

SUMMARY OF THE EFFECTS OF AGNES ON OYSTER SETTING IN VIRGINIA IN 1972

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DEXTER HAVEN

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WILLIAM J. HARGIS, JR.

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Oyster setting in Virginia River Systems dropped to the lowest level on record during 1972. Spatfall studies indicate this poor condition to be the direct result of the effects of tropical storm Agnes. This low set occurred in all major oyster producing areas in the state. No area received sufficient "set" to be of any value commercially.

In all areas, the catch of seed oysters and later on the catch of market oysters will be lowered. In terms of production of seed or market oysters, the severity of these effects will, of course, depend on the future survival rates of the oysters now existing on the beds. Certain assumptions, however, are possible. In the James River, density of seed on the bottom has been slowly declining since 1960 due to the poor setting and the 1972 set failure will result in a further reduction of the 1 to 2 inch seed-sized oysters available for harvesting during the 1973-74 season and later.

In the Great Wicomico and Piankatank Rivers where there was little seed available in the spring of 1972, the absence of a 1972 set means that 1 to 2 inch seed-sized oysters will be largely unavailable in those systems during the 1973-74 season.

On the Baylor Survey or public rocks which depend on a natural strike to maintain their productivity, there will be a lowered

productivity of market oysters 3 or 4 years from now which will coincide with the time when the 1972 set would ordinarily have reached market size.

The preceding statements are based on an extensive monitoring system regularly conducted by the Virginia Institute of Marine Science. The monitoring program was started on a regular basis in 1947. Setting is evaluated by three methods and involves 37 stations at which observations are made. These stations are distributed in all major rivers and their tributaries. Measurements from all 37 stations indicated that spatfall and setting in 1972 was, with two minor exceptions, the lowest on record. The two exceptions occurred in the James River during 1965 and 1967 at Wreck Shoals and Horsehead Shoals. During these two periods and at these stations, setting was as poor as it was in 1972. As an aid in understanding this summary, the three techniques are briefly outlined.

A. Fall and Winter Surveys of Public Oyster Rocks in the State.

In this program, bushel samples are collected from the various public rocks and numbers of oysters and spat counted. This method shows the numbers on the bottom and their condition.

B. Shell Bags. Wire bags containing about 1/4 bushel of oyster shells are placed near the sites surveyed in the "A" program described above. Shell bags are put out in June prior to the setting period under study. In fall, after setting has stopped, the shell bags are removed and the spat surviving on the shells are counted. This method shows the numbers of spat surviving on shell bags from the set of the year. Commercial growers often use shell bags to obtain spat for their "plantings". Shell bags are more easily

controlled and handled than is shell scattered over the bottom.

C. Shell Strings. Fifteen oyster shells are strung on a piece of wire, and this is placed in the water during the setting season each week. At the end of the week, the string is removed and replaced by a fresh string. Total spat setting on all strings at a single station during a season is recorded as total spat per shell. Due to the occurrence of spat scars, it is also possible to determine those that set but did not survive the week. Data obtained from shell strings are shown in this summary as the total numbers of spat setting per shell for the season.

Handled in this fashion, shell strings show the numbers of spat set during and surviving for the week they are overboard. Thus, a good evaluation of the pattern or timing of setting can be obtained. When the numbers of spat occurring each week on the shell strings are totaled at the end of the setting season, it is possible to determine, thereby, the total number of oysters that have set at that station. Comparing these data with those from methods A and B described above, it is possible to deduce survival or mortality of spat, i.e. to distinguish between the numbers that set and those that survived. The number that set has been called "theoretical spatfall." Of course, in actual practice, only those surviving, "surviving spatfall", are of economic significance. However, by being able to distinguish between theoretical spatfall and surviving spatfall, one can determine mortality and, with proper observations, even determine some aspects of timing and causes of mortality. Only when these data are known and available is it possible to plan further practical experiments related to mitigation of mortality or to develop methods to directly reduce or avoid mortalities! Such data are essential to proper management of oyster

farming and production.

Attached to this report are 21 tables which substantiate the statements made in the opening paragraphs of this report. For brevity, 12 of these tables have been condensed and the average set for the past MSX period (after 1960) has been compared to set observed in 1972 (Table A). In all instances, data are given as spat per shell*. It is fully realized that averaging obscures yearly variation. However, if tables 1-21 are consulted, it will be seen that in all but the two instances mentioned above, set in 1972 (no matter how measured) was lower than for any period prior to 1972. The two exceptions at Wreck Shoals and Horsehead Shoals in the James River for 1965 and 1967 shows sets about equal to those for 1972. It is not know at this time why setting in these two years at these two stations in the James were lower than those for 1972 but there is little doubt that Agnes has been the most significant factor affecting spatfall during the 25 year period in which records have been kept.

*For shell strings, spat per shell is the number for the smooth side of the shell only.

Table A

Summary of Average Range in Spatfall for Stations in all Major Estuaries in Virginia in the Post MSX Period Compared Similar Data for 1972.

I. James River:						
A. Shell Bags	Normal	1961-71	0.9	to	4.3	spat/shell
	Agnes	1972	0.1	to	<u>0.0</u>	spat/shell
*B. Shell Strings	Normal	1961-71	3.8	to	9.8	spat/shell/season
	Agnes	1972	<u>0.7</u>	to	<u>3.3</u>	spat/shell/season
C. Natural Cultch	Normal	1961-71	0.1	to	0.4	spat/shell
	Agnes	1972	<u>0.00</u>	to	<u>0.05</u>	spat/shell
II. Rappahannock River:						
A. Shell Bags	Normal	1959-71	0.1	to	3.8	spat/shell
	Agnes	1972	0.00	to	0.03	spat/shell
*B. Shell Strings	Normal	1971	0.0	to	25.0	spat/shell/season
	Agnes	1972	0.0	to	0.0	spat/shell/season
C. Natural Cultch	Normal	1961-71	.01	to	.18	spat/shell/season
	Agnes	1972	0.0	to	0.0	spat/shell/season
III. York River:						
A. Shell Bags	Normal	1963-71	0.1	to	4.0	spat/shell
	Agnes	1972	0.0	to	0.03	spat/shell
*B. Shell Strings ^t	Normal	1963-71	44.1			spat/shell/season
	Agnes	1972	0.3			spat/shell/season
C. Natural Cultch	Normal	1961-71	.03	to	.05	spat/shell
	Agnes	1972	0.00	to	0.02	spat/shell
IV. Piankatank River:						
A. Shell Bags	Normal	1963-71	1.2	to	4.2	spat/shell
	Agnes	1972	0.01	to	0.14	spat/shell
*B. Shell Strings	Normal	1964-71	12.7	to	67.9 total	spat/shell/season
	Agnes	1972	0.0	to	1.2	spat/shell/season
C. Natural Cultch	Normal	1961-71	0.55	to	1.09	spat/shell
	Agnes	1972	0.0	to	0.02	spat/shell

V. Great Wicomico River:

A. Shell Bags	Normal	1965-71	2.4	to	8.2	spat/shell
	Agnes	1972	0.01	to	0.05	spat/shell
*B. Shell Strings	Normal	1964-71	19.0	to	90.6	spat/shell/season
	Agnes	1972	0.00	to	0.00	spat/shell/season
C. Natural Cultch	Normal	1968-69	2.0	to	200.0	spat/shell
	Agnes	1972	0.00	to	0.01	spat/shell

VI. Corrotoman River:

**A. Natural Cultch	Normal	1961-71	0.4	to	0.5	spat/shell
	Agnes	1972	less than		0.01	spat/shell

* Counts smooth side shell only.

t Gloucester Point only.

** Data on spat per bushel in table divided by 500 to obtain spat/shell

Table 1

Seasonal Spatfall on Shellbags in the James River¹

Spat per Shell

Calendar Year	LOCATION		
	Brown Shoal	Wreck Shoal	Horse Head Shoal
1947	4.5	14.4	8.7
8	3.8	9.0	6.5
9	12.0	17.0	3.6
1950	5.2	13.3	1.7
1	7.4	7.6	3.9
2	5.7	6.4	1.8
Average	6.4	11.3	4.4
1958	21.0	28.7	6.9
9	N/A	9.6	N/A
1960	7.0	3.0	9.2
Average	14.5	13.8	8.0
1961	0.8	3.6	N/A
2	1.6	1.2	0.5
3	2.1	0.3	0.1
4	1.5	2.7	1.5
5	0.7	0.1	0.0
6	0.6	0.4	0.4
7	0.1	0.2	1.0
8	N/A	N/A	N/A
9	N/A	N/A	N/A
1970	0.4	1.3	3.0
1	31.0	0.2	0.6
Average	4.3	1.1	0.9
1972	0.03*	0.1	

1. Andrews, J.D., manuscript; data not available for 1953-1957 and 1968-1969; 1970-1 data from Haven, D.S., Marine Resource Information Bulletin, VIMS.

* Miles Watch House.

Table 2

Sum of Weekly Spatfall in the James River¹
(Spat per Smooth Shellface)

Calendar Year	Type of Collector	Duration of Setting	LOCATION			
			Brown Shoal	Wreck Shoal	Horse Head Shoal	Deep Water Shoal
1947	SB	7/ 9 - 10/17		157.8		15.7
8	SB	7/ 1 - 10/ 7		84.9		
9	SB	6/28 - 11/ 2	155.6	107.2		4.7
1950	SB	7/11 - 10/19	140.4	108.6		2.9
1950	SS	7/11 - 9/20	132.8	157.4	7.2	2.4
1	SB	7/ 6 - 10/12		40.1		
2	SB	7/ 2 - 10/ 6	88.5	40.2		3.5
Average	SB		128.2	99.5		5.8
1963	SS	7/16 - 9/26	14.1	.6	.4	0
4	SS	7/28 - 9/29	6.8	4.7	2.1	1.3
5	SS	7/26 - 10/10	.2	.4	0	0
6	SS	7/ 5 - 10/14	6.9	3.8	3.3	2.9
7	SS	7/18 - 9/27	.6	.7	1.4	0.8
8	SS	6/13 - 11/ 9	2.1	9.2	6.4	11.6
9	SS	7/ 2 - 10/17	5.2	40.8	19.8	5.6
1970	SS	7/20 - 10/12	21.5	14.8	15.1	4.7
1	SS	6/14 - 10/ 6	31.1	9.7	12.0	7.1
Average			9.8	9.4	6.7	3.8
1972	SS	8/1 - 10/ 2	0.7	3.0	3.3	0.9

1. Andrews, J.D., unpublished data 1947-67; data not available for 1953 through 1962; blanks indicate that data were not available. Haven, D.S., in Marine Resource Information Bulletin. VIMS. 1969 and 1970. Haven, D. S., unpublished data 1968 and 1971.

2. SB = Shell bag; SS = Shellstring.

Table 3

Highest Weekly Spatfall on Shell Strings in the James River¹
 Spat Counted per Smooth Shellface Plus Week of Occurance²

Calendar Year	Type of Collector ³	LOCATION			
		Brown Shoal	Wreck Shoal	Horse Head Shoal	Deep Water Shoal
1947	SB		40.5 S1		6.2 S1
8	SB		17.9 A5		
9	SB	32.6 A2	18.4 A3		2.6 A2
1950	SB	45.6 S2	39.0 S1		1.0 S1
1950	SS	99.2 S2	81.1 S2	4.4 S1	1.3 S1
1	SB		12.7 J4		
2	SB	23.0 S2	11.1 S3		.7 A3
Average	SB	33.7	23.3		2.6
1963	SS	4.7 A5	.4 A5	.2 S2	0
4	SS	3.3 S2	1.8 S2	1.1 A5	.5 A5
5	SS	.1 A3	.2* O1	0	0
6	SS	1.9 A1	1.1 A3	.8 A1	1.1* J4
7	SS	.3 S1	.5 S1	.6 A4	.3 A4
8	SS	.4 A3	2.0 A3	1.5 A3	2.5 A3
9	SS	1.7 S2	21.1 S1	15.1 J3	2.4 J3
1970	SS	6.0 A1	9.2 A1	7.6 A1	2.8 A1
1	SS	17.0 A4	3.4 A1	7.7 A1	3.2 A1
Average	SS	3.9	4.4	3.8	1.4
2	SS	0.3 A4	1.2 S3	1.1 S3	0.5 S4

1. Andrews, J.D., unpublished data 1947 through 1967; data not available for 1953 through 1962; blanks indicate that data were not available. Haven, D.S., in Marine Resource Information Bulletin, VIMS, 1969 and 1970. Haven, D.S., unpublished data 1968 and 1971.

2. Letters indicate the month of occurrence (J = July, A = August, S = September, and O = October). The digits following the letters indicate the week of the month.

3. SB = Shellbags; SS = Shellstrings. * Shell string was in the water two weeks.

Table 4

Comparison of Average Numbers of Oysters in Bushel Samples of
Natural Cultch in Pre and Post-MSX Periods in James River, Virginia
1947 - 1972¹

AREA	MARKET			SMALL & YEARLING			SPAT		
	1947-60	1961-71	1972	1947-60	1961-71	1972	1947-60	1961-71	1972
Deep Water Shoals	20	31	0	645	457	50	1,062	216	0
Horse Head	7	34	30	1,500	804	366	1,638	135	0
Point of Shoals	18	65	14	944	543	238	365	182	26
Wreck Shoals	17	53	24	1,563	789	276	1,522	197	18
Brown Shoals	74	69	18	679	123	6	744	62	0
Average	27	50	17	1,066	543	187	1,066	158	9

Table 5

Comparison of Average Numbers of Spat per Shell on Natural Cultch, Shellbags and Shellstrings in Pre and Post-MSX Periods in the James River, Virginia, 1947-1960 (period 1953-1960 msg) and 1961-1971.

AREA	NATURAL CULTCH ¹			SHELLBAGS			SUM OF WEEKLY SET SHELLSTRINGS ²		
	1947-52	1961-71	1972	1947-52	1961-71	1972	1947-52	1961-71	1972
Deep Water Shoals	2.1	.4	0	----	---	---	11.6	7.6	1.8
Horse Head	3.3	.3	0	4.4	.9	0	14.4	13.4	6.6
Point of Shoals	.7	.4	.05	----	---	---	----	----	---
Wreck Shoals	3.0	.4	.03	11.3	1.1	0.1	199.0	18.8	6.0
Brown Shoals	1.5	.1	0	6.4	4.3	0.03 ³	256.4	19.6	1.4

1. Assuming 500 shells per bushel.

2. Total spatfall per shell for entire season; data from Table number per shellface doubled.

3. Miles[†] Watch House.

Table 6

Seasonal Setting on Shellbags in the Rappahannock River¹
(Spat/Shell)

Calendar Year	LOCATION							
	Parrott Rock	Orchard Point/ Drumming Ground	Hogg House Rock	Long Point	Smokey Point	Off Mulberry Creek	Morrattico Bar	Bowler's Rock
1949	1.4	2.5			.2		<.1 ²	
50	.8	1.0			.2		<.1 ²	<.1 ²
1		1.2						<.1 ²
Average	1.1	1.6			.2		<.1 ²	<.1 ²
1959			.6				0	
60								
1								
2					<.1 ²			
3				.8			<.1 ²	
4	.4			.8	.8	.4	.2	
5	4.1	11.1	2.4		2.4	7.5		
6								
7	<.1 ²	.2	<.1 ²		0			
8								
9								
1970			0		<.1 ²			0
1	.5	.1	.12		.12			0
Average	1.3	3.8	.6	.8	.6	4.0	.1	"
1972	0	0.03	0		0		0	0

1. Andrews, J.D. unpublished data for 1949 through 1967. Haven, D.S., in Marine Resource Information Bulletin, VIMS. 1970-1; blanks indicate that data were not available.

2. < is the symbol for "less than".

Table 7

Comparison of Average Number of Oysters in Bushel Samples of Natural Cultch in Pre and Post-MSX Years in the Rappahannock River of Virginia
1947 - 1971

AREA	MARKET		SMALL & YEARLING		SPAT	
	1947-60	1961-71	1947-60	1961-71	1947-60	1961-71
Bowler's Rock	33	40	38	35	5	5
Morattico Bar	33	43	37	107	9	14
Smokey Point	61	55	117	129	37	46
Hogg House	69	45	121	47	31	28
Drumming Ground	67	29	126	96	121	93
Average	53	43	88	83	41	37

Table 8

Comparison of Average Numbers of Spat per Shell, on Natural Cultch, Shellbags and Shellstrings in Pre and Post-MSX periods in the Rappahannock River, Virginia
1947 - 1971

AREA	NATURAL CULTCH ¹		SHELLBAGS		SUM OF WEEKLY SET SHELLSTRINGS ²	
	1947-60	1961-71	1947-60	1961-71	1952	1969-71
Bowler's Rock	.01	.01	<.1	0		
Morattico Bar	.02	.03	<.1	.1		
Smokey Point	.07	.09	.2	.6		
Hogg House	.06	.06	.6	.6	17	7
Drumming Ground	.24	.18	1.6	3.8	51	8

< is the symbol for "less than"..

1. Assuming 500 shells per bushel.
2. Total spatfall per shell for entire season; number per shell-face doubled.

Table 9

Comparison of Average Numbers of Oysters in Bushel Samples
of Natural Cultch in Pre and Post-MSX Years in Corrotoman River
1947 - 1972¹

AREA	MARKET			SMALL & YEARLING			SPAT ²		
	1947-60	1961-71	1972	1947-60	1961-71	1972	1947-60	1961-71	1972
Shelton Pt.	51	25	52	248	183	144	190	202	0
Elack Stump	42	25	24	352	113	94	184	177	0
Island Bar	53	26	--	289	240	---	167	256	-
Middle Ground	45	37	--	210	179	---	128	155	-
Corrotoman Pt.	72	33	10	224	176	126	134	183	2
Average	52	29	28	265	178	121	159	195	1

1. 1971 Data for Island Bar and Middle Ground not included.

Table 10

Seasonal Spatfall on Shellbags in the Piankatank River¹
Spat Per Shell

Calendar Year	LOCATION					
	Milford Haven ²	3 Branch Shore	Burton Point	Cape Toon	Palace Bar	Ginny Point
1963	8.3					11.1
4	1.4		1.3	2.0	1.7	1.6
5	3.1	3.6	2.6	2.2		5.8
6	1.4	.8		1.9	1.4	
7		.2	.2		1.5	.6
8						
9						
1970	1.1		2.9			3.9
1	.2	.2	.2	.9		2.0
Average	2.6	1.2	1.4	1.8	1.5	4.2
1972	0.01	0.05	0.05	0.04 ³	0.09	0.14

1. Andrews, J.D., unpublished data for 1963 through 1967; Haven, D.S., in Marine Resource Information Bulletin, VIMS, 1970 & 71. Blanks indicate that data were not available.

2. Hole in the Wall.

3. Iron Point

Table 11

Sum of Weekly Spatfall on Shellstrings in the Piankatank River¹
Spat Per Shellface

Calendar Year	Duration of Setting	LOCATION					
		Milford Haven	3 Branch Shore	Burton Point	Cape Toon	Palace Bar	Ginny Point
1964	7/ 6- 9/15	22.0					48.0
5	6/21- 9/ 6	115.8					190.9
6	6/23- 9/26	79.7					72.9
7	6/14-10/ 3	10.2		6.4	14.4	20.1	17.8
8	6/19-10/18	46.5	18.6	24.1	138.3	21.2	54.2
9	6/ 9- 9/22	3.7	3.8	4.5	10.4	12.1	27.7
1970	6/ 4-10/ 7	11.7	10.6	19.8			60.5
1	6/15-10/12	22.6	29.1*	8.7		11.4	71.2
Average		39.0	15.6	12.7	54.4	16.2	67.9
1972	6/20-10/2	0.1	0	0		0.1	1.2

* Data to 9/7 only.

Table 12

Highest Weekly Spatfall on Shellstrings in the Piankatank River¹
Spat Counted Per Smooth Shellface Plus Week of Occurance²

Calendar Year	Milford Haven	3 Branch Shore	Burton Point	Cape Toon	Palace Bar	Ginny Point
1964	7.1 S1					11.6 S1
5	55.6 J3					85.6 J3
6	40.3 A5					23.2 A5
7	3.8 J4		2.8 J5	9.3 A2	6.5 A2	10.4 A2
8	27.4 J3	10.3 J3	14.3 J3	60.9 J3	9.5 J3	28.5 J3
9	1.1 S3	1.5 S3	1.1 J3	3.8 J2	5.4 J4	9.5 J2
1970	1.5 S1	3.9 A3	7.3 J2			29.7 J2
1	12.3 S1	14.8 S1	3.2 S1		3.9 J1	13.5 A2
2	0.1 J3	0	0		0.1 E4	0.8 J2

1. Andrews, J.D., unpublished data for 1964 through 1967; Haven D.S., in Marine Resource Information Bulletin, VIMS, 1969 through 1971. Haven, D. S., unpublished data. 1968. Blanks indicate that data were not available.
2. The letters to the right of the spat counts indicate the month (E = June; J = July; A = August; S = September; O = October). The digits immediately following the letters indicate the week of the month.

Table 13

Comparison of Average Numbers of Oysters in Bushel Samples of
 Natural Cultch in Pre and Post-MSX Years in Piankatank River
 1948 - 1972

AREA	MARKET			SMALL & YEARLING			SPAT		
	1948-60	1961-71	1972	1948-60	1961-71	1972	1948-60	1961-71	1972
Ginny Point	46	18	4	298	296	172	210	277	2
Palace Bar	78	19	0	328	209	190	400	546	10
Middle Ground	40	31	4	389	228	106	---	343	4
Burton Point	43	19	14	119	220	198	303	300	4
Average	52	22	6	284	238	166	304	366	5

Table 14

Comparison of Average Numbers of Spat per Shell, on Natural Cultch and Shellbags and Total Weekly Set on Shellstrings in Post-MSX Period in the Piankatank River, Virginia

1948 - 1972

AREA	NATURAL CULTCH ¹			SHELLBAGS		SUM OF WEEKLY SET SHELLSTRINGS ²	
	1948-60	1961-71	1972	1961-71	1972	1964-71	1972
Ginny Point	.42	.55	0.004	4.2	0.14	135.8	2.4
Palace Bar	.80	1.09	0.02	1.5	0.09	32.4	0.2
Cape Toon	---	.69 ³	0.008 ³	1.8	0.04 ⁴	108.8	---
Burton Point	<u>.61</u>	.60	0.008	1.4	0.05	25.4	0
Milford Haven	----	----	0	2.6	0.01	78.0	0.2

1. Assuming 500 shells per bushel.

2. Total spatfall per shell for entire season; number per shellface doubled.

3. Middle Ground.

4. Iron Point.

Table 15

Seasonal Spatfall on Shellbags in the Great Wicomico River¹
Spat per Shell

Calendar Year	<u>LOCATIONS</u>					
	Dameron Marsh	Whaley Flats	Cranes Creek	Haynie's Bar	Hudnell's Dock	Glebe Point
1965	18.3	17.4	28.8	10.4	17.9	2.2
6	6.3	6.8	1.5	9.1	10.6	4.4
7	1.4	.9	1.9		1.6	2.7
1971	.6	1.0	.5	.2	.5	.2
Average	6.6	6.5	8.2	6.6	7.6	2.4
1972	0.01		0.05		0.02	

1. Andrews, J.D., unpublished data. Data for 1968 through 1970 not available. Haven, D.S., in Marine Resource Information Bulletin. VIMS. 1971. Blank indicates that data was not available.

Table 16

Sum of Weekly Spatfall on Shell Strings in the Great Wicomico River¹.
Spat Per Smooth Shell Face

<u>Calendar Year</u>	<u>Duration of Setting</u>	<u>Dameron Marsh</u>	<u>Mill Creek</u>	<u>Whaley's Flats</u>	<u>Cranes Creek</u>	<u>Fleet Point</u>
1964	6/21- 9/21	407.7	-	-	-	-
5	6/14- 9/ 4	105.2	-	210.6	419.3	-
6	6/20- 9/19	-	-	33.3	-	-
7	6/12- 9/27	8.4	8.8	29.4	25.7	-
8	6/17- 8/27 ²	48.5	36.0	142.3	250.2	-
9	6/ 9-10/29	9.6	39.7	64.8	75.8	26.9
1970	6/ 4-10/ 7	50.6	70.1	-	169.8	29.8
1	6/21- 9/24	4.4	2.9	2.0	4.0	0.2
Average		90.6	31.5	80.4	157.5	19.0
1972	6/19- 9/18	0	0	-	0	0

<u>Calendar Year</u>	<u>Duration of Setting</u>	<u>Cockrells Creek</u>	<u>Haynies Bar</u>	<u>Shell Bar</u>	<u>Hudnells Dock</u>	<u>Glebe Point</u>
1964	6/21- 9/21	-	-	-	-	-
5	6/14- 9/4	-	491.1	-	240.4	133.8
6	6/20- 9/19	-	-	-	170.8	151.8
7	6/12- 9/27	-	79.3	-	91.1	226.1
8	6/17- 8/27 ²	-	48.8	-	204.5	181.9
9	6/ 9-10/29	51.5	189.8	226.7	151.1	67.2
1970	6/ 4-10/7	55.0	428.7	454.0	513.6	834.5
1	6/21- 9/24	1.7	8.1	11.7	17.4	46.3
Average		36.1	207.6	230.8	198.4	234.5
1972	6/19- 9/18	0.1	0	0.5	0.4	3.1

1. Andrews, J.D., unpublished data 1964-67; Haven, D.S., in Marine Resource Information Bulletin, VIMS, 1969-1971. Haven, D. S., unpublished data. 1968. Blanks indicate that data were not available.

2. Observations stopped on this date.

Table 17

Highest Weekly Spatfall on Shellstrings in the Great Wicomico River¹
Spat per Smooth Shellface, Plus Week of Occurance²

<u>Calendar Year</u>	<u>Dameron Marsh</u>	<u>Mill Creek</u>	<u>Whaley's Flats</u>	<u>Crane's Creek</u>	<u>Fleet Point</u>
1964	239.9 E4	-	-	-	-
5	74.2 J3	-	129.2 J3	253.2 J3	-
6	-	-	17.8 J2	-	-
7	3.6 A2	5.0 A2	10.6 A1	11.5 A1	-
8	19.9 J4	17.2 J4	106.1 J3	119.1 J3	-
9	7.5 J1	28.1 J1	59.4 J1	71.8 J1	25.7 J1
1970	34.4 E4	48.7 E4	-	132.7 E4	26.6 E4
1	3.1 A4	1.4 A4	1.5 A4	1.4 A4	0.8 S1
2	0	0	-	0	0

<u>Calendar Year</u>	<u>Cockrell's Creek</u>	<u>Haynie's Bar</u>	<u>Shell Bar</u>	<u>Hudnell's Dock</u>	<u>Glebe Point</u>
1964	-	-	-	-	-
5	-	250.2 J3	-	134.3 J2	67.8 J2
6	-	-	-	83.1 J2	49.9 J2
7	-	46.0 J4	-	60.3 J4	167.9 J4
8	-	19.7 J4	-	77.1 J4	66.4 J3
9	48.5 J1	175.3 J1	209.3 J1	134.7 J1	34.4 J1
1970	55.0 E4	283.3 E4	290.2 E4	373.5 E4	530.7 J1
1	1.3 A3	3.5 A4	1.3 A3	2.2 A3	18.8 A3
2	0.1 S2	0	0.3 E4	0.4 E4	2.0 E4

1. Andrews, J.D., unpublished data 1964 through 1967; Haven, D.S., in Marine Resources Information Bulletin, VIMS, 1969-1971. Haven, D. S., unpublished data. 1968. Blanks indicate that data were not available.
2. The letters to the right of the spat counts indicate the month (E = June; J = July; A = August and S = September). The digits following the letters indicate the week in the month.

Table 18

Seasonal Spatfall on Shellbags in the York River¹
Spat Per Shell

Calendar Year	LOCATION								
	Ellen Island	Wormley Rock	Gloucester Point	Green Rock	Page's Rock	Aberdeen Rock	Clay Bank	Purtan Bay	Bell's Rock
1947			1.9						
8					.3			.1	0
9		1.1			1.3			.7	.2
1950		.3			.5	1.4			1.6
Average		.7	1.9		.8	1.4		.4	.6
1958			1.7						
9	.9	.	.1		.1				
1960					.4				
Average	.9		.9		.2				
1961			.5						
2				.2	.1		1.1		
3	.5		3.8	.5	.4		.2		
4	.3	.1	2.6	3.8					
5			.4		.4				
6	.4		.2	1.2	.4		2.4		
7	<.1 ²		<.1 ²		.1		<.1 ²		
8									
9									
1970			2.3	<.1 ²			.4		0
1			22.0	1.9	1.3		1.2	.1	.12
Average	.3	.1	4.0	1.3	.4		.9	.1	.12
1972	0 ³		0	0.01	0.01		0.03		0

1. Andrews, J.D., unpublished data for 1947 through 1967; data not available for 1951 through 1957. Haven, D.S., in Marine Resource Information Bulletin, VIMS, 1970-71. Blanks indicate that data were not available.

2. < is the symbol for "less than".

3. Tues Light.

Table 19

Weekly Spatfall on Shell Strings in the York River
Near Gloucester Point;¹ Sum, Maximum and Week of Occurrence.

Spat Per Smooth Shellface

Calendar Year	Duration of Setting	Sum of Weekly Spatfall	Max. Wkly Spatfall & Wk. of Occurrence ²
1947	7/ 7 - 10/7	28.5	5.8 A 5
8	6/28 - 9/27	11.0	2.7 S 2
9			
1950	7/12 - 9/27	36.8	13.8 S 2
1	6/27 - 10/10	44.8	11.8 A 4
2	6/23 - 11/17	51.0	21.4 S 2
3	6/12 - 10/ 7	56.7	19.5 A 4
4	6/28 - 11/ 8	28.5	14.2* S 3
5	7/ 7 - 8/27!	34.7	11.1 J 3
Average		36.5	
1963	7/12 - 9/23	19.5	6.5 S 3
4	8/17 - 10/ 5	224.5	156.7 S 1
5	7/12 - 10/28	5.4	1.9 A 4
6	7/ 5 - 10/17	26.8	7.7 S 1
7	7/17 - 10/14	1.0	.8 S 2
8	6/26 - 9/ 1!	.4	.1 J 4
9	7/ 2 - 10/13	12.2	.7 S 3
1970	8/ 5 - 10/15	19.7	5.1 S 3
1	7/20 - 10/19	87.2	53.2 S 2
Average		44.1	
1972	9/ 1 - 9/8	0.3	0.3 S 1

1. Andrews, J.D., unpublished data for 1947 through 1968; data not available for 1949 and 1956 - 1962. Haven, D.S., 1969-1971, Marine Resource Information Bulletin, VIMS. Data were taken at the Yorktown Fish pier in 1947-48 and at VIMS' pier, Gloucester Point, in the remaining years.

2. Letters indicate the month of occurrence (J = July, A = August, and S = September). The digits immediately following the letters indicate the week of the month.

* Shell string stayed in water about 4 weeks.

! Observations stopped on this date.

Table 20

Comparison of Average Number of Oysters in Bushel
Samples of Natural Cultch in Pre and Post-MSX Years in York River
1947 - 1971

<u>AREA</u>	<u>MARKET</u>		<u>SMALL & YEARLING</u>		<u>SPAT</u>	
	1946-60	1961-71	1946-60	1961-71	1946-60	1961-71
Bell's Rock	76	39	140	178	124	15
Aberdeen Rock	46	37	139	58	73	25
Page's Rock	55	28	77	55	42	22
Green Rock	21	7	20	2	34	9
Average	50	28	94	73	68	18

Table 21

Comparison of Average Numbers of Spat per Shell on Natural Cultch, Shellbags
and Shellstrings in Pre and Post-MSX Periods in the York River, Virginia
1946-1971

<u>AREA</u>	<u>NATURAL CULTCH¹</u>		<u>SHELLBAGS</u>		<u>SUM OF WEEKLY SET SHELLSTRINGS²</u>	
	1946-60	1961-71	1946-60	1961-71	1946-60	1961-71
Bell's Rock	.25	.03	.6	0		
Aberdeen Rock	.08	.05	1.4			
Page's Rock	.07	.04	.9	.4		
Green Rock	.07	.02		1.3		
Gloucester Pt.			1.2	4.0	36.5	88.2

1. Assuming 500 shells per bushel.

2. Total spatfall per shell for entire season; number per shellface doubled.