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Cooperative Gulf of Mexico Estuarine Inventory and Study—Texas: Area Description

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SEATTLE, WA
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UNITED STATES
DEPARTMENT OF COMMERCE
Rogers C. B. Morton, Secretary

NATIONAL OCEANIC AND
ATMOSPHERIC ADMINISTRATION
Robert M. White, Administrator

National Marine
Fisheries Service
Robert W. Schoning, Director

CONTENTS

Figures

Tables

Cooperative Gulf of Mexico Estuarine Inventory and Study—Texas: Area Description

RICHARD A. DIENER[1]

ABSTRACT

Seven Texas estuarine areas are described in terms of their dimensions; major vegetation types; geology and geological history; drainage basins and stream discharge records; hydrological, biological, and benthic properties; populations and economic development; pollution; and navigation projects. These areas include the Sabine Lake, Galveston Bay, Matagorda Bay-Brazos River Delta, San Antonio Bay, Copano-Aransas Bay, Corpus Christi Bay, and the Laguna Madre. A list of pertinent literature is also presented.

The estuaries cover over 1,532,000 acres (620,460 hectares) of open waters and are surrounded by an additional 1,141,400 acres (462,267 hectares) of marshlands and tidal flats. They are formed from either drowned river mouths or the development of barrier islands and peninsulas, and are late Pleistocene and Recent in age. Approximately three-fourths of the more than 39,000 cubic feet per second entering these waters from gaged streams enters Sabine Lake and Galveston Bay.

Water temperatures are generally lower on the upper coast than the lower coast during the winter but are relatively uniform during the summer. Salinities generally range from about 5 to 25‰ except in the Laguna Madre area where hypersalinity is common. A rich and varied fauna displaying many varied life-history types is supported by these waters.

Human populations in Cameron Parish, La. and Texas counties contiguous to the seven estuarine areas increased from 31,751 persons in 1850 to 2,962,125 persons in 1970. A sharp increase resulted when oil production began in 1901, and an economy based on manufacture of petrochemicals, shipping, and other industries expanded. Beef cattle and cotton are the mainstays of Texas coastal agriculture, with rice important on the upper coast while citrus fruits are important to the economy of the lower Laguna Madre area. The Texas coast is also important for its sport and commercial fisheries and for waterfowl hunting.

Pollution from domestic and indsutrial sources has forced the closing of about 325,090 acres (131,661 hectares) of open bay waters to shellfishing and an additional 16,600 acres (6,723 hectares) closed on a conditional basis. Over 1,050 miles (1,691 km) of Federal navigation channels are situated on the Texas coast, the most important of which is the Gulf Intracoastal Waterway, which extends from the Sabine River to Brownsville. Large areas of open estuarine waters, especially in the Sabine Lake and Galveston Bay areas, have been displaced by large spoil areas.

INTRODUCTION

There has been a growing need for documentation and classification of the physical and biological characteristics of coastal waters throughout the Gulf of Mexico. Demands upon water resources of Gulf coast estuaries and associated watersheds are producing rapid and marked changes in the estuarine evironment. Increased use of freshwater, much of it for human consumption, is hastening construction of dams and diversion channels, and this reduces flow to Gulf estuaries. Construction of channels and placement of spoil, activities associated with exploitation of mineral resources, and construction for waterborne commercial and recreational facilities are altering water circulation and interchange patterns in the estuaries. Flood control and hurricane protection structures also modify estuarine conditions. Effects of such modifications upon estuarine flora and fauna are noticeable, but these effects have not been cataloged for the northern Gulf. Preparation of reports that evaluate proposed water resource projects is often laborious and time-consuming because background information on coastal areas is not easily available.

The Cooperative Gulf of Mexico Estuarine Inventory and Study was designed to provide background information on coastal waters of the states bordering the Gulf. The planning and organizing of the format were done under the auspices of the Estuarine Technical Coordinating Committee (ETCC) of the Gulf States Marine Fisheries Commission, composed of representatives of the fishing industry and of the State and Federal conservation agencies in Alabama, Florida, Louisiana, Mississippi, and Texas. Partial funding for the study in Alabama, Louisiana, and Mississippi was provided through the Commercial Fisheries Research and Development Act (Public Law 88-309, as amended). The Galveston and St. Petersburg Beach Laboratories of the Gulf Coastal Fisheries Center, National Marine Fisheries Service, NOAA, undertook the Texas and Florida portions of the study largely because other uses were made of Public Law 88-309 funds in those states. Members of the ETCC developed work outlines that all participants agreed to follow so that methods of study would be similar and the results comparable. The material presented here uses the format of the Area Description portion of the report.

THE TEXAS COAST

The Texas coastline is nearly 370 miles (595 km) long. Climate of coastal Texas ranges from humid in the Sabine Lake area (Port Arthur), where the average annual precipitation exceeds 55 inches (1,397 mm), to

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semiarid in the Rio Grande Delta (Port Isabel), where annual rainfall slightly exceeds 25 inches (635 mm) (Table 1). Temperature likewise exhibits considerable variation along the Texas coast. Port Isabel's average January temperature of 62.2°F (16.7°C) contrasts with the 53.6°F (12.0°C) recorded for the Port Arthur and Houston airports (Table 2). Average rainfall ranges from less than 30 inches (762 mm) in the Rio Grand Delta to over 55 inches (1,397 mm) in the Sabine Lake area. The growing season is usually more than 300 days.

Tidal marshes and mud flats border all of the estuaries which, with the exception of the Laguna Madre, are too turbid to support extensive growths of submerged vegetation. The dense salt marshes typical of the humid estuaries of the upper Texas coast are gradually replaced on middle and lower coasts with mud flats and with small marsh plants that tolerate high salinity.

Texas estuaries have two basic shapes: 1) simple (oval) and 2) complex (branching or dendritic). All are in the second category except Sabine Lake (Figs. 1-3).

Geomorphologically, Texas estuaries are of two types: 1) coastal plain, composed of drowned river mouths, and 2) bar-built, in which an offshore sand bar partially encloses a body of water (Pritchard 1967). The first type is represented by Sabine Lake, Galveston and Trinity bays, Matagorda and Lavaca bays, San Antonio Bay, Copano Bay, Corpus Christi Bay, and Baffin Bay. Estuaries of the Brazos and Colorado rivers and of the Rio Grande have filled. Examples of the second type include East and West (Galveston) bays, eastern Matagorda and East Matagorda bays, Espiritu Santo Bay, Aransas and Redfish bays, and the Laguna Madre.

Most Texas estuaries have relatively shallow depths that permit mixing of surface and bottom waters through the action of wind-driven waves and normal flow of tidal currents, thus they were considered to be one-layer systems.

Emery and Stevenson (1957) define two types of estuaries based upon tidal and salinity features: 1) normal or "positive" type, and 2) hypersaline or "negative" type. The former is characterized by having upstream salinities lowered by adequate river discharge and mixing; the latter, found in arid regions, is characterized by poor land runoff, limited tidal influence, and salinities higher than those of the adjacent ocean. The bays of Texas from Sabine Lake to Corpus Christi Bay are examples of the former; the Laguna Madre is representative of the latter.

DIMENSIONS

Each of the seven Texas estuarine study areas is described by a set of boundaries: seaward, landward, and internal (Figs. 1-3). Seward boundaries were established by custom, by the definition of estuaries by Pritchard (1967), and by procedures established by Pearcy (1959). Pritchard states that an estuary is a semienclosed coastal body of water which has a free connection with the open ocean and within which seawater is measurably diluted with freshwater derived from land drainage. Pearcy described methods for defining the geographical boundaries between bays and the territorial sea, but for purposes of this paper, the method of drawing the coastline between headlands, islands, and peninsulas will suffice.

Landward boundaries of the estuarine study areas were determined by limited field observations of the landward penetration of plants characteristic of the coastal marshes and by examination of aerial photographs of the U.S. Soil Conservation Service and topographic maps of the U.S. Geological Survey.

Internal boundaries between open waters of estuarine study areas were established arbitrarily except where historical precedent dictated otherwise. Inland, these boundaries approximate established boundaries of river basins, and they are used for the purpose of pollution studies contained in this report.

Table 3 lists the area, depth, tidal range, and volume of major waters in the seven estuarine study areas. Areas were measured on maps of the U.S. Geological Survey and charts of the U.S. Coast and Geodetic Survey with a compensating planimeter. The values in Table 3 are averages of the results. Depths are averages of the most recent soundings at mean low water (MLW) exclusive of navigation channels. Average tidal range data are from the U.S. Geological Survey and the U.S. Army Corps of Engineers. The tides are diurnal. The volume at MLW is the product of the area and the average depth; the volume at mean high water (MHW) is the product of the area at MHW and the average depth plus average tidal range. Intertidal volume is the difference between the two volumes.

The total open water area major estuaries of the Texas coast at MHW is 1,532,430 acres (620,634 hectares) or 0.74 times the area recorded for Chesapeake Bay, America's largest estuary.

VEGETATION

The wide variation in climate on the Texas coast causes the principal plant zone—the coastal prairie and marshes—to have many floral differences within its range. This area covers approximately 9.5 million acres (3,847,500 hectares) (Correll and Johnston 1970) of which about 884,000 acres (358,020 hectares) are marshlands of various types. In addition, approximately 50,000 acres (20,250 hectares) of marshlands are in the Sabine Lake area in Louisiana. Inland, this zone borders three other plant zones: 1) the timber belt, 2) the post oak savannah, and 3) the Rio Grande Plains (Figs. 4-6). Each plant zone usually grades imperceptibly into its neighbor, and elements of all three zones occur in isolated areas on the barrier islands and peninsulas that border the Gulf of Mexico and along the numerous watersheds that traverse the coastal prairie (Correll and Johnston 1970).

Marshlands and the Coastal Prairie

Marsh areas were planimetered from U.S. Geological Survey topographic maps, scales 1:24,000 and 1:62,500 (Figs. 4-6). Emergent and submerged vegetation in each of the seven estuarine areas were plotted and acreages computed from modified State Land Tract maps prepared by the Texas Parks and Wildlife Department (Table 4).

Submerged plant growth is scattered in the Texas estuaries, its growth and abundance being dependent on water depth, turbidity, and salinity. The usually turbid estuaries of the upper and central Texas coast have scattered patches of plant growth generally in depths of 6 feet (1.8 m) or less, whereas the less turbid estuaries of the Copano-Aransas and the Laguna Madre areas have comparatively large areas of submerged vegetation.

The algae *Enteromorpha*, *Lyngbya*, *Polysiphonia*, *Ulva*, and *Gracilaria* occur in the seven estuarine study areas, but their distributions are sporadic and are not differentiated in Figures 4-6. They appear primarily in spring and early summer.

Dominant submerged vascular forms include widgeon grass, *Ruppia maritima*; turtle grass, *Thalassia testudinum*; and *Halodule beaudettei*. Manatee grass, *Cymodocea manatorum*, is widespread in the lower Laguna Madre.

The coastal marsh, including the beach community described by Tharp (1926), consists of plants in zones influenced by varying degrees of tidal inundation, and it forms a broad belt of intergradation with the coastal prairie. Marsh soils consist mainly of acid sands, sandy loams, and clay.

The coastal marsh is best developed in the Sabine Lake and Galveston Bay areas. Dominant species include smooth cordgrass, *Spartina alterniflora*; saltmeadow cordgrass, *S. patens*; coastal dropseed, *Sporobolus virginicus*; and horned rush, *Rhynchospora corniculata*. The *Spartina alterniflora* marsh is one of the major emergent plant communities that surround parts of the estuaries on the upper Texas coast. Individual plants attain their maximum growth midway between low- and high-water levels. Areas in the *S. alterniflora* marsh above the high-water level frequently are invaded by saltgrass, *Distichlis spicata*, and *Monanthochloë littoralis*. Also large amounts of the saltmarsh bulrush, *Scirpus maritimus*, occur in sections of this marsh that border estuarine waters of low to moderate salinity.

The beach community occupies isolated sand ridges and dunes on the upper Texas coast, but it increases in importance to the west and south, invading large areas of mud flats. Depending on the frequency of tidal inundation, dominants include vidrillos, *Batis maritima*; seaside heliotrope, *Heliotropium curassavicum*; *Monanthochloë littoralis*; glassworts, *Salicornia bigelovii*; sea purselane, *Sesuvium maritimum*; coastal dropseed, and a sea blite, *Suaeda linearis*.

The sand dunes of the lower Texas coast, especially those of Padre Island, are characterized by unique floral assemblages in addition to elements of the beach community described above. The coastal bluestem, *Schizachyrium scoparium*, is the leading dominant on many of the dunes along with sea oats, *Uniola paniculata*, while gulf dune paspalum, *Paspalum monostachyum*, is characteristic of the sandy depressions between the dunes.

The coastal prairie lies between the marshlands and the three mesic plant zones represented by the timber belt, post oak savannah, and the Rio Grande Plains. It forms an irregular arc, as wide as 80 miles (129 km) in places, stretching from the Sabine Lake area to the Rio Grande. It encompasses a nearly level, slowly drained plain less than 150 feet (46 m) in elevation with numerous sluggish rivers, creeks, bayous, and sloughs. It is characterized by level grasslands that support ranching and farming, low flat woodlands (especially along streams), swamps, and freshwater marshes.

Upland prairie soils are usually heavy-textured acid-clays, clay loams, and sandy loams. Much of the prairie is grazed by cattle in large land holdings where the better soils are under cultivation or are improved pastures. Wildlife, especially deer, is an important consideration in range management.

Vegetation of the coastal prairie is predominantly tall grasses including big bluestem, *Andropogon gerardi*; seacoast bluestem, *Schizachyrium scoparium*; eastern gamagrass, *Tripsacum dactyloides*; Gulf muhly, *Muhlenbergia capillaris*; *Panicum* spp.; and others.

Major invaders, usually indicators of overgrazing, fires, or other disturbances, include mesquite, *Prosopus glandulosa*; oaks (especially live oaks, *Quercus virginiana*); prickley pear, *Opuntia* sp.; and several acacias, *Acacia* spp. Other invaders are broomsedge, *Andropogon virginicus*; smut-grass, *Sporobolus poiretii*; western ragweed, *Ambrosia psilostachya*; tumble grass, *Schedonnardus paniculatus*; and many annual weeds and grasses.

The vegetation of the river bottoms that cross the coastal prairie is different from that of the uplands. The principal species include sedges, *Cyperus* sp.; pecan, *Carya illinoensis*; bur oak, *Quercus macrocarpa*; lizards tail, *Saurus cernuus*; and bald cypress, *Taxodium distichum*. Subdominants are Texas hackberry, *Celtus laevigata*; eastern cottonwood, *Populus deltoides*; and black willow, *Salix nigra*. Farther west and south, *Celtus laevigata*, *Populus deltoides*, and cedar elm, *Ulmus crassifolia*, become increasingly dominant. All of these give way to forms more typical of the marshlands or the beach communities as such factors as periods of soil inundation and salinity increase.

The Upland Plant Zones

Of the three upland plant zones forming the interior boundary of the coastal prairie and marsh zone, the timber belt has the greatest amount of woody vegetation (Fig. 4). It is characterized by extensive pine and pine-hardwood forests with intermittent swamps and occasional cultivated land or pasture land. Large areas of undisturbed vegetation in southeast Texas are referred to as the "Big Thicket," the preservation of which is the object of several conservation groups.

The major timber species in southeast Texas include the longleaf pine, *Pinus palustris*; loblolly pine, *P. taeda*; blackjack oak, *Quercus marilandica*; post oak, *Q. stellata*; and the red oak, *Q. rubra*. Many hardwoods such as elm, *Ulmus* spp.; magnolia, *Magnolia* spp.; hickory, *Carya* spp.; and maple, *Acer* spp., are also present in the overstory.

The post oak savannah begins near the western margin of Harris County and terminates near the western margin of Victoria County (Figs. 4, 5). Dominant woody species include *Quercus marilandica*, *Q. stellata*, and black hickory, *Carya texana*. Major grasses include little bluestem, *Schizachyrium scoparium*; switch grass, *Panicum virgatum*; purple-top, *Tridens flavus*; silver bluestem, *Bothriochloa saccharoides*; wintergrass, *Stipa leucotricha*; and *Chasmantium sessiliflorum*.

The eastern margins of the Rio Grande Plains extend from approximately the northern margin of Refugio County south to beyond the Rio Grande Delta (Figs. 5, 6). It is characterized by short live oaks, *Quercus virginiana*; *Q. stellata*; and honey mesquite, *Prosopus juliflora*, the latter species frequently being an indicator of overgrazing. Numerous grasses are interspersed in the grasslands, including species of *Setaria*, *Paspalum*, *Chloris*, and *Trichloris*. Low saline areas are characterized by Gulf cordgrass, *Spartina spartina*; sacaton, *Sporobolus wrightii*; and saltgrass, *Distichlis spicata*.

In the extreme southern part of the Rio Grande Valley, small groves of a native palm, *Sabal texana*, still survive the encroachment of agriculture. In these groves and in the surrounding country occur shrubs, vines, and herbs that have their affinity farther to the south.

GEOLOGY

Geological History

During the last Pleistocene glacial stage (the Wisconsin), the sea was about 450 feet (137.3 m) lower than it is today, and the shoreline was from 50 to 140 miles (80.5 to 225.4 km) seaward of the present shoreline (Le Blanc and Hodgson 1959). Rivers such as the Sabine, Trinity, Brazos, Colorado, Guadalupe, Nueces, and Rio Grande flowed across this broad plain, deeply eroding trenches (Fig. 7A) that were often more than 100 feet (30.5 m) below the adjacent upland surface (Van Siclen 1961). During this period the valley surfaces attained much of their final forms, now preserved beneath the alluvium that filled most of the valleys. As the last of the great Pleistocene glaciers melted during the early Recent, the sea rose and drowned the lower portions of rivers, thereby forming a series of estuaries (Fig. 7B). The landward, or mainland shorelines of present-day Galveston, Matagorda, San Antonio, Copano, and Corpus Christi bays, and nearly all of Sabine Lake originated in this period.

About 5,000 years ago the sea level reached its present position (Le Blanc and Hodgson 1959), and the barrier islands and peninsulas were formed (Fig. 7C). The rising sea not only occupied the lower parts of valleys but it also weakened the river currents near river mouths, and this caused deposition of mud, sand, and gravel. This process continues to this day (Table 5).

Stevens (1951) discussed the silt loads of Texas streams in detail. A direct relationship exists between the size and load of each stream and the configuration and characteristics of the shorelines where the streams meet salt water. The streams with large drainage areas (the Brazos, Colorado, and Rio Grande rivers) possess large deltaic plains that have filled their estuaries. The smaller streams have considerably smaller deltas that are developing at the heads of the estuaries. The rates of change of depths due to shoaling or scouring in various Texas bays are listed in Table 6.

Price (1933) described the possible origin of certain marine terraces during the Illinoian-Wisconsin interglacial period of the late Pleistocene. Ingleside Lagoon and the mature barrier islands were probably formed when currents carrying sediments alongshore developed barrier islands and created the lagoon (Fig. 8A). As time progressed, the river carried sediments into the lagoon and built broad deltaic plains (Fig. 8B). When the Pleistocene glaciers developed (the Wisconsin, etc.), the sea level dropped, exposing a broad plain (Fig. 8C). The lagoon gradually filled with waterborne and wind-driven sediments, and the barrier islands became a terrace as high as 30 feet (9.2 m) in some places (Fig. 8D).

The present barrier islands—Galveston, Matagorda, St. Joseph, Mustang, and Padre islands—and the Bolivar and Matagorda peninsulas are the results of processes similar to those that formed the marine terraces described above. They originated near the end of the late Pleistocene with rising sea level and developed further in the early Recent. Originally many began as narrow strips of land, but coastal deposition of sediments in association with longshore currents, winnowing processes, and bayward sediment deposition increased their lengths and widths to present dimensions. The result was separation of the lagoons from the Gulf.

The building of a second Colorado River Delta below Matagorda is unique in the geology of the Gulf coast. A log jam developed in the Colorado River prior to 1690 below the town of Bay City and above the town of Matagorda (Wadsworth 1966). Between 1925 and 1929 the log jam and associated debris were removed from the stream by a dredging company, and the accumulated sediments in the river were carried downstream where a delta developed rapidly on the original undivided eastern arm of Matagorda Bay. Growth of the Colorado River Delta between September 1908 and April 1941 is shown in Figure 9.

In 1936, a channel for handling flood discharges from the Colorado River was cut through the delta and Matagorda Peninsula to the Gulf (Wadsworth 1966). Most of the spoil from the dredging was placed along the western bank of the channel. In August 1940, the U.S. Army Corps of Engineers cut the Gulf Intracoastal Waterway through land paralleling the northern shores of East Matagorda Bay, eastern Matagorda Bay, and across the northern limits of the developing delta near Matagorda. The spoil deposition and additional growth of the delta from these dredging activities severely limited the once flourishing oyster-fishing industry in eastern Matagorda Bay (Weeks 1945). A paved road has since been constructed along the east bank of the channel between Matagorda and the Gulf of Mexico. Large trees and other vegetation on sides of the channel now mark the site of waters once forming the undivided eastern arm of Matagorda Bay.

Formations

Exposed geologic formations on the Texas coast are chiefly late Pleistocene or Recent. Pleistocene formations consist of inland sediments, usually 5 feet (1.5 m) or more thick. They occur in the uplands and generally lie between the alluvial valleys of the major rivers (Figs. 10-12). The deposits forming the inland boundaries are primarily Beaumont clays between Sabine Lake and the Laguna Madre. Also, Live Oak Bar and Ingleside formations are situated primarily between San Antonio Bay and the upper Laguna Madre. All are underlain by increasingly older Pleistocene deposits.

The Recent deposits consist of broad alluvial river valleys, low-lying lands characterized by salt marshes, filled river valleys, barrier islands, and peninsulas.

Aquifer Systems

Geologic formations that yield water to wells are known collectively as the Gulf Coast Aquifer Sands and consist of interbedded layers of sand and clay on the Texas coast. These formations occur at the surface throughout the region and dip gently beneath the surface toward the Gulf of Mexico (Winslow 1961). Their dip is greater than the slope of the land surface and, therefore, the formations at the outcrops are beveled by the land surface. The alternation of sand and clay layers and their structure are ideal for the occurrence of artesian water (Fig. 13).

The predominantly sandy zones shown in Figure 13 are the important water-producing formations. These zones consist of extremely irregular beds of sand and gravel and some beds of silt and clay that may grade into each other laterally and vertically in relatively short distances. The predominantly clayed zones shown in the section are more persistent than the sandy zones and contain many irregular sandy beds. The crosshatched boxes on the cross section indicate the zones now being exploited extensively in the Houston region. Some of the deep formations, although not now used, could yield additional large supplies of groundwater of usable quality to wells in the northern part of the region.

Rainwater enters the outcropping sandy zones as recharge, moving down the dip of the beds to the wells. Originally, wells throughout the Gulf coast aquifer region flowed above the land surface. However, extensive pumping in some areas had caused water levels in the wells to decline; by 1961 the water levels had dropped to as much as 270 feet (82.3 m) below sea level in the Pasadena area where pumping is the greatest (Winslow 1961).

Groundwater temperature in the Houston region is about the same—68°F (20°C)—as the average air temperature. Temperature increased about 1°F for each 200 feet (61 m) depth to about 1,600 feet (488 m). Below 1,600 feet, the average rate of increase is slightly greater. See Winslow (1961) for data on mineral content.

Figure 13 shows the approximate position of salt water in the formations underlying the Houston-Galveston area and may typify conditions throughout the coastal region. The salt water probably was present in the sediments at the time of their deposition. As sea level fell, freshwater began to percolate through the formations, tending to flush out the salt water; incomplete flushing of the deeper formations resulted in retention of much salt water.

ESTUARINE BOTTOM SEDIMENTS

The distribution of bottom sediments in six of the seven estuarine study areas is summarized in Figures 14 through 19. Only Sabine Lake remains univestigated. The results vary because of the types of techniques used to analyze sediments. Should detailed data on sediments be desired for Texas estuaries, the reader should contact Shell Oil Company, Humble Oil and Refining Company, or other oil companies headquartered in Houston where maps are available for scientific study.

STREAM DISCHARGE

Diversity of stream flow on the Texas coast exceeds that of the other Gulf states because the coast lies in the transition zone between the humid southeastern United States and the arid plateau of Mexico and Texas. One result is that streams of the upper Texas coast display relatively uniform seasonal flow while those of the central and lower coast have frequent periods of low or no flow.

With two exceptions, Tables 7-1 through 7-31 record discharge data from water supply publications of the U.S. Geological Survey of all gaged streams which empty into Texas estuarine areas. Data for the San Jacinto River (Sam Houston Dam spillway) were computed from a scale of water heights prepared by the Department of Civil Engineering, University of Iowa, Iowa City, Iowa; those of the Rio Grande were furnished by the International Boundary Commission, U.S. Section, El Paso, Tex. In each table, the data through the "Mean" line were copied as they appeared in these publications. Monthly means were calculated to the nearest whole number when the mean exceeded 99.9, to the nearest tenth when the mean fell between 10.0 and 99.9, and to the nearest hundredth when the mean fell between 1.00 and 9.99. The number in the lower right corner of each table (under "The Year" and to the right of "Mean") is the mean of "The Year" column not the "Mean" line; it differs slightly from the number calculated by averaging monthly means because individual figures in "The Year" column are calculated from the sum of daily discharges divided by 365 (or 366), not from the sum of monthly mean discharges divided by 12.

Table 8 shows the combined average discharge of gaged streams on the Texas coast and the volumes of the seven estuarine systems. The trend is toward smaller streamflow with distance west and south; in fact, the flow to Sabine Lake and Galveston Bay accounts for over three-quarters of the flow to all Texas estuaries.

PRINCIPAL ENVIRONMENTAL PROPERTIES

Because of their relatively shallow depths and broad surfaces, Texas estuaries are vulnerable to sudden and often drastic environmental changes. Sudden drops in water temperature caused by cold fronts have been known to produce fish kills often over a wide area. Moreover flood dishcarges from contributing watersheds may suddenly depress salinities throughout an estuary, destroying or severely reducing one or more of its fisheries. Personnel of the Texas Parks and Wildlife Department described a sudden freshening of Corpus Christi Bay due to floods that destroyed the oyster fishery in 1963.

Temperature

Table 9 contains average and extreme low February surface water temperatures and average and extreme high July temperatures from seven locations on the Texas coast. Temperature extremes greater than those cited in Table 8 often occur in shallow isolated pockets where there is little tidal exchange. Personnel of the Galveston Laboratory, National Marine Fisheres Service, NOAA, recorded a February low of 3°C and a July high of 39°C in parts of Galveston Bay between 1963 and 1966.

Fish kills frequently accompany rapid temperature decreases that result from the sudden arrivals of cold fronts in late fall and winter (Gunter and Hildebrand 1951). They occur most frequently on the upper Texas coast. Gunter (1941) found that rapid temperature drops —one as great as 40°F (about 22°C) within a 4-h period—have resulted in the death of millions of marine organisms. A change of 20°F (about 11°C) within a 5-day period is not unusual (Skud and Wilson 1960).

Unpublished data in files of the Galveston Laboratory show that in relatively deep water, including navigation channels, surface water is generally warmer than bottom water in summer and cooler than bottom water in winter. However, the mixing of waters by wind and tide tends to equalize surface and bottom temperatures in shallow areas.

Salinity

Except for unusaully high salinity in the Laguna Madre, and occasional periods of extremely low salinity in Corpus Christi Bay, the salinity in Texas estuaries generally lies between about 5 and 25‰ (Figs. 20-27). Hedgpeth (1953) noted that salinities above 70‰ were not uncommon in the upper Laguna Madre, including a record high of 113.9‰ between 1946 and 1948 before the dredging of the Gulf Intracoastal Waterway in 1949. However, extremes of 55‰ to a low approaching that of seawater were recorded in 1963 and 1965 in the upper Laguna Madre (Fig. 26). The Laguna Madre, unlike other Texas estuaries, has no major stream discharging into it. Other salinity extremes, i.e., from a low of 1.5‰ to a high of 75.05‰, have been recorded in the upper reaches of Alazan Bay (Breuer 1957).

Corpus Christi Bay has received periodic flood discharges from the Nueces River, and these caused exceedingly low salinities throughout the bay. Personnel of the Texas Parks and Wildlife Department suggest that such flooding contributed to the virtual elimination of the once flourishing oyster fishery in the bay prior to 1963.

THE FAUNA

Like plants, animals are restricted to certain segments of the estuarine habitat according to their tolerance to chemical and physical conditions. Salinity is the factor most frequently considered. The faunal components of an estuary can be divided initially into two categories: incidental species and estuarine-dependent species. Incidental species are freshwater or ocean inhabitants that venture into the estuary accidentally, that perform no life function there other than possibly feeding, and that must return to the original habitat or eventually perish (Diener 1964). These forms are usually present in small numbers. Estuarine-dependent species are those that normally utilize the estuary during part or all of their life cycle for such purposes as breeding, feed, or developing into juveniles or subadults (Diener 1964).

Skud and Wilson (1960) divided estuarine-dependent species into transients and residents. The majority of the more abundant forms are transients, examples being menhaden, *Brevoortia* sp.; mullet, *Mugil* sp.; and shrimp, *Penaeus* sp. The transients are "semicatadromous" in that the adults spawn offshore and the young move into less saline waters. The residents, on the other hand, spend their entire lives within estuaries. The oyster, *Crassostrea virginica*, is one example of a resident.

The literature pertaining to the various aspects of the fauna of Texas estuaries is too voluminous to cite in detail in this publication. However, considerable information may be obtained from personnel of the Texas Parks and Wildlife Department at Seabrook, Rockport, and Austin, Tex. and from its series of Annual Reports, Marine Laboratory, Rockport, beginning in 1949. Much of the data include checklists of many species ranked according to their relative abundance.

The series *Contributions to Marine Science* (formerly *Publications of the Institute of Marine Science*), first published by the University of Texas in 1945, contains many papers on the biota of Texas coastal waters.

Clam Beds

The quahog clam, *Mercenaria mercenaria*, has supported essentially no commercial fishery in Texas since about 1900. Prior to 1900, a small fishery did exist. The species occurs in lower Galveston Bay near Port Bolivar and near Carancahua Reef in central West Bay and occupies a combined area of about 4 acres (1.6 hectares) (William R. More, Texas Parks and Wildlife Department, Seabrook, Tex., pers. commun.). A similar species, *M. campechiensis*, occurs in Mesquite Bay (Schultz 1962) and in South Bay (Breuer 1962a).

Other clams, *Rangia* sp., have been found from Sabine Lake to Copano Bay, but their local distribution has been studied only in Galveston Bay where *R. flexuosa* lives throughout much of Trinity Bay and in small areas in upper Galveston and East bays (C. R. Mock, National Marine Fisheries Service, NOAA, Galveston, Tex., pers. commun.).

Oysters

Oyster reefs of varying sizes are present in all of the estuarine systems of Texas but reach their best development between Galveston Bay and Corpus Christi Bay. The American oyster, *Crassostrea virginica*, is the species most frequently encountered, although another species, *C. rhyzophorae*, has been reported from the hypersaline waters of the lower Laguna Madre. Reefs formed by oysters are frequently extensive, and they often divide the bays into segments and alter circulation patterns.

Oysters are attacked by a variety of predators and parasites, and they are also susceptible to being covered by silt, not only through natural processes but by dredging and spoil deposition operations. Moreover, shell reefs that are important places for the setting of oyster larvae (spat) are being exploited for construction material in bays between Galveston and Corpus Christi.

Natural oyster reefs.—Natural oyster reefs are defined herein as reefs which have been built up over many years, perhaps centuries, and are open to public harvest. In addition to providing a valuable commercial fishery for the economy of the Texas coast, the reefs provide a habitat for various food organisms and shelter for many species of fish, several of which are valuable to sport and commercial fisheries. Figures 28 through 32 show the approximate locations of the major oyster reefs; Table 10 gives their areas.

Oysters grow wherever conditions are favorable—on pilings, bulkheads, seawalls, and on reefs ranging in size and shape from small mounds to long ridges extending several miles. Oysters of premium commercial quality are found near the mouths of typical estuaries where salinity ranges from 10 to 30‰. Here, growth is rapid and the fluctuating salinities reduce predation. Oyster growers often plant medium-sized specimens in waters where salinity is about 25‰ and harvest them before predators and parasites become established (Butler 1954).

Breuer (1962a) believes that certain oysters in the lower Laguna Madre may represent a distinct physiological race because they spawn and grow rapidly in salinities greater than 40‰.

Of the 3,242,000 pounds (1,471,868 kg) of oyster meat taken from Texas waters in 1968, about 88% came from Galveston Bay (Orman H. Farley, Branch of Statistics and Market News, National Marine Fisheries Service, NOAA, Galveston, Tex., pers. commun.). The potential harvest from Galveston and from other bays is endangered by steadily increasing pollution.

Private oyster reefs.—Figures 28 through 32 show the locations of private oyster leases as of 1 May 1967 in the estuaries between Galveston and Corpus Christi bays, and Table 10 gives their acreage. Leases are granted to individuals or corporations upon application to Texas Parks and Wildlife Department, Austin, Tex. A total of 5,219 acres (2,113 hectares) of bay bottom is currently leased for oyster cultivation.

Commercial fishermen hold several leases in areas where oysters do not occur naturally. They obtain oysters from reefs (public or private) in the areas designated as unsuitable for commercial shellfishing due to poor water quality and transport them to their leases where water quality is acceptable. Here the oysters remain, generally for about 1 mo, until they rid themselves of undesirable foreign matter. They are then harvested and placed on the market. This practice is overseen by the Texas Department of Health.

Artificial reefs.—Figures 33 through 38 show the locations of artificial fishing reefs established by the Texas Parks and Wildlife Department, and Table 11 gives known statistics. They were established for the purpose of oyster research.

POPULATIONS

Paralleling a national trend, the population of counties and cities larger than 2,500 bordering Texas estuaries has increased steadily since 1850 (Tables 12-14.7). Nueces County experienced the most rapid rate of increase—from 698 in 1850 to 237,544 in 1970. The Corpus Christi area began rapid growth with the development of chemical, petroleum, and shipping industries after World War II. Other growth centers are Harris County (includes Houston), which increased from 4,668 in 1850 to 1,741,912 in 1970, and Jefferson County (Beaumont and Port Arthur), which increased from 1,836 to 244,773 in the same period. The City of Beaumont recorded the greatest relative growth from a population of 151 in 1850 to 115,919 in 1970. In the same period the population of Houston increased from 2,396 to 1,232,802.

Vulnerability to hurricanes have slowed or discouraged development in Galveston, Matagorda (Matagorda County), and Indianola (Calhoun County). Galveston renewed its growth after temporary slowdowns in the late 19th century and in the early 1900's, but Matagorda remains a small town of 700, and Indianola no longer exists.

Population projections reflect the industrial potential of such cities as Houston, Corpus Christi, Beaumont, and Port Arthur (Table 15). Many other communities should grow because they are either commuter towns near major cities or because they contain industries, tourist attractions, or outstanding recreational facilities. Although population density based on county statistics is greatest in the Galveston Bay area, high densities exist also on the western shore of Sabine Lake and on Corpus Christi Bay (Tables 14.1-14.7).

ECONOMIC DEVELOPMENT

The production of minerals, petrochemical manufacture, construction, agriculture, shipping and shipbuilding, miscellaneous manufacturing, and tourism are major socioeconomic activities along the Texas coast. Sport and commercial fisheries and waterfowl hunting, also important activities, are described in a subsequent section.

The following narrative describes the commerce and agriculture in the 18 counties and Cameron Parish, La. that lie contiguous to the seven estuarine study areas of Texas. Data for Cameron Parish were obtained from Parish officials at Cameron. Data for the Texas counties were compiled by the U.S. Bureau of Census in 1963 and published in the Texas Almanac (A. H. Belo Corporation 1967).

Industries

The centers of commerce and industry on the Texas coast are centered about the Houston-Galveston, Corpus Christi, and Beaumount-Port Arthur metropolitan areas. These centers are, in turn, supported by a large mineral producing industry which had its beginning near Beaumont when the Spindletop Field began producing in 1901. Table 16 summarizes mineral production on the Texas coast, and Table 17 lists the major features of commerce and industry.

The City of Houston, the most populous city of Texas, is the nation's third ranking seaport and a leading center for petrochemicals, petroleum production, and related supplies. Houston is also a center for pipeline transmission, and a large science-based industry which is centered primarily about the nearby Lyndon B. Johnson Manned Spacecraft Center in the Clear Lake area. Outlying communities such as Pasadena, Channelview, Deer Park, and Baytown are sites for numerous petrochemical plants and refineries which line the Houston Ship Channel.

Like Houston, Beaumont-Port Arthur and Corpus Christi are also centers for the petrochemical industry, which is supported largely by nearby productive mineral deposits. These centers are also major termini for numerous railroads which carry large amounts of freight to their factories and processing plants and to their wharves for shipping to distant ports.

Agriculture

The agriculture of the Texas Gulf coast is based on beef cattle and cotton. Other valuable products include rice in the upper section of the coast and citrus fruit in the Rio Grande Valley. The features of this agrarian economy are summarized in Table 18.

In addition to the features described in Table 18 each county has numerous agribusiness establishments related to the agricultural products of the area. Large grain storage facilities are located at Corpus Christi and Houston. Cotton gins are situated in Calhoun, Jackson, Matagorda, Nueces, Refugio, San Patricio, Victoria, and

Willacy counties. Saw mills and rice mills are located in Jefferson and Orange counties.

Fisheries and Waterfowl Hunting

Commercial fisheries.—Tables 19.1 through 19.5 show the 1968 commercial fish harvest from Texas waters including the Gulf of Mexico. Information of this type is collected and summarized by the Division of Statistics, National Marine Fisheries Service, NOAA, Galveston, Tex. Most of the harvest, in terms of poundage and value, consists of species classified as estuarine-dependent (Skud and Wilson 1960; Diener 1964). For the period 1960-68, estuarine-dependent species comprised about 98% (by poundage) of the catch in all but 2 yr. In 1960 and 1961 these species comprised 96 and 70% of the catch, respectively, and these values reflected drops in the shrimp and menhaden harvest. The reduction in percentage of estuarine-dependent species in the catch was most pronounced in 1961 when shrimp trawling was prohibited in Sabine Lake and the shrimp harvest was low. Large-scale menhaden, *Brevoortia patronus*, and commercial shrimp, *Penaeus aztecus* and *P. setiferus*, make up the bulk (by weight) of the catch of estuarine-dependent species.

Dockside value of the Texas catch has followed similar trends for the same period. Estuarine-dependent species comprised 89% of the value of the catch in 1960 and 1961, the percentage increased to 91% in 1962, and it remained around 99% through 1968. The species of greatest value are the shrimp.

The value of Texas landings continues to rise, chiefly due to inflation. For example, the 223 million pounds landed in 1960 were valued at $25.3 million, and the 127.6 million pounds landed in 1968 were valued at $43.7 million. The decline in catch of menhaden accounts for most of the drop in poundage, while the increase in value of shrimp and oysters accounts for the steady increase in value of the catch.

Table 20 summarizes the status of the commercial fishing industry in Texas for 1967. The Galveston Bay area contains the greatest number of seafood processing plants, but the greatest number of people in the fishing industry are employed in the Brownsville (Laguna Madre) area. Oyster processors predominate in the Galveston area, and shrimp and general seafood processors predominate in the Brownsville area. The products of shrimp and general seafood processors rank first and second, respectively, in terms of gross wholesale value.

Sport fisheries and waterfowl hunting.—Table 21 summarizes the status of sport fishing and waterfowl hunting on the Texas coast during 1968. Galveston Bay has the most sport fishing pressure—2,186,800 man-days—while the Sabine Lake area shows the least amount of pressure—85,000 man-days.

According to Belden Associates (1960), the foremost popular sportfishes are spotted seatrout, *Cynoscion nebulosus*; redfish or red drum, *Sciaenops ocellata*; drum, Sciaenidae; and assorted Flounder, *Paralichthys* sp. There is some confusion with the term "drum," as this probably includes several species. Other fish, in order of number taken, include Atlantic croacker, *Micropogon undulatus*; sea catfishes, *Arius felis* and *Bagre marinus*; sand seatrout, *Cynoscion arenarius*; whiting, *Menticirrhus* sp.; sheepshead, *Archosargus probatocephalus*; red snapper, *Lutjanus campechanus*; Spanish mackerels, *Scomberomorus* sp.; Florida pompano, *Trachinotus carolinus*; and others.

A summary of waterfowl hunting is also given in Table 21. The greatest pressure is in the Galveston Bay area with 28,300 man-days, and the least amount of pressure is recorded for the Sabine Lake area.

The Texas coast is the terminus or stopover for many migratory game birds on the Mississippi and Central flyways. As a result, many species of ducks, geese, and other migratory game birds are to be found there during the winter.

POLLUTION

Of all of man's adverse effects upon the estuarine habitats of fishes and wildlife, pollution is one of the more insidious and most destructive. Depending on the nature and amount of pollutant, damage to an estuary may range from rendering a segment of the estuary unsanitary for human use to alteration of the water chemistry and destruction of bay bottom, vegetation, and biota. This problem of pollution is expected to worsen as domestic and industrial growth occurs.

In the past, documentation of the occurrence of pollution in the coastal waters of Texas has not been thorough or complete, but such documentation is improving. An increasing number of pollution sources are being located, and others are being monitored more frequently. New and improved water treatment facilities are being constructed along the coast for the treatment of domestic and industrial wastes.

Due to increasing public concern, the types of pollution being monitored are also increasing. For example, in 1967, the U.S. Geological Survey initiated a program of monitoring the types and quantities of agricultural pesticides at selected stream gaging stations throughout Texas. It can be expected that all Federal, State, and local agencies concerned with pollution and its control will increase their surveillance as laws and funding enable them to do so.

Domestic Wastes

Data on quantity and quality of discharges of domestic wastes are collected by the Texas Water Quality Board. Examples of such data are presented in Table 22, based on a survey taken during 1967-1969.

Table 22 contains data on discharge volume, BOD (Bioglogical Oxygen Demand), ortho-phosphates, nitrogenous compounds, suspended solids, and chlorides, and the sampling, done on an irregular basis, is continuing. Table 22 gives information on known outfalls within the seven estuarine study areas of Texas, and Figures 39 through 45 show the approximate locations of these outfalls. Locations of all outfalls except those in the Galveston Bay area may be identified with those in Table 22 through Texas Water Quality Board Permit Numbers. Code numbers follow the permit number for the Galveston Bay area segment of Table 22 and correspond to numbers found on Figure 40.

Domestic pollution in Texas is being monitored, and the resulting data are being recorded by Federal and State agencies. The U.S. Public Health Service maintains, and is updating, domestic pollution data in its inventory of municipal and industrial waste facilities. The Texas Water Quality Board monitors effluent quality and quantity from domestic waste treatment facilities and establishes standards and policies which such facilities must follow.

Industrial Wastes

Unlike domestic wastes, industrial wastes are more varied and complex. Data on quality and quantity of effluent containing these wastes were taken from an assemblage collected by the Texas Water Quality Board, and they are presented in Table 23 based on a survey taken during 1967-69.

Table 23 contains data on discharge volume, pH, BOD, COD (Chemical Oxygen Demand), and major chemical characteristics, and the sampling, done on an irregular basis, is continuing. Information on known outfalls within the seven estuarine study areas of Texas is given in Table 23, and Figures 39 through 45 show the approximate locations of these outfalls. On the figures, locations of all outfalls except those in the Galveston Bay area may be identified with those in Table 23 through Texas Water Quality Board Permit Numbers. Code numbers follow the permit numbers for the Galveston Bay area segment of Table 23 and correspond to numbers found on Figure 40.

Like domestic pollution, industrial pollution in Texas is being monitored, and the resulting data are being recorded by Federal and State agencies. The U.S. Public Health Service maintains, and is updating, industrial pollution data in its inventory of municipal and industrial waste facilities. The Texas Water Quality Board monitors quality and quantity of effluent from industrial sites and establishes standards and policies which industry must follow.

Agricultural Pollution

Until 1967, no known attempt was made in Texas to monitor the quality and quantity of agricultural pesticides entering the waters of Texas. In 1967, the U.S. Geological Survey began to collect relevant data on some compounds from selected points on a random schedule. These compounds included Aldrin, DDT (1,1,1-trichloro-2,2-bis(*p*-chlorophenyl) ethane) and its by-products, DDD (6,6'-dithiodi-2-naphthol) and DDE (1,1-dichloro-2,2-bis-(*p*-chorphenyl)ethylene), Dieldrin, Endrin, Hepatachlor, Hepatachlor epoxide, Lindane, BHC (Benzene hexachloride), Menthol Parathion, Parathion, 2,4-D, Silvex, and 2,4,5-T.

Available data suggest that use of pesticides is seasonal and differs slightly between the upper and lower coastal regions (Childress 1965, 1966, 1967). Insecticides were found in Texas streams throughout the year, but they appeared to be more abundant between March and September. A peak appeared on the lower coast during March and on the upper coasts during April. Both coastal areas displayed declines in quantities of insecticides around September.

Herbicides appeared in Texas coastal streams throughout the year but were most abundant between March and August. There appeared to be little variation between upper and lower coastal areas.

Childress (1965, 1966, 1967) surveyed pesticide use on the Texas coast and reported on the amounts of these chemicals in the tissues of estuarine fishes, shellfishes, and certain birds. Sabine Lake, a well-known rice-producing area, was not surveyed. The rice-producing areas of the upper coast and the citrus fruit-producing areas of the lower coast received the greatest applications of pesticide. Tissues from samples of fish and oysters from all Texas bays contained pesticides, but highest concentrations were found in samples from the lower Laguna Madre.

Table 24 shows the extent of application and total amounts of pesticides present in water and sediment samples from selected Texas estuaries. The insecticides for which tests were made included DDT (also DDD and DDE), and Dieldrin, and the herbicides included 2,4-D, Silvex, and 2,4,5-T.

Condition of Estuarine Waters

Pollution from domestic, industrial, and agricultural sources is a threat to the estuaries of Texas. Large areas have been declared closed to shellfishing, especially the harvest of oysters, due to existence of various pollutants and associated high counts of coliform bacteria over long periods of time. Sabine Lake has been closed to the harvest of oysters (Fig. 39), and much of the Gulf Intracoastal Waterway which cuts through land areas is considered to be heavily polluted.

Figures 39 through 45 show the polluted and conditionally approved portions of the Texas estuaries—those areas where oyster fishing is prohibited or conditionally approved by the Texas State Board of Health—as determined by counts of coliform bacteria. Conditionally approved waters are those normally polluted but which may have sufficiently low counts of coliform bacteria over long periods of time to permit oyster fishing. Table 25 gives the approximate acreage of polluted (or closed) and conditionally approved waters in each of the seven Texas estuaries. The size of conditionally approved waters varies to some extent, depending upon the amount of runoff from the land and discharge from major tributaries. During periods of high discharge of freshwater, an area may be polluted, whereas during periods of low discharge the same area may be clean enough to allow oyster harvesting. The boundaries of polluted and conditionally approved shellfishing areas may be modified as determined by continuous sampling by the Texas Department of Health in cooperation with the Texas Parks and Wildlife Department, the Texas Water Quality Board, and several local and Federal agencies.

In the Galveston Bay area, oyster fishermen frequently take oysters from polluted waters and transplant them on private reefs in the approved waters of West Bay and lower Galveston Bay. This practice is described in detail in a previous section.

CHANNELIZATION AND FILL

A network of navigation channels constructed by the Galveston District of the U.S. Army Corps of Engineers and by numerous local groups interconnects the coastal areas. Local groups include navigation districts, oil companies, industrial firms, municipalities, county governments, and developers of both domestic and industrial properties.

hrough 48 show the general location of the Texas coast as described in Table

rmy Corps of Engineers, the largest navigation channels on the Texas coast, more than 1,050 miles (1,691 km) of nd proposes to construct an additional 45 (Table 26). The largest channel on the the Gulf Intracoastal Waterway which of the coast from east of the Sabine sabel and Brownsville.

he construction of navigation channels was first conducted by State or private rly as 1857, the first channelization in ea was completed. The State of Texas shallow-draft channel between Aransas risti bays. A number of other small dredged by various private interests eefs and through upland obstructions. ements began about 1892 with construc-l 5 feet (1.5 m) deep by 40 feet (12.2 m) Bay on the present Intracoastal Water-udies showed that a 9- by 100-foot (2.7-nnel was needed between the Sabine-ay and Corpus Christi.

nd faster boats came into use, it was arge the channel again. On 23 July 1942 as obtained to dredge the channel to 12 7 by 38.1 m) between the Sabine River . The amount of boat traffic and boat eased since 1942 and studies for the 16 by 150 feet (4.8 by 45.7 m) have .

s the channels maintained by the U.S. Engineers on the Texas coast. Included present or existing dimensions) and pro- or authorized) dimensions—length, bottom th at mean low tide (MLT). Generally, having dimensions greater than projected e constructed by local or private in-

fill in the bays of Texas resulted from spoil from the dredging of navigation es 49 through 55 show major fill areas. are based on modern charts and the vailable. The most significant fill areas bine Lake in which the Corps of Engi- designated a large area in the open ake for disposal of spoil (Fig. 49). The ty Dyke and Pelican Island in lower were built with spoil from construction of Harbor and numerous navigation channels.

SUMMARY

States Marine Fisheries Commission ini-ative inventory of U.S. Gulf of Mexico l years ago. This paper constitutes the n part of the Texas inventory. Similar ade simultaneously in Alabama, Florida, Mississippi.

tory combines original observations with e literature on dimensions, vegetation, ne bottom sediments, stream discharge, onmental properties, fauna (oyster and clam beds), human populations, economic development, pollution, and channelization and fill.

3. The length of the Texas Gulf coast is approximately 370 miles (595 km), and the coastal climate varies from humid to semiarid.

4. Estuaries of the Texas coast consist of two basic shapes: 1) simple (oval) and 2) complex (branching or dendritic). Sabine Lake is representative of the first category, and the remaining estuaries are of the second.

5. The open water area of major estuaries of Texas (1,532,430 acres = 620,634 hectares) is 0.74 times the area of America's largest estuary, Chesapeake Bay.

6. There are approximately 1,141,400 acres (462,267 hectares) of marsh vegetation (emergents) surrounding Texas estuaries and 249,365 acres (100,992 hectares) of submerged vegetation.

7. Geologically, Texas' Gulf coast estuaries were formed from either drowned river mouths or from the development of barrier islands and peninsulas. The Brazos, Colorado, and Rio Grande rivers possess large deltaic plains that have filled their estuaries. Aquifer systems in the Gulf coast consist of gently sloping interbedded layers of sands and clays. Exposed geologic formations are chiefly Recent or late Pleistocene.

8. Stream discharge on the upper Texas coast is much greater than that on the central and lower coast. The Sabine Lake and Galveston Bay areas receive over three-fourths of the total gaged discharge entering the seven estuarine areas.

9. Average February water temperatures range from 63.7°F (17.6°C) at Port Isabel to 55.6°F (13.1°C) in the Gulf at Galveston according to records of the U.S. Coast and Geodetic Survey. Average July water temperatures are about the same at all stations, ranging from 83.4°F to 87.4°F (28.5°C to 30.2°C).

10. Estuarine salinities generally range from about 5 to 25‰ except in the Laguna Madre area, where hypersalinity is common. Large rivers depress salinity at the heads of bays and throughout entire estuarine areas during periods of flooding. High salinities approaching 35‰ (the approximate salinity of Gulf of Mexico surface water) are common about tidal passes.

11. Estuarine faunal elements may be divided into two primary groups: incidentals which are typical of the freshwater or oceanic habitats, and estuarine-dependents which spend part or all of their life cycles within the estuary. Estuarine-dependent species are classified as transients that spend only a part of their life cycle in the estuary, or residents that utilize the estuary for their entire life cycles.

12. The total measured acreage of natural and private oyster leases on the Texas coast is 7,287 acres (2,951 hectares) and 5,190 acres (2,102 hectares), respectively. Oyster production is foremost in the Galveston Bay area where approximately 5,880 acres (2,380 hectares of natural or public reefs and 2,768 acres (1,120 hectares) of private leases are located.

13. Human population increased from 31,751 persons in 1850 to 2,962,125 persons in 1970 in Cameron Parish and Texas counties contiguous to the seven estuarine areas. Harris County had the greatest population in 1970 with 1,741,912 persons while Kenedy County had the least, 678 persons.

14. The extraction of petroleum, natural gas and natural gas liquids along with the manufacture of petrochemicals, miscellaneous chemicals, shipping, and ship-

building and repair are the most important commercial activities on the Texas Gulf coast. Other major socioeconomic activities include production of metal products, lumber and wood products, tourism, and recreational activities.

15. Texas coastal agriculture is based primarily upon the production of beef cattle and cotton. Rice is important to the economy of the upper Gulf coast of Texas while citrus fruit production is important to the Rio Grande valley.

16. Fisheries and waterfowl hunting are important to the Texas coast. Commercial fisheries yielded 7.7 million pounds from Texas waters in 1968. The gross wholesale value of fishery products during 1967 was valued at $95.2 million. Sportfishing and hunting activities on the Texas coast consumed approximately 6,395,500 and 66,200 man-days, respectively, in 1968.

17. Pollution from domestic and industrial sources has forced the closing of about 325,090 acres (131,661 hectares) to shellfishing. Of the total of about 1,532,430 acres (620,634 hectares) of open estuarine water in Texas, an additional 16,600 acres (6,723 hectares) of open estuarine waters have been closed on a conditional basis.

18. There are currently over 1,015 miles (1,634 km) of Federal navigation channels within the seven estuarine study areas. These channels, along with numerous private channels, destroy or seriously alter estuarine areas and adjacent marshlands. The most significant channelization has taken place in Sabine Lake and Galveston Bay where large areas of open estuarine waters have been displaced by large spoil areas. The largest channel is the Gulf Intracoastal Waterway which parallels the coast from Sabine Lake to Port Isabel.

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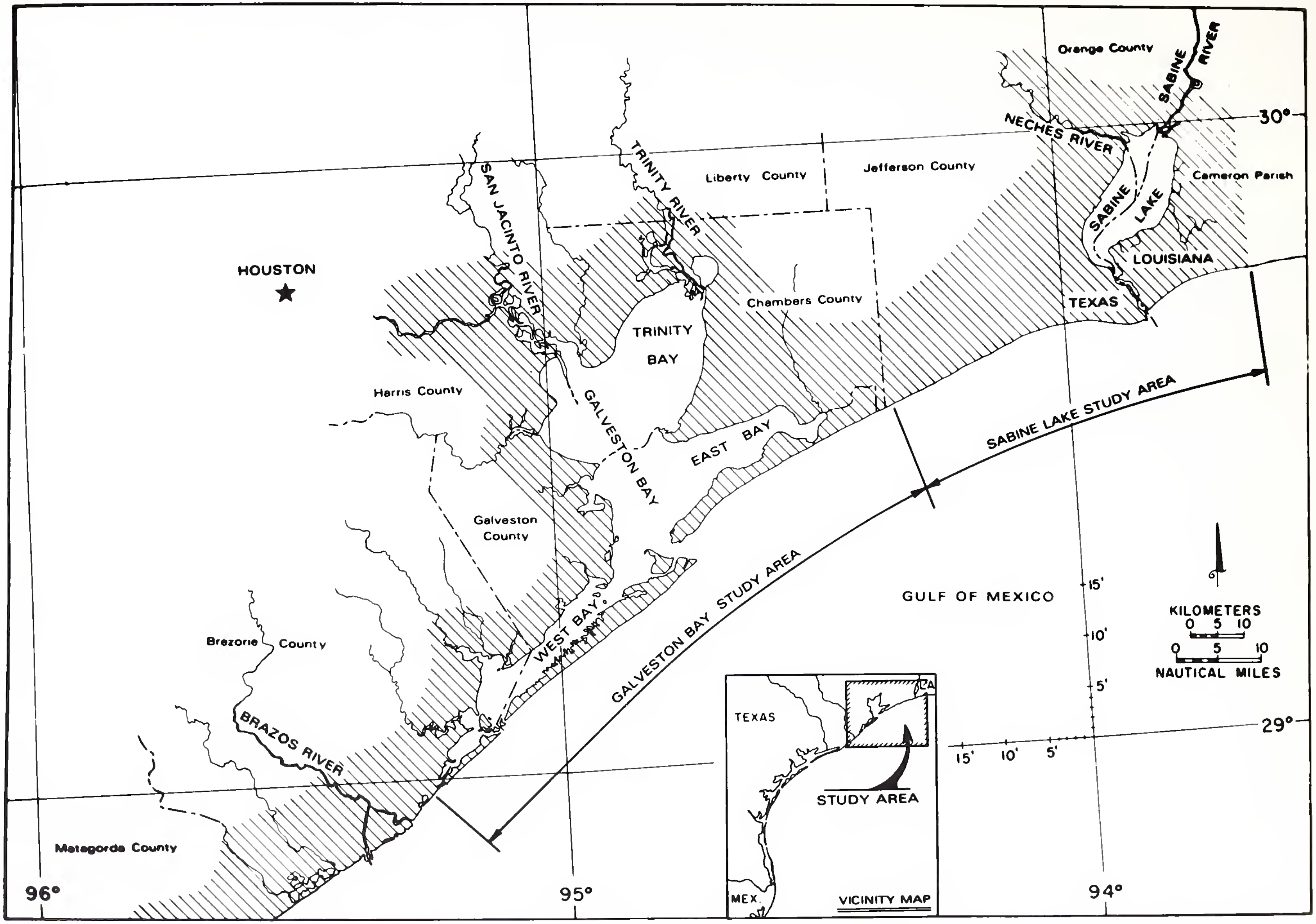


Figure 1.—The upper Texas coast and adjacent segment of Louisiana showing the Sabine Lake and Galveston Bay study areas. The shaded area approximates the extent of marsh vegetation.

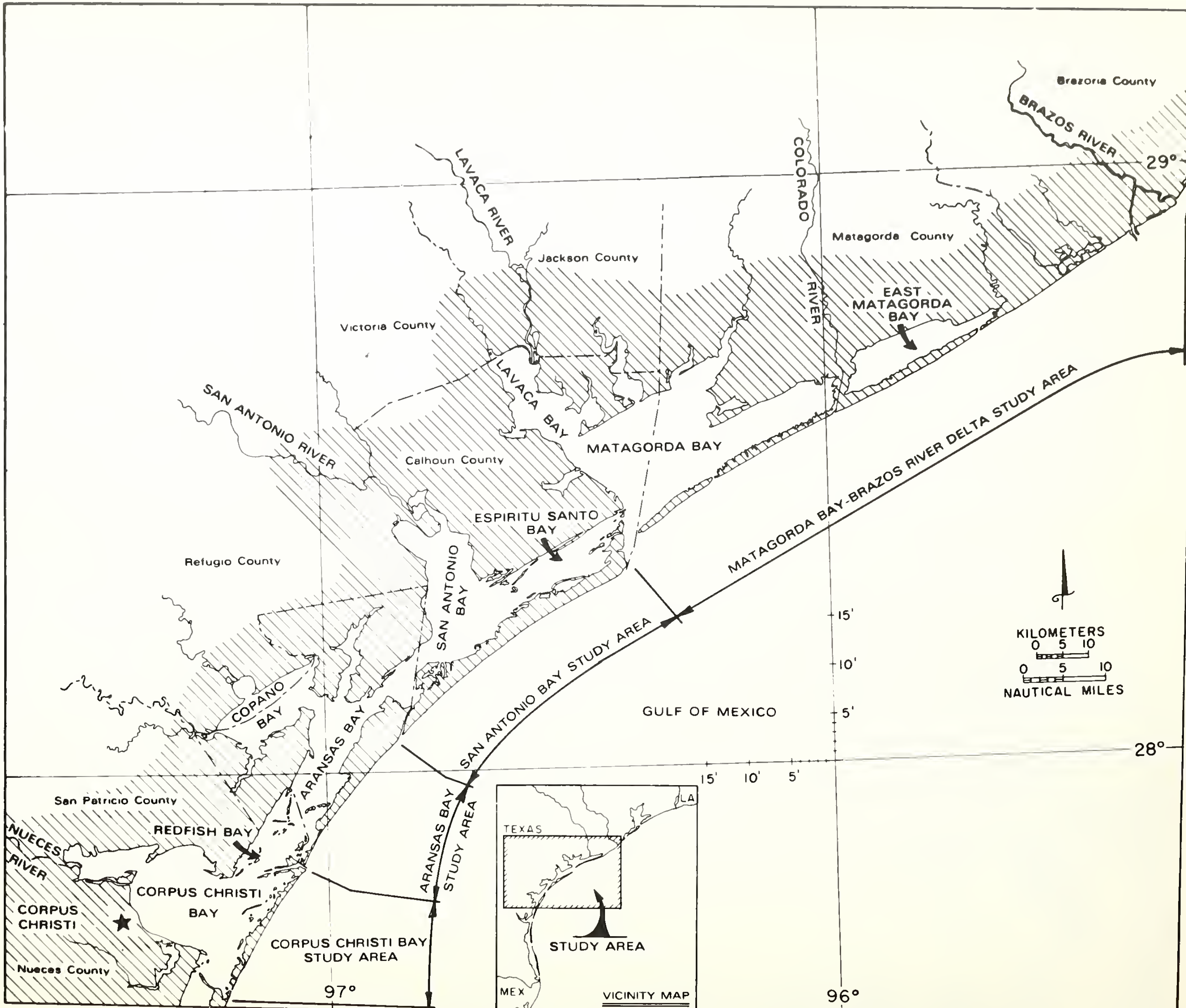


Figure 2.—The central Texas coast showing the Matagorda Bay-Brazos River Delta, San Antonio Bay, Aransas Bay, and Corpus Christi Bay study areas. The shaded

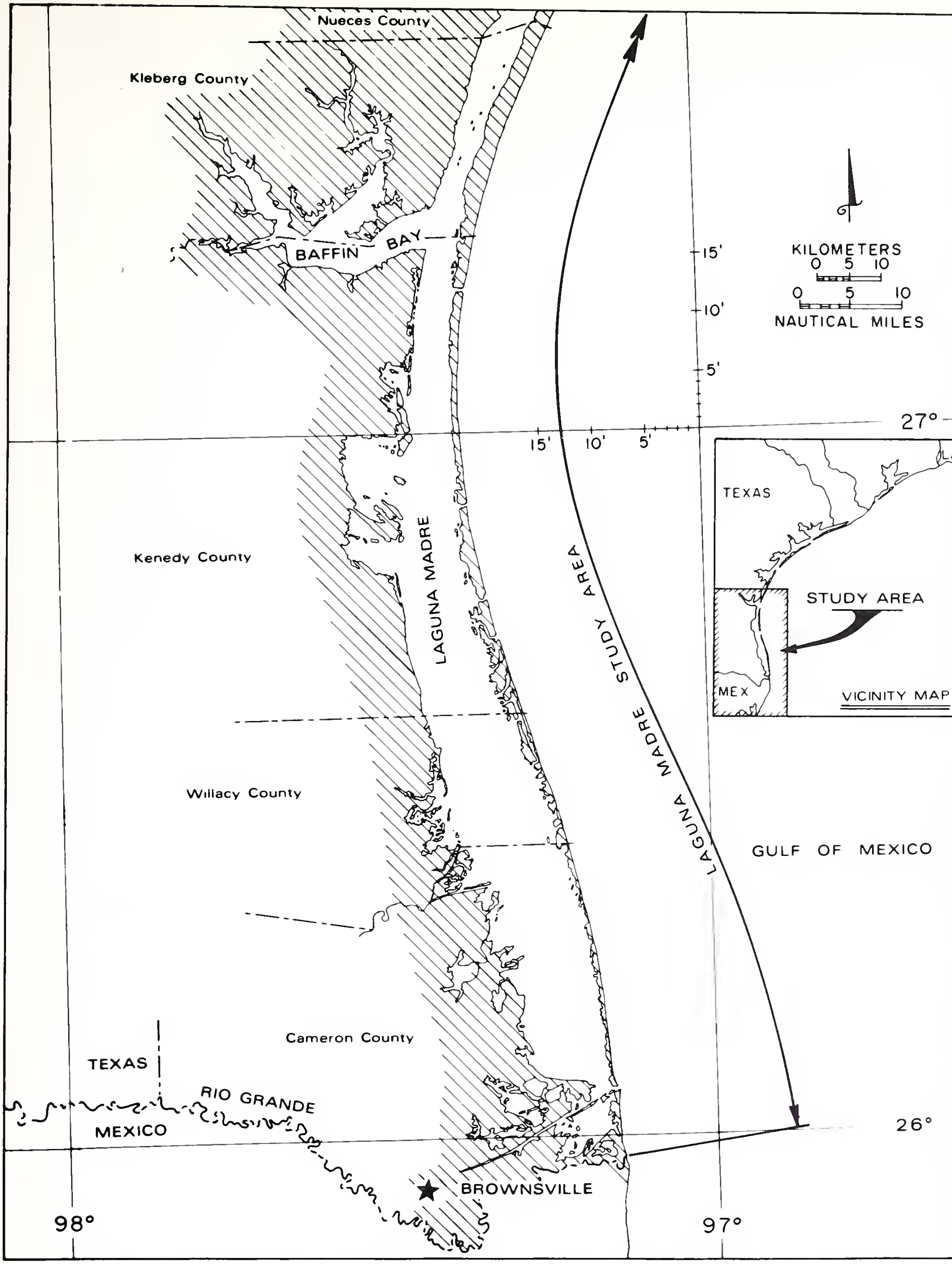


Figure 3.—The lower Texas coast showing the Laguna Madre Study area. The shaded area approximates the extent of marsh vegetation and tidal flats

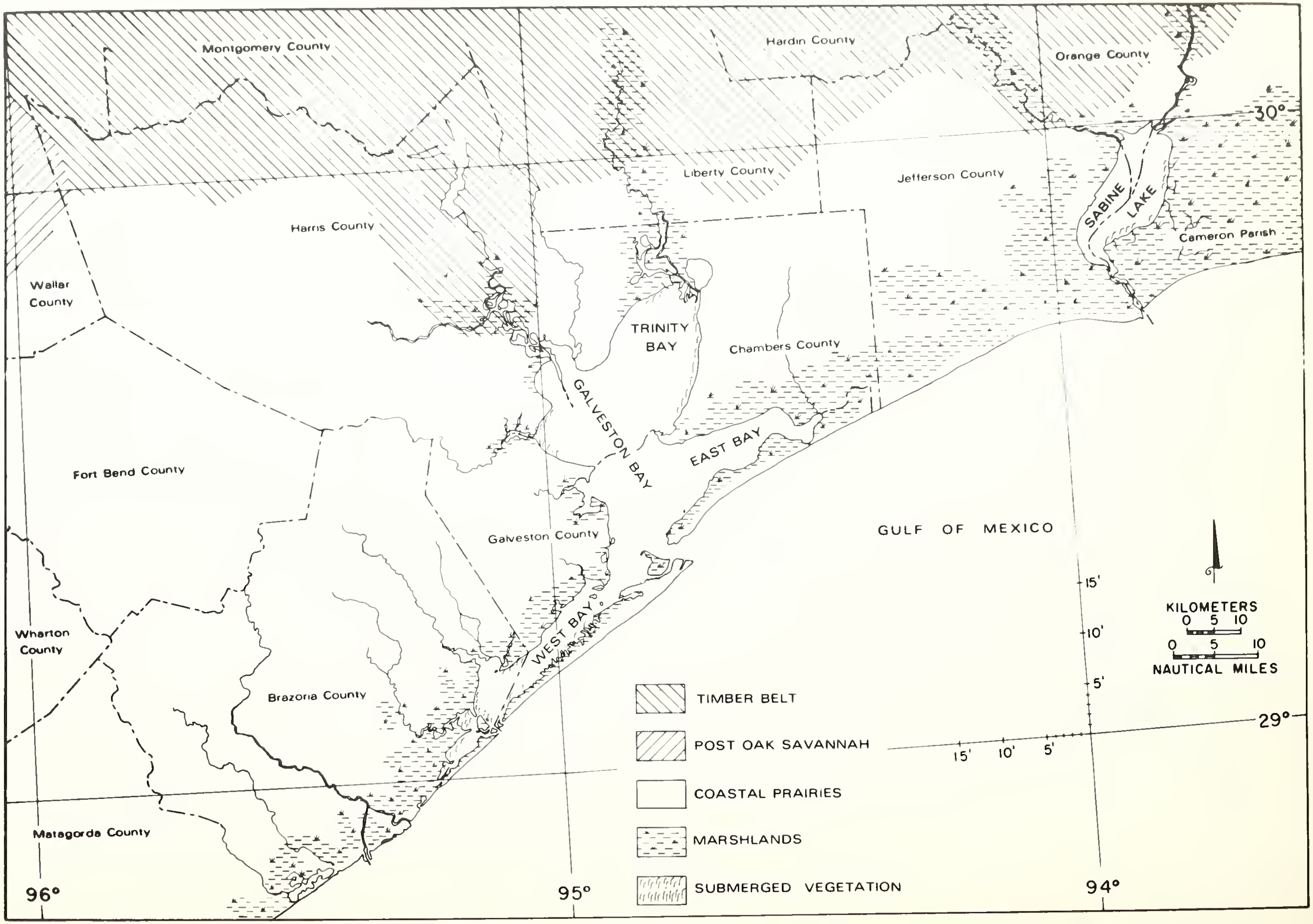


Figure 4.—Major vegetational areas along the upper Texas coast. (Modified from: Correll and Johnston 1970; unpublished data, Texas Parks and Wildlife Department.)

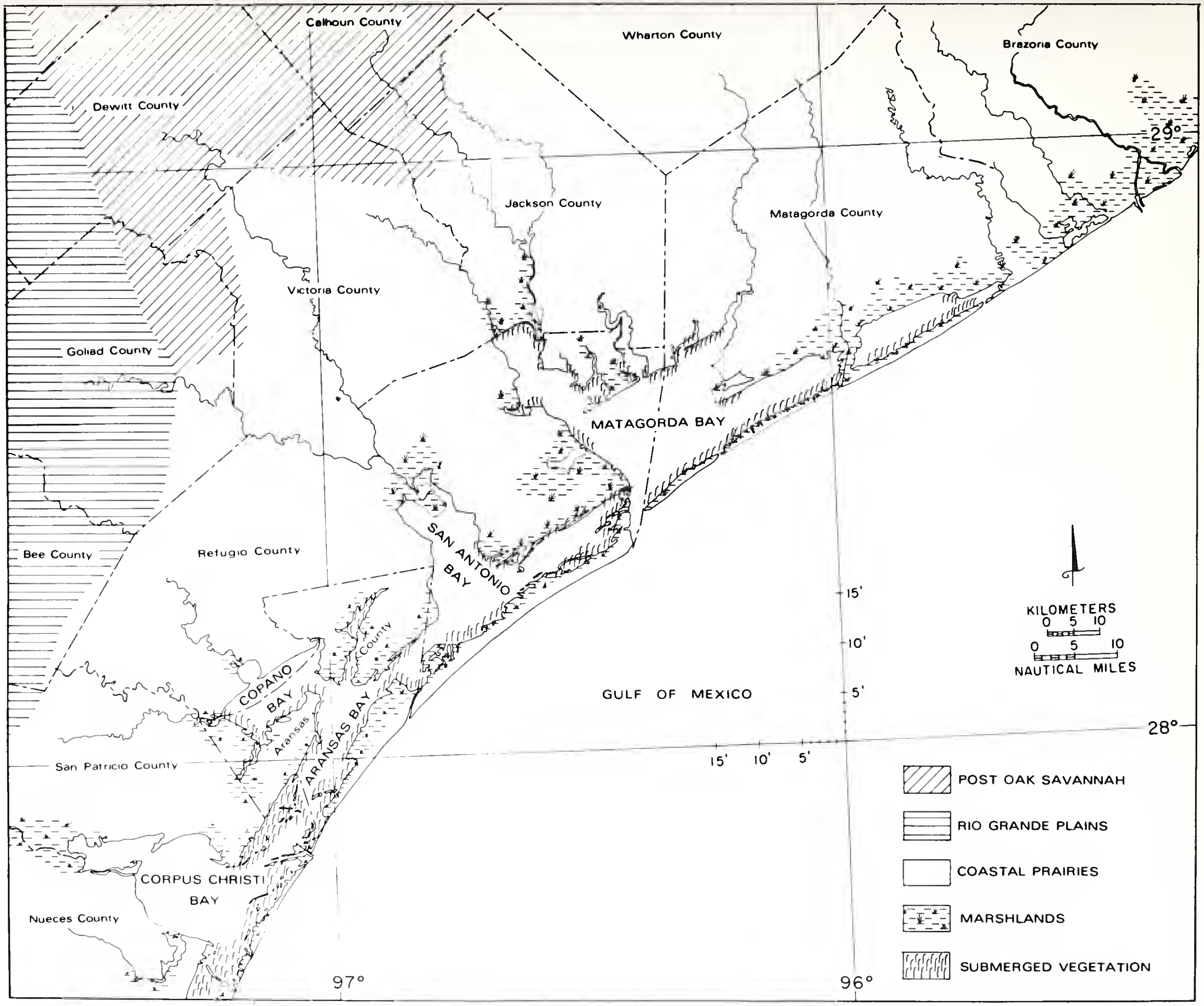


Figure 5.—Major vegetational areas along the central Texas coast. (Modified from: Correll and Johnston 1970; unpublished data, Texas Parks and Wildlife Department.)

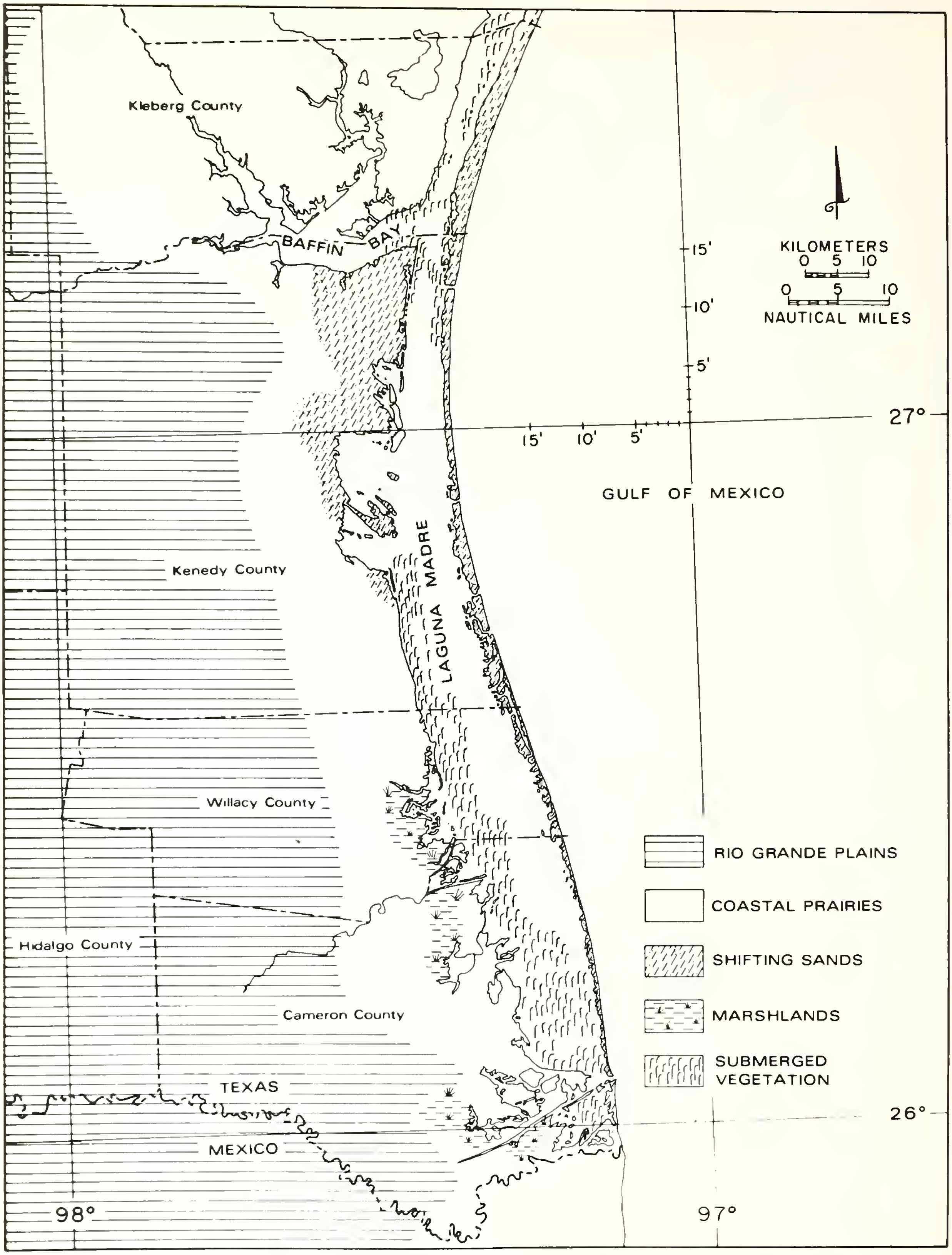


Figure 6.—Major vegetational areas along the lower Texas coast. Much of the Laguna Madre not occupied by submerged vegetation represents wind-blown soils with little or no vegetation. (Modified from: Correll and Johnston 1970; unpublished data, Texas Parks and Wildlife Department).

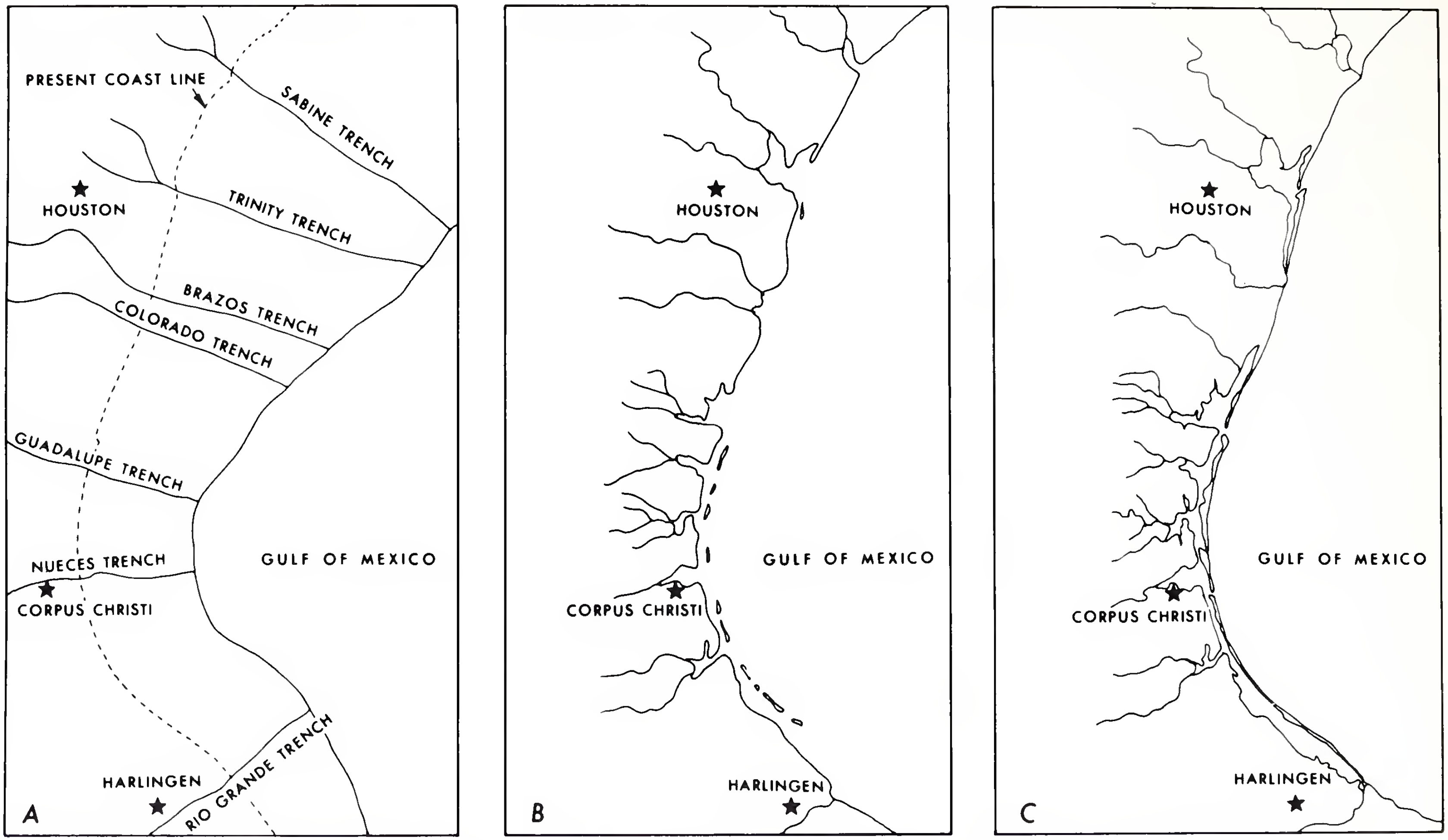


Figure 7.—The origin and development of the Texas shoreline: (A) the late Pleistocene following sea level stage; (B) the early Recent rising sea level stage; and (C) the Recent standing sea level stage. (After LeBlanc and Hodgson 1959.)

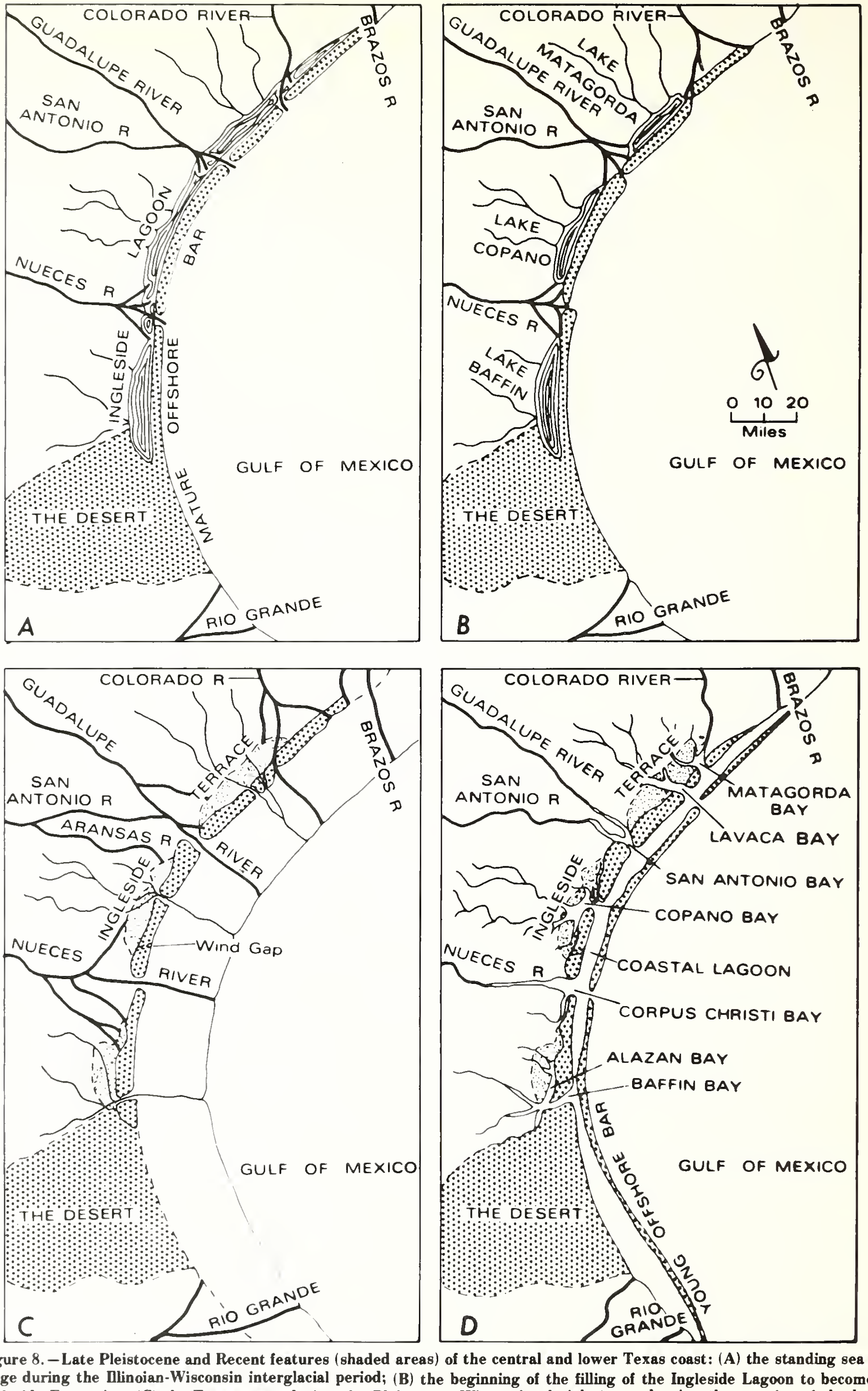


Figure 8.—Late Pleistocene and Recent features (shaded areas) of the central and lower Texas coast: (A) the standing sea level stage during the Illinoian-Wisconsin interglacial period; (B) the beginning of the filling of the Ingleside Lagoon to become the Ingleside Formation; (C) the Texas coast during the Pleistocene-Wisconsin glacial stage, showing the remains of the barrier islands and lagoons; and (D) developing features of the Recent standing sea level stage. (After Price 1933.)

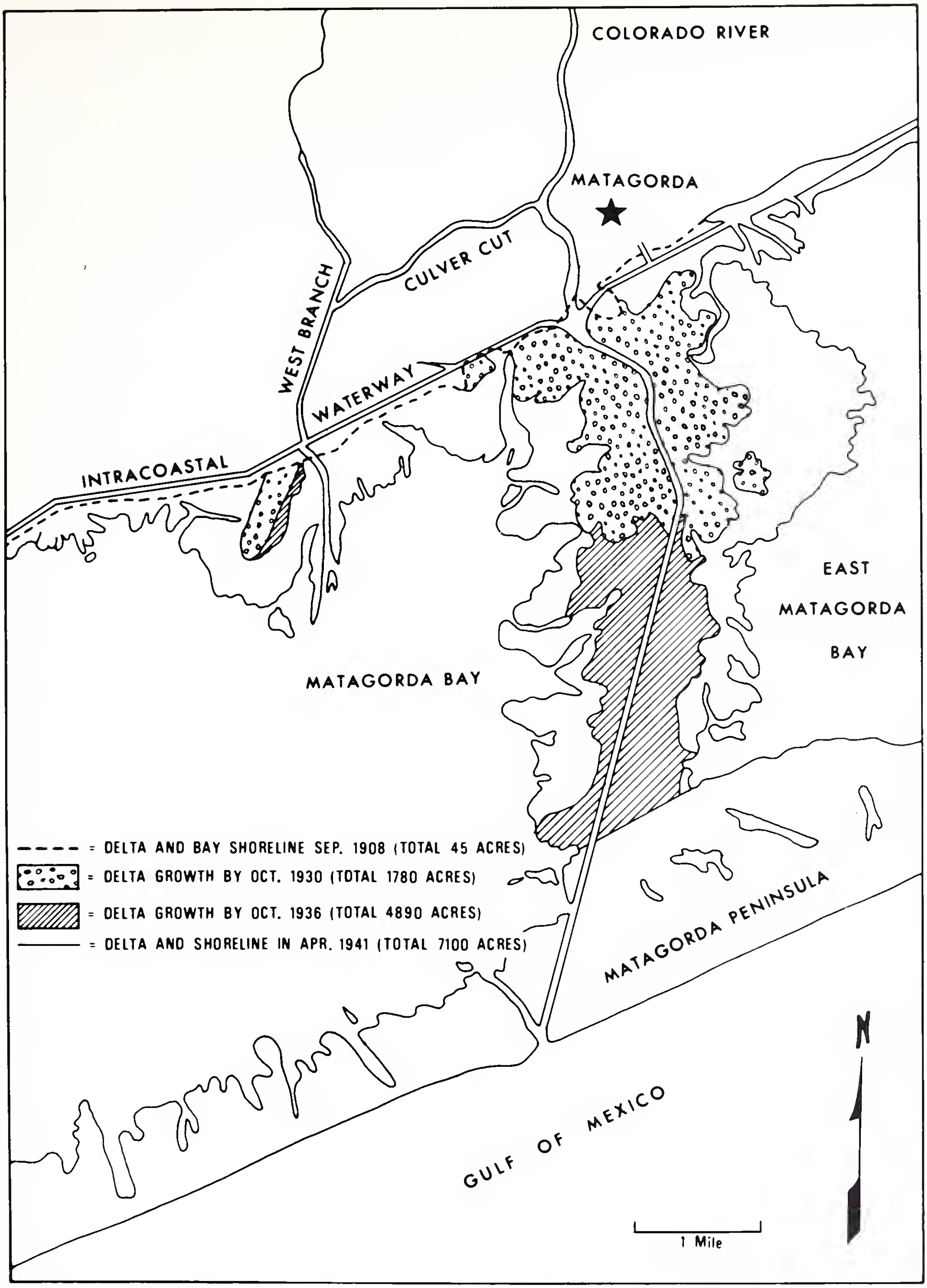


Figure 9.—Successive growth stages of the modern delta of the Colorado River, September 1908 to April 1941. (After Wadsworth 1966.)

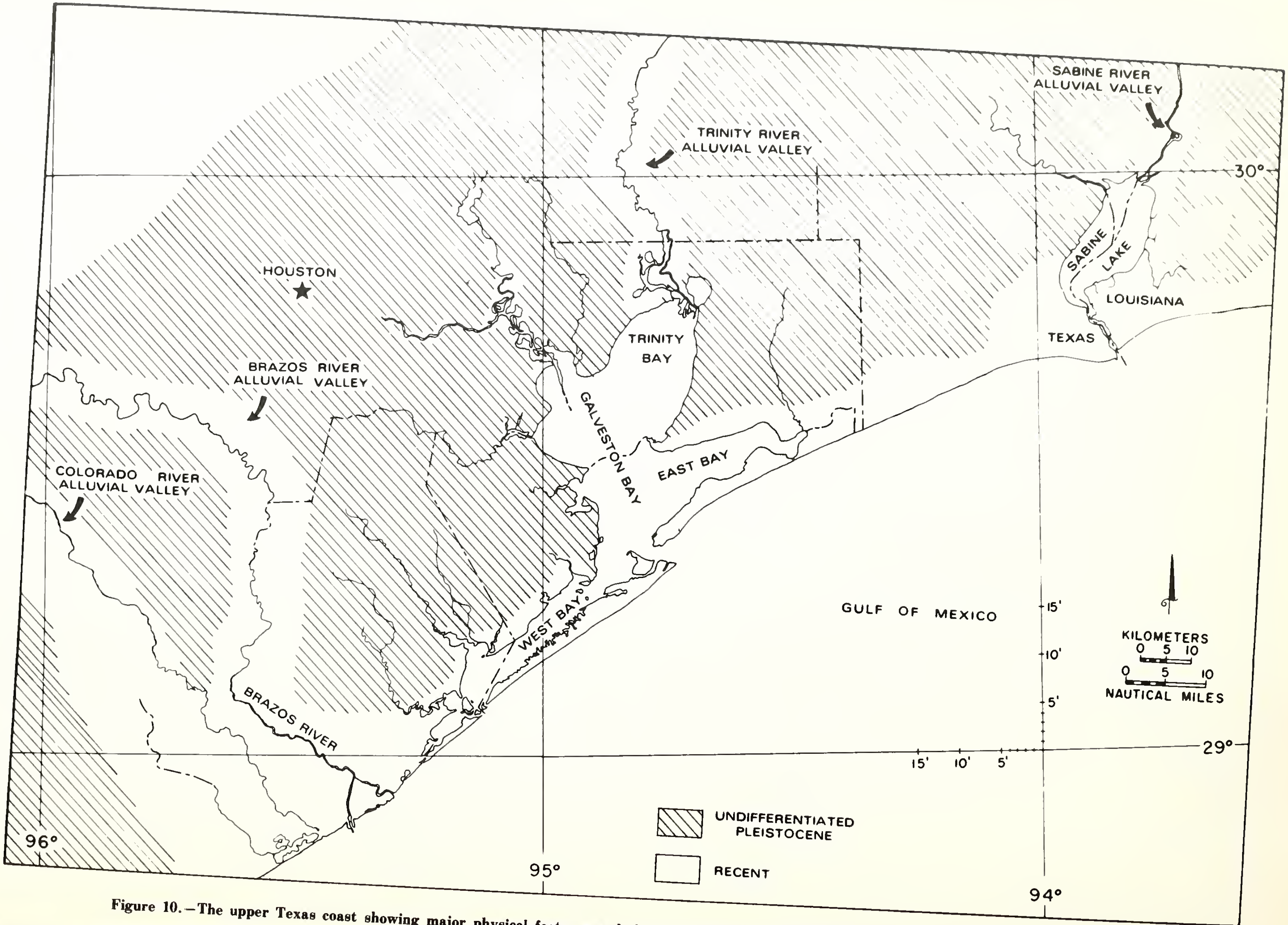


Figure 10.—The upper Texas coast showing major physical features and their geological age. (Modified after LeBlanc and Hodgson 1959.)

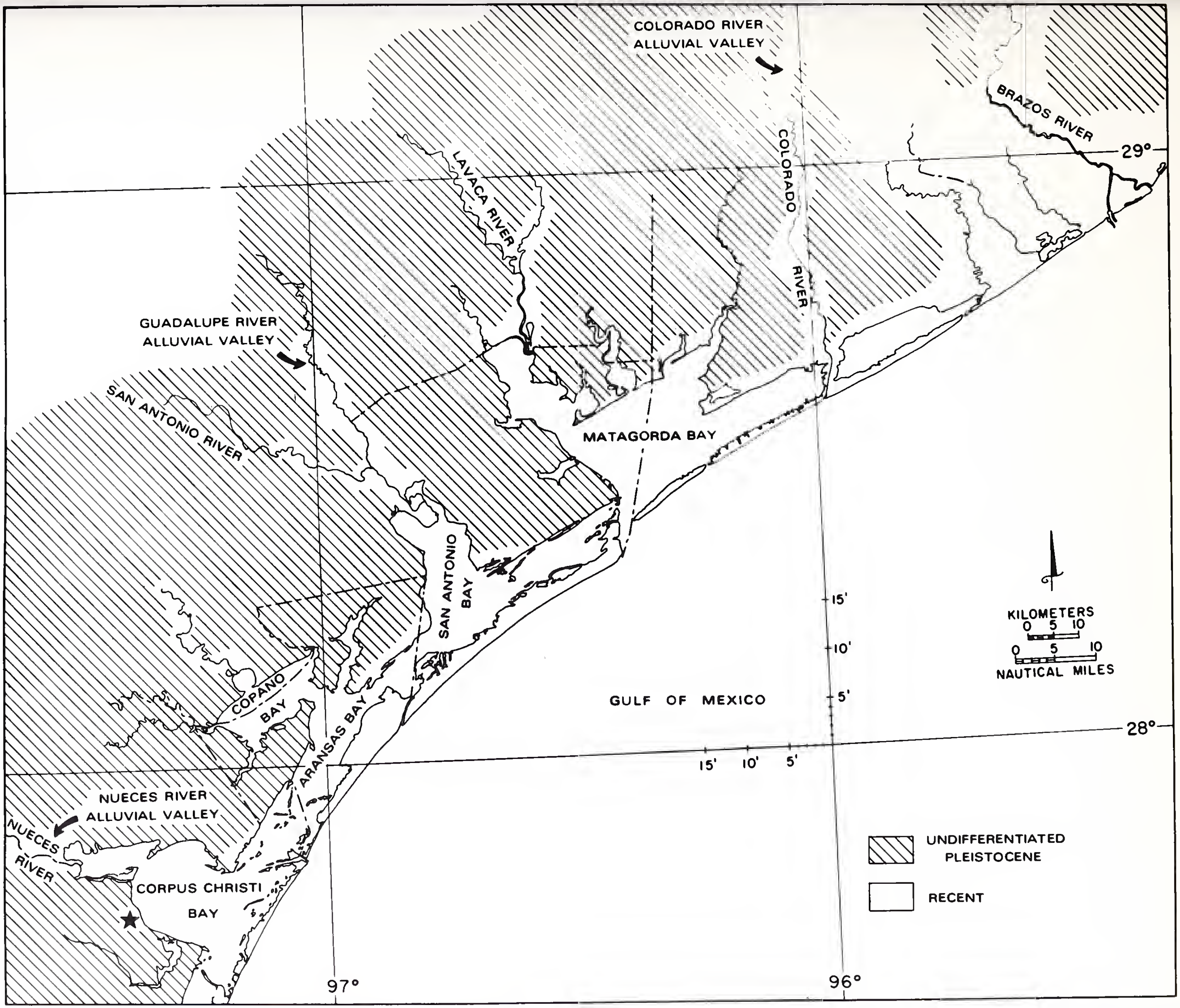


Figure 11.—The central Texas coast showing major physical features and their geological age. (Modified after LeBlanc and Hodgson 1959.)

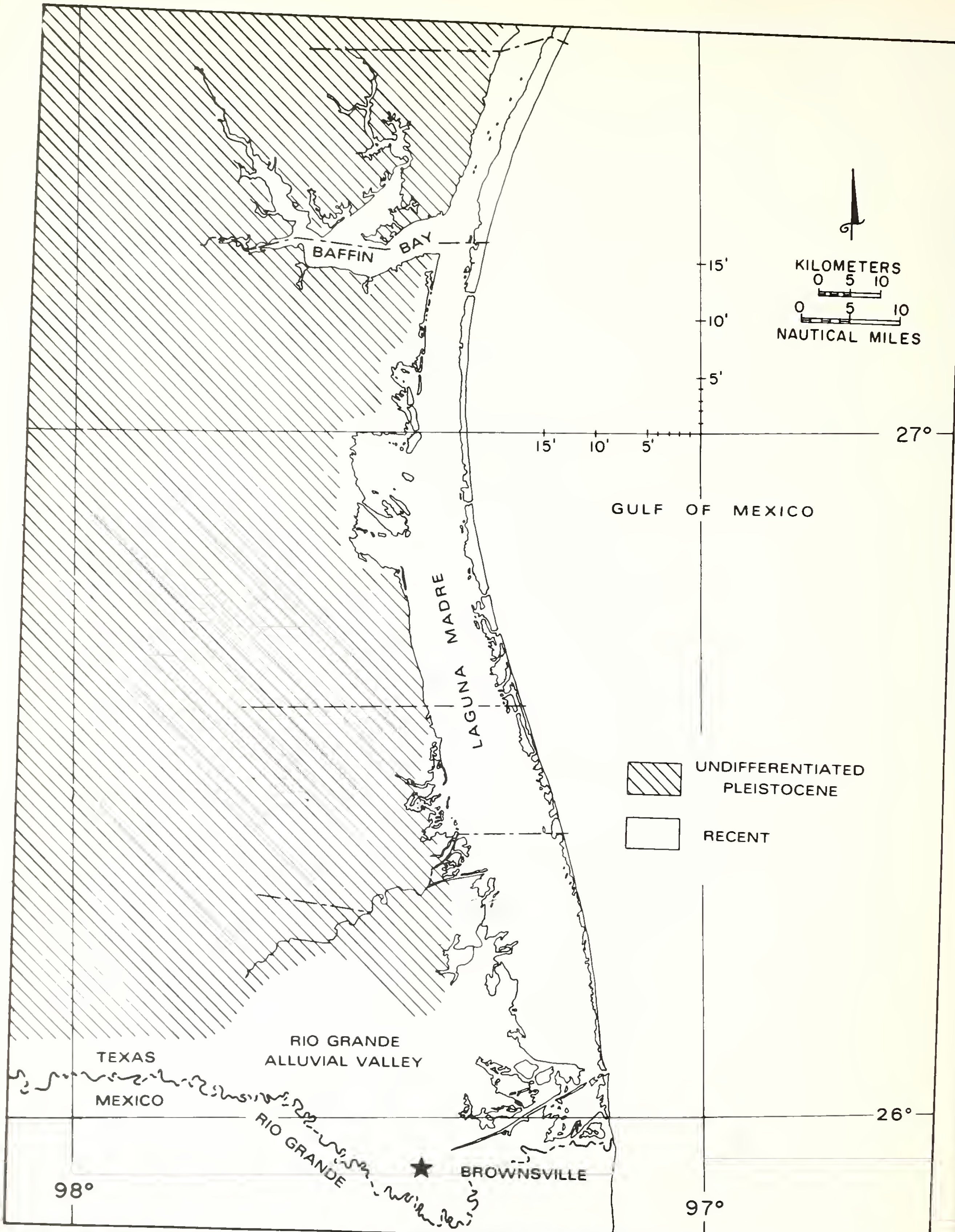


Figure 12.—The lower Texas coast showing major physical features and their geological age. (Modified after LeBlance and Hodgson 1959.)

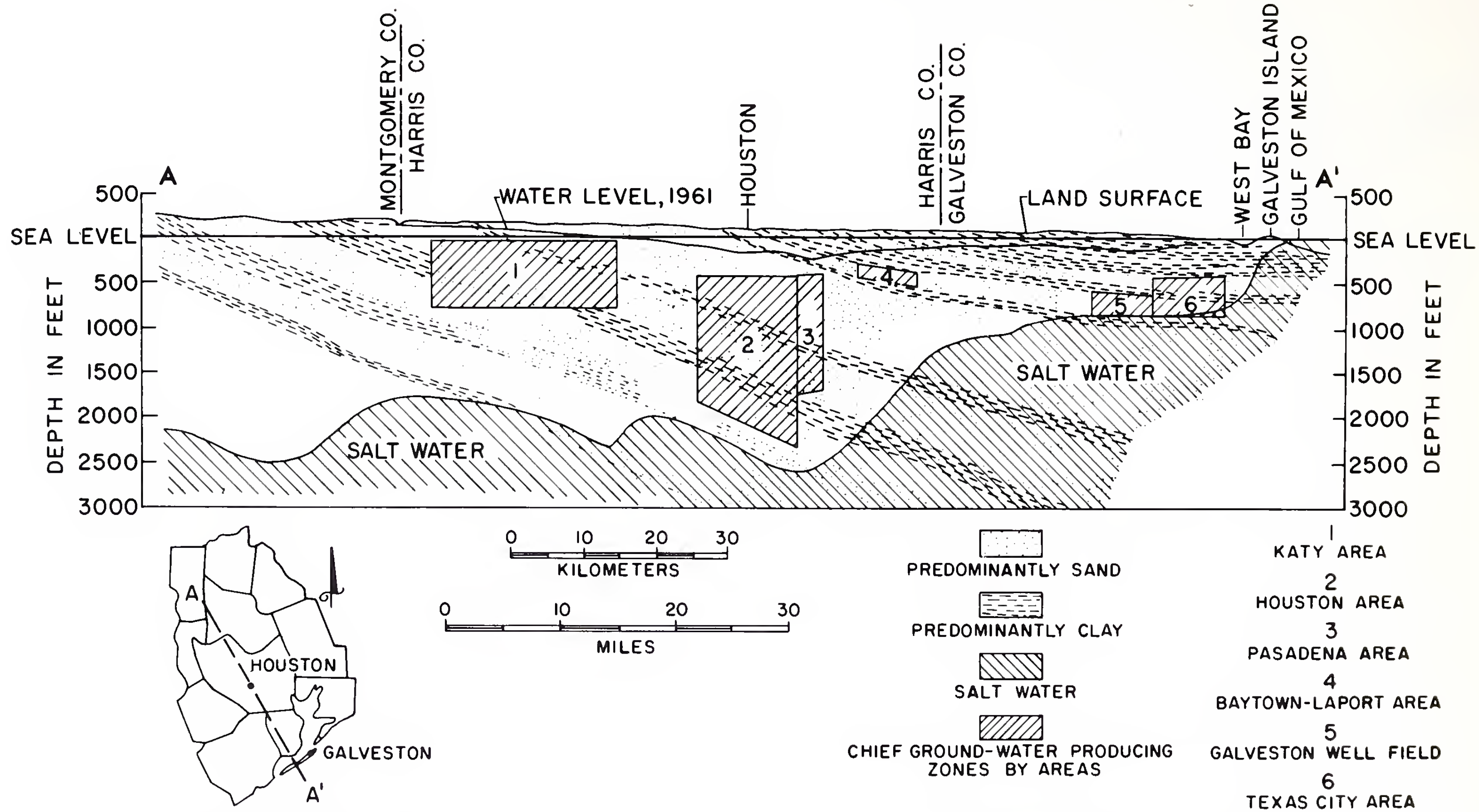


Figure 13.—Generalized cross section of the Houston-Galveston region showing major water-bearing formations. (Modified from Winslow 1961.)

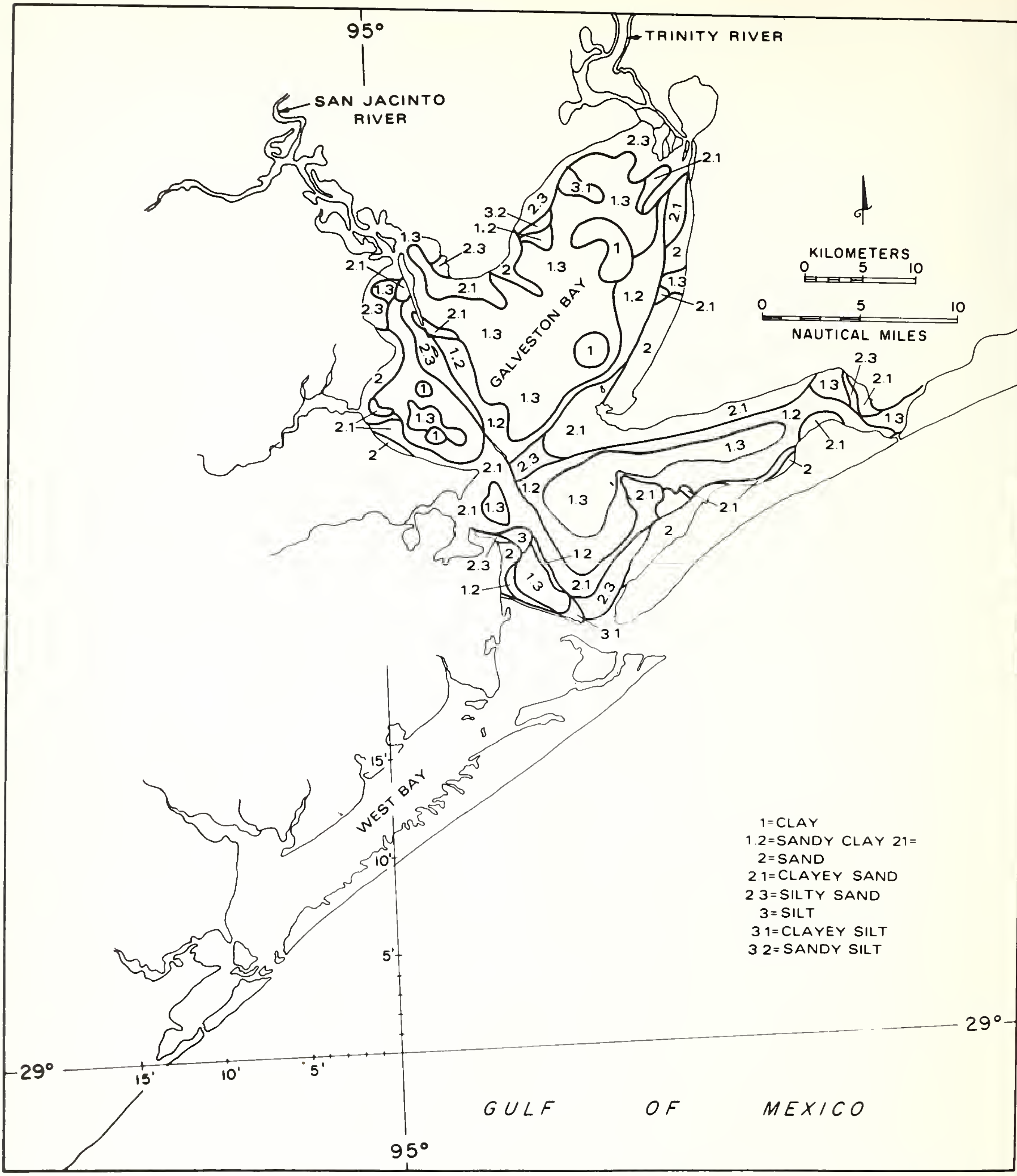


Figure 14.—Bottom sediment types in the Galveston Bay study area. (C. R. Mock, National Marine Fisheries Service, NOAA, Galveston, Tex., pers. commun.)

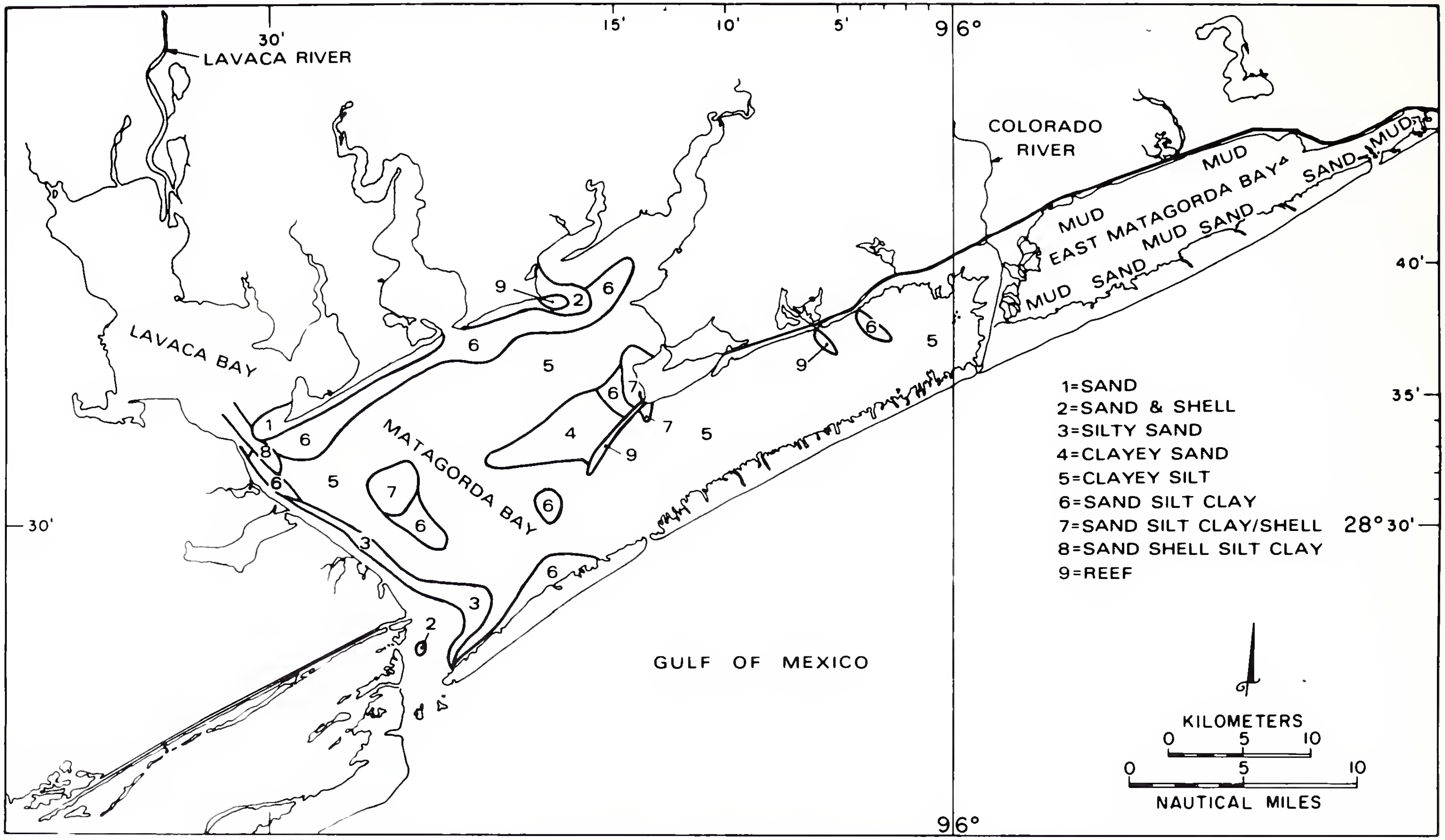


Figure 15.—Bottom sediment types in the Matagorda Bay study area. (After Shenton 1957; Day 1959.)

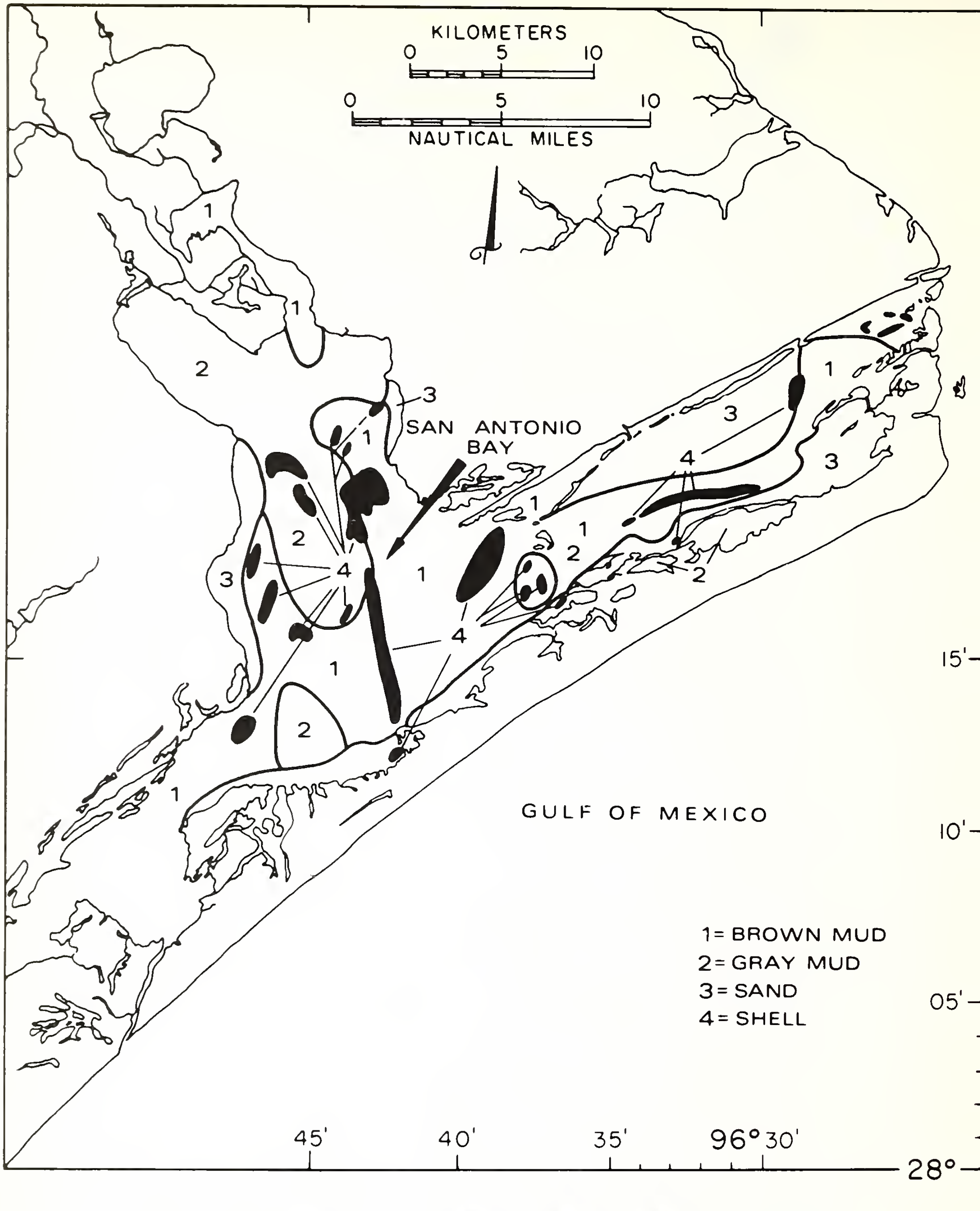


Figure 16.—Bottom sediment types in the San Antonio Bay study area. (After Childress 1960.)

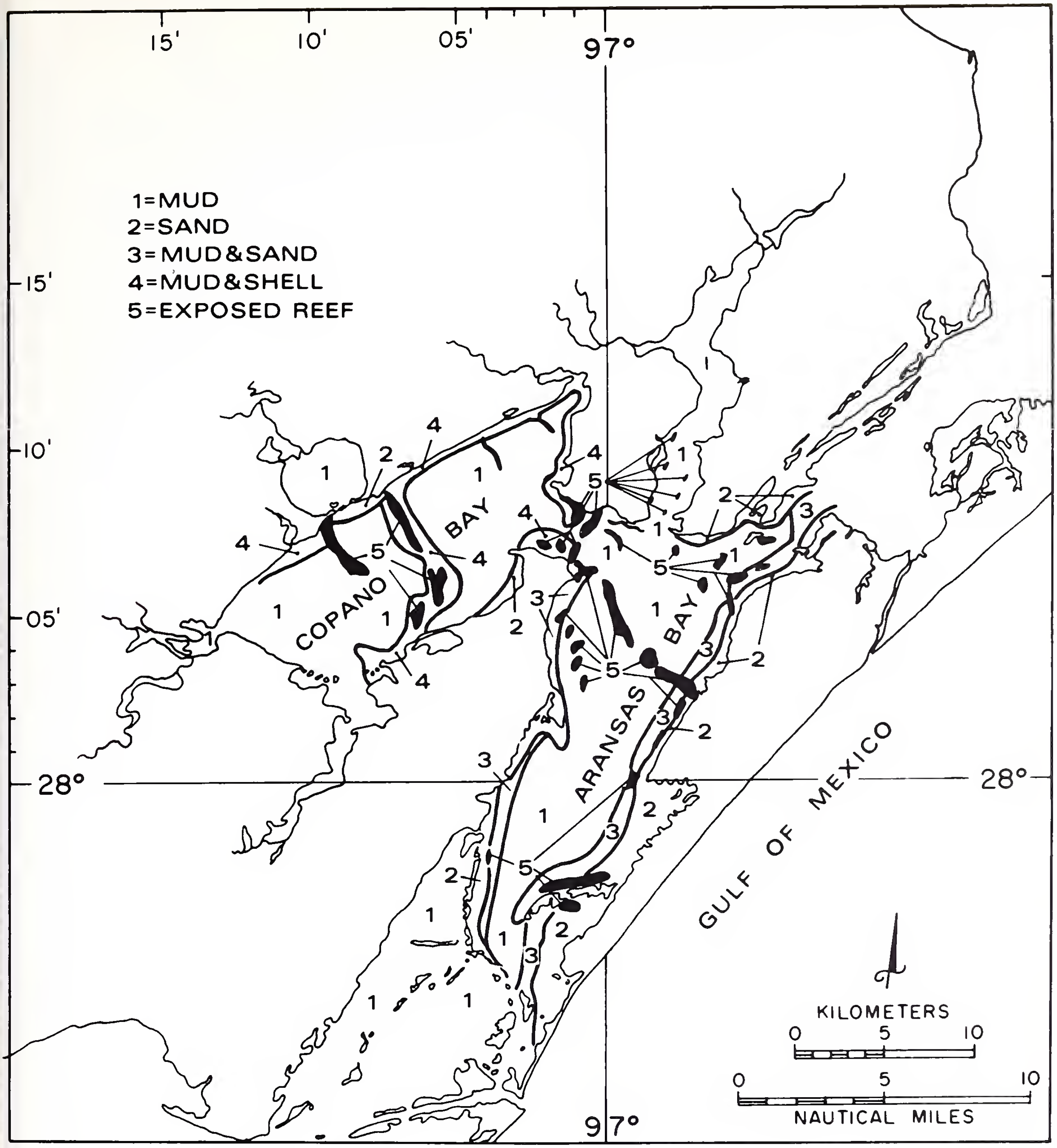


Figure 17.—Bottom sediment types in the Copano-Aransas Bay study area. (After Heffernan 1959.)

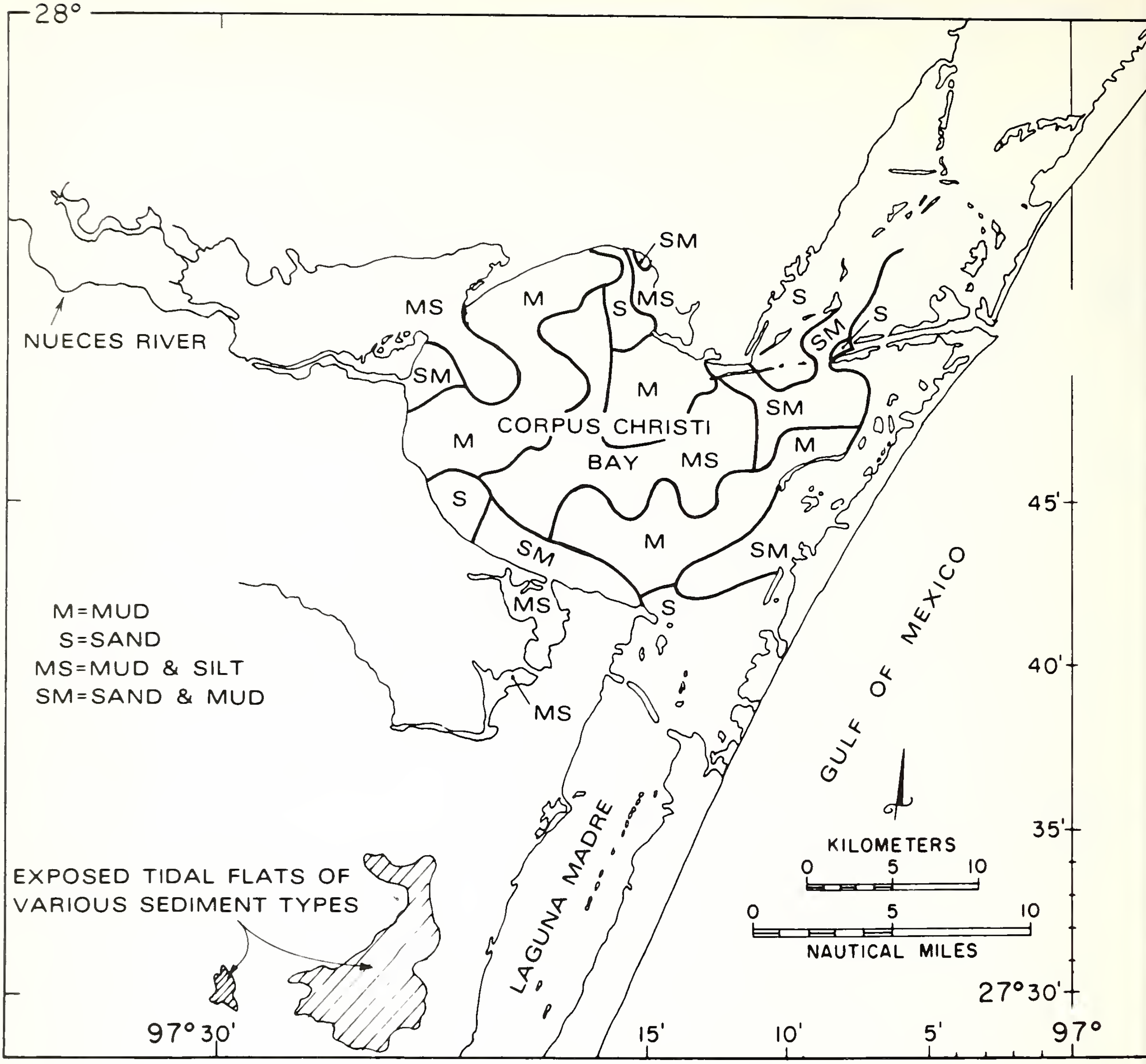


Figure 18.—Bottom sediment types in the Corpus Christi Bay study area. (Modified after data published by Stevens 1959.)

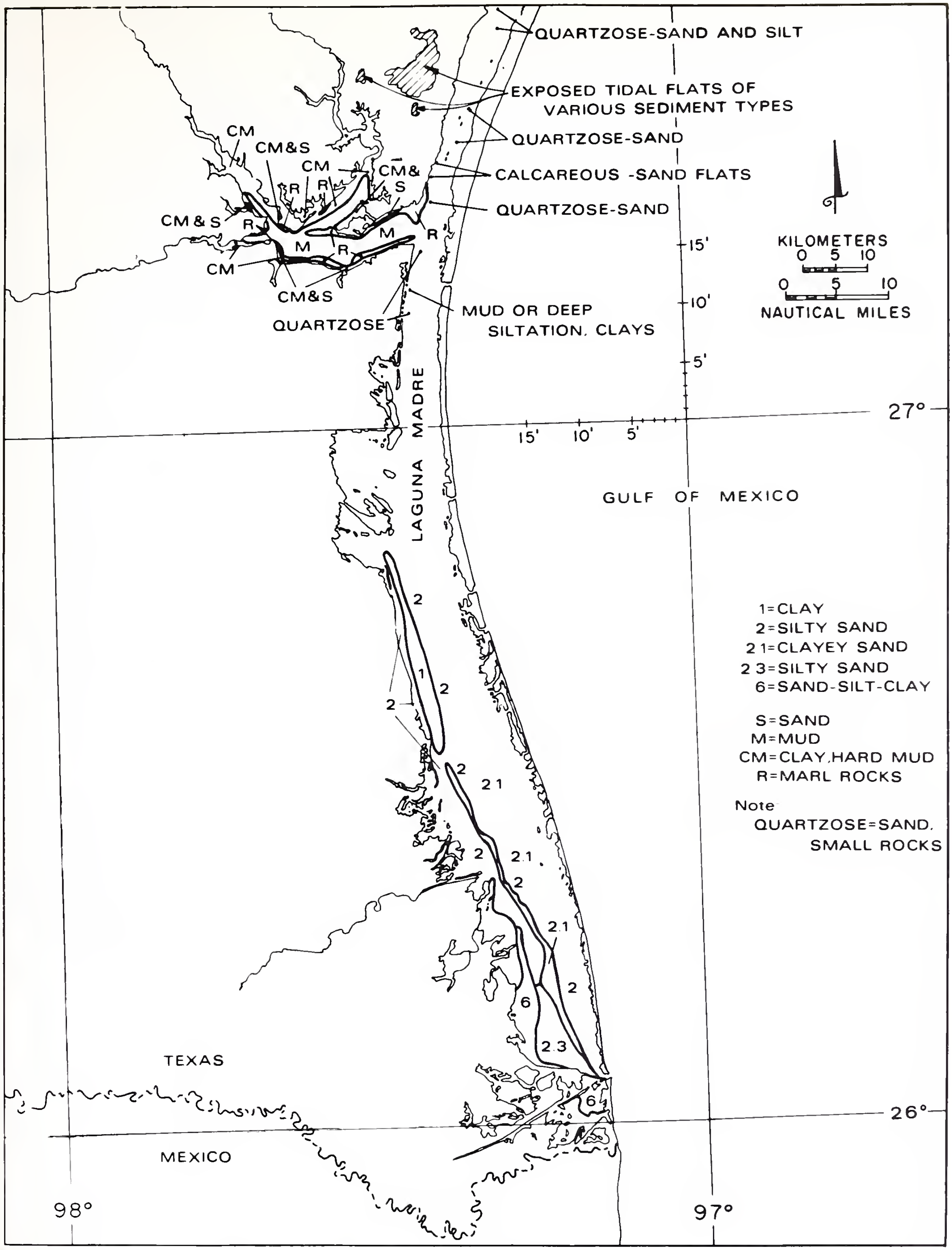


Figure 19.—Bottom sediment types in the upper Laguna Madre. (After Simmons 1957; Breuer 1957; Shepard and Rusnak 1957.)

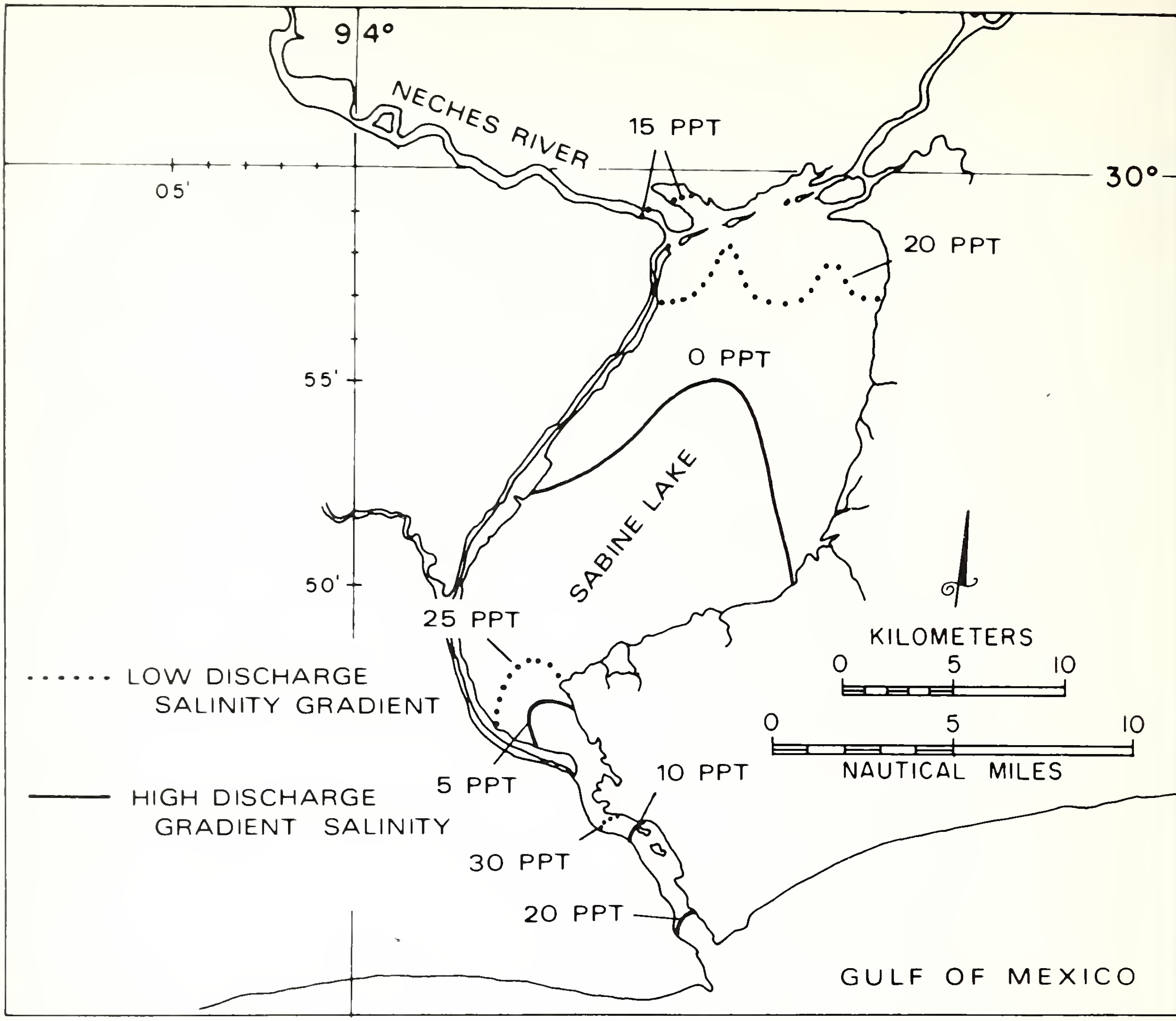


Figure 20.—Observed surface salinity gradients during periods of high (May) and low (November-December) freshwater discharge into Sabine Lake during 1958. (Data from: Texas Company, Gulf Oil Corporation, City of Port Arthur; the Texas Parks and Wildlife Department.

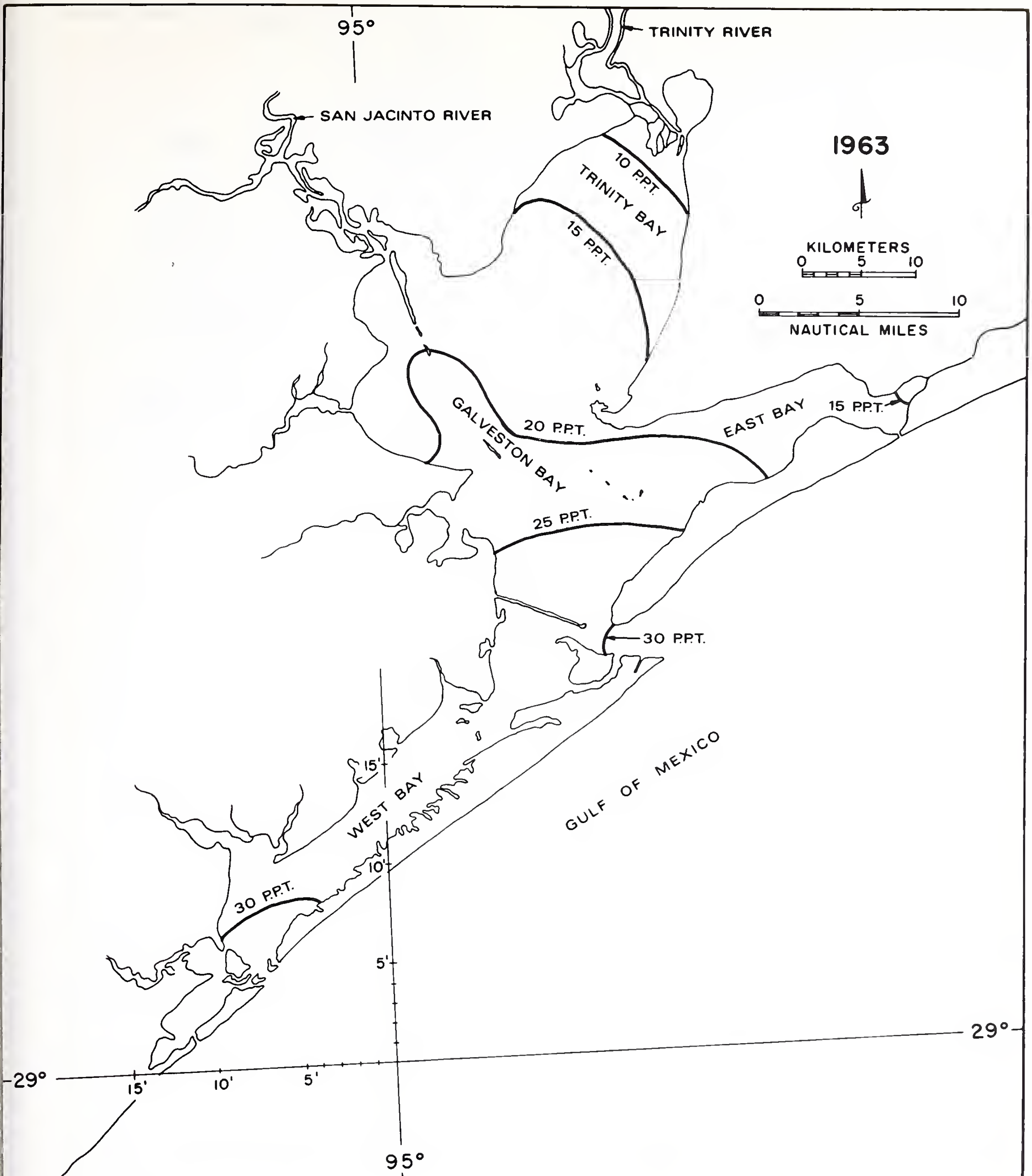
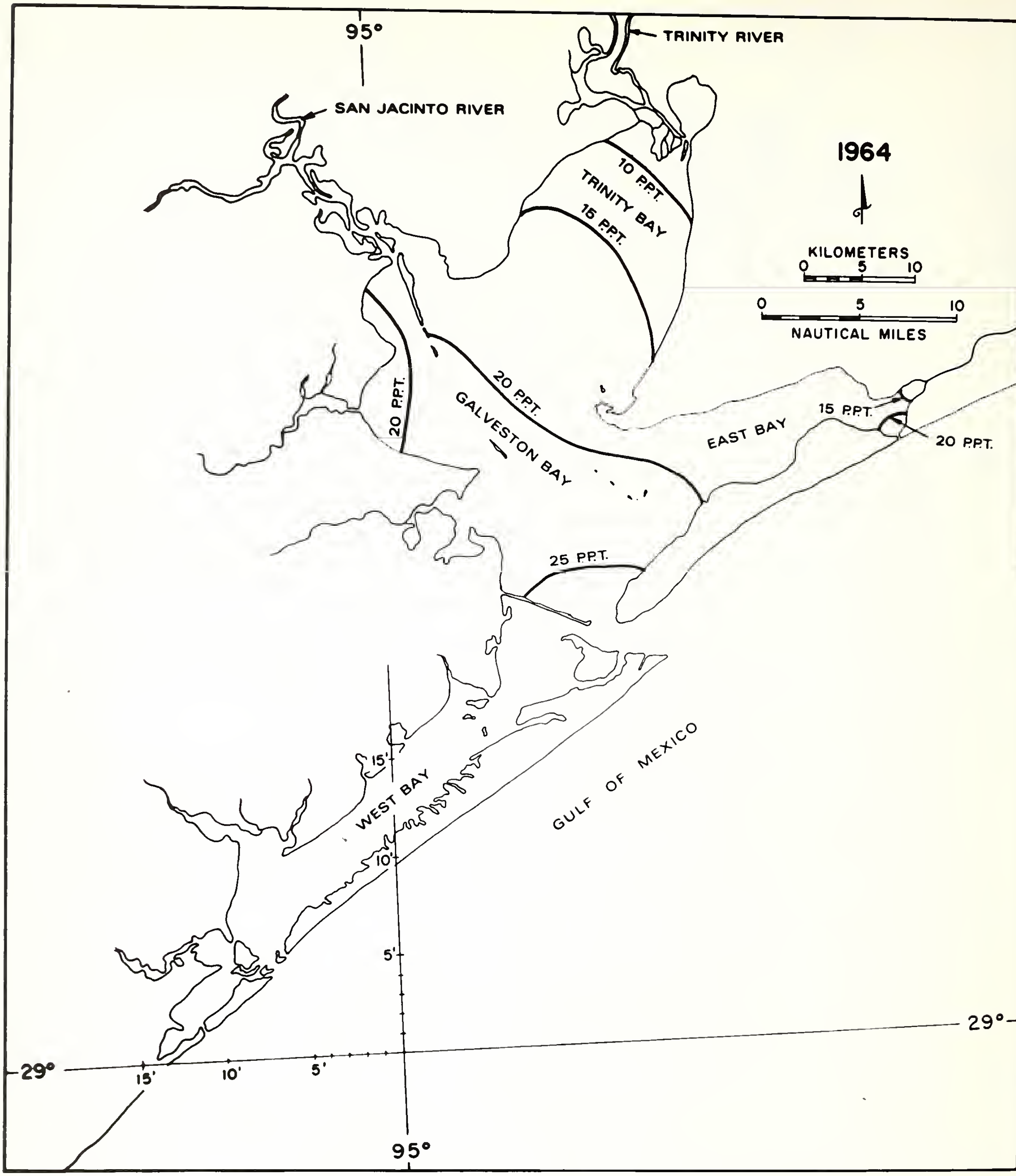


Figure 21.—Distribution of average annual surface salinity in the Galveston Bay area for 1963-1966. (Sources: unpublished data from Galveston Biological Laboratory, National Marine Fisheries Service; More 1963, 1964; Martinez 1965, 1966.)



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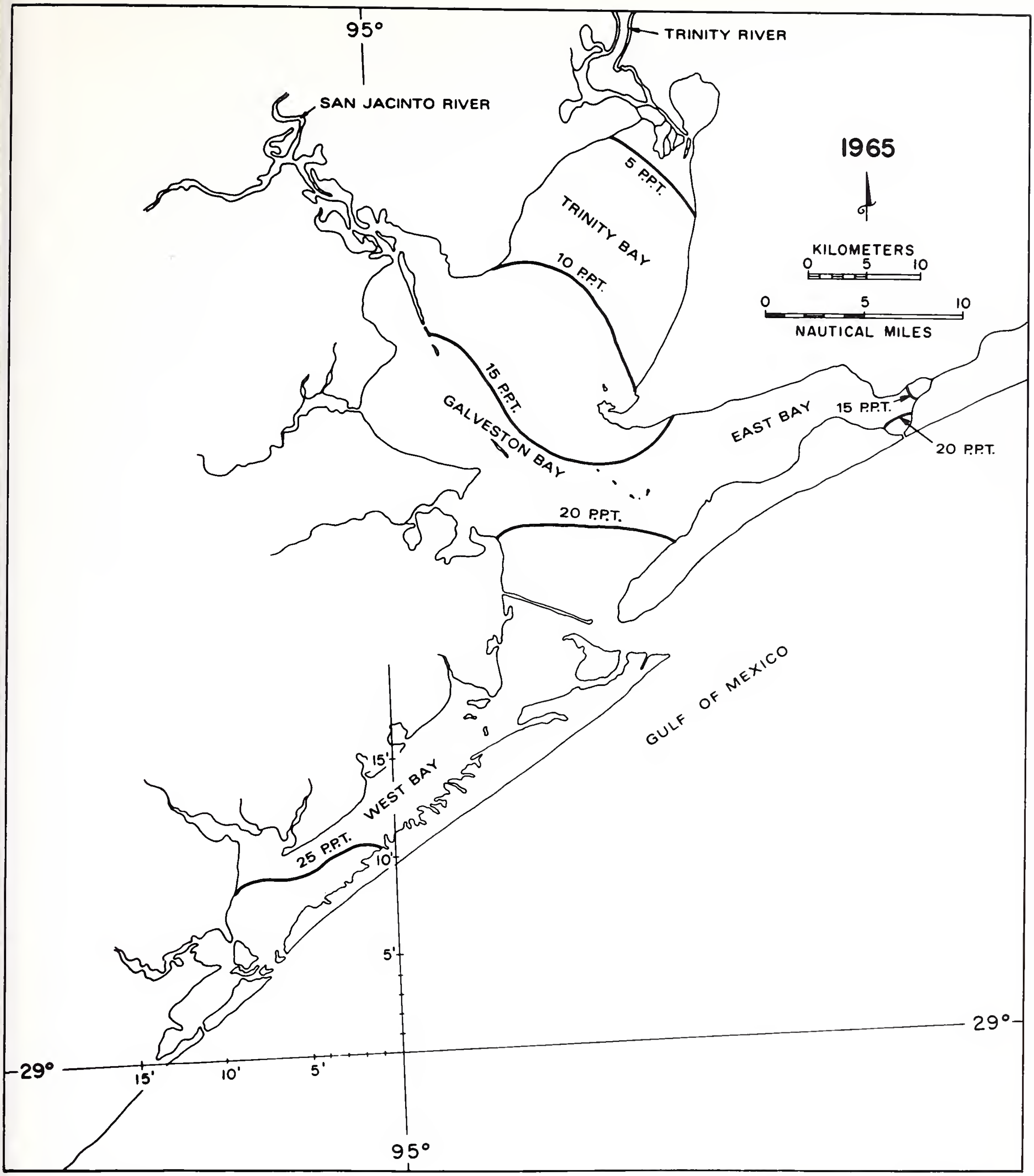

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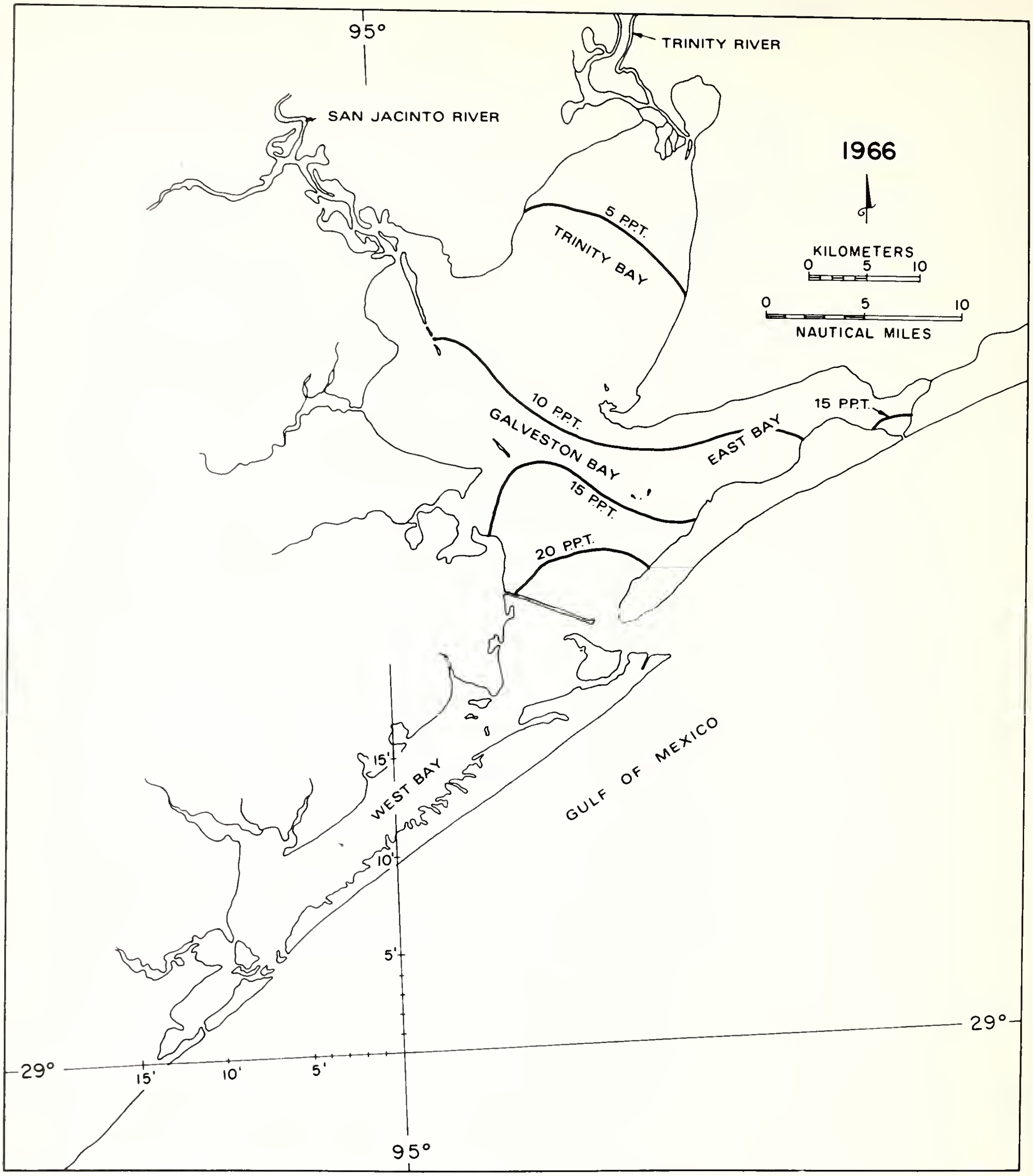

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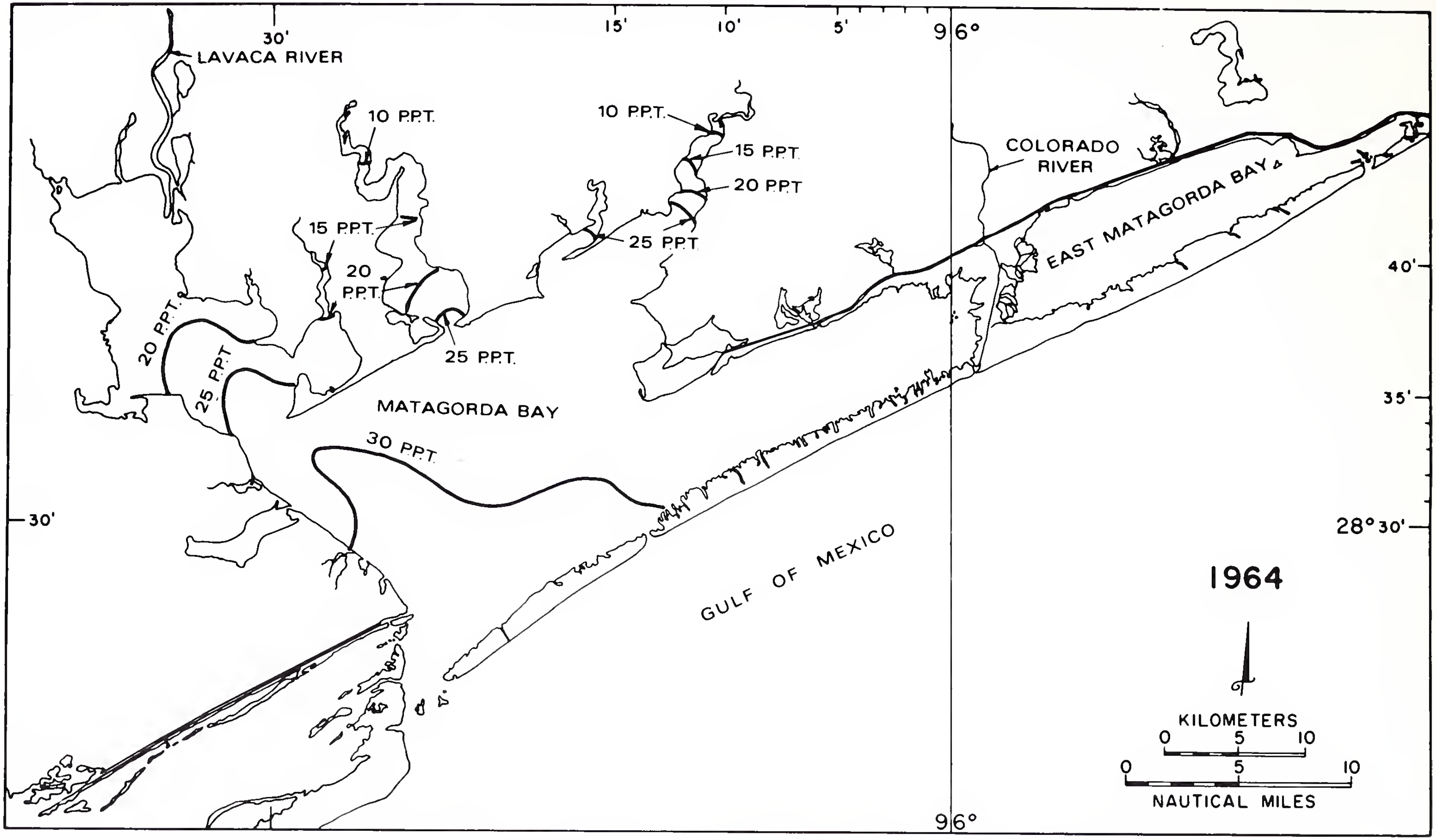
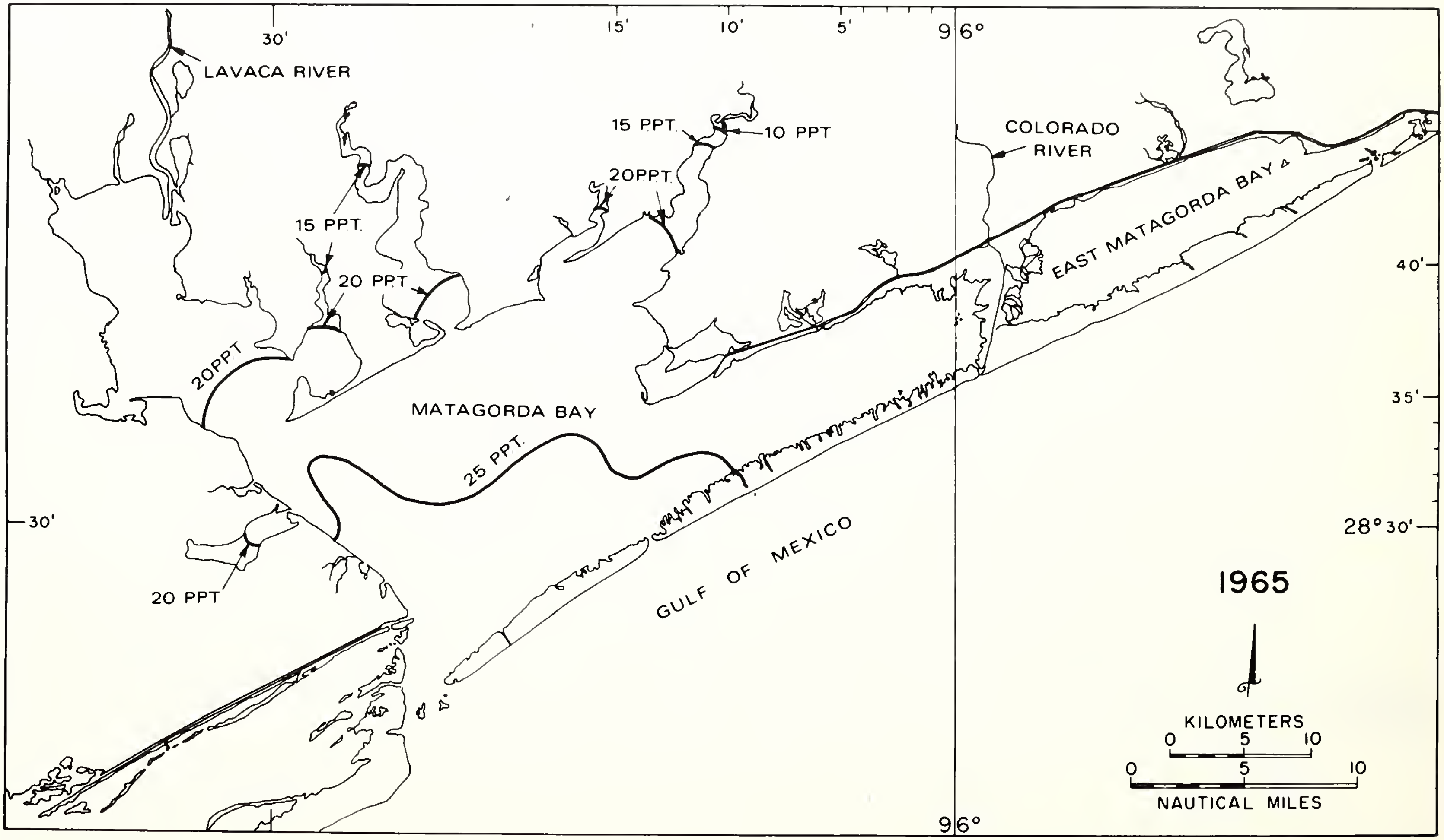


Figure 22.—Distribution of average annual surface salinity in the Matagorda Bay area for 1964-1966. (From Munro and King 1964; Martinez 1965, 1966.)



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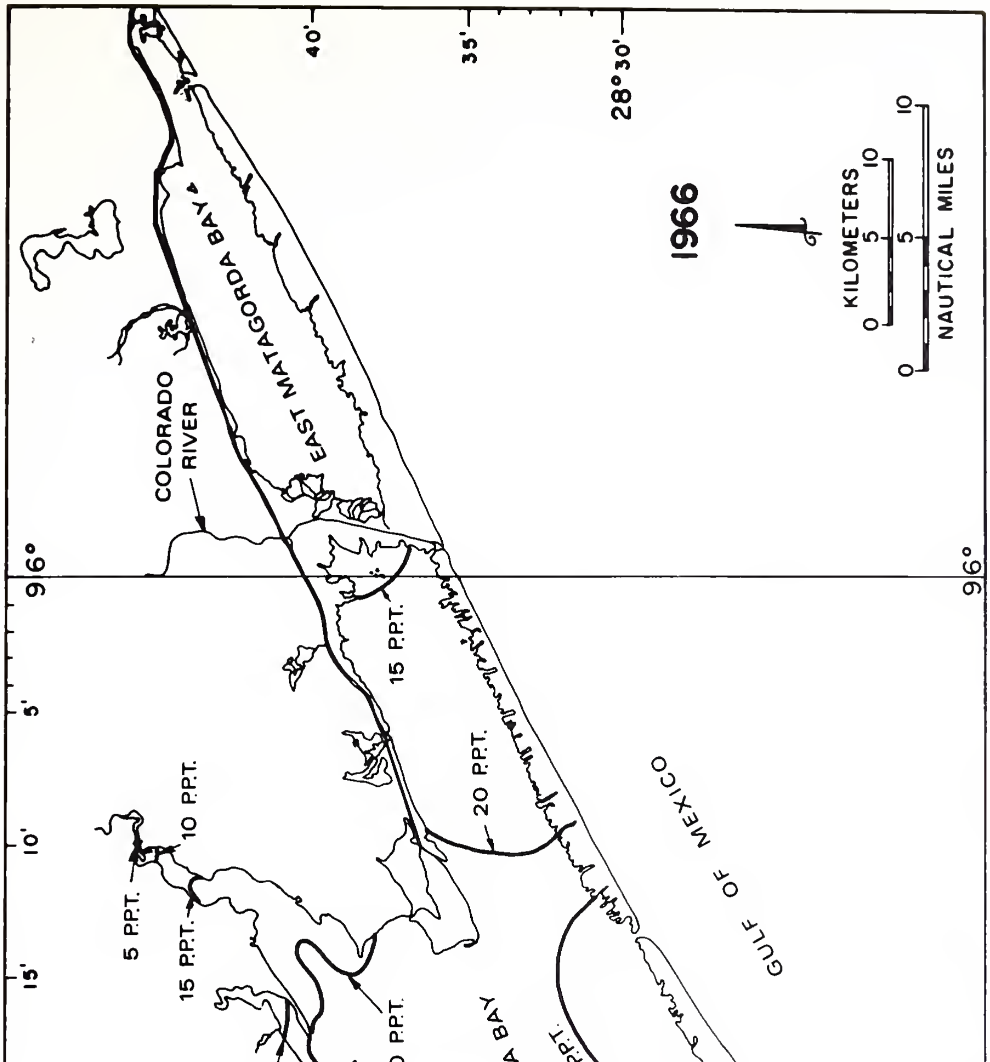

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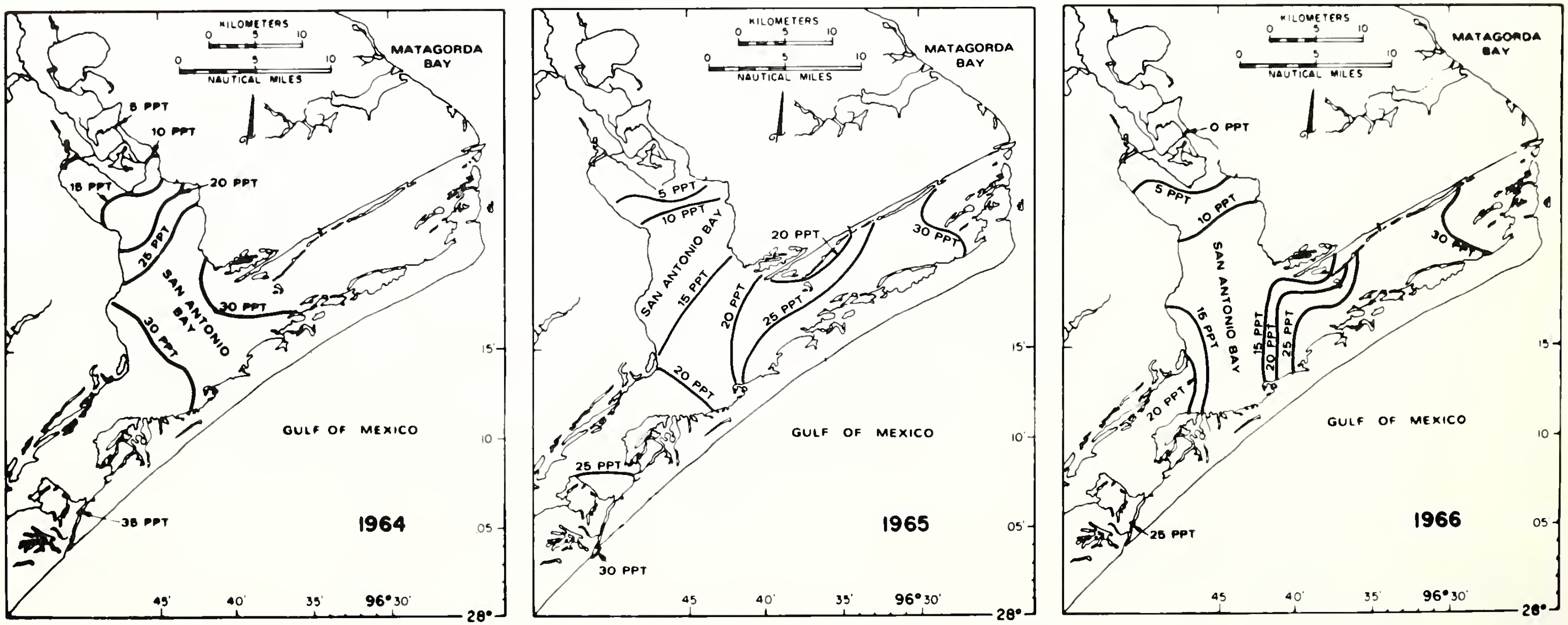


Figure 23.—Distribution of average annual surface salinity in the San Antonio Bay area for 1964-1966. (From Childress 1964; Martinez 1965, 1966.)

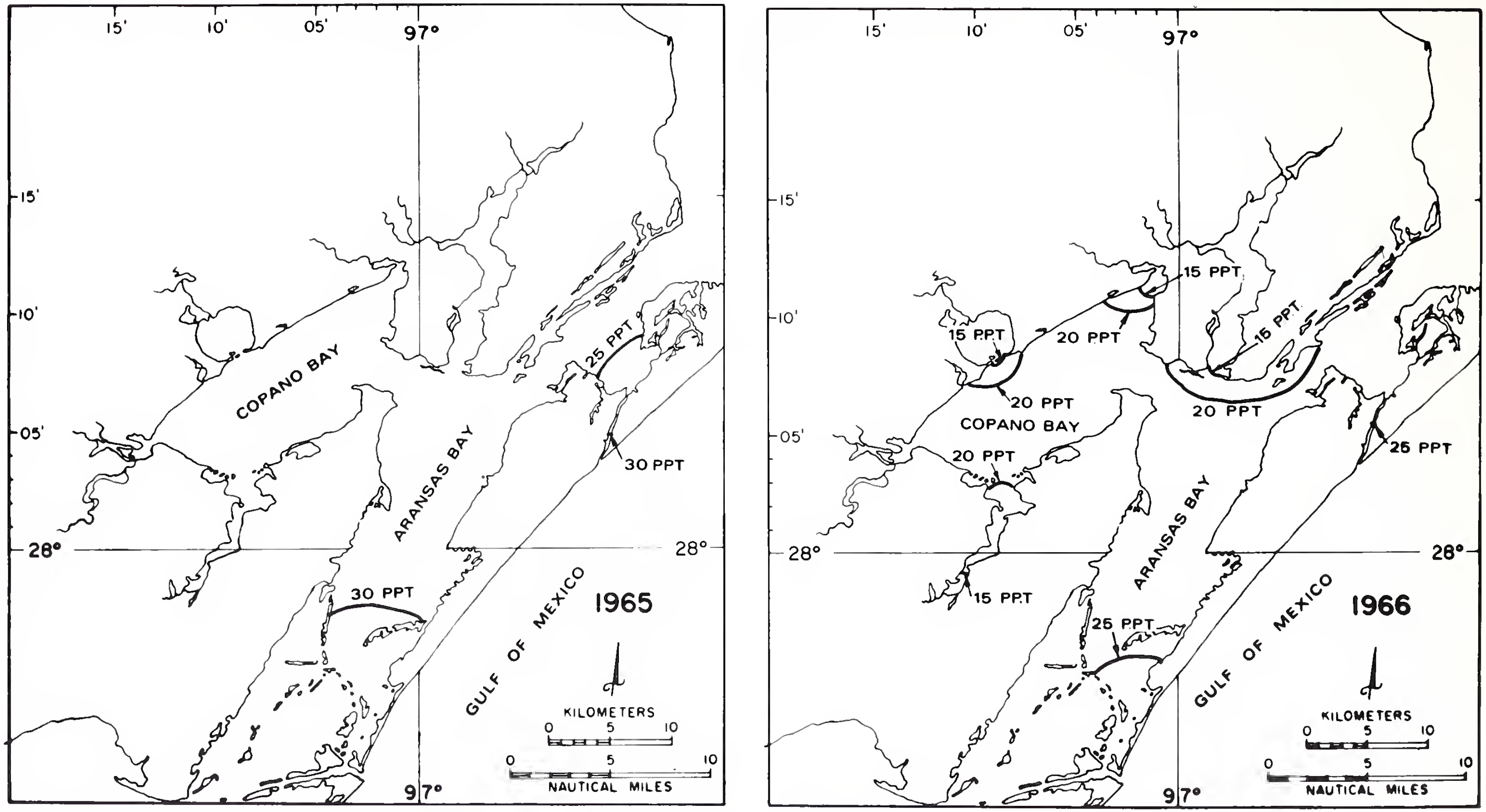


Figure 24.—Distribution of average annual surface salinity in the Copano-Aransas Bay area for 1965-1966. (From Martinez 1965-1966.)

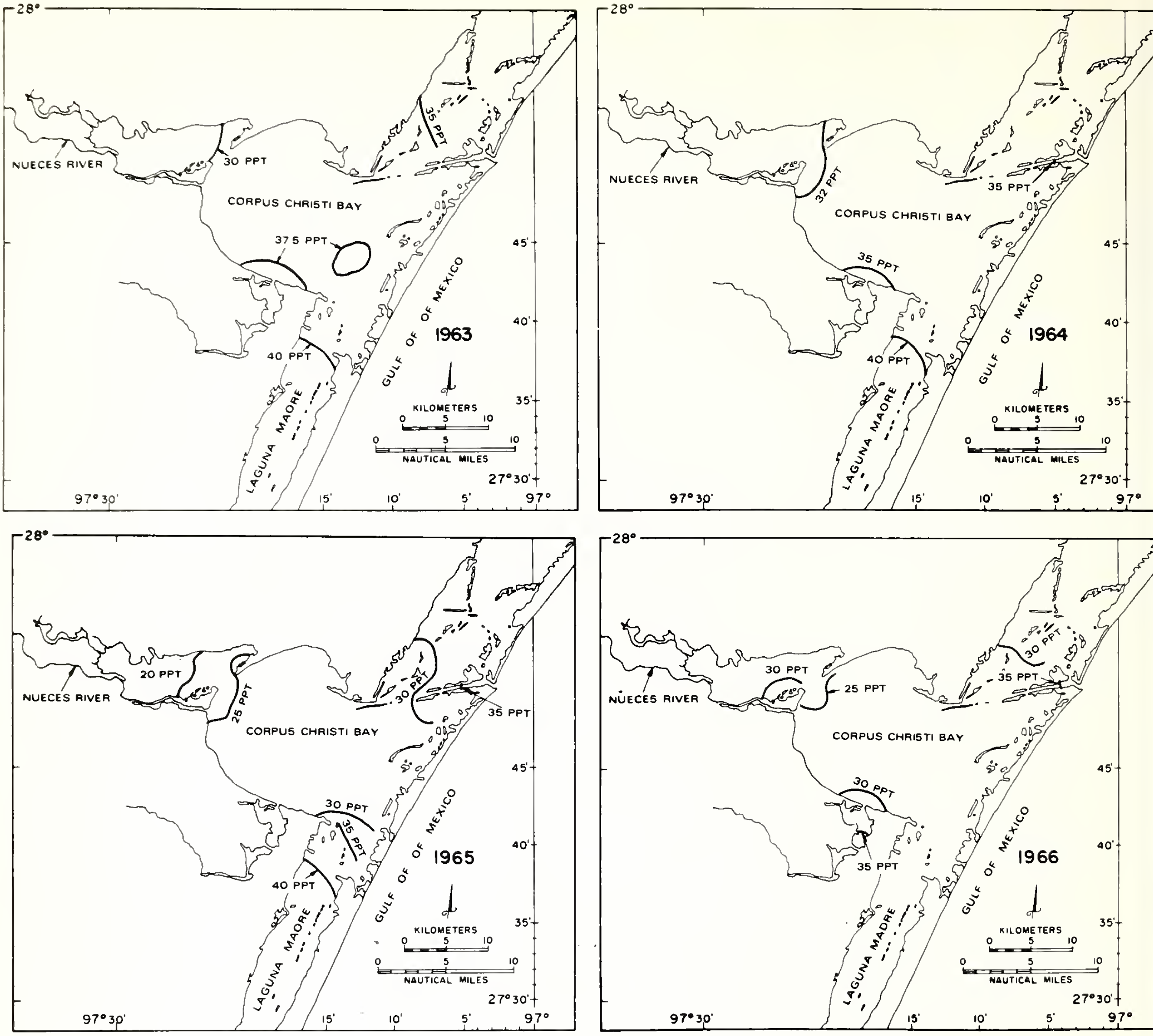


Figure 25.—Distribution of average annual surface salinity in the Corpus Christi Bay area for 1963-1966. (From Martinez 1963, 1964, 1965, 1966.)

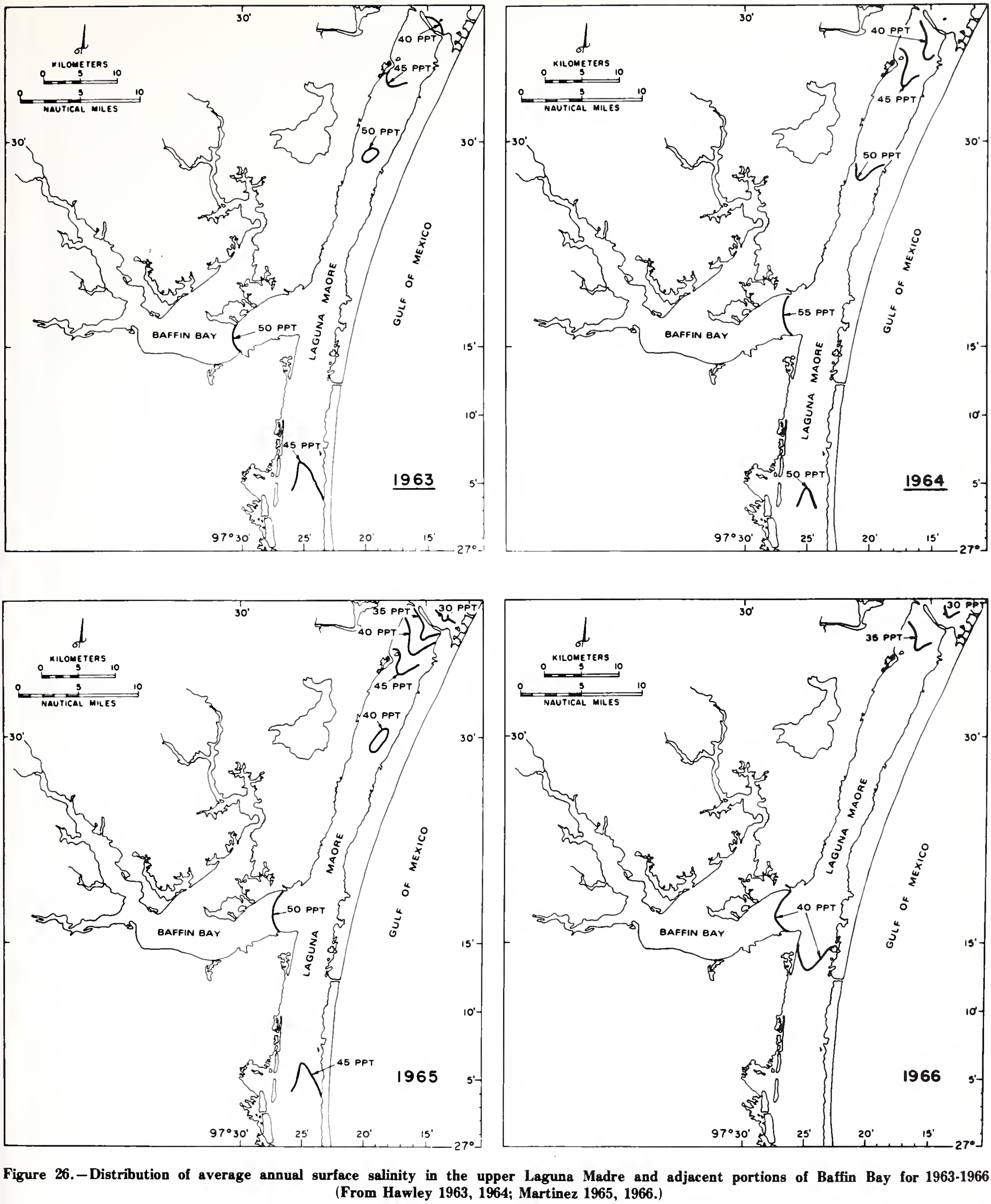
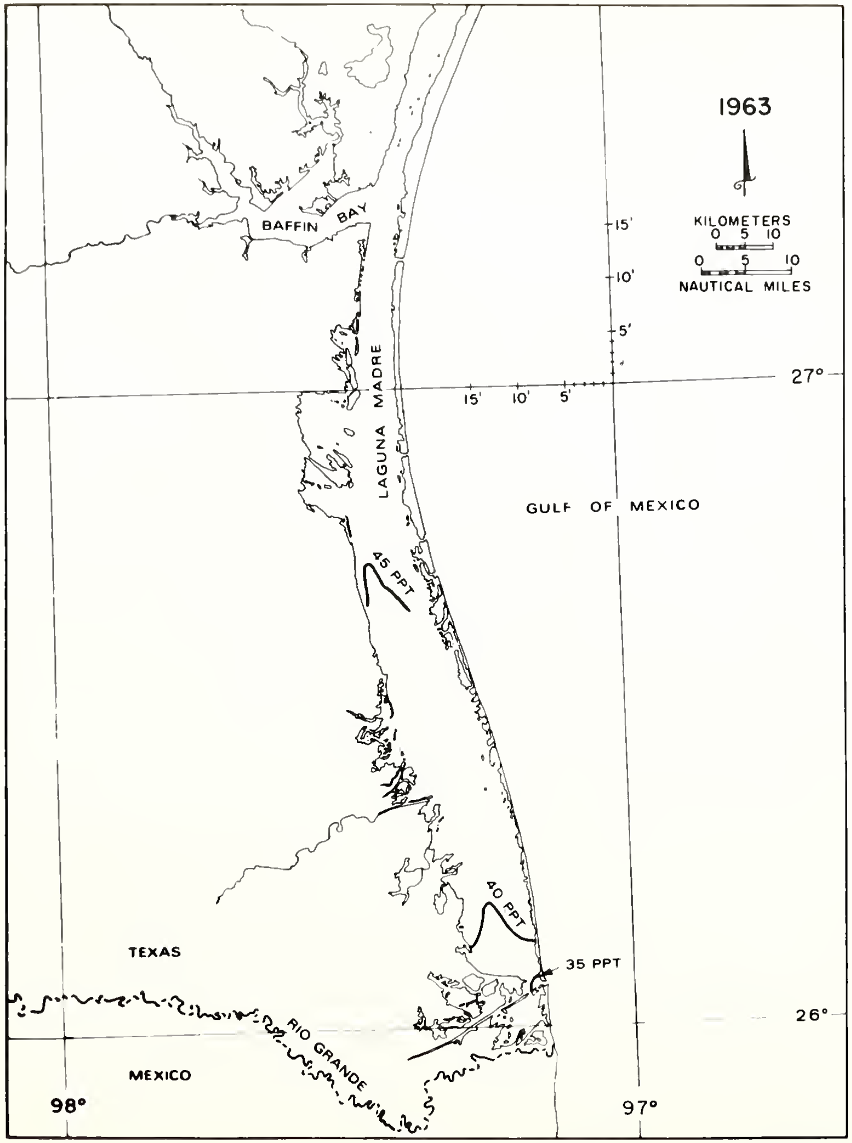


Figure 26.—Distribution of average annual surface salinity in the upper Laguna Madre and adjacent portions of Baffin Bay for 1963-1966. (From Hawley 1963, 1964; Martinez 1965, 1966.)



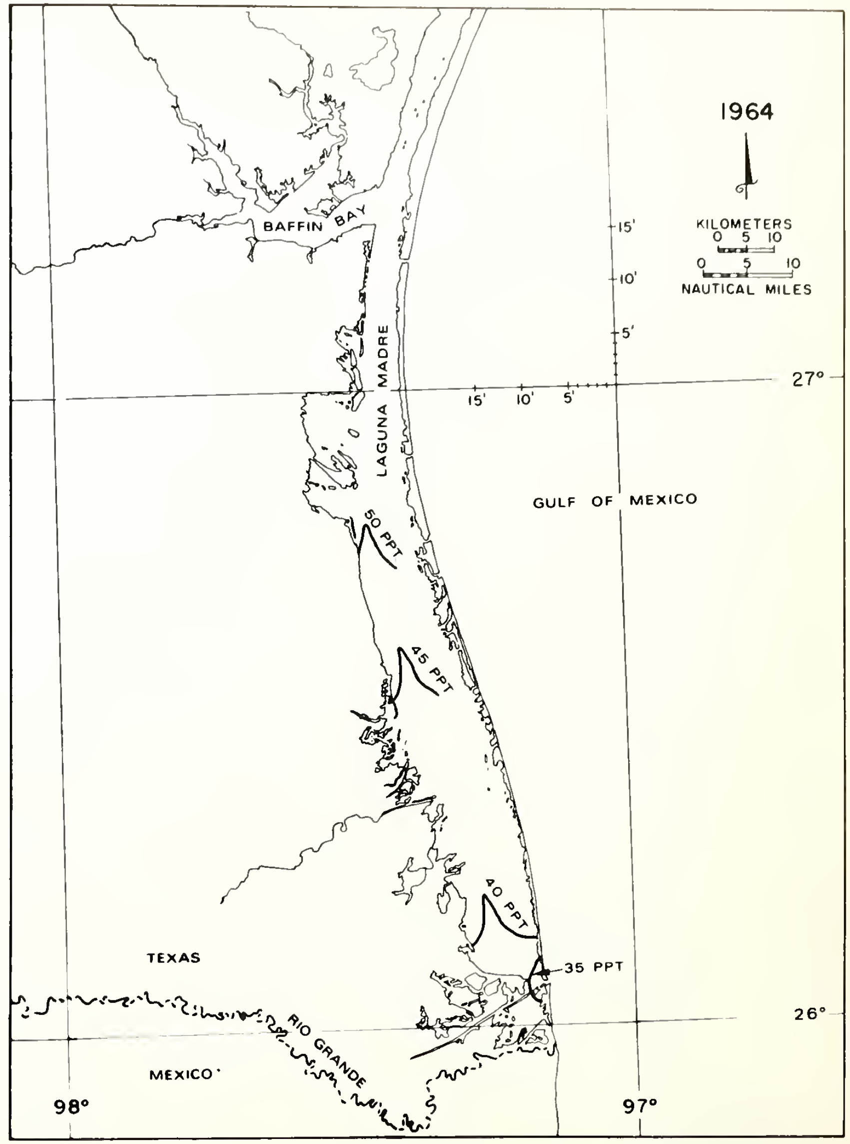
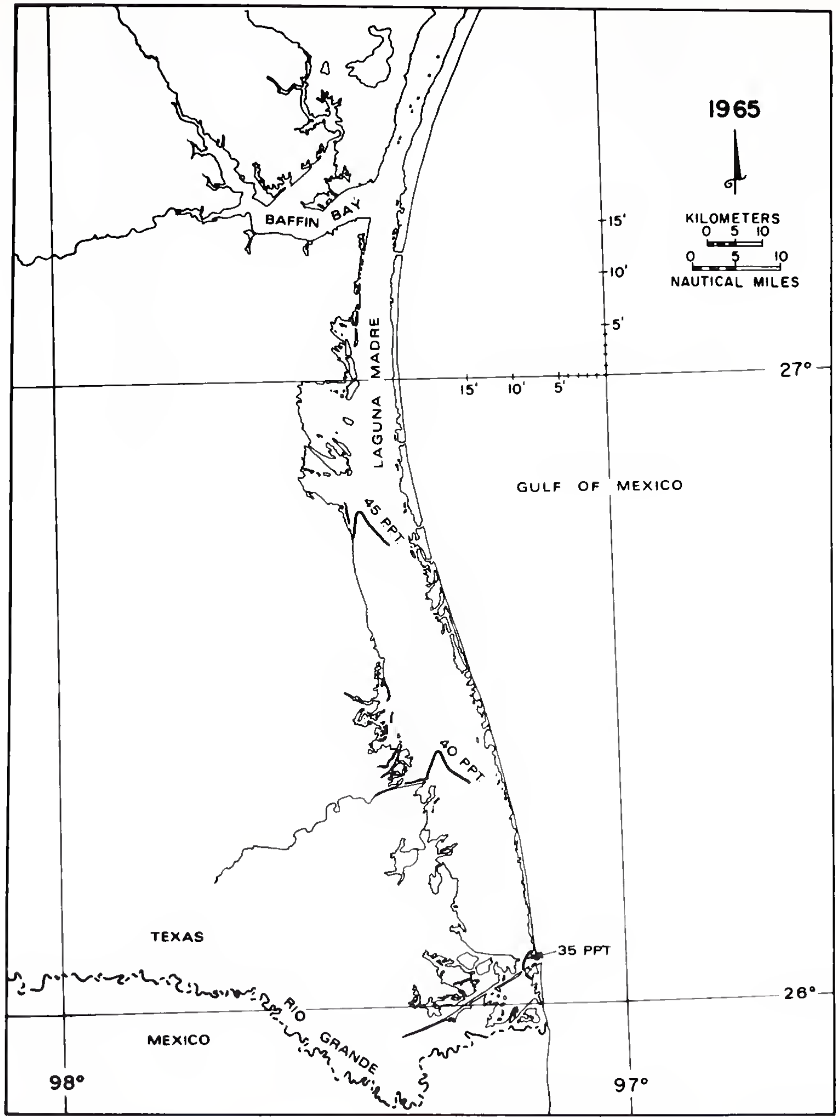


Figure 27.—Distribution of average annual surface salinity in the lower Laguna Madre for 1963-1966. (From Johnson 1963, 1964; Martinez 1965, 1966.)



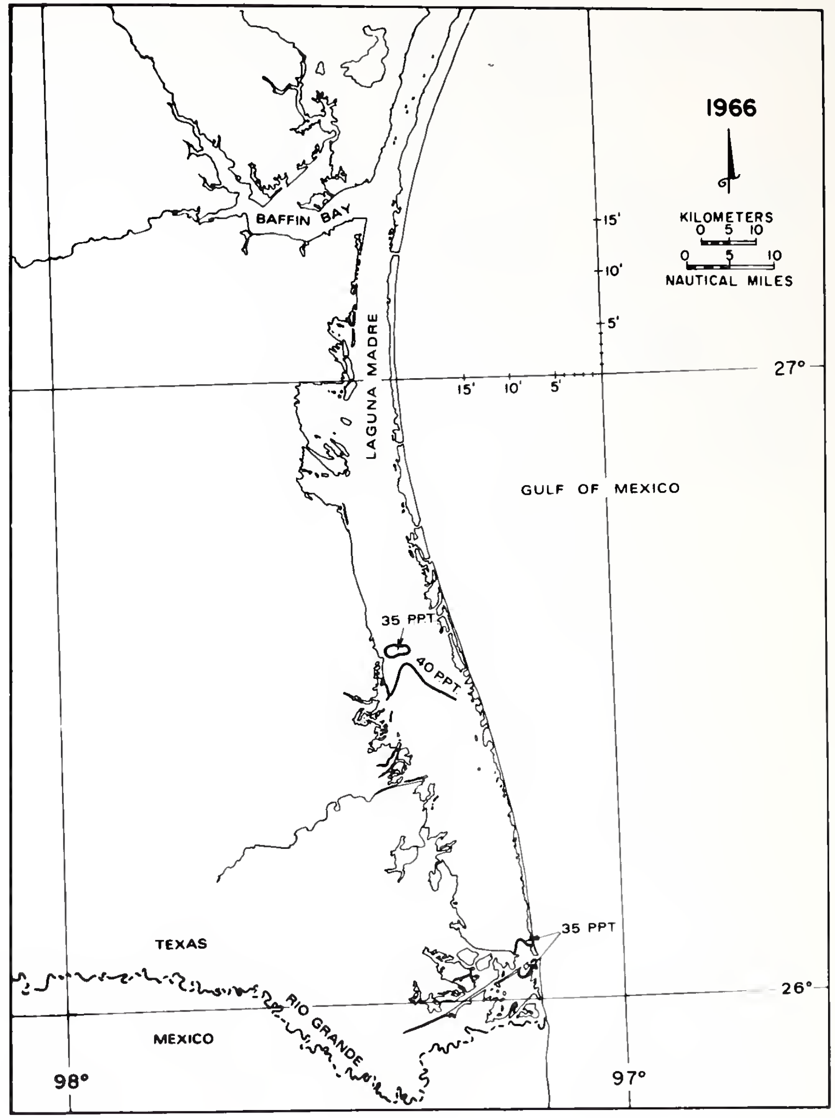


Figure 27.—Continued.

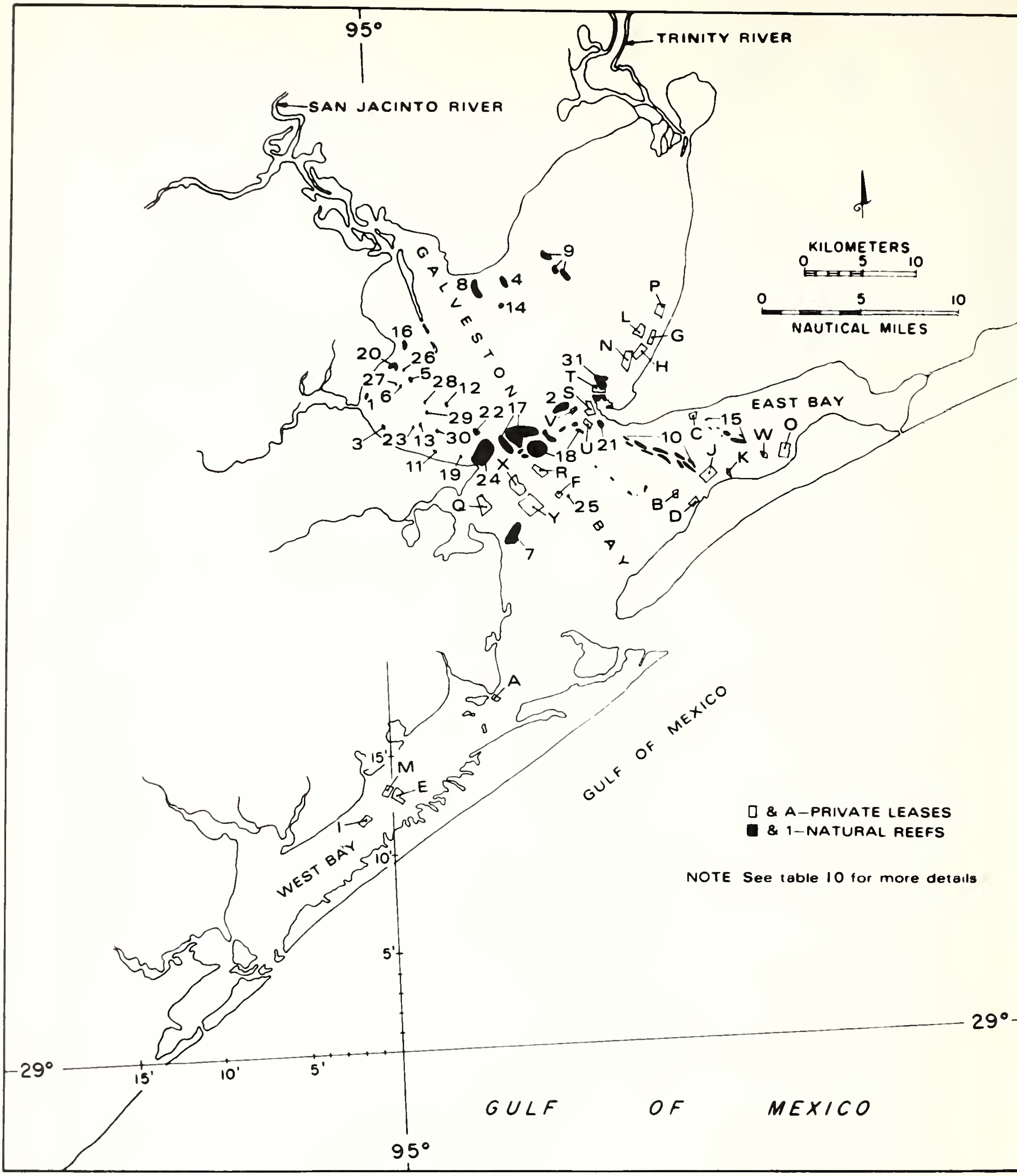


Figure 28.—Approximate locations of natural oyster reefs (solid and numbered) and private oyster leases (open and lettered) in the Galveston Bay area (see Table 10). Locations and areas plotted from charts furnished by the Texas Parks and Wildlife Department.

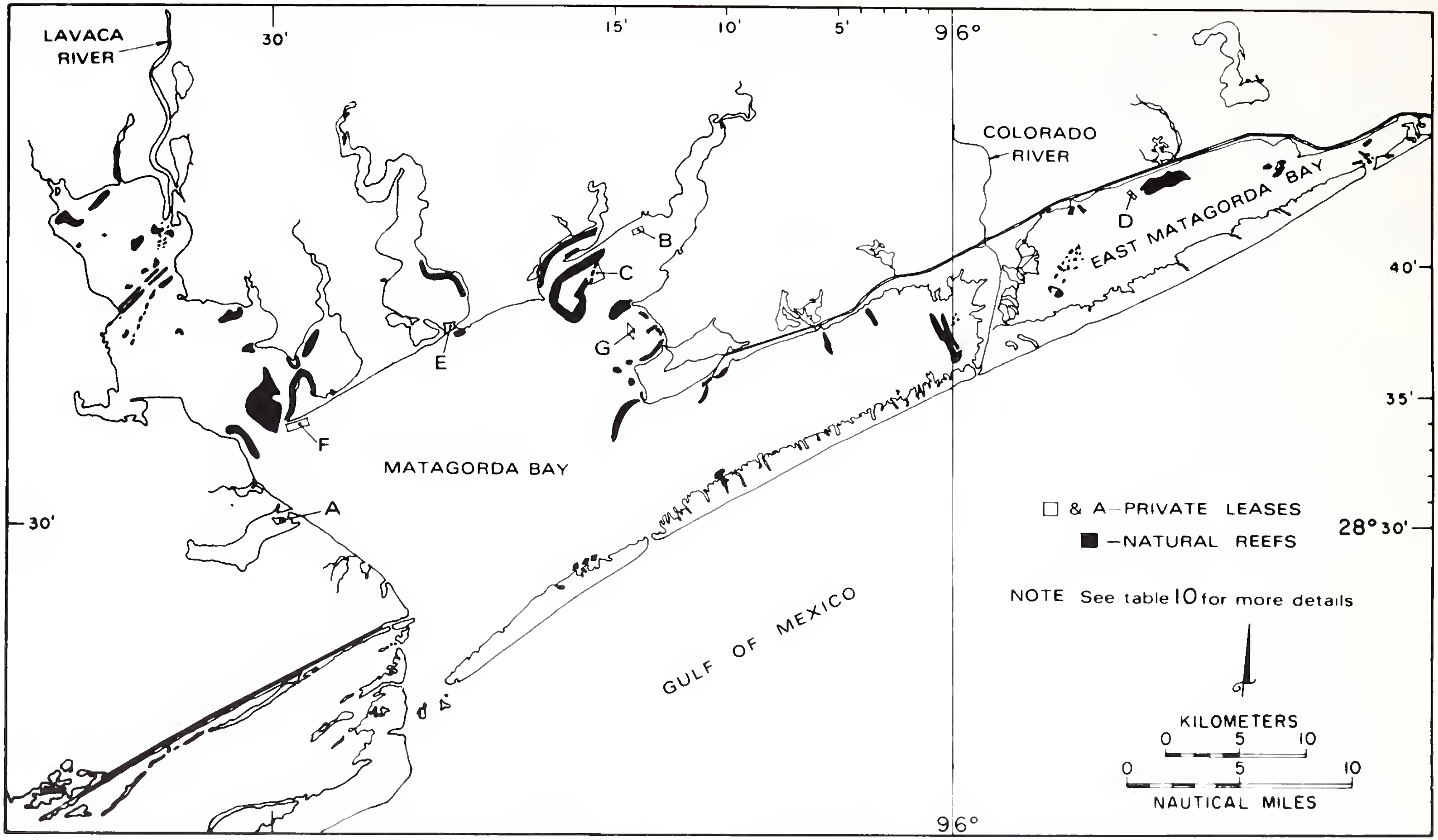


Figure 29.—Approximate locations of natural oyster reefs (solid) and private oyster leases (open and lettered) in the Matagorda Bay area (see Table 10). Locations and areas plotted from charts furnished by the Texas Parks and Wildlife Department.

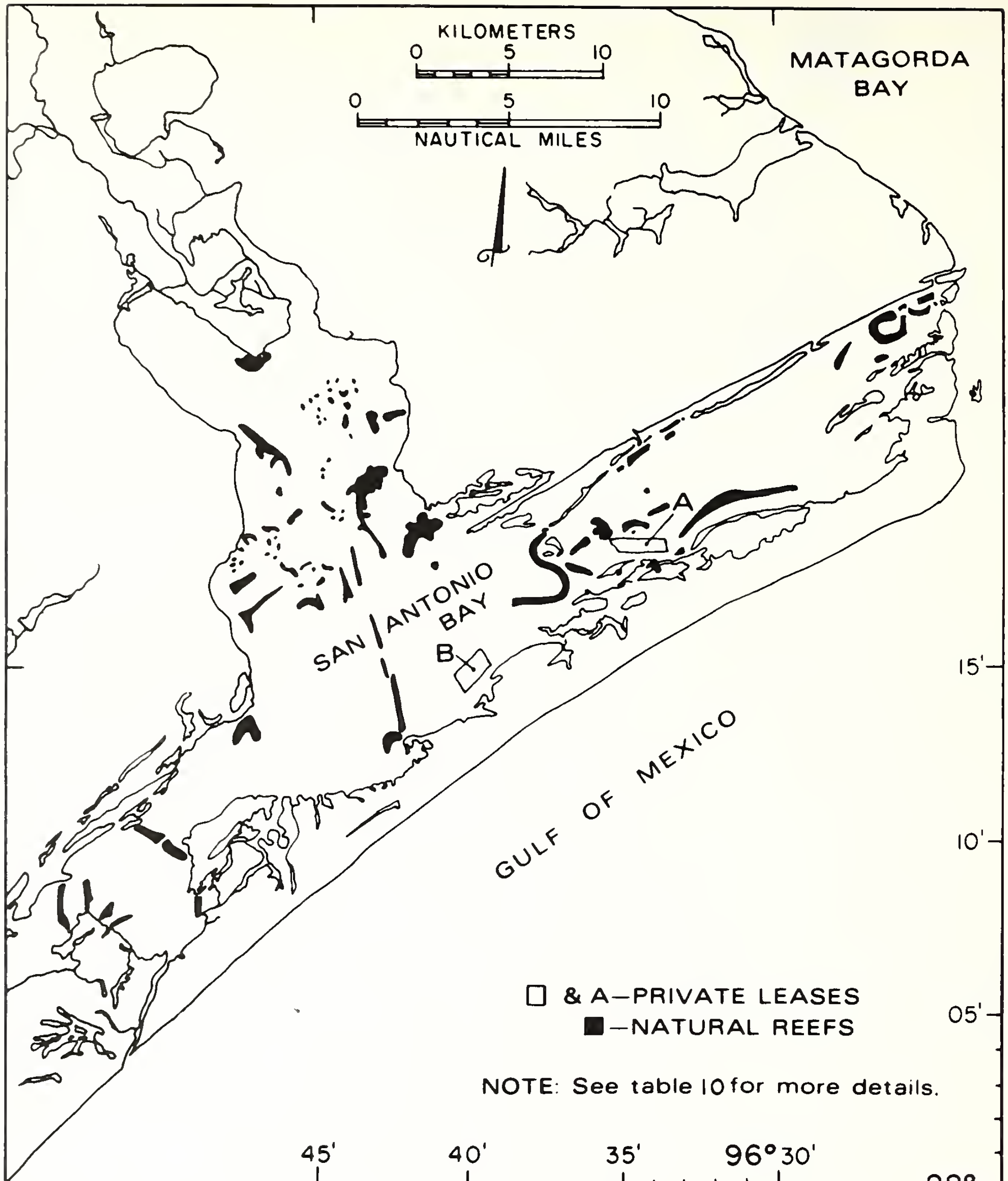


Figure 30.—Approximate locations of natural oyster reefs (solid) and private oyster leases (open and lettered) in the San Antonio Bay Area (see Table 10). Locations and areas plotted from charts furnished by the Texas Parks and Wildlife Department.

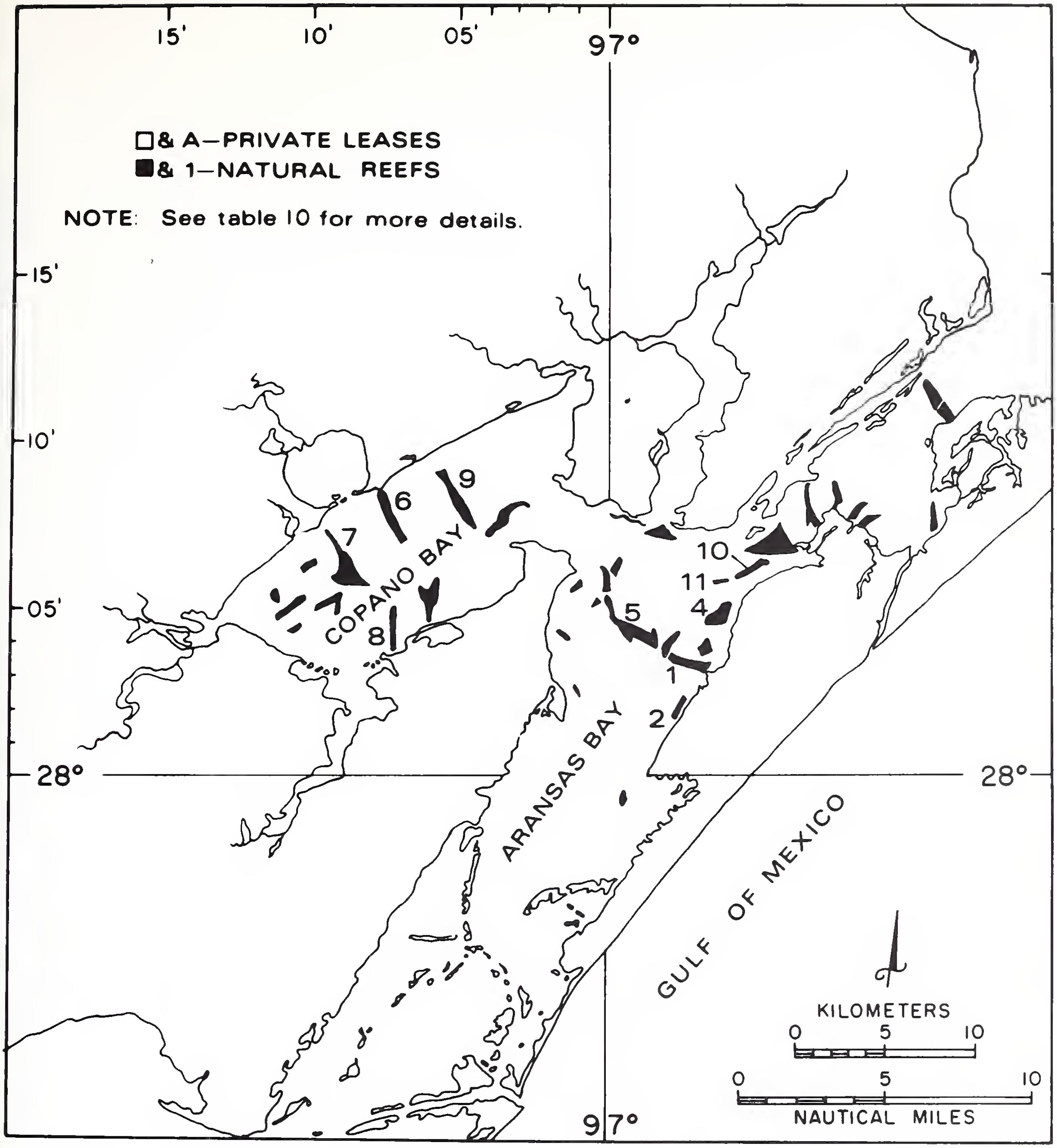


Figure 31.—Approximate locations of natural oyster reefs in the Copano-Aransas Bay area (see Table 10). Locations and areas plotted from charts furnished by the Texas Parks and Wilife Department.

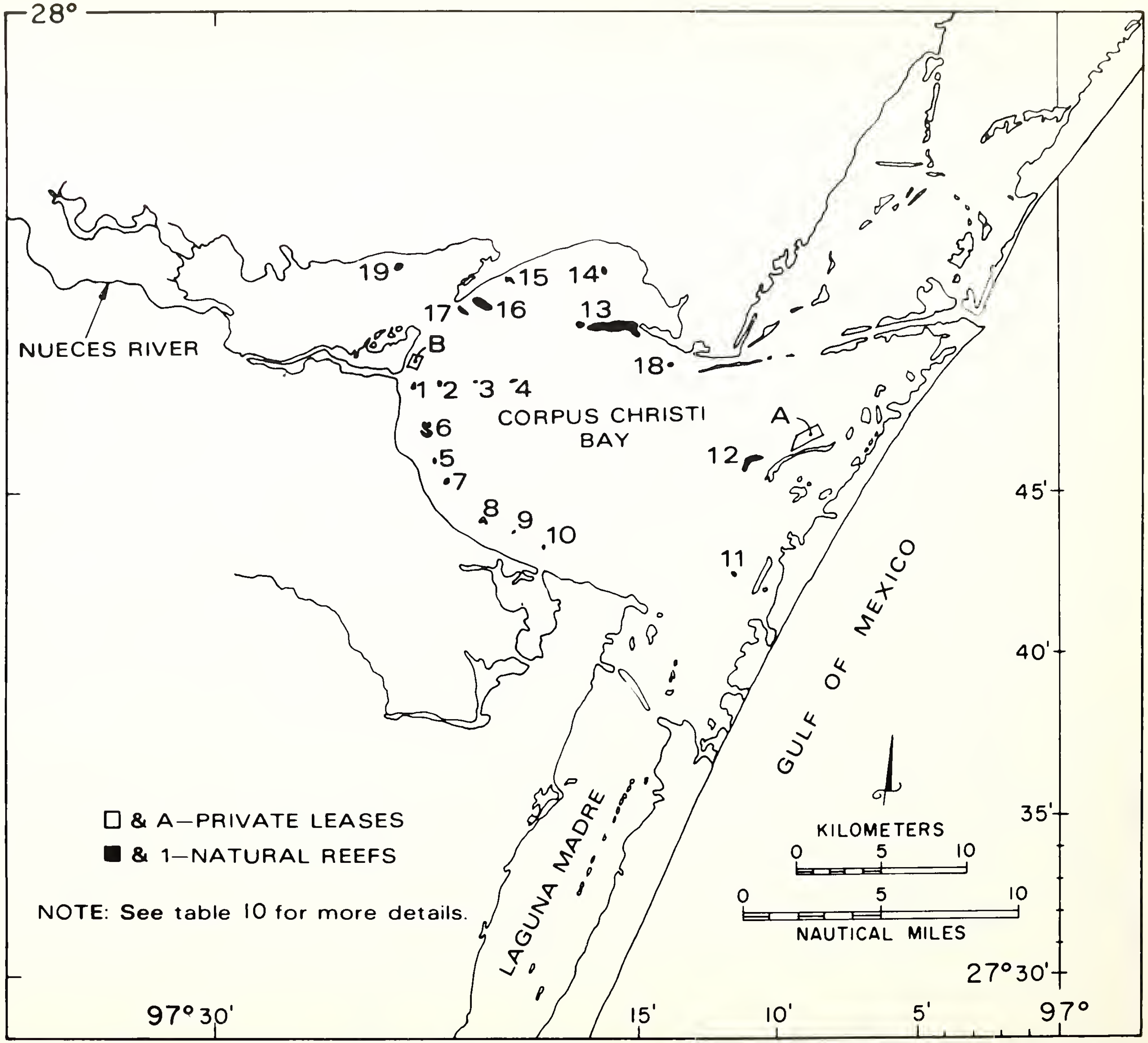


Figure 32.—Approximate locations of natural oyster reefs (solid and numbered) and private oyster leases (open and lettered) in the Corpus Christi Bay area (see Table 10). Locations and areas plotted from charts furnished by the Texas Parks and Wildlife Department.

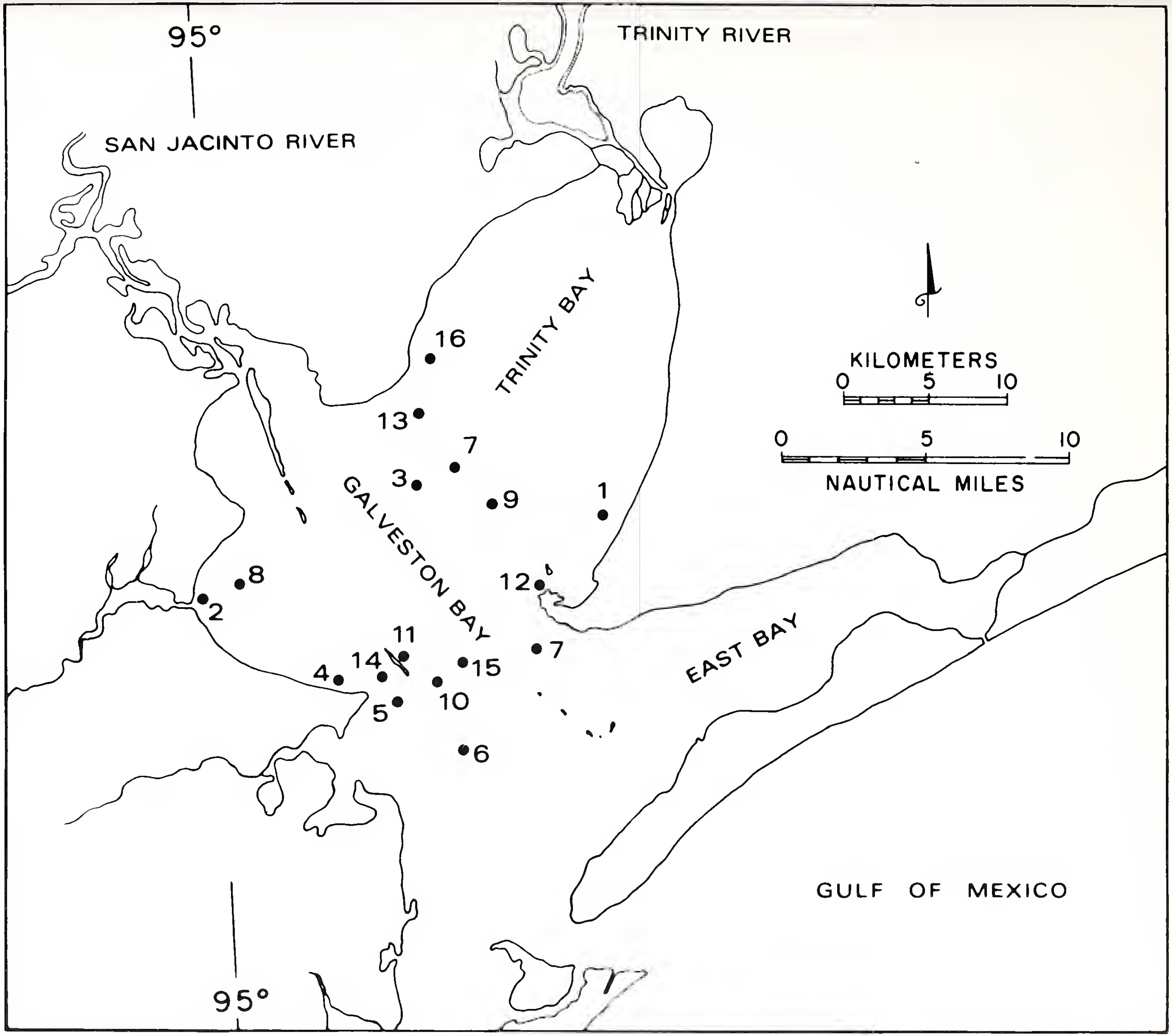


Figure 33.—Approximate locations of artificial and experimental oyster reefs established in the Galveston Bay area by the Texas Parks and Wildlife Department. (Plotted from charts furnished by the Texas Parks and Wildlife Department; see Table 11.)

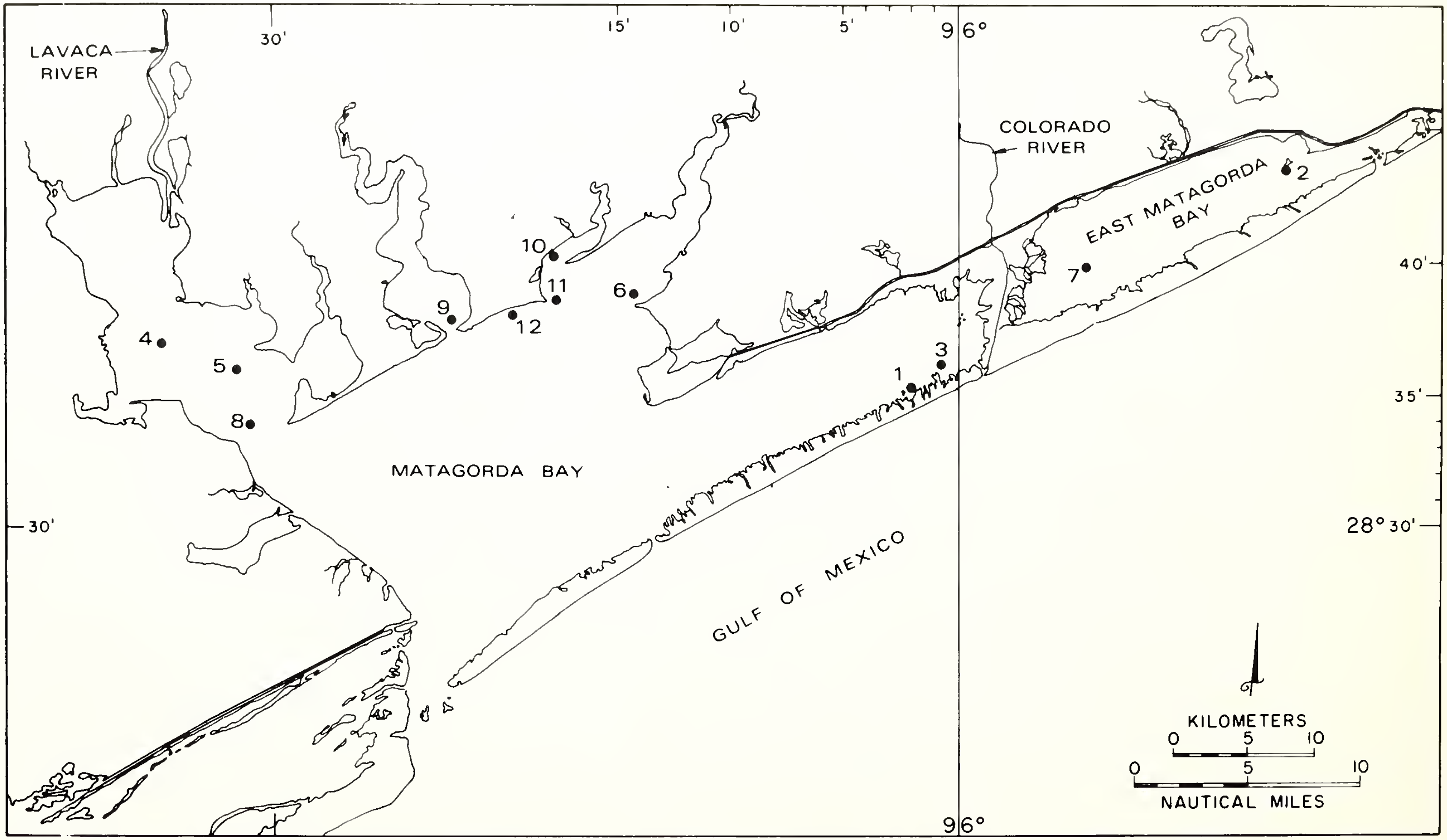


Figure 34.—Approximate locations of artificial and experimental oyster reefs established in the Matagorda Bay area by the Texas Parks and Wildlife Department. (Plotted from charts furnished by the Texas Parks and Wildlife Department; see Table 11.)

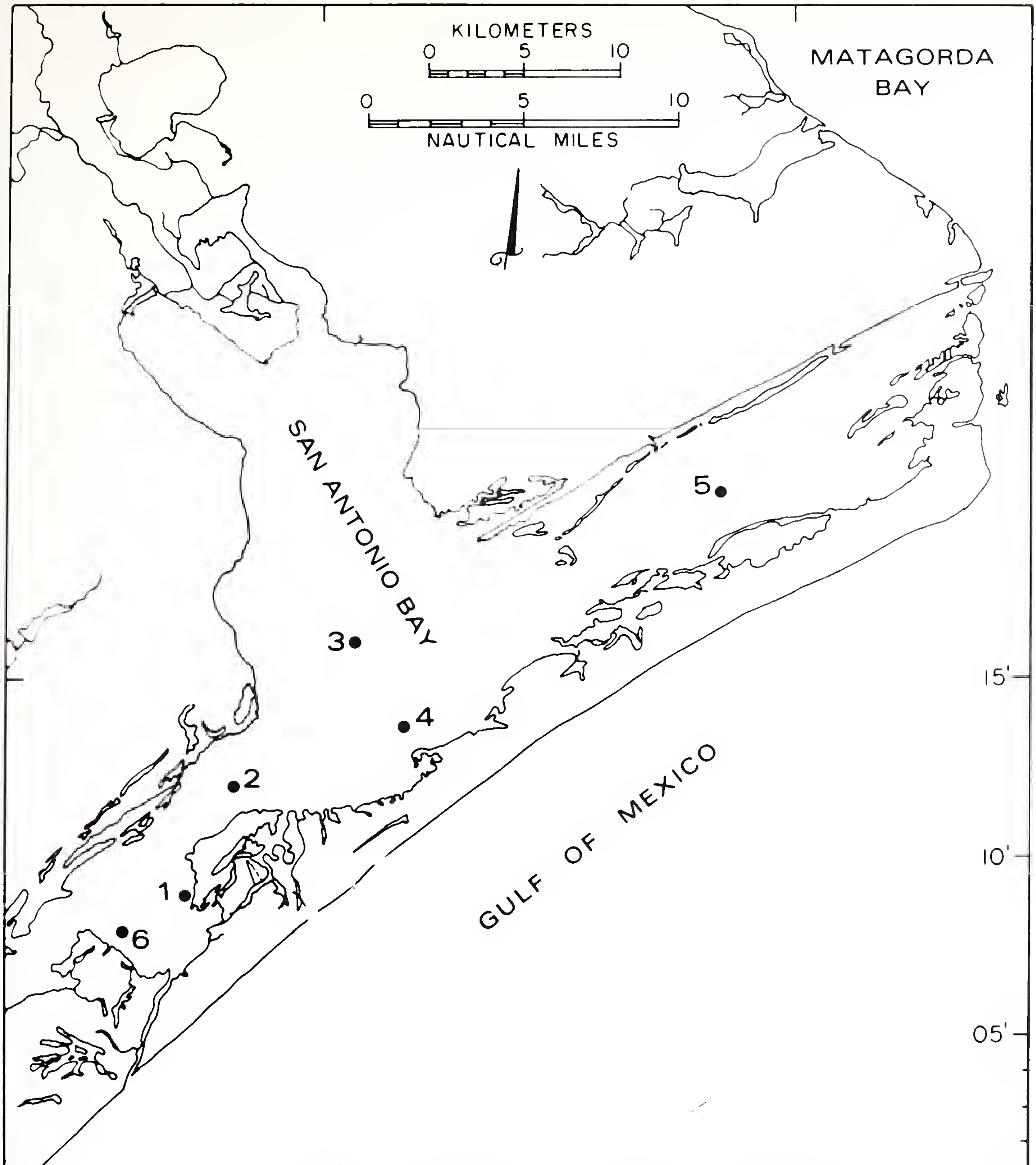


Figure 35.—Approximate locations of artificial and experimental oyster reefs established in the San Antonio Bay area by the Texas Parks and Wildlife Department. (Plotted from charts furnished by the Texas Parks and Wildlife Department; see Table 11.)

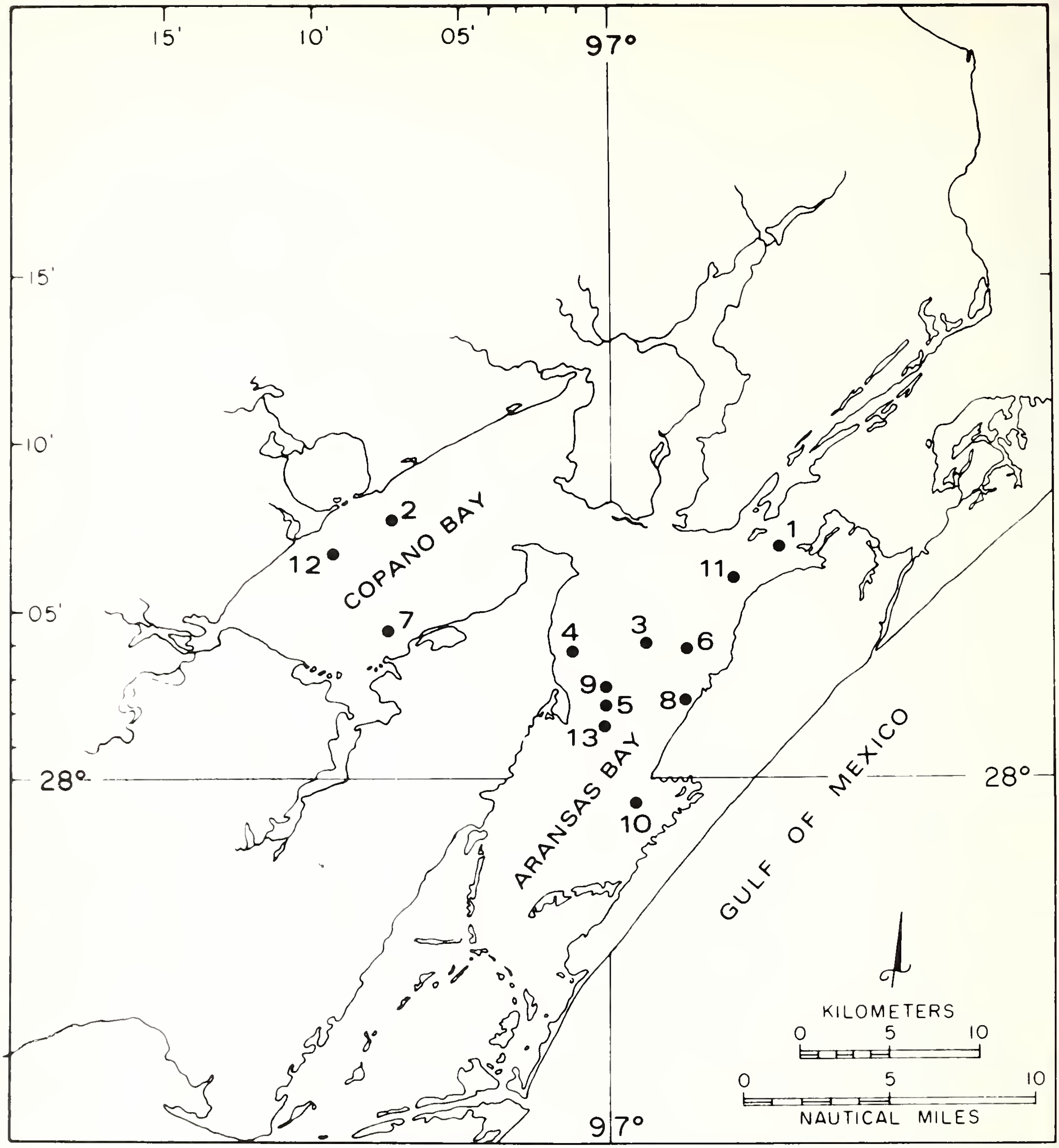


Figure 36.—Approximate locations of artificial and experimental oyster reefs established in the Copano-Aransas Bay area by the Texas Parks and Wildlife Department. (Plotted from charts furnished by the Texas Parks and Wildlife Department; see Table 11.)

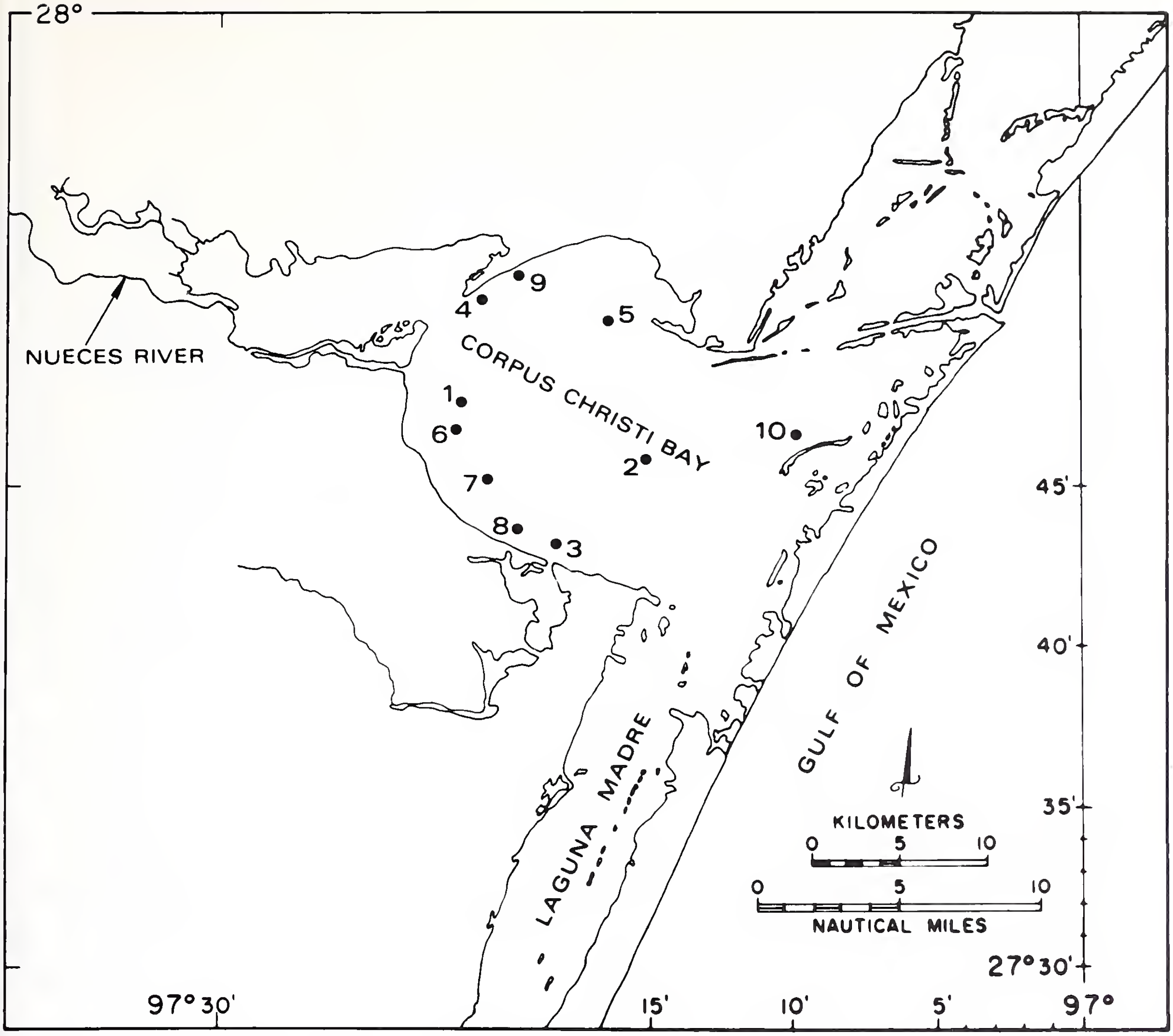


Figure 37.—Approximate locations of artificial and experimental oyster reefs in the Corpus Christi Bay area established by the Texas Parks and Wildlife Department. (Plotted from charts furnished by the Texas Parks and Wildlife Department; see Table 11.)

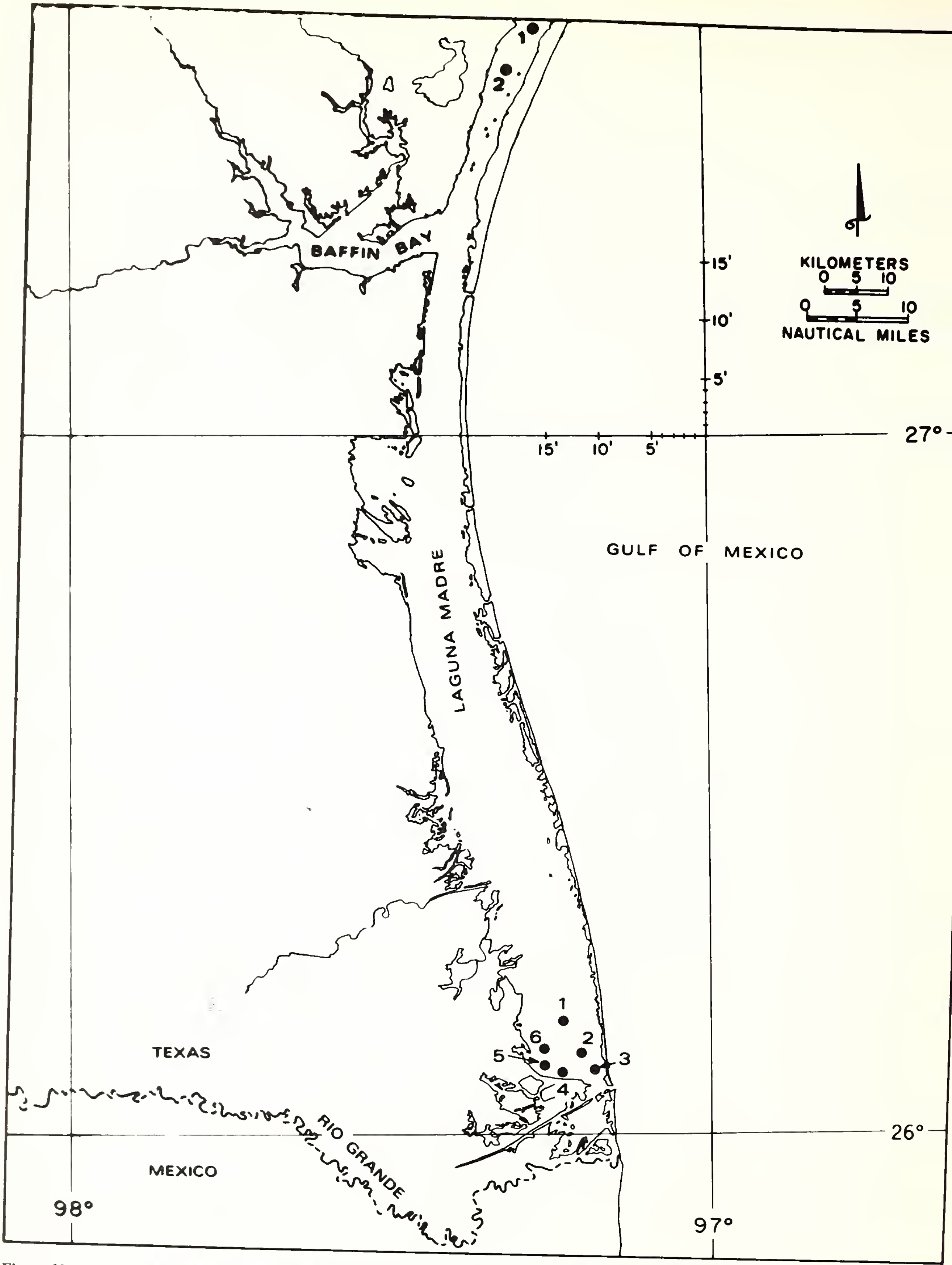


Figure 38.—Approximate locations of artificial and experiment oyster reefs in the Laguna Madre area established by the Texas Parks and Wildlife Department (see Table 11). (Modified from Breuer 1959, 1962b.)

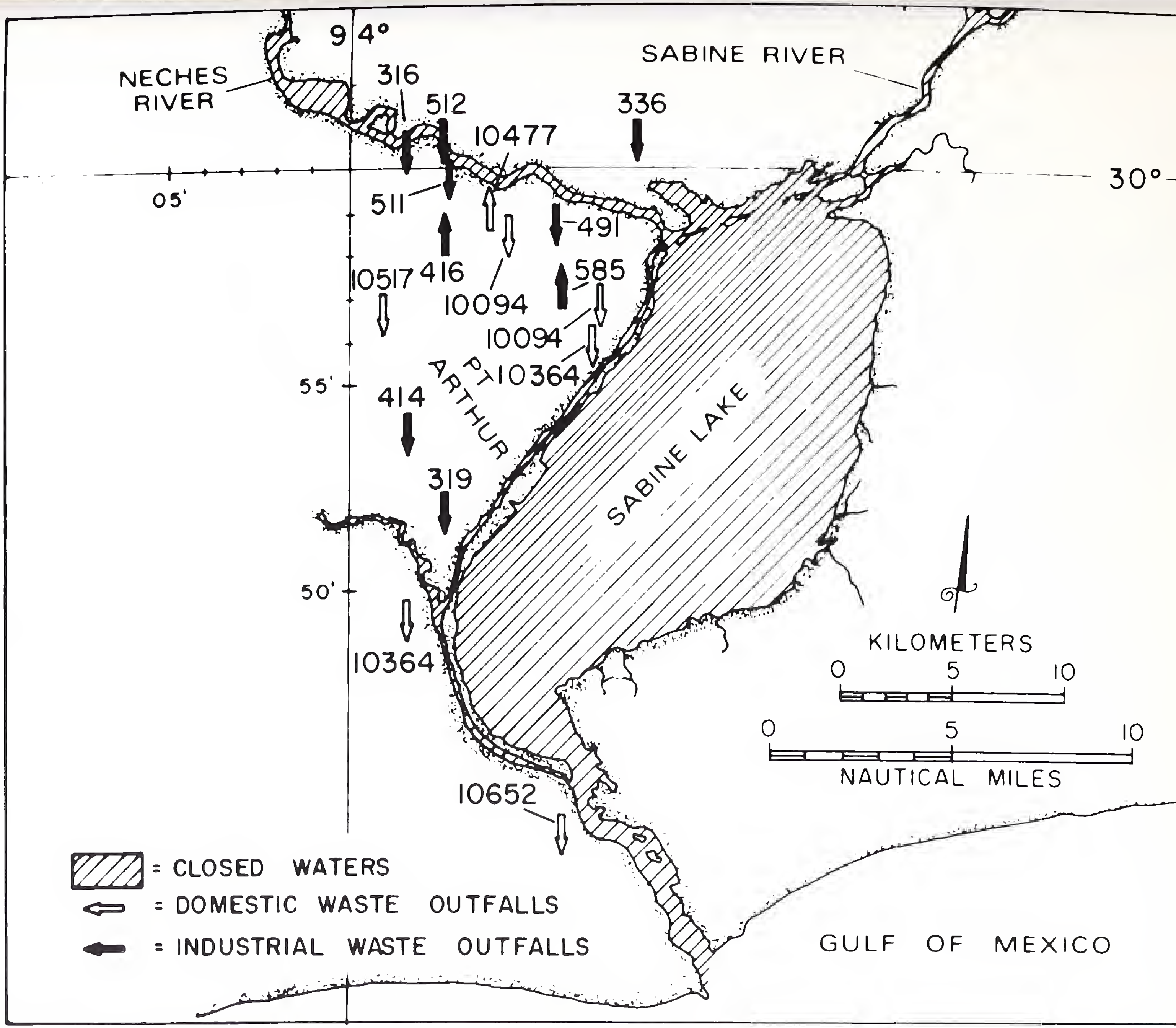


Figure 39.—The Sabine Lake area showing known sources of domestic pollution (see Table 22), industrial pollution (see Table 23), and waters closed to shellfishing. (Modified from Texas Water Quality Board data and from Texas Board of Health maps.)

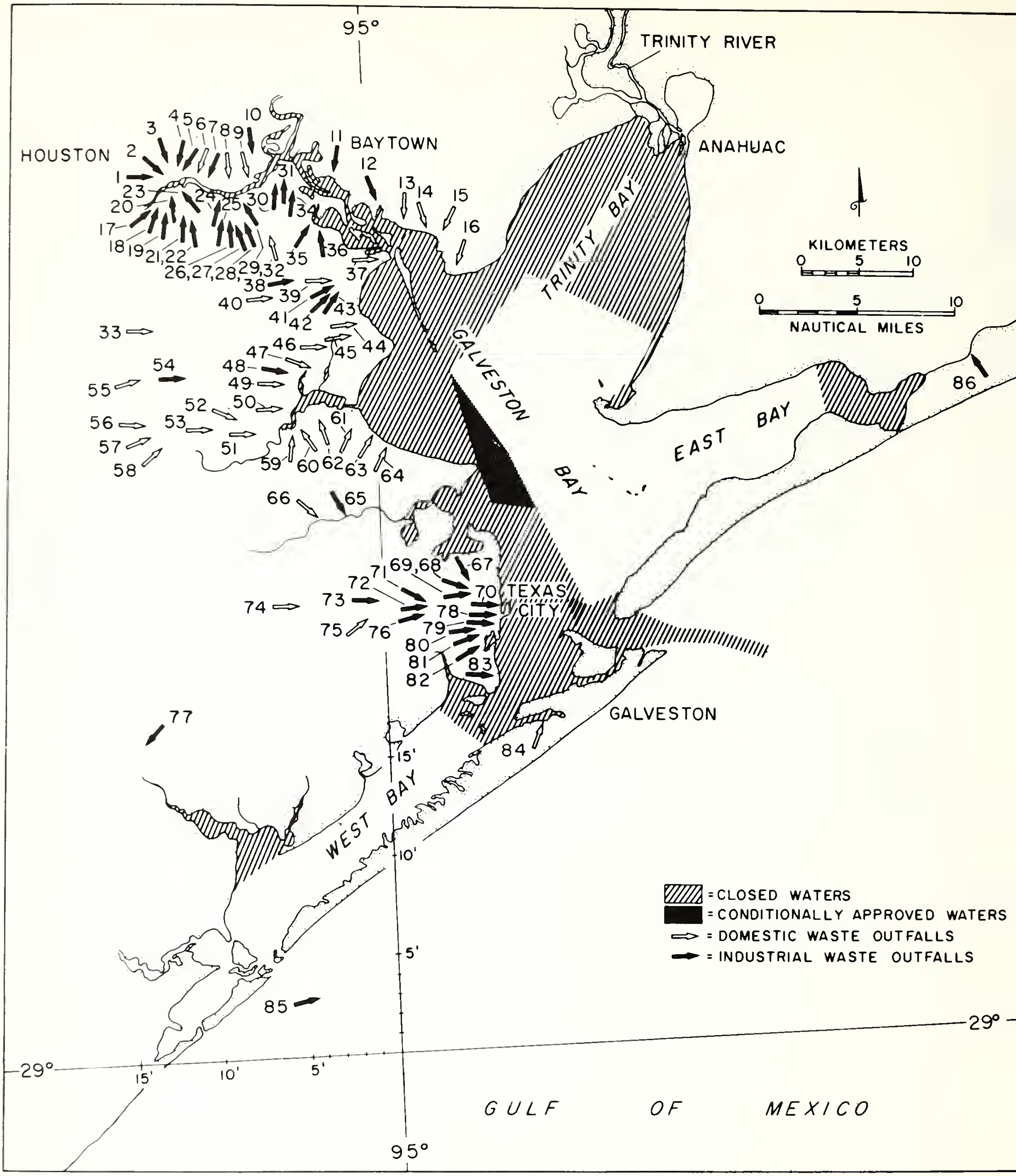


Figure 40.—The Galveston Bay area showing known sources of domestic pollution (see Table 22), industrial pollution (see Table 23), and water closed—or conditionally approved—to shellfishing. (Modified from Texas Water Quality Board data and from Texas Board of Health maps.)

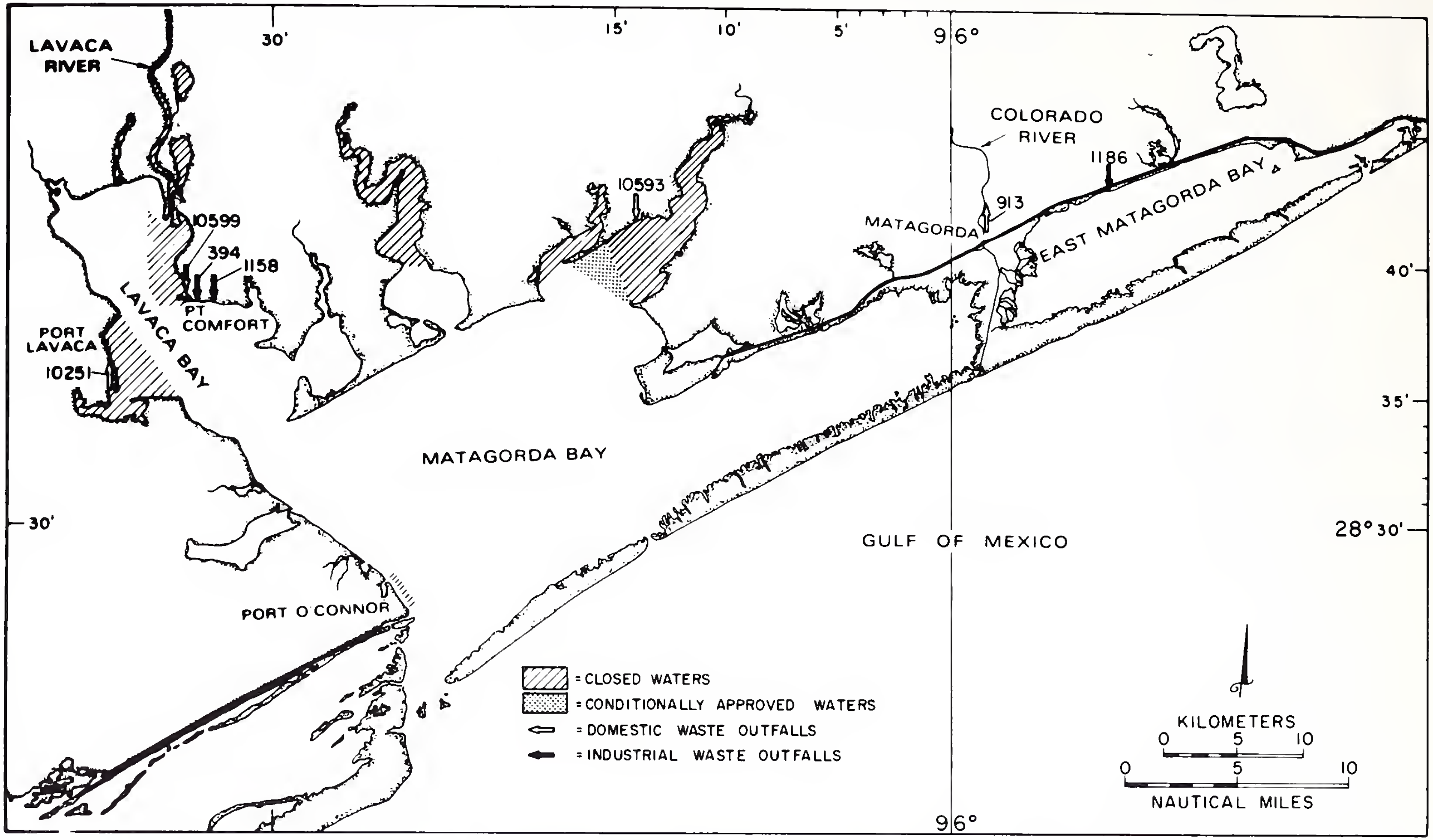


Figure 41.—The Matagorda Bay area showing known sources of domestic pollution (see Table 22), industrial pollution (see Table 23), and waters closed—or conditionally approved—to shellfishing. (Modified from Texas Water Quality Board data and from Texas Board of Health maps.)

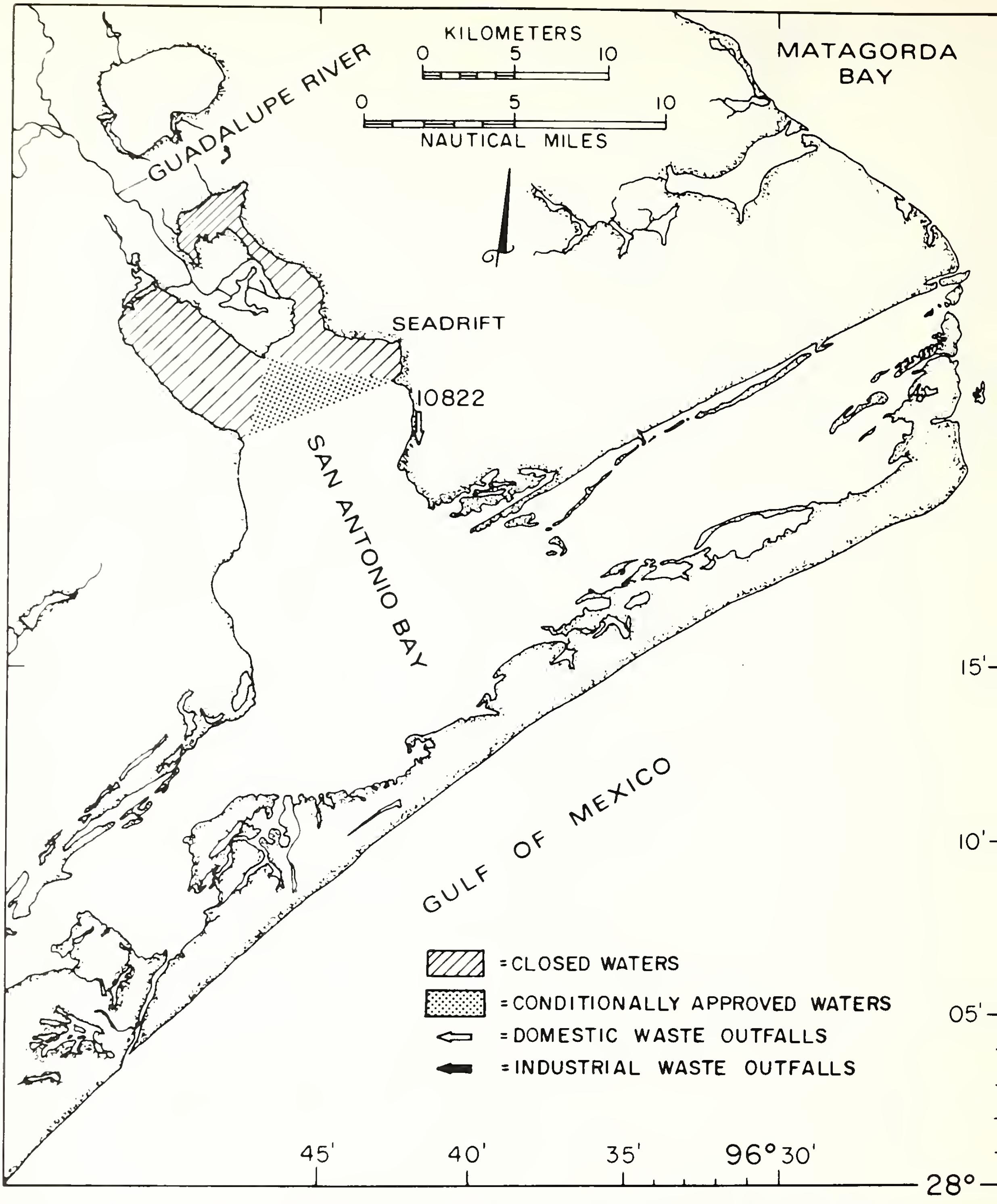


Figure 42.—The San Antonio Bay area showing known sources of domestic pollution (see Table 22) and waters closed—or conditionally approved—to shellfishing. (Modified from Texas Water Quality Board data and from Texas Board of Health maps.)

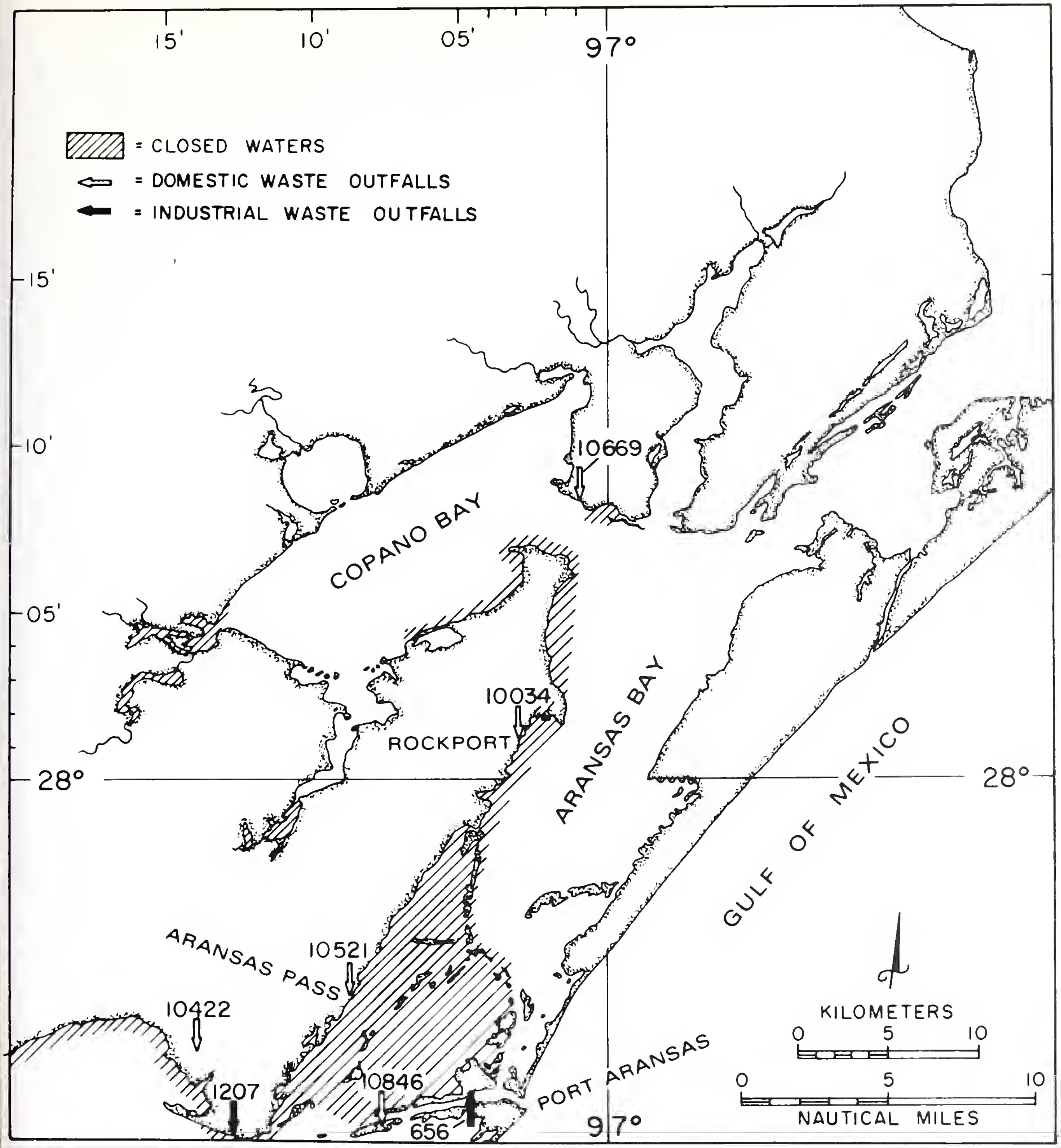


Figure 43.—The Copano-Aransas Bay area showing known sources of domestic pollution (see Table 22), industrial pollution (see Table 23), and waters closed to shellfishing. (Modified from Texas Water Quality Board data and from Texas Board of Health maps.)

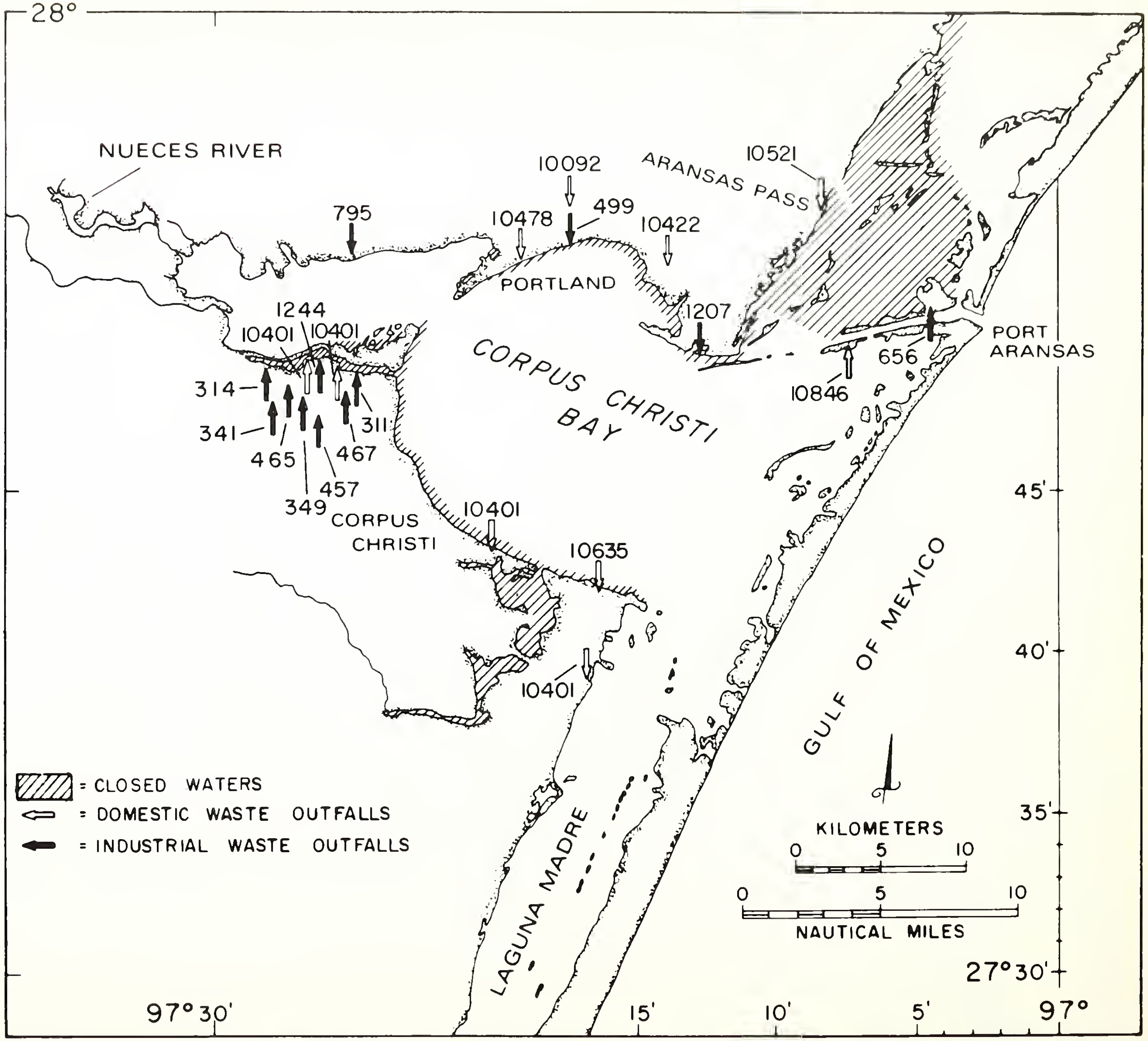


Figure 44.—The Corpus Christi Bay area showing known sources of domestic pollution (see Table 22), industrial pollution (see Table 23), and waters closed to shellfishing. (Modified from Texas Water Quality Board data and from Texas Board of Health maps.)

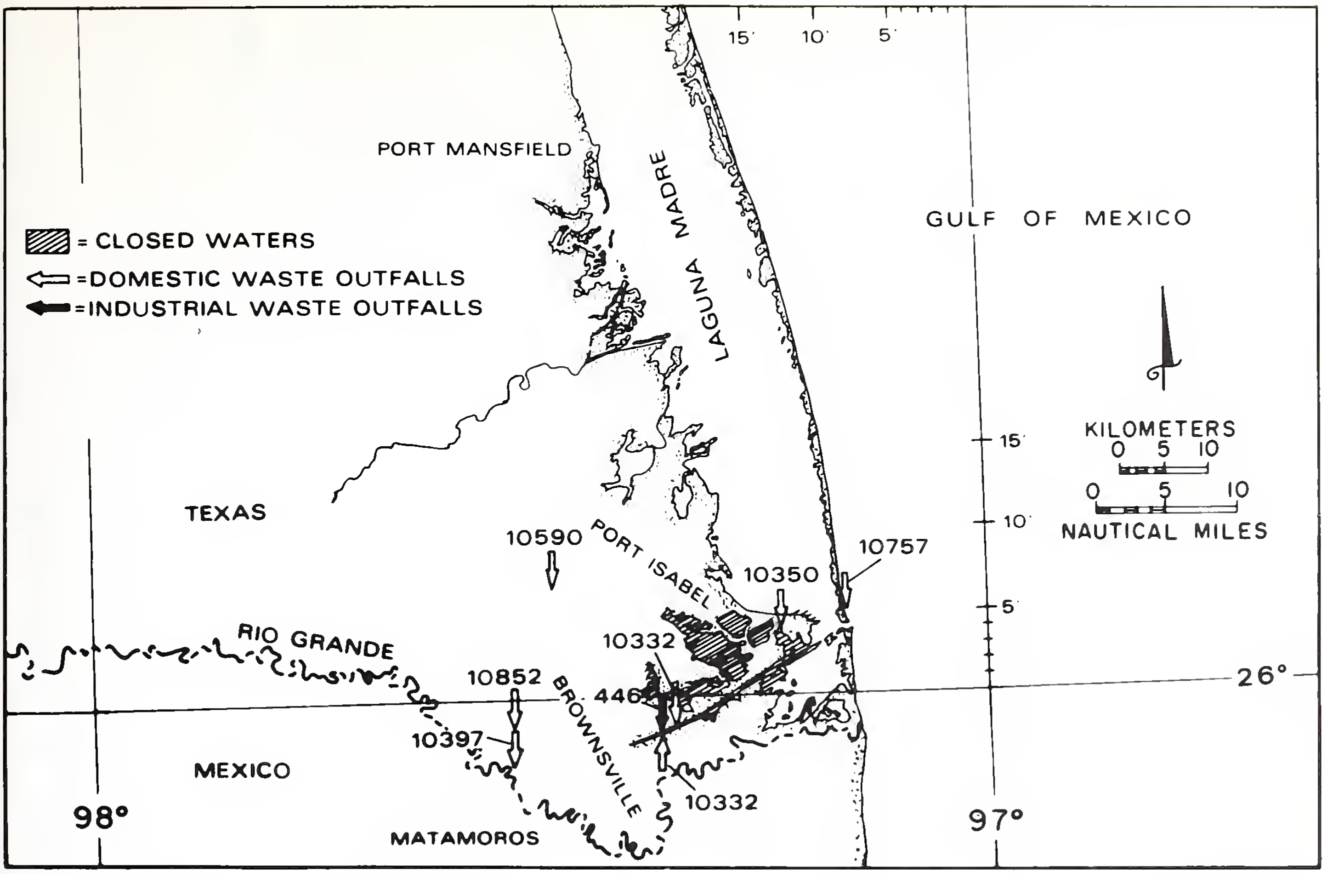


Figure 45.—The Laguna Madre area showing known sources of domestic pollution (see Table 22), industrial pollution (see Table 23), and waters closed to shellfishing. (Modified from Texas Water Quality Board data and from Texas Board of Health maps.)

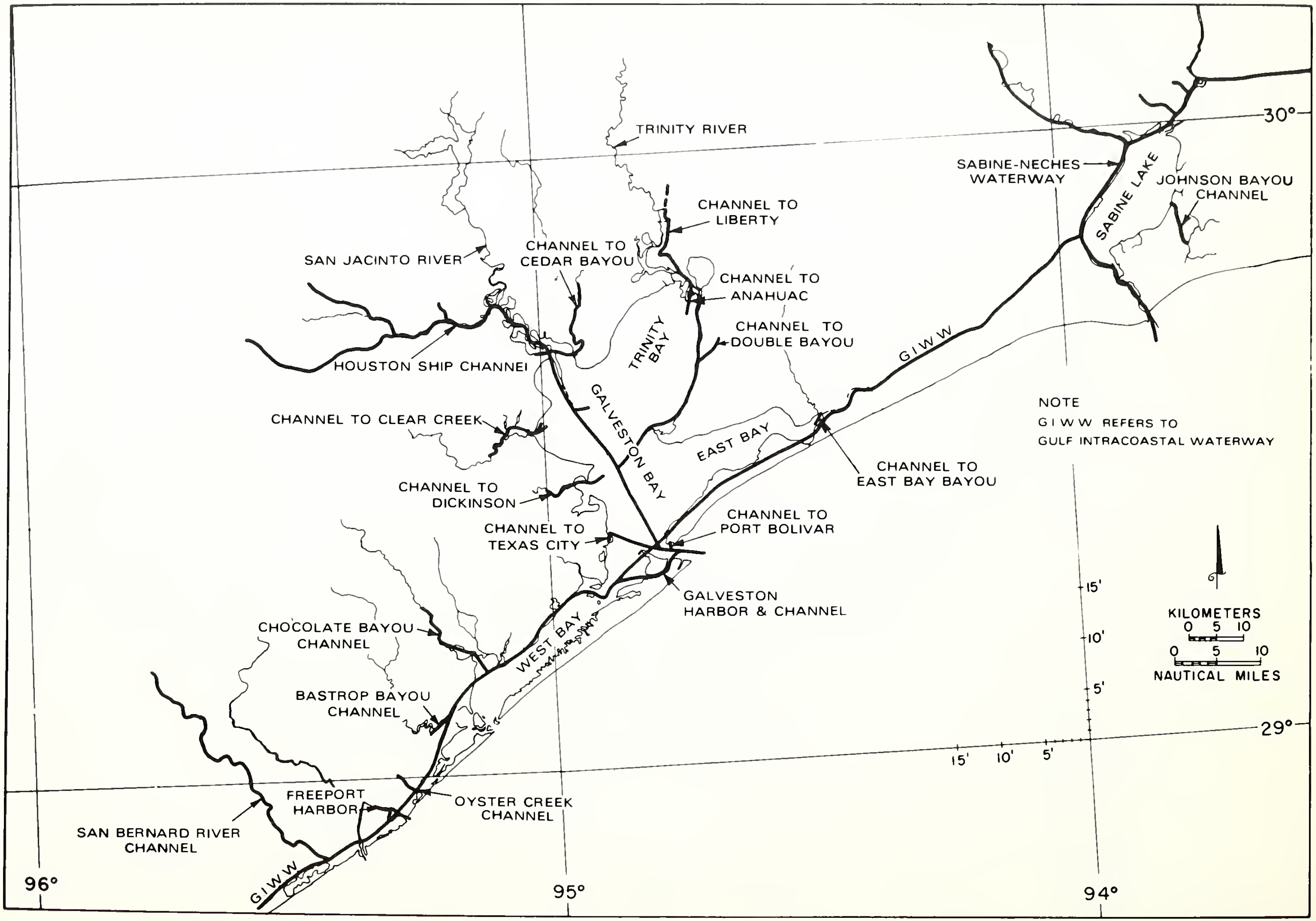


Figure 46. — The upper Texas coast showing major U.S. Army Corps of Engineers navigation projects (see Table 26.)

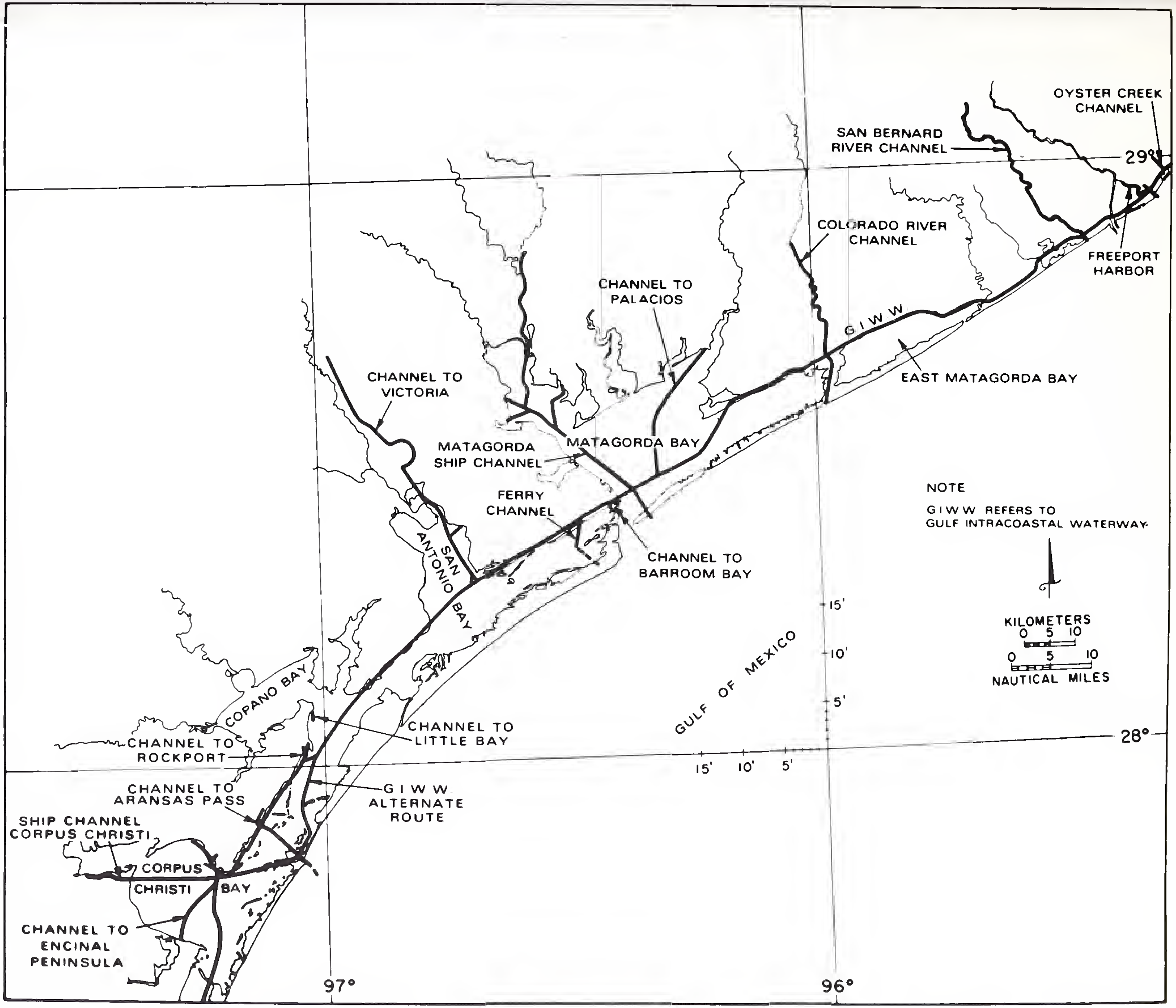


Figure 47.—The central Texas coast showing major U.S. Army Corps of Engineers navigation project (see Table 26.)

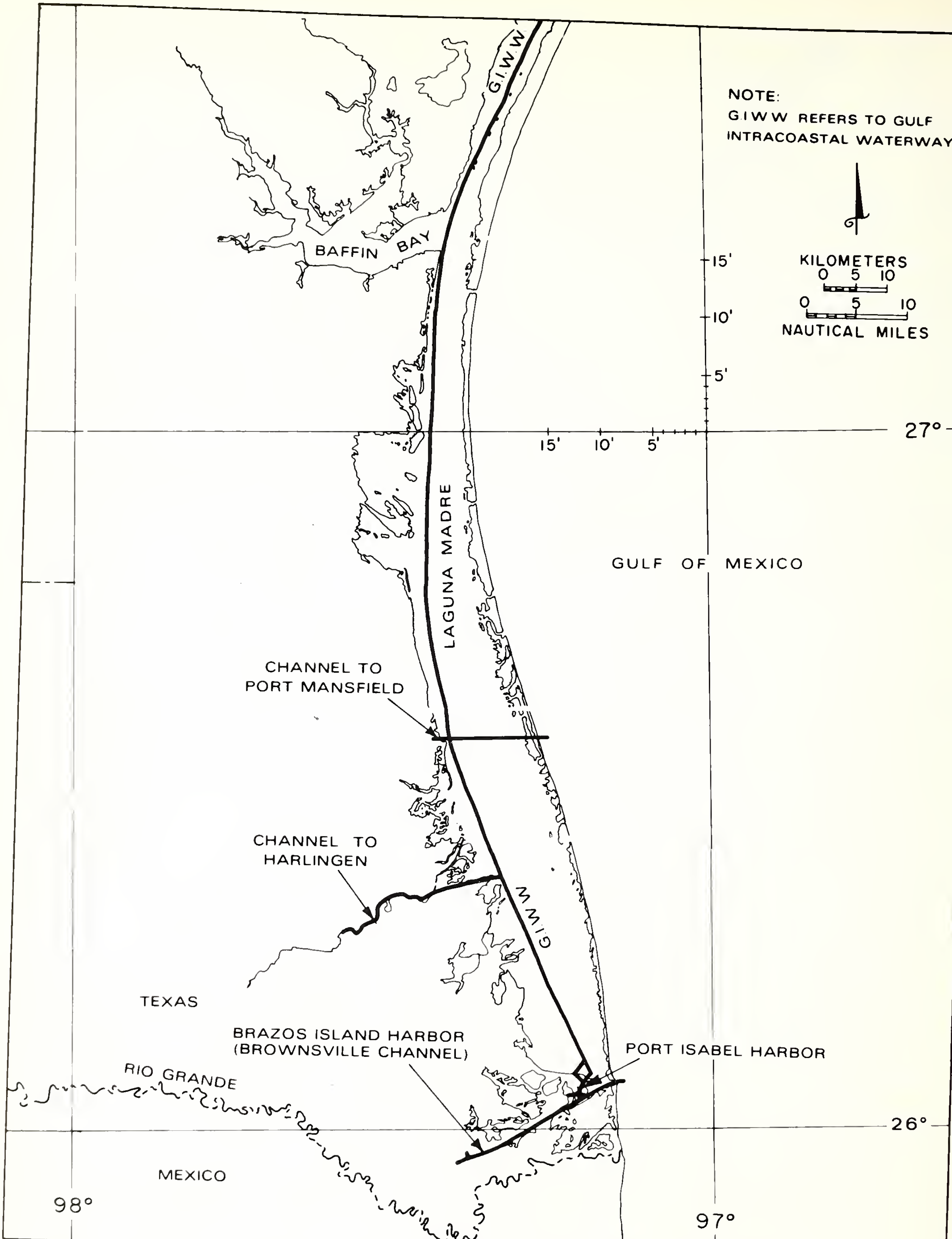


Figure 48.—The lower Texas coast with major U.S. Army Corps of Engineers navigation projects (see Table 26.)

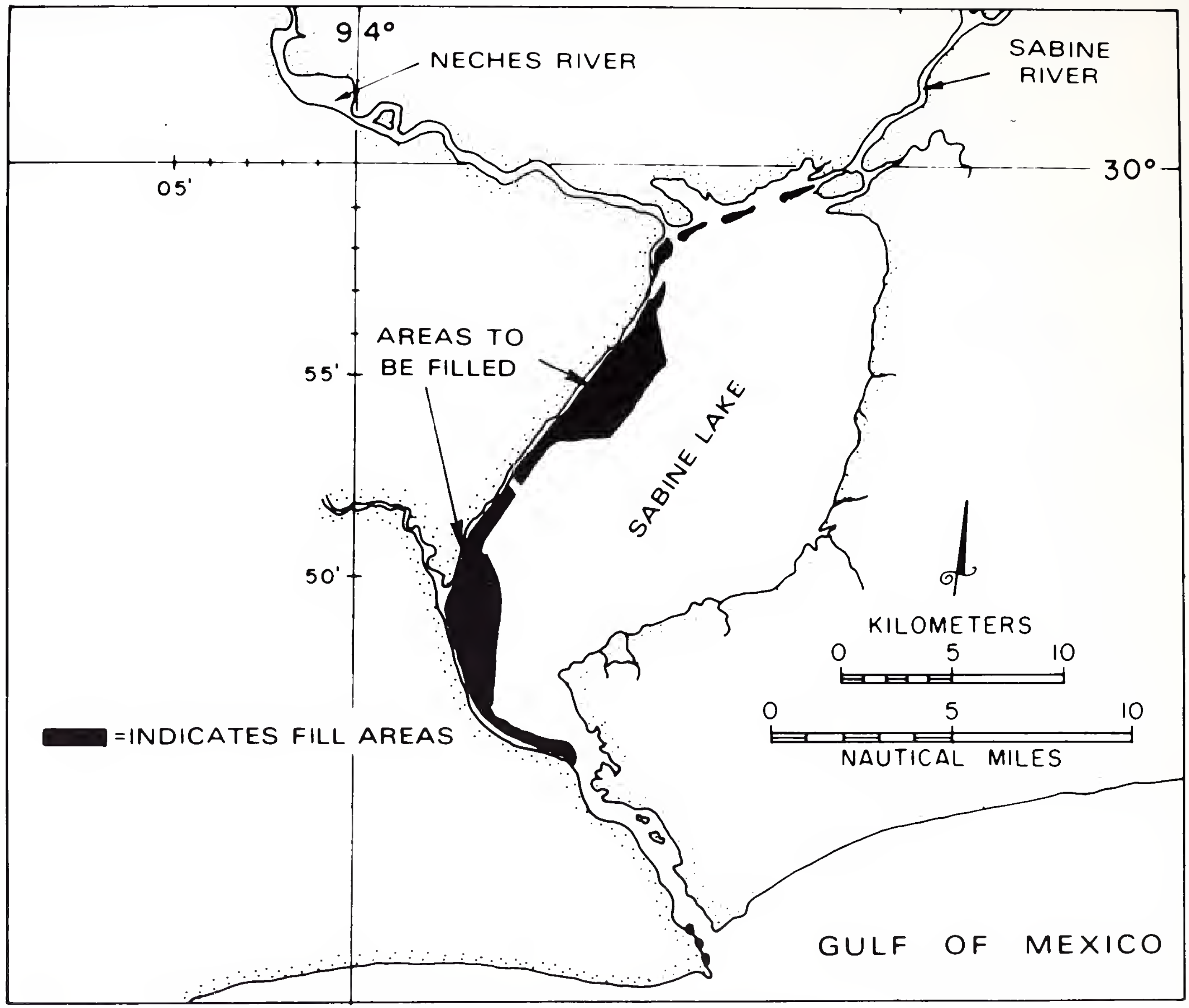


Figure 49.—Known fill areas in the Sabine Lake area.

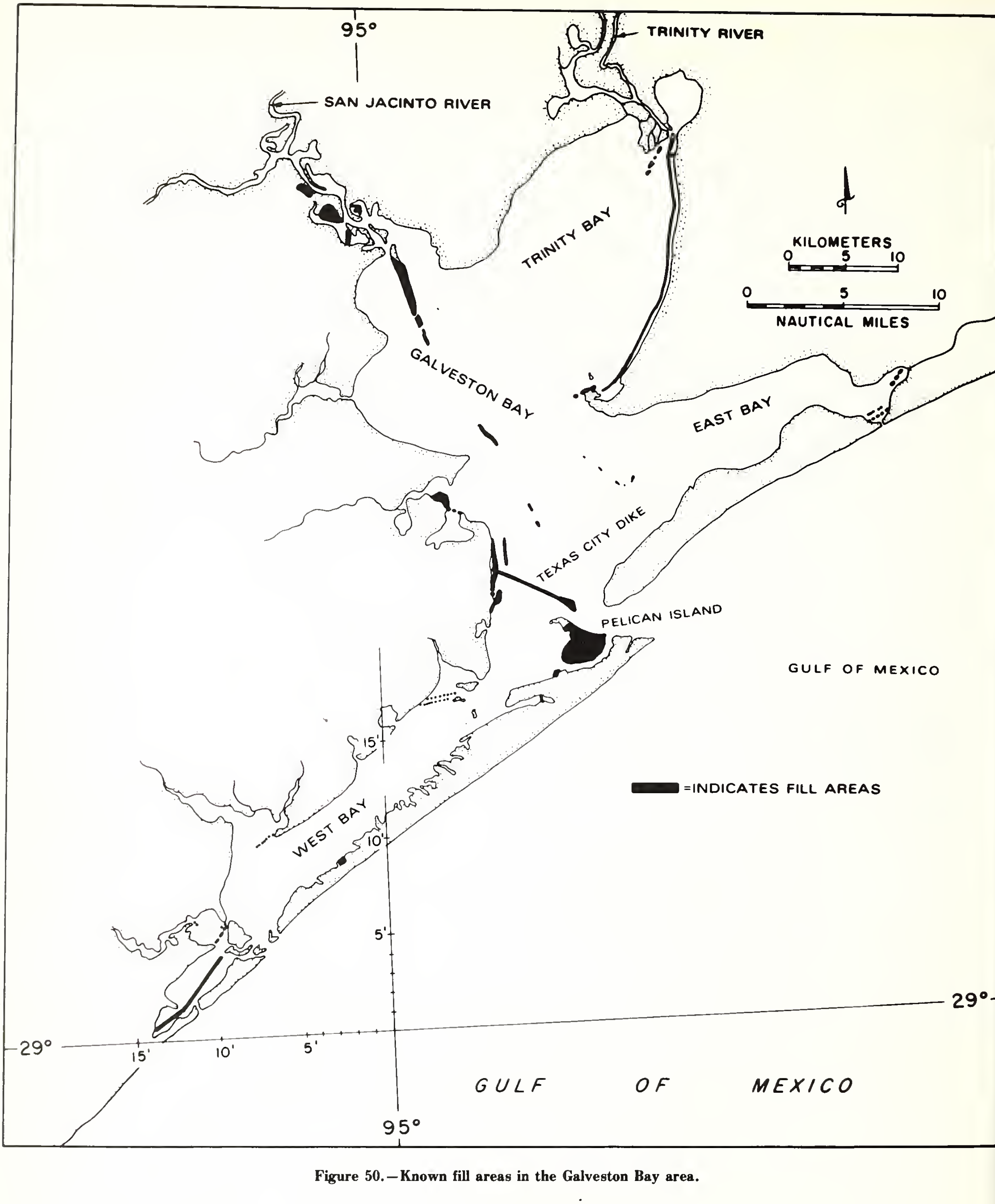


Figure 50.—Known fill areas in the Galveston Bay area.

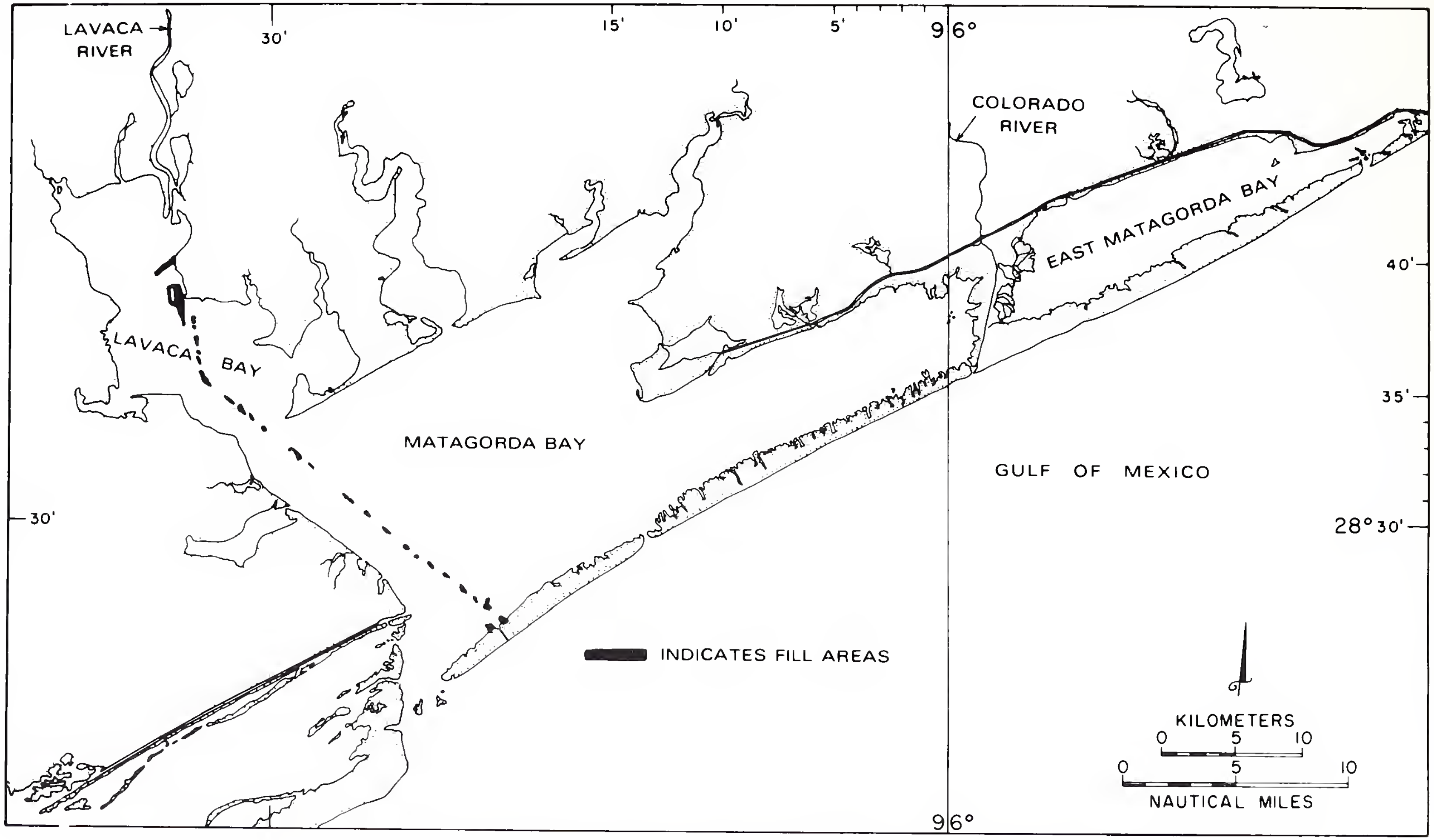


Figure 51.—Known fill areas in the Matagorda Bay area or portions of the Colorado River Delta attributable to dredging activity refer to Figure 9.

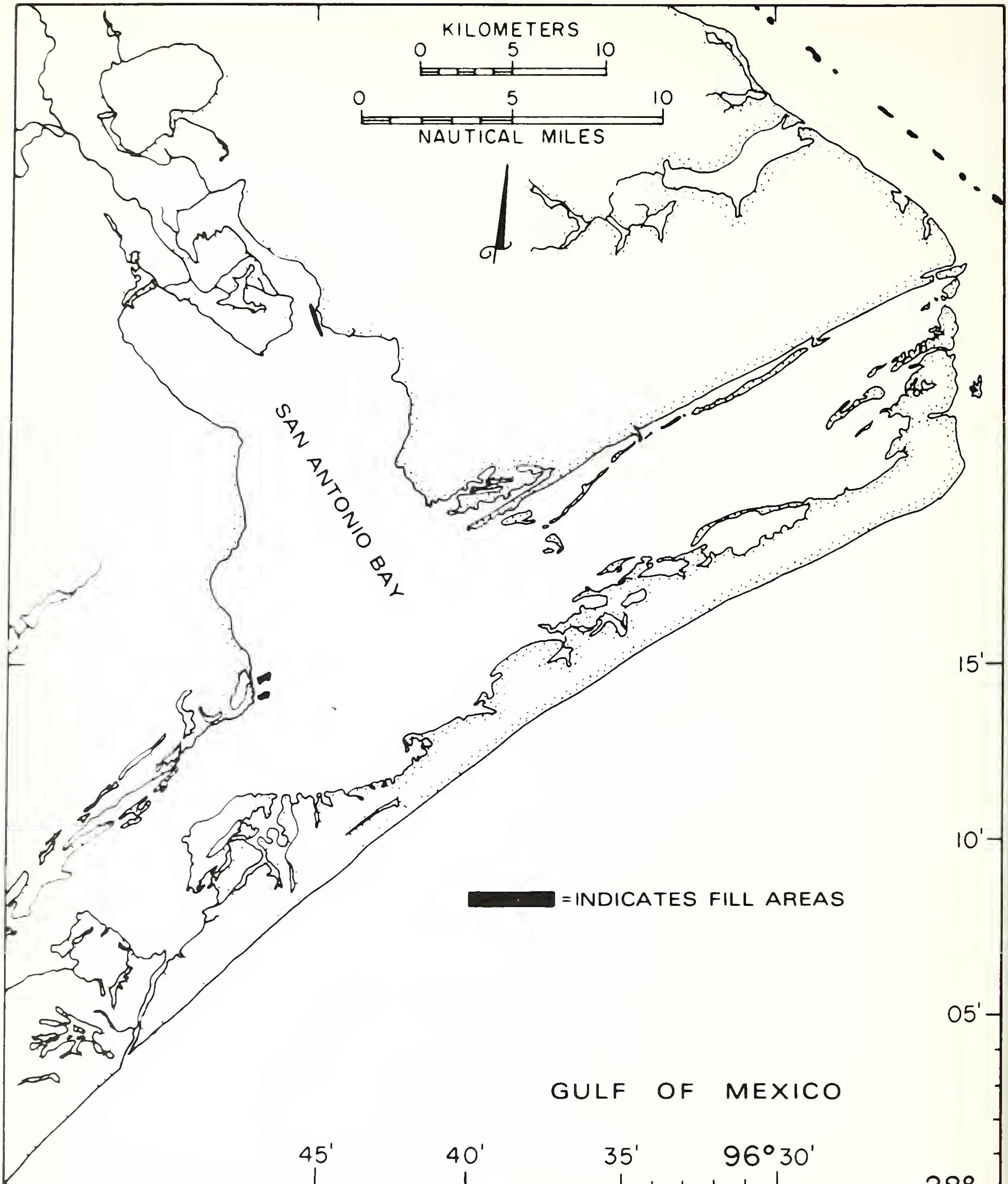


Figure 52.—Known fill areas in the San Antonio Bay area.

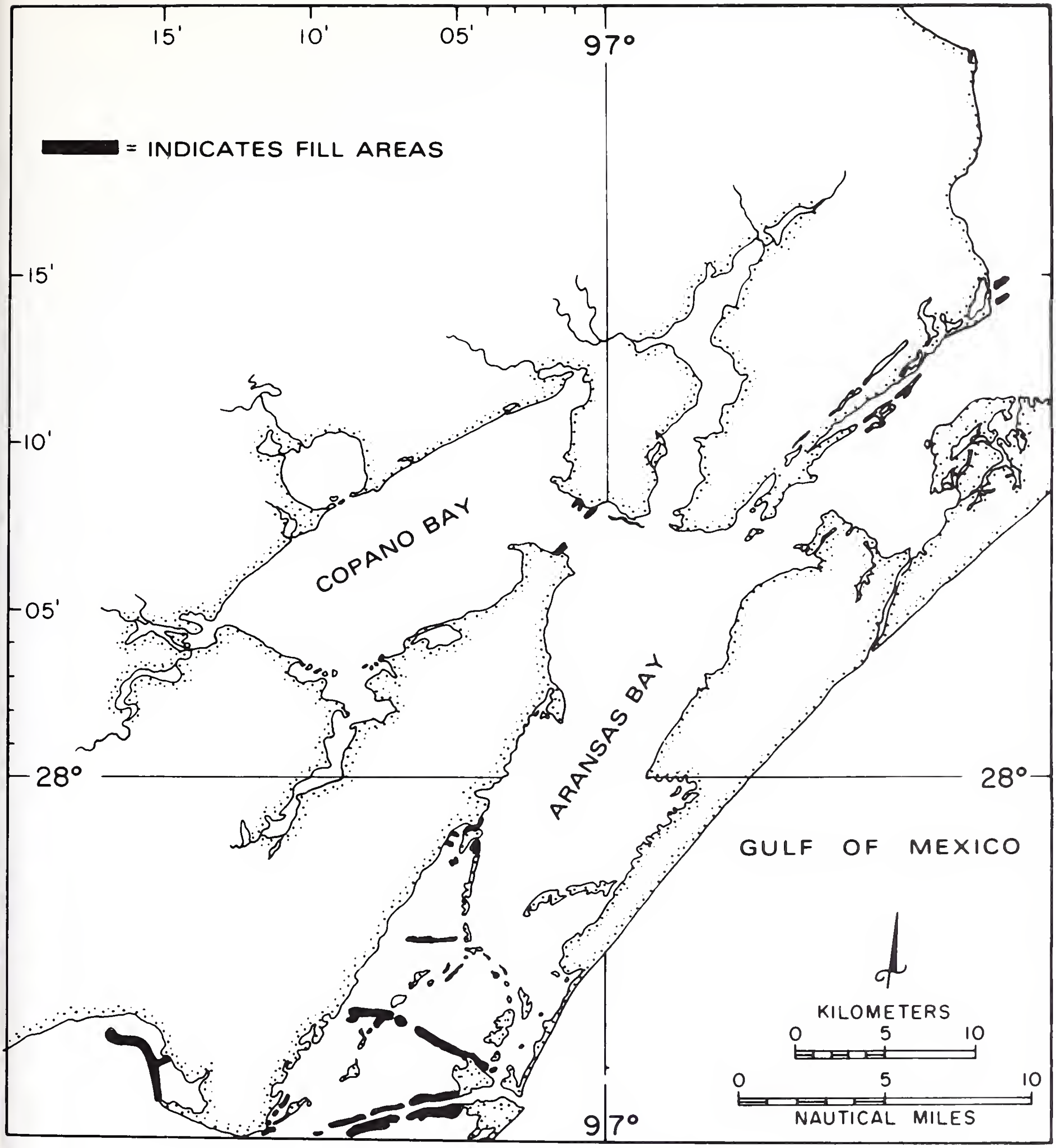


Figure 53.—Known fill areas in the Copano—Aransas Bay area.

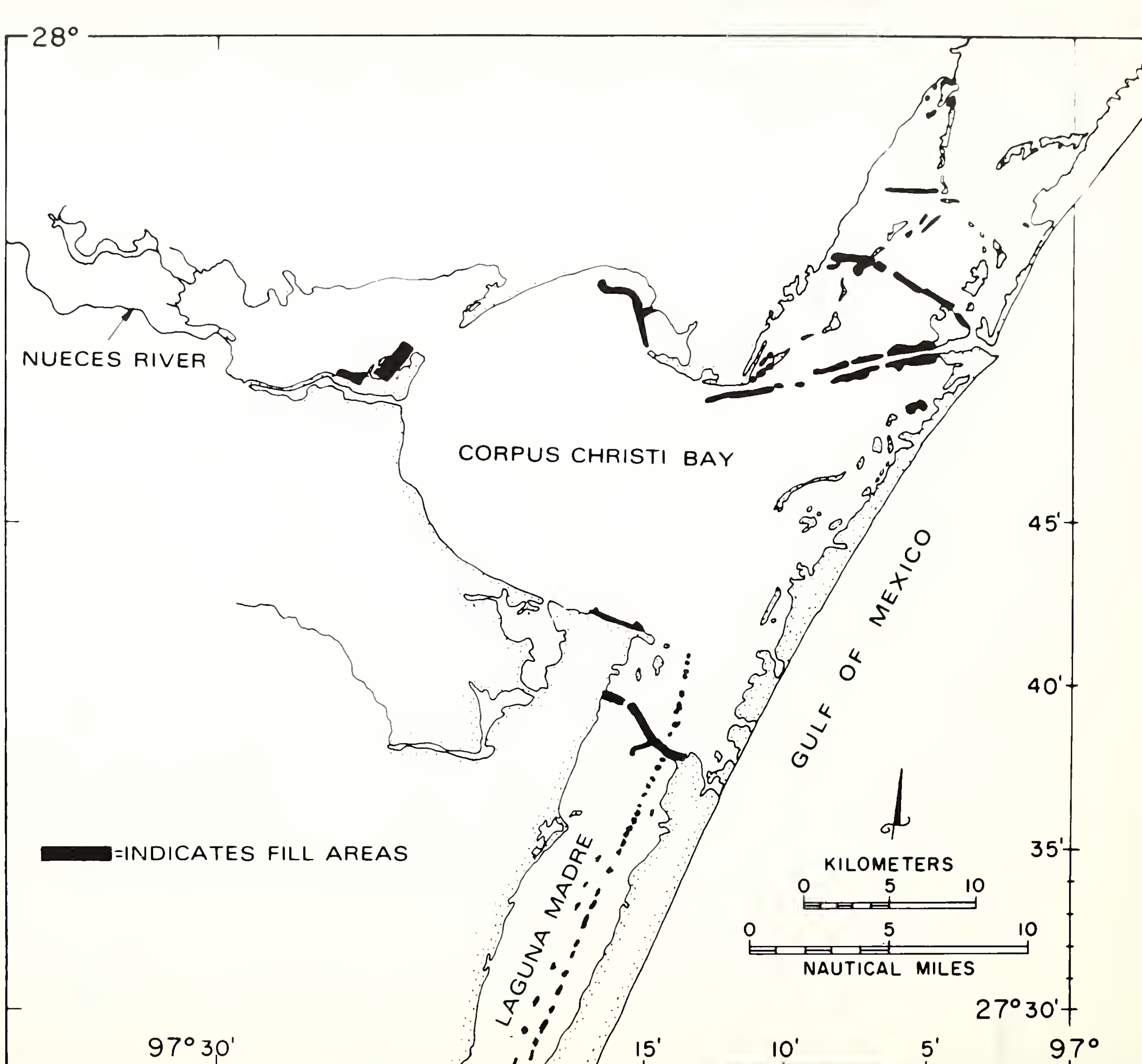


Figure 54.—Known fill areas in the Corpus Christi Bay area.

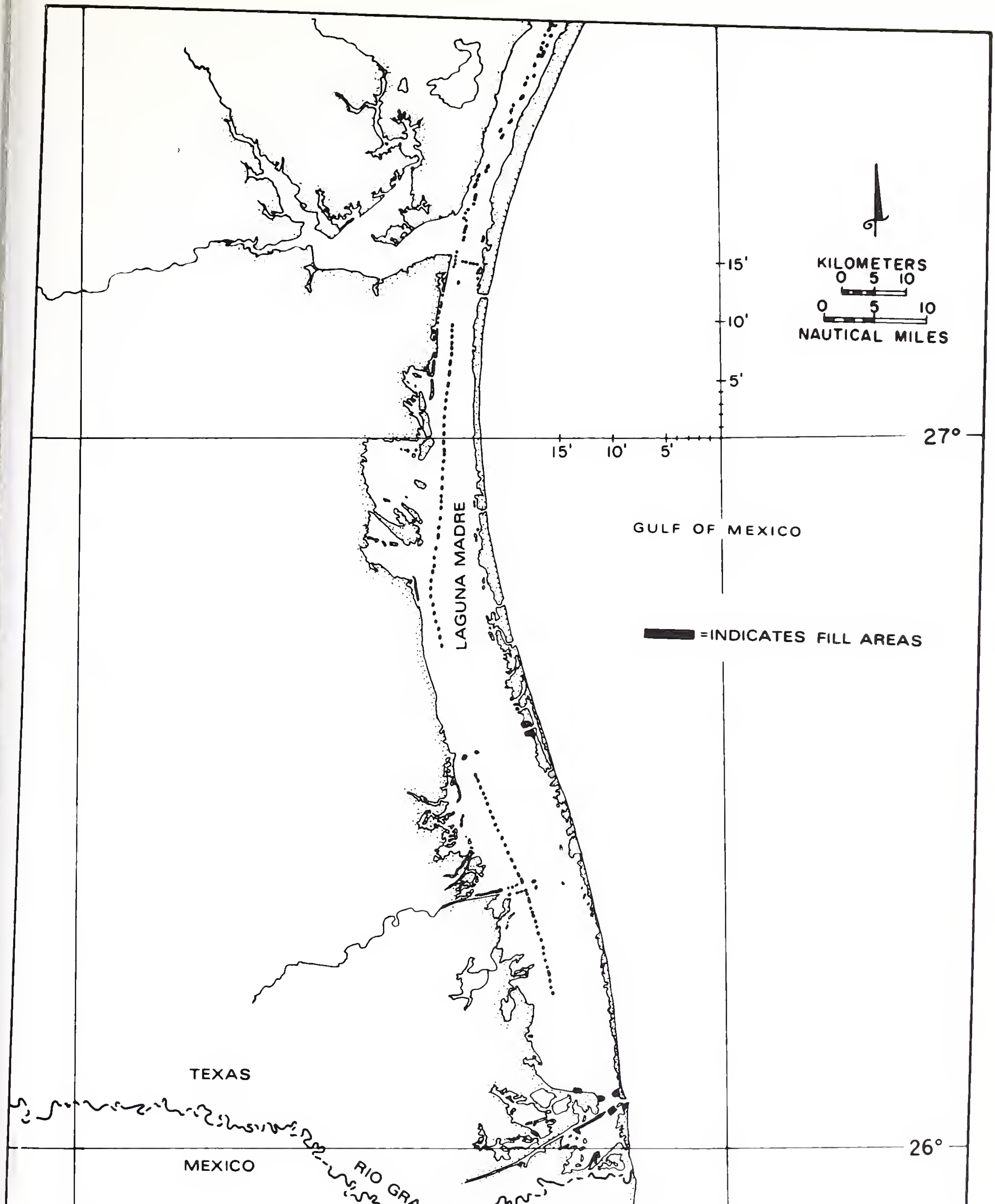


Figure 55.—Known fill areas in the Laguna Madre area.

Table 1.--Monthly and annual average precipitation from selected stations in counties contiguous to the Texas estuaries (from U.S. Department of Commerce 1968, 1969) through 1969.

Stations (County)	Years of record	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
	Number	Inches[1/]												
Beaumont Filter Plant (Jefferson)	80	4.43	4.50	3.23	4.44	5.05	4.35	5.95	5.43	4.67	3.17	4.04	5.03	54.29
Port Arthur (Jefferson)[2/]	56	4.36	4.18	3.79	4.27	4.64	4.46	6.96	5.06	5.49	3.43	3.77	4.94	55.35
Port Arthur Airport (Jefferson)	24	4.23	4.45	3.44	3.94	4.94	4.29	6.00	5.49	4.88	2.88	3.46	5.09	53.09
Baytown (Harris)	21	4.43	4.22	3.25	3.80	4.72	3.75	5.53	4.21	4.83	3.73	4.48	4.76	51.71
Houston City (Harris)	83	3.72	3.21	2.40	3.42	4.43	3.38	5.15	3.55	3.81	3.60	4.04	4.10	45.26
Houston Airport (Harris)	53	3.78	3.44	2.67	2.80	4.32	3.69	4.29	4.27	4.26	3.77	3.86	4.36	45.51
Galveston City (Galveston)	97	3.46	2.88	2.86	2.59	2.79	2.65	4.79	4.39	5.09	2.86	3.56	3.89	41.81
Angleton (Brazoria)	55	3.63	3.84	3.18	3.20	3.90	3.51	5.53	4.82	5.44	3.80	3.70	4.61	49.16
Matagorda (Matagorda)	58	3.03	3.06	2.37	3.22	3.29	2.70	3.53	4.24	5.03	3.51	2.95	3.65	40.52
Edna (Jackson)[3/]	58	2.65	2.79	2.41	3.18	3.88	3.38	3.45	3.18	4.10	3.49	2.65	2.72	37.88
Victoria Airport (Victoria)	77	2.34	2.34	2.32	2.62	4.12	3.04	3.61	3.13	4.23	3.48	2.36	2.61	36.20
Corpus Christi Airport (Nueces)	81	1.63	1.70	1.44	2.14	2.99	2.39	2.32	2.77	4.40	2.76	1.72	2.08	28.34
Sarita (Kenedy)	67	1.91	1.62	1.42	1.68	3.21	2.18	2.01	2.50	5.16	2.31	1.12	1.49	26.61
Raymondville (Willacy)	57	1.83	1.15	1.30	1.45	3.48	2.46	1.94	3.00	4.65	2.57	1.37	1.33	26.53
Brownsville Airport (Cameron)	97	1.35	1.48	1.04	1.55	2.36	2.96	1.68	2.77	4.99	3.53	1.32	1.72	26.75
Harlingen (Cameron)	54	1.48	1.22	1.03	1.66	3.14	2.58	1.89	3.08	4.57	2.68	1.25	1.51	26.09
Port Isabel (Cameron)	45	1.66	1.35	1.15	1.69	1.98	2.49	1.21	2.19	4.97	3.05	1.75	2.31	25.80

[1/] To convert to metric, 1 inch = 25.4 millimeters

[2/] No records for 1968; complete through 1967.

[3/] Station closed 1968.

Table 2.--Monthly and annual average air temperature for selected stations in counties contiguous to the estuaries of Texas (U.S. Department of Commerce 1968, 1969) through 1969.

Stations (county)	Years of record	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
	Number	Degrees F[1/]												
Port Arthur (Jefferson)[2/]	50	53.9	56.3	61.3	68.8	76.1	82.2	83.5	83.6	79.7	72.0	61.0	55.4	69.4
Port Arthur Airport (Jefferson)	24	53.6	56.0	61.1	68.2	74.7	80.6	81.9	82.3	78.2	70.3	59.7	54.8	68.4
Houston City (Harris)	82	54.6	57.1	62.4	69.3	76.2	82.2	83.9	84.1	79.8	72.4	61.6	56.5	70.0
Houston Airport (Harris)	44	53.6	55.8	61.3	68.5	76.0	81.6	83.0	83.2	79.2	71.4	60.8	55.7	69.1
Galveston City (Galveston)	97	54.9	56.8	61.4	68.5	75.8	81.7	83.1	83.3	80.1	73.5	63.0	57.2	69.9
Angleton (Brazoria)	54	54.7	57.6	61.8	68.5	75.0	80.5	82.3	82.3	78.8	71.5	61.7	57.1	69.3
Matagorda (Matagorda)	41	56.3	58.7	63.0	69.5	76.3	81.9	83.7	83.8	80.0	73.2	63.3	58.2	70.6
Victoria Airport (Victoria)	68	55.4	58.0	63.2	70.0	76.2	81.3	83.2	83.4	79.1	72.6	62.4	57.2	70.1
Corpus Christi Airport (Nueces)	81	57.4	60.4	65.2	71.7	77.5	82.3	84.1	84.2	80.8	74.5	64.1	59.2	71.7
Raymondville (Willacy)	53	60.5	63.2	68.2	74.6	79.7	83.3	84.9	85.0	81.5	75.3	66.3	61.6	73.6
Brownsville Airport (Cameron)	107	61.4	64.0	67.9	73.9	79.0	82.7	84.0	84.1	81.2	75.9	67.6	62.9	73.7
Harlingen (Cameron)	53	61.5	64.3	68.7	75.0	79.9	83.6	85.2	85.4	81.9	76.2	67.6	62.6	74.3
Port Isabel (Cameron)[3/]	45	62.2	64.3	67.7	73.2	78.5	82.4	83.7	83.7	81.9	77.3	69.6	64.3	74.0

[1/] °C = 5/9 (°F - 32).

[2/] Station closed 1968.

[3/] Incomplete records for 1968: March and April based upon combined 1967 and 1968 data.

Table 3.--Dimensions of estuarine study areas along the Texas coast[1]

Study area	Surface area		Depth at mean low water[3]		Average tidal range	Volume		Maximum intertidal volume
	Mean low water	Mean high water[2]	Maximum	Average		Mean low water	Mean high water	
	- - - - - - - Acres - - - - - - -		- - - - Feet	- - - - - - - - -		- - - - - - - - Feet $^3 \times 10^6$ - - - - - - - - -		
Sabine Lake								
Sabine Lake	43,960	44,830	24	5.1	0.2	9,765.9	10,349.8	583.9
Sabine Pass	1,360	1,360	40			556.8	633.8	77.0
Galveston Bay								
East Bay	33,370	33,690	12	3.3	1.2	4,796.8	6,603.9	1,807.1
Trinity Bay	83,310	86,240	17	5.2	1.0	18,870.7	23,291.0	4,420.3
Galveston Bay (upper)	69,890	70,080	42	5.7	1.0	17,353.1	20,452.9	3,099.8
Galveston Bay (lower)	89,380	90,390	44	6.5	1.4	25,307.0	31,105.3	5,798.3
Lake Anahuac (Turtle Bay)	4,660	4,850	5	2.1	[4]	[4]	[4]	[4]
Scott-San Jacinto Bay	3,230	4,310	40	1.8	1.0	253.2	525.6	272.4
Clear Lake	1,260	1,280	14	2.7	0.9	148.1	200.7	52.6
Dickinson Bay	1,520	1,540	6	2.1	0.7	139.0	187.8	48.8
Moses Lake (Dollar Bay)	2,130	2,140	36	5.2	0.5	482.4	531.3	48.9
Offats Bayou	1,180	1,200	28	14.5	1.0	745.3	810.2	64.9
Jones Lake	1,040	1,050	2	1.6	1.0	72.4	118.9	46.5
West Bay	44,390	45,420	25	3.9	0.9	7,541.1	9,496.7	1,955.6
Chocolate Bay	4,890	4,920	12	2.6	0.6	553.8	685.8	132.0
Bastrop-Oyster Bay	9,690	10,410	20	3.2	0.7	1,350.7	1,768.4	417.7
Matagorda Bay								
East Matagorda Bay	37,810	39,080	5	3.4	0.4	5,599.8	6,468.8	869.0
Matagorda Bay	167,570	170,130	36	8.0	0.7	58,394.7	64,474.5	6,079.8
Oyster Lake	2,450	2,570	12	2.7	0.5	288.1	358.2	70.1
Tres Palacios Bay	9,440	9,860	12	4.1	0.6	1,685.9	2,018.6	332.7
Turtle Bay	1,280	1,760	5	2.5	0.6	139.3	237.6	98.3
Carancahua Bay	12,160	12,300	7	3.8	0.5	2,012.8	2,303.8	291.0
Salt, Redfish lakes	920	950	4	1.2	0.5	48.0	70.3	22.3
Keller Bay	4,770	4,850	8	3.2	0.6	644.8	802.8	138.0
Lavaca Bay	39,970	40,080	36	4.2	0.7	7,312.5	8,554.8	1,242.3
Swan Lake	860	880	3	1.4	0.1	52.4	57.4	5.0
Lavaca River Estuary	740	760	13	8.0	0.2	257.8	271.4	13.6
Chocolate Bay	1,440	1,760	12	2.7	0.5	169.3	245.3	76.0
Powderhorn Lake	2,890	2,970	4	2.2	0.7	276.9	375.1	98.2
Cedar Lakes Complex	3,760	3,840	12	2.1	0.5	343.9	434.9	91.0
San Antonio Bay								
Espiritu Santo Bay	38,940	40,630	14	5.9	0.3	10,007.7	10,973.0	965.3
San Antonio Bay	76,530	77,700	12	4.6	0.3	15,334.7	16,584.5	1,249.8
Guadalupe Bay	2,070	2,090	9	2.7	0.2	243.4	264.0	20.6
Mission Lake	1,820	2,400	--[5]	--	--	--	--	--
Hynes Bay	6,580	6,610	3	2.4	0.2	687.8	748.6	60.8
Ayers Bay	2,220	2,550	12	3.2	0.3	309.4	388.7	79.3
Mesquite Bay	8,080	9,220	12	3.4	0.2	1,196.6	1,445.8	249.2
Copano Bay								
St. Charles Bay	8,410	8,730	6	3.6	0.2	1,318.8	1,445.0	126.2
Mission Bay	3,760	3,760	2	1.9	0.1	311.1	327.5	16.4
Copano Bay	41,740	42,930	9	3.7	0.3	6,727.3	7,480.1	752.8
Port Bay	1,650	2,000	9	2.2	0.2	158.1	209.0	50.9
Mission Lake	100	100	--	--	--	--	--	--
Aransas Bay	56,220	59,220	25	7.8	0.4	19,101.7	21,152.7	2,051.2
Corpus Christi								
Redfish Bay	9,630	13,420	17	2.0	0.4	838.9	1,402.9	564.0
Corpus Christi Bay	73,820	75,560	40	10.5	0.7	33,763.7	36,863.6	3,099.9
Nueces Bay	18,470	18,550	3	2.2	0.4	1,770.0	2,100.8	330.8
Oso Bay	5,070	5,070	15	1.6	0.9	353.3	552.1	198.8
Laguna Madre								
Upper Laguna Madre[6]	47,240	68,360	12	2.8	0.7	5,761.7	10,422.1	4,660.4
Lower Laguna Madre[6]	175,160	329,740	26	4.7	1.0	35,860.8	81,871.8	46,011.0
South Bay-La Badilla Grande Complex	4,380	7,300	36	1.5	1.5	286.1	953.9	667.8
Baffin Bay	31,870	32,610	12	7.7	0.5	10,689.5	11,648.0	958.5
Alazan Bay	13,860	14,750	4	2.9	0.5	1,750.8	2,184.5	433.7
Cayo del Infernillo	700	1,630	2	0.7	0.5	21.3	85.2	63.9
Laguna Salada	3,230	3,530	6	2.8	0.5	393.9	507.4	113.5
Cayo del Grullo	4,470	8,470	6	2.8	0.5	545.1	1,217.5	672.4

[1] Conversion factors: 1 acre = 0.4046 hectares; 1 foot = 0.3048 meter; 1 cubic foot = 0.0283 cubic meter.

[2] Does not include peripheral marsh areas.

[3] Exclusive of navigation channels.

[4] Depth controlled largely by river discharge, range and volumes cannot be computed.

[5] -- = no data.

[6] The "land cut", a mass of wind-blown sand from the mainland and Padre Island, is located on a point central to lat. 27°10' N and approximates the boundary between the upper and lower portions.

Table 4.--By study area, the major types and approximate acreage of emergent and submerged vegetation along the Texas coast.

Study area and major species		Approximate acreage 1/
Sabine Lake		
Emergent -	Distichlis spicata, Juncus roemerianus, Scirpus olney, Spartina alterniflora, S. patens	2/ 425,000
Submerged -	Ruppia maritima	-- 3/
Galveston Bay		
Emergent -	Batis maritima, Distichlis spicata, Juncus roemerianus, Monanthochloë littoralis, Scirpus olney, Spartina alterniflora, S. patens	231,400
Submerged-	Helodule beaudetti, Ruppia maritima	18,100
Matagorda Bay		
Emergent -	Batis maritima, Monanthochloë littoralis, Spartina alterniflora, S. patens, Sporobolus virginicus	120,000
Submerged -	Halodule beaudetti, Ruppia maritima	7,040
San Antonio Bay		
Emergent -	Batis maritima, Distichlis spicata, Monanthochloë littoralis, Spartina alterniflora, S. patens	25,000
Submerged -	Halodule beaudetti, Ruppia maritima	16,350
Copano-Aransas Bays		
Emergent -	Batis maritima, Monanthochloë littoralis, Salicornia bigelovii, Spartina alterniflora, S. patens, Sporobolus virginicus	45,000
Submerged -	Halodule beaudetti, Ruppia maritima, Thalassia testudinum	4,125
Corpus Christi Bay		
Emergent -	Batis maritima, Monanthochloë littoralis, Salicornia bigelovii, Scirpus maritimus, Schizachyrium scoparium, Spartina alterniflora, Sporobolus virginicus, Suaeda linearis, Uniola paniculata	45,000
Submerged -	Ruppia maritima	12,750
Laguna Madre		
Emergent -	Monanthochloë littoralis, Paspalum monostachyum, Salicornia bigelovii, Schizachyrium scoparium, Suaeda linearis, Uniola paniculata	250,000
Submerged -	Cynadocea manatorum, Halodule beaudetti, Ruppia maritima	191,000

1/ 1 acre = 0.4046 hectare.

2/ Does not include approximately 50,000 acres in Cameron Parish, La.

3/ -- = not measured.

Table 5.--Summary of silt data for some of the major Texas rivers. (Data from Texas Board of Water Engineers as summarized by Shepard, 1953.)

Major rivers	Periods of record	Average annual discharge	Annual average amount of silt		Drainage area
	Years	Acre-ft. 1/	Acre-ft. 1/	Tons 1/	Sq. miles 1/
Sabine	1932-33; 1935-54	2,672,345	636	970,766	4,854
Trinity	1936	5,689,331	3,622	5,520,960	17,192
San Jacinto	1932-33; 1937-54	703,528	213	325,280	1,811
Brazos 2/	1924-54	5,186,640	20,148	30,756,580	34,810
Colorado 3/	1937-42	3,167,710	5,898	8,991,960	29,140
Lavaca	1945-54	122,837	88	133,945	887
Guadalupe	1945-54	799,662	303	461,214	5,311
San Antonio	1942-54	395,231	373	568,218	3,918
Nueces	1942-54	555,636	116	177,690	-- 4/
Rio Grande	1929-43	4,166,619	12,588	19,192,311	157,204

1/ To convert to metric, 1 acre-ft. = 1,233 cubic meters; 1 ton (short) = 0.91 metric ton; 1 sq. mile = 2.59 sq. km.

2/ Empties directly into Gulf of Mexico.

3/ Empties partially into Gulf of Mexico.

4/ -- = no data.

Table 6. Depth changes in Texas bays with estimated silt loads per 100 years and shoaling and scouring rates for periods of record and adjusted for 100-year periods. (From Shepard 1953).

Estuarine area / Bay	Estimated silt load (acre feet) 1/	Shoaling (+) or scouring rates (-) in feet 1/: Period of record (years of record)	Adjusted rates for 100-year period
Galveston Bay area			
Galveston Bay	86,000	+1.15 (1854-1933)	+1.44
West Bay	-- 2/	-0.37 (1867-1934)	-0.56
Matagorda Bay area			
Matagorda Bay	--	-0.17 (1858-1934)	-0.22
Eastern Matagorda Bay	--	+2.63 (1859-1934)	+3.50
Lavaca Bay	4,155	+0.3 (1870-1934)	+0.46
East Matagorda Bay	--	+1.0 (1871-1935)	+1.58
San Antonio Bay area			
San Antonio Bay	23,000	+0.75 (1874-1935)	+1.23
Espiritu Santo Bay	--	+0.25 (1873-1934)	+0.47
Mesquite Bay	--	+0.58 (1875-1932)	+0.97
Aransas-Copano Bay area			
Mission Bay	--	+1.0 (1875-1935)	+1.60
St. Charles Bay	--	+0.03 (1875-1935)	+0.05
Copano Bay	--	+0.52 (1875-1935)	+0.87
Aransas Bay	--	+0.84 (1875-1934)	+1.42
Corpus Christi Bay area			
Corpus Christi Bay	31,590	+1.03 (1860-1934)	+1.56

1/ Cubic meters = acre-feet x 1,233; 1 foot = 0.3048 meters.

2/ -- = no data.

Table 7-1.--Stream discharge from Sabine River, 1951-1968. (U.S. Geological Survey Station 8-0305 near Ruliff, Tex., lat. 30° 18.2', long. 93° 44.5')[1].

Water year	Monthly and yearly mean discharge in cubic feet per second (c.f.s.)[2]												
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	The year
1951	1,809	1,737	1,801	7,420	7,453	8,723	10,960	5,674	2,537	2,469	759	1,425	4,374
1952	926	1,003	3,093	2,717	12,790	10,510	16,900	15,840	8,613	3,348	1,208	484	6,415
1953	378	653	3,903	5,563	11,090	21,590	7,666	66,020	20,610	4,264	3,608	1,966	12,340
1954	994	1,162	4,965	6,083	5,756	3,131	6,079	15,660	3,672	790	514	348	4,097
1955	39[illegible]	2,822	1,672	3,434	12,070	5,708	15,970	6,327	3,660	2,260	10,190	3,124	5,574
1956	1,308	958	1,966	3,039	12,630	5,652	5,746	7,298	1,509	687	364	326	3,421
1957	285	722	3,696	1,637	4,936	11,020	15,020	40,290	23,310	10,690	1,548	2,222	9,645
1958	4,898	23,290	18,350	15,120	13,770	10,420	9,608	24,150	8,773	4,472	2,624	12,330	12,290
1959	11,080	3,064	3,013	2,847	16,790	9,382	11,390	10,700	4,550	3,900	3,360	1,367	6,723
1960	2,890	2,666	7,433	15,440	16,580	17,110	4,891	3,395	2,259	3,177	1,536	1,322	6,545
1961	2,098	4,871	16,820	35,570	21,990	20,520	17,520	3,385	4,253	8,772	3,323	10,320	12,410
1962	2,207	5,258	20,810	14,200	11,310	9,395	5,801	10,790	4,908	2,100	1,346	1,854	7,500
1963	1,321	1,359	3,385	5,307	4,643	4,245	2,722	4,404	1,383	1,481	742	3,062	2,831
1964	460	1,324	2,805	3,936	3,218	9,715	7,245	6,305	1,878	868	642	536	3,250
1965	504	576	2,700	2,391	6,514	8,052	9,247	5,407	10,710	1,848	603	820	4,081
1966	728	695	4,132	5,485	24,850	5,152	3,738	32,980	10,320	1,304	1,204	1,265	7,553
1967	1,017	1,213	1,841	2,959	2,998	2,628	5,598	2,044	1,833	805	382	333	1,959
1968	292	327	1,696	4,241	1,559	2,532	6,335	6,205	17,190	5,584	3,278	5,648	4,560
Mean	1,865	2,983	5,782	7,632	10,608	9,193	9,024	14,826	7,331	3,267	2,068	2,708	6.420

1/ Enters Sabine Lake; drainage area: 9,329 sq. miles; period of record: Oct. 1924 to Sept. 1968; average doscjarge 8,187 c.f.s. for 44 years; extremes: 121,000 c.f.s. May 22, 1953, 270 c.f.s. Sept. 27-30, Oct. 1-3, 17-20, 1956.

2/ Liter per sec. = c.f.s. x 28.3; 1 sq. miles = 258.9 hectares.

Table 7-2.—Stream discharge for Cow Bayou, 1951-1968. (U.S. Geological Survey Station 8-0310 near Mauriceville, Tex., lat. 30° 11.2', long. 93° 54.5')[1].

Water year	Monthly and yearly mean discharge in cubic feet per second (c.f.s.)[2]												
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	The year
1951	-- [3]	--	--	--	--	--	--	--	--	--	--	--	--
1952	--	--	--	--	--	--	531	124	5.75	91.1	0.33	0.05	--
1953	0.10	0.22	9.72	11.5	194	63.2	100	536	2.57	2.52	5.85	21.9	78.6
1954	0.10	0.11	36.2	67.7	5.61	3,0	107	163	3.62	0.16	0.05	0	32.5
1955	0.27	1.31	0.14	77.0	293	12.1	254	32.1	3.19	0.55	27.1	59.1	61.3
1956	0.10	0	38.8	63.6	284	40.8	4.80	17.6	0.53	0	0.02	0.04	36.5
1957	0	0.11	261	6.27	5.25	373	218	178	101	147	0.33	118	118
1958	154	375	157	270	231	80.1	206	72.2	7.70	2.21	1.29	667	184
1959	36.3	0.25	5.68	41.5	961	80.9	366	18.2	1.77	320	89.2	13.4	155
1960	7.16	1.92	144	182	297	41.3	8.93	22.6	0.09	5.85	52.8	15.4	64.2
1961	85.1	205	246	879	543	120	45.6	0.63	145	161	11.4	90.0	209
1962	0.23	120	229	99.2	38.5	15.2	25.8	27.7	63.5	1.35	0.43	2.05	52.1
1963	0.88	6.29	89.6	80.1	128	14.3	0.26	0.28	0.24	12.9	0.46	816	94.4
1964	4.25	78.1	194	171	115	225	23.6	60.5	58.5	0.24	0.29	39.4	81.1
1965	17.1	5.85	128	31.0	56.6	112	21.2	0.67	0.09	0.17	0.08	1.49	31.2
1966	0.03	0.05	51.4	165	327	55.0	116	193	2.94	1.28	19.4	0.62	76.0
1967	8.44	13.3	10.4	32.7	105	5.54	338	9.18	36.1	0.22	0.23	0.06	45.5
1968	0.04	0.08	17.9	267	27.4	85.5	321	163	532	58.2	3.18	98.0	130
Mean	19.5	50.4	101	152	225	82.8	134	93.3	59.8	44.5	13.2	121	90.5

1/ Enters Sabine Lake via Sabine River; drainage area: 83.3 sq. miles; period of record: Mar. 1952-Sept. 1968; average discharge: 90.6 c.f.s. for 16 years; extremes: 4,600 c.f.s. Sept. 19, 1963, no flow at times.

2/ Liter per sec. = c.f.s. x 28.3; 1 sq. miles = 258.9 hectares.

3/ -- = no or incomplete data.

Table 7-3.--Stream discharge for Neches River, 1951-1968. (U.S. Geological Survey Station 8-0410 at Evadale, Tex., lat. 30° 21.4', long. 94° 05.6')1/.

Water year	Monthly and yearly mean discharge in cubic feet per second (c.f.s.)2/												
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	The year
1951	930	1,012	1,291	2,450	3,128	4,006	6,300	1,780	1,455	1,267	358	670	2,042
1952	526	354	1,370	1,656	5,618	7,002	9,151	11,450	4,829	1,329	1,094	353	3,718
1953	180	288	1,722	4,065	6,772	13,790	7,424	46,790	11,200	2,271	1,954	1,123	8,177
1954	471	428	1,707	3,693	2,633	1,729	3,109	7,172	2,521	1,139	507	245	2,114
1955	169	280	910	2,470	8,966	4,135	12,160	3,300	3,022	863	1,449	740	3,149
1956	548	549	509	636	4,495	2,307	3,371	4,284	1,120	885	551	194	1,608
1957	178	110	143	159	394	3,811	5,681	30,630	9,205	2,726	1,024	735	4,607
1958	3,915	16,580	16,890	15,660	11,880	7,730	4,805	14,400	2,100	1,961	1,320	4,467	8,465
1959	8,630	1,941	1,713	1,776	7,720	5,462	12,450	10,110	5,377	3,134	2,867	1,021	5,162
1960	675	2,569	5,801	10,370	11,030	13,860	3,711	3,627	1,649	2,146	898	465	4,728
1961	2,397	4,472	18,680	31,060	18,250	18,330	14,050	3,784	2,361	5,888	1,670	4,196	10,410
1962	1,250	1,952	10,800	8,869	8,907	6,400	3,902	12,540	3,852	1,924	1,216	498	5,174
1963	619	1,232	2,257	5,024	3,993	4,164	3,235	1,283	1,112	959	730	1,348	2,153
1964	573	720	1,309	2,373	2,378	7,254	6,137	7,261	1,517	889	418	335	2,603
1965	268	188	301	628	1,728	3,403	4,293	2,160	4,340	1,379	633	686	1,659
1966	329	214	2,485	2,888	9,660	2,541	2,317	12,960	2,625	2,168	1,020	1,422	3,354
1967	1,885	1,360	1,460	1,637	1,136	1,437	2,747	2,316	2,253	1,118	1,072	903	1,612
1968	547	448	537	3,098	2,708	3,645	11,870	11,900	11,660	9,136	4,170	1,800	5,126
Mean	1,338	1,927	3,882	5,472	6,188	6,167	6,474	10,430	4,011	2,287	1,275	1,177	4,214

1/ Enters Sabine Lake; drainage area 7,951 sq. miles; period of record; July 1904-Dec. 1906, April 1921-Sept. 1968, average discharge: 6,033 c.f.s. for 49 years; extremes: 92,100 c.f.s. May 11, 1944, 63 c.f.s. Nov. 26-28, 1956.

2/ Liter per sec. = c.f.s. x 28.3; 1 sq. miles = 258.9 hectares.

Table 7-4.--Stream discharge for Village Creek, 1951-1968. (U.S. Geological Survey Station 8-0415 near Kountze, Tex., lat. 30° 23.9', long. 94° 15.8')1/.

Water year	Monthly and yearly mean discharge in cubic feet per second (c.f.s.)2/												
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	The year
1951	131	151	169	391	400	442	645	210	113	84.6	55.3	412	265
1952	120	111	321	191	442	426	1,681	1,793	341	346	84.0	46.1	492
1953	37.0	94.0	340	744	1,426	1,009	807	6,932	330	520	221	200	1,058
1954	92.8	153	598	700	373	258	549	643	107	63.1	115	46.7	309
1955	82.6	138	115	374	1,523	264	1,675	198	90.0	161	186	138	402
1956	85.9	70.7	139	335	1,280	668	289	109	69.5	38.4	28.8	26.5	258
1957	26.3	61.4	146	113	240	799	928	1,858	634	216	89.5	373	458
1958	641	2,072	1,120	3,318	1,940	987	588	323	124	115	70.6	378	967
1959	199	148	131	159	1,213	459	1,433	384	170	550	466	125	447
1960	293	272	1,040	1,084	1,416	713	215	265	409	374	123	103	524
1961	360	1,595	1,489	4,817	2,569	1,513	618	289	1,090	1,970	380	2,111	1,561
1962	244	824	1,229	956	678	500	417	826	351	182	66.5	96.3	531
1963	94.7	180	641	698	735	453	239	89.5	124	191	68.1	592	339
1964	78.0	254	730	824	952	1,695	816	435	219	60.8	90.4	69.1	518
1965	56.9	88.2	308	198	443	474	560	210	146	58.9	51.8	63.2	220
1966	44.5	141	614	849	4,420	626	651	870	208	91.4	170	116	708
1967	218	250	274	382	416	337	738	198	141	71.0	35.3	35.3	256
1968	22.8	34.9	125	273	169	393	1,043	1,238	1,928	659	140	197	517
Mean	157	368	529	911	1,146	667	771	937	366	318	135	279	546

1/ Enters Sabine Lake via Neches River, drainage area: 860 sq. miles; period of record: May 1924-Nov. 1929, Apr. 1939-Sept. 1968; average discharge: 773 c.f.s. for 32 years; extremes: 67,200 c.f.s. Nov. 26, 1940, 16 c.f.s. Oct. 1-2, 1956.

2/ Liter per sec. = c.f.s. x 28.3; 1 sq. miles = 258.9 hectares.

Table 7-5.--Stream discharge data for Trinity River, 1951-1968. (U.S. Geological Survey Station 8-0665 at Romayor, Tex., lat. 30° 25.5', long. 94° 51.1')[1]

Monthly and yearly mean discharge in cubic feet per second (c.f.s.)[2]

Water year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	The year
1951	3,182	1,339	904	1,173	2,511	2,579	1,600	2,186	9,702	2,188	514	909	2,387
1952	437	556	765	864	2,152	2,607	7,975	10,720	6,320	516	286	237	2,779
1953	223	927	5,258	3,805	3,870	8,590	3,334	33,040	4,794	677	475	590	5,511
1954	597	1,207	4,376	2,617	1,201	724	1,202	6,237	749	501	550	214	1,694
1955	1,974	3,848	1,153	2,305	7,960	2,876	9,735	2,767	1,739	525	462	498	2,935
1956	620	274	407	678	3,229	955	2,032	5,143	774	201	128	165	1,211
1957	181	1,303	476	498	2,173	3,943	14,190	62,000	45,120	9,757	10,140	1,847	12,690
1958	15,960	21,620	8,948	12,860	7,388	6,931	7,179	37,220	8,204	4,460	1,568	7,513	11,690
1959	2,602	929	1,069	945	6,757	2,507	13,720	15,420	6,190	6,615	1,709	686	4,909
1960	9,365	4,037	10,480	20,500	12,220	7,528	2,469	4,031	4,049	1,999	1,598	1,064	6,621
1961	2,581	8,404	22,900	29,950	21,750	11,100	7,659	1,960	6,837	6,166	1,087	5,579	10,440
1962	1,349	2,133	8,916	5,628	4,381	3,724	3,729	8,115	2,687	2,580	3,762	6,529	4,469
1963	8,166	2,318	7,899	3,141	3,239	1,805	2,805	7,693	2,657	944	533	528	3,495
1964	381	537	1,018	1,164	1,467	3,775	3,923	2,844	1,999	531	598	1,131	1,612
1965	5,567	5,086	8,166	4,650	14,510	7,960	6,576	19,000	14,350	1,216	670	858	7,333
1966	855	1,764	5,764	3,433	8,270	2,534	9,933	51,990	11,680	5,996	2,570	2,162	8,946
1967	1,753	750	892	952	990	1,004	3,331	2,377	4,518	1,849	524	2,365	1,771
1968	2,755	8,421	5,206	10,990	9,382	14,130	28,500	26,460	22,110	7,243	2,078	1,274	11,520
Mean	3,252	3,636	5,255	5,897	6,302	4,737	7,216	16,622	8,582	2,992	1,625	1,897	5,667

1/ Enters Galveston Bay; drainage area: 17,186 sq. miles; period of record: May 1924-Sept. 1968; average discharge: 7,155 c.f.s. for 44 years; extremes: 111,000 c.f.s. May 9, 1942, 102 c.f.s. Aug. 24-25, 1956.

2/ Liter per sec. = c.f.s. x 28.3; 1 sq. miles = 258.9 hectares.

Table 7-6.--Stream discharge for San Jacinto River, 1954-1965. (U.S. Geological Survey Station 8-0720, Lake Houston Dam near Sheldon, Tex., lat. 29° 54.9', long. 95° 08.5')[1].

Monthly and yearly mean discharge in cubic feet per second (c.f.s.)[2]

Water year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	The year
1954	0	0	0	0	0	0	0	0	0	0	258	0	--[3]
1955	0	166	0	612	3,571	290	566	112	0	0	0	0	443
1956	0	0	0	0	344	16.1	366	0	0	0	0	0	60.5
1957	0	0	0	0	0	32.2	2,783	6,580	1,816	145	0	316	972
1958	3,870	5,816	1,725	7,661	3,732	758	1,133	2,580	33.3	0	0	66.6	2,281
1959	1,016	516	0	0	2,214	709	9,566	2,870	110	2,048	887	500	1,703
1960	3,193	966	2,741	3,338	4,637	8,225	450	1,548	6,133	3,741	2,274	816	3,171
1961	4,064	6,450	5,758	8,677	8,803	2,016	1,533	274	3,550	4,225	790	8,600	4,561
1962	16.1	16.6	548	403	2,535	80.6	483	1,048	216	0	0	0	445
1963	0	50.0	1,258	1,016	1,232	274	216	0	0	0	0	0	337
1964	0	0	0	362	853	2,238	1,631	624	490	0	0	0	516
1965	0	0	161	758	1,913	129	133	483	533	0	0	0	342
Mean	1,105	1,270	1,108	2,075	2,712	1,342	1,714	1,465	1,171	923	359	936	1,348

1/ Enters Galveston Bay; drainage area: 2,828 sq. miles; period of record: April 1954-Sept. 1965; average discharge 1,348 c.f.s. for 11 years; extremes: 65,500 c.f.s. Sept. 12, 1961, no flow for long periods; data computed from measurements obtained from Dept. Civil Engineering, Univ. Iowa, Iowa City.

2/ Liter per sec. = c.f.s. x 28.3; 1 sq. miles = 258.9 hectares.

3/ -- = no or incomplete data.

Table 7-7.--Stream discharge for Buffalo Bayou, 1951-1957, 1962-1968. (U.S. Geological Survey Station 8-0740 at Houston, Tex., lat. 29° 45.6', long. 95°24.5')[1]/.

Water year	Monthly and yearly mean discharge in cubic feet per second (c.f.s.)[2]/											
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	The year
1951	19.8	8.6	11.7	24.0	14.0	179	31.1	13.1	14.5	9.1	9.2	124	38.3
1952	20.0	15.0	17.2	7	137	21.4	666	127	52.4	79.9	22.7	44.6	99.7
1953	19.2	123	398	87.5	183	18.3	87.1	1,483	47.7	33.9	250	311	256
1954	36.8	313	348	232	16.2	9.4	194	17.5	11.7	101	590	55.4	162
1955	61.3	63.3	27.2	153	661	13.3	15.0	29.4	35.7	49.5	155	102	107
1956	32.1	7.0	18.6	119	103	10.6	72.1	46.6	67.9	9.8	20.0	29.6	44.4
1957	10.1	14.7	44.3	11.3	23.8	625	263	288	85.0	21.9	15.1	99	126
1958	-- 3/	--	--	--	--	--	--	--	--	--	--	--	--
1959	--	--	--	--	--	--	--	--	--	--	--	--	--
1960	--	--	--	--	--	--	--	--	--	--	--	--	--
1961	--	--	--	--	--	--	--	--	--	--	--	--	--
1962	--	--	--	51.9	113	26.3	76.7	76.4	390	297	60.1	143	--
1963	160	200	435	526	243	33.9	27.9	79.3	211	91.5	61.4	86.5	180
1964	37.9	62.8	163	89.9	385	498	70.2	51.0	91.9	88.7	109	153	149
1965	111	88.4	154	132	247	26.5	33.6	117	42.1	71.3	95.3	132	103
1966	159	561	447	242	757	163	795	846	114	105	268	264	390
1967	116	24.2	50.3	105	46.8	37.1	147	113	116	147	90.5	319	109
1968	169	36.1	116	537	66.0	92.5	69.1	1,832	1,458	809	93.0	407	476
Mean	73.2	116	171	174	221	132	190	387	180	124	136	163	172

1/ Enters Galveston Bay; drainage area 358 sq. miles; period of record: May 1936-Sept. 1957; Jan. 1962-Sept. 1968; average discharge: 241 c.f.s. for 27 years; extremes: 10,900 c.f.s. Aug. 30, 1945, 12 c.f.s. June 9-10, 1963.

2/ Liter per sec. = c.f.s. x 28.3; 1 sq. miles = 258.9 hectares.

3/ -- = No data or incomplete.

Table 7-8.--Stream discharge for White Oak Bayou, 1951-1968. (U.S. Geological Survey Station 8-0745 at Houston, Tex., lat. 29° 46.5', long. 95° 23.8')[1]/.

Water year	Monthly and yearly mean discharge in cubic feet per second (c.f.s.)[2]/											
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	The year
1951	2.12	2.84	4.90	9.15	5.12	48.3	3.33	7.74	4.62	6.38	1.02	34.9	10.9
1952	1.93	3.32	3.36	2.11	64.6	4.30	83.3	22.7	7.06	20.4	3.95	6.61	18.3
1953	2.70	37.8	85.0	20.2	55.6	4.56	8.22	346	9.33	9.25	78.1	24.0	57.1
1954	8.33	45.9	51.3	64.8	5.41	4.44	18.8	4.04	2.92	140	100	9.25	38.5
1955	19.2	5.45	2.43	24.6	155	2.92	4.23	3.76	5.29	19.6	13.3	24.1	22.4
1956	22.4	2.25	7.85	37.3	26.3	2.26	8.44	20.6	12.9	11.2	3.37	1.67	13.1
1957	2.91	5.08	11.3	2.91	9.79	138	150	39.5	20.0	5.12	2.77	52.5	36.6
1958	270	144	16.6	175	83.4	9.12	29.8	7.60	26.3	6.18	13.9	52.3	69.5
1959	18.3	12.1	4.31	17.4	234	6.86	202	86.9	35.8	134	249	90.5	89.8
1960	89.4	95.2	152	78.7	161	16.1	22.4	8.48	235	69.6	95.1	25.8	86.9
1961	183	190	213	159	468	20.0	34.0	10.0	189	282	14.7	276	167
1962	13.0	262	78.3	21.2	37.1	11.8	37.2	40.3	111	20.0	8.39	23.7	54.8
1963	26.9	115	73.4	115	80.5	14.8	9.82	33.8	58.1	16.5	11.2	30.3	48.5
1964	15.0	20.7	47.6	37.8	64.4	92.5	34.9	49.9	24.7	11.3	26.4	31.9	38.0
1965	10.7	27.9	52.6	26.5	86.2	8.8	7.8	48.4	23.7	9.1	15.7	20.4	27.8
1966	16.5	60.3	62.2	72.8	157	45.2	279	136	54.5	17.5	31.5	18.8	79.2
1967	34.5	5.03	20.2	29.4	13.0	8.51	31.2	20.6	10.8	32.7	26.1	80.9	26.1
1968	37.7	6.51	37.8	70.4	14.2	37.4	35.6	338	179	30.8	20.4	93.4	75.3
Mean	42.9	57.8	51.2	53.5	95.5	26.3	55.5	67.9	56.0	46.7	39.6	49.7	53.3

1/ Enters Galveston Bay via Buffalo Bayou; drainage area: 84.7 sq. miles; period of record: May 1936-Sept. 1968; average discharge: 68.3 c.f.s. for 32 years; extremes: 3,550 c.f.s. May 10, 1968, no flow at times.

2/ Liter per sec. = c.f.s. x 28.3; 1 sq. miles = 258.9 hectares.

Table 7-9.--Stream discharge for Brays Bayou, 1951-1968. (U.S. Geological Survey Station 8-0750 at Houston, Tex., lat. 29° 41.8', long. 95° 24.7') 1/.

Monthly and yearly mean discharge in cubic feet per second (c.f.s.) 2/

Water year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	The year
1951	6.82	5.69	5.98	13.8	12.4	70.7	9.08	11.3	14.7	8.33	8.9	34.6	16.9
1952	6.41	12.6	6.99	5.67	68.6	8.38	97.9	30.4	9.23	16.9	10.3	12.2	23.5
1953	7.54	36.5	106	36.6	82.4	8.63	11.8	299	19.4	15.4	236	73.8	78.2
1954	14.2	146	109	65.7	9.8	9.12	93.9	22.3	9.12	22.5	12.9	8.54	43.6
1955	13.6	13.6	14.9	53.3	220	7.39	12.8	21.2	22.2	26.3	44.7	43.4	39.8
1956	14.1	9.86	15.6	46.6	34.8	12.5	17.1	61.5	27.6	10.3	14.8	15.9	23.4
1957	12.9	19.1	29.0	10.6	18.6	207	146	66.9	27.2	13.7	19.6	36.3	50.7
1958	222	240	16.7	155	101	19.4	45.4	18.4	19.7	26.4	27.5	87.3	81.1
1959	117	23.0	16.1	22.0	548	26.6	299	42.9	36.6	127	101	48.1	114
1960	188	180	211	132	172	26.4	24.2	19.8	498	42.6	136	35.0	138
1961	241	91.6	201	178	387	38.9	43.5	21.3	261	320	37.6	318	176
1962	22.7	241	47.2	36.7	26.3	26.3	60.9	81.5	161	53.7	36.7	62.4	71.0
1963	79.8	158	186	171	109	33.4	22.6	30.6	220	65.7	25.0	53.6	95.9
1964	15.6	74.0	121	65.3	172	111	46.0	41.4	31.0	24.2	37.5	50.9	65.4
1965	25.8	55.6	127	35.1	89.9	24.1	24.7	63.5	46.5	30.4	42.7	41.5	50.4
1966	49.1	80.9	161	114	262	112	402	382	35.8	42.9	70.1	50.3	146
1967	70.4	26.8	37.2	67.4	56.4	36.7	70.0	55.5	40.5	67.2	57.4	79.0	55.4
1968	58.7	30.4	59.2	159	41.0	81.9	67.1	274	568	183	48.1	258	152
Mean	64.7	80.2	81.6	75.9	133	47.7	82.9	85.7	113	60.8	53.7	72.6	78.9

1/ Enters Galveston Bay via Buffalo Bayou; drainage area: 88.4 sq. miles; period of record: May 1936-Sept. 1968; average discharge: 90.5 c.f.s. for 32 years; extremes: 12,600 June 26, 1960, 0.1 c.f.s. Oct. 11-12, 1937, Mar. 14, Apr. 1, 1958.

2/ Liter per sec. = c.f.s. x 28.3; 1 sq. miles = 258.9 hectares.

Table 7-10.--Stream discharge data for Sims Bayou, 1953-1968. (U.S. Geological Survey Station 8-0755 at Houston, Tex., lat. 29° 40.4', long. 95° 17.3') 1/.

Monthly and yearly mean discharge in cubic feet per second (c.f.s.) 2/

Water year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	The year
1953	5.68	24.2	70.7	25.2	76.0	7.82	9.75	135	13.9	8.56	130	63.5	47.5
1954	8.03	83.1	100	24.9	9.69	6.12	13.1	18.0	10.0	17.0	13.4	6.53	25.9
1955	10.4	5.8	5.03	37.7	182	4.56	8.98	10.7	5.41	11.4	12.9	13.1	24.6
1956	5.19	3.43	5.04	14.9	23.0	5.35	9.97	16.6	9.83	4.53	6.38	7.50	9.26
1957	4.87	10.7	15.2	5.77	13.3	284	150	31.5	57.8	8.12	11.2	26.5	51.8
1958	214	209	13.3	109	97.4	11.3	21.8	10.1	6.98	22.8	9.52	152	72.6
1959	19.0	9.17	7.6	11.4	470	15.6	249	69.5	25.8	218	196	51.4	109
1960	92.6	131	126	83.1	120	10.9	11.9	9.86	386	24.4	86.0	22.2	91.3
1961	124	45.0	201	177	192	16.5	19.7	10.7	176	228	12.7	226	118
1962	8.24	151	39.8	19.7	9.12	11.7	30.8	28.7	87.0	14.8	14.0	16.4	35.8
1963	23.3	60.5	111	97.7	68.4	20.4	11.4	10.7	68.9	23.8	11.3	14.6	43.3
1964	8.58	47.9	103	34.1	146	55.4	16.2	12.8	9.25	9.06	12.5	24.3	39.5
1965	11.8	39.4	150	19.6	46.4	10.1	10.3	67.1	26.4	14.5	12.8	17.8	35.6
1966	21.5	50.6	98.0	88.6	233	53.3	264	383	24.8	23.0	38.7	79.0	112
1967	29.4	12.6	16.9	39.6	52.0	20.8	44.6	27.4	12.4	40.8	25.2	43.4	30.3
1968	18.7	12.1	29.3	149	26.4	49.7	62.1	274	326	53.1	27.2	74.8	92.0
Mean	37.7	55.9	68.2	58.5	110	36.4	58.2	69.7	77.8	45.0	38.6	52.3	58.6

1/ Enters Galveston Bay via Buffalo Bayou; drainage area 64.0 sq. miles; period of record: Oct. 1952-Sept. 1968; average discharge: 58.7 c.f.s. for 16 years; extremes: 8,030 c.f.s. June 26, 1960, 0.9 c.f.s. Aug. 7, 1955.

2/ Liter per sec. = c.f.s. x 28.3; 1 sq. miles = 258.9 hectares.

Table 7-11.--Stream discharge for Greens Bayou, 1953-1968. (U.S. Geological Survey Station 8-0760 at Houston, Tex., lat. 29° 55.1', long. 95° 18.4')[1].

Water year	Monthly and yearly mean discharge in cubic feet per second (c.f.s.)[2]												
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	The year
1953	0	9.50	43.3	8.34	23.8	1.27	9.17	266	1.90	3.52	25.1	8.81	33.7
1954	1.71	18.8	28.2	50.5	1.67	0.40	3.78	5.59	0.12	273	27.9	3.71	35.2
1955	9.40	0.41	0	9.37	107	0.05	1.05	1.57	1.39	16.1	12.4	7.01	13.2
1956	16.9	0	1.51	14.9	18.6	0.38	0.13	0.25	1.28	1.43	24.4	1.97	6.82
1957	0.11	1.04	2.10	0.06	0.35	64.9	47.0	20.6	1.61	0.45	0.81	48.9	15.7
1958	166	98.3	4.40	136	63.5	3.24	2.22	7.26	2.22	2.25	5.89	16.9	42.4
1959	5.16	6.82	0.60	5.53	92.2	4.36	116	128	12.3	82.6	114	11.7	48.1
1960	74.0	23.8	89.3	54.1	103	8.40	6.10	3.17	180	37.3	42.5	18.5	53.1
1961	92.9	129	166	137	353	20.6	9.63	4.69	91.6	291	12.1	443	144
1962	4.82	124	62.3	17.5	25.4	7.45	15.2	22.5	19.5	44.4	5.19	8.26	29.6
1963	18.1	108	53.1	77.9	59.5	7.35	4.27	5.18	7.11	6.25	3.73	8.19	29.6
1964	62.4	4.71	20.7	19.7	34.3	66.8	83.0	215	53.6	5.81	6.84	10.3	48.8
1965	4.60	9.56	15.5	8.98	23.4	5.50	4.44	23.1	9.51	8.41	12.1	19.6	12.0
1966	9.77	29.9	93.7	58.8	149	22.3	240	130	9.34	10.7	32.0	23.3	66.6
1967	52.3	4.26	8.20	16.5	7.61	5.42	18.7	13.4	8.76	13.9	11.1	66.5	18.9
1968	11.4	4.63	24.0	62.6	8.37	23.2	19.9	148	173	14.7	9.73	41.4	45.1
Mean	33.0	35.7	38.3	42.3	66.8	15.0	36.2	62.0	35.8	50.7	21.5	46.0	40.1

1/ Enters Galveston Bay via Buffalo Bayou; drainage area: 72.7 sq. miles; period of record: Oct. 1952-Sept. 1968; average discharge 40.2 c.f.s. for 16 years; extremes: 7,000 c.f.s. July 30, 1954, no flow at times.

2/ Liter per sec. = c.f.s. x 28.3; 1 sq. miles = 258.9 hectares.

Table 7-12.--Stream discharge for Halls Bayou, 1953-1968. (U.S. Geological Survey Station 8-0765 at Houston, Tex., lat. 29° 51.7', long. 95° 20.1')[1].

Water year	Monthly and yearly mean discharge in cubic feet per second (c.f.s.)[2]												
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	The year
1953	0	3.99	12.4	4.77	11.5	1.32	1.63	100	1.16	1.30	4.94	1.35	12.2
1954	2.43	15.9	13.3	21.7	1.57	0.49	2.93	2.09	0.08	74.0	4.91	0.65	11.8
1955	5.92	3.05	0.67	10.4	76.9	0.38	0.67	1.19	0.85	12.6	23.0	13.1	11.9
1956	4.84	0.38	2.15	9.41	11.5	1.31	0.95	0.99	2.00	0.42	1.95	0.25	2.99
1957	0.95	0.62	1.75	0.30	1.05	22.0	30.7	8.97	2.32	6.96	0.84	23.4	8.32
1958	44.6	44.9	3.80	48.1	31.9	4.68	12.8	3.98	3.99	1.95	5.67	25.8	19.2
1959	4.64	5.36	1.78	4.98	90.1	5.67	45.3	63.6	10.8	85.9	71.6	3.99	32.5
1960	28.3	9.58	37.0	31.4	50.9	6.16	5.09	1.65	76.5	25.1	11.0	5.27	23.8
1961	38.2	75.1	77.5	60.9	127	9.98	9.45	5.25	67.0	149	8.03	146	63.8
1962	1.91	70.1	40.9	13.3	15.9	4.52	8.95	15.7	29.4	12.9	1.61	1.98	18.0
1963	8.03	34.6	25.9	38.4	30.8	5.07	3.19	2.39	4.74	4.98	0.78	2.23	13.3
1964	3.88	2.64	9.34	5.82	9.81	17.1	17.2	55.5	8.73	1.36	14.7	13.2	13.3
1965	2.25	7.63	14.4	4.33	9.97	2.51	3.16	6.16	3.98	2.08	15.6	26.0	8.13
1966	9.97	27.7	64.3	43.8	89.8	17.6	89.7	46.4	12.1	5.53	6.84	12.0	35.0
1967	27.2	2.16	4.02	8.69	5.47	3.10	7.94	11.4	4.96	9.22	8.68	35.1	10.7
1968	8.58	2.33	12.4	44.4	7.32	18.0	16.0	79.2	106	9.96	5.62	31.9	28.5
Mean	11.9	19.0	20.0	21.8	35.6	7.4	15.9	25.2	20.8	25.1	11.5	21.3	19.5

1/ Enters Galveston Bay via Buffalo Bayou; drainage area: 24.7 sq. miles; period of record; Oct. 1952-Sept. 1968; average discharge: 19.6 c.f.s. for 16 years; extremes: 3,400 c.f.s. Sept. 12, 1961; no flow at times.

2/ Liter per sec. = c.f.s. x 28.3; 1 sq. miles = 258.9 hectares.

Table 7-13.--Stream discharge for Clear Creek, 1951-1968. (U.S. Geological Survey Station 8-0770 near Pearland, Tex., lat. 29° 35.8', long. 95° 17.2')[1/]

Water year	Monthly and yearly mean discharge in cubic feet per second (c.f.s.)[2/]												
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	The year
1951	16.4	0.23	0.48	3.78	3.17	12.4	8.75	8.90	9.10	1.04	1.31	48.3	9.46
1952	8.21	1.03	0.53	0.76	14.9	1.13	44.6	27.6	29.2	21.1	6.18	35.7	15.8
1953	10.7	15.0	53.5	20.1	53.0	5.26	14.5	68.7	14.3	11.8	81.0	56.5	33.6
1954	2.21	50.5	69.9	18.8	2.54	2.13	7.12	11.7	6.27	6.81	25.5	11.8	18.0
1955	2.92	0.44	0.03	11.5	104	0.28	5.64	30.0	0.84	1.85	61.5	23.3	19.7
1956	1.27	0	0.01	0.81	8.39	0.37	5.11	16.3	2.73	2.25	7.90	8.41	4.44
1957	0.28	0.09	5.41	0	0.46	169	109	44.5	70.3	3.86	7.50	28.5	36.7
1958	132	85.6	6.72	60.2	51.7	3.74	7.47	7.41	3.78	14.1	10.4	71.5	37.8
1959	6.56	1.76	0.42	2.30	300	8.21	113	42.7	14.5	118	127	33.6	62.3
1960	44.6	60.2	73.1	--[3/]	--	--	--	--	--	--	--	--	--
1961	--	--	--	--	--	--	--	--	--	--	--	--	--
1962	--	--	--	--	--	--	--	--	--	--	--	--	--
1963	--	--	--	--	--	--	2.93	2.56	17.7	10.7	6.92	7.52	--
1964	0.64	5.13	28.8	4.45	64.5	14.3	4.97	9.06	4.55	11.3	12.1	16.1	14.5
1965	4.36	16.4	61.6	2.11	12.8	3.19	3.55	34.7	20.9	7.25	5.00	5.40	14.8
1966	2.57	14.7	36.0	39.1	145	15.4	150	230	30.7	22.5	41.0	13.1	61.0
1967	4.02	1.15	0.86	7.56	12.5	6.86	16.6	11.5	12.7	16.9	23.8	13.0	10.6
1968	3.39	0.69	2.15	71.5	6.33	11.1	27.8	198	219	25.7	5.38	16.7	49.1
Mean	13.9	13.7	19.0	17.2	55.6	18.0	36.9	52.8	31.3	18.8	29.6	27.2	27.6

1/ Enters Galveston Bay; drainage area: 38.8 sq. miles; period of record: April 1947-Dec. 1959, March 1963-Sept. 1968; average discharge: 31.7 c.f.s. for 17 years; extremes: 2,170 c.f.s. March 18, 1957, no flow at times.

2/ Liter per sec. = c.f.s. x 28.3; 1 sq. miles = 258.9 hectares.

3/ -- = no or incomplete data.

Table 7-14.--Stream discharge for Chocolate Bayou, 1951-1968. (U.S. Geological Survey Station 8-0780 near Alvin, Tex., lat. 29° 22.3', long. 95° 19.2')[1/].

Water year	Monthly and yearly mean discharge in cubic feet per second (c.f.s.)[2/]												
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	The year
1951	22.5	0.03	0.65	11.2	11.1	47.1	39.5	66.2	94.5	48.8	76.0	204	51.8
1952	16.7	1.65	3.87	0.95	81.8	29.8	318	233	84.5	69.0	38.9	93.0	80.4
1953	17.2	31.4	90.6	16.5	83.4	10.1	26.7	252	90.7	133	270	276	108
1954	8.78	291	133	51.3	6.70	15.3	40.9	94.3	57.4	56.8	102	42.3	75.2
1955	10.4	0.96	0.23	33.6	205	1.63	18.9	51.4	59.3	75.5	72.6	46.1	46.8
1956	0.89	3.19	3.01	1.62	18.7	2.97	23.1	35.7	30.7	21.3	38.7	19.5	16.6
1957	4.37	1.08	0.92	0.16	5.73	379	135	123	244	32.6	38.3	48.3	84.8
1958	289	238	17.1	138	--[3/]	--	--	--	--	--	--	--	--
1959	--	--	--	--	--	20.4	66.4	100	128	406	512	81.6	--
1960	90.2	259	171	115	176	12.1	20.7	33.9	354	67.4	187	62.3	128
1961	82.6	101	332	365	117	10.7	22.3	43.6	489	408	97.6	409	207
1962	7.57	280	45.3	6.81	4.33	6.43	67.2	52.0	108	152	60.9	62.5	70.9
1963	65.7	124	249	30.7	30.6	5.81	33.7	40.0	160	120	49.0	37.7	79.0
1964	18.6	12.0	46.0	17.3	75.8	51.7	25.5	46.4	43.2	80.3	43.8	64.9	43.7
1965	9.03	58.3	226	10.3	24.4	11.3	39.9	88.1	84.2	89.9	63.2	46.2	63.0
1966	18.2	86.9	173	130	395	23.9	199	336	165	127	200	79.5	159
1967	49.2	17.0	2.19	27.8	53.1	37.3	53.4	105	79.5	87.6	58.4	54.6	52.1
1968	17.6	2.26	4.22	357	18.2	21.6	215	340	876	91.2	54.7	58.4	171
Mean	27.4	79.3	92.5	73.4	81.6	41.6	79.9	121	188	103	90.6	100	89.8

1/ Enters Galveston (West) Bay; drainage area: 87.7 sq. miles; period of record: Jan. 1947-Feb. 1958, March 1959-Sept. 1968; average discharge: 96.0 c.f.s. for 19 years; extremes: 7,400 c.f.s. Oct. 8, 1949, no flow at times.

2/ Liter per sec. = c.f.s. x 28.3; 1 sq. miles = 258.9 hectares.

3/ -- = no or incomplete data.

Table 7-15.--Stream discharge from Oyster Creek, 1951-1968. (U. S. Geological Survey Station 8-0790 near Angleton, Tex., lat. 29° 09.5', long. 95° 28.5')1/

Water year	Monthly and yearly mean discharge in cubic feet per second (c. f. s.) 2/												
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	The year
1951	48.3	46.3	45.3	47.1	44.2	95.4	46.7	66.2	134	80.3	74.2	134	71.9
1952	80.4	91.2	99.4	91.8	146	71.5	340	137	151	82.8	83.2	80.1	120
1953	72.1	78.3	102	71.1	122	132	132	375	132	130	138	229	143
1954	135	481	233	180	141	179	78.3	140	183	99.6	70.3	65.4	165
1955	77.6	76.9	75.1	80.4	173	83.1	39.7	29.4	150	121	72.8	129	91.7
1956	49.6	31.9	25.7	127	134	129	146	153	105	20.6	89.6	109	93.1
1957	109	147	133	146	57.6	199	197	3,767	324	162	131	165	467
1958	267	286	149	216	202	131	142	153	154	131	66.0	183	173
1959	115	105	124	43.1	454	123	199	165	153	253	303	148	180
1960	155	155	218	206	205	130	74.3	93.1	245	179	150	81.7	158
1961	184	168	395	577	200	128	133	146	580	585	147	820	339
1962	168	462	253	148	128	129	86.0	95.3	166	147	144	168	175
1963	157	143	256	204	136	103	156	161	75.1	160	168	163	157
1964	149	104	182	147	161	168	149	148	148	111	144	151	147
1965	27.0	36.2	160	72.6	108	79.2	114	678	433	165	167	163	184
1966	66.7	116	200	113	264	74.8	137	333	97.8	22.2	74.6	129	135
1967	150	132	119	136	162	157	164	157	146	161	192	171	154
1968	163	143	147	450	135	123	253	355	1,000'	202	132	150	271
Mean	120	155	162	169	165	124	143	397	243	156	130	179	179

1/ Enters Gulf Intracoastal Waterway; drainage area: 211 sq. miles; period of record: Oct. 1944-Sept. 1968, average discharge: 171 c.f.s. for 24 years; extremes: 10,600 c.f.s. May 10, 1957, no flow at times.

2/ Liter per sec. = c.f.s. x 28.3; 1 sq. miles = 258.9 hectares.

Table 7-16.--Stream discharge from Brazos River, 1951-1968. (U.S. Geological Survey Station 8-1145 near Juliff, Tex., lat 29° 27.3', long. 95° 31.9')1/.

Water year	Monthly and yearly mean discharge in cubic feet per second (c.f.s.) 2/												
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	The year
1951	2,423	969	809	913	1,265	916	1,054	455	3,230	252	156	1,060	1,119
1952	766	572	600	502	989	1,319	5,158	4,961	3,139	316	0.90	38.4	1,525
1953	61.2	357	3,755	4,557	2,172	4,027	877	27,220	1,282	261	455	1,816	3,949
1954	3,024	3,820	8,348	2,352	928	283	289	6,352	2,149	171	289	176	2,368
1955	544	816	425	539	4,681	914	4,183	3,707	4,914	1,059	883	663	1,914
1956	10,510	978	639	899	2,492	919	540	4,740	246	109	138	429	1,870
1957	586	1,170	966	576	826	3,890	17,870	77,210	53,580	14,110	2,814	1,393	14,650
1958	28,660	18,160	7,878	9,455	14,010	14,010	5,446	26,290	3,813	5,454	1,314	4,818	11,630
1959	3,817	2,040	1,553	1,277	6,027	2,027	14,640	7,760	4,629	3,488	1,891	1,137	4,160
1960	23,330	10,910	10,260	16,200	12,890	6,454	3,193	7,359	8,101	4,917	1,483	1,054	8,857
1961	7,882	17,310	25,650	36,020	34,540	13,650	5,361	2,143	15,120	14,860	4,493	12,900	15,710
1962	5,245	5,326	6,355	3,930	3,976	2,273	1,452	2,455	4,041	2,255	3,528	6,890	3,972
1963	4,609	2,378	7,196	4,245	4,406	1,971	2,507	607	2,755	1,394	161	355	2,709
1964	681	950	993	833	2,126	3,524	1,341	2,110	1,858	861	315	2,465	1,500
1965	2,902	4,156	2,735	7,573	18,160	5,802	6,810	41,150	18,920	4,720	3,158	1,492	9,751
1966	1,979	6,873	8,612	3,983	8,128	6,915	11,710	37,150	4,881	1,054	2,971	11,070	8,785
1967	5,254	1,548	1,352	1,115	829	323	1,423	2,095	2,137	995	981	1,124	1,605
1968	1,039	4,683	2,749	17,970	12,490	15,220	16,820	36,060	28,120'	17,080	2,487	3,614	13,200
Mean	5,739	4,612	5,048	6,274	7,274	4,690	5,593	16,101	9,050	4,075	1,528	2,916	6,070

1/ Enters Gulf of Mexico; drainage area: 44,100 sq. miles; period of record: May 1949-Sept. 1968; average discharge: 6,036 c.f.s. for 19 years; extremes: 95,200 c.f.s. May 6-7, 1957, no flow at times.

2/ Liter per sec. = c.f.s. x 28.3; 1 sq. miles = 258.9 hectares.

Table 7-17.--Stream discharge for Big Creek, 1952-1968. (U.S. Geological Survey Station 8-1150 near Needville, Tex., lat. 29° 28.6', long. 95° 48.7')[1/].

Water year	Monthly and yearly mean discharge in cubic feet per second (c.f.s.)[2/]												
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	The year
1952	--[3/]	--	--	--	--	--	125	59.7	7.31	3.48	1.05	0.70	--
1953	0.41	17.0	27.6	1.83	12.1	0.82	0.27	146	0.16	0.48	145	106	38.4
1954	1.73	27.7	86.9	13.1	0.40	0	0	8.57	0.06	0.90	1.11	0.19	11.9
1955	0.23	0.01	0	10.6	85.0	0	0.70	26.1	1.05	12.4	3.53	7.84	11.8
1956	0.24	0	0	19.3	12.6	0	1.26	5.28	3.39	0.02	0.11	0.60	3.54
1957	0	0	0.18	0	0.16	130	126	12.7	16.8	0.33	0.25	23.3	25.9
1958	172	96.8	0.70	62.4	42.0	0.60	0.48	1.61	1.73	1.34	1.27	31.7	34.3
1959	15.5	0.83	1.98	1.79	223	2.35	143	25.7	1.44	8.60	81.0	2.20	40.9
1960	254	120	65.3	27.5	45.3	1.17	15.2	1.45	467	4.77	43.8	1.36	86.8
1961	82.2	15.8	108	61.6	93.0	0.89	7.56	1.94	222	166	1.26	168	77.1
1962	0.80	40.8	16.6	0.15	0.04	0.03	4.66	11.3	11.7	6.06	0.82	26.5	9.93
1963	0.87	4.59	91.2	65.4	20.3	0.37	0.35	0.33	11.1	9.21	0.81	0.55	17.2
1964	0.31	1.38	24.1	11.8	49.1	64.5	1.31	1.51	5.11	1.49	1.54	18.7	15.0
1965	14.4	17.1	42.0	55.4	61.7	0.39	1.10	17.4	11.9	3.15	2.41	2.11	18.9
1966	20.8	103	57.6	39.0	94.7	3.79	137	135	7.96	4.48	8.77	30.8	53.1
1967	1.49	0.11	0.38	9.36	3.63	0.86	6.20	17.5	2.00	7.69	57.7	34.4	11.9
1968	26.4	0.43	30.7	70.9	18.2	13.0	12.0	102	201	14.5	3.35	21.2	42.8
Mean	36.9	27.8	34.5	28.0	47.5	13.6	28.5	32.0	60.2	15.0	22.1	29.7	31.1

1/ Enters Gulf of Mexico via Brazos River; drainage area: 42.3 sq. miles; period of record: May 1947-June 1950, March 1952-Sept. 1968; average discharge: 29.7 c.f.s. for 18 years; extremes: 10,400 c.f.s. June 26, 1960, no flow at times.

2/ Liter per sec. = c.f.s. x 28.3; 1 sq. miles = 258.9 hectares.

3/ -- = no or incomplete data.

Table 7-18.--Stream discharge from Fairchild Creek, 1951-1955. (U.S. Geological Survey Station 8-1155 near Needville, Tex., lat. 29° 26.7', long. 95° 45.7')[1/].

Water year	Monthly and yearly mean discharge in cubic feet per second (c.f.s.)[2/]												
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	The year
1951	0	0	0	0.24	0.08	18.6	19.5	6.49	2.75	0	0	36.5	6.99
1952	10.6	0.36	0.01	0	46.1	0.50	62.5	37.4	0.58	6.30	0	0	13.5
1953	0	8.70	8.95	1.23	9.42	0.86	0	92.8	0	0	103	43.8	22.6
1954	7.29	42.0	34.6	11.3	0.16	0	0	0.77	0	0	6.00	0.24	8.58
1955	0.03	--[3/]	--	--	--	--	--	--	--	--	--	--	--
Mean	4.47	12.7	10.8	3.19	13.9	4.99	20.5	34.3	0.83	1.57	27.2	20.1	12.9

1/ Enters Gulf of Mexico via Big Creek and Brazos River; drainage area: 24.9 sq. miles; period of record: May 1947-Oct. 1955; average discharge 14.9 c.f.s. for 7 years; extremes: 2,560 c.f.s. May 18, 1953, no flow at times.

2/ Liter per sec. = c.f.s. x 28.3; 1 sq. miles = 258.9 hectares.

3/ -- = no or incomplete data.

Table 7-19.--Stream discharge from Dry Creek, 1957-1968. (A. U.S. Geological Survey Station 8-1165, lat. 29° 30.3', long 95° 42.6', near Richmond; B. 8-1164, lat. 29° 30.7', long 95° 44.7', near Rosenberg, Tex.)1/.

Water year	Monthly and yearly mean discharge in cubic feet per second (c.f.s.)2/												
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	The year
1957 (A)	0	0	0.10	0	0.17	33.1	28.8	5.02	12.8	3.31	3.24	0.62	7.28
1958 (A)	50.2	145	--3/	--	--	--	--	--	--	--	--	--	--
1959 (B)	2.39	0.19	0.19	0.11	38.0	0.46	21.3	4.31	1.61	1.81	6.59	1.31	6.28
1960 (B)	50.4	31.0	14.0	4.73	14.4	0.10	53.2	4.29	80.5	3.82	21.1	1.31	23.1
1961 (B)	42.9	6.64	28.9	12.9	20.7	0.04	2.10	1.28	46.2	48.2	0.26	39.0	20.7
1962 (B)	0	5.27	1.31	0	0	0.98	4.57	12.0	9.77	2.23	24.6	4.24	5.45
1963 (B)	0.49	1.47	15.7	11.0	4.24	0.01	8.13	11.8	3.98	3.12	0.57	1.50	5.19
1964 (B)	0.04	0.25	5.10	1.97	7.66	5.48	2.25	4.97	4.03	7.75	3.29	4.73	3.95
1965 (B)	3.65	0.48	5.30	5.11	15.7	31.6	3.80	5.44	2.75	1.57	2.55	0.38	6.50
1966 (B)	4.37	22.7	12.5	8.14	20.6	2.34	34.0	30.7	3.36	3.03	2.81	9.82	12.7
1967 (B)	0.034	0	0.013	1.31	37.0	1.09	11.9	7.35	0.872	7.78	5.21	5.39	6.27
1968 (B)	3.97	0	9.51	16.5	4.17	2.63	25.1	28.8	47.8	19.3	8.84	8.40	14.6
Mean	9.8	6.1	8.4	5.6	14.7	7.0	17.7	10.5	19.3	9.2	7.1	6.9	10.1

1/ Enters Gulf of Mexico via Big Creek and Brazos River, A. (Station 8-1165) drainage area: 10.3 sq. miles; period of record: May 1947-June 1950, Oct. 1956-Sept. 1958; average discharge not determined, extremes: 1,790 c.f.s. Oct. 15, 1957, no flow at times. B. (Station 8-1164) drainage area: 8.53 sq. miles; period of record: Oct. 1959-Sept. 1968; average discharge: 10.1 c.f.s. for 10 years; extremes: 2,410 c.f.s. Oct. 31, 1959, no flow at times.

2/ Liter per sec. = c.f.s. x 28.3; 1 sq. miles = 258.9 hectares.

3/ -- = no or incomplete data.

Table 7-20.--Stream discharge from San Bernard River, 1954-1968. (U.S. Geological Survey Station 8-1175 near Boling, Tex., lat. 29° 18.8', long. 95°53.6')1/.

Water year	Monthly and yearly mean discharge in cubic feet per second (c.f.s.)2/												
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	The year
1954	--3/	--	--	--	--	--	--	114	24.6	34.5	118	88.5	--
1955	17.4	10.5	62.4	182	983	12.9	26.0	416	89.1	58.1	81.2	150	169
1956	15.0	5.23	7.17	147	135	5.97	37.1	22.8	10.4	10.7	26.8	35.2	37.9
1957	3.27	7.90	28.4	6.57	17.0	2,142	969	1,133	390	28.9	67.3	136	414
1958	3,326	1,258	180	1,246	921	149	27.2	293	34.2	53.5	62.9	673	685
1959	276	92.7	109	130	2,149	178	2,244	636	168	133	619	171	561
1960	437	1,468	475	574	579	128	83.6	354	2,901	1,146	252	140	707
1961	781	770	1,064	1,441	2,651	164	98.1	111	2,314	1,417	229	3,069	1,159
1962	58.6	679	174	44.5	124	40.6	89.7	163	297	310	111	192	189
1963	52.4	19.8	340	482	263	40.1	15.2	37.4	138	168	158	101	151
1964	58.1	115	293	57.7	638	555	18.1	49.8	268	110	111	427	223
1965	296	273	337	765	675	90.5	24.9	601	96.0	109	117	150	293
1966	314	1,190	659	418	1,024	154	849	1,623	157	193	232	270	587
1967	121	8.19	7.83	51.4	15.2	8.69	90.7	271	199	155	257	629	151
1968	589	31.2	69.3	1,509	174	153	117	1,942	3,938	1,056	196	394	848
Mean	453	423	271	503	739	272	334	546	785	353	180	466	441

1/ Enters Gulf Intracoastal Waterway; drainage area: 727 sq. miles; period of record: May 1954-Sept. 1968; average discharge: 441 c.f.s. for 14 years; extremes: 21,200 c.f.s. June 28, 1960, 2.4 c.f.s. Nov. 28-30, 1956.

2/ Liter per sec. = c.f.s. x 28.3; 1 sq. miles = 258.9 hectares.

3/ -- = no or incomplete data.

Table 7-21.--Stream discharge from Colorado River, 1951-1968. (U.S. Geological Survey Station 8-1625 near Bay City, Tex., lat. 28° 58.4', long. 96° 00.7')[1].

Monthly and yearly mean discharge in cubic feet per second (c.f.s.)[2]

Water year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	The year
1951	692	680	788	841	1,045	529	295	446	1,489	71.4	299	1,289	700
1952	635	439	406	344	450	345	979	1,830	454	503	235	763	616
1953	390	622	1,940	1,374	1,612	714	458	4,924	178	619	898	1,508	1,273
1954	1,315	884	1,625	784	403	260	384	676	222	193	545	474	651
1955	453	378	362	485	1,646	296	436	1,418	2,640	1,511	1,541	1,073	1,014
1956	2,508	1,793	898	497	994	388	472	886	815	164	367	314	840
1957	286	226	297	249	348	2,037	5,027	27,750	24,560	4,058	1,757	4,975	5,980
1958	12,820	8,559	6,173	6,146	9,910	7,537	5,050	5,611	3,544	3,412	2,080	3,804	6,200
1959	2,330	2,609	1,035	1,231	3,675	1,348	7,564	2,926	1,500	844	2,506	2,575	2,491
1960	10,410	6,010	4,408	4,205	4,954	3,693	3,829	5,898	8,909	2,566	1,949	1,113	4,829
1961	4,944	7,059	3,708	4,849	8,289	4,682	3,672	1,877	8,613	7,675	2,876	11,160	5,743
1962	1,736	4,713	3,580	2,672	1,058	700	562	341	1,183	582	275	888	1,525
1963	813	681	1,358	979	1,637	577	387	355	384	636	313	393	705
1964	352	318	343	258	482	800	125	227	505	115	114	878	375
1965	766	695	573	2,233	4,850	774	368	6,250	6,364	1,369	189	447	2,051
1966	1,018	3,464	4,101	1,890	1,966	1,556	2,154	6,532	1,129	428	583	93.9	2,081
1967	588	851	297	270	246	257	324	453	294	1.00	311	2,675	544
1968	1,101	1,329	677	8,228	6,700	5,908	6,859	10,130	12,050	3,375	739	1,907	4,900
Mean	2,397	2,295	1,809	2,085	2,792	1,800	2,163	4,362	4,157	1,562	976	2,018	2,362

1/ Enters Gulf of Mexico and Matagorda Bay via Gulf Intracoastal Waterway; drainage area: 41,650 sq. miles; period of record: April 1948-Sept. 1968; average discharge: 2,312 c.f.s. for 20 years; extremes; 84,100 c.f.s. June 26, 1960, no flow at times.

2/ Liter per sec. = c.f.s. x 28.3; 1 sq. miles = 258.9 hectares.

Table 7-22.--Stream discharge from Lavaca River, 1951-1968. (U.S. Geological Survey Station 8-1640 near Edna, Tex., lat. 28° 57.6', long. 96° 41.2')[1].

Monthly and yearly mean discharge in cubic feet per second (c.f.s.)[2]

Water year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	The year
1951	5.13	5.66	10.9	14.8	17.9	19.5	15.8	11.3	322	6.77	1.92	141	47.2
1952	28.9	14.0	14.0	10.9	37.0	24.0	240	1,295	202	29.4	19.9	17.3	162
1953	4.16	287	386	49.8	58.5	32.6	50.1	682	27.2	18.5	232	112	163
1954	25.8	18.1	16.5	16.2	13.5	12.2	85.2	69.1	6.21	2.14	5.24	7.60	23.2
1955	1.58	0.14	0.28	9.73	649	15.7	32.0	695	110	12.2	151	43.8	140
1956	5.05	2.24	4.85	5.57	18.3	6.58	4.43	8.16	0.94	16.7	0.50	0.41	6.12
1957	0.95	0.003	32.6	0.05	83.0	447	1,424	460	310	15.4	5.09	169	244
1958	1,904	1,158	120	668	1,186	166	75.8	387	31.0	121	14.9	387	514
1959	229	66.8	116	60.3	1,169	105	1,328	342	141	59.0	71.2	75.1	306
1960	265	234	170	187	223	82.4	116	85.1	1,084	183	639	78.9	278
1961	3,631	852	594	951	1,148	163	116	92.9	1,364	564	82.2	2,073	966
1962	157	1,097	125	95.9	96.3	72.6	624	96.2	239	54.5	20.9	154	234
1963	58.7	35.6	60.3	83.0	318	49.4	30.0	29.5	29.2	72.5	7.51	6.57	63.4
1964	5.08	19.8	38.9	36.4	73.2	89.1	74.3	30.5	296	17.6	26.4	193	74.2
1965	40.9	10.7	14.9	595	1,006	82.8	71.2	1,621	686	49.1	32.2	20.8	349
1966	87.5	818	279	123	290	150	586	734	143	86.6	45.1	35.8	280
1967	19.0	18.7	21.9	24.6	21.6	27.0	74.8	38.0	11.8	4.39	19.2	1,885	178
1968	841	84.2	46.3	998	154	165	222	1,361	1,930	208	61.8	111	516
Mean	406	262	113	218	364	94.9	287	446	385	84.4	79.7	306	252

1/ Enters Matagorda Bay; drainage area: 826 sq. miles; period of record: Aug. 1938-Sept. 1968; average discharge: 276 c.f.s. for 30 years; extremes: 73,000 c.f.s. July 1, 1940, no flow at times.

2/ Liter per sec. = c.f.s. x 28.3; 1 sq. miles = 258.9 hectares.

Table 7-23.--Stream discharge from Navidad River, 1951-1968. (U.S. Geological Survey Station 8-1645 near Ganado, Tex., lat. 29° 01.5', long. 96° 33.1')[1/].

Water year	Monthly and yearly mean discharge in cubic feet per second (c.f.s.)[2/]												
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	The year
1951	17.9	4.94	9.51	11.3	14.7	65.2	32.6	18.1	947	15.0	34.9	404	130
1952	84.2	22.6	15.1	9.14	99.7	43.8	908	1,601	281	49.0	40.5	121	273
1953	12.0	398	704	106	117	34.5	31.6	1,410	32.2	83.4	549	1,012	376
1954	41.1	24.4	71.8	13.8	9.50	8.98	16.6	79.4	2.04	2.94	21.3	48.4	28.6
1955	23.8	0.34	0.36	14.0	831	5.38	28.8	619	185	23.5	107	288	172
1956	45.9	0	0	8.98	79.1	0	24.9	1.05	8.69	0.21	22.6	39.5	18.9
1957	1.18	0.65	44.7	0.19	114	1,166	1,941	1,349	1,372	18.4	25.5	509	544
1958	3,109	1,660	125	1,033	1,530	150	80.0	512	37.5	157	63.4	616	751
1959	253	189	398	214	2,212	132	2,723	446	855	132	341	234	661
1960	859	637	623	540	660	135	249	375	3,474	666	1,306	287	815
1961	2,680	1,591	1,060	1,525	2,966	198	128	82.7	2,435	1,062	168	4,419	1,508
1962	119	1,101	93.1	102	129	76.0	668	152	357	237	73.4	280	280
1963	42.2	13.8	177	240	307	39.5	30.1	49.6	69.4	348	79.3	75.5	122
1964	20.4	103	202	43.6	272	158	37.6	52.7	494	117	115	507	175
1965	114	52.9	14.4	570	804	52.0	74.2	2,552	726	151	99.2	175	448
1966	233	1,487	550	337	727	355	895	1,801	497	262	306	190	634
1967	79.9	10.4	17.4	36.5	18.2	17.2	111	125	67.0	100	361	3,582	374
1968	983	73.1	30.7	2,723	250	226	257	2,019	4,905	530	142	367	1,043
Mean	484	409	229	418	618	159	457	735	930	219	214	730	464

1/ Enters Matagorda Bay via Lavaca River; drainage area: 1,063 sq. miles; period of record: May 1939-Sept. 1968; average discharge: 497 c.f.s. for 29 years; extremes: 64,500 c.f.s. July 2, March 26, 1940, no flow at times.

2/ Liter per sec. = c.f.s. x 28.3; 1 sq. miles = 258.9 hectares.

Table 7-24.--Stream discharge from Guadalupe River, 1951-1968. (U.S. Geological Survey Station 8-1765 at Victoria, Tex., lat. 28° 47.6', long. 97° 00.7')[1/].

Water year	Monthly and yearly mean discharge in cubic feet per second (c.f.s.)[2/]												
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	The year
1951	355	354	409	393	424	427	455	564	2,279	310	186	375	542
1952	238	315	326	336	401	335	590	1,350	1,355	472	180	3,993	819
1953	707	963	1,884	1,652	834	650	731	2,551	336	319	485	1,730	1,074
1954	1,684	693	886	582	505	413	484	702	246	147	108	107	548
1955	121	200	242	259	950	329	290	771	797	214	211	158	374
1956	100	107	183	195	255	158	157	224	59.7	53.9	37.6	51.6	132
1957	164	59.6	486	118	410	1,165	4,147	6,954	5,312	676	355	3,859	1,973
1958	7,945	4,209	1,990	4,070	8,645	3,922	2,015	4,293	1,764	1,248	743	2,013	3,541
1959	1,852	2,229	1,450	1,271	1,967	1,302	3,304	1,675	1,132	1,290	826	739	1,580
1960	2,504	1,299	1,114	1,431	1,509	1,204	1,300	2,392	2,854	2,635	1,805	1,091	1,764
1961	9,217	7,761	3,289	3,833	4,640	2,459	1,619	1,151	6,855	2,637	1,175	1,901	3,865
1962	1,035	2,235	997	906	902	781	945	746	881	511	332	736	914
1963	651	687	805	697	1,044	663	738	489	368	304	172	201	565
1964	213	775	474	450	808	1,198	678	447	559	260	271	716	568
1965	834	966	526	1,599	4,735	1,271	1,220	4,327	4,018	1,116	698	707	1,812
1966	1,275	1,969	2,620	1,235	1,669	1,589	2,051	2,606	1,200	893	640	869	1,551
1967	878	703	596	596	541	512	474	392	280	209	302	9,335	1,234
1968	2,270	2,213	1,114	7,130	2,348	1,869	2,907	4,991	6,178	1,669	962	1,649	2,941
Mean	1,780	1,540	1,077	1,486	1,810	1,124	1,339	2,034	2,026	831	527	1,679	1,433

1/ Enters San Antonio Bay; drainage area: 5,198 sq. miles; period of record: Nov. 1934-Sept. 1968; average discharge: 1,593 c.f.s. for 33 years; extremes: 179,000 c.f.s. July 3, 1936, 14 c.f.s. Aug. 20, 1956.

2/ Liter per sec. = c.f.s. x 28.3; 1 sq. miles = 258.9 hectares.

Table 7-25.--Stream discharge from Coleto Creek, 1953-1968. (U.S. Geological Survey Station 8-1770 near Schroeder, Tex., lat. 28° 49.9', long. 97° 11.2')[1/].

Water year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	The year
	Monthly and yearly mean discharge in cubic feet per second (c.f.s.)[2/]												
1953	8.51	126	46.5	7.85	8.84	4.81	4.27	225	6.65	0.90	236	65.6	62.3
1954	27.4	6.46	3.44	3.66	2.87	2.01	4.03	32.4	0.62	0.24	0.14	0.21	7.03
1955	0.58	0.36	0.29	0.17	67.1	0.70	1.45	57.4	3.95	0.18	18.0	6.72	12.7
1956	1.31	0.33	0.38	1.05	0.36	0.33	0.31	11.9	0.22	0.08	0.01	9.81	2.18
1957	41.6	61.7	3.20	0.25	4.55	91.0	560	264	240	1.92	0.44	78.8	112
1958	155	435	16.9	286	1,122	57.2	23.3	254	12.7	13.4	0.68	119	201
1959	143	21.8	22.8	14.9	182	22.3	307	104	14.3	5.86	3.53	17.2	70.4
1960	29.2	7.58	5.73	10.1	10.6	7.57	6.24	6.65	84.5	68.7	80.2	12.5	27.6
1961	895	238	164	98.9	138	26.7	19.7	19.8	156	34.5	5.83	14.2	151
1962	4.45	48.8	7.33	6.57	23.6	7.29	34.2	6.68	84.2	2.68	0.27	68.6	24.2
1963	3.65	4.36	23.2	9.07	21.2	5.73	2.97	1.63	8.18	20.3	0.05	0.29	8.34
1964	0.28	4.22	16.1	19.7	52.5	24.5	3.03	4.23	0.38	0.32	86.8	52.7	22.0
1965	1.11	0.41	1.25	113	354	14.3	5.02	303	313	6.93	2.25	0.98	90.9
1966	39.3	6.99	32.5	15.1	27.1	8.09	58.5	147	200	50.4	3.35	9.96	36.1
1967	2.02	1.05	1.72	3.93	2.30	2.51	4.82	2.58	0.073	0.056	11.0	4,690	388
1968	1,015	63.4	23.2	146	46.7	32.7	16.5	641	488	45.0	12.3	350	241
Mean	149.9	64.1	23	46	128.9	19.1	65.6	130	89.5	15.6	28.8	343.5	90.9

1/ Enters San Antonio Bay; drainage area: 369 sq. miles; period of record: Jan. 1930-Dec. 1933, Oct. 1952-Sept. 1968; average discharge: 88.3 c.f.s. for 19 years; extremes: 122,000 c.f.s. Sept. 21, 1967, no flow at times.

2/ Liter per sec. = c.f.s. x 28.3; 1 sq. miles = 258.9 hectares.

Table 7-26.--Stream discharge from San Antonio River, 1951-1968. (U.S. Geological Survey Station 8-1885 at Goliad, Tex., lat. 28° 38.9', long. 97° 23.1')[1/].

Water year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	The year
	Monthly and yearly mean discharge in cubic feet per second (c.f.s.)[2/]												
1951	131	126	132	125	199	174	195	493	1,113	121	90.2	790	306
1952	150	156	150	137	214	175	316	499	176	166	77.4	3,306	456
1953	149	226	256	271	164	171	206	941	85	124	324	1,319	353
1954	234	156	196	150	124	112	159	261	126	82.5	49.9	66.8	143
1955	124	133	86.5	127	352	177	89.3	314	166	69	165	243	169
1956	75.1	76.2	115	104	107	83.9	86.8	192	26.2	52.4	60.6	200	98.2
1957	368	156	382	110	167	492	2,515	2,904	2,321	164	109	2,025	974
1958	952	896	296	1,641	2,884	638	367	2,065	454	505	196	932	974
1959	1,202	1,608	582	464	516	399	638	621	350	342	226	221	597
1960	679	396	335	394	382	394	350	318	572	518	553	248	429
1961	2,520	1,769	944	868	1,358	685	423	267	1,368	1,012	383	363	994
1962	554	799	342	331	325	245	327	252	697	166	146	318	374
1963	153	235	379	215	385	198	209	154	126	113	47.9	150	196
1964	295	344	245	214	537	446	193	152	290	88.8	472	207	289
1965	316	599	229	568	1,778	324	462	2,605	732	231	173	177	676
1966	596	240	710	292	360	322	487	596	268	187	241	377	390
1967	207	162	183	194	175	175	186	169	71.4	175	394	12,050	1,165
1968	1,052	969	385	4,309	1,014	647	678	2,063	843	538	292	854	1,141
Mean	542	502	330	584	613	325	438	826	543	258	222	1,324	540

1/ Enters San Antonio Bay; drainage area: 3,921 sq. miles; period of record: June 24-March 29, Feb. 1939-Sept. 1968; average discharge: 554 c.f.s. for 33 years; extremes: 138,000 c.f.s. Sept. 23, 1967, 1.2 c.f.s. June 16, 1956.

2/ Liter per sec. = c.f.s. x 28.3 sq. miles = 258.9 hectares.

Table 7-27.--Stream discharge data for Mission River, 1951-1968. (U.S. Geological Survey Station 8-1895 at Refugio, Tex., lat. 28° 17.5', long. 97° 16.7')1/.

Water year	Monthly and yearly mean discharge in cubic feet per second (c.f.s.)2/											
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	The year
1951	2.33	3.01	3.51	3.47	3.18	3.18	3.11	8.97	27.8	3.03	3.36	399	38.2
1952	8.93	4.36	5.00	4.20	12.2	4.16	14.4	253	15.8	6.88	4.25	859	98.5
1953	23.7	16.8	15.1	11.1	9.78	8.35	9.65	67.5	5.15	3.48	96.3	231	41.5
1954	171	10.9	7.01	6.11	5.35	5.02	6.73	4.66	3.28	3.18	3.23	3.79	19.5
1955	24.2	3.74	3.83	4.36	4.33	3.97	3.70	3.18	3.64	3.99	4.82	19.8	6.97
1956	5.09	4.20	3.38	5.65	3.16	29.1	3.76	30.5	2.15	2.02	3.57	2.32	7.99
1957	2.07	1.47	46.2	2.23	2.18	93.5	504	269	256	7.02	2.52	71.6	105
1958	3.79	42.1	6.39	386	1,178	35.3	24.0	46.6	11.3	5.64	2.65	101	146
1959	212	32.2	19.1	12.4	210	18.6	9.37	26.6	105	5.41	24.1	10.3	56.0
1960	272	21.0	8.27	10.7	88.2	79.9	12.5	15.3	431	29.1	60.1	20.5	87.0
1961	1,122	110	374	214	252	29.6	108	16.4	47.1	69.4	7.35	13.6	198
1962	5.84	21.6	6.55	6.31	5.26	5.58	5.23	3.24	254	8.04	2.20	184	41.9
1963	5.39	39.0	37.5	6.14	5.15	3.77	2.25	11.0	2.52	1.55	1.16	11.8	10.6
1964	1.97	24.4	5.15	5.83	17.1	7.83	2.77	10.6	2.02	57.2	29.5	1.94	13.9
1965	1.82	2.03	3.82	27.5	226	6.25	6.52	264	16.4	2.06	2.13	1.69	45.7
1966	8.07	26.6	56.8	16.8	46.4	5.39	244	807	30.8	174	51.8	25.2	126
1967	6.16	4.14	4.15	5.20	4.66	3.36	2.51	96.3	2.26	2.65	92.3	7,646	647
1968	o35	66.1	35.4	47.9	71.0	22.4	15.4	1,110	272'	92.5	18.8	22.9	203
Mean	139	24.0	35.5	43.1	119	20.2	54.2	169	82.6	26.4	22.7	534	105

1/ Enters Copano Bay via Mission Bay; drainage area: 690 sq. miles; period of record: July 1939-Sept. 1968; average discharge: 98.1 c.f.s. for 29 years; extremes: 116,000 c.f.s. Sept. 21, 1967, 0.7 c.f.s. at times.

2/ Liter per sec. = c.f.s. x 28.3; 1 sq. miles = 258.9 hectares.

Table 7-28.--Stream discharge from Aransas River, 1964-1968. (U.S. Geological Survey Station 8-1897 near Skidmore, Tex., lat. 28° 16.9', long. 97° 37.2')1/.

Water year	Monthly and yearly mean discharge in cubic feet per second (c.f.s.)2/											
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	The year
1964	--3/	--	--	--	--	--	0.51	16.9	2.56	28.5	0.10	2.53	--
1965	0.06	0.17	0.72	1.82	56.2	22.6	5.28	51.5	19.7	0.07	--	--	--
1966	9.30	1.68	2.78	1.38	1.64	0.54	110	191	1.75	0.59	1.21	8.67	27.7
1967	0.12	0.31	0.85	1.34	1.10	0.67	0.30	21.9	0.02	8.43	29.6	2,356	199
1968	85.2	4.53	2.25	3.95	2.91	1.67	1.43	177	30.4	9.36	1.67	7.14	27.6
Mean	31.5	2.17	1.96	2.23	1.88	0.96	37.2	129	10.7	6.12	10.8	790	84.7

1/ Enters Copano Bay; drainage area: 247 sq. miles; period of record: Oct. 1965-Sept. 1968; average discharge: 8.7 c.f.s. for 4 years; extremes: 82,800 c.f.s. Sept. 22, 1967, no flow at times.

2/ Liter per sec. = c.f.s. x 28.3; 1 sq. miles = 258.9 hectares.

3/ -- = no or incomplete data.

Table 7-29.--Stream discharge from Nueces River, 1951-1968. (U.S. Geological Survey Station 8-2110 near Mathis, Tex., lat. 28° 02.3', long. 97° 51.6')[1/].

Water year	Monthly and yearly mean discharge in cubic feet per second (c.f.s.)[2/]												
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	The year
1951	216	59.6	47.6	42.4	45.0	42.7	48.1	970	2,318	67.0	67.4	3,126	583
1952	313	69.2	40.5	44.3	59.3	75.3	157	399	1,381	155	76.4	175	244
1953	55.3	45.5	44.1	51.2	46.2	52.8	70.0	1,320	73.4	82.4	386	6,725	741
1954	1,068	687	44.1	44.4	58.8	60.4	52.5	60.4	929	2,362	86.6	77.8	465
1955	72.4	129	58.4	48.5	54.4	69.2	74.1	281	255	90.3	99.6	385	135
1956	672	61.5	45.4	52.0	52.9	59.0	49.0	70.1	106	110	183	740	184
1957	635	108	93.3	60.4	63.6	321	2,663	9,482	8,142	109	106	1,735	1,962
1958	2,033	780	91.3	4,994	5,165	4,377	87.2	83.5	104	166	188	659	1,538
1959	4,168	3,372	325	394	155	114	87.5	95.3	114	845	132	98.5	829
1960	4,354	318	107	95.3	131	73.3	87.6	85.8	231	298	889	480	602
1961	2,534	1,584	1,000	837	1,163	182	290	122	1,369	457	457	200	847
1962	110	105	102	107	112	95.6	107	133	103	133	128	90.7	111
1963	107	83.6	65.6	88.3	83.4	90.1	110	146	128	143	157	108	109
1964	107	85.1	75.1	75.4	68.6	82.7	109	103	133	133	157	116	104
1965	3,092	384	73.8	69.1	1,257	515	104	2,655	875	158	132	123	787
1966	96.0	95.3	86.3	76.4	93.6	96.7	131	3,346	896	209	132	115	452
1967	120	116	104	94.5	85.4	108	144	140	164	171	152	24,950	2,167
1968	3,418	339	350	3,582	689	447	102	4,399	542	512	111	131	1,232
Mean	1,287	467	152	597	521	381	248	1,327	992	344	202	2,224	727

1/ Enters Corpus Christi Bay; drainage area: 16,660 sq. miles; period of record: Aug. 1939-Sept. 1968; average discharge: 826 c.f.s. for 29 years; extremes: 138,000 c.f.s. Sept. 24, 1967, 6.8 c.f.s. Aug. 15, 1940.

2/ Liter per sec. = c.f.s. x 28.3; 1 sq. miles = 258.9 hectares.

Table 7-30.--Stream discharge from San Fernando Creek, 1965-1968. (U.S. Geological Survey Station 8-2119 at Alice, Tex., lat. 27° 46.3', long. 98° 02.0')[1/].

Water year	Monthly and yearly mean discharge in cubic feet per second (c.f.s.)[2/]												
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	The year
1965	--[3/]	--	--	1.08	3.12	28.6	2.20	30.9	1.30	0.74	0.73	0.79	--
1966	42.5	1.55	2.99	2.88	2.13	1.63	35.1	89.6	1.93	1.58	1.36	2.22	15.6
1967	2.00	1.44	1.45	2.01	1.64	1.43	1.28	1.95	1.54	1.30	4.96	1,023	85.9
1968	9.62	1.63	1.49	1.90	1.78	1.78	1.90	21.3	2.43	4.82	2.09	4.76	4.66
Mean	18.0	1.54	1.97	2.26	1.85	1.61	12.76	37.6	1.96	2.56	2.80	343	35.3

1/ Enters Laguna Madre via Grulla Bayou; drainage area: 507 sq. miles; period of record: Dec. 1964-Sept. 1968, average discharge: 35.3 c.f.s. for 3 years; extremes: 16,900 c.f.s. Sept. 23, 1967, no flow at times.

2/ Liter per sec. = c.f.s. x 28.3; 1 sq. mile = 258.9 hectares.

3/ -- = no or incomplete data.

Table 7-31.--Stream discharge from the Rio Grande, 1951-1968. (U.S. Geological Survey Station 4750 near Brownsville, Tex., lat. 25° 52', long. 97° 23')[1/].

Water year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	The year
	Monthly and yearly mean discharge in cubic feet per second (c.f.s.)[2/]												
1951	2,620	60.4	43.4	0.9	9.9	9.8	18.9	2,370	1,360	98.3	159	4,390	930
1952	1,270	526	54.4	3.9	2.4	0.7	3.7	160	1,360	1,330	150	16.5	408
1953	13.8	18.0	5.5	9.0	11.3	5.7	20.0	1.1	0	0	1,020	5,220	523
1954	3,780	482	277	118	110	33.4	534	74.1	615	249	85.5	79.0	541
1955	461	96.6	112	105	119	52.6	152	101	133	252	98.4	207	158
1956	30.7	75.7	69.0	80.8	86.0	44.3	95.4	67.3	40.8	21.4	13.3	16.0	53.2
1957	12.3	21.6	9.3	4.6	19.0	34.8	14.7	524	372	18.2	3.5	22.1	88.4
1958	29.7	57.1	8.5	31.8	65.5	76.2	34.6	175	178	210	29.9	589	123
1959	9,220	8,870	7,800	3,640	6,510	5,870	2,130	551	833	468	526	415	3,890
1960	735	326	279	423	610	422	638	449	432	461	394	884	503
1961	501	432	295	363	262	250	567	523	631	290	911	2,250	606
1962	715	534	436	240	239	209	422	349	569	350	192	137	366
1963	138	125	200	185	116	82.0	91.6	203	507	222	84.8	113	172
1964	210	137	135	51.0	105	117	111	312	169	85.1	69.0	72.1	131
1965	108	92.3	181	68.5	215	73.9	65.6	542	173	146	134	121	160
1966	170	128	112	146	748	570	255	1,030	1,020	3,100	1,590	6,290	1,136
1967	778	361	155	225	135	131	99.6	601	317	162	375	8,680	1,096
1968	12,000	3,870	2,910	3,410	2,570	1,600	1,220	2,080	779	1,420	5,966	1,880	2,863
Mean	1,821	900	726	505	662	532	359	561	527	493	655	1,743	763

1/ Enters Gulf of Mexico, some overflow into Laguna Madre and South Bay; drainage area: 182,215 sq. miles; period of record: Jan. 1934-Sept. 1965; average discharge: 2,117 c.f.s. for 26 years; extremes: 31,700 c.f.s. Oct. 8, 1945, no flow at times.

2/ Liter per sec. = c.f.s. x 28.3; 1 sq. miles = 258.9 hectares.

Table 8.--The cumulative average annual discharge, area volume, and ratios of discharge to volume of area for seven major Texas estuarine areas.

Estuarine areas	Cumulative average annual discharge		Volume of estuarine area at mean low water	Approximate ratio of discharge to volume of area x 10^6	
	Historic	1951-1968		Historic	1951-1968
	c.f.s.[1,2/]		Ft.^{3} x[1,3/]10^6		
Sabine Lake	15,334	11,521	10,333	1: 1	1: 1
Galveston Bay	9,149	7,554	78,040	1: 8	1: 10
Matagorda Bay[4/]	3,085	3,078	76,902	1: 25	1: 25
San Antonio-Espiritu Santo bays	2,235	2,063	[5/]27,780	1: 12	1: 14
Copano-Aransas bays	182	189	27,617	1: 151	1: 146
Corpus Christi Bay	826	727	36,726	1: 44	1: 51
Laguna Madre[6/]	37	37	55,309	1:1,480	1:1,480

1/ To convert to metric, 1 cubic foot = 0.0283 cubic meter; 1 acre = 0.4046 hectares.

2/ Compiled from Table 7.1 through 7.31.

3/ Computed from Table 3.

4/ Excludes Brazos River Delta streams; Colorado River flows only partially into bay.

5/ Excludes Mission Lake.

6/ Affected by Rio Grande only during heavy discharge.

Table 9.--Extremes in surface water temperatures at seven locations along the Texas coast.(U.S. Department of Commerce, 1965)

Station (period of record)	Temperature °F 1/			
	February		July	
	Minimum	Average 2/	Maximum	Average
Galveston (Gulf coast) Sept. 1958-Dec. 1962	46	55.6	90	85.8
Galveston (Channel) Jan. 1922-Dec. 1962	37	58.2	97	86.4
Freeport Harbor May 1955-Dec. 1962	42	57.6	89	83.5
Rockport Jan. 1948-Dec. 1954	40	62.2	94	87.4
Port Aransas June 1958-Aug. 1967	50	57.1	90	86.0
Brazos Santiago June 1958-Dec. 1962 3/	41	59.0	89	83.4
Port Isabel April 1944-Dec. 1962	45	63.7	90	85.3

1/ °C = 5/9 (°F-32).

2/ Data recorded to nearest degree; averages computed to nearest tenth.

3/ Records not complete.

Table 10.--Natural (public) and private oyster leases on the Texas coast. (Data from the Texas Parks and Wildlife Department, Seabrook, Tex.) 1/

Study area (Figure reference)	Public reefs			Private leases		
	Figure Symbol	Name	Acres 2/	Figure symbol	Lease number(s)	Acres 2/
Galveston Bay (28)	1	Barrell	3/22.0	A	171-A	14.1
	2	Bart's Pass	265.9	B	268-A	50.3
	3	Bayview	3/40.0	C	299-A	100.0
	4	Beasley's	3/91.3	D	301-A	100.0
	5	Deep	3/15.0	E	311-A	
	6	De George	3/ 2.0		350-A	134.1
	7	Dollar	3/292.5	F	346-A	49.9
	8	Dow	162.1	G	347-A	100.0
	9	Fisher	151.8	H	350-A	
	10	Hanna	1,429.2		395-A	121.0
	11	Humble Camp	3/5.0	I	351-A	
	12	Lewis	3/1.0		352-A	197.65
	13	Little Tin Can	2.0	J	353-A	
	14	Lost	15.2		354-A	
	15	Moody	3/500.0		355-A	
	16	Red Bluff	3/20.0		356-A	200.0
	17	Redfish (N)	406.9	K	357-A	33.32
	18	Redfish (S)	1,632.0	L	359-A	
	19	San Leon	20.0		360-A	84.9
	20	Scott's	3/50.0	M	361-A	100.0
	21	Shelton	3/80.0	N	357-A	
	22	Switchover	118.0		368-A	
	23	Tin Can	3/9.0		369-A	167.4
	24	Todd's Dump	390.7	O	372-A	
	25	Unnamed	3/80.0		373-A	
	26	Unnamed	3/ 1.0		374-A	
	27	Unnamed	3/ 3.0		375-A	200.0
	28	Unnamed	3/ 3.0	P	376-A	
	29	Unnamed	3/ 2.0		377-A	82.0
	30	Unnamed	3/ 4.0	Q	378-A	
	31	Vingteune	67.3		379-A	
					380-A	162.3
				R	381-A	59.12
				S	382-A	
					386-A	91.5
				T	383-A	
					384-A	80.7
				U	387-A	75.7
				V	388-A	27.2
				W	389-A	34.4
				X	390-A	
					391-A	
					392-A	160.41
				Y	393-A	
					394-A	183.9
				4/	396-A	86.87
				4/	397-A	71.68

Table 10.--Continued.

Study area (Figure reference)	Public reefs			Private leases		
	Figure symbol	Name	Acres[2]	Figure symbol	Lease number(s)	Acres[2]
Matagorda Bay (29)	[Natural reefs generally not known by name, area not determined]			A	162-A	24.60
				B	310-A	25.00
				C	312-A through 319-A	741.65
				D	329-A	27.30
				E	332-A 333-A 334-A	118.90
				F	336-A	24.40
				G	344-A	29.20
				[4]	370-A	35.44
				[4]	371-A	21.80
				[4]	385-A	61.67
San Antonio Bay (30)	[Natural reefs usually not known by name; there are approximately 7,200 acres in this study area]			A	320-A 321-A 322-A 328-A	363.34
				B	323-A through 327-A	410.40
Copano-Aransas bays (31)	1	Long	256.19	[No private leases in Copano-Aransas Bay area]		
	2	Pauls	24.79			
	3	Daggar	30.70			
	4	Jay Bird	167.63			
	5	Half Moon	85.94			
	6	Copano	41.52			
	7	Shellbank	35.09			
	8	Lone Tree	26.14			
	9	Lap Reef Bank	21.67			
	10	Spaulding	104.45			
	11	Proverty	46.24			
Corpus Christi Bay area (32)[5]	1	Midway	1	A	336-A	275.40
	2	Hawkins	3	B	362-A	
	3	Mitchill	1		363-A	36.94
	4	Tucker	8	[4]	364-A	82.40
	5	Mason	9	[4]	365-A	84.70
	6	Alta Vista	70	[4]	366-A	68.50
	7	Mathew	15			
	8	Edison	11			
	9	Little Oso	2			
	10	Oso	3			
	11	Bulkhead	4			
	12	Shamrock	83			
	13	Long	174			
	14	La Quinta	8			
	15	Portland	32			
	16	Indian Point	93			
	17	Causeway	17			
	18	Ingleside	11			
	19	Donnel	20			

1/ Sabine Lake reefs are scattered; no map showing their location is known to exist. There are scattered oyster reefs in the Laguna Madre.

2/ 1 acre = 0.4046 hectare.

3/ Approximate.

4/ Not shown on the cited figure.

5/ Oyster fishing practically destroyed by flood waters in 1963.

Table 11.--Artificial and experimental oyster reefs established on the Texas coast by the Texas Parks and Wildlife Department. (Data from the Texas Parks and Wildlife Department, Seabrook and Rockport, Tex.).1/

Study area (Figure reference)	Figure symbol	Name	Area
			Acres 2/
Galveston Bay (33)	1	Clamshell	10.1
	2	Courthouse	7.0
	3	Dry Hole	15.6
	4	Eagle Point	33.2
	5	Experimental	10.1
	6	Fourbit	--3/
	7	Gaspipe	33.1
	8	Halfway	--
	9	Lonesome	17.8
	10	Missing	--
	11	Range Light	--
	12	Spoonbill	3.2+
	13	Sunflare	--
	14	Switchover	118.1
	15	Triangle	--
	16	Trinity	--
Matagorda Bay (34)	1	Big Bayou	--
	2	Dressing Point	--
	3	Forked Bayou	--
	4	Galliniper	--
	5	Mitchill's	--
	6	Oliver Point	--
	7	Raymond Landing Shoal	--
	8	Sand Point	--
	9	Schicker's Point	--
	10	Shell Beach	--
	11	Well's Point	--
	12	Unnamed	--
San Antonio Bay (35)	1	Bray's	--
	2	Chicken Foot	--
	3	Panther Point (N)	--
	4	Panther Point (S)	--
	5	Josephine	--
	6	Rattlesnake	--
Copano-Aransas bays (36)	1	Cape Carlos	--
	2	Copano	--
	3	Half Moon	--
	4	Hall's	--
	5	Iron Stake	--
	6	Light 25	--
	7	Lone Tree	--
	8	Paul's Mott	--
	9	Peanut	--
	10	Pin Tail	--
	11	Poverty	--
	12	Shellbank	--
	13	Two by Four	--

Table 11. --Continued.

Study area (Figure reference)	Figure symbol	Name	Area
			Acres[2/]
Corpus Christi Bay (37)	1	Alta Vista	--
	2	Bay Central	--
	3	College	--
	4	Indian Point	--
	5	Long	--
	6	Mason's	--
	7	Mathew's	--
	8	Oso	--
	9	Portland	--
	10	Shamrock	--
Laguna Madre (38)	1	(Upper Laguna Madre)	1.00
	2	(Upper Laguna Madre)	1.00
	1	(Lower Laguna Madre)	0.25
	2	(Lower Laguna Madre)	0.25
	3	(Lower Laguna Madre)	0.25
	4	(Lower Laguna Madre)	0.25
	5	(Lower Laguna Madre)	0.25
	6	(Lower Laguna Madre)	0.25

1/ No experimental reefs are situated in the Sabine Lake area.

2/ 1 acre = 0.4046 hectares.

3/ -- = no estimate.

Table 12.--Population records of Texas counties and Cameron Parish, Louisiana, contiguous to the seven estuarine areas of Texas, 1850-1960. (U.S. Bureau of the Census data.)

Study area and county or parish	1850	1860	1870	1880	1890	1900	1910	1920	1930	1940	1950	1960
Sabine Lake												
Cameron (La.)	--[1/]	--	1,591	2,416	2,828	3,952	4,288	3,952	6,054	7,203	6,244	6,909
Jefferson	1,836	1,995	1,906	3,489	5,857	14,239	38,182	73,120	133,391	145,329	195,083	245,659
Orange	--	1,916	1,255	2,938	4,770	5,905	9,528	15,379	15,149	17,382	40,567	60,357
TOTAL	1,836	3,911	4,752	8,843	13,455	24,096	51,998	92,451	154,594	169,914	241,894	312,925
Galveston Bay												
Brazoria	4,841	7,143	7,527	9,774	11,506	14,861	13,299	20,614	23,054	27,069	46,549	76,204
Chambers	--	1,508	1,503	2,187	2,241	3,046	4,234	4,162	5,710	7,511	7,871	10,379
Galveston	4,520	8,229	15,290	24,121	31,476	44,116	44,479	53,150	64,401	81,173	113,066	140,364
Harris	4,668	9,070	17,375	27,985	37,249	63,786	115,693	186,667	359,328	528,961	806,701	1,243,158
TOTAL	14,029	25,950	41,695	64,067	82,472	125,809	177,705	264,593	452,493	644,714	974,187	1,470,105
Matagorda Bay												
Brazoria	4,841	7,143	7,537	9,774	11,506	14,861	13,299	20,614	23,054	27,069	46,549	76,204
Calhoun	1,110	2,642	3,443	1,739	815	2,395	3,635	4,700	5,385	5,911	9,222	16,592
Jackson	996	2,612	2,278	2,723	3,281	6,094	6,471	11,244	10,980	11,720	12,916	14,040
Matagorda	2,124	3,454	3,377	3,940	3,985	6,097	13,594	16,589	17,678	20,066	21,559	25,744
Victoria	2,019	4,171	4,860	6,289	8,737	13,678	14,990	18,271	20,048	23,741	31,241	46,475
Total	11,090	20,022	21,485	24,465	28,324	43,125	51,989	71,418	77,145	88,507	121,487	179,055
San Antonio-Espiritu Santo Bay												
Aransas	--	--	--	966	1,824	1,716	2,106	2,064	2,219	3,469	4,252	7,006
Calhoun	1,110	2,642	3,443	1,739	815	2,395	3,635	4,700	5,385	5,911	9,222	16,592
Refugio	288	1,600	2,324	1,585	1,239	1,641	2,814	4,050	7,691	10,383	10,113	10,975
Victoria	2,019	4,171	4,860	6,289	8,737	13,678	14,990	18,271	20,048	23,741	31,241	46,475
TOTAL	3,417	8,413	10,627	10,579	12,615	19,430	23,545	29,085	35,343	43,504	54,828	81,048
Copano-Aransas Bay												
Aransas	--	--	--	966	1,824	1,716	2,106	2,064	2,219	3,469	4,252	7,006
Nueces[2/]	698	2,906	3,975	7,673	8,093	10,439	21,955	22,807	51,779	92,661	165,471	221,573
Refugio	288	1,600	2,324	1,585	1,239	1,641	2,814	4,050	7,691	10,383	10,113	10,975
San Patricio	200	620	602	1,010	1,312	2,372	7,307	11,386	23,836	28,871	35,842	45,021
TOTAL	1,186	5,126	6,901	11,234	12,468	16,168	34,182	40,307	85,525	135,384	215,678	284,575
Corpus Christi Bay												
Aransas	--	--	--	966	1,824	1,716	2,106	2,064	2,219	3,469	4,252	7,006
Nueces[2/]	698	2,906	3,975	7,673	8,093	10,439	21,955	22,807	51,779	92,661	165,471	221,573
San Patricio	200	620	602	1,010	1,312	2,372	7,307	11,386	23,836	28,871	35,842	45,021
TOTAL	898	3,526	4,577	9,649	11,229	14,527	31,368	36,257	77,834	125,001	205,565	273,600
Laguna Madre												
Cameron[3,4/]	8,451	6,028	10,999	14,959	14,424	16,095	27,158	36,662	77,540	83,202	125,170	151,098
Kenedy[4,5/]	--	--	--	--	--	--	--	1,033	701	700	632	884
Kleberg[6/]	--	--	--	--	--	--	--	7,837	12,451	13,344	21,991	30,052
Nueces[2/]	698	2,906	3,975	7,673	8,093	10,439	21,955	22,807	51,779	92,661	165,471	221,573
Willacy[7/]	--	--	--	--	--	--	--	--	10,499	13,230	20,920	20,084
TOTAL	9,149	8,934	14,904	22,632	22,517	26,534	49,113	68,339	152,970	203,139	334,184	423,711
GRAND TOTAL	31,751	53,894	78,305	123,794	139,637	210,432	329,733	493,687	847,894	1,121,926	1,675,410	2,372,574

1/ -- = County unorganized, no data.

2/ Parts of Nueces taken to form Jim Wells in 1911, Kleberg in 1913.

3/ Cameron, Starr and Webb reported together in 1850; population credited to Cameron.

4/ Part of Cameron to form Willacy in 1911; part was taken again in 1921 to form part of new area of Willacy when Kenedy was created from Willacy.

5/ Kenedy created from part of Willacy County in 1921.

6/ Jim Wells created from part of Nueces in 1911; Kleberg organized from part of Nueces in 1913.

7/ Old Willacy created from parts of Cameron and Hidalgo in 1911; name changed to Kenedy in 1921; new Willacy organized from parts of Cameron and Hidalgo in 1921.

Table 13.--Population records of Texas cities, 1850-1950, in counties contiguous to Texas estuaries and having a population of as much as 2,500 in 1960 or during any previous date (U.S. Bureau of Census data, unless otherwise indicated).

Estuarine area, City (County)	1850	1860	1870	1880	1890	1900	1910	1920	1930	1940	1950
Sabine Lake											
Beaumont (Jefferson)[1/]	151	--[2/]	--	--	3,296	9,427	20,640	40,422	57,732	59,061	94,014
Bridge City (Orange)	--	--	--	--	--	--	--	--	--	--	--
Groves (Jefferson)	--	--	--	--	--	--	--	--	--	--	--
Nederland (Jefferson)	--	--	--	--	--	--	--	--	--	--	3,805
Orange (Orange)	--	--	--	--	3,173	3,835	5,527	9,212	7,913	7,472	21,174
Pear Ridge (Jefferson)	--	--	--	--	--	--	--	--	--	1,198	2,029
Port Arthur (Jefferson)	--	--	--	--	--	900	7,663	22,251	50,902	46,140	57,530
Port Neches (Jefferson)	--	--	--	--	--	--	--	--	2,327	2,487	5,448
Vidor (Orange)	--	--	--	--	--	--	--	--	--	--	2,136
West Orange (Orange)	--	--	--	--	--	--	--	--	--	--	2,539
Galveston Bay											
Alvin (Brazoria)	--	--	--	--	261	906	1,453	1,519	1,511	3,087	3,701
Baytown (Harris)[2/]	--	--	--	--	--	--	--	--	--	--	22,983
Goose Creek	--	--	--	--	--	--	--	--	5,208	6,929	--
Pelly	--	--	--	--	--	--	--	--	3,452	3,712	--
Bellaire (Harris)	--	--	--	--	--	--	--	--	390	1,124	10,173
Deer Park (Harris)	--	--	--	--	--	--	--	--	--	--	--
Dickinson (Galveston)	--	--	--	--	--	--	--	--	829	--	1,461
Galena Park (Harris)	--	--	--	--	--	--	--	--	--	1,562	7,162
Galveston (Galveston)	4,117	7,307	13,818	22,248	29,084	37,788	36,981	44,255	52,938	60,862	65,898
Highlands (Harris)	--	--	--	--	--	--	--	--	--	--	2,723
Hitchcock (Galveston)	--	--	--	--	--	--	--	--	--	--	1,105
Houston (Harris)	2,396	4,845	9,382	16,513	27,557	44,633	78,800	138,276	292,352	384,514	594,321
Jacinto City (Harris)	--	--	--	--	--	--	--	--	--	--	6,848
La Marque (Galveston)	--	--	--	--	--	--	--	--	--	--	7,359
La Porte (Harris)	--	--	--	--	--	537	678	889	1,280	3,072	4,957
League City (Galveston)	--	--	--	--	--	--	--	--	--	--	1,341
Pasadena (Harris)	--	--	--	--	--	--	--	--	1,647	3,436	22,483
South Houston (Harris)	--	--	--	--	--	--	--	--	612	982	4,126
Spring Valley (Harris)	--	--	--	--	--	--	--	--	--	--	--
Texas City (Galveston)	--	--	--	--	--	--	--	2,509	3,534	5,748	16,620
West University Place (Harris)	--	--	--	--	--	--	--	--	1,322	9,221	17,074
Matagorda Bay											
Brazos River Delta											
Angleton (Brazoria)	--	--	--	--	--	--	--	1,043	1,229	1,763	3,399
Clute (Brazoria)	--	--	--	--	--	--	--	--	--	--	--
Freeport (Brazoria)	--	--	--	--	--	--	--	1,798	3,162	2,579	6,008
Lake Jackson (Brazoria)	--	--	--	--	--	--	--	--	--	--	2,896
Sweeney (Brazoria)	--	--	--	--	--	--	--	--	--	--	1,393
West Columbia (Brazoria)	--	--	--	--	--	--	--	--	--	1,573	2,100
Matagorda Bay											
Bay City (Matagorda)	--	--	--	--	--	--	3,156	3,454	4,070	6,594	9,427
Edna (Jackson)	--	--	--	--	--	--	--	--	1,752	2,724	3,845
Palacios (Matagorda)	--	--	--	--	--	--	1,389	1,335	1,318	2,288	2,799
Port Lavaca (Calhoun)	--	--	--	--	--	--	1,699	1,213	1,367	2,069	5,599
San Antonio-Espiritu Santo bays											
Victoria (Victoria)[1/]	440	--	2,500	--	3,046	4,010	3,673	5,957	7,421	11,566	16,126
Copano-Aransas bays											
Refugio (Refugio)	--	--	--	--	--	--	773	933	2,019	4,077	4,666
Rockport (Aransas)	--	--	--	--	1,069	1,153	1,382	1,545	1,140	1,729	2,266
Sinton (San Patricio)	--	--	--	--	--	--	--	1,058	1,852	3,770	4,254
Taft (San Patricio)	--	--	--	--	--	--	--	--	1,792	2,686	2,978
Corpus Christi Bay											
Aransas Pass (San Patricio-Aransas)	--	--	--	--	--	--	1,197	1,569	2,482	4,095	5,396
Bishop (Nueces)	--	--	--	--	--	--	--	--	953	1,329	2,731
Corpus Christi (Nueces)	--	175	2,140	3,257	4,387	4,703	8,222	10,522	27,741	57,301	108,287
Ingleside (San Patricio)	--	--	--	--	--	--	--	--	--	--	1,424
Mathis (San Patricio)	--	--	--	--	--	--	--	--	--	1,950	4,038
Portland (San Patricio)	--	--	--	--	--	--	--	--	--	--	1,292
Robstown (Nueces)	--	--	--	--	--	--	--	948	4,183	6,780	7,278
Laguna Madre											
Brownsville (Cameron)	--	2,734	4,905	4,938	6,134	6,305	10,517	11,791	22,021	22,083	36,066
Harlingen (Cameron)	--	--	--	--	--	--	--	1,784	12,124	13,306	23,202
Kingsville (Kleberg)	--	--	--	--	--	--	--	4,770	6,815	7,782	16,857
La Feria (Cameron)	--	--	--	--	--	--	--	236	1,594	1,644	2,937
Port Isabel (Cameron)	--	--	--	--	--	--	--	--	1,177	1,440	2,372
Raymondville (Willacy)	--	--	--	--	--	--	--	--	2,050	4,050	9,136
San Benito (Cameron)	--	--	--	--	--	--	--	5,070	10,753	9,501	13,271

1/ Census if incorporated towns of Texas taken in 1858 by assessors and collectors in each county.

2/ -- - no census taken.

3/ Goose Creek, Pelly and Baytown were merged in 1947 and the single community was given the name of Baytown

Table 14-1. County (Tex.) or Parish (La.) populations, densities, and city populations in 1960 and 1970 in the Sabine Lake area. (Data from the U.S. Bureau of the Census.)

County (or Parish) city	1960 population	1970 population	County area	County population density 1960	County population density 1970
	- - - - - Number - - - - -		Sq. mi. 1/	Number/sq. mi. 1/	
Cameron Parish 2/	6,909	8,191 3/	1,444	4.8	5.6
Jefferson County	245,659	244,773	945	259.9	259.0
Beaumont 4/	119,175	115,919			
Groves	17,304	18,067			
Nederland	12,036	16,810			
Port Arthur	66,676	57,371			
Port Neches	8,696	10,894			
Sabine	260	50			
Sabine Pass	500	650			
Orange County	60,357	71,170	356	169.5	199.9
Bridge City	4,677	8,614			
Orange	26,605	24,457			
Orangefield	500	700			
West Orange	4,848	4,820			

1/ To convert to metric, 1 sq. miles = 2.59 sq. km.

2/ No cities exist in the Sabine Lake area.

3/ Estimated.

4/ City totals do not tabulate to county totals.

Table 14-2.--County densities, populations, and city populations in 1960 and 1970 in the Galveston Bay (Tex.) area. (Data from the U.S. Bureau of the Census.)

County (or Parish) City	1960 Population	1970 Population	County area	County population density 1960	County population density 1970
	- - - - - Number - - - - -		Sq. miles 1/	Number/sq. mi. 1/	
Brazoria County 2/	76,204	108,312	1,422	53.6	76.1
Chambers County	10,379	12,187	617	16.8	19.7
Anahuac	1,985	1,881			
Galveston County	140,364	169,812	429	327.2	395.8
Bacliff	1,707	2,000 3/			
Caplen	30	35 3/			
Galveston	67,175	61,809			
Gilchrist	750	300 3/			
High Island	500	300 3/			
Hitchcock	5,216	5,565			
Kemah	550	1,144			
La Marque	13,969	16,131			
Port Bolivar	400	650			
San Leon	100	900 3/			
Texas City	32,065	38,908			
Harris County	1,243,158	1,741,912	1,711	726.6	1,018.0
Baytown	28,159	43,980			
Channelview	1,150	12,000			
Deer Park	4,865	12,773			
Galena Park	10,852	10,479			
Houston	938,219	1,232,802			
La Porte	4,512	7,149			
Morgans Point	560	593			
Pasadena	58,737	89,277			
Seabrook	500	3,811			
Shoreacres	518	1,872			

1/ To convert to metric, 1 sq. miles = 2.59 sq. km.

2/ No cities exist in the Galveston Bay area.

3/ Seasonal populations: Bacliff, 2,806; Caplen, 100; Gilchrist, 2,000; High Island, 800; San Leon, 3,000.

Table 14-3.--County densities, populations, and city populations in 1960 and 1970 in the Brazos-Colorado Delta and the Matagorda Bay (Tex.) area. (Data from the U.S. Bureau of the Census.)

County (or Parish) City	1960 Population	1970 Population	County area	County population density 1960	County population density 1970
	----- Number -----		Sq. miles 1/	Number/sq. mi. 1/	
Brazoria County 2/	76,204	108,312	1,422	53.6	76.1
Clute	4,501	6,023			
Freeport	11,619	11,997			
Jones Creek-Gulf Park	1,895	1,268 3/			
Lake Jackson	9,651	13,376			
Calhoun County	16,592	17,831	536	30.9	33.2
Port Lavaca 4/	8,864	10,491			
Port O'Connor 4/	950	900 5/			
Point Comfort	1,453	1,446			
Jackson County 4/	14,040	12,975	854	16.4	15.1
Matagorda County	25,744	27,913	1,140	22.6	24.4
Collegeport	100	200			
Matagorda	650	700			
Palacios	3,676	3,642			
Victoria County 6/	46,475	53,766	893	52.0	60.2

1/ To convert to metric, 1 sq. miles = 2.59 sq. km.

2/ Includes most of the Brazos-Colorado Delta area.

3/ Jones Creek only.

4/ Matagorda Bay area only.

5/ Seasonal population, 2,000.

6/ There are no cities in the Bay area.

Table 14-4.--County densities, populations, and city populations in 1960 and 1970 in the San Antonio Bay (Tex.) area. (Data from the U.S. Bureau of the Census.)

County (or parish) city	1960 population	1970 population	County area	County population density 1960	County population density 1970
	----- Number -----		Sq. miles 1/	Number/sq. miles 1/	
Aransas County 2/	7,006	8,902	276	25.4	32.2
Calhoun County	16,592	17,831	536	30.9	33.2
Long Mott	100	150			
Port O'Connor	950	900 3/			
Seadrift	1,082	1,092			
Refugio County	10,975	9,494	771	14.2	12.3
Austwell	287	284			
Tivoli	400	500			
Victoria County 4/	46,475	53,766	893	52.0	60.2

1/ To convert to metric, 1 sq. miles = 2.59 sq. km.

2/ No data for cities in Bay area.

3/ Seasonal population: 2,000.

4/ There are no cities in the Bay area included since Channel to Victoria extends through the San Antonio Bay.

Table 14-5.--County densities, populations, and city populations in 1960 and 1970 in the Copano-Aransas Bay (Tex.) area. (Data from the U.S. Bureau of the Census.)

County (or parish) city	1960 population	1970 population	County area	County population density 1960	County population density 1970
	----- Number -----		Sq. miles 1/	Number/sq. miles 1/	
Aransas County	7,006	8,902	276	25.4	32.2
Fulton	350	1,101 2/			
Lamar	50	150 2/			
Rockport	2,989	3,879			
Refugio County	10,975	9,494	771	14.2	12.3
Bayside	150	350			
San Patricio County 3/	45,021	47,288	680	66.2	69.5

1/ To convert to metric, 1 sq. miles = 2.59 sq. km.

2/ Seasonal population: Fulton, 5,000; Lamar, 300.

3/ There are no cities in this Bay area.

Table 14-6.--County densities, populations, and city populations in 1960 and 1970 in the Corpus Christi Bay (Tex.) area. (Data from the U.S. Bureau of the Census.)

County (or parish) city	1960 population	1970 population	County area	County population density 1960	1970
	- - - - - Number - - - - -		Sq. miles 1/	Number/sq. miles 1/	
Aransas County	7,006	8,902	276	25.4	32.2
Aransas Pass 2/	6,956	5,813			
Nueces County	221,573	237,544	838	264.4	283.4
Corpus Christi	167,690	204,525			
Port Aransas	824	1,218			
San Patricio County	45,021	47,288	680	66.2	69.5
Aransas Pass 2/	6,956	5,813			
Ingleside	3,022	3,763			
Portland	2,538	7,302			

1/ To convert to metric, 1 sq. miles = 2.59 sq. km.

2/ The community of Aransas Pass is situated in both Aransas and San Patricio counties.

Table 14-7.--County densities, populations, and city populations in 1960 and 1970 in the Laguna Madre (Tex.) area. (Data from the U.S. Bureau of the Census.)

County (or parish) city	1960 population	1970 population	County area	County population density 1960	1970
	- - - - - Number - - - - -		Sq. miles 1/	Number/sq. miles 1/	
Cameron County	151,098	140,638	883	171.1	159.2
Brownsville	48,040	52,522			
Laguna Heights	550	2/600			
Laguna Vista	141	287			
Port Isabel	3,575	3,067			
Kenedy County	884	678	1,407	0.6	0.4
Kleberg County	30,052	33,166	850	35.4	39.0
Nueces County	221,573	237,544	838	264.4	283.4
Willacy County	20,084	15,570	595	33.8	26.1
Port Mansfield	100	100			

1/ To convert to metric, 1 sq. miles = 2.59 sq. km.

2/ Seasonal population: 900.

Table 15. Population projections for selected communities in counties contiguous to the seven estuarine systems of Texas. (Modified from Texas Water Development Board data.)

Estuarine area	Community	County	Population 1960	1990	2020
Sabine Lake	Beaumont	Jefferson	119,175	239,400	496,000
	Bridge City	Orange	4,677	7,100	10,000
	Groves	Jefferson	17,304	33,900	62,000
	Lakeview	Jefferson	3,849	8,400	12,000
	Nederland	Jefferson	12,036	24,400	44,600
	Orange	Orange	25,605	51,000	121,600
	Pear Ridge	Jefferson	3,470	8,400	12,000
	Port Arthur	Jefferson	66,676	118,600	248,000
	Port Neches	Jefferson	8,696	17,600	32,200
	Vidor	Orange	4,938	13,400	20,000
	West Orange	Orange	4,848	8,100	15,000
Galveston Bay	Alvin	Brazoria	5,643	25,600	74,400
	Anahuac	Chambers	1,985	4,300	9,000
	Baytown	Harris	28,159	59,100	111,600
Galveston Bay (cont.)	Bellaire	Harris	19,872	26,900	31,000
	Deer Park	Harris	4,865	12,300	18,600
	Dickinson	Galveston	4,715	13,500	34,000
	Galena Park	Harris	10,852	22,400	31,000
	Galveston	Galveston	67,175	92,600	124,000
	Highlands	Harris	4,336	8,700	18,600
	Hitchcock	Galveston	5,216	19,400	37,200
	Houston	Harris	938,219	2,165,700	3,968,000
	Jacinto City	Harris	9,546	17,700	24,800
	La Marque	Galveston	13,969	34,900	68,200
	La Porte	Harris	4,512	12,600	24,800
	League City	Galveston	2,622	9,800	30,000
	Pasadena	Harris	58,737	88,700	124,000
	South Houston	Harris	7,523	12,300	18,600
	Texas City	Galveston	32,065	76,600	148,800
	W. University Place	Harris	14,628	16,100	18,600

Table 15.--Continued.

Estuarine area	Community	County	Population 1960	1990	2020
Matagorda Bay -Brazos River Delta	Angleton	Brazoria	7,312	18,400	43,400
	Clute	Brazoria	4,501	12,600	24,800
	Freeport	Brazoria	11,619	24,100	62,000
	Lake Jackson	Brazoria	9,651	15,300	24,800
	Sweeney	Brazoria	3,087	9,600	24,800
-Matagorda Bay	Bay City	Matagorda	11,656	24,100	43,400
	Edna	Jackson	5,038	7,400	11,200
	Palacios	Matagorda	3,676	8,500	18,000
	Port Lavaca	Calhoun	8,864	27,100	49,600
San Antonio Bay	Victoria	Victoria	33,047	82,900	158,700
Copano-Aransas Bay	Refugio	Refugio	4,944	6,200	8,000
	Rockport	Aransas	2,989	4,100	5,200
	Sinton	San Patricio	6,008	14,400	37,200
	Taft	San Patricio	3,463	4,400	5,500
Corpus Christi Bay	Aransas Pass	San Patricio-Aransas	6,956	12,600	24,800
	Bishop	Nueces	3,722	6,800	12,500
	Corpus Christi	Nueces	167,690	371,700	930,000
	Ingleside	San Patricio	3,022	6,200	9,500
	Mathis	San Patricio	6,075	14,400	37,200
	Portland	San Patricio	2,538	6,200	9,500
	Robstown-San Pedro	Nueces	17,900	35,000	74,400
Laguna Madre	Brownsville	Cameron	48,040	83,600	130,200
	Harlingen	Cameron	41,207	78,500	124,000
	Kingsville	Kleberg	25,297	46,600	93,070
	La Feria	Cameron	3,047	6,700	12,000
	Port Isabel	Cameron	3,575	6,700	12,000
	Port Mansfield	Willacy	100	4,800	7,500
	Raymondville	Willacy	9,385	17,400	37,000
	San Benito	Cameron	16,422	30,000	49,600

Table 16.--Characteristics of mineral production in the Texas counties and Cameron Parish (La.) contiguous to the seven estuarine study areas as of 1963. (From the Texas Almanac, A. H. Belo, Corporation 1967)

Characteristics	County (Parish)																		
	Cameron[1/]	Aransas	Brazoria	Calhoun	Cameron	Chambers	Galveston	Harris	Jackson	Jefferson	Kenedy	Kleberg	Matagorda	Nueces	Orange	Refugio	San Patricio	Victoria	Willacy
Mineral production units	--[2/]	64	142	93	20	116	88	378	178	144	34	84	144	248	70	142	183	162	115
Major mineral products																			
Petroleum	x[3/]	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Cement								x	x					x	x				
Natural gas liquids	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x
Natural gas		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Salt	x		x			x		x		x							x		
Sulphur	x									x			x						
Sand and gravel			x	x		x	x	x	x	x				x	x		x	x	
Lime			x	x				x					x	x					
Clays							x	x		x			x		x		x	x	
Borite																	x		
Shell		x		x		x	x						x	x					
Bromine			x																
Magnesium			x																
Stone			x									x	x				x		

1/ From parish authorities, Cameron, La.

2/ -- = no data.

3/ x denotes major activity.

Table 17.--Characteristics of commercial activities in the Texas counties and Cameron Parish (La.) contiguous to the seven study areas as of 1963. (From the Texas Almanac, A. H. Belo, Corporation 1967)

Characteristics	County (Parish)																		
	Cameron[1/]	Aransas	Brazoria	Calhoun	Cameron	Chambers	Galveston	Harris	Jackson	Jefferson	Kenedy	Kleberg	Matagorda	Nueces	Orange	Refugio	San Patricio	Victoria	Willacy
Service based industries	--[2/]	93	472	118	642	60	914	8,810	91	1,505	0	127	167	1,308	273	65	245	280	64
Retail outlets	--	106	828	198	1,262	137	1,451	11,225	168	2,210	1	232	328	1,909	505	155	432	518	117
Wholesale outlets	--	14	63	21	241	16	136	2,829	17	403	0	28	42	400	43	11	52	89	19
Manufacturing establishments	--	3	73	19	125	4	96	2,048	9	220	0	7	21	165	51	2	22	36	10
Major manufacturing activities or services																			
Food products	x[3/]	x			x			x					x	x	x		x		
Wearing apparel and fabrics								x											
Lumber and wood products						x	x	x		x				x	x				
Printing and publishing								x						x					
Petrochemicals			x	x	x		x	x		x				x	x				
Chemicals (other)			x	x	x		x	x		x		x		x	x		x	x	
Stone, clay and glass								x					x	x					
Primary metals				x			x	x									x		
Fabricated metals								x		x				x	x				
Machinery								x											
Transportation equipment								x											
Administrative (auxiliary)								x											
Starch				x															
Beer							x	x											
Cotton processing							x												
Shipping	x	x	x		x		x	x		x				x	x		x	x	x
Shipbuilding and repair	x	x			x		x	x		x			x	x	x				
Fertilizer										x									
Aircraft																		x	
Rice rolling								x		x					x				
Concrete								x										x	
Tourism	x	x	x		x		x	x		x			x	x	x	x	x		x

1/ From parish authorities, Cameron, La.

2/ -- = no data.

3/ x denotes major activity.

Table 18. --Status of agriculture as of 1964 in the Texas counties and Cameron Parish (La.) adjacent to the seven estuarine study areas. (Modified from the Texas Almanac, A. H. Belo Corporation 1967)

Agricultural statistics	County (Parish)																		
	Cameron[1/]	Aransas	Brazoria	Calhoun	Cameron	Chambers	Galveston	Harris	Jackson	Jefferson	Kenedy	Kleberg	Matagorda	Nueces	Orange	Refugio	San Patricio	Victoria	Willacy
Number of farms	479	52	1,425	244	1,754	409	374	2,122	585	546	16	209	839	838	206	263	676	1,071	547
Average size (acres)[2/]	1,435	999	489	667	243	849	322	365	922	747	33,338	4,410	765	773	499	2,159	802	550	692
Acreage under irrigation (Thousands)	100	0	56	7	282	45	12	38	28	60	0	0	45	10	4	0	19	5	36
Major agricultural products																			
Beef cattle	x[3/]	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Dairying							x	x											
Poultry							x	x						x	x				
Lumber										x					x				
Cotton		x		x	x			x	x				x	x		x	x	x	x
Rice	x		x	x		x		x	x				x		x		x		
Grain sorghums		x		x										x		x	x	x	
Figs			x																
Truck crops			x		x		x	x						x					x
Citrus fruit					x		x												x
Peanuts								x											
Soybeans								x							x			x	
Feed grain									x										
Corn								x										x	
Flaxseed								x						x					

1/ From parish authorities, Cameron, La.

2/ 1 acre = 0.4046 hectare.

3/ x denotes major activity.

Table 19.1.--Texas commercial catch from the Sabine Lake and Galveston Bay areas, for the year 1968. (Modified from the Branch of Statistics, National Marine Fisheries Service, Galveston, Tex.)

Species	Sabine		Galveston	
	Landings	Value	Landings	Value
	Pounds[1/]	Dollars	Pounds[1/]	Dollars
Finfish				
Croaker	--[2/]	--	17,700	812
Drum, Black	1,200	92	54,400	4,075
Drum, Red	9,100	1,812	21,200	4,413
Flounders (unclassified)	500	100	31,900	6,887
King Whiting (Kingfish)	200	9	18,100	902
Mullet	--	--	8,300	360
Sea Catfish (Gafftopsail)	--	--	13,700	751
Sea Trout (Spotted)	46,200	9,635	174,200	37,279
Sea Trout (White)	--	--	16,400	1,649
Sheepshead (Saltwater)	200	13	20,300	1,251
Unclassified (food)	--	--	130,800	6,730
Reduction and animal food	--	--	12,900	554
Total	57,400	11,661	519,900	65,663
Shellfish				
Crabs, Blue	788,800	63,167	1,542,600	128,007
Oysters	--	--	2,838,700	1,250,805
Shrimp, Brown and Pink	3,300	759	307,800	48,924
Shrimp, White	75,700	33,896	2,514,000	1,145,479
Squid	--	--	700	102
Total	867,800	97,822	7,203,800	2,573,317
Grand Total	925,200	109,483	7,723,700	2,638,980

1/ 1 pound = 0.45 kilograms.

2/ -- = no data.

Table 19.2.--Texas commercial catch from the Matagorda and San Antonio Bay areas for the year 1968. (Modified from the Branch of Statistics, National Marine Fisheries Service, Galveston, Tex.)

Species	Matagorda		San Antonio	
	Landings	Value	Landings	Value
	Pounds[1]	Dollars	Pounds[1]	Dollars
Finfish				
Croaker	3,000	209	--[2]	--
Drum, Black	50,300	3,960	14,800	1,277
Drum, Red	121,200	23,839	31,800	8,402
Flounders (unclassified)	50,500	10,740	9,900	3,080
King Whiting (Kingfish)	4,700	239	--	--
Mullet	1,800	227	--	--
Sea Catfish (Gafftopsail)	20,800	1,172	5,200	532
Sea Trout (Spotted)	267,900	52,895	81,200	21,542
Sea Trout (White)	1,100	146	--	--
Sheepshead (Saltwater)	19,400	1,484	18,300	2,100
Unclassified (Food)	10,400	652	--	--
Total	551,100	95,563	161,200	36,933
Shellfish				
Crabs, Blue	933,300	74,679	472,500	35,301
Oysters	228,600	119,640	163,800	69,378
Shrimp, Brown and Pink	82,100	15,623	--	--
Shrimp, White	2,364,500	836,401	1,203,200	380,809
Squid	500	70	--	--
Total	3,609,000	1,046,413	1,839,500	485,488
Grand Total	4,160,000	1,141,976	2,000,700	522,421

1/ 1 pound = 0.45 kilograms.

2/ -- = no data.

Table 19.3.--Texas commercial catch from the Copano-Aransas and Corpus Christi Bay areas for the year 1968. (Modified from the Branch of Statistics, National Marine Fisheries Service, Galveston, Tex.)

Species	Copano-Aransas		Corpus Christi	
	Landings	Value	Landings	Value
	Pounds[1]	Dollars	Pounds[1]	Dollars
Finfish				
Croaker	1,900	149	2,500	246
Drum, Black	59,700	6,369	42,200	5,921
Drum, Red	105,600	24,221	14,500	3,382
Flounders (unclassified)	27,200	6,845	600	147
Mullet	12,300	578	--[2]	--
Pompano	900	426	--	--
Sea Catfish (Gafftopsail)	15,400	1,948	700	81
Sea Trout (Spotted)	199,000	45,607	48,500	10,982
Sheepshead (Saltwater)	40,100	3,397	2,700	356
Unclassified (food)	800	38	--	--
Reduction and animal food	46,900	1,982	2,300	90
Total	509,800	91,560	114,000	21,205
Shellfish				
Crabs, Blue	197,500	16,186	--	--
Oysters	8,300	3,516	--	--
Shrimp, Brown and Pink	12,700	3,017	600	377
Shrimp, White	1,736,600	617,975	633,700	228,450
Total	1,955,100	640,694	634,300	228,827
Grand Total	2,464,900	732,254	748,300	250,032

1/ 1 pound = 0.45 kilograms.

2/ -- = no data.

Table 19.4.--Texas commercial catch from the Laguna Madre area and the Gulf of Mexico for the year 1968. (Modified from the Branch of Statistics, National Marine Fisheries Service, Galveston, Tex.)

Species	Laguna Madre		Gulf of Mexico	
	Landings	Value	Landings	Value
	Pounds[1]	Dollars	Pounds[1]	Dollars
Finfish				
Cobia (Ling)	--[2]	--	23,900	2,886
Croaker	3,100	292	110,400	4,115
Drum, Black	422,600	61,422	32,200	3,938
Drum, Red	584,900	141,297	36,600	8,103
Flounders (unclassified)	32,500	8,380	183,100	39,259
Groupers	--	--	93,000	9,646
King Whiting (Kingfish)	--	--	96,000	4,966
Menhaden	--	--	51,073,400	674,242
Mullet	--	--	5,100	272
Pompano	2,100	962	1,000	423
Sea Catfish (Gafftopsail)	2,000	199	16,000	996
Sea Trout (Spotted)	713,600	170,285	340,700	70,925
Sea Trout (White)	--	--	2,500	248
Sheepshead (Saltwater)	53,600	4,834	38,400	2,877
Snapper, Red	--	--	1,127,500	366,843
Spanish Mackerel	--	--	3,000	331
Snook	900	85	--	--
Unclassified (food)	--	--	51,900	3,014
Reduction and animal food	--	--	16,900	661
Warsaw	--	--	7,400	866
Total	1,815,300	387,756	53,259,900	1,194,611
Shellfish				
Crabs, Blue	124,100	9,928	24,800	1,985
Oysters	2,600	1,275	--	--
Shrimp, Brown and Pink	34,900	7,753	63,509,800	35,637,100
Shrimp, White	41,300	28,631	10,637,600	6,858,368
Other	--	--	177,700	26,023
Squid	--	--	10,000	1,051
Total	202,900	47,587	74,359,900	42,524,527
Grand Total	2,018,200	435,343	127,619,800	43,719,138

[1] 1 pound = 0.45 kilograms.

[2] -- = no data.

Table 19.5.--Total commercial catch from the Texas waters for the year 1968. (Modified from the Branch of Statistics, National Marine Fisheries Service, Galveston, Tex.)

Species	Total	
	Landings	Value
	Pounds[1/]	Dollars
Finfish		
Cobia (Ling)	23,900	2,886
Croaker	138,600	5,823
Drum, Black	677,400	87,054
Drum, Red	924,900	215,469
Flounders (unclassified)	336,200	75,438
Groupers	93,000	9,646
King Whiting (Kingfish)	119,000	6,116
Menhaden	51,073,400	674,242
Mullet	27,500	1,437
Pompano	4,000	1,811
Sea Catfish (Gafftopsail)	73,800	5,679
Sea Trout (Spotted)	1,871,300	419,150
Sea Trout (White)	20,000	2,043
Sheepshead (Saltwater)	193,000	16,312
Snapper, Red	1,127,500	366,843
Spanish Mackerel	3,000	331
Snook	900	85
Unclassified (food)	193,900	10,434
Reduction and animal food	79,000	3,287
Warsaw	7,400	866
Total	56,987,000	1,904,952
Shellfish		
Crabs, Blue	4,083,600	329,323
Oysters	3,242,000	1,444,614
Shrimp, Brown and Pink	63,951,200	35,713,553
Shrimp, White	19,206,600	10,130,009
Other	177,700	26,023
Squid	11,200	1,223
Total	90,672,300	47,644,745
Grand Total	147,659,300	49,549,727

1/ 1 pound = 0.45 kilograms.

Table 20.--Status of the commercial fishing industry by estuarine area along the Texas Gulf coast in 1967. (From Statistical Branch, National Marine Fisheries Service, Galveston, Tex.)

Estuarine area, type of firm, by-products	Producing firms	Employees[1]	Gross wholesale value[2,3]
	Number		Dollars
Sabine Lake			
General seafoods, unpackaged	3	25	--[3]
Crabmeat, picked	1	23	52,552
Oysters, shucked	1	23	29,148
Shrimp, raw headless	4	116	405,554
Industrial fish products	1	104	437,454
Total	[4]9	[4]278	924,708
Galveston Bay			
General seafoods, unpackaged	13	129	[2]3,991,740
Seafood specialty	1	10	46,500
Crabmeat, picked	3	34	126,323
Oysters, shucked	28	380	1,226,033
Shrimp, raw headless	6	153	2,608,674
Processed shell	2	52	1,644,000
Total	[4]48	[4]677	[2]9,643,270
Brazos River-Matagorda Bay			
General seafoods, unpackaged	12	225	--
Crabmeat, picked	3	86	177,441
Oysters, shucked	13	344	269,139
Shrimp, raw headless	8	746	19,489,743
Total	[4]32	[4]1,150	19,936,323
San Antonio-Espiritu Santo bays			
General seafoods, unpackaged	1	12	--
Oysters, shucked	4	46	150,032
Total	5	58	150,032
Copano-Aransas bays			
General seafoods, unpackaged	3	41	--
Oysters, shucked	1	17	37,608
Total	4	58	37,608
Corpus Christi Bay			
General seafoods, unpackaged	12	324	--
Crabmeat, picked	1	3	4,200
Shrimp, raw headless	2	99	1,797,665
Total	15	426	1,801,865
Laguna Madre			
General seafoods, unpackaged	28	536	--
Seafood specialty	2	579	1,408,643
Crabmeat, picked	1	200	28,000
Oysters, shucked	2	585	115,691
Shrimp, raw headless	15	2,701	61,156,839
Total	[4]43	[4]3,189	62,709,173
Texas Coast			
General seafoods, unpackaged	72	1,302	[2,3]3,991,740
Seafood specialty	3	589	1,455,143
Crabmeat, picked	9	346	388,516
Oysters, shucked	49	1,395	1,827,651
Shrimp, raw headless	35	3,815	85,458,475
Industrial fish products	1	104	437,454
Processed shell	2	52	1,644,000
Grand Total	[4]156	[4]5,836	95,202,979

[1] Peak of employment.

[2] Estimated.

[3] Complete data not available.

[4] Excludes duplicate firms and employees.

Table 21.--Sport fishing and waterfowl hunting by estuarine study area on the Texas coast during 1968. (Data from the Division of River Basin Studies, U.S. Bureau of Sport Fisheries and Wildlife; Fort Worth, Tex.)

Estuarine study areas	Sport fishing estimated	Waterfowl hunting (estimated)	
	Man-days[1/]	Man-days	Birds taken
Sabine Lake	85,000	1,050	2,100
Galveston Bay	2,186,800	28,300	70,200
Matagorda Bay	864,000	8,450	16,900
San Antonio Bay	137,000	4,460	9,000
Copano-Aransas bays	242,000	7,640	12,000
Corpus Christi Bay	962,700	9,100	22,800
Laguna Madre	1,238,000	6,200	10,000
Total estuarine	5,715,500	65,200	143,000
Gulf of Mexico	680,000	1,000	2,000
TOTAL	6,395,500	66,200	145,000

1/ The U.S. Bureau of Sport Fisheries values one man-day at $9.55 and one man-day of waterfowl hunting at $7.82.

Table 22.--Domestic waste quality data from known outfalls in the seven estuarine areas of Texas, 1967-1969. (Data from the Texas Water Quality Board, Austin.)

Study area, River basin or coastal plain, Permittee (number) county	Discharge Gal.[1] flow/ day x 10^3 pH	BOD_5 Ortho PO_4 (mg/l)	Observed value or range Nitrogen (mg/l) NH_3	 NO_2	 NO_3	 Suspended solids (mg/l) Volatile	 Fixed	 Total	 Chlorides (mg/l)
Sabine Lake Area (Fig. 39)									
1. Nueces River Basin									
Groves, City of (South Plant) (10094) Jefferson	1,000 7.5	18 17.9	13.0	0.2	0.3	13	14	27	--[2]
Groves, City of (North Plant) (10094) Jefferson	500 7.5	55 14.6	1.0	0.7	6.3	--	--	10	--
Jefferson Co. FWSDI (10652) Jefferson	90 2.8	5 1.6	0.2	0.1	0.1	--	--	10	--
Jefferson Co. WCID 9 (East Port Neches) (10517) Jefferson	-- 6.6	25 56.0	4.4	0.6	5.2	--	--	10	--
Port Arthur (Main Plant) (10364) Jefferson	5,000 7.4	75 32.0	17.6	1.2	1.1	7	4	11	--
Port Arthur (Lakeside Park) (10364) Jefferson	-- 7.7	19 42.0	5.2	0.9	1.6	12	13	25	--
Port Neches (10477) Jefferson	1,000 7.4	12 18.8	7.8	1.5	3.2	6	10	16	0.7
Galveston Bay Area (number following permit number refers to map code, Fig. 40)									
1. Trinity-San Jacinto Coastal Basin									
Baytown, City of (Baytown W. Main) (10395) 13 Harris	1,800-2,350 7.4-7.7	2-16 22.0-28.0	9.8-11.6	0.1-0.9	0.9-3.4	1-14	6-11	12-21	1.0-1.5
Baytown (West Baytown Plant) (10395) 14 Harris	440-470 7.5-7.8	75-80 33.0-96.6	23.0-28.0	0.1	0.3	22-95	12-27	34-72	--
Baytown (Baytown Lakewood) (10395) 15 Harris	960-1,100 7.0	25 25.0	2.0	0.1	4.0	11	15	26	1.0
Baytown (East District) (10395) 16 Harris	500-1,500 6.7-7.6	1-23 9.5-25.0	1.0-1.6	0.1	0.3	8	9	10-17	1.0
Deer Park, City of (So. Plant) (10519) 32 Harris	144 8.0	4 0.2	7.4	0.1	1.7	9	10	19	--
Deer Park (North Plant) (10519) 9 Harris	180-790 7.7-7.8	3-15 18.0	22.0	0.1	0.1	9	--	9-51	1.5
Harris Co. WCID #55 (Seabrook) (10671) 61 Harris	216-1,080 7.5	3-5 --	--	--	--	7-13	7-15	10-28	0.3-0.4
La Porte (10206) 39 Harris	600 7.3	7 --	--	--	--	--	--	10	--

Study area, River basin or coastal plain, Permittee (number) county	Observed value or range: Discharge Gal.[1/] flow/ day x 10^3 / pH	BOD5 / Ortho PO4 (mg/l)	Nitrogen (mg/l) NH_3	Nitrogen (mg/l) NO_2	Nitrogen (mg/l) NO_3	Suspended solids (mg/l) Volatile	Suspended solids (mg/l) Fixed	Suspended solids (mg/l) Total	Chlorides (mg/l)
Galveston Bay Area (cont.)									
2. San Jacinto River Basin									
Bacliff MOR Average	303	0							
(10627) 64 Galveston	7.0	--	--	--	--	--	--	--	1.0
Bayview MUD	28	4							
(10770) 63 Galveston	8.0	--	--	--	--	16	43	59	0.2
Frank L. Willaert (Lower Estates)	--	30							
(10790) 56 Galveston	8.1	--	--	--	--	--	--	10	--
Galveston Co. WCID (Dickinson #2 Plt.)	200-288	9-10							
(10173) 66 Galveston	7.0-7.2	--	--	--	--	21	19	40	0.7
Galveston Co. WCID 8 (Alta Loma)	432	7							
(10174) 74 Galveston	7.9	--	--	--	--	16	14	30	2.5
Harris Co. FWSD 47 (Channelwoods)	135	30-70							
(10794) 6 Harris	7.7	--	--	--	--	3-93	11-170	14-263	--
Harris Co. FWSD 6	65	9							
(10184) 8 Harris	7.1	49.0	5.2	0.9	6.6	5	6	11	1.5
Hitchcock, City of	288	19							
(10690) 75 Galveston	7.6	--	3.4	0.5	3.0	8	13	21	0.6
Houston (Almeda Plaza)	375-700	5-8							
(10495) 55 Harris	7.2-7.6	--	--	--	--	11	2	10-13	0.8
Bayshore MUD STP	29-75	15-72							
(10523) 44 Harris	7.1-7.7	53.0	5.2	0.2	0.3	15-74	1-10	20-82	--
City of Friendswood (Plt. #1-old)	120-145	1-16							
(10175) 57 Galveston	7.1-7.4	39.0	5.8	0.2	2.4	1-13	3-9	10-17	0.1-1.5
City of Friendswood (Plt. #2-new)	120-130	2-5							
(10175) 58 Galveston	7.3-7.4	--	--	--	--	1-11	11	12-22	0.5-1.0
Clear Lake, City (Plt. #1-small)	125-300	5-189							
(10539) 49 Harris	7.2-7.6	45.0	16.6	0.2	0.3	17-316	10-192	17-508	1.0-1.5
Clear Lake City (Plt. #2-large)	400-1,200	9-45							
(10539) 49 Harris	7.5-7.7	25.0-28.0	6.0-15.6	0.2-0.6	0.3-0.9	20-100	5-73	25-158	0.6-1.0

Table 22.--Continued.

Study area, River basin or coastal plain, Permittee (number) county	Discharge Gal.[1] flow/ day x 10^3 / pH	BOD_5 / Ortho PO_4 (mg/l)	Observed value or range: Nitrogen (mg/l) NH_3	NO_2	NO_3	Suspended solids (mg/l) Volatile	Fixed	Total	Chlorides (mg/l)
Galveston Bay Area (cont.)									
2. San Jacinto River Basin (cont.)									
Dept. of U.S. Air Force (Ellington AFB)	350	4							
(10755) 33 Harris	7.9	--	--	--	--	2	5	7	0.5
Galv. Co. WCID #12 (Kemah Plts. 1 & 2 series)	288-303	14-45							
(10029) 62 Galveston	7.4	23.0	18.0	0.2	0.3	29-35	29-53	5-18	0.8-1.2
Galveston, City of (Main Plt.)	6,500	179							
(10688) 84 Galveston	7.1	7.0	--	--	--	89	26	115	--
Harris Co. Clr. Wds. Dist. STP	70-75	3-11							
(10858) 53 Harris	7.3-7.5	20.3	--	--	--	16-32	53-61	69-93	1.5
Harris Co. WCID #45 (Webster)	230-295	45-75							
(10520) 52 Harris	7.1-7.6	--	--	--	--	53-209	2-120	69-329	1.0-4.0
Harris Co. WCID #50 (El Largo)	160-260	27-45							
(10243) 47 Harris	7.0-7.6	50.0-75.0	15.5-30.5	0.5	0.3-1.4	8-23	1-30	18-50	1.0-4.0
Harris Co. WCID #56 (Fairmont Pk. Subd.)	115	7-14							
(10185) 40 Harris	7.6	26.0	4.0	0.2	3.1	10-23	13	10-33	1.0
Harris Co. WCID #75 (Lbr. Cove Subd.)	70-150	1-6							
(10106) 46 Harris	7.6-7.9	--	--	--	--	37	20	10-57	0.5-1.0
Harris Co. WCID #83 (Nassau Bay 1-2)	610-730	5-55							
(10526) 51 Harris	7.1-7.6	36.0	22.0	0.2	0.3	10-399	1-127	11-526	2.0-5.0
Lagoon Utility Co. (Swan Lagoon) STP	20-132	1-40							
(10676) 50 Harris	7.0-7.3	46.0	14.6	0.1	0.1	2-15	1-6	5-17	1.0-3.0
League City (Main Plt.)	800	2-4							
(10568) 59 Galveston	7.5-7.6	24.0	1.0	0.2	6.3	4	--	4-10	0.3-1.0
League City (Glen Cove)	75	5-28							
(10568) 60 Galveston	7.5-8.2	21.0	1.0	0.2	0.3	12-20	35-62	10-74	0.1-0.8
Shore Acres, City of, STP	--	5-15							
(10758) 45 Harris	7.5-7.8	--	--	--	--	6-17	10-20	16-37	1.0-1.5

Table 22. --Continued.

Study area, River basin or coastal plain, Permittee (number) county	Discharge Gal.[1/] flow/ day x 10^3 / pH	BOD_5 / Ortho PO_4 (mg/l)	Observed value or range: Nitrogen (mg/l) NH_3	NO_2	NO_3	Suspended solids (mg/l) Volatile	Fixed	Total	Chlorides (mg/l)
Matagorda Bay Area (Fig. 41)									
1. Colorado River Basin									
Matagorda WDWSC (Matagorda Plt.) (10913) Matagorda	50 / 8.4	8 / 19.5	1.0	0.1	12.6	1	21	22	--
2. Colorado-Lavaca Coastal Basin									
Palacios, STP (10593) Matagorda	230 / 7.7	5 / 39.0	1.0	0.1	15.0	10	--	--	--
Point Comfort, City of, STP (10599) Calhoun	105 / 7.7	45 / 51.5	21.0	0.1	0.3	43	27	70	--
Port Lavaca, City of, STP (10251) Calhoun	650 / 7.0	28 / 39.0	19.5	2.0	0.9	20	7	27	--
San Antonio Bay Area (Fig. 42)									
Seadrift, City of, STP (10822) Calhoun	90 / 8.3	30 / 53.0	1.0	1.0	9.8	18	2	20	--
Copano-Aransas and Corpus Christi Bay Areas (Figs. 43 and 44)									
1. San Antonio-Nueces Coastal Basin									
Amer. Liberty Oil Co. (Seagull Inn STP) (10669) Aransas	15 / 7.5	3 / 26.0	1.0	0.2	8.6	9	6	15	2.0
Aransas Pass, City of, STP new (10521) San Patricio	500-650 / 7.5	13-68 / 22.0-34.0	9.8-17.0	0.1	0.1-0.3	13-80	5-24	18-104	0.1-1.0
Corpus Christi (Stephen Water Plt.) (10401) Nueces	400 / 7.7	47 / 0.2	0.2	0.1	0.1	999	999	999	--
Corpus Christi (Broadway STP) (10401) Nueces	10,000 / 7.2	29 / 24.0	22.0	1.8	1.6	27	1	28	--
Nueces WCID #40 outfall 1 (10846) Nueces	45 / 7.9	6 / 0.2	4.0	0.1	0.1	10	17	27	--
Rockport, City of (STP outfall 1) (10034) Aransas	300 / 8.1	2 / 13.0	2.0	0.1	4.7	14	6	20	4.5

Table 22. --Continued.

Study area, River basin or coastal plain, Permittee (number) county	Discharge Gal.[1] flow/ day x 10^3 / pH	BOD_5 / Ortho PO_4 (mg/l)	Observed value or range: Nitrogen (mg/l) NH_3	NO_2	NO_3	Suspended solids (mg/l) Volatile	Fixed	Total	Chlorides (mg/l)
Copano-Aransas and Corpus Christi Bay Areas (Figs. 43 and 44) (Cont.)									
2. Nueces-Rio Grande Coastal Basin									
Gregory, City of, STP outfall 1	36-55	55							
(10092) San Patricio	7.2-7.7	26.0	32.0-45.0	0.1	0.1	21-77	15-79	36-156	--
Ingleside, City of, STP outfall 1	324	210							
(10422) San Patricio	7.1	--	37.5	0.1	0.1	--	--	96	--
Corpus Christi, City of, OSO STP	5,000-8,600	6-77							
(10401) Nueces	7.1-7.3	15.0-34.0	1.0-17.0	0.2	0.5	23	2	13-25	1.0
Flour Bluff	50	5							
(10401) Nueces	7.4	19.0	0.2	0.1	14.0	--	--	10	1.0
Portland, City of, LEST outfall	650	160							
(10478) San Patricio	7.0-7.6	52.0-63.0	28.0-33.0	0.2-0.3	0.1-0.3	130-409	59-129	189-538	--
U.S. Naval Air Sta. (STP Corpus Christi)	1,000-1,250	11-140							
(10635) Nueces	7.5-7.7	13.0-15.0	8.2-29.5	0.1-1.9	0.3-2.4	21-27	1-14	28-35	0.8-1.0
Laguna Madre Area (Fig. 45)									
1. Lower Rio Grande River									
Brownsville (Filter Plt. #1)	200	11							
(10397) Cameron	7.5	0.2	--	--	--	--	--	999	--
Brownsville (Filter Plt. #2)	600	35							
(10397) Cameron	7.3	0.2	--	--	--	399	82	481	0.2
Brownsville (STP outfall 1)	3,500-5,000	45-110							
(10397) Cameron	6.9-7.2	15.0-24.0	18.0-33.0	0.1-0.2	0.1-0.3	29-74	6-27	35-101	0.1
Brownsville Nav. Dist. (Turning Basin)	--	1-2							
(10332) Cameron	8.4	0.2	1.0	0.1-0.2	0.3	11-13	27-34	40-45	--
Brownsville (Fishing Harbor)	--	1							
(10332) Cameron	8.2-8.5	0.2	1.0	0.1-0.2	0.3	15-18	34-74	52-89	--
Los Fresnos, City of, STP outfall 1	60	60							
(10590) Cameron	7.0	22.0	21.0	0.1	0.3	62	21	83	--
Park CMSNRS (Cameron City)									
(Isla Blanca Pk.)	6-30								
(10757) Cameron	7.2-8.2	0.2-19.5	0.2-28.0	0.5-0.6	0.3-0.5	17	1	10-18	--
Port Isabel, City of, STP outfall 1	300-310	30-85							
(10350) Cameron	7.1-8.5	6.4-14.0	1.0-7.5	0.1-1.5	0.1-0.3	67-71	18-88	89-155	--
Valley Mun. Util. Dist. (Country Club STP)	12	45							
(10852) Cameron	7.0	22.0	17.0	0.1	0.3	23	15	38	--

1/ To convert to metric, 1 gal. = 0.0037 cubic meters or 3.78 liters.

2/ -- = no data.

Table 23.--Industrial waste quality data from known outfalls in the seven estuarine areas of Texas, 1967-1969. (Data modified from the Texas Water Quality Board, Austin.)

Study area, River basin or coastal plain, Permittee (number), county	Outfall	Discharge Gal.[1/] flow/ day x 10^3	pH	BOD_5 (mg/l)	COD (mg/l)	Other parameters Type	(mg/l)[3/]
	Number						
Sabine Lake Area (Fig. 39)							
1. Neches River Basin							
Ameripol, Inc., Texas U.S. (00512) Jefferson	1	--2/	7.1	15	--	NH_3-N Phosphate	12 1.8
B. P. Corp. (Pt. Arthur Refinery) (00491) Jefferson	1 2	-- 907	8.8 7.3	510 10	840 120	Sulphate --	208 --
Gulf State Util. Co. (Sabine Power Sta.) (00330) Orange	1	7,200	6.8	3	35	--	--
Jefferson Chem. Co., Inc. (Pt. Neches Plt.) (00585) Jefferson	1 2	-- 6,250	11.6 11.6	725 550	780 1,320	-- NH_3-N	-- 38
Neches Butane (00511) Jefferson	1	--	7.1	15	--	NH_3-N Phosphate	12 1.8
Pure Oil Co. (Beaumont Ref.) (00316) Jefferson	2	3,600	9.5-10.0	240-287	318-480	Phosphate Alkalinity (tot) Hardness	7.0 452 42
Texaco, Inc., Port Neches (00416) Jefferson	1	2	6.8	15	--	LAS (detergent) NH_3-N	0.4 5.8
Gulf Oil Co., U.S. (Pt. Arthur Ref.) (00319) Jefferson	1	35,280	8.2-8.3	75-85	200-500	Sulfate NH_3-N Alkalinity (tot)	720 34 98
Texaco, Inc. (Pt. Arthur Plt.) (00414) Jefferson	1	--	6.6	65	330	Alkalinity (tot) Hardness	28 114
Galveston Bay Area (number following permit number refers to map code (Fig. 40)							
1. Trinity-San Jacinto Coastal Plain							
A. O. Smith Corp. of Texas (00672) 1 Harris	1	500-850	7.1-7.3	30-40	270	Iron Sulfate	31 138
Ashland Chem. Co. (Baytown Plt.) (00549) 11 Harris	1	1,000	6.7	70	--	Sulfate	1,250
Humble Oil and Ref. (Baytown Ref.) (00592) 12 Harris	1	400	6.9	57	--	--	--
Richfield Chem., Inc. (Syn. Resins Plt.) (00662) 4 Harris	1	5	2.3-4.2	1	200-300	Turbidity NO_3-N	750 225
The Upjohn Co. (Organic Chem. Mfg.) (00663) 31 Harris	1	474-600	7.5-8.0	3-61	--	Sulfate	150
2. San Jacinto River Basin							
Air Products and Chem. (La Porte) (01280) 36 Harris	1	19	9.4	1	20	Chromium Zinc	-- --
Best Fertilizer Co. (La Porte Rd. Plt.) (01204) 38 Harris	1	10	6.4	17	--	--	--
Celanese Plastics Co. (Deer Park Plt.) (00544) 29 Harris	1	250	7.1	31	--	Alkalinity (tot)	250

Table 23.--Continued.

Study area, River basin or coastal plain, Permittee (number), county	Outfall	Observed value or range					
		Discharge Gal.1/ flow/ day x 10^3	pH	BOD_5 (mg/l)	COD (mg/l)	Other parameters	
						Type	(mg/l)3/
	Number						
Galveston Bay Area (cont.)							
2. San Jacinto River Basin (cont.)							
Chemstron Chem. (La Porte Plt.) (01220) 42 Harris	1	94-112	1.6-10.1	3-6	60	Alkalinity (tot)	720
Crown Central Petr. Corp. (Pasadena Plt.) (00574) 17 Harris	2	288	9.7	185	340	Chromium	0.7
						Phenols	0.8
Diamond Shamrock Chem. (Monument Plt.) (01000) 30 Harris	1	129	8.5	4	--	--	--
Diamond Shamrock Chem. (Greens Bayou) (00749) 5 Harris	5	576-864	3.0-5.5	120-660	900-1,440	Arsenic	0.2
						DDT	0.9
	7	8-144	7.3-9.0	25-3,150	25-1,740	--	--
E. I. Du Pont (La Porte) (00474) 41 Harris	1	3,000-4,300	3.0-8.5	8-58	70-185	--	--
Equity Export Corp. (Grain Export Plt.) (01205) 34 Harris	1	2	7.6	130	--	--	--
Ethyl Corp. (Pasadena) (00492) 18 Harris	1	18,000-34,000	5.9-6.3	9-140	130-250	Sulfate	940
						Lead	3.2
General Analine and Film Corp. (Texas City) (01263) 69 Galveston	1	--	2.8	110	250	--	--
Grief Bros. Cooperage Corp. (La Porte) (01217) 43 Harris	1	29	9.3	12	33	--	--
Hard Lowe Chem. (Clear Creek Plt.) (00951) 54 Harris	1	50-56	2.3-8.1	5-210	10-740	Chromium	27-45
						Copper	225
Hess Terminals (Galena Park Plt.) (00671) 23 Harris	1	--	7.3	150	--	--	--
Houston L&P Co. (Berton Sta.) (01026) 35 Harris	1	90,160	6.5-7.0	4-7	260	--	--
Houston L&P Co. (Deepwater Plt.) (01032) 22 Harris	3	5,760	7.4	30	--	--	--
	4	25,000	7.1	8	--	--	--
Lubrizoil Corp. (Deer Park Plt.) (00639) 24 Harris	1	360-432	9.8-12.1	912-950	1,785-1,980	--	--
McGinnes Ind. Maint. Corp. (01221) 73 Galveston	1	720	8.1-8.2	3	370	Sulfate	440-492
Mirichen Co. (Haden Rd.) (00485) 3 Harris	1	35-360	7.5-10.7	9.3-3,970	90-7,000	Phenols	8
Olin Mathieson Chem. Co. (Pasadena) (00649) 20 Harris	1	8,640-10,152	3.1-7.2	19	190	--	--
	3	864-2,160	6.5-9.2	9-14	130	--	--
	5	2,376-6,624	4.4-4.8	12-23	150	--	--
	6	252-2,880	6.8-9.8	2-7	20	--	--
	7	720-878	2.2-7.6	17-19	90	--	--
Parker Bros, Inc. (Clay Rd. Plt.) (00797) 37 Harris	1	2	8.0	18	15	Turbidity	22
						Alkalinity (tot)	190
Parker Bros, Inc. (Main Plt.) (00806) 86 Harris	1	3	11.9	18	80	Alkalinity (tot)	620
						Phosphate	168
Pennsault Chem. Corp. (Houston) (00445) 10 Harris	1	144	8.9	1-28	950	Turbidity	140
						Alkalinity (tot)	190-264
						Sulfate	77
Petro Processors, Inc. (01051) 33 Galveston	1	10-36	1.9-4.5	596	16,500	Alkalinity (tot)	130-150
						Sulfate	454
Phillips Petrol. Co. (Pasadena) (00815) 21 Harris						Alkalinity (tot)	50
	1	20-25	6.8-7.9	9-63	20	Sulfate	171
	2	1,500-1,700	8.4-8.6	1-4	20	Copper	17
						Chromium	3
						Sulfate	171
	4	200-432	5.9-6.2	5-20	1,100	Sulfate	50

Study area, River basin or coastal plain, Permittee (number), county	Outfall	Observed value or range: Discharge Gal.[1]/ flow/ day x 10^3	pH	BOD_5 (mg/l)	COD (mg/l)	Other parameters: Type	(mg/l)[3]/
	Number						
Galveston Bay Area (cont.)							
2. San Jacinto River Basin (cont.)							
Robin & Hess Co. (Deer Park Plt.) (00458) 25 Harris	1	1,000-2,160	7.7-8.6	170-4,120	430-5,280	--	--
	2	104-500	7.5-8.3	90-113	75-180	--	--
Shell Chemical Co. (Deer Park Plt.) (00402) 26 Harris	1	5,000-8,200	7.1-12.4	1-1,000	1,275-2,110	--	--
Shell Oil Co. (Deer Park Plt.) (00403) 27 Harris	1	233-360	3.9-9.1	2-19	20	--	--
	3	212-432	6.4-7.2	5-7	26-37	--	--
	4	309-360	6.9-7.3	1-10	20	--	--
	6	25-72	6.7-7.1	7	2-13	--	--
	7	108-150	7.4-8.3	9-13	11-39	--	--
	9	151-196	7.5-8.8	1-10	20	--	--
	10	2,900-4,608	5.9-7.2	21-103	--	--	--
	13	203-360	6.2-6.7	37-113	90	--	--
Stauffer Chem. Co. (Greens Bayou Plt.) (00541) 7 Harris	1	7	69-123	1-9	20	--	--
	2	58	12.3-12.4	1-3	20	--	--
Tenneco Chem. Co. (Deer Park Plt.) (00002) 28 Harris	1	440-1,800	1.6-9.5	12-30	50-115	Alkalinity (tot)	380-1,650
						Sulfate	290
						Turbidity	40
						Phosphate	7.5-13.0
						NH_3-N	43-63
Texas City RR (Texas City Plt.)						Alkalinity (tot)	750
(00944) 82 Galveston	1	--	8.0	6	15	Turbidity	20
	4	--	7.4	30	100	Alkalinity (tot)	330
						Turbidity	25
Tom Christi, Jr. (floating dredge) (01002) 85 Harris	1	--	--	--	--	--	--
Velsicol Chem. Co. (Galena Park Plt.) (00786) 2 Harris	1	76-340	9.5-9.8	115	240	Sulfate	45
3. San Jacinto-Brazos Coastal Plain							
American Oil Co. (Texas City) (00443) 78 Galveston	1	13,000-14,000	8.0-10.0	18-300	230-600	--	--
Amoco Chem. Corp. (Plt. A, Texas City)						Cyanide	1
(00451) 79 Galveston	1	250-645	4.3-9.9	23-300	160-2,910	Chromium	2.6
						Iron	1
Amoco Chem. Corp. (Plt. B, Texas City) (00452) 80 Galveston	1	317-750	7.0-7.2	35-45	35-45	--	--
Borden Chem. Co. (Texas City)						Phosphate	1,110-4,870
(00450) 81 Galveston	1	150-173	2.0-2.5	5-25	50-155	NH_3-N	38-155
Gulf Chem. & Mat. Corp. (Texas City) (01040) 76 Galveston	1	146	8.0	5-7	15-20	Iron	1.6-3.0
	2	324	3.0-6.0	25	50-170	Iron	1.3-2.8
	3	--	1.5-1.6	100	350	Iron	55-1,000
	4	324	6.0	2-30	10-40	--	--
	5	233	7.9	2	20	--	--
Humble Oil & Ref. (Bayport) (01054) 48 Harris	1	--	8.1	16	70	--	--
Malone Service Co. (Texas City) (01049) 71 Galveston	1	--	--	--	--	--	--
Marathon Oil Co. (Texas City) (00990) 72 Galveston	1	615	10.3-10.4	4-5	110	Chromium	10.6
	2	864	8.9-9.4	65-90	155-230	--	--
Mineral Oil Ref. Co. (Dickinson) (00377) 65 Galveston	1	15	9.2	22	40	--	--
Monsanto Chem. Co. (Chocolate Bayou)						Phenols	0.4
(00001) 77 Brazoria	1	2,160-3,096	6.9-10.9	45-90	115-310	Chromium	0.7

Table 23.--Continued.

Study area, River basin or coastal plain, Permittee (number), county	Outfall	Observed value or range					
		Discharge Gal.[1]/ flow/ day x 10^3	pH	BOD_5 (mg/l)	COD (mg/l)	Other parameters Type	(mg/l)[3]/
	Number						
Galveston Bay Area (cont.)							
3. San Jacinto-Brazos Coastal Plain (cont.)							
Monsanto Chem. Co. (Texas City)						Cyanide	36-155
(00575) 67 Galveston	1	10-200	12.0-12.3	1-90	1,590-6,770	Chromium	1.1-2.8
						NH_3-N	3,720
	2	57,600	6.9-7.1	4-50	600-820	Cyanide	1
						Aluminum	37
	3	20,160-28,880	7.8-11.8	1-8	400-600	Cyanide	1
	4	20,000-28,000	5.7-6.0	1-3	600-870	Cyanide	1
						Aluminum	22
	5	72-360	11.1-11.2	30	50-95	--	--
Texas City Ref. Co. (Texas City)							
(00449) 68 Galveston	1	259-1,446	5.8-6.4	30-125	200-280	Cyanide	0.1-882
Union Carbide Chem. Co. (Texas City)							
(00448) 70 Galveston	1	10,088-13,250	8.6-11.1	14-760	1,000-2,360	--	--
	2	22-144	10.1-10.3	4-9	45-130	--	--
	3	7	9.6-10.1	4-45	45-145	--	--
Matagorda Bay Area (Fig. 41)							
1. Brazos-Colorado Coastal Basin							
Texas Gulf Sulphur Co. (Old Gulf)							
(01186) Matagorda	1	2,600-2,635	8.0-8.8	24	90	Sulfate	1,000-1,370
2. Colorado-Lavaca Coastal Basin							
Aluminum Co. of Am. (Pt. Comfort)							
(00394) Calhoun	1	120	7.8-8.6	210-300	130-430	Sulfate	32-103
	2	40-49	9.4-10.0	9-10	60-75	Sulfate	44-50
						Fluoride	21-23
	3	60-105	4.1-8.7	14-22	65	Sulfate	208
	4	36	8.1-8.6	2-9	20-60	Sulfate	387
	5	86-250	9.6-10.0	4-54	50-170	Sulfate	30-75
						Fluoride	22
	6	9,420-9,730	8.4-8.6	3-85	170-610	Sulfate	1,030-1,860
						Fluoride	4
	7	490-660	8.2-9.4	3-15	25-30	Sulfate	104-113
	11	1,800	8.7	3	260	Fluoride	18
	12	25-570	10.0-10.9	1-8	45-50	--	--
	4-A	200	8.5-8.9	--	25-30	Sulfate	19
						Fluoride	49
	8-A	940-1,130	8.4-11.5	1-210	170-560	Sulfate	2,600
						Fluoride	1
Whitco Chem. Co. (Pt. Comfort)							
(01158) Calhoun	1	180-820	8.5-8.8	10-16	210	Sulfate	1,030
Copano-Aransas and Corpus Christi Bay areas (Figs. 43 and 44)							
1. San Antonio-Nueces Coastal Basin							
Amer. Smelt. & Ref. Co. (Corpus Christi)						Zinc	1-1.1
(00314) Nueces	1	10-360	1.9-8.0	1-6	20-40	Sulfate	820
						Lead	0.5-1.0
	2	400-500	1.7-1.8	160-185	65-185	Zinc	90-210
						Sulfate	1,400
						Acidity	3,050 (pH range)
						Lead	5-6
						Magnesium	1
	3	20-144	2.4-12.4	1-30	40-230	Zinc	211-810
						Lead	1-2
						Phosphate	40
						Manganese	99
						Turbidity	99
	4	65-260	2.0-8.1	1-4	30-210	Alkalinity (tot)	140
						Zinc	107-530
						Manganese	15
						Lead	1.0-3.4
Atlantic Pipeline (Aransas Pass)						Sulfate	1,020
(00656) Nueces	1	14	7.0	--	40	NH_3-N	105
Central P&L (Nueces Bay Station)						Sulfate	2,250
(01244) Nueces	1	59,000-78,000	8.0-8.4	1-4	--	Turbidity	8

Table 23.--Continued.

Study area, River basin or coastal plain, Permittee (number), county	Outfall	Discharge Gal.[1] flow/ day x 10^3	pH	Observed value or range BOD$_5$ (mg/l)	COD (mg/l)	Other parameters Type	(mg/l)[3]
	Number						
Copano-Aransas and Corpus Christi Bay areas (cont.)							
1. San Antonio-Nueces Coastal Basin (cont.)							
Central States Petro Corp. (Corpus Christi)						Chromium	0.05
(00465) Nueces	1	1,000-1,728	7.1-10.2	135-1,420	161-1,420	Turbidity	360
						NH_3-N	61-150
						Iron	41
						Sulfate	284
						NO_3-N	0.3-6.4
						Phenols	1-6
Hess Oil Corp. (Corpus Christi)						Phenols	1
(00341) Nueces	1	800	8.8	225	400	Oil and Grease	71
						NH_3-N	43
	2	7	8.6	30	60	--	--
Sinclair Oil & Gas Co. (Taft 20 Plt.)						Turbidity	325
(00795) San Patricio	1	12-14	6.9	165	2,230-4,170	Alkalinity (tot)	260
2. Nueces-Rio Grande Coastal Basin							
Central Cement Co. (Corpus Christi Plt.)						Sulfate	790-1,600
(00311) Nueces	1	1,152-2,000	7.6-8.6	8-9	--	Alkalinity (tot)	124
						Turbidity	250
P.P.G. Industries (Corpus Christi)						Alkalinity (tot)	420
(00349) Nueces	1	55,000-75,000	8.2-8.7	4	--	Sulfate	2,320
						Phosphate	1
						NH_3N	1
	3	1,728-1,800	11.2-11.4	1	5,000	Alkalinity (tot)	3,400-3,650
Pontiac Ref. Corp. (Corpus Christi)						Carbon Chloroform ext.	0
(00467) Nueces	1	194	8.2	18	75	Phenols	0
						Alkalinity (tot)	50
	2	200-302	7.3-8.6	145-275	310-460	Phenols	0.2
						Carbon Chloroform ext.	52
Reynolds Metal Co. (Sherwin Plt.)						Chromium	18
(00499) San Patricio	1	72	8.4	4	10	Alkalinity (tot)	80
	3	29	10.0	3	--	Alkalinity (tot)	350
						Sulfate	120
Southwestern Oil & Ref. Co. (Corpus Christi)						Sulfate	447
(00457) Nueces	1	288	8.3	35	--	NH_3-N	53
	4	--	10.0	17	--	Phosphate	69
Sun Pipe Line Co. (Ingleside Term.)							
(01207) San Patricio	1	14	7.4	4	--	Sulfate	740
Laguna Madre Area (Fig. 45)							
1. Nueces-Rio Grande Coastal Basin							
Union Carbide Corp. (Brownsville)						NH_3-N	1.0-1.6
(00446) Cameron	1	87,200	7.5-8.3	26-251	1-3	Sulfate	1,390-2,680

1/ To convert to metric, 1 gal. = 0.0037 cubic meters or 3.78 liters.

2/ -- = no data.

3/ Alkalinity shown in terms of Milliequivalents /l

Table 24.--Pesticides in waters and sediments from selected Texas study areas. (Data fromDupuy, Manigold, and Schulze 1970).

Estuary	Insecticide[1/]										Herbicide							
	Water					Sediments					Water				Sediments			
	DDD	DDE	DDT	Diel-drin	Total (ppb)	DDD	DDE	DDT	Diel-drin	Total (ppb)	2,4-D	Silvex	2,4,5-T	Total (ppb)	2,4-D	Silvex	2,4,5-T	Total (ppb)
Sabine Lake Area:																		
Sabine-Neches rivers	nd[1/]	nd	nd	nd	nd	X[1/]	X	nd	nd	1.40	nd	nd	X	0.02	--[1/]	--	--	--
Matagorda Bay Area:																		
Colorado River	nd	nd	nd	nd	nd	X	X	X	nd	24.70	X	nd	X	0.07	--	--	--	--
East Matagorda Bay	nd	nd	nd	nd	nd	X	X	X	nd	2.83	X	nd	X	0.08	--	--	--	--
Tres Palacios Bay	nd	nd	nd	nd	nd	X	X	nd	X	--	X	nd	X	0.22	--	--	--	--
Lavaca Bay	X	X	X	nd	1.02	--	--	--	--	--	X	nd	X	0.18	--	--	--	--
Lavaca River	nd	nd	nd	nd	nd	X	X	X	X	8.16	nd	nd	nd	nd	--	--	--	--
Intracoastal Waterway	X	X	X	nd	0.69	--	--	--	--	--	nd	nd	nd	nd	--	--	--	--
San Antonio Bay Area:																		
San Antonio Bay	nd	nd	X	nd	0.02	X	X	X	X	3.64	X	nd	X	0.17	--	--	--	--
Guadalupe Bay	nd	nd	X	nd	0.61	X	X	X	X	9.14	X	nd	X	0.27	--	--	--	--
Guadalupe River	nd	nd	X	nd	0.02	X	X	nd	nd	4.00	nd	nd	nd	nd	--	--	--	--
Guadalupe River Delta	nd	nd	X	nd	0.01	X	X	nd	nd	4.30	nd	nd	nd	nd	--	--	--	--
Copano-Aransas Bay Area:																		
Mission-Aransas bays	nd	nd	nd	nd	nd	--	--	--	--	--	nd	nd	X	0.13	--	--	--	--
Corpus Christi Bay Area:																		
Nueces Bay	nd	nd	nd	nd	nd	--	--	--	--	--	nd	nd	nd	nd	--	--	--	--
Nueces River Delta	nd	nd	nd	nd	nd	--	--	--	--	--	--	--	--	--	--	--	--	--
Laguna Madre Area:																		
Baffin Bay	nd	nd	X	nd	0.01	X	X	nd	nd	2.50	nd	nd	X	0.02	--	--	--	--
Arroyo Colorado	X	X	nd	nd	0.05	--	--	--	--	--	nd	nd	nd	nd	--	--	--	--
Laguna Madre (Arroyo Colorado)	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	X	0.01	--	--	--	--

1/ (X) indicates compound is present in sample; (nd) indicates compound is not detected in sample; (--) indicates no sample or data available.

Table 25.--Approximate acreage[1/] of estuarine surface water declared as closed and conditionally approved for shellfishing by the Texas State Board of Health. (See Figs. 3l9 through 45)

System	Estuarine Area Conditionally Polluted		
	(MHW)[2/]	Conditionally Approved	Closed
Sabine	45,320	0	45,320
Galveston	349,940	8,000	188,000
Matagorda	282,300	3,850	29,470
San Antonio-Espiritu Santo	136,240	4,750	13,300
Copano-Aransas	111,880	0	14,800
Corpus Christi	106,990	0	32,000
Laguna Madre	280,910	0	2,200

1/ To convert to metric, 1 acre = 0.4046 hectare.

2/ Mean high water.

Table 26.--Dimensions of U.S. Army Corps of Engineers Navigation Channels along the Texas coast as of 1968. (Data from the Galveston District, U.S. Army Corps of Engineers.)

Channel or section of channel	Authorized dimensions[1]			Existing dimensions[1]		
	Depth below M.L.T.	Bottom width	Length	Depth below M.L.T.	Bottom width	Length
	- - - - - Feet - - - - -		Miles	- - - - - Feet - - - - -		Miles
Sabine Lake Area						
Gulf Intracoastal Waterway[2]						
--Calcasieu River to Sabine River (La.)	30	125	24.90	30	125	24.90
--Port Arthur Channel to High Island (Tex.)	16	150	26.00	12	125	26.00
Johnson's Bayou Channel (La.)	6	--[3]	0.43	6	--[3]	0.43
Sabine-Neches Waterway (Tex.)						
--Sabine Bank Channel	42	800	14.73	[4]	--	14.73
--Sabine Pass Outer Bar Channel	42	800	3.40	37	800	3.40
--Sabine Pass Jetty Channel	40	500-800	4.06	36	500-800	4.06
1. Sabine Pass Anchorage Basin	40	1,500	0.56	40	1,500	0.56
--Sabine Pass Channel	40	500	5.61	40	500	5.61
--Port Arthur Channel	40	500	6.17	36-40	500	6.17
--Entrance to Port Arthur Turning Basins	40	200-665	0.28	36	200-665	0.28
--Port Arthur East Turning Basin	40	420	0.33	36	370-547	0.33
--Port Arthur West Turning Basin	40	600	0.30	36	350-550	0.30
--Channel connecting Port Arthur West Turning Basin and Taylors Bayou Turning Basin	40	200-250	0.57	36	200-250	0.57
--Taylors Bayou Turning Basin	40	150-1,000	0.65	36	90-1,233	0.65
--Sabine-Neches Channel (Port Arthur to Neches River[2])	40	400	11.24	36	400	11.24
1. Turning Point at Mile 25	40	900	0.17	[5]	[5]	[5]
--Neches River Channel (Mouth to Maneuvering Area at Beaumont Turning Basin)	40	400	18.34	36-40	350-400	18.34
1. Turning Point (Vicinity of Mile 31)	40	1,000	0.13	40	1,000	0.13
2. Turning Point (Vicinity of Mile 37)	40	1,000	0.07	[5]	[5]	[5]
3. Turning Point (Vicinity of Mile 41)	40	1,000	0.07	[5]	[5]	[5]
4. Channel Extension (Vicinity of Mile 41)	36	350	0.22	36	350	0.22
--Maneuvering area at Beaumont Turning Basin	40	--	0.22	36	--	0.22
1. Beaumont Turning Basin	34	500	0.28	34	160-535	0.28
--Beaumont Turning Basin Extension	34	350	0.40	34	300	0.40
--Beaumont Turning Basin Extension to end of Channel Vicinity Bethlehem Steel Company	30	200	0.73	30	200	0.73
--Sabine-Neches Canal (Neches River to Sabine River[2])	30	200	4.35	30	200	4.35
--Sabine River Channel (Mouth to foot of Green Avenue[2]	30	200	9.45	30	200	9.45
--Orange Turning Basin	30	--	0.29	30	--	0.29
--Orange Municipal Slip	30	200	0.46	30	150-200	0.46
--Old Channel around Harbor Island	25	150-200	2.39	25	150-200	2.39
--Channel to Echo	12	125	4.60	--	--	--
--Adams Bayou	12	100	1.68	12	100	1.68
--Cow Bayou	13	100	7.70	13	100	7.00
--Orange Field Turning Basin	13	300	0.09	13	300	0.09
Total length of channels in Sabine Lake area			151.00			145.39

Table 26. --Continued.

Channel or section of channel	Authorized dimensions 1/			Existing dimensions 1/		
	Depth below M. L. T.	Bottom width	Length	Depth below M. L. T.	Bottom width	Length
	- - - - - Feet - - - - - -		Miles	- - - - -Feet - - - - -		Miles
Galveston Bay Area						
Channel to Anahuac	6	100	5.60	6	100	5.60
Bastrop Bayou Channel	4	100	6.00	4	60	1.50
Channel to Cedar Bayou	10	100	11.00	10	100	3.40 6/
Channel to Chocolate Bayou						
--Channel via East Turnout 7/	12	125	8.20	10	100	8.20
--West Turnout	12	125	0.80	10	125	0.80
--Channel	9	100	5.00	0	0	--
--Turning Basin	9	600	0.11	0	0	--
Channel to Clear Creek and Clear Lake						
--Entrance Channel	7	75	1.80	7	75	1.80
--North Fork Channel	7	60	0.70	7	60	0.70
--Channel to League City	7	60	7.70	7	60	7.70
Channel to Dickinson Bayou	6	60	11.40	6	60	11.40
Channel to Double Bayou	7	100	2.00	7	100	2.00
Channel to East Bay Bayou	4	100	--	4	100	--
Galveston Harbor and Channel						
--Entrance Channel	42	800	4.73	42	800	4.73
--Outer Bar Channel	42	800	1.65	42	800	1.65
--Inner Bar Channel	40	800	3.19	40	800	3.19
--Bolivar Roads Channel	40	800	0.95	40	800	0.95
--Galveston Channel						
1. Bolivar Roads Channel to 43rd Street	36	1,200	3.92	36	1,200	3.92
2. 43rd Street to 51st Street	32	1,200	0.68	5/	5/	0.68
3. 51st Street to 57th Street	32	1,000	0.44	5/	5/	0.44
4. 57th Street to Gulf Intracoastal Waterway	12	125	2.33	12	125	2.33
Gulf Intracoastal Waterway						
--High Island to Houston Ship Channel	16	150	35.00	12	125	35.00
--Houston Ship Channel to Swan Lake	12	125	41.00	12	125	41.00
Houston Ship Channel						
--Bolivar Roads to Morgan Point	40	400	26.16	40	400	26.16
--Morgan Point to Boggy Bayou	40	400	12.76	40	400	12.76
--Boggy Bayou to Greens Bayou	40	300	2.36	40	300	2.36
--Greens Bayou to Simms Bayou	40	300	5.26	40	300	5.26
1. Hunting Bayou Turning Point	40	900-1,000	0.26	40	948-1,002	0.26
2. Clinton Island Turning Basin	40	800	0.30	40	965-1,070	0.30
--Simms Bayou to Southern Pacific Slip	40	300	0.54	40	300	0.54
--Southern Pacific Slip to Houston Turning Basin	36-40	300	2.94	36	300	2.94
--Houston Turning Basin	36	400-1,000	0.58	36	400-1,000	0.58
1. Upper Turning Basin	36	150	0.18	36	150-527	0.18
--Brady Island Channel	10	60	0.90	10	60	0.90
--Barbour Terminal Channel	16	100	1.47	16	100	1.47
1. Turning Basin	16	1,100	0.18	16	1,000	0.18

Table 26. --Continued.

Channel or section of channel	Authorized dimensions[1/] Depth below M. L. T.	Authorized dimensions[1/] Bottom width	Authorized dimensions[1/] Length	Existing dimensions[1/] Depth below M. L. T.	Existing dimensions[1/] Bottom width	Existing dimensions[1/] Length
	- - - - - Feet - - - - - -		Miles	- - - - - Feet - - - - -		Miles
--Five-Mile Cut Channel	8	125	1.89	8	125	1.89
--Light Draft Channel						
1. Upper Turning Basin to Jensen Drive	10	60	4.14	10	60	4.14
2. Turkey Bend Channel	10	60	0.83	10	60	0.83
3. Jensen Drive to White Oak Bayou	10	60	1.49	8	40	1.49
--Greens Bayou Channel						
1. Mile 0.0 to Mile 0.3	36	175	0.34	36	175	0.34
2. Mile 0.3 to Mile 1.5	15	100	--	5/	5/	5/
3. Mile 1.5 to Mile 2.8	12	100	--	5/	5/	5/
Channel to Liberty (Trinity River Channel)						
--Houston Ship Channel to Anahuac	9	150	23.20	9	150	23.20
--Anahuac to Liberty	9	150	25.70	6	8/	18.20
Channel to Port Bolivar	30	200	0.17	14	200	0.17
--Turning Basin	30	750	0.30	5/	5/	5/
Channel to Texas City	40	400	6.75	40	400	6.75
--Turning Basin	40	1,000	0.80	40	1,000	0.80
--Industrial Barge Canal[9/]	12-16	125-195	1.87	34	200-250	1.87
1. Turning Basin[9/]	12	400	0.07	34	1,000	0.07
Total lengths of channels in Galveston Bay area			275.76			250.92
Matagorda Bay Area						
Colorado River Channel	9	100	15.50	9	100	15.50
--Turning Basin	9	400	0.09	9	400	0.09
--Flood Discharge Channel	12	100	6.00	5/	5/	5/
--Entrance Channel	15	200	0.75	5/	5/	5/
--Turning Basin, Matagorda	12	350	0.27	5/	5/	5/
--Sitting Basin	9	150	0.47	9	150	0.47
Freeport Harbor Area						
--Outer Bar Channel	38	300	2.93	38	300	2.93
--Jetty Channel	36	200	0.92	36	200	0.92
--Channel to Brazosport Turning Basin	36	200	1.08	36	200-350	1.08
--Brazosport Turning Basin	36	700	0.12	36	744-800	0.12
--Channel to Upper Turning Basin	36	375	1.59	36	350-375	1.59
--Upper Turning Basin	36	600	0.11	36	600	0.11
--Channel to Stauffer Chemical Plant	30	200	1.15	25	200	1.15
--Stauffer Turning Basin	30	500	0.09	25	500	0.09
--Brazos Harbor Channel	30	200	0.50	30	200	0.50
--Brazos Harbor Turning Basin	30	550-600	0.12	30	525-675	0.12
Gulf Intracoastal Waterway	12	125	82.00	12	125	82.00
Matagorda Ship Channel						
--Outer Bar and Jetty Channel	38	300	3.21	38	300	3.21
--Channel to Point Comfort	36	200-300	20.88	36	200-300	20.88

Channel or section of channel	Authorized dimensions 1/ Depth below M. L. T.	Authorized dimensions 1/ Bottom width	Authorized dimensions 1/ Length	Existing dimensions 1/ Depth below M. L. T.	Existing dimensions 1/ Bottom width	Existing dimensions 1/ Length
	- - - - - Feet - - - - -		Miles	- - - - - Feet - - - - -		Miles
--Approach Channel to Turning Basin	36	200-300	1.12	36	200-300	1.12
1. Turning Basin	36	1,000	0.18	36	1,000	0.18
--Channel to Port Lavaca	12	125	4.12	12	125	4.12
1. Lynn Bayou Turning Basin	12	27-342	0.10	12	27-342	0.10
--Channel to Harbor of Refuge	12	125	1.92	12	125	1.92
1. North-South Basin	12	300	0.31	12	300	0.31
2. East-West Basin	12	250	0.33	12	250	0.33
--Channel to Red Bluff	6	100	20.24	6	100	20.24
Oyster Creek Channel	4	40	2.02	4	40	2.02
Channel to Palacios	12	125	16.10	12	125	16.10
--Turning Basin No. 1	12	200	0.13	12	200	0.13
--Turning Basin No. 2	12	300	0.21	12	300	0.21
--Connecting Channel	12	150-480	0.08	12	150-480	0.08
Total lengths of channels in the Matagorda Bay area			214.18			203.72
San Antonio Bay Area						
Channel to Barroom Bay	6	60	10/	--	--	10/
Ferry Channel	9	100	6.20	9	100	6.20
Gulf Intracoastal Waterway	12	125	36.00	12	125	36.00
Channel to Victoria, via east turnout from Gulf Intracoastal Waterway	9	100	34.70	9	100	34.70
--Turning Basin	9	600	0.14	9	500	0.15
--West Turnout from Gulf Intracoastal Waterway	9	100	0.80	9	100	0.80
--Channel to Seadrift via South Turnout from Channel to Victoria	9	100	2.00	9	100	2.00
--North Turnout	9	100	0.50	9	100	0.50
--Turning Basin	9	250	0.05	9	250	0.05
--Refuge Harbor at Seadrift	9	200	10/	10/	10/	10/
Total lengths of channels in the San Antonio Bay Area			80.41			80.41
Copano-Aransas Bay Area						
Gulf Intracoastal Waterway	12	125	16.00	12	125	16.00
--Alternate route via Lydia Ann Channel	12	125	19.00	12	125	19.00
Channel to Little Bay	8	100	0.37	8	100	0.37
--Turning Basin	8	200	0.26	8	200	0.26
Channel to Rockport	9	200	2.10	9	200	2.10
--Turning Basin	9	475	0.23	9	313-372	0.23
Total lengths of Channels in the Copano-Aransas Bay Area			38.62			38.62
Corpus Christi Bay Area						
Channel to Aransas Pass	12	125	6.10	12	125	6.10
--Turning Basin	12	300	0.41	12	300	0.41
--Channel to Conn Brown Harbor	12	125	0.20	12	125	0.20

Table 26. --Continued.

Channel or section of channel	Authorized dimensions 1/ Depth below M. L. T.	Bottom width	Length	Existing dimensions 1/ Depth below M. L. T.	Bottom width	Length
	- - - - - Feet	- - - - -	Miles	- - - - - Feet	- - - - -	Miles
--Conn Brown Harbor	12	300	--	12	300	--
Channel to Encinal Peninsula	30	200	8.00	30	200	8.00
--Turning Basin	30	3,000	0.37	30	2,000	0.37
Gulf Intracoastal Waterway (main Corpus Christi Ship Channel)	12	125	26.00	12	125	26.00
--Aransas Pass Outer Bar Channel	47	700	1.84	42	700	1.84
--Aransas Pass Jetty Channel	45	600	0.96	40	600	0.96
--Inner Basin at Harbor Island	45	730-1,720	0.29	40	600-1,000	0.29
--Channel to Port Aransas	12	100	0.14	12	100	0.14
1. Port Aransas Turning Basin	12	200	0.03	12	200	0.03
2. Anchorage Basin at Port Aransas	12	300-400	0.17	12	300-400	0.17
--Inner Basin at Harbor Island to Corpus Christi Turning Basin	45	400-600	20.70	40	400	20.70
--Corpus Christi Turning Basin	45	800	1.02	40	1,000	1.02
--Industrial Canal	45	400	1.08	40	400	1.08
--Avery Point Turning Basin	45	975	0.21	40	1,000	0.21
--Channel to Chemical Turning Basin	45	400	0.65	40	350	0.65
--Chemical Turning Basin	45	1,200	0.32	40	350-1,050	0.32
--Tule Lake Channel	45	300	3.07	40	200	3.07
--Tule Lake Turning Basin	45	1,200	0.18	40	900	0.18
--Viola Channel	45	300-350	1.82	40	200-250	1.82
--Viola Turning Basin	45	1,200	0.18	40	700-900	0.18
--Channel to La Quinta	45	300-400	5.57	36	200	5.57
1. La Quinta Turning Basin	45	1,000	0.15	36	1,000	0.15
2. Turning Point at La Quinta Channel Junction	45	1,200	0.22	5/	5/	5/
--Jewel Fulton Canal	12	100	0.77	12	100	0.77
1. Jewel Fulton Turning Basin	12	200	0.07	12	200	0.07
2. Mooring Area "A" at Ingleside	45	150	--	5/	5/	5/
3. Mooring Area "B" at Ingleside	45	150	--	5/	5/	5/
Total lengths of channels in the Corpus Christi Bay Area			80.77			80.54
Laguna Madre Area						
Brazos Island Harbor (Channel to Brownsville)						
--Outer Bar and Jetty Channels	36-38	300	2.55	36-38	300	2.55
--Padre Island to Long Island	36	200	2.08	36	200	2.08
--Long Island to Goose Island	36	200	9.56	36	200	9.56
--Goose Island to Turning Basin extension	36	300	3.18	36	200	3.18
--Turning Basin extension	36	500	1.35	36	500	1.35
1. Brownsville Turning Basin	36	1,000	0.50	32-36	500-1,000	0.50
--Port Isabel Channel via east turnout	36	200	1.35	36	200-1,000	1.35
1. West Wye from Brownsville Channel	36	200	0.83	36	200	0.83
2. Port Isabel Turning Basin	36	1,000	0.24	36	950-1,000	0.24
--Fishing Harbor (entrance channel)	15	100	0.14	15	100	0.14
1. West Basin	15	305-370	0.27	15	305-370	0.27
2. Middle Basin	15	305-370	0.22	15	305-370	0.22

Table 26. --Continued.

Channel or section of channel	Authorized dimensions 1/ Depth below M. L. T.	Bottom width	Length	Existing dimensions 1/ Depth below M. L. T.	Bottom width	Length
	- - - - - Feet - - - - -		Miles	- - - - - Feet - - - - -		Miles
3. East Basin	15	370	0.27	15	370	0.27
4. Connecting Channel	15	270	0.23	15	265	0.23
Gulf Intracoastal Waterway	12	125	119.00	12	125	119.00
Channel to Harlingen	12	125 11/	31.00	12	125	25.80
--Turning Basin near Rio Hondo	12	400	0.09	12	400	0.09
--North turnout	12	200	0.66	12	200	0.66
Port Isabel Harbor						
--Entrance Channel to small boat harbor	7	75	1.45	7	75	1.45
--Harbor Channel	6	50	0.27	6	50	0.27
--Boat Basin	6	72-501	0.24	6	72-501	0.24
--Port Isabel Side Channels	12	125	0.80	12	125	0.80
--Port Isabel Side Channels	6	60	0.30	6	60	0.30
--Port Isabel Side Channels	12	125	0.30	12	125	0.30
Channel to Port Mansfield						
--Entrance Channel	16	250	0.80	26	250	0.80
--Approach to Hopper Dredge Turning Basin	16	100	0.40	26	100	0.40
--Hopper Dredge Turning Basin	16	300	0.05	26	300	0.05
--Channel across Padre Island and Laguna Madre to Gulf Intracoastal Waterway	14	100	7.70	14	100	7.70
--Turnout Channel east side Gulf Intracoastal Waterway						
1. North Turnout	12	100	0.56	12	100	0.56
2. South Turnout	12	100	0.56	12	100	0.56
--Channel (West side of Gulf Intracoastal Waterway to point of turnout channel)	12	100	0.40	12	100	0.40
--Turnout Channel, west side Gulf Intracoastal Waterway						
1. North Turnout	12	200	0.56	12	200	0.56
2. South Turnout	12	200	0.56	12	200	0.56
--Channel from point of termination of Turnout channels to approach channel to Main Turning Basin	14	125	0.60	14	125	0.60
--Approach channel to Main Turning Basin	14	200	0.30	14	200	0.30
--Main Turning Basin	14	400	0.23	14	400	0.23
--Turning Basin extension	14	1,000	0.10	14	1,000	0.10
--Small Craft Basin	8	160	0.16	8	160	0.16
--Shrimp Basin	12	350	0.27	12	350	0.27
Total lengths of channels in Laguna Madre Area			190.26			190.06
Total lengths of channels in Texas estuarine areas			1,031.03			989.69

1/ Conversion factors: 1 mile = 1.6 km. 1 foot = 0.3 meter.

2/ Segments of project utilized by Gulf Intracoastal Waterway; total length of Gulf Intracoastal Waterway in Sabine Lake System is 75 miles, 5,059 feet.

3/ -- = no data.

4/ Not improved, 37 feet controlling depth available.

5/ Not improved.

6/ Natural channel dimensions for remainder of 11-mile length adequate.

7/ East turnout dredged to 10 feet x 150 feet dimensions by local interests.

8/ Navigable width.

9/ Constructed by private interests following Federal alignment.

10/ Inactive.

11/ South turnout 200 feet wide.

370. Collecting and processing data on fish eggs and larvae in the California Current region. By David Kramer, Mary J. Kalin, Elizabeth G. Stevens, James R. Thrailkill, and James R. Zweifel. November 1972, iv + 38 p., 38 figs., 2 tables. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

371. Ocean fishery management: Discussions and research. By Adam A. Sokoloski (editor). (17 papers, 24 authors.) April 1973, vi + 173 p., 38 figs., 32 tables, 7 appendix tables.

372. Fishery publications, calendar year 1971: Lists and indexes. By Thomas A. Manar. October 1972, iv + 24 p., 1 fig. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

374. Marine flora and fauna of the northeastern United States. Annelida: Oligochaeta. By David G. Cook and Ralph O. Brinkhurst. May 1973, iii + 23 p., 82 figs. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

375. New Polychaeta from Beaufort, with a key to all species recorded from North Carolina. By John H. Day. July 1973, xiii + 140 p., 18 figs., 1 table. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

376. Bottom-water temperatures on the continental shelf, Nova Scotia to New Jersey. By John B. Colton, Jr. and Ruth R. Stoddard. June 1973, iii + 55 p., 15 figs., 12 appendix tables. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

377. Fishery publications, calendar year 1970: Lists and indexes. By Mary Ellen Engett and Lee C. Thorson. December 1972, iv + 34 p., 1 fig. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

378. Marine flora and fauna of the northeastern United States. Protozoa: Ciliophora. By Arthur C. Borror. September 1973, iii + 62 p., 5 figs. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

379. Fishery publications, calendar year 1969: Lists and indexes. By Lee C. Thorson and Mary Ellen Engett. April 1973, iv + 31 p., 1 fig. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

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