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JOB REPORT

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A Summary of Oyster (*Crassostrea virginica*) Studies along the Texas Coast

Abstract: Both seed oyster *Crassostrea virginica* stock and market oyster stock continued to decline in Aransas, San Antonio, Matagorda and Galveston Bays. Losses appeared to be most severe in the Aransas Bay area, diminishing up the coast to Galveston Bay. Much of the loss in the middle coast was attributed to "Aransas Bay disease" which affected young seed oysters as well as the older market oysters. The disease was found in 1963 in Aransas Bay and was apparently associated with mortalities in San Antonio and Lavaca Bays. During 1964 the disease spread into Copano Bay, most of San Antonio Bay, Lavaca Bay and Matagorda Bay. The organism responsible for Aransas Bay disease was identified by Dr. J. G. Mackin as an intra-cell organism similar to that associated with Malpeque Bay disease in Canadian waters. Severe mortalities in Tres Palacios Bay appeared to be caused by *Dermocystidium marinum* judging by the high infection incidence found in samples during the late summer. However, the catastropic losses among seed oysters was more characteristic of "Aransas Bay disease". In Galveston Bay *Dermocystidium* spread further up the bay than in 1963 and was assumed to be the primary cause of oyster mortalities. Tray studies at two stations showed an annual mortality rate of approximately 50 per cent, both in 1963 and 1964. Most of the mortality at each station was due to *Dermocystidium*.

Oyster production, in spite of high mortalities, set a new record during the 1964-65 season. Most of the harvest came from Galveston Bay where heavy fishing pressure compensated for the relatively low abundance of market oysters.

Objective: To summarize data obtained from studies of the oyster *Crassostrea virginica* population in several bay areas along the Texas coast.

Procedures: Thirteen oyster reefs (six in Galveston Bay, three in Matagorda Bay and four in San Antonio Bay) were sampled at intervals (generally monthly) with a small oyster dredge. A standard sample consisting of one bushel (2150 cubic inches) of unculled oysters was collected at each station visit. All live oysters in the samples were measured to the nearest millimeter along the right valve from beak to bill. In certain instances, additional bushel samples were collected to provide supplementary information on market oyster stocks. In such samples only market oysters, over 75 mm long, were measured.

Beginning in April, ten oysters from each of the monthly samples in Galveston Bay and Matagorda Bay were selected for determination of the infection incidence of the parasite *Dermocystidium marinum*. Sections of rectal tissue from each oyster were cultured in fluid thioglycollate medium containing Mycostatin and Chloromycetin for five days or longer before examination.

Analyses of the tissue cultures, following Ray's methods (1952), were made at the Seabrook Laboratory. The weighted incidence of D. marinum infection was determined using the numerical system described by Mackin (1961).

Oyster platforms supporting 2,000 or more oysters in trays were employed in Aransas and Galveston Bays for special mortality studies conducted under contract with Dr. J. G. Mackin of Texas A & M University. Oysters were examined at weekly or bi-weekly intervals and all dead oysters were removed and measured. Gaper tissues were cultured in thioglycollate-antibiotic medium to determine the presence of Dermocystidium marinum. The gapers were then fixed in Zenker fixative, washed in tap water and preserved in 70 per cent iso-propyl alcohol. Live oyster samples were also collected and treated in a similar manner. Analyses of the thioglycollate cultures were made at the Seabrook and Rockport laboratories. Preserved oysters were sent to Texas A & M University for sectioning and study.

Findings and Discussion:

Galveston Bay stations included Hanna Reef at the mouth of East Bay, Red Fish Reef in central Galveston Bay, Bart's Pass in lower Trinity Bay off Smith Point, Todd's Dump in central Galveston Bay off Eagle Point, Scott's Reef in upper Galveston Bay off the Seabrook shoreline and Beasley's Reef in upper Trinity Bay between Houston Point and Umbrella Point. The Matagorda Bay stations included Middle Ground Reef in Tres Palacios Bay, Gadwall Reef, an artificial reef off Well Point in Matagorda Bay and Sand Point Reef in lower Lavaca Bay. Stations in San Antonio Bay included Mosquito Point Reef in middle San Antonio Bay, Panther Point Reef and Chicken Foot Reef in lower San Antonio Bay and Josephine Reef in Espiritu Santo Bay. Stations in each bay area were unchanged from previous years.

Reef samples in the Aransas Bay area were discontinued because extensive mortalities had reduced seed and market oyster stocks to very low levels. Most of the oysters surviving in the bay system were Ostrea equestris. Sampling was also discontinued in South Bay although a small, but commercially valuable, oyster population was present.

Oyster Population Trends

Galveston Bay:

The 1964 oyster spat set was generally less abundant than that in 1963 and peak sample abundance of spat (oysters up to 26 mm in length) occurred later in the year (September and October) than in 1963 (July). Survival of the spat appeared to be better in 1964 than in 1963. As in the previous year, spat were more abundant along the east shore of the bay and were least abundant in upper Galveston Bay and upper Trinity Bay.

Seed oyster stocks, which were abundant in February-March, 1963 declined continually to a low abundance in late spring and early summer, 1964. Seed oysters (26 mm - 75 mm in length) increased in number in samples collected in August as the 1964 spat entered seed size but the peak sample abundance of seed oysters in 1964 was less than the low sample abundance in 1963. Survival of the 1962 and 1963 year classes appeared to be poor resulting in a declining seed oyster stock.

Market oyster stocks, (oysters over 75 mm long) which had reached peak abundance in samples during November and December, 1963 declined to a low in August 1964. A slight increase occurred thereafter but market abundance remained fairly constant throughout the remainder of the year, and well below the abundance found during fall and winter 1963.

Matagorda Bay:

In 1963, peak abundance of spat was found in August and October. Although more abundant than the set in Galveston Bay, it appeared to be less abundant than sets in the lower coastal areas (Hofstetter, 1964). The spat set in 1964 was much more abundant than in the previous year with two peaks (June and October). Much of the set consisted of Ostrea equestris spat (King, 1965). The Gulf oyster spat were more plentiful at Sand Point Reef, averaging 69 per cent of the number of oysters sampled each month. At Gadwall Reef O. equestris spat averaged 57 per cent of the oysters sampled each month and at Middle Ground Reef the average was 45 per cent. Even with the high percentage of Gulf oyster spat, the abundance of C. virginica spat in monthly samples was much higher than that recorded from any area in previous years.

Seed stocks were abundant throughout 1963 with a major peak in abundance found in the April samples and a secondary peak in the July samples. Seed oysters were least abundant in samples during May and June. The seed stock in 1964 was generally less abundant than in 1963. Peak abundance was found in the October samples while seed oysters were least abundant in the December samples. This indicated poor survival of the 1963 year class and a heavy mortality among the 1964 spat.

Market oysters fluctuated in sample abundance during 1963 with a tendency to increase in November - December. Generally, market stocks were more abundant in 1964 than in 1963. However, from August through December, market stocks declined, reaching very low levels (3-4 per unculled bushel) in November and December.

San Antonio Bay:

During 1963 spatfall was abundant but survival appeared to be poor and seed oyster stocks declined to low levels in December. Market oyster stocks followed a similar trend, starting to decline in July and having low abundance from September through December.

Sampling was infrequent during 1964 but indicated that peak abundance of spat possibly occurred later in the year (perhaps August-September) rather than July as in 1963 (Hofstetter, 1964). Survival of the spat could not be determined.

Seed oysters appeared to have been most abundant in late spring-early summer, declining in the fall and winter. This appeared to be the result of losses among the 1963 year class which were not offset by late appearing 1964 spat.

Market oysters were low in abundance throughout 1964. They were most abundant in spring samples and, by the end of the year, market oysters were found only on Josephine Reef in Espiritu Santo Bay and Mosquito Point Reef in central San Antonio Bay.

Aransas Bay:

In 1963 seed oysters decreased in abundance from a peak in March to a low in August. The seed stock increased from September through November as the 1963 spat attained seed size but the abundance remained well below the March peak. Market oysters also declined in spring to a low in July and remained low in abundance throughout the remainder of the year. Actually, very few market oysters were found in Aransas Bay and Mesquite Bay samples after July; market oysters were most abundant in Copano Bay.

Reef sampling was discontinued during 1964 but occasional samples were collected. Some recovery of seed stock was noted but market oyster abundance remained low. Mortalities among seed and market oysters in Copano Bay occurred in October and November; all seed and market oysters were lost on the major reefs (Heffernan, personal communication). Isolated stocks were found in Salt Lake, near the Aransas River mouth, and at the head of Port Bay but were not present in sufficient numbers to support a commercial fishery.

Oyster Mortality

During 1963 heavy mortalities among tray-held oysters in Aransas Bay occured in March-May and October-November (Heffernan, 1964). Similar mortalities were noted among reef oysters in San Antonio Bay beginning in July (Childress, 1964) and in Lavaca Bay in September (King, 1964). These mortalities were not associated with *Dermocystidium marinum*.

The organism associated with the Aransas Bay mortality was later identified by Dr. J. G. Mackin of Texas A & M University as an intra-cell organism similar to the "Malpeque Bay" disease organism in Canadian waters. Although no samples of dead or dying oysters were collected in San Antonio and Lavaca Bays for analysis, the nature of the mortality in each area was similar to that in Aransas Bay. That is, an almost complete mortality was found among seed and market oyster stocks.

In 1964 tray stocks in Aransas Bay were again affected with "Aransas Bay disease" in April and all oysters were dead by June (Heffernan, 1964). Seed and market oysters were affected in Copano Bay in October and November.

A similar mortality, presumably caused by "Aransas Bay disease", was first observed in San Antonio Bay in June. Oysters in all but the extreme upper end of the bay appeared to be affected. (Childress, 1965). However, market oysters were present in middle San Antonio Bay and in Espiritu Santo Bay at the end of the year although the stock was not large enough to support a commercial fishery.

In the Matagorda Bay area heavy mortalities among reef oysters began in August. Gapers (dying oysters) collected from Gadwall Reef in Matagorda Bay during October were found to be infected with the "Aransas Bay disease" organism (J. G. Mackin, personal communication). Heavy mortalities were observed among reef oysters in Lavaca Bay in December.

At Middle Ground Reef in Tres Palacios Bay, mortalities first noted in August appeared to be associated with *D. marinum* (King, 1965). Market oyster samples contained infection incidences well above epidemic level from April through October and, during September and October, the infection incidence reached a peak. Infection among seed oysters during September and October was also high.

After October, no market oysters could be found on Middle Ground Reef and very few seed oysters were collected (most of which were *O. equestris*). The high *Dermocystidium* infection among market and seed stocks indicates that *D. marinum* was probably the primary cause of mortality. However, the rapid depletion of seed stock was more characteristic of "Aransas Bay disease".

In Galveston Bay, the incidence of *Dermocystidium* infection increased in the upper bay area and, during late summer the incidence was very high at all sample stations. Tray studies indicated that the annual mortality rate among market oysters and older seed oysters was around 50 per cent (Hofstetter, 1965a). Most of the mortalities among tray-held oysters were attributed to *Dermocystidium*.

Oyster Production

During the 1963-64 harvest season, 2,404,143 pounds of oyster meat were harvested from Texas waters with approximately 85 per cent of this total (2,043,351 pounds) reported from Galveston Bay.

During the 1964-65 harvest season, no production was reported from Aransas Bay and little was produced in San Antonio or Lavaca Bays. However, the total harvest reported exceeded that produced in 1963-64. Most of the oyster harvest was taken from Galveston Bay. The record production from Galveston Bay occurred when reef sampling indicated that market oyster abundance was lower than in 1963 (Hofstetter, 1965b). It is believed that heavy fishing pressure compensated for the lower market oyster abundance resulting in a larger harvest.

Comments:

The initial occurrence of "Aransas Bay disease" in 1963 appeared to be associated with high temperatures and hypersaline waters. The 1963 mortality in San Antonio Bay was also associated with hypersaline waters but the Lavaca Bay mortality occurred when salinities were below 30 ppt.

During 1964 mortalities in Aransas Bay began in the spring as the water temperature increased but at salinities of 28-32 ppt. The "Aransas Bay disease" was found in Matagorda Bay during the high summer temperatures and at salinities of 26-30 ppt. Mortalities in Lavaca Bay were found after water temperatures dropped but at salinities of 28-29 parts per thousand.

Possibly the "Aransas Bay disease" organism may require hypersaline conditions for initial infection of the oyster population but it appears to be active at salinities about 25 ppt. Mortalities associated with the organism have most often occurred when the water temperatures increased but, if the 1964 Lavaca Bay mortality was caused by "Aransas Bay disease", it can also remain active at lower temperatures.

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