MARINE RELATED INDUSTRIES

Exploration, Extraction and Refining Industries

Primary among the major marine related industries located along the Texas Gulf Coast are

the oil and gas refineries, chemical production plants and the combination of these two—the petrochemical plants.

The largest and fastest growing industry along the Texas coast line is the petrochemical industry. Located along this coast is the Nation's greatest concentration of petrochemical processing plants, and the center of this mass is the Houston SMSA. According to the *Houston-Gulf Coast Chemical Directory* published in 1967 by the Research Department of the Houston Chamber of Commerce, Houston produces approximately 40 percent of every basic petrochemical produced in the United States, and nearly 60 percent of the U. S. sulphur supply is produced along the Houston-Gulf Coast.

One of the main supports to the foregoing is the Texas petroleum industry which has produced nearly 31 billion barrels of crude oil since oil was discovered at Spindletop in 1902. This represents approximately 36 percent of the total U. S. production since that time.

An index of marine related activity in the petroleum field is the aggressive competition for Federal offshore leases. Many of the major oil and gas producing companies were participants in the 1968 lease sales for the potentially lucrative Federal offshore tracts. The 1968 sale of 110 tracts totaling 584,600 acres for \$593,899,046 was a strong indicator of planned drilling activity in this area. This interest was supported by Texas offshore gas production as of July 1, 1968, which reported 518,164,268 Mcf of gas and 9,307,577 barrels of condensate in both oil and gas reservoirs from state and Fed-

Table 9
ORIENTATION OF SELECTED MARINE RELATED INDUSTRIES IN THE STUDY AREA (1968-69)

Industry Category	STANDARD METROPOLITAN STATISTICAL AREA						Total
	Beaumont Orange Port Arthur	Brownsville	Corpus Christi	Galveston	Houston	Other Cities	
Boat, ship building, repair	16	6	3	10	21	34	90
Research, design, engineering, manufacturing services	*	*	*	*	141	21	162
Seafood processing	1	12	*	4	1	40	58
Shell	1	*	1	*	6	5	13
Storage terminals	11	5	*	7	8	*	31
Surveying & exploration	*	3	*	6	21	4	34
Tow boats & barges	7	8	3	7	13	2	40
Marine services & supplies	*	*	*	1	38	4	43
Ship brokers & chartering	*	*	*	*	9	*	9
Other	3	*	2	9	12	10	36

*Indicates either not reported or no industry active in this category.

SOURCE: Respective Chambers of Commerce, 1969. *Texas Directory, of Manufacturers and Undersea Technology Handbook Directory, 1969.*

eral leases. Texas offshore Federal lease history from 1954 to 1968 is presented in Table 10. Notable changes reflected in the table are that acreage leased in 1968 more than doubled the cumulative total for the previous years and likewise lease value appreciated at an even greater rate.

A graphic illustration of the geographical positioning of the offshore oil and gas fields with associated pipeline network is displayed in Figure 6.

Seafood Harvesting and Processing

A study of coastal marine business activities must of necessity include a discussion of seafood harvesting and processing. One other facet of the seafood business—the economics of marketing and merchandising will be discussed in broader detail in a subsequent study. Statistical research into these segments of the seafood industry was concentrated on landings or catches and on dockside values of these landings.

Domestic landings of both finfish and shellfish at Texas ports in 1967 approximated 138.1 million pounds valued at \$49.7 million at dockside. This was 15.3 million pounds and \$7.0 million above the volume and value of 1966 landings. This increase in both quantity and value resulted from record shrimp landings.

Preliminary 1968 statistics indicate that the volume of catch of finfish and shellfish was 144.8 million pounds, and increase of 4.8 per-

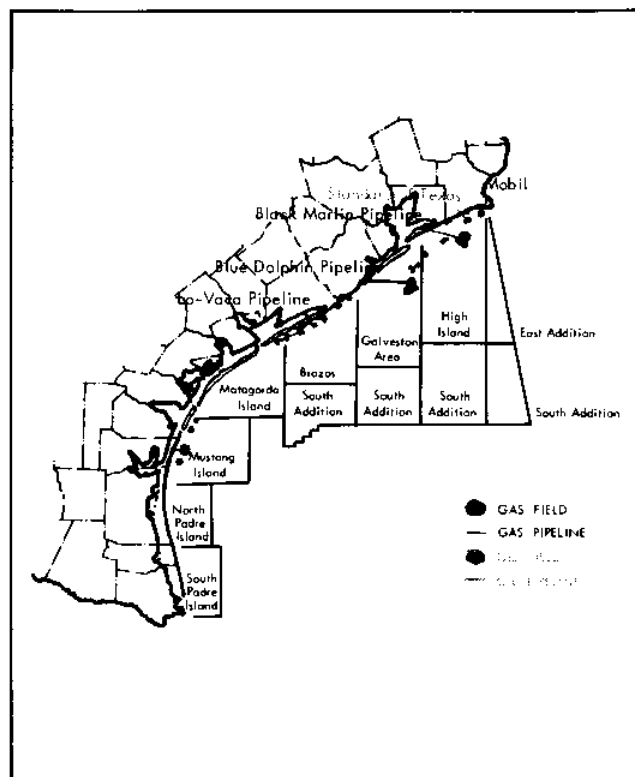


FIGURE 6 Location of Oil and Gas Fields in Texas Offshore Area

cent over 1967 volume. Value figures for 1968 had not been released at the time of publication of this study.

Finfish.

Edible finfish landings amounted to 6.0 million pounds valued at \$1.3 million compared with 6.4 million pounds valued at \$1.4 million in 1966. The 1967 decline resulted from a drop in landings of red snapper and flounders from Gulf waters.

Table 11 shows the volume in pounds and the value in dollars of finfish landed in Gulf waters near the Texas Coast from 1963 thru 1967. Volume of catch has consistently decreased for the five year period while value of catch has decreased from 1965 to 1967.

Shellfish.

The shellfish classification includes blue crab, oysters, shrimp, squid and lobster.

Blue crab landings of 2.6 million pounds in 1967 valued at \$223,000 were slightly below the 1966 commercial harvest of 2.8 million pounds valued at \$228,000.

Commercial oystermen harvested 3.6 million pounds of oyster meats valued at \$1.6 million in 1967, a decrease of 1.2 million pounds and \$267,000 compared with the 1966 commercial harvest.

Table 10

TEXAS OFFSHORE FEDERAL LEASE HISTORY

Lease Year	Acre Leased (Thousands)	Dollar Value (Millions)	Number of Leases
1954	67.1	\$ 23.4	19
1955	149.8	8.4	27
1960	240.5	35.7	48
1962	28.8	0.6	10
1968	584.6	593.9	110
TOTAL	1,070.8	\$662.0	214

SOURCE: 1954-62 data from *Petroleum Engineer*, January, 1969, pp. 55 and 1968 data from *Offshore*, June 1968, pp. 17.

In 1967, landings of headless shrimp amounted to 64.2 million pounds valued at \$46.4 million to fishermen and/or vessel owners. The record volume and value was 20.4 million pounds and \$7.9 million above 1966 landings. Record landings at Texas ports exceeded the 61.5 million pound record established in 1945 by Louisiana fishermen in that state. Texas accounted for 45 percent of the volume and 52 percent of the value of shrimp landings at Gulf ports in 1967, compared with 39 percent of the volume and 46 percent of the value in 1966.

Figure 7 illustrates a comparison of State of Texas finfish and shellfish landings in 1966 with the catches in Louisiana, Florida, Mississippi and Alabama. The figure shows that the Texas catch exceeded the catch from the other states in the respective order presented.

Other Marine Related Data

Tables 12 through 15 present other marine related data: volume and value of catch in Texas; number of employees and reporting units by industry classification in the study area; volume and value of catch in Texas, Gulf Coast and United States; and wholesaling and processing of seafood products, value of processed products, and number of fishermen on vessels in Texas.

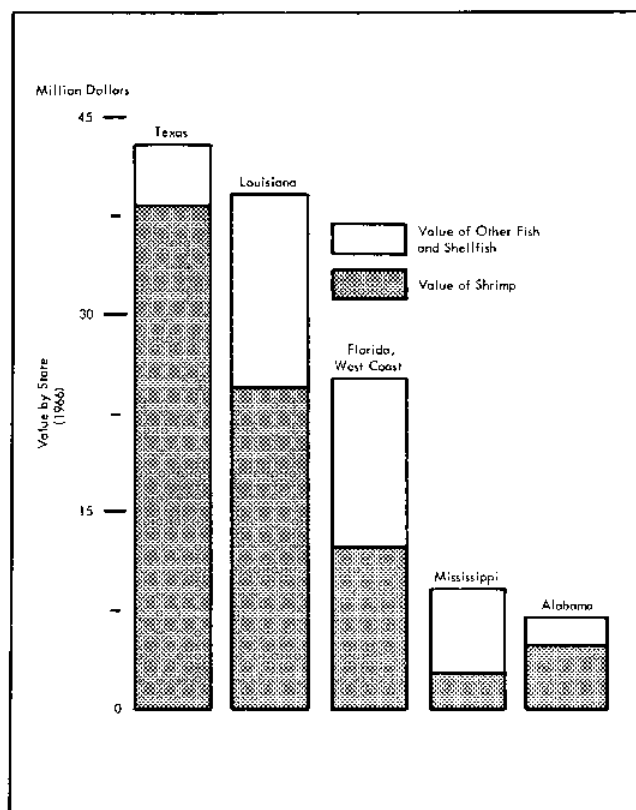


FIGURE 7 Value of Catch by Gulf

Table 11
CATCH AND VALUE OF TEXAS FINFISH (Pounds/Dollars)

Region		1963	1964	1965	1966	1967
Gulf of Mexico	(P)*	86,922,800	69,793,100	64,816,800	41,644,800	25,397,600
	(D)**	\$1,755,761	\$1,556,772	\$1,848,018	\$1,467,763	\$874,888
Sabine	(P)	122,100	46,200	51,700	44,600	41,500
	(D)	\$20,586	\$5,841	\$13,870	\$6,372	\$8,167
Galveston	(P)	219,400	498,300	875,500	592,600	767,900
	(D)	\$44,095	\$90,397	\$116,077	\$74,321	\$115,585
Matagorda	(P)	185,500	134,000	215,200	598,400	349,700
	(D)	\$37,067	\$25,589	\$45,319	\$128,463	\$63,409
Aransas	(P)	1,260,700	763,100	689,900	791,400	866,400
	(D)	\$209,451	\$140,676	\$140,097	\$176,796	\$162,253
Laguna	(P)	1,764,800	1,829,500	2,061,500	1,706,100	1,634,500
	(D)	\$290,766	\$283,144	\$330,141	\$324,605	\$337,488
TOTAL POUNDS		90,475,300	73,064,200	68,710,600	45,377,900	29,057,600
TOTAL DOLLARS		\$2,357,726	\$2,102,419	\$2,493,522	\$2,178,320	\$1,561,790

*(P)—Pounds

** (D)—Dollars

SOURCE: *Texas Landings*, Bureau of Commercial Fisheries, U. S. Department of Interior, Washington, D. C.

Table 12
VOLUME AND VALUE OF CATCH IN TEXAS

Year	FISH		SHRIMP		SHELLFISH (EXCLUDING SHRIMP)	
	Volume*	Value**	Volume*	Value**	Volume*	Value**
1940	3,037	\$ 287	14,779	\$ 591	1,553	\$ 114
1950	50,925	1,285	45,812	9,904	513	75
1960	151,203	2,413	81,303	24,606	5,178	834
1962	110,248	2,253	56,143	27,149	115,965	3,019
1964	73,152	2,114	66,053	26,144	5,865	1,270
1966	45,512	2,193	69,907	38,485	7,525	2,067
1967	29,057	1,561	102,875	46,355	6,189	1,793

*Volume in thousands of pounds

**Value in thousands of dollars

SOURCE: *Fishery Statistics of the United States*, Bureau of Commercial Fisheries, U. S. Department of Interior, Washington, D. C.

Table 13
NUMBER OF EMPLOYEES AND REPORTING UNITS BY INDUSTRY CLASSIFICATION IN THE STUDY AREA

Standard Industrial Classification Number and Industry	1964		1967	
	Number of Reporting Units	Number of Employees Mid-March Pay Period*	Number of Reporting Units	Number of Employees Mid-March Pay Period*
09 Fisheries	296	1,054	356	1,428
13 Oil and Gas Extraction	1,530	18,151	1,435	22,447
131 Crude Petroleum and Natural Gas	721	10,028	683	6,339
132 Natural Gas Liquids	32	1,558	5	246
138 Oil and Gas Field Services	601	9,915	623	13,673
1381 Drilling Oil and Gas Wells	200	4,051	145	4,388
1382 Oil and Gas Exploration Services	42	251	61	660
1389 Oil and Gas Field Services	257	5,066	321	6,421
20 Food and Kindred Products	590	29,703	540	31,129
2036 Fresh or Frozen Packaged Fish	8	*	11	1,858
2094 Animal and Marine Fats and Oils	9	293	9	277
28 Chemicals and Allied Products	254	15,190	273	32,640
29 Petroleum and Coal Products	64	28,391	82	26,247
291 Petroleum Refining	45	13,382	51	11,640
33 Primary Metal Industries	83	10,186	90	13,383
34 Fabricated Metal Products	397	16,172	443	22,592
37 Transportation Equipment	109	6,173	138	7,885
373 Ship and Boat Building and Repair	42	1,455	70	2,058
3731 Ship Building and Repair	16	1,887	24	1,452
3732 Boat Building and Repair	19	249	36	594
44 Water Transportation	259	16,813	278	19,046
441 Deep Sea Foreign Transportation	16	*	13	1,913
442 Deep Sea Domestic Transportation	3	*	5	*
444 Transportation on Rivers & Canals	20	498	17	377
445 Local Water Transportation	89	1,900	100	1,607
446 Water Transportation Services	96	8,183	118	11,431
4463 Marine Cargo Handling	52	7,778	61	10,592
TOTAL	5,850	208,327	5,988	252,323

*Some individual county figures withheld to avoid disclosure of operations of individual reporting units.

SOURCE: *County Business Patterns, 1964 and 1967*, Bureau of the Census, U. S. Department of Commerce, Washington, D. C.

Table 14
VOLUME AND VALUE OF CATCH IN TEXAS, GULF COAST AND UNITED STATES

Year	VOLUME OF CATCH* (MILLIONS OF POUNDS)			VALUE OF CATCH* (MILLIONS OF DOLLARS)		
	Texas	Gulf Coast	United States	Texas	Gulf Coast	United States
1940	19	250	4,060	\$ 1.0	\$10.6	\$ 99.0
1950	97	571	4,901	11.2	50.4	347.4
1960	238	1,266	4,942	27.8	85.5	353.6
1967	138	1,181	4,055	49.7	217.4	439.6
1968	144	1,275	4,116	N.A.	125.4	471.5

*Combined fish and shellfish

N.A.—Not Available

SOURCE: *Fishery Statistics of the United States*, Bureau of Commercial Fisheries, U. S. Department of the Interior, Washington, D. C. and *Fisheries of the United States*, Bureau of Commercial Fisheries, U. S. Department of the Interior, Washington, D. C.

Table 15
WHOLESALE AND PROCESSING OF SEAFOOD PRODUCTS, VALUE OF PROCESSED PRODUCTS AND NUMBER OF FISHERMEN ON VESSELS IN TEXAS

Year	Wholesaling and Processing Establishments	PERSONS EMPLOYED		Value Product (000)	Number of Fishermen on Vessels
		Average for Season	Average for Year		
1940	60	N.A.	99	\$ 1,630	239
1950	94	2,595	1,001	16,439	2,392
1960	143	5,828	4,049	55,175	4,789
1962	153	5,329	3,265	62,910	3,904
1964	142	4,786	3,490	55,414	4,469
1966	153	5,618	4,088	76,356	4,544

N.A.—Not Available

SOURCE: *Fishery Statistics of the United States*, Bureau of Commercial Fisheries, U. S. Department of Interior, Washington, D. C.

7. GOVERNMENTAL AGENCIES

The greatest impetus in the development of the Texas coastal zone and its related marine research comes from the Federal government. Within the Federal structure, five departments—Commerce, Defense, Interior, Transportation, and State—sponsor and/or carry on investigations in the coastal zone of Texas. The National Science Foundation supports educational institutions throughout the state in marine science research and faculty support. The National Aeronautics and Space Administration's Manned Spacecraft Center is involved in research and development which is directly applicable to the ocean environment.

At the state level, numerous departments and agencies operate within the coastal zone of the state. An effort to organize the state's various agencies into a coordinated mechanism for marine resource development is centered in the Office of the Governor. In a newly established Interagency Natural Resources Council, recommendations and suggestions are being formulated to submit to the Texas Legislature on how the permanent organization and structuring for the state's marine activities can best be accomplished.

FEDERAL GOVERNMENT ACTIVITIES AND EXPENDITURES IN TEXAS

In Texas, seven Federal agencies and departments spent more than \$94,000,000 in FY 1968 in the coastal zone for marine related research and development, maintenance of facilities, and new construction. The U. S. Navy and NSF programs are primarily directed toward basic marine scientific research, although naval research also supports op-

erational missions. Other agencies usually fund projects which are mission oriented. Table 16 shows a summary of Federal government expenditures for marine related activities in Texas for FY 1968. A brief summary of each agency is included. In addition to funding research at universities and in industry, the Federal agencies maintain their own laboratories (with the exception of NSF). The Federal laboratories in Texas which are directly concerned with marine resource development and ocean research are shown in Figure 8. Also shown in Figure 8 are the six National Wildlife Refuges in Texas and Padre Island National Seashore.

Department of Commerce

Within the Department of Commerce, two agencies are directly concerned with the marine environment—the Environmental Science Services Administration (ESSA) and the Maritime Administration (MARAD). These two agencies represent the primary funding sources in marine research and resource development within the state. In addition, the Economic Development Administration (EDA) contributes indirectly to the growth of marine resource development through its aid to communities along the coastal area of Texas. During FY 1968, the Department of Commerce spent \$13,385,510 in marine related activities in Texas, as shown in Table 16.

Department of Defense

The Department of Defense is the largest Federal organization at work in the state in terms of spending. For FY 1968, the U. S. Army Corps of Engineers directed \$34,500,021 in Texas for work in the coastal zone. The U. S. Navy, through its Office

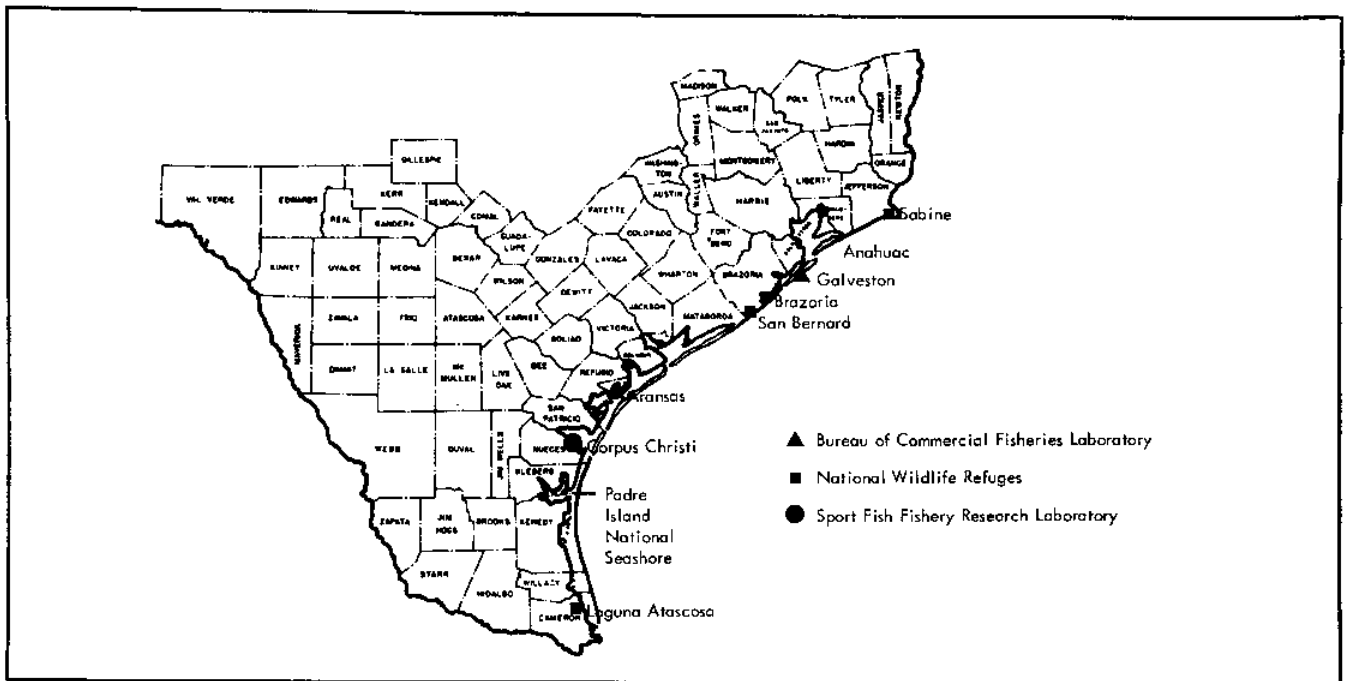


FIGURE 8 Federal Marine Research Laboratories and Coastal Wildlife Refuges in Texas

of Naval Research, Naval Oceanographic Office, and other offices spent \$5,500,000 for marine research and development in the state.

The Department of the Interior

The Department of Interior is concerned with the preservation and conservation of the nation's natural resources. Nine agencies within Interior operate and conduct studies and programs within the marine environment in Texas: The Bureaus of Commercial Fisheries and Sport Fisheries and Wildlife; Geological Survey; Federal Water Pollution Control Administration; National Park Service; Bureau of Land Management; Bureau of Outdoor Recreation; Office of Saline Water; and Office of Water Resources Research. These branches of the Department of Interior spent \$15,742,400 during FY 1968 in Texas on marine related activities.

Department of State

The Department of State becomes involved in the coastal zone because of international boundary waters. The principal Federal agency involved in Texas is the International Boundary and Water Commission (IBWC) of the Department of State. Principal water related activities of the IBWC deal with construction, operation, and maintenance of diversion dams, storage reservoirs, hydroelectric plants, and flood control projects along the U. S.-Mexico Rio Grande River Boundary.

Department of Transportation

The U. S. Coast Guard was placed in the Department of Transportation when it was formed in 1967. A military service and a branch of the U. S. Armed Forces at all times, the Coast Guard operates under the Navy in time of war or when the President directs.

For the coastal zone, the Coast Guard provides search and rescue services, administers merchant marine safety laws, undertakes an effective port security program, as well as its military functions. It also is involved in oceanographic research.

The Coast Guard marine, harbor and shore services totaled \$9,045,507 for the state of Texas during FY 1968.

National Aeronautics and Space Administration

The vast technological development within the National Aeronautics and Space Administration (NASA) programs have multiple applications in marine resource development. The technical and scientific personnel involved in its activities can play an important role in consulting and advising such projects as "Man-in-the-Sea" and other programs which draw upon the body of knowledge built upon the space age.

The Earth Resources Survey Program of NASA is one which bears a direct relationship to marine research. The Manned Spacecraft Center (MSC) in Houston has been designated as the primary center in the Earth Resources Survey Program. The study of the Earth's resources from space is the objective of the program; five areas of application are identi-

fied: Agricultural and Forestry Resources; Geology and Mineral Resources; Hydrology and Water Resources; Geography, Cartography and Cultural Resources; and Oceanography and Marine Resources. Of the approximately \$10 million MSC Earth Resources Survey FY 1968 funds, about 20 percent, or \$2 million, was directed to oceanography and marine resource development. This figure is research and development only and does not include salaries and facilities maintenance.

National Science Foundation

Created in 1950, the National Science Foundation (NSF) was created to strengthen basic U. S. scientific research and education. In the area of oceanography, the NSF administers the Sea Grant College Program created in 1966 as a means of involving academic institutions in the practical problems of marine resource development. In addition to the Sea Grant Program, the NSF supports research in marine biology, geology and pollution and gives grants for laboratory facility and ship construction. Approximately 40 percent of all support to institutions for research in marine science comes from the Foundation.

The Sea Grant program began funding activities in 1968 and Texas A&M University received a grant of \$475,000 to begin a five-year program in marine resource development. The FY 1969 institutional grant awarded to Texas A&M University amounts to \$750,000. These grants are allocated on a matching fund basis with the university contributing approximately 33 percent of the total program. Other Sea Grant funds for the state include a project grant to Del Mar College, in cooperation with Southwest Research Institute, for \$110,800 for a technician training program which will begin in September 1969.

Other NSF sponsored marine related programs in Texas for FY 1968 amounted to \$811,000 for a total of \$1,286,000 for the year.

Table 16
SUMMARY OF FEDERAL GOVERNMENT EXPENDITURES MARINE RELATED ACTIVITIES IN THE STATE OF TEXAS, FY 1968

Department or Agency	Expenditures
Department of Commerce	\$13,385,510
Department of Defense	40,000,021
Department of Interior	15,742,400
Department of State	13,378,697
Department of Transportation	9,045,507
National Aeronautics & Space Administration	2,000,000
National Science Foundation	1,286,000
TOTAL	\$94,838,135

SOURCE: *Federal Outlays in Texas*, 1968. Federal Information Exchange System, Office of Economic Opportunity, U. S. Department of Commerce, Washington, D. C.

The State of Texas has no governmental department or agency engaged solely in marine related activities. Various departments within the state are involved in marine resource activities to some degree. In 1965 the 59th Legislature established the Planning Agency Council for Texas (PACT) to coordinate State long-range planning and functional activities at all levels of operation. The Council has authority to review and unify state efforts underway or envisioned in the fields of water supply, parks and other recreational facilities, transportation (including highways and public transit), and other programs involving the use of Federal, state, and local funds.

The Governor was designated as the Chief Planning Officer of the State in 1967 by the 60th Legislature. In addition to the Office of the Governor, the Council is composed of the administrative heads or designated planning representatives from respective agencies of the State Department of Health, Texas Employment Commission, Texas Highway Department, Texas Industrial Commission, Parks and Wildlife Department, State Soil and Water Conservation Board, Railroad Commission of Texas, and the Texas Water Development Board.

The members of the Planning Agency Council with exception of the State Department of Health and the Texas Employment Commission participate with four other state agencies in the newly created Interagency Natural Resources Council which was formed by the Governor of Texas to give attention to the interagency coordination necessary for the

unified development of water, parks, and environmental quality programs in Texas.

Members of the Interagency Natural Resources Council are as follows:

- General Land Office
- Texas Air Control Board
- Texas Industrial Commission
- Texas Railroad Commission
- Texas Highway Department
- Texas Parks and Wildlife Department
- Texas Soil and Water Conservation Board
- Texas Water Development Board
- Texas Water Quality Board
- Texas Water Rights Commission

Specific amounts directed to marine related activities by these agencies were not available. Table 17 gives the annual budgets for FY 1968 for all activities for selected agencies in Texas.

8. COORDINATION OF ACTIVITIES

The use of the Texas coastal zone, including the waters and submerged lands of the Gulf of Mexico and the adjacent shoreline, is clearly multi-purpose. It is also clear that the use is multi-institutional; universities, research institutions, Federal, state and local agencies and private industry are all deeply immersed in the marine activities of the state. The full development of the vast natural resources that are the state's marine environment involves cooperative activity with each of these institutions.

The Role of the Federal Government

Many Federal policies and programs must be carried out in connection with states, industry, the academic community and other institutions. The Federal government serves as a catalyst for marine resource development but at the same time it is an important source of funds for marine research in Texas.

A substantial fraction of Federal funds for marine science and technology is also spent through contracts with industry. It is felt that the Federal activity is needed to stimulate industrial growth and to reinforce state programs. These contracts help build and maintain a base of engineering competence that can be applied broadly to future ocean developments.

The basic national goals for marine science center around the desire to develop and maintain a coordinated, comprehensive program in marine science for the benefit of mankind.

The Role of Industry

The investment in ocean enterprises made by private industry in Texas is substantially greater than Federal and state funding levels combined. Although this study has not attempted to delineate the spending level of private industry in the state, the \$593,899,046 expended by companies for 110 Texas offshore tracts in 1968 could be a prelude to a con-

Table 17
BUDGETS OF SELECTED AGENCIES IN TEXAS FOR FY 1968

Agency	Annual Budget
General Land Office	\$ 1,649,937*
Texas Air Control Board	15,477
Texas Employment Commission	24,368,132
Texas Industrial Commission	309,416
Texas Parks and Wildlife Commission	15,793,234
Texas Railroad Commission	4,470,206**
Texas Soil and Water Conservation Board	420,831
Texas State Department of Health	19,888,827
Texas State Highway Department	531,892,196
Texas Water Development Board	3,704,683
Texas Water Quality Board	2,929,542
Texas Water Rights Commission	767,357
TOTAL	\$606,209,838

*Includes Veterans' Land Board Special Fee Fund of \$238,138.

**Comprised of \$234,397 from General Revenue Funds and \$4,235,809 from the Railroad Commission Operating Fund.

SOURCE: *General and Special Laws of the State of Texas*, 60th Legislature, 1967, Austin, Texas

siderably greater investment if these leases contain substantial oil and gas deposits.

University Interests

The colleges and universities of Texas provide a wealth of resource personnel who are available to assist in planning and coordinating the state's marine activities.

The Sea Grant Program at Texas A&M University combines all the elements of marine resources development into a comprehensive package which can provide assistance to the state effort. Under the Sea Grant Program, the University, and other cooperating colleges and universities, are assisted by industry and state and Federal governments to carry out a vast program of applied research in ocean oriented problems. From fisheries to technician training, the Sea Grant Program focuses on the needs of the region and provides the academic and scientific background to implement these needs.

State and Local Interests

Texas has already begun to assess the problems of the coastal zone through its Interagency Natural Resources Council. The Council and its member agencies are directly concerned with the state's interest in:

1. Continental Shelf resources within the State's jurisdiction
2. Fisheries regulations
3. Pollution control in bays, estuaries, and land and water use regulations
4. Coastal recreation
5. Research and development

There is still much to be done by the state if the needs of the coastal zone are to be realized. With the help of universities and research institutions, the Council is expected to provide leadership in the development of Texas marine resources.

Conclusions

Texas is deeply concerned with the marine environment. Almost 50 percent of its population lives in the study area and dozens of major industrial complexes compete for use of the coastal margin. Agencies from the state and Federal governments direct multimillion-dollar programs in an attempt to understand and effectively manage the Texas coastal zone. Universities and institutes turn to the coast for research and development activities. Commercial and sport fishermen ply the waters of the Gulf. More than 170 million tons of goods are passed through Texas ports each year. And everywhere along the Texas Gulf coast benefits are derived from marine resources, and problems of conflicting uses are faced.

Spurred on by a rapidly expanding technology, marine resource development grows. The extent to which this growth is healthy and beneficial will be determined by the coordination of the diverse activities into a well-developed and comprehensive master plan for the Texas coast. The logical source for this coordination is within the state structure, whether it be the Interagency Natural Resources Council or another state level group. Whoever is to assume this leadership position must be prepared to work with other groups, Federal agencies, private industry, the academic community and individual research institutes if the realization of the marine potential of Texas is to be fulfilled.

