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Salinity Projections for the James, York, and Rappahannock Rivers

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Marine Resource Advisory

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by Dr. Albert Kuo and Michael J. Oesterling

The movement of salt water into Chesapeake Bay and its tributaries is of great concern to all Virginians. As a result of reduced rainfall and subsequent decreased freshwater discharges, unusually high salinities are being recorded for Virginia rivers. All indications are that these conditions will continue through 1981 and possibly into 1982.

Salinity will determine the distribution of various marine animals, including both beneficial and harmful ones (Table 1). Oysters, clams, blue crabs and finfish all have specific salinity requirements and preferences. Increased salinities in some areas may permit these animals to expand their areas of preference and hence their distribution. This, in effect, could alter traditional fishing grounds.

Likewise, marine diseases and noxious animals may have their territories expanded by increased salinities. This is particularly true for oyster diseases (MSX and Dermo) and predators (drills). Along with higher salinities, increases in ship-worms (borers) and stinging nettles (jellyfish) could be expected.

SPECIES	SALINITY RANGE (ppt)
MSX *(Minchinia nelsoni)*	9°/oo - 35°/oo
Dermo *(Perkinsus marinus)*	9°/oo - 35°/oo
Oyster drills *(Urosalpinx cinera, Eupleura caudata)*	15°/oo - 35°/oo
Ship-worms *(Bankia gouldi)*	5°/oo - 35°/oo
Stinging Nettle *(Chrysaora quinquecirrha)*	6°/oo - 35°/oo
Hard Clam *(Mercenaria mercenaria)*	12°/oo - 35°/oo
Soft Clam *(Mya arenaria)*	7°/oo - 35°/oo
Oyster *(Crassostrea virginica)*	5°/oo - 35°/oo
Blue Crab *(Callinectes sapidus)*	2°/oo - 35°/oo

Table 1. Representative Chesapeake Bay marine organisms and their salinity tolerance limits. Those with upper limits of 35 /oo can survive in full-strength sea water or even greater in some cases. Lower limits are those salinities at which survival is questionable or death occurs.

In an effort to help watermen better plan their fishing activities, predictions of possible salinities have been computed by Dr. Albert Kuo of the Physical Oceanography Department at the Virginia Institute of Marine Science. Using sophisticated computer modelling based upon present salinities and anticipated freshwater discharges, Dr. Kuo has computed salinities for the James, York and Rappahannock Rivers. Freshwater discharge was projected to be 30% below normal by the National Weather Service. If more rain falls than expected, these salinity rises would not be as dramatic as indicated. Conversely, if less rain falls, higher salinities could result farther up-river than originally projected. The following figures illustrate possible salinities through September, 1981.

Figures 1A and 1B. Salinity projections for the James River based upon computer predictions, assuming freshwater discharges to be 30% below normal for the remainder of the year. March readings are actual measurements; April, July and September projections. All salinities are in parts per thousand (open ocean salinity is approximately 35 ppt). River numbers are miles from the river mouth.

Figures 2A and 2B. Salinity projections for the York and Pamunkey Rivers based upon computer predictions, assuming freshwater discharges to be 30% below normal for the remainder of the year. No projections were done for the Mattoponi River. March readings are actual measurements; April, July and September projections. All salinities are in parts per thousand (open ocean salinity is approximately 35 ppt). River numbers are miles from the river mouth.

Figures 3A and 3B. Salinity projections for the Rappahannock River based upon computer predictions, assuming freshwater discharges to be 30% below normal for the remainder of the year. March readings are actual measurements; April, July and September projections. All salinities are in parts per thousand (open ocean salinity is approximately 35 ppt). River numbers are miles from the river mouth.

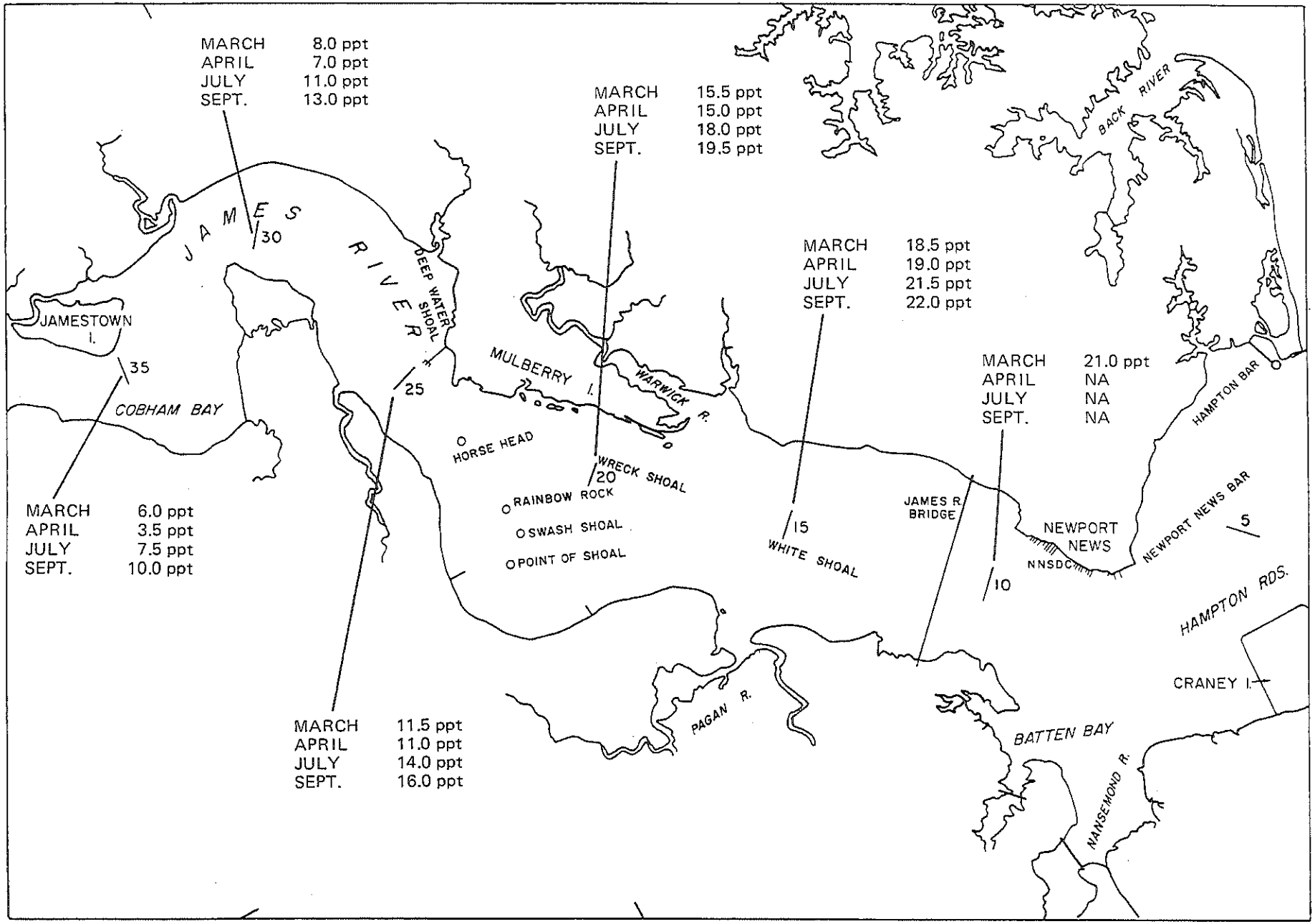
MARCH 8.0 ppt
APRIL 7.0 ppt
JULY 11.0 ppt
SEPT. 13.0 ppt
30
JAMES RIVER
DEEP WATER SHOAL
JAMESTOWN I.
35
COBHAM BAY
MARCH 6.0 ppt
APRIL 3.5 ppt
JULY 7.5 ppt
SEPT. 10.0 ppt
25
MARCH 11.5 ppt
APRIL 11.0 ppt
JULY 14.0 ppt
SEPT. 16.0 ppt
MARCH 15.5 ppt
APRIL 15.0 ppt
JULY 18.0 ppt
SEPT. 19.5 ppt
MULBERRY I.
WARWICK R.
HORSE HEAD
WRECK SHOAL
20
RAINBOW ROCK
SWASH SHOAL
POINT OF SHOAL
MARCH 18.5 ppt
APRIL 19.0 ppt
JULY 21.5 ppt
SEPT. 22.0 ppt
15
WHITE SHOAL
JAMES R. BRIDGE
MARCH 21.0 ppt
APRIL NA
JULY NA
SEPT. NA
10
NEWPORT NEWS
NNSDC
BACK RIVER
HAMPTON BAR
NEWPORT NEWS BAR
5
HAMPTON RDS.
CRANEY I.
PAGAN R.
BATTEN BAY
NANSEMOND R.

Figure 1A

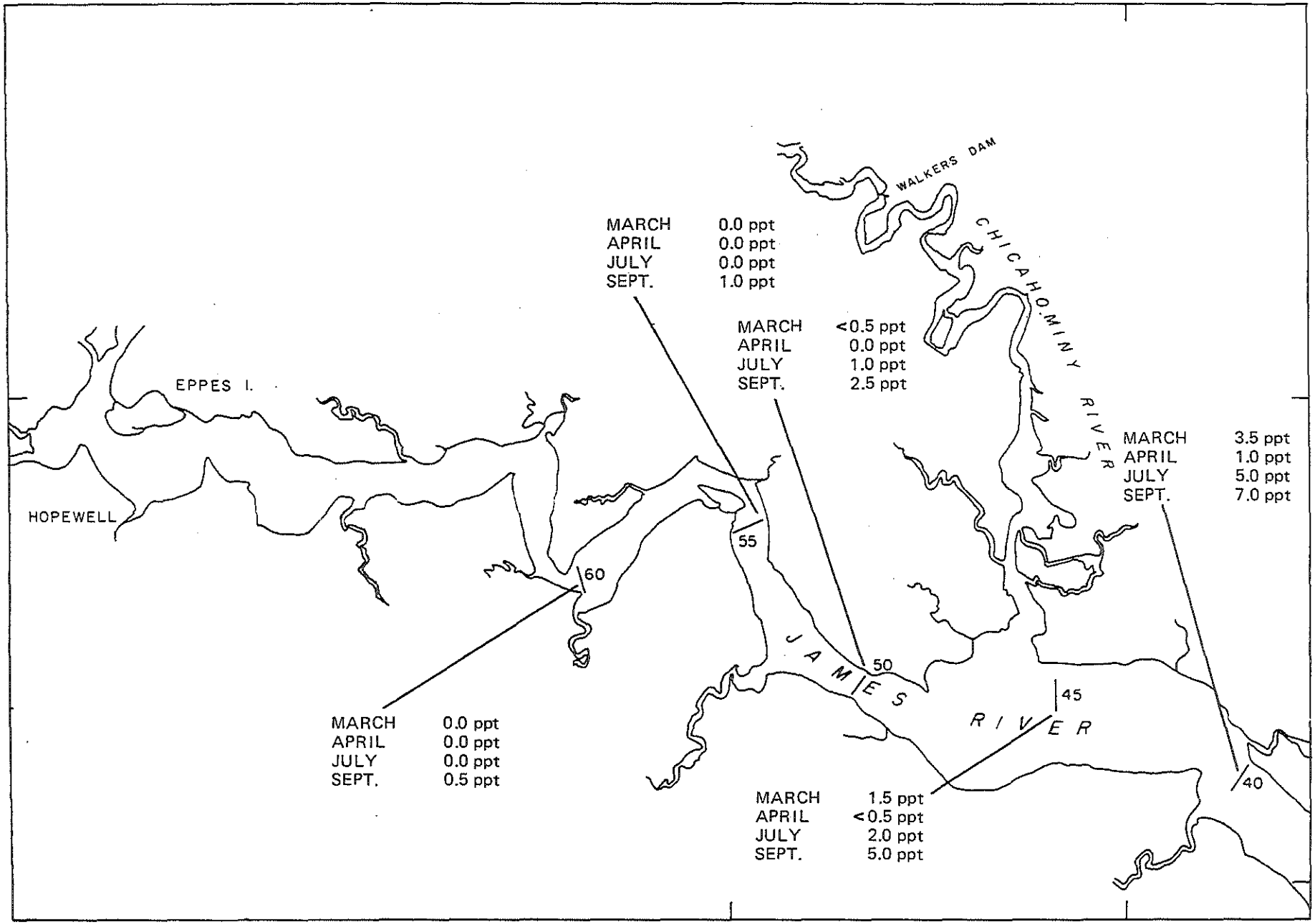
WALKERS DAM
CHICAHOMINY RIVER
EPPES I.
HOPEWELL
JAMES RIVER
MARCH 0.0 ppt
APRIL 0.0 ppt
JULY 0.0 ppt
SEPT. 1.0 ppt
MARCH <0.5 ppt
APRIL 0.0 ppt
JULY 1.0 ppt
SEPT. 2.5 ppt
MARCH 3.5 ppt
APRIL 1.0 ppt
JULY 5.0 ppt
SEPT. 7.0 ppt
MARCH 0.0 ppt
APRIL 0.0 ppt
JULY 0.0 ppt
SEPT. 0.5 ppt
MARCH 1.5 ppt
APRIL <0.5 ppt
JULY 2.0 ppt
SEPT. 5.0 ppt
60
55
50
45
40

Figure 1B

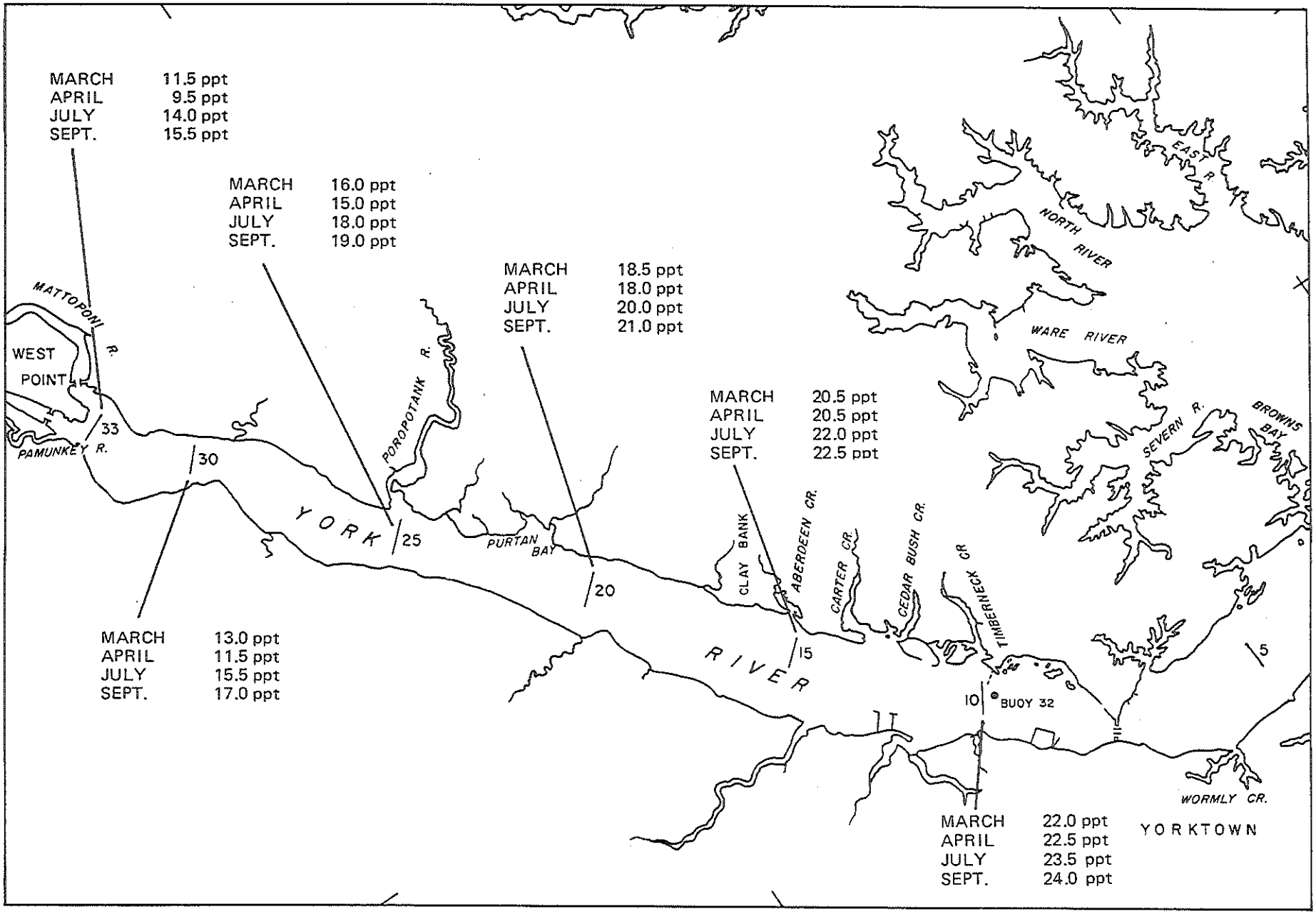
MARCH 11.5 ppt
APRIL 9.5 ppt
JULY 14.0 ppt
SEPT. 15.5 ppt
MARCH 16.0 ppt
APRIL 15.0 ppt
JULY 18.0 ppt
SEPT. 19.0 ppt
MARCH 18.5 ppt
APRIL 18.0 ppt
JULY 20.0 ppt
SEPT. 21.0 ppt
MARCH 20.5 ppt
APRIL 20.5 ppt
JULY 22.0 ppt
SEPT. 22.5 ppt
MARCH 13.0 ppt
APRIL 11.5 ppt
JULY 15.5 ppt
SEPT. 17.0 ppt
MARCH 22.0 ppt
APRIL 22.5 ppt
JULY 23.5 ppt
SEPT. 24.0 ppt
MATTOPONI R.
WEST POINT
PAMUNKEY R.
POROPOTANK R.
PURTAN BAY
CLAY BANK
ABERDEEN CR.
CARTER CR.
CEDAR BUSH CR.
TIMBERNECK CR
NORTH RIVER
EAST R.
WARE RIVER
SEVERN R.
BROWNS BAY
WORMLY CR.
YORKTOWN
BUOY 32
YORK
RIVER
33
30
25
20
15
10
5

Figure 2A

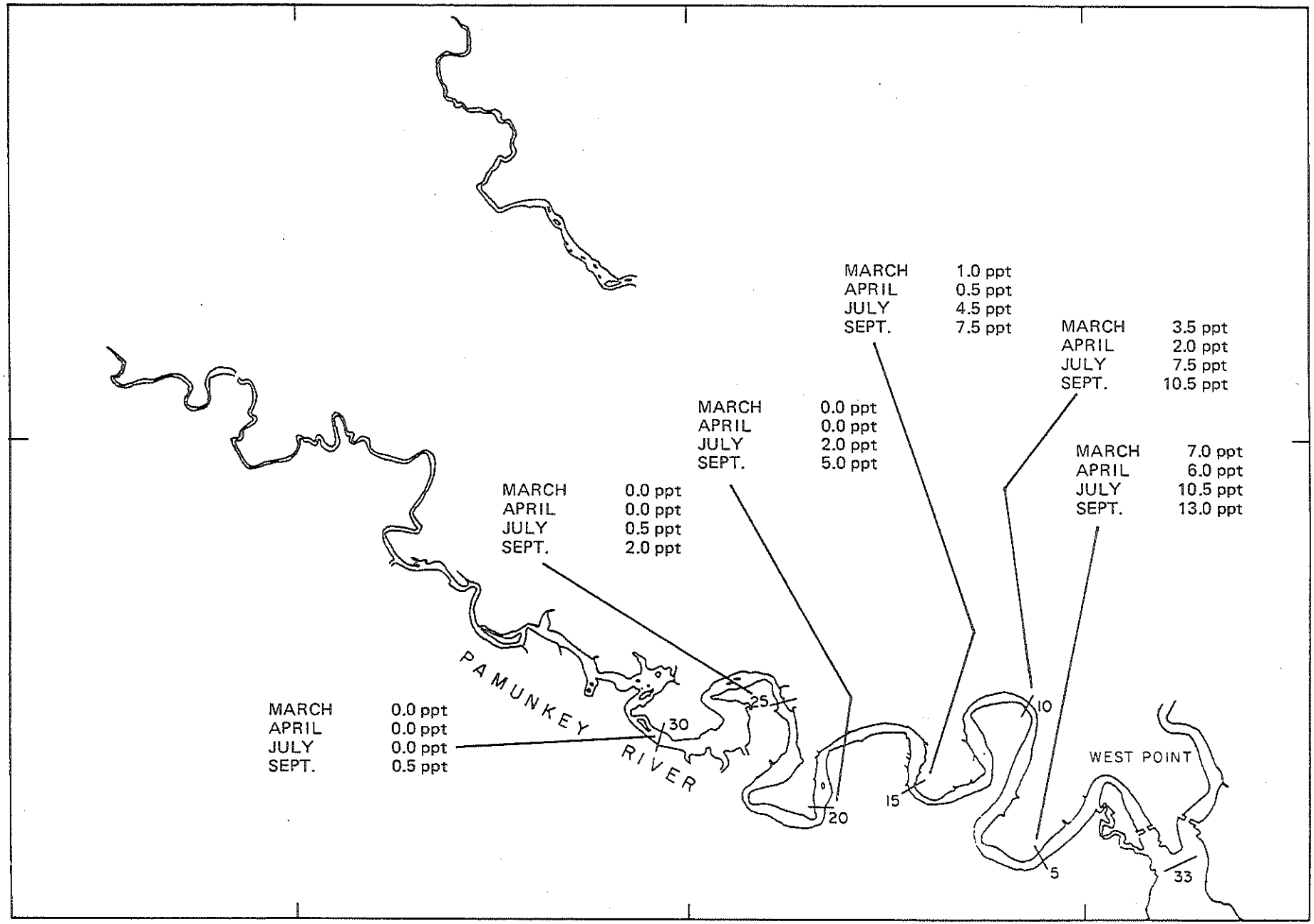
MARCH 1.0 ppt
APRIL 0.5 ppt
JULY 4.5 ppt
SEPT. 7.5 ppt
MARCH 3.5 ppt
APRIL 2.0 ppt
JULY 7.5 ppt
SEPT. 10.5 ppt
MARCH 0.0 ppt
APRIL 0.0 ppt
JULY 2.0 ppt
SEPT. 5.0 ppt
MARCH 7.0 ppt
APRIL 6.0 ppt
JULY 10.5 ppt
SEPT. 13.0 ppt
MARCH 0.0 ppt
APRIL 0.0 ppt
JULY 0.5 ppt
SEPT. 2.0 ppt
MARCH 0.0 ppt
APRIL 0.0 ppt
JULY 0.0 ppt
SEPT. 0.5 ppt
PAMUNKEY RIVER
WEST POINT
25
30
20
15
10
5
33

Figure 2B

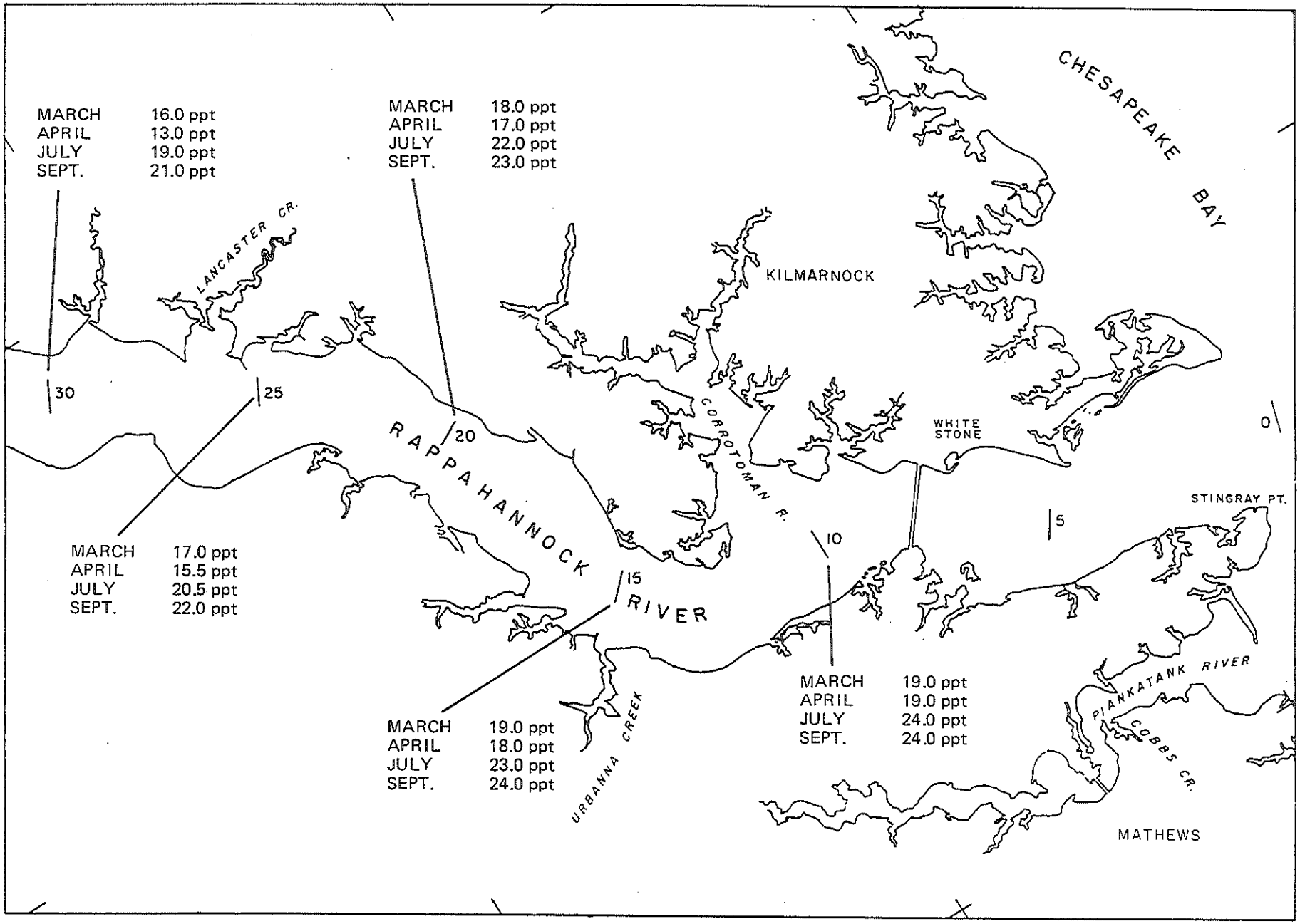
MARCH 16.0 ppt
APRIL 13.0 ppt
JULY 19.0 ppt
SEPT. 21.0 ppt
MARCH 18.0 ppt
APRIL 17.0 ppt
JULY 22.0 ppt
SEPT. 23.0 ppt
MARCH 17.0 ppt
APRIL 15.5 ppt
JULY 20.5 ppt
SEPT. 22.0 ppt
MARCH 19.0 ppt
APRIL 18.0 ppt
JULY 23.0 ppt
SEPT. 24.0 ppt
MARCH 19.0 ppt
APRIL 19.0 ppt
JULY 24.0 ppt
SEPT. 24.0 ppt
CHESAPEAKE BAY
LANCASTER CR.
KILMARNOCK
CORROTOMAN R.
WHITE STONE
STINGRAY PT.
RAPPAHANNOCK RIVER
URBANNA CREEK
PIANKATANK RIVER
COBBS CR.
MATHEWS
30
25
20
15
10
5
0

Figure 3A

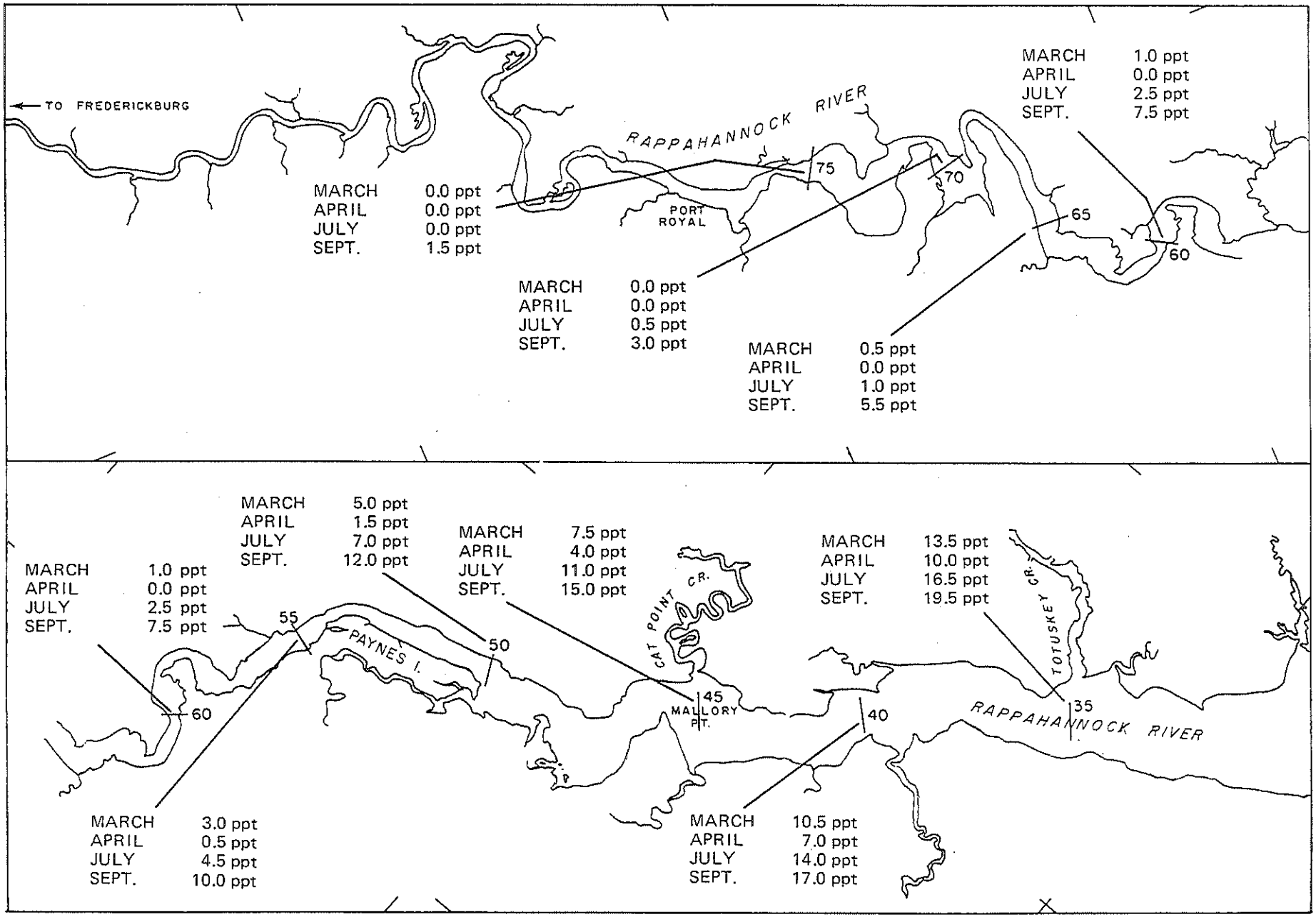
TO FREDERICKBURG
RAPPAHANNOCK RIVER
PORT ROYAL
MARCH 0.0 ppt
APRIL 0.0 ppt
JULY 0.0 ppt
SEPT. 1.5 ppt
MARCH 0.0 ppt
APRIL 0.0 ppt
JULY 0.5 ppt
SEPT. 3.0 ppt
MARCH 0.5 ppt
APRIL 0.0 ppt
JULY 1.0 ppt
SEPT. 5.5 ppt
MARCH 1.0 ppt
APRIL 0.0 ppt
JULY 2.5 ppt
SEPT. 7.5 ppt
75
70
65
60
MARCH 1.0 ppt
APRIL 0.0 ppt
JULY 2.5 ppt
SEPT. 7.5 ppt
MARCH 5.0 ppt
APRIL 1.5 ppt
JULY 7.0 ppt
SEPT. 12.0 ppt
MARCH 7.5 ppt
APRIL 4.0 ppt
JULY 11.0 ppt
SEPT. 15.0 ppt
MARCH 13.5 ppt
APRIL 10.0 ppt
JULY 16.5 ppt
SEPT. 19.5 ppt
55
50
45
40
35
60
PAYNES I.
CAT POINT CR.
MALLORY PT.
TOTUSKEY CR.
RAPPAHANNOCK RIVER
MARCH 3.0 ppt
APRIL 0.5 ppt
JULY 4.5 ppt
SEPT. 10.0 ppt
MARCH 10.5 ppt
APRIL 7.0 ppt
JULY 14.0 ppt
SEPT. 17.0 ppt

Figure 3B

Marine Resource Advisory

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Kym Young . . . . . Editor

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