1982

Development of oyster resources

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UNITED STATES
DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Management Division
State Federal Relations Branch

Completion REPORT

State : Virginia

Project No. : 3-314-D

Contract No. : NA81FAD VAAB

Project Title : Development of Oyster Resources

Period Covered : April 15, 1979 to April 14, 1982

Prepared By : Katherine V. Leonard

Approved By : Robert D. Craft

Date : July 15, 1982

COMPLETION REPORT

1. A. Commonwealth of Virginia

B. Project #3-314-D

2. Work Accomplished

Job I. Planting Oyster Cultch & Transplanting Seed Oysters

During the 3-year project period, augmentation of cultch material and transplanting of seed oysters as a means of increasing oyster production was used. Sites were selected for the planting and transplanting. These sites were evaluated based on several criteria. One of the major considerations is the relative abundance of previous spatfall or production in a given area. Several additional factors reviewed for selection included approximate date of peak setting, substrate type (muddy, sandy, rocky, etc. bottom), impact of MSX, estimate of bar potential, gross fishing efforts and salinity regimes. It is important to plant a week or two prior to peake setting, because if shells are planted much too early or late, they may become so fouled with marine organisms that spat or larvae will not set.

Areas were shells were planted:

Project Period	Area	Quantity(Bu.)	Cost ($)
1979-80	Rappahannock	100,499.00	$28,537.94
	Eastern Shore	71,694.00	28,677.60
	Mobjack Bay	80,588.86	24,470.78
Totals		252,782.86	$81,956.32

Project Period	Area	Quantity(Bu.)	Cost($)
1980-81	Chesapeake Bay	292,561.28	$92,156.81
	Milford Haven	15,098.00	4,960.85
Totals		307,659.28	$97,117.66
1981-82	Chesapeake Bay	275,150.54	$108,409.31
	Mobjack Bay area, North River	42,689.88	18,826.24
Totals		317,840.42	$127,235.55

Areas were seed oysters were transplanted:

Project Period	Area	Quantity(Bu.)	Cost($)
1980-81	Eastern Shore Pocomoke Sound	32,753.00	$58,245.05
	Poquoson River	3,089.00	5,096.00
Totals		35,842.00	$63,341.90

Different planting and transplanting areas require different strategies of planning. In general, the maximum concentration of shells planted were 8-10,000 bushels of shells per acre and seed oysters transplanted were 600 bushels of seed per acre.

Job II. Spatfall and Production Success

Monitoring is accomplished in two (2) ways: One, a spatfall monitoring system using shell strings is conducted on a State-wide level by the Commission and the Virginia Institute of Marine Science; and two, a sampling of the areas where

shells were planted and seed oysters were transplanted using normal harvesting gears is done by the Commission on specially selected bars to check on growth, population, MSX, deathrate, etc.

A copy of the Virginia Institute of Marine Science's 1981 Annual Summary of Oyster Spatfall of Virginia Rivers is included as a supplement to this report. The two (2) previous annual summaries have been submitted with annual reports.

The Marine Resources Commission conducts spot checks throughout the spawning season and ensuing months to determine relative success. See attached MRC report.

The following table indicates the trend of productivity for four (4) oyster seasons for all Tidal Waters in Virginia. The 1981-82 oyster season figures are not available at this time.

Oyster Season	Seed & Shucking (Bu.)	Dockside Value ($)
77/78	963,754	$4,562,687
78/79	1,115,930	5,008,178
79/80	1,036,095	5,868,867
80/81	1,036,100	5,675,263

MRC SPAT COUNT MONITORING FOR SHELLS PLANTED IN 1981

BODY OF WATER	GEAR USED	DATE	SPAT COUNT BY BUSHEL	REMARKS
Chesapeake Bay				
Deep Rock	Dredge	11/2/81	1950	Excellent spat count, high salinity, low run-off
Beverlys Rock	Patent tong	10/23/81	1800	Excellent spat count, high salinity, low run-off
Mobjack Bay				
Brown's Bay	Patent tong	3/16/82	390	Low spat strike for both public/private grounds; but still good for spat growth. High death rate in area as a whole.
North River	Patent tong	3/16/82	515	Fair spat count

MRC SPAT COUNT MONITORING FOR SHELLS PLANTED IN 1980

Chesapeake Bay				
Beverlys Rock	Patent tong	12/8/80	1830	Excellent spat count
Deep Rock	Patent tong	12/8/80	775	Good spat count
Milford Haven	Patent tong	9/4/80	2070	Excellent spat count - monitoring done right after set in July

MRC SPAT COUNT MONITORING FOR SEED OYSTERS TRANSPLANTED IN 1980

Eastern Shore			
Pocomoke Sound	7/80 thru 10/80		Little or no growth - more than normal death rate
	1981		Further check in '81 showed surviving seed oysters had excellent growth with little or no death rate
Poquoson River			almost no death rate and good growth

MRC SPAT COUNT MONITORING FOR SHELLS PLANTED IN 1979

BODY OF WATER	GEAR USED	DATE	SPAT COUNT BY BUSHELS	REMARKS
Pocomoke Sound				
Parkers Rock	Dredge	4/15/82	315	Count taken on 2 year old small oysters - no death rate
Pungoteague Creek	Hand Tong	3/30/80	830	Good Spat count - minimal death rate
Rappahannock River				
Broad Creek	Patent tong	9/79	790	Very good spat count
Drumming Ground	Patent tong	9/79	420	Fair spat count
Mobjack Bay				
Pultz Bar	Patent tong	11/15/79	450	Fair spat count - no death rate

NOTE: below 400 per bu. is poor count; 400-500 per bu. is fair count; 600-900 per bu. is good to very good; and over 1,000 per bu. is excellent spat count

MARINE RESOURCE SPECIAL REPORT

A SEA GRANT ADVISORY SERVICE

Virginia Institute of Marine Science Gloucester Point, Virginia 23062

1981 Annual Summary

OYSTER SPATFALL IN VIRGINIA RIVERS

BY

Dexter Haven and Paul Kendall

The Virginia Institute of Marine Science (VIMS) conducts weekly surveys from June through early October to obtain oyster spatfall information. Spat counts are made from oyster shells strung on wire and suspended from stakes on public and private beds. The number of spat on shells are counted each week of the spawning season to determine the potential of a particular area for receiving a strike and to predict the most likely period the strikes will occur.

A moderate or heavy strike on shellstrings usually indicates a significant strike on exposed bottom cultch. This is especially true for cultch planted a week or two prior to the peak set.

However, a good strike on shellstrings in some localities may not always be accompanied by a good spatfall on naturally occurring bottom shell material or on shells planted too early or too late in the season. Bottom shells are often so fouled by other marine life that no room is left for small spat to attach. Moreover, even with a reasonable spatfall, survival of spat on the bottom in saltier waters may be extremely low due to predators such as oyster drills and blue crabs which eat the small spat.

Usually a light set of spat on shellstrings indicates a poor set on bottom cultch. During certain exceptional years, due probably to the absence of predators and fouling, a light set on our shellstrings may be accompanied by an above average set on the natural bottom.

The number of spat which set in one week on the smooth side of 10 shells is determined by microscopic examination; the average of the 10 shells is shown in this report as spat-per-shell-per-week. Weekly set is artibrarily rated as follows: fair, 0.1 to 1.0; moderate, 1.1 to 10; heavy, 10.1 to 100. As an index of total seasonal spatfall, the weekly sets are summed in this report for each station (total seasonal set). In evaluating setting levels, it should be recognized that in certain rivers,

such as the Rappahannock, York and Potomac, the set is typically very low or zero in many sections and only fair in others. Other systems, including the lower James and Piankatank River, Mobjack Bay and Seaside of the Eastern Shore, typically receive a moderate or heavy set and, as a result, often produce quantities of seed oysters or market oysters.

The shellstring study is supplemented each year in late fall by counts of spat on natural bottom cultch. This study is made after seasonal setting has stopped and indicates how many spat have survived. Half-bushel samples of bottom cultch were collected from selected locations with a dredge during the fall and winter of 1981-82. Numbers of oyster spat setting on cultch were counted. The data are expressed as number of spat per bushel.

SUMMARY OF SETTING FOR 1981

The 1981 season was unusual in many ways during this year of exceptionally high salinity.

In the James River, levels of set on shellstrings reached record heights; this was reflected by an exceptionally good set on bottom cultch in many areas, especially in the Wreck Shoal area. In the James the onset of setting was 1 to 4 weeks earlier than normal. Moreover, the period of peak set occurred about one month earlier than was typical for this system.

Shellstrings were not maintained in the Rappahannock in 1981 but surveys of bottom cultch indicated that the mid and upper part experienced an exceptionally good set.

Other regions where the set on shellstrings or on the bottom were above average were: Ware River; East River; upper Potomac; and Milford Haven. The Great Wicomico in 1981 showed high levels of set on shellstrings very early in the season; however, there was an abrupt decline during August which was not typical.

Setting was lower in the York River, Mobjack Bay and the Piankatank River, and the two regions monitored on the Seaside of the Eastern Shore showed below average levels of set.

JAMES RIVER - The total seasonal set for the James River was exceptionally high. At Wreck Shoal it was the highest since 1960; for Horsehead Bar and Deep Water Shoal it was the highest recorded by VIMS in 24 years. For other stations it was the highest recorded during the past 10 years or longer. The only exception was at Brown Shoal; the 1980 set exceeded that observed in 1981.

The 1981 season was unusual in other respects: 1) For most stations setting began 1 to 4 weeks earlier than usual; 2) Peak weekly sets occurred at all stations between mid-July and early August and then declined to nearly zero at most stations during September. Typically September is the peak setting

period in this estuary. There follows a summary of the highest weekly set (a) and the total seasonal set (b) for each station (a/b). Nansemond Ridge - 11.7/31.7; Naseway Shoal - 130.5/313.0; Brown Shoal - 5.1/21.1; Miles Watch House - 7.8/21.3; White Shoal - 17.9/71.0; Wreck Shoal - 24.4/51.9; Point of Shoal - 40.1/74.3; Mulberry Swash - 51.2/79.9; Horsehead - 40.3/71.9; Deep Water Shoal - 21.5/65.0.

Two extra stations above Deep Water Shoal were maintained in 1981 to monitor how far upriver the set occurred during a high salinity year. The station farthest upriver off Hog Island (above the seed area) showed a total set of 4.6 spat in August and September.

Samples of bottom cultch dredged from the oyster bars adjacent to the shellstring stations demonstrated that an exceptional strike had occurred on the natural oyster bars. There follows a summary of the number of 1981 spat counted in bushel samples of bottom material collected during early October 1981: Brown Shoal - 152; Naseway Shoal - 1078; White Shoal - 212; Wreck Shoal - 778; Point of Shoal - 796; Horsehead - 552; and Deep Water Shoal - 546. However, samples collected in January 1982 indicate substantial mortalities at several locations.

A survey of historical data on set on natural bottom shells shows the 1981 strike (with the exception of Deep Water Shoal) ranged from the highest to among the upper 10% since 1960.

YORK RIVER - The total seasonal set at Gloucester Point showed a major decline from 48.5 in 1980 to 6.7 spat for the 1981 season. This latter level was about the same as for 1978 and 1979. The number of spat setting on bottom cultch in the upper York in 1981 ranged from very low to zero. The number of spat per bushel of bottom cultch were: Green Rock - 0; Pages Rock - 0; Aberdeen Rock - 4; and Bell Rock - 0; in 1980 slightly higher levels were observed.

MOBJACK BAY - At the Brown's Bay station setting occurred over a long period with a peak in early to mid-August. The total seasonal set was only 10.8 spat which was far lower than in 1980. It was, however, about the same as for 1978 and 1979.

At the Tow Stake station the total seasonal set was very high (94.0 spat). The peak (66.4 spat/shell/week) occurred the same time as for Brown's Bay. At both stations the set began early in the season (the last week in June) and extended through September.

WARE RIVER - There was an exceptionally heavy set on shellstrings in the Ware River off Wilsons Creek. The set began in June and rose to a peak of 89.4 spat/shell/week during late July. Thereafter, it tapered to low levels in August and to zero in mid to late September. The total seasonal set for the station was 177.3 spat which was the highest recorded in the past 8 years.

EAST RIVER - There was an exceptionally high total seasonal set in this area (99.3 spat) in 1981. The season began in mid to late June and had its peak of 67.3 spat/shell/week in mid-August (about one month later than for the Ware River).

PEPPER CREEK - The Pepper Creek shellstring began receiving a set very early in the season in mid-June as did the other Mobjack tributaries. Setting occurred from this time through September with a peak of 10.9 spat/shell/week in mid-July. The total seasonal set of 20.9 spat was lower than for 1980 but about average for the past 8 years.

PIANKATANK RIVER - Four stations were monitored in this estuary. At all locations setting did not begin in June as it did in the James and the Mobjack area. Instead it began (as was usual) in early July, peaked in mid to late July, and was over by October. At all stations, the total seasonal set is ranked as high (range 34.5 to 76.8 spat). However, at all four stations it was lower than for 1980.

Additional shellstrings were hung late in the season upriver from the usual monitoring locations to learn if setting occurred upriver due to high salinities. The following total set was recorded: Doctor Point (2.9 spat in 2 weeks); and Twigg Branch (3.4 spat in 7 weeks).

Numbers of spat surviving on bottom cultch in late fall were above the previous 10 year averages at all stations except Ginney Point. Counts per bushel were: Three Branches - 272; Burtons Point - 212; Cape Tune - 490; Island Bar - 468; Palace Bar - 466; and Ginney Point - 798.

MILFORD HAVEN - This small area received an exceptionally heavy set in mid-July of 51.9 spat/shell/week. Records indicate a total seasonal set of 83.3 spat.

RAPPAHANNOCK RIVER - Shellstrings were not maintained in the Rappahannock in 1981. However, surveys of bottom cultch were conducted. There follows a summary of numbers of spat per bushel at various localities: Parrotts Rock - 486; Drumming Ground - 892; Hogg House - 152; Smokey Point - 214; Morattico - 186; and Bowlers Rock - 16.

These counts are exceptionally high for the mid and upper section of the Rappahannock. That is, for Drumming Ground, Hogg House, Morattico Bar and Bowlers the numbers were higher than in any of the previous 35 years. At Smokey Point they were the third highest in 35 years. Parrotts Rock set was the highest seen in five years of monitoring there.

GREAT WICOMICO RIVER - Since 1972 the Great Wicomico River has experienced a series of low set seasons. Previous records indicate that this system ranked among the best setting estuaries in the state.

Four stations in the lower part of this system demonstrated the usual post-1972 setting pattern. At Dameron Marsh, Cranes Creek, Fleet Point and Whaleys Flats the total seasonal set was low and ranged from 2.3 to 5.7 spat. Most of the set occurred in July; few spat set after this month.

Upriver at Haynie Point, Shell Bar, Hudnalls and Glebe Point total seasonal set reached a high for the past 9 years (range - 25.9 to 296.8 spat). An unusual occurrence during 1981 was the abrupt cessation in setting at the end of July at every station in the river; when setting resumed later on in August it was at very low levels.

The bushel samples of bottom cultch dredged from the natural rocks near the shellstring stations showed that a moderate to heavy set had occurred. There follows a tabulation of number of 1981 spat per bushel: Whaleys - 306; Dameron Marsh - 426; Fleet Point - 286; Cranes Creek - 338; Haynie Point - 441; and Rogue Point - 638. At all but Fleet Point and Cranes Creek these numbers were the highest counts recorded in the past 5 years.

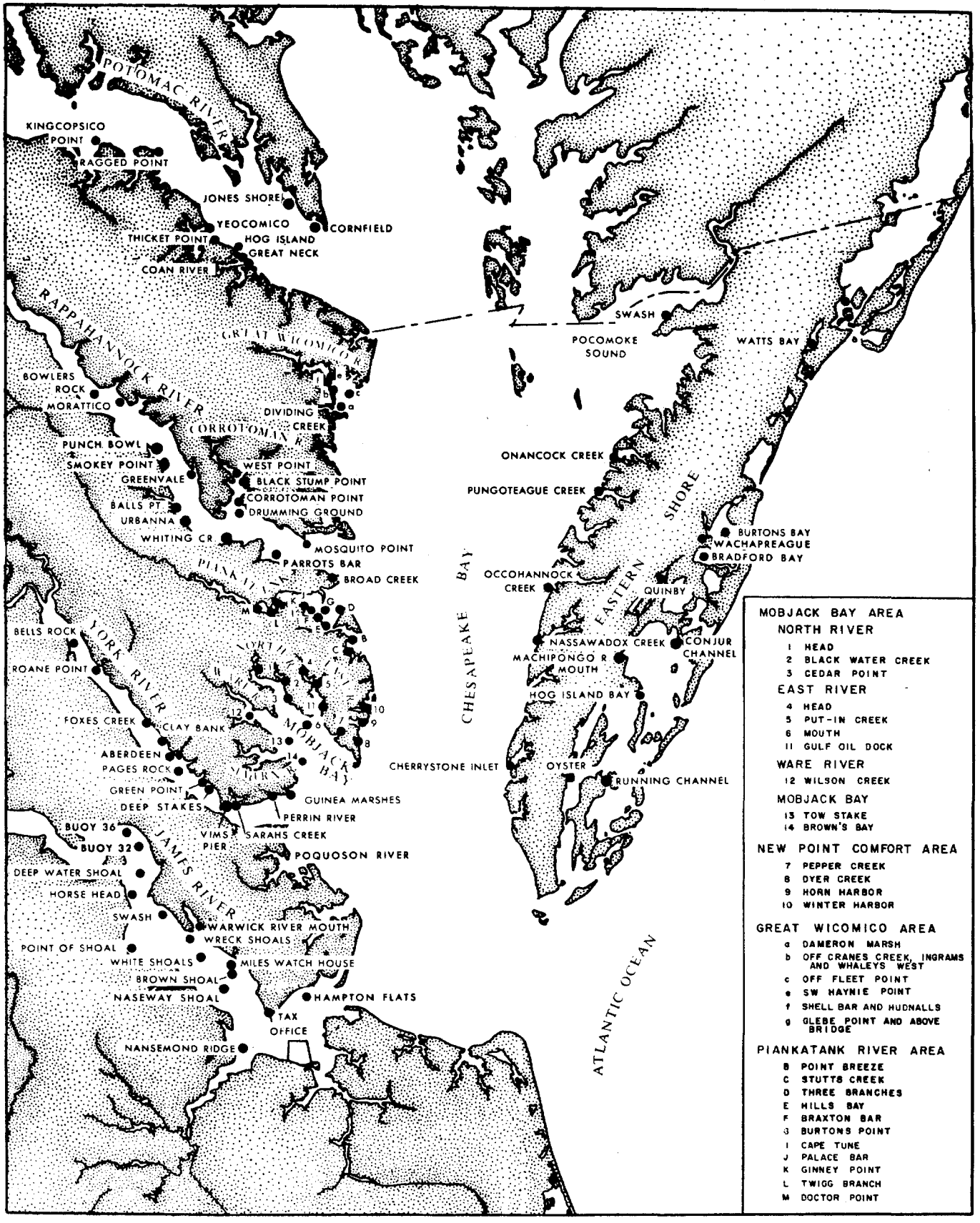
POTOMAC RIVER - In the seed area established by the Potomac River Fisheries Commission (at Jones Shore) the total seasonal set was far above average for the period since 1972, but was lower than for 1980. Setting began in late June, peaked at both stations during early August, and tapered slowly downward through September.

At the other shellstring stations upriver from the seed area the total seasonal set was light, similar to patterns observed since 1972. Possible exceptions to this general statment were at Yeocomico and Ragged Point. At these two stations 1981 was the second year in 10 in which we observed any spat on shellstrings.

EASTERN SHORE, SEASIDE - Only two stations were monitored on Seaside during 1981 (Quinby Bridge and VIMS Pier at Wachapreague). These two stations showed lower total seasonal sets (14.3 and 6.9 spat, respectively) than in the previous three years. The setting season began in early to mid June and peaked in late July. Following these peaks there was an abrupt decline in weekly set to practically zero during most of August. None was recorded during September.

ACKNOWLEDGMENTS - We wish to express appreciation to the Virginia Marine Resources Commission personnel who did the work of putting out and collecting the shellstrings in the Mobjack Bay area, on Nansemond Ridge and in the Piankatank, Great Wicomico and Potomac Rivers. Other samples were collected by VIMS' personnel at Gloucester Point and Wachapreague. VIMS' personnel counted the spat. The cooperation and assistance of all the above and their supervisors is gratefully acknowledged.

SHELLSTRING SURVEY STATIONS



MOBJACK BAY AREA

NORTH RIVER
- 1 HEAD
- 2 BLACK WATER CREEK
- 3 CEDAR POINT

EAST RIVER
- 4 HEAD
- 5 PUT-IN CREEK
- 6 MOUTH
- 11 GULF OIL DOCK

WARE RIVER
- 12 WILSON CREEK

MOBJACK BAY
- 13 TOW STAKE
- 14 BROWN'S BAY

NEW POINT COMFORT AREA
- 7 PEPPER CREEK
- 8 DYER CREEK
- 9 HORN HARBOR
- 10 WINTER HARBOR

GREAT WICOMICO AREA
- a DAMERON MARSH
- b OFF CRANES CREEK, INGRAMS AND WHALEYS WEST
- c OFF FLEET POINT
- e SW HAYNIE POINT
- f SHELL BAR AND HUDNALLS
- g GLEBE POINT AND ABOVE BRIDGE

PIANKATANK RIVER AREA
- B POINT BREEZE
- C STUTTS CREEK
- D THREE BRANCHES
- E MILLS BAY
- F BRAXTON BAR
- G BURTONS POINT
- I CAPE TUNE
- J PALACE BAR
- K GINNEY POINT
- L TWIGG BRANCH
- M DOCTOR POINT

VIRGINIA INSTITUTE OF MARINE SCIENCE
AND
SCHOOL OF MARINE SCIENCE,
THE COLLEGE OF WILLIAM AND MARY
GLOUCESTER POINT, VIRGINIA 23062

Spatfall on Shellstrings*
Annual Summary
1978-1981

JAMES RIVER

Dates Exposed**	Nansemond Ridge				Naseway Shoal		Brown Shoal			
	1978	1979	1980	1981	1980	1981	1978	1979	1980	1981
Jun 18-25	--	0.0	--	--	--	3.7	0.0	--	--	0.2
Jun 25-29	0.0	0.0	0.0		--			--	--	
Jun 29-Jul 8		0.0	0.0	0.9	0.0	8.2	0.0	0.1	0.0	2.1
Jul 8-13	0.0	0.1	0.1		0.0	20.5	0.0	0.3	0.1	2.6
Jul 13-20		0.1	0.1	11.7	0.4	61.8	0.0	0.5	0.0	2.9
Jul 20-27	0.0	--	0.1	7.3	0.3	14.3	0.0	0.4	0.4	1.1
Jul 27-Aug 3	0.0	--	--	8.2	2.7	130.5	0.1	0.4	0.0	3.4
Aug 3-10	0.8	3.1	0.1	1.9	51.0	40.7	0.2	0.2	2.5	5.1
Aug 10-17	0.2	3.3	1.8	1.6	50.5	23.8	0.2	2.0	7.8	1.7
Aug 17-24	0.9	0.4	0.8	--	37.2	3.5	0.1	0.0	6.1	1.1
Aug 24-31	0.1	0.1	0.6	--	9.4	2.7	0.1	0.4	10.1	0.2
Aug 31-Sep 8	0.9		--	--	34.5	0.8	0.0	0.5	8.3	0.2
Sep 8-14		0.3		--	24.0	0.9	0.5	1.5	5.8	0.3
Sep 14-21	0.0	--	2.1	0.0	9.2	0.3	0.7	1.3	--	0.1
Sep 21-28	0.4	--		0.1	3.5	0.5		0.0	2.0	--
Sep 28-Oct 5	--	--		--		0.5	0.3	0.0		--
Oct 5-12	0.0	--	--	--	--	0.3	0.0		0.2	0.1
Oct 12-20	--	--	--	--	--	--	--			--
TOTALS	3.3	7.4	5.7	31.7	222.7	313.0	2.2	7.6	43.3	21.1

* Shows spat per shell (smooth side only).
** Dates shown are for 1981. Dates in other years were approximately the same.
● Not sampled in previous years.

General Guide to Setting:

0.1 to 1.0 spat per shell = fair
1.1 to 10.0 spat per shell = moderate
10.1 to 100 spat per shell = heavy

Dates Exposed**	Miles Watch House				White Shoal				Wreck Shoal			
	1978	1979	1980	1981	1978	1979	1980	1981	1978	1979	1980	1981
Jun 18-25	0.0	--	--	0.4	0.0	--	--	1.6	0.0	--	--	1.1
Jun 25-29		--	--			--	--			--	--	
Jun 29-Jul 8	0.0	0.0	0.0	--	0.0	0.0	0.0	1.7	0.0	0.0	0.0	0.0
Jul 8-13	0.0	0.5	0.0	1.5	0.1	0.0	0.1	7.9	0.0	0.3	0.2	3.8
Jul 13-20	0.0	0.1	0.0	7.8	0.0	0.1	0.6	17.9	0.0	--	0.3	24.4
Jul 20-27	0.0	0.7	0.2	0.8	0.0	0.7	0.0	7.4	0.0	0.5	0.8	5.5
Jul 27-Aug 3	0.1	0.2	0.0	5.7	0.0	1.6	0.2	13.5	0.2	1.2	0.4	9.3
Aug 3-10	0.3	0.4	0.7	2.0	0.1	2.7	2.4	12.9	0.6	1.8	2.0	2.9
Aug 10-17	0.1	2.9	1.5	0.7	0.0	2.0	7.8	4.0	0.0	1.5	2.7	2.3
Aug 17-24	0.2	0.0	5.6	0.5		0.5	3.4	2.6	0.0		1.3	1.6
Aug 24-31	--	0.1	2.6	1.6	0.2	0.2	4.0	0.7	0.1	0.2	2.8	0.1
Aug 31-Sep 8	0.9	0.2	5.2	0.0	0.3	0.3	5.7	0.3	0.1	0.1	2.7	0.0
Sep 8-14	0.3	0.0	1.8	0.1	0.2	0.1	9.3	0.2		0.5	1.7	0.4
Sep 14-21	1.0	0.8	0.6	0.0	0.9	0.8	3.9	0.1	0.2	0.7	1.0	0.0
Sep 21-28	0.7	0.6	0.7	--	0.6	0.0	1.7	0.0	0.1	0.1	0.4	0.1
Sep 28-Oct 5	0.0	0.0		--	0.0	0.0		0.2	0.4	0.1	0.1	0.3
Oct 5-12	--		--	0.2	--		0.5	0.0	0.2		0.0	0.1
Oct 12-20	--		--	--	--			--	--		--	--
TOTALS	3.6	5.9	18.9	21.3	2.4	9.0	39.6	71.0	1.9	6.9	16.4	51.9

Dates Exposed**	Point of Shoal				Mulberry Swash				Horsehead Bar			
	1978	1979	1980	1981	1978	1979	1980	1981	1978	1979	1980	1981
Jun 18-25	0.0	--	--	0.6	0.0	--	--	3.4	0.0	--	--	2.1
Jun 25-29		--	--		0.0	--	--		0.0	--	--	
Jun 29-Jul 8	0.0	0.0	0.0	3.2	0.0	0.0	0.0	2.7	0.0	0.0	0.0	2.7
Jul 8-13	0.0	0.1	0.0	4.6	0.0	0.6	0.0	8.5	0.0	0.1	0.0	7.2
Jul 13-20	0.0	0.0	0.0	40.1	0.0	0.0	0.0	51.2	0.0	0.0	0.0	40.3
Jul 20-27	0.0	0.0	1.9	3.2	0.0	0.0	0.6	1.7	0.0	0.0	2.7	3.9
Jul 27-Aug 3	0.0	0.4	--	11.6	0.0	0.6	0.2	--	0.0	0.6	0.0	6.0
Aug 3-10	0.0	0.4	5.2	2.2	0.1	0.7	4.9	7.0	0.1	1.4	2.6	3.9
Aug 10-17	0.2	1.0	23.4	3.3	0.4	1.2	7.4	2.4	0.0	0.7	9.1	2.2
Aug 17-24		0.0	17.9	4.1		0.5	2.6	1.9	0.1	0.0	0.2	2.6
Aug 24-31	0.3	0.1	1.1	1.3	0.3	0.3	2.0	0.5	0.0	0.2	1.8	0.7
Aug 31-Sep 8	0.0	0.0	0.4	0.1	1.1	0.0	1.0	0.0	0.5	0.0	0.1	0.1
Sep 8-14		0.0	2.2	0.0		0.1	0.8	0.2		0.0	3.2	0.1
Sep 14-21	--	0.2	3.1	0.0	0.7	0.0	0.5	0.0	--	0.0	1.0	0.1
Sep 21-28	0.2	0.0	0.3	0.0	0.4	0.0	--	0.4	0.1	0.0	0.0	0.0
Sep 28-Oct 5	0.0	0.0	0.3	0.0	0.7	0.0	0.3	0.0	0.2	0.0	0.0	0.0
Oct 5-12	2.0			0.0	0.2			0.0	--			0.0
Oct 12-20	--			--	--			--	--			--
TOTALS	0.9	2.2	55.8	74.3	3.9	4.0	20.3	79.9	1.0	3.0	20.7	71.9

Dates Exposed**	Deepwater Shoal 1978	1979	1980	1981	Buoy 32 1981	Buoy 36 1981
Jun 18-25	0.0	--	--	4.1	--	--
Jun 25-29	0.0	--	--		--	--
Jun 29-Jul 8	0.0	0.0	0.0	4.5	--	--
Jul 8-13	0.0	0.0	0.0	8.6	--	--
Jul 13-20	0.0	0.0	0.0	21.5	--	--
Jul 20-27	0.0	0.0	0.8	9.4	--	--
Jul 27-Aug 3	0.4	0.5	0.3	2.9	--	--
Aug 3-10	0.0	0.3	0.6	5.2	4.0	1.6
Aug 10-17	0.0	0.7	1.8	2.8	4.2	1.6
Aug 17-24	0.6	0.3	1.2	3.9		
Aug 24-31	0.0	0.4	0.2	1.5	3.7	1.1
Aug 31-Sep 8	0.4	0.4	0.0	0.1	0.3	0.1
Sep 8-14		0.0	0.1	0.3	0.0	0.2
Sep 14-21	0.0	0.0	0.1	0.1	0.0	0.0
Sep 21-28	0.3	0.0	0.1	0.0	0.0	0.0
Sep 28-Oct 5	0.3			0.1	0.0	
Oct 5-12	0.2		0.1	0.0	0.0	0.0
Oct 12-20	--	0.0		--	--	--
TOTALS	2.2	2.6	5.2	65.0	12.2	4.6

Dates Exposed**	YORK RIVER VIMS Ferry Pier 1978	1979	1980	1981	WARE RIVER Off Wilson's Creek Station 12 1978	1979	1980	1981	EAST RIVER Mouth Station 6 1978	1979	1980	1981
Jun 18-Jul 1	0.0	0.0	0.0	--	0.2	0.0	1.1	1.2	1.2	0.0	1.7	0.8
Jul 1- 8	0.0	0.0	0.0	0.1	11.5	1.7	0.3	6.4		0.0	0.9	3.2
Jul 8-15	0.0	0.0	0.0	0.0	30.8	6.5	3.2	0.1	0.5	1.3	0.2	2.2
Jul 15-22	0.1	0.3	0.1	0.0	3.0	25.6	0.1	0.7		1.3	1.2	8.8
Jul 22-29	0.1	1.0	0.2	0.2	0.4	102.2	0.7	89.4	5.4	2.2	0.0	3.6
Jul 29-Aug 5	0.3	0.6	0.5	0.0	2.4	0.9	0.0	45.7		4.6	0.2	3.0
Aug 5-12	0.1	0.0	--	0.3	0.7	0.0	1.0	9.6	1.6	1.3	10.4	4.7
Aug 12-19	0.6	0.3	10.3	0.9	1.0	27.6	8.0	17.0	26.6	8.4	69.6	67.3
Aug 19-26	0.9	1.3	21.8	1.6	5.1	0.2	4.8	2.0	1.2	0.2	46.9	3.6
Aug 26-Sep 2	0.4		6.1	0.6	12.0	0.2	2.1	3.8		0.1	0.0	1.9
Sep 2- 9	0.1	0.0	6.1	0.0	0.0	0.0	3.4	1.2	2.8	0.2	0.7	0.1
Sep 9-16	0.3	1.6	1.7	0.4	6.4	0.2	0.0	0.0	--	1.6	0.2	0.1
Sep 16-22	0.1	0.0	0.7	1.8		0.0	0.2	0.2	--	0.6	2.4	0.0
Sep 22-25					0.0			0.0	--		1.2	0.1
Sep 25-30	0.1	0.1	1.0	0.7		0.1	0.2			0.3		
Sep 30-Oct 5	--			0.1	--		--	0.0	--		--	
Oct 5-16	--		--	0.0	--		--	0.0	--		--	0.0
TOTALS	3.1	5.2	48.5	6.7	73.5	165.2	25.1	177.3	39.5	22.1	135.6	99.3

PEPPER CREEK

MOBJACK BAY

Dates Exposed**	Deepwater Shoal 1978	1979	1980	1981	Buoy 32 1981	Buoy 36 1981
Jun 18-25	0.0	--	--	4.1	--	--
Jun 25-29	0.0	--	--			
Jun 29-Jul 8	0.0	0.0	0.0	4.5	--	--
Jul 8-13	0.0	0.0	0.0	8.6	--	--
Jul 13-20	0.0	0.0	0.0	21.5	--	--
Jul 20-27	0.0	0.0	0.8	9.4	--	--
Jul 27-Aug 3	0.4	0.5	0.3	2.9	--	--
Aug 3-10	0.0	0.3	0.6	5.2	4.0	1.6
Aug 10-17	0.0	0.7	1.8	2.8	4.2	1.6
Aug 17-24	0.6	0.3	1.2	3.9		
Aug 24-31	0.0	0.4	0.2	1.5	3.7	1.1
Aug 31-Sep 8	0.4	0.4	0.0	0.1	0.3	0.1
Sep 8-14		0.0	0.1	0.3	0.0	0.2
Sep 14-21	0.0	0.0	0.1	0.1	0.0	0.0
Sep 21-28	0.3	0.0	0.1	0.0	0.0	0.0
Sep 28-Oct 5	0.3			0.1	0.0	
Oct 5-12	0.2		0.1	0.0	0.0	0.0
Oct 12-20	--	0.0		--	--	--
TOTALS	2.2	2.6	5.2	65.0	12.2	4.6

Dates Exposed**	YORK RIVER VIMS Ferry Pier 1978	1979	1980	1981	WARE RIVER Off Wilson's Creek Station 12 1978	1979	1980	1981	EAST RIVER Mouth Station 6 1978	1979	1980	1981
Jun 18-Jul 1	0.0	0.0	0.0	--	0.2	0.0	1.1	1.2	1.2	0.0	1.7	0.8
Jul 1- 8	0.0	0.0	0.0	0.1	11.5	1.7	0.3	6.4		0.0	0.9	3.2
Jul 8-15	0.0	0.0	0.0	0.0	30.8	6.5	3.2	0.1	0.5	1.3	0.2	2.2
Jul 15-22	0.1	0.3	0.1	0.0	3.0	25.6	0.1	0.7		1.3	1.2	8.8
Jul 22-29	0.1	1.0	0.2	0.2	0.4	102.2	0.7	89.4	5.4	2.2	0.0	3.6
Jul 29-Aug 5	0.3	0.6	0.5	0.0	2.4	0.9	0.0	45.7		4.6	0.2	3.0
Aug 5-12	0.1	0.0	--	0.3	0.7	0.0	1.0	9.6	1.6	1.3	10.4	4.7
Aug 12-19	0.6	0.3	10.3	0.9	1.0	27.6	8.0	17.0	26.6	8.4	69.6	67.3
Aug 19-26	0.9	1.3	21.8	1.6	5.1	0.2	4.8	2.0	1.2	0.2	46.9	3.6
Aug 26-Sep 2	0.4		6.1	0.6	12.0	0.2	2.1	3.8		0.1	0.0	1.9
Sep 2- 9	0.1	0.0	6.1	0.0	0.0	0.0	3.4	1.2	2.8	0.2	0.7	0.1
Sep 9-16	0.3	1.6	1.7	0.4	6.4	0.2	0.0	0.0	--	1.6	0.2	0.1
Sep 16-22	0.1	0.0	0.7	1.8	0.0	0.0	0.2	0.2	--	0.6	2.4	0.0
Sep 22-25												
Sep 25-30	0.1	0.1	1.0	0.7		0.1	0.2	0.0	--	0.3	1.2	0.1
Sep 30-Oct 5	--			0.1	--		--	0.0	--		--	
Oct 5-16	--		--	0.0	--		--	0.0	--		--	0.0

Dates Exposed**	Palace Bar Station J 1978	1979	1980	1981	Ginney Point Station K 1978	1979	1980	1981	Twigg Branch Station L 1981	Doctor Point Station M 1981
Jun 22-29	0.0	0.3	--	0.0	0.0	0.0	--	0.0	--	--
Jun 29-Jul 6	0.0	0.0	0.0		0.0	0.0	0.0		--	--
Jul 6-13	0.0	9.9	29.1	--	0.0	48.0	3.0	4.4	--	--
Jul 13-20	1.0	145.1	70.5	12.6	0.0	--	2.0	21.0	--	--
Jul 20-27	0.1	11.6	5.0	46.8	0.3	30.6	5.9	2.5	--	--
Jul 27-Aug 3	0.0	0.6	82.1	2.9	0.0	0.1	84.9	--	--	--
Aug 3-11	0.0	3.5	71.3	10.5	0.0	0.0	23.0	3.3	--	--
Aug 11-17	0.8	5.5	0.9	2.6	--	20.1	15.7	3.1	0.9	2.9
Aug 17-24		1.4	--	1.0	--	0.3	36.0	--	2.4	--
Aug 24-31		3.0	4.4	--	--	0.0	3.4	--	--	--
Aug 31-Sep 8	3.4	1.9	1.1		--	1.6	0.4		0.0	--
Sep 8-15		0.6	0.9	0.0	--	0.1	0.4	--	0.0	0.0
Sep 15-22		--	0.0	--	--	--	0.3	--		
Sep 22-29	--	0.0	0.0	0.4	--	0.0	0.1	0.2	0.1	--
Sep 29-Oct 5	--	--	--		--	--	--			
TOTALS	5.3	183.4	265.3	76.8	0.3	100.8	175.1	34.5	3.4	2.9

GREAT WICOMICO RIVER

Dates Exposed**	Dameron Marsh Station a 1978	1979	1980	1981	Cranes Creek Station b 1978	1979	1980	1981	Fleet Point Station c 1978	1979	1980	1981
Jun 22-29	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Jun 29-Jul 7	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.2
Jul 7-14	0.0	0.0	0.9	0.4	0.0	0.0	0.7	1.1	0.0	0.0	0.8	0.2
Jul 14-21	0.0	0.1	4.5	1.8	0.0	0.0	5.2	2.6	0.0	0.5	2.0	0.4
Jul 21-29	0.0	0.5	5.1	0.2	0.0	0.0	5.7	1.4	--	0.7	--	0.1
Jul 29-Aug 4	0.0	0.0	1.6	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.2
Aug 4-10	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.4	0.0	1.3	0.0
Aug 10-17	0.0	0.0	0.0	0.4	0.0	0.0	0.1	--	0.0	0.0	1.5	0.0
Aug 17-24	0.3	0.0	0.7	--	0.0	0.0	1.0	0.0	0.1	--	2.6	1.0
Aug 24-31	--	0.1	0.5	0.0	0.1	0.0	0.7	0.1	1.5	0.0	0.7	0.0
Aug 31-Sep 7	0.4	0.3	0.1	0.0	0.0	0.0	0.2	0.1	--	0.0	0.1	0.0
Sep 7-14	--	0.0	0.2	0.0	0.0	0.1	0.1	0.1	0.2	0.1	0.0	0.0
Sep 14-22	--	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.8	0.1	0.0	0.0
Sep 22-28	--	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	--	0.2
Sep 28-Oct 5	--	--	0.0	0.0	--	--	0.0	0.1	--	--	--	0.0
TOTALS	0.7	1.0	13.7	3.3	0.1	0.1	14.8	5.7	2.2	1.4	9.0	2.3

Dates Exposed**	Whaley Flats Station b			Haynie Point Station e				Shell Bar Station f			
	1979	1980	1981	1978	1979	1980	1981	1978	1979	1980	1981
Jun 22-29	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Jun 29-Jul 7	0.0	0.0	--	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0
Jul 7-14	0.0	0.2	0.0	0.0	0.8	1.4	1.9	0.0	0.6	3.4	2.2
Jul 14-21	2.2	--	0.9	0.1	0.0	1.3	19.2	0.0	4.5	8.3	--
Jul 21-29	0.1	3.4	0.8	0.0	0.6	6.2	4.4	0.0	10.5	--	35.1
Jul 29-Aug 4	0.0	1.0	0.0	0.0	0.5	1.8	0.0	0.0	0.0	2.6	0.0
Aug 4-10	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	3.5	0.0
Aug 10-17	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
Aug 17-24	0.0	0.4	0.7	0.1	0.0	0.4	0.1	0.0	0.3	0.1	0.0
Aug 24-31	0.0	0.3	0.0	0.7	0.1	0.7	0.1	0.6	0.0	1.0	0.3
Aug 31-Sep 7	0.0	0.1	0.0	0.0	--	0.1	0.0	0.1	0.0	0.5	0.4
Sep 7-14	0.0	0.1	0.0	0.2	0.0	0.4	--	0.3	0.1	0.8	--
Sep 14-22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Sep 22-28	0.0	0.0	--	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.0
Sep 28-Oct 5	--	0.0	--	--	--	0.0	0.0	--	--	0.0	0.1
TOTALS	2.3	5.5	2.6	1.1	2.1	12.7	25.9	1.0	16.1	20.3	38.2

Dates Exposed**	Hudnall's Dock Station f				Glebe Point Station g				Upper Middle Ground Station g	Island Bar Station g
	1978	1979	1980	1981	1978	1979	1980	1981	1981	1981
Jun 22-29	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--	--
Jun 29-Jul 7	0.0	---	0.0	0.6	0.0	--	0.0	0.4	--	--
Jul 7-14	0.0	0.5	7.3	1.0	0.2	0.0	2.1	0.7	--	--
Jul 14-21	--	1.8	9.8	22.3	0.0	0.0	1.9	118.8	--	--
Jul 21-29	0.0	10.5	28.0	6.9	--	6.3	0.6	171.1	--	--
Jul 29-Aug 4	0.0	0.2	6.3	0.3	0.0	0.0	3.1	--	--	--
Aug 4-10	0.0	0.0	2.1	0.0	0.1	0.0	1.4	0.0	--	--
Aug 10-17	0.0	0.0	0.0	0.0	--	0.0	0.0	--	0.0	0.0
Aug 17-24	0.2	0.0	0.9	0.0	0.2	0.0	0.1	0.0	0.4	0.0
Aug 24-31	0.7	0.0	1.2	0.1	0.4	0.1	1.2	0.6	0.0	0.0
Aug 31-Sep 7	0.5	0.0	1.1	0.3	0.1	0.1	0.1	1.6	0.8	0.0
Sep 7-14	0.0	0.0	0.2	0.1	0.1	0.0	0.0	3.4	0.0	0.0
Sep 14-22	0.0	0.0	0.0	0.0	0.4	0.0	0.0	--	0.0	0.0
Sep 22-28	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.2	0.0	0.0
Sep 28-Oct 5	--	--	0.0	0.0	--	--	0.0	0.0	0.1	0.0
TOTALS	1.4	13.0	56.9	31.6	1.9	6.5	10.5	296.8	1.3	0.0

POTOMAC RIVER

Dates Exposed**	Cornfield				Jones Shore				Great Neck			
	1978	1979	1980	1981	1978	1979	1980	1981	1978	1979	1980	1981
Jun 18-29	0.0	0.0	--	0.0	0.0	0.0	--	0.0	0.0	0.0	--	0.0
Jun 29-Jul 6	0.0	0.0	0.0	2.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0	0.3
Jul 6-13	0.0	0.0	0.5	--	0.0	0.0	0.6	0.7	0.0	0.0	0.0	0.0
Jul 13-20	0.0	0.0	12.8	0.0	0.0	0.2	26.9	1.6	0.0	0.0	0.3	0.1
Jul 20-27	--	0.0	9.5	--	0.0	0.3	4.9	0.0	0.0	0.0	0.0	0.0
Jul 27-Aug 3	0.0	--	2.5	0.0	--	0.0	--	0.0	0.0	0.0	0.2	0.0
Aug 3-10	0.0	--	1.4	1.3	0.0		1.9	3.8	--		0.0	0.0
Aug 10-17	--	0.0	1.2	15.8	0.0	0.0	1.4	3.2	0.0	0.0	0.0	0.0
Aug 17-24	--	0.0	5.6			0.0	0.6		0.0	0.0	0.2	
Aug 24-31	0.3		0.0	--	0.1		0.1	2.5	0.0		0.1	0.0
Aug 31-Sep 7	0.2	0.1	0.0	0.0	0.0	0.5	0.5	0.1	0.0	0.2	0.4	0.0
Sep 7-14	0.5	0.0	0.1	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sep 14-21	0.3	0.0	0.0	0.6	0.7	--	0.0	1.8	0.0	--	0.0	0.0
Sep 21-28	0.0		0.0	--	0.0	0.0	0.0	0.0	0.0	--	0.0	0.1
Sep 28-Oct 5	--	--	0.0	--	--	--	0.0	--	--	--	0.0	--
TOTALS	1.3	0.1	33.6	21.7	0.8	1.0	36.9	15.0	0.0	0.2	1.2	0.5

Dates Exposed**	Coan				Hog Island				Thicket Point			
	1978	1979	1980	1981	1978	1979	1980	1981	1978	1979	1980	1981
Jun 18-29	0.0	0.0	--	0.0	--	0.0	--	0.0	--	0.0	--	0.0
Jun 29-Jul 6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	--	0.0	0.0	0.0
Jul 6-13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--	0.0	0.1	0.0
Jul 13-20	0.0	0.0	1.2	0.0	0.0	0.0	0.0	0.0	--	0.0	0.0	0.1
Jul 20-27	--	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--	0.1	0.0	0.1
Jul 27-Aug 3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Aug 3-10	0.0		0.0	0.0	0.0		0.0	0.0	0.0		0.0	0.0
Aug 10-17	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.0	0.0	0.0	0.0
Aug 17-24	0.0	0.0	0.1		0.0	0.0	0.2		0.0	0.0	0.5	
Aug 24-31	0.0		0.0	0.2	0.0		0.0	0.1	0.0		0.0	0.3
Aug 31-Sep 7	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.2	0.0	0.0
Sep 7-14	0.0	0.0	0.0	0.0	0.1	0.1	0.0	--	--	0.0	0.0	0.0
Sep 14-21	0.0	--	0.0	0.0	2.0	--	0.0	0.6	--	--	0.1	0.0
Sep 21-28	0.0	0.0	0.0	0.0	0.0	--	0.0	0.1	0.0	0.0	0.0	0.4
Sep 28-Oct 5	--	--	0.0	--	--	--	0.0	--		--	0.0	--
TOTALS	0.0	0.0	1.3	0.3	2.1	0.2	0.3	1.4	0.0	0.3	0.7	0.9

Dates Exposed**	Yeocomico River 1978	1979	1980	1981	Ragged Point 1978	1979	1980	1981	King Copsico 1978	1979	1980	1981
Jun 18-29		--	--	0.1			--	--	0.0		--	--
Jun 29-Jul 6		0.0	--	0.0			--	--	--		--	--
Jul 6-13		0.0	--	0.0			0.0	--	--		0.0	--
Jul 13-20		0.0	--	0.1			0.0	--	--		0.0	--
Jul 20-27		0.0	0.0	0.5			0.0	--	--		0.0	--
Jul 27-Aug 3	ALL		0.0	--	ALL	ALL	0.0	--	0.0	ALL	0.0	--
Aug 3-10		0.0	0.0	0.0			0.0	0.0	0.0		0.0	0.0
Aug 10-17	ZEROS	0.0	0.0		ZEROS	ZEROS	0.0	0.0	0.0	ZEROS	0.0	0.0
Aug 17-24			0.0	0.0			0.0	0.0	0.0		0.0	0.0
Aug 24-31		0.1	0.0	0.0				0.4	0.0			0.0
Aug 31-Sep 7		0.0	0.0	0.0					0.0			
Sep 7-14		0.2	--	0.1				0.0	0.0			0.0
Sep 14-21		--	0.0	0.1			0.0		0.1		0.0	
Sep 21-28		--	0.0	0.0					--			
Sep 28-Oct 5		--	0.0	--					--			--
TOTALS		0.3	0.0	0.9			0.0	0.4	0.1		0.0	0.0

EASTERN SHORE, SEASIDE

Dates Exposed**	Machipongo River at Quinby Bridge 1978	1979	1980	1981	VIMS Pier at Wachapreague 1978	1979	1980	1981
Jun 22-29	0.0	0.0	0.0	0.7	0.0	0.0	0.3	1.0
Jun 29-Jul 8	0.0	0.0	5.0	3.7	0.0	0.0	0.2	0.7
Jul 8-15	0.2	1.5	8.9	2.0	0.0	66.4	1.8	1.2
Jul 15-22	0.3	6.2	1.2	4.9	6.4	42.4	2.3	2.2
Jul 22-30	1.3	3.9	0.2	0.7	72.4	59.2	0.6	1.6
Jul 30-Aug 6	3.0	44.2	0.9	2.1	21.6	1.2	0.7	0.1
Aug 6-13	12.3	1.4	1.0	0.2	4.1	180.2	0.7	0.0
Aug 13-25	8.4	0.6	0.0	0.0	0.5	18.6	0.0	0.1
Aug 25-Sep 3	1.0	0.0	2.4	0.0	0.2	0.3	6.5	0.0
Sep 3- 9	0.0		13.4	0.0	14.3		9.0	0.0
Sep 9-15	0.1	0.1	0.0	0.0	2.0	0.2	2.3	0.0
Sep 15-25	0.0		--	0.0	1.2		--	0.0
Sep 25-Oct 2		0.1	--	--		0.0	--	--
Oct 2- 9	0.0		--	--	0.0		--	--
Oct 9-Nov 1		--	--	--		--	--	--
TOTALS	26.6	58.0	33.0	14.3	122.7	368.4	24.4	6.9

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