STATUS OF THE PUBLIC OYSTER RESOURCE OF VIRGINIA - FALL 1991

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SUMMARY

1. There are fewer market (>3") oysters on public oyster shoals in Virginia than in previous years. Market oyster production may increase in future years depending upon the survival of strong year classes recruited in 1990 and 1991.

2. Overall recruitment was better in 1991 than in 1990, which was considerably better than in previous years. Spatfall was good in the upper James River (Horsehead and Point of Shoals), the Piankatank River, and the lower Rappahannock River (Broad Creek).

3. The strong recruitment in 1990 in the James River and Great Wicomico River resulted in a good supply of seed oysters in those areas in 1991.

4. The oyster pathogen, *Perkinsus marinus* (Dermo), is now resident throughout Virginia, even in areas such as the upper James River and the upper Rappahannock River, that were formerly considered refuges from disease. Prevalence of *P. marinus* at Horsehead in the James River has steadily increased over the past several years. It is now 100% and the intensities are such that mortality is likely occurring.

INTRODUCTION

Oysters have been harvested from Virginia waters as long as humans have inhabited the area. Depletion of natural stocks in the late 1880's led to the establishment of regulations by public fisheries agencies. A survey of bottom areas in which oysters grew naturally was completed in 1896 under the direction of Lt. Baylor, USN. These areas (over 243,000 acres) were set aside by legislative action for public use and have come to be known as the Baylor Survey Grounds or Public Oyster Grounds of Virginia, and are presently administered by the Virginia Marine Resources Commission (VMRC).

Twice a year the Virginia Institute of Marine Science (VIMS) conducts a survey of selected public oyster bars (shoals) in Virginia waters for the purpose of assessing the status of the resource. Surveys conducted in the spring provide information about over-winter mortality and relative fishing pressure from the current harvesting season[1]. Surveys conducted in the fall provide information about spatfall or recruitment, summer (disease) mortality, and the status of each shoal as a source of seed or market oysters prior to the beginning of the harvesting season.

This report summarizes the findings of the Fall 1991 Oyster Shoal Survey, conducted between 23 September and 4 October, 1991.

METHODS

Three 0.5 bushel (25 quart) samples of bottom material were taken at each shoal using a 24 inch dredge having 4 inch teeth. The shoals sampled are shown in Figure 1. Sampling dates, times, water depths, and Loran coordinates are given in Table I.

The following data were obtained for each sample: number of market (>3" in shell height) oysters, number of small (submarket sized) oysters, number of spat (1991 recruits), number of recent boxes (inside of shells clean; dead a month or less), and number of old boxes (inside of shells dirty; dead a month or more). Surface water samples were obtained at each location for temperature (°C) and salinity (ppt) determination. Where possible, 25 oysters were collected for disease analysis (prevalence of *Perkinsus marinus*)[2]. In addition, observations were made regarding the condition of the bottom at each shoal:

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[1]Oysters may be harvested from public shoals in Virginia between 1 October and 1 June with the exception of the seaside of the Eastern Shore, where harvesting is restricted to the period from 1 November to 1 April.

[2]More complete disease data, including prevalence and intensity of both MSX and Perkinsus in Virginia waters, are available from the VIMS disease monitoring program.

bottom material, predators, and fouling organisms.

Data were summarized for each shoal as the average number of market, small, spat, and total oysters per bushel and percent mortality, calculated as : [recent boxes and gapers/oysters + recent boxes and gapers] x 100.

RESULTS
(Refer to Table II)

James River

Seven shoals were sampled in the James River. Surface temperature ranged from 21.8 °C at Long Rock and Dry Shoal to 23.2 °C at Thomas Rock. Salinity was lowest at Horsehead (10.0 ppt) and highest at Wreck Shoal (19.0 ppt).

Market oysters (>3") were most numerous at Long Rock where 15 per bushel were found. Average counts per bushel were 10 at Horsehead, 7 at Dry Shoal, 6 at Wreck Shoal, 4 at Point of Shoals, and 1 at Thomas Rock. Market oysters were not found at Nansemond Ridge. The number of small oysters was greatest at Horsehead, where 1148 per bushel were recovered. At Point of Shoals, Long Rock, Dry Shoal and Wreck Shoal, small oysters averaged between 200 and 500 per bushel, while average counts of 49 and 53 per bushel were found at Thomas Rock and Nansemond Ridge, respectively. Recruitment was greatest at Horsehead, where 580 spat per bushel were found. About 350 spat per bushel were counted at Point of Shoals and Long Rock, about 200 per bushel each at Dry Shoal, Wreck Shoal and Nansemond Ridge, and 109 per bushel at Thomas Rock.

The number of old boxes ranged from 18 per bushel at Point of Shoals to 56 per bushel at Wreck Shoal, while the number of new boxes ranged from 12 per bushel at Thomas Rock to 99 per bushel at Wreck Shoal. Many of the new boxes were spat that had been killed by crabs. Recent mortality exceeded 10% only at Wreck Shoal and Thomas Rock.

Prevalence of *P. marinus* was 100% at Horsehead and Wreck Shoal, 96% at Point of Shoals, and 92% at Nansemond Ridge. This is the first year that a prevalence of 100% has been found as far upriver as Horsehead.

York River

Temperature at the surface was 22.7 °C at Bell Rock and 23.0 °C at Aberdeen Rock in the York River. Salinity was 15.0 ppt at Bell Rock, the upriver station, and 21.0 ppt at Aberdeen Rock, the downriver station.

No market oysters were found at either station. There were 5 small oysters and 4 spat per bushel at Bell Rock and 9 small oysters and 5 spat per bushel at Aberdeen Rock.

One old box per bushel occurred at both Bell Rock and Aberdeen Rock. No new boxes were found at either station. Recent mortality was therefore 0% at both stations.

P. marinus prevalence in the York River was the lowest among the various river systems surveyed, 36% at Aberdeen Rock and 4% at Bell Rock.

Mobjack Bay

Surface temperature was 22.8 °C at Pultz Bar and 23.0 °C at Tow Stake, and salinity was 21.0 ppt at both locations.

At Pultz Bar, 1 market oyster per bushel, and at Tow Stake, 10 market oysters per bushel, were found. There were 58 small oysters per bushel at Pultz Bar and 205 per bushel at Tow Stake. Seventeen spat per bushel were found at Pultz Bar and 122 spat per bushel were found at Tow Stake.

At Pultz Bar there were 37 old and 10 new boxes per bushel, and at Tow Stake 92 old boxes and 25 new boxes per bushel were found. Resultant recent mortality was 12% at Pultz Bar and 7% at Tow Stake.

P. marinus was found in 100% of the oysters examined from both stations.

Piankatank River

At the three stations sampled in the Piankatank River, surface temperature was between 21.7 and 21.9 °C, and salinity was between 19.0 and 20.0 ppt.

No market oysters were found at any of the stations. There were 95 small oysters per bushel at Palace Bar, 126 per bushel at Burton Point, and 194 per bushel at Ginney Point. Spat counts per bushel averaged 813 at Ginney Point, 841 at Palace Bar, and 622 at Burton Point.

The number of old boxes per bushel ranged from 15 at Palace Bar to 43 at Burton Point, and the number of new boxes per bushel varied from 33 at Burton Point to 36 at Ginney Point. Most of the new boxes were spat that had been preyed upon by crabs. Recent mortality was 3% at Ginney Point and 4% at Palace Bar and Burton Point.

Prevalence of *P. marinus* was 100% at both Ginney Point and Palace Bar and 92% at Burton Point.

Rappahannock River

At the eight stations surveyed in the Rappahannock River, surface temperature ranged from 20.4 °C at Bowlers Rock to 23.2 °C at Hog House. Salinity generally increased in a downriver direction, from 15.0 ppt at Morattico Bar to 20.0 ppt at Broad

Creek. Several of the salinity samples were lost.

Counts of market oysters per bushel were 33 at Bowlers Rock, decreasing to 21 at Smokey Point, 11 at Morattico Bar, 9 at Broad Creek, 4 at Hog House, 2 at Parrot Creek, 1 at Ross Rock, and 0 at Drumming Ground. Small oysters were most numerous at Broad Creek (147 per bushel), decreasing to 91 per bushel at Ross Rock, 87 per bushel at Hog House, 57 per bushel at Parrot Creek, 56 per bushel at Smokey Point, 41 per bushel at Bowlers Rock, 23 per bushel at Morattico, and 21 per bushel at Drumming Ground. The number of spat per bushel increased in a downriver direction, from <10 at Ross Rock, Bowlers Rock, and Morattico Bar to 10 at Smokey Point, 57 at Hog House, 204 at Drumming Ground, 981 at Parrot Creek, and 1139 at Broad Creek.

The number of old boxes per bushel ranged from 0 at Ross Rock to 103 at Broad Creek, and the number of new boxes per bushel ranged from 0 at Ross Rock to 67 per bushel at Broad Creek (mostly spat). At Morattico Bar, Hog House, and Smokey Point, however, many of the new boxes were market sized oysters, indicating recent disease-related mortality. Overall, recent mortality ranged from 0% at Ross Rock to 15% at Drumming Ground. Recent mortality was <10% at all other stations.

Prevalence of *P. marinus* was 0% at Ross Rock, 44% at Drumming Ground, 88% at Bowlers Rock, and 100% at all other stations. Oysters taken from Ross Rock after this survey were found to be infected with Perkinsus.

Corrotoman River

At the Middle Ground station in the Corrotoman River, temperature at the surface was 22.6 °C and salinity was 18.0 ppt.

There were 6 market oysters per bushel, 39 small oysters per bushel, and 106 spat per bushel.

An average of 27 old boxes and 10 new boxes per bushel were found. Recent mortality was thus 6%.

P. marinus was found in 96% of the oysters sampled.

Great Wicomico River

Temperature at the surface ranged from 22.7 °C to 23.2 °C at the three stations sampled in the Great Wicomico River. Salinity was 18.0 ppt at Fleeton Point, the only station for which a sample was collected.

There was an average of 1 market oyster per bushel at Whaleys East, 6 per bushel at Haynie Point, and 9 per bushel at Fleeton Point. The number of small oysters per bushel ranged from 176 at Haynie Point to 339 at Whaleys East. Spat counts were 147 per bushel at Whaleys East, 218 per bushel at Fleeton Point, and 328 per bushel at Haynie Point.

The average number of old boxes per bushel was 29 at Haynie Point, 17 at Whaleys East, and 42 at Fleeton Point. The average number of new boxes per bushel was 26 at Haynie Point, 47 at Fleeton Point, and 30 at Whaleys East. Recent mortality was 5% at Haynie Point, 6% at Whaleys East, and 8% at Fleeton Point.

The prevalence of *P. marinus* was 80% at Haynie Point, 84% at Whaleys East, and 88% at Fleeton Point.

DISCUSSION

Market Oysters

Market oysters represent the harvestable portion of the population. The greatest concentration of market oysters is presently in the upper James River (Horsehead and Long Rock) and in the upper Rappahannock River (Bowlers Rock, Morattico Bar, and Smokey Point). The average number of market oysters in the James River (10-15 per bushel at Horsehead and Point of Shoals) is lower than that found in 1990 and previous years (Figure 2). In the Rappahannock River, the number of market oysters found this year at both Bowlers Rock and Morattico Bar (33 and 11 per bushel, respectively) was similar to that found in previous years (Figure 3). Based on these results, market oyster harvest from public grounds in Virginia for the 1991-92 harvest season probably will be lower than the total from 1990-91, even with a similar level of effort. Increased production from public grounds on the Eastern Shore may offset this decrease, however.

Small Oysters

Small oysters are over 1 year old but are too small to be harvestable. They represent oysters that are potentially harvestable next year or the year after, depending on survival and growth rates. The upper James River (Horsehead, Point of Shoals and Long Rock) had between 335 and 1148 small oysters per bushel. The Great Wicomico River (Haynie Point, Whaleys East, and Fleeton Point) had 176-339 small oysters per bushel. In both cases, the large number of small oysters in 1991 is correlated with a large number of spat in 1990. These areas are presently the best "seed"[3] areas in the state and have the best chance of producing market oysters in the next two years.

Movement of seed oysters has to be done with careful consideration of the potential for transporting disease along with seed. In general, seed oysters should never be moved to an area of lower *P. marinus* prevalence than from where they came. Also, the survival rate of seed oysters to market size will be determined to a large extent by resident disease activity at the growout site.

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[3]Seed oysters are small oysters that are moved to other areas (usually private grounds) for growout.

Spat

Spat are juvenile oysters that have been recruited into the population within the last spawning season (few months). They are potentially important as seed oysters (in 1-3 years) and market oysters (in 3-5 years), depending on growth and survival. Overall, recruitment was greater in 1991 than in 1990. Good counts of spat were found in the James River at Horsehead, Point of Shoals, and Long Rock, at all three shoals in the Piankatank River, and at Parrot Creek and Broad Creek in the Rappahannock River, and to a lesser extent in the Great Wicomico River at Haynie Point. The Piankatank and Great Wicomico Rivers continue to be good spat collection areas, and good candidates for shell planting. Broad Creek near the mouth of the Rappahannock River is also a likely candidate for shell planting, especially considering its hard sand bottom, and excellent growing conditions.

Mortality and Disease

Prediction of future seed and market harvests is difficult due to differential mortality rates caused by predators such as crabs and the pathogens MSX and *P. marinus*. Much of the recent mortality seen in this survey was due to spat that had recently been killed by crabs. Mortality caused by predators is usually quite high for small oysters (spat), but decreases as oysters become larger. Mortality caused by disease becomes important in the second and third years of growth, usually just as oysters are reaching market size. It was noteworthy that at Morattico Bar, Smokey Point, and Hog House in the Rappahannock River, there were relatively large numbers of older oysters that had died, probably within the last several months, from disease. The market oysters that were surviving at the time of the survey were of poor condition, probably due to sublethal effects of *P. marinus*.

Overall, prevalence and distribution of *P. marinus* is the greatest it has ever been. In 1990, the prevalence of *P. marinus* at Horsehead in the James River was 88%, all light infections. This year the prevalence was 100%, with moderate and heavy infections being found. This prevalence and intensity would indicate that some of the larger (market) oysters are being killed by the parasite. The considerably greater number of boxes (both old and new) in the upper James River this year (1991) compared to last year (1990) substantiates this mortality. At Ross Rock in the Rappahannock River, *P. marinus* was not found at the time of the survey but was found the following month. This means that *P. marinus* is now prevalent throughout the state. In some instances, however, there are highly variable prevalences within the same systems. The relatively low prevalence of 44% at Drumming Ground in the Rappahannock River, and at both stations in the York River (36% at Aberdeen Rock and 4% at Bell Rock) may be due to the fact that only small (young) oysters were present, and as stated before, *P. marinus* does not become established until oysters are 2-3 years old. Another possible explanation for the low prevalence in the York River is that there are so few

oysters there that disease transmission from one oyster to another is inhibited. The threat posed by oyster pathogens, especially *P. marinus*, makes any attempt to rehabilitate depleted oyster populations extremely difficult.

ACKNOWLEDGEMENTS

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TABLE I

Station Locations and Dates Sampled - Fall 1991

Station	Date	Time	Depth	Loran Coordinates	
James River					
Horsehead	27 Sept.	0913	6.2′	27346.0	41333.2
Pt. of Shoals	25 Sept.	1251	12.0′	27344.0	41310.6
Long Rock	27 Sept.	1040	9.0′	27338.4	41312.9
Dry Shoal	27 Sept.	1146	8.5′	27332.5	41302.3
Wreck Shoal	27 Sept.	1322	12.0′	27326.0	41301.8
Thomas Rock	25 Sept.	0934	12.0′	27302.7	41218.8
Nansemond Ridge	25 Sept.	1117	11.0′	27280.6	41218.8
York River					
Bell Rock	23 Sept.	0941	15.0′	27424.7	41596.8
Aberdeen Rock	23 Sept.	1049	6.2′	27368.3	41501.2
Mobjack Bay					
Pultz Bar	24 Sept.	1020	15.0′	27310.6	41534.6
Tow Stake	24 Sept.	1137	17.0′	27316.9	41521.5
Piankatank River					
Ginney Point	26 Sept.	1319	9.5′	27347.2	41659.6
Palace Bar	26 Sept.	1135	10.0′	27338.0	41658.0
Burton Point	26 Sept.	1035	12.0′	27326.4	41652.3
Rappahannock River					
Ross Rock	30 Sept.	1030	5.0′	27496.8	41897.8
Bowlers Rock	30 Sept.	1130	8.5′	27472.4	41847.3
Morattico Bar	30 Sept.	1215	12.0′	27447.0	41820.0
Smokey Point	30 Sept.	1325	13.0′	27418.1	41779.9
Hog House	1 Oct.	1436	18.0′	27398.3	41725.8
Drumming Ground	1 Oct.	1310	11.0′	27377.8	41738.1
Parrot Creek	1 Oct.	1134	9.0′	27361.9	41710.4
Broad Creek	1 Oct.	1013	16.0′	27329.0	41698.0
Corrotoman River					
Middle Ground	1 Oct.	1355	9.5′	27386.2	41763.0
Great Wicomico River					
Haynie Point	4 Oct.	1119	5.5′	27366.4	41881.4
Whaleys East	4 Oct.	1030	12.0′	27361.0	41866.7
Fleeton Point	4 Oct.	1240	10.5′	27358.2	41868.1

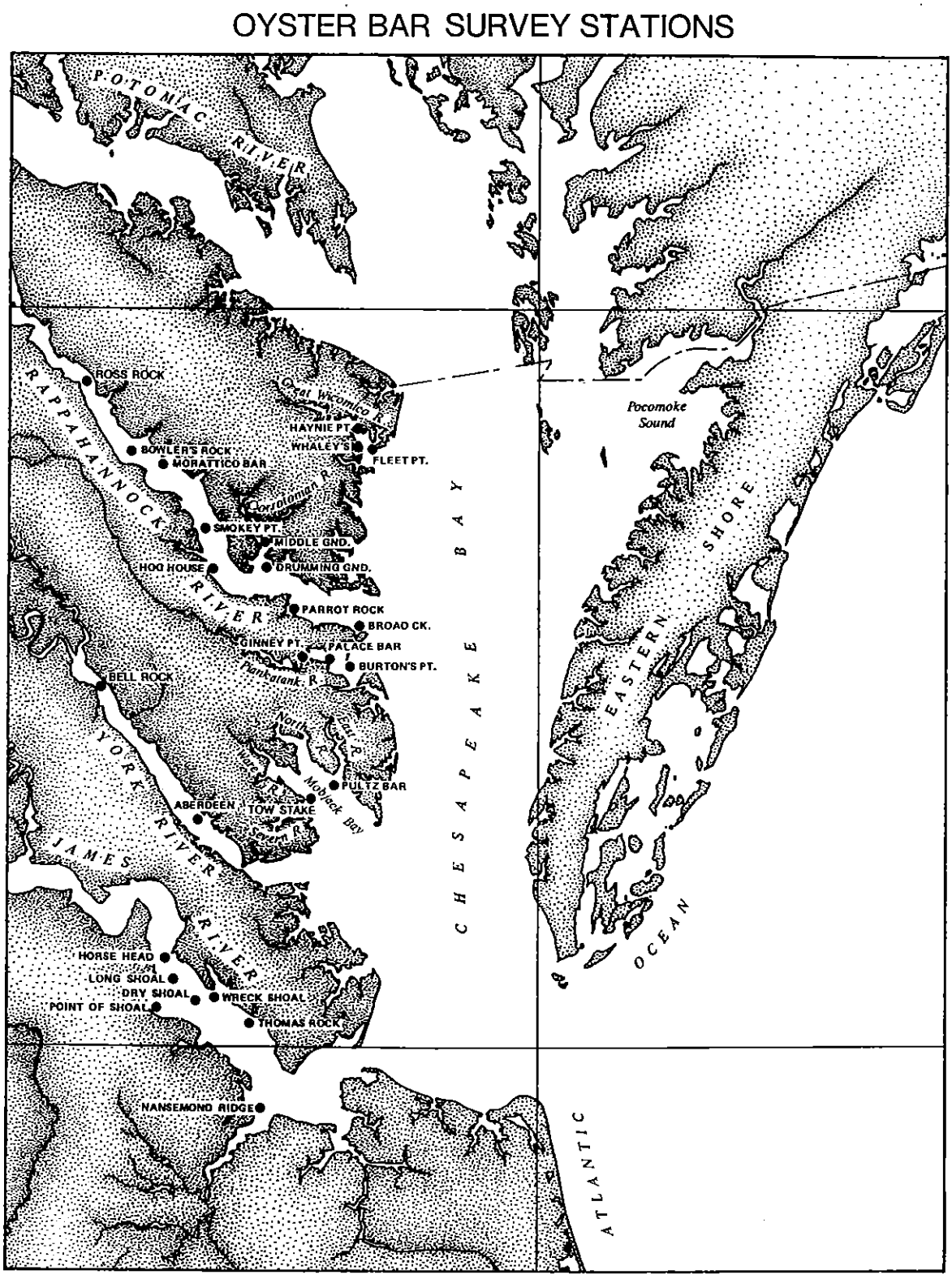


Figure 1. Oyster shoal survey stations.

TABLE II

Results of Public Oyster Shoal Survey - Fall 1991

STATION	TEMP. (°C)	SAL. (ppt)	AVERAGE NO. OYSTERS PER BUSHEL Market	Small	Spat	Total	BOXES Old	New	% RECENT MORTALITY	Perkinsus (% Prev.)
James River										
Horsehead	21.9	10.0	10	1148	580	1738	21	41	2	100
Pt. of Shoals	23.1	15.0	4	507	351	862	18	39	4	96
Long Rock	21.8	13.0	15	335	366	716	25	27	4	---
Dry Shoal	21.8	15.0	7	208	199	414	25	54	12	---
Wreck Shoal	22.3	19.0	6	382	239	627	56	99	14	100
Thomas Rock	23.2	18.0	1	49	109	159	39	12	7	---
Nansemond Rdg	----	18.0	0	53	178	231	29	15	6	92
York River										
Bell Rock	22.7	15.0	0	5	4	9	1	0	0	4
Aberdeen Rock	23.0	21.0	0	9	5	14	1	0	0	36
Mobjack Bay										
Pultz Bar	22.8	21.0	1	58	17	76	37	10	12	100
Tow Stake	23.0	21.0	10	205	122	337	92	25	7	100
Piankatank River										
Ginney Point	21.7	19.0	0	194	813	1007	29	36	3	100
Palace Bar	21.7	19.0	0	95	841	936	15	34	4	100
Burton Point	21.9	20.0	0	126	622	748	43	33	4	92

TABLE II, continued

STATION	TEMP. (°C)	SAL. (ppt)	AVERAGE NO. OYSTERS PER BUSHEL Market	Small	Spat	Total	BOXES Old	New	% RECENT MORTALITY	Perkinsus (% Prev.)
Rappahannock River										
Ross Rock	20.5	----	1	91	6	98	0	0	0	0
Bowlers Rock	20.4	----	33	41	2	76	13	2	3	88
Morattico Bar	21.0	15.0	11	23	1	35	37	1	3	100
Smokey Point	21.6	17.0	21	56	10	87	26	9	9	100
Hog House	23.2	----	4	87	57	148	21	12	8	100
Drumming Gnd	23.0	19.0	0	21	204	225	5	41	15	44
Parrot Creek	22.2	----	2	57	981	1040	35	63	6	100
Broad Creek	21.8	20.0	9	147	1139	1295	103	67	5	100
Corrotoman River										
Middle Ground	22.6	18.0	6	39	106	151	27	10	6	96
Great Wicomico River										
Haynie Point	22.7	----	6	176	328	510	29	26	5	80
Whaleys East	22.7	----	1	339	147	487	17	30	6	84
Fleeton Point	23.2	18.0	9	318	218	545	42	47	8	88

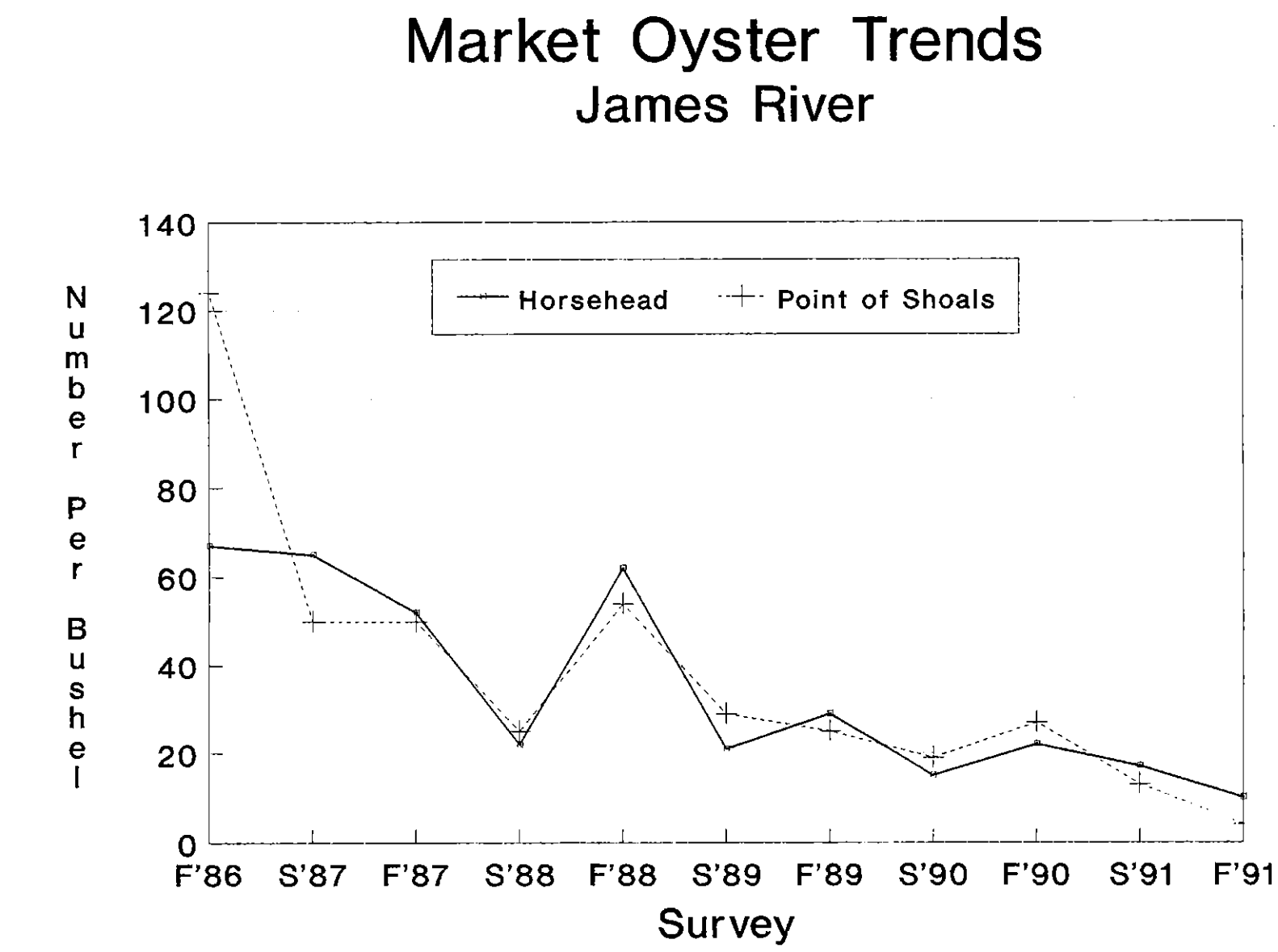
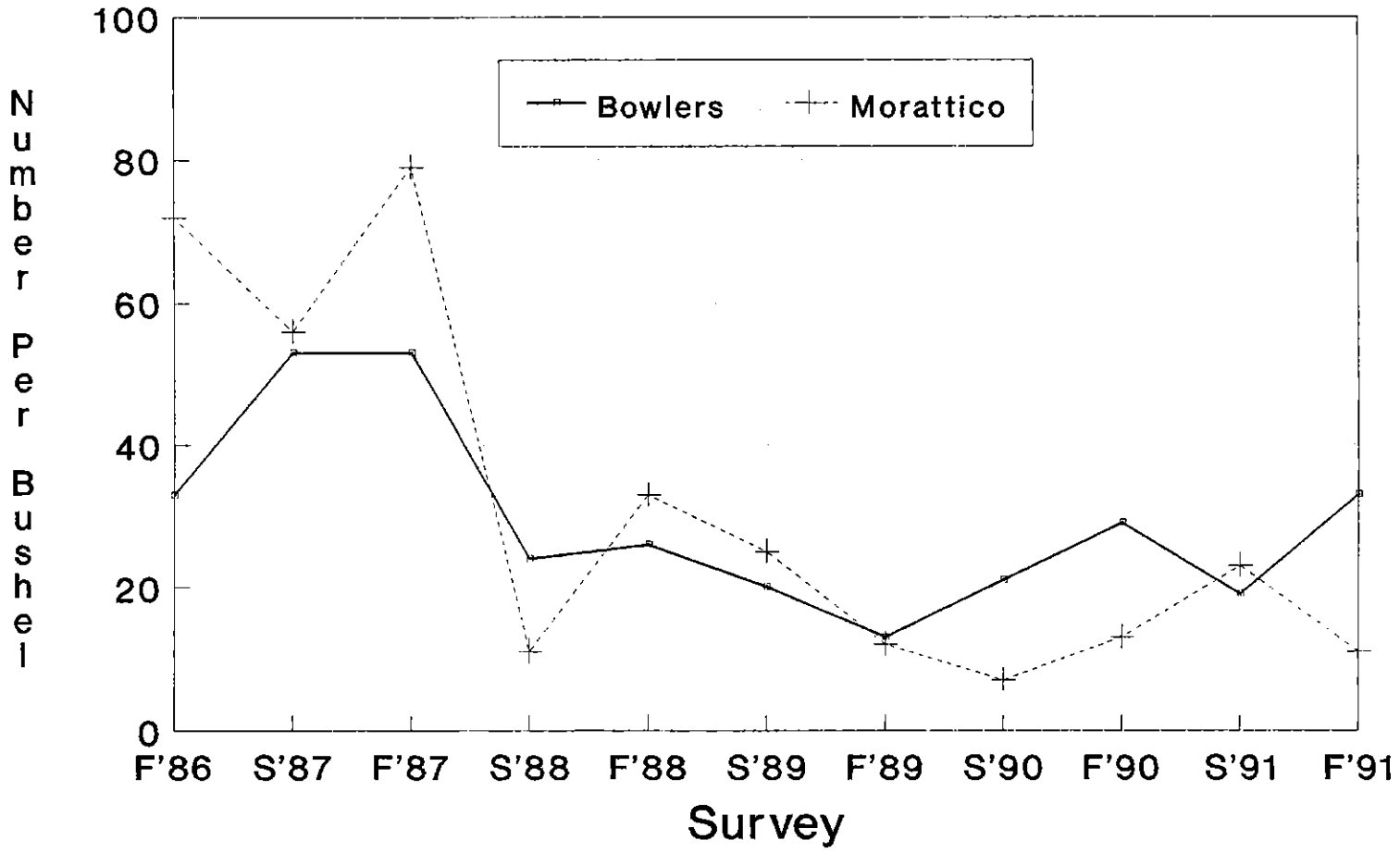


Figure 2. Number of market oysters per bushel at Horsehead and Point of Shoals.

Market Oyster Trends
Rappahannock River



S=Spring; F=Fall

Figure 3. Number of market oysters per bushel at Bowlers Rock and Morattico Bar.