ACCESS NUMBER: 29011

STUDY TITLE: Texas Barrier Islands Ecological Characterization

REPORT TITLE: Texas Barrier Islands Region Ecological Characterization: Environmental Synthesis Papers

CONTRACT NUMBERS: BLM: MU9-14; MMS: 14-12-0001-29011

SPONSORING OCS REGION: Gulf of Mexico

APPLICABLE PLANNING AREAS: Western Gulf of Mexico

FISCAL YEARS OF PROJECT FUNDING: 1979; 1980; 1981

COMPLETION DATE OF REPORT: September 1981

COSTS: FY 1979: $427,000; FY 1980: $250,270; FY 1981: $150,000

CUMULATIVE PROJECT COST: $827,270

PROJECT MANAGERS: J. Johnston

AFFILIATION: U.S. Fish and Wildlife Service

ADDRESS: 1010 Gause Boulevard, Slidell, Louisiana 70458

PRINCIPAL INVESTIGATORS*: R. Baumann, L. Dunn, T. Fritts, D. Shew

KEY WORDS: Western Gulf; Texas; biology; characterization; barrier islands; lagoons; biology; geology; hydrology; climate; literature synthesis; drainage basin; terrestrial; riverine; freshwater; estuarine; coastal zone; pollutants; fish; floral zones; faunal zones; sediment; municipal sewage; shellfish; agriculture; seasonality

BACKGROUND: This report is a synthesis of selected environmental literature for the Texas Barrier Islands Region and is part of the Texas Barrier Islands Region Ecological Characterization Study. This study is intended to serve as a general reference work and planning guide to the literature, and is designed to be used in planning for requirements of Outer Continental Shelf (OCS) oil and gas development and coastal zone management.

OBJECTIVE: To synthesize the literature on geology, climate, hydrology, and biology of the drainage basins along the Texas coast.

DESCRIPTION: The synthesis deals with the six drainage basins along the Texas coast (i.e., Galveston, Matagorda-Brazos, San Antonio, Copano-Aransas, Corpus Christi, and Laguna Madre), as well as the marine system offshore of these drainage basins.

SIGNIFICANT CONCLUSIONS: The Galveston Bay system is the most affected of the six bay systems by human activity. The development of this area as a major port has

caused introduction of pollutants in this system. The Matagorda-Brazos system transcends the humid climate of northeast Texas and grades into an increasingly arid climate downcoast. Man's use of the river draining into this basin has affected freshwater and sediment input into estuaries. The San Antonio Bay system remains in a relatively natural state because of isolation and modest human use. The Copano-Aransas system averages the lowest absolute freshwater inflow of the bay systems because of the paucity of input by the Mission and Aransas Rivers. The Corpus Christi Bay system exemplifies man's expanding needs altering and reducing the natural resources of the system. The Laguna Madre system is vastly different from the other systems. Climatic processes interact strongly with geologic and hydrologic variables, resulting in environments characterized by few resident species but often with large populations.

STUDY RESULTS: Development of the Galveston Bay system as a major port, an extensive industrial and oil refining center, and a major urban center has resulted in chemical, hydrocarbon, and domestic pollution. Pollutants enter the estuary from many sources: Houston Ship Channel, Trinity and San Jacinto Rivers, Texas City Harbor, and numerous bayous and tertiary bays. The cumulative effect of these sources is unknown. This system is distinctive in having emergent marshes instead of submerged grassbeds as the major vegetative form. The Trinity and San Jacinto Rivers provide the largest average freshwater inflow of the six basins which is partly responsible for large shellfish harvests. Excessive groundwater withdrawal by Houston-Galveston populations and removal of shallow oil deposits has resulted in severe subsidence.

The Matagorda-Brazos system represents a transition from a humid climate to an increasing arid climate. Several examples of biotic parallels to the climatic transition are evident. Woody shrubs are present in fewer numbers than in the southern basins, giving way to extensive grasslands along upland prairie. Several species characteristic of bottomlands of the southeastern U.S. (e.g., water oak *Quercus nigra* and bald cypress *Taxodium distichum*) are present in this basin. The floodplain of the Brazos and Colorado Rivers contains the largest bottomland hardwood habitat in the region. The ichthyofauna of these rivers is significantly different than the other basins. Relatively large riverine input has moderated estuarine salinities, and a large number of fish use the estuary. Species composition varies with seasonal freshwater discharge and water temperature. Sediment loads are substantial and have resulted in formation of three active deltas which serve as valuable nursery areas. Man's use of the rivers has affected the inputs into the estuaries, but effects on biological production and flushing are not well documented.

Human populations and exploitation of terrestrial and aquatic communities in the San Antonio Bay system is less than in the other basins. Nutrient loads come from sewage inflow due to inadequate sewage treatment and agriculture. Annual freshwater inflow adequately maintains finfish and shellfish nursery grounds in bay areas. Dredging operations associated with shell extraction and maintenance of navigational channels pose a threat to grass beds and oysters. If these effects increase in the future, they will cause alteration of this system.

The Copano-Aransas system averages the lowest absolute freshwater inflow of the six basins. Salinities fluctuate rapidly in the bays. Hypersaline conditions usually do not occur partially through increased rainfall, but primarily through continuous, low salinity water influx from the San Antonio Bay system. This salinity stabilization helps finfish productivity, but shellfish harvests are low. In this system, rivers form small fluvial floodplains because of the limited flows and narrow meander belts. Fluvial lands provide habitats for diverse fauna, but the small area limits viable populations to relatively small numbers. More elevated and drier habitats constitute the extensive upland community. Floral and faunal components of this system closely resemble those of the two neighboring systems. Human populations are small in the study area. Water quality problems are caused by agriculture. Cattle grazing have caused erosion and subsequent shoaling in the bays.

The Corpus Christi Bay area is being affected by man's influence on that area. The most striking is what man has done and is doing to the Nueces River, the major freshwater source to the bay and principal reason why the bay is not usually hypersaline. River flow quantity is highly variable, both seasonally and yearly. This inherent variability has been related to species numbers and fishery production in the estuary. Higher freshwater inflows generally result in higher production of those species of sport and commercial value. While the data are not conclusive, primary productivity and fishery biomass estimates indicate that the Corpus Christi estuary is now less productive per unit area than other bays along the central Texas coast. Present diversions of Nueces River flow by man amount to approximately 4% of average annual flow; by 2010, diversions have been projected at approximately 35%. However, percentage reduction in annual flow is not as important as percentage of time flow is below a critical level. Petroleum and petrochemical industries in the area have increased population and needs for industrial and municipal waste disposal systems, deepwater ports, and recreational facilities. Agriculture adds nutrients and toxins to the basin.

In the Laguna Madre system, hypersaline conditions prevail. Wind is the major driving mechanism for circulation and migration of hypersalinity because of the lack of precipitation, riverine input, and tidal flux, combined with high evapotranspiration rates and shallow depths. Aquatic fauna are concentrated near submerged grass beds and/or freshwater outflows with a food chain based predominantly on benthic plants. Within upland areas, oak mottes, playas, and natural brushland are often associated with wildlife concentrations. The lower Rio Grande floodplain and delta historically have supported a diverse array of habitats in an otherwise low diversity region. Agriculture and increased population has led to near decimation of floodplain habitats in this area. Tourism is a major industry within the barrier island-lagoon complex. A study of long-term geologic processes indicates that the lagoon system is gradually being transformed into terrestrial habitat.

The Gulf waters off the Texas coast are contiguous with the basins. The area can be divided into two broad communities: (1) the upper shoreface community, which extends from mean high water to the 5-m contour; and (2) the nearshore community, which

extends to the 3-league line. The Gulf physical environment forms a continuum of habitats through which fauna can move at wil

STUDY PRODUCTS: Shew, D. M., R. H. Baumann, T. H. Fritts, and L. S. Dunn. 1981. Texas Barrier Islands Region Ecological Characterization: Environmental Synthesis Papers. A final report by the U.S. Fish and Wildlife Service for the U.S. Department of the Interior, Bureau of Land Management Gulf of Mexico OCS Office, New Orleans, LA. NTIS No. PB82-130782. FWS/OBS-81/32. Contract No. 14-12-0001-29011. 413 pp.

Other products from this characterization study include an annotated environmental bibliography on magnetic tape; socioeconomic synthesis papers; 1:24,000 scale habitat maps; an ecological atlas of 1:100,000 scale maps of biological resources, socioeconomic features, and oil and gas infrastructures; ecosystem models; and a narrative report.

*P.I.'s affiliation may be different than that listed for Project Managers.