Oyster Mortality Studies along the Texas Coast during 1966

Project: MO-R-8

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ABSTRACT

Mortality studies among groups of seed and market oysters (Crassostrea virginica) were conducted in Aransas, San Antonio, Matagorda and Galveston Bays. In general, death rates were low in winter, increased in spring, dropped in early summer and rose to late summer or early fall peaks.

Spring flooding reduced salinity along the coast and apparently eliminated, or retarded, infection from the Aransas Bay disease organism (ABO). Mortality rates were low among all stocks except those in Matagorda Bay where high death rates were associated with Dermocystidium infection. Dermocystidium was also present in San Antonio and Galveston Bays but was not found in Aransas Bay until late in the year.

Predation by the southern oyster drill (Thais haemastoma) was a factor in spring and summer mortality in Galveston and Matagorda Bays.

INTRODUCTION

Studies of mortality among various stocks of oysters (Crassostrea virginica) have been conducted along the Texas coast since 1962. Initially, such studies were confined to Aransas and Galveston Bays in cooperation with Dr. J. G. Mackin of Texas A & M University and were designed to furnish information on disease organisms present and their effects upon the oyster population (Heffernan, 1964; Hofstetter, 1965a). Massive mortality among Aransas Bay oysters during 1963 and 1964 was first detected in the tray study and found (by Dr. Mackin) to be caused by a hitherto unreported organism. Subsequent studies in Aransas, Matagorda and Galveston Bays investigated the incidence of both "Aransas Bay disease" and Dermocystidium and compared mortality rates among oysters of different sizes or oysters transplanted from different bay areas (Hofstetter, Heffernan and King, 1966).

During 1966 mortality studies were continued in the three estuaries and expanded to include San Antonio Bay where severe mortality had been detected in recent years (Childress, 1965; Hofstetter, 1965b). In Aransas Bay survival of oysters transplanted from Galveston Bay and South Bay to an area of epidemic "Aransas Bay disease" were compared. In the other areas, death rates among seed and market oysters were investigated. Results of these studies are summarized below.

STATION LOCATION

Locations of the oyster stations within each estuary are shown in Figure 1. Station 1 (Halfmoon) in Aransas Bay was one of two stations in use since 1962 located in an area of high ABO (Aransas Bay organism) infection. Stations 2 (Chicken Foot) and 3 (Mosquito Point) in San Antonio Bay were located in

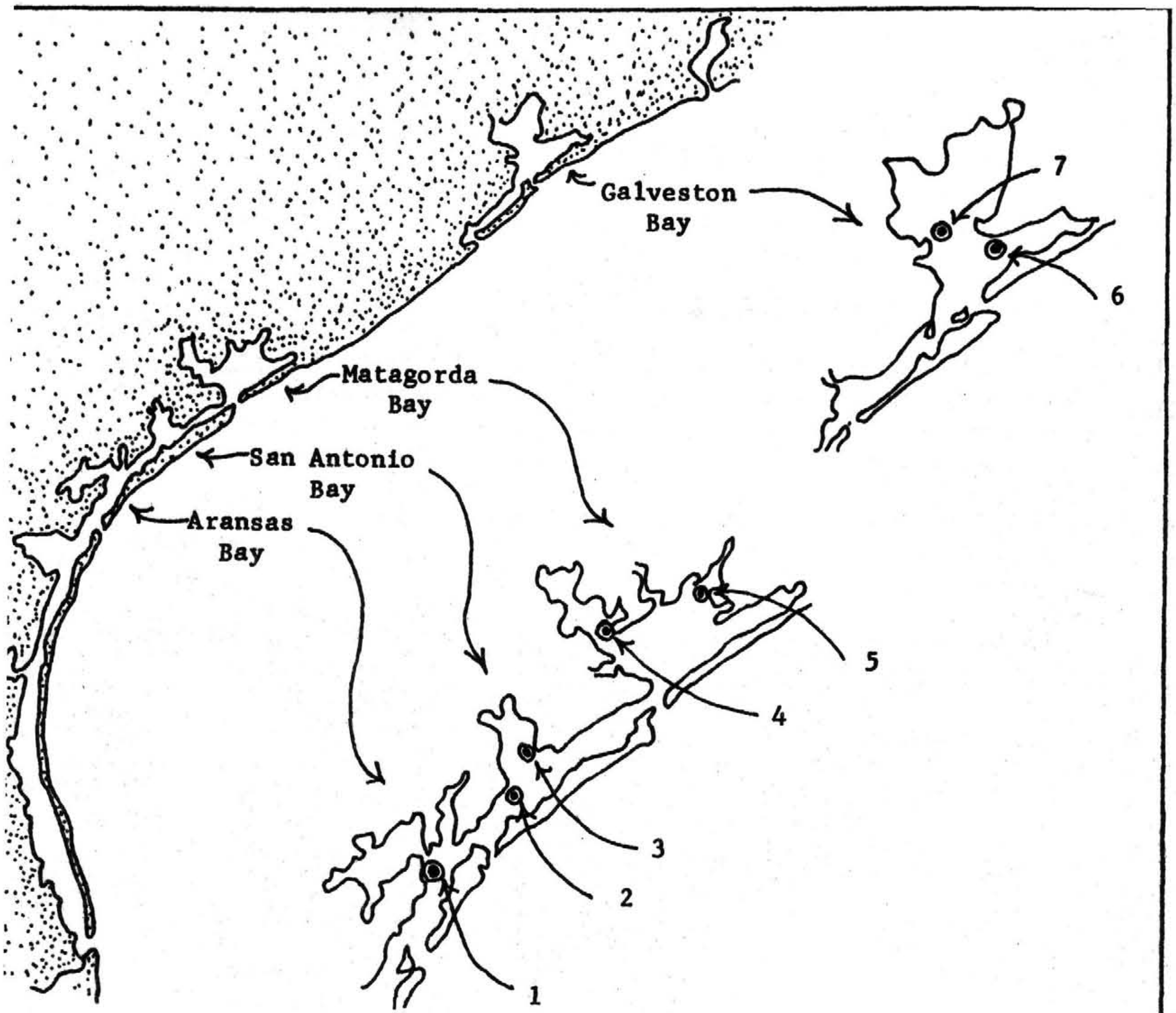


Figure 1: Outline of Texas Coast showing location of oyster stations in Aransas, San Antonio, Matagorda and Galveston Bays.

Station 1. Half Moon
2. Chicken Foot
3. Mosquito Point
4. Sand Point
5. Coon Island
6. Hanna
7. Switchover

areas possibly subject to ABO infection as well as heavy Dermocystidium infection. Stations 4 (Sand Point) and 5 (Coon Island) in Matagorda Bay were located in areas of heavy Dermocystidium infection as well as confirmed ABO infection. Stations 6 (Hanna) and 7 (Switchover) in Galveston Bay were established in 1963 in Dermocystidium endemic areas with no known history of ABO infection.

METHODS

The Aransas Bay station was stocked with seed oysters obtained from South Bay and from Galveston Bay. Stations in San Antonio Bay and Matagorda Bay were stocked with seed and market oysters obtained locally. Galveston Bay stations contained groups of oysters originally stocked in 1965 and designated as "spat", "small", "medium" and "large" according to stocking size.

All oysters were held in vinyl-coated metal trays, 32-inches long, 18-inches wide and 4-inches deep, covered with galvanized hardware cloth (1/8 to 1/2 inch mesh depending upon oyster size). Trays containing small oysters were also lined with hardware cloth.

Stations were visited at least monthly. Dead oysters (boxes and gapers) were removed and measured at each station visit while live oysters were measured at irregular intervals. All measurements were made along the dorso-ventral axis on the right valve and reported to the nearest millimeter.

Gaper tissue sections were cultured in fluid thioglycollate medium containing Chloromycetin and Mycostatin to determine Dermocystidium infection. Tissues were fixed in Zenker-acetic and preserved in 70 per cent isopropyl alcohol for further study. Live oysters were also collected and processed in the same manner.

Death rates were calculated as per cent per month. That is, the percentage of oysters alive at the beginning of each month that died during that month.

RESULTS

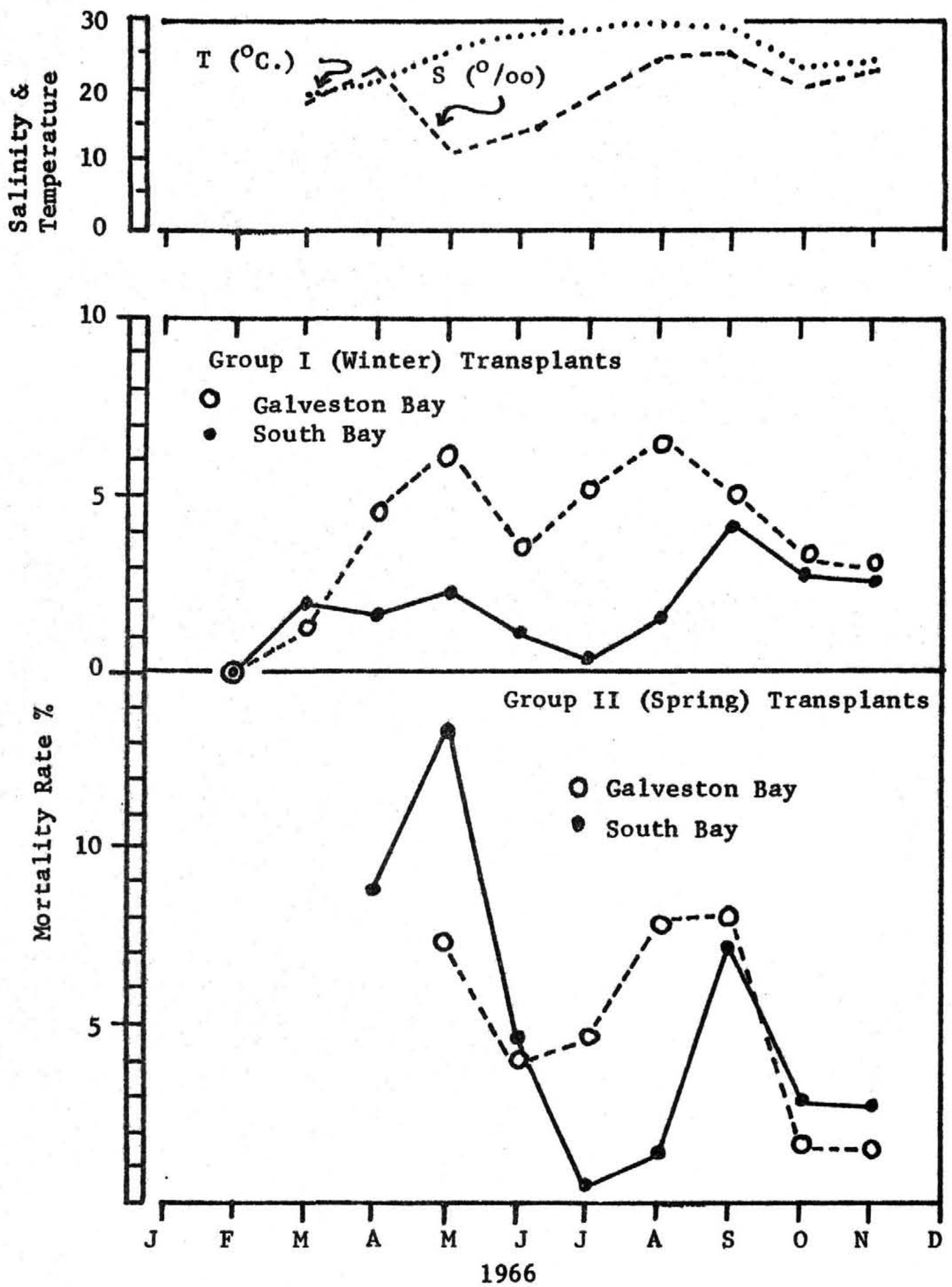
Aransas Bay

Comparison of mortality among oysters transplanted from several bays in 1965 indicated better survival among South Bay oysters and, to a lesser extent, among Galveston Bay oysters (Hofstetter, Heffernan and King, 1966). Seed stock from both areas were therefore selected for further study. Originally, transplants were planned at quarterly intervals to compare seasonal mortality but the winter and spring transplants experienced such low mortality that summer and fall transplants were cancelled.

Winter transplants (January) consisted of 265 South Bay oysters and 343 Galveston Bay oysters. Spring transplants consisted of 285 South Bay oysters (March) and 303 Galveston Bay oysters (May). Monthly mortality rates among the winter transplants (Group I) and spring transplants (Group II) are shown in Figure 2.

Among the Galveston Bay winter transplants, peak mortality occurred in August with a slightly smaller peak in May. South Bay oysters suffered less mortality throughout the period with maximum death rates in September and a

Figure 2: Monthly mortality rates (%) among oysters from Galveston Bay and South Bay transplanted to Aransas Bay in winter (Group I) and spring (Group II), 1966.



minor peak in May. A definite summer decrease in death rates was noted among both groups; in June among Galveston stocks, July among South Bay stocks.

Mortality among the spring transplants of both groups was higher than that among the winter transplants. Spring peaks in May were due, in part, to culling and handling losses but coincided with spring peaks among the Group I stocks. Peak summer death rates generally coincided with peak rates among the Group I stocks although mortality was highest in September, rather than August, in the Galveston Group II stock. Again, a definite decrease in death rate occurred during the summer in June or July, coinciding with the summer drop among Group I stocks.

Salinity, which had begun to increase in April, dropped rapidly in May due to heavy rainfall. Although salinity gradually increased to a peak in August-September, it remained below 25 parts per thousand throughout the year.

It is not known whether "Aransas Bay disease" was present, but if so, it had slight effect upon the stocks. Dermocystidium, although initially present among Galveston Bay oysters, was not detected among the transplants until November (when a light infection among South Bay oysters was reported). Aransas Bay oysters increased in abundance during the year following a heavy spat set. Thus the local population, like the transplanted stock, was not subject to high mortality characteristic of ABO infection.

San Antonio Bay

Mosquito Point station was stocked in April with 215 seed oysters and 228 market oysters while the Chicken Foot station was stocked in August with 215 seed oysters and 235 market oysters. All oysters were obtained from local reefs. Monthly death rates among the stocks at both stations are shown in Figure 3.

Mortality at Mosquito Point station was low with peak death rates occurring late in the year (October among seed stock, November among market stock). Seed oysters suffered higher mortality than did market stock. Mortality was greater among both groups at Chicken Foot station with peak death rates occurring in September. Unlike the Mosquito Point stocks, mortality was higher among market oysters than seed oysters.

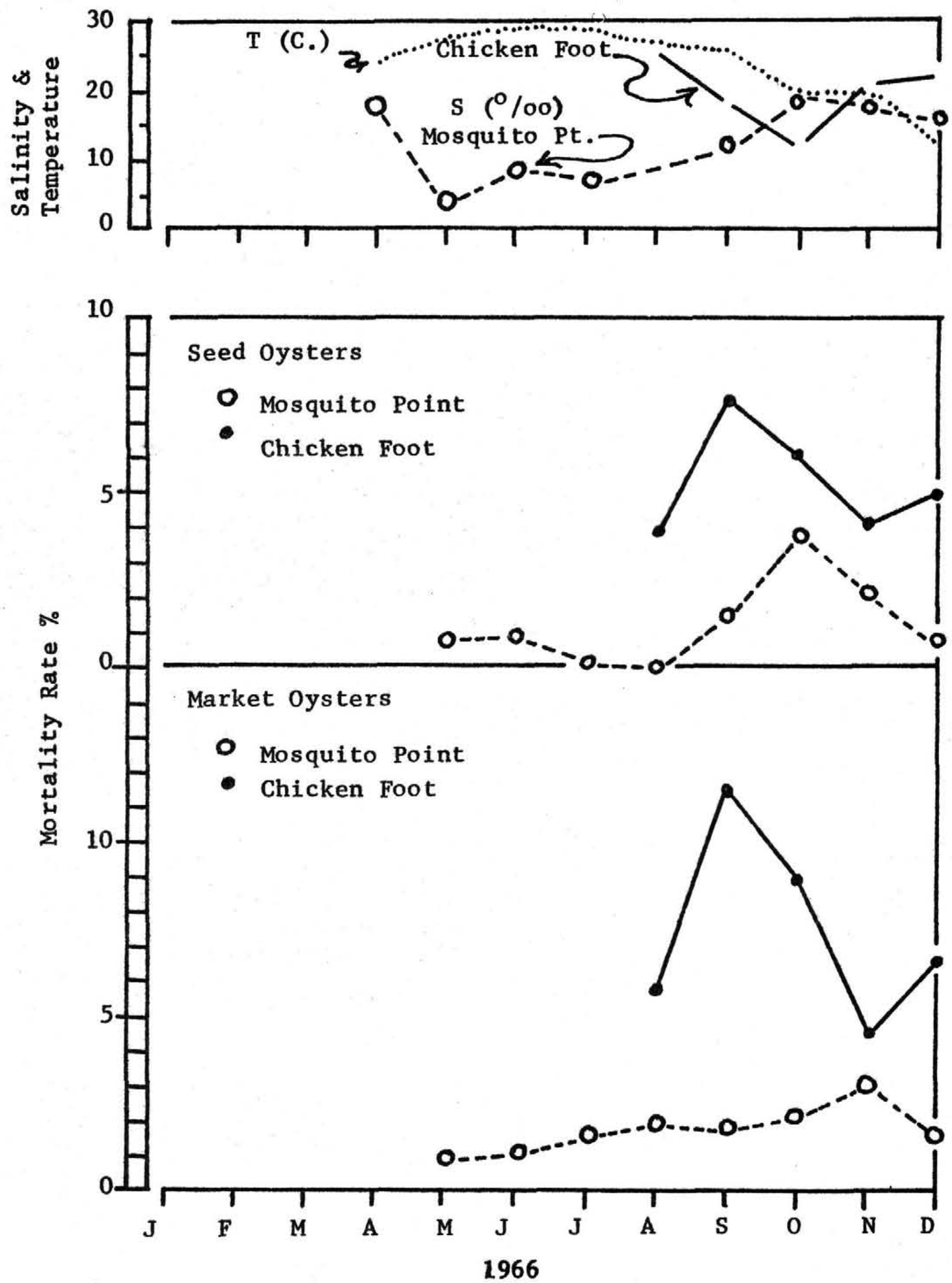
Peak death rates among Mosquito Point stocks occurred when salinity ranged above 15 parts per thousand. At Chicken Foot station, the peak summer death rate occurred earlier, while salinity decreased, but a month after maximum salinity was recorded. Early winter mortality increased at Chicken Foot station along with salinity but decreased at Mosquito Point station, coinciding with a decrease in salinity.

Dermocystidium was present among stocks at both stations (Table 1) but the infection incidence was light at Mosquito Point. Maximum (moderate) infections among Chicken Foot oysters were found in October and November.

Matagorda Bay

Both the Coon Island and Sand Point stations were stocked in March with approximately 200 seed oysters and 200 market oysters obtained from Tres Palacios Bay. Monthly death rates among stocks at both stations are shown in Figure 4.

Figure 3: Monthly mortality rates (%) among seed and market oysters at Mosquito Point and Chicken Foot stations in San Antonio Bay during 1966.



Mortality cycles among Coon Island seed and market oysters were similar with light to moderate death rates in spring decreasing to a low in June. Late summer peaks, higher among market oysters, occurred in August-September.

At Sand Point, however, death rates among seed stock increased from April through July, dropped in August, and rose sharply in September and October. Only ten seed oysters survived through October. Mortality among market oysters increased from May through September with a sharp drop in October and November. Unlike seed stock, no late summer drop in death rate occurred among the market stock.

The incidence of Dermocystidium infection remained above epidemic levels among seed and market stocks at both stations throughout most of the year but generally attained higher levels at Sand Point (Table 2). The infection incidence among Coon Island seed and market stocks decreased in July and August without a corresponding decrease in death rate. The incidence among Sand Point seed oysters dropped in July (a month before the drop in death rate) and rose to a maximum in August (a month before the peak death rate). Sand Point market stocks were moderately to heavily infected from May through October without an early summer drop.

Death rates at both stations coincided more closely with water temperature changes than salinity, with maximum mortality occurring when temperature was high and decreasing as the water cooled. However, maximum mortality also coincided with, or followed, maximum salinity.

At Sand Point station, the southern oyster drill (Thais haemastoma) was abundant during the spring, especially among the seed oysters and was undoubtedly responsible for a percentage of the spring mortality. The drill was not found at the Coon Island station.

Galveston Bay

Both Hanna and Switchover stations had been stocked in April, 1965 with groups of oysters designated as "small" (31-60 mm in height), "medium" (61-90 mm high) and "large" (over 100 mm in height). In August 1965, year class spat from the May set were also stocked. Survivors of these four groups (approximately 1800 oysters) were observed through a second year. Monthly death rates among the groups are shown in Figure 5.

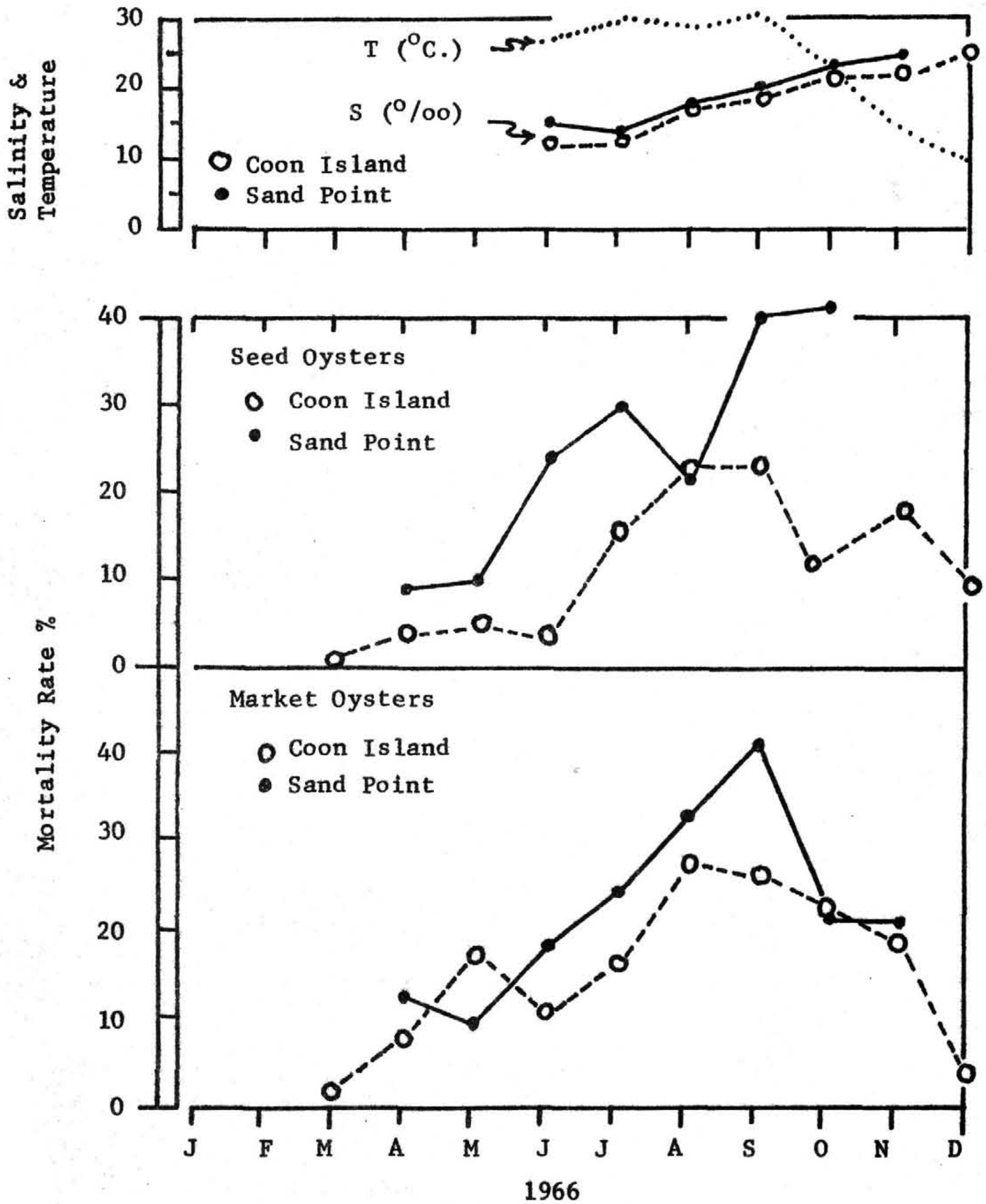
In spring and early summer, death rates among the 1965 spat were low at both stations but increased in late summer or early fall. Mortality was less among Hanna spat than among the Switchover spat.

Spring mortality among the small and medium groups at Switchover reached a peak in May with a slight decrease in June. Death rates increased in summer to a peak in September, dropped in October, and rose in November and December. Among the Hanna groups, spring mortality was highest in March or April with a summer low in June and a late summer peak in September-October. The small group death rate increased in December but the medium group death rate continued to decline after October.

Death rates among the large oyster groups were erratic, probably due to the small number (less than one hundred). At Switchover, spring mortality was absent. Deaths began in June, reaching a peak in September. At Hanna, low mortality peaks occurred at the end of the winter, spring and summer quarters (March, June and September). No deaths were found in November and December.

Figure 4: Monthly mortality rate (%) among seed and market oysters at Coon Island and Sand Point stations in Matagorda Bay during 1966.

Note change in mortality rate scale.



(Table 3). Switchover spat were only lightly infected throughout the year with the highest incidence (1.2) in December. Hanna spat, however, were moderately infected in summer (August) and carried light to moderate infections through fall. Small and medium oyster groups, which were lightly infected in spring and early summer, became moderately infected in late summer. Medium oysters carried moderate infection through December. Light infections occurred among the large oyster group at Switchover during spring and summer, increasing to heavy infections in the fall. Light winter infections among the Hanna large oyster group increased to moderate to heavy in summer and moderate in the fall.

Reduced salinity in early summer resulting from spring flooding on the Trinity River did not appear to alter the seasonal cycle of spring and late summer mortality peaks. However, peak death rates among most size groups were less than those observed in previous years.

The southern oyster drill was active at the Hanna station in spring and in late summer in spite of low salinity and was a complicating factor in mortality. Predation among the small and medium oyster groups was more severe than predation among either the spat or the large oyster groups.

DISCUSSION

Although differences existed in the onset and intensity of mortality among the oyster stocks, general cycles were similar with low death rates in winter, moderate increases in spring followed by a marked decrease in early summer before rising to late summer peaks.

Until tissue sections obtained from each study had been examined, the presence of "Aransas Bay disease" cannot be verified. However, the low mortality among Aransas Bay oysters indicated that ABO infection was retarded, if not eliminated. Dermocystidium apparently did not begin to infect oysters until late in the year. As a result the Aransas Bay oyster population, for the first time in several years, began to increase to a level sufficient to support a fishery. In San Antonio Bay as well, little mortality occurred among the oyster stocks (even though Dermocystidium was present) and the population level increased

Mortality rates among Matagorda Bay oysters were the highest observed, approaching those associated with ABO infection but evidently caused by Dermocystidium alone. Reasons for the virulence of Dermocystidium infection among Matagorda oyster stocks are not known.

In Galveston Bay similar groups of oysters were followed in 1963-64 and 1965-66, permitting comparison of mortality rates (Figure 6). Histograms represent total mortality during each quarter. Bars above the histograms represent total mortality during comparable periods (spring, summer and fall quarters). Mortality rates in 1965-66 are based upon the small, medium and large oyster groups only since these were comparable in size to oysters used in the 1963-64 study.

At Switchover, total mortality during the spring, summer and fall seasons declined from 1963 through 1966. Spring and summer death rates decreased from 1964 through 1966 but fall death rates increased. Except in 1964, peak deaths occurred during the summer.

At Hanna, total mortality increased from 1963 through 1964, gradually decreased in 1965, and dropped sharply in 1966. Peak death rates occurred each summer although deaths in spring, 1965 were only slightly lower than

Figure 5: Monthly mortality rate (%) among four size groups of oysters at Hanna and Switchover stations in Galveston Bay during 1966.

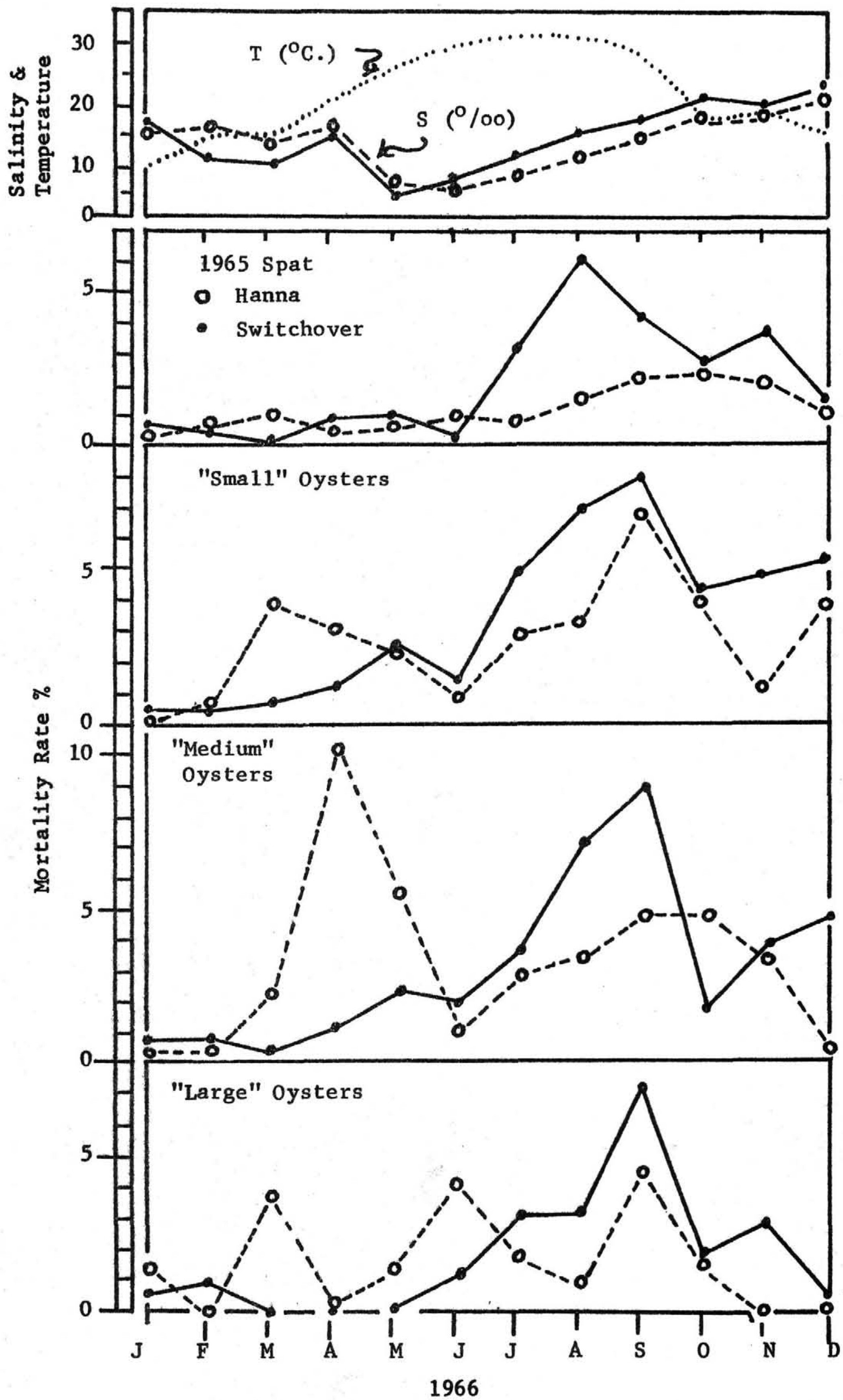
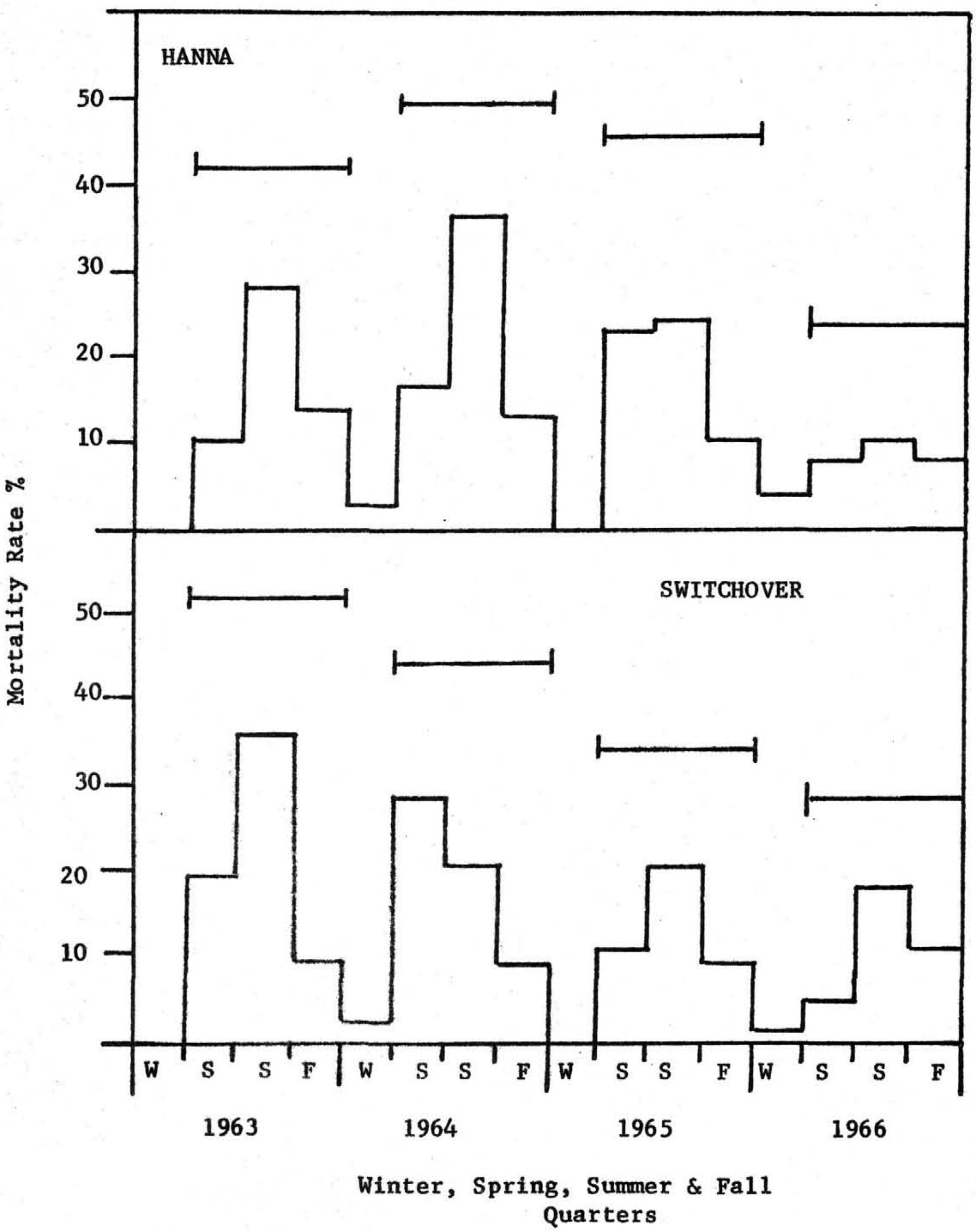


Figure 6: Comparison of quarterly death rates among similar groups of oysters at Hanna and Switchover stations in Galveston Bay during 1963-64 and 1965-66. Bars above the histograms represent total mortality during the spring, summer and fall quarters of each year.



LITERATURE CITED

dress, U. R. 1965. Study of oyster growth and population structure in San Antonio and Espiritu Santo Bays. Coastal Fisheries Project Reports (1964), Texas Parks & Wildlife Dept.

ernan, Thomas L. 1964. Survey of oyster diseases in Aransas Bay. Coastal Fisheries Project Reports (1963), Texas Parks & Wildlife Dept.

tetter, R. P. 1965a. Survey of oyster diseases in the Galveston Bay area. Coastal Fisheries Project Reports (1964), Texas Parks & Wildlife Dept.

tetter, R. P. 1965b. A summary of oyster studies along the Texas Coast. Coastal Fisheries Project Reports (1964), Texas Parks & Wildlife Dept.

tetter, R. P., Thomas L. Heffernan & B. D. King III. 1966. Oyster mortality studies along the Texas Coast. Coastal Fisheries Project Reports (1965), Texas Parks & Wildlife Dept.

Table 1: Incidence of Dermocystidium marinum infection among seed and market oysters at Mosquito Point and Chicken Foot stations in San Antonio Bay during 1966.

	STATION			
	MOSQUITO POINT		CHICKEN FOOT	
MONTH	SEED	MARKET	SEED	MARKET
1				
2				
3				
4				
5	0.0	0.0		
6	0.0	0.2		
7	0.2	0.1		
8	-	-	0.4	1.4
9	0.1	1.0	1.2	1.4
10	0.1	0.3	2.2	2.4
11	0	1.0	2.4	2.2
12	0.1	1.0	0.5	0.3

Table 2: Incidence of Dermocystidium marinum infection among seed and market oysters at Coon Island and Sand Point stations in Matagorda Bay during 1966.

	STATION			
	COON ISLAND		SAND POINT	
MONTH	SEED	MARKET	SEED	MARKET
1				
2				
3	0.4	1.5	1.7	1.0
4	-	-	-	-
5	-	-	-	3.5
6	2.3	3.5	4.0	5.0
7	1.0	3.5	0.8	5.0
8	3.0	0.5	5.0	5.0
9	2.5	3.0	3.0	3.5
10	1.7	2.0	2.8	3.8
11	2.0	3.0	-	1.5
12	-	-	-	-

Table 3: Incidence of Dermocystidium marinum among live oysters at Switchover and Hanna stations in Galveston Bay during 1966.

	STATION							
	SWITCHOVER				HANNA			
MONTH	SPAT	SMALL	MEDIUM	LARGE	SPAT	SMALL	MEDIUM	LARGE
1	0.5	1.4	3.0	2.1	0.7	1.9	2.6	2.3
2	0.5	1.7	0.8	1.0	0	1.0	1.0	1.0
3	-	-	-	-	0	0.5	0.5	0
4	-	-	-	-	-	-	-	-
5	0.8	0.4	0.5	0.2	-	-	-	-
6	-	-	-	-	0	1.0	2.2	3.0
7	-	-	-	-	-	-	-	-
8	0.8	3.7	3.0	0.5	3.2	3.1	3.2	5.0
9	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-
12	1.2	1.4	3.0	5.0	1.5	2.6	3.3	3.5