Acc# 2153

Job Report

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Project Name: Analysis of Populations of Sports and Commercial Fin-Fish and of Factors Which Affect These Populations in the Coastal Bays of Texas.

Period Covered: January 1, 1964 to December 31, 1964 Job No. 20

A Study of the Hydrography and Meteorology of the Texas Coast

Abstract: Each bay area along the Texas Coast is an entity with its own particular hydrographic problems. The Galveston, Matagorda and San Antonio Bay Systems have an average annual rainfall in excess of 25 inches, plus large river drainage systems which tend to maintain relatively low salinities. From Aransas Bay to the Laguna Madre, rainfall decreases to less than 20 inches and hypersalinity becomes a problem.

Fisheries landings indicate that hydrographic conditions affect the productivity and abundance of shrimp, crab and some species of fish. During drouth periods salinities become high and catches decline, while during periods of normal rainfall salinities become comparable to those of true estuarine systems and catches increase.

Objectives: To compile and prepare for dissemination hydrographic and meteorological data obtained from the coastal bays of Texas.

Procedure: In each bay area (Figure 1) water samples were taken at fixed stations on a monthly or semi-monthly basis. From these samples, salinities and water temperatures were determined. Salinities were determined with hydrometers and Knudsen's Hydrographic Tables and recorded as parts per thousand total salts. In some cases the Mohr Titration method was used to determine salinity. Temperatures were measured in degrees centigrade and meteorological information was taken from U. S. Department of Commerce Weather Publications.

Findings and Discussion: The coast of Texas has extensive variations in rainfall, runoff and salinity (Figure 2).

The upper coast has generally heavier rainfall and lower salinities than the lower coast.

Several water shed or river basin complexes affect the hydrography of particular bay areas. The Trinity and the San Jacinto River Basins dump approximately 6.268 million acre feet of water into the Galveston Bay System annually (Area 1). This tends to keep salinities in Area 1 lower than other areas (Figure 2).

The Matagorda Bay System (Area 2) received almost as much rainfall as the Galveston Bay System (Area 1) but salinities were generally higher. The main reason is that Area 2 received only 79 acre feet of water annually, through the Lavaca-Navidad River system. Even heavy local rainfall did not appreciably affect the salinities of the Matagorda Area (Figure 2).

The San Antonio Bay Area (Area 3) receives approximately 1.39 million acre feet of fresh water annually and the average salinity is comparable to that of Area 1. Only during dry summer months did salinities become greater than those of Area 1 (Figure 2).

Area 4 (Aransas Bay Area) and Area 2 have roughly comparable salinities although the Mission River Basin dumps approximately 160 acre feet of water into Area 4 annually. Area 2 salinities are somewhat lower but that can be attributed to higher annual rainfall. The Mission and Aransas Rivers do not flow during drouth years and salinities in Mission and Copano Bays reached 50 p.p.t. in 1963 and 1964.

The historic annual flow into the Corpus Christi Bay Area (Area 5) from the Nueces River Basin is about 610 thousand acre feet of water. During the last few years of drouth this flow has been virtually eliminated by Wesley Seale Dam, and salinities have been as high or higher than in Area 4. During years of normal rainfall, salinities should be lower than in Area 4.

The Upper Laguna Madre (Area 6) is in the Los Almos drainage area which consists of several intermittent creeks. No reliable measuring stations are located on these streams so no information is available on the amount of flow.

Salinities in Area 6 are higher than in any other area on the Texas Coast (Figure 2). These extreme salinities could probably be reduced by improving circulation with adjacent waters. A land fill causeway on the north and a natural obstruction at the Landcut on the south helps make the Upper Laguna Madre hypersaline. This area has been known to have salinity kills of fish and other organisms. (Gunter and Hildebrand, 1951).

On the extreme southern end of the Texas Coast lies the Lower Laguna Madre (Area 7). The Rio Grande River Basin has many diversions and water control systems and supplies little fresh water to Area 7. Area biologists claim that tides and winds cause mixing of Gulf and bay waters, thus keeping salinities from reaching the extremes that the Upper Laguna Madre experiences. The average salinity in Area 7 is only slightly higher than in Areas 4 or 5, yet it receives much less rainfall (Figure 2).

In 1964, with the exception of Areas 7, 6 and 2, salinity values were similar to 1963. Area 7, 6 and 2 had higher salinities. Since 1962 all areas have recorded increases in salinity due to the prevailing drouth.

Air temperatures (Figure 3) were found to approximate water temperatures for the entire coast. Variations were found in the spring and fall months, when a lag in water temperature was evident. Water temperature varied sharply between areas (Figure 3). This may be attributed to different sampling dates and techniques. In Areas 3 and 4, water samples were taken semi-monthly while all other areas were sampled monthly. This can cause variation since weather conditions and other factors control the time of sampling. The difference between air temperatures for each area is slight, but there is a definite gradient.

Temperature variations have had considerable influence on shrimp, fish and other marine organisms. In 1964 cooler than usual water delayed shrimp growth and resulted in a slight change in the closed season. It is possible that once critical water temperatures are established and correlated with air temperatures, activities of fish and shellfish can be accurately predicted.

Wind and barometric pressure have pronounced effects on the water levels of Texas estuaries. According to Marmer (1954) tide or sea levels are greatest along the Texas Coast in April and May, and again in August, September, and October. Tides bring many species of larval fish and shellfish into the bays to complete their life cycles. Peaks of abundance for these animals correlate with periods of high tides. Therefore, it is important that tide records be maintained and studied.

Sampling during periods of high tide for larval fish and shellfish in the passes correlated with sampling for sub-adult and juvenile forms on the nursery grounds could provide the groundwork for good management programs.

Fisheries landings for Texas (Figure 5) have declined since 1961. This decline in landings correlates well with the reduced rainfall (Figure 2).

Gunter and Hildebrand (1954) showed a direct correlation between rainfall and shrimp production. Crab catches in 1964 were almost invariably higher in areas of high rainfall (Figure 6). For this evaluation the coast was broken down into four areas. The Galveston Bay System is treated as Area 1 and the Matagorda Bay System as Area 2. San Antonio, Aransas and Corpus Christi Bays were treated as Area 3 and the Laguna Madre was treated as Area 4. Schultz (1962) also showed this relationship of crab landings to rainfall in the Aransas Area. With long range plans for further reducing river flow into some areas reductions in fishery production of some species is probable.

Another problem facing the fisheries of the Texas Coast is the loss of productive nursery areas. One channel alone between Rockport and Aransas Pass, 10 miles long and 100 feet wide destroyed 130 acres of nursery grounds. The spoil from this channel destroyed an additional 600 acres. Schultz (1962-63) has shown that for every acre of nursery destroyed, approximately 20 redfish and 40 trout are lost annually. This would mean that about 44,000 fish have been eliminated from the standing fish population annually since 1958 by this one channel.

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Approved by _____
Coordinator

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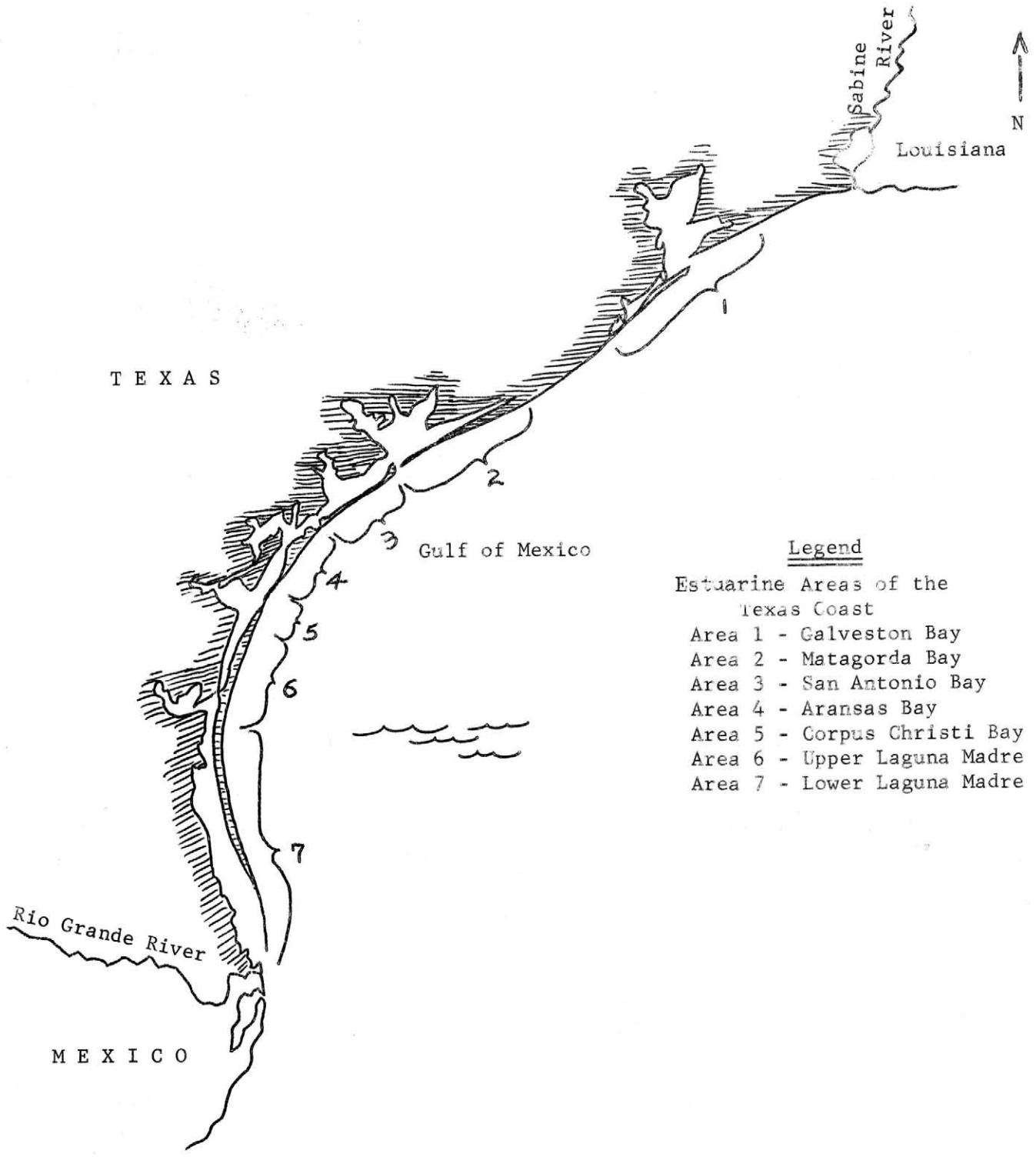
Figure 1


Sabine River
N
Louisiana
TEXAS
Gulf of Mexico
Rio Grande River
MEXICO
1
2
3
4
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Legend
Estuarine Areas of the Texas Coast
Area 1 - Galveston Bay
Area 2 - Matagorda Bay
Area 3 - San Antonio Bay
Area 4 - Aransas Bay
Area 5 - Corpus Christi Bay
Area 6 - Upper Laguna Madre
Area 7 - Lower Laguna Madre

Figure 2
A Comparison of Salinity and Rainfall for Areas of the Texas Coast

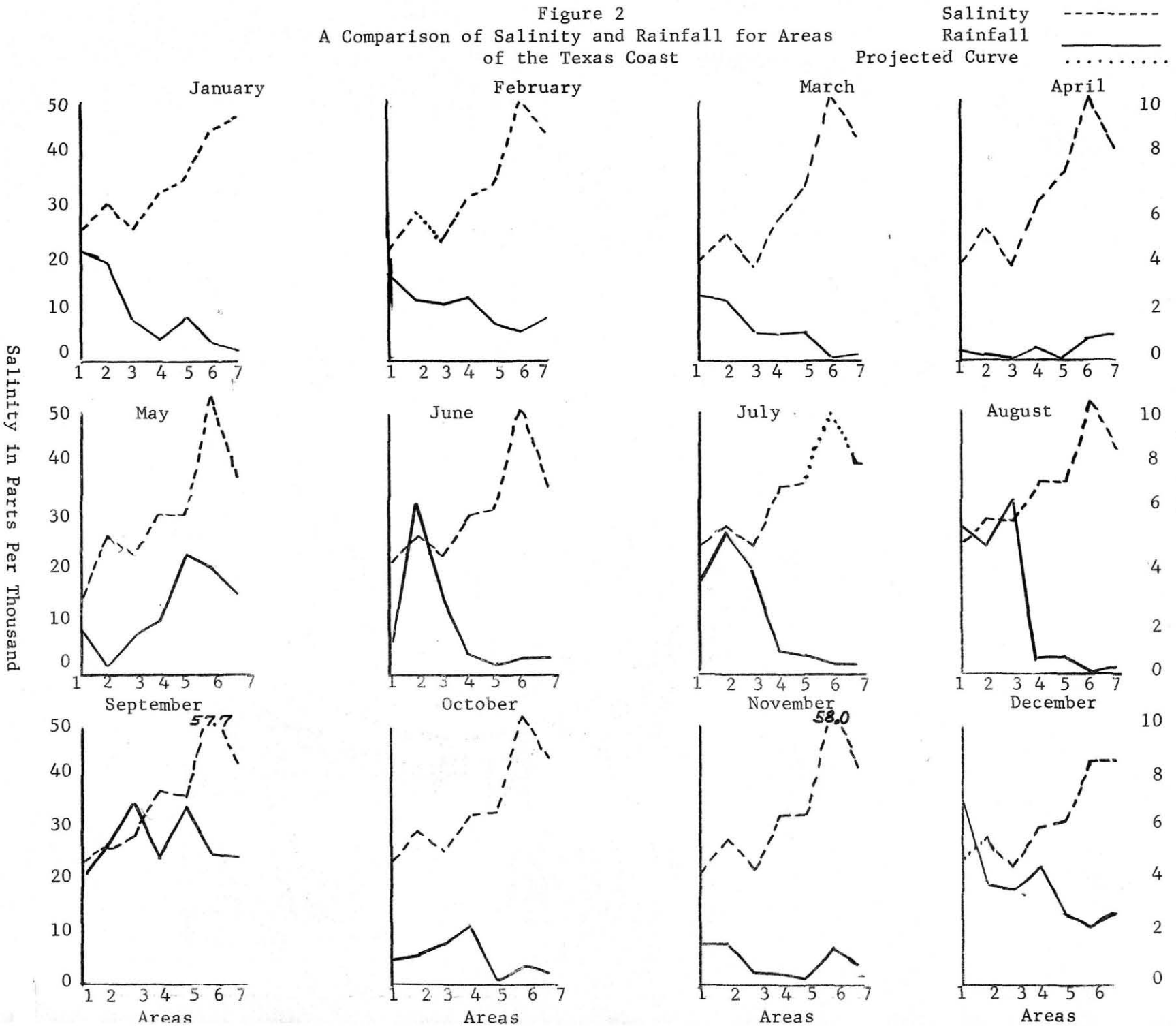

Figure 3
Air Temperature as Related to Water Temperature

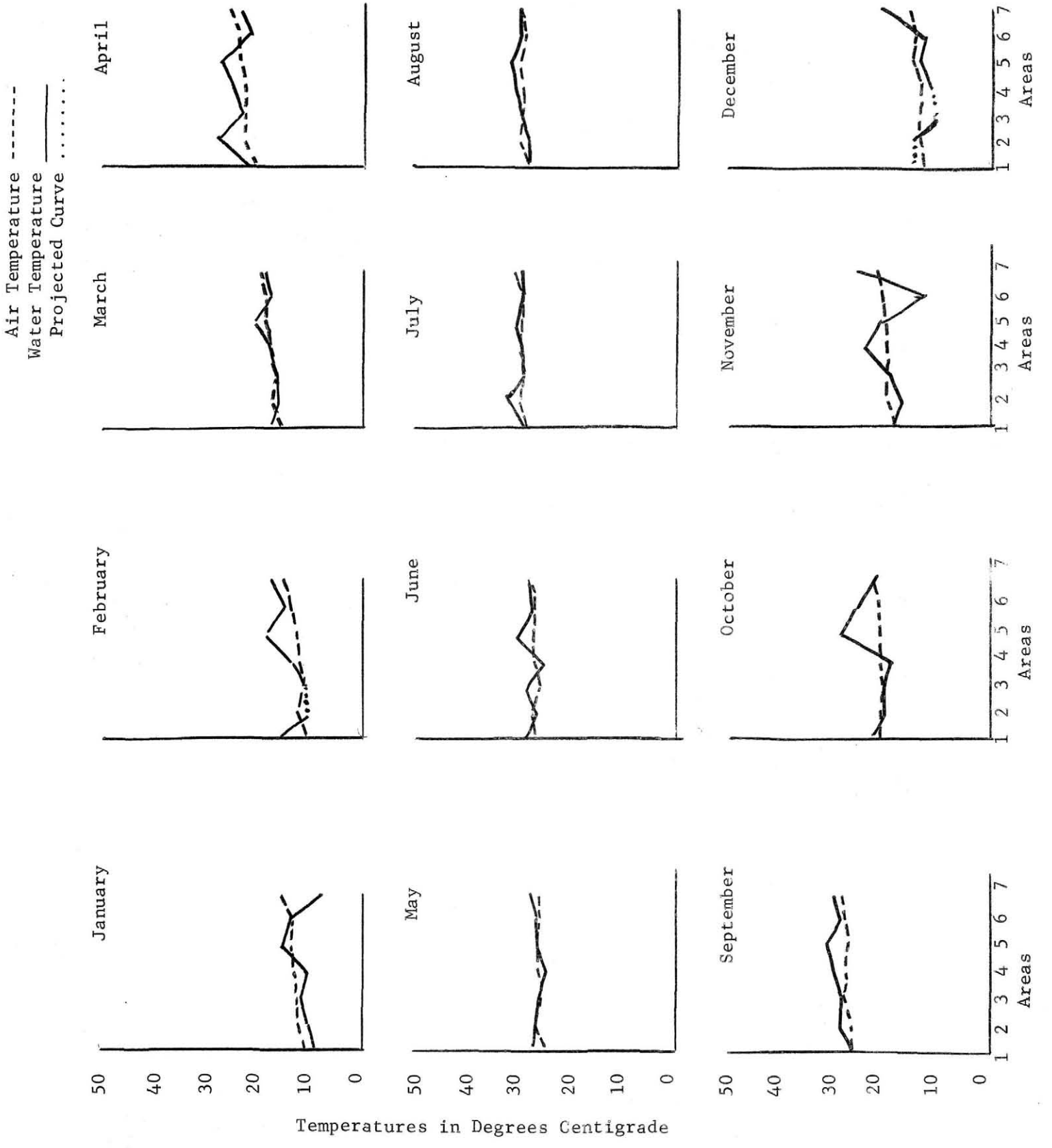

Figure 4
Sea Level Variation for Galveston and Port Isabel, Texas
(H. A. Marmer 1954)

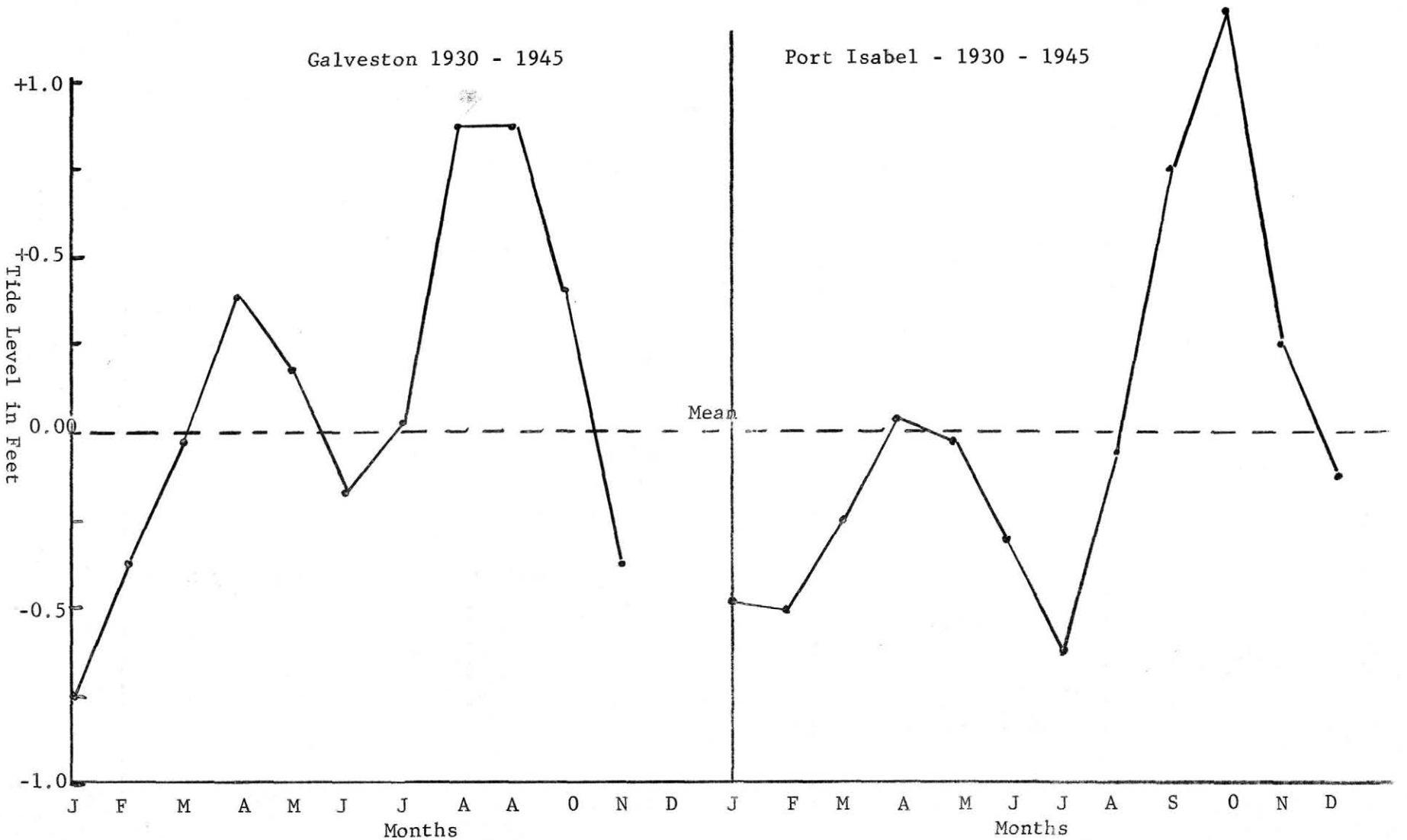

Figure 5
Texas Landings - 1961-1964

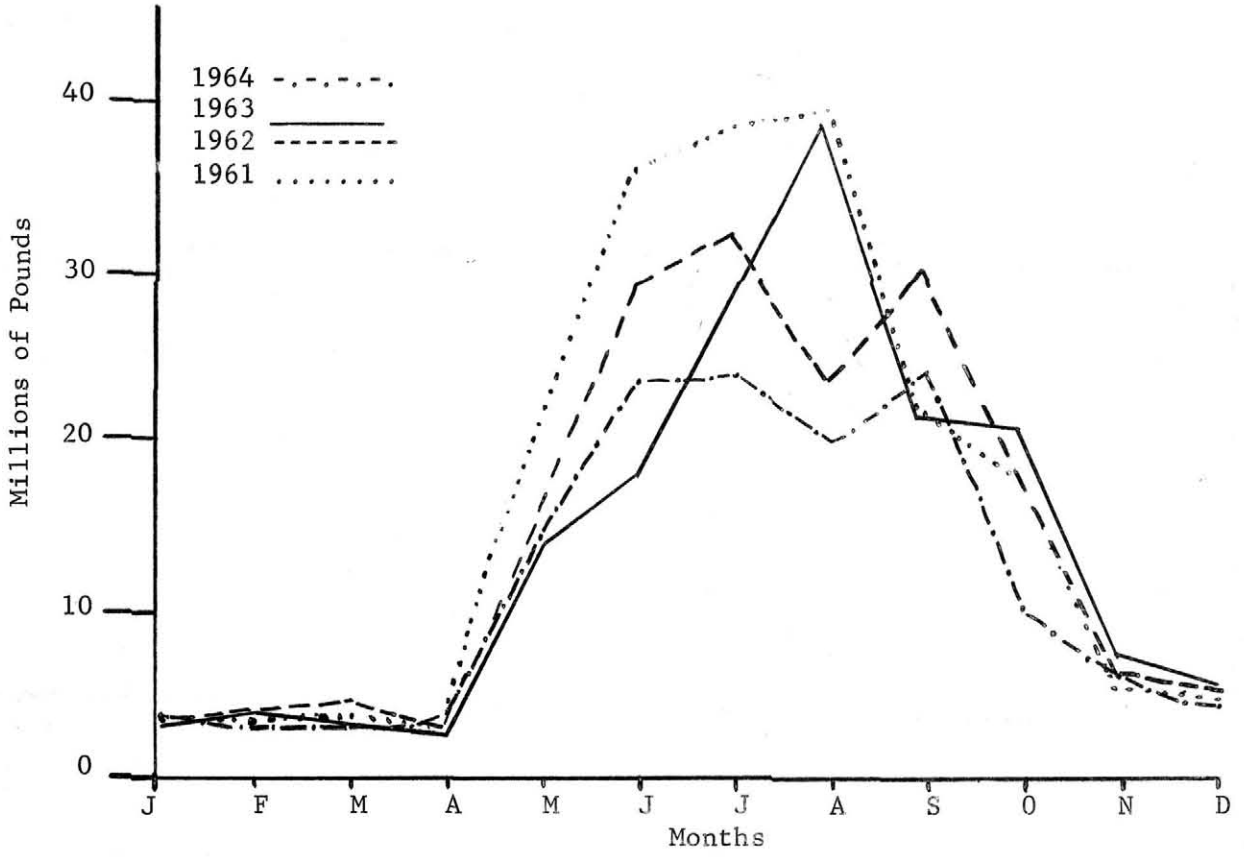

Figure 6
Texas Crab Landings 1964 Compared to Rainfall
Average Rainfall in Inches