

Reports

2-1991

Oyster Spatfall in Virginia Waters: 1990 Annual Summary

Bruce J. Barber

Virginia Institute of Marine Science

Follow this and additional works at: <https://scholarworks.wm.edu/reports>



Part of the [Aquaculture and Fisheries Commons](#), and the [Natural Resources Management and Policy Commons](#)

Recommended Citation

Barber, B. J. (1991) Oyster Spatfall in Virginia Waters: 1990 Annual Summary. Marine Resource Special Report. Virginia Institute of Marine Science, College of William and Mary. <https://doi.org/10.21220/V5731Z>

This Report is brought to you for free and open access by W&M ScholarWorks. It has been accepted for inclusion in Reports by an authorized administrator of W&M ScholarWorks. For more information, please contact scholarworks@wm.edu.

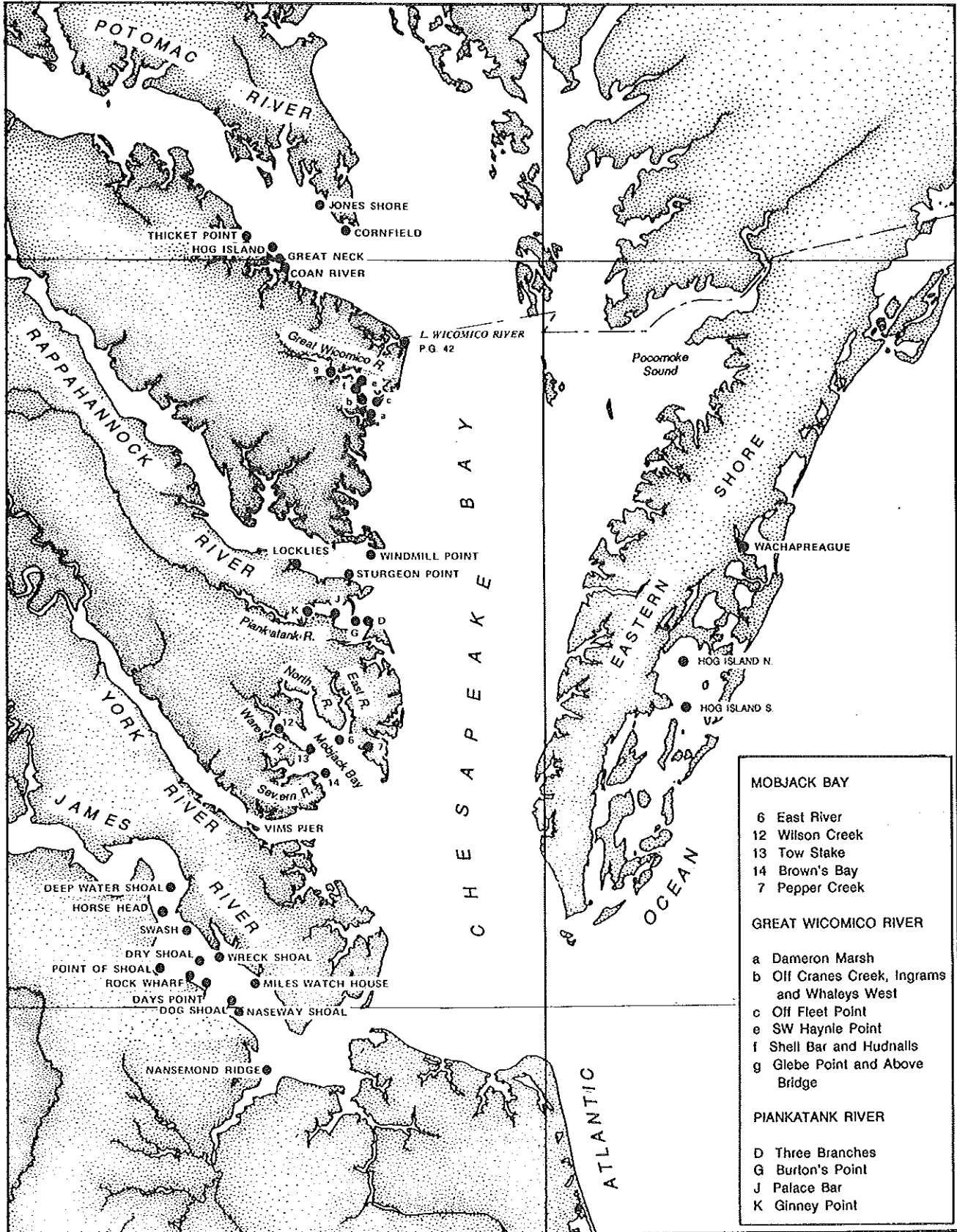
Oyster Spatfall In Virginia Waters

❖ *1990 Annual Summary* ❖

Bruce J. Barber, Ph.D.

Virginia Institute of Marine Science
College of William and Mary
Gloucester Point, VA 23062

SHELLSTRING SURVEY STATIONS



Introduction

The Virginia Institute of Marine Science (VIMS) conducts surveys of oyster spatfall (or "setting") in Virginia waters throughout the summer reproductive period. This survey provides an estimate of the potential of a particular area for receiving a "strike" or set of oysters on the bottom and helps define the timing of setting events. Information obtained from this effort is valuable to the Virginia Marine Resources Commission (VMRC) for its shell repletion program, and to private oyster growers, both of which are interested in maximizing the timing of shell planting. In addition, by maintaining a long-term data base, trends in spatfall throughout the lower Chesapeake Bay can be monitored.

Bi-weekly updates of spatfall data are provided to interested parties throughout the summer. This report summarizes data collected during the entire 1990 setting season.

Methods

Spatfall in 1990 was monitored from June through September at a total of 40 stations (Figure 1). In addition, data was obtained from Urbanna Creek on the Rappahannock River for the month of July. Throughout these periods shellstrings were deployed 0.5 m off the bottom at each station. A shellstring consisted of 12 oyster shells of similar size (about 3") drilled through the center and strung on a piece of heavy gauge wire. Shellstrings were replaced after a one week exposure, and the number of spat that attached to the smooth surface (underside) of the center 10 shells was counted with the aid of a

dissecting microscope. This number was then divided by 10 to get the number of spat per shell for that time interval. A computer program was used to calculate the number of spat per shell per week. These values were interpreted as follows: , "none"; 0.1-1.0, "light"; 1.1-10.0, "moderate"; and 10.1, "heavy."

Weekly sampling allowed setting trends over the course of the summer to be compared between the various locations. Comparisons of setting intensity between years were made by adding the weekly values of spat per shell for the entire setting season.

Results

Weekly spat/shell values and annual spatfall totals (sums of weekly values) are given in Table I.

❖ *James River*

Twelve stations were monitored in the James River. Spat settlement began the week of June 29 and continued at seven of the stations through the week of September 21. "Moderate" spatfall occurred from the week of July 6 through the week of August 10. "Heavy" spatfall was seen at Nansmond Ridge, Dog Shoal, and Days Point the week of July 13 and at Dry Shoal the weeks of July 20 and 27.

For the year, spatfall totals ranged from 1.0 spat/shell at Horsehead to 45.8 spat/shell at Dry Shoal. Dry Shoal, Nansmond Ridge, Dog Shoal, Days Point, Naseway Shoal, and Rock Wharf received the greatest spatfall.

❖ *Mobjack Bay*

Spat settlement was followed at five locations in Mobjack Bay. Setting began the week of June 22 and continued through the end of September. "Moderate" setting began at Wilson Creek the week of June 29 and occurred at all

the stations throughout the summer. "Heavy" spatfall was concentrated in a three week period beginning with the week of August 31, and included all the stations except Brown's Bay.

Over the course of the setting season, spatfall was highest at Wilson Creek (101.9 spat/shell) and lowest at Brown's Bay (44.7 spat/shell).

❖ *York River*

The VIMS oyster pier was the only shellstring station located on the York River. "Light" setting began the week of June 29. "Moderate" setting occurred the week of August 10 and again from the week of August 31 through the week of September 28.

Total spatfall for the year was 14.4 spat/shell.

❖ *Piankatank River*

Spatfall was first seen at the four stations in the Piankatank River the week of June 29. Settlement was continuously "moderate" to "heavy" at all locations through the week of September 21. "Heavy" spatfall took place in three pulses: the first occurred at Burton Point, Palace Bar, and Ginney Point from the week of July 6 to the week

of July 27; the second occurred at Palace Bar and Ginney Point the weeks of August 17 and 24; and the third occurred at Three Branches, Burton Point, and Palace Bar the weeks of September 7 and 14.

For the year, spatfall ranged from 55.7 spat/shell at Three Branches to 139.9 spat/shell at Palace Bar.

❖ *Great Wicomico River*

Six stations were monitored in the Great Wicomico River. Spat settlement was first seen at Hudnall's Dock the week of June 29; settlement continued at all stations through the week of September 21. Some "moderate" settlement occurred at some of the stations from the week of July 6 through the week of August 10. "Heavy" spatfall was concentrated to a four week period beginning July 13 at Cranes Creek, Hudnall's Dock, and Haynie Point.

Total spatfall for the year was lowest at Fleeton Point (18.1 spat/shell) and greatest at Hudnall's Dock (119.6 spat/shell).

❖ *Little Wicomico River*

Setting at P.G. 42 in the Little Wicomico River

began the week of July 6 and continued through the week of September 14. "Moderate" spatfall occurred the weeks of July 13 and August 17. No "heavy" spatfall was recorded.

For the entire setting season, spatfall was 5.2 spat/shell.

❖ *Rappahannock River*

Spatfall began at two of the four stations monitored in the Rappahannock River the week of June 29.

"Moderate" settlement was seen at Sturgeon Creek the weeks of July 13 through July 27, and at Locklies Creek the weeks of July 13 and 20. "Heavy" spatfall occurred at Windmill Point the weeks of July 13 through July 27.

Yearly spatfall totals were available only for Locklies Creek (4.6 spat/shell) and Windmill Point (98.5 spat/shell).

❖ *Potomac River*

Spat settlement began at three of the six stations monitored in the Potomac River the week of July 6 but was "light" and sporadic at all but the Cornfield station. At Cornfield, moderate setting was seen the weeks of July 13 and 20 and the week of August 24.

Spatfall totals for the year ranged from 0.1 spat/shell at Coan River to 8.9 spat/shell at Cornfield.

❖ *Eastern Shore*

Three stations were monitored for spatfall on the seaside of the Eastern Shore. Spatfall generally extended from the week of June 15 through the end of September. At

Wachapreague, "moderate" spatfall occurred from the week of June 22 through the week of July 27 and again from the week of August 17 through the week of October 5; "heavy" spatfall was recorded from the weeks of July 6 through July 20 and again the weeks of September 14 and 21. In Hog Island Bay, "moderate" spatfall occurred the weeks of July 6 and 13, August 24, and September 14 and 21.

For the year, spatfall totals were 211.4 spat/shell at Wachapreague, 21.2 spat/shell at Hog Island North, and 14.2 spat/shell at Hog Island South.

Discussion

As previously mentioned, spatfall on shellstrings is an indicator of relative numbers of larvae (ready to set) in a particular location at a particular time. Subsequent spat settlement and survival on nearby shoal areas is variable and dependent on a number of factors.

High spat counts on shellstrings may not be accompanied by a good set on bottom shell if it is not plentiful or clean enough to attract the metamorphosing larvae. Conversely, for unknown reasons, good setting on bottom shell may occur even though setting on shellstrings was light. It is not known what level of setting on shellstrings is indicative of good setting on bottom cultch, if conditions on the bottom are optimal. Also, it is not known whether recruitment is more readily effected by continuous, light setting or intense setting of short duration.

Subsequent survival of oysters that do set on the bottom is controlled to a great extent by environmental conditions, predators, and disease. Results from the shellstring surveys are reflective of the abundance of oyster larvae present in an area, and thus an indication of reproductive activity and the potential for recruitment, depending on prevailing conditions.

The areas having the greatest likelihood for recruitment in 1990 based on the shellstring survey were:

1. James River - Dry Shoal and Nansemond Ridge

2. Mobjack Bay - Wilson Creek, Tow Stake, East River, and Pepper Creek

3. Piankatank River - Three Branches, Burton Point, Palace Bar, and Ginney Point

4. Great Wicomico River - Hudnall's Dock, Haynie Point, and Cranes Creek

5. Rappahannock River - Windmill Point

6. Eastern Shore - Wachapreague

Based on the results of the shellstring survey, the spatfall potential was generally greater in 1990 than in 1989. Table II contains annual spat/shell totals for 1980 through 1990, where available. Of the 40 locations monitored in 1990 for which data was obtained, 33 experienced greater spat/shell totals in 1990 than in 1989. Spatfall was markedly higher in 1990 than 1989 in Mobjack Bay (all stations), the Piankatank River (all stations), the Great Wicomico River (all stations), the Rappahannock River (Windmill Point), and at Wachapreague on the Eastern Shore. Settlement in the James River (Nansemond Ridge and Dry Shoal), the York River (VIMS Pier), the Little Wicomico River (P.G. No. 42), and the Potomac River (Cornfield) was also greater in 1990 than in 1989.

Spat/shell totals in 1990 were lower than in 1989 at Naseway Shoal and Dog Shoal in the James River, and at both Hog Island locations in the Eastern Shore.

Spat/shell totals in 1990 were lower than the running (up to 10 year)

means at 23 of 37 stations where comparisons were possible (Table II). Thus, even though spatfall was greater in 1990 than in 1989, it is still below historic averages. This is especially true in the James River, where only Nansmond Ridge had a greater spat/shell total than the average from the previous 10 years.

The general decline in spatfall that has occurred in Virginia in recent years can be attributed to several potential causes. First of all, there are fewer adult oysters available for reproduction. The oyster diseases MSX and *Perkinsus* have caused widespread mortality in many areas of the state since 1959, particularly in the higher salinity (lower) portions of the rivers. Even though MSX has been eliminated from many areas due to a recent return to "normal" rainfall and salinity, *Perkinsus* continues to be prevalent and cause mortality. In areas such as the upper James River where disease has not caused oyster mortality to any great extent, harvesting pressure—by selectively removing larger oysters—may be having the same effect. 1990 is the third year in a row that spat/shell totals in the upper James River (Point of Shoals,

Horsehead, Deepwater Shoal) have been below the 10 year average. Secondly, a decline in overall water quality can reduce the reproductive capability of oysters and affect larval survival. The extent to which a reduction in water quality is affecting oyster recruitment, however, is difficult to quantify.



Acknowledgments

Thanks to the following people for their assistance with the 1990 Shellstring Survey: Cliff Dameron, Mike Dobson, Dan Eskridge, Herbert Grimstead, Rick Kellam, and Keith Nuttall (VMRC); Doug Ayres, Chris MacLauchlin, and Ken Walker (VIMS).

TABLE I

Average number of spat/shell (10 shells) for a 7 day period starting with the date shown. Yearly totals are given to the right. (-- indicates that no data was obtained for the week)

Week of:	June					July				August					September				October	Total
	1	8	15	22	29	6	13	20	27	3	10	17	24	31	7	14	21	28	5	
JAMES RIVER																				
Nansemond Rdg.	0.0	0.0	0.0	0.0	<0.1	6.8	20.7	3.6	3.2	2.3	2.1	0.1	<0.1	0.2	0.3	0.4	0.9	--	--	40.6
Naseway Shoal	0.0	0.0	0.0	0.0	0.0	1.3	4.7	5.3	4.4	1.8	0.2	0.1	0.1	0.4	0.8	0.7	0.8	--	--	20.6
Dog Shoal	0.0	0.0	0.0	0.0	0.0	3.4	11.1	6.8	6.5	4.5	0.7	0.3	0.2	0.1	0.1	0.4	0.3	--	--	34.4
Miles W. H.	0.0	0.0	0.0	0.0	<0.1	0.2	0.4	--	0.5	0.4	<0.1	0.1	0.1	0.1	0.4	0.1	0.1	--	--	2.4
Days Point	0.0	0.0	0.0	0.0	0.0	3.6	11.4	5.0	4.3	2.1	0.6	0.0	0.0	0.0	0.3	0.8	0.5	--	--	28.6
Rock Wharf	0.0	0.0	0.0	0.0	0.0	3.1	9.4	1.4	1.6	1.4	<0.1	0.1	0.1	--	--	0.0	0.0	--	--	17.1
Wreck Shoal	0.0	0.0	0.0	0.0	0.1	0.4	1.0	1.8	1.5	0.6	0.2	0.0	0.0	0.0	0.0	0.1	0.2	--	--	5.9
Dry Shoal	0.0	0.0	0.0	0.0	<0.1	2.5	9.5	15.8	12.3	3.0	1.4	0.1	0.1	0.2	0.1	0.2	0.6	--	--	45.8
Pt. of Shoals	0.0	0.0	0.0	0.0	0.0	1.1	1.0	0.1	0.2	0.3	0.0	0.0	<0.1	0.1	0.1	0.0	0.0	--	--	2.9
Swash	0.0	0.0	0.0	0.0	0.0	0.5	1.5	0.3	0.4	0.6	0.4	<0.1	0.1	<0.1	0.1	0.0	0.0	--	--	3.9
Horsehead	0.0	0.0	0.0	0.0	<0.1	0.1	<0.1	0.1	0.2	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--	--	1.0
Deepwater	0.0	0.0	0.0	0.0	<0.1	0.2	0.6	1.3	1.0	0.4	0.3	0.0	0.0	0.0	0.0	0.0	--	--	--	3.8
MOBJACK BAY																				
Brown's Bay	0.0	0.0	0.0	0.0	0.0	0.1	2.6	3.4	3.4	2.9	8.3	5.8	1.9	4.9	5.5	3.6	2.0	0.3	--	44.7
Tow Stake	0.0	0.0	0.0	0.1	0.2	1.6	6.4	8.6	1.6	1.1	0.4	0.6	2.8	8.9	12.1	10.1	8.2	2.0	--	64.7
Wilson Creek	0.0	0.0	0.0	0.4	2.7	2.6	2.1	2.7	1.3	0.3	0.1	0.6	6.5	24.0	32.3	19.8	6.5	--	--	101.9
East River	0.0	0.0	0.0	0.0	0.6	1.4	1.7	2.6	2.3	1.2	2.5	3.0	4.0	10.0	15.9	12.7	4.4	1.7	--	64.0
Pepper Creek	0.0	0.0	0.0	0.0	0.0	2.6	4.7	3.8	4.9	4.8	2.2	1.4	2.8	6.0	19.3	19.7	1.5	0.5	--	74.2

TABLE I, continued

Week of:	June					July					August					September				October	Total
	1	8	15	22	29	6	13	20	27	3	10	17	24	31	7	14	21	28	5		
YORK RIVER																					
VIMS Pier	0.0	0.0	0.0	0.0	0.1	0.6	0.2	0.3	0.8	0.4	1.2	0.3	0.4	2.1	2.1	1.9	2.0	2.0	--	14.4	
PIANKATANK RIVER																					
Three Branches	--	--	--	0.0	0.6	4.7	6.3	6.5	6.5	4.0	4.0	2.1	1.9	1.9	4.5	12.3	0.4	--	--	55.7	
Burton Point	0.0	0.0	0.0	0.0	1.9	13.7	15.7	13.9	9.5	10.1	4.9	3.2	7.2	4.4	5.5	11.8	0.3	--	--	102.1	
Palace Bar	0.0	0.0	0.0	0.0	1.0	9.0	22.1	18.9	10.5	7.6	3.5	10.8	26.9	5.5	12.0	11.1	1.0	--	--	139.9	
Ginney Point	0.0	0.0	0.0	<0.1	0.1	13.2	13.2	10.1	2.7	5.8	3.0	8.0	16.6	3.9	5.4	2.9	0.7	--	--	85.6	
GREAT WICOMICO RIVER																					
Dameron Marsh	--	0.0	0.0	0.0	0.0	5.9	7.1	4.5	6.2	3.6	0.6	0.4	0.2	0.2	0.3	0.0	0.1	0.1	--	29.2	
Cranes Creek	0.0	0.0	0.0	0.0	0.0	8.9	12.2	5.9	7.0	4.4	0.2	0.1	0.2	0.1	0.1	0.0	0.0	0.0	--	39.1	
Hudnall's Dock	0.0	0.0	0.0	0.0	0.7	1.3	56.3	30.0	15.6	11.8	2.7	0.2	<0.1	0.1	0.4	0.4	0.1	0.0	--	119.6	
Haynie Point	--	0.0	0.0	0.0	0.0	5.8	18.9	13.4	14.2	11.9	1.9	0.0	0.2	0.3	0.2	0.7	0.4	0.0	--	67.9	
Glebe Point	0.0	0.0	0.0	0.0	0.0	8.1	8.6	1.9	0.1	0.2	0.3	0.2	0.0	0.1	0.1	0.1	0.1	0.0	--	19.8	
Fleeton Point	0.0	0.0	0.0	0.0	0.0	2.5	5.6	3.6	2.5	1.9	0.8	0.3	0.3	0.2	0.2	0.1	0.1	0.0	--	18.1	
LITTLE WICOMICO RIVER																					
P.G. No. 42	0.0	0.0	0.0	0.0	0.0	0.2	1.2	0.9	0.1	0.1	0.1	1.1	1.0	0.3	0.2	<0.1	0.0	0.0	--	5.2	

TABLE I, continued

Week of:	June					July					August					September				October	Total
	1	8	15	22	29	6	13	20	27	3	10	17	24	31	7	14	21	28	5		
RAPPAHANNOCK RIVER																					
Sturgeon Creek	--	0.0	0.0	0.0	<0.1	0.5	3.0	3.9	6.4	--	--	--	--	--	--	--	--	--	--	--	
Locklies Creek	--	0.0	0.0	0.0	0.2	0.4	1.2	1.2	0.9	0.1	0.1	0.1	0.1	0.1	0.1	0.1	--	--	--	4.6	
Windmill Point	--	0.0	0.0	0.0	0.0	4.6	32.3	31.2	20.7	1.2	1.2	1.2	1.0	0.7	0.7	0.7	--	--	--	98.5	
Urbanna Creek	--	--	--	--	0.0	0.1	<0.1	0.0	0.0	--	--	--	--	--	--	--	--	--	--	--	
POTOMAC RIVER																					
Jones Shore	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--	--	0.4	
Hog Island	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--	--	0.2	
Coan River	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	<0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--	--	0.1	
Great Neck	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--	--	--	0.2	
Thicket Point	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	--	--	0.2	
Cornfield	0.0	0.0	0.0	0.0	<0.1	0.1	2.7	2.3	0.9	0.5	0.0	0.0	1.6	0.2	0.0	0.2	0.4	--	--	8.9	
EASTERN SHORE																					
Wachapreague	0.0	0.0	0.1	3.4	6.8	39.3	63.4	28.5	1.4	0.7	0.7	2.6	8.6	7.2	8.0	15.7	16.8	7.1	1.1	211.4	
Hog Island No.	0.0	0.0	0.1	0.6	0.8	2.0	3.0	0.1	0.1	0.0	0.0	0.0	<0.1	0.1	1.0	6.7	6.7	--	--	21.2	
Hog Island So.	0.0	0.0	0.0	0.2	0.3	1.0	0.8	0.1	0.0	0.0	0.2	1.7	3.4	0.2	1.5	2.4	2.4	--	--	14.2	

TABLE II

Spat/shell totals for years 1980-1990 (when available) and running mean (up to 10 years);
 (+ or - indicates relationship of 1990 total to 1989 total and running mean;
 - - indicates an absence of data for that year)

Location	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	Running Mean	1990 (+/-, +/-)
JAMES RIVER												
Nansemond Ridge	5.7	31.7	19.7	46.7	15.1	69.7	8.8	18.4	8.9	26.0	25.4	40.6 (+, +)
Naseway Shoal	222.7	313.0	81.0	224.7	41.0	465.9	40.0	296.6	18.5	59.4	176.3	20.6 (-, -)
Dog Shoal	--	--	--	--	38.3	568.8	32.1	356.9	27.5	73.0	182.8	34.4 (-, -)
Miles W.H.	18.9	21.3	18.5	46.8	16.7	20.9	9.8	33.7	3.2	4.2	19.4	2.4 (-, -)
Days Point	--	--	--	--	24.4	120.3	22.3	481.6	17.3	25.9	115.3	28.6 (+, -)
Rock Wharf	--	--	--	--	38.7	163.5	11.4	285.7	40.9	3.5	90.6	17.1 (+, -)
Wreck Shoal	16.4	51.9	36.7	104.8	21.2	26.3	7.9	35.1	10.0	10.5	32.1	5.9 (-, -)
Dry Shoal	--	--	--	--	24.0	87.1	16.8	241.5	13.2	10.1	65.4	45.8 (+, -)
Point of Shoals	55.8	74.3	18.1	77.4	23.5	31.2	4.6	75.4	9.9	2.1	37.2	2.9 (+, -)
Swash	20.6	87.6	55.6	333.8	37.2	38.1	9.2	79.5	7.6	3.8	67.3	3.9 (+, -)
Horsehead	20.7	71.9	16.3	96.6	28.1	36.0	7.3	100.0	3.7	1.5	38.2	1.0 (-, -)
Deepwater Shoal	55.8	74.3	18.1	77.4	23.5	31.2	4.6	75.4	9.9	2.1	37.2	3.8 (+, -)
MOBJACK BAY												
Brown's Bay	332.6	10.8	36.0	71.1	4.6	7.1	241.1	8.0	2.2	29.9	74.3	44.7 (+, -)
Tow Stake	98.4	94.0	61.2	18.8	14.3	2.5	15.7	1.9	5.3	28.8	34.1	64.7 (+, +)
Wilson Creek	25.1	177.3	27.5	11.0	39.3	1.7	5.7	2.6	4.8	42.8	33.8	101.9 (+, +)
East River	135.6	99.3	33.3	26.8	14.1	9.4	29.2	8.9	13.1	37.8	40.8	64.0 (+, +)
Pepper Creek	127.3	20.6	46.1	87.5	18.3	112.5	264.6	40.7	4.7	18.0	74.0	74.2 (+, +)

TABLE II, Continued

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	Running Mean	1990 (+/-, +/-)
YORK RIVER												
VIMS Pier	48.5	6.7	16.0	6.2	2.2	20.5	165.2	25.0	7.1	5.4	30.3	14.4 (+, -)
PIANKATANK RIVER												
Three Branches	84.2	36.2	45.0	27.2	17.6	- -	97.9	64.9*	1.7	22.5	44.1	55.7 (+, +)
Burton Point	57.9	34.6	23.3	27.1	38.8	85.7	252.8	43.9*	4.7	31.6	60.0	102.1 (+, +)
Palace Bar	256.3	76.8	59.4	146.2	59.7	124.5	376.5	243.9*	9.1	42.3	139.5	139.9 (+, +)
Ginney Point	175.1	34.5	60.0	171.7	126.6	82.7	204.2	133.3*	5.6	30.0	102.4	85.6 (+, -)
GREAT WICOMICO RIVER												
Dameron Marsh	13.7	3.3	30.2	12.7	0.9	8.6	43.3	29.1	59.3	6.1	20.7	29.2 (+, +)
Cranes Creek	14.8	5.7	54.1	6.7	1.3	6.3	121.6	30.5	17.4	11.7	27.0	39.1 (+, +)
Hudnall's Dock	56.9	31.6	122.9	16.3	3.3	14.2	237.6	50.8	61.8	28.4	62.4	119.6 (+, +)
Haynie Point	12.7	25.9	74.9	12.9	0.7	7.6	170.8	10.5	57.4	20.1	39.4	67.9 (+, +)
Glebe Point	10.5	296.8	364.5	0.6	2.2	10.9	364.6	23.6	27.1	9.1	111.0	19.8 (+, -)
Fleeton Point	9.0	2.3	50.8	42.7	1.7	78.4	42.8	157.9	10.1	9.0	40.5	18.1 (+, -)
LITTLE WICOMICO RIVER												
P.G. No. 42	- -	- -	- -	- -	- -	- -	- -	- -	- -	0.2	- -	5.2 (+)

TABLE II, Continued

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	Running Mean	1990 (+/-, +/-)
RAPPAHANNOCK RIVER												
Sturgeon Creek	--	--	--	--	--	--	21.6*	1.1	1.7	1.7	6.5	--
Locklies Creek	--	--	--	--	--	--	27.7	2.8	3.3	2.4	9.0	4.6 (+, -)
Windmill Point	--	--	--	--	--	--	--	45.9	1.4	1.0	16.1	98.5 (+, +)
POTOMAC RIVER												
Jones Shore	53.3	15.4	381.1	14.5	0.7	20.6	16.2	27.2	3.8	0.1	53.3	0.4 (+, -)
Hog Island	0.3	1.7	1.9	1.5	0.3	1.7	4.8	1.8	0.0	0.1	1.4	0.2 (+, -)
Coan River	1.3	0.3	4.2	0.9	0.0	0.0	10.8	0.0	0.4	0.0	1.8	0.1 (+, -)
Great Neck	1.2	0.5	3.1	1.9	0.0	5.2	6.4	1.9	1.4	0.0	2.2	0.2 (+, -)
Thicket Point	0.8	0.9	1.8	1.1	0.1	0.2	5.0	0.3	0.6	0.0	1.1	0.2 (+, -)
Cornfield	37.7	26.6	246.0	22.9	0.2	29.5	3.6	49.6	6.7	1.8	42.5	8.9 (+, -)
EASTERN SHORE												
Wachapreague	24.4	6.9	46.5	121.0	56.4	31.9	66.7	29.7	47.1	144.1	57.5	211.4 (+, +)
Hog Island N.	--	--	--	--	--	--	--	--	--	49.9	--	21.2 (-)
Hog Island S.	--	--	--	--	--	--	--	--	--	48.7	--	14.2 (-)

* -total is based on less than a full setting season, but is included in running mean

