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Status of the Public Oyster Fishery of Virginia - Fall 1989

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EXECUTIVE SUMMARY

The deterioration of the public oyster fishery in Virginia is continuing. The 1989-90 harvest season is beginning with about the same number of market-sized oysters that remained after the 1988-89 season. These are restricted to a few shoals in the upper James River and the Upper Rappahannock River. Overall, 1989 was a poor recruiting year, with the exception of the lower Piankatank River (Burton Point) and the lower Great Wicomico River. Further depletion of broodstock can only negatively affect recruitment and the declining supply of seed oysters, especially in the James River.

The relatively low salinities that prevailed throughout the state in 1989 (due to increased rainfall) have reduced the presence of one oyster disease (MSX) but not another (Perkinsus). Although there is little indication of disease mortality in the upper James and Rappahannock Rivers, Perkinsus is now present throughout the state, so the potential for mortality in these areas exists, especially if drought conditions return. The movement of diseased seed to upriver locations may have contributed to the spread of this disease.

The following recommendations regarding the public oyster fishery are made:

1. THE UPPER JAMES RIVER SEED AREA CONTAINS ANY POTENTIAL THE PUBLIC FISHERY HAS FOR RECOVERY AND SHOULD BE MANAGED (=CONSERVED) AS A SEED AREA. REMOVAL (MOVEMENT AND HARVEST) OF MARKET OYSTERS FROM THIS AREA SHOULD BE ELIMINATED TO HELP MAINTAIN BROODSTOCK. LIMITED SEED HARVEST COULD POTENTIALLY BE SUSTAINED.

2. SHELL PLANTING EFFORTS IN THE PIANKATANK RIVER AND GREAT WICOMICO RIVER SHOULD BE CONTINUED.

3. TO REDUCE FURTHER SPREAD OF DISEASE (ESP. PERKINSUS), OYSTER "SEED" SHOULD NOT BE MOVED FROM AREAS OF HIGHER DISEASE PREVALENCE TO AREAS OF LOWER DISEASE PREVALENCE.

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. Public oyster grounds in Virginia are presently adimnistered by the Virginia Marine Resources Commission (VMRC).

Twice a year the Virginia Institute of Marine Science 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. 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 and/or market oysters prior to the beginning of the harvesting season.

This report summarizes the results of the Fall 1989 Oyster Shoal Survey, conducted between September 26 and October 5, 1989, and includes comments about the state of the fishery as well as biological management recommendations. More detailed recommendations regarding the entire Virginia oyster fishery can be found in Hargis and Haven (1988).

METHODS

The areas sampled are shown in Figure 1. Loran coordinates for each location are given in Table I. At least three 0.5 bushel samples (1 bushel = 50 quarts) of bottom material were taken at each shoal using a 24 inch dredge having four inch teeth.

The following data were recorded for each sample: number of market oysters (>3" in shell height), number of small (submarket oysters), number of spat (1989 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). Bottom water samples were obtained at each location for temperature

(^{o}C) and salinity (^{o}/oo) determination. Where possible, 25 oysters were collected for disease analysis. In addition, observations were made regarding the condition of the bottom at each shoal- shell, predators, fouling.

Data were summarized for each shoal as the average number of market, small, yearling, and total oysters per bushel and percent recent mortality, calculated as: [recent boxes and gapers/ oysters + recent boxes and gapers] x 100. This information, along with the temperature, salinity, and disease prevalence (% infected), is provided in Table II.

RESULTS

James River

Seven shoals were sampled in the James River. The number of market oysters per bushel increased in an upriver direction, ranging from 0 at Nansemond Ridge and Thomas Rock to 29 at Horsehead. Small oysters also increased in number from 31 per bushel at Thomas Rock upriver to 305 per bushel at Point of Shoals. Number of spat in 1989 was low, ranging from 33 per bushel at Long Rock to 163 per bushel at Nansemond Ridge. The total number of oysters per bushel was fairly consistent throughout the river, ranging from 116 (Thomas Rock) to 378 (Pt. of Shoals).

The greatest number of old boxes occurred at Wreck Shoal and the greatest number of new boxes occurred at Point of Shoals and Wreck Shoal. Recent mortality was 5% or less at all locations sampled.

Bottom temperature ranged from 19.8 ^{o}C at Nansemond Ridge to 21.5 ^{o}C at Horsehead. Salinity varied from 3.9 ^{o}/oo at Horsehead to 12.1 ^{o}/oo at Thomas Rock.

Prevalence of Perkinsus was 100% at Wreck Shoal and 20% at Horsehead.

York River

The two shoals examined in the York River, Bell Rock and Aberdeen Rock, had 0 market oysters per bushel, 5 and 6 small oysters per bushel, and 0 and 2 spat per bushel, respectively. Thus total oysters per bushel were 5 at Bell Rock and 8 at Aberdeen Rock.

Very few boxes (old or new) were found at either location, but because there were so few oysters present, recent mortality was 11% at Aberdeen Rock.

At Bell Rock, bottom temperature was 22.7 °C and salinity was 12.4 °/oo. At Aberdeen Rock, bottom temperature was 22.1 °C and salinity was 15.3 °/oo.

Mobjack Bay

The two shoals sampled in Mobjack Bay also had very few living oysters. There were 4 market and 6 small oysters per bushel at Tow Stake and 0 market and 13 small oysters per bushel at Pultz Bar. Spat were absent from both locations.

There were 4 old boxes per bushel at Pultz Bar and 9 old boxes per bushel at Tow Stake. Both shoals had 1 new box per bushel, for a recent mortality of 7% at Pultz Bar and 9% at Tow Stake.

At Pultz Bar, bottom temperature was 21.9 °C and at Tow Stake, bottom temperature was 21.8 °C. Salinity was 18.5 °/oo at both shoals.

At Tow Stake, 88% of the oysters sampled had Perkinsus.

Piankatank River

There were 2 or fewer market oysters per bushel at the three shoals sampled in the Piankatank River. Numbers of small oysters per bushel ranged from 13 at Burton Point to 120 and Ginney Point. Numbers of spat per bushel varied from 147 at Palace Bar to 893 at Burton Point. Total oysters ranged from 232 per bushel at Palace Bar to 907 per bushel at Burton Point.

At Ginney Point, 12 old boxes and 11 new boxes were found per bushel. At Palace Bar there were 8 old boxes and 9 new boxes per bushel, and at Burton Point there were 2 old boxes and 22 new boxes per bushel. However, because live oysters were relatively numerous, recent mortality was 4% or less at all locations.

Bottom temperature ranged from 19.8 °C at Burton Point to 21.0 °C at Ginney Point while bottom salinity ranged from 14.4 °/oo at Ginney Point to 15.4 °/oo at Burton Point.

Prevalence of Perkinsus was 92% at Ginney Point and 88% at Palace Bar.

Rappahannock River

The Rappahannock River was sampled at eight locations from near the mouth (Broad Creek) to the uppermost productive shoal (Ross Rock). The most market oysters (11-13 per bushel) were found at the upriver shoals, Morattico Bar, Bowlers Rock, and Ross Rock. The number of small oysters per bushel ranged from 2 at Drumming Ground to 131 at Ross Rock. The number of spat per bushel increased in a downriver direction; there were 0 spat per bushel at Ross Rock and Bowlers Rock and 246 spat per bushel at Broad Creek. Since the most spat occurred at Broad Creek, total oysters per bushel were most numerous at Broad Creek (324) and least numerous at Drumming Ground and Hog House (7).

The number of old boxes ranged from 2 per bushel at Ross Rock to 14 per bushel at Morattico Bar. New boxes were most numerous at Broad Creek (27 per bushel, mostly spat). No new boxes were found at Ross Rock, Bowlers Rock, Smokey Point, and Hog House; thus recent mortality was 0% at these shoals. Recent mortality was greatest at Drumming Ground (50%; mostly spat), where there was only 7 total oysters per bushel.

Bottom temperature in the Rappahannock River varied from 19.1 ^{o}C at Ross Rock to 22.0 ^{o}C at Smokey Point, while salinity ranged from 2.0 ^{o}/oo at Ross Rock to 15.8 ^{o}/oo at Broad Creek.

Perkinsus was present throughout the Rappahannock River; prevalence ranged from 30% at Ross Rock to 100% at Morattico Bar.

Corrotoman River

Middle Ground was the only shoal sampled in the Corrotoman River, a tributary of the Rappahannock River. There were 0 market oysters per bushel, 61 small oysters per bushel, and 77 spat per bushel, for a total of 138 total oysters per bushel.

There were 9 old boxes and 3 new boxes per bushel; recent mortality was 2%.

Bottom temperature was 20.2 ^{o}C and bottom salinity was 13.3 ^{o}/oo.

Prevalence of Perkinsus was 74%.

Great Wicomico River

The three shoals sampled in the Great Wicomico River were quite similar. Market oysters numbered 1 or 0 at all three locations. Small oysters varied between 174 per bushel (Whaleys East) and 225 per bushel (Haynie Point). Spat were most numerous at Fleeton Point (299 per bushel) and least numerous at Whaleys East (151 per bushel). Total oysters per bushel ranged from 325 at Whaleys East to 507 at Fleeton Point.

There were 14 old boxes per bushel at Fleeton Point and 1 per bushel at Whaleys East. New boxes ranged from 6 per bushel at Whaleys East to 17 per bushel at Haynie Point. Recent mortality was greatest at Haynie Point (4%).

Among the three shoals, bottom temperature ranged from 17.8 ^{o}C to 19.0 ^{o}C and bottom salinity ranged from 14.9^{o}/oo to 15.2 ^{o}/oo.

Perkinsus was present in 84-88% of the oysters sampled.

DISCUSSION

Fishery

The Virginia public oyster fishery is presently in the poorest condition it has ever been in. Areas that were eliminated from market production by disease (lower James River, York River, Mobjack Bay, and lower Rappahannock River including the Corrotoman River) remain non-productive and diseases (primarily Perkinsus) remain endemic (see Table II). This has limited fishing effort for market oysters in recent years to two primary areas, the upper James River (formerly harvested for seed; opened to market harvest in 1986) and the upper Rappahannock River. The result of concentrating the entire fishing effort in two relatively small areas can be dramatically seen in Figures 2 and 3. In the upper James River, the average number of market oysters per bushel has been reduced from over 120 in the fall of 1986 to the present figure of less than 30.[1] In the upper Rappahannock, the number of market oysters per bushel has decresed from 60-80 as recently as the fall of 1987 to the present figure of less than 15. In each of the last three fishing

1. It should be noted that in the James River, market size is 2.5" rather than 3.0", as used in this survey.

seasons (1986-87, 1987-88, and 1988-89, the effect of harvesting effort has been seen as a reduction in the number of average market oysters per bushel from the fall (pre-harvest) to the spring (post-harvest). This can be seen in Figures 2 and 3. Any post-harvest recovery that the fishery might make would occur over the summer and would be seen as in increase in the average number of market oysters per bushel. This was seen to a moderate extent in both rivers in the summer of 1988, but not the summer of 1989 (Figures 2 and 3). Thus the 1989-90 harvest season is beginning with the same number (or fewer) of market-sized oysters that were present at the end of last season. As a point of reference, public oyster production last season was 164,074 bushels, an all time low (VMRC data).

The short-term potential for improvement is dismal. The number of small or "seed" oysters that will grow to market size (if conditions for survival allow) are alarmingly low throughout the fishery as well. The greatest numbers exist at Point of Shoals (305 per bushel) and Horsehead (138 per bushel) in the James River and in the Great Wicomico River (about 200 per bushel). These numbers are even lower than last year when Point of Shoals had 420 small oysters per bushel and Horsehead had 231 small oysters per bushel. Thus it would appear that the once vast supply of seed oysters that were harvested from public beds (particularly in the James) is disappearing.

Survival of spat in 1989 was slightly better than in 1988 in a few areas. There were 893 spat per bushel at Burton Point in the Piankatank River and 299 spat per bushel at Fleeton Point in the Great Wicomico River. However, when a good abundance of spat in found in disease endemic areas such as these, survival to market size is prohibited. Alternatively, the danger of spreading disease <u>should</u> prohibit its movement to other areas. Thus even when successful recruitment occurs in disease endemic areas, it is effectively of little use to the public fishery. In the James River, average numbers of spat per bushel were between 33 and 163. In contrast, spat counts exceeding 1000 were not uncommon in the James prior to 1960.

Recent mortality was relatively low throughout the survey (generally <10%), indicating that there has been no recent increase in disease activity. There were three shoals that had a recent mortality over 10%. In two of these (Aberdeen Rock in the York River and Drumming Ground in the Rappahannock River), disease is endemic and the number of live oysters is low, indicating that what few oysters are there are dying from disease. However, at Morattico

Bar in the upper Rappahannock, recent mortality was 11% while prevalence of Perkinsus was 100%. This suggests that disease mortalities may be occurring there, and because of the high prevalence, may increase in the near future.

The Relationship Between Broodstock and Recruitment

What made the upper James River such an excellent seed area in past years was the consistent, heavy spatfall that occurred there. Spatfall began a drastic decline after 1960 in association with disease-related mortality of older, broodstock oysters in the lower James River. These numbers are documented and correlate quite well (Haven et al., 1978).

Due to continuing disease activity in the lower part of the river, broodstock in the James is presently confined to the area between Wreck Shoal and Deepwater Shoal. This is the area that for the last three harvest seasons has received the greatest fishing effort and as a result has provided the bulk of public market harvest in Virginia (VMRC data). Although it can be argued that two oysters, each producing millions of gametes, is all that is theoretically needed to repopulate an area, clearly the more oysters there are to reproduce, the greater the recruitment potential. At some point, the increased removal of broodstock from a population has to affect recruitment. This was seen in the lower James as a result of disease mortality, and may be occurring in the upper James as a result of harvesting activity. The movement of oysters from Deepwater Shoal to a site downriver (undertaken by VMRC this past summer) further depletes broodstock because these oysters will either be harvested or killed by disease. Without recruitment, the resource will not be able to sustain itself and harvests will continue to decline. Examination of the relationship between broodstock abundance and recruitment is continuing.

Disease Dynamics

Salinity was lower in Virginia waters in 1989 due to above average rainfall. Salinities listed in Table II are indicative of the entire year. In the James River, salinity at Wreck Shoal was consistently below 15 $^{o}/oo$ all summer. As a result, MSX was eliminated in the James River from Wreck Shoal upriver. However, Perkinsus was not similarly affected; Wreck Shoal now has a 100% prevalence, and Perkinsus is now present on all oyster shoals in the state (Table II).

It was previously thought that upriver shoals were protected from Perkinsus due to lower salinity. Based on what occurred this year, it is clear that low salinity is not a barrier to Perkinsus. It may be that physical limitations on the spread of Perkinsus upriver have been circumvented by the movement of diseased seed to previously non-diseased areas. For example, as part of the state's repletion program, seed from Palace Bar in the Piankatank River (88% Perkinsus prevalence) was planted on Ross Rock in the Rappahannock River this year; we now are finding Perkinsus there (Table II). Similarly, Perkinsus was seen for the first time last year at Horsehead and Deepwater Shoal, the uppermost shoals in the James River. Although decreased salinity has not stopped the spread of Perkinsus, it may have reduced the intensification of the disease and resultant mortality. Another warm, dry summer could have dire consequences. Research examining the relationlships between salinity and oyster diseases is currently underway at VIMS.

Condition of Substrate

The basis for an oyster shoal is provided by the underlying shell. On a productive shoal, new shell is produced by living, growing oysters. This provides substrate for the attachment of spat. If there is no substrate there can be no recruitment, even if there is an abundance of larvae.

When oyster production ceases, such as has occurred in many areas of Virginia due to the effects of disease, two things happen to the remaining shell substrate. First of all, the shoal begins silting over, and depending on flow and currents, can become buried, thus rendering it unavailable for recruitment. Secondly, the dead shell is gradually broken apart and decomposed by boring and fouling organisms. Harvesting activity further tends to break up old shell. Fouling organisms also compete with oyster recruits for limited space. These trends have been observed to an increasing degree in recent surveys. If disease impacts should abate and oyster larvae become suddenly abundant, recovery of the fishery would then be limited by the declining condition of available substrate.

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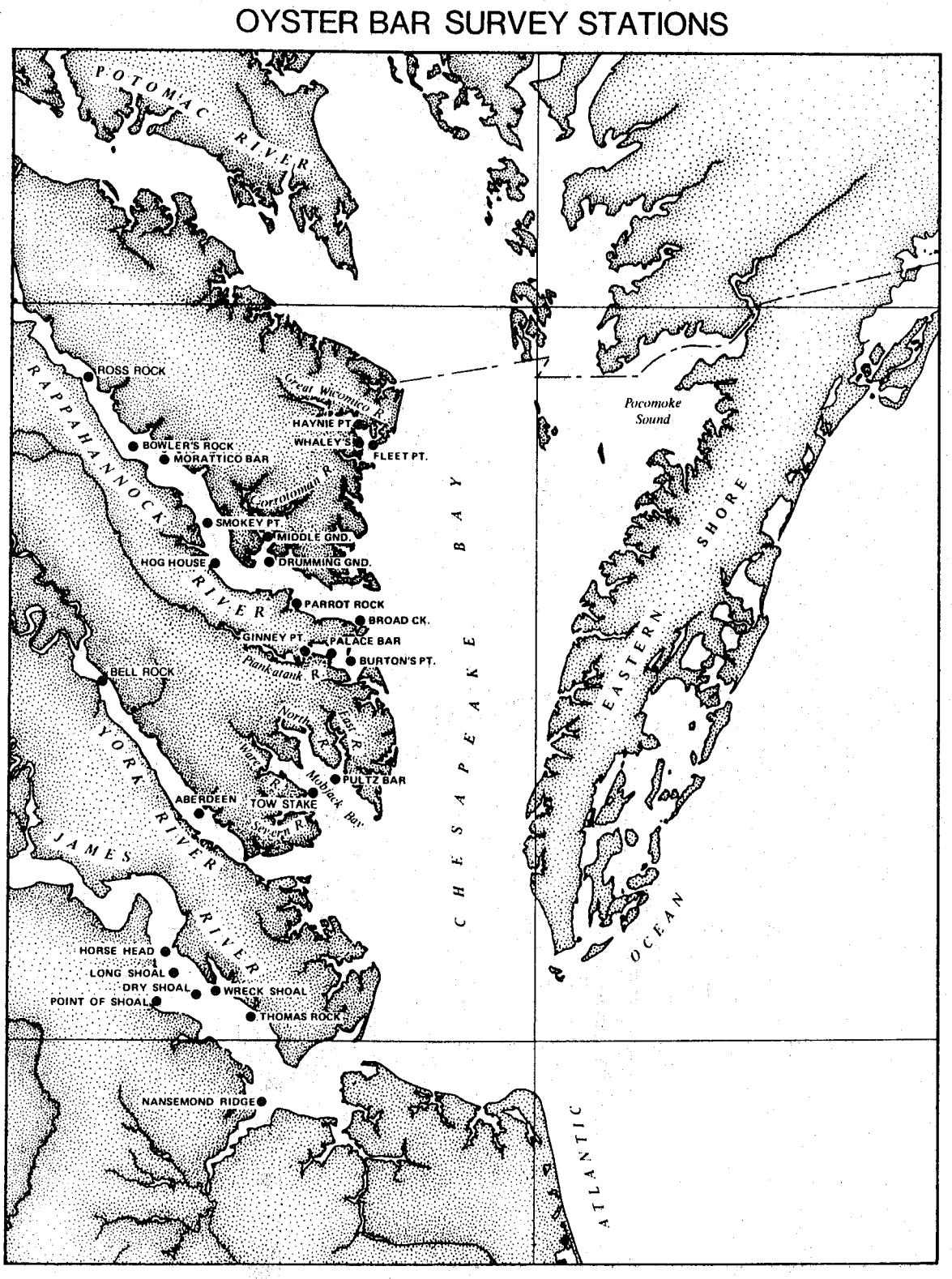

Figure 1. Map showing locations of oyster shoals sampled.

TABLE I

Station Locations and Dates Sampled - Fall 1989

Station	Date	Loran Coordinates	
James River			
Horsehead	28 Sept.	27346.0	41333.2
Pt. of Shoals	29 Sept.	27344.0	41310.6
Long Rock	29 Sept.	27338.4	41312.9
Dry Shoal	29 Sept.	27332.5	41302.3
Wreck Shoal	29 Sept.	27326.0	41301.8
Thomas Rock	28 Sept.	27302.7	41218.8
Nansemond Ridge	28 Sept.	27280.6	41218.8
York River			
Bell Rock	26 Sept.	27424.7	41596.8
Aberdeen Rock	26 Sept.	27368.3	41501.2
Mobjack Bay			
Pultz Bar	26 Sept.	27310.6	41534.6
Tow Stake	26 Sept.	27316.9	41521.5
Piankatank River			
Ginney Point	27 Sept.	27347.2	41659.6
Palace Bar	27 Sept.	27338.0	41658.0
Burton Point	27 Sept.	27326.4	41652.3
Rappahannock River			
Ross Rock	4 Oct.	27496.8	41897.8
Bowlers Rock	3 Oct.	27472.4	41847.3
Morattico Bar	3 Oct.	27447.0	41820.0
Smokey Point	3 Oct.	27418.1	41779.9
Hog House	2 Oct.	27398.3	41725.8
Drumming Ground	2 Oct.	27377.8	41738.1
Parrot Rock	2 Oct.	27361.9	41710.4
Broad Creek	2 Oct.	27329.0	41698.0

TABLE I, cont.

Station	Date	Loran Coordinates	
Corrotoman River			
Middle Ground	2 Oct.	27386.2	41763.0
Great Wicomico River			
Haynie Point	5 Oct.	27366.4	41871.4
Whaleys East	5 Oct.	27361.0	41866.7
Fleeton Point	5 Oct.	27358.2	41868.1

TABLE II

Results of Public Oyster Shoal Survey - Fall 1989

STATION	TEMP. (°C)	SAL. (°/oo)	AVERAGE NO. OYSTERS PER BUSHEL				BOXES		RECENT MORTALITY (%)	Perkinsus (% Prev.)
			Market	Small	Spat	Total	Old	New		
James River										
Horsehead	21.5	3.9	29	138	105	272	24	7	3	20
Pt. of Shoals	21.0	2.6	25	305	48	378	17	10	3	
Long Rock	21.5	5.7	19	111	33	163	41	9	5	
Dry Shoal	20.7	8.1	3	98	49	150	36	6	4	
Wreck Shoal	20.1	6.6	8	90	108	206	63	11	5	100
Thomas Rock	20.2	12.1	0	31	85	116	21	2	2	
Nansemond Ridge	19.8	10.6	0	41	163	204	14	5	2	
York River										
Bell Rock	22.7	12.4	0	5	0	5	2	0	0	
Aberdeen Rock	22.1	15.3	0	6	2	8	1	1	11	
Mobjack Bay										
Pultz Bar	21.9	18.5	0	13	0	13	4	1	7	
Tow Stake	21.8	18.5	4	6	0	10	9	1	9	88
Piankatank River										
Ginney Point	21.0	14.4	1	120	230	351	12	11	<1	92
Palace Bar	20.9	14.4	2	83	147	232	8	9	4	88
Burton Point	19.8	15.4	1	13	893	907	2	22	2	

TABLE II, cont.

STATION	TEMP. (°C)	SAL. (°/oo)	AVERAGE NO. OYSTERS PER BUSHEL				BOXES		RECENT MORTALITY (%)	Perkinsus (% Prev.)
			Market	Small	Spat	Total	Old	New		
Rappahannock River										
Ross Rock	19.1	2.0	11	131	0	142	2	0	0	30
Bowlers Rock	21.3	6.7	13	91	0	104	6	0	0	40
Morattico Bar	21.3	11.0	12	9	4	16	14	2	11	100
Smokey Point	22.0	11.6	4	26	10	40	11	0	0	44
Hog House	21.5	13.4	0	6	1	7	4	0	0	
Drumming Ground	21.5	13.9	0	2	5	7	3	7	50	
Parrot Rock	21.2	14.2	0	46	13	59	3	4	6	56
Broad Creek	21.2	15.8	1	77	246	324	9	27	8	44
Corrotoman River										
Middle Ground	20.2	13.3	0	61	77	138	9	3	2	74
Great Wicomico River										
Haynie Point	19.0	15.0	1	225	183	409	12	17	4	88
Whaleys East	17.8	15.2	0	174	151	325	1	6	2	84
Fleeton Point	18.0	14.9	1	207	299	507	14	7	1	88

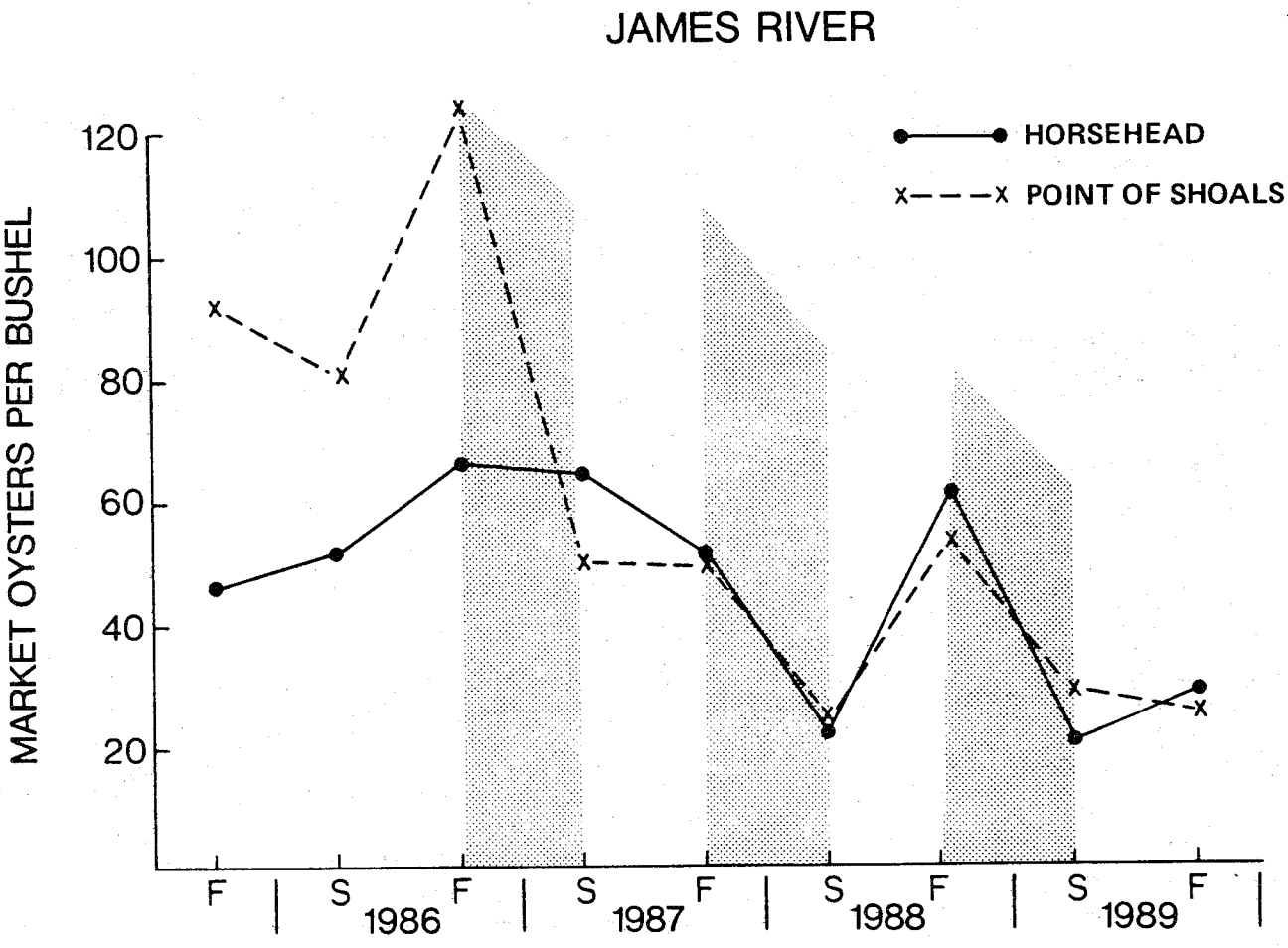

Figure 2. Average number of market oysters per bushel of dredged material. Shaded areas indicate periods of harvesting activity.
S= Spring; F= Fall

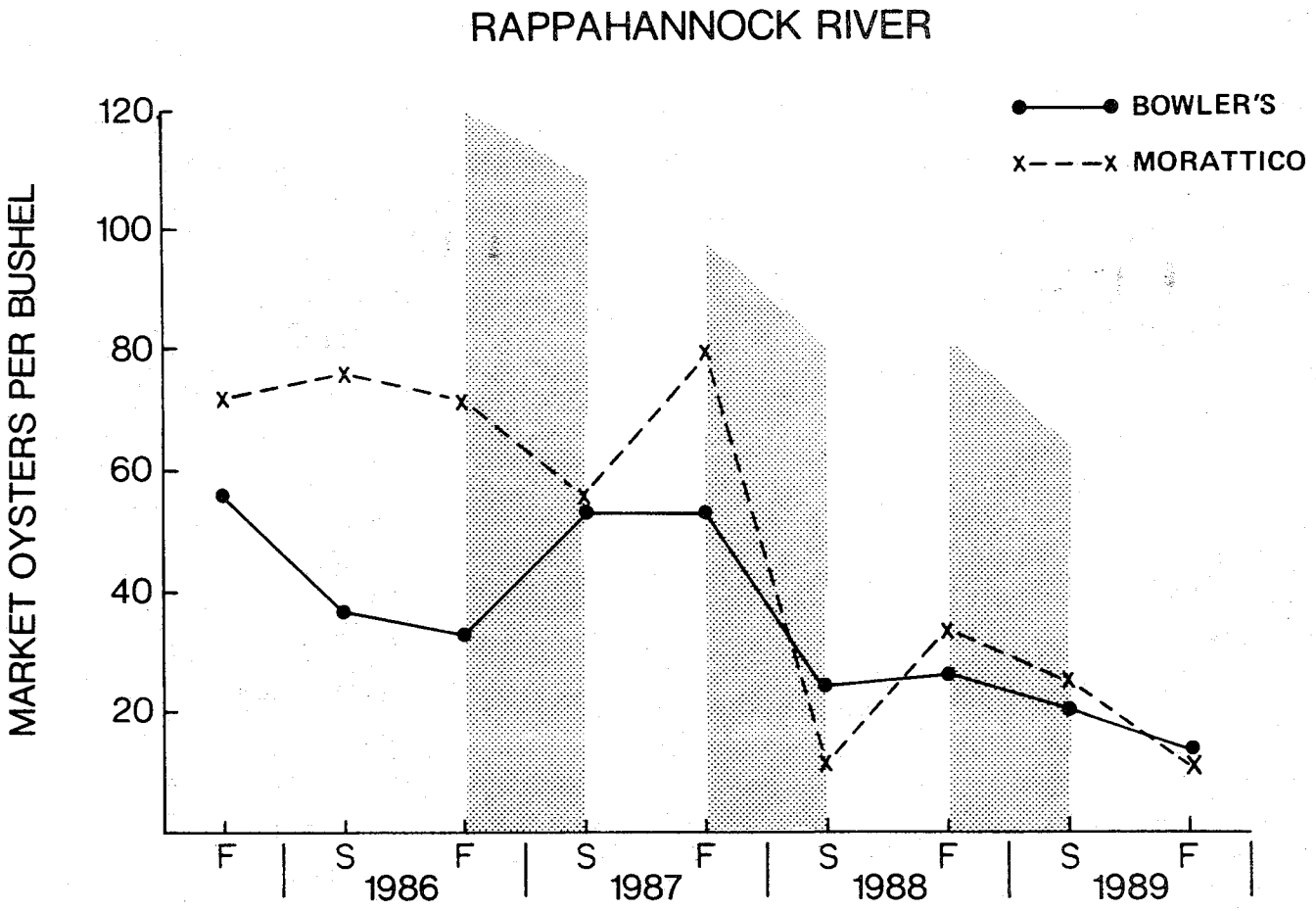

Figure 3. Average number of market oysters per bushel of dredged material. Shaded areas indicate periods of harvesting activity.
S= Spring; F= Fall