Study of the Oyster Population on Public Reefs in Galveston Bay during 1966

Project: MO-R-8

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ABSTRACT

Public reefs in Galveston Bay and East Bay were sampled monthly to determine seasonal changes in oyster (Crassostrea virginica) stocks.

Spring flooding killed oysters in Trinity Bay but affected major harvest centers only slightly. Spat setting was retarded and peak setting did not occur until fall. Seed oyster stocks generally declined until fall but market oyster stocks increased from winter through fall. Market oysters were less abundant in East Bay samples but were of larger size than those collected in Galveston Bay.

Dermocystidium infection among oyster stocks decreased in late spring and early summer but increased at most stations in the fall. High infections were common in November.

The oyster harvest was below the record 1965-66 harvest although fishing pressure was similar and the season was extended through April by law.

INTRODUCTION

Sampling of oyster (Crassostrea virginica) population on public reefs has been conducted in several estuaries to study changes in oyster stocks and to determine the possible effects such changes might have upon the oyster fishery. These studies have provided the basis for recommendations concerning oyster harvest regulations.

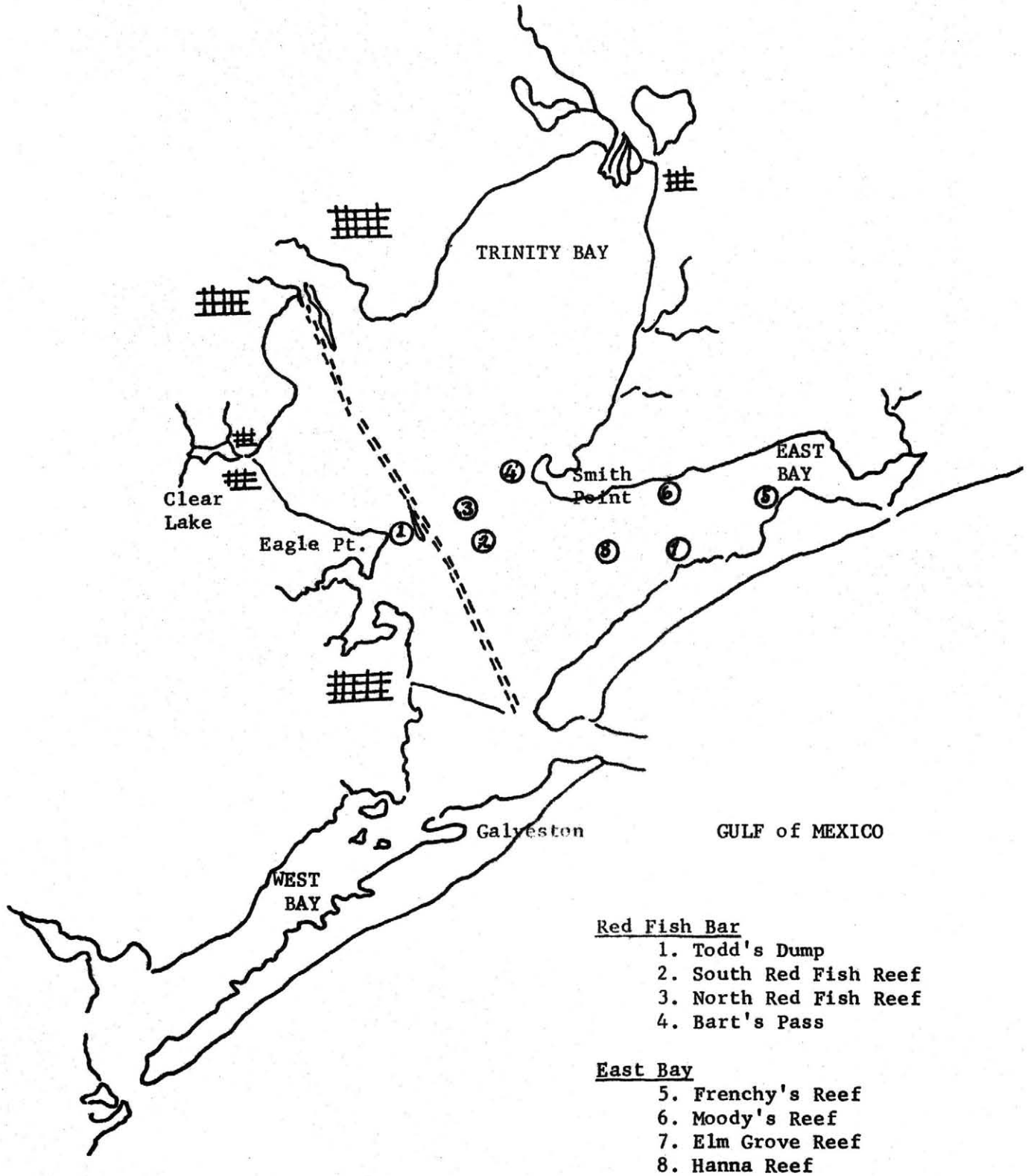
In past years oyster reef sampling was conducted in South Bay, Aransas Bay, San Antonio Bay and Matagorda Bay as well as Galveston Bay. Samples in South Bay and Aransas Bay were discontinued after 1963 because of minor harvests and disease-depleted stocks. San Antonio and Matagorda Bay samples were discontinued after 1965 because of depleted stocks caused by disease.

Reef sampling during 1966 was confined to the Galveston Bay area where fishing pressure and oyster harvests remained at high levels. This report summarizes the results of sampling in two major harvest centers within the bay.

DESCRIPTION OF SAMPLE AREAS

Sampling stations were established in two major oyster harvest centers: Red Fish Bar in mid-Galveston Bay and the reef network in East Bay (Figure 1). Four stations were sampled on Red Fish Bar: Todd's Dump (Station 1) off Eagle Point; South Red Fish Reef (Station 2) and North Red Fish Reef (Station 3) both east of the Houston Ship Channel and in the middle of Red Fish Bar; and Bart's Pass (Station 4) off Smith Point on the east shore. All four reefs have

Figure 1: Outline of the Galveston Bay system showing location of oyster reef sampling stations on Red Fish Bar and in East Bay.



Red Fish Bar
1. Todd's Dump
2. South Red Fish Reef
3. North Red Fish Reef
4. Bart's Pass

East Bay
5. Frenchy's Reef
6. Moody's Reef
7. Elm Grove Reef
8. Hanna Reef

contributed heavily to the oyster harvest in recent years. Although disconnected now by channels and cuts, the four reefs form the major components of a barrier-type reef extending across the middle of Galveston Bay.

East Bay stations included Frenchy's Reef (Station 5) in the upper bay near Marsh Point; Moody's Reef (Station 6), a north-shore segment of an extensive mid-bay chain; and Elm Grove Reef (Station 7), a south-shore segment of the mid-bay chain. Hanna Reef (Station 8), a barrier-type reef across the mouth of East Bay, was sampled at the beginning of the year but was discontinued because of the low population level.

Reefs in East Bay (other than Hanna Reef) had not been sampled in past years and little information was available concerning oyster population levels. Unlike reefs in Galveston Bay, the East Bay reefs were generally flat, or only slightly ridged, and were composed chiefly of shell fragments mixed with mud. In general, the long axis of the reefs was oriented at right angles to the shoreline. Inshore reefs usually had better defined ridges than those in the middle of the bay.

METHODS

Samples, consisting of three standard bushels (2150 cubic inches per bushel) of unculled oysters were dredged from each station at monthly intervals. Live oysters were culled, measured to the nearest millimeter along the dorso-ventral axis on the right valve, and grouped into size intervals of 25 millimeters. These groups were designated as "spat" (1-25 mm), "seed" (26-50 mm); "sub-market" (51-75 mm); "small market" (76-100 mm); "medium market" (101-125 mm) and "large market" (126-150 mm).

Samples were grouped into quarterly intervals (January-March, April-June, (etc.) and the average number of oysters of each size group per bushel was computed for each quarter.

Rectal tissues from ten market oysters in each sample were cultured in fluid thioglycollate medium (containing Chloromycetin and Mycostatin) for determination of Dermocystidium marinum infection. Infection incidence was based upon a numerical system ranging from 0 for negative infection to 5 for heavy infection.

Bottom water samples were collected at each station visit for determination of temperature and salinity. Organisms associated with oysters were noted with particular attention given to predators.

RESULTS

Salinity

Spring flooding occurred on the Trinity River resulting in a sharp reduction in salinity, primarily in Trinity Bay but, to a lesser extent, in Galveston Bay and East Bay as well. Salinity levels were lowest in May at the Red Fish Bar stations and in May-June at the East Bay stations (Table 1). During early summer, salinity generally remained under fifteen parts per thousand and did not rise above twenty parts per thousand until fall. Salinity increased more rapidly at Red Fish Bar stations than in East Bay.

Oyster Stocks on Red Fish Bar

Light spat sets were initially found in spring (May-June) but low salinity evidently retarded spawning or setting since spat did not occur in appreciable numbers until fall (Table 2). As in past years, setting was most abundant at Bart's Pass.

Seed oysters increased at all stations in spring but decreased in summer samples. Decreases were most noticeable in samples from Bart's Pass and reflected the partial kill due to the flood. By fall, seed oyster stock had increased at all stations except Todd's Dump.

Sub-market oysters increased at most stations during spring and summer, decreasing in fall to levels equal to, or slightly below winter levels. At Bart's Pass, however, sub-market stocks decreased in summer and increased only slightly in fall.

Market oysters (consisting almost entirely of the small, 76-100 mm group) increased in samples from winter through fall. Although market oyster stocks decreased at Bart's Pass in summer, fall stocks were equal to those found in winter and spring samples. Medium market oysters, scarce at all stations, tended to decline during the year. Large market oysters were rarely collected.

In spring the southern oyster drill (Thais haemastoma) was commonly collected in samples from both North and South Red Fish Reef. It disappeared from early summer samples when salinity was low and was not collected during the remainder of the year.

Oyster Stocks in East Bay

Judging from the relative number of spat collected during the winter quarter (Table 3), setting probably occurred late in 1965 in the mid-bay region with little setting in the upper bay. The 1966 set was first observed during summer (August) at Elm Grove Reef with light sets at Moody's and Frenchy's Reefs. Peak setting did not occur until fall (October- November) and was most abundant at Elm Grove Reef.

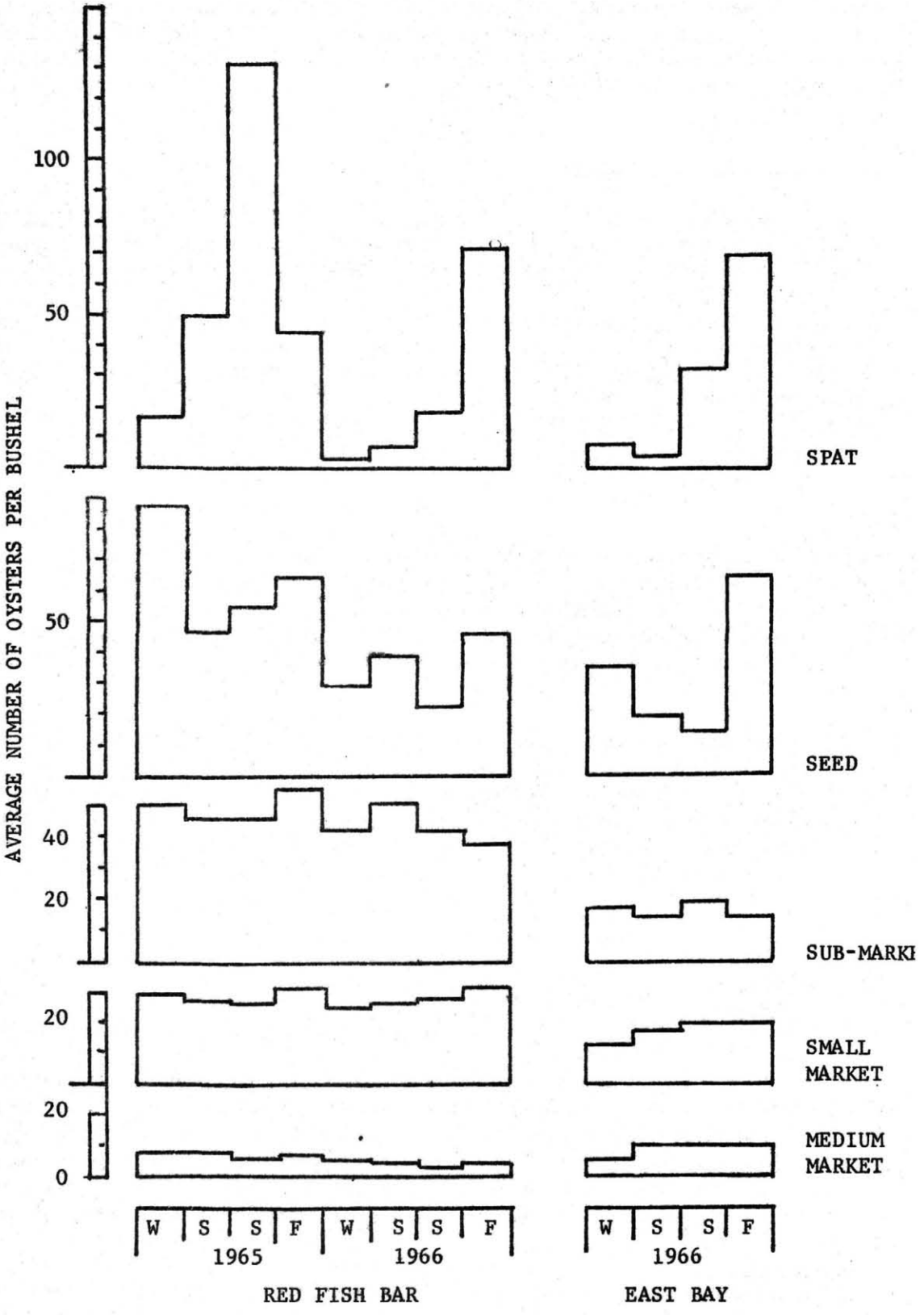
Seed oyster stocks decreased in sample abundance at all stations during spring and only at Elm Grove Reef did a summer increase occur. By fall, seed oysters increased at all stations as the 1966 spat were recruited but the increase was substantial only at Elm Grove Reef.

Sub-market oyster stocks declined at Frenchy's Reef throughout the year. At Moody's Reef, however, they increased gradually from a winter low. Although abundant in summer samples at Elm Grove Reef, sub-market oysters decreased noticeably in the fall.

Market oysters, consisting primarily of the small group, were least abundant in winter samples and most abundant during summer and fall. Medium market oysters were common on Elm Grove Reef in spring samples, remaining essentially unchanged through summer and fall. Large market oysters were scarce at all stations.

The relatively greater abundance of market oysters obtained in samples at Elm Grove Reef is misleading. Throughout much of the reef area, the base consisted of shell covered by a thin layer of black mud. Much more effort was required to obtain a three-bushel sample than on any other reef unless a slight ridge was encountered. Aside from the small, scattered ridges, the population

Figure 2: Seasonal changes in oyster stocks at Red Fish Bar (1965-66) and East Bay (1966).



level was believed to be the lowest of the reefs sampled.

At all three stations, the larger oysters were found to be heavily infected with the boring clam (Diplothyra). The infestations were much more numerous than those found on Red Fish Bar. The hooked mussel (Brachidontes recurvus) was common but not abundant. In past years (prior to 1963) mussel fouling had been a serious problem throughout much of East Bay, limiting the value of the oysters. The southern oyster drill, although common on Hanna Reef, was not found on Moody's and Frenchy's Reefs and only one was collected at Elm Grove Reef (in November).

Comparison of Oyster Stocks

Seasonal changes in oyster stocks at Red Fish Bar and East Bay, based upon the average number of oysters of each size group (per bushel sample) collected quarterly at all stations, are shown in Figure 2.

During 1966, spat and seed oyster stocks on Red Fish Bar and in East Bay were similar, with peak sample abundance found in the fall. The 1966 spat were slightly more abundant at Red Fish Bar but seed oysters were more abundant in East Bay.

Sub-market oyster stocks were more abundant in Red Fish Bar samples throughout the year. Stocks at both locations, however, tended to decline in the fall.

Small market oysters in both areas increased in sample abundance throughout the year but were always more numerous in Red Fish Bar samples. Medium market oysters decreased at Red Fish Bar but increased in East Bay. However, the increase occurred at Elm Grove Reef only and was not characteristic of all three stations. Large market oysters were scarce in both areas and were not included in the histograms.

Spat and seed oysters were more abundant in 1965 than 1966 on Red Fish Bar. Peak spat abundance occurred in summer, rather than fall, and peak seed abundance occurred in winter, 1965. Sub-market oysters tended to increase in sample abundance during 1965 but generally declined in 1966. Small market oysters, however, increased in 1966 to a fall abundance equal to that found in fall 1965. Medium market oysters were more abundant in 1965 with a tendency to decline to a low in the summer, 1966.

Dermocystidium Infection

The cycle of Dermocystidium marinum infection, in particular among East Bay oysters, followed salinity cycles (Figure 3). Infection incidence increased in May following an increase in salinity and temperature in April. Infections decreased in June following decreased salinity in May although water temperature continued to rise. As salinity gradually increased in summer, infection incidence also increased. Maximum infection incidence coincided with maximum fall salinity at Frenchy's Reef and Elm Grove Reef and was found at all three stations when water temperatures were decreasing.

Dermocystidium infections at Red Fish Bar stations were disimilar. At Bart's Pass maximum infection incidence occurred in April and infections remained low in fall even though salinity had increased above winter levels. The incidence dropped slightly in May at North and South Red Fish Reefs along with salinity but increased in June. Maximum incidence was found in July

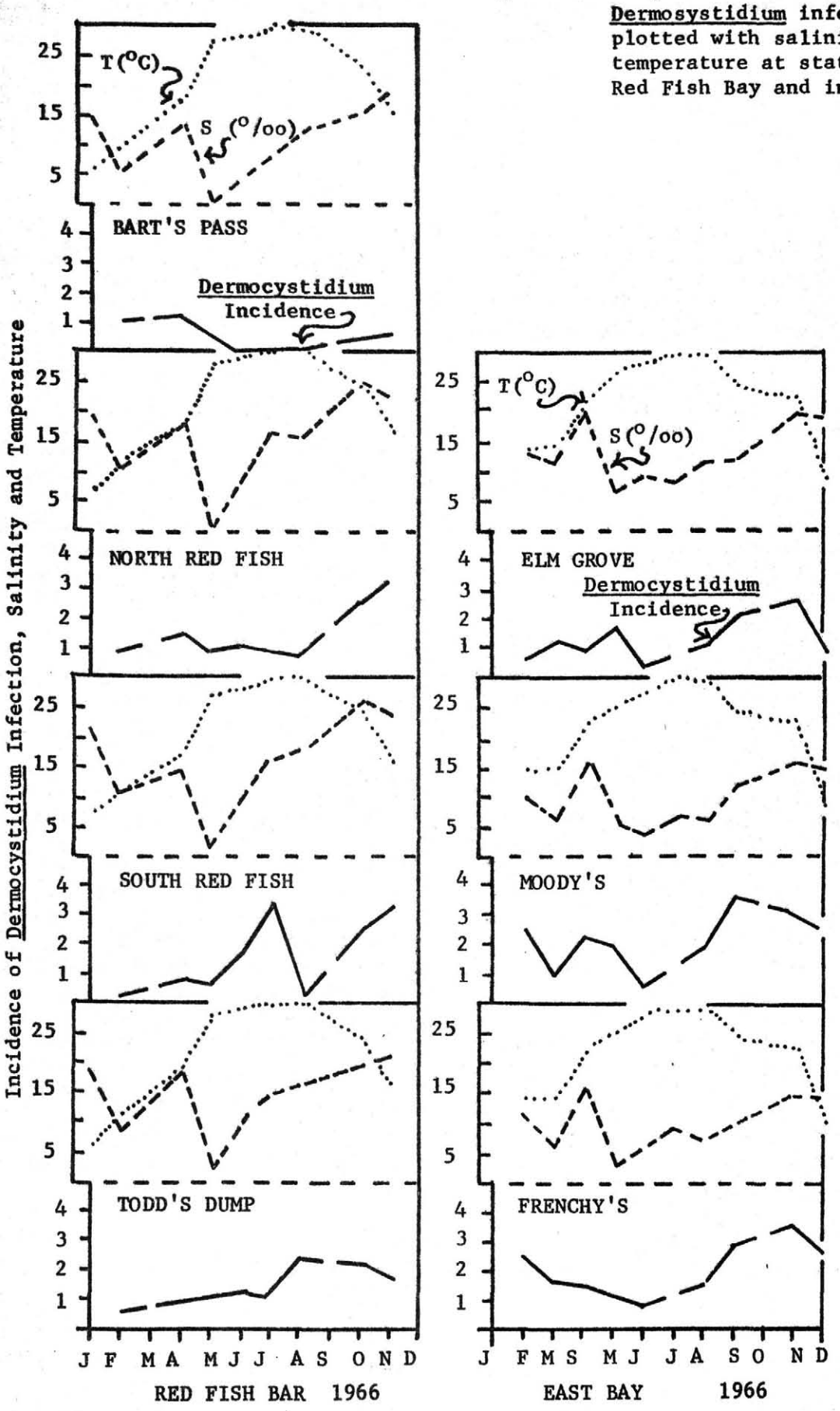


Figure 3: Weighted incidence of Dermosystidium infection plotted with salinity and temperature at stations o Red Fish Bay and in East

at South Red Fish with a sharp drop in August. The incidence was also low at North Red Fish in August but the high July peak did not occur. At both stations incidence increased from the August low to a fall peak in November. At Todd's Dump, the incidence increased gradually from February through June with a slight drop in July. The seasonal peak occurred in August (when the incidence at Red Fish Reef was lowest) with a gradual decline in the fall.

Dermocystidium infections were generally higher in East Bay, especially in the upper bay, and in the central Red Fish Bar area. Infections were lowest on the east and west ends of Red Fish Bar.

The Oyster Fishery

As in the previous season, the fishery was concentrated on Red Fish Bar with lesser effort in East Bay (Table 4). South Red Fish Reef, the largest in the Red Fish Bar complex, was most heavily fished while Bart's Pass was fished the least. Fishing pressure in East Bay did not appear to be concentrated in any particular location.

In both seasons, fishing effort was greatest in January. During the 1965-66 season, effort gradually decreased through February and March but in the 1966-67 season it dropped sharply during these months. The season was extended by legislation through April, 1967 but fishing pressure continued to decline.

Peak monthly production during the 1965-66 season was reported in December with a gradual decline through February and a sharp decline in March (Table 5). In 1966-67 peak production occurred in November and, in spite os sustained fishing pressure, decreased through the remainder of the season.

Production, by volume, declined approximately 45,000 barrels (21%) and, by weight, approximately 1,300,000 pounds (32%) from the 1965-66 record harvest. Production was also under the 1964-65 harvest but exceeded that in 1963-64.

COMMENTS

Although sampling revealed fall stocks of market oysters (on Red Fish Bar) to be similar to stocks present in the fall 1965, a declining harvest under sustained fishing pressure indicated a reduction in quantity of oysters available to the fishery. The two are not necessarily conflicting. Sampling methods are based upon the relative number of oysters while the harvest is based upon volume.

The majority of the market oysters in samples were found to be in the small market group. Although these increased in number, the medium market group, which would contribute substantially to the volume, tended to decrease during the year and were less abundant in 1966 than in 1965. In addition, sub-market stocks, from which market oysters would be recruited during the harvest season, were less abundant in 1966 than in 1965. Thus, market stocks would be replenished at a slower rate than in the previous season.

Sampling methods should consider relative volume, as well as number, to provide a better estimate of the available stocks.

Table 1: Monthly salinity values (parts per thousand) at sample stations on Red Fish Bar and in East Bay during 1966.

	Red Fish Bar				East Bay			
Month	1	2	3	4	5	6	7	8
1	18.7	21.5	19.5	14.5	-	-	-	-
2	8.5	10.3	11.0	5.5	11.3	9.4	13.5	17.7
3	-	-	-	-	6.0	6.9	12.0	16.5
4	18.5	19.7	18.9	13.5	16.6	15.9	18.8	24.6
5	2.2	1.0	0.4	0.3	3.0	5.4	6.9	17.8
6	10.0	10.0	9.7	4.1	6.0	4.4	8.7	12.4
7	14.5	16.6	16.1	8.1	9.6	6.9	8.5	13.6
8	16.1	17.6	15.8	12.3	7.1	6.5	11.0	11.9
9	-	-	-	-	9.6	12.0	12.0	13.6
10	19.3	25.6	24.6	15.2	-	-	-	-
11	21.1	23.3	22.7	18.3	14.4	15.5	18.9	20.0
12	-	-	-	-	14.4	14.4	18.3	20.5

Station 1: Todd's Dump
2: South Red Fish Reef
3: North Red Fish Reef
4: Bart's Pass
5: Frenchy's Reef
6: Moody's Reef
7: Elm Grove Reef
8: Hanna Reef

Table 2: Average number of oysters per bushel in each size group collected in winter, spring, summer and fall samples at stations on Red Fish Bar during 1966.

Station	Size Group MM	Season W	S	S	F
Todd's Dump	1 - 25	0	3	9	33
	26 - 50	17	29	19	16
	51 - 75	34	42	42	34
	76 - 100	21	21	34	31
	101 - 125	2	3	3	2
	126 - 150	1	1	0	0
South Red Fish	1 - 25	2	8	32	38
	26 - 50	32	34	32	38
	51 - 75	41	59	50	41
	76 - 100	24	31	31	32
	101 - 125	5	4	3	3
	126 - 150	0	0	0	0
North Red Fish	1 - 25	0	3	11	50
	26 - 50	31	34	17	31
	51 - 75	40	54	52	39
	76 - 100	27	30	36	39
	101 - 125	5	2	2	2
	126 - 150	1	0	0	0
Bart's Pass	1 - 25	1	3	12	138
	26 - 50	37	52	24	80
	51 - 75	52	51	32	36
	76 - 100	28	26	17	31
	101 - 125	5	4	1	3
	126 - 150	1	1	0	0

Table 3: Average number of oysters per bushel in each size group collected in winter, spring, summer and fall samples at stations in East Bay during 1966.

Station	Size Group MM	Season W	S	S	F
Frenchy's	1 - 25	1	0	7	15
	26 - 50	14	8	2	14
	51 - 50	22	16	15	8
	76 - 100	11	14	18	12
	101 - 125	5	4	7	5
	126 - 150	1	1	1	2
Moody's	1 - 25	13	3	4	7
	26 - 50	59	35	16	40
	51 - 75	10	14	16	20
	76 - 100	10	15	12	17
	101 - 125	1	4	6	5
	126 - 150	0	1	0	1
Elm Grove	1 - 25	5	1	82	179
	26 - 50	32	15	24	139
	51 - 75	17	12	23	13
	76 - 100	16	22	29	28
	101 - 125	5	19	15	18
	126 - 150	0	1	2	2

Table 4: Average number of oyster dredge boats per day observed fishing Galveston Bay reefs during the 1965-66 and 1966-67 seasons.

Season	Area	Months					
		Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
1965-66							
	Red Fish Bar	50	69	66	54	24	
	East Bay	14	20	32	18	31	
	Other	14	18	19	16	11	
	Total	78	107	117	88	66	
1966-67							
	Red Fish Bar	54	62	74	32	40	28
	East Bay	18	21	16	6	7	3
	Other	8	9	4	12	4	6
	Total	80	92	94	50	51	37

Table 5: Comparison of the Galveston Bay oyster harvest during the 1965-66 and 1966-67 seasons.

Month	Barrels		Pounds	
	1965-66	1966-67	1965-66	1966-67
November	44,559	41,604	780,588	728,070
December	56,635	38,928	1,116,544	681,241
January	46,133	38,542	1,009,164	674,548
February	40,118	20,794	789,828	409,235
March	28,816	20,486	630,350	358,503
April	*	10,488	*	160,591
Total	216,331	170,842	4,326,474	3,012,188

(* Oyster season closed by law on March 31 during the 1965-66 season, but extended by law through April during the 1966-67 season.)