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A conceptual report

Economic Development in the Texas Coastal Zone

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March 1973

SEA GRANT PROGRAM

A conceptual report

ECONOMIC DEVELOPMENT
IN THE
TEXAS COASTAL ZONE

Prepared for

OFFICE OF THE GOVERNOR
DIVISION OF PLANNING COORDINATION
COASTAL RESOURCES MANAGEMENT PROGRAM
INTERAGENCY COUNCIL ON NATURAL RESOURCES
AND THE ENVIRONMENT
STATE OF TEXAS

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Prepared for

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FOREWORD

Economic changes occurring in the 36 counties comprising the Coastal Zone of Texas are presented in this report, Economic Development Study of the Texas Coastal Zone.

As one of six studies sponsored by the Coastal Resources Management Program of Texas under the Interagency Council on Natural Resources and the Environment, this study provided baseline data on economic, human and natural resources of the Coastal Zone and the State of Texas. An analysis of these resources reveals numerous clues to growth patterns and changes occurring in the Coastal Zone. Identification and recognition of factors important to future developments in the Coastal Zone are essential if coastal resources are to be preserved, protected and developed for maximum benefits to present and future generations. In addition to the economic development study, other research studies in the comprehensive program include bay and estuarine management, legal/institutional arrangements, power plant siting, transportation, and waste management alternatives.

The economic development study was conducted and the report prepared by Gerald R. Rapp, David M. French and John Miloy of the Industrial Economics Research Division, College of Engineering, Texas A&M University, College Station, Texas.

Basic data concerned with the economic growth of the Coastal Zone for the past 30 years have been assembled by the authors with specific documentation of population, industrial, employment and income trends. Current resources have been analyzed according to their renewable and nonrenewable characteristics. Urban and rural changes have been identified and discussed with emphasis on significant economic data. Future assumptions and economic projections have been generated to evaluate potential economic changes in the Coastal Zone of Texas to the year 2000. Particular emphasis has been placed on population shifts, industry changes and employment levels.

The Industrial Economics Research Division is grateful for the assistance of firms and companies, numerous federal and state agencies, and many individuals who provided information and other assistance in the development of the study. Particular appreciation by the authors is acknowledged to Joe B. Harris and Joe C. Moseley II of the Coastal Resources Management Program for their cooperation and assistance.

This project was partially funded by the National Sea Grant Program's grant 2-35213, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, made to Texas A&M University.

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June, 1972

SYNOPSIS

POPULATION TRENDS

The Texas Coastal Zone experienced a higher rate of growth than the rest of the state from 1940 to 1970. Total population increased from 1,539,221 in 1940 to 3,502,546 in 1970. It is expected that Coastal Zone population will range from 5 to 6 million persons by the year 2000.

INDUSTRIAL GROWTH TRENDS

Primary or extraction industries have declined in importance relative to the manufacturing and services sector in the study area.

Agriculture in the Coastal Zone remained at a constant 18 percent of total state market value. This is expected to remain relatively constant as livestock will undergo a relative decrease in value and crop values will increase.

Mining activities increased in economic importance to almost twice that of agriculture in the Coastal Zone by 1970 and are expected to continue increasing due to more intensive offshore activities.

Secondary industries, i.e., the various manufacturing activities, remained constant in economic importance but will slowly increase at the expense of primary industries. Increases in value added by manufacture over the study period were due mainly to the growth of the chemical and petrochemical industries. Future growth, however, will be due largely to food processing activities.

Tertiary industries, or the trade and service sectors, have increased in relative importance in recent years and will continue to do so in the future at the expense of primary and secondary industry activities. Tertiary industries in the Coastal Zone will climb to 55 percent of total industrial sector activities by the year 2000.

EMPLOYMENT TRENDS

Employment trends essentially follow the same pattern as industrial growth trends with growth in primary industry employment lagging behind the other sectors. The Coastal Zone is projected to provide over one-third of the 2.2 million new jobs generated in the state by the year 2000.

URBAN AND RURAL CHANGES

The largest growth in population has been in the metropolitan sectors of the region, so also has the per capita income. In 1969,

about 36 percent of the land area of the Coastal Zone contained 87 percent of the population and 91 percent of the total earnings of the labor force in the study area. Growth into as yet undeveloped areas of the Coastal Zone is not expected until the latter part of the century.

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CHAPTER I

HISTORY OF ECONOMIC GROWTH

I. STUDY AREA

The Coastal Zone of Texas studied in this report is composed of 36 counties located in five State Planning Regions adjacent to the Gulf Coast. These regions and counties are listed below and are shown in Figure 1:

1. Lower Rio Grande Valley: Cameron, Hidalgo, Wallacy
2. Coastal Bend: Aransas, Bee, Brooks, Duval, Kenedy, Kleberg, Live Oak, McMullen, Nueces, Refugio, San Patricio, Jim Wells
3. Golden Crescent: Calhoun, DeWitt, Goliad, Jackson, Lavaca, Victoria
4. Gulf Coast: Austin, Chamber, Colorado, Fort Bend, Galveston, Harris, Liberty, Matagorda, Montgomery, Walker, Waller, Wharton
5. South East Texas: Jefferson, Orange.

Also referred to in this report are six Standard Metropolitan Statistical Areas composed of 12 metropolitan counties. These SMSA's and their constituent counties are listed below and are shaded-in on Figure 1:

1. Brownsville-Harlingen-San Benito: Cameron County
2. McAllen-Pharr-Edinburg: Hidalgo County
3. Corpus Christi: Nueces and San Patricio Counties
4. Houston: Harris, Brazoria, Fort Bend, Liberty, and Montgomery Counties
5. Galveston-Texas City: Galveston County
6. Beaumont-Port Arthur-Orange: Jefferson and Orange Counties.

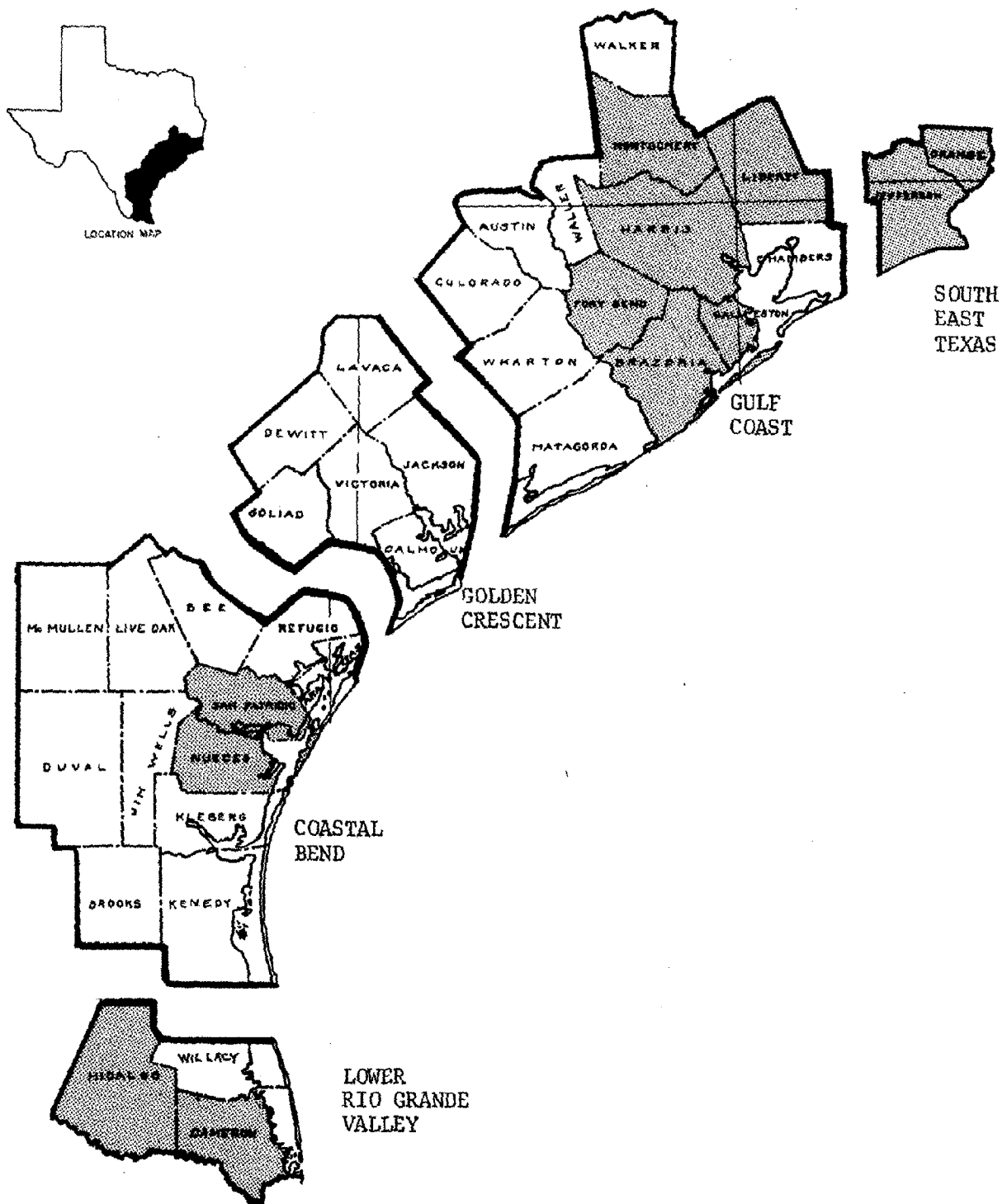


FIGURE 1

STUDY AREA
Coastal Zone State Planning Regions
and Standard Metropolitan Statistical Areas

II. POPULATION TRENDS 1940-1970

The Coastal Zone of Texas, in 1970, had a net population of 3,502,546. Table 1 and Figure 2 show this to be a 127.6 percent increase over the 1940 population of 1,539,221 and an increase from 24.0 percent of the state's population in 1940 to 31.3 percent in 1970. As indicated in Figure 3, the rate of population change for the entire Coastal Zone appears to have peaked during the 1940's since the highest percentage, 39.3, was recorded in the 1950 census; this was nearly twice the growth rate of the state. Since 1950, this rate of population increase in the Coastal Zone has been higher than the rate of increase for the state. The Coastal Zone's rate of increase, however, has decreased from the 1950 peak to 21.4 percent in 1970, versus 16.9 percent for the state.

A total of 24 of the 36 counties comprising the Coastal Zone of Texas showed net increases in population over the three decades from 1940 to 1970. However, this number dropped to 19 counties showing net population increases from 1960 to 1970. For the sake of analysis and further discussion, these 36 counties will be grouped into their designated state planning regions.

The Lower Rio Grande Valley Planning Region increased from 204,831 persons enumerated in 1940 to 335,133 in 1970 to account for 9.6 percent of the current population of the Coastal Zone. This planning region's highest percentage change in population was recorded in the 1950 census as a 49.2 percent increase; however, it has since decreased to a 5.04 percent change recorded in 1970.

Proceeding up the coast to the Coastal Bend State Planning Region, a similar growth pattern is found. Comparatively high growth rates of 43.5 and 42.5 percent occurred in the 1930's and 1940's respectively. This increase, however, dropped to 3.8 percent from 1960 to 1970. The region's total population increased from 224,248 in 1940 to 420,360 in 1970 to comprise 12.0 percent of the Coastal Zone's current population.

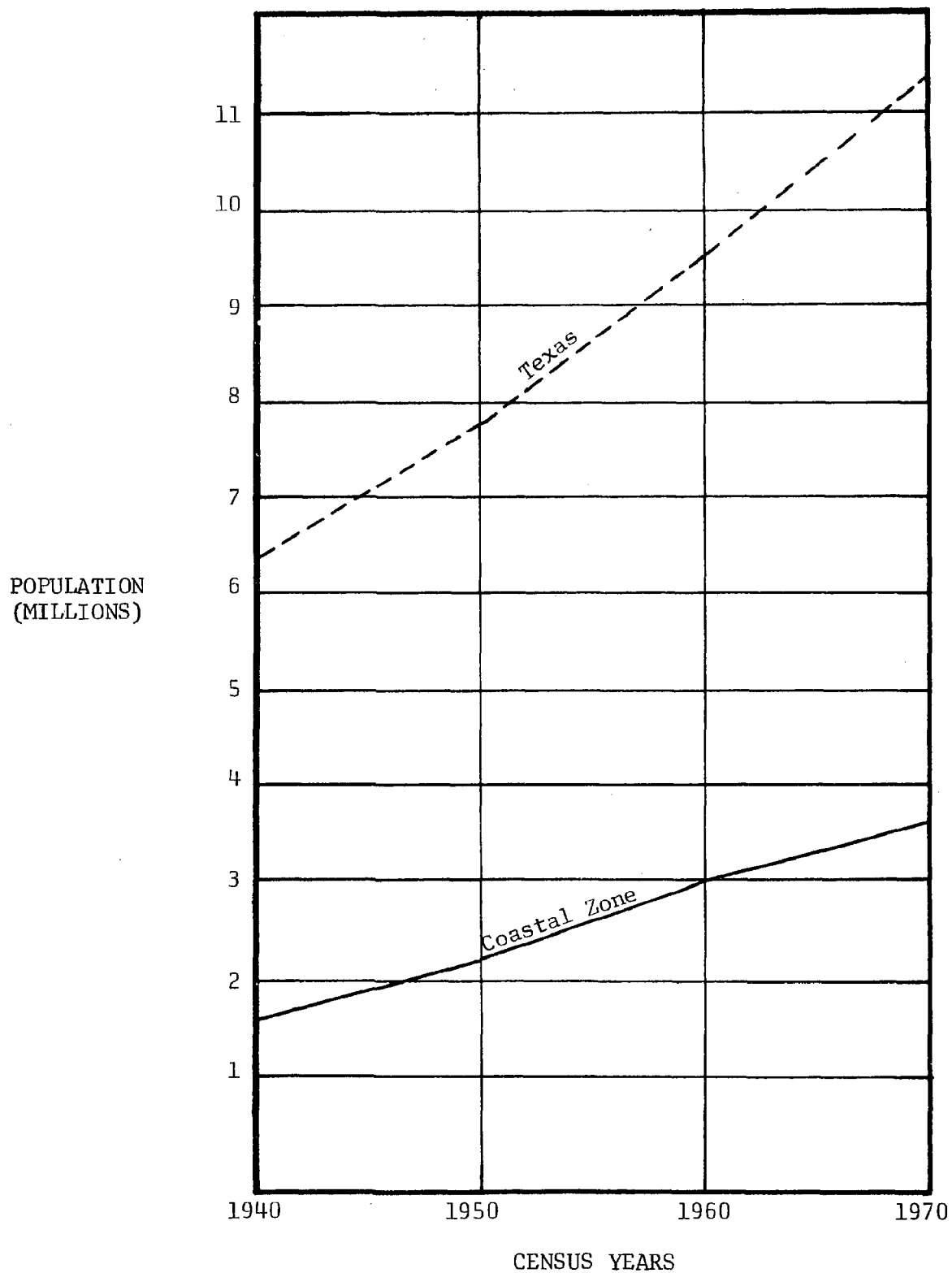
The Golden Crescent State Planning Region had a peak percentage increase of 17.8 recorded during the period from 1950 to 1960. This has since fallen off as with the previously mentioned regions to 2.1 percent. In 1940 the population was 100,590 and it has now increased to 126,004, making up 3.6 percent of the state's Coastal Zone population.

The Gulf Coast Planning Region has consistently shown the most dynamic growth rate of all the planning regions in the Coastal Zone. Population increased from 846,841 in 1940 to 2,305,106 in 1970, to account for 65.8 percent of the population of the Coastal Zone. This planning region alone has increased its proportion of the Coastal Zone population since 1950. It had a peak increase of 44.1 percent in 1960 which has since been reduced to 35.7 percent in 1970. However, this rate of change clearly stands out as substantially higher than that of any other Coastal Zone planning region.

TABLE 1
POPULATION OF THE COASTAL ZONE
1940 TO 1970

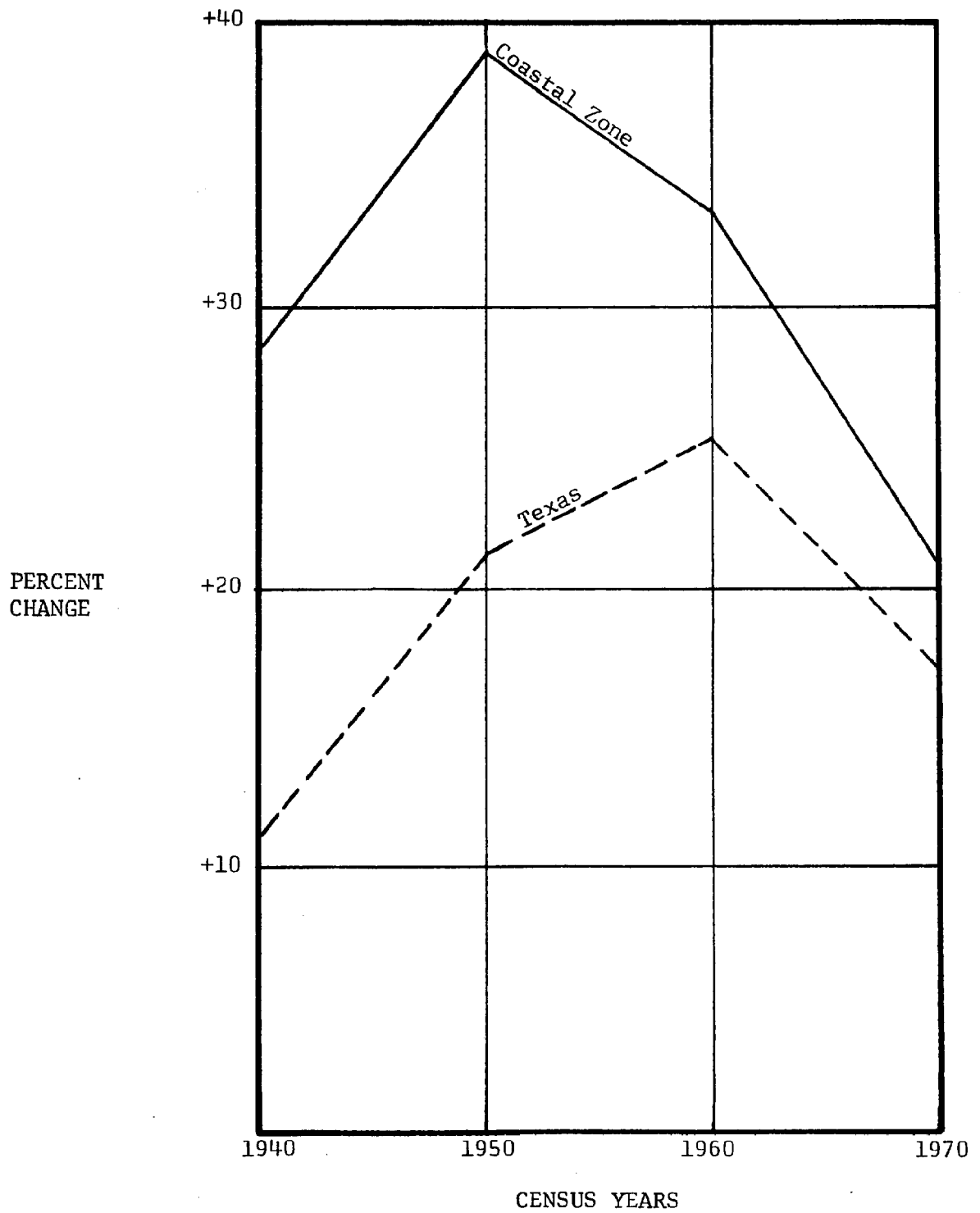
STATE PLANNING REGIONS	1940		1950		1960		1970	
	TOTAL	Percent of Coastal Zone	TOTAL	Percent of Coastal Zone	TOTAL	Percent of Coastal Zone	TOTAL	Percent of Coastal Zone
Lower Rio Grande Valley	204,831	13.3	305,700	14.3	352,922	12.2	335,133	9.6
Coastal Bend	224,248	14.6	319,545	14.9	404,783	14.0	420,360	12.0
Golden Crescent	100,590	6.5	104,730	4.9	123,393	4.3	126,004	3.6
Gulf Coast	846,841	55.0	1,178,475	55.0	1,698,748	58.9	2,305,106	65.8
Southeast Texas	162,711	10.6	235,650	11.0	306,016	10.6	315,943	9.0
Coastal Zone Totals	1,539,221	100.0	2,144,100	100.0	2,885,862	100.0	3,502,546	100.0
State Totals	6,414,824		7,711,194		9,579,677		11,196,730	
Coastal Zone as Percent of State		24.0		27.8		30.1		31.3

SOURCES: U. S. Census of Population, Bureau of the Census, U. S. Department of Commerce, Washington,
D. C.; and Industrial Economics Research Division, Texas A&M University, College Station, Texas.



POPULATION TRENDS IN TEXAS AND THE COASTAL ZONE
1940-1970
(ABSOLUTE NUMBERS)

FIGURE 2



POPULATION TRENDS IN TEXAS AND THE COASTAL ZONE
1940-1970
(PERCENT CHANGE)

FIGURE 3

TABLE 2

POPULATION OF COASTAL ZONE STANDARD METROPOLITAN STATISTICAL AREAS
1940-1970

COASTAL ZONE SMSA's	1940	1950		1960		1970	
	TOTAL	TOTAL	Percent Change 1940-50	TOTAL	Percent Change 1950-60	TOTAL	Percent Change 1960-70
Beaumont-Port Arthur-Orange	162,711	235,650	+44.8	306,016	+29.9	315,943	+ 3.2
Brownsville -Harlingen -San Benito	83,202	125,170	+50.4	151,098	+20.7	140,368	- 7.6
Corpus Christi	121,532	201,313	+65.6	266,594	+32.4	284,852	+ 6.8
Galveston -Texas City	81,173	113,066	+39.3	140,364	+24.1	169,812	+21.0
Houston	636,589	935,539	+47.0	1,418,323	+51.6	1,985,031	+40.0
McAllen-Pharr -Edinburg	106,059	160,446	+51.3	180,904	+12.8	181,535	+ 0.3
TOTALS	1,191,266	1,771,184	+48.7	2,463,299	+39.1	3,077,521	+24.9
SMSA's as a Percent of Coastal Zone	77.4	82.6		85.4		87.9	

SOURCE: U. S. Census of Population, Bureau of the Census, U. S. Department of Commerce,
Washington, D. C.; and Industrial Economics Research Division, Texas A&M University,
College Station, Texas.

The South East Texas State Planning Region shows a pattern of increase similar to the first three planning regions. Population increased from 162,711 in 1940 to 315,943 in 1970 to account for 9.0 percent of the population of the Coastal Zone. The greatest percentage increase in population occurred in this region during the 1940's and was recorded as 44.8 percent in 1950. However, it has since dropped to a 3.2 percent increase from 1960 to 1970.

A study of the distribution of population over the last three decades clearly reveals the statistical shift to metropolitan areas. Table 2 shows the population change for each of the Standard Metropolitan Areas (SMSA) in the Coastal Zone. In 1940, 77.4 percent of the Coastal Zone's population inhabited those counties now comprising the six Standard Metropolitan Statistical Areas. This metropolitan proportion of the population increased to 82.6 percent in 1950, 85.4 percent in 1960, and 87.9 percent in 1970. The major concentration of urbanization has occurred in the Houston SMSA which in 1970 contained 56.7 percent of the population of the Coastal Zone with 1,985,031 inhabitants. As with most of Texas' SMSA's, Houston's highest percentage of population increase occurred in the 1950's, with a 51.6 percent increase recorded in the 1960 census. The rate then dropped in accordance with the overall rate of growth to 40.0 percent recorded in 1970.

The Galveston-Texas City SMSA was the only other SMSA in the Coastal Zone to maintain a significantly high growth rate during the 1960's of 21.0 percent. Galveston-Texas City alone of the SMSA's in Texas ranging from 100,000 to 250,000 population had a net in-migration during the 1960's.

The Brownsville-Harlingen-San Benito SMSA increased typically from 1940 to 1960 from 83,202 to 151,098; however, it alone of the Coastal Zone SMSA's experienced a net decrease during the 1960-to-1970 decade of 7.6 percent to 140,368 inhabitants.

Other SMSA's showing rapid growth during the last three decades include the Beaumont-Port Arthur-Orange SMSA which increased from 162,711 inhabitants in 1940 to 315,943 in 1970. The Corpus Christi SMSA similarly increased from 121,532 persons enumerated in 1940 to 284,832 in 1970. The McAllen-Pharr-Edinburg SMSA grew rapidly during the 1940's then tapered off to only a 0.3 percent recorded increase during the 1960's. Total population increased from 106,059 in 1940 to 181,535 in 1970.

III. INDUSTRIAL GROWTH TRENDS

One criterion of growth patterns in industry is an analysis of the historical shifts in emphasis between primary, secondary, and tertiary industries. The primary industries are those based on the extraction of natural resources such as agriculture, forestry, fishing, and mining.

The secondary industries are those that "add value" to the natural resources through manufacturing, processing, and construction.

The tertiary industries, often regarded as the key measure of material progress, are those that provide services to businessmen and consumers, i.e., in transportation, communication, wholesale-retail trade, finance, recreation activities, and the professional services.

This section of the report will survey the historical trends and shifts in emphasis in these three broad sectors of industry in the 36-county Coastal Zone of Texas from 1940 to 1970. Where suitable information has been obtainable, whether in production quantities or dollar values, trends and percentages have been calculated with the basic assumption that past data will yield important clues to future growth patterns. Furthermore, an attempt has been made to explain the trends in the broad industry sectors of the Coastal Zone in terms of their subcategories and relate them to the values found for the entire state.

A. Primary Industries

Agricultural trends--An overview of the agricultural statistics in the decade from 1930 to 1940 shows the beginning of trends set in agriculture that are apparent today. In 1930, over half of the agricultural income of the state was primarily from the cotton harvest. By the end of the decade, approximately 20 percent of the agricultural income of the state was from the production of cotton. During the same period, approximately eight million acres of state farm land were reassigned primarily for the production of feed grains (mostly sorghums) and grazing. This shift in land use reflected the trend toward a more diversified economy and more stable livestock industry, which was not as directly subject to the uncertainties of drought and periodic plagues of insects.

This trend was intensified by World War II, which created an abnormal demand for beef. Substantial improvement in Texas pastures and ranges was evident in the early 1940's, such as the construction of tanks for stock water, control of noxious shrubs, including mesquite and other kinds of underbrush, and tick eradication programs.

Current trends in farm mechanization first appeared in 1940 as statistics for that year showed a drop in the number of farms from 495,489 in 1930 to 418,000. The increased mechanization was also reflected in a diversification of various crops within the state. Crops other than cotton which became economically significant were feed grains, rice, wheat, vegetables, and citrus fruits.

Irrigation made dramatic progress in the early 1940's. Compared with 843,839 acres irrigated in 1939, there was a 60.9 percent increase to 1,358,000 acres in 1943. The largest irrigated area was found in the coastal prairie region with some 396,000 acres to accommodate the developing rice-growing industry.

Agricultural trends in the Coastal Zone during this period reflect its advantageous position with respect to irrigation facilities. For example, total agricultural income for the state in 1944 reached nearly \$1 billion. This total income was evenly distributed between crops and livestock with total crop values of \$563,077,000 and values of livestock and livestock products at \$435,178,000. Values in the Coastal Zone, however, reflected a greater economic significance of crops sold than the value of livestock and livestock products.

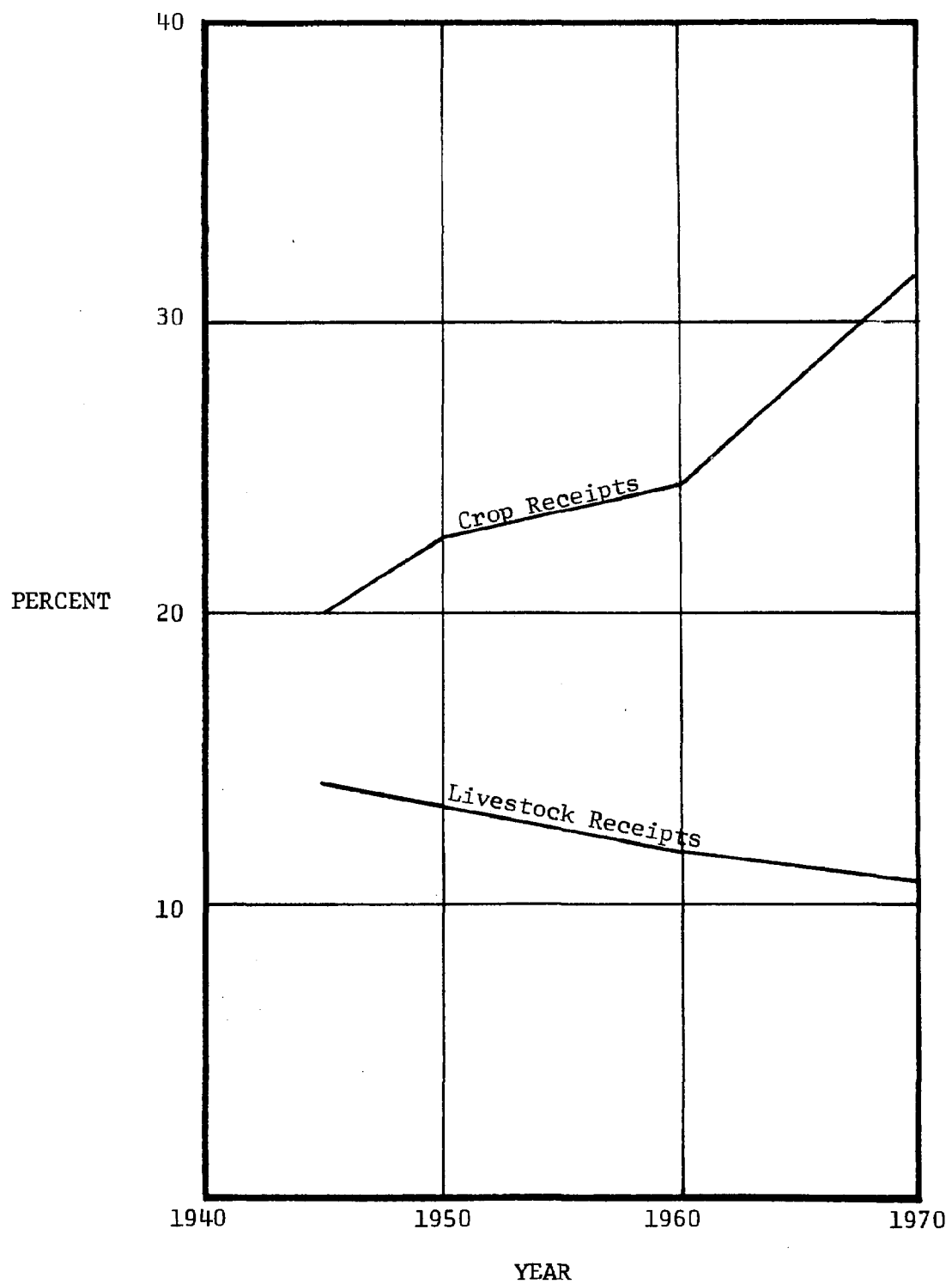
Approximately 17.5 percent of the \$1 billion total agricultural income in 1944 was found to come from the Coastal Zone. This percentage did not change significantly from 1944 to 1970. However, the relative significance of the total values of crops plus the total values of livestock in the Coastal Zone changed dynamically. As demonstrated by Figure 4 and Table 3, the value of crops rose steadily from 20.1 percent of the state values in 1944 to 30.4 percent of state values in 1970. On the other hand, values of livestock and livestock products for the Coastal Zone decreased from 14.2 percent of state income in 1944 to 11.8 percent in 1970.

The value of crops relative to the total agricultural receipts in the Coastal Zone increased from 64.5 percent in 1944 to 72.5 percent in 1964. This represents an increasing economic importance of crops over that of livestock during the study period.

This increased economic importance and diversification of crops is due primarily to three major factors:

1. The development of rice as a major export commodity requiring a high degree of mechanization and irrigation;
2. The increasing concentration of grain sorghum production in the Lower Rio Grande Valley and in the Corpus Christi hinterland;
3. The development of fresh produce and citrus fruits concentrated in the southern portion of the Coastal Zone due to its favorable climate, its diversity of soils, and availability of water.

More recent agricultural statistics show that in 1970, a total of \$3,136,861,000 was received from agricultural productivity in the state.



CASH RECEIPTS FOR CROPS AND LIVESTOCK IN THE
COASTAL ZONE AS A PERCENTAGE OF
TOTAL CASH RECEIPTS FOR THE STATE

FIGURE 4

TABLE 3

VALUE OF ALL CROPS AND LIVESTOCK SOLD IN TEXAS AND THE COASTAL ZONE
1944-1970

	1944	1949	1954	1959	1964	1970
CROPS						
Coastal Zone	\$113,722,518	\$ 247,549,313	\$ 298,588,379	\$ 265,395,751	\$ 291,658,423	\$ 367,873,300
Texas	563,077,610	1,134,458,150	1,087,553,504	1,137,385,495	1,173,993,168	1,191,116,000
Percent of Texas	20.2	21.8	27.5	23.3	24.8	30.9
LIVESTOCK						
Coastal Zone	\$ 61,454,547	\$ 83,276,206	\$ 77,510,446	\$ 121,997,093	\$ 111,000,237	\$ 230,848,000
Texas	435,178,039	616,719,119	554,515,820	971,495,151	973,554,195	1,945,745,000
Percent of Texas	14.1	13.5	14.0	12.6	11.4	11.9

SOURCE: Agricultural Census, U. S. Commerce Department, Washington, D. C.; and Texas County Statistics, Texas Department of Agriculture, Statistical Reporting Service; Austin, Texas.

This does not include government payments but represents total cash receipts from both livestock and livestock products as well as crops. Of this, 19.1 percent or \$598,721,300 represented the total cash receipts from agriculture in the Coastal Zone. Some 63 percent of this total represents the value of crops in the Coastal Zone, while the remaining 37 percent represents receipts from livestock and livestock products.

Trends in commercial fishing--The growth of the commercial fishing industry in Texas can be demonstrated by observing that a total annual catch of both finfish and shellfish rose from a total of 19,138,418 pounds in 1938, to a total of 156,300,000 pounds in 1969.

In recent years, a steadily increasing trend in dollar values of the total commercial fish catch in the Texas Gulf Coast can be observed. Table 4 indicates a 57 percent increase in dollar value of commercial fish from \$30,163,022 in 1963 to \$47,286,329 in 1969. The overwhelming majority (greater than 90 percent) of this value is due to the shrimping industry.

An accurate economic analysis of the fishing industry in general is complicated by the open access mobility, life cycle and seasonal characteristics of the resource.

TABLE 4
POUNDS AND VALUE OF GULF COAST CATCH
OF FINFISH AND SHELLFISH*
(MILLIONS)

	1963		1965		1967		1969	
	POUNDS	VALUE	POUNDS	VALUE	POUNDS	VALUE	POUNDS	VALUE
Finfish	90.5	\$ 2.4	68.7	\$ 2.5	29.0	\$ 1.6	78.5	\$ 2.3
Shellfish								
Shrimp	70.2	26.6	77.0	31.2	102.9	46.4	67.7	42.9
Oysters	2.6	0.9	4.8	1.5	3.6	1.6	3.8	1.5
Crabs (blue)	3.0	0.3	3.6	0.3	2.6	0.2	6.3	0.6
Total Shellfish	75.8	27.8	81.9	33.1	109.1	48.1	77.8	45.0
Grand Total	166.3	\$30.2	154.2	\$35.6	138.1	\$49.7	156.3	\$47.3

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

* All numbers rounded.

Trends in mining and minerals industry--Total mineral values as reflected in Table 5 indicate that the land mass of the Coastal Zone traditionally supports about one-third of the total mineral values of the state. The mineral industry of the State of Texas has maintained its important position in the economy of the state from 1954 through 1969. By 1969, Texas ranked as the nation's foremost producer of petroleum, natural gas, natural gas liquids, magnesium metal, and produced significant quantities of cement, clays, gypsum, lignite, lime, salt, sand and gravel, stone and sulfur. In all, a total of 26 different commercial minerals have been developed throughout the state. The dollar value of minerals, including fuels, in the Coastal Zone, has increased 54.7 percent from \$3,730,162,000 in 1954 to \$5,769,970,000 in 1969. This is somewhat less than the 63 percent increase in the overall state values for the same period.

TABLE 5
TOTAL MINERAL VALUES IN THE COASTAL ZONE AND TEXAS
1954-1969

YEAR	VALUE FOR COASTAL ZONE	VALUE FOR TEXAS	PERCENT
1954	\$1,167,754,196	\$3,730,162,000	31.3
1960	1,205,645,616	4,134,901,000	29.2
1964	1,413,602,365	4,548,824,000	31.1
1969	1,906,001,000	5,769,970,000	33.0

SOURCE: Mineral Yearbooks, Bureau of Mines, U. S. Department of the Interior, Washington, D. C.

As a sulfur producing area, the Gulf Coast rose to prominence early in the century when World War I impeded the import of Spanish sulfur. The major sulfur companies along the Gulf Coast have grown to their present commanding position partly due to the expansion and exploration of the oil industry. It is largely in exploration for oil that salt domes with their yellow caps of sulfur have been found, and the intense search for petroleum along the Gulf Coast has resulted in a widespread and accurate geologic mapping of the Gulf Coast area that the sulfur industry has found beneficial to its development.

Observation of the historical trends in crude oil production from the year 1940 to 1969, as reflected in Table 6, shows that the Coastal Zone land mass has supported a steady 28.5 percent of state volume of crude oil production. The 490,918,556 barrels produced in the Coastal Zone in 1940 increased to 31,714,064,496 in 1969.

The first drilling for oil or gas in Texas' offshore waters began in 1937. The largest field found in state offshore waters was discovered in 1954 off Kleberg County. Though its discovery occurred 17 years after the drilling of the first Texas offshore well, it proved that commercial oil and gas deposits lay under the Gulf of Mexico and it is considered the start of the Texas offshore oil and gas development. Since that time, from one to four state lease sales have been made annually, and on those purchased leases, 21 fields of state acreage produce daily over 350 million cubic feet of natural gas and 25,000 barrels of oil. As seen from Table 7, the number of producing offshore oil wells has increased from one in 1957 to 22 in 1967 and decreased to 10 in 1968. While this volume cannot be considered a huge amount of production, it currently brings the state over \$3 million a year.

TABLE 6
VOLUME OF CRUDE OIL PRODUCTION IN THE
COASTAL ZONE AND TEXAS
1940-1969

YEAR	BARRELS PRODUCED IN COASTAL ZONE	BARRELS PRODUCED IN TEXAS	PERCENT
1940	143,146,097	490,918,556	29.2
1947	2,980,118,325	10,423,886,000	28.6
1949	3,509,484,902	12,141,921,265	27.6
1954	5,118,202,249	17,672,870,822	28.9
1958	6,047,174,194	21,422,828,807	28.2
1966	7,618,565,900	28,403,016,481	26.8
1969	8,411,643,516	31,714,064,496	26.5

SOURCE: Railroad Commission of Texas, Annual Reports of the Oil and Gas Division, Austin, Texas; and Minerals Yearbooks, U. S. Bureau of Mines, Department of the Interior, Washington, D. C.

TABLE 7
OFFSHORE EXPLORATORY DRILLING IN TEXAS
1957-1968

Year	<u>Producing Wells</u>		<u>Dry Holes</u>		<u>Total Wells</u>		Percent Successful
	Number	Footage	Number	Footage	Number	Footage	
1957	1	12	5	54	6	66	17
1958	3	25	11	84	14	109	21
1959	2	22	5	46	7	68	29
1960	0	0	10	96	10	96	0
1961	3	37	14	148	17	185	18
1962	N.A.	N.A.	4	52	4	52	N.A.
1963	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
1964	1	10	6	60	7	70	14
1965	4	41	24	231	28	272	14
1966	2	18	37	339	39	357	5
1967	22	200	39	345	61	545	36
1968	10	90	30	284	40	374	25

N. A. - Not Available.

SOURCE: American Association of Petroleum Geologists Drilling Statistics, Petroleum and Sulphur on the U. S. Continental Shelf. U. S. Department of the Interior, Washington, D. C.

During the early part of the study period, earnings from primary industry activities in the Coastal Zone were distributed evenly between farming and mining. However, as land use shifts occurred to accommodate the growing chemicals industry, mining became the dominant factor in primary sector activities. These trends are shown clearly in Table 8. It can be seen that farm earnings increased almost four-fold and earnings from mining activities increased by a factor 5.4 from 1940 to 1969.

TABLE 8
PRIMARY INDUSTRY SECTOR EARNINGS
IN THE COASTAL ZONE
1940-1969

YEAR	AGRICULTURAL (000)	PERCENT OF TOTAL	MINING (000)	PERCENT OF TOTAL	TOTAL (000)
1940	\$ 64,460	47.37	\$ 71,614	52.63	\$136,074
1950	230,760	41.54	235,069	50.46	465,829
1959	212,228	26.76	580,980	73.24	793,208
1969	245,243	33.40	489,209	66.60	734,452

SOURCES: Office of Business Economics, U. S. Department of Commerce, Washington, D. C.; and Industrial Economics Research Division, Texas A&M University, College Station, Texas.

B. Secondary Industries

As seen in Table 9, of the two major segments of secondary industry, manufacturing has represented an overwhelming contribution to the activities of the Coastal Zone from 1940 to 1969. Texas manufacturing began with the processing of local raw materials. Cotton gins, cottonseed, oil mills, and meat packing were based on the supply of cotton, and cattle in the early 1940's. Flour mills processed wheat and canning plants processed fruits and vegetables. Food processing has grown to be the largest industry in the state in employment and third in value added by manufacture.

The largest and perhaps economically most significant industry in the Coastal Zone has been the refining of crude oil. In the early development of the Texas oil industry, refineries were distributed throughout the state, located largely in the midst of producing wells. By 1959, however, refineries in the Coastal Zone processed 80 percent of the petroleum produced in the state, which was a little more than the average for the previous decades. Current information indicates that Coastal Zone refineries have the capacity to produce almost 90 percent of the state's refined crude oil.

TABLE 9

VALUE OF SECONDARY SECTOR EARNINGS
IN THE TEXAS COASTAL ZONE
1940-1969

YEAR	CONTRACT CONSTRUCTION (000)	MANUFACTURING (000)	TOTAL (000)
1940	\$ 38,781	\$ 113,693	\$ 152,474
1950	217,295	507,594	724,889
1959	300,873	1,108,684	1,409,557
1969	877,900	2,225,264	3,103,164

SOURCES: U. S. Department of Commerce, Washington, D. C.; and Industrial Economics Research Division, Texas A&M University, College Station, Texas.

As the result of the many activities related to oil field equipment manufacturing, the refining business has traditionally been the number one ranked industry in the Coastal Zone with respect to the "value added" criteria. The industry ranks second only to the chemical industry in the number of employees, payroll, and value of products.

The most recent major secondary activity based on the availability of local raw materials is the petrochemical industry. The demand for synthetic rubber created by World War II stimulated rapid expansion of this industry that had already begun to develop along the Texas Gulf Coast. Tremendous investments in petrochemical plants in the Coastal Zone were one of the most spectacular of the state economic expansions during the war and post-war period. Continuously expanding markets for these new products have resulted in a steadily increasing output of this industry. By 1963, the value added by manufacture of petrochemicals was the largest for any manufacturing group in the state. The development of petrochemical manufacturing has been based on the plentiful supply of oil and gas as a primary raw material, and in addition, supplies of other materials such as sulfur, salt, shell, and limestone. Since the products of these industries are bulky, location of the plants along the coast, where ocean shipping and intracoastal carriers are available, has been an important factor.

Chemicals and chemical products, the only industry in Texas to go over one billion dollars in annual net value of products during the 1950-1960 period, showed a net value of \$1,063,163,000 according to the census of 1958. The industry is concentrated in the upper Coastal Bend, the Gulf Coast, and the South East Texas Planning Regions. The chief reason for the rapid development of the chemical industry in Texas has been the availability of natural gas, and the availability of carbon black, sulfur, salt, lime, and other minerals has also been encouraging to the establishment of chemical plants in the Coastal Zone.

World War II resulted in the creation of the large aircraft manufacturing industry in Texas and post-war developments have continued in an upward trend. These developments include the building of new assembly plants for automobiles and a growing shipbuilding industry.

Texas has become important enough as a market area to warrant the building of major steel producing facilities in the state. Manufacturers indicate that the industry will continue to expand. Other metals, particularly aluminum, may be expected to help the primary metals classification to maintain a high rate of growth.

One of the most significant features of the history of manufacturing in Texas is a shift toward the fabrication of products for end use. The automobile and the electronics industries are two examples of this type of industry. The fabrication of final consumer and industrial goods is

one of the characteristics of a mature economy, whereas in the early stages of economic development the emphasis is placed on raw materials and then on processing through the first stages of their conversion to finished goods.

Perhaps the most important indicator of trends in secondary industries is the "value added" by manufacture. As summarized in Table 10, it represents the value of goods less the cost of materials, supplies, fuels, utilities, and contract work, and plus the value of work-in-progress inventory and value added by the various merchandising activities of manufacturing establishments.

In 1940, the value added by manufacture was \$448,523,000 throughout the state with over five thousand establishments engaged in manufacturing activities. Statistics of the United States Bureau of Census indicate that by 1967, Texas had 12,722 manufacturing establishments adding almost \$11 billion to unprocessed products. Approximately 25 percent of those establishments (3,737) were located in the Coastal Zone and generated a \$4,744,200,000 value added by manufacture or 43.4 percent of the state value for that year.

TABLE 10
VALUE ADDED BY MANUFACTURE AND MANUFACTURING ESTABLISHMENTS
IN THE COASTAL ZONE AND TEXAS
1940-1967

YEAR	TEXAS		COASTAL ZONE			
	NUMBER	VALUE ADDED (000)	NUMBER	PERCENT OF STATE	VALUE ADDED (000)	PERCENT OF STATE
1940	5,085	\$ 488,523	1,371	27.0	\$ 211,022	47.0
1947	7,128	1,501,050	1,847	25.9	742,549	49.5
1954	8,890	3,501,706	2,510	28.2	1,532,592	43.8
1967	12,722	10,922,400	3,737	29.4	4,744,200	43.4

SOURCE: Texas Almanac, Various Years; Dallas Morning News, Dallas, Texas.

C. Tertiary Industries

Wholesale and Retail Trade--The decade of the 1940's saw an increase in retail establishments throughout the state from 20,357 in 1940 to 90,674 in 1949 doing a business of approximately \$6,518,877,000 covering the business calendar for 1948. There were 11,558 wholesale establishments by the end of the decade with a total for the year amounting to \$8,197,169,000. Approximately one-third of this value was supported by the Coastal Zone.

Of the 13 classifications of retail trade as listed by the Bureau of Census, the food group led in Texas, both in number of stores and in total sales volume during the decade of the 1940's. The automotive group ranked second in expenditures and volume of sales. Third place in Texas consumer spending went to the lumber, building and hardware group.

Observation of Table 11 shows that by 1940 the Coastal Zone had generated just over \$500 million or a little more than 27 percent of the total state cash receipts from retail sales. As in most industry sector categories, there was a very large increase in retail sales activities between 1940 and 1950: a 325 percent increase in the Coastal Zone as opposed to 311 percent for the state over the same period. This was primarily due to the increase in automotive sales following World War II.

By 1960, the Coastal Zone retail sales amounted to 28.9 percent of total retail sales for the state at \$3,323,380,000 and statistics for that year showed a significant shift. The food sales category became the most important sector of retail sales as sales receipts in food markets increased to 31.75 percent of the total retail sales in the Coastal Zone. Sales of automotive supplies remained second with a total of \$1,142,193,000 or 19 percent of the total retail sales in the zone.

A historical overview of retail sales in the Coastal Zone, outlined in Table 12, shows a steady increase from 27 percent of total state receipts in 1940 to 31.2 percent in 1970. This is reflected by a concurrent increase in the number of retail establishments in the study area which increased from 20,357 or 23 percent of the state total in 1940 to 33,493 or 29 percent of the state total in 1970.

While there is a concentration of retail business in the cities that is greater than the concentration of population, there is an even greater concentration of wholesale business. The two largest wholesale centers, Dallas and Houston, currently do over one-half of the wholesale business of the state. This concentration of wholesale business is characteristic to all parts of the country, but to an even greater

TABLE 11

TOTAL RETAIL SALES VALUES AND EXPENDITURES ON FOOD, AUTOMOBILES AND GENERAL
MERCHANDISE IN THE COASTAL ZONE AND TEXAS
1940-1970

YEAR		TOTAL RETAIL SALES (000)	PERCENT CHANGE	FOOD (000)	PERCENT OF TOTAL SALES	AUTOMO- BILES (000)	PERCENT OF TOTAL SALES	GENERAL MERCHAN- DISE (000)	PERCENT OF TOTAL SALES
1940	Coastal Zone	\$ 500,045	N.A.	N.A.		\$ 40,171	8.03	N.A.	N.A.
	State	1,850,004	N.A.	N.A.		150,423	8.13	N.A.	N.A.
	Percent of State Values	27.03		N.A.		26.70		N.A.	N.A.
1950	Coastal Zone	2,128,485	+325.7	\$ 306,041	14.38	495,354	23.27	230,549	10.83
	State	7,616,428	+311.7	1,627,946	21.37	1,929,397	25.33	955,750	12.54
	Percent of State Values	27.95		18.80		25.67		24.12	
1960	Coastal Zone	3,323,380	+ 56.13	854,002	25.70	618,229	18.60	369,593	11.12
	State	11,507,575	+ 51.09	2,689,871	23.37	2,342,008	20.35	1,487,753	12.92
	Percent of State Value	28.88		31.75		26.40		24.84	
1970	Coastal Zone	6,017,088	+ 81.05	1,430,556	23.77	1,142,193	18.98	1,094,279	18.19
	State	19,279,604	+ 67.54	4,263,451	22.11	3,780,755	19.61	3,408,499	17.68
	Percent of State Values	31.20		33.55		30.21		32.10	

SOURCE: Respective years, Sales Management, Survey of Buying Power, New York City, New York
and Industrial Economics Research Division, Texas A&M University, College Station, Texas.

TABLE 12
VALUE OF RETAIL SALES ESTIMATES FOR THE
STATE AND COASTAL ZONE
1940-1970

YEAR	COASTAL ZONE RETAIL SALES (000)	STATE RETAIL SALES (000)	PERCENTAGE OF STATE VALUE
1940	\$ 500,045	\$ 1,850,004	27.0
1950	2,128,485	7,616,428	27.9
1960	3,323,380	11,507,575	28.9
1970	6,017,088	19,279,604	31.2

SOURCE: Texas Almanac, Respective Years; Dallas Morning News, Dallas, Texas.

degree in Texas because of the large volume of raw agricultural and mineral products that are handled. Due to the increased importance of raw mineral products and slightly greater population growth rates, a larger percentage of wholesale business as compared with the Dallas area has shifted to the Houston area in the latter part of the study period.

In 1940, approximately 30 percent of the wholesale sales in Texas was found in the Coastal Zone and valued at \$670,566,000. This business was generated by the 2,284 wholesale establishments in the Coastal Zone at that time. Values of wholesale sales in the study area had risen to \$2.5 billion in 1947, which represented 30.6 percent of the state wholesale sales. In 1958, there were 4,524 establishments which accounted for \$4.9 billion worth of wholesale business, or 34.7 percent of the total state wholesale sales for that year.

Services--The history of the development of the service sector relative to finance and trade activities in the Coastal Zone is summarized in Table 13. Observation shows a steady increase in service sector earnings from \$78 million or just under 30 percent of state earnings in 1940 to \$1.4 billion or about 38.5 percent of state earnings by 1969.

While the service sector has traditionally ranked behind the wholesale and retail trade category in total earnings, it can be seen that it is the only major category that has shown relative growth over the study period. The trade and finance categories have declined relative to total tertiary earnings.

TABLE 13

VALUE OF TERTIARY SECTOR INDUSTRY EARNINGS
IN THE COASTAL ZONE
1940-1969

YEAR	FINANCE INSURANCE (000)	PERCENT OF TOTAL	SERVICES (000)	PERCENT OF TOTAL	TRADE (000)	PERCENT OF TOTAL	TOTAL (000)
1940	\$ 38,449	14.63	\$ 78,413	29.83	\$ 146,032	55.55	\$ 262,894
1950	122,231	13.09	286,307	30.67	524,907	56.23	933,445
1959	234,096	13.74	575,309	33.76	894,949	52.51	1,704,354
1969	476,677	12.99	1,412,210	38.48	1,781,198	48.53	3,670,085

SOURCE: Office of Business Economics, U. S. Department of Commerce, Washington, D. C.

Table 14 summarizes some quantitative information relating broad industry sector earnings in the Coastal Zone to that of the state and showing percentage changes throughout the study period. Primary industry earnings in the Coastal Zone relative to the state increased at an average rate of about one percent per year from 1940 to 1959, and decreased at an average rate of about three-fourths of one percent from 1959 to 1969. Currently, primary industry earnings in the Coastal Zone amount to about 35 percent of overall state primary industry earnings. Secondary sector earnings in the study area remained at a relatively constant average of 40 percent of state earnings over the period from 1940 to 1969. The tertiary sector earnings has shown cyclic trends since 1940, showing a net decline by 1969 to just under 27 percent of total state values.

TABLE 14
DOLLAR VALUE OF BROAD INDUSTRY SECTOR EARNINGS
FOR THE STATE AND COASTAL ZONE
1940-1969

	1940 (000)	PERCENT CHANGE* (1929-40)	1950 (000)	PERCENT CHANGE (1940-50)	1959 (000)	PERCENT CHANGE (1950-59)	1969 (000)	PERCENT CHANGE (1965-69)
PRIMARY INDUSTRY								
Coastal Zone	\$137,76	+ 6.70	\$ 506,754	+269.1	\$ 865,872	+70.87	\$ 879,223	+ 1.54
State	553,439	-12.55	1,822,965	+229.4	2,021,039	+10.87	2,485,722	+14.92
Percent of State Value	24.80		27.80		42.84		35.37	
SECONDARY INDUSTRY								
Coastal Zone	152,474	+39.21	724,889	+375.42	1,409,557	+94.45	3,103,164	+53.04
State	358,790	+ 1.03	1,842,400	+413.50	3,664,008	+98.87	8,300,266	+60.19
Percent of State Value	42.50		39.34		38.47		37.39	
TERTIARY INDUSTRY								
Coastal Zone	263,394	+28.84	933,445	+254.39	1,704,354	+82.59	3,670,085	+51.82
State	850,459	+ 3.22	3,039,884	+257.44	5,438,849	+78.92	13,645,377	+82.95
Percent of State Value	30.97		30.71		31.34		26.90	

*Percent change from 1929 values.

SOURCE: Office of Business Economics, U. S. Department of Commerce, Washington, D. C.

IV. EMPLOYMENT TRENDS 1948 TO 1970

Employment trends in the Coastal Zone discussed here are based on the earliest consistently collected data available in the County Business Pattern series of the United States Census Bureau. The data analyzed spans two eight-year periods--1948 to 1956 and 1956 to 1964, with a six-year span to the latest available data issued for 1970. Five counties additional to the 36 counties comprising the Coastal Zone study area are included due to the agglomeration of certain counties in the 1948 and 1956 collection of data by County Business Patterns. The boundaries of four of the five state planning regions to be discussed therefore required modification in order to maintain a consistent data base over the 22-year time period.

The types of economic activity (industrial sectors) used in the study were classified as primary or resource extraction oriented, secondary or manufacturing oriented, and tertiary or services oriented. Only selected occupations were included at each level of activity. Thus, employment used in this study indicates only the proportions among the different activities and the change over time. They do not represent absolute total employment. The employment trends examined here are based on data for all private, non-farm activities and non-profit organizations reported under the Federal Insurance Contributions Act as included in County Business Patterns. It does not represent complete coverage of the Social Security program. Chief among the wage and salary workers absent from the available data are agriculture, domestic service, government, and self-employed workers.

Under the major industrial activity heading of primary industries are included agricultural services, forestry, fisheries and mining. Secondary industries include contract construction and manufacturing. Under tertiary industries, wholesale and retail trade, transportation and other public utilities, finance, insurance, real estate, and services are included.

Table 15 reveals the major employment trends by broad industrial sectors in Texas and in the Coastal Zone from 1948 to 1970. From this table, the following information can be obtained:

1. total number of employees for the State of Texas and for the Coastal Zone in each of the four years for which data was collected and the percentage changes;
2. the total number of employees for each of the major industrial sectors in the state and in the Coastal Zone for each year and the percentage changes;
3. the percent of the total labor force in the state and in the Coastal Zone made up by the respective number of employees in each major industrial sector for each year.

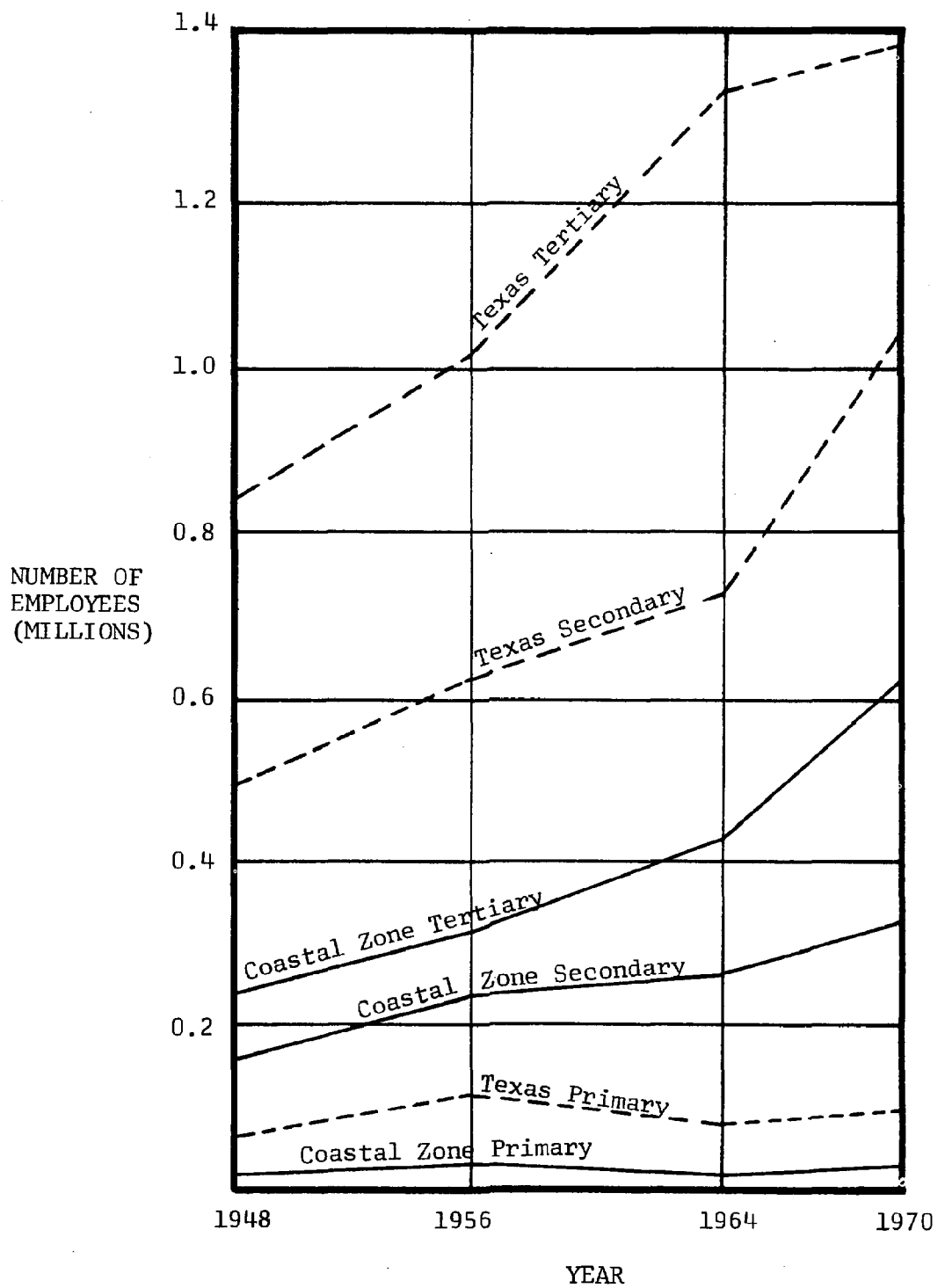
TABLE 15

EMPLOYMENT TRENDS BY BROAD INDUSTRIAL SECTORS
IN TEXAS AND THE COASTAL ZONE
1948-1970

BROAD INDUSTRIAL SECTOR	1948		1956		1964		1970	
	TEXAS	COASTAL ZONE	TEXAS	COASTAL ZONE	TEXAS	COASTAL ZONE	TEXAS	COASTAL ZONE
PRIMARY:								
Number	88,143	23,587	141,667	43,606	111,821	35,868	118,647	46,524
Percent								
Change	--	--	+60.7	+84.9	-21.1	-17.7	+ 6.1	+29.7
Percent of								
Labor Force	6.1	5.1	7.6	6.1	5.1	4.9	4.0	4.6
SECONDARY:								
Number	493,260	176,272	627,997	229,732	725,216	251,082	1,004,432	343,104
Percent								
Change	--	--	+27.3	+30.3	+15.5	+ 9.3	+38.5	+36.7
Percent of								
Labor Force	33.9	38.1	33.5	36.9	33.0	34.4	33.7	33.9
TERTIARY:								
Number	864,198	260,799	1,077,413	343,376	1,349,130	433,207	1,834,985	616,512
Percent								
Change	--	--	+24.7	+31.7	+25.2	+26.2	+36.0	+42.3
Percent of								
Labor Force	59.4	56.4	57.5	55.1	61.4	59.4	61.5	60.9
TOTAL:*								
Number	1,454,418	462,717	1,874,253	623,031	2,197,331	729,392	2,984,536	1,012,090
Percent								
Change	--	--	+28.9	+34.6	+17.2	+17.1	+35.8	+38.8

*Includes Unclassified Employment

SOURCE: County Business Patterns, Bureau of the Census, U. S. Department of Commerce, Washington, D. C.; and the Industrial Economics Research Division, Texas A&M University, College Station, Texas.



EMPLOYMENT TRENDS BY BROAD INDUSTRIAL SECTORS
IN TEXAS AND THE COASTAL ZONE
1948-1970
(ABSOLUTE NUMBERS)

FIGURE 5

Among the major trends evident in Table 15 is the approximate doubling of total state employment with a fluctuating growth rate, highest in the 1964-1970 period. Similarly, the employment trends in the Coastal Zone follow the state with higher growth rates in the 1948-1956 and the 1964-1970 periods. Consequently, employment in the Coastal Zone more than doubled from 1948 to 1970.

According to Figure 5, primary industrial activity, associated with resource extraction and composed of employment in agricultural services, forestry, fisheries and mining, appears to have progressed erratically during the study period with an increase from 1948 to 1956, followed by a decrease from 1956 to 1964 in both the state and in the Coastal Zone. In the 1964-1970 period, however, while the state experienced only a 6.1 percent increase, primary sector employment in the Coastal Zone increased by 29.7 percent. Therefore, while state primary employment increased by approximately one-third from 1948 to 1970, primary employment in the Coastal Zone nearly doubled. After 1956, however, the percentage of primary employment in the total labor force decreased from 7.6 in the state and 6.1 in the Coastal Zone to 4.0 and 4.6 percent respectively in 1970.

The secondary industrial sector of contract construction and manufacturing shows more stable growth trends than the primary sector over the study period. The Coastal Zone led the state in growth of secondary industry employment only during the 1948 to 1956 period. However, both the state and the Coastal Zone approximately doubled the number of employees in the secondary sector from 1948 to 1970. At the state level, the secondary sector remained at approximately 33 percent of the state's total labor force over the entire 22-year study period, while in the Coastal Zone its contribution to total employment dropped from 38.1 percent in 1948 to 33.9 percent in 1970. Although the growth rates for the secondary sector in both the state and the Coastal Zone were high over the study period, they were not high enough to increase the relative proportion of secondary employment in either area.

The reduction in the relative proportion of the total labor force in both primary and secondary industrial activities is balanced by the growth of the labor force involved in tertiary industrial activities listed under wholesale and retail trade, transportation and other public utilities, finance, insurance, real estate, and services. State employment in the tertiary sector increased at an increasing rate over the study period to ultimately grow two and one half times by 1970. Employment in the tertiary industrial activities increased at an even higher rate in the Coastal Zone. However, as a proportion of the total labor force in each area, Coastal Zone tertiary employment of 60.9 percent was slightly below the state tertiary proportion of 61.5 percent, as it had been for all preceding years in the study period.

While Coastal Zone primary industrial employment showed a major increase from 26.8 percent of the primary employment in the state in 1948 to 39.2 percent in 1970, Coastal Zone secondary employment decreased slightly from 35.7 percent to 34.2 percent. Employment in tertiary industrial activities in the Coastal Zone increased from 30.2 percent of the state's tertiary total in 1948 to 33.6 percent in 1970.

Since the greatest gains were made in the relatively smaller industrial activities with no relative gain in the percentage of secondary employment, total employment in the Coastal Zone increased by only 2.1 percent to 33.9 percent of the state's labor force in 1970. The majority of this increase was accounted for by growth of the tertiary sector in the Coastal Zone.

Table 16 presents a geographic breakdown of employment by broad industrial sector in approximate Coastal Zone state planning regions from 1948 to 1970. Boundaries of four of the five planning regions are approximate due to the agglomeration of county data in 1948 and 1956. This table provides the following information:

1. the total number of employees in each approximate state planning region in the Coastal Zone in 1948 and in 1970 and the percentage of the Coastal Zone labor force comprised by each total;
2. the total number of employees in each major industrial sector for 1948 and 1970 and the percent of the Coastal Zone labor force comprised by each;
3. for each approximate planning region, the number of employees in each major industrial sector for 1948 and 1970 and the percentage of the individual region's labor force made up by each of the totals.

The Lower Rio Grande Valley State Planning Region, not including Willacy County, showed the largest relative regional increase in employment in primary activities from 1.5 to 4.4 percent of the region's labor force. Secondary sector employment, while increasing absolutely, showed a reduction of 9.4 percent in proportion to the total regional labor force. Tertiary industrial activity increased typically; however, this region's total labor force dropped from 6.4 percent of the Coastal Zone labor force in 1948 to 5.2 percent in 1970.

The Coastal Bend State Planning Region, with the exception of Bee, Refugio, and Aransas Counties, and the addition of Willacy County, while gaining employment absolutely also showed a decrease in its contribution

TABLE 16

EMPLOYMENT BY BROAD INDUSTRIAL SECTOR IN THE
COASTAL ZONE STATE PLANNING REGIONS¹
1948 AND 1970

STATE PLANNING REGIONS	YEAR	PRIMARY	PERCENT OF LABOR FORCE	SECONDARY	PERCENT OF LABOR FORCE	TERTIARY	PERCENT OF LABOR FORCE	TOTAL ²	PERCENT OF COASTAL ZONE LABOR FORCE
LOWER RIO GRANDE VALLEY	1948	438	1.5	9,271	31.3	19,724	66.5	29,642	6.4
	1970	2,336	4.4	11,608	21.9	38,378	72.3	53,077	5.2
COASTAL BEND	1948	4,102	8.8	10,976	23.5	31,386	67.2	46,724	10.1
	1970	7,814	9.0	21,101	24.3	62,580	72.1	86,751	8.6
GOLDEN CRESCENT	1948	1,226	7.1	4,345	25.1	11,602	67.1	17,302	3.7
	1970	3,206	8.7	12,115	32.8	21,652	58.6	36,973	3.7
GULF COAST	1948	16,603	5.4	115,444	37.8	171,825	56.3	305,191	66.0
	1970	30,628	4.1	254,276	34.4	450,822	61.0	739,221	73.0
SOUTHEAST TEXAS	1948	1,218	1.9	36,336	56.9	26,162	41.0	63,854	13.8
	1970	2,540	2.7	43,516	46.4	47,720	50.9	93,803	9.3
TOTAL (COASTAL ZONE)	1948	23,587	5.1	176,372	38.1	260,699	56.3	462,717 ³	
	1970	46,524	4.6	342,616	33.9	613,695	60.6	1,012,090 ³	

¹Planning regions are approximate (see text)

²Includes unclassified employments

³Totals are relative proportions (see text)

SOURCE: County Business Patterns 1948 and 1970, Bureau of the Census, U. S. Department of Commerce,
Washington, D. C.; and Industrial Economics Research Division, Texas A&M University, College
Station, Texas.

to the total Coastal Zone labor force. While the primary and secondary sectors increased slightly in importance among the industrial activities of this region during the study period, the dominant tertiary sector showed the greatest contributonal increase to the region's labor force.

The Golden Crescent State Planning Region, with the addition of Bee, Refugio, Aransas, Gonzales, and Carnes Counties, was the only region to maintain its relative proportion of the Coastal Zone labor force from 1948 to 1970. This maintenance of proportional contribution can be accounted for by above average growth in this region's secondary industrial sector, along with the second highest proportional increase among zone regions in tertiary sector employment.

The Gulf Coast State Planning Region, with the addition of Grimes, Houston, and Madison Counties, was the only region to increase its contribution to the Coastal Zone labor force over the study period. Its already dominant proportion, 66.0 percent, of the Coastal Zone labor force in 1948 was increased to 73.0 percent in 1970. Although increasing primary industrial employment absolutely by nearly doubling in size, the Gulf Coast was the only planning region in the Coastal Zone to reduce the importance of primary activities within its own regional labor force. Secondary sector employment, although more than doubling in absolute size, also was reduced in relative importance by tertiary sector growth. Tertiary industrial employment increased by more than two and one-half times and rose by 5.3 percent to 61.0 percent of the region's labor force.

The South East Texas State Planning Region reduced its contribution to the Coastal Zone labor force from 13.8 percent in 1948 to 9.3 percent in 1970. This reduction may be attributed partially to the 10.5 percent drop in the importance of secondary sector activity within the region, the largest of such decreases in all the Coastal Zone planning regions. Partially offsetting this decrease, however, was the largest regional increase in the importance of tertiary industrial activity. Primary activity within the region gained slightly in importance; however, the absolute figures were relatively small.

V. INCOME TRENDS--1940 TO 1969

As can be interpreted from Table 17, per capita personal income for the entire geographical area of the Coastal Zone has increasingly fallen behind the average per capita income for the state. This trend at one time may have been partially accounted for by higher population growth rates in the Coastal Zone, but rather it now appears to have continued more rapidly since 1950, when urbanization and industrialization at the state level began to match or exceed development in the Coastal Zone. While per capita income for the state increased from

\$366 in 1940 to \$3,064 in 1969, the Coastal Zone increased from a leading \$403 per capita to a significantly lesser figure of \$2,783 during the same time. On a proportional population basis, however, most inhabitants of the Coastal Zone may actually be receiving equal or higher incomes since nearly 75 percent of the zone's population in 1969 lived in planning regions which nearly equaled or exceeded the state in average per capita income.

TABLE 17
PER CAPITA INCOME FOR THE STATE AND COASTAL
ZONE PLANNING REGIONS
1940-1969

STATE PLANNING REGIONS	1940	1950	1959	1969
Lower Rio Grande Valley	\$259	\$ 857	\$1,183	\$2,005
Coastal Bend	379	1,192	1,725	2,818
Golden Crescent	291	1,052	1,328	2,421
Gulf Coast	483	1,362	1,879	2,975
South East Texas	586	1,449	2,094	3,571
Coastal Zone	\$403	\$1,216	\$1,689	\$2,783
State	\$366	\$1,233	\$1,728	\$3,064

SOURCES: Office of Business Economics, U. S. Department of Commerce, Washington, D. C.; and Industrial Economics Research Division, Texas A&M University, College Station, Texas

The Lower Rio Grande Valley State Planning Region shows the lowest per capita income level of all the Coastal Zone planning regions for each census year ranging from only \$259 in 1940 to \$2,005 in 1969. Although this region maintained a similar growth trend in per capita income and grew relatively well during the 1960's, it still achieved only two-thirds of the state average per capita income in 1969. The low personal income levels of this planning region may be partially attributed to the large proportion of rural inhabitants and the seasonal nature of agricultural employment in the valley area.

The Coastal Bend State Planning Region shows per capita income growth consistent with the Coastal Zone average, ranging from \$379 in 1940 to \$2,818 in 1969. However, these averages have also fallen below state averages in recent years. The growth trend in per capita income in this region is stimulated chiefly by employment in the Corpus Christi SMSA while simultaneously being counter-balanced by its large proportion of rural inhabitants with lower earning capabilities.

The Golden Crescent State Planning Region had an average per capita income of \$291 in 1940, which increased to \$2,421 in 1969. This range of income growth was well below state and Coastal Zone averages, even though the slow growth of the 1950's was greatly made up for by growth in the 1960's. The non-metropolitan nature of this planning region, also the smallest in population size in the Coastal Zone, is a factor in the lower than average income earning capacities of rural inhabitants.

The Gulf Coast State Planning Region, while ahead of both state and Coastal Zone average per capita incomes for all years except 1969 when it fell below the state average, ranged from \$483 in 1940 to \$2,975 in 1969. This region may now be feeling the effects of the lower incomes of a proportionally small rural population and movement of rural migrants to urban areas, since more than half of the wages and salaries paid in the Coastal Zone in 1969 were paid within the Houston SMSA.

Highest of all the Coastal Zone planning regions in per capita income for every year recorded was the South East Texas State Planning Region, in which incomes ranged from \$586 in 1940 to \$3,571 in 1969. Such high per capita incomes may be accounted for by the population density of this region and by the fact that its boundaries are contiguous with the heavily industrialized Beaumont-Port Arthur-Orange SMSA.

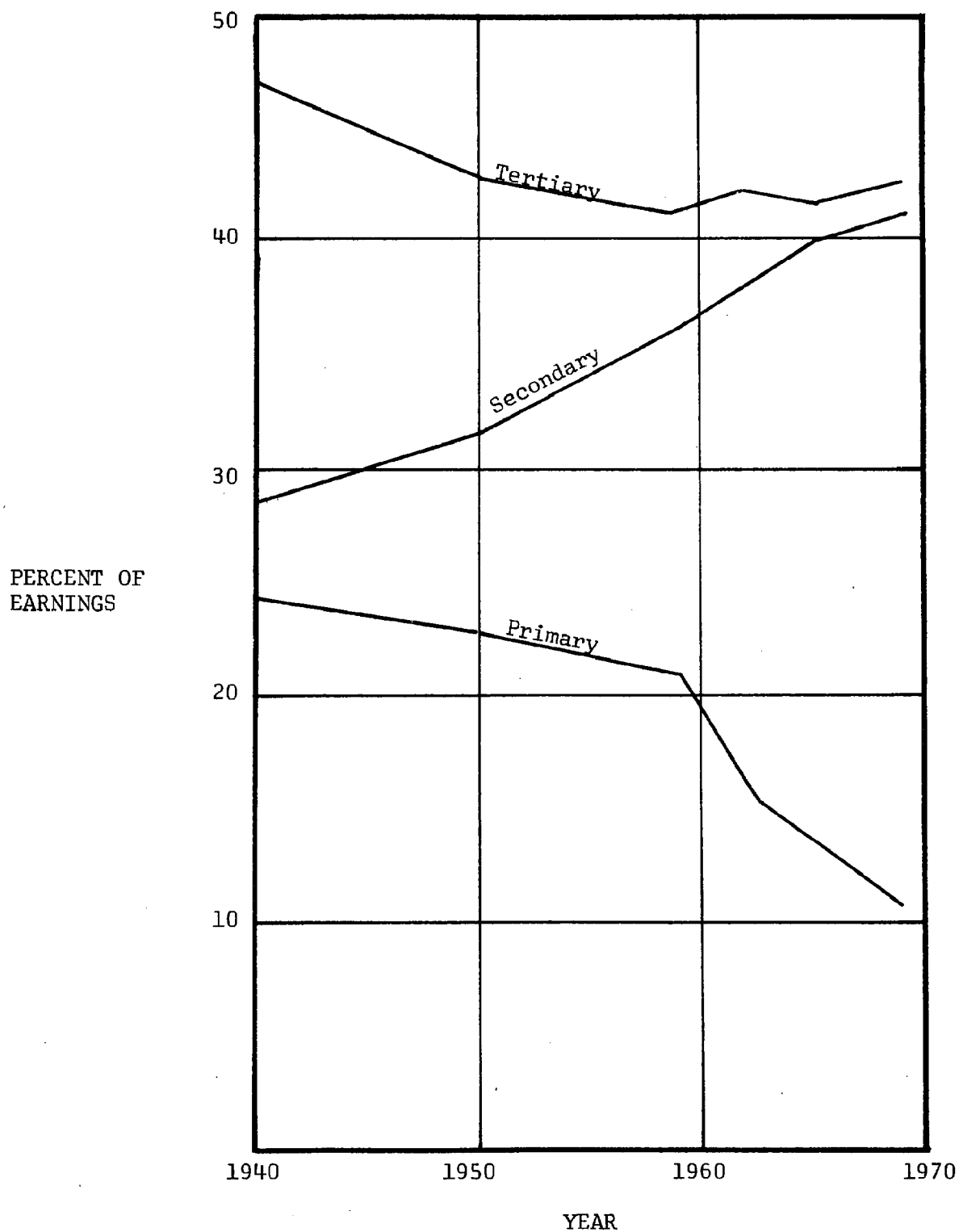
VI. SUMMARY

The Coastal Zone of Texas has experienced a higher rate of population growth over the study period than the state. Within the study area the most significant proportion of growth has taken place in the

Houston SMSA centered in the Gulf Coast State Planning Region. However, the general shift of population to the metropolitan areas of the Coastal Zone has continued at a decreasing rate since the decade of the 1950's. During the decade of the 1960's two of the six SMSA's--Houston and Galveston-Texas City--maintained relatively high rates of growth. In general, the decreasing rate of increase in SMSA populations is a reflection of a larger reduction in population growth rates for the Coastal Zone of Texas since the 1940's and 1950's. The concentration of population in metropolitan areas of the Coastal Zone has limited the income earning ability of a growing proportion of the zone's rural inhabitants as well as that of unskilled urban migrants and minority group members. This is a contributing factor to the relatively slower growth of per capita income in the study area as compared with the state.

When plotted as a percentage of total industrial earnings in the Coastal Zone, as shown in Figure 6, primary sector earnings have been the least significant and have experienced a relative decrease over the study period. However, while primary industry earnings have decreased from about 25 percent in 1940 to just over 11 percent in 1970, secondary industry earnings have grown from 28 percent to 42 percent over the same period. Tertiary industry earnings have remained relatively constant showing slight increases from 42 to 47 percent during the study period.

No definite trends in broad industry sector earnings can be established by the quantitative comparisons of Coastal Zone and state values as were shown in Table 14. Employment figures, however, indicate that growth in the study area has been comparable to that of the state in both the secondary and tertiary industries. Employment in secondary sector activities, while maintaining importance in overall state activities, shows a reduced contribution in the Coastal Zone in the latter part of the study period at the expense of a shift toward tertiary industry employment. Employment in primary industry activities in the study area has risen significantly in proportion to the state.



EARNINGS BY BROAD INDUSTRIAL SECTORS AS
A PERCENT OF TOTAL EARNINGS
1940-1970

FIGURE 6

CHAPTER II

CURRENT RESOURCES

I. RENEWABLE RESOURCES

Agricultural resources--As mentioned earlier, current agricultural statistics show that of the \$3.14 billion in cash receipts for crops and livestock throughout the state in 1970, the Coastal Zone values amounted to almost \$600 million or just over 19 percent. Furthermore, cash receipts for crop values in the study area reached almost \$368 million in 1970 and amounted to just under 31 percent of state values.

In terms of production quantities the most significant crops produced in the study area are the various truck crops or vegetables for marketing and processing. The combined production for the Coastal Zone in 1970 amounted to about 11 million pounds with the major portion found in the Lower Rio Grande Valley. Combined vegetable production in the study area represented some 39 percent of the state production of vegetables.

The economically most important grains produced are the various sorghums used for feed stock. A total of 77,205,600 bushels of grain sorghum was harvested from 1,416,100 acres in the Coastal Zone in 1970, which represented 23.5 percent of the total state production. The largest production areas are centered in the Coastal Bend State Planning Region, primarily San Patricio and Nueces Counties with a total output of 25,325,803 bushels. Other important areas for sorghum production found in the Lower Rio Grande Valley are Hidalgo and Cameron Counties, together reporting 19,259,700 bushels.

The Coastal Zone produced over 90 percent of the state output of rice with a total of 1,871,700,000 pounds in 1970. Most of the rice is located in the Gulf Coast planning region centered primarily in Wharton County, which currently produces about 317,600,000 pounds. Jefferson County in the South East Texas State Planning Region is another significant area for rice production with 229,600,000 pounds.

The Coastal Zone is significant for the production of citrus fruits and nuts. The prime production area is located mostly in the Lower Rio Grande Valley. Total combined output of fruits and nuts for this area is 34,000,980 boxes as compared with approximately 40,000,000 boxes produced by the entire state.

Whether considered in terms of present production ratios or future economic potential, livestock production in the Coastal Zone is not as economically significant in the study area as that of crops and citrus fruits. The total number of cattle in the state according to the 1970 Texas County Statistics of the United States Department of Agriculture was 12,212,000. Only about 150,000 were found in the Coastal Zone, of which 76,000 were located in Austin and San Patricio Counties. Total cash receipts for livestock in the Coastal Zone by 1970 had, as mentioned earlier, declined to 11.8 percent of the state values of livestock sold, or \$230,848,000.

Preservation and future intensification of production of these agricultural resources will depend largely on the results of the many research efforts now under way. Perhaps the most promising aspect of agricultural research may be found in aerial surveying to determine irrigation and fertilization needs. Aerial photography and remote sensing scanners currently are being considered to reflect the color and temperature of fields to determine various conditions of crops and changes in plant metabolism.

Commercial fishing resources--The total values of the commercial shell and finfish catch in 1970 amounted to more than \$53.4 million. Some 95 percent of this total was due to the shellfish catch which was valued at over \$51 million.

As seen from Table 18, the largest shellfish catch was located in the Galveston and Trinity bay areas and valued at nearly \$4 million.

The total values of the shrimp catch for the Texas Gulf Coast in 1970 shown in Table 19 represented over 90 percent of the total value of the overall commercial fish catch at \$48,613,510. The major source of supply, other than the Gulf waters, is found in the Galveston and Trinity bay areas where 5,625,500 pounds of fish caught were valued at nearly \$2 million.

Preservation and intensification of production by the various research fisheries are of utmost importance as reflected by the various research activities. It is generally recognized that great potential lies in mariculture research programs. Emphasis has been placed on shrimp culture because it holds the highest expectations relative to commercial production and economic gain. Research activities have focused on the necessity to identify factors causing mortality, and develop suitable techniques for low-cost harvesting from both natural and reservoir ponds.

TABLE 18
REGION AND VALUE OF TEXAS CATCH
OF FINFISH AND SHELLFISH
1969 AND 1970

REGION	FINFISH		SHELLFISH	
	1969	1970	1969	1970
Gulf of Mexico	\$1,694,449	\$1,428,133	\$39,255,445	\$44,924,316
Sabine Lake	2,145	100	117,255	73,016
Galveston and Trinity Bays	49,120	44,019	3,441,864	3,919,976
Matagorda, East Matagorda and Lavaca Bays	72,090	79,664	893,793	994,811
San Antonio, Mesquite, Espiritu Santo Bays and Green Lake	19,434	41,485	647,395	554,875
Aransas and Copano Bays	87,976	79,144	438,666	602,815
Corpus Christi and Nueces Bays	17,859	23,043	157,235	91,872
Baffin Bay and Upper Laguna Madre	145,889	188,675	56,823	425
Central and Lower Laguna Madre	188,995	196,414	595	1,832
TOTAL	\$2,277,957	\$2,080,677	\$45,009,071	\$51,163,938

SOURCE: Texas Landings, Respective years, "Fisheries of Texas,"
Respective years, National Marine Fisheries Service, U. S.
Department of Commerce, Galveston, Texas, and Texas Parks
and Wildlife Services, Austin, Texas.

II. NONRENEWABLE RESOURCES

Mineral Fuels--The total value of Texas minerals in 1970 reached a new high at \$6,341,761,000 which compared with \$5,769,970,000 in 1969. The most recent statistics released by the Interior Department's Bureau of Mines shows that Texas heads the nation in total mineral values in 1971 with a record \$6,639 billion. The Coastal Zone provides for about one-third of this or \$2.2 billion. Some 1.22 billion barrels of crude oil were produced statewide during 1971 and valued at over \$4.3 billion. The study area contributed approximately \$1 billion of the total state value of raw crude oil. During 1970, statewide gas production amounted to about 8.34 trillion cubic feet at standard pressure and temperature with a total value of over \$1.2 billion. Mineral fuels heavily dominate the Texas mineral industry in the state and Coastal Zone accounting for 93 percent of the total value of Texas minerals.

TABLE 19
REGION AND VALUE OF TEXAS CATCH OF SHRIMP
1970

REGION	POUNDS	VALUE
Gulf of Mexico	77,698,400	\$44,922,208
Sabine Lake	24,800	9,018
Galveston and Trinity Bays	5,625,500	1,974,357
Matagorda, East Mata- gorda, Lavaca Bays	1,997,500	740,792
San Antonio, Mesquite, Espiritu Santo Bays, and Green Lake	1,306,800	405,846
Aransas and Copano Bays	1,327,000	469,417
Corpus Christi and Nueces Bays	345,700	91,872
TOTAL	88,325,700	\$48,613,510

SOURCE: Texas Landings, Respective years, "Fisheries of Texas," Respective years, National Marine Fisheries Service, U. S. Department of Commerce, Galveston, Texas, and Texas Parks and Wildlife Service, Austin, Texas.

Approximately 30 percent of the increase in United States production of oil from 1954 to 1966 was produced from wells in the Gulf of Mexico. Annual Gulf of Mexico crude oil production has increased steadily from less than one percent of the national total in 1954 to more than eight percent in 1967. Currently, Texas accounts for more than 30 percent of the annual total domestic crude oil production. More than 40 percent of the nation's natural gas reserves are located on the Texas Gulf Coast. However, the state's share of reserves and national output has declined over the past 20 years in relation to the national total. This fact has prompted many geologists to observe that Texas may be over its prime as a major fossil fuel producing state. The extension of drilling technology to offshore oil provinces has perhaps been the greatest recent innovation in the industry. Maintenance of the state's reserves and capacity position relative to the nation will depend largely on the degree of productivity yielded by offshore exploration.

Table 20 shows a history of estimated crude oil reserves and annual production for the state from 1940 to 1970. The state's proven oil reserves, as estimated by the American Petroleum Institute, has declined from nearly 15 billion barrels in 1955 to just over 13 billion barrels by 1970.

TABLE 20
ESTIMATED CRUDE OIL RESERVES AND ANNUAL
OIL PRODUCTION FOR TEXAS
1940-1970

YEAR	PROVEN RESERVES BARRELS (000)	ANNUAL PRODUCTION BARRELS (000)
1940	9,768,371	486,662
1945	11,375,480	751,045
1950	13,509,732	817,842
1955	14,982,003	1,022,480
1960	14,859,674	892,084
1965	14,299,847	932,810
1970	13,063,182	1,207,625

SOURCE: Annual Report, 1970, Oil and Gas Division, Railroad Commission of Texas, Austin, Texas.

The Railroad Commission of Texas has determined that annual oil production in 1970 was just over 1.2 billion barrels. It is, therefore, apparent that imports of oil to Texas may be needed within the next decade to meet the problems of growing demand and depleting reserves.

Modifications of allowable extraction policies and various incentive measures will determine the depletion rates of currently available fuel reserves. However, measures should be taken to expand future proven reserves specifically into the offshore areas of the Texas Gulf.

As shown in Table 21, the Coastal Zone contains about 88 percent of the state's refining capacity at over 3.1 million barrels per day. The heaviest concentration of refineries is located in the South East Texas State Planning Region where the capacity is about 1.25 million barrels per day.

TABLE 21

MAXIMUM DAILY CAPACITY OF CRUDE OIL REFINERIES
IN THE COASTAL ZONE AS OF DECEMBER, 1970

PLANT LOCATION	CAPACITY (BBLS)
Port Arthur	811,200
Houston	675,365
Beaumont	440,000
Texas City	434,000
Corpus Christi	346,300
Baytown	345,000
Port Neches	53,000
LaBlanca	5,000
COASTAL ZONE TOTAL	3,109,865
STATE TOTAL	3,529,570

SOURCE: Annual Report, 1970, Oil and Gas Division, Railroad Commission of Texas, Austin, Texas.

Non-fuel Minerals--The important group of non-fuel minerals are those used as chemical raw materials. These support an extensive chemical industry located in the upper portion of the Coastal Zone. Included in this group are salt, sulfur, limestone and shell used for lime. Minor raw materials such as dolomite, salt cake, and natural sodium sulfate are also found.

Salt--Salt resources of Texas are virtually inexhaustible. Enormous deposits occur in the salt domes of the Texas Gulf Coastal Plains and along some of the bays and lagoons of the South Texas Gulf Coast. Texas is currently one of the leading salt producing states. Most of the salt is produced as brines from wells drilled into underground deposits. Recent brine production has been reported in Brazoria, Chambers, Duval, Fort Bent, Harris, and Jefferson Counties of the Coastal Zone. Most of the salt production goes into the chemical industries of the Gulf Coast for use as a basic raw material.

Sulfur--Texas is one of the world's principal sulfur producing areas. Sulfur is the most valuable mineral produced in Texas exclusive of oil and gas. Production comes from two sources--it is mined from deposits of native sulfur and extracted from natural gas. Native sulfur is found in large deposits at the top of the salt domes in the Coastal Zone of Texas. When obtained from underground deposits, it is known as frash sulfur, named for the chemist who devised the method of drilling wells into the deposits. Native frash sulfur is produced from Gulf Coast salt domes in Fort Bend, Jefferson, Liberty, Matagorda, and Wharton Counties.

Lime--Lime in the Coastal Zone is produced from high purity limestone and primarily from shell dredged from coastal bays. Since limestone is notably lacking in the Coastal Zone, dredged reef shell is the primary source of lime for the region. Dredged shell also is used as the principal raw material for the coastal cement industry.

Non-fuel minerals in general decreased 9.7 percent in value from 1969 to 1970, primarily due to the declines in value for cement, stone, sulfur, sand and gravel. Table 22 summarizes the non-fuel minerals abundant in the Coastal Zone with total state values for 1970.

TABLE 22

MAJOR NON-FUEL MINERALS FOUND IN THE
COASTAL ZONE AND APPROXIMATE MARKET VALUE
1970

MINERAL	VALUE
Cement	\$126,729,000
Stone	64,422,000
Sulphur	53,208,000
Salt	47,620,000
Sand and Gravel	38,667,000
Lime	22,320,000
Clay	7,759,000
Gypsum	4,599,000

SOURCE: U. S. Bureau of Mines, Murphy E. Hawking, Liaison Officer, Austin, Texas.

Water Resources--One of the principal factors in the economic development of the Texas Coastal Zone is the location and acquisition of surface and ground water for agricultural, industrial, and municipal uses, and for low cost transportation. Water for agriculture comes from three sources: rainfall, streams, and wells. Currently, almost all of the 417,039 acres of rice in Texas is grown in the Gulf Coast region between the Guadalupe and Sabine Rivers. Each acre requires from one and one half to four feet of water in addition to rainfall. About 40 percent is irrigated by ground water and the remaining by surface water. Another intensively irrigated area is in the Lower Rio Grande Valley in Cameron, Hidalgo, and Willacy Counties where citrus fruits, vegetables, and cotton are irrigated with water from the Rio Grande River and from wells. Cotton and other crops are irrigated in places throughout the Coastal Zone but principally in the area between and including Fort Bend County and Northern Brooks County as well as the Lower Rio Grande Valley.

Along the Gulf Coast, wells are located to obtain moderate to large quantities of water from porous substrate. These formations consist of layers of sand and clay which constitute an extensive ground water reservoir in which water is usually confined by overlying beds of clay. The formations dip underground toward the Gulf and salt water is encountered at various depths below the freshwater sands. Maximum thickness of the freshwater sections ranges to about 3,200 feet. These sands furnish large quantities of water for rice fields and municipal and industrial uses in the Gulf Coast area.

The latest reliable statistics gathered by the Texas Water Commission in 1963 shows that Texas Coastal Zone counties contained about 60 percent of the state's surface water used for both municipal and industrial purposes or just over 4.2 million acre feet. Some 429 thousand acre feet of ground water was extracted for industrial and municipal use the same year or approximately 37 percent of the total extracted for the state.

The largest volume of total surface and ground water in the Coastal Zone is consumed by industrial rather than municipal uses. For example, in 1963, of the total 4,634,821 acre feet of surface and ground water consumed in the Coastal Zone, only 389,894 acre feet supported municipal activities.

The abundance of ground and surface water for industrial use has been a principal factor in the location of the oil refineries and petrochemical plants on the Texas Gulf Coast.

Other Texas industries that require large amounts of water are the paper mills in Harris and Jasper Counties, the metal refining industry in Harris County, aluminum plants in Calhoun and San Patricio Counties, and the magnesium plant in Brazoria County. The non-fuel minerals industry also requires large amounts of water for industrial use. The major requirements include the recovery of sulfur by the frasch method and processing salt from one of the many salt domes in the Gulf Coast Region.

Precipitation is the source of all fresh ground water. Most precipitation on the land surface "runs off" or is consumed by evaporation or infiltrates into the pores of the soil and subsoil through the fractures and solution channels of the rocks to form zones of saturation.

III. SUMMARY

It is clear that the Coastal Zone of Texas contains renewable resources in more intense quantities than the rest of the state. The study area represents about one-eighth of the land mass of the state

yet yields almost 20 percent of the statewide cash receipts from marketed agricultural products. While the various agricultural commodities currently outweigh the income from commercial fishing, the growth of this industry has shown great possibilities. The total value of the commercial fishing catch in the Texas Gulf amounted only to 1.68 percent of the combined income from renewable resource activities. However, this is based solely on a total market value of about \$53 million and does not include the economic impact of this industry on related activities in the Coastal Zone.

Nonrenewable resource development also is seen to be more intense in the Coastal Zone of Texas where the total mineral values represent one-third of overall state values. Generally obscured by the overwhelming mineral fuel values is a growing non-fuel mineral industry providing non-metallic raw material inputs to support the construction industry.

It is the interplay between the desire for preservation and intensification of renewable resources and demands for conservation and development of nonrenewable resources that provides the context for rational resource management. To this end estimates of future economic possibilities are discussed in Chapter IV.

CHAPTER III

URBAN AND RURAL CHANGES

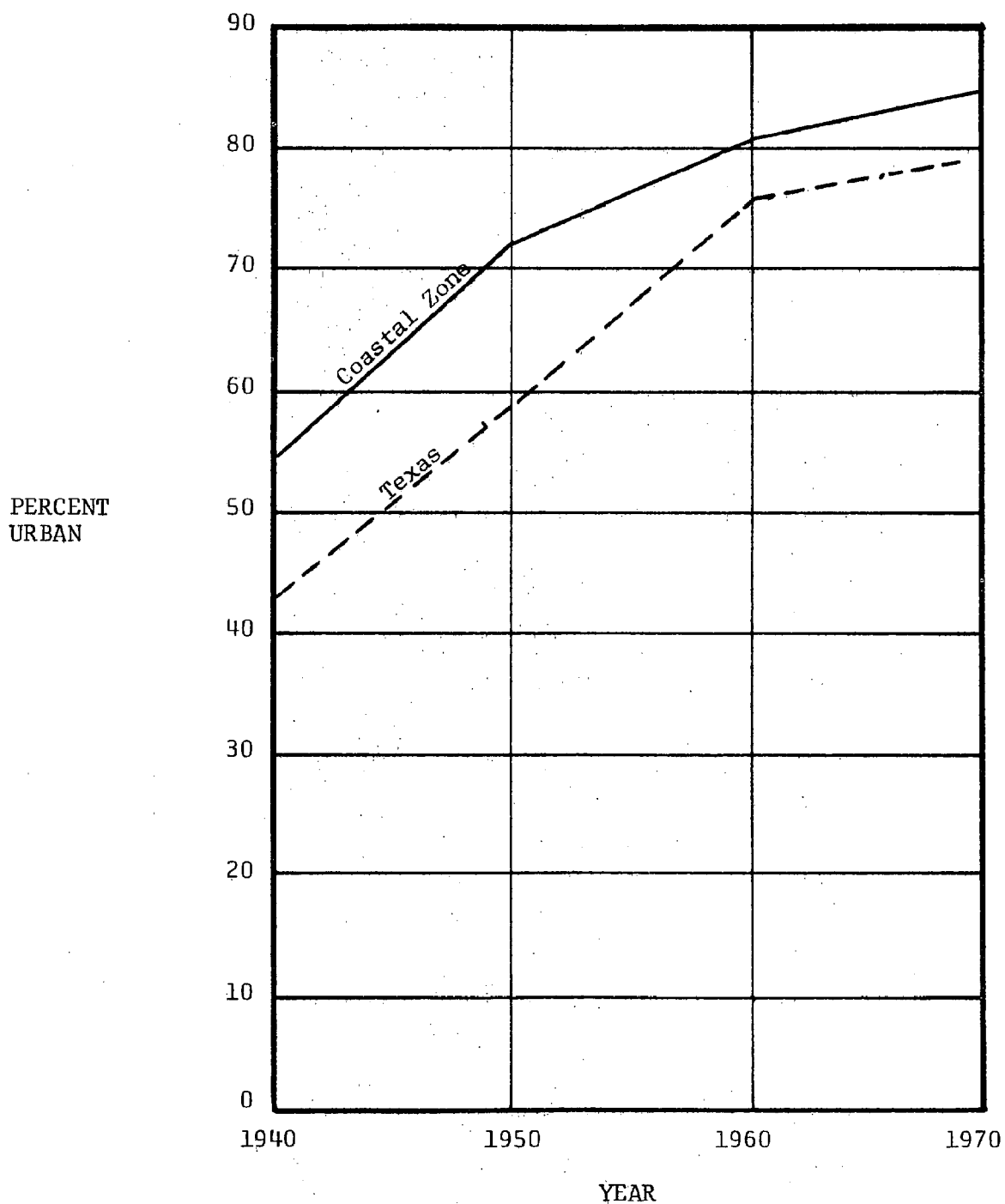
I. DEMOGRAPHIC TRENDS

In delineating the relative changes occurring between urban and rural areas in the Coastal Zone, it is necessary to define the urban population as that comprised of all persons living in urbanized areas and in places of 2,500 inhabitants or more outside urbanized areas. Although urban areas have grown rapidly in Texas throughout the 20th century, a significant shift in population from rural to urban areas has taken place since 1940. This pattern has been demonstrated in a similar fashion in the Coastal Zone. The trend illustrated by Figure 7 indicates that the Coastal Zone has led the state in the proportion of total population classified as urban; however, since 1950 the difference between the two areas has decreased.

Table 23 illustrates the urban-rural population trends from 1940 to 1970. From this table, the following information can be obtained:

1. The total urban and total rural populations of the Coastal Zone for each census year and the percent urban;
2. The percent urban and rural population of the state and the percent urban for each census year;
3. The urban and rural portions of the Coastal Zone as a percent of the urban and rural portions of the state for each year;
4. The urban and rural populations and the percent urban of each state planning region in the Coastal Zone for each census year.

The urban population of the Coastal Zone in 1940 was 857,829, which comprised 29.5 percent of the state's total urban population. This figure rose to 2,946,723 or 33 percent of the state's urban population in 1970. The rural population of the Coastal Zone dropped from 680,933 in 1940 to 558,163 in 1970. However, the rural proportion



POPULATION DISTRIBUTION TRENDS IN
TEXAS AND THE COASTAL ZONE
1940-1970
(PERCENT URBAN)

FIGURE 7

TABLE 23
URBAN-RURAL POPULATION TRENDS IN TEXAS AND THE COASTAL ZONE
1940-1970

STATE PLANNING REGIONS	1940		1950		1960		1970	
	URBAN	PERCENT URBAN	URBAN	PERCENT URBAN	URBAN	PERCENT URBAN	URBAN	PERCENT URBAN
LOWER RIO GRANDE VALLEY	99,520	48.6	176,627	57.8	254,593	72.1	251,313	75.0
COASTAL BEND	106,817	47.6	221,875	69.4	309,067	76.4	341,820	81.3
GOLDEN CRESCENT	24,497	24.3	40,905	39.1	65,383	53.0	72,595	57.6
GULF COAST	514,322	60.7	904,598	76.7	1,433,967	84.4	2,001,456	86.8
SOUTH EAST TEXAS	112,673	69.2	200,032	84.9	275,611	90.1	279,539	88.5
COASTAL ZONE	857,829	55.7	1,544,037	72.0	2,338,621	81.0	2,946,723	84.1
STATE	2,911,389	45.4	4,612,666	59.8	7,187,470	75.0	8,920,946	79.7
COASTAL ZONE AS A PERCENT OF STATE	29.5	19.4	33.5	19.6	32.5	22.8	33.0	24.5

SOURCES: U. S. Census of Population, Bureau of the Census, U. S. Department of Commerce, Washington, D. C.; and Industrial Economics Research Division, Texas A&M University, College Station, Texas.

of the state living in the Coastal Zone rose from 19.4 percent to 24.5 percent, hence indicating a lower tendency for rural people in the Coastal Zone, versus the state, to migrate to urban areas. This rising relative percentage of rural population also corresponds to the rising percentage of employment in primary or resource extraction activities in the Coastal Zone versus the state. The urban population of the Coastal Zone as a percentage of the urban population of the state appears to have experienced a boost in the 1940's and has remained stable through 1970. However, the Coastal Zone's proportion of the state's rural population has grown steadily since 1950.

The Lower Rio Grande Valley State Planning Region grew from 48.6 percent urban in 1940 to 75.0 percent urban in 1970. During the last decade, however, it has lost population in both the urban and rural sectors.

The Coastal Bend State Planning Region rose to 81.3 percent urban in 1970 from 47.6 percent in 1940. While population increased rapidly in the urban sector, the number of inhabitants in the rural sector has been steadily decreasing, however, at a slower rate.

The Golden Crescent State Planning Region, which had only 24.3 percent of the population living in urban areas in 1940, rose to 57.6 percent urban in 1970, well below the state's 79.7 percent urban and the Coastal Zone's 84.1 percent urban.

The Gulf Coast State Planning Region, which presently contains 65.8 percent of the Coastal Zone's entire population, grew from 60.7 percent urban in 1940 to 86.8 percent urban in 1970. This planning region alone gained absolutely in rural inhabitants between 1960 and 1970; however, this did not offset the loss experienced between 1940 and 1960.

The most urbanized of the zone's planning regions in 1940 was the South East Texas State Planning Region, which had 69.2 percent of the population located in urban areas. This proportion rose to 90.1 percent in 1960, then dropped off to 88.5 percent in 1970; however, this region still maintained the highest percentage of urban population among the five state planning regions in the Coastal Zone.

II. INCOME TRENDS

Regarding geographic categories for comparing per capita income, metropolitan areas are defined as Standard Metropolitan Statistical Areas or the county or contiguous counties which contain a central city or cities with a minimum population of 50,000, together with

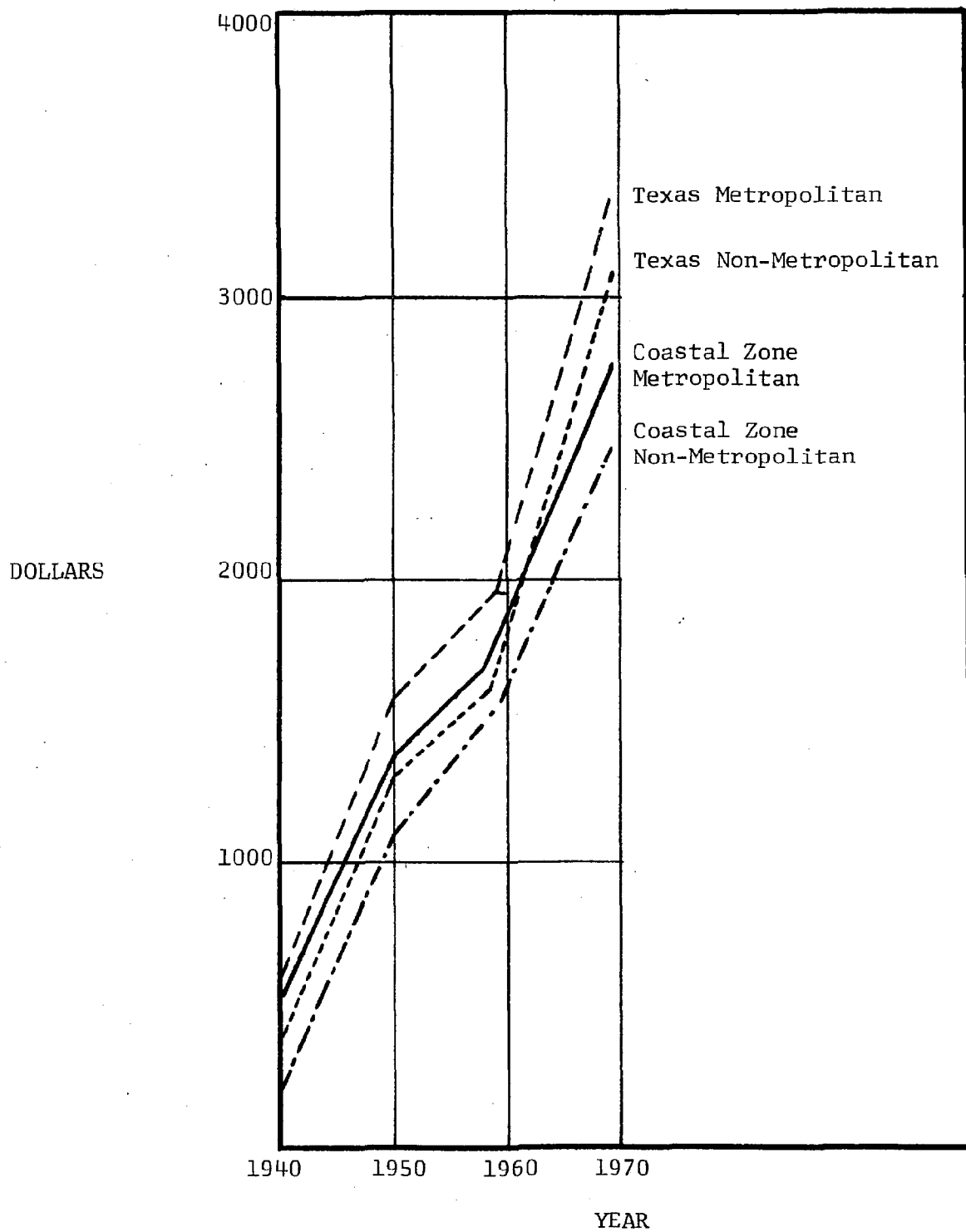
surrounding counties which are socially and economically integrated with the central city. Non-metropolitan areas include all of those counties not included within standard metropolitan statistical areas.

Figure 8 shows that per capita income trends in standard metropolitan statistical areas and in non-metropolitan areas of Texas and the Coastal Zone from 1940 to 1969 have followed a rather consistent pattern of increases. The most dramatic of these occurred in the 1940's and again in the 1960's. State metropolitan per capita income has significantly increased its lead by 1970. During the 1960's, the state per capita income in non-metropolitan areas surpassed the per capita income in Coastal Zone metropolitan areas. Although Coastal Zone non-metropolitan per capita income has generally followed the previously-mentioned trends, it has increased much less in relation to per capita income in state non-metropolitan areas. The relative slowness of rural people to migrate to urban areas in the Coastal Zone relative to migration in the state as a whole, together with low rural earning power, may partially account for the sluggishness in the per capita income trend in Coastal Zone non-metropolitan areas.

In Table 24, per capita income trends among the Coastal Zone state planning regions indicate that the Gulf Coast State Planning Region has led in the metropolitan category from 1940 to 1959, but lost this lead to the South East Texas State Planning Region in 1969. The Coastal Bend State Planning Region led in the non-metropolitan category in 1940; however, it relinquished this lead to the non-metropolitan sector of the Gulf Coast Planning Region in 1969. Two of the four planning regions with metropolitan categories, the Gulf Coast and South East Texas Regions, have led the state per capita income in metropolitan areas since 1940. All four of the Coastal Zone planning regions with non-metropolitan per capita income with the exception of the Coastal Bend State Planning Region, which surpassed the state average in 1940 and again in 1959.

III. INDUSTRIAL EARNINGS

Figure 9, illustrating earnings for metropolitan and non-metropolitan areas of the Coastal Zone from 1940 to 1969, shows the dominance of metropolitan areas in the Coastal Zone in regard to total payments made to employees at their job location. The metropolitan areas of the Coastal Zone are composed of 12 counties totaling 11,978 square miles or 35.9 percent of the land area of the Coastal Zone. The non-metropolitan sector is composed of 24 counties totaling 21,320 square miles or 64.1 percent of the land area of the zone. The dynamic growth of earnings in metropolitan areas relative to the earnings achieved in non-metropolitan areas is a reflection more of the growth of population, industry and employment within the metropolitan areas rather than a



PER CAPITA INCOME TRENDS IN METROPOLITAN AND NON-METROPOLITAN
AREAS OF TEXAS AND THE COASTAL ZONE
1940-1969
(IN DOLLARS)

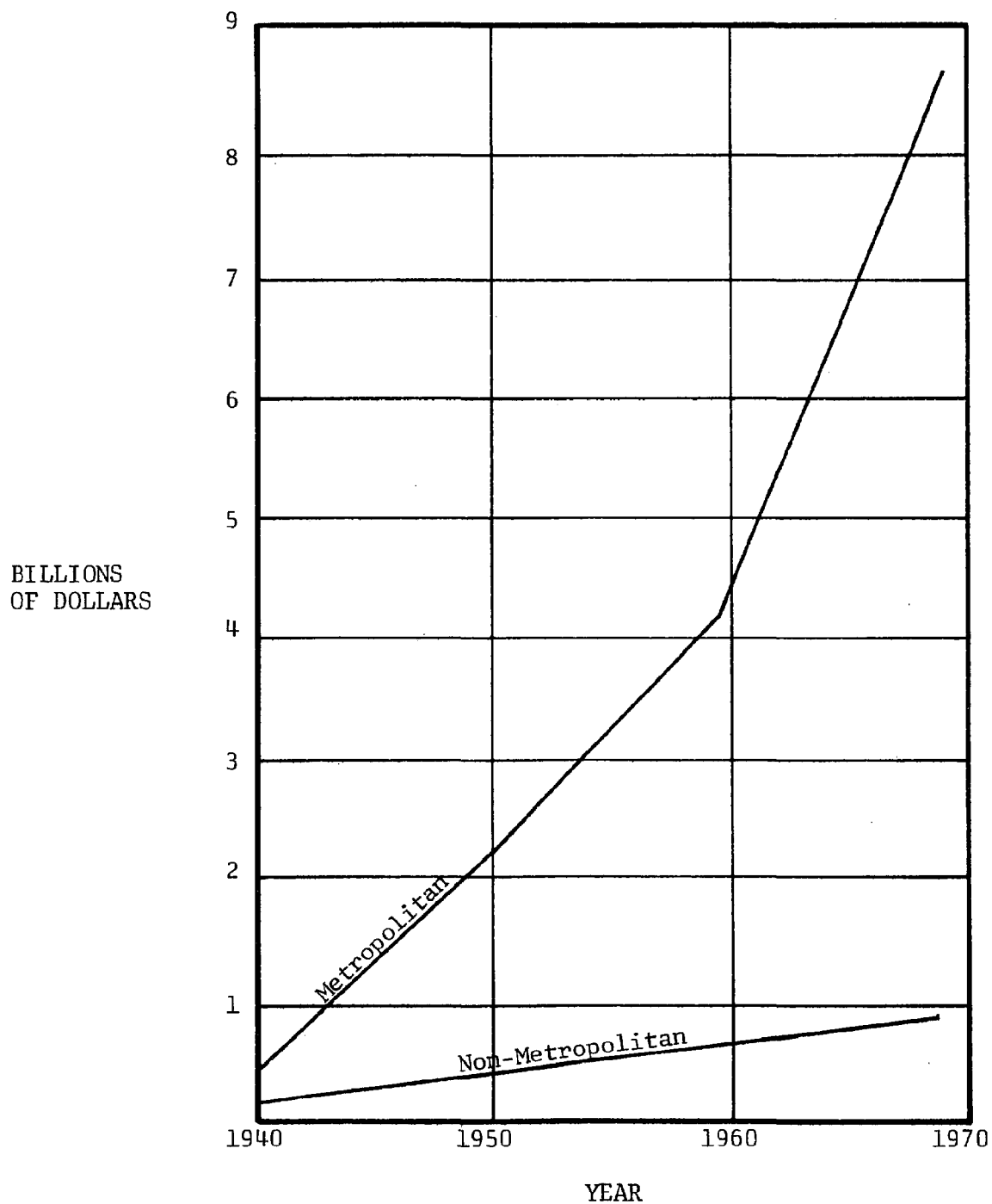
FIGURE 8

TABLE 24

PER CAPITA INCOME IN STANDARD METROPOLITAN STATISTICAL AREAS
AND NON-METROPOLITAN AREAS
OF COASTAL ZONE STATE PLANNING REGIONS
1940 TO 1969

STATE PLANNING REGIONS	1940		1950		1959		1969	
	SMSA	NON- SMSA	SMSA	NON- SMSA	SMSA	NON- SMSA	SMSA	NON- SMSA
LOWER RIO GRANDE VALLEY	\$288	\$204	\$ 824	\$ 925	\$1,106	\$1,388	\$1,952	\$2,114
COASTAL BEND	478	359	1,332	1,164	1,713	1,728	2,958	2,790
GOLDEN CRESCENT		291		1,052		1,328		2,421
GULF COAST	694	269	1,701	1,001	2,179	1,539	3,391	2,457
SOUTH EAST TEXAS	586		1,449		2,094		3,571	
COASTAL ZONE	505	309	1,305	1,078	1,729	1,556	2,869	2,572
STATE	495	352	1,429	1,211	1,847	1,715	3,210	3,048

SOURCES: Office of Business Economics, U. S. Department of Commerce,
Washington, D. C.; and Industrial Economics Research Division,
Texas A&M University, College Station, Texas.



TOTAL EARNINGS FOR METROPOLITAN AND NON-METROPOLITAN
AREAS OF THE COASTAL ZONE
1940-1969

FIGURE 9

shift of population from non-metropolitan to metropolitan areas, since 77 percent of the Coastal Zone population already inhabited the metropolitan areas in 1940 and this had increased by only slightly more than 10 percent by 1970.

The earnings by broad industrial sector for metropolitan and non-metropolitan areas in Table 25 illustrate the following information:

1. The total earnings of workers in the Coastal Zone for each census year from 1940 to 1969 by metropolitan and non-metropolitan areas and the percentage of each;
2. Total farm earnings in the Coastal Zone for each year by metropolitan and non-metropolitan sectors and the percentage of each;
3. The total non-farm earnings of workers in the Coastal Zone for each year by metropolitan and non-metropolitan sectors and the percentage of each.

Under "total earnings," the labor force in the Coastal Zone shows a total of \$698 million in 1940 compared with \$9.39 billion in 1969. Slightly more than \$616 million or 88.2 percent of the 1940 total for the Coastal Zone was earned in standard metropolitan statistical areas. The metropolitan earnings rose to \$8.55 billion in 1969, or 91.1 percent of the total earnings for the Coastal Zone. On the other hand, non-metropolitan areas, while increasing from \$82 million in 1940 to \$833 million in 1969, decreased in their proportional contribution to the Coastal Zone earnings from 11.8 percent in 1940 to 8.9 percent in 1969.

Farm earnings, a relatively small proportion of the total earnings of the Coastal Zone, again illustrate the dominance of metropolitan areas, even in this most rural of industries. In 1940, metropolitan areas contributed 53.6 percent or \$34.5 million of the Coastal Zone farm earnings. The metropolitan area proportional contribution dropped only slightly to 51.2 percent in 1969, or \$125 million of the \$245 million total farm earnings. Over this same time period, the non-metropolitan areas correspondingly increased their farm earnings from \$29.9 million to \$119.8 million, thereby raising their proportional contribution by 2.4 percent 48.8 percent of the total farm earnings for the zone.

The non-farm industrial sector, which contributes the bulk of the Coastal Zone earnings nearly quadrupled from \$634 million in 1940 to \$2.38 billion in 1950 and thenceforth nearly doubled by each census year until reaching \$9.14 billion in 1969. As could be expected,

TABLE 25
EARNINGS BY BROAD INDUSTRIAL SECTOR FOR METROPOLITAN (SMSA) AND
NON-METROPOLITAN AREAS IN THE COASTAL ZONE
1940 TO 1969
(000)

	1940	PERCENT	1950	PERCENT	1959	PERCENT	1969	PERCENT
TOTAL EARNINGS	698,597	100.0	2,614,432	100.0	4,686,785	100.0	9,392,952	100.0
Metropolitan	616,482	88.2	2,303,893	88.1	4,176,800	89.1	8,559,457	91.1
Non-Metropolitan Areas	82,115	11.8	310,539	11.9	509,985	10.9	833,495	8.9
FARM EARNINGS	64,460	100.0	230,760	100.0	212,228	100.0	245,243	100.0
Metropolitan	34,520	53.6	121,599	52.7	111,069	52.3	125,447	51.2
Non-Metropolitan Areas	29,940	46.4	109,161	47.3	101,159	47.7	119,796	48.8
NON-FARM EARNINGS	634,137	100.0	2,383,672	100.0	4,474,557	100.0	9,147,709	100.0
Metropolitan	581,962	91.8	2,182,294	91.6	4,065,731	90.9	8,434,010	92.2
Non-Metropolitan Areas	52,175	8.2	201,378	8.4	408,826	9.1	713,699	7.8

SOURCES: Office of Business Economics, U. S. Department of Commerce, Washington, D. C.; and Industrial Economics Research Division, Texas A&M University, College Station, Texas.

metropolitan areas contributed 91.8 percent of this total in 1940 and continued to provide the momentum to sustain its proportional share, which amounted to \$8.4 billion or 92.2 percent of the non-farm earnings in 1969. The non-metropolitan areas contributed only 8.2 percent or \$52.2 million in 1940, and while increasing to \$713.7 million in 1969, fell slightly in percentage contribution to 7.8 percent of the total non-farm earnings.

IV. LAND USE

Population density in Coastal Zone urban areas has been decreasing due to the faster growth of the physical size of municipalities as compared to actual population growth. The liberal annexation powers granted to Texas cities by the state has encouraged this sprawling growth as can be seen for the coastal cities of Houston and Beaumont, which grew from 160.0 and 31.4 square miles respectively in 1950 to 447.0 and 71.7 square miles, respectively, in 1970. Conversion of rural or vacant land to urban uses chiefly for industrial and/or residential development can therefore be expected to take place more rapidly in the largest of the Coastal Zone's metropolitan areas. These areas have the greatest absolute annexation power and will provide the largest labor supplies and consumer markets necessary to attract such development in the immediate future. Sprawling, low-density growth, however, will be limited by the central city's ability to provide the essential utilities and services necessary for development once diseconomies of scale become evident. Such diseconomies already exist to a certain extent and are reflected by higher land prices, increasing tax rates, parking problems, and traffic congestion in central city areas. Even though most new industries established in 1971 were located within SMSA's, many manufacturing concerns joined the increasing tendency to locate outside central cities in the suburban fringe of metropolitan areas.

Later in the century, rural areas and small cities located along major highways and transportation routes will become more attractive to industries requiring large land areas for their operations and room for expansion. Relatively lower land values and tax rates in these areas will spur such dispersions. However, by that time, labor supplies will be centralized within metropolitan areas and increased reverse commuting to hinterland areas for work will become necessary. The network of transportation facilities within the Coastal Zone will therefore have a great effect upon the development of land use patterns.

If growth trends in industry and housing do shift from the suburbs, as is the present experience, to rural areas and outlying small towns, desertion of large central cities may take place, initially causing central areas to become relatively economically depressed. Such a trend

would release currently highly valued land for agglomerated redevelopment into integratively planned intensive uses which could take better advantage of their central location within the metropolitan areas.

V. SUMMARY

As growth in the Coastal Zone population has occurred predominantly in the urban and metropolitan sectors of the region, so also has the per capita income. These income increases are a reflection of the 90 percent proportion of the total Coastal Zone earnings contributed by the workers in metropolitan areas. Thus, in 1969 only 35.9 percent of the land area of the entire Coastal Zone accounted for 87 percent of the total population and 91 percent of the total earnings of the Coastal Zone labor force. The other 64.1 percent of the land area, which is non-metropolitan in nature, may therefore be viewed as a future resource for expansion and/or distribution of the population and for the dispersion of industry to lure this growth. Such growth, however, cannot be expected until the latter part of the century, as there yet remains much developable land within current standard metropolitan statistical areas, particularly on the fringes.

CHAPTER IV

FUTURE ASSUMPTIONS AND ECONOMIC PROJECTIONS

I. POPULATION

A. Future Assumptions

Relative to the positive growth rate in state population throughout the 1940-1970 study period, the Coastal Zone has led the state, however, at a decreasing rate of increase since 1950.

Although the state population will continue significant absolute growth during the 1970's, it is expected that the Coastal Zone will fall in line with the steadily declining state population growth rate. Trends toward smaller families and the increased ability and propensity to plan for the delay or spacing of children will be a major factor in the gradual population growth slow-down. Barring unforeseen mass in-migrations, this growth will not be distributed equally throughout the zone, but will be accounted for by a stable, high growth rate in the Houston-Galveston metropolitan region. The other state planning regions in the Coastal Zone will maintain relatively small population growth rates with modest growth during the 1970's and 1980's. Major shifts in the location of industry at the state level are not expected to occur until perhaps near the end of the century when depletion of non-renewable resources may force an alteration in the current pattern and emerging trends of industrial and hence population distribution; such a redistribution would most probably be toward the Coastal Zone.

Dramatic shifts of the Coastal Zone population from rural areas to metropolitan areas were basically completed during the late 1950's and early 1960's. Coastal Zone SMSA's are therefore not expected to increase in number or, with the exception of Houston and Galveston-Texas City, experience other than moderate incremental increases in population growth.

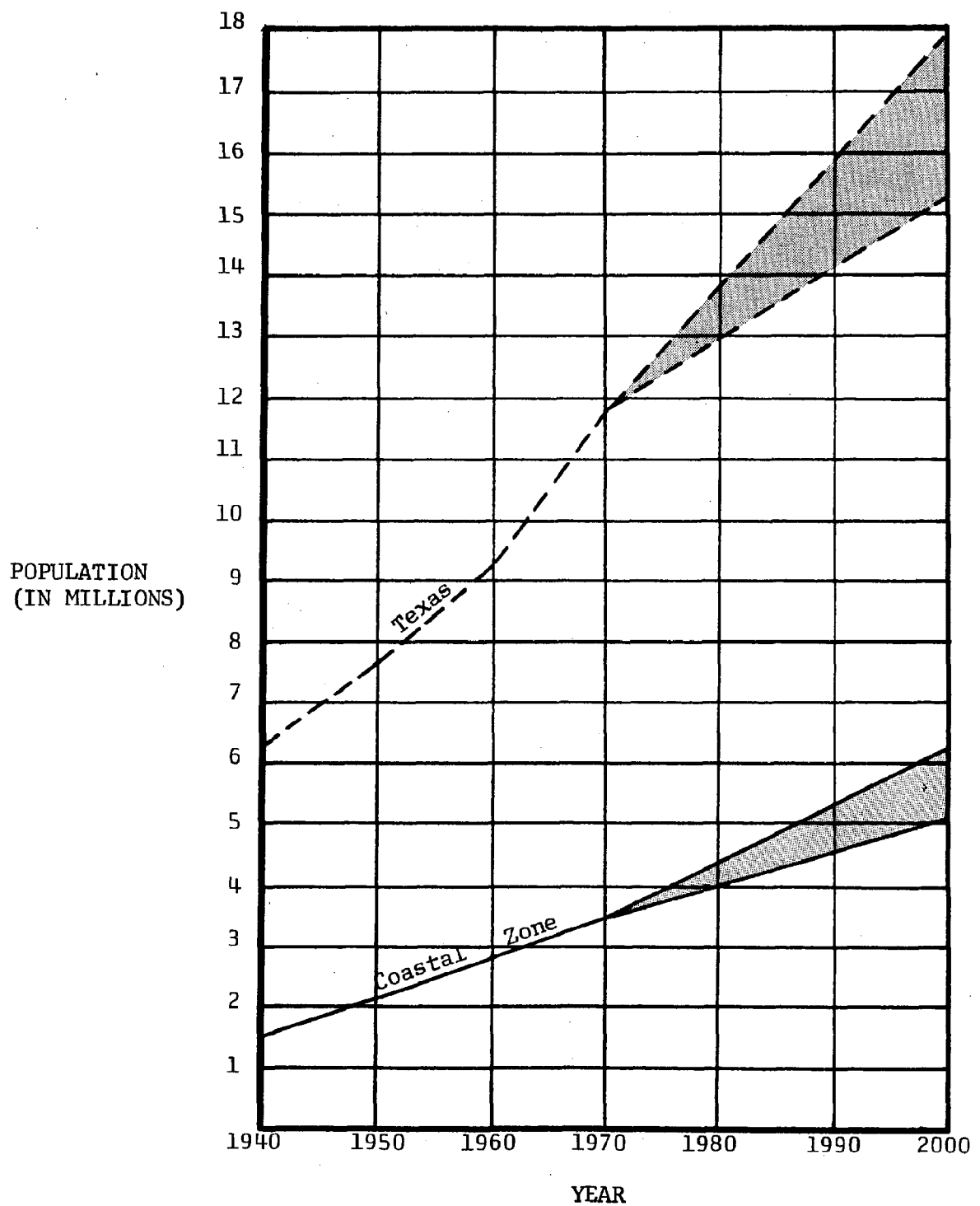
B. Projections: 1970-2000

The Coastal Zone is expected to increase in population from 3,502,546 in 1970 to an estimated range between 5.1 million and 6.05 million in the year 2000. Upper and lower limits of this range, as illustrated in Figure 10, are chiefly a variable of fertility rates and if, as it has been assumed, family sizes will tend to decrease, the actual figure for 2000 should fall between the midpoint and lower limits of this range. If, however, fertility rates do remain at present levels or tend to increase slightly, population sizes can be expected to fall within the upper limits of the projected range. The total fertility rate as defined by the Bureau of Census, is the number of births that 1,000 women would have in their lifetime if at each year of age they experienced the birth rates occurring in a specified calendar year.

The number of children per family is here assumed to be closely related to total fertility rates; and each woman and her children are assumed to make up a family unit. Fertility rates and therefore the number of children per family have been decreasing during the last decade from 3.69 children per family in the 1960 to 1964 period to 2.63 children per family in the 1965 to 1969 period. Estimates of 2.45 children per family in the year 2000, as is assumed in the lower limits of the projection range in Figure 12, do not seem inordinately low. Indeed, the Bureau of the Census is currently making another series of state population projections assuming an even lower total fertility rate.

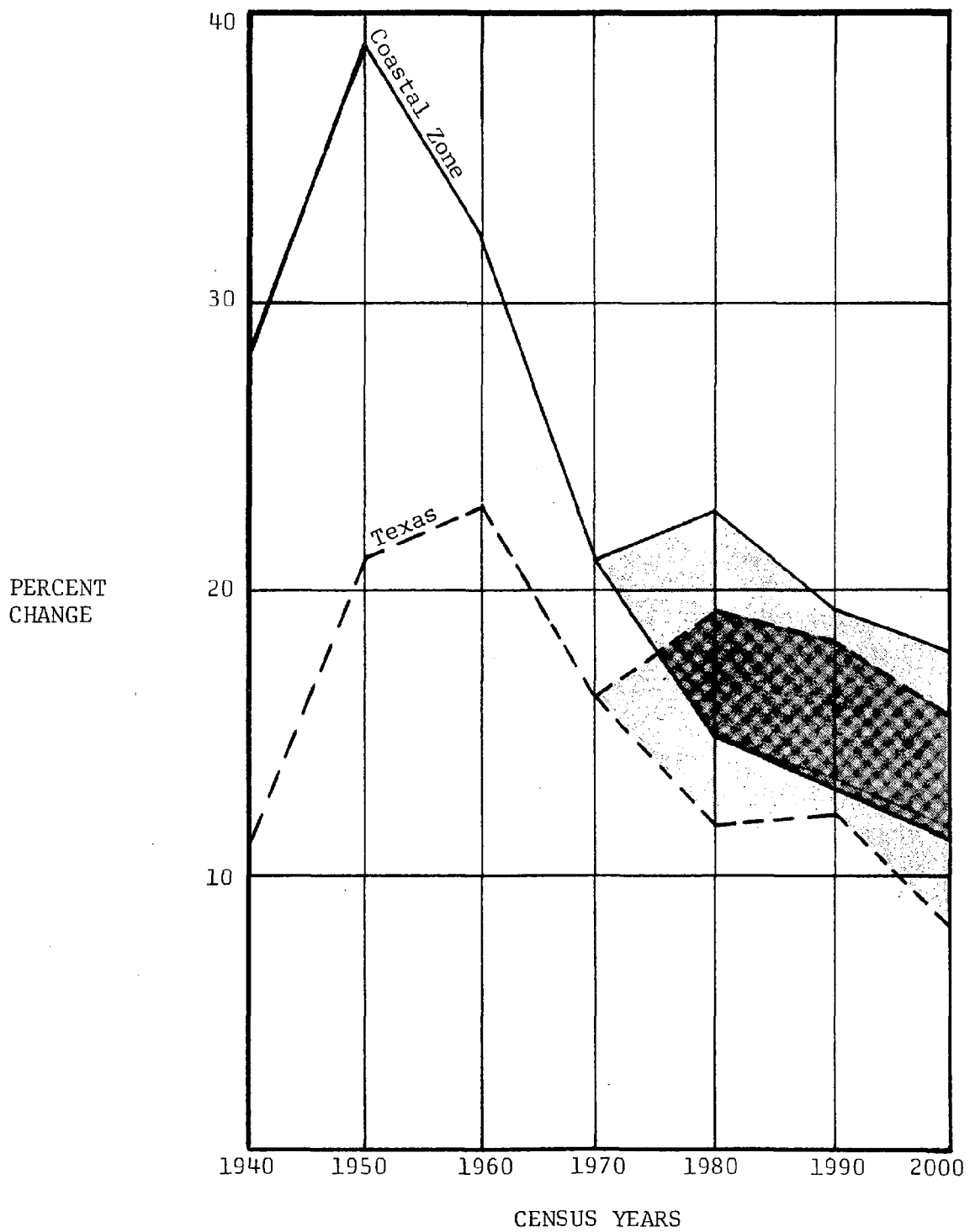
The upper limits of the projection range are based on total fertility rates similar to those experienced during the 1963-1966 period, or approximately 3.10 children per family.

Since Coastal Zone population growth rates are not expected to fall in line with the lower state population growth rates until the early 1980's, it is forecasted that more than one-third of the increase in the state's projected population range for 2000 of 15.30 million to 17.90 million will take place within the Coastal Zone. These rising figures, however, will be countered by a decline in the rates of population growth for both the state and the Coastal Zone as are reflected by the projected ranges of population change illustrated in Figure 11. Population growth rates for the state are expected to level off at current rates and eventually drop to a range of 12 to 15 percent per ten years when joined by the Coastal Zone growth rates in the latter part of the century. Again, the assumed absence of large in-migrations, together with slightly decreasing fertility rates, are predicted to be the chief causal factors in the projected steady decline in population growth rates. However, increased industrialization in the zone and in the state will assure steady absolute population growth.



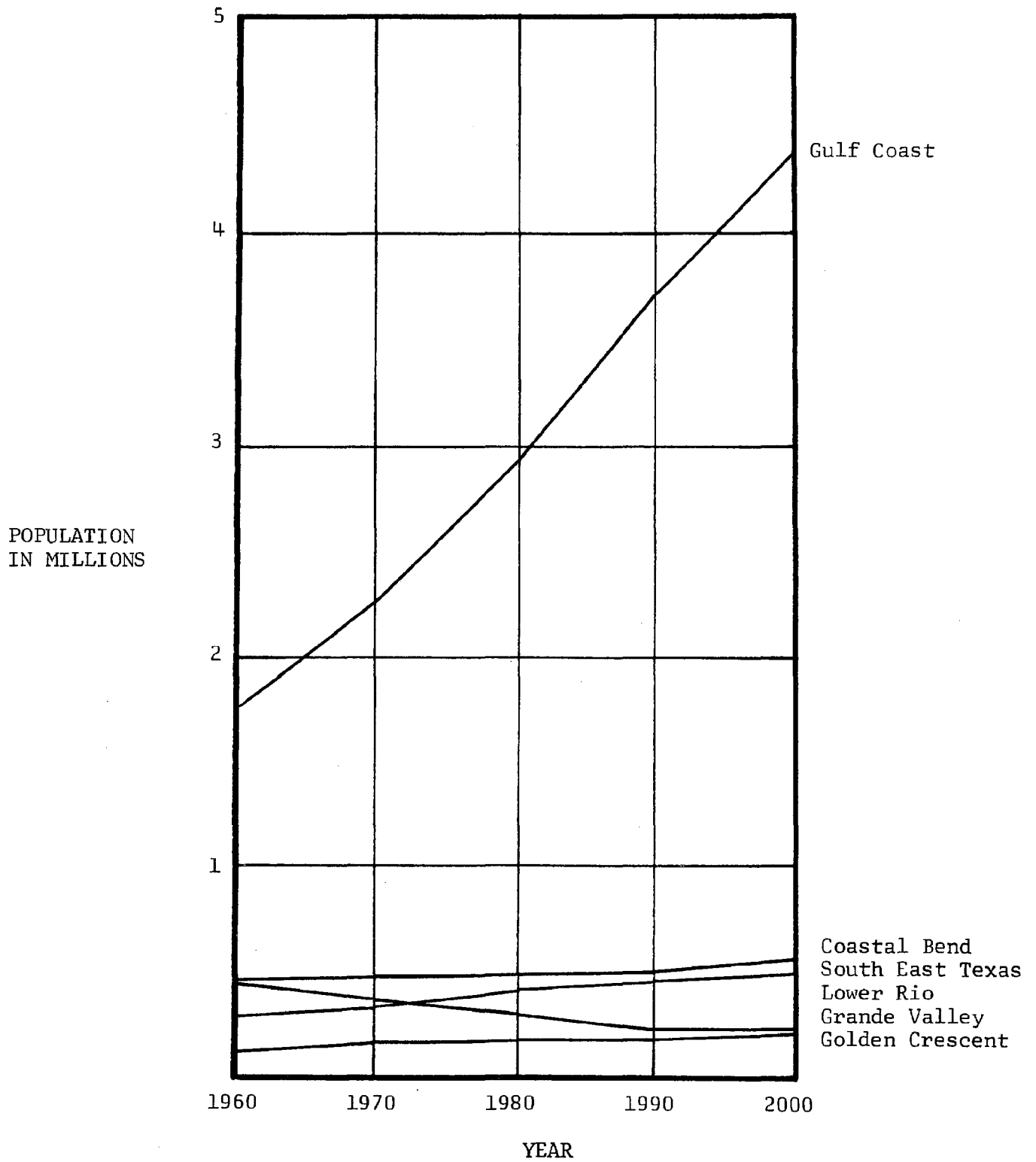
PROJECTED POPULATION RANGES FOR TEXAS AND THE COASTAL ZONE
1940-2000
(ABSOLUTE NUMBERS)

FIGURE 10



PROJECTED POPULATION TRENDS IN TEXAS AND THE COASTAL ZONE
1970-2000
(PERCENT CHANGE)

FIGURE 11



MID-RANGE POPULATION PROJECTIONS FOR COASTAL
ZONE STATE PLANNING REGIONS
1960-2000

FIGURE 12

Figure 12 indicates the mid-range of the population projections for the five Coastal Zone state planning regions. Outstanding among these projections is the Gulf Coast State Planning Region for which a population increase of nearly 2,000,000 is projected to take place between 1970 and the year 2000. Factors influencing this projection of singular outstanding growth within the Coastal Zone include the growth rate of this planning region over the past 30 years and the fact that it has been the only region to increase its percentage proportion of the zone's population since 1950. Consequently, more than 65 percent of the present Coastal Zone population currently reside within this region. Rapid industrialization and population growth in the Houston SMSA and the influence of this growth on the Galveston-Texas City SMSA will also continue to contribute heavily to the attraction of more industry and population.

Of the other four state planning regions, only the Lower Rio Grande Valley region is expected to experience a moderate decrease in population before 1980 and is thereafter expected to level off and begin increasing before the end of the century. The Coastal Bend State Planning Region is expected to experience modest yet steady increases in population such that it will surpass the one-half million mark by the year 2000. The Corpus Christi SMSA will be the focus of population growth within this region.

The already heavily industrialized South East Texas State Planning Region which currently has the highest population density in the Coastal Zone (243 persons per square mile), is predicted to experience only modest population growth before the end of the century. The Golden Crescent State Planning Region, which also is expected to experience only modest growth, exhibits greater future potential however, since it is now totally non-metropolitan and lies mid-way between the Houston and Corpus Christi SMSA's. Near the end of the century when industrial growth is predicted to extend beyond the metropolitan boundaries into the rural areas, the Golden Crescent region will most likely begin to experience rapid growth as a part of the Houston-Corpus Christi corridor.

II. INDUSTRY

A. Primary Industries

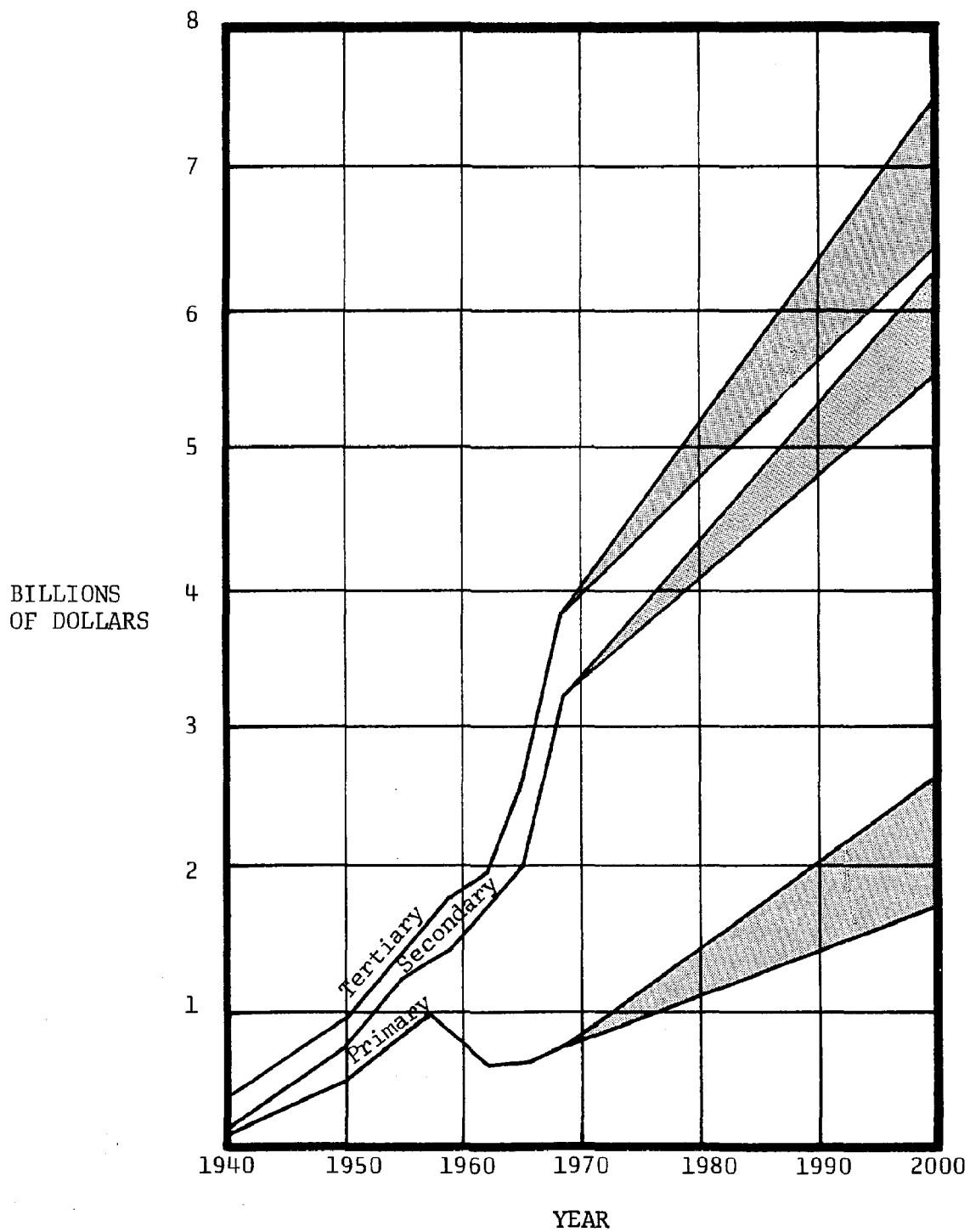
As mentioned in Chapter I, primary industries are those based on natural resources of the earth such as agriculture, forestry, fisheries, and extraction activities such as mining for important minerals for use in the construction and petrochemical industries and the drilling for fuel and natural gas for use in production of fossil fuels.

Typically, an area will first experience the development of natural resources and most of the industrial activity involved with the production or preparation of crops and livestock, lumber, fish products and mineral and fuel extraction.

Regions dominated by primary industry employment are generally rural and endowed with relatively valuable natural resources. The future industrial trend of the area depends on the future value of these resources, their supply, and the development of other industrial opportunities in the region.

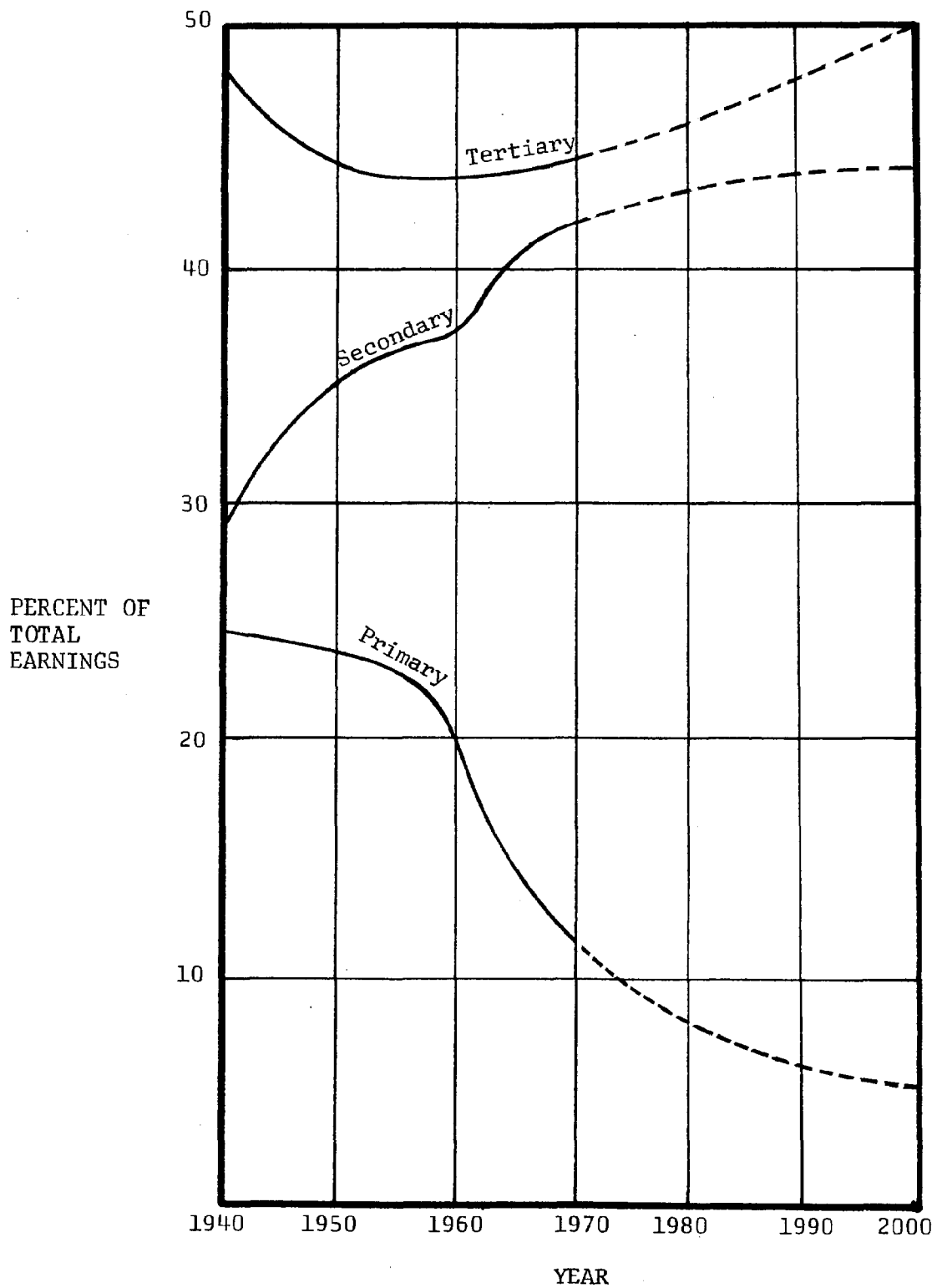
With respect to the trends and the growth of primary industries in the Coastal Zone both past and future, Figures 13 and 14 reflect the future economic importance of primary industries in the Coastal Zone relative to other economic sectors. Figure 13 shows that primary industries as measured by primary sector earnings will increase to a value of from \$2 to \$2.5 billion by the year 2000. More informative, however, are the economic projections indicated by Figure 14 depicting the percentage of primary industry earnings of total earnings by the industrial sector in the Coastal Zone. Projections to the year 2000 show that primary sector earnings will decline from its position at approximately 12 percent in 1970 to about 5 percent by the year 2000. As the industrial development of the Coastal Zone becomes more sophisticated, secondary industries begin developing due to the effects of vertical integration and the economies of scale in production and manufacturing systems. Further development of secondary industries causes demand for any additional supporting services of the tertiary industries and as a result, primary industries decline at the expense of both secondary and tertiary industries.

The main factors, however, contributing to the steady increase in the value of primary sector earnings as reflected in Figure 13 are, of course, trends in agricultural and extraction activities. Agriculture in Texas has shown a steady increase in total cash receipts of approximately 1.5 percent per year. Since, on the average, there has been no significant change over the study period in the percentage of cash receipts in the Coastal Zone with respect to the state, it is assumed that the current 18.6 percent of total cash receipts from agriculture in the Coastal Zone will continue. It is thus estimated that total cash receipts from agriculture in the Coastal Zone will range from approximately \$1 billion to \$1.3 billion by the year 2000. Of this amount, crop receipts will range from \$750 to \$900 million and receipts from livestock and livestock products will range from \$300 to \$400 million. Figure 15 shows the percentage of cash receipts for crops and livestock in the Coastal Zone relative to the total cash receipts for the state. Projections to the year 2000 indicate that crop receipts will increase to a range of 35 to 45 percent of total state receipts and livestock will decline from 10 to 7 percent of total agricultural

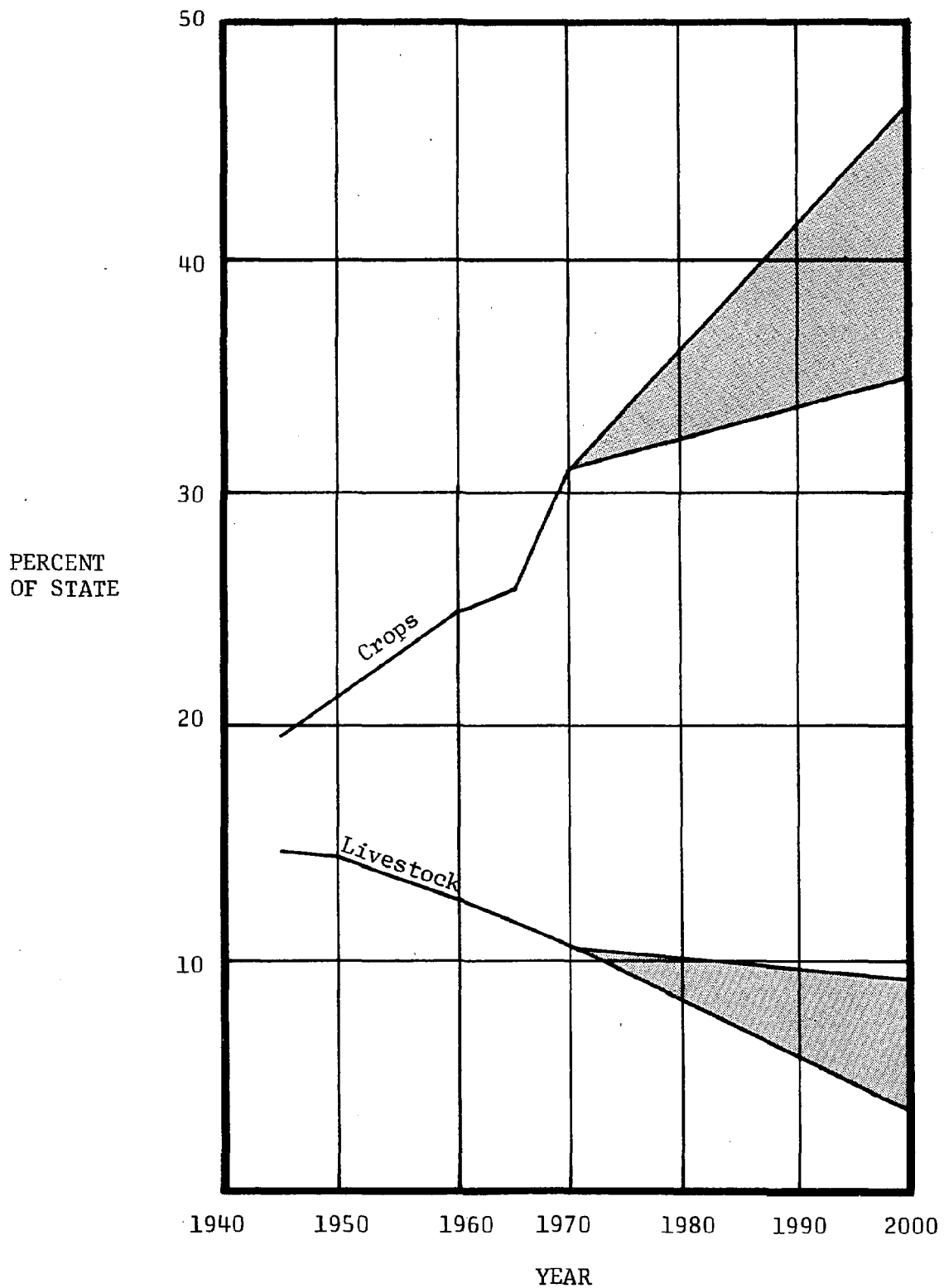


DOLLAR VALUE OF PRIMARY, SECONDARY AND TERTIARY
INDUSTRY SECTOR EARNINGS IN THE COASTAL ZONE
1940-2000

FIGURE 13



PROJECTED BROAD INDUSTRIAL SECTOR
EARNINGS OF THE COASTAL ZONE
1940-2000



CASH RECEIPTS FOR CROPS AND LIVESTOCK
IN THE COASTAL ZONE

FIGURE 15

receipts for the state. Hence, the Coastal Zone will become a slightly less important area in production of livestock and livestock products and the dollar value of crops sold in the Coastal Zone will increase to at least \$750 million by the year 2000.

The reason for the dynamic growth in crops in the Coastal Zone is due to several factors. It is projected that the production of grain sorghums will decrease statewide by the year 2000 due to the depletion of the available irrigation water in the western portions of the state. Production of grain sorghum in the Coastal Zone, however, will increase with respect to the rest of the state as the high intensity production areas around Corpus Christi utilize better irrigation techniques in the Coastal Zone and greater availability and recharge of ground water.

Rice is projected to decrease in economic value unless this is modified by success in consumer education practices.

Vegetables are the major commodity affecting total crop receipts in the Coastal Zone. A dramatic 150 percent increase over 1967 values is projected for the year 2000. In order of economic importance, the vegetables produced in the Lower Rio Grande Valley and the Coastal Bend State Planning Regions of the Coastal Zone are onions, carrots, lettuce, cantaloupes, potatoes, cabbage, and watermelons. The total statewide production of vegetables in 1967 was 23,738,000 cwt valued at \$124,414,000. Projections to 1980 made by the Bureau of Business Research in Austin indicate a statewide production of vegetables of 5.8 million pounds valued at \$306 million. Since the Coastal Zone produces approximately 30 percent of the statewide production of vegetables, the economic value of these crops will increase proportionately. Approximately 98 percent of the total citrus fruit production in the state is produced in the Coastal Zone, specifically in the Lower Rio Grande Valley and the lower portion of the Coastal Bend region. About 80 percent of the citrus fruit production is grapefruit. Estimated production in 1967 was 121,000 tons valued at \$5,740,000. A dramatic 500 percent increase in grapefruit production is projected to the year 2000 when the estimated yield will be 800,000 tons valued at \$35,500,000.

Cotton will continue to be the state's number one crop in economic value; however, no significant growth trends are observed in the percentages of cotton produced in the Coastal Zone relative to that of the state. Agricultural statistics show that the Coastal Zone produces approximately 15 percent of the state's cotton with no significant relative changes over the study period. It is assumed that the Coastal Zone will share proportionately in the economic growth of cotton to the year 2000.

In general, Texas agriculture will evolve from a more extensive to a more intensive activity. For example, rather than exploitation and expansion, Texas agriculture will continue to trend toward more efficient use of existing acreage. This will be felt particularly in the Coastal Zone with its advantage in soil properties and water resources.

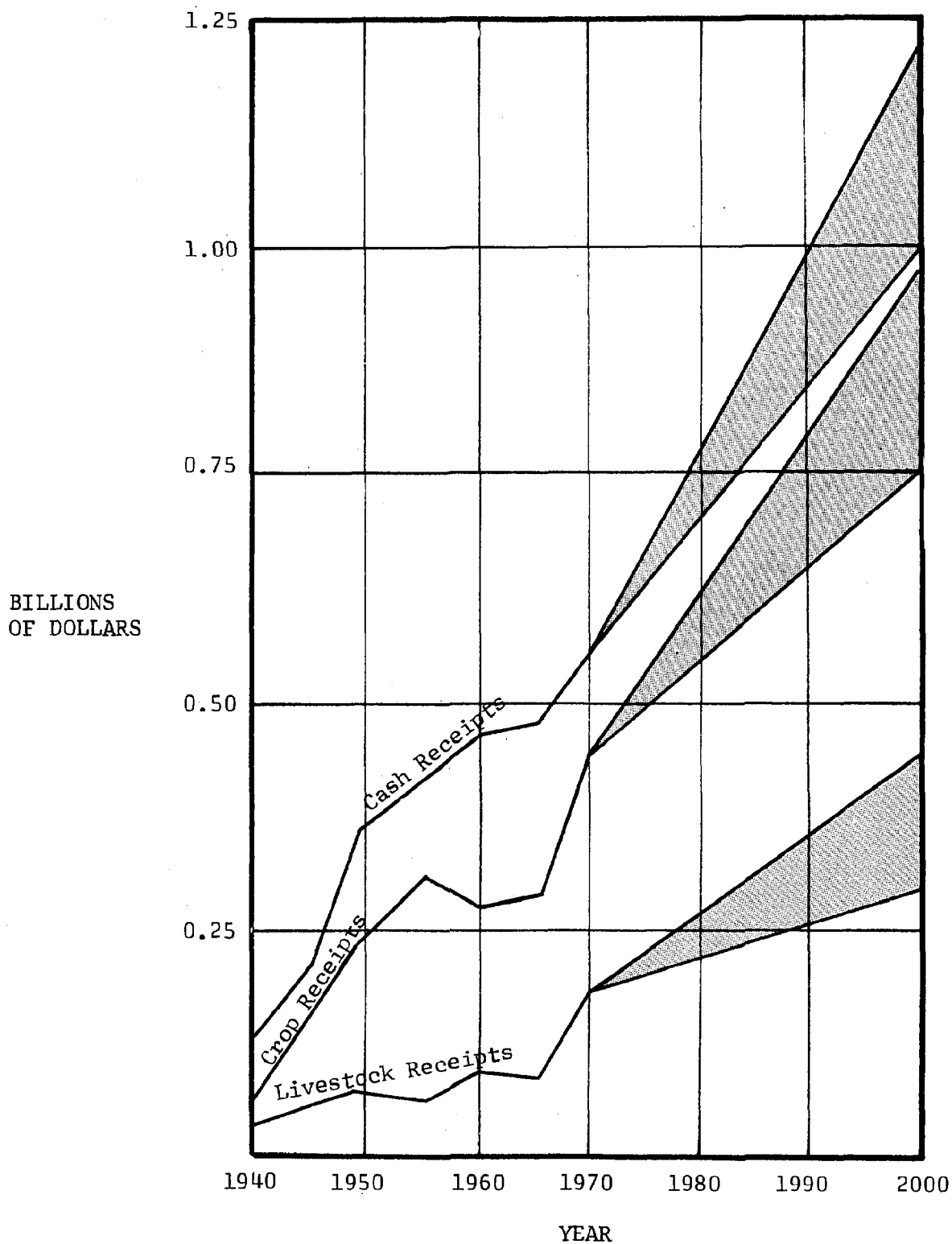
Figure 16 projects the range of cash receipts for agricultural commodities in the Coastal Zone to the year 2000. Total cash receipts in the study area should range from 1 to 1.25 billion dollars. Of this total, the majority of receipts will be due to the growth in crop values which should range from \$750 million to \$900 million by the year 2000. As stated, livestock and related products will not show dramatic increases in the Coastal Zone. Projections indicate that receipts for livestock and related products will be valued at over \$250 million by the year 2000.

One of the major reasons for the projected absolute increase in primary industry sector earnings in the Coastal Zone is due to the growth in the mining of minerals indigenous to the Coastal Zone. Projections to the year 2000 shown in Figure 17 indicate the value of minerals produced in the Coastal Zone will range from \$3.5 to \$5 billion. In 1969 the values of minerals in the Coastal Zone was approximately one-third of that of the state. Projections show that this should increase to approximately 47.6 percent by the year 2000 as the increased production of offshore mineral activities is felt.

Of the total value of minerals produced in the state, petroleum represents 63 percent, natural gas represents 20 percent, and non-fuel minerals resources such as sand and gravel, gypsum, sulfur, salt, and lime, yield the remaining 17 percent.

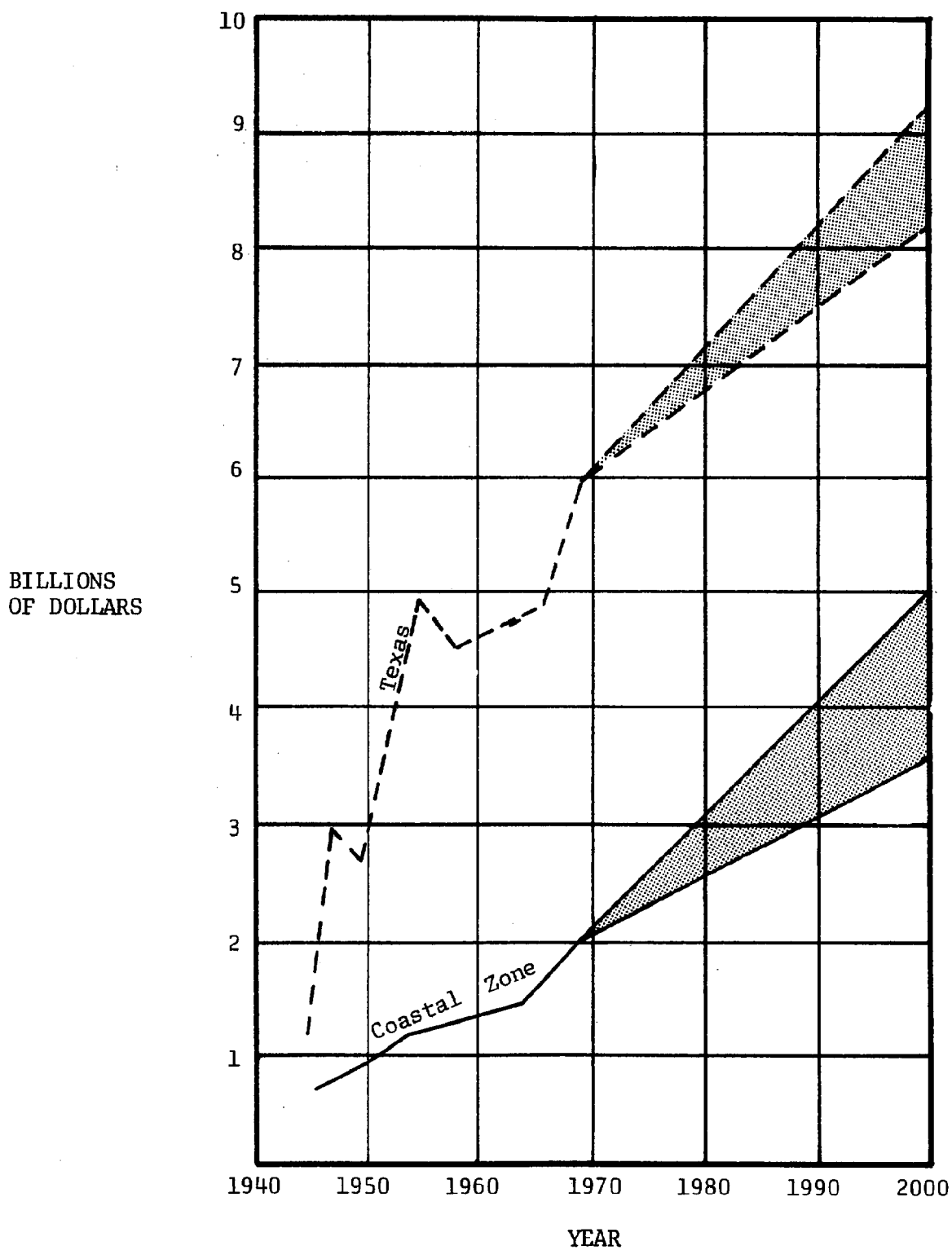
Figure 18 projects the cumulative volume of crude oil production in the state and the Coastal Zone. By the year 2000 some 50 to 60 billion barrels of crude oil will have been extracted throughout the state. This, of course, is subject to the allowable extraction policy. Projections for the Coastal Zone show that the year 2000 will have an accumulative yield of 15 billion barrels. This is largely dependent on results of offshore technology and assumptions of increasing yields in the Gulf of Mexico. These projections could be modified by changes in allowable extraction policies determined by the estimated crude oil reserves for the state.

Annual production rates for the state have shown steady increases in recent years to just over 1.2 billion barrels in 1970. Many variables are involved in projections of annual production but direct extrapolation indicates that annual production by the year 2000 should range from 1.5 to 2.0 billion barrels per year for the entire state.



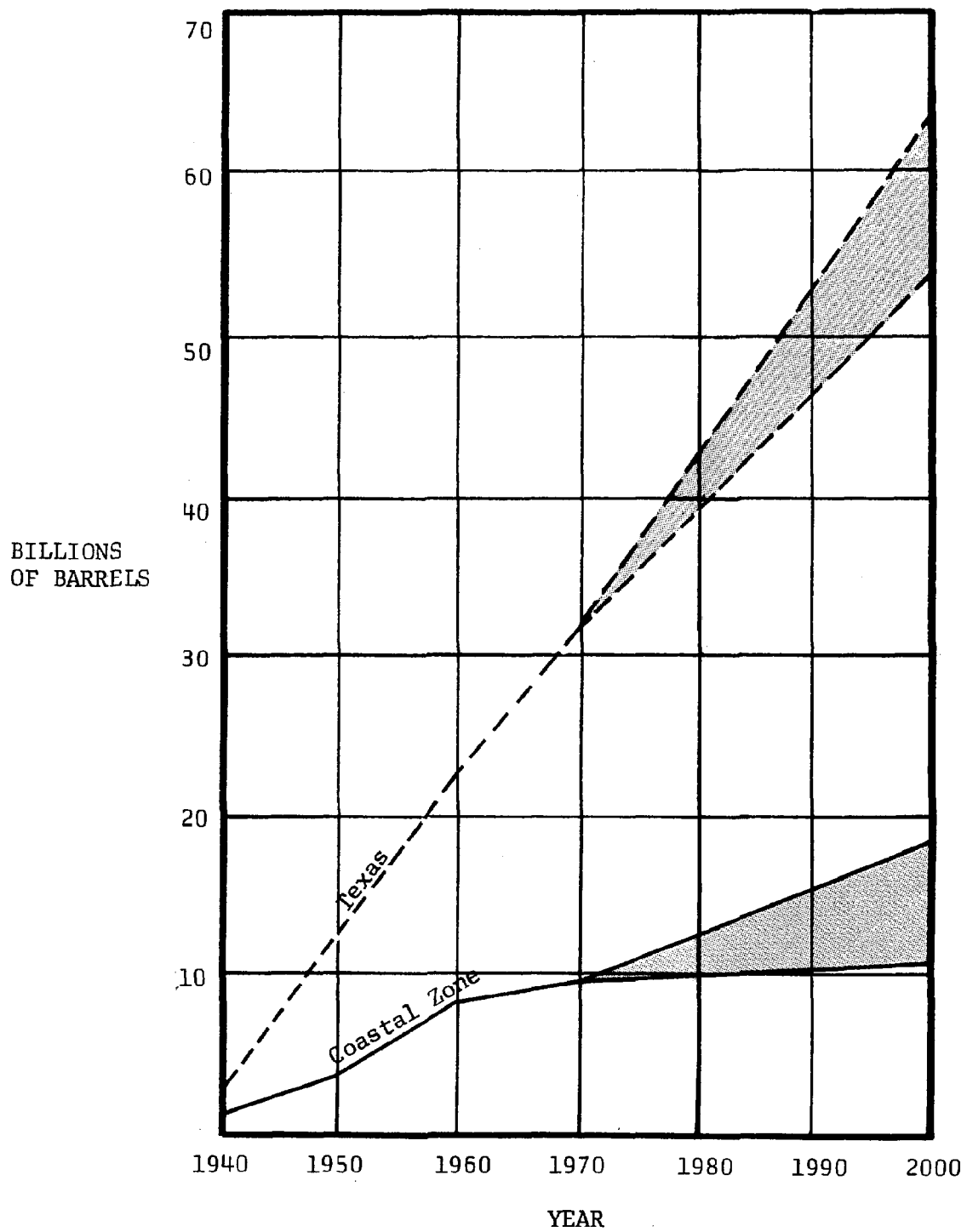
CASH RECEIPTS FOR AGRICULTURAL COMMODITIES
IN THE COASTAL ZONE

FIGURE 16



DOLLAR VALUE OF MINERALS PRODUCED IN
TEXAS AND THE COASTAL ZONE

FIGURE 17



CUMULATIVE VOLUME OF CRUDE OIL PRODUCTION
IN TEXAS AND THE COASTAL ZONE

FIGURE 18

Some estimates show oil production increasing at a rate of 0.5 percent per year, peaking in 1985 and subsequently falling off rapidly. This, again, will depend on incentive measures to increase the discovery rate of independent oil reserves as well as allowable extraction policies. Nevertheless, it now appears that with the energy demand increasing at its current rate, even the most optimistic projection of annual oil production indicates an increasing future dependence on imports.

In general, it can be said that percentages of the Coastal Zone mineral activity relative to the state will increase as offshore mining activities become more productive. Also, the demand and subsequent value of cement, sand and gravel, and lime will increase in the Coastal Zone. This is due primarily to the positive atmosphere in the construction industry created by the projected increase in population in the Coastal Zone. Furthermore, the inorganic chemical industry has and will gradually improve. The major portion of this industry which involves the extraction of sulfur, salt, reef shell and limestone, will continue to grow in the Coastal Zone. Since products of these industries are bulky, plant locations near the availability of water transportation has been and will continue to be an important factor.

B. Secondary Industries

As stated previously, secondary industries consist of those involved in manufacturing, processing, and construction. They develop due to the economic linkage effects and economies of scale in production and manufacturing. The rate of growth in secondary industries is generally a good measure of traditional industrial development. In order for the labor force to be heavily oriented toward secondary industries, the region must be generally a net exporter of manufactured goods and possess a reasonably viable service sector.

As indicated previously in Figure 13, the value of secondary industry sector earnings in the Coastal Zone should range from \$6.3 to \$7.5 billion by the year 2000. Furthermore, Figure 14 indicates that secondary industries relative to total industrial sector earnings is projected to increase slightly from 43 percent to 45 percent.

Figure 19 shows that the overwhelming majority of secondary sector earnings is due to manufacturing in the Coastal Zone. Projections indicate that earnings due to manufacturing will range from \$3.9 to \$4.8 billion by the year 2000. The latest reliable figures on value added statistics show the Coastal Zone manufacturers to have added \$4,744,300,000 to their raw materials in 1967. This was 43.3 percent of the state value for that year. Increasing population and transportation facilities in the Coastal Zone could increase value added by manufacture in the

Coastal Zone to some 45 percent of the state values. If this trend holds, manufacturers in the Coastal Zone of Texas should add a total value of \$21 billion to raw materials and semi-manufactures by the year 2000.

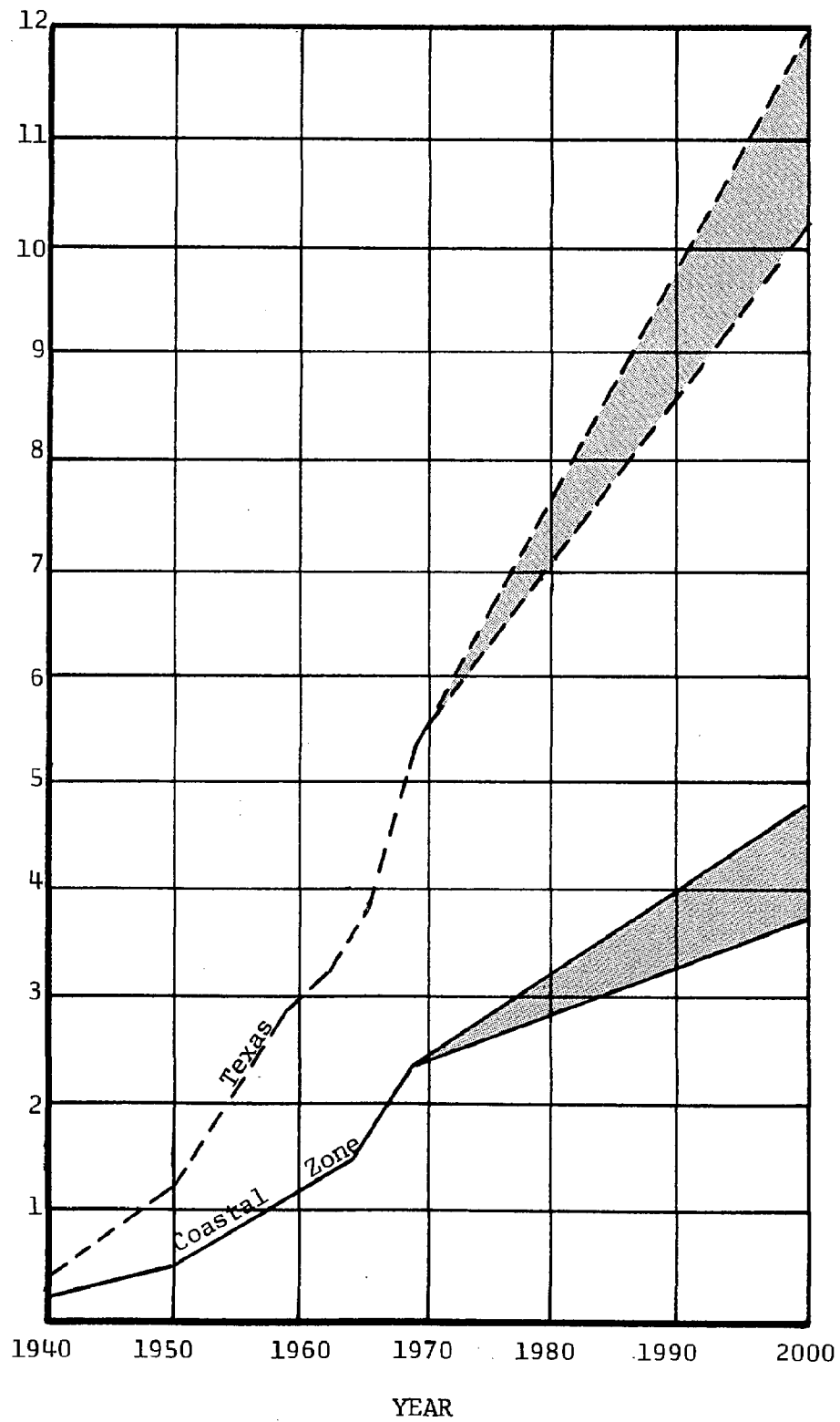
The major manufacturing component in the Coastal Zone is oil refining activity. The maximum daily capacity of oil refineries for the state is 3,529,557 barrels per day. Of this, 3,209,165 barrels per day are produced in various Coastal Zone cities from Beaumont to Corpus Christi. Oil refining is the largest and economically the most significant industry based on local raw materials. Projections for the future of oil refining do not show a dynamic increase in economic importance. However, this could be modified by increased production of offshore oil activities. The rate of increase, however, may not be as great here as in some other sections of the nation because of the shift to new resources of crude supply. Alaska, for example, may become a major source for raw materials for the nation's refineries.

The most recent major industry based on the local raw materials is the petrochemical industry developing rapidly in the Coastal Zone. Chemical manufacture, which accounts for a high proportion of value added in Texas, will continue to expand at a rapid rate. It is safe to say that this segment of manufacture will be the source of enormous new investment in the state during the next three decades. For example, the demand for ethylene is expected to double during the next ten years. New chemicals from hydrocarbon products will be developed. Examples of new products which can be expected on the market by 1980 include insecticides free of the residual effects produced by some now in use. Texas chemical factories will also expand to meet the demands of growing local and regional markets for plastics, polymers, fertilizers, and other such products.

Texas' primary metals industry will expand output considerably over the projection period. The manufacture of some types of steel products will be increased when United States Steel's new plant at Baytown begins operating at full capacity. To stay competitive, the primary metals industry must develop new high-strength products and find new ways to process low grade ones and scrap iron and increase plant efficiency. Newly developed products will likely include greatly improved container and packaging materials as well as other items which will be adapted as standard components for construction of homes and commercial and industrial buildings.

Due primarily to population shifts, food processing will increase dramatically in the Coastal Zone throughout the projection period. This industry did not automate at the same time as did many other industries during the 1950's and 1960's, but it can be expected to apply many new mechanized production techniques during the next three decades.

BILLIONS
OF DOLLARS



DOLLAR VALUE OF INDUSTRY SECTOR EARNINGS DUE TO
MANUFACTURING IN TEXAS AND THE COASTAL ZONE

FIGURE 19

The market for convenience foods will grow not only because of population, but because Texans with increased leisure time will spend more time away from home and will become more dependent on foods which are ready for the table. Revolutionary methods to improve freezing and dehydration of foods now in experimental stages will be adopted and substitutes for standard table items will be manufactured. Expanded processing of low-cost protein foods such as fish meal, can also be expected. Commercial catfish farming, which has developed rapidly in Texas and in the Southwest during the past few years, may supply the necessary raw materials.

C. Tertiary Industries

With the expansion of secondary industries comes the demand for many additional supporting services of the tertiary industries in the areas of transportation, communication, wholesale and retail trade, finance, recreational and professional services. The typical development process requires that the region be able to shift emphasis from one resource base to another. For example, the primary activities are basically oriented toward the location of natural resource inputs whereas the secondary activities are more concerned with the factors of proximity to markets, raw materials, labor, semi-processed inputs, or other factors determining the profitable operation of their firms. Finally, the tertiary activities are mainly oriented toward population and consumer marketing centers.

As indicated previously in Figure 13, tertiary sector earnings in the Coastal Zone will reach from \$6.3 to \$7.5 billion by the year 2000. Again, Figure 14 shows the future increase in importance of tertiary industries as a percentage of overall industrial sector earnings in the Coastal Zone. As projected, the various tertiary activities will yield one-half of all industrial sector earnings in the Coastal Zone by the year 2000.

From Figure 20 it can be seen that wholesale-retail trade and services make up the major source of earnings relative to tertiary activities. Projections in wholesale and retail trade earnings in the Coastal Zone show that trade earnings will range from \$3.3 billion to \$4.4 billion by the year 2000. Projected earnings for services, on the other hand, will range from \$2.6 billion to \$3.8 billion.

Recreation and Tourism--The present and future importance of recreation and tourism activities in the Coastal Zone can be demonstrated by observation of the following known and projected trends:

1. Increase in population of the Coastal Zone between 1970 and 2000.
2. Greater concentration of population in the urban centers of the Coastal Zone.
3. Greater regional and national per capita and disposable income.
4. More leisure time and greater mobility.

Recreation and tourism activities associated with the Texas Gulf Coast currently runs into billions of dollars annually and this constitutes a vital part of the economic base of virtually all urban centers as well as moderate sized communities located on or near the shoreline.

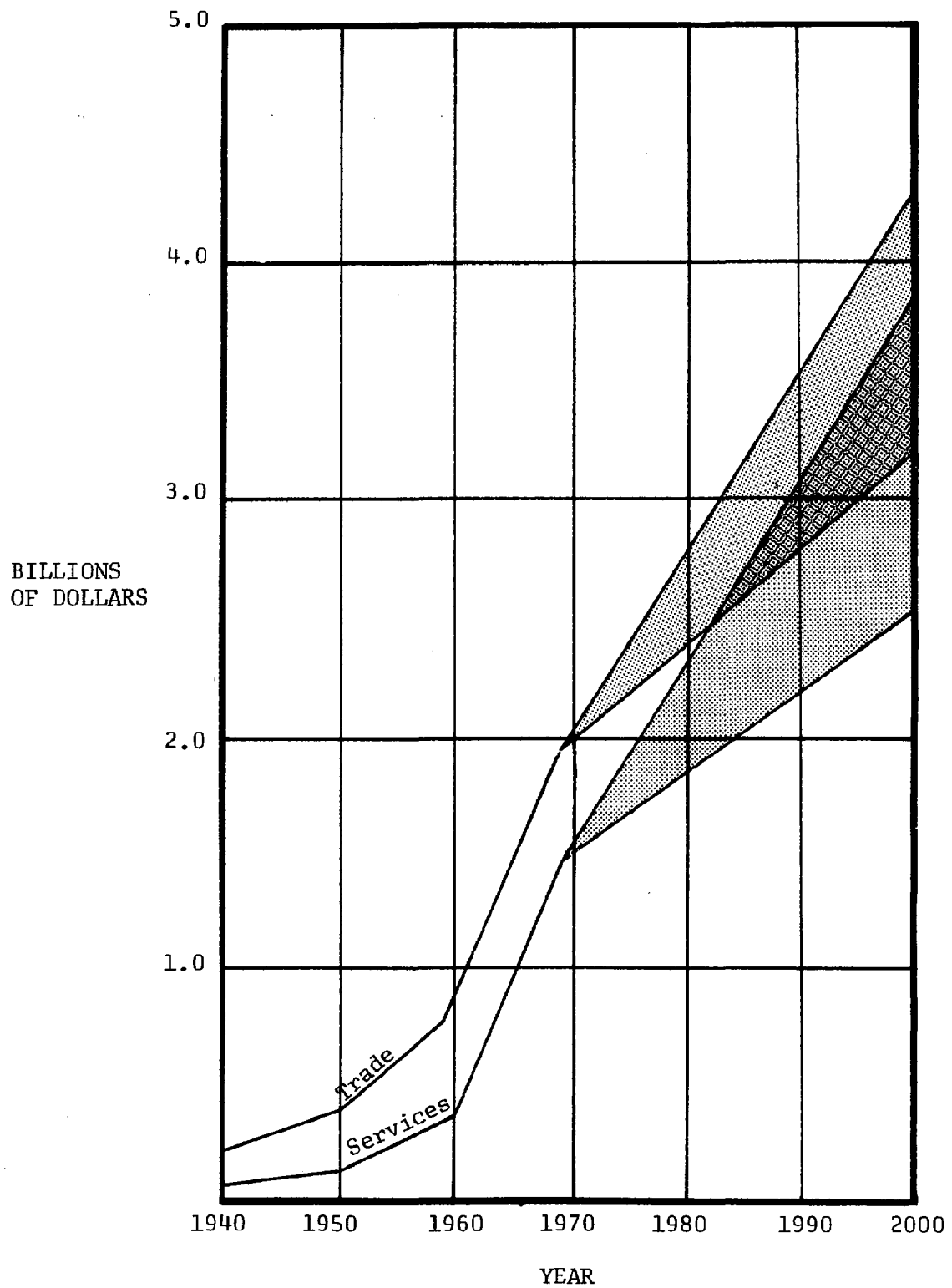
Although relatively undeveloped in recreation and tourist activities as compared with other coastal areas of the nation, the Texas coast receives heavy year-around use by persons engaged in a wide variety of leisure activities. Major centers for future growth potential in leisure activities in the Coastal Zone are located in Galveston Island, Freeport and Port Arthur, the Padre Island-Corpus Christi area, Port Aransas and Brownsville area.

Tourism--The Texas Coast represents the only recreational coastline accessible to persons living in the great plains states. Approximately 11 percent of the six million out-of-state tourists visited the coastal areas of Texas in 1964. This increased to about 18 percent of 16.5 million visitors to the state in 1968 or roughly three million tourists.

Figure 21 shows estimated and projected number of out-of-state tourists visiting the Texas coast from 1964 to the year 2000. Subject to variables of future disposable income and leisure time, it is estimated that the Texas coast will have 5 1/2 million out-of-state visitors during the year 2000.

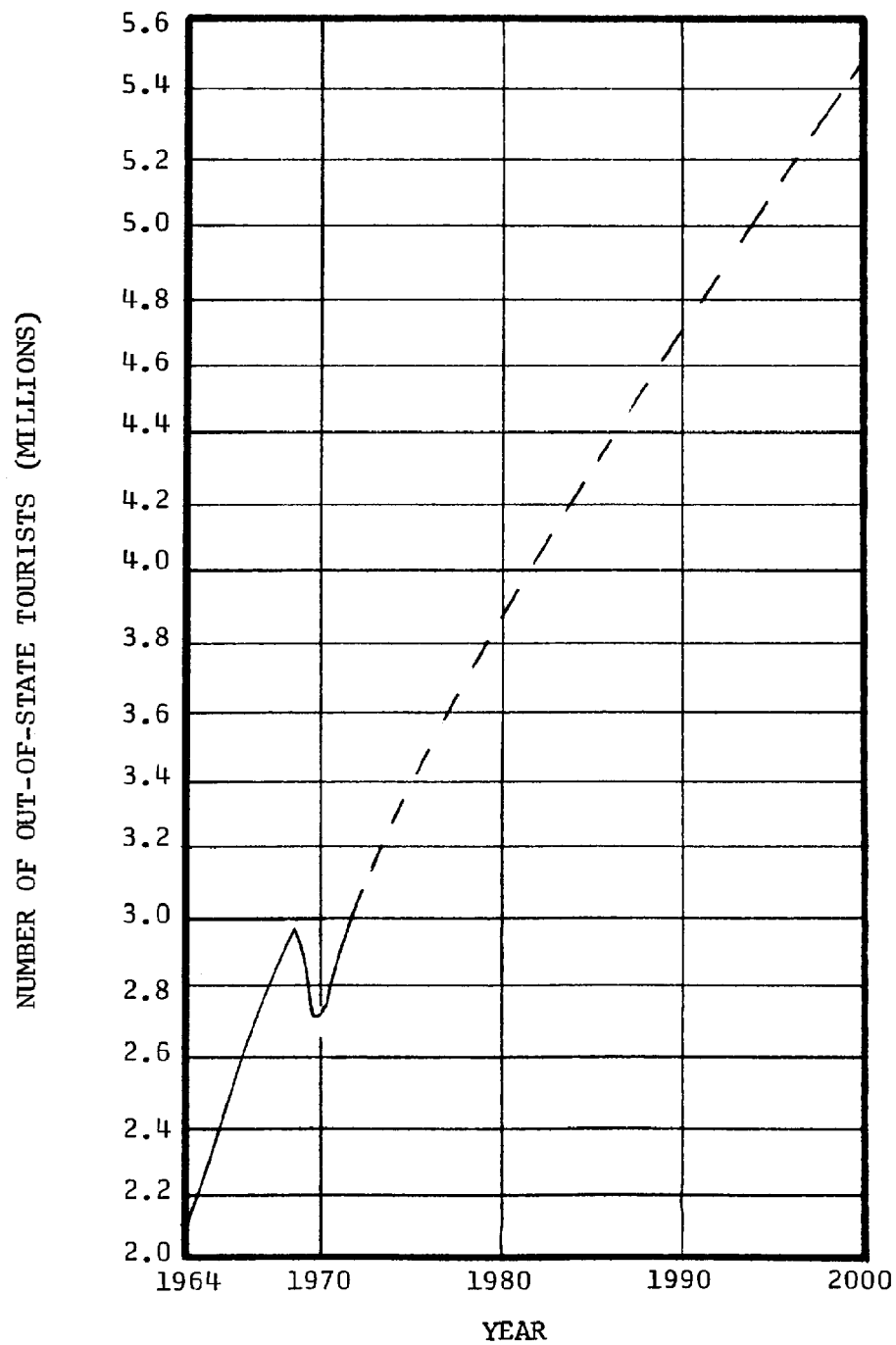
Of the tourist expenses outlined in Table 26, it is seen that over one-half of the tourist dollar is spend on food and lodging. According to the Travel and Information Division of the Texas Highway Department, some \$183 million was spent in the Texas coastal area by out-of-state visitors in 1968. By the year 2000, this should increase to some \$470 million as demonstrated in Figure 22.

Recreation--The climate on the Texas coast, largely dominated by the warm moist Gulf air, is generally favorable for year-around recreational activities. It is expected that the recent implementation of the "Monday Holiday Act" which assured at least five non-religious



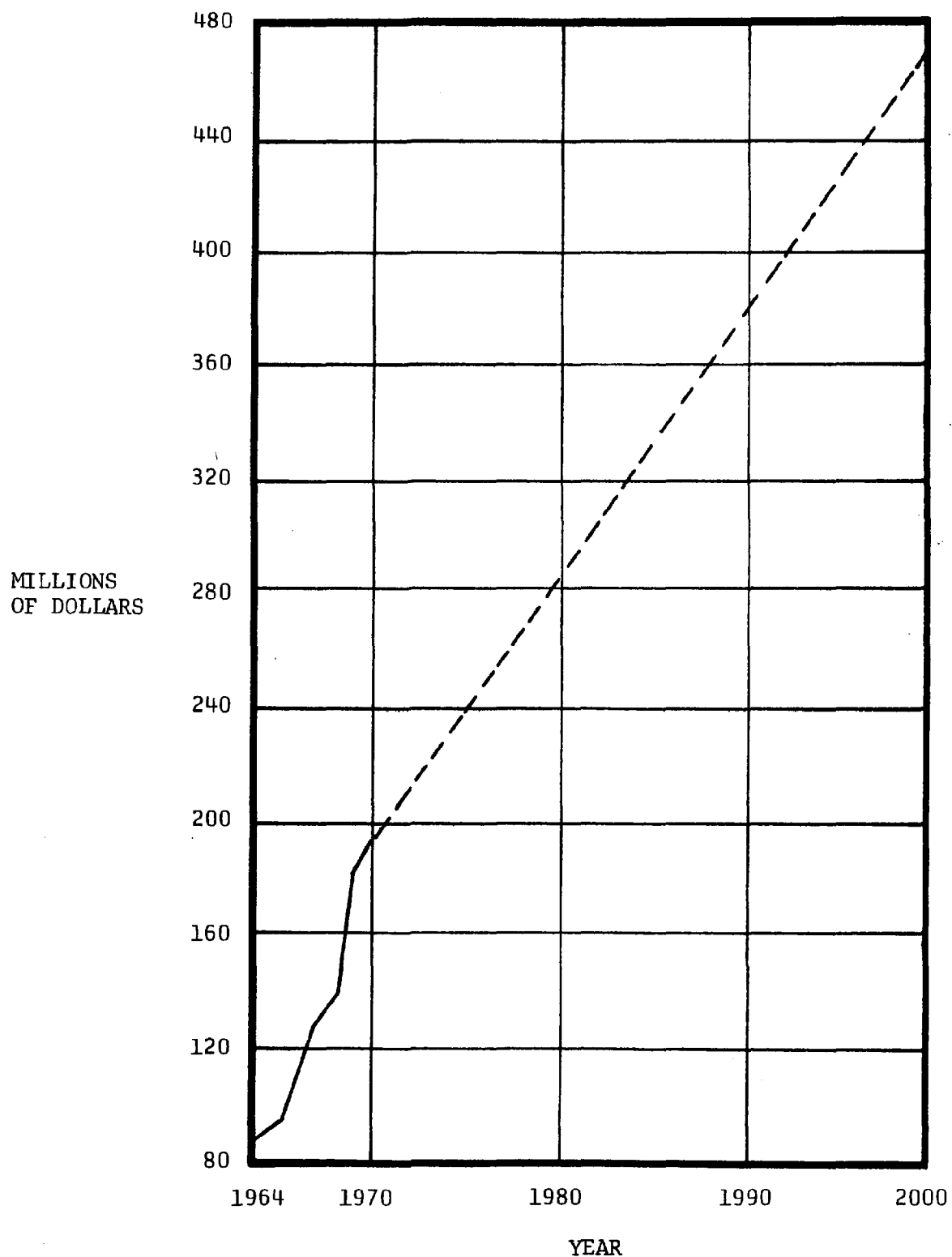
PROJECTIONS OF DOLLAR VALUE OF MAJOR TERTIARY
ACTIVITY EARNINGS IN THE COASTAL ZONE

FIGURE 20



ESTIMATED AND PROJECTED NUMBER OF OUT-OF-STATE
TOURISTS VISITING THE TEXAS COAST
1964 to 1971 (ESTIMATED)
1971 to 2000 (PROJECTED)

FIGURE 21



ESTIMATED AND PROJECTED EXPENDITURES OF OUT-OF-STATE VISITORS TO THE TEXAS COAST 1964-2000

FIGURE 22

TABLE 26

EXPENSE DISTRIBUTION OF THE OUT-OF-STATE
TOURIST DOLLAR
(1971 visitors touring Texas by automobile only)

EXPENSE ITEM	TOURIST DOLLAR
Auto	22¢
Lodging	26¢
Food	25¢
Entertainment	11¢
Other	16¢

SOURCE: Texas Visitor Industry 1971. Texas Highway Department, Travel and Information Division, Austin, Texas.

long weekends for most working people, will increase the demand for recreational activities. This consolidation of leisure time should ultimately enhance the quality of management of the various recreational sites along the coast. Demand factors influencing the future growth of recreation on the Texas coast are:

1. Time and distance to site, quality of highways and related information distribution centers.
2. Prices of recreational activities.
3. Recreation site management: control of congestion and cleanliness.
4. Mix of activities available at the site.
5. Aesthetic quality of the site itself.

TABLE 27
ACRES OF COASTAL ZONE STATE PARKS

STATE PLANNING REGION	PARK	ACRES
LOWER RIO GRANDE VALLEY	Bentsen-Rio Grande	587
	Brazos Island	217
	Port Isabel	<u>1</u>
	SUB TOTAL	805
COASTAL BEND	Copano Bay Causeway	6
	Goose Island	307
	Lake Corpus Christi	14,188
	Lipantitlan	5
	Tips	<u>31</u>
	SUB TOTAL	14,543
GOLDEN CRESCENT	Port Lavaca Causeway	<u>2</u>
	SUB TOTAL	2
GULF COAST	Galveston Island	1,922
	Huntsville	2,122
	San Jacinto Battleground	445
	Stephen F. Austin	664
	Varner-Hogg Plantation	66
	Velasco	<u>1,500</u>
	SUB TOTAL	6,719
SOUTHEAST TEXAS	-----	-----
COASTAL ZONE TOTAL		22,069

SOURCE: Texas Almanac, The Dallas Morning News, Dallas, Texas.

Table 27 shows that the Coastal Zone has over 22,000 acres of state parks. The largest area is found in the Coastal Bend State Planning Region where Lake Corpus Christi is located. The Gulf Coast State Planning Region has the most state parks with six, totaling 6,719 acres.

Table 28 indicates that the Coastal Zone contains 335,757 acres of national recreational sites. The largest is the recently established Padre Island National Seashore, totaling 134,000 acres.

TABLE 28
ACRES OF NATIONAL RECREATIONAL SITES
IN THE TEXAS COASTAL ZONE

SITE	ACRES
Anahuac National Wildlife Refuge	9,837
Aransas National Wildlife Refuge	47,261
Laguna Atascosa National Wildlife Refuge	44,700
Padre Island National Seashore	134,000
Sam Houston National Forest	<u>99,959</u>
TOTAL ACRES	335,757

SOURCES: Boykin, Rosemary E., Texas and the Gulf of Mexico, Center for Marine Resources, Texas A&M University, College Station, Texas, 1971; and The Dallas Morning News, Texas Almanac, Dallas, Texas.

Among the various specific recreational activities, fishing, swimming, and boating are the most popular. The relatively placid waters of bays and open gulf and the gulf beaches are excellent for swimming and surfing activities. Table 29 inventories the more than 1,100 miles of Texas shoreline showing over 300 miles of beaches.

Boating and fishing activities have and will continue to become extremely popular in the Gulf Coast. Currently there are over 100,000 pleasure craft registered in the Texas Coastal Zone. Since the future holds great promise for coastal boating activities, there will be a growing need for innovative marina management techniques to maintain reasonable standards of cleanliness and safety.

TABLE 29

TEXAS GULF COAST SHORELINE INVENTORY

SHORELINE TYPE	MILES
Beach shoreline	301
Bluff Shore	421
Marsh Shore	359
Public Recreation Areas	5
Restricted Shore Areas	<u>18</u>
Total Shoreline	1,104

SOURCES: Miloy, John and E. Anthony Copp, Economic Impact Analysis of Texas Marine Resources and Industries, Texas A&M University, College Station, 1970; Industrial Economics Research Division, Texas A&M University, College Station, Texas.

III. EMPLOYMENT

A. Future Assumptions

While absolute growth in secondary and tertiary industrial employment is expected to be maintained at high levels in the Coastal Zone, the relative growth of such employment probably will taper off in the future or even stabilize, particularly in secondary activities where new technologies and automation will offset the need for increased labor to meet increasing demand. Primary sector employment, increasing in proportion to the state primary labor force, will be maintained within the Coastal Zone as renewable resources are more intensively utilized; however, gains may be offset as nonrenewable resources are depleted and extraction processes become more mechanized.

The increasing availability of work opportunities in the Coastal Zone will stimulate moderate in-migration and simultaneously increase

market sizes, as will climatic attraction to the zone for retirement living. Education and training programs may also counter a moderate portion of the job losses due to automation.

Geographically, the Gulf Coast State Planning Region will be outstanding in both total contribution to the Coastal Zone labor force and absolute growth in employment. The Houston-Galveston metropolitan area will no doubt assist in maintaining the region's employment generating abilities. Dramatic growth in the relative contributions of the other four Coastal Zone regional labor forces seems unlikely, even though their absolute growth in number of employees will continue as a function of population growth, currently stable primary activities and growth in tertiary industries.

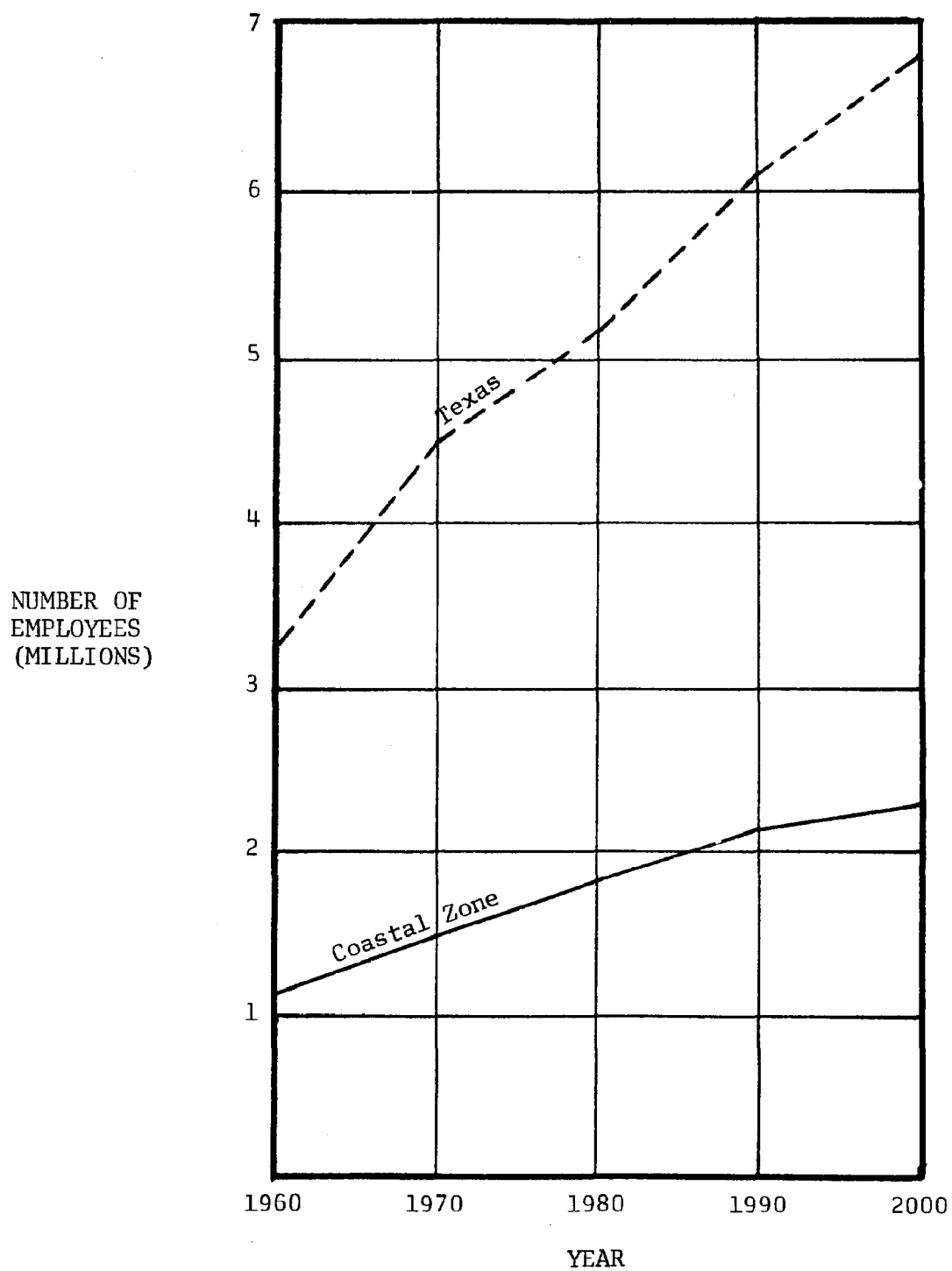
Income in the Coastal Zone, as in recent years, will lag behind state per capita income with regard to the entire zone. However, income in the major metropolitan areas, particularly in the Houston-Galveston and Beaumont-Port Arthur areas, will in all likelihood exceed state averages. As industries migrate outward from heavily urbanized metropolitan areas and as federal job training programs decrease the ranks of unskilled rural and minority labor, per capita income growth of small town and rural-oriented inhabitants is expected to increase during the 1980's. This eventual dispersion of industry throughout the Coastal Zone in the latter part of the century will assist the zone in meeting, and perhaps exceeding, state per capita income growth.

B. Projections

As employment in Texas is expected to increase from 4.5 million workers in 1970 to approximately 6.7 million in 2000, the Coastal Zone is projected to provide over one-third of the new jobs generated within the state. The work force in the Coastal Zone, estimated at 1.48 million in 1970, will rise to approximately 2.3 million in the year 2000. These projected employment trends for the state and the Coastal Zone are illustrated in Figure 23.

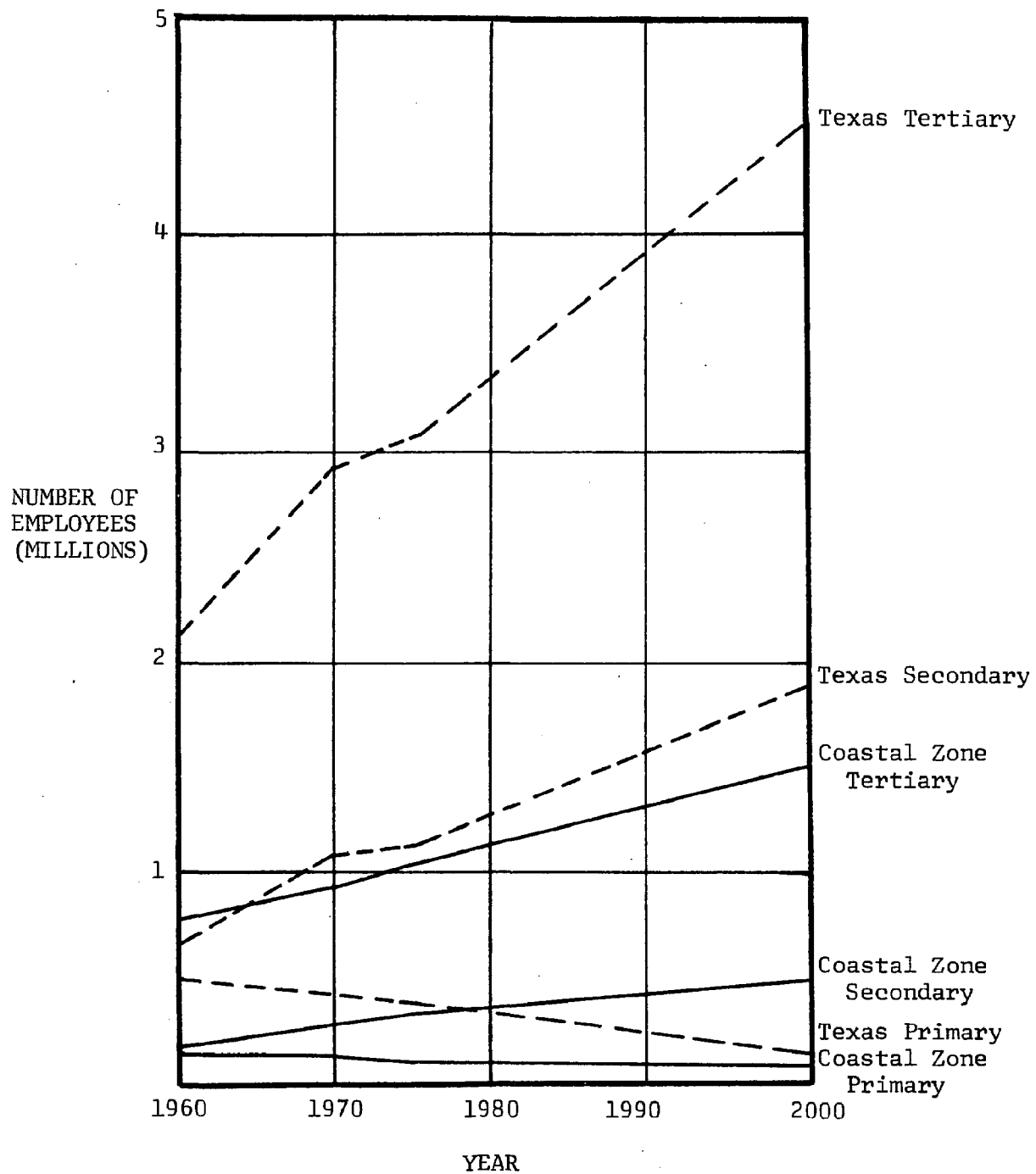
At a more detailed level, Figure 24 illustrates the projected employment for the state and the Coastal Zone by economic industrial sector. Most projections show a slow-down in employment from the growth experienced during the 1960's and especially during the Viet Nam era.

Primary industrial sector employment in agricultural, forestry, fisheries, and mining activities are projected to drop from approximately



PROJECTED EMPLOYMENT FOR TEXAS AND THE COASTAL ZONE
1960-2000

FIGURE 23



PROJECTED EMPLOYMENT BY BROAD INDUSTRIAL
SECTOR FOR TEXAS AND THE COASTAL ZONE
1960-2000

FIGURE 24

9.3 percent of the state's labor force in 1970, or 418,000 workers to 3 percent or approximately 200,000 in the year 2000. Simultaneously, primary employment in the Coastal Zone will drop from approximately 10 percent of the zone's labor force in 1970, or 156,000 workers to a more stable 4.5 percent or 104,000 workers in 2000. New technologies for the extraction of raw materials and increased mechanization and intensification of agricultural production along with the depletion of non-renewable resources leave little room for expansion in the primary sector and only hopes of stabilization toward the end of the century.

Secondary industrial activity in the areas of construction and manufacturing will show steady increases from the 1970 state estimate of 1,098,000 workers or 24.4 percent of the state's labor force to 28.9 percent or 1.94 million workers in the year 2000. The Coastal Zone will follow a similar, yet slightly more subdued, growth path as has been indicated by historic trends. Secondary Coastal Zone employment, comprising approximately 24.5 percent of the zone's labor force or 361,000 workers in 1970, is expected to rise steadily, barring any major national economic setbacks, to 27.2 percent of the zone's labor force or approximately 630,000 by the end of the century.

Tertiary industrial sector employment, comprised of jobs in the areas of trade, transportation and public utilities, finance, services, and public administration, are expected to increase incrementally with population growth at both the state and Coastal Zone levels. Therefore, while growth in the tertiary sector is expected to increase in proportion to the state's labor force by less than 2 percent between 1970 and 2000, the total number of workers in this sector is expected to increase from near 3.0 million to 4.58 million. Slightly more rapid growth in this sector may occur in the Coastal Zone as market sizes are projected to increase more rapidly in this area than in the rest of the state. While numbering just under 1.0 million, or 64.9 percent of the zone's labor force in 1970, tertiary workers will account for 68.3 percent of the jobs in the zone in the year 2000 and number in excess of 1.5 million.

Employment in the Coastal Zone is projected to increase slightly ahead of state projections due to several factors, one of which is the relatively higher concentration of dense population growth in the northern part of the Coastal Zone. Other important resources of the zone contributing to the attraction of industry, and hence the generation of jobs, will be its abilities to provide year-around shipping to both the East and West coasts via the warm Gulf, which also provides a recreational attraction, as well as a continuing supply of raw materials for manufacturing.

IV. SUMMARY

The population of the Coastal Zone of Texas is expected to increase from 3.5 million to an estimated range of 5.1 to 6 million persons by the year 2000. Lower fertility rates and in-migration should hold growth to the lower limit of this range and the relatively high rate of population growth should decrease to a steady average of from 1.2 percent to 1.5 percent per year. The Houston-Galveston metropolitan area is expected to absorb the great majority of this growth.

Employment in the study area estimated at 1.48 million workers in 1970, will increase to a total of 2.3 million by the year 2000. The primary industry activities will comprise about 4.5 percent of the projected total or about 104,000 workers. Although this proportion is higher than the primary sector contribution to employment on a state-wide basis, new technologies for resource extraction and the general depletion of non-renewable resources allow little hope for expansion of the work force associated with primary industries. Primary sector earnings in the study area are therefore projected to decrease from 12 percent in 1970 to an estimated 5 percent of the total broad industrial sector earnings by the year 2000. Absolute primary sector earnings, however, should increase from one to two billion dollars during the same period.

Automation in secondary industries will lower the relative growth rate of employment in this category; however, the absolute number of workers should increase from 361,000 in 1970 to 630,000 by 2000. Furthermore, secondary industry earnings in the Coastal Zone will increase from \$3 billion to just under \$6 billion over the same period, even though as a percent of total industrial activity there should be little, if any, increase.

By contrast, tertiary industry employment will increase incrementally with population to account for 68.3 percent of 1.5 million of the jobs in the Coastal Zone by 2000. Moreover, one-half of the total industrial sector earnings should be due to tertiary activities and will represent an estimated \$7 billion. Since tertiary activities are consumer oriented, the more densely populated northern sections of the Coastal Zone will account for a greater contribution to tertiary industry growth. Thus the Houston-Galveston and Beaumont-Port Arthur-Orange areas likely will exceed state averages for growth in both employment and per capita income.

Appendix A gives the methodology used in establishing projections for population, industry and employment in the Coastal Zone.

Appendix B delineates future studies that are needed to support and clarify initial research efforts. Particular emphasis is placed

on continuous monitoring of key indicators to identify changes important to future planning and policy formulation.

Appendices C and D are scenarios reflecting the economic importance for Texas of several potential developments. Appendix C describes the economic implications of a deepwater superport in the Gulf of Mexico, and Appendix D presents the economic considerations evolving from the location of a nuclear power source in the Coastal Zone of Texas.

APPENDIX A

APPENDIX A

PROJECTION METHODOLOGY

POPULATION

The ratio correlation method was utilized to determine the population projections for Texas counties which were used to compute the state, Coastal Zone, and state planning region projections. Five symptomatic variables: births, deaths, automobile registrations, food sales, and retail sales were used in a regression equation to predict county portions of the state's variables. When combined with a 1970/1960 regression equation predicting the proportionate representation of the state's total population in each county, a projected population proportion for each county was produced. These proportions were then multiplied by U.S. Census Bureau (1967) projected state totals (adjusted to reflect the 1970 census) and two sets of projections were obtained:

1. The upper limit of the projection range includes assumptions of slightly increasing fertility during the projection period based on the Bureau of the Census projection series I-B.
2. The lower limit of the projection range includes assumptions of slightly decreasing fertility during the period based on Bureau of Census projection series I-D.

INDUSTRY

The method employed to obtain future production and economic value projections was the standard linear regression model assuming constant slope. This was modified by allowing tolerances of from five to ten percent above and below the value projected for the year 2000 depending on the accuracy of the data and future assumptions used.

The ranges given for mineral values and cumulative crude oil production in Figures 16 and 17 are located entirely below that predicted by the model due to the preponderance of crude oil in total mineral values and recent trends in proven reserves.

The trends in future percentage distribution of broad sector industries in Figure 14 were faired graphically and projected in accordance with the normal development of a balanced region.

EMPLOYMENT

Employment trends indicated by total employment figures for 1960, 1968, 1970 and Texas Employment Commission estimates for 1975 were used in a least squares linear regression formula to obtain a trend line to the year 2000. When combined with population trends and projections and modified according to past trends, state and Coastal Zone employment projections were developed dependently and independently of each other.

Historical trends in employment since 1948 and industrial growth projected to the year 2000 by broad industrial sector were utilized to facilitate the breakdown of projections for the state and Coastal Zone into primary, secondary and tertiary industrial employment. These were also adjusted to reflect Texas Employment Commission short-range estimates for employment by industrial sector.

RECOMMENDED PROJECTION MONITORING

New socio-economic and industrial projections made at two-year intervals should be superimposed over previous projections to obtain a trend line in projections. Such a technique will serve to validate and/or refine methodology as well as obtain a more broadbased and consequently more realistic range of projections.

APPENDIX B

APPENDIX B

FUTURE STUDIES

Future study efforts recommended here should be coordinated by the Governor's Planning Office and administered by the Councils of Government in the appropriate Coastal Zone state planning region who will be able to immediately integrate the information into their own regional planning studies.

1. Systematic, continuous monitoring and collection of land use and socio-economic data can be utilized to formulate an accurate composite picture of the Coastal Zone on a per county basis.
2. Future assumptions for economic development should be reviewed and updated periodically in order to form a more accurately defined reference point from which to project future needs, trends, and resources.
3. Future efforts should include regional environmental impact studies of alternative land use development patterns and changes in resource allocations.
 - a. Renewable resource studies should be tied to an economic impact analysis of the food processing industry in the Coastal Zone.
 - b. Non-renewable resource studies should be related closely to an impact analysis of the petrochemical industry in the Coastal Zone.
4. Redistribution of industrial activity in the Coastal Zone relative to that of statewide activity should be monitored as a key indicator of future demographic distribution.
 - a. Primary industrial activity should be broken down into more specific S.I.C. components and growth trends identified.

- b. A more specific analysis of the various manufacturing activities in the Coastal Zone should be made with emphasis on trends in value added and capital expenditures.
 - c. Trends in the various tertiary or consumer-oriented activities should be differentiated as a key indicator of the economic maturity of the Coastal Zone. Any detailed tertiary industry analysis should integrate an in-depth study of the economic impact of coastal recreation and tourism.
5. Studies outlining the potential of alternative sources of power and water should be undertaken in order to assist in the formulation of policies influencing the future utilization of these resources.
- a. The potential of nuclear power to provide electricity and water to the Coastal Zone and state should be given priority in long range planning.
 - b. Optimal site location studies relative to nuclear and fossil fuel power plants should be modified only by analysis of the most rational and scientific environmental data and standards.

APPENDIX C

APPENDIX C

ECONOMIC IMPLICATIONS OF THE TEXAS SUPERPORT

The economy of Texas during the past 30 or 40 years has changed from one dominated by agriculture to one oriented toward manufacturing with a strong dependence upon water transportation. Petroleum refining and petrochemical-based industries have grown especially fast during this period due to Texas' plentiful supplies of essential raw materials--crude oil, natural gas, sulfur, salt, limestone, and water. Today, however, because of the decline in exploration activity, domestic reserves of oil and gas are rapidly being depleted in Texas and throughout the nation, and demand for imports of oil and gas is rising.

During World War II, the standard oil tanker in service was the T-2, a vessel with 16,600 deadweight tons (dwt) capacity and a fully-loaded draft of 30 feet. The depth of water in substantially all of the world's harbors was adequate for the draft of this class vessel. However, starting in 1967 after the second closing of the Suez Canal, the dual demands of huge volumes and long distances for oil moved to Western European markets caused a mushrooming in the average size of new tankers. Today, many oil-hauling ships have capacities in excess of 200,000 dwt and fully-loaded drafts of 60 to 90 feet.

In 1970, more than 185 million tons of cargo moved through the 12 deep water ports of Texas. Of this total, 140 million tons, or about 75 percent, consisted of liquids, mainly petroleum, petroleum products and petrochemicals. This high proportion of liquid cargo indicates the degree of Texas' dependence upon tanker traffic. Yet, because of recent trends toward bigness in tankers, existing ports in Texas are grossly inadequate to meet the depth requirements of new generation ships. It has been estimated that by 1983, more than 1,400 vessels, out of a world tanker fleet of 4,384, will be unable to enter Texas ports.

The impact of a superport upon Texas will be significant. Construction of a deep water terminal presents a clear opportunity for our industrial community to grow. Industrial expansion will occur in companies utilizing imported oil and gas to produce finished products for export and domestic consumption. Service industries to support and maintain the superport and related onshore facilities would show

dramatic growth. Direct benefits would accrue, for instance, to firms providing barge and tug services as well as to other transportation modes like rail and truck services. Also enjoying growth would be scientific and technical firms, repair and maintenance oriented companies, and a host of service and supply firms related to the construction and operation of gathering stations, pipeline terminals and onshore pipeline facilities.

It is also evident that the trade losses to the Texas economy will be directly and indirectly significant if we fail to build a deep water port. Presently, Texas deepdraft ports handle 1/7 of the total tonnage shipped in the United States annually. But, without adequate docking facilities in the state, supersized ships will establish trade routes where such facilities exist and Texans will not enjoy the economic advantages of lower transportation costs available through use of giant ships.

The marine transportation industry in Texas employs over 55,000 people and annually contributes over \$1 billion to the state's economy. There will be a direct loss in tonnage and employment if Texas cannot accommodate the supertankers.

APPENDIX D

APPENDIX D

ECONOMIC CONSIDERATIONS
OF A NUPLEX

During the remainder of this century, the State of Texas has an outstanding opportunity to serve the individual, municipal, agricultural and industrial components of society; the Coastal Zone will play a major role in these events.

In the near future, the Nation, the State of Texas, and the Coastal Zone are going to need:

- more - water,
- electricity,
- energy,
- food,
- industrial production,
- employment,
- economic development of rural areas,
- equitable distribution of our population between urban and rural areas, and
- opportunities for the less advantageous members of our society.

But simultaneously we will have to have:

- less - pollution of our environment,
- congestion, crime, and urban sprawl in our major population areas,

and a

- better - utilization of all our natural resources and
- way of live for our entire population.

Advanced technology in the areas of atomic power, the generating of electricity, and the desalting of sea water into fresh water provides

a means by which many of these problems can be met. The integration of these technologies are embodied in the Nuplex concept. A Nuplex is a large agglomeration of agricultural and industrial facilities combined with the necessary supporting population and producing and fabricating products derived from the abundant supply of low-cost electricity and desalted water provided by a nuclear power reactor. The concept is based upon the efficient utilization of energy to provide food, industrial and chemical products, and consumer goods to a modern society.

Based on physical, social, and economic considerations, Texas appears to be a state in which Nuplex will most likely be located. It is one of the very few states which can locate a Nuplex such that it will be:

1. near a large body of salt water,
2. near vast acreages of semi-arid land suitable for multiple croppings,
3. near several large population centers which have (or will have):
 - a. good transportation and marketing facilities of all forms and
 - b. shortages of water and/or electricity within the next decade, and
4. simultaneously in a rural, relatively undeveloped area from which a new city could be developed using the Nuplex as its "economic heart."

The social and economic impacts of an abundant supply of fresh water and cheap electricity to the economy of southern Texas could be enormous. Fresh water production could be important to the region in two ways. First, the cost of desalination is continually decreasing. In 1952 the cost of desalting water was more than \$4 per 1000 gallons. Last year, Mexico completed a 7.5 million g.p.d. desalting plant in which the cost is expected to be about 65¢ per 1000 gallons. In the near future, sea water desalting facilities will be combined with electricity generating facilities in large dual-purpose plants which will reduce the cost of desalting water to less than 20¢ per 1000 gallons as well as lower the cost of generating electricity.

The second important consideration is that the value of water to our society has been increasing and will continue to increase due to the rapid growth in population and the per capita consumption of water.

The value of fresh water to south Texas, our primary study area, could be quite high due to the region's long growing season, long days of bright sunlight, moderate winter temperatures, fertile soil and large supply of unskilled labor available. With adequate fresh water, south Texas could become a major producer of virtually all of the high value fruit, vegetable and nut crops. Given the climate, topography and labor supply of south Texas, it would appear that intensified agriculture could be expanded considerably with additional fresh water and thereby help reduce the low income, unemployment and social problems in the area.

In addition to the water requirement for agriculture, the water requirements for municipalities are increasing, and the availability of water from present sources is rapidly diminishing. This condition will become more serious as population in the major metropolitan centers continues to increase. According to the Office of Saline Water, there are 88 Texas communities with a population of 1000 or more which have a water supply containing total dissolved solids in excess of 1000 p.p.m. These 88 communities had a combined 1969 population of 700,000. This same agency states that good drinking water should not contain more than 500 dissolved p.p.m. and that 1000 p.p.m. should not be used for human consumption. Present research studies being conducted by agencies such as the Oak Ridge National Laboratory and universities such as Texas A&M University promise to improve the efficiency of desalting plants to the point that desalted water could be a competitive source of supply.

Similarly, the impact of low-cost electricity generation could have a strong stimulating effect on this region. Texas has been attracting new industries at an unprecedented rate during the last several years. However, only a limited number have located in southern Texas outside the major cities. The proximity to major consumer markets of the nation, a good transportation network, an abundant supply of labor and a favorable climate are the major factors that most industries seek in a plant location. These factors are presently available in this area. A low-cost source of electrical power could serve as the catalyst for the economic development of a depressed region inhabited by a minority ethnic group.

The scope and breadth of all the economic considerations of a Nuplex project are virtually unlimited. The socio-economic group is concerned primarily with finding answers to the questions regarding who, what, when, where, and why. For example,

- who will build the Nuplex;
- who will organize and operate it;
- what should it produce;

- what sections of the economy are most important--should we concentrate most of the Nuplex's output towards serving the industrial sector, supplying water and electricity for municipalities, or towards serving the agricultural sector;
- what will be the major inputs and outputs of the Nuplex;
- what type of transportation will be required for most of the products--do we need to have air, railroad, pipeline, and large facilities available or can some of these facilities be excluded;
- what will be the social consequences of the Nuplex in terms of:
 - a. population redistribution,
 - b. economic stimulation to rural development and urban renewal,
 - c. alleviation of congestion in central cities, and
 - d. development of new towns;
- where will the Nuplex be located;
- where should it be located to optimize alternative objectives such as:
 - a. maximum economic efficiency,
 - b. maximum social benefit,
 - c. maximum social cost and risk, and
 - d. maximum net social benefit;
- where will its primary markets be;
- from where will its imported resources have to come;
- when is the optimum time to build the facility and should it be built all at once or in stages?

The answer to the why question regarding the whole Nuplex operation and each of its particular components has to be answered in this way: because a Nuplex offers the cheapest, most efficient (or less disruptive) alternative means of obtaining these products for society.

There are many problems with a Nuplex which have yet to be resolved; however, with the continuing advancement of technology and the additional research efforts that are now being applied in this area, these problems will be overcome.

The Nuplex will not solve all of our problems, but considering the number and magnitude of problems that society has and will have within the next two decades, its place in history will be secure if it can merely help alleviate some of these difficulties.

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