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Virginia Institute of Marine Science

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MARINE RESOURCE INFORMATION

BULLETIN Virginia Institute of Marine Science

TO SHELLFISH INDUSTRY October 27, 1969

OYSTER KILL IN UPPER YORK RIVER

During the last week of August and the first two weeks of September, an oyster kill occurred in the upper York River in the area from Bells Rock to Roane Point. An estimated 100,000 bushels of oysters planted on private beds died.

The salt content of the river was lowered drastically by floodwaters of Hurricane Camille during this period of time. Scientists believe the excess fresh water killed the oysters. Oysters cannot survive prolonged exposure to low salinities, especially during summer when water temperatures are high.

Death rate was highest in shallow water (under ten feet) where losses averaged 42 percent. VIMS scientists first noted that oysters were dying on 2 September, following a week of very low surface salinities. On 19 September a survey of growing areas in the upper York directed by Mr. Dexter Haven, Head of the Applied Biology Department in the Division of Applied Science and Ocean Engineering, confirmed the kill.

SEQUENCE OF EVENTS LEADING TO OYSTER KILLS FROM FRESH OR LOW SALINITY WATER

1. Heavy rains cause excessive fresh water to run off in rivers and creeks when temperatures are high.

2. The fresh or low salinity water forms a layer on the surface and moves downstream mixing with and diluting the bottom layer of salty water.

3. If salinity over the oyster bed is lowered to about 5 o/oo (five parts salt per thousand parts water), oysters close their shells and stop feeding.

4. If salinity remains between 0 o/oo and 5 o/oo for about one week during warm weather, oyster begin dying in a week or two.

NOTE: At cooler water temperatures during winter or early spring, oysters may last several weeks longer.

OYSTER KILL IN LOWER MACHODOC AND NOMINI CREEKS

A heavy loss of oysters in two tributaries on the Virginia side of the Potomac River-Lower Machodoc and Nomini Creeks — took place during the last week in

August and first week in September. Losses are estimated at over 100,000 bushels in the upper portions of both creeks.

Investigation by Mr. Haven on 12 September indicated that shells of oysters examined on that date were a jet-black color upstream and beginning to return to the normal light brown color downstream. Blue crabs were reported to have crawled out of the water at the time when oysters were dying. These facts, together with data from oxygen samples taken in both creeks, indicate that the oysters died from lack of sufficient oxygen in the water.

SEQUENCE OF EVENTS LEADING TO OYSTER KILLS IN CREEKS FROM LOW OXYGEN

1. Creeks susceptible to these conditions have restricted entrances (narrow channels) and receive only a small freshwater flow at the head of the system.

2. Heavy rains fall in a very short period, usually amounting to 3-5 inches (in this case as a result of Hurricane Camille). This excess water floods into the creeks. A surface layer of fresh water forms over the more dense salty water already in the creek. Large quantities of organic matter are also added.

3. A period of hot weather and calm winds follows the rains during which freshwater on the surface is not mixed with salty water on the bottom. This creates a critical situation since bottom waters receive oxygen by mixing with surface waters. Under these abnormal conditions bacteria feeding on the organic matter quickly use up the available supply of oxygen down below.

4. Oysters may begin dying a week or two after the rains. Characteristically, shells turn jet-black (a sign which indicates that oysters were killed by low oxygen and not by low salinity water).

NOTE ON BOTH KILLS: It should be pointed out that oysters can withstand longer periods of low salinity or low oxygen during the time in which oysters are inactive (about the middle of December through the middle of March). However, once oysters become active (from about the middle of March through the middle of December - depending on water temperatures) exposure to radical changes in environment can be quickly fatal.

VIRGINIA INSTITUTE OF MARINE SCIENCE
SALINITY-TEMPERATURE REPORT
SEPTEMBER

The Ecology-Pollution Department of the Division of Applied Marine Science and Ocean Engineering (DAMSOE) conducts monthly cruises up the James, York, and Rappahannock rivers to measure various physical and chemical characteristics of the waters. These surveys start at the mouth of each river and proceed upstream to the transition zone between fresh and salt water. Stations are established and sampled at each 5 part per thousand break in salinity as measured at the 10-foot depth. All samples are taken at slack before flood tide.

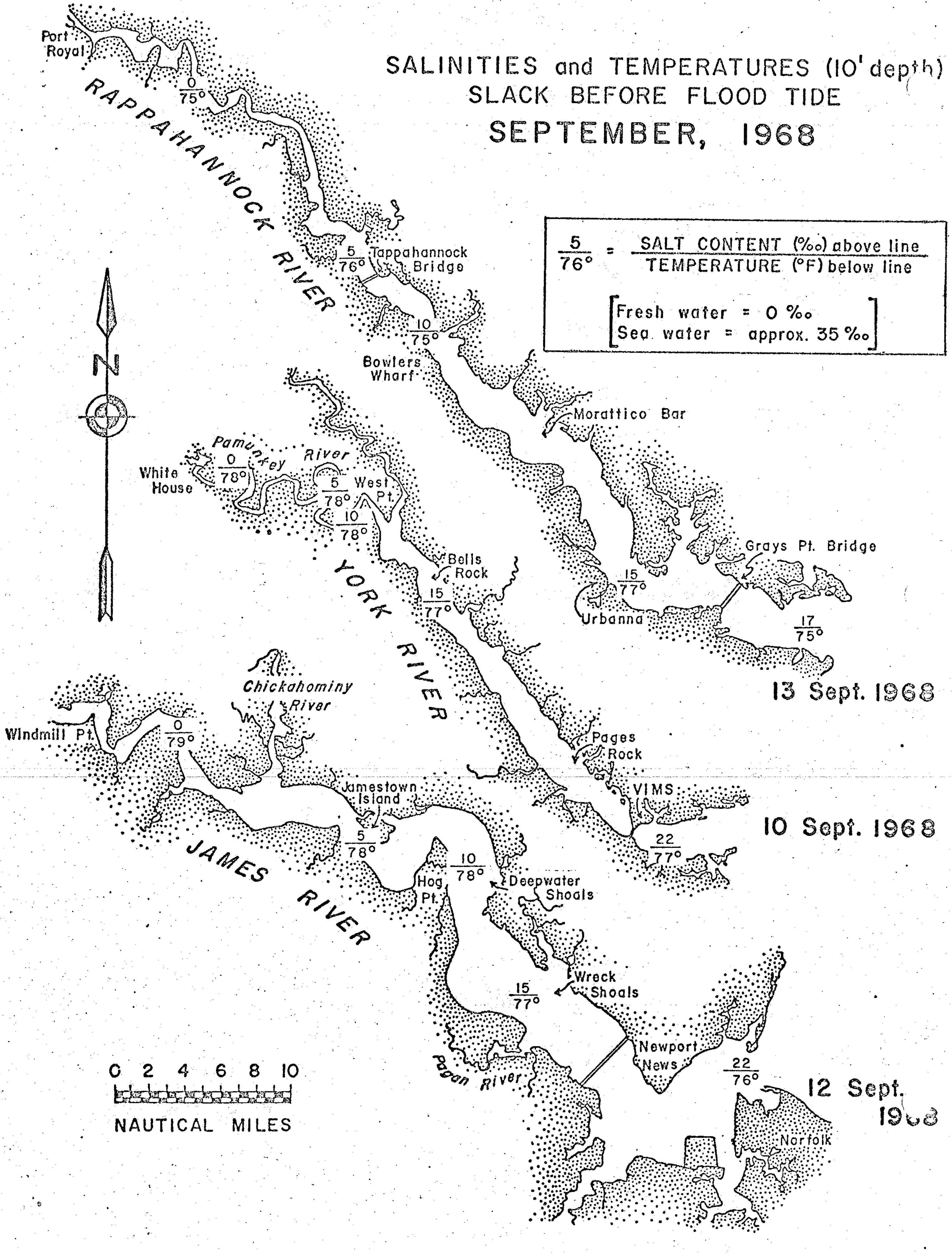
The attached charts compare the salinities and the temperatures found at the 10-foot depth for September 1968 and September 1969.

Freshwater discharges in the systems as measured at Richmond, Hanover and Fredericksburg indicate that 1968 was drier than normal enabling the salt water to move farther upstream thus producing higher salinities in the lower estuary. The location of the 15 o/oo line (15 parts of salt to 1000 parts of water: standard seawater is 35 parts per thousand or 35 o/oo) is especially significant because it represents the approximate upstream intrusion of drills and diseases.

Also, in 1968 the transition zone between fresh and salt water was about 10 miles upstream from where it would be found under normal rainfall and freshwater discharge conditions. The water temperatures were in the high 70's, well within the expected range.

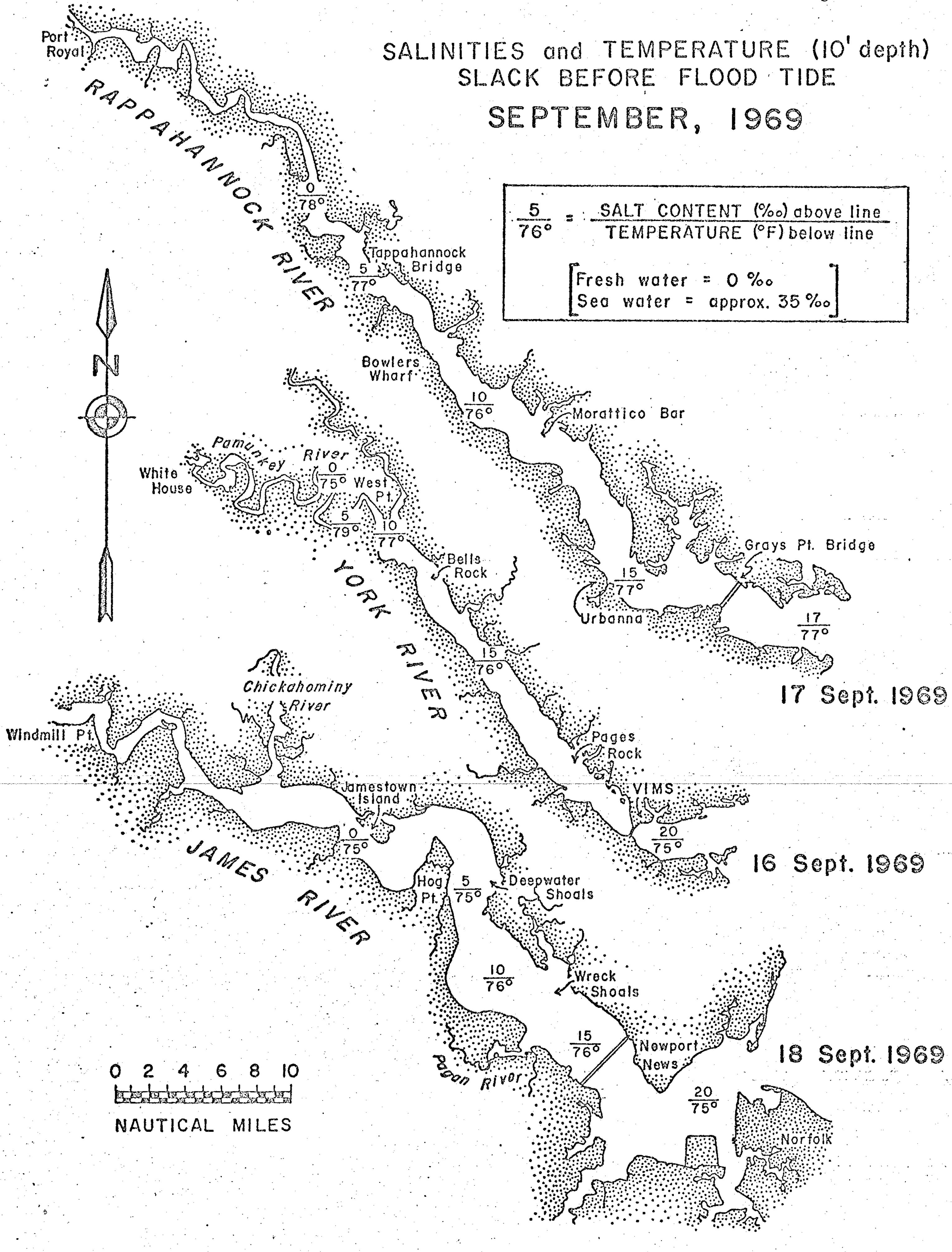
The 1969 salinity data show the residual effects of Hurricane Camille in the James and York rivers. The salinities over the commercially important shellfish beds were approximately 5 o/oo lower than they were in 1968. Also,samples taken at 6-foot intervals from surface to bottom indicated a greater vertical difference in salinities than had been measured the previous year. The Rappahannock River, which did not receive the heavy rainfall in its upper drainage basin, had salinities within the expected range for this time of the year.

Water temperatures were slightly lower in 1969 than in 1968. Ten years of Gloucester Point temperature data indicate that the average value for this period is 76°F. The lowest value recorded during this period was 72° and the highest 81°.


SALINITIES and TEMPERATURES (10' depth)
SLACK BEFORE FLOOD TIDE
SEPTEMBER, 1968
5/76° = SALT CONTENT (‰) above line / TEMPERATURE (°F) below line
[Fresh water = 0 ‰
Sea water = approx. 35 ‰]
Port Royal
0/75°
RAPPAHANNOCK RIVER
5/76°
Tappahannock Bridge
10/75°
Bowlers Wharf
Morattico Bar
Grays Pt. Bridge
15/77°
Urbanna
17/75°
13 Sept. 1968
Pamunkey River
White House
0/78°
5/78°
West Pt.
10/78°
Bells Rock
15/77°
YORK RIVER
Pages Rock
VIMS
22/77°
10 Sept. 1968
Chickahominy River
Windmill Pt.
0/79°
Jamestown Island
5/78°
JAMES RIVER
10/78°
Hog Pt.
Deepwater Shoals
Wreck Shoals
15/77°
Newport News
Pagan River
22/76°
Norfolk
12 Sept. 1968
N
0 2 4 6 8 10
NAUTICAL MILES

SALINITIES and TEMPERATURE (10' depth) SLACK BEFORE FLOOD TIDE

SEPTEMBER, 1969



VIRGINIA INSTITUTE OF MARINE SCIENCE
SALINITY-TEMPERATURE REPORT
OCTOBER

The Ecology-Pollution Department continued its program of monthly cruises up the James, York, and Rappahannock rivers during October. The salinity and temperature data from various locations in the estuaries shown on the attached charts represent only two of the thirty-six different measurements taken from the water samples. These, however, are of considerable interest to the shellfish industry since they describe the physical environment in which the oysters are living.

The 1968 data represented an unusual set of conditions in the Chesapeake Bay system. Salinity levels in Chesapeake Bay were within the normal range as the result of average or above average freshwater discharges from the tributary streams from the Potomac Basin northward to the Susquehanna Basin. Despite this condition in the northern portion the drainage basins of the James, York, and Rappahannock suffered drought conditions. The drought covered the area from Chesapeake Bay to the Appalachain mountains.

In October 1968, the salinities at the mouths of the three rivers were within the normal range as the result of nearly normal salinities in the Chesapeake Bay itself. The 15 o/oo line moved far upstream in each Virginia tributary, however, because of the low freshwater inflow. It was located near Mulberry Point in the James River, above Bell's Rock in the York River, and in the vicinity of Bowler's Wharf in the Rappahannock River. For comparison, the salinity of the water over Wreck Shoals was only 2 o/oo lower in 1968 than it was during a comparable period during the extreme drought year of 1965.

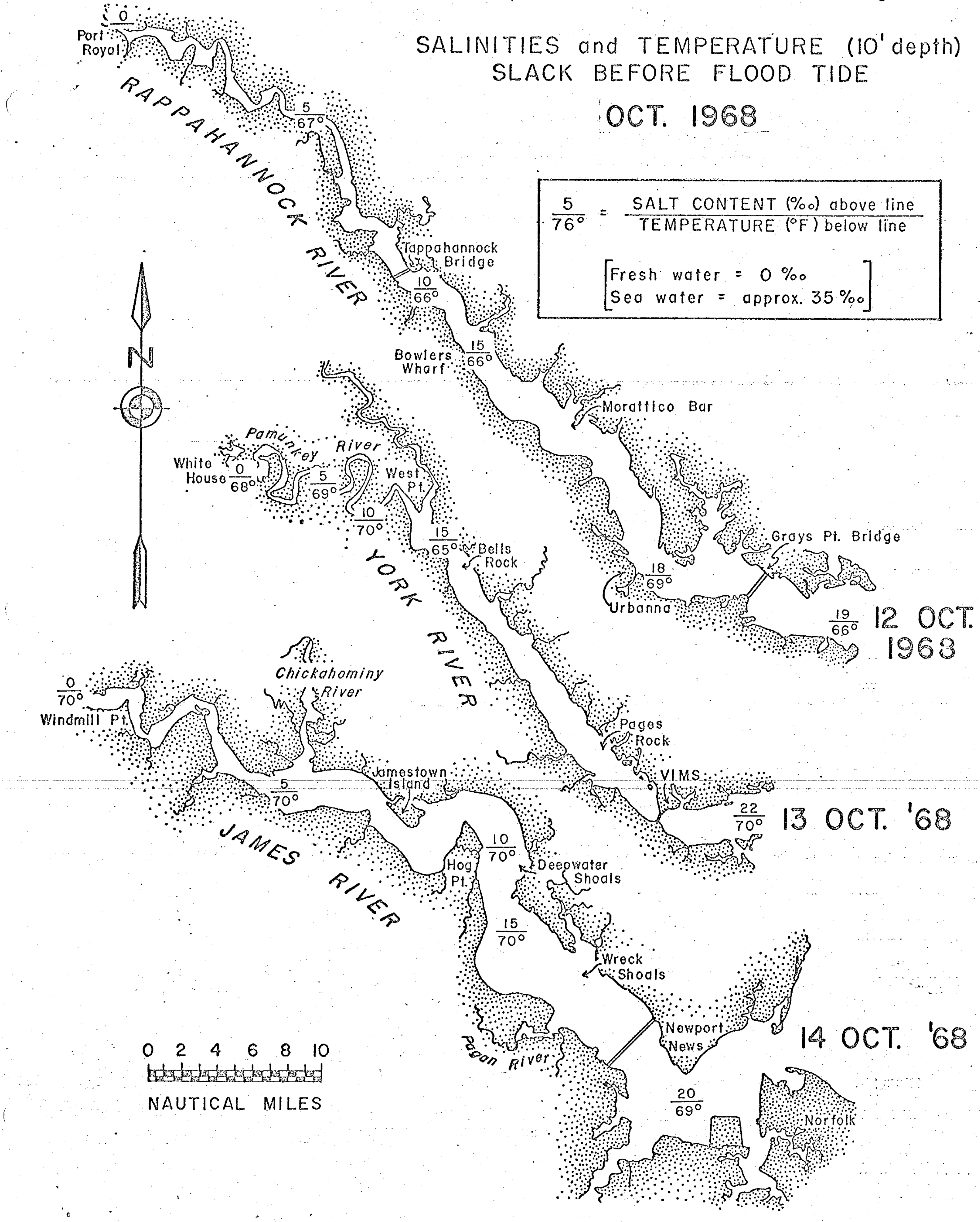
The 10 o/oo line had moved to above Deep Water Shoals in the James River, above West Point in the York River, and to the Tappahannock bridge in the Rappahannock River. The upper limit of salt water intrusion or the transition zone between fresh and salt water extended to just below Hopewell in the James River, near the Pamunkey Indian Reservation in the York River, and just below Port Royal in the Rappahannock River.

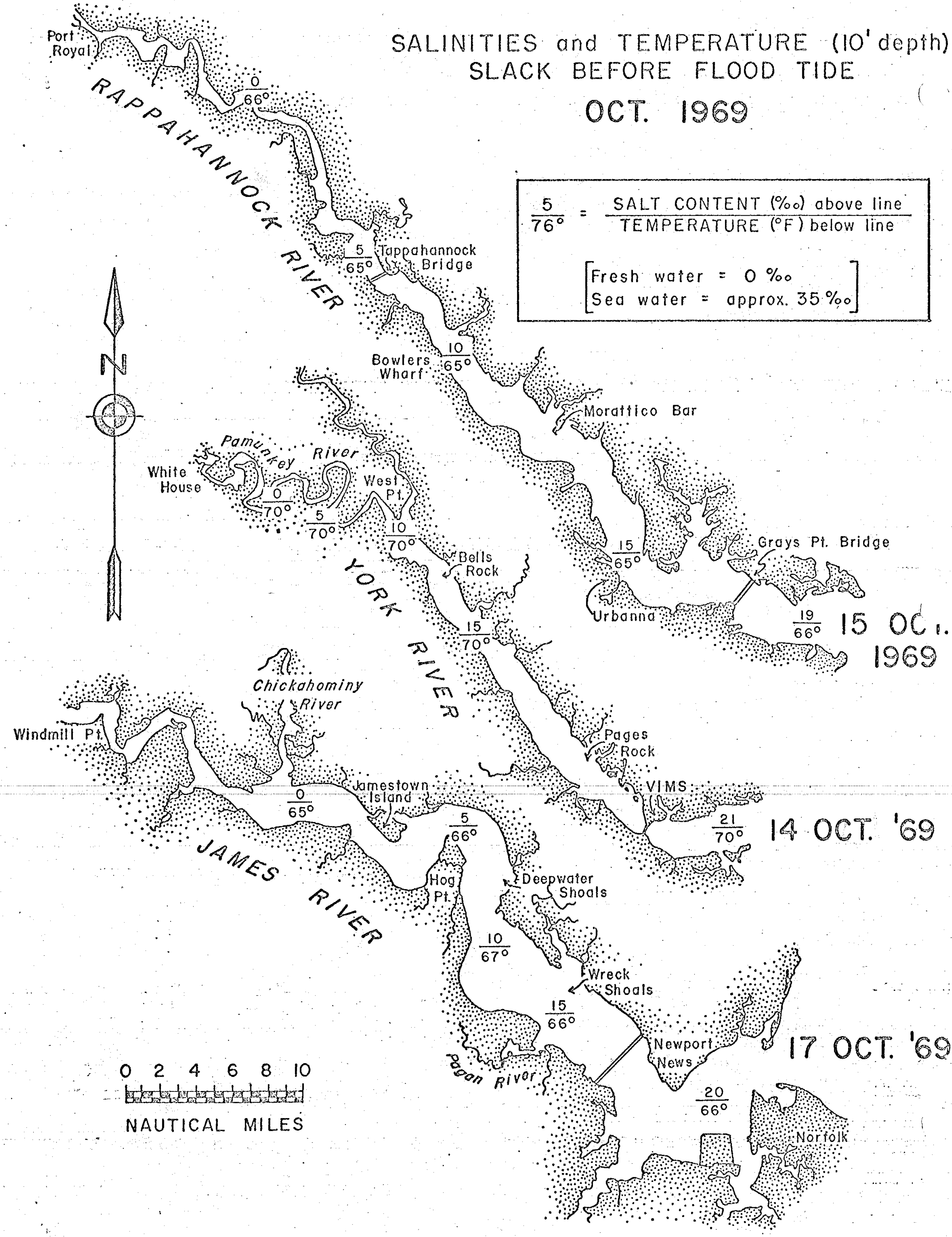
Although many factors are probably involved in oyster fattening, the high salinities during 1968 may have been an important factor contributing to the poor yields produced by oysters in Virginia estuaries.

The October 1969 salinity data indicate that the James and York rivers had recovered from the effects of Hurricane Camille and that the salinities in the three systems were within normal expected range for this time of the year. The salinity at Wreck Shoals was 15 o/oo whereas it had been approximately 12 o/oo the previous month. The salinity over a given rock in the York River had also increased about 2 o/oo over the September values. Salinity changes in the Rappahannock River were insignificant except at the mouth where they increased from 17 to 19 o/oo.

Water temperatures during October 1969 had dropped between 5°F. and 10°F. from the September values. The 10-year average for this period is 68°F., with 61°F. being the lowest value recorded and 72°F. the highest.

The temperature and salinity data as shown on the attached charts indicate that the 1969 oyster season opened under a near average of physical conditions.


SALINITIES and TEMPERATURE (10' depth)
SLACK BEFORE FLOOD TIDE
OCT. 1968
5/76° = SALT CONTENT (‰) above line / TEMPERATURE (°F) below line
[Fresh water = 0 ‰
Sea water = approx. 35 ‰]
Port Royal
0
RAPPAHANNOCK RIVER
5/67°
Tappahannock Bridge
10/66°
Bowlers Wharf
15/66°
Morattico Bar
Grays Pt. Bridge
18/69°
Urbanna
19/66°
12 OCT. 1968
Pamunkey River
White House
0/68°
5/69°
West Pt.
10/70°
15/65°
Bells Rock
YORK RIVER
Pages Rock
VIMS
22/70°
13 OCT. '68
Chickahominy River
0/70°
Windmill Pt.
Jamestown Island
5/70°
JAMES RIVER
Hog Pt.
10/70°
Deepwater Shoals
15/70°
Wreck Shoals
Newport News
Pagan River
20/69°
Norfolk
14 OCT. '68
0 2 4 6 8 10
NAUTICAL MILES


SALINITIES and TEMPERATURE (10' depth)
SLACK BEFORE FLOOD TIDE
OCT. 1969
5/76° = SALT CONTENT (‰) above line / TEMPERATURE (°F) below line
[Fresh water = 0 ‰
Sea water = approx. 35 ‰]
Port Royal
RAPPAHANNOCK RIVER
0/66°
5/65°
Tappahannock Bridge
10/65°
Bowlers Wharf
Morattico Bar
15/65°
Grays Pt. Bridge
Urbanna
19/66°
15 OCT. 1969
N
Pamunkey River
White House
West Pt.
0/70°
5/70°
10/70°
Bells Rock
YORK RIVER
15/70°
Pages Rock
VIMS
21/70°
14 OCT. '69
Chickahominy River
Windmill Pt.
Jamestown Island
0/65°
5/66°
JAMES RIVER
Hog Pt.
Deepwater Shoals
10/67°
Wreck Shoals
15/66°
Newport News
Pagan River
17 OCT. '69
20/66°
Norfolk
0 2 4 6 8 10
NAUTICAL MILES

VIMS Bulletins are prepared and distributed by the Information and Education Department, Virginia Institute of Marine Science at Gloucester Point, Virginia 23062. Work is done in cooperation with the School of Marine Science, College of William and Mary as a project of the Virginia State Technical Services Program under authority of the State Technical Services Act of 1965. Bulletins are mailed to persons licensed to catch, harvest, process and buy seafood, as well as others using or managing the sea for profit or service. Purpose is to inform on matters relating to use, development, and replenishment of marine resources, including scientific studies, technological advances, legislation and problems. Comments and suggestions for items in bulletins are welcomed. References to trade names of commercial products do not imply endorsement.

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