Summary of the effects of Agnes on oyster setting in Virginia in 1972

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

by

DEXTER HAVEN

and

WILLIAM J. HARGIS, JR.

Virginia Institute of Marine Science
Gloucester Point, Virginia 23062

20 March 1973
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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


I. James River:

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
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<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>spat/shell</td>
<td></td>
<td>spat/shell</td>
<td></td>
</tr>
<tr>
<td>A. Shell Bags</td>
<td></td>
<td></td>
<td>0.9 to 4.3</td>
<td>0.1 to 0.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B. Shell Strings</td>
<td>Normal</td>
<td></td>
<td>3.8 to 9.8</td>
<td>0.7 to 3.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C. Natural Cultch</td>
<td>Normal</td>
<td></td>
<td>0.1 to 0.4</td>
<td>0.00 to 0.05</td>
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II. Rappahannock River:

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<td></td>
<td></td>
<td></td>
<td>spat/shell</td>
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<td>spat/shell</td>
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<tr>
<td>A. Shell Bags</td>
<td></td>
<td></td>
<td>0.1 to 3.8</td>
<td>0.00 to 0.03</td>
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<td></td>
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<tr>
<td>B. Shell Strings</td>
<td>Normal</td>
<td></td>
<td>0.0 to 25.0</td>
<td>0.0 to 0.0</td>
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<td></td>
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<tr>
<td>C. Natural Cultch</td>
<td>Normal</td>
<td></td>
<td>0.01 to 0.18</td>
<td>0.0 to 0.0</td>
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III. York River:

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<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>spat/shell</td>
<td></td>
<td>spat/shell</td>
<td></td>
</tr>
<tr>
<td>A. Shell Bags</td>
<td></td>
<td></td>
<td>0.1 to 4.0</td>
<td>0.0 to 0.03</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B. Shell Strings</td>
<td>Normal</td>
<td></td>
<td>44.1</td>
<td>0.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C. Natural Cultch</td>
<td>Normal</td>
<td></td>
<td>0.03 to 0.05</td>
<td>0.00 to 0.02</td>
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<td></td>
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IV. Piankatank River:

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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>spat/shell</td>
<td></td>
<td>spat/shell</td>
<td></td>
</tr>
<tr>
<td>A. Shell Bags</td>
<td></td>
<td></td>
<td>1.2 to 4.2</td>
<td>0.01 to 0.14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B. Shell Strings</td>
<td>Normal</td>
<td></td>
<td>12.7 to 67.9 total spat/shell/season</td>
<td>0.0 to 1.2</td>
<td>spat/shell/season</td>
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<tr>
<td>C. Natural Cultch</td>
<td>Normal</td>
<td></td>
<td>0.55 to 1.09</td>
<td>0.0 to 0.02</td>
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V. Great Wicomico River:

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<th>Normal</th>
<th>1965-71</th>
<th>2.4 to 8.2</th>
<th>spat/shell</th>
<th>Agnes</th>
<th>1972</th>
<th>0.01 to 0.05</th>
<th>spat/shell</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A. Shell Bags</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>B. Shell Strings</strong></td>
<td>Normal</td>
<td>1964-71</td>
<td>19.0 to 90.6</td>
<td>spat/shell/season</td>
<td>Agnes</td>
<td>1972</td>
<td>0.00 to 0.00</td>
<td>spat/shell/season</td>
</tr>
<tr>
<td><strong>C. Natural Cultch</strong></td>
<td>Normal</td>
<td>1968-69</td>
<td>2.0 to 200.0</td>
<td>spat/shell</td>
<td>Agnes</td>
<td>1972</td>
<td>0.00 to 0.01</td>
<td>spat/shell</td>
</tr>
</tbody>
</table>

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.
† 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 River

**Spat per Shell**

<table>
<thead>
<tr>
<th>Calendar Year</th>
<th>Brown Shoal</th>
<th>Wreck Shoal</th>
<th>Horse Head Shoal</th>
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<tbody>
<tr>
<td>1947</td>
<td>4.5</td>
<td>14.4</td>
<td>8.7</td>
</tr>
<tr>
<td>1948</td>
<td>3.8</td>
<td>9.0</td>
<td>6.5</td>
</tr>
<tr>
<td>1949</td>
<td>12.0</td>
<td>17.0</td>
<td>3.6</td>
</tr>
<tr>
<td>1950</td>
<td>5.2</td>
<td>13.3</td>
<td>1.7</td>
</tr>
<tr>
<td>1951</td>
<td>7.4</td>
<td>7.6</td>
<td>3.9</td>
</tr>
<tr>
<td>1952</td>
<td>5.7</td>
<td>6.4</td>
<td>1.8</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td><strong>6.4</strong></td>
<td><strong>11.3</strong></td>
<td><strong>4.4</strong></td>
</tr>
<tr>
<td>1958</td>
<td>21.0</td>
<td>28.7</td>
<td>6.9</td>
</tr>
<tr>
<td>1959</td>
<td>N/A</td>
<td>9.6</td>
<td>N/A</td>
</tr>
<tr>
<td>1960</td>
<td>7.0</td>
<td>3.0</td>
<td>9.2</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td><strong>14.5</strong></td>
<td><strong>13.8</strong></td>
<td><strong>8.0</strong></td>
</tr>
<tr>
<td>1961</td>
<td>0.8</td>
<td>3.6</td>
<td>N/A</td>
</tr>
<tr>
<td>1962</td>
<td>1.6</td>
<td>1.2</td>
<td>0.5</td>
</tr>
<tr>
<td>1963</td>
<td>2.1</td>
<td>0.3</td>
<td>0.1</td>
</tr>
<tr>
<td>1964</td>
<td>1.5</td>
<td>2.7</td>
<td>1.5</td>
</tr>
<tr>
<td>1965</td>
<td>0.7</td>
<td>0.1</td>
<td>0.0</td>
</tr>
<tr>
<td>1966</td>
<td>0.6</td>
<td>0.4</td>
<td>0.4</td>
</tr>
<tr>
<td>1967</td>
<td>0.1</td>
<td>0.2</td>
<td>1.0</td>
</tr>
<tr>
<td>1968</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>1969</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>1970</td>
<td>0.4</td>
<td>1.3</td>
<td>3.0</td>
</tr>
<tr>
<td>1971</td>
<td>31.0</td>
<td>0.2</td>
<td>0.6</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td><strong>4.3</strong></td>
<td><strong>1.1</strong></td>
<td><strong>0.9</strong></td>
</tr>
<tr>
<td>1972</td>
<td>0.03*</td>
<td>0.1</td>
<td></td>
</tr>
</tbody>
</table>


* Miles Watch House.
Table 2
Sum of Weekly Spatfall in the James River
(Spat per Smooth Shellface)

<table>
<thead>
<tr>
<th>Calendar Year</th>
<th>Type of Collector</th>
<th>Duration of Setting</th>
<th>Brown Shoal</th>
<th>Wreck Shoal</th>
<th>Horse Head Shoal</th>
<th>Deep Water Shoal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1947</td>
<td>SB</td>
<td>7/9 - 10/17</td>
<td></td>
<td>157.8</td>
<td></td>
<td>15.7</td>
</tr>
<tr>
<td>1948</td>
<td>SB</td>
<td>7/1 - 10/7</td>
<td></td>
<td>84.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1949</td>
<td>SB</td>
<td>6/28 - 11/2</td>
<td>155.6</td>
<td>107.2</td>
<td>4.7</td>
<td></td>
</tr>
<tr>
<td>1950</td>
<td>SB</td>
<td>7/11 - 10/19</td>
<td>140.4</td>
<td>108.6</td>
<td>2.9</td>
<td></td>
</tr>
<tr>
<td>1950</td>
<td>SS</td>
<td>7/11 - 9/20</td>
<td>132.8</td>
<td>157.4</td>
<td>7.2</td>
<td>2.4</td>
</tr>
<tr>
<td>1951</td>
<td>SB</td>
<td>7/6 - 10/12</td>
<td></td>
<td>40.1</td>
<td></td>
<td>3.5</td>
</tr>
<tr>
<td>1952</td>
<td>SB</td>
<td>7/2 - 10/6</td>
<td>88.5</td>
<td>40.2</td>
<td></td>
<td></td>
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<tr>
<td>Average</td>
<td>SB</td>
<td></td>
<td>128.2</td>
<td>99.5</td>
<td>5.8</td>
<td></td>
</tr>
<tr>
<td>1963</td>
<td>SS</td>
<td>7/16 - 9/26</td>
<td>14.1</td>
<td>.6</td>
<td>.4</td>
<td>0</td>
</tr>
<tr>
<td>1964</td>
<td>SS</td>
<td>7/28 - 9/29</td>
<td>6.8</td>
<td>4.7</td>
<td>2.1</td>
<td>1.3</td>
</tr>
<tr>
<td>1965</td>
<td>SS</td>
<td>7/26 - 10/10</td>
<td>.2</td>
<td>.4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1966</td>
<td>SS</td>
<td>7/5 - 10/14</td>
<td>6.9</td>
<td>3.8</td>
<td>3.3</td>
<td>2.9</td>
</tr>
<tr>
<td>1967</td>
<td>SS</td>
<td>7/18 - 9/27</td>
<td>.6</td>
<td>.7</td>
<td>1.4</td>
<td>0.8</td>
</tr>
<tr>
<td>1968</td>
<td>SS</td>
<td>6/13 - 11/9</td>
<td>2.1</td>
<td>9.2</td>
<td>6.4</td>
<td>11.6</td>
</tr>
<tr>
<td>1969</td>
<td>SS</td>
<td>7/2 - 10/17</td>
<td>5.2</td>
<td>40.8</td>
<td>19.8</td>
<td>5.6</td>
</tr>
<tr>
<td>1970</td>
<td>SS</td>
<td>7/20 - 10/12</td>
<td>21.5</td>
<td>14.8</td>
<td>15.1</td>
<td>4.7</td>
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<td>1971</td>
<td>SS</td>
<td>6/14 - 10/6</td>
<td>31.1</td>
<td>9.7</td>
<td>12.0</td>
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<td>9.8</td>
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<td>SS</td>
<td>8/1 - 10/2</td>
<td>0.7</td>
<td>3.0</td>
<td>3.3</td>
<td>0.9</td>
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</table>


2. SB = Shell bag; SS = Shellstring.
<table>
<thead>
<tr>
<th>Calendar Year</th>
<th>Type of Collector</th>
<th>Brown Shoal</th>
<th>Wreck Shoal</th>
<th>Horse Head Shoal</th>
<th>Deep Water Shoal</th>
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<tbody>
<tr>
<td>1947</td>
<td>SB</td>
<td></td>
<td>40.5 S1</td>
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<td>6.2 S1</td>
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<tr>
<td>8</td>
<td>SB</td>
<td></td>
<td>17.9 A5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>SB</td>
<td>32.6 A2</td>
<td>18.4 A3</td>
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<td>2.6 A2</td>
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<tr>
<td>1950</td>
<td>SB</td>
<td>45.6 S2</td>
<td>39.0 S1</td>
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<td>1.0 S1</td>
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<td>1950</td>
<td>SS</td>
<td>99.2 S2</td>
<td>81.1 S2</td>
<td>4.4 S1</td>
<td>1.3 S1</td>
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<tr>
<td>1</td>
<td>SB</td>
<td>23.0 S2</td>
<td>12.7 J4</td>
<td></td>
<td></td>
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<tr>
<td>2</td>
<td>SB</td>
<td></td>
<td>11.1 S3</td>
<td></td>
<td>.7 A3</td>
</tr>
<tr>
<td>Average</td>
<td>SB</td>
<td>33.7</td>
<td>23.3</td>
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<td>2.6</td>
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<td>SS</td>
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<td>.4 A5</td>
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<tr>
<td>4</td>
<td>SS</td>
<td>3.3 S2</td>
<td>1.8 S2</td>
<td>1.1 A5</td>
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<td>.2* O1</td>
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<td>6</td>
<td>SS</td>
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<td>1.1 A3</td>
<td>.8 A1</td>
<td>1.1* J4</td>
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<tr>
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<td>SS</td>
<td>.3 S1</td>
<td>.5 S1</td>
<td>.6 A4</td>
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<tr>
<td>8</td>
<td>SS</td>
<td>.4 A3</td>
<td>2.0 A3</td>
<td>1.5 A3</td>
<td>2.5 A3</td>
</tr>
<tr>
<td>9</td>
<td>SS</td>
<td>1.7 S2</td>
<td>21.1 S1</td>
<td>15.1 J3</td>
<td>2.4 J3</td>
</tr>
<tr>
<td>1</td>
<td>SS</td>
<td>17.0 A4</td>
<td>3.4 A1</td>
<td>7.7 A1</td>
<td>3.2 A1</td>
</tr>
<tr>
<td>Average</td>
<td>SS</td>
<td>3.9</td>
<td>4.4</td>
<td>3.8</td>
<td>1.4</td>
</tr>
<tr>
<td>2</td>
<td>SS</td>
<td>0.3 A4</td>
<td>1.2 S3</td>
<td>1.1 S3</td>
<td>0.5 S4</td>
</tr>
</tbody>
</table>


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 - 1972

<table>
<thead>
<tr>
<th>AREA</th>
<th>MARKET</th>
<th>SMALL &amp; YEARLING</th>
<th>SPAT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deep Water Shoals</td>
<td>20</td>
<td>31</td>
<td>0</td>
</tr>
<tr>
<td>Horse Head</td>
<td>7</td>
<td>34</td>
<td>30</td>
</tr>
<tr>
<td>Point of Shoals</td>
<td>18</td>
<td>65</td>
<td>14</td>
</tr>
<tr>
<td>Wreck Shoals</td>
<td>17</td>
<td>53</td>
<td>24</td>
</tr>
<tr>
<td>Brown Shoals</td>
<td>74</td>
<td>69</td>
<td>18</td>
</tr>
<tr>
<td>Average</td>
<td>27</td>
<td>50</td>
<td>17</td>
</tr>
</tbody>
</table>
Table 5


<table>
<thead>
<tr>
<th>AREA</th>
<th>NATURAL CULTCH</th>
<th>SHELLBAGS</th>
<th>SHELLSTRINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deep Water Shoals</td>
<td>2.1</td>
<td>.4</td>
<td>0</td>
</tr>
<tr>
<td>Horse Head</td>
<td>3.3</td>
<td>.3</td>
<td>0</td>
</tr>
<tr>
<td>Point of Shoals</td>
<td>.7</td>
<td>.4</td>
<td>.05</td>
</tr>
<tr>
<td>Wreck Shoals</td>
<td>3.0</td>
<td>.4</td>
<td>.03</td>
</tr>
<tr>
<td>Brown Shoals</td>
<td>1.5</td>
<td>.1</td>
<td>0</td>
</tr>
</tbody>
</table>

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 River\(^1\) (Spat/Shell)

<table>
<thead>
<tr>
<th>Calendar Year</th>
<th>Parrott Rock</th>
<th>Orchard Point/Drumming Ground</th>
<th>Hogg House Rock</th>
<th>Long Point</th>
<th>Smokey Point</th>
<th>Off Mulberry Creek</th>
<th>Morrattico Bar</th>
<th>Bowler's Rock</th>
</tr>
</thead>
<tbody>
<tr>
<td>1949</td>
<td>1.4</td>
<td>2.5</td>
<td>.2</td>
<td>.2</td>
<td>&lt;.1(^2)</td>
<td></td>
<td>&lt;.1(^2)</td>
<td>&lt;.1(^2)</td>
</tr>
<tr>
<td>1950</td>
<td>.8</td>
<td>1.0</td>
<td></td>
<td>.2</td>
<td>&lt;.1(^2)</td>
<td></td>
<td>&lt;.1(^2)</td>
<td>&lt;.1(^2)</td>
</tr>
<tr>
<td>1951</td>
<td>1.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>1.1</td>
<td>1.6</td>
<td>.2</td>
<td>&lt;.1(^2)</td>
<td>&lt;.1(^2)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1959</td>
<td>.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>1960</td>
<td>.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>&lt;.1(^2)</td>
<td>&lt;.1(^2)</td>
<td></td>
</tr>
<tr>
<td>1961</td>
<td>.8</td>
<td></td>
<td>&lt;.1(^2)</td>
<td>&lt;.1(^2)</td>
<td>&lt;.1(^2)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1962</td>
<td>1.1</td>
<td></td>
<td>&lt;.1(^2)</td>
<td>.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1963</td>
<td>.4</td>
<td>.8</td>
<td>&lt;.1(^2)</td>
<td>.4</td>
<td>.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1964</td>
<td>4.1</td>
<td>11.1</td>
<td>2.4</td>
<td>2.4</td>
<td>7.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>1.3</td>
<td>3.8</td>
<td>.6</td>
<td>.8</td>
<td>.6</td>
<td>4.0</td>
<td>.1</td>
<td></td>
</tr>
<tr>
<td>1970</td>
<td>.5</td>
<td></td>
<td></td>
<td>.12</td>
<td>.12</td>
<td>&lt;.1(^2)</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>1971</td>
<td>.1</td>
<td></td>
<td></td>
<td>.12</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>1.3</td>
<td>3.8</td>
<td>.6</td>
<td>.8</td>
<td>.6</td>
<td>4.0</td>
<td>.1</td>
<td></td>
</tr>
</tbody>
</table>


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

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Bowler's Rock</td>
<td>33</td>
<td>40</td>
<td>38</td>
<td>35</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Morattico Bar</td>
<td>33</td>
<td>43</td>
<td>37</td>
<td>107</td>
<td>9</td>
<td>14</td>
</tr>
<tr>
<td>Smokey Point</td>
<td>61</td>
<td>55</td>
<td>117</td>
<td>129</td>
<td>37</td>
<td>46</td>
</tr>
<tr>
<td>Hogg House</td>
<td>69</td>
<td>45</td>
<td>121</td>
<td>47</td>
<td>31</td>
<td>28</td>
</tr>
<tr>
<td>Drumming Ground</td>
<td>67</td>
<td>29</td>
<td>126</td>
<td>96</td>
<td>121</td>
<td>93</td>
</tr>
<tr>
<td>Average</td>
<td>53</td>
<td>43</td>
<td>88</td>
<td>83</td>
<td>41</td>
<td>37</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>AREA</th>
<th>NATURAL CULTCH(^1) 1947-60</th>
<th>1961-71</th>
<th>SHELLBAGS 1947-60</th>
<th>1961-71</th>
<th>SHELLSTRINGS(^2) 1952</th>
<th>1969-71</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bowler's Rock</td>
<td>.01</td>
<td>.01</td>
<td>&lt;.1</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Morattico Bar</td>
<td>.02</td>
<td>.03</td>
<td>&lt;.1</td>
<td>.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Smokey Point</td>
<td>.07</td>
<td>.09</td>
<td>.2</td>
<td>.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hogg House</td>
<td>.06</td>
<td>.06</td>
<td>.6</td>
<td>.6</td>
<td>17</td>
<td>7</td>
</tr>
<tr>
<td>Drumming Ground</td>
<td>.24</td>
<td>.18</td>
<td>1.6</td>
<td>3.8</td>
<td>51</td>
<td>8</td>
</tr>
</tbody>
</table>

\(^1\) 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 - 1972

<table>
<thead>
<tr>
<th>AREA</th>
<th>MARKET</th>
<th>SMALL &amp; YEARLING</th>
<th>SPAT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shelton Pt.</td>
<td>51</td>
<td>25</td>
<td>52</td>
</tr>
<tr>
<td>Black Stump</td>
<td>42</td>
<td>25</td>
<td>24</td>
</tr>
<tr>
<td>Island Bar</td>
<td>53</td>
<td>26</td>
<td>--</td>
</tr>
<tr>
<td>Middle Ground</td>
<td>45</td>
<td>37</td>
<td>--</td>
</tr>
<tr>
<td>Corrotoman Pt.</td>
<td>72</td>
<td>33</td>
<td>10</td>
</tr>
<tr>
<td>Average</td>
<td>52</td>
<td>29</td>
<td>28</td>
</tr>
</tbody>
</table>

1. 1971 Data for Island Bar and Middle Ground not included.
Table 10

Seasonal Spatfall on Shellbags in the Piankatank River

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>Calendar Year</th>
<th>Milford Haven</th>
<th>3 Branch Shore</th>
<th>Burton Point</th>
<th>Cape Toon</th>
<th>Palace Bar</th>
<th>Ginny Point</th>
</tr>
</thead>
<tbody>
<tr>
<td>1963</td>
<td>4</td>
<td>1.4</td>
<td>3.6</td>
<td>1.3</td>
<td>2.0</td>
<td>1.7</td>
<td>11.1</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>3.1</td>
<td>1.4</td>
<td>2.6</td>
<td>2.2</td>
<td>1.9</td>
<td>1.4</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td></td>
<td>.8</td>
<td>.2</td>
<td>1.5</td>
<td>.6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>7</td>
<td></td>
<td>.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1970</td>
<td>9</td>
<td>1.1</td>
<td>2.9</td>
<td>.2</td>
<td>.9</td>
<td>3.9</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>.2</td>
<td>.2</td>
<td>.2</td>
<td>.9</td>
<td>2.0</td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td></td>
<td>2.6</td>
<td>1.2</td>
<td>1.4</td>
<td>1.8</td>
<td>1.5</td>
<td>4.2</td>
</tr>
<tr>
<td>1972</td>
<td></td>
<td>0.01</td>
<td>0.05</td>
<td>0.05</td>
<td>0.043</td>
<td>0.09</td>
<td>0.14</td>
</tr>
</tbody>
</table>


2. Hole in the Wall.

3. Iron Point
Table 11

Sum of Weekly Spatfall on Shellstrings in the Piankatank River

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>Milford 3 Branch</th>
<th>Burton</th>
<th>Cape</th>
<th>Palace</th>
<th>Ginny</th>
</tr>
</thead>
<tbody>
<tr>
<td>Setting</td>
<td>Haven</td>
<td>Shore</td>
<td>Point</td>
<td>Bar</td>
<td>Point</td>
</tr>
<tr>
<td>1964</td>
<td>7/ 6- 9/15</td>
<td>22.0</td>
<td></td>
<td></td>
<td>48.0</td>
</tr>
<tr>
<td>5</td>
<td>6/21- 9/6</td>
<td>115.8</td>
<td></td>
<td></td>
<td>190.9</td>
</tr>
<tr>
<td>6</td>
<td>6/23- 9/26</td>
<td>79.7</td>
<td></td>
<td></td>
<td>72.9</td>
</tr>
<tr>
<td>7</td>
<td>6/14-10/3</td>
<td>10.2</td>
<td>6.4</td>
<td>14.4</td>
<td>20.1</td>
</tr>
<tr>
<td>8</td>
<td>6/19-10/18</td>
<td>46.5</td>
<td>18.6</td>
<td>24.1</td>
<td>138.3</td>
</tr>
<tr>
<td>9</td>
<td>6/ 9- 9/22</td>
<td>3.7</td>
<td>3.8</td>
<td>4.5</td>
<td>10.4</td>
</tr>
<tr>
<td>1970</td>
<td>6/ 4-10/7</td>
<td>11.7</td>
<td>10.6</td>
<td>19.8</td>
<td>27.7</td>
</tr>
<tr>
<td>1</td>
<td>6/15-10/12</td>
<td>22.6</td>
<td>29.1*</td>
<td>8.7</td>
<td>60.5</td>
</tr>
<tr>
<td>Average</td>
<td></td>
<td>39.0</td>
<td>15.6</td>
<td>12.7</td>
<td>54.4</td>
</tr>
<tr>
<td>1972</td>
<td>6/20-10/2</td>
<td>0.1</td>
<td>0</td>
<td>0</td>
<td>0.1</td>
</tr>
</tbody>
</table>

* Data to 9/7 only.

Table 12

Highest Weekly Spatfall on Shellstrings in the Piankatank River

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


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

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Ginny Point</td>
<td>46</td>
<td>18</td>
<td>4</td>
<td>298</td>
<td>296</td>
<td>172</td>
<td>210</td>
<td>277</td>
<td>2</td>
</tr>
<tr>
<td>Palace Bar</td>
<td>78</td>
<td>19</td>
<td>0</td>
<td>328</td>
<td>209</td>
<td>190</td>
<td>400</td>
<td>546</td>
<td>10</td>
</tr>
<tr>
<td>Middle Ground</td>
<td>40</td>
<td>31</td>
<td>4</td>
<td>389</td>
<td>228</td>
<td>106</td>
<td>333</td>
<td>343</td>
<td>4</td>
</tr>
<tr>
<td>Burton Point</td>
<td>43</td>
<td>19</td>
<td>14</td>
<td>119</td>
<td>220</td>
<td>198</td>
<td>303</td>
<td>300</td>
<td>4</td>
</tr>
<tr>
<td>Average</td>
<td>52</td>
<td>22</td>
<td>6</td>
<td>284</td>
<td>238</td>
<td>166</td>
<td>304</td>
<td>366</td>
<td>5</td>
</tr>
</tbody>
</table>
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

<table>
<thead>
<tr>
<th>AREA</th>
<th>NATURAL CULTCH(^1)</th>
<th>SHELLBAGS</th>
<th>SUM OF WEEKLY SET SHELLSTRINGS(^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ginny Point</td>
<td>.42</td>
<td>.55</td>
<td>0.004</td>
</tr>
<tr>
<td>Palace Bar</td>
<td>.80</td>
<td>1.09</td>
<td>0.02</td>
</tr>
<tr>
<td>Cape Toon</td>
<td>---</td>
<td>.69(^3)</td>
<td>0.008(^3)</td>
</tr>
<tr>
<td>Burton Point</td>
<td>.61</td>
<td>.60</td>
<td>0.008</td>
</tr>
<tr>
<td>Milford Haven</td>
<td>---</td>
<td>---</td>
<td>0</td>
</tr>
</tbody>
</table>

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 River
Spat per Shell

<table>
<thead>
<tr>
<th>Calendar Year</th>
<th>Dameron Marsh</th>
<th>Whaley Flats</th>
<th>Cranes Creek</th>
<th>Haynie's Bar</th>
<th>Hudnell's Dock</th>
<th>Glebe Point</th>
</tr>
</thead>
<tbody>
<tr>
<td>1965</td>
<td>18.3</td>
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<td>28.8</td>
<td>10.4</td>
<td>17.9</td>
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<td>6.8</td>
<td>1.5</td>
<td>9.1</td>
<td>10.6</td>
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<td>2.7</td>
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<td>.5</td>
<td>.2</td>
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<tr>
<td>Average</td>
<td>6.6</td>
<td>6.5</td>
<td>8.2</td>
<td>6.6</td>
<td>7.6</td>
<td>2.4</td>
</tr>
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<td>1972</td>
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<td></td>
<td>0.02</td>
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</tr>
</tbody>
</table>

### Table 16

**Sum of Weekly Spatfall on Shell Strings in the Great Wicomico River.**

**Spat Per Smooth Shell Face**

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

<table>
<thead>
<tr>
<th>Calendar Year</th>
<th>Duration of Setting</th>
<th>Cockrells Creek</th>
<th>Haynies Bar</th>
<th>Shell Bar</th>
<th>Hudnells Dock</th>
<th>Glebe Point</th>
</tr>
</thead>
<tbody>
<tr>
<td>1964  1.</td>
<td>6/21- 9/21</td>
<td>-</td>
<td>-</td>
<td>240.4</td>
<td>133.8</td>
<td>-</td>
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<td>6/14- 9/4</td>
<td>-</td>
<td>491.1</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>6</td>
<td>6/20- 9/19</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>170.8</td>
<td>151.8</td>
</tr>
<tr>
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<td>6/12- 9/27</td>
<td>-</td>
<td>79.3</td>
<td>-</td>
<td>91.1</td>
<td>226.1</td>
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<tr>
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<td>6/ 9-10/29</td>
<td>-</td>
<td>48.8</td>
<td>-</td>
<td>204.5</td>
<td>181.9</td>
</tr>
<tr>
<td>1970  1.</td>
<td>6/ 4-10/7</td>
<td>51.5</td>
<td>189.8</td>
<td>226.7</td>
<td>151.1</td>
<td>67.2</td>
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<tr>
<td>1</td>
<td>6/21- 9/24</td>
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<td>428.7</td>
<td>454.0</td>
<td>513.6</td>
<td>834.5</td>
</tr>
<tr>
<td>Average 1972</td>
<td>6/19- 9/18</td>
<td>36.1</td>
<td>207.6</td>
<td>230.8</td>
<td>198.4</td>
<td>234.5</td>
</tr>
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</table>


2. Observations stopped on this date.
Table 17

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

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

<table>
<thead>
<tr>
<th>Calendar Year</th>
<th>Cockrell's Creek</th>
<th>Haynie's Bar</th>
<th>Shell Bar</th>
<th>Hudnell's Dock</th>
<th>Glebe Point</th>
</tr>
</thead>
<tbody>
<tr>
<td>1964</td>
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<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>5</td>
<td>-</td>
<td>250.2 J3</td>
<td>-</td>
<td>134.3 J2</td>
<td>67.8 J2</td>
</tr>
<tr>
<td>6</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>83.1 J2</td>
<td>49.9 J2</td>
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<tr>
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<td>-</td>
<td>46.0 J4</td>
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<td>60.3 J4</td>
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<td>19.7 J4</td>
<td>-</td>
<td>77.1 J4</td>
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<td>175.3 J1</td>
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<td>34.4 J1</td>
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<td>290.2 E4</td>
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<td>0</td>
<td>0.3 E4</td>
<td>0.4 E4</td>
<td>2.0 E4</td>
</tr>
</tbody>
</table>

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 River**

**Spat Per Shell**

<table>
<thead>
<tr>
<th>Calendar Year</th>
<th>Ellen Island</th>
<th>Wormley Rock</th>
<th>Gloucester Point</th>
<th>Green Rock</th>
<th>Page's Rock</th>
<th>Aberdeen Rock</th>
<th>Clay Bank</th>
<th>Purtan Bay</th>
<th>Bell's Rock</th>
</tr>
</thead>
<tbody>
<tr>
<td>1947</td>
<td></td>
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<td>.3</td>
<td></td>
<td>.5</td>
<td>.1</td>
<td></td>
<td>.7</td>
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</tr>
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<td>.8</td>
<td>1.4</td>
<td></td>
<td>.4</td>
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<td>.1</td>
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<td>1.1</td>
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</tr>
<tr>
<td>4</td>
<td>.4</td>
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<td>.1</td>
<td>2.6</td>
<td>3.8</td>
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<td>.2</td>
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<td></td>
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<td>.1</td>
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<td>.1</td>
<td>.4</td>
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<td>4.0</td>
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<td>.4</td>
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<td>.1</td>
<td>22.0</td>
<td>1.3</td>
<td>1.2</td>
<td>.1</td>
<td>.12</td>
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<td>.1</td>
<td>4.0</td>
<td>.3</td>
<td>.4</td>
<td></td>
<td>.9</td>
<td>.1</td>
<td>.12</td>
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<tr>
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<td>.03</td>
<td></td>
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<td>0.01</td>
<td>0.01</td>
<td>0.03</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

---


2. $<\cdot$ 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

<table>
<thead>
<tr>
<th>Calendar Year</th>
<th>Duration of Setting</th>
<th>Sum of Weekly Spatfall</th>
<th>Max. Wkly Spatfall &amp; Wk. of Occurrence</th>
</tr>
</thead>
<tbody>
<tr>
<td>1947 8</td>
<td>7/7 - 10/7</td>
<td>28.5</td>
<td>5.8 A 5</td>
</tr>
<tr>
<td>1947 9</td>
<td>6/28 - 9/27</td>
<td>11.0</td>
<td>2.7 S 2</td>
</tr>
<tr>
<td>1950 1</td>
<td>7/12 - 9/27</td>
<td>36.8</td>
<td>13.8 S 2</td>
</tr>
<tr>
<td>1950 2</td>
<td>6/27 - 10/10</td>
<td>44.8</td>
<td>11.8 A 4</td>
</tr>
<tr>
<td>1950 3</td>
<td>6/23 - 11/17</td>
<td>51.0</td>
<td>21.4 S 2</td>
</tr>
<tr>
<td>1950 4</td>
<td>6/12 - 10/7</td>
<td>56.7</td>
<td>19.5 A 4</td>
</tr>
<tr>
<td>1950 5</td>
<td>6/28 - 11/8</td>
<td>28.5</td>
<td>14.2* S 3</td>
</tr>
<tr>
<td>Average</td>
<td></td>
<td>36.5</td>
<td></td>
</tr>
<tr>
<td>1963 4</td>
<td>7/12 - 9/23</td>
<td>19.5</td>
<td>6.5 S 3</td>
</tr>
<tr>
<td>1963 5</td>
<td>8/17 - 10/5</td>
<td>224.5</td>
<td>156.7 S 1</td>
</tr>
<tr>
<td>1963 6</td>
<td>7/12 - 10/28</td>
<td>5.4</td>
<td>1.9 A 4</td>
</tr>
<tr>
<td>1963 7</td>
<td>7/17 - 10/17</td>
<td>26.8</td>
<td>7.7 S 1</td>
</tr>
<tr>
<td>1963 8</td>
<td>6/26 - 9/1</td>
<td>.4</td>
<td>.4 J 4</td>
</tr>
<tr>
<td>1963 9</td>
<td>6/20 - 10/19</td>
<td>12.2</td>
<td>.7 S 3</td>
</tr>
<tr>
<td>Average</td>
<td>9/1 - 9/8</td>
<td>0.3</td>
<td>0.3 S 1</td>
</tr>
</tbody>
</table>


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

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

### 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

<table>
<thead>
<tr>
<th>AREA</th>
<th>1946-60</th>
<th>1961-71</th>
<th>1946-60</th>
<th>1961-71</th>
<th>1946-60</th>
<th>1961-71</th>
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<tbody>
<tr>
<td></td>
<td>NATURAL CULTCH</td>
<td>SHELLBAGS</td>
<td>SHELLSTRINGS</td>
<td></td>
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</tr>
<tr>
<td>Bell's Rock</td>
<td>.25</td>
<td>.03</td>
<td>.6</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Aberdeen Rock</td>
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<td>.05</td>
<td>1.4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Page's Rock</td>
<td>.07</td>
<td>.04</td>
<td>.9</td>
<td>.4</td>
<td></td>
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</tr>
<tr>
<td>Green Rock</td>
<td>.07</td>
<td>.02</td>
<td>1.3</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Gloucester Pt.</td>
<td>1.2</td>
<td>4.0</td>
<td>36.5</td>
<td>88.2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Assuming 500 shells per bushel.

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