Acc# 2120

Study of the oyster (Crassostrea virginica) population along the Texas Coast.

Project: MO-R-7

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## ABSTRACT

Reef sampling was continued in Galveston, Matagorda and San Antonio Bays to study trends in the oyster (Crassostrea virginica) population. In Galveston Bay a continued decline in spat and seed oyster stock occurred, with a lesser decline in market oyster stock. Matagorda Bay oyster stocks, which had suffered extensive mortality in 1964, showed only slight recovery. In San Antonio Bay, the oyster population in the central bay, which had been decimated by disease in 1964, increased in abundance, but oyster stocks in the lower bay area diminished.

Spring and late summer mortalities were common in all areas sampled. Generally, summer mortalities exceeded those in spring. Dermocystidium marinum infections were high in Galveston Bay but low, or negative, in other areas. The presence of ABO ("Aransas Bay Organism") was suspected in Matagorda Bay and San Antonio Bay but was not confirmed.

In spite of declining oyster stocks, the 1965-66 harvest set a new record of over four million pounds. As in past years, almost all of the harvest came from Galveston Bay.

## INTRODUCTION

Sampling of the oyster population on major commercial reefs within several Texas bay systems has been conducted for a number of years. Objectives of the sampling program have been to determine changes in the oyster population and the possible effects such changes might have upon the oyster fishery. This program has provided the basis for recommendations on oyster harvest regulations.

Oyster samples were, in past years, regularly collected in South Bay, Aransas Bay, San Antonio Bay, Matagorda Bay and Galveston Bay. Continual sampling in South Bay did not appear to be warranted by the small, local fishery and was dropped in 1964. Heavy mortalities among oysters of all size classes in Aransas Bay, beginning in 1962-63, resulted in an almost total loss of harvestable stocks. Reef sampling was discontinued in 1964, but oyster stocks were monitored by means of tray stations. Sampling was continued in San Antonio and Matagorda Bays through 1965 although oysters in both areas, subject to heavy mortalities within the past two years, have been of minor importance in the overall oyster harvest. In Galveston Bay, increased fishing pressure, and increased harvests, during recent years fully justified a continuation of sampling routine.

This report summarizes reef sampling data collected in Galveston, Matagorda and San Antonio Bays during 1965.

## DISCRIPTION OF SAMPLE AREAS

General locations of all reef sample stations are shown in Figure 1. Galveston Bay stations included Hanna Reef (Station 1), a barrier-type reef across the mouth of East Bay; Todd's Dump (Station 2), Red Fish Reef (Station 3) and Bart's Pass (Station 4) representing segments of Red Fish Bar extending across mid-Galveston Bay from Eagle Point to Smith Point; Scott's Reef (Station 5) in upper Galveston Bay; and Beasley's Reef (Station 6) in Trinity Bay. Scott's Reef and Beasley's Reef were located in areas closed to oystering because of possible sewage pollution.

Matagorda Bay stations included Middle Ground Reef (Station 7) near the mouth of Tres Palacios Bay; Gadwall Reef (Station 8), an artificial oyster reef constructed in 1961 off Well Point; and Sand Point Reef (Station 9) at the mouth of Lavaca Bay.

San Antonio Bay stations included Mosquito Point Reef (Station 10) in the central bay near the eastern shore; Josephine Reef (Station 11) in Espiritu Santo Bay; Panther Point Reef (Station 12) and Chicken Foot Reef (Station 13) in lower San Antonio Bay.

## METHODS

Oyster samples, consisting of one or more bushels (2150 cubic inches) of unculled oysters and shell, were dredged at intervals (generally monthly) throughout the year. All live oysters were culled and measured to the nearest millimeter along the dorso-ventral axis on the right valve (height). The oysters were grouped into spat, seed and market categories based upon size. Spat included oysters 1 mm to 25 mm in height; seed oysters ranged from 26 mm to 75 mm; and market oysters ranged from 76 mm to 175 mm.

In Matagorda Bay, oyster spat were not counted because of the large number of Gulf oysters (Ostrea equestris) present. To obtain an estimate of the spat set, plastic collectors were tried. The collectors consisted of twelve 2-inch squares of green plastic (Sears lawn edging) strung horizontally on monel wire with 1-inch lengths of plastic tubing between the squares as spacers. The collectors were anchored to the bottom with the lower plate approximately twelve inches off the bottom, held upright by fastening the wire to a stake or piling, and remained in the water for one month. The brick anchors were found to collect more spat than the plastic squares, and plate counts were not considered reliable estimates of setting intensity.

Ten market oysters from each reef sample were selected for determination of Dermocystidium marinum infection. Rectal tissues were cultured in fluid thioglycollate medium containing Mycostatin and Chloromycetin, stained in Lugol's iodine solution and examined. The weighted incidence of Dermocystidium infection was determined using a numerical system grading from 0 for negative infections to 5 for heavy infections (Mackin, 1961).

Water samples were collected at each station visit for determination of temperature and salinity (by hydrometer, titration or refractometer). Organisms associated with oysters were noted with particular attention given to predators.

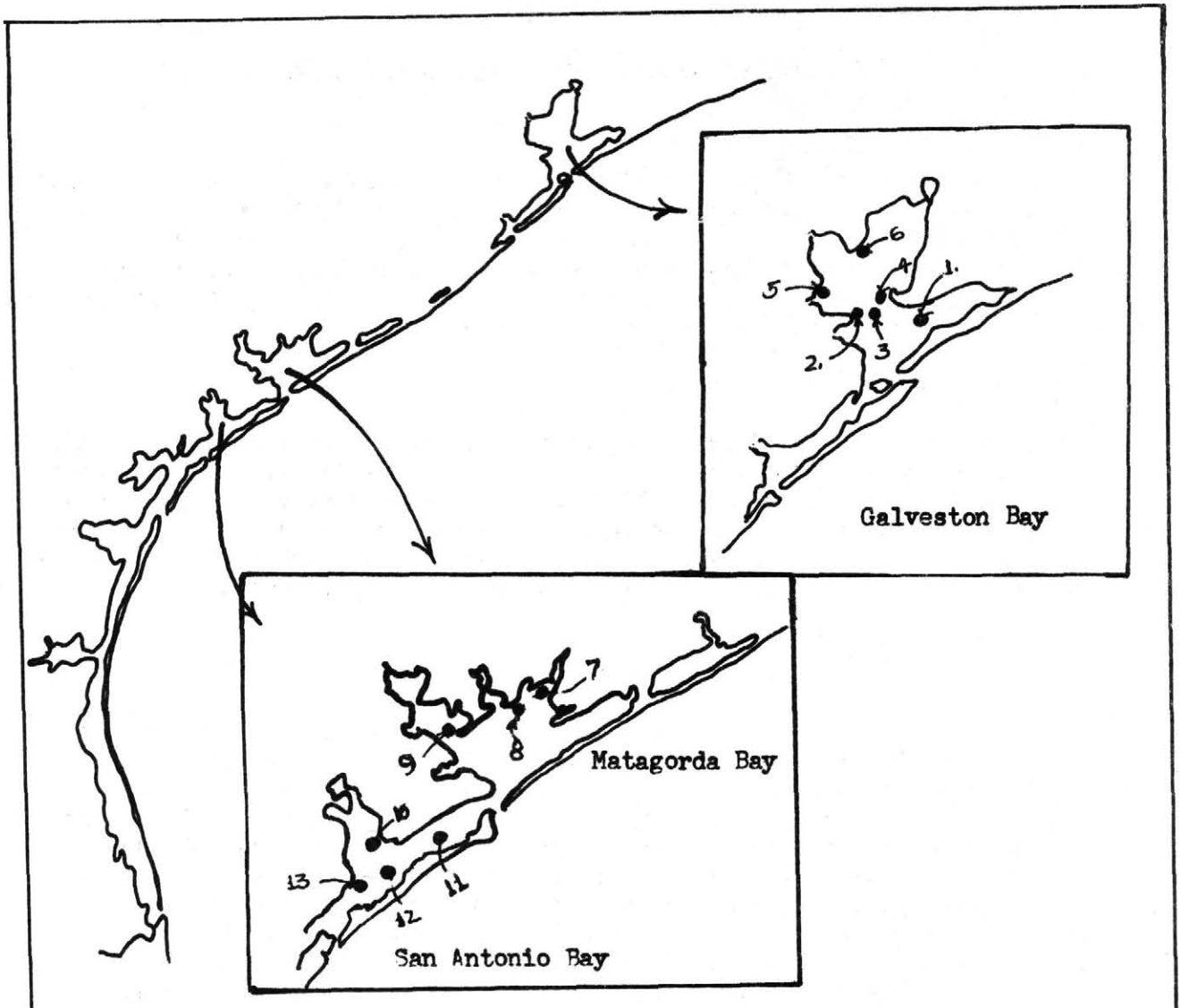


FIGURE 1: Outline of Texas Coast showing location of reef sample stations in Galveston, Matagorda and San Antonio Bays.

Galveston Bay: Station 1 = Hanna Reef
2 = Todd's Dump
3 = Red Fish Reef
4 = Bart's Pass
5 = Scott's Reef
6 = Beasley's Reef

Matagorda Bay
Station 7 = Middle Ground Reef
8 = Gadwall Reef
9 = Sand Point Reef

San Antonio Bay
Station 10 = Mosquito Point Reef
11 = Josephine Reef
12 = Panther Point Reef
13 = Chicken Foot Reef

## RESULTS

### Oyster Population Trends in Galveston Bay

Hanna Reef:

Spat present at the beginning of the year were survivors of the late fall set in 1964 (Table 1). Two setting periods occurred in 1965; one in spring (May-June), the other in fall (September-October). Both sets were very light and survival was poor as indicated by the decline in seed stock after May. Market oysters were most abundant in the June sample, declining steadily thereafter. Few oysters of any size remained in December.

Todd's Dump:

The 1965 spat set was first observed in late May, reaching peak abundance in the July sample with a minor fall set in October (Table 2). Although spat were more abundant in 1965 than in 1964, decreasing seed stock in late summer indicated poorer survival of the spring set. Market oyster stocks fluctuated slightly from January through August but increased in September through recruitment of seed oysters. Generally market stocks were less abundant in 1965 than in 1964.

Red Fish Reef:

Spat setting began in late May, reaching peak abundance in June with a second set appearing in October (Table 3). Seed oysters, which had been abundant at the beginning of the year, declined to a low in August but increased during the fall and winter indicating better survival among the fall-set spat than among the spring-set spat. Market oysters, which were least abundant in summer and fall samples, increased noticeably in November. Possibly, heavy fishing pressure in the area broke up oyster clusters, making oysters more available to the relatively light sample dredge. However, recruitment of seed stock during this period increased the number of small market oysters. In general, seed and market stocks were less abundant in 1965 than in 1964.

Bart's Pass:

Although the spring spat set was negligible, the fall set was the most abundant of any reef sampled and exceeded the 1964 fall set (Table 4). Seed oyster stock, which was abundant at the beginning of the year due to recruitment of the 1964 set, declined to a low in July. Recruitment of the 1965 set resulted in an increase in seed stock during fall and winter. Market oysters were abundant throughout the year but tended to decline in late fall and early winter. Market stocks were more abundant in 1965 than in 1964.

Scott's Reef:

A light spat set was observed in June with negligible setting thereafter (Table 5). Seed oyster stock, which had been declining since late summer 1964, began to increase as the 1965 set was recruited. Market oyster stocks were less abundant than in 1964 and tended to decrease during the fall and winter.

Beasley's Reef:

Unlike 1964, a light spring set was observed in June, reaching peak abundance in the July sample (Table 6). A second setting period was found in October. Seed stock, which was low in July, increased in late summer through recruitment of the spring set. Market oysters were more abundant in spring and summer, declining slightly during the fall and winter. Market stocks were generally less abundant in 1965 than in 1964.

## Oyster Population Trends in Matagorda Bay

Middle Ground Reef:

A light spat set was observed in June but a fall set did not occur. Although spat were not counted in the population samples, it was apparent that the intense sets recorded in 1964 (Table 7) were not repeated. Seed oyster stock, which had been reduced considerably by late fall mortalities in 1964, began to increase in June and reached a peak in November. A recent mortality, as indicated by the number of fresh boxes, was found in December along with a slight reduction in seed stock. Market oysters were not collected from November, 1964 until September, 1965.

Gadwall Reef:

Spat setting was first noted in May with a moderate set in June. A light set was also observed in September. Survival of the 1965 set appeared to be poor since seed stock increased little by the end of the year (Table 8). Seed stock at the beginning of the year were survivors of the heavy sets in 1964 and consisted largely of Ostrea equestris (estimated 95 percent). Market oysters, which had suffered extensive mortalities in 1964, were not found after May.

Sand Point Reef:

A heavy spat set was observed in June followed by a minor setting peak in November. Survival appeared good as evidence by the increase in seed stock during summer and fall (Table 9). Market oyster stocks, which had begun to increase in late winter and early spring following the 1964 mortalities, became scarce after April.

## Oyster Population Trends in San Antonio Bay

Mosquito Point Reef:

A moderate spat set was observed in June and a minor setting period possibly occurred in the fall (Table 10). Seed oysters increased in samples after July indicating good survival of the 1965 set. Market oysters decreased in summer samples but increased in the fall as seed stock was recruited. Both seed and market stocks were more abundant in 1965 than in 1964.

Josephine Reef:

The large number of spat present in the March sample were remnants of a late fall set in 1964 (Table 11). Possibly, these included O. equestris which was reported from other reefs in the lower bay. A moderate spat set was found in July but no oysters could be found in September and the station was discontinued.

Panther Point Reef:

Spat found in late winter-early spring were remnants of a heavy fall set in 1964 including a large number of O. equestris (Table 12). Apparently a spring setting peak did not occur but a light set was found in October. Seed stock declined in summer but increased in late fall through recruitment of the 1965 spat. Market oysters, which had disappeared from the 1964 samples, were not found in 1965.

Chicken Foot Reef:

Winter spat stocks were remnants of the late 1964 set including O. equestris. The spring set appeared to be negligible (Table 13); possibly peak setting occured in the fall (as indicated by the September sample). Seed stock decreased in August and there was no appreciable recruitment from the late spat sets. Market oysters, which had disappeared abruptly in spring, 1964, were scarce throughout much of the year but increased in the fall.

## Oyster Mortality

Galveston Bay:

Reduction in seed oyster stock during spring and early summer and losses among market oyster stock in late summer were indicative of mortality cycles. These periods coincided with cycles in the intensity of Dermocystidium infections which generally increased in April or May, dropped in June, and increased to summer or early fall peaks (Table 14). Tray studies at Hanna Reef and Switchover Reef (Todd's Dump) showed similar patterns of mortality among seed and market stocks with a minor peak in spring and a major peak in late summer (Hofstetter, Heffernan and King, 1966). Most of the mortality among tray stock was attributed to D. marinum. In view of the high infection incidences among oysters on all reefs sampled, it is believed that Dermocystidium was the major cause of mortality within Galveston Bay.

However, predation by the conch (Thais haemastoma) was a contributing factor in spring mortalities at the Hanna tray station and was believed to be a major cause of spat and seed losses on Hanna Reef. The conch was also present on Red Fish Reef and undoubtedly contributed to oyster losses in that area. Fresh water, from spring flooding on the Trinity River, was also responsible for losses among oysters within a limited area in upper Trinity Bay.

Matagorda Bay:

Decreases in sample abundance of seed and market oysters on Gadwall Reef and Sand Point Reef in late spring or early summer (Tables 8, 9) were indicative of high mortality periods. Dermocystidium infections were negative or very light (Table 15) and were not believed to be a contributing factor. The presence of ABO was suspected but not confirmed. The presence of fresh boxes on Middle Ground Reef in December coincided with a high November mortality among seed and market oysters at Coon Island tray station a few miles away (Hofstetter, Heffernan and King, 1966). As yet, the causative organism has not been determined.

Fall mortalities among seed stock at Sand Point Reef (September through November) were believed due to predation by the conch which had become very common on the reef during the year.

San Antonio Bay:

Mortalities among all oyster groups were indicated in spring in lower San Antonio Bay (Panther Point Reef) and in Espiritu Santo Bay (Josephine Reef) but apparently did not occur in the central bay (Mosquito Point Reef) nor in the lower western bay (Chicken Foot Reef). Very light infections of Dermocystidium were found among oysters in the central and lower bay areas during spring and summer but were not found at Josephine Reef (Table 16). All areas exhibited summer mortalities but these were most extensive in Espiritu Santo Bay and lower San Antonio Bay. Dermocystidium was not found in any sample after June. The presence of ABO was suspected in spring and summer mortalities but was not confirmed.

## The Oyster Harvest

In Galveston Bay a record harvest of over 4.3 million pounds of oyster meat was reported during the 1965-66 season (November through March) representing 89 per cent of the total Texas catch (Table 17). Most of the harvest was taken from the Red Fish Bar complex in mid-Galveston Bay, primarily from Bart's Pass and south Red Fish Reef. East Bay reefs contributed heavily to the fishery toward the end of the season. Spoil banks along the Houston Ship Channel between Beacons 59-60 and 63-64 were also heavily fished during the final weeks of the season. The drop in production during February was due chiefly to bad weather which curtailed fishing, but a decline in the quantity of oysters on the usual fishing grounds also occurred.

Production in Matagorda Bay was limited to East Matagorda Bay and Lavaca Bay. Closure of the season in Galveston Bay (April) stimulated the fishery in Lavaca Bay and many of the oysters were shipped to Galveston Bay processing plants.

Oystering in San Antonio Bay was limited to the upper bay area and most of the harvest was obtained by tonging. No oysters were available for harvest in Aransas Bay. South Bay produced a limited harvest; considerably less than that taken in past years.

## DISCUSSION

During recent years, oyster stocks along the Texas coast have decreased in abundance, as indicated by reef sampling (Hofstetter, 1964-1965). Losses have been most severe in the mid-coastal area (Aransas, San Antonio and Matagorda Bays) where the availability of harvestable oysters has been seriously curtailed. Losses have also occurred in Galveston Bay to a lesser extent and have generally been obscured by the large harvests.

The trend in abundance of oyster stocks within Galveston and Matagorda Bays during the four year period 1962-65 is illustrated in Table 18. The yearly indexes of abundance among spat, seed and market stock were prepared by averaging the number of oysters of each size group per month collected at all bay stations during June through December (when most data were available).

In Matagorda Bay spat increased in abundance through 1964 when extremely heavy sets were recorded. Although the 1964 set consisted largly of O.

equestris spat, the C. virginica set was the most abundant recorded in any bay system. Spat were not counted in 1965 but observed setting was much less abundant than that in the previous year.

Seed stock also increased from 1962 through 1963 but, in spite of heavy spat sets, declined sharply in 1964 and continued to decline in 1965. Market oysters declined continually fron 1962 through 1965 with the sharpest decline occurring in 1965, reflecting the onset of disease (probably ABO) which first appeared in late 1964. Increased harvests during the 1965-66 season were due to increased fishing effort in upper Lavaca Bay where stocks were apparently less affected by disease.

In Galveston Bay, spat (which never attained the magnitude of the Matagorda Bay sets) decreased in abundance throughout the four year period, with the sharpest decline between 1962 and 1963. Seed stock showed a similar trend with a sharp decline between 1963 and 1964. Market stock, however, were most abundant in the 1963 samples, decreasing markedly in 1964 with a lesser decline in 1965. The trend in market oyster abundance coincided with the trend in Dermocystidium incidence (Table 19) as indicated by the average monthly infection incidence during June through December of each year. The incidence was low in 1963 when market oyster stocks were most abundant, increased in 1964 when market losses were most noticeable, and dropped slightly in 1965 along with a slight reduction in market stock. However, the trend in infection did not coincide with the continual decline in spat and seed stock. Other factors controlling the setting and survival of spat were involved.

In spite of the apparent decline in oyster stocks, the harvest in Galveston Bay increased considerably, establishing a new record in production each succeeding year. Record harvests were due, in part to a reduction in legal size limit from 3 1/2 inches to 3 inches (beginning in February, 1963) making more oysters available to the fishermen. However, the major cause was increased fishing pressure due to poor harvests along the lower Texas coast and in Louisiana. There has, as yet, been no indication that oyster stocks in Galveston Bay have been over-exploited, and it appears that underfishing, rather than overfishing, has been the trend in recent years.

## LITERATURE CITED

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Table 1: Comparison of the number of spat, seed and market oysters per bushel sample collected at Hanna Reef during 1964 and 1965.

| MONTH | NUMBER OF OYSTERS PER BUSHEL | | | | | |
|---|---|---|---|---|---|---|
| | SPAT | | SEED | | MARKET | |
| | 1964 | 1965 | 1964 | 1965 | 1964 | 1965 |
| 1 | | 179 | | 80 | | 15 |
| 2 | | 94 | | 149 | | 9 |
| 3 | | 136 | | 154 | | 0 |
| 4 | | 26 | | 75 | | 16 |
| 5 | 20 | 18 | 109 | 102 | 19 | 25 |
| 6 | 136 | 44 | 81 | 38 | 18 | 31 |
| 7 | 211 | 2 | 46 | 19 | 13 | 21 |
| 8 | 160 | 2 | 34 | 10 | 7 | 10 |
| 9 | 189 | 34 | 35 | 6 | 11 | 10 |
| 10 | 385 | 16 | 64 | 5 | 12 | 2 |
| 11 | 230 | 5 | 63 | 6 | 5 | 3 |
| 12 | 264 | 4 | 79 | 10 | 9 | 0 |

Table 2: Comparison of the number of spat, seed and market oysters per bushel sample collected at Todd's Dump during 1964 and 1965.

| MONTH | NUMBER OF OYSTERS PER BUSHEL | | | | | |
|---|---|---|---|---|---|---|
| | SPAT | | SEED | | MARKET | |
| | 1964 | 1965 | 1964 | 1965 | 1964 | 1965 |
| 1 | | 9 | | 113 | | 19 |
| 2 | | 5 | | 59 | | 12 |
| 3 | | 5 | | 111 | | 24 |
| 4 | | 2 | | 41 | | 17 |
| 5 | 179 | 100 | 76 | 74 | 37 | 17 |
| 6 | 225 | 203 | 77 | 76 | 35 | 17 |
| 7 | 122 | 300 | 118 | 68 | 40 | 20 |
| 8 | 77 | 54 | 182 | 132 | 36 | 14 |
| 9 | 70 | 26 | 148 | 106 | 35 | 28 |
| 10 | 31 | 34 | 124 | 102 | 19 | 35 |
| 11 | 29 | 15 | 124 | 93 | 25 | 28 |
| 12 | 14 | 4 | 100 | 50 | 28 | 22 |

Table 3: Comparison of the number of spat, seed and market oysters per bushel sample collected at Red Fish Reef during 1964 and 1965.

| MONTH | NUMBER OF OYSTERS PER BUSHEL | | | | | |
|---|---|---|---|---|---|---|
| | SPAT | | SEED | | MARKET | |
| | 1964 | 1965 | 1964 | 1965 | 1964 | 1965 |
| 1 | | 13 | | 115 | | 36 |
| 2 | | 6 | | 102 | | 57 |
| 3 | | 7 | | 103 | | 50 |
| 4 | | 4 | | 103 | | 47 |
| 5 | 8 | 28 | 65 | 114 | 49 | 25 |
| 6 | 69 | 68 | 64 | 97 | 41 | 38 |
| 7 | 109 | 54 | 86 | 79 | 49 | 23 |
| 8 | 108 | 15 | 115 | 68 | 48 | 20 |
| 9 | 73 | 17 | 116 | 96 | 35 | 30 |
| 10 | 67 | 55 | 163 | 138 | 41 | 23 |
| 11 | 29 | 19 | 143 | 101 | 41 | 46 |
| 12 | 34 | 10 | 101 | 98 | 44 | 50 |

Table 4: Comparison of the number of spat, seed and market oysters per bushel sample collected at Bart's Pass during 1964 and 1965.

| MONTH | NUMBER OF OYSTERS PER BUSHEL | | | | | |
|---|---|---|---|---|---|---|
| | SPAT | | SEED | | MARKET | |
| | 1964 | 1965 | 1964 | 1965 | 1964 | 1965 |
| 1 | | 42 | | 200 | | 45 |
| 2 | | 16 | | 207 | | 33 |
| 3 | | 36 | | 210 | | 57 |
| 4 | | 5 | | 106 | | 55 |
| 5 | 7 | 7 | 58 | 103 | 38 | 50 |
| 6 | 40 | 24 | 78 | 110 | 41 | 46 |
| 7 | 61 | 56 | 80 | 86 | 30 | 52 |
| 8 | 196 | 113 | 101 | 109 | 27 | 41 |
| 9 | 320 | 538 | 120 | 157 | 28 | 57 |
| 10 | 201 | 162 | 141 | 187 | 47 | 46 |
| 11 | 107 | 50 | 185 | 159 | 43 | 42 |
| 12 | 51 | 37 | 135 | 145 | 41 | 42 |

Table 5: Comparison of the number of spat, seed and market oysters per bushel sample collected at Scott's Reef during 1964 and 1965.

| MONTH | NUMBER OF OYSTERS PER BUSHEL | | | | | |
|---|---|---|---|---|---|---|
| | SPAT | | SEED | | MARKET | |
| | 1964 | 1965 | 1964 | 1965 | 1964 | 1965 |
| 1 | | 0 | | 5 | | 29 |
| 2 | | 0 | | 3 | | 23 |
| 3 | | 0 | | 1 | | 21 |
| 4 | | 0 | | 0 | | 21 |
| 5 | 0 | 0 | 19 | 4 | 32 | 30 |
| 6 | 2 | 35 | 25 | 5 | 56 | 31 |
| 7 | 1 | 14 | 14 | 10 | 39 | 24 |
| 8 | 2 | 6 | 9 | 17 | 34 | 24 |
| 9 | 0 | 2 | 12 | 10 | 34 | 13 |
| 10 | 0 | 2 | 7 | 7 | 30 | 13 |
| 11 | 0 | 2 | 8 | 16 | 30 | 28 |
| 12 | 0 | 0 | 5 | 5 | 28 | 15 |

Table 6: Comparison of the number of spat, seed and market oysters per bushel sample collected at Beasley's Reef during 1964 and 1965.

| MONTH | NUMBER OF OYSTERS PER BUSHEL | | | | | |
|---|---|---|---|---|---|---|
| | SPAT | | SEED | | MARKET | |
| | 1964 | 1965 | 1964 | 1965 | 1964 | 1965 |
| 1 | | 7 | | 61 | | 37 |
| 2 | | 2 | | 21 | | 62 |
| 3 | | 6 | | 49 | | 31 |
| 4 | | 1 | | 19 | | 40 |
| 5 | 1 | 3 | 34 | 38 | 74 | 40 |
| 6 | 0 | 14 | 44 | 34 | 64 | 53 |
| 7 | 1 | 21 | 36 | 21 | 58 | 51 |
| 8 | 5 | 10 | 32 | 30 | 29 | 37 |
| 9 | 59 | 6 | 25 | 43 | 41 | 50 |
| 10 | 13 | 21 | 27 | 32 | 44 | 32 |
| 11 | 8 | 16 | 46 | 34 | 48 | 47 |
| 12 | 1 | 10 | 28 | 57 | 47 | 35 |

Table 7: Comparison of the number of seed and market oysters per bushel (spat were not counted in 1965) collected at Middle Ground Reef during 1964 and 1965.

| MONTH | NUMBER OF OYSTERS PER BUSHEL | | | | | |
|---|---|---|---|---|---|---|
| | SPAT | | SEED | | MARKET | |
| | 1964 | 1965 | 1964 | 1965 | 1964 | 1965 |
| 1 | 110 | | 264 | 35 | 42 | 0 |
| 2 | 255 | | 301 | 53 | 54 | 0 |
| 3 | 151 | | 217 | 73 | 44 | 0 |
| 4 | 123 | | 210 | 96 | 43 | 0 |
| 5 | 172 | | 228 | 83 | 75 | 0 |
| 6 | 16000 | | 176 | 119 | 38 | 0 |
| 7 | 6700 | | 199 | 105 | 48 | 0 |
| 8 | 4900 | | 135 | 264 | 39 | 0 |
| 9 | 3800 | | 176 | 433 | 30 | 1 |
| 10 | 7800 | | 127 | 493 | 3 | 0 |
| 11 | 4800 | | 53 | - | 0 | - |
| 12 | 5700 | | 51 | 403 | 0 | 1 |

Table 8: Comparison of the number of seed and market oysters per bushel (spat were not counted in 1965) collected at Gadwall Reef during 1964 and 1965.

| MONTH | NUMBER OF OYSTERS PER BUSHEL | | | | | |
|---|---|---|---|---|---|---|
| | SPAT | | SEED | | MARKET | |
| | 1964 | 1965 | 1964 | 1965 | 1964 | 1965 |
| 1 | 708 | | 656 | 172 | 108 | 2 |
| 2 | 646 | | 497 | 201 | 59 | 0 |
| 3 | 420 | | 449 | 186 | 56 | 2 |
| 4 | 454 | | 415 | 157 | 65 | 1 |
| 5 | 402 | | 526 | 116 | 53 | 1 |
| 6 | 6000 | | 261 | 64 | 41 | 0 |
| 7 | 5500 | | 232 | 37 | 42 | 0 |
| 8 | 3700 | | 245 | 50 | 18 | 0 |
| 9 | 2900 | | 277 | 66 | 19 | 0 |
| 10 | 18000 | | 427 | 52 | 18 | 0 |
| 11 | 7600 | | 184 | 79 | 2 | 0 |
| 12 | 6200 | | 165 | - | 1 | - |

Table 9: Comparison of the number of seed and market oysters per bushel (spat were not counted in 1965) collected at Sand Point Reef during 1964 and 1965.

| MONTH | NUMBER OF OYSTERS PER BUSHEL | | | | | |
|---|---|---|---|---|---|---|
| | SPAT | | SEED | | MARKET | |
| | 1964 | 1965 | 1964 | 1965 | 1964 | 1965 |
| 1 | 307 | | 66 | 329 | 0 | 3 |
| 2 | - | | - | 423 | - | 17 |
| 3 | 262 | | 79 | 383 | 0 | 21 |
| 4 | 293 | | 165 | 486 | 0 | 21 |
| 5 | 240 | | 170 | - | 1 | - |
| 6 | 16600 | | 243 | 126 | 1 | 1 |
| 7 | 12000 | | 163 | 118 | 1 | 1 |
| 8 | 9300 | | 378 | 355 | 0 | 0 |
| 9 | 5700 | | 525 | 442 | 1 | 1 |
| 10 | 6300 | | 696 | 374 | 10 | 0 |
| 11 | 5000 | | 538 | 275 | 10 | 2 |
| 12 | 3500 | | 398 | 419 | 7 | 0 |

Table 10: Comparison of the number of spat seed and market oysters per bushel sample collected at Mosquito Point Reef during 1964 and 1965.

| MONTH | NUMBER OF OYSTERS PER BUSHEL | | | | | |
|---|---|---|---|---|---|---|
| | SPAT | | SEED | | MARKET | |
| | 1964 | 1965 | 1964 | 1965 | 1964 | 1965 |
| 1 | - | - | - | - | - | - |
| 2 | - | - | - | - | - | - |
| 3 | - | 20 | - | 178 | - | 34 |
| 4 | - | - | - | - | - | - |
| 5 | - | - | 72 | - | 0 | - |
| 6 | - | 13 | - | 90 | - | 30 |
| 7 | 701 | 345 | 117 | 150 | 0 | 14 |
| 8 | - | - | - | - | - | - |
| 9 | - | 89 | - | 341 | - | 6 |
| 10 | 369 | - | 187 | - | 5 | - |
| 11 | - | 10 | - | 301 | - | 34 |
| 12 | - | - | - | - | - | - |

Table 11: Comparison of the number of spat, seed and market oysters per bushel sample collected at Josephine Reef during 1964 and 1965.

| MONTH | NUMBER OF OYSTERS PER BUSHEL | | | | | |
|---|---|---|---|---|---|---|
| | SPAT | | SEED | | MARKET | |
| | 1964 | 1965 | 1964 | 1965 | 1964 | 1965 |
| 1 | 529 | - | 226 | - | 12 | - |
| 2 | - | - | - | - | - | - |
| 3 | - | 450 | - | 75 | - | 2 |
| 4 | - | - | - | - | - | - |
| 5 | 506 | - | 161 | - | 18 | - |
| 6 | - | 0 | - | 0 | - | 0 |
| 7 | 352 | 195 | 125 | 20 | 17 | 2 |
| 8 | - | - | - | - | - | - |
| 9 | - | 0 | - | 0 | - | 0 |
| 10 | 955 | - | 61 | - | 11 | - |
| 11 | - | - | - | - | - | - |
| 12 | - | - | - | - | - | - |

Table 12: Comparison of the number of spat, seed and market oysters per bushel sample collected from Panther Point Reef during 1964 and 1965.

| MONTH | NUMBER OF OYSTERS PER BUSHEL | | | | | |
|---|---|---|---|---|---|---|
| | SPAT | | SEED | | MARKET | |
| | 1964 | 1965 | 1964 | 1965 | 1964 | 1965 |
| 1 | - | - | - | - | - | - |
| 2 | - | 349 | - | 130 | - | 0 |
| 3 | - | - | - | - | - | - |
| 4 | 454 | 380 | 161 | 84 | 2 | 0 |
| 5 | - | - | - | - | - | - |
| 6 | 476 | 32 | 73 | 114 | 0 | 0 |
| 7 | - | - | - | - | - | - |
| 8 | - | 60 | - | 70 | - | 0 |
| 9 | - | - | - | - | - | - |
| 10 | 1000 | 64 | 73 | 83 | 0 | 0 |
| 11 | - | - | - | - | - | - |
| 12 | 779 | 28 | 102 | 119 | 0 | 0 |

Table 13: Comparison of the number of spat, seed and market oysters per bushel sample collected at Chicken Foot Reef during 1964 and 1965.

| MONTH | NUMBER OF OYSTERS PER BUSHEL | | | | | |
|---|---|---|---|---|---|---|
| | SPAT | | SEED | | MARKET | |
| | 1964 | 1965 | 1964 | 1965 | 1964 | 1965 |
| 1 | - | - | - | - | - | - |
| 2 | - | 119 | - | 66 | - | 5 |
| 3 | - | - | - | - | - | - |
| 4 | 151 | 197 | 234 | 94 | 49 | 3 |
| 5 | - | - | - | - | - | - |
| 6 | 268 | 26 | 58 | 85 | 0 | 2 |
| 7 | - | - | - | - | - | - |
| 8 | - | 43 | - | 113 | - | 5 |
| 9 | 330 | - | 108 | - | 0 | - |
| 10 | - | 92 | - | 58 | - | 12 |
| 11 | - | - | - | - | - | - |
| 12 | 630 | 26 | 198 | 79 | 0 | 21 |

Table 14: Weighted incidence of Dermocystidium marinum infection at six stations in Galveston Bay during 1965.

| MONTH | WEIGHTED INCIDENCE OF INFECTION STATIONS | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| 1 | 1.5 | 1.6 | 1.6 | 2.0 | 2.0 | 1.6 |
| 2 | 1.7 | 1.0 | 1.6 | 1.5 | 1.8 | 1.2 |
| 3 | | 0.9 | 0.4 | 0.8 | 1.2 | 0.7 |
| 4 | 2.3 | 1.4 | 2.6 | 1.8 | 2.8 | 2.8 |
| 5 | 2.4 | 1.6 | 2.0 | 2.4 | 2.4 | 3.1 |
| 6 | 1.6 | 2.4 | 1.5 | 0.8 | 3.1 | 0.1 |
| 7 | 3.1 | 3.7 | 3.9 | 1.9 | 2.4 | 0.1 |
| 8 | 4.0 | 2.7 | 4.3 | 2.4 | 2.7 | 2.2 |
| 9 | 3.0 | 2.8 | 3.4 | 4.0 | 3.6 | 1.5 |
| 10 | 2.7 | 2.2 | 1.8 | 3.1 | 5.0 | 3.4 |
| 11 | 1.3 | 1.8 | 1.6 | 2.4 | 2.9 | 2.0 |
| 12 | | 2.0 | 2.9 | 2.2 | 3.6 | 1.2 |

(1) = Hanna Reef (2) = Todd's Dump (3) = Red Fish Reef

(4) = Bart's Pass (5) = Scott's Reef (6) = Beasley's Reef

Table 15: Weighted incidence of *Dermocystidium marinum* infection at three stations in Matagorda Bay during 1965.

| MONTH | WEIGHTED INCIDENCE OF INFECTION STATIONS | | |
|---|---|---|---|
| | 1 | 2 | 3 |
| 1 | 0 | - | - |
| 2 | 0 | - | - |
| 3 | 0 | - | - |
| 4 | 0.5* | 0 | 0 |
| 5 | 0.2* | 0 | - |
| 6 | 0 | 0 | 0 |
| 7 | 0 | 0 | 0 |
| 8 | 0 | 0.3* | 0 |
| 9 | 0 | - | - |
| 10 | - | - | - |
| 11 | - | - | - |
| 12 | - | - | - |

(1): Middle Ground Reef (2): Gadwall Reef

(3): Sand Point Reef

(*): All infections found were somewhat doubtful. Cells were generally only slightly enlarged and dark blue or black, opaque.

Table 16: Weighted incidence of Dermocystidium marinum infection at four stations in San Antonio Bay during 1965

| MONTH | WEIGHTED INCIDENCE OF INFECTION | | | |
|---|---|---|---|---|
| | STATIONS | | | |
| | 1 | 2 | 3 | 4 |
| 1 | - | - | - | - |
| 2 | - | - | - | - |
| 3 | 0.4 | - | - | 0 |
| 4 | - | 0 | 0.8 | - |
| 5 | - | - | - | - |
| 6 | 0 | 0.05 | 0 | - |
| 7 | 0 | - | - | 0 |
| 8 | - | - | 0 | - |
| 9 | 0 | - | - | - |
| 10 | - | 0 | 0 | - |
| 11 | 0 | - | - | - |
| 12 | - | 0 | 0 | - |

(1): Mosquito Point Reef (2): Panther Point Reef

(3): Chicken Foot Reef (4): Josephine Reef

Table 17: Oyster harvest (pounds of meat) along the Texas Coast during the 1965-66 season.

| MONTH | POUNDS OF OYSTER MEAT | | | |
|---|---|---|---|---|
| | Galveston Bay | Matagorda Bay | San Antonio Bay | South Bay |
| Sept. 65 | | | 158 | 0 |
| Oct. | | 223 | 1,418 | 18 |
| Nov. | 780,588 (794,537) | 8,331 | 6,405 | 18 |
| Dec. | 1,116,544 (1,166,734) | 39,173 | 10,903 | 114 |
| Jan. 66 | 1,009,164 (1,066,520) | 46,699 | 10,438 | 219 |
| Feb. | 789,828 (901,417) | 74,962 | 5,460 | 166 |
| March | 630,350 (754,890) | 111,913 | * | 464 |
| April | | 214,419 | * | 263 |
| TOTAL | 4,326,474 | 495,720 | 34,782 | 1262 |

Total Harvest = 4,858,238 Pounds

*: = Production figures not available.

Table 18: Index of sample abundance of spat, and market oysters in Matagorda and Galveston Bays during 1962-65. The yearly index was obtained by averaging the number of oysters in each size category collected from all stations during a seven month period, June through December, when most data were available.

| Bay Area | Size Group | Yearly Abundance Index 1962 | 1963 | 1964 | 1965 |
|---|---|---|---|---|---|
| Matagorda: | Spat | 392 | 410 | 7400 | - |
| | Seed | 239 | 297 | 269 | 228 |
| | Market | 30 | 28 | 16 | 1 |
| Galveston: | Spat | 164 | 107 | 86 | 49 |
| | Seed | 236 | 161 | 77 | 64 |
| | Market | 38 | 51 | 33 | 30 |

Table 19: Average monthly weighted incidence of Dermocystidium infection among market oysters in Galveston Bay during 1962-65. The yearly infection incidences were obtained by averaging the June-December monthly incidences.

| Month | Weighted Infection Incidence 1962 | 1963 | 1964 | 1965 |
|---|---|---|---|---|
| 1 | - | - | - | 1.7 |
| 2 | - | 0.7 | - | 1.5 |
| 3 | - | 0.4 | - | 0.8 |
| 4 | - | 1.5 | - | 2.3 |
| 5 | - | 1.4 | 1.4 | 2.3 |
| 6 | 1.9 | 1.0 | 2.0 | 1.6 |
| 7 | 1.6 | 1.1 | 2.2 | 2.5 |
| 8 | 2.6 | 1.0 | 3.2 | 3.0 |
| 9 | 2.3 | 2.7 | 3.0 | 3.0 |
| 10 | 2.2 | 2.5 | 3.2 | 3.0 |
| 11 | 2.0 | 2.5 | 2.9 | 2.0 |
| 12 | 1.9 | 2.4 | 2.0 | 2.4 |
| Yearly Index: June-December Data | 2.1 | 1.9 | 2.6 | 2.5 |