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DATA REPORT: HYPOXIA IN THE
YORK RIVER, 1988 - 1989

G. M. Sisson
A. Y. Kuo
and
J. M. Brubaker

Data Report # 33

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

January 1991
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I. INTRODUCTION

As part of the hypoxia program of the Virginia Chesapeake Bay Initiatives, the Division of Physical Oceanography of the Virginia Institute of Marine Science (VIMS) conducted a series of measurements in the York River estuary. The measurements were made in summer, 1988 and 1989. Two types of measurements were conducted in each year: measurements at moored stations and measurements by slackwater surveys. The former collected data for investigation of dissolved oxygen (DO) variation, and associated physical parameters, in an intratidal time scale, as well as for studying the vertical distributions of the measured parameters. The latter collected data for spatial distributions of DO, temperature, and salinity, and for investigation of temporal variation over the summer.

This data report describes the field measurements and provides graphical presentation of the data. The numerical values of the data are archived and stored on magnetic tapes, which may be retrieved through the VIMS computer system.
II. MEASUREMENTS AT MOORED STATIONS

A. Deployments and Instruments

Since previous study (Kuo and Neilson, 1987) have shown hypoxic conditions to exist only in the lower portion of the estuary and mostly during summer, all moored stations were located near the river mouth and measurements were made in summer. From 19 July to 14 September, 1988, two strings of instruments were deployed at two stations along the channel: one at the river mouth, and the other at 3.90 km upriver (Figure 1). Figure 2 illustrates their vertical alignments.

In summer 1989, currents and dissolved oxygen were measured at three stations and at various depths at a transect near the York River mouth (Figure 3). One General Oceanic Model 6011 and eight InterOcean Model S4 meters were deployed to measure current velocity. DO meters (Datasonde) were placed near the bottom at each station. The specifics of each type of meter and where they were located are presented in Table 1.

B. Current Data

The currents observed in the York River are primarily along distinct ebb and flood axes. Because of irregular channel topography, these axes can vary with location in the estuary, with depth at the same location, and are not
Figure 1. The York River and Moored Stations.
Figure 2. Longitudinal profile (facing north) and meter locations of two moorings (1988 survey).
Figure 3. Cross-sectional profile (facing upstream) and meter locations at York River mouth (1989 survey).


**TABLE 1**

**TYPES AND LOCATIONS OF MOORED INSTRUMENTS**

| General Oceanic | Inclinometer with data stored on magnetic tape. |
| InterOcean     | Electromagnetic with solid state memory. |
| Datasonde      | Automated conductivity-temperature-DO sensor using a Recessed-Cathode Cell. |

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>STATION</th>
<th>DEPTH</th>
<th>INSTRUMENT TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mid-channel</td>
<td>0.0</td>
<td>1.5 m</td>
<td>InterOcean S4 with CTD</td>
</tr>
<tr>
<td>at mouth</td>
<td></td>
<td>2.8 m</td>
<td>Datasonde DO meter</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6.5 m</td>
<td>InterOcean S4 with CTD</td>
</tr>
<tr>
<td></td>
<td></td>
<td>11.5 m</td>
<td>InterOcean S4 with CTD</td>
</tr>
<tr>
<td></td>
<td></td>
<td>14.9 m</td>
<td>Datasonde DO meter</td>
</tr>
<tr>
<td></td>
<td></td>
<td>15.7 m</td>
<td>InterOcean S4 with CTD</td>
</tr>
<tr>
<td>Mid-channel</td>
<td>3.9</td>
<td>1.5 m</td>
<td>InterOcean S4 with CTD</td>
</tr>
<tr>
<td>upstream</td>
<td></td>
<td>6.5 m</td>
<td>InterOcean S4 with CTD</td>
</tr>
<tr>
<td></td>
<td></td>
<td>11.5 m</td>
<td>InterOcean S4 with CTD</td>
</tr>
<tr>
<td></td>
<td></td>
<td>15.1 m</td>
<td>InterOcean S4 with CTD</td>
</tr>
</tbody>
</table>

<table>
<thead>
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<th>LOCATION</th>
<th>STATION</th>
<th>DEPTH</th>
<th>INSTRUMENT TYPE</th>
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<td>North side</td>
<td>N2</td>
<td>1.3 m</td>
<td>InterOcean S4</td>
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<tr>
<td>of mouth</td>
<td></td>
<td>5.3 m</td>
<td>Datasonde DO meter</td>
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<tr>
<td></td>
<td></td>
<td>7.0 m</td>
<td>InterOcean S4</td>
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<tr>
<td>Mid-channel</td>
<td>RB</td>
<td>1.3 m</td>
<td>InterOcean S4 with CTD</td>
</tr>
<tr>
<td>at mouth</td>
<td></td>
<td>6.5 m</td>
<td>InterOcean S4 with CTD</td>
</tr>
<tr>
<td></td>
<td></td>
<td>11.5 m</td>
<td>InterOcean S4 with CTD</td>
</tr>
<tr>
<td></td>
<td></td>
<td>15.3 m</td>
<td>Datasonde DO meter</td>
</tr>
<tr>
<td></td>
<td></td>
<td>16.3 m</td>
<td>InterOcean S4 with CTD</td>
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<tr>
<td>South side</td>
<td>TUE</td>
<td>1.3 m</td>
<td>InterOcean S4</td>
</tr>
<tr>
<td>of mouth</td>
<td></td>
<td>6.0 m</td>
<td>General Oceanic with CTD</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10.1 m</td>
<td>Datasonde DO meter</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10.8 m</td>
<td>InterOcean S4 with CTD</td>
</tr>
</tbody>
</table>
necessarily opposing. The ebb and flood currents can be seen in the stickplots of observed velocities (Appendices A1 and A2). These vectors (and all others reported in this study) were adjusted from magnetic north to true north by the annual local magnetic variation, which was about 9 degrees west from 1988 through 1989. Files of current readings were edited for elimination of extraneous points before further analysis.

In order to determine the major axis of flow, it is necessary to find the principal axis along which the longitudinal component is maximized. This axis was determined for each location as follows:

\[ PA = 0.5 \tan (A/B) \]

where
- \( PA \) is principle axis relative to true north,
- \( \tan \) is the arctangent function,
- \( A = 2UV \),
- \( U \) is the east-west component,
- \( V \) is the north-south component,
- overbars indicate averaging over all data,
- \( * \) is multiplication,
- \( ** \) is exponentiation.

The data points were then split into two groups by a line perpendicular to the principal axis. Ebb and flood axes were determined by calculating the average vector direction for each group of data respectively. The angles of the principal, ebb, and flood axes are presented in Tables 2A (1988) and 2B (1989). The relationships between these axes and the observed currents are evident in the scatterplots (Appendices II-6).
necessarily opposing. The ebb and flood currents can be
seen in the stickplots of observed velocities (Appendices
A1 and A2). These vectors (and all others reported in
this study) were adjusted from magnetic north to true
north by the annual local magnetic variation, which was
about 9 degrees west from 1988 through 1989. Files of
current readings were edited for elimination of extraneous
points before further analysis.

In order to determine the major axis of flow, it is
necessary to find the principal axis along which the longi-
tudinal component is maximized. This axis was determined
for each location as follows:

$$\text{PA} = 0.5 \ \text{ATAN} \ (A/B)$$

where
- \( \text{PA} \) is principle axis relative to true north,
- \( \text{ATAN} \) is the arctangent function,
- \( A = 2U*V \),
- \( B = V^2 - U^2 \),
- \( U \) is the east-west component,
- \( V \) is the north-south component,
- overbars indicate averaging over all data,
- * is multiplication,
- ** is exponentiation.

The data points were then split into two groups by a line
perpendicular to the principal axis. Ebb and flood axes
were determined by calculating the average vector direction
for each group of data respectively. The angles of the principal,
ebb, and flood axes are presented in Tables 2A (1988) and
2B (1989). The relationships between these axes and the
observed currents are evident in the scatterplots (Appendices

II-6
### TABLE 2A

**PRINCIPAL AXES AND AVERAGE VELOCITY COMPONENTS (1988)**

<table>
<thead>
<tr>
<th>STATION/ RANGE DEPTH</th>
<th>OF DATES</th>
<th>DEPLOY #</th>
<th>OBS</th>
<th>AXES</th>
<th>AVGAN</th>
<th>VELAN</th>
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<td>07/19-07/25</td>
<td>1</td>
<td>279</td>
<td>74</td>
<td>75</td>
<td>250</td>
</tr>
<tr>
<td>1.5 M</td>
<td>07/25-08/02</td>
<td>2</td>
<td>371</td>
<td>78</td>
<td>75</td>
<td>262</td>
</tr>
<tr>
<td>08/02-08/15</td>
<td>3</td>
<td>609</td>
<td>74</td>
<td>74</td>
<td>254</td>
<td>4.5</td>
</tr>
<tr>
<td>08/15-08/30</td>
<td>4</td>
<td>707</td>
<td>76</td>
<td>75</td>
<td>257</td>
<td>1.7</td>
</tr>
<tr>
<td>08/30-09/14</td>
<td>5</td>
<td>684</td>
<td>75</td>
<td>77</td>
<td>252</td>
<td>2.4</td>
</tr>
<tr>
<td><strong>TOTAL/AVG’S:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>2650</strong></td>
<td>75</td>
</tr>
</tbody>
</table>

|                      | 07/19-07/25 | 1 | 0 | |
| 6.5 M                | 07/25-08/02 | 2 | 371 | 75 | 76 | 250 | 6.0 | -1.9 |
| 08/02-08/15 | 3 | 567 | 75 | 79 | 250 | 4.5 | -2.0 |
| 08/15-08/30 | 4 | 607 | 75 | 78 | 248 | 5.9 | -2.1 |
| 08/30-09/14 | 5 | 709 | 76 | 77 | 254 | 4.0 | -1.0 |
| **TOTAL/AVG’S:** | | | | | **2254** | 75 | 77 | 250 | 5.0 | -1.7 |

|                      | 07/19-07/25 | 1 | 279 | 71 | 78 | 250 | -9.4 | -0.4 |
| 11.5 M               | 07/25-08/02 | 2 | 370 | 75 | 77 | 252 | -0.2 | -1.2 |
| 08/02-08/15 | 3 | 609 | 74 | 77 | 251 | -1.4 | -1.0 |
| 08/15-08/30 | 4 | 698 | 73 | 75 | 252 | -4.3 | -0.5 |
| 08/30-09/14 | 5 | 709 | 74 | 77 | 250 | 1.3 | -1.3 |
| **TOTAL/AVG’S:** | | | | | **2665** | 74 | 77 | 251 | -2.1 | -0.9 |

|                      | 07/19-07/25 | 1 | 279 | 78 | 66 | 259 | -9.1 | 0.4 |
| 15.7 M               | 07/25-08/02 | 2 | 371 | 71 | 72 | 251 | -5.2 | 0.0 |
| 08/02-08/15 | 3 | 609 | 73 | 73 | 253 | -4.7 | -0.1 |
| 08/15-08/30 | 4 | 607 | 86 | 85 | 267 | -7.5 | 0.0 |
| 08/30-09/14 | 5 | 708 | 94 | 97 | 272 | -2.4 | -1.4 |
| **TOTAL/AVG’S:** | | | | | **2574** | 82 | 83 | 261 | -5.3 | -0.4 |
### TABLE 2A (CON’T)

PRINCIPAL AXES AND AVERAGE VELOCITY COMPONENTS (1988)

<table>
<thead>
<tr>
<th>STATION/DEPTH</th>
<th>RANGE OF DATES</th>
<th>DEPLOY #</th>
<th>OBS</th>
<th>PRIN AVG VELOCITY</th>
<th>EBB</th>
<th>FLOOD</th>
<th>AVG</th>
<th>LONG</th>
<th>TRAN</th>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>CM/S</td>
<td>CM/S</td>
<td>CM/S</td>
<td>CM/S</td>
<td>CM/S</td>
<td>CM/S</td>
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<td>12.2</td>
<td>-0.1</td>
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</tr>
<tr>
<td></td>
<td>07/25-08/02</td>
<td>2</td>
<td>372</td>
<td>77 75 260</td>
<td>1.5</td>
<td>1.0</td>
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<td></td>
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<tr>
<td></td>
<td>08/02-08/15</td>
<td>3</td>
<td>607</td>
<td>75 76 253</td>
<td>4.2</td>
<td>-1.0</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>08/15-08/30</td>
<td>4</td>
<td>700</td>
<td>75 75 254</td>
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<tr>
<td></td>
<td>08/30-09/14</td>
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<tr>
<td>TOTAL/AVG’S: ALL</td>
<td>2669</td>
<td>76 76 255</td>
<td>2.7</td>
<td>-0.3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Y3.9 6.5 M    | 07/19-07/25    | 1        | 281 | 77 77 258         | -3.1| -0.1  |
|               | 07/25-08/02    | 2        | 372 | 76 78 253         | 3.3 | -1.9  |
|               | 08/02-08/15    | 3        | 607 | 79 80 257         | 1.9 | -0.5  |
|               | 08/15-08/30    | 4        | 700 | 77 77 253         | 4.7 | -0.8  |
|               | 08/30-09/14    | 5        | 709 | 75 74 256         | 1.1 | 0.3   |
| TOTAL/AVG’S: ALL | 2669 | 76 77 255 | 2.1 | -0.5 |

| Y3.9 11.5 M   | 07/19-07/25    | 1        | 283 | 68 62 250         | -6.8| 1.6   |
|               | 07/25-08/02    | 2        | 372 | 77 77 257         | 2.3 | 0.1   |
|               | 08/02-08/15    | 3        | 607 | 80 79 261         | -1.0| 0.3   |
|               | 08/30-09/14    | 5        | 709 | 71 70 251         | 1.0 | 0.5   |
| TOTAL/AVG’S: ALL | 1971 | 75 74 256 | -0.5| 0.5 |

<p>| Y3.9 15.1 M   | 07/19-07/25    | 1        | 281 | 66 62 247         | -6.2| 0.9   |
|               | 07/25-08/02    | 2        | 371 | 68 49 259         | -2.3| 5.1   |
|               | 08/02-08/15    | 3        | 607 | 70 60 254         | -3.0| 2.1   |
|               | 08/15-08/30    | 4        | 700 | 68 68 249         | -4.9| -0.8  |
|               | 08/30-09/14    | 5        | 709 | 72 72 252         | -0.7| -0.7  |
| TOTAL/AVG’S: ALL | 2668 | 69 63 252 | -3.1| 0.9 |</p>
<table>
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<th>STATION/ RANGE DEPLOY DEPTH OF DATES</th>
<th># OBS</th>
<th>AXES</th>
<th>AVG VEL</th>
<th>VEL</th>
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<tbody>
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<td>Long cm/s</td>
<td>Tran cm/s</td>
</tr>
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<td>-4.1</td>
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<tr>
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<tr>
<td>07/13-07/20 3 321 96 98 273</td>
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<td>-1.0</td>
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</tr>
<tr>
<td>07/21-07/28 4 330 92 93 272</td>
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<td>-0.3</td>
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</tr>
<tr>
<td>07/28-08/02 5 231 89 93 265</td>
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<td>-1.7</td>
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<td>08/02-08/17 6 704 94 96 272</td>
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<td>-0.7</td>
<td></td>
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</tr>
<tr>
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<td>0.2</td>
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</tr>
<tr>
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## Table 2B (Cont.)

**Principal Axes and Average Velocity Components (1989)**

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Bl and B2). Superimposed on these are two dashed lines (showing flood and ebb directions) and a solid line (showing the principle axis direction).

Current velocities were resolved into longitudinal and transverse components relative to the principal axis averaged over all deployments at each location. These components are strongly influenced by semidiurnal tides, which can be seen in the time series component plots (Appendices C1, C2, D1, and D2).

In order to study mean circulation it is necessary to remove the tidal variation from the data. One approach is to apply a low pass filter, which removes variations with frequencies higher than a specified cutoff value. The low pass filtering procedure used here involves the application of a frequency domain filter response function to the fast Fourier transformed data series. The filtered series is recovered by an inverse FFT (Walters and Heston, 1981). The response function is shown in Figure 4. The cut off period for the filter was chosen to be 36 hours.

At the mid-channel stations, the low pass filtered longitudinal components generally exhibited a seaward surface flow and a landward bottom flow (Appendices E1 and E2). Variations from this mean pattern were largely the result of meteorological forcing caused especially by wind. At the station (N2) on the north side of the river mouth transect, the low pass filtered longitudinal components were landward throughout the water column, while those at station (TUE) on the south side were dominated by seaward flow.
Figure 4. Amplitude response of the low pass filter.
The filtered transverse components were much smaller than the along-channel flows, and thus they were not plotted.

C. Salinity Data

In addition to recording currents, the InterOcean S4 current meter also measured conductivity and temperature. These two parameters were converted to salinity in parts per thousand (ppt) using the Practical Salinity Scale of 1978 (UNESCO, 1981). The locations and durations of usable data are presented in Table 3. Plots of salinity against time are shown in Appendices F1 and F2.

D. Dissolved Oxygen Data

Datasonde meters were used to measure the dissolved oxygen near the top and bottom of the 1988 station at the river mouth (‘0.0’) and then at select depths of all 3 stations monitored in 1989 (‘N2’, ‘RB’, and ‘TUE’). Table 4 lists the depths and usable date ranges for these data, and time series plots of DO are in Appendices G1 and G2.
TABLE 3

A) AVAILABLE SALINITY DATA (1988)

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>STATION</th>
<th>DEPTH</th>
<th>STARTING AND ENDING DATES</th>
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</thead>
<tbody>
<tr>
<td>YR mouth - mid-chan</td>
<td>0.0</td>
<td>1.5 m</td>
<td>07/19 - 08/15 08/30 - 09/14</td>
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<tr>
<td>YR mouth - mid-chan</td>
<td>0.0</td>
<td>6.5 m</td>
<td>07/19 - 09/14</td>
</tr>
<tr>
<td>YR mouth - mid-chan</td>
<td>0.0</td>
<td>11.5 m</td>
<td>07/19 - 09/14</td>
</tr>
<tr>
<td>YR mouth - mid-chan</td>
<td>0.0</td>
<td>15.7 m</td>
<td>07/19 - 08/02</td>
</tr>
<tr>
<td>Upriver - mid-chan</td>
<td>3.9</td>
<td>1.5 m</td>
<td>07/19 - 09/14</td>
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<td>Upriver - mid-chan</td>
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<td>6.5 m</td>
<td>08/02 - 09/14</td>
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<tr>
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<td>3.9</td>
<td>11.5 m</td>
<td>08/30 - 09/14</td>
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<tr>
<td>Upriver - mid-chan</td>
<td>3.9</td>
<td>15.7 m</td>
<td>07/19 - 08/15 08/30 - 09/14</td>
</tr>
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</table>

B) AVAILABLE SALINITY DATA (1989)

<table>
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<th>STATION</th>
<th>DEPTH</th>
<th>STARTING AND ENDING DATES</th>
</tr>
</thead>
<tbody>
<tr>
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<tr>
<td>YR mouth - mid-chan</td>
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<tr>
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<td>RB</td>
<td>11.0 m</td>
<td>07/06 - 09/06</td>
</tr>
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<td>RB</td>
<td>16.0 m</td>
<td>07/06 - 09/06</td>
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<tr>
<td>YR mouth - south</td>
<td>TUE</td>
<td>6.0 m</td>
<td>07/13 - 09/06</td>
</tr>
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<td>YR mouth - south</td>
<td>TUE</td>
<td>10.0 m</td>
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### TABLE 4

#### A) AVAILABLE DISSOLVED OXYGEN DATA (1988)

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#### B) AVAILABLE DISSOLVED OXYGEN DATA (1989)

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II-15
III. TIDE DATA AT FIXED STATIONS

Surface elevation was measured at two locations in the lower York River (Figure 1). The tide gauges used were the Fischer & Porter Model 35-1550 (Bellfort Instrument Company, Baltimore, Maryland), which records water level at 6-minute intervals on a paper tape.

The Gloucester Point gauge ('GP'), owned by NOAA and maintained by the Geological Oceanography Division at VIMS, has been leveled in to the National Geodetic Vertical Datum (NGVD). The gauge near station N2 (operating during the 1989 survey) is maintained by the Physical Oceanography Division at VIMS and has not been leveled in. Surface elevation measurements on the hour were determined by computing the five point average for the 6-min readings centered on that hour. In addition to the observed surface elevations, a low pass filter with similar characteristics as the one applied to current measurements was used to examine the mean or nontidal surface elevations. The observed and low pass filtered surface elevations are found in Appendices H1 (1988) and H2 (1989).
IV. SLACKWATER SURVEYS

In 1988, a total of 16 slackwater surveys were conducted from 26 May to 28 September. All surveys were conducted at slackwater before ebb. During each survey, temperature, conductivity, and dissolved oxygen measurements were taken at 12 stations along the river, plus two stations in Chesapeake Bay. Station locations for these surveys are shown in Figure 5. In this figure, the designation for river stations (e.g., 0.00, 3.90) refers to distance from the river mouth in kilometers. All stations are located at the deepest point of their respective river transect. The designation for bay stations (e.g. NY8) refers to the navigation buoy along the approaching channel into the river.

Temperature and conductivity were measured with an Applied Micro System Conductivity-Temperature-Depth probe (CTD). Continuous vertical profiles, top to bottom, for these variables were obtained at each station. Dissolved oxygen was measured using a probe made by Yellow Springs Instruments. Dissolved oxygen measurements were taken every meter from the surface to 15 meter depth, then measurements were taken every 2 meters until the bottom.
Conductivity measurements were converted to salinity employing UNESCO algorithms (1981). Salinity, temperature, and dissolved oxygen data are displayed as isoconcentration contours in the vertical-longitudinal plane in Appendix II.

In 1989, a total of 10 slackwater surveys were conducted from 30 May to 15 September. The measurement protocol for 1989 was the same as that for 1988. These data are presented in Appendix I2.
Figure 5. The York River and Slackwater Survey Stations.
V. REFERENCES


APPENDIX A1

STICKPLOTS OF CURRENTS (1988)
1988 YORK RIVER HYPOXIA SURVEY
YORK 0.0 KM FROM MOUTH
DEPTH = 1.5 M
VECTORS ARE IN M/SEC, POSITIVE Y-AXIS TO THE EAST
1988 YORK RIVER HYPOXIA SURVEY
YORK 0.0 KM FROM MOUTH DEPTH = 6.5 M
VECTORS ARE IN M/SEC. POSITIVE Y-AXIS TO THE EAST
1988 YORK RIVER HYPOXIA SURVEY
YORK 0.0 KM FROM MOUTH DEPTH = 11.5 M
VECTORS ARE IN M/SEC, POSITIVE Y-AXIS TO THE EAST
1988 YORK RIVER HYPOXIA SURVEY
YORK 0.0 KM FROM MOUTH DEPTH = 15.7 M
VECTORS ARE IN M/SEC, POSITIVE Y-AXIS TO THE EAST
1988 YORK RIVER HYPOXIA SURVEY
YORK 3.9 KM FROM MOUTH DEPTH = 1.5 M
VECTORS ARE IN M/SEC, POSITIVE Y-AXIS TO THE EAST
1988 YORK RIVER HYPOXIA SURVEY
YORK 3.9 KM FROM MOUTH
DEPTH = 6.5 M
VECTORS ARE IN M/SEC, POSITIVE Y-AXIS TO THE EAST
1988 YORK RIVER HYPOXIA SURVEY
YORK 3.9 KM FROM MOUTH DEPTH = 11.5 M
VECTORS ARE IN M/SEC. POSITIVE Y-AXIS TO THE EAST
1988 YORK RIVER HYPOXIA SURVEY
YORK 3.9 KM FROM MOUTH DEPTH = 15.1 M
VECTORS ARE IN M/SEC, POSITIVE Y-AXIS TO THE EAST
APPENDIX A2

STICKPLOTS OF CURRENTS (1989)
1989 YORK RIVER HYPOXIA SURVEY
STATION = N2 DEPTH = 1 M
VECTORS ARE IN M/SEC, POSITIVE Y-AXIS TO THE EAST
1989 YORK RIVER HYPOXIA SURVEY
STATION = N2 DEPTH = 1 M
VECTORS ARE IN M/SEC, POSITIVE Y-AXIS TO THE EAST
1989 YORK RIVER HYPOXIA SURVEY
STATION = N2 DEPTH = 7 M
VECTORS ARE IN M/SEC, POSITIVE Y-AXIS TO THE EAST
1989 YORK RIVER HYPOXIA SURVEY
STATION = N2  DEPTH = 7  M
VECTORS ARE IN M/SEC.  POSITIVE Y-AXIS TO THE EAST
1989 YORK RIVER HYPOXIA SURVEY
STATION = RB  DEPTH = 1 M
VECTORS ARE IN M/SEC, POSITIVE Y-AXIS TO THE EAST
1989 YORK RIVER HYPOXIA SURVEY
STATION = RB  DEPTH = 1  M
VECTORS ARE IN M/SEC, POSITIVE Y-AXIS TO THE EAST
1989 YORK RIVER HYPOXIA SURVEY
STATION = RB DEPTH = 6 M
VECTORS ARE IN M/SEC, POSITIVE Y-AXIS TO THE EAST
1989 YORK RIVER HYPOXIA SURVEY
STATION = RB DEPTH = 6 M
VECTORS ARE IN M/SEC. POSITIVE Y-AXIS TO THE EAST
1989 YORK RIVER HYPOXIA SURVEY
STATION = RB DEPTH = 11 M
VECTORS ARE IN M/SEC. POSITIVE Y-AXIS TO THE EAST
1989 YORK RIVER HYPOXIA SURVEY
STATION = RB  DEPTH = 11 M
VECTORS ARE IN M/SEC, POSITIVE Y-AXIS TO THE EAST
1989 YORK RIVER HYPOXIA SURVEY
STATION = RB  DEPTH = 16 M
VECTORS ARE IN M/SEC, POSITIVE Y-AXIS TO THE EAST
1989 YORK RIVER HYPOXIA SURVEY
STATION = RB  DEPTH = 16 M
VECTORS ARE IN M/SEC. POSITIVE Y-AXIS TO THE EAST
1989 YORK RIVER HYPOXIA SURVEY
STATION = TUE DEPTH = 1 M
VECTORS ARE IN M/SEC, POSITIVE Y-AXIS TO THE EAST
1989 YORK RIVER HYPOXIA SURVEY
STATION = TUE DEPTH = 1 M
VECTORS ARE IN M/SEC, POSITIVE Y-AXIS TO THE EAST
1989 YORK RIVER HYPOXIA SURVEY
STATION = TUE
DEPTH = 6 M
VECTORS ARE IN M/SEC, POSITIVE Y-AXIS TO THE EAST
1989 YORK RIVER HYPOXIA SURVEY
STATION = TUE DEPTH = 6 M
VECTORS ARE IN M/SEC. POSITIVE Y-AXIS TO THE EAST
1989 YORK RIVER HYPOXIA SURVEY
STATION = TUE DEPTH = 10 M
VECTORS ARE IN M/SEC, POSITIVE Y-AXIS TO THE EAST
1989 YORK RIVER HYPOXIA SURVEY
STATION = TUE DEPTH = 10 M
VECTORS ARE IN M/SEC, POSITIVE Y-AXIS TO THE EAST
APPENDIX B1

SCATTERPLOTS OF CURRENTS (1988)
1988 YORK RIVER HYPOXIA SURVEY
YORK 0.0 KM FROM MOUTH DEPTH = 1.5 M
19 JUL, 1988 - 14 SEP, 1988 2650 OBSERVATIONS
PRINCIPAL AXIS  EBB  FLOOD
75.  75.  256.
1988 YORK RIVER HYPOXIA SURVEY
YORK 0.0 KM FROM MOUTH DEPTH = 6.5 M
19 JUL, 1988 - 14 SEP, 1988 2254 OBSERVATIONS
PRINCIPAL AXIS EBB FLOOD
75. 77. 250.
1988 YORK RIVER HYPOXIA SURVEY
YORK 0.0 KM FROM MOUTH DEPTH = 11.5 M
19 JUL. 1988 - 14 SEP. 1988 2665 OBSERVATIONS
PRINCIPAL AXIS EBB FLOOD
74. 77. 251.
1988 YORK RIVER HYPOXIA SURVEY
YORK 0.0 KM FROM MOUTH DEPTH = 15.7 M
19 JUL, 1988 - 14 SEP, 1988 2574 OBSERVATIONS
PRINCIPAL AXIS
EBB 82.
FLOOD 83.
261.
1988 YORK RIVER HYPOXIA SURVEY
YORK 3.9 KM FROM MOUTH DEPTH = 1.5 M
19 JUL. 1988 - 14 SEP. 1988 2669 OBSERVATIONS
PRINCIPAL AXIS EBB FLOOD
76. 76. 255.
1988 YORK RIVER HYPOXIA SURVEY
YORK 3.9 KM FROM MOUTH DEPTH = 6.5 M
19 JUL, 1988 - 14 SEP, 1988 2669 OBSERVATIONS
PRINCIPAL AXIS EBB FLOOD
76. 77. 255.
1988 YORK RIVER HYPOXIA SURVEY
YORK 3.9 KM FROM MOUTH DEPTH = 11.5 M
19 JUL. 1988 - 14 SEP. 1988 1971 OBSERVATIONS
PRINCIPAL AXIS EBB FLOOD
75. 74. 256.
APPENDIX B2

SCATTERPLOTS OF CURRENTS (1989)
1989 YORK RIVER HYPOXIA SURVEY
STATION = TUE DEPTH = 10M
06 JUL - 07 SEP. 1989 1898 OBSERVATIONS
PRINCIPAL AXIS
EBB       FLOOD
71.       75.       248.
1989 YORK RIVER HYPOXIA SURVEY
STATION = TUE DEPTH = 6 M
06 JUL - 07 SEP. 1989  2857 OBSERVATIONS
PRINCIPAL AXIS  EBB  FLOOD
81.  80.  263.
1989 YORK RIVER HYPOXIA SURVEY
STATION = TUE DEPTH = 1 M
06 JUL – 07 SEP. 1989  2888 OBSERVATIONS
PRINCIPAL AXIS EBB FLOOD
78.   77.   261.
1989 YORK RIVER HYPOXIA SURVEY
STATION = RB  DEPTH = 16 M
06 JUL - 07 SEP. 1989  2906 OBSERVATIONS
PRINCIPAL AXIS  EBB  FLOOD
72.  73.  251.
1989 YORK RIVER HYPOXIA SURVEY
STATION = RB  DEPTH = 11 M
06 JUL - 07 SEP, 1989  2911 OBSERVATIONS
PRINCIPAL AXIS  EBB  FLOOD
72.   76.   249.
1989 YORK RIVER HYPOXIA SURVEY
STATION = RB  DEPTH = 6 M
13 JUL - 07 SEP, 1989  2578 OBSERVATIONS
PRINCIPAL AXIS  EBB   FLOOD
79.   83.   254.
1989 YORK RIVER HYPOXIA SURVEY
STATION = RB DEPTH = 1 M
06 JUL - 01 SEP, 1989  2626 OBSERVATIONS
PRINCIPAL AXIS  EBB  FLOOD
78.  77.  259.
1989 YORK RIVER HYPOXIA SURVEY
STATION = N2  DEPTH = 7 M
06 JUL - 07 SEP, 1989  2863 OBSERVATIONS
PRINCIPAL AXIS  EBB  FLOOD
92.  94.  271.
1989 YORK RIVER HYPOXIA SURVEY
STATION = N2  DEPTH = 1  M
06 JUL - 07 SEP, 1989  2558 OBSERVATIONS
PRINCIPAL AXIS  EBB  FLOOD
86.  93.  260.
APPENDIX C1

LONGITUDINAL COMPONENTS OF CURRENTS (1988)
1988 YORK RIVER HYPOXIA SURVEY
YORK 0.0 KM FROM MOUTH DEPTH = 1.5 M
LONGITUDINAL COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB
1988 YORK RIVER HYPOXIA SURVEY
YORK 0.0 KM FROM MOUTH DEPTH = 6.5 M
LONGITUDINAL COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB
1988 YORK RIVER HYPOXIA SURVEY
YORK 0.0 KM FROM MOUTH DEPTH = 11.5 M
LONGITUDINAL COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB
1988 YORK RIVER HYPOXIA SURVEY
YORK 0.0 KM FROM MOUTH DEPTH = 15.7 M
LONGITUDINAL COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB
1988 YORK RIVER HYPOXIA SURVEY
YORK 3.9 KM FROM MOUTH DEPTH = 1.5 M
LONGITUDINAL COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB
1988 YORK RIVER HYPOXIA SURVEY
YORK 3.9 KM FROM MOUTH DEPTH = 6.5 M
LONGITUDINAL COMPONENTS (m/s)
POSITIVE Y AXIS IS EBB
1988 YORK RIVER HYPOXIA SURVEY
YORK 3.9 KM FROM MOUTH DEPTH = 11.5 M
LONGITUDINAL COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB
1988 YORK RIVER HYPOXIA SURVEY
YORK 3.9 KM FROM MOUTH DEPTH = 15.1 M
LONGITUDINAL COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB
APPENDIX C2

LONGITUDINAL COMPONENTS OF CURRENTS (1989)
1989 YORK RIVER HYPOXIA SURVEY
STATION = N2 DEPTH = 1 M
LONGITUDINAL COMPONENTS (m/s)
POSITIVE Y AXIS IS EBB
1989 YORK RIVER HYPOXIA SURVEY
STATION = N2 DEPTH = 7 M
LONGITUDINAL COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB
1989 YORK RIVER HYPOXIA SURVEY
STATION = RB  DEPTH = 1 M
LONGITUDINAL COMPONENTS  (M/S)
POSITIVE Y AXIS IS EBB
1989 YORK RIVER HYPOXIA SURVEY
STATION = RB DEPTH = 6 m
LONGITUDINAL COMPONENTS (m/s)
POSITIVE Y AXIS IS EBB
1989 YORK RIVER HYPOXIA SURVEY
STATION = RB  DEPTH = 11 M
LONGITUDINAL COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB
1989 YORK RIVER HYPOXIA SURVEY
STATION = RB  DEPTH = 16 m
LONGITUDINAL COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB
1989 YORK RIVER HYPOXIA SURVEY
STATION = TUE DEPTH = 1 M
LONGITUDINAL COMPONENTS (m/s)
POSITIVE Y AXIS IS EBB
1989 YORK RIVER HYPOXIA SURVEY
STATION = TUE DEPTH = 10 M
LONGITUDINAL COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB
APPENDIX D1

TRANSVERSE COMPONENTS OF CURRENTS (1988)
1988 YORK RIVER HYPOXIA SURVEY
YORK 0.0 KM FROM MOUTH DEPTH = 1.5 M
TRANSVERSE COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB MINUS 90 DEG.
1988 YORK RIVER HYPOXIA SURVEY
YORK 0.0 KM FROM MOUTH DEPTH = 6.5 M
TRANSVERSE COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB MINUS 90 DEG.
1988 YORK RIVER HYPOXIA SURVEY
YORK 0.0 KM FROM MOUTH DEPTH = 11.5 M
TRANSVERSE COMPONENTS (m/s)
POSITIVE Y AXIS IS EBB MINUS 90 DEC.
1988 YORK RIVER HYPOXIA SURVEY
YORK 0.0 KM FROM MOUTH DEPTH = 15.7 M
TRANSVERSE COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB MINUS 90 DEG.
1988 YORK RIVER HYPOXIA SURVEY
YORK 3.9 KM FROM MOUTH
DEPTH = 1.5 M
TRANSVERSE COMPONENTS (m/s)
POSITIVE Y AXIS IS EBB MINUS 90 DEG.
1988 YORK RIVER HYPOXIA SURVEY
YORK 3.9 KM FROM MOUTH DEPTH = 6.5 M
TRANSVERSE COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB MINUS 90 DEG.
1988 YORK RIVER HYPOXIA SURVEY
YORK 3.9 KM FROM MOUTH DEPTH = 11.5 M
TRANSVERSE COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB MINUS 90 DEG.
1988 YORK RIVER HYPOXIA SURVEY
YORK 3.9 KM FROM MOUTH DEPTH = 15.1 M
TRANSVERSE COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB MINUS 90 DEG.
APPENDIX D2

TRANSVERSE COMPONENTS OF CURRENTS (1998)
1989 YORK RIVER HYPOXIA SURVEY
STATION = N2 DEPTH = 1 M
TRANSVERSE COMPONENTS (m/s)
POSITIVE Y AXIS IS EBB MINUS 90 DEG.
1989 YORK RIVER HYPOXIA SURVEY
STATION = N2 DEPTH = 7 M
TRANSVERSE COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB MINUS 90 DEG.
1989 YORK RIVER HYPOXIA SURVEY
STATION = RB  DEPTH = 1 M
TRANSVERSE COMPONENTS  (m/s)
POSITIVE Y AXIS IS EBB MINUS 90 DEG.
1989 YORK RIVER HYPOXIA SURVEY
STATION = RB DEPTH = 6 M
TRANSVERSE COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB MINUS 90 DEG.
1989 YORK RIVER HYPOXIA SURVEY
STATION = RB  DEPTH = 11 M
TRANSVERSE COMPONENTS  (m/s)
POSITIVE Y AXIS IS EBB MINUS 90 DEG.
1989 YORK RIVER HYPOXIA SURVEY
STATION = RB  DEPTH = 16 M
TRANSVERSE COMPONENTS  (m/s)
POSITIVE Y AXIS IS EBB MINUS 90 DEG.
1989 YORK RIVER HYPOXIA SURVEY
STATION = TUE DEPTH = 1 m
TRANSVERSE COMPONENTS (m/s)
POSITIVE Y AXIS IS EBB MINUS 90 DEG.
1989 YORK RIVER HYPOXIA SURVEY
STATION = TUE
DEPTH = 6 M
TRANSVERSE COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB MINUS 90 DEG.
1989 YORK RIVER HYPOXIA SURVEY
STATION = TUE DEPTH = 10 M
TRANSVERSE COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB MINUS 90 DEG.
APPENDIX E1

LOW PASS FILTERED LONGITUDINAL COMPONENTS OF CURRENTS (1988)
1988 YORK RIVER HYPOXIA SURVEY
YORK 0.0 KM FROM MOUTH DEPTH = 6.5 M
LONGITUDINAL COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB
CUT OFF PERIOD FOR FILTER = 36 HOURS
1988 YORK RIVER HYPOXIA SURVEY
YORK 0.0 KM FROM MOUTH DEPTH = -11.5 M
LONGITUDINAL COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB
CUT OFF PERIOD FOR FILTER = 36 HOURS
1988 YORK RIVER HYPOXIA SURVEY
YORK 0.0 KM FROM MOUTH DEPTH = 15.7 m
LONGITUDINAL COMPONENTS (m/s)
POSITIVE Y AXIS IS EBB
CUT OFF PERIOD FOR FILTER = 36 HOURS
1988 YORK RIVER HYPOXIA SURVEY
YORK 3.9 KM FROM MOUTH DEPTH = 1.5 M
LONGITUDINAL COMPONENTS (m/s)
POSITIVE Y AXIS IS EBB
CUT OFF PERIOD FOR FILTER = 36 HOURS
1988 YORK RIVER HYPOXIA SURVEY
YORK 3.9 KM FROM MOUTH DEPTH = 6.5 M
LONGITUDINAL COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB
CUT OFF PERIOD FOR FILTER = 36 HOURS
1988 YORK RIVER HYPOXIA SURVEY
YORK 3.9 KM FROM MOUTH DEPTH = 11.5 M
LONGITUDINAL COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB
CUT OFF PERIOD FOR FILTER = 36 HOURS
1988 YORK RIVER HYPOXIA SURVEY
YORK 3.9 KM FROM MOUTH DEPTH = 15.1 M
LONGITUDINAL COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB
CUT OFF PERIOD FOR FILTER = 36 HOURS
APPENDIX E2

LOW PASS FILTERED LONGITUDINAL COMPONENTS OF CURRENTS (1989)
1989 YORK RIVER HYPOXIA SURVEY
STATION = N2 DEPTH = 1 M
LONITUDINAL COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB
CUT OFF PERIOD FOR FILTER = 36 HOURS
1989 YORK RIVER HYPOXIA SURVEY
STATION = N2 DEPTH = 7 M
LONGITUDINAL COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB
CUT OFF PERIOD FOR FILTER = 36 HOURS
1989 YORK RIVER HYPOXIA SURVEY
STATION = RB DEPTH = 1 M
LONGITUDINAL COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB
CUT OFF PERIOD FOR FILTER = 36 HOURS
1989 YORK RIVER HYPOXIA SURVEY
STATION = RB  DEPTH = 6 M
LONGITUDINAL COMPONENTS  (M/S)
POSITIVE Y AXIS IS EBB
CUT OFF PERIOD FOR FILTER = 36 HOURS
1989 YORK RIVER HYPOXIA SURVEY
STATION = RB  DEPTH = 11 M
LONGITUDINAL COMPONENTS  (M/S)
POSITIVE Y AXIS IS EBB
CUT OFF PERIOD FOR FILTER = 36 HOURS
1989 YORK RIVER HYPOXIA SURVEY
STATION = RB DEPTH = 16 M
LONITUDINAL COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB
CUT OFF PERIOD FOR FILTER = 36 HOURS
1989 YORK RIVER HYPOXIA SURVEY
STATION = TUE DEPTH = 1 M
LONGITUDINAL COMPONENTS (m/s)
POSITIVE Y AXIS IS EBB
CUT OFF PERIOD FOR FILTER = 36 HOURS
1989 YORK RIVER HYPOXIA SURVEY
STATION = TUE DEPTH = 6 M
LONITUDINAL COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB
CUT OFF PERIOD FOR FILTER = 36 HOURS
1989 YORK RIVER HYPOXIA SURVEY
STATION = TUE DEPTH = 10 M
LONGITUDINAL COMPONENTS (m/s)
POSITIVE Y AXIS IS EBB
CUT OFF PERIOD FOR FILTER = 36 HOURS
APPENDIX F1

OBSERVED SALINITIES (1988)
1988 YORK RIVER HYPOXIA SURVEY
SALINITY (PPT)
YORK 0.0 KM FROM MOUTH DEPTH = 1.5 M
1988 YORK RIVER HYPOXIA SURVEY
SALINITY (PPT)
YORK 0.0 KM FROM MOUTH DEPTH = 6.5 M
1988 YORK RIVER HYPOXIA SURVEY
SALINITY (PPT)
YORK 0.0 KM FROM MOUTH DEPTH = 11.5 M
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1988 YORK RIVER HYPOXIA SURVEY
SALINITY (PPT)
YORK 3.9 KM FROM MOUTH DEPTH = 1.5 m
1988 YORK RIVER HYPOXIA SURVEY
SALINITY (PPT)
YORK 3.9 KM FROM MOUTH DEPTH = 6.5 M
1988 YORK RIVER HYPOXIA SURVEY
SALINITY (PPT)
YORK 3.9 KM FROM MOUTH DEPTH = 11.5 M
1988 YORK RIVER HYPOXIA SURVEY
SALINITY (PPT)
YORK 3.9 KM FROM MOUTH DEPTH = 15.1 M
APPENDIX F2

OBSERVED SALINITIES (1989)
1989 YORK RIVER HYPOXIA SURVEY
SALINITY (PPT)
STATION = RB  DEPTH = 1  Y
1989 YORK RIVER HYPOXIA SURVEY
SALINITY (PPT)
STATION = RB  DEPTH = 6 M
1989 YORK RIVER HYPOXIA SURVEY
SALINITY (PPT)
STATION = RB  DEPTH = 11 m
1989 YORK RIVER HYPOXIA SURVEY
SALINITY (PPT)
STATION = RB  DEPTH = 16  M
1989 YORK RIVER HYPOXIA SURVEY
SALINITY (PPT)
STATION = TUE DEPTH = 6 M
1989 YORK RIVER HYPOXIA SURVEY
SALINITY (PPT)
STATION = TUE DEPTH = 10 M
APPENDIX G1

OBSERVED DISSOLVED OXYGEN (1988)
1988 YORK RIVER HYPOXIA SURVEY
DISSOLVED OXYGEN (MG/L)
YORK 0.0 KM FROM MOUTH DEPTH = 2.8 M
1988 YORK RIVER HYPOXIA SURVEY
DISSOLVED OXYGEN (MG/L)
YORK 0.0 KM FROM MOUTH DEPTH = 14.9 M
APPENDIX G2

OBSERVED DISSOLVED OXYGEN (1989)
1989 YORK RIVER HYPOXIA SURVEY
DISSOLVED OXYGEN (MG/L)
STATION = N2. FROM 07/20/89 TO 07/31/89
DEPTH= 5.3 meters
1989 YORK RIVER HYPOXIA SURVEY
DISSOLVED OXYGEN (MG/L)
STATION = N2. FROM 08/01/89 TO 09/05/89
DEPTH = 5.3 meters
1989 YORK RIVER HYPOXIA SURVEY
DISSOLVED OXYGEN (MG/L)
STATION = RB. FROM 06/22/89 TO 07/31/89
DEPTH = 15.3 meters
1989 YORK RIVER HYPOXIA SURVEY
DISTRIBUTED OXYGEN (MG/L)
STATION = RB. FROM 08/01/89 TO 09/04/89
DEPTH = 15.3 meters
1989 YORK RIVER HYPOXIA SURVEY
DISSOLVED OXYGEN (MG/L)
STATION = TUE FROM 06/22/89 TO 07/31/89
DEPTH = 10.1 meters
1989 YORK RIVER HYPOXIA SURVEY
DISSOLVED OXYGEN (mg/L)
STATION = TUE FROM 08/01/89 TO 09/07/89
DEPTH = 10.1 meters
APPENDIX H1

OBSERVED AND LOW PASS FILTERED SURFACE ELEVATIONS (1988)
SURFACE ELEV. (M) VS. ELAPSED TIME (DAYS)

START 07/18/88 0000 EST

GLOUC. PT.
SURFACE ELEV. (M) VS. ELAPSED TIME (DAYS)
START 08/17/88 0000 EST
APPENDIX H2

OBSERVED AND LOW PASS FILTERED SURFACE ELEVATIONS (1989)
SURFACE ELEV. (M) VS. ELAPSED TIME (DAYS)

START 06/01/89 0000 EST

GLOUC. PT.
SURFACE ELEV. (M) VS. ELAPSED TIME (DAYS)

START 06/01/89 0000 EST

STATION "N2"
SURFACE ELEV. (M) VS. ELAPSED TIME (DAYS)

START 07/01/89 0000 EST

GLOUC. PT.
SURFACE ELEV. (M) VS. ELAPSED TIME (DAYS)
START 07/01/89 0000 EST
STATION "N2"
SURFACE ELEV. (M) VS. ELAPSED TIME (DAYS)

START 07/31/89 0000 EST

GLOUC. PT.
SURFACE ELEV. (M) VS. ELAPSED TIME (DAYS)

START 07/31/89 0000 EST

STATION "N2"
APPENDIX II

SLACKWATER SURVEYS (1988)
York River Temperature
26 May 1988
Slack Before Ebb

Depth (m)

Distance Upstream from Mouth (Kilometers)
YORK RIVER
SALINITY

01 JUNE 1966
SLACK BEFORE EBB

DISTANCE UPSTREAM FROM MOUTH
(Kilometers)
YORK RIVER
SALINITY
10 JUNE 1933
SLACK BEFORE EBB
YORK RIVER
DISSOLVED OXYGEN
10 JUNE 1983
SLACK BEFORE EBB

DISTANCE UPSTREAM FROM MOUTH (Kilometers)

DEPTH (m)

10 20 30 40 50
York River
Temperature

16 June 1988
Slack Before Ebb

Distance Upstream from Mouth (Kilometers)

Depth (m)
York River Temperature

20 June 1988

Slack Before Ebb

Distance Upstream from Mouth
(Kilometers)
YORK RIVER TEMPERATURE

29 JUNE 1988
SLACK BEFORE EBB

DISTANCE UPSTREAM FROM MOUTH (Kilometers)

DEPTH (m)
YORK RIVER
TEMPERATURE
13 JULY 1988
SLACK BEFORE EBB

DISTANCE UPSTREAM FROM MOUTH
(Kilometers)
YORK RIVER
Dissolved Oxygen
13 July 1933
Slack Before Ebb

Distance Upstream from Mouth
(Kilometers)

Depth (m)

Distance Upstream from Mouth
(Kilometers)

0 10 20 30 40 50

-20 -18 -16 -14 -12 -10 -8 -6 -4 -2 0

-20 -18 -16 -14 -12 -10 -8 -6 -4 -2 0
YORK RIVER TEMPERATURE
13 JULY 1983
SLACK BEFORE EBB

DISTANCE UPSTREAM FROM MOUTH (Kilometers)

DEPTH (m)
YORK RIVER
DISSOLVED OXYGEN

13 JULY 1988
SLACK BEFORE EBB

DISTANCE UPSTREAM FROM MOUTH
(Kilometers)
York River
Dissolved Oxygen
10 August 1983
Slack Before Ebb

Distance Upstream from Mouth
(Kilometers)

Depth (m)
YORK RIVER
SALINITY
26 AUGUST 1988
SLACK BEFORE EBB

DEPTH
(m)

DISTANCE UPSTREAM FROM MOUTH
(Kilometers)
YORK RIVER TEMPERATURE

12 SEPTEMBER 1988
SLACK BEFORE EBB

DISTANCE UPSTREAM FROM MOUTH (Kilometers)
 YORK RIVER
 DISSOLVED OXYGEN

12 SEPTEMBER 1988
 SLACK BEFORE EBB

DISTANCE UPSTREAM FROM MOUTH (Kilometers)
APPENDIX I2

SLACKWATER SURVEYS (1989)
YORK RIVER
TEMPERATURE
30 MAY 1989
SLACK BEFORE EBB

DISTANCE UPSTREAM FROM MOUTH
(Kilometers)

DEPTH
(m)

20
10
0
-10
-20
-30
-40

0
10
20
30
40
YORK RIVER
TEMPERATURE
12 JULY 1989
SLACK BEFORE EBB

DISTANCE UPSTREAM FROM MOUTH (Kilometers)

DEPTH (m)

0 10 20 30 40 50

-20 -18 -16 -14 -12 -10 -8 -6 -4 -2 0

21 21 27 27 21 21 27 27 27 27 28 28 28 28 29 29 29
York River
Dissolved Oxygen
12 July 1989
Slack Before Ebb

Distance upstream from mouth (kilometers)

Depth (m)

50

0
YORK RIVER
SALINITY

27 JULY 1989
SLACK BEFORE EBB

DISTANCE UPSTREAM FROM MOUTH
(Kilometers)
York River
Temperature
11 August 1989
Slack Before Ebb

Distance upstream from mouth (kilometers)

Depth (m)

0 10 20 30 40 50

YORK RIVER
TEMPERATURE
SLACK BEFORE EBB
YORK RIVER
SALINITY
29 AUGUST 1989
SLACK BEFORE EBB

DISTANCE UPSTREAM FROM MOUTH
(Kilometers)

DEPTH
(m)

0 10 20 30 40 50
YORK RIVER TEMPERATURE 06 SEPTEMBER 1989 SLACK BEFORE EBB

DISTANCE UPSTREAM FROM MOUTH (Kilometers)

DEPTH (m)

0 10 20 30 40 50