1-1991

Data report : hypoxia in the York River, 1988-1989

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Recommended Citation

Sisson, G. M., Kuo, A. Y., & Brubaker, J. M. (1991) Data report : hypoxia in the York River, 1988-1989. Data report (Virginia Institute of Marine Science) ; no. 33. Virginia Institute of Marine Science, College of William and Mary. https://doi.org/10.21220/V5CK5J

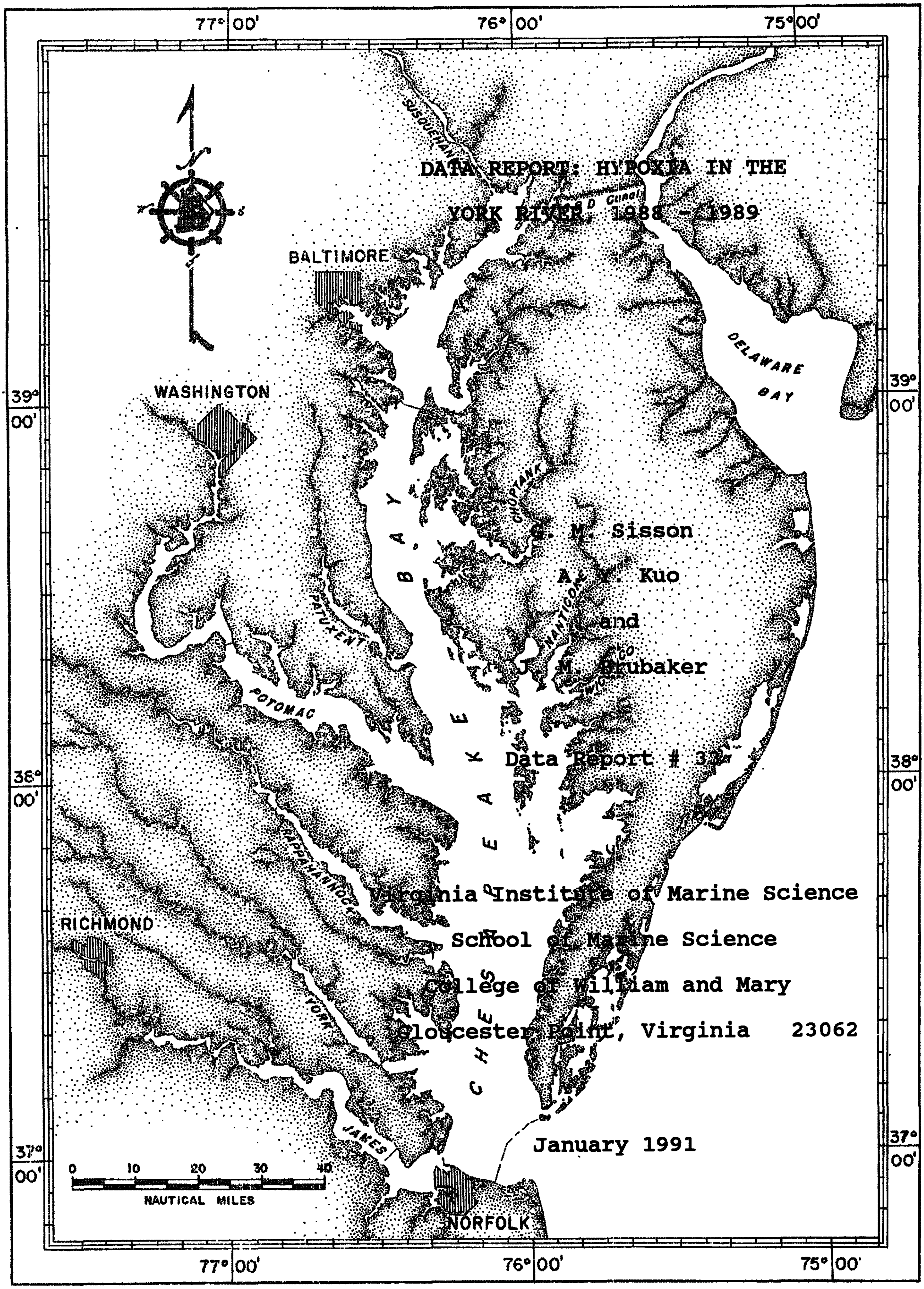

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TABLE OF CONTENTS

LIST OF FIGURES.................................. iii

LIST OF TABLES................................... iv

I. INTRODUCTION..................................... I-1

II. MEASUREMENTS AT MOORED STATIONS.................. II-1
A. Deployments and Instruments
B. Current Data
C. Salinity Data
D. Dissolved Oxygen Data

III. TIDE DATA AT FIXED STATIONS.....................III-1

IV. SLACKWATER SURVEYS............................... IV-1

V. REFERENCES....................................... V-1

APPENDICES

A1 STICKPLOTS OF CURRENTS (1988)................ A1-1
A2 STICKPLOTS OF CURRENTS (1989)................ A2-1

B1 SCATTERPLOTS OF CURRENTS (1988).............. B1-1
B2 SCATTERPLOTS OF CURRENTS (1989).............. B2-1

C1 LONGITUDINAL COMPONENTS OF CURRENTS (1988)....C1-1
C2 LONGITUDINAL COMPONENTS OF CURRENTS (1989)....C2-1

D1 TRANSVERSE COMPONENTS OF CURRENTS (1988)......D1-1
D2 TRANSVERSE COMPONENTS OF CURRENTS (1989)......D2-1

E1 LOW PASS FILTERED LONGITUDINAL
COMPONENTS OF CURRENTS (1988)................ E1-1
E2 LOW PASS FILTERED LONGITUDINAL
COMPONENTS OF CURRENTS (1989)................ E2-1

F1 OBSERVED SALINITIES (1988).................. F1-1
F2 OBSERVED SALINITIES (1989).................. F2-1

G1 OBSERVED DISSOLVED OXYGEN (1988)............. G1-1
G2 OBSERVED DISSOLVED OXYGEN (1989)............. G2-1

H1 OBSERVED AND LOW PASS FILTERED
SURFACE ELEVATIONS (1988).................... H1-1
H2 OBSERVED AND LOW PASS FILTERED
SURFACE ELEVATIONS (1989).................... H2-1

I1 SLACKWATER SURVEYS (1988).................... I1-1
I2 SLACKWATER SURVEYS (1989).................... I2-1

LIST OF FIGURES

Page

1. The York River and Moored Stations..............II-2
2. Cross Section of the York River for 1988 Survey (longitudinal)..................II-3
3. Cross Section of the York River for 1989 Survey (transverse)....................II-4
4. Amplitude response of the low pass filter.......II-12
5. The York River and Slackwater Survey Stations...IV-3

LIST OF TABLES

Page

1. Types and locations of Moored Instruments.......II-5

2A. Principal Axes and Average Velocity Components (1988)................................II-7

2B. Principal Axes and Average Velocity Components (1989)................................II-9

3. Available Salinity Data..........................II-14

4. Available Dissolved Oxygen Data.................II-15

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 slack-water 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

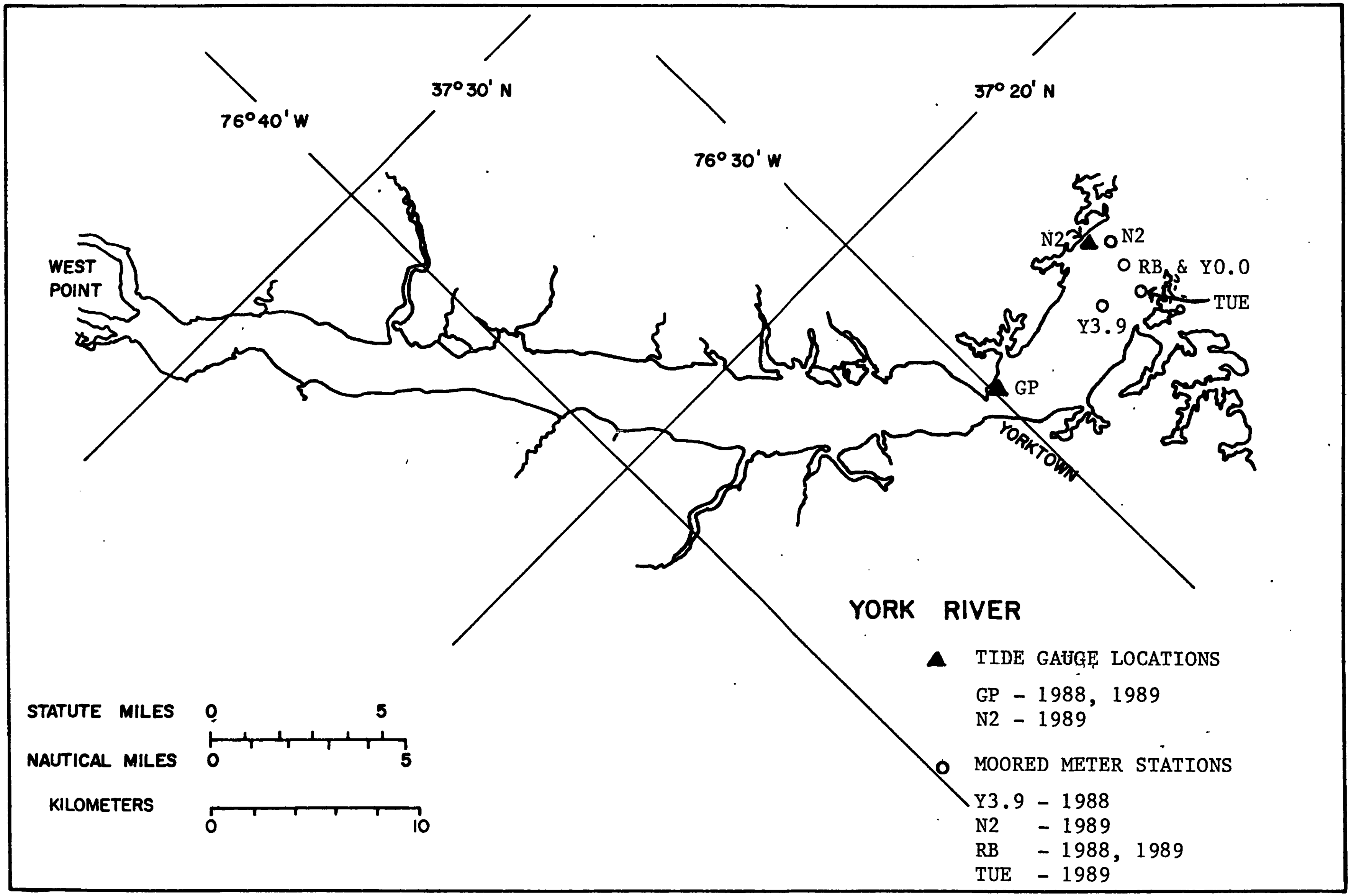

Figure 1. The York River and Moored Stations.

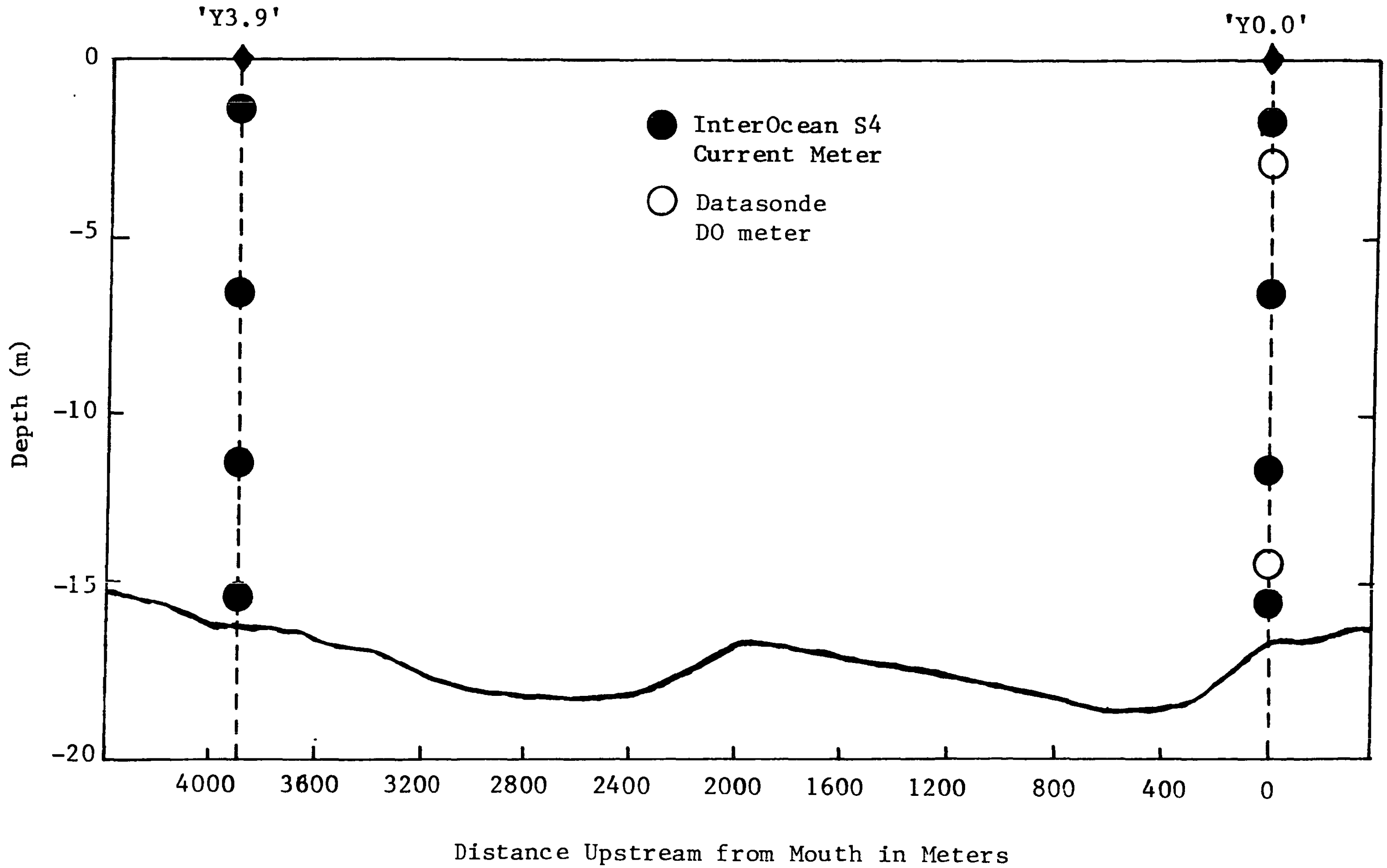

Figure 2. Longitudinal profile (facing north) and meter locations of two moorings (1988 survey).

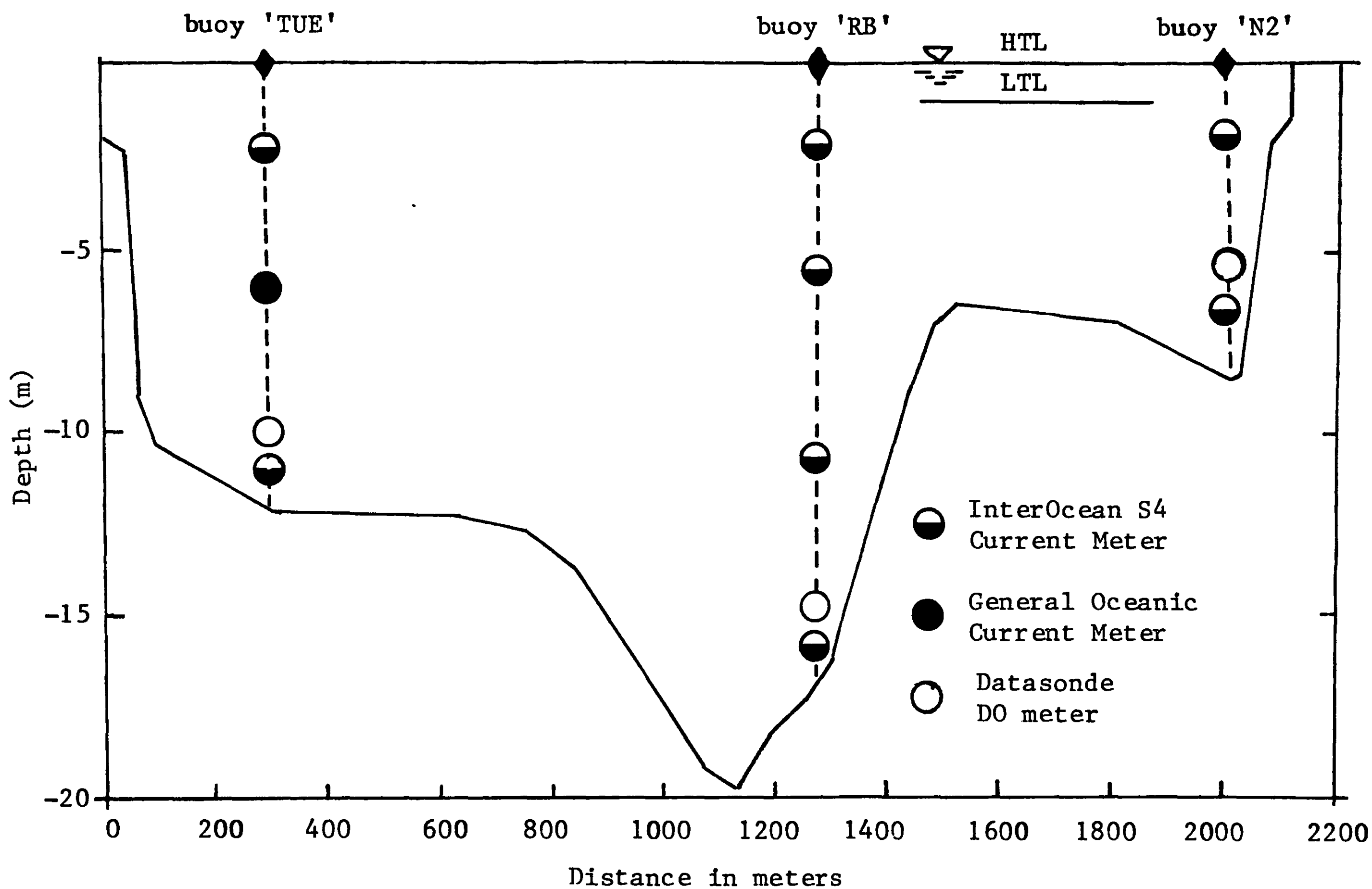

Figure 3. Cross-sectional profile (facing upstream) and meter locations at York River mouth (1989 survey).

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.

- 1988 -

LOCATION	STATION	DEPTH	INSTRUMENT TYPE
Mid-channel at mouth	0.0	1.5 m	InterOcean S4 with CTD
		2.8	Datasonde DO meter
		6.5	InterOcean S4 with CTD
		11.5	InterOcean S4 with CTD
		14.9	Datasonde DO meter
		15.7	InterOcean S4 with CTD
Mid-channel upstream	3.9	1.5 m	InterOcean S4 with CTD
		6.5	InterOcean S4 with CTD
		11.5	InterOcean S4 with CTD
		15.1	InterOcean S4 with CTD

- 1989 -

LOCATION	STATION	DEPTH	INSTRUMENT TYPE
North side of mouth	N2	1.3 m	InterOcean S4
		5.3	Datasonde DO meter
		7.0	InterOcean S4
Mid-channel at mouth	RB	1.3 m	InterOcean S4 with CTD
		6.5	InterOcean S4 with CTD
		11.5	InterOcean S4 with CTD
		15.3	Datasonde DO meter
		16.3	InterOcean S4 with CTD
South side of mouth	TUE	1.3 m	InterOcean S4
		6.0	General Oceanic with CTD
		10.1	Datasonde DO meter
		10.8	InterOcean S4 with CTD

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 ATAN (A/B)

where
PA is principle axis relative to true north,
ATAN is the arctangent function,

$A=\overline{2*U*V}$,
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 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.

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TABLE 2A

PRINCIPAL AXES AND AVERAGE VELOCITY COMPONENTS (1988)

STATION/ DEPTH	RANGE OF DATES	DEPLOY #	# OBS	AXES PRIN	AXES EBB	AXES FLOOD	AVG LONG cm/s	VEL TRAN cm/s
Y0.0	07/19-07/25	1	279	74	75	250	9.9	0.7
1.5 M	07/25-08/02	2	371	78	75	262	2.7	-0.5
	08/02-08/15	3	609	74	74	254	4.5	-0.7
	08/15-08/30	4	707	76	75	257	1.7	0.0
	08/30-09/14	5	684	75	77	252	2.4	-1.4
	TOTAL/AVG'S:	ALL	2650	75	75	256	3.7	-0.5
Y0.0	07/19-07/25	1	0					
6.5 M	07/25-08/02	2	371	74	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:	ALL	2254	75	77	250	5.0	-1.7
Y0.0	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:	ALL	2665	74	77	251	-2.1	-0.9
Y0.0	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:	ALL	2574	82	83	261	-5.3	-0.4

TABLE 2A (CON'T)

PRINCIPAL AXES AND AVERAGE VELOCITY COMPONENTS (1988)

STATION/ DEPTH	RANGE OF DATES	DEPLOY #	# OBS	AXES PRIN	AXES EBB	AXES FLOOD	AVG LONG cm/s	VEL TRAN cm/s
Y3.9	07/19-07/25	1	281	76	76	257	12.2	-0.1
1.5 M	07/25-08/02	2	372	77	75	260	1.5	1.0
	08/02-08/15	3	607	75	76	253	4.2	-1.0
	08/15-08/30	4	700	75	75	254	0.7	-0.4
	08/30-09/14	5	709	76	76	256	0.2	-0.3
	TOTAL/AVG'S:	ALL	2669	76	76	255	2.7	-0.3
Y3.9	07/19-07/25	1	281	77	77	258	-3.1	-0.1
6.5 M	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	75	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	07/19-07/25	1	283	68	62	250	-6.8	1.6
11.5 M	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
		4	0					
	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
Y3.9	07/19-07/25	1	281	66	62	247	-6.2	0.9
15.1 M	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

TABLE 2B

PRINCIPAL AXES AND AVERAGE VELOCITY COMPONENTS (1989)

STATION/ DEPTH	RANGE OF DATES	DEPLOY #	# OBS	A X E S PRIN	EBB	FLOOD	AVG LONG cm/s	VEL TRAN cm/s
N2	07/06-07/13	2	327	84	91	257	-1.0	-2.6
1.0 M		3	0					
	07/21-07/28	4	327	85	94	259	-3.9	-4.1
	07/28-08/02	5	239	88	94	264	-5.5	-1.7
	08/02-08/17	6	707	86	94	260	-2.7	-3.1
	08/18-09/01	7	671	86	92	260	-0.8	-2.6
	09/01-09/07	8	287	86	93	262	-7.2	-1.4
	TOTAL/AVG'S:	ALL	2558	86	93	260	-2.9	-2.7
N2	07/06-07/13	2	319	96	96	277	-0.1	0.0
7.0 M	07/13-07/20	3	321	96	98	273	2.7	-1.0
	07/21-07/28	4	330	92	93	272	-2.8	-0.3
	07/28-08/02	5	231	89	93	265	-0.7	-1.7
	08/02-08/17	6	704	94	96	272	-0.5	-0.7
	08/18-09/01	7	671	91	92	271	-2.5	0.2
	09/01-09/07	8	287	89	94	266	-4.8	-0.8
	TOTAL/AVG'S:	ALL	2923	86	94	271	-1.3	-0.5
RB	07/06-07/13	2	326	78	74	265	5.1	1.4
1.0 M	07/13-07/20	3	373	83	81	265	-1.2	0.4
	07/21-07/28	4	322	78	79	257	5.4	-0.7
	07/28-08/02	5	236	81	82	259	3.9	-1.0
	08/02-08/17	6	701	78	77	259	3.3	-0.3
	08/18-09/01	7	668	75	75	255	5.4	-1.4
		8	0					
	TOTAL/AVG'S:	ALL	2626	78	77	259	3.7	-0.4
RB		2	0					
6.0 M	07/13-07/20	3	371	77	83	243	7.9	-5.5
	07/21-07/28	4	322	81	84	257	1.8	-1.8
	07/28-08/02	5	235	80	82	256	2.7	-1.6
	08/02-08/17	6	696	77	81	250	3.2	-2.3
	08/18-09/01	7	668	80	83	257	-0.9	-1.8
	09/01-09/07	8	286	83	84	262	4.6	-1.3
	TOTAL/AVG'S:	ALL	2578	79	83	254	2.7	-2.4
RB	07/06-07/13	2	317	72	75	250	-9.1	-0.3
11.0 M	07/13-07/20	3	384	75	77	253	-2.0	-1.2
	07/21-07/28	4	322	71	74	248	-0.3	-1.2
	07/28-08/02	5	232	73	74	252	-2.0	-0.2
	08/02-08/17	6	704	72	75	251	-4.5	-0.8
	08/18-09/01	7	665	71	78	247	-4.9	-1.1
	09/01-09/07	8	287	73	78	248	1.5	-2.0
	TOTAL/AVG'S:	ALL	2911	72	76	249	-3.5	-1.0

TABLE 2B (CON'T)

PRINCIPAL AXES AND AVERAGE VELOCITY COMPONENTS (1989)

STATION/ DEPTH	RANGE OF DATES	DEPLOY #	# OBS	AXES PRIN	EBB	FLOOD	AVG LONG cm/s	VEL TRAN cm/s
RB	07/06-07/13	2	319	72	68	252	-9.5	0.3
16.0 M	07/13-07/20	3	377	73	70	254	-6.2	0.7
	07/21-07/28	4	322	71	75	248	-3.4	-1.1
	07/28-08/02	5	229	71	71	251	-7.4	0.1
	08/02-08/17	6	706	72	71	253	-5.6	0.1
	08/18-09/01	7	667	71	74	250	-6.7	0.8
	09/01-09/07	8	286	71	73	250	-0.2	-0.2
	TOTAL/AVG'S:	ALL	2906	72	73	251	-5.7	0.2
TUE	07/06-07/13	2	325	76	74	261	7.4	1.1
1.0 M	07/13-07/20	3	332	82	75	270	1.6	3.2
	07/21-07/28	4	332	78	76	261	4.8	0.7
	07/28-08/02	5	237	78	79	256	5.2	-1.2
	08/02-08/17	6	704	78	76	261	3.9	0.7
	08/18-09/01	7	666	78	78	258	7.1	-1.3
	09/01-09/07	8	292	81	82	260	1.1	-1.4
	TOTAL/AVG'S:	ALL	2888	78	77	261	4.7	0.2
TUE	07/06-07/13	2	323	87	89	266	0.0	-0.9
6.0 M	07/13-07/20	3	331	77	78	252	10.4	-0.6
	07/21-07/28	4	325	84	82	266	3.0	1.3
	07/28-08/02	5	237	82	80	264	4.4	1.1
	08/02-08/17	6	700	79	78	260	0.6	0.1
	08/18-09/01	7	656	81	80	262	1.7	0.2
	09/01-09/07	8	285	85	83	267	2.2	0.6
	TOTAL/AVG'S:	ALL	2857	81	80	263	2.7	0.2
TUE	07/06-07/13	2	320	74	83	250	-2.3	-1.3
10.0 M	07/13-07/20	3	310	78	79	256	2.0	-0.7
	07/21-07/28	4	327	70	74	247	-0.2	-2.0
		5	0					
		6	0					
	08/18-09/01	7	656	70	77	244	-2.7	-1.7
	09/01-09/07	8	285	72	69	255	1.0	1.3
	TOTAL/AVG'S:	ALL	1898	71	75	248	-0.9	-1.1

B1 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.

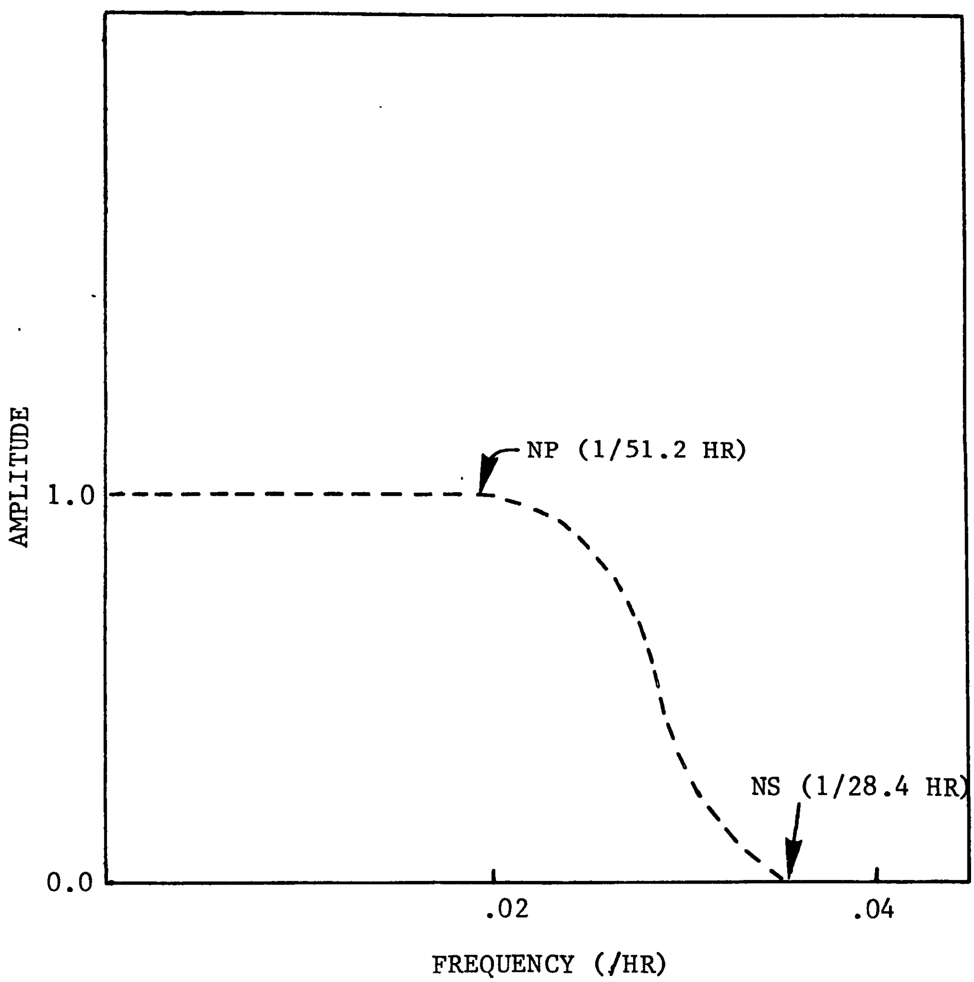

Figure 4. Amplitude response of the low pass filter.

The filtered transverse components were much smaller than the 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)

LOCATION	STATION	DEPTH	STARTING AND ENDING DATES
YR mouth - mid-chan	0.0	1.5 m	07/19 - 08/15 08/30 - 09/14
YR mouth - mid-chan	0.0	6.5 m	07/19 - 09/14
YR mouth - mid-chan	0.0	11.5 m	07/19 - 09/14
YR mouth - mid-chan	0.0	15.7 m	07/19 - 08/02
Upriver - mid-chan	3.9	1.5 m	07/19 - 09/14
Upriver - mid-chan	3.9	6.5 m	08/02 - 09/14
Upriver - mid-chan	3.9	11.5 m	08/30 - 09/14
Upriver - mid-chan	3.9	15.7 m	07/19 - 08/15 08/30 - 09/14

B) AVAILABLE SALINITY DATA (1989)

LOCATION	STATION	DEPTH	STARTING AND ENDING DATES
YR mouth - mid-chan	RB	1.0 m	07/06 - 09/01
YR mouth - mid-chan	RB	6.0 m	07/13 - 09/02
YR mouth - mid-chan	RB	11.0 m	07/06 - 09/06
YR mouth - mid-chan	RB	16.0 m	07/06 - 09/06
YR mouth - south	TUE	6.0 m	07/13 - 09/06
YR mouth - south	TUE	10.0 m	07/06 - 09/06

TABLE 4

A) AVAILABLE DISSOLVED OXYGEN DATA (1988)

LOCATION	STATION	DEPTH	STARTING AND ENDING DATES
YR mouth - mid-chan	0.0	2.8 m	07/19 - 07/29 08/04 - 08/17 08/17 - 09/14
YR mouth - mid-chan	0.0	14.9 m	08/02 - 08/15 08/30 - 09/14

B) AVAILABLE DISSOLVED OXYGEN DATA (1989)

LOCATION	STATION	DEPTH	STARTING AND ENDING DATES
YR mouth - north	N2	5.3 m	07/20 - 09/06
YR mouth - mid-chan	RB	15.3 m	06/22 - 06/28 07/06 - 09/06
YR mouth - south	TUE	10.1 m	06/22 - 09/07

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 I1.

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.

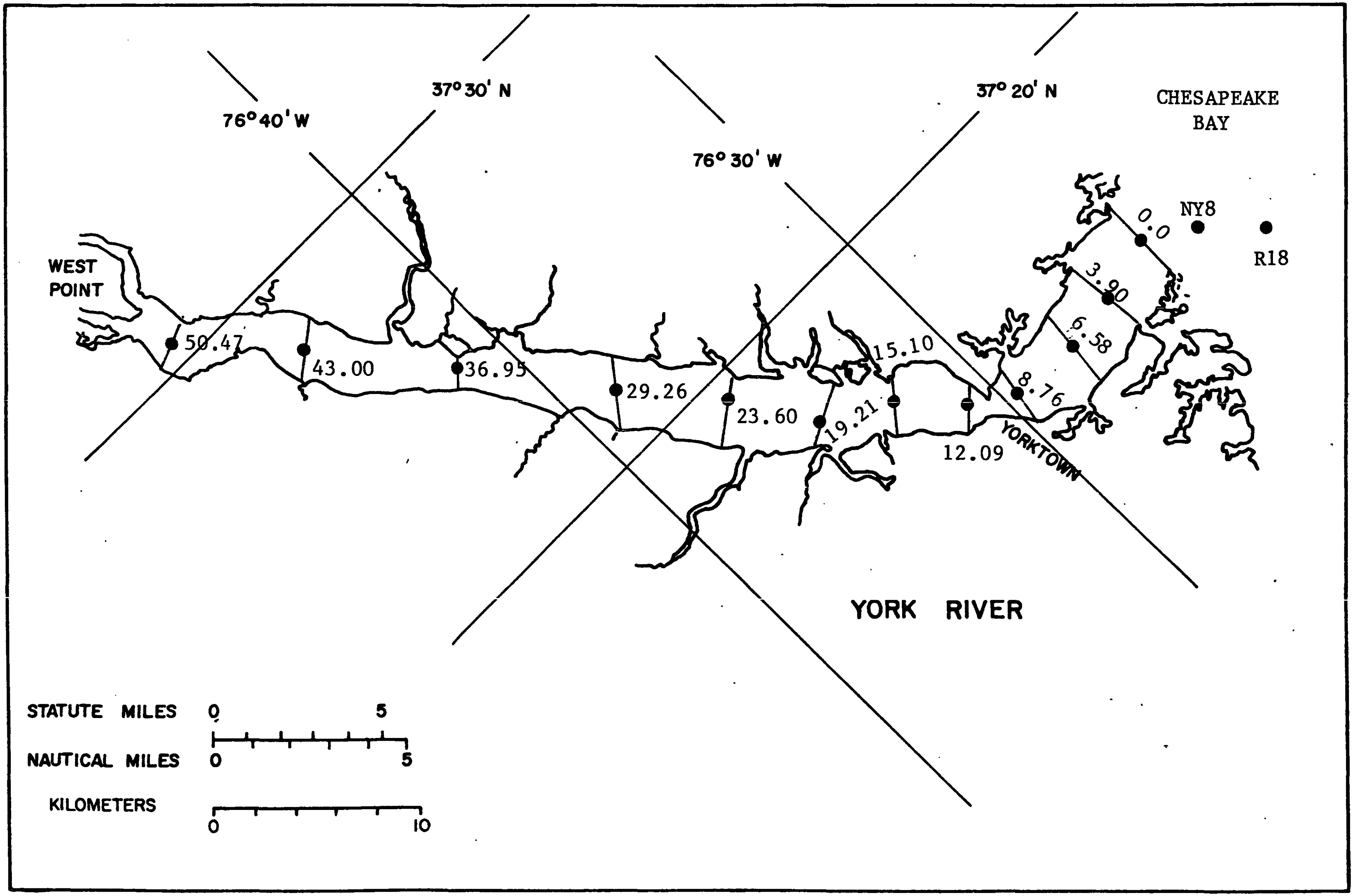

Figure 5. The York River and Slackwater Survey Stations.

V. REFERENCES

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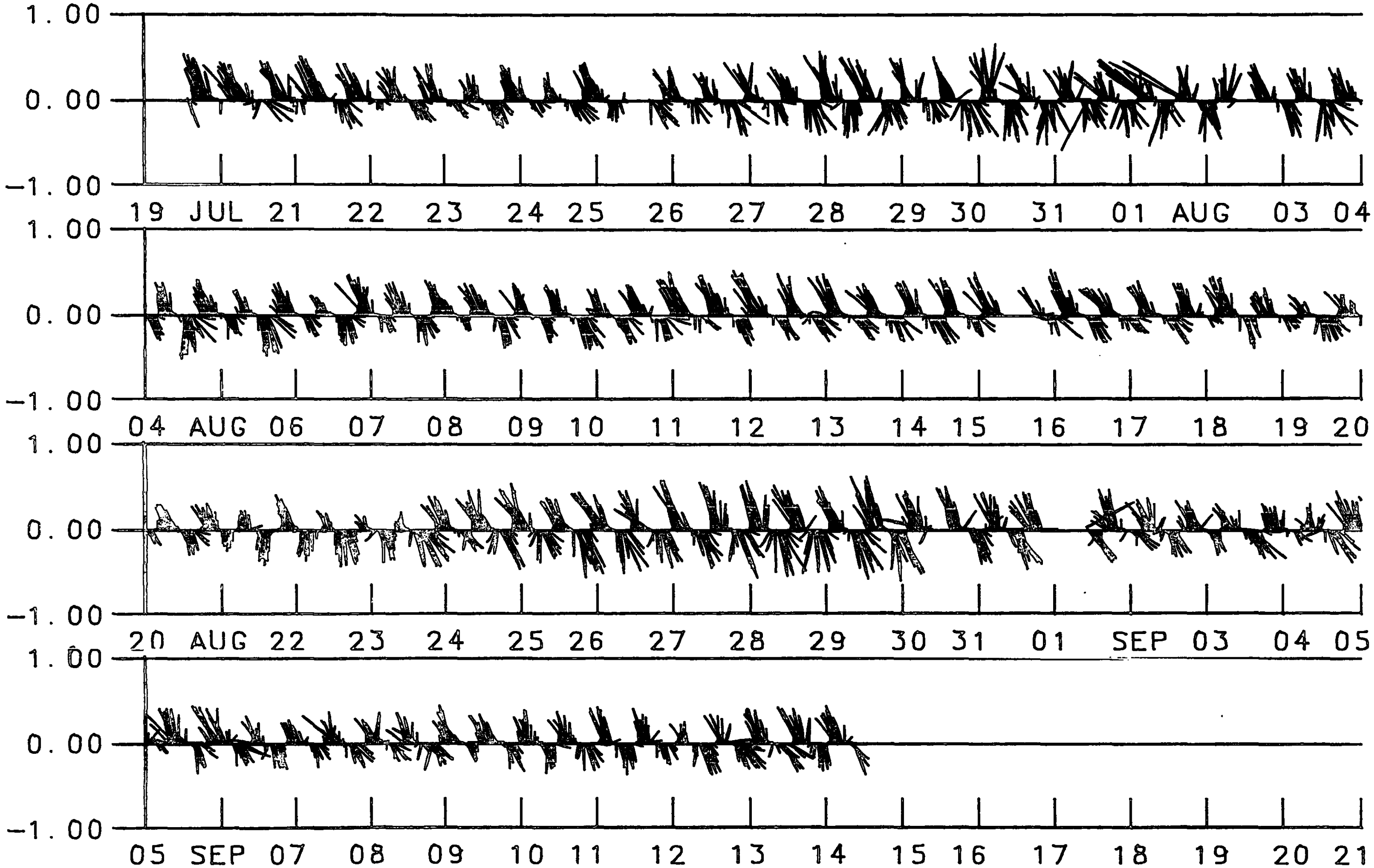
UNESCO, 1981. Technical Report 37. Practical Salinity Scale 1978.

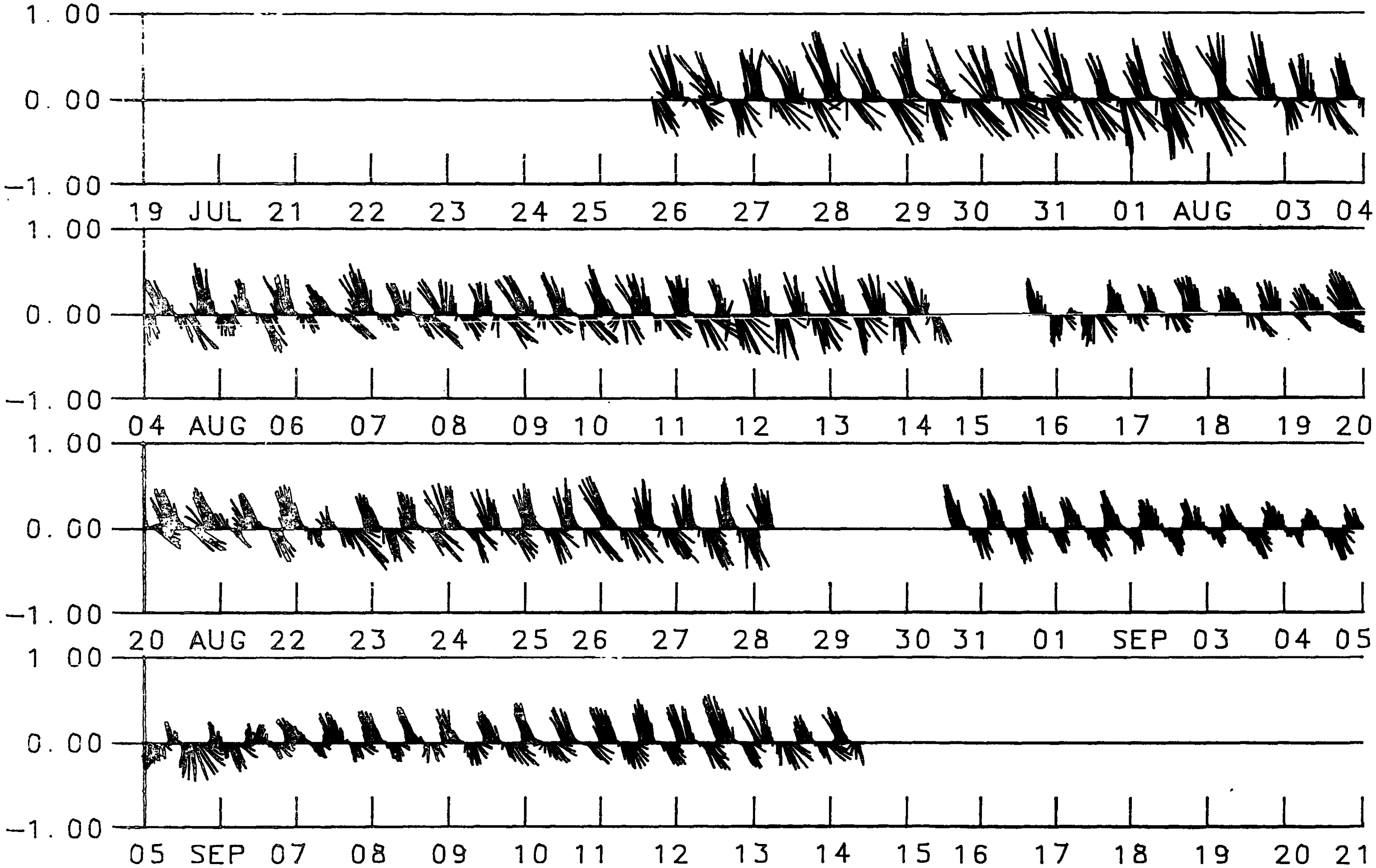
Walters, R. A. and C. Heston, 1981. Removing Tidal-Period Variations from Time-Series Data Using Low-Pass Digital Filters. Journal of Physical Oceanography. Volume 12, pp. 112-115.

APPENDIX A1

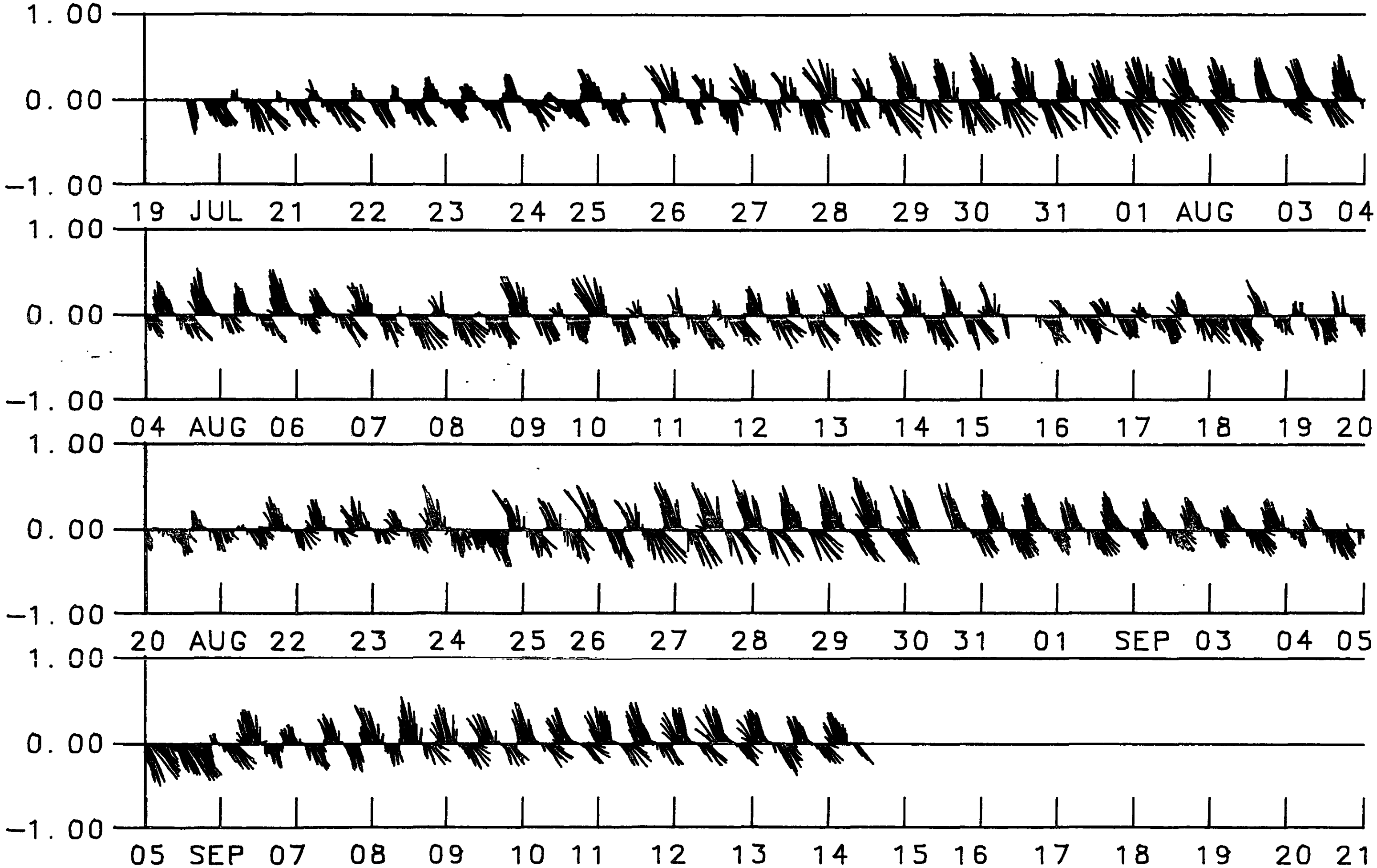
STICKPLOTS OF CURRENTS (1988)



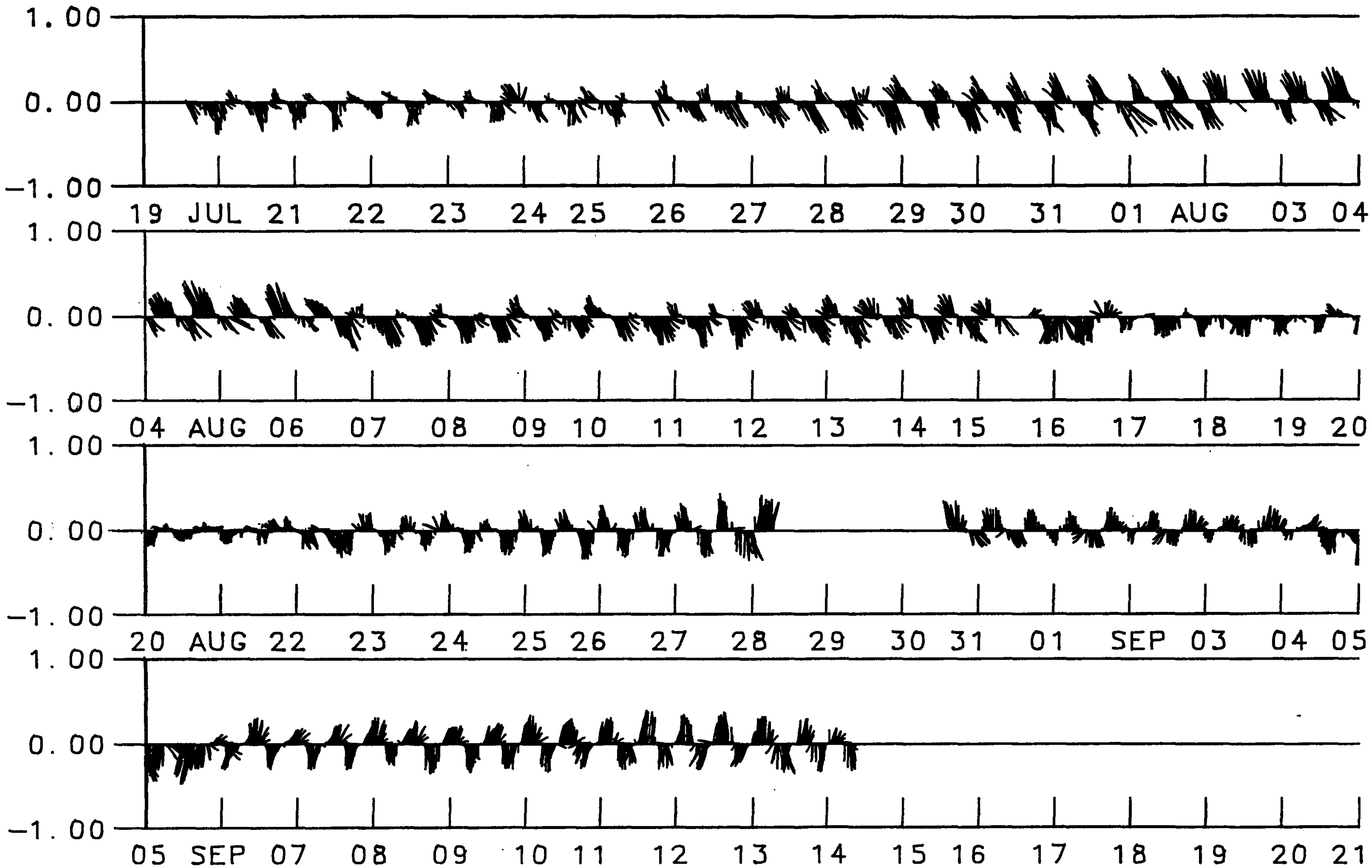
1988 YORK RIVER HYPOXIA SURVEY
YORK 0.0 KM FROM MOUTH DEPTH = 1.5 M
VECTORS ARE IN M/SEC, POSITIVE Y-AXIS TO THE EAST



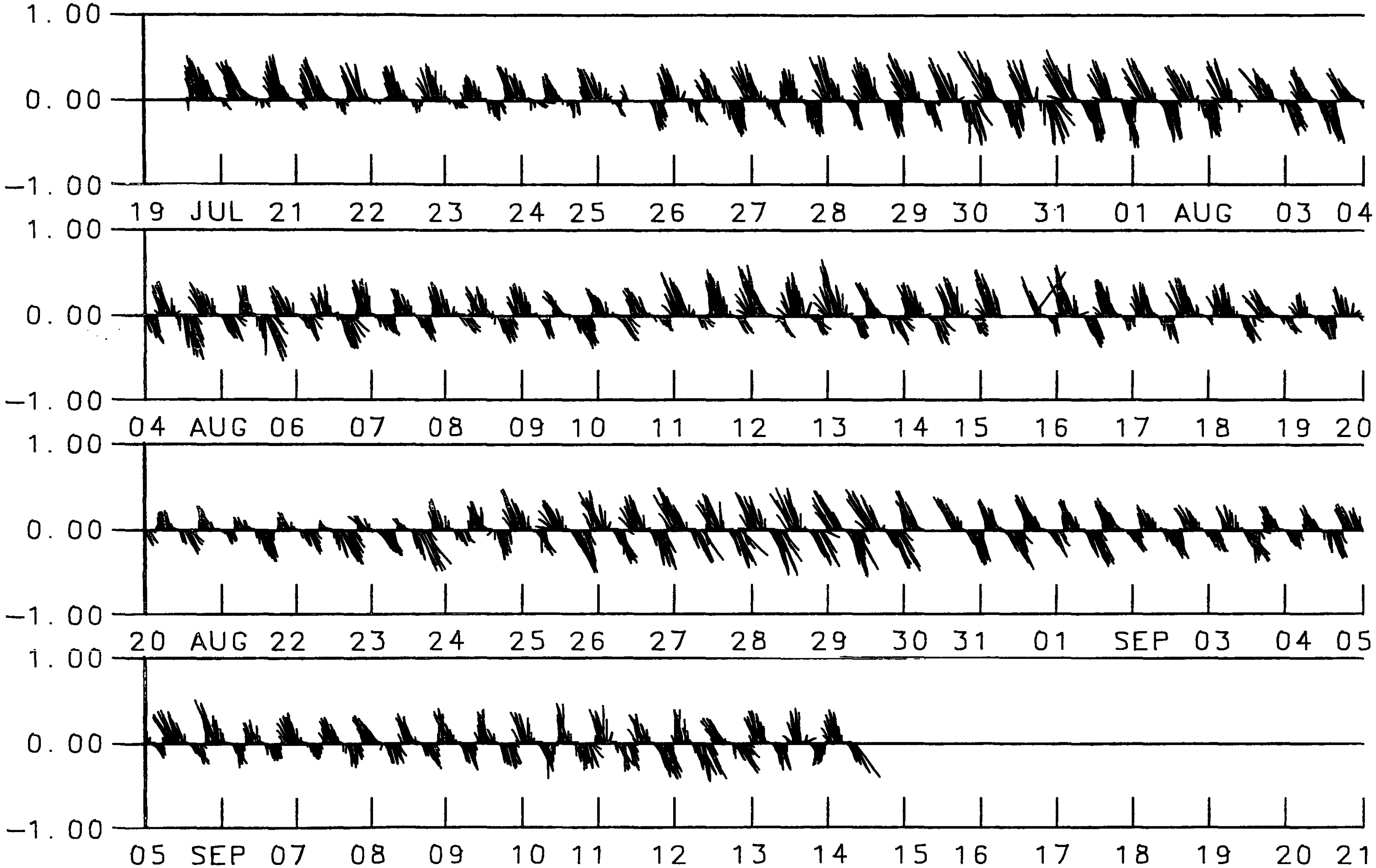
1988 YORK RIVER HYPOXIA SURVEY
YORK 0.0 KM FROM MOUTH DEPTH = 6.5 M
VECTORS ARE IN M/SEC, POSITIVE Y-AXIS TO THE EAST



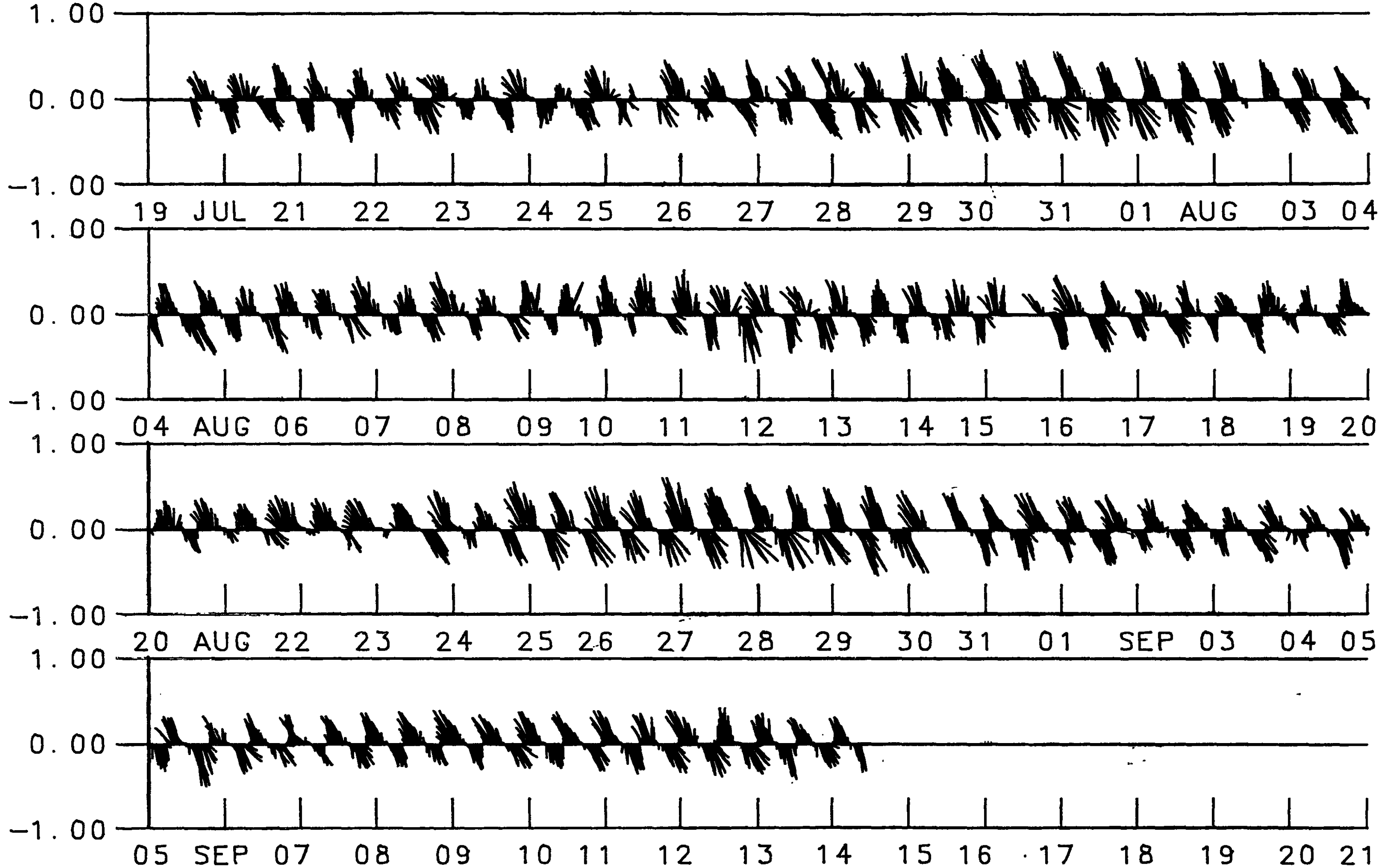
1988 YORK RIVER HYPOXIA SURVEY
YORK 0.0 KM FROM MOUTH DEPTH = 11.5 M
VECTORS ARE IN M/SEC, POSITIVE Y-AXIS TO THE EAST



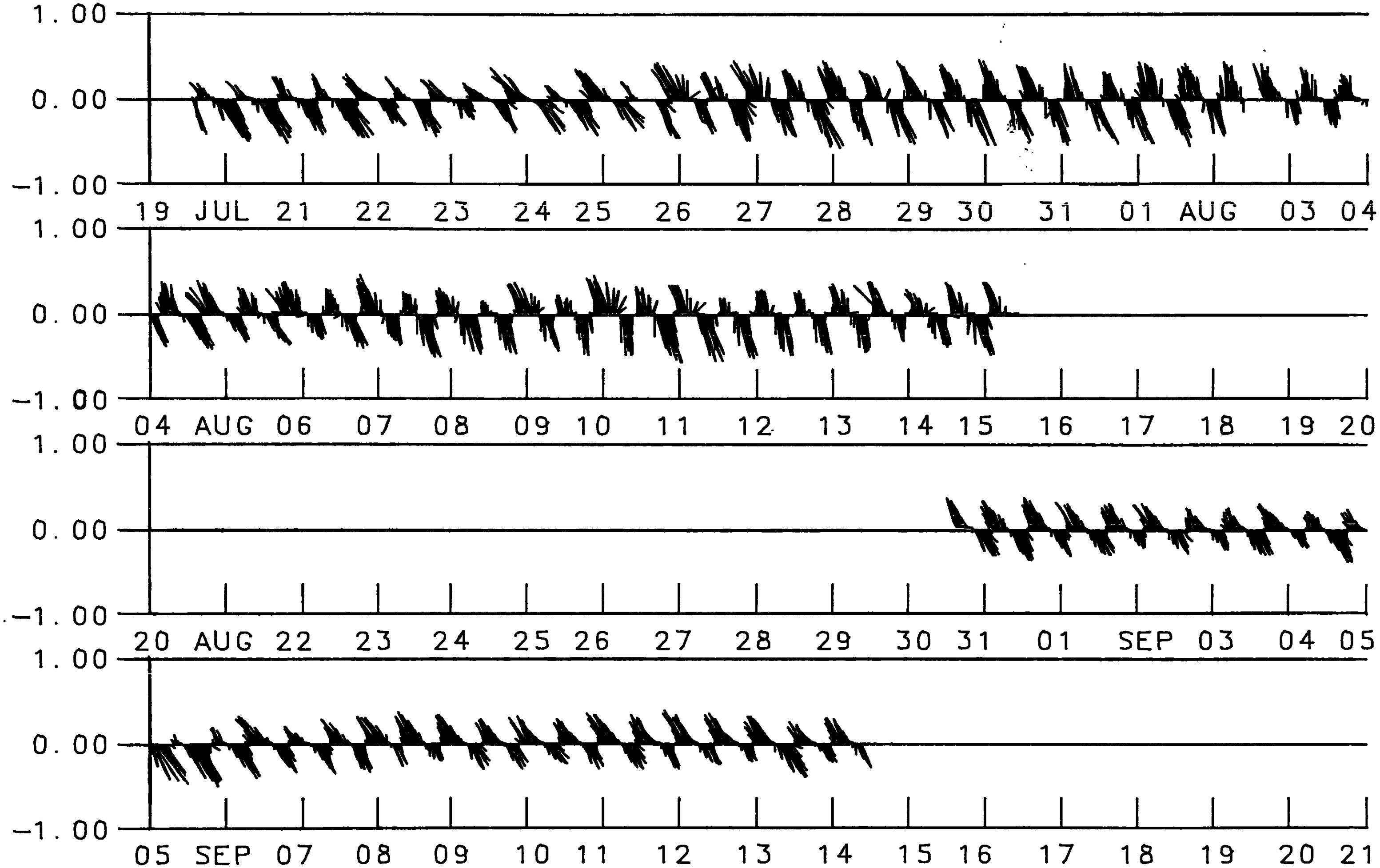
1988 YORK RIVER HYPOXIA SURVEY
YORK 0.0 KM FROM MOUTH DEPTH = 15.7 M
VECTORS ARE IN M/SEC, POSITIVE Y-AXIS TO THE EAST



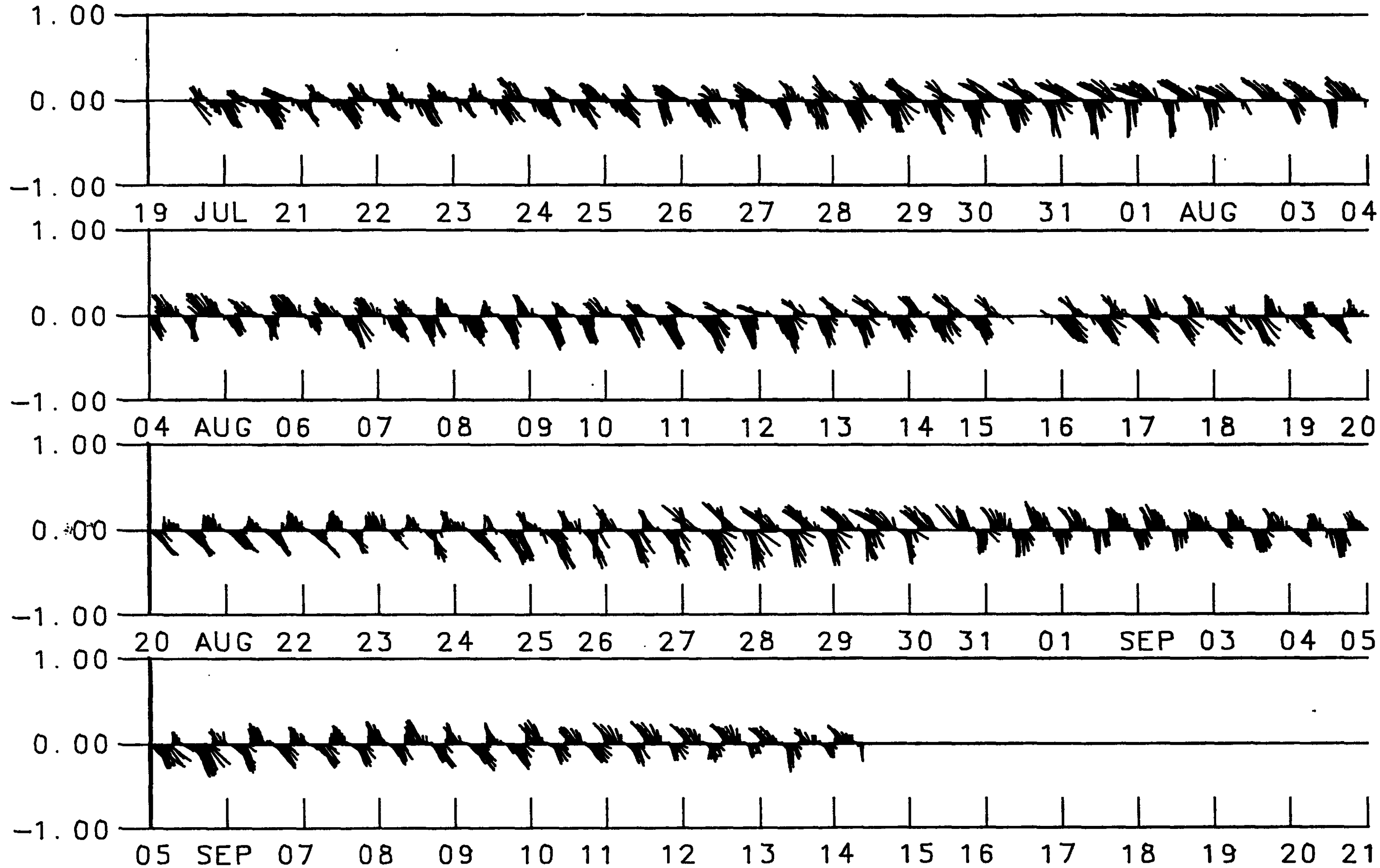
1988 YORK RIVER HYPOXIA SURVEY
YORK 3.9 KM FROM MOUTH DEPTH = 1.5 M
VECTORS ARE IN M/SEC, POSITIVE Y-AXIS TO THE EAST



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



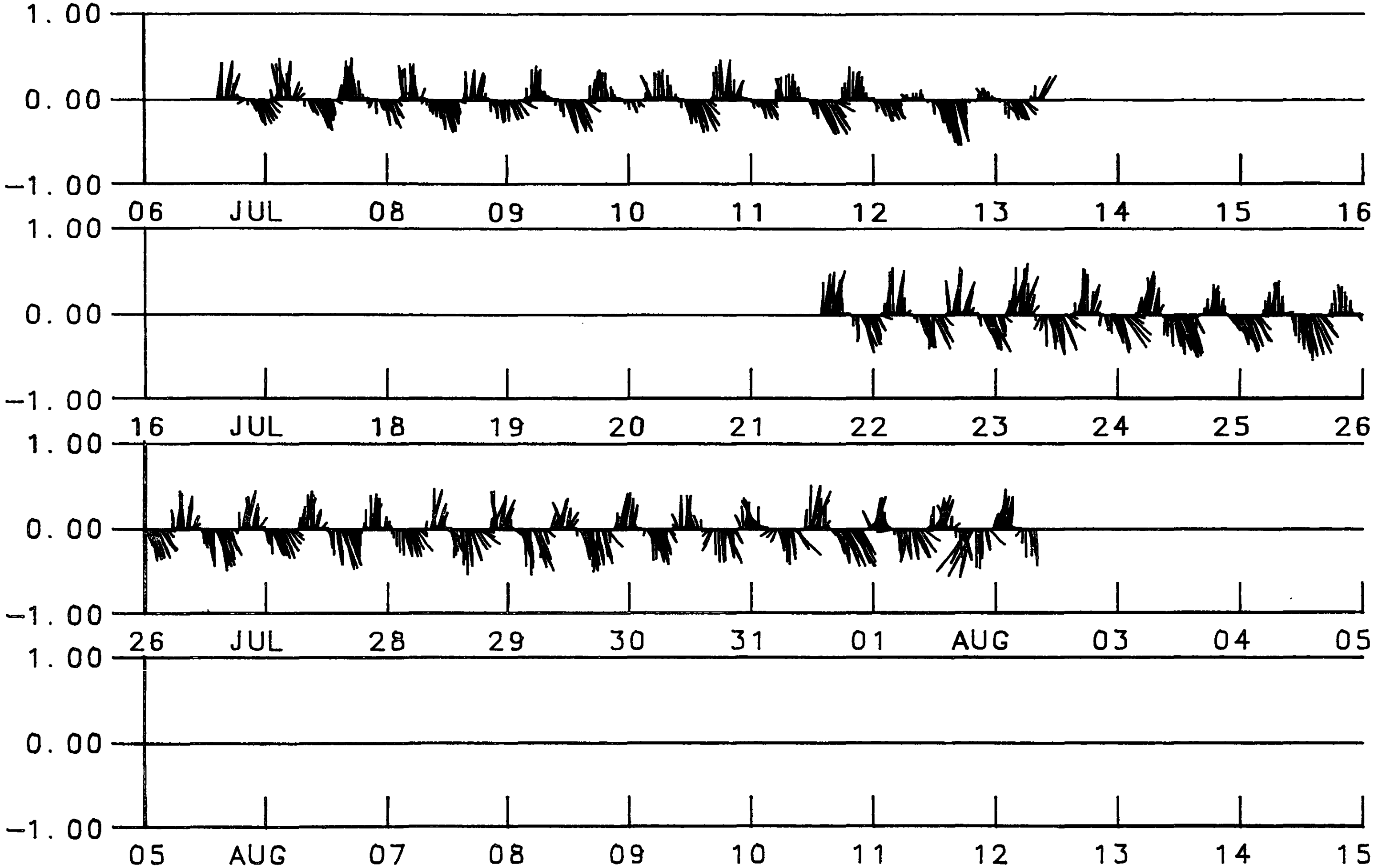
1988 YORK RIVER HYPOXIA SURVEY
YORK 3.9 KM FROM MOUTH DEPTH = 11.5 M
VECTORS ARE IN M/SEC, POSITIVE Y-AXIS TO THE EAST



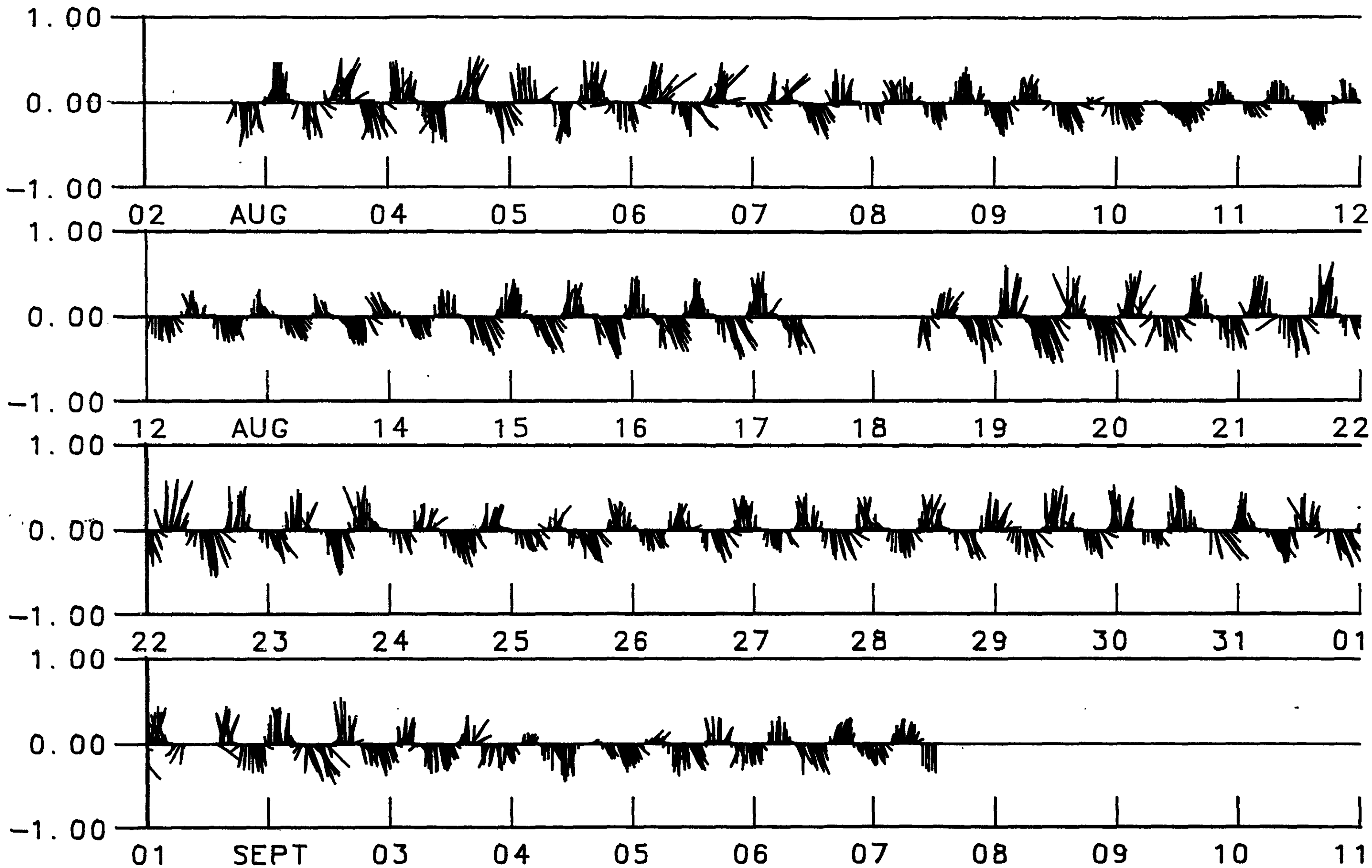
1988 YORK RIVER HYPOXIA SURVEY
YORK 3.9 KM FROM MOUTH DEPTH = 15.1 M
VECTORS ARE IN M/SEC, POSITIVE Y-AXIS TO THE EAST

APPENDIX A2

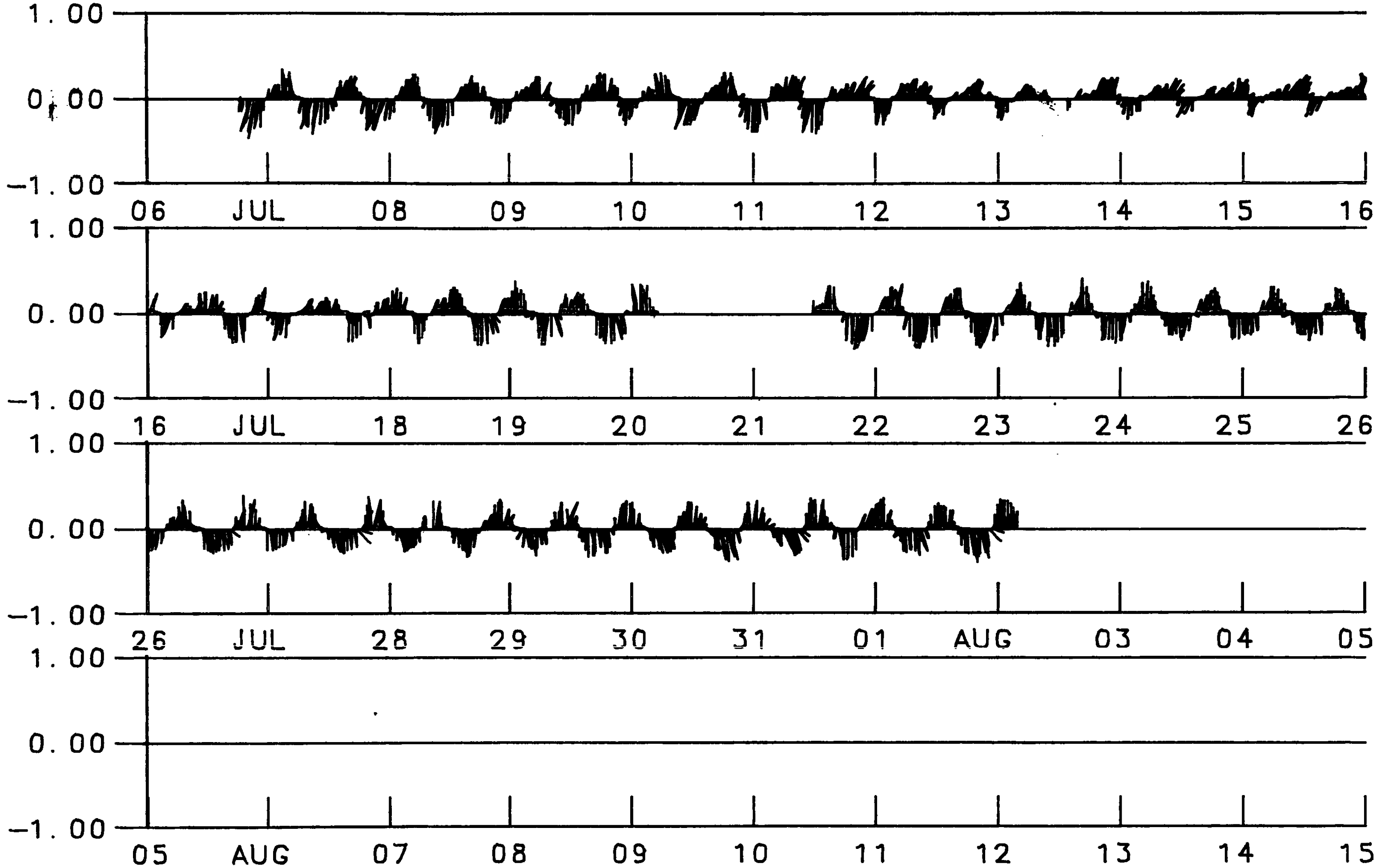
STICKPLOTS OF CURRENTS (1989)



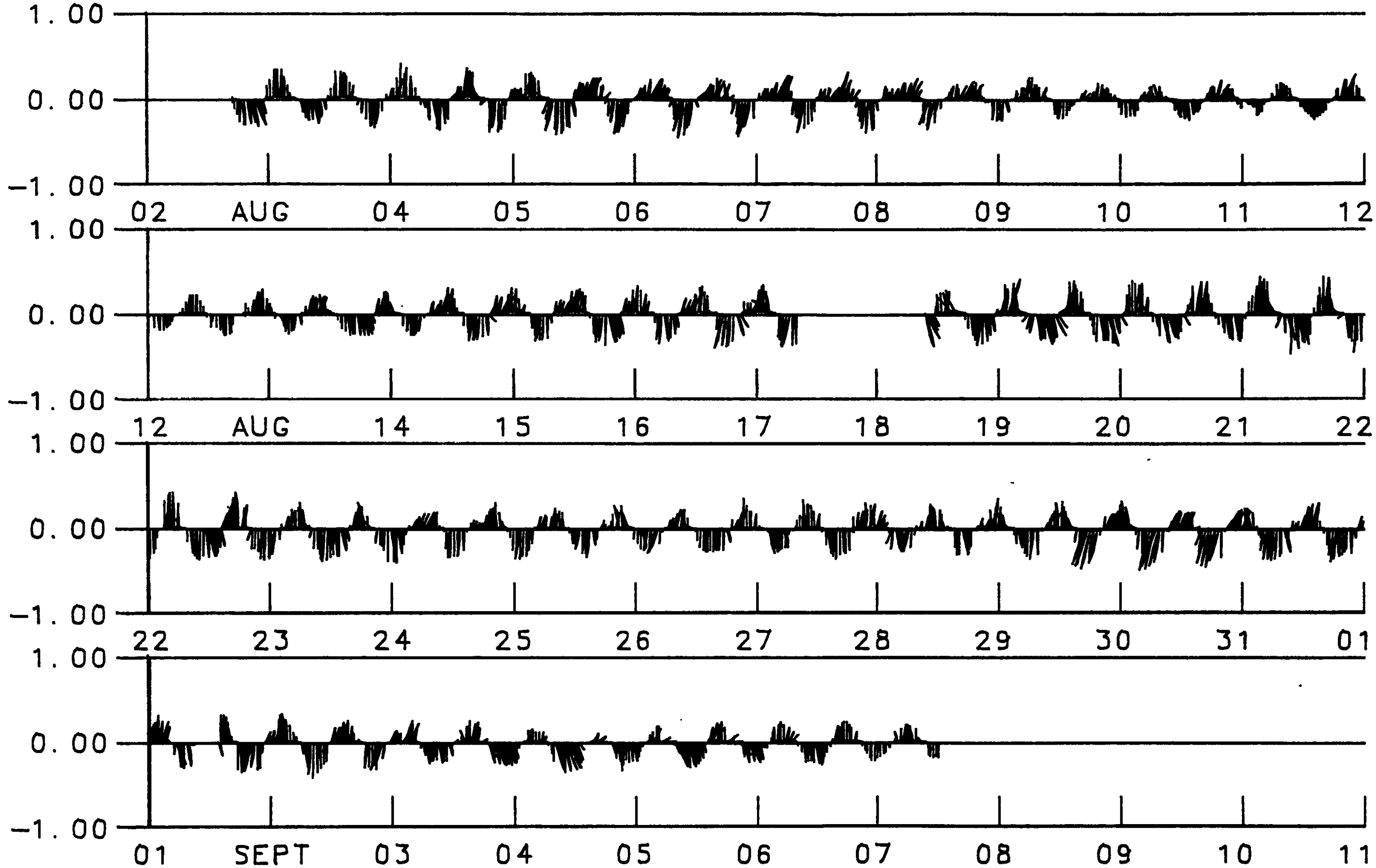
1989 YORK RIVER HYPOXIA SURVEY
STATION = N2 DEPTH = 1 M
VECTORS ARE IN M/SEC, POSITIVE Y-AXIS TO THE EAST



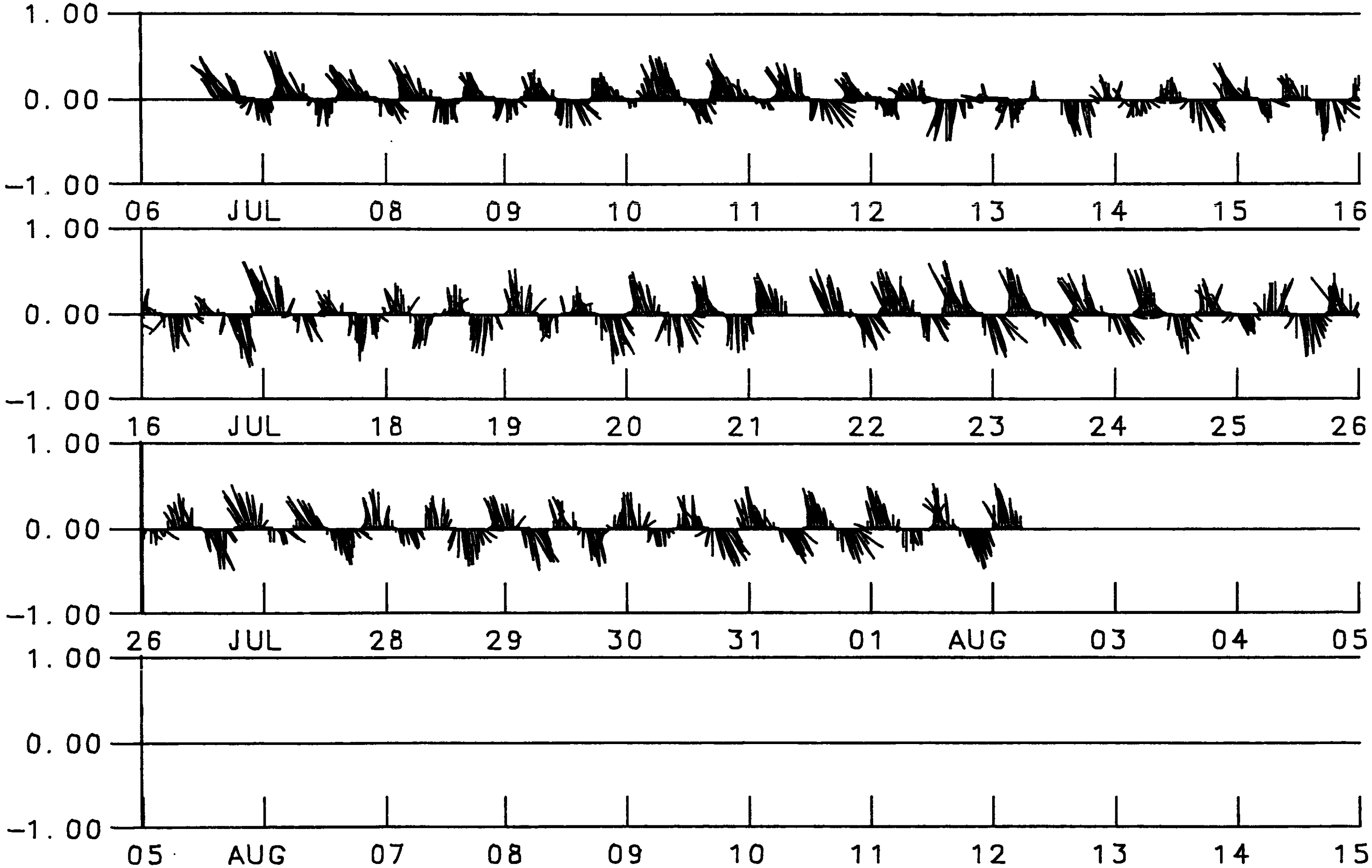
1989 YORK RIVER HYPOXIA SURVEY
STATION = N2 DEPTH = 1 M
VECTORS ARE IN M/SEC, POSITIVE Y-AXIS TO THE EAST



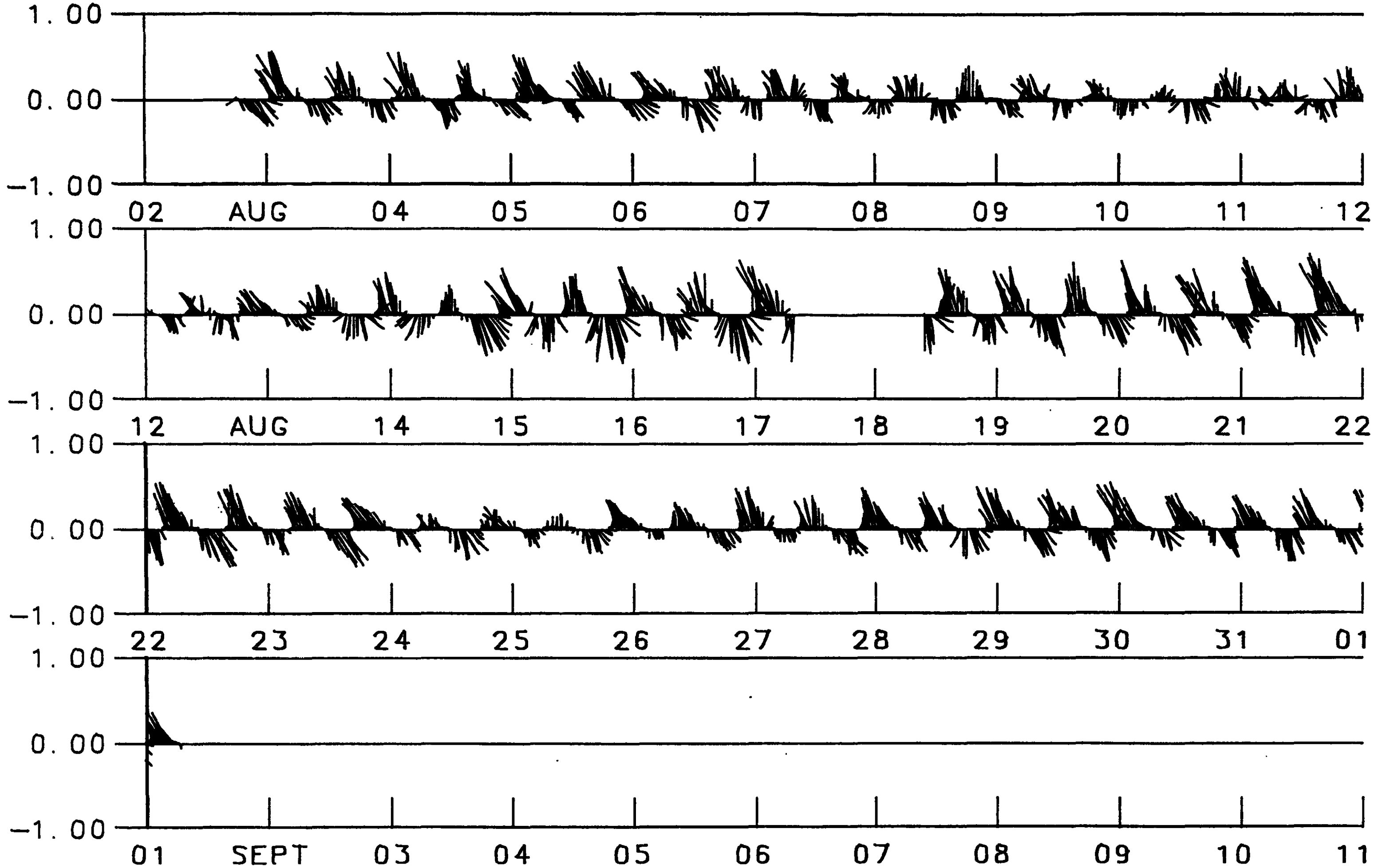
1989 YORK RIVER HYPOXIA SURVEY
STATION = N2 DEPTH = 7 M
VECTORS ARE IN M/SEC, POSITIVE Y-AXIS TO THE EAST



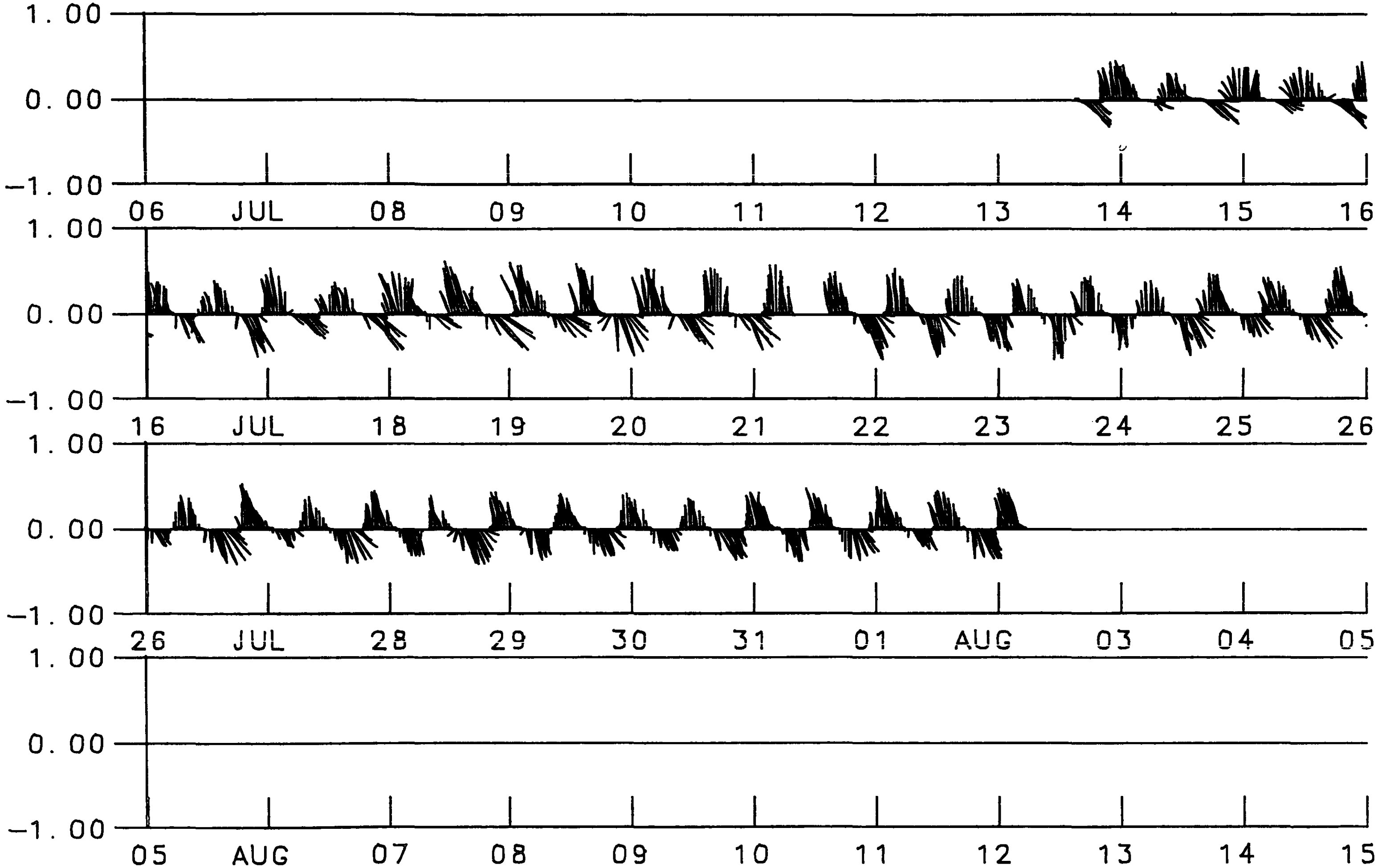
1989 YORK RIVER HYPOXIA SURVEY
STATION = N2 DEPTH = 7 M
VECTORS ARE IN M/SEC, POSITIVE Y-AXIS TO THE EAST



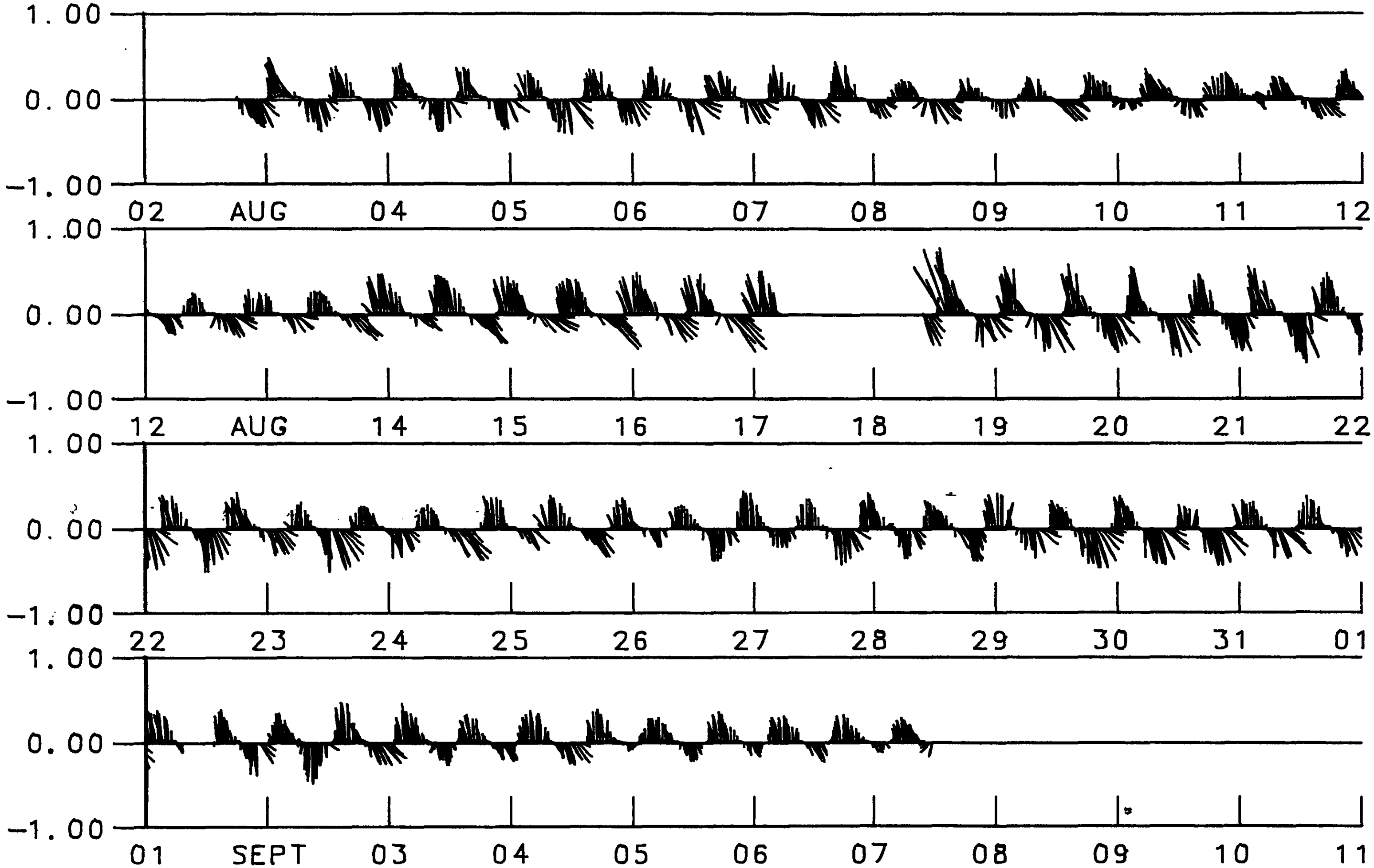
1989 YORK RIVER HYPOXIA SURVEY
STATION = RB DEPTH = 1 M
VECTORS ARE IN M/SEC, POSITIVE Y-AXIS TO THE EAST



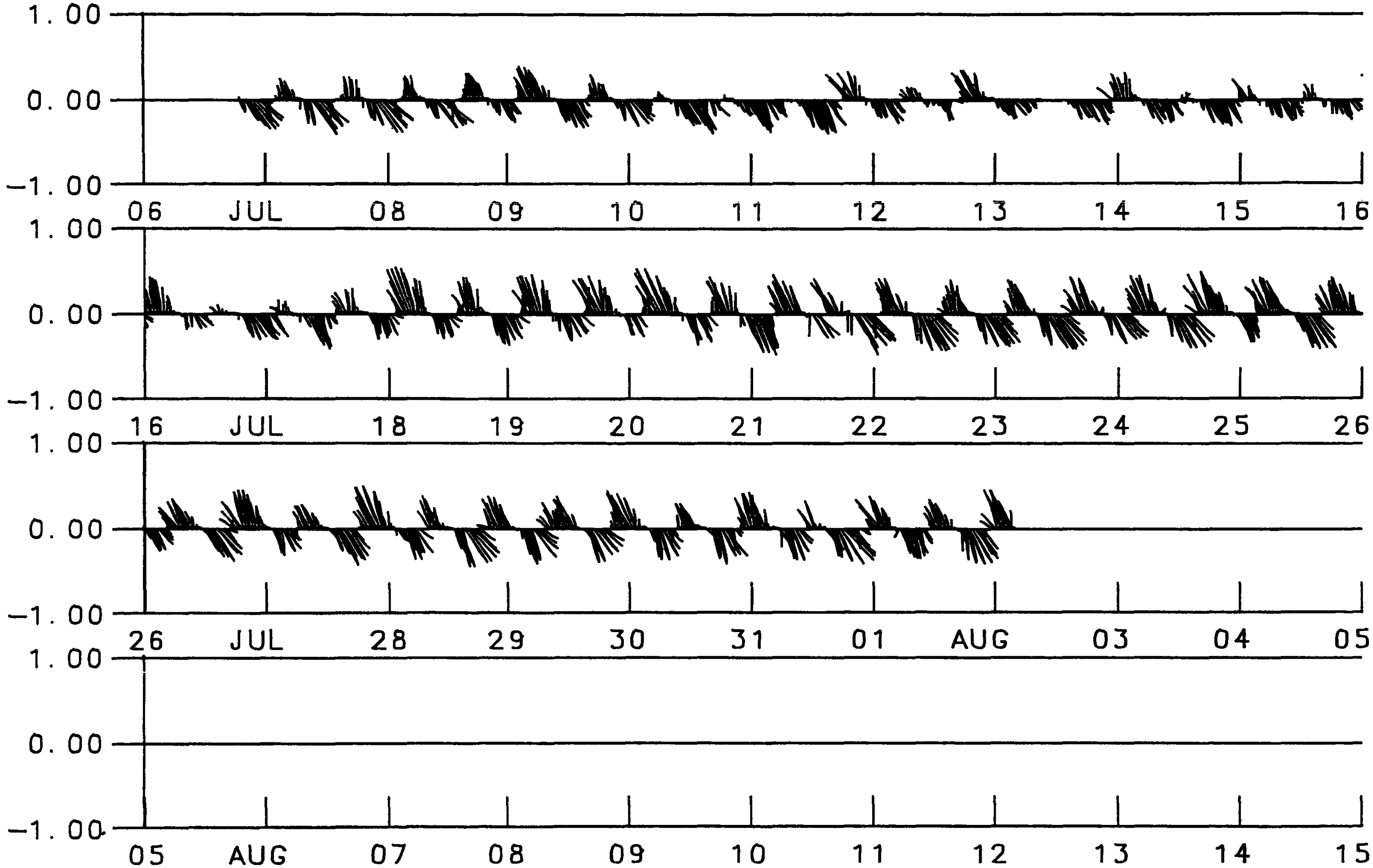
1989 YORK RIVER HYPOXIA SURVEY
STATION = RB DEPTH = 1 M
VECTORS ARE IN M/SEC, POSITIVE Y-AXIS TO THE EAST



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
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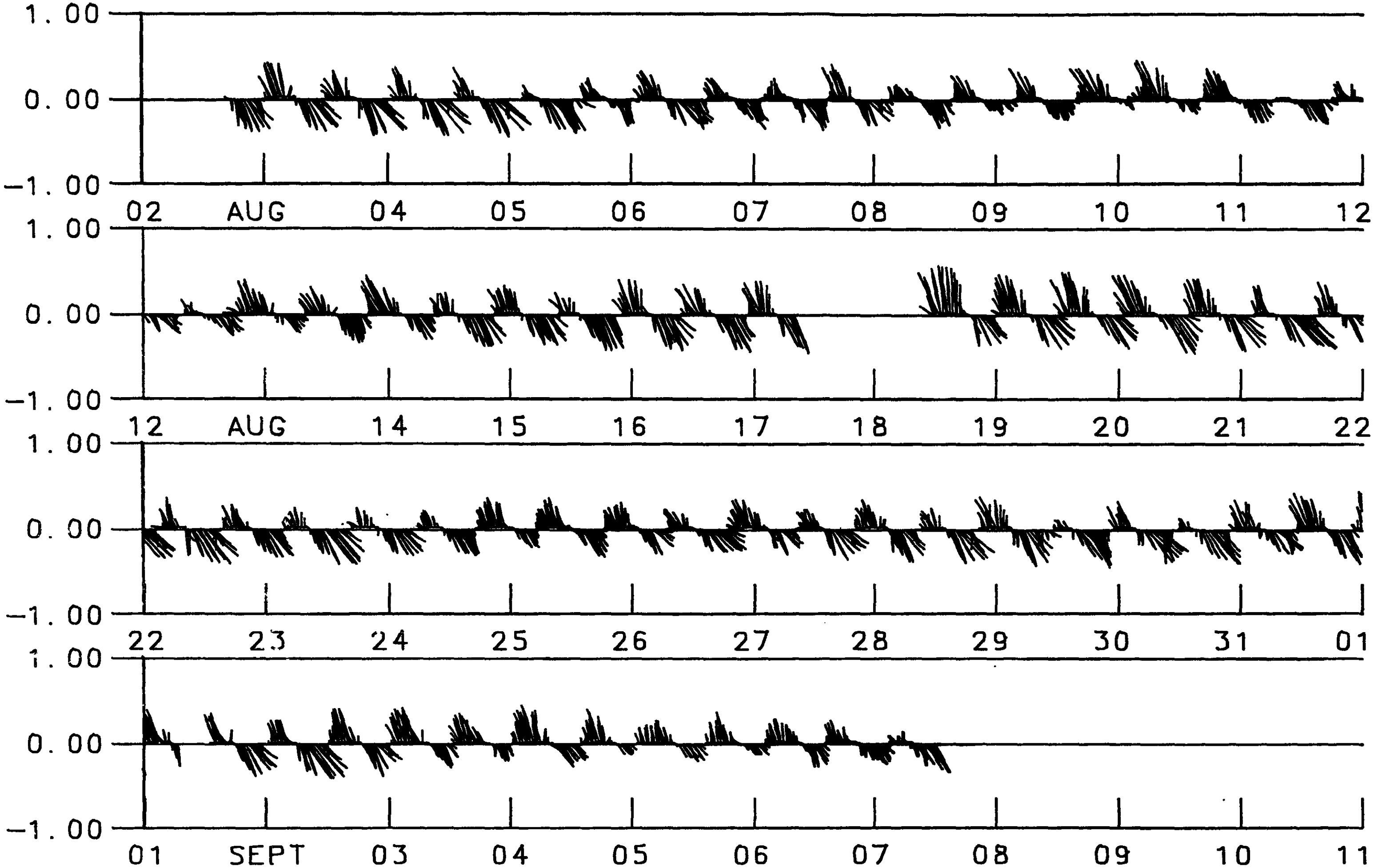
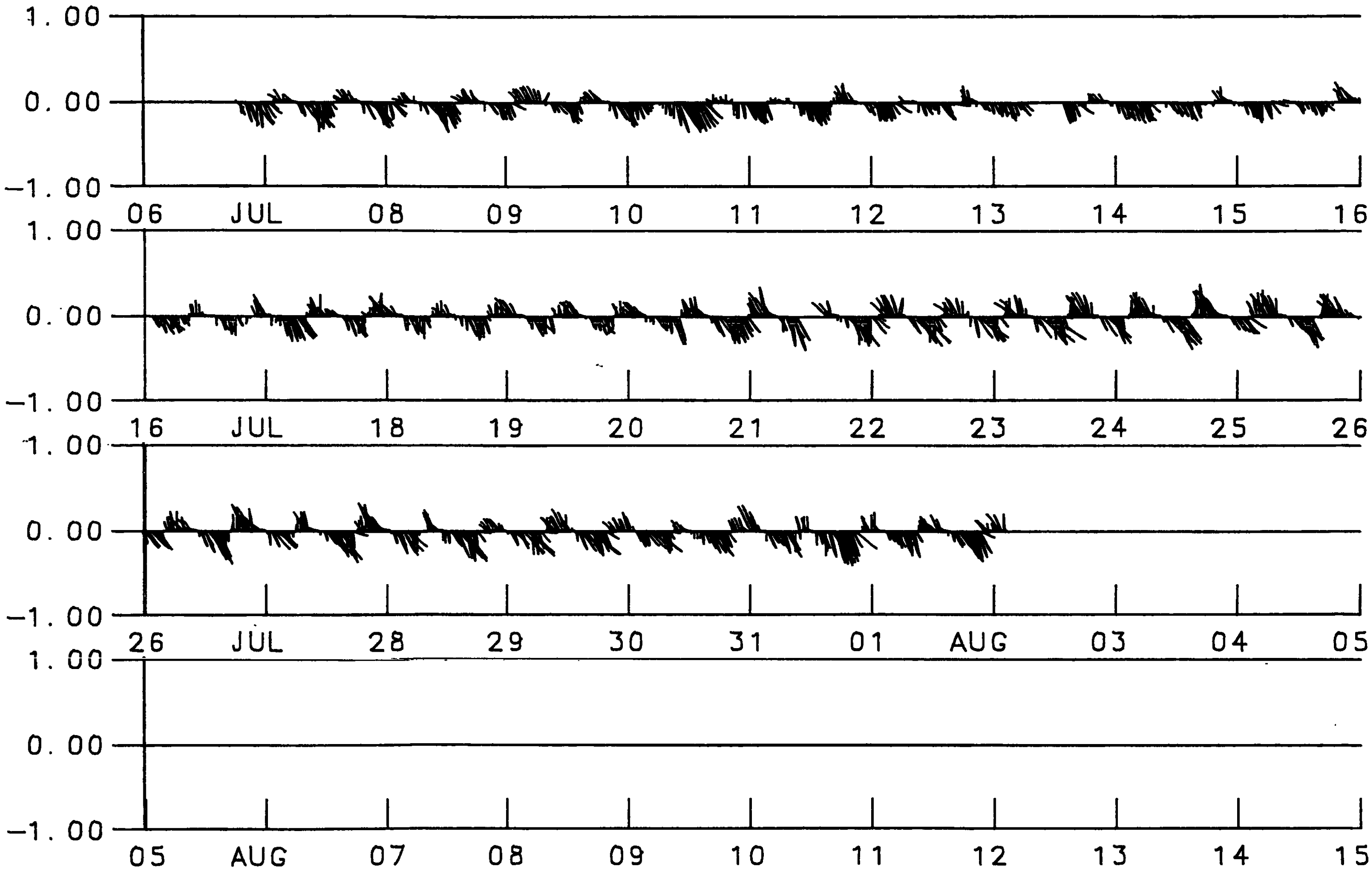
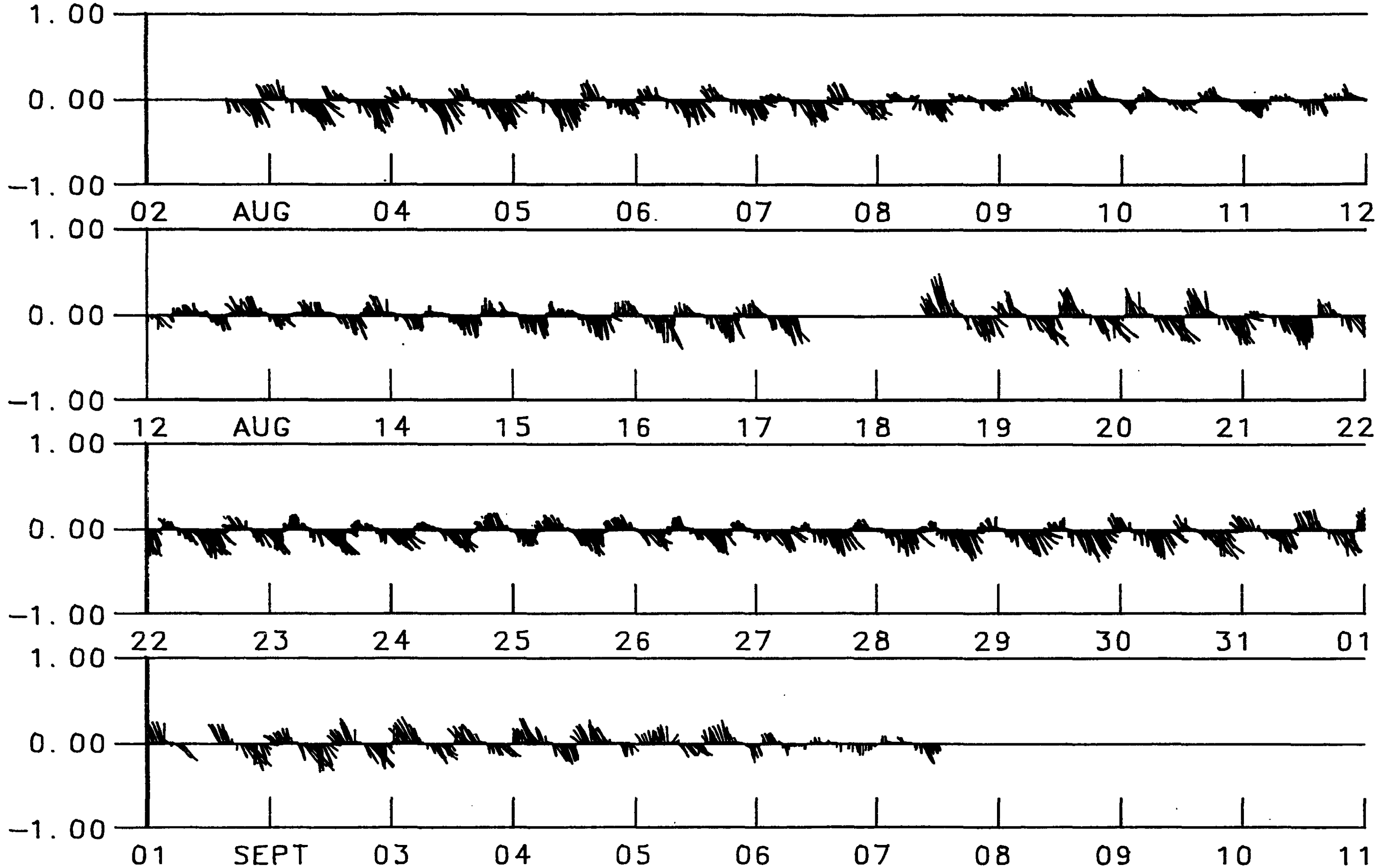


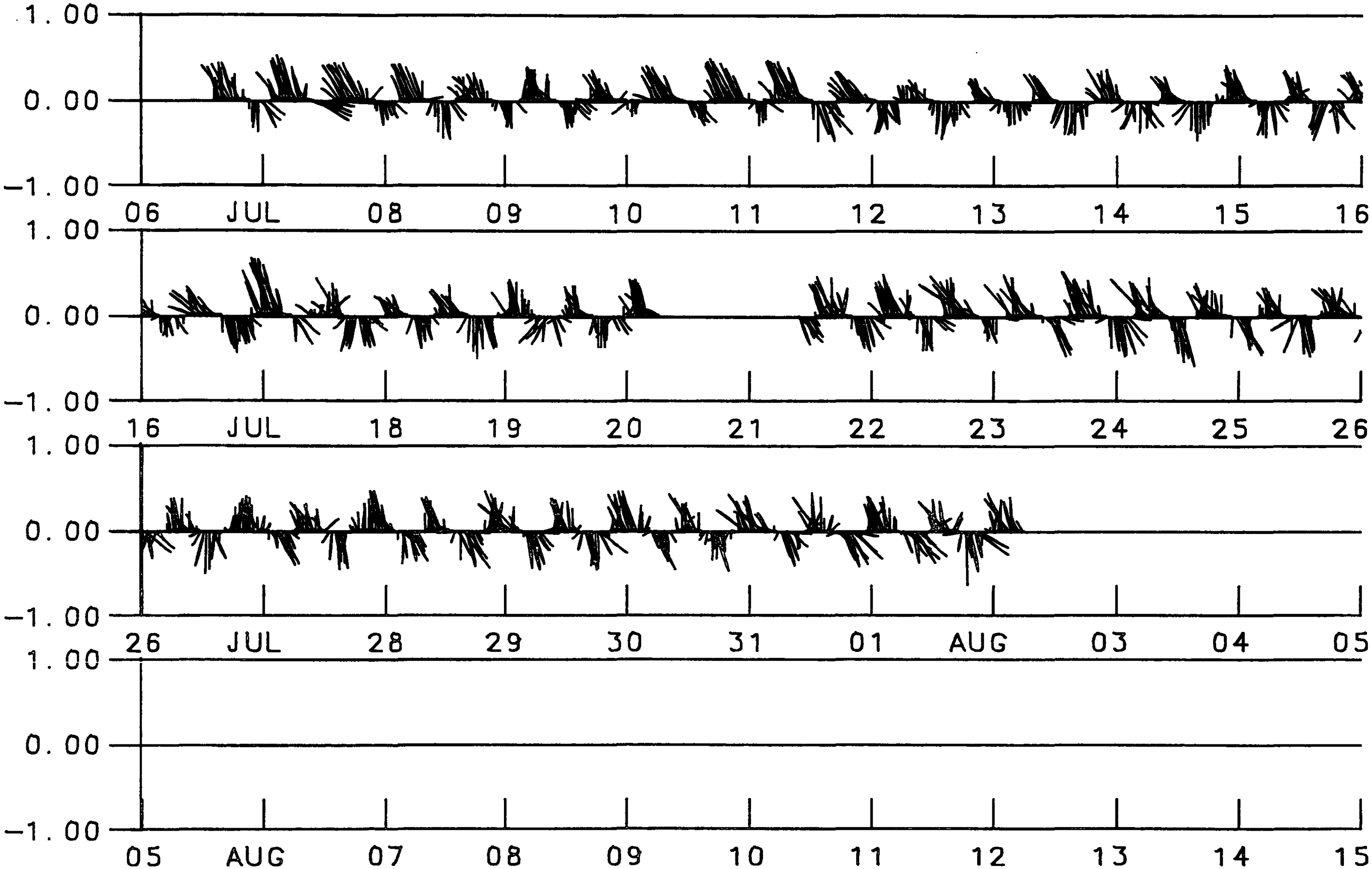
1989 YORK RIVER HYPOXIA SURVEY
STATION = RB DEPTH = 11 M
VECTORS ARE IN M/SEC, POSITIVE Y-AXIS TO THE EAST



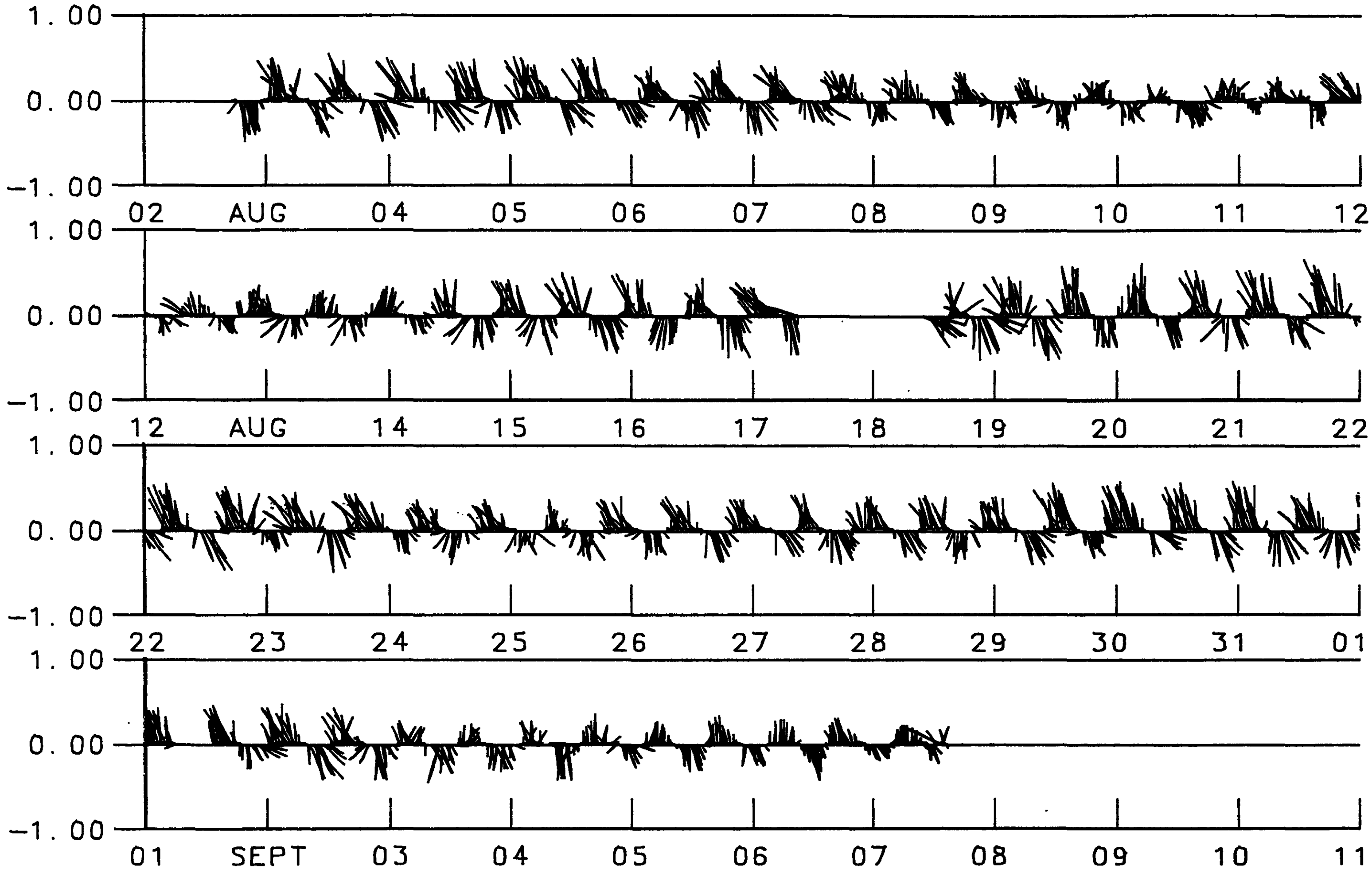
1989 YORK RIVER HYPOXIA SURVEY
STATION = RB DEPTH = 16 M
VECTORS ARE IN M/SEC, POSITIVE Y-AXIS TO THE EAST



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



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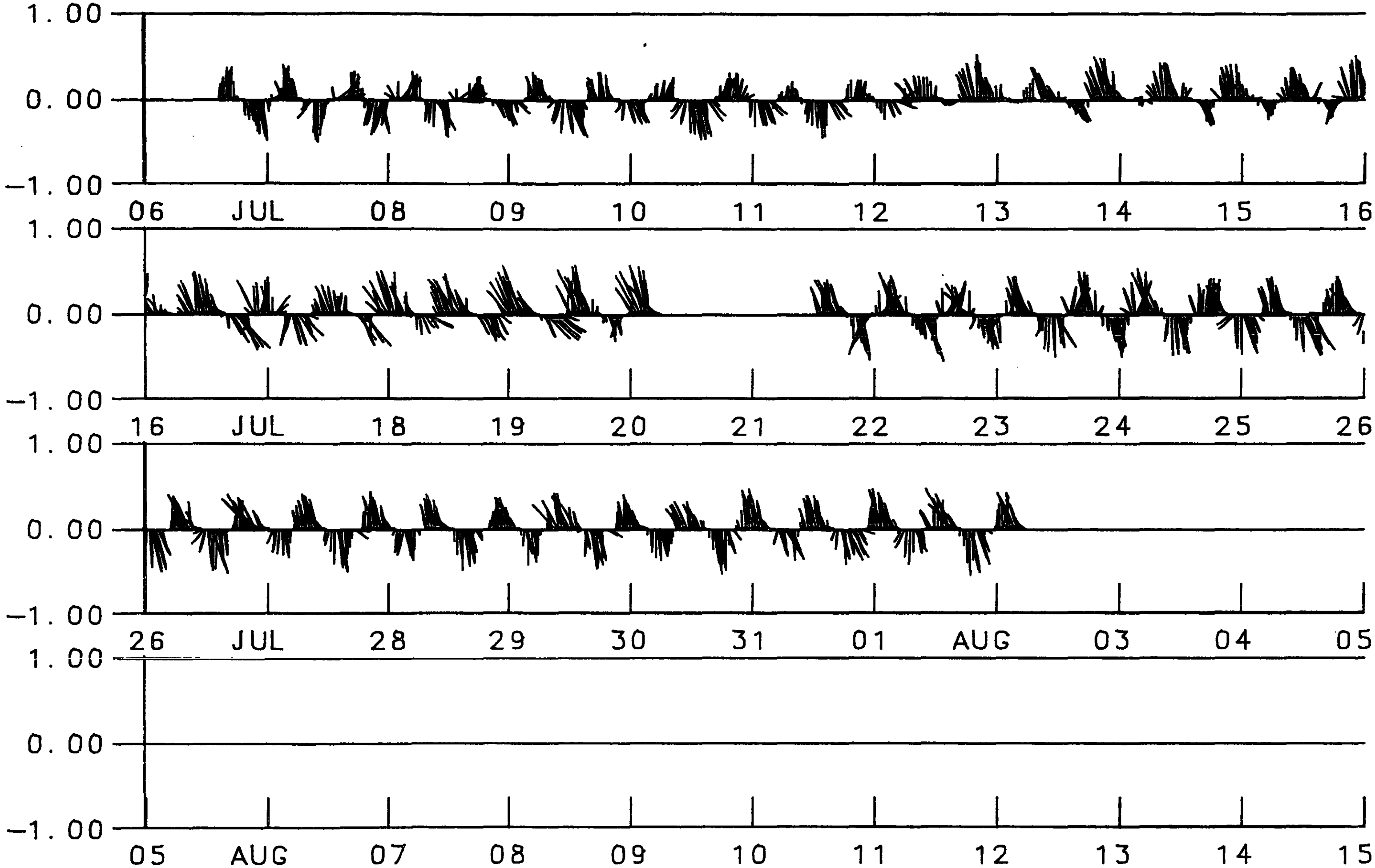
VECTORS ARE IN M/SEC, POSITIVE Y-AXIS TO THE EAST



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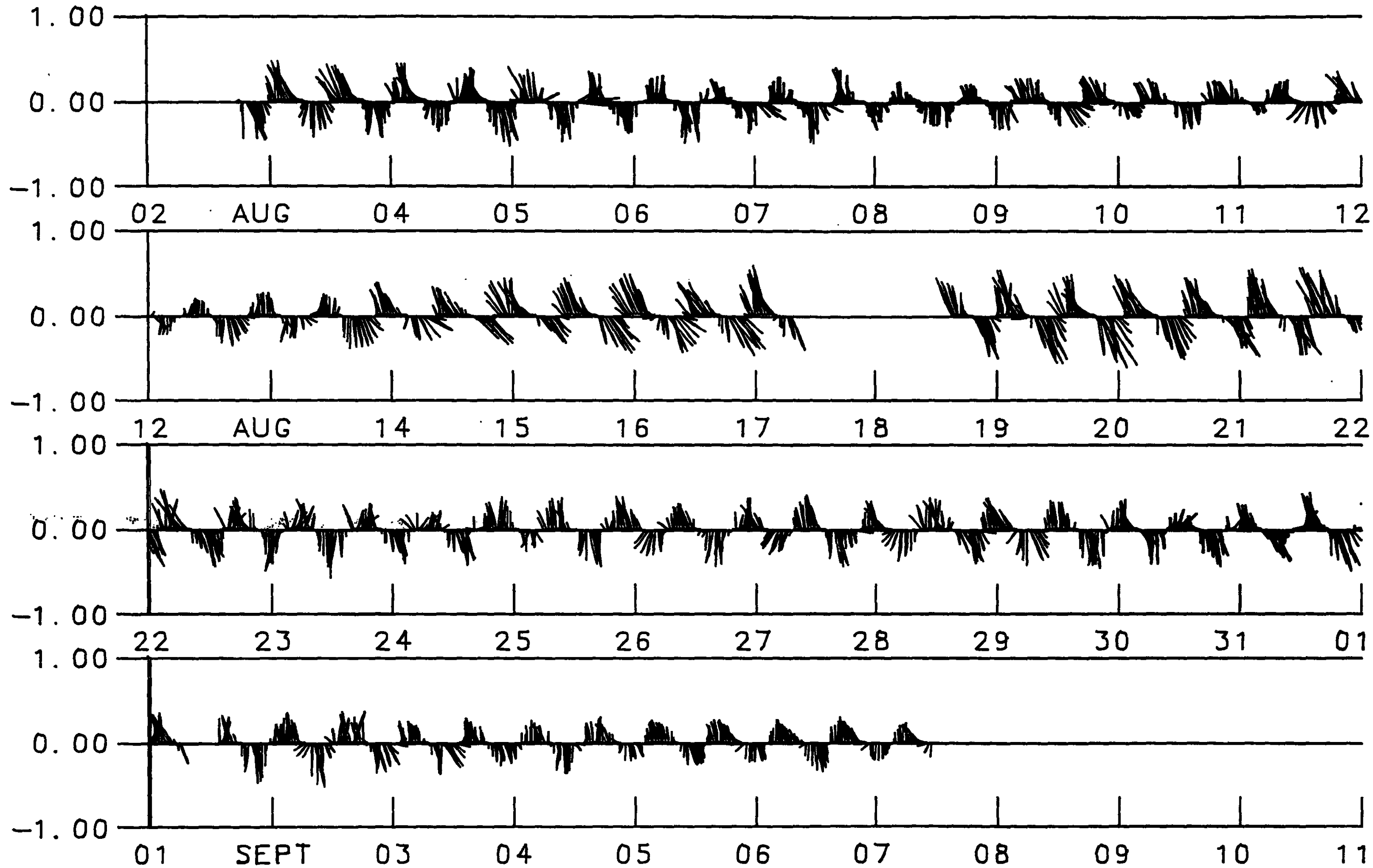
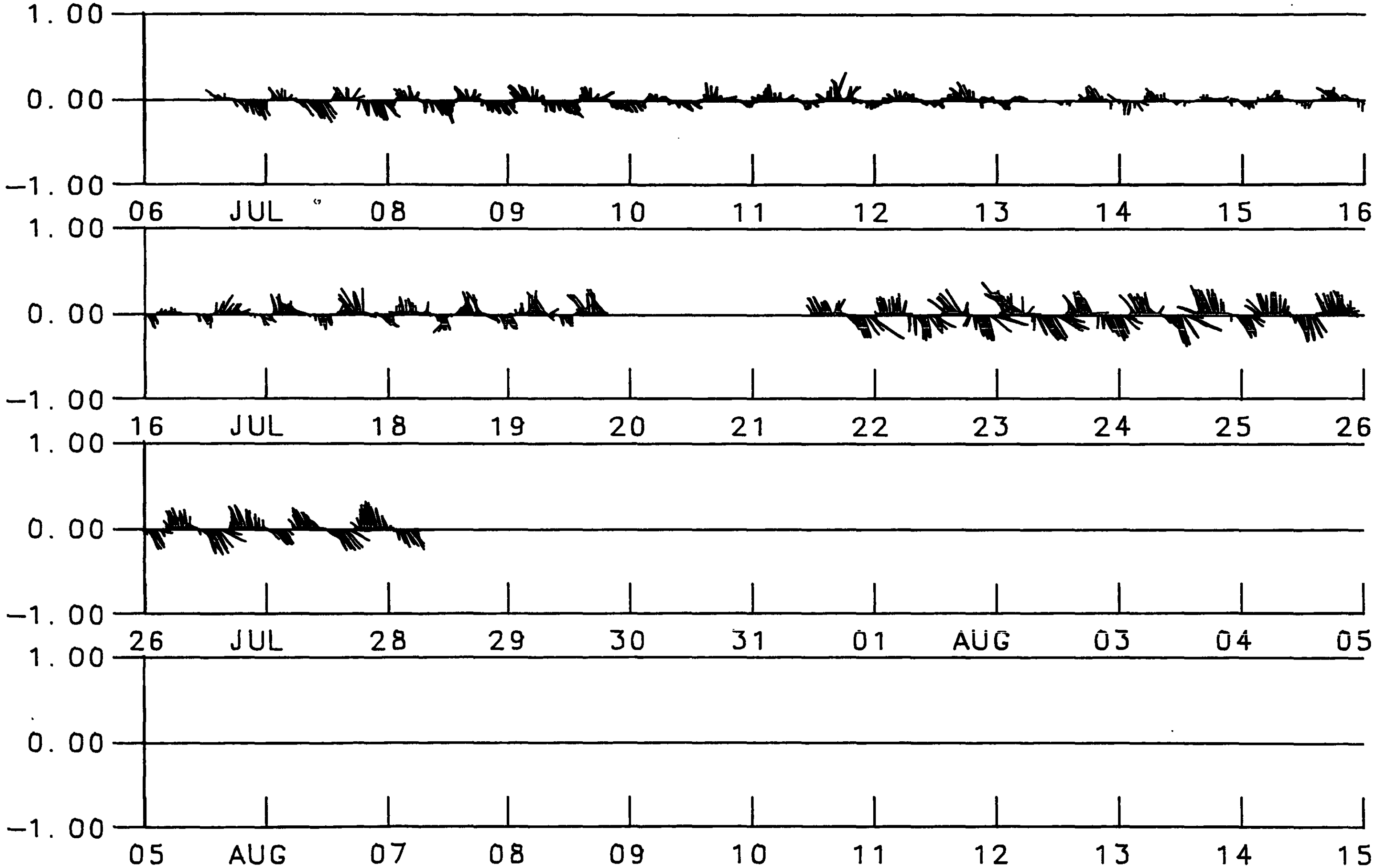
VECTORS ARE IN M/SEC, POSITIVE Y-AXIS TO THE EAST



1989 YORK RIVER HYPOXIA SURVEY
STATION = TUE DEPTH = 6 M
VECTORS ARE IN M/SEC, POSITIVE Y-AXIS TO THE EAST



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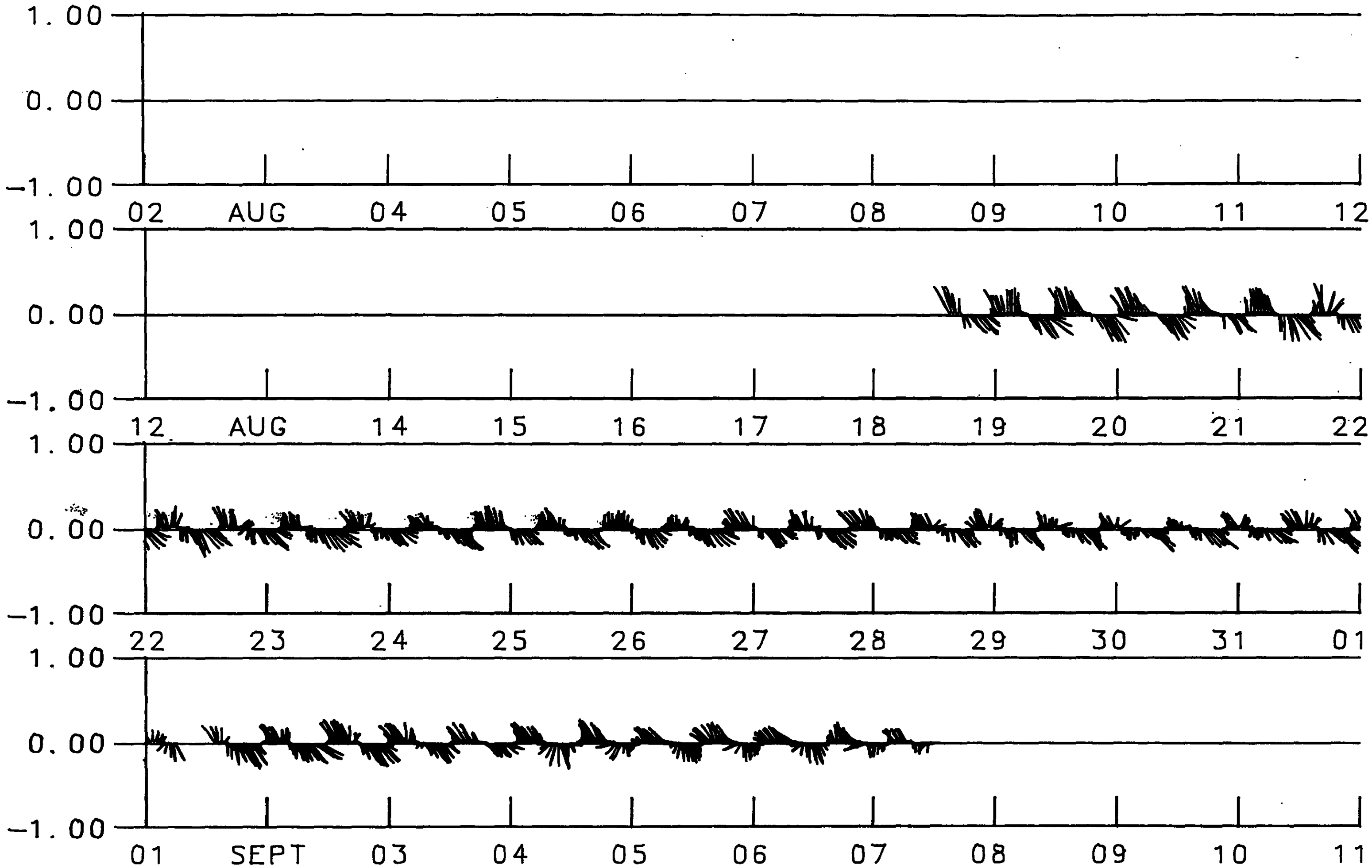
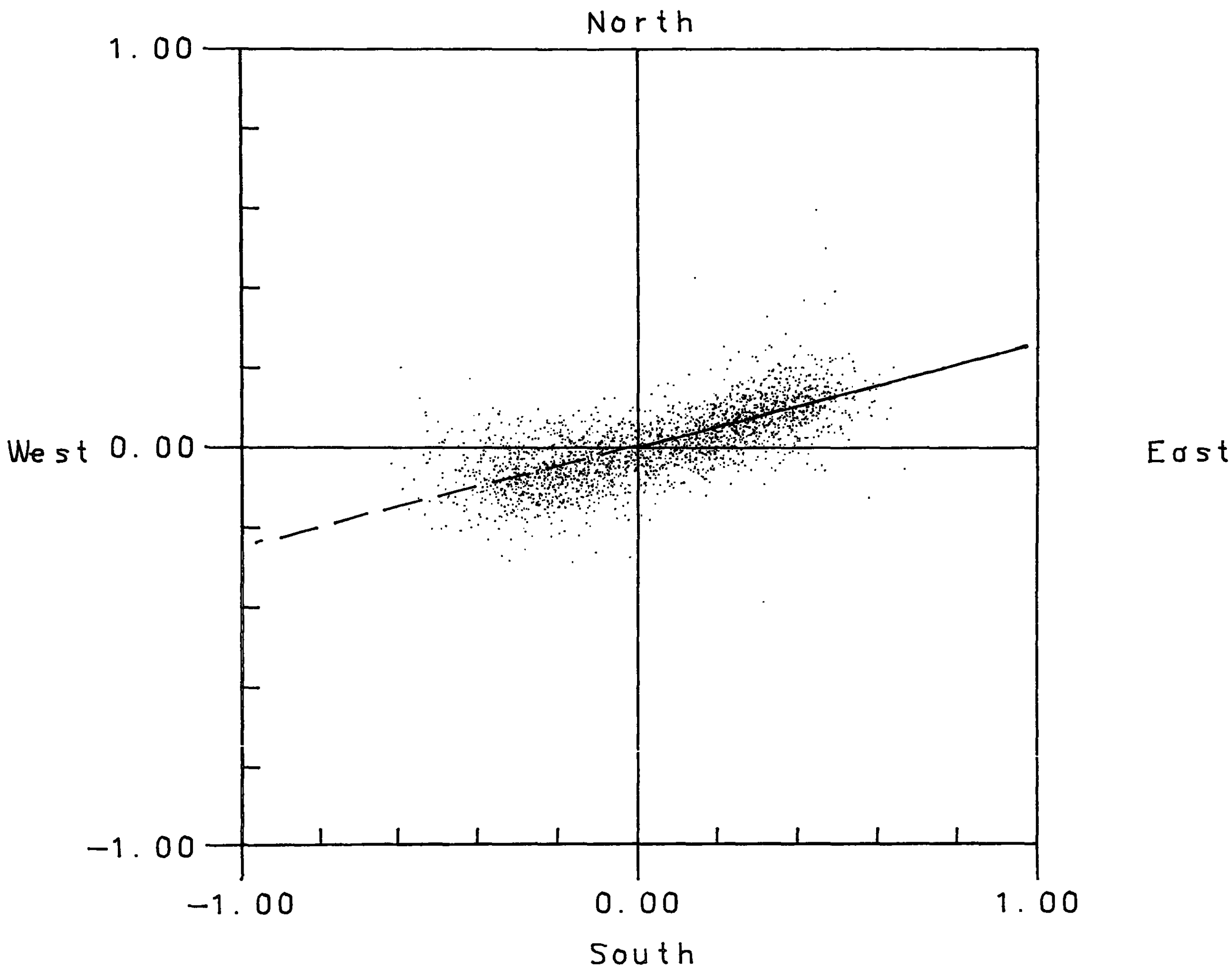
VECTORS ARE IN M/SEC, POSITIVE Y-AXIS TO THE EAST



1989 YORK RIVER HYPOXIA SURVEY
STATION = TUE DEPTH = 10 M
VECTORS ARE IN M/SEC, POSITIVE Y-AXIS TO THE EAST

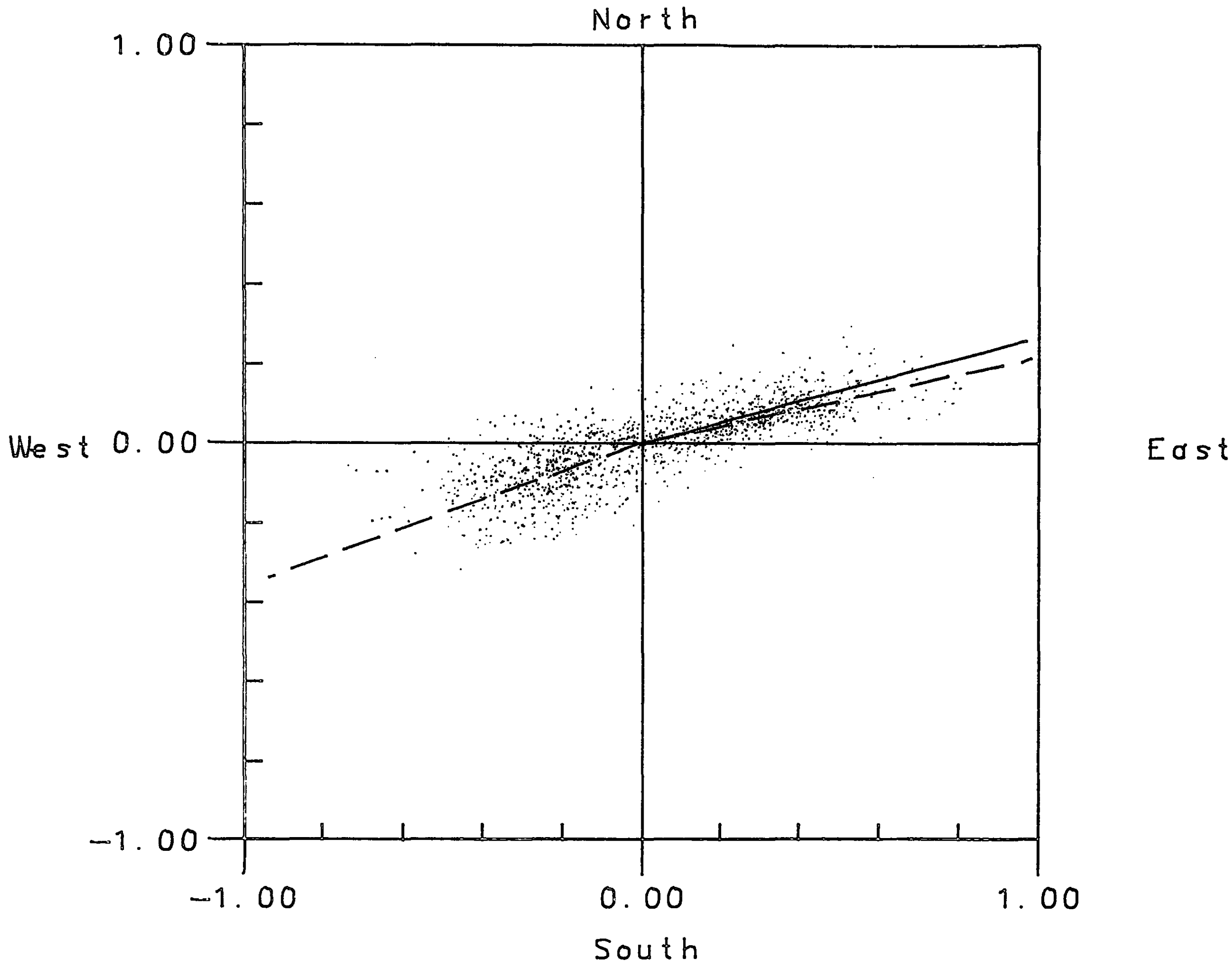
APPENDIX B1

SCATTERPLOTS OF CURRENTS (1988)



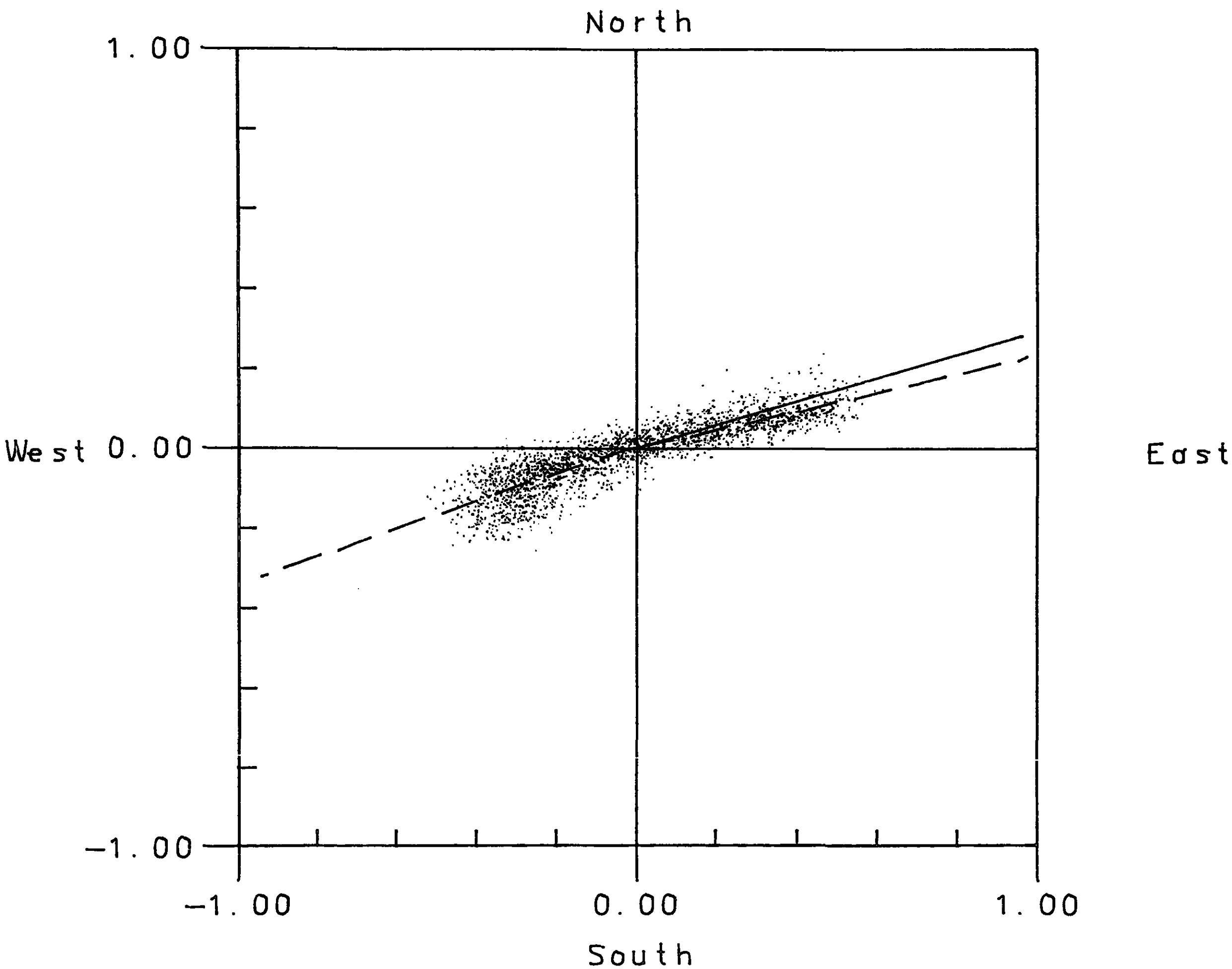
1988 YORK RIVER HYPOXIA SURVEY
YORK 0.0 KM FROM MOUTH DEPTH = 1.5 M
19 JUL, 1988 - 14 SEP, 1988 2650 OBSERVATIONS

PRINCIPAL AXIS	EBB	FLOOD
75.	75.	256.



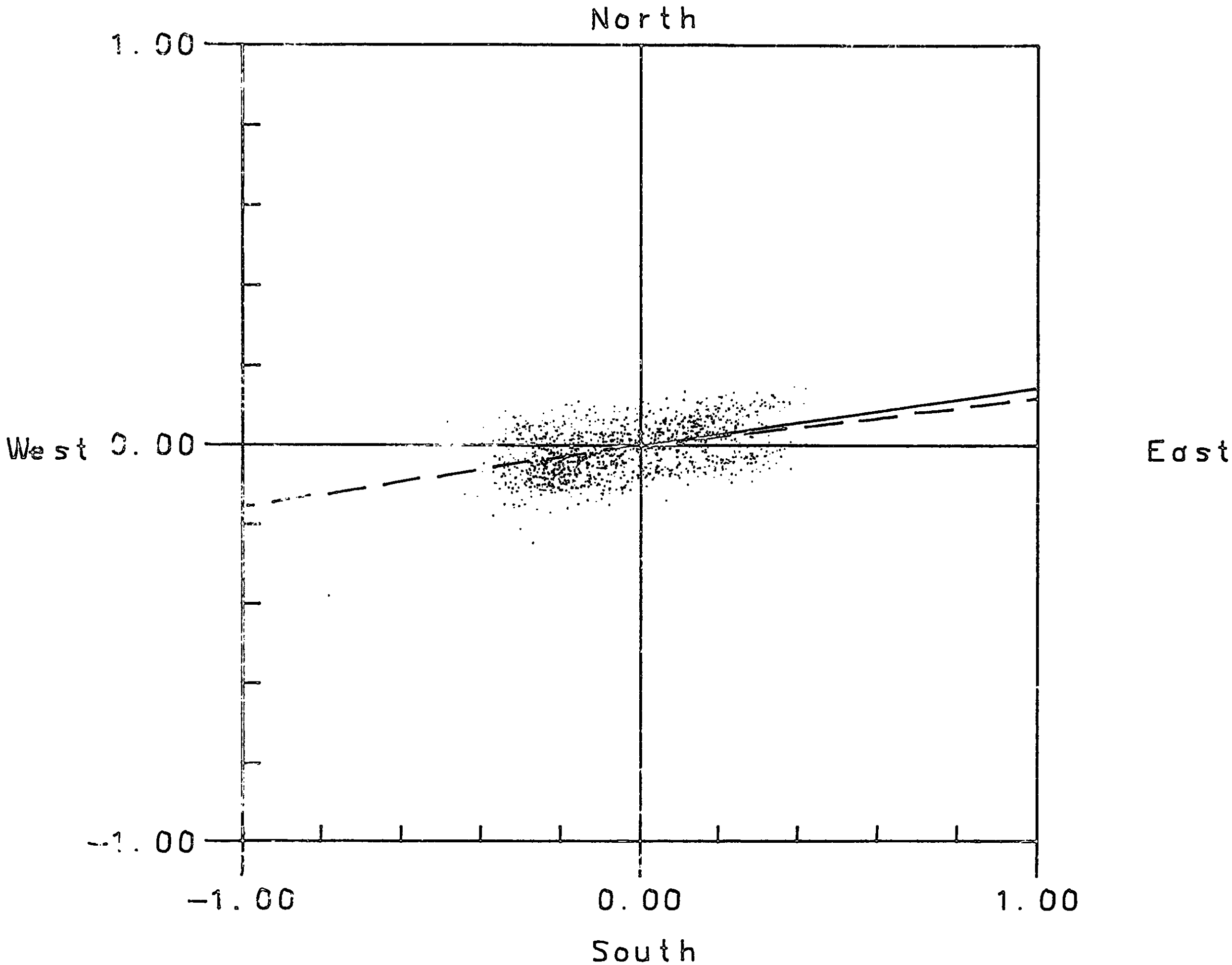
1988 YORK RIVER HYPOXIA SURVEY
YORK 0.0 KM FROM MOUTH DEPTH = 6.5 M
19 JUL, 1988 - 14 SEP, 1988 2254 OBSERVATIONS

PRINCIPAL AXIS	EBB	FLOOD
75.	77.	250.



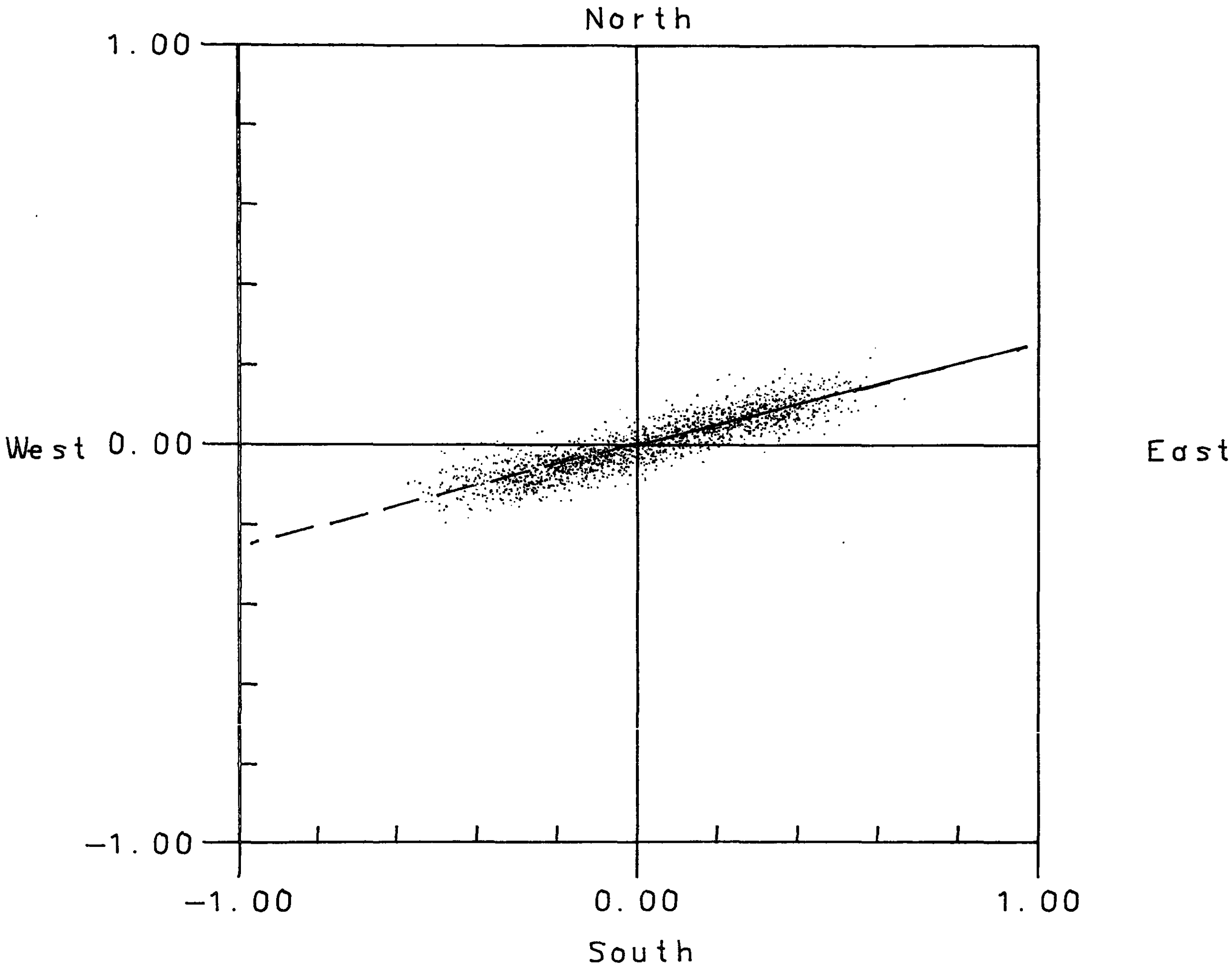
1988 YORK RIVER HYPOXIA SURVEY
YORK 0.0 KM FROM MOUTH DEPTH = 11.5 M
19 JUL. 1988 – 14 SEP. 1988 2665 OBSERVATIONS

PRINCIPAL AXIS	EBB	FLOOD
74.	77.	251.



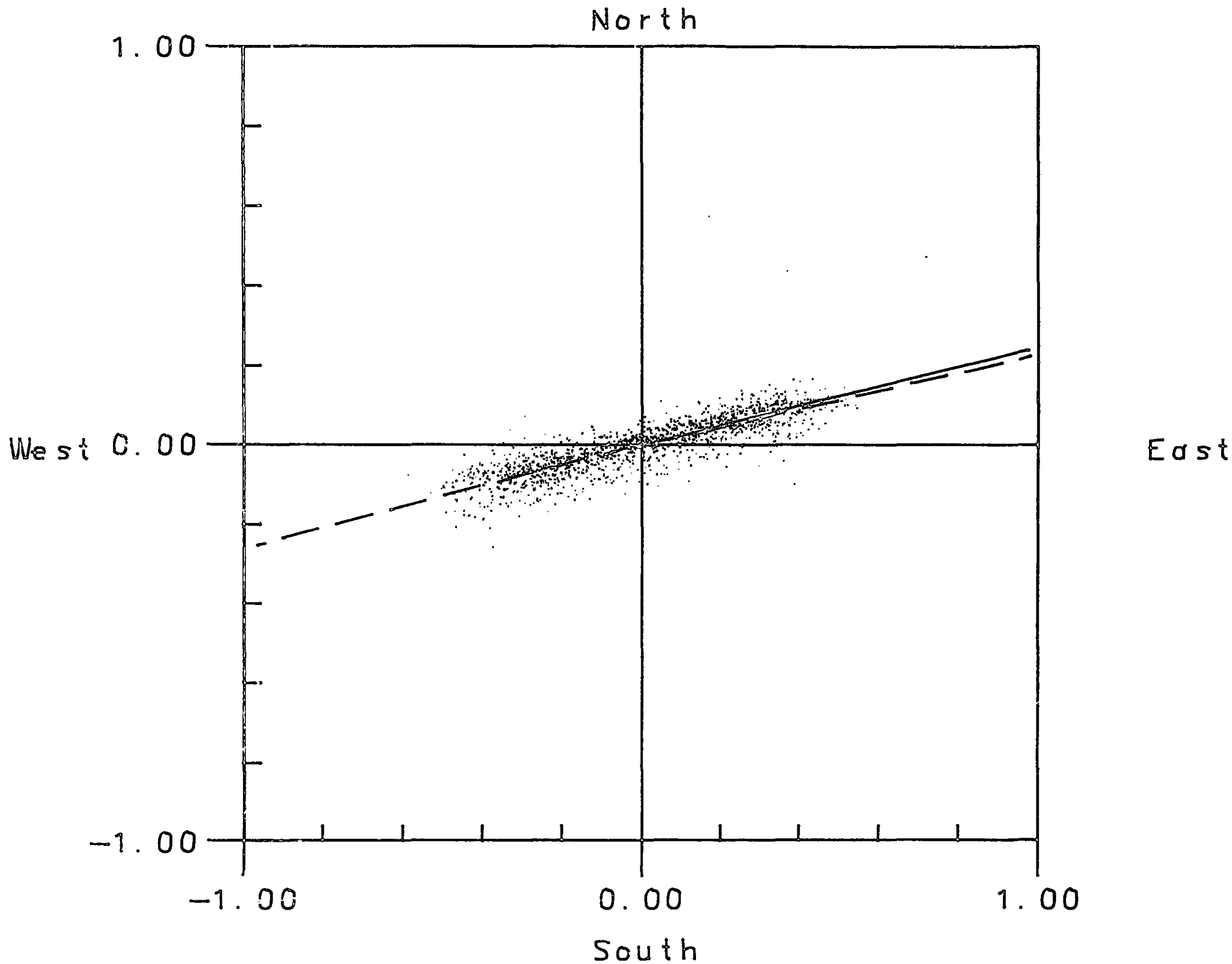
1988 YORK RIVER HYPOXIA SURVEY
YORK 0.0 KM FROM MOUTH DEPTH = 15.7 M
19 JUL, 1988 - 14 SEP, 1988 2574 OBSERVATIONS

PRINCIPAL AXIS	EBB	FLOOD
82.	83.	261.



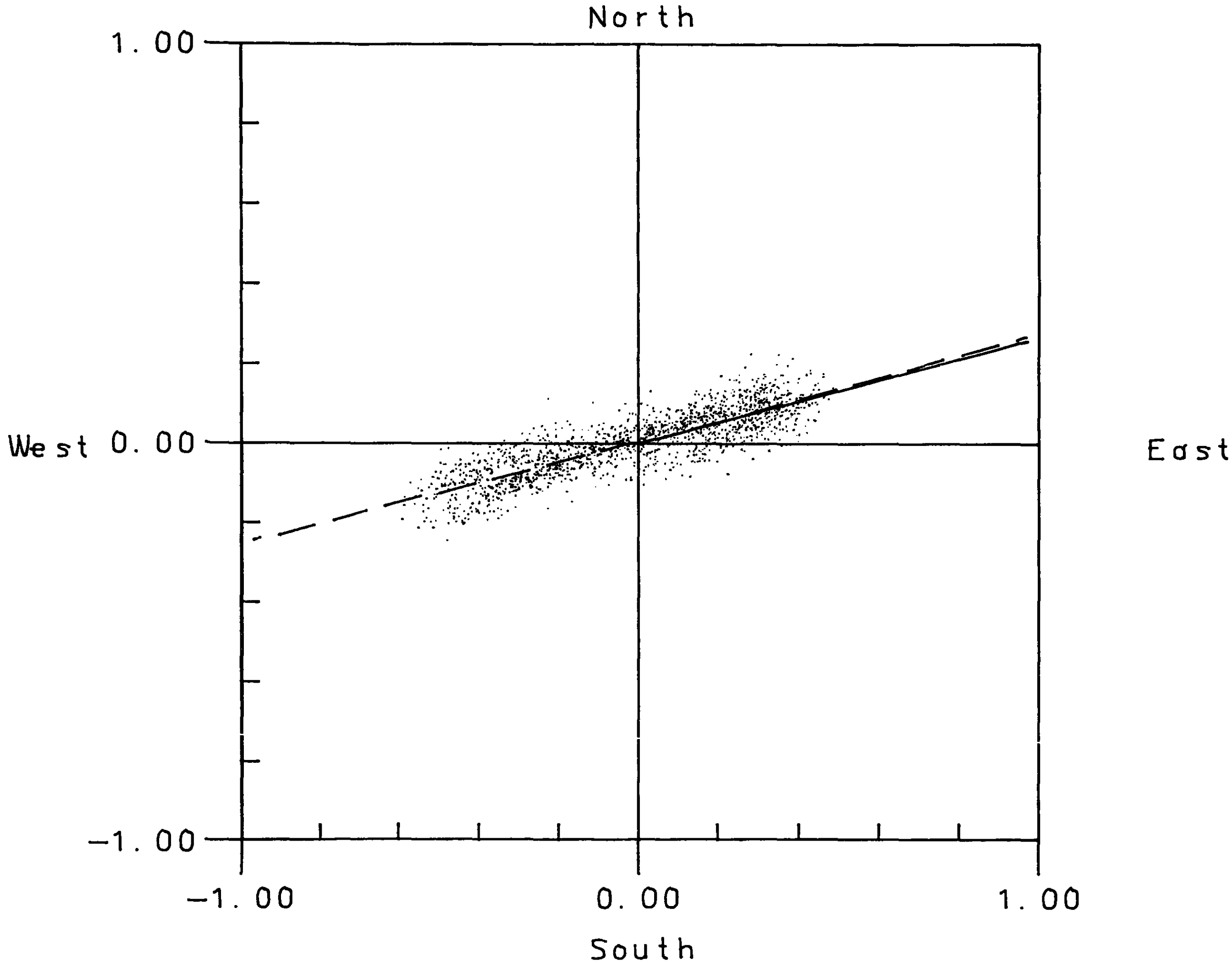
1988 YORK RIVER HYPOXIA SURVEY
YORK 3.9 KM FROM MOUTH DEPTH = 1.5 M
19 JUL. 1988 – 14 SEP. 1988 2669 OBSERVATIONS

PRINCIPAL AXIS	EBB	FLOOD
76.	76.	255.



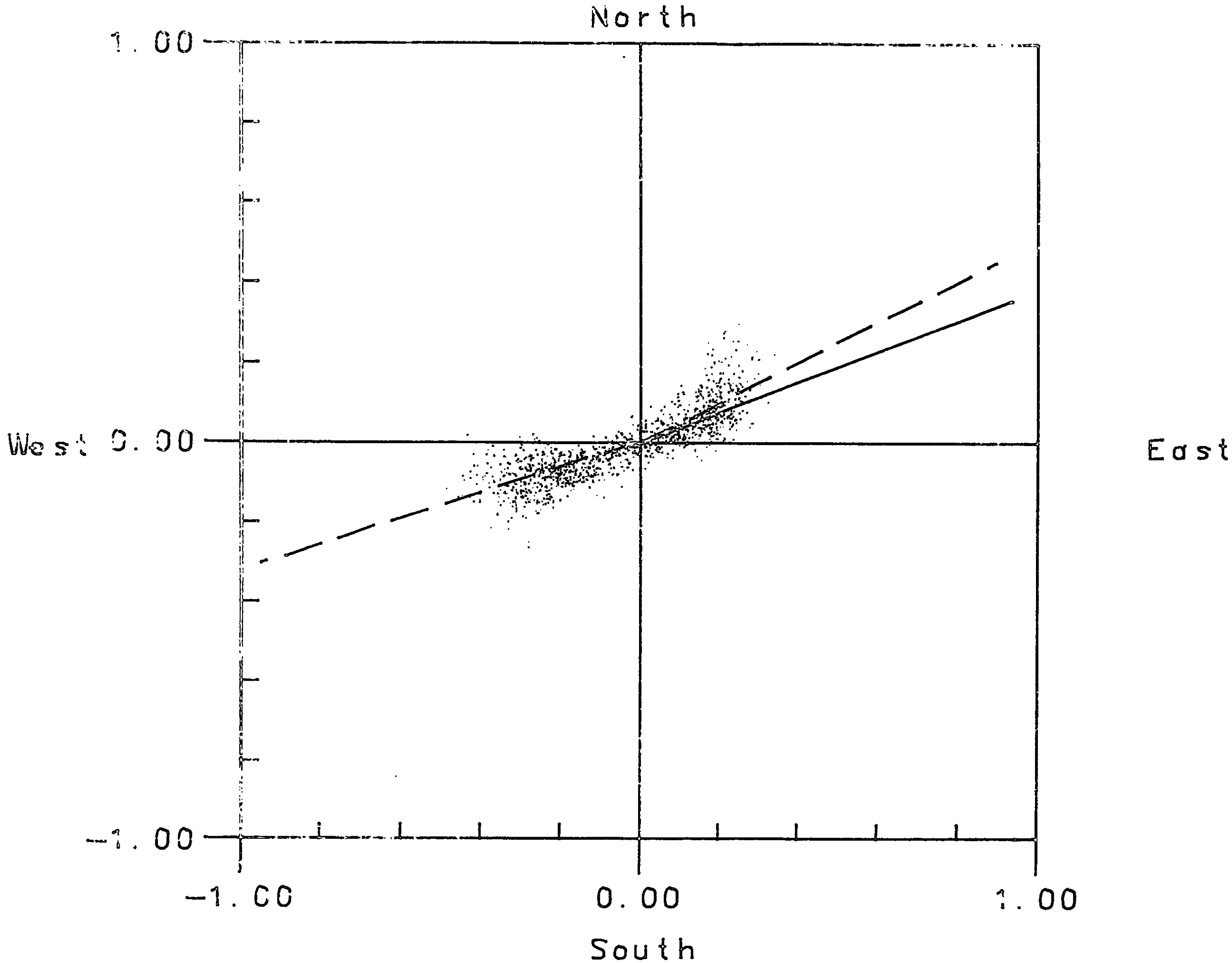
1988 YORK RIVER HYPOXIA SURVEY
YORK 3.9 KM FROM MOUTH DEPTH = 6.5 M
19 JUL. 1988 - 14 SEP. 1988 2669 OBSERVATIONS

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.

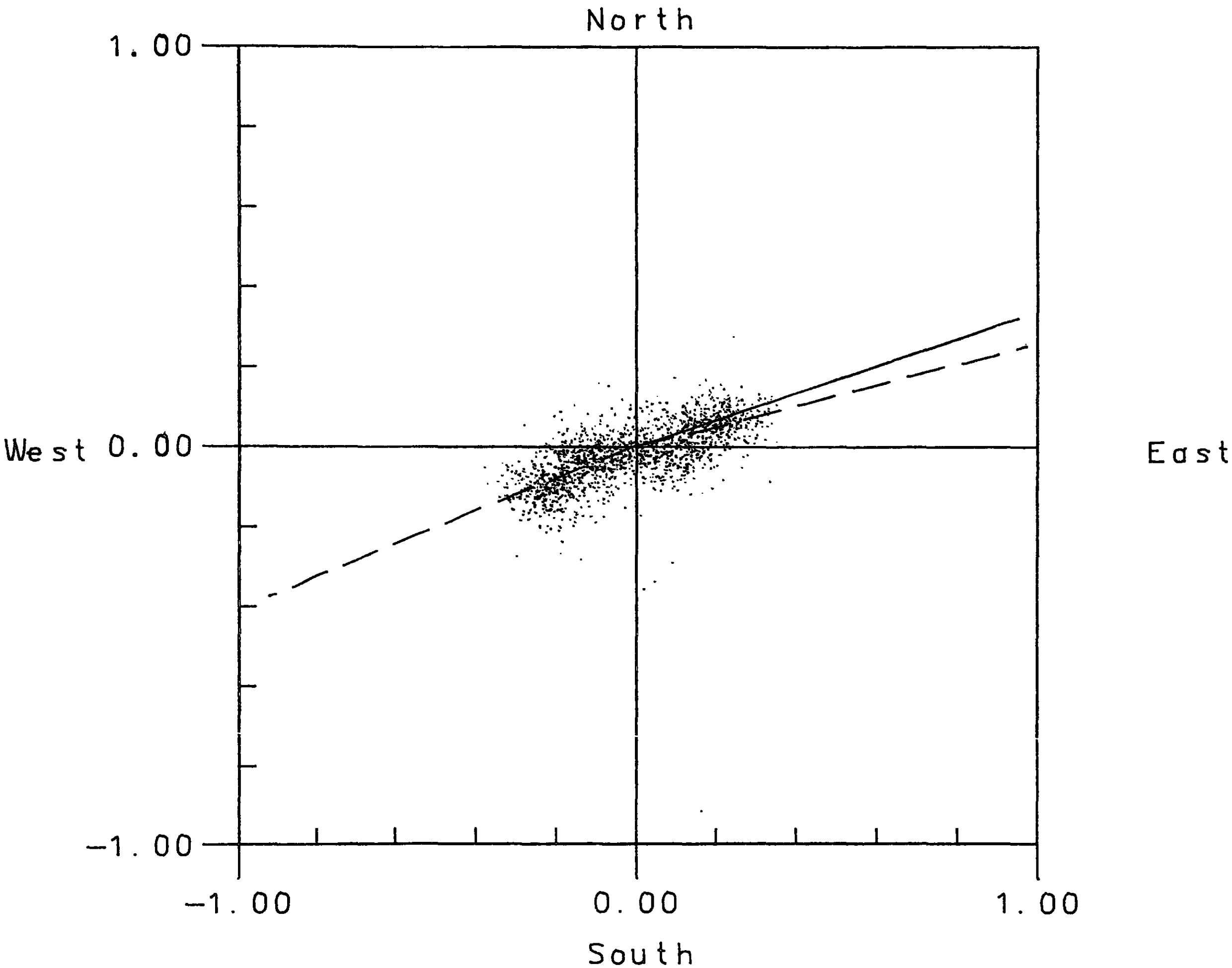


1988 YORK RIVER HYPOXIA SURVEY
YORK 3.9 KM FROM MOUTH DEPTH = 15.1 M
19 JUL. 1988 – 14 SEP. 1988 2668 OBSERVATIONS

PRINCIPAL AXIS	EBB	FLOOD
69.	63.	252.

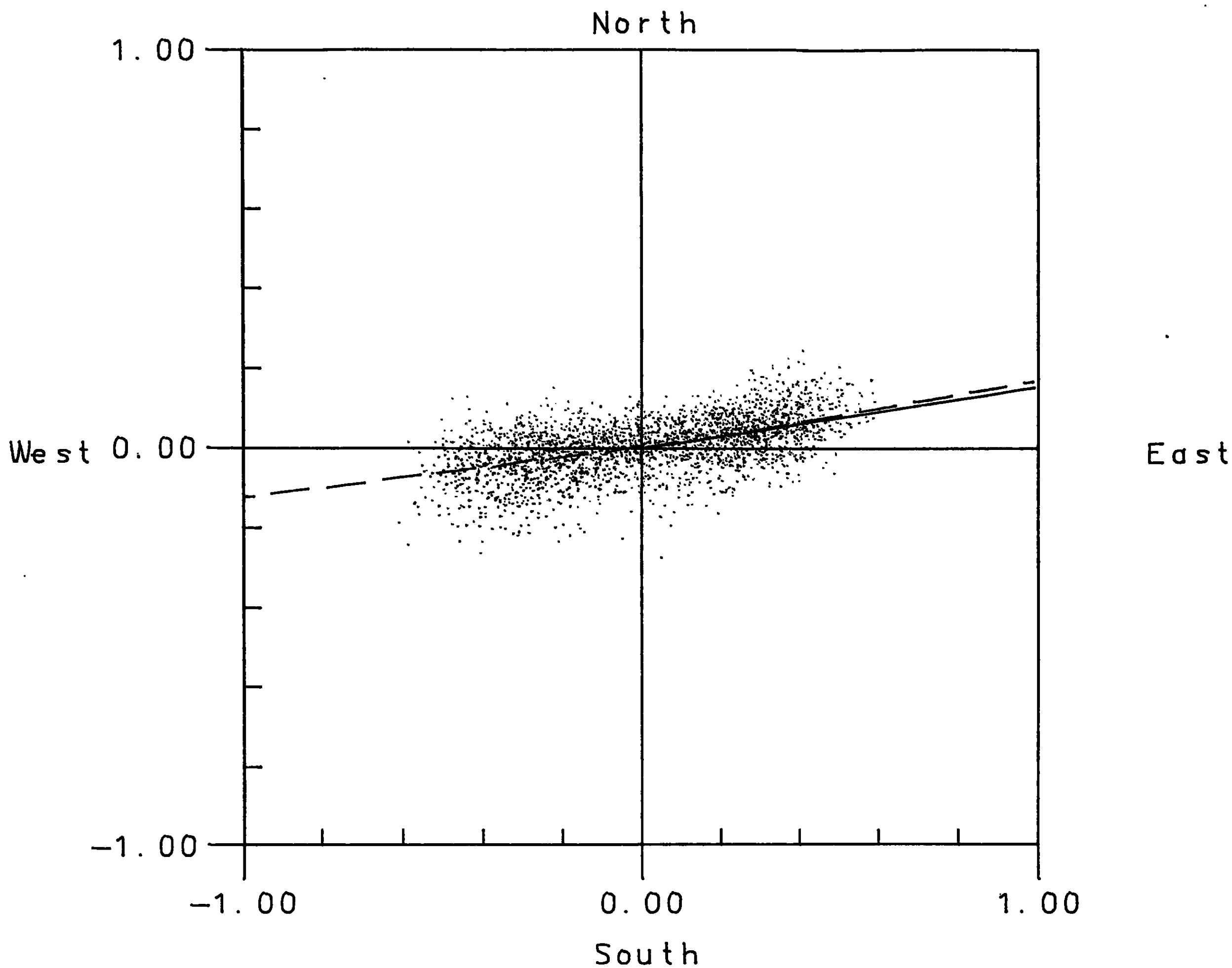
APPENDIX B2

SCATTERPLOTS OF CURRENTS (1989)



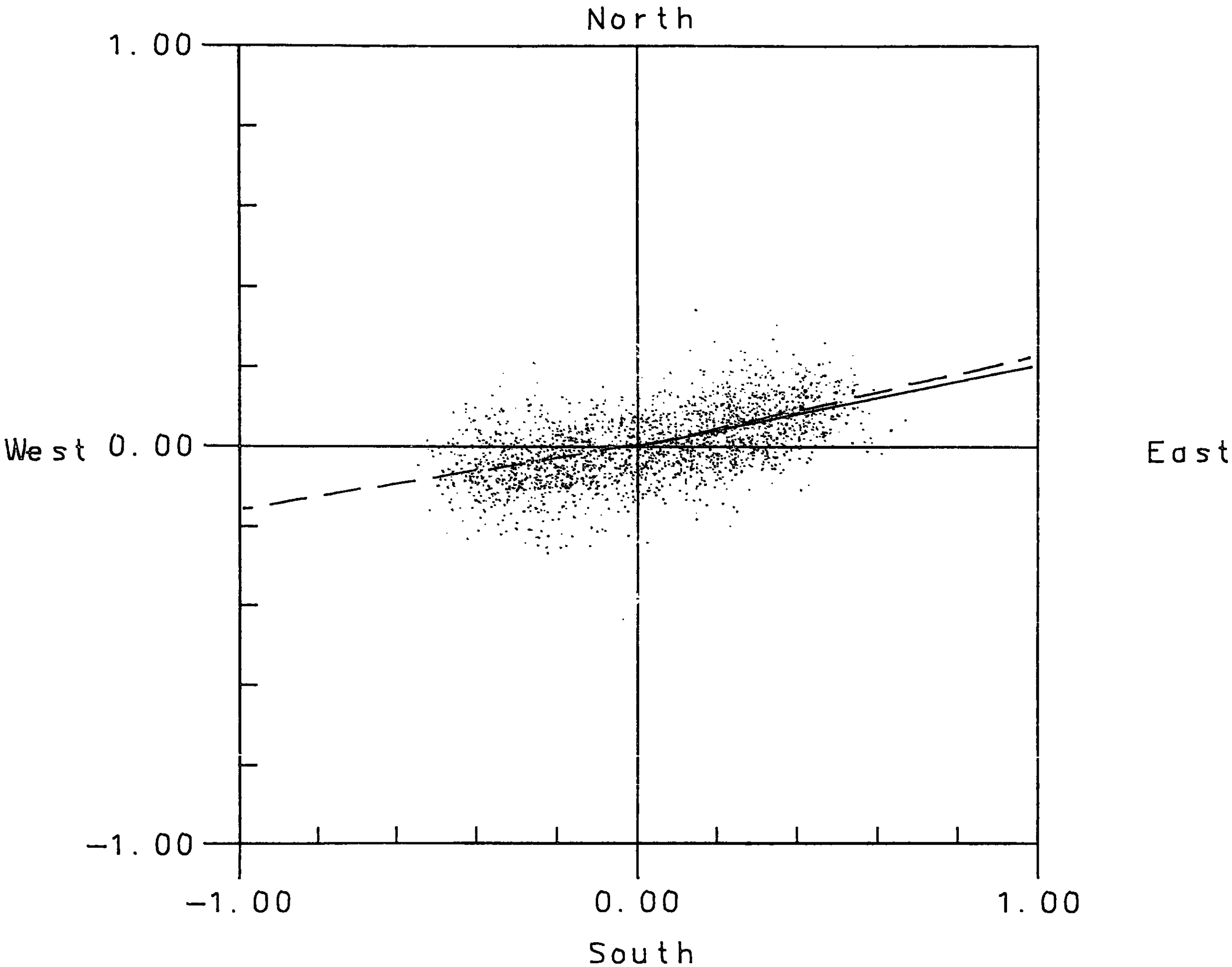
1989 YORK RIVER HYPOXIA SURVEY
STATION = TUE DEPTH = 10M
06 JUL - 07 SEP, 1989 1898 OBSERVATIONS

PRINCIPAL AXIS	EBB	FLOOD
71.	75.	248.



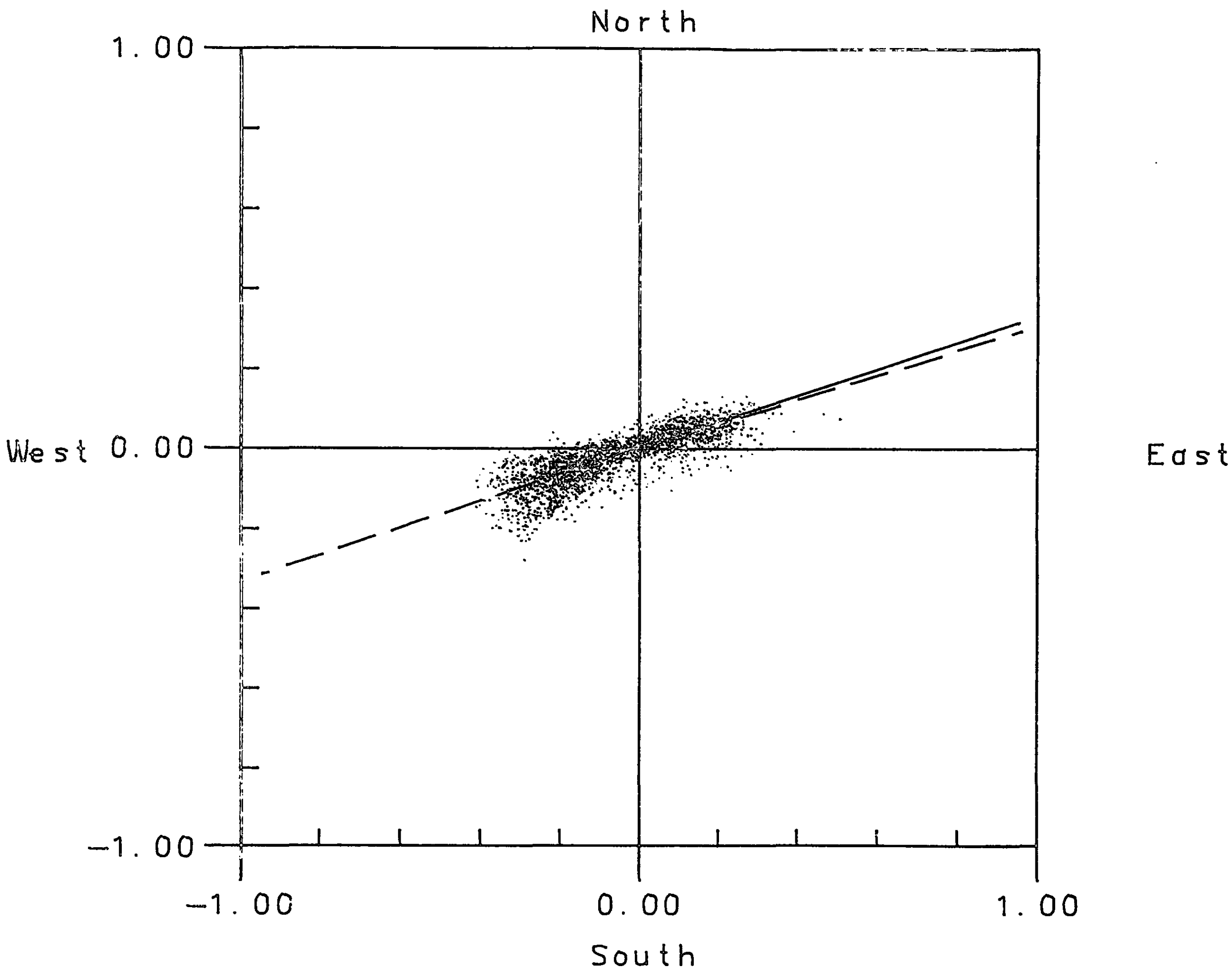
1989 YORK RIVER HYPOXIA SURVEY
STATION = TUE DEPTH = 6 M
06 JUL - 07 SEP, 1989 2857 OBSERVATIONS

PRINCIPAL AXIS	EBB	FLOOD
81.	80.	263.



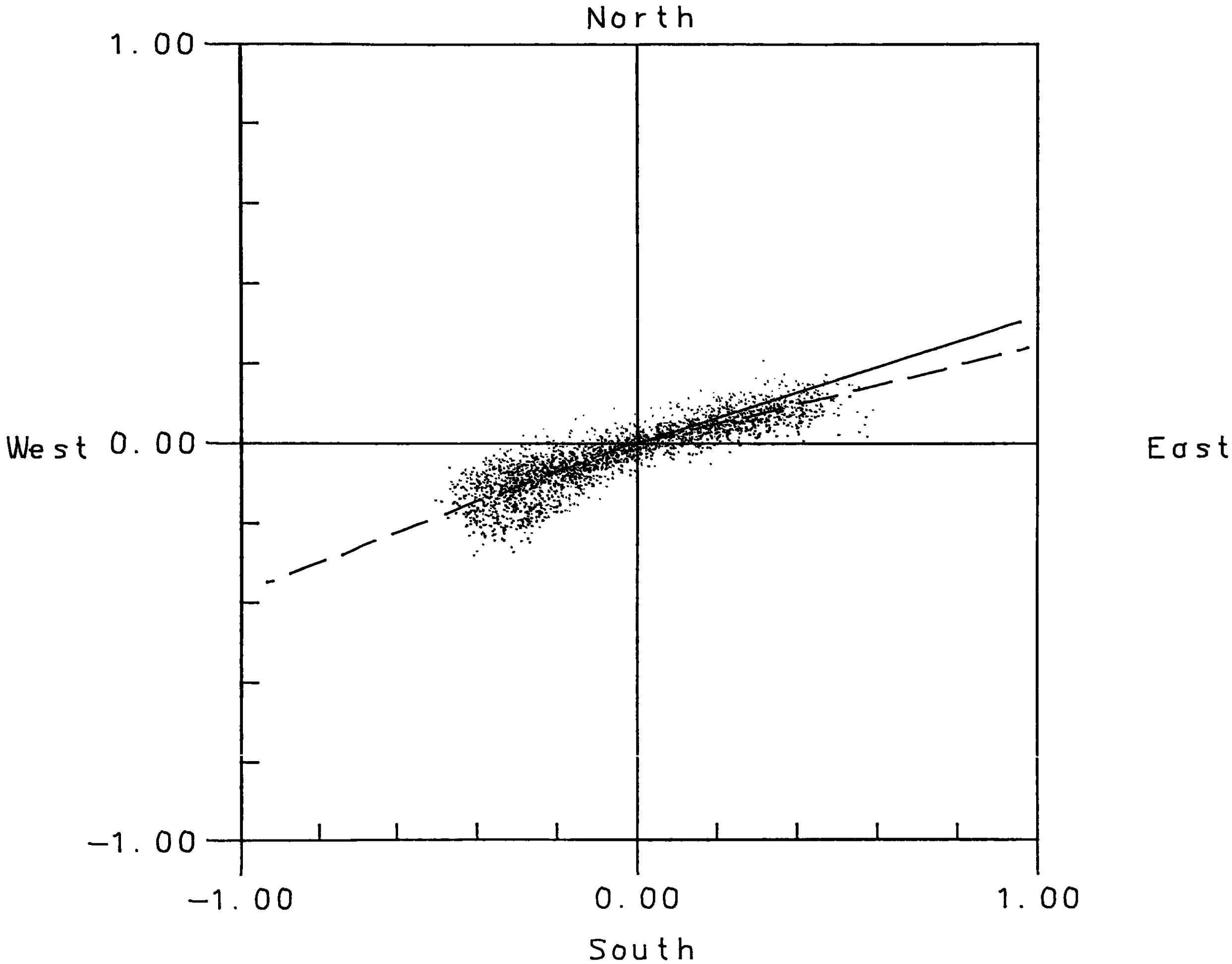
1989 YORK RIVER HYPOXIA SURVEY
STATION = TUE DEPTH = 1 M
06 JUL - 07 SEP, 1989 2888 OBSERVATIONS

PRINCIPAL AXIS	EBB	FLOOD
78.	77.	261.



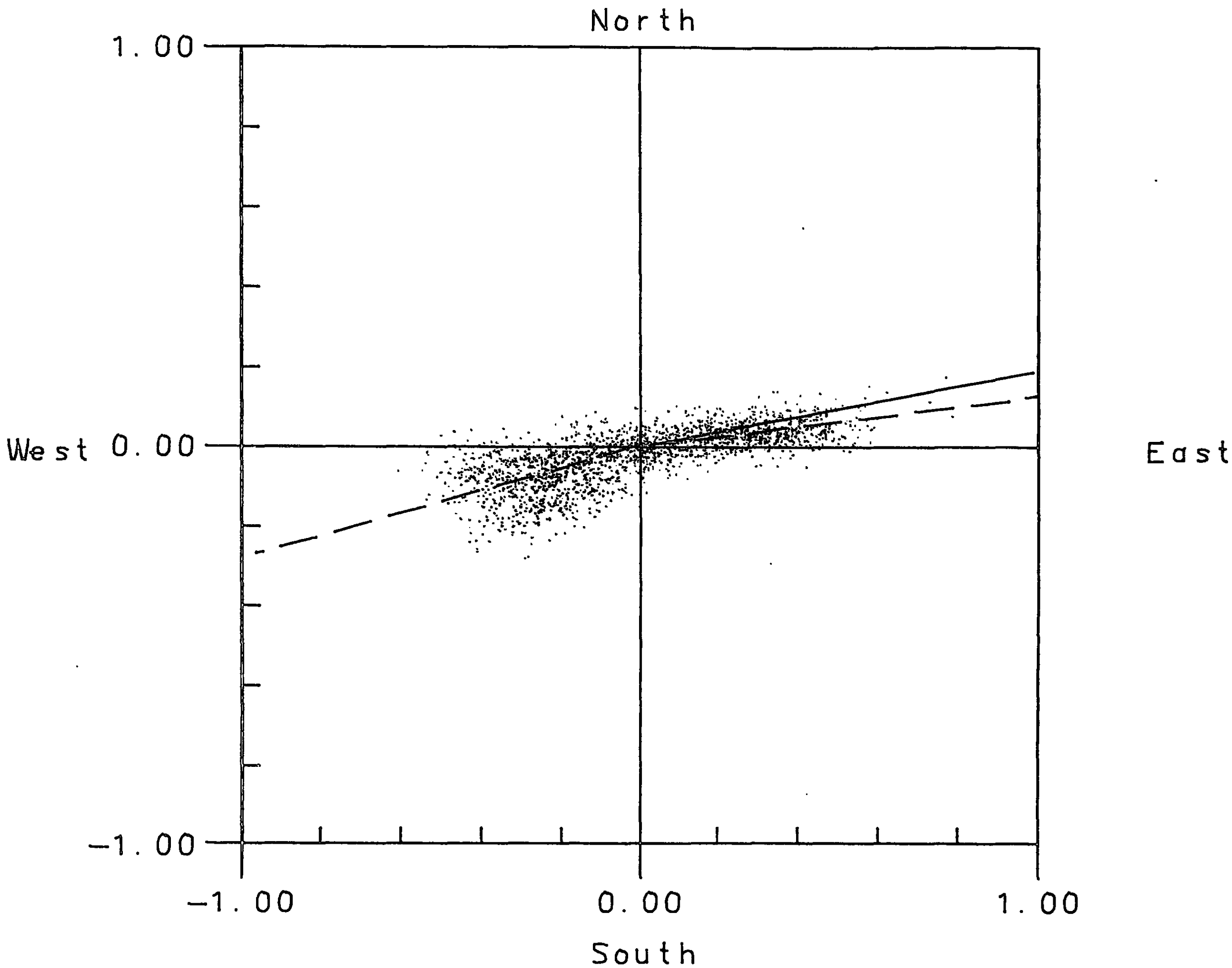
1989 YORK RIVER HYPOXIA SURVEY
STATION = RB DEPTH = 16 M
06 JUL - 07 SEP, 1989 2906 OBSERVATIONS

PRINCIPAL AXIS	EBB	FLOOD
72.	73.	251.



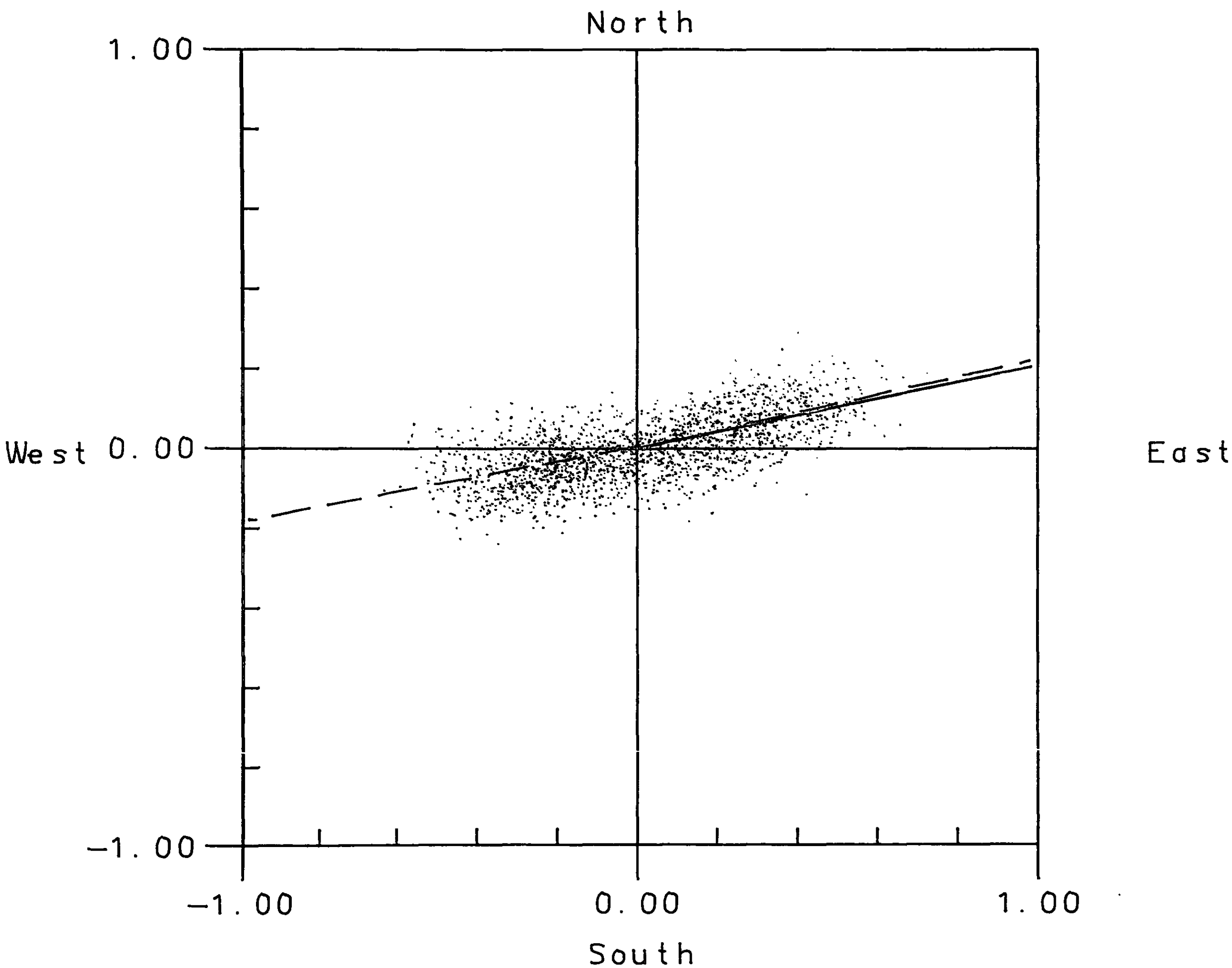
1989 YORK RIVER HYPOXIA SURVEY
STATION = RB DEPTH = 11 M
06 JUL - 07 SEP, 1989 2911 OBSERVATIONS

PRINCIPAL AXIS	EBB	FLOOD
72.	76.	249.



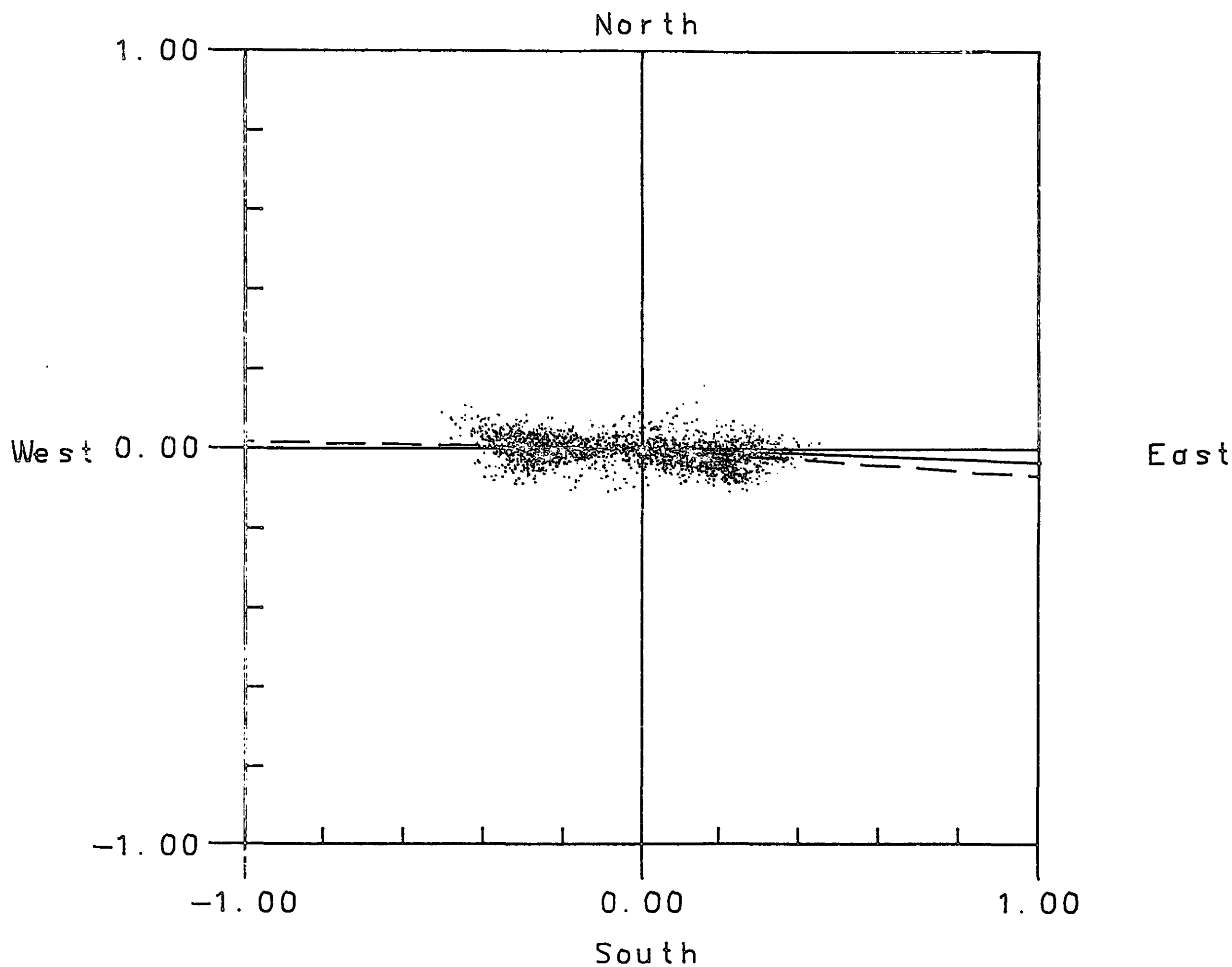
1989 YORK RIVER HYPOXIA SURVEY
STATION = RB DEPTH = 6 M
13 JUL - 07 SEP, 1989 2578 OBSERVATIONS

PRINCIPAL AXIS	EBB	FLOOD
79.	83.	254.



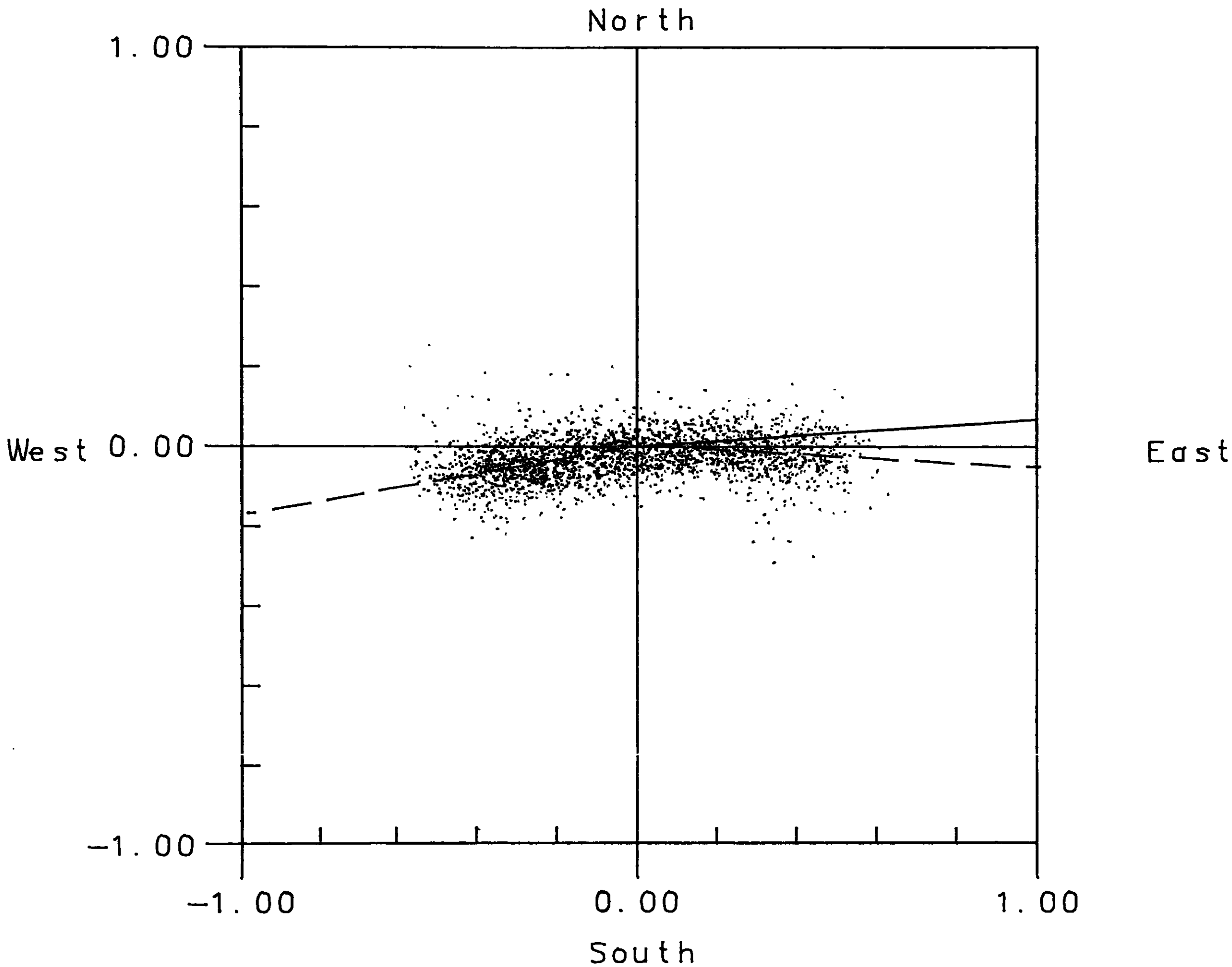
1989 YORK RIVER HYPOXIA SURVEY
STATION = RB DEPTH = 1 M
06 JUL - 01 SEP, 1989 2626 OBSERVATIONS

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.

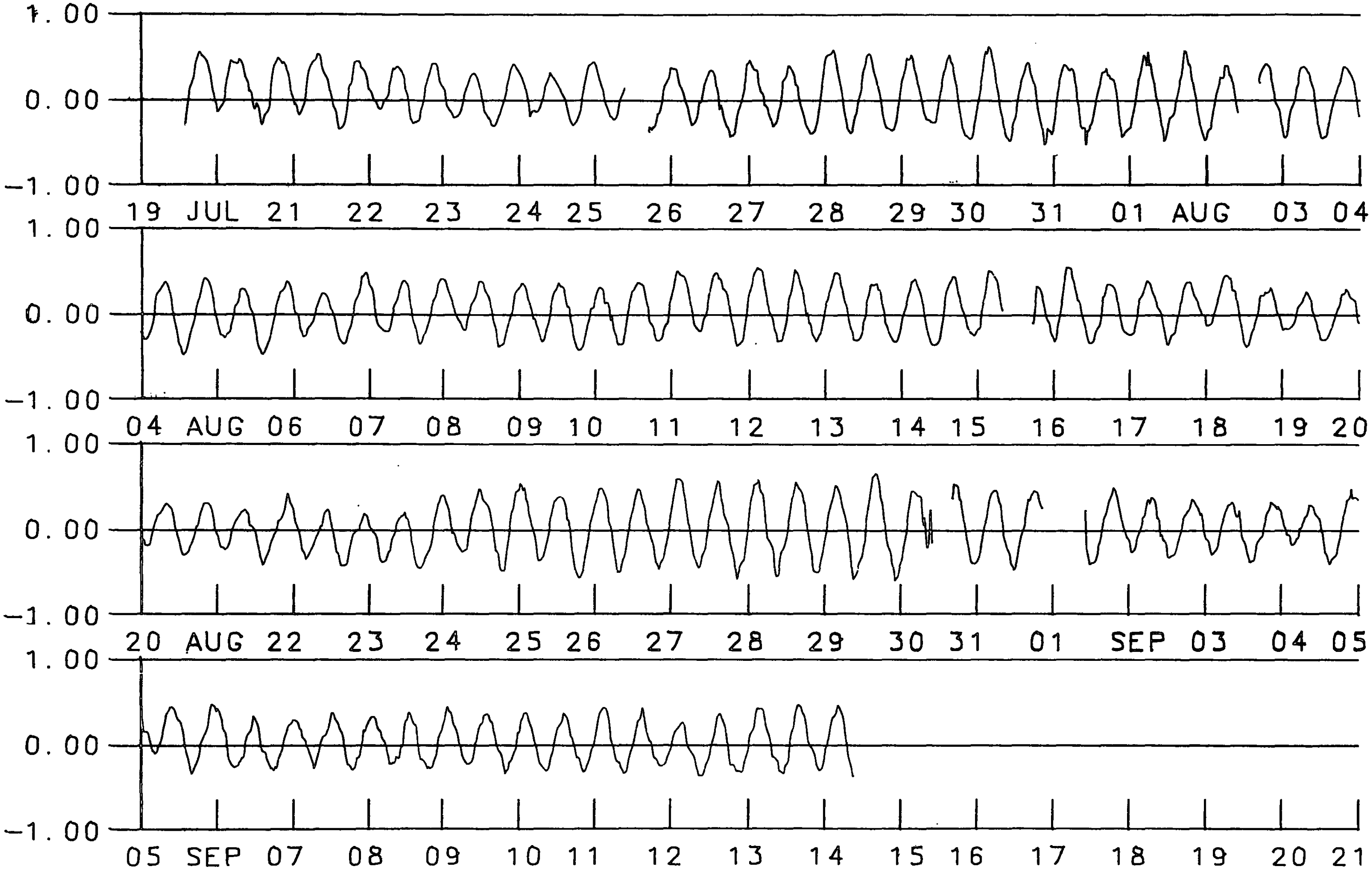


1989 YORK RIVER HYPOXIA SURVEY
STATION = N2 DEPTH = 1 M
06 JUL - 07 SEP, 1989 2558 OBSERVATIONS

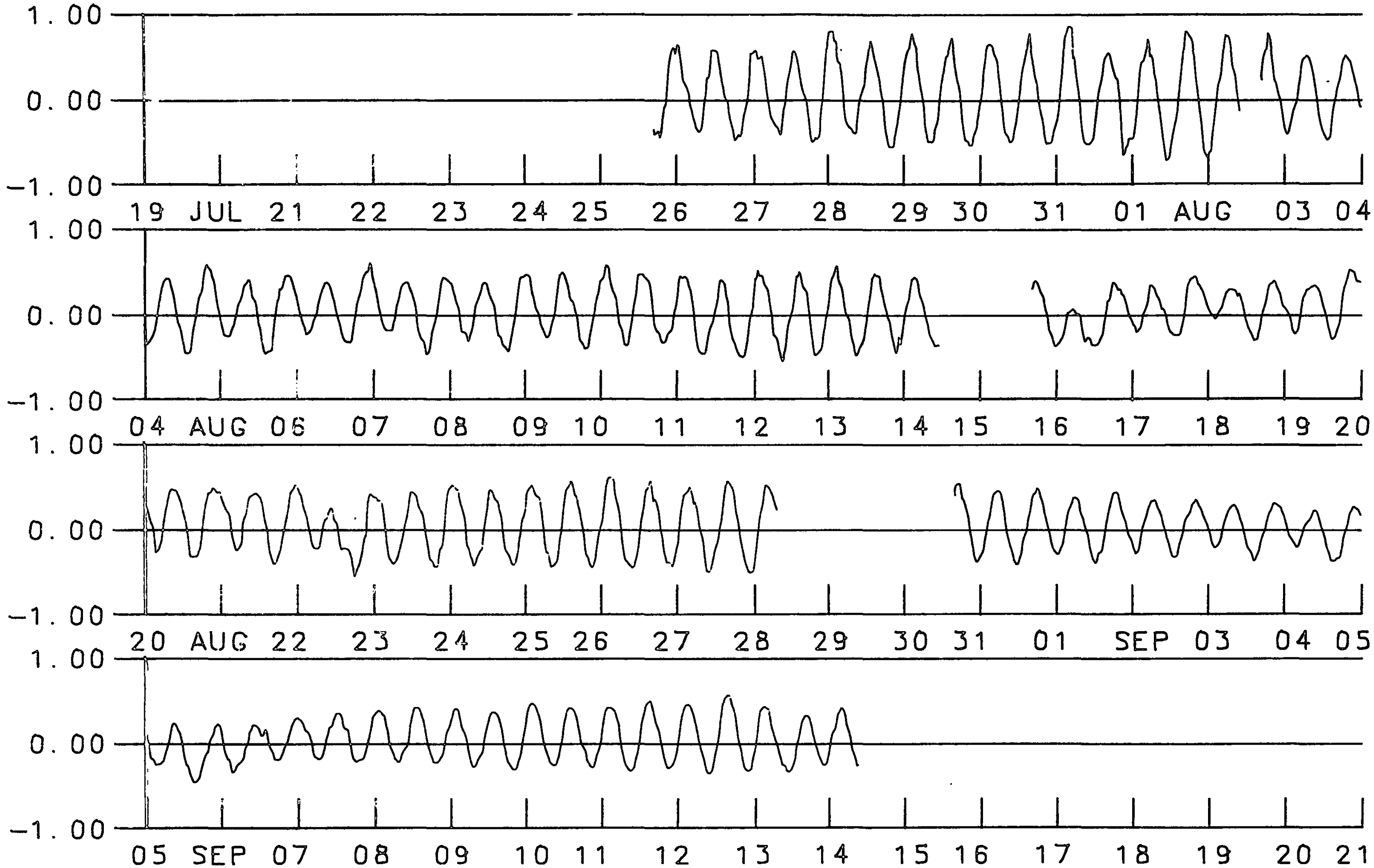
PRINCIPAL AXIS	EBB	FLOOD
86.	93.	260.

APPENDIX C1

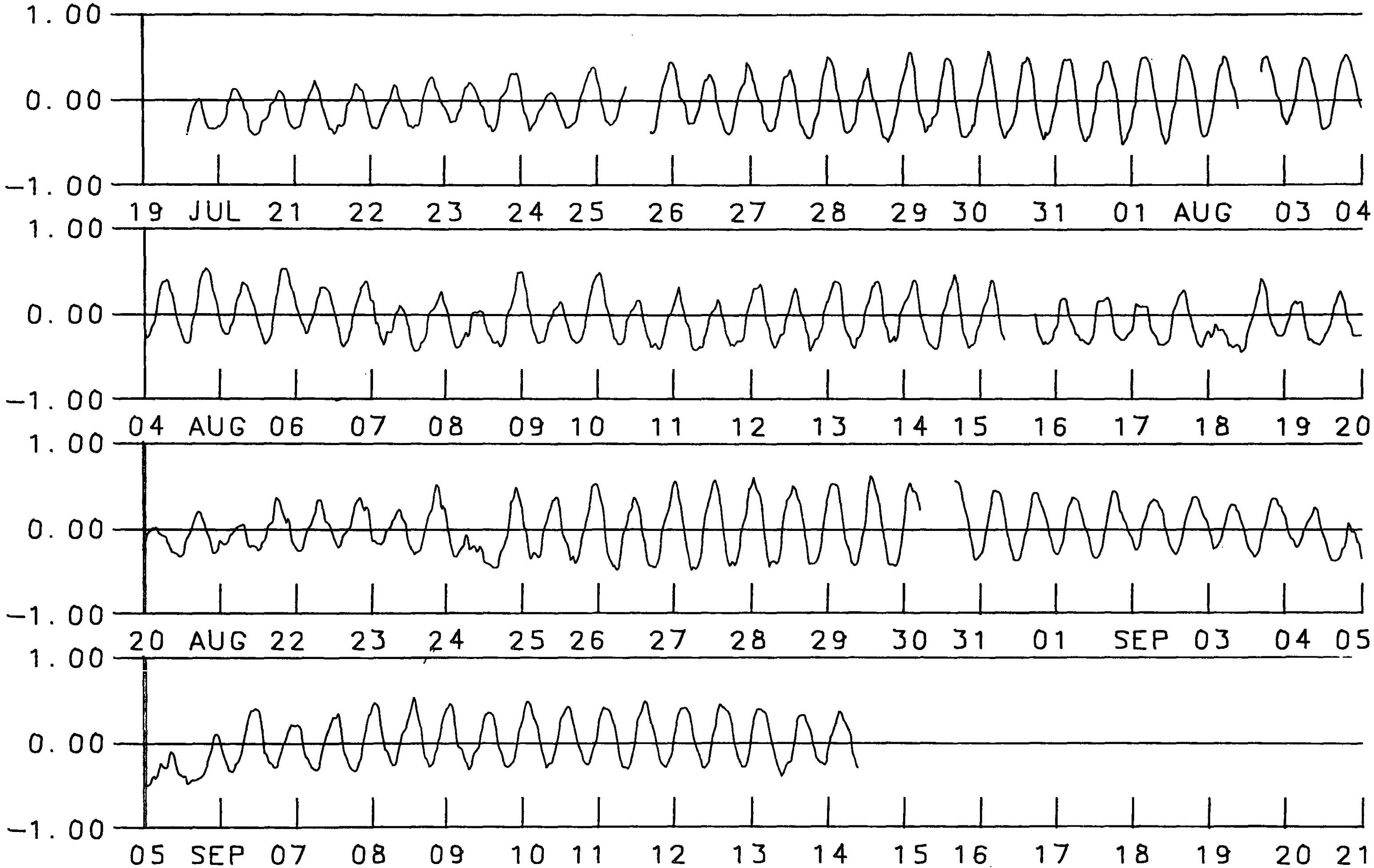
LONGITUDINAL COMPONENTS OF CURRENTS (1988)



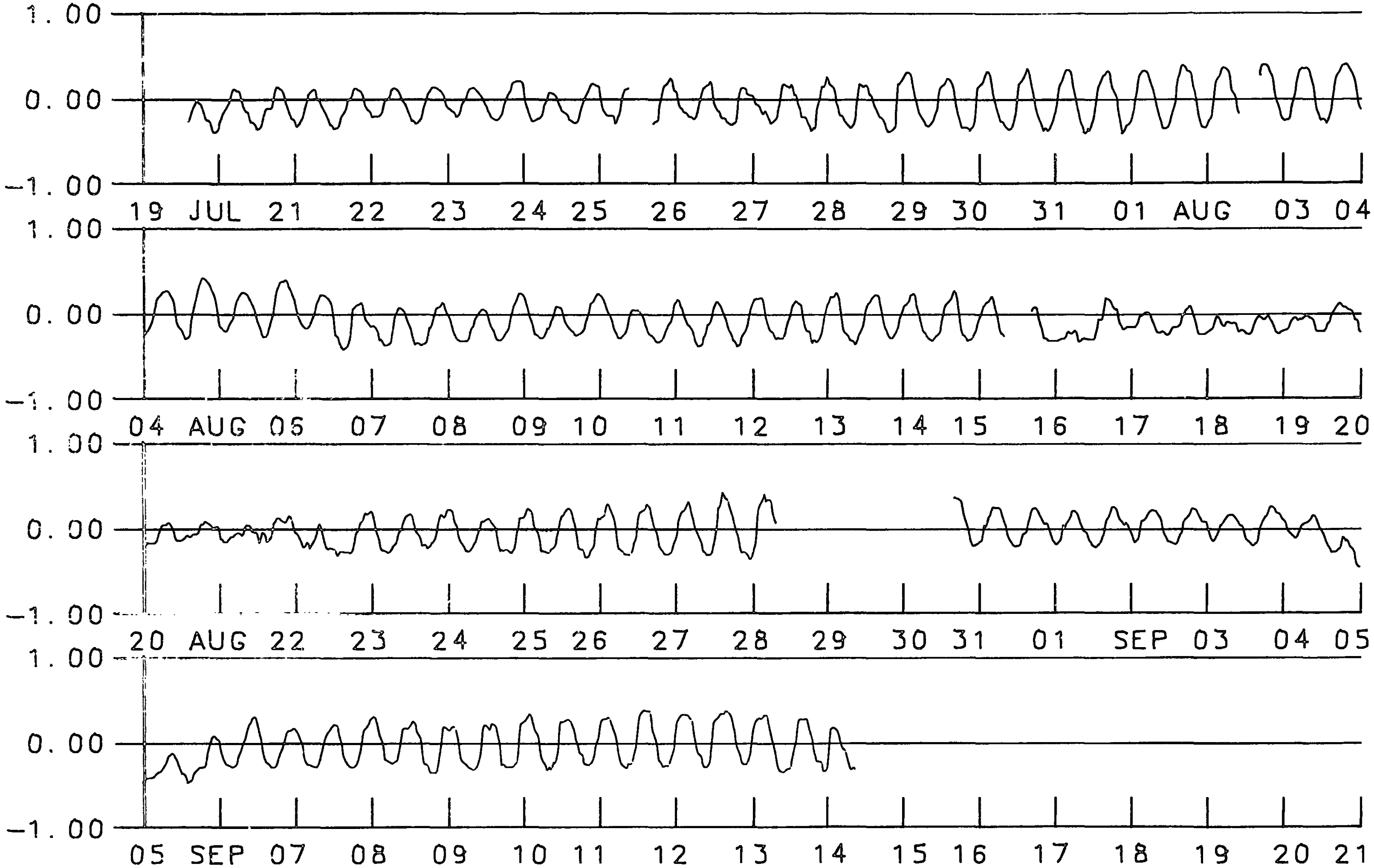
1988 YORK RIVER HYPOXIA SURVEY
YORK 0.0 KM FROM MOUTH DEPTH = 1.5 M
LONGITUDINAL COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB



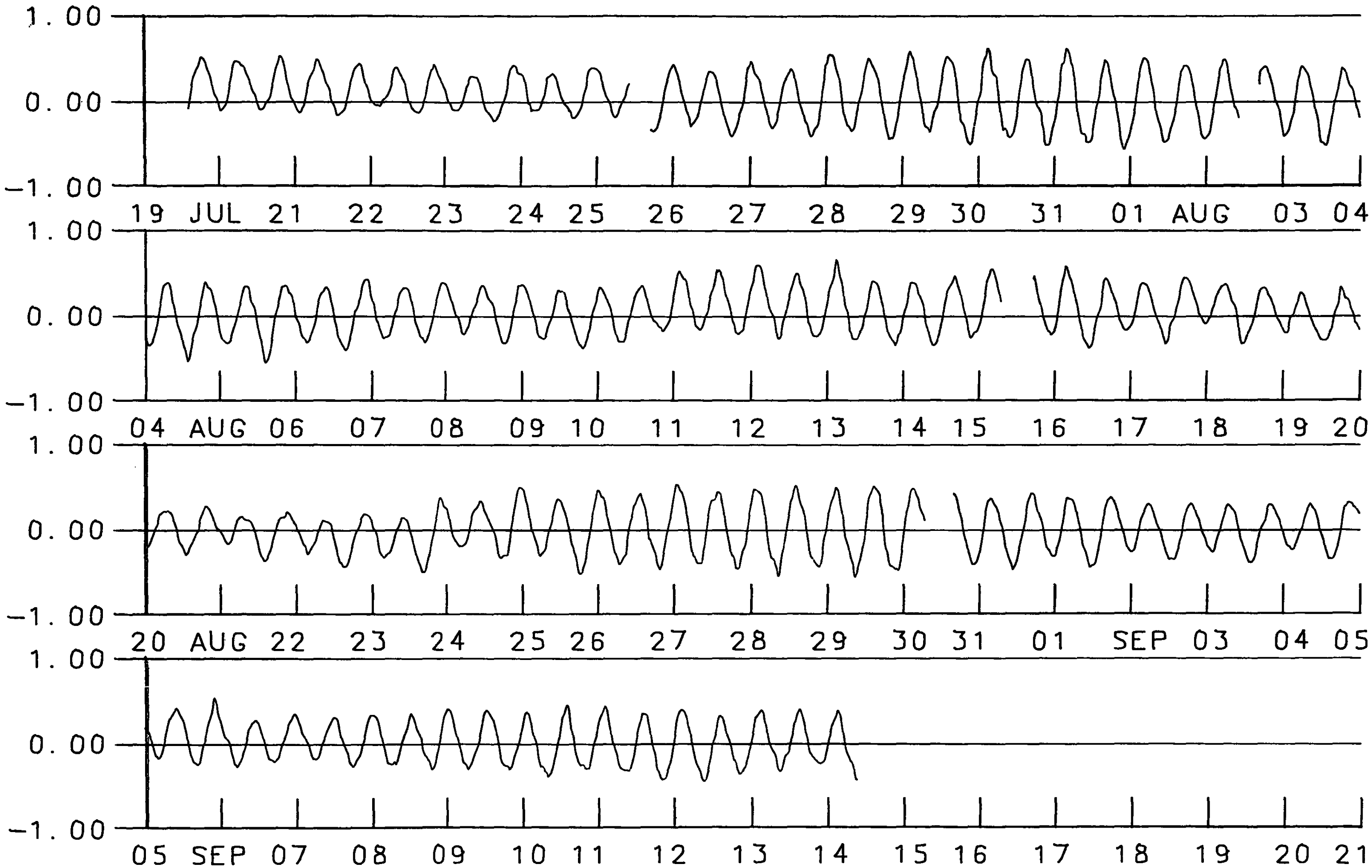
1988 YORK RIVER HYPOXIA SURVEY
YORK 0.0 KM FROM MOUTH DEPTH = 6.5 M
LONGITUDINAL COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB



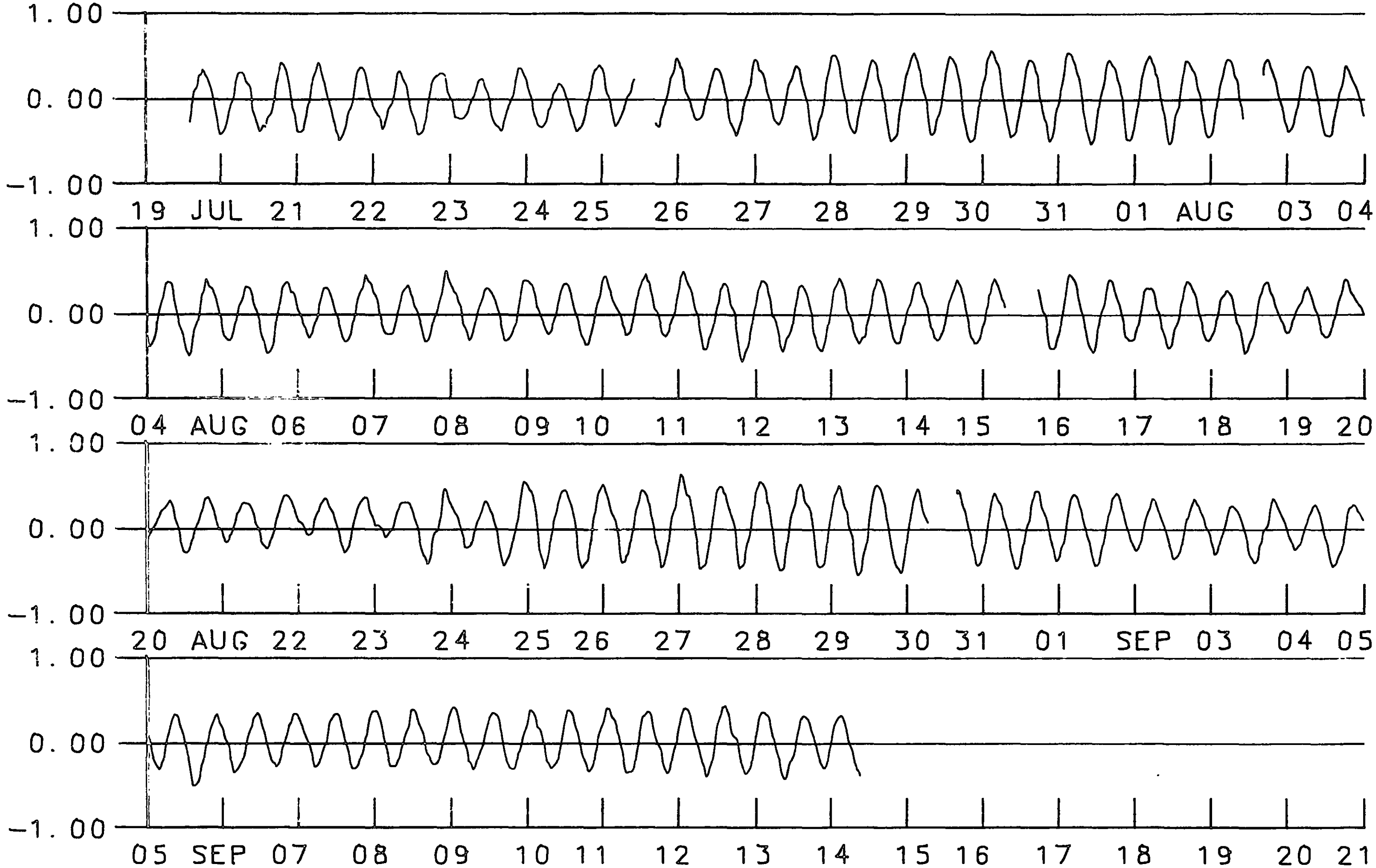
1988 YORK RIVER HYPOXIA SURVEY
YORK 0.0 KM FROM MOUTH DEPTH = 11.5 M
LONGITUDINAL COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB



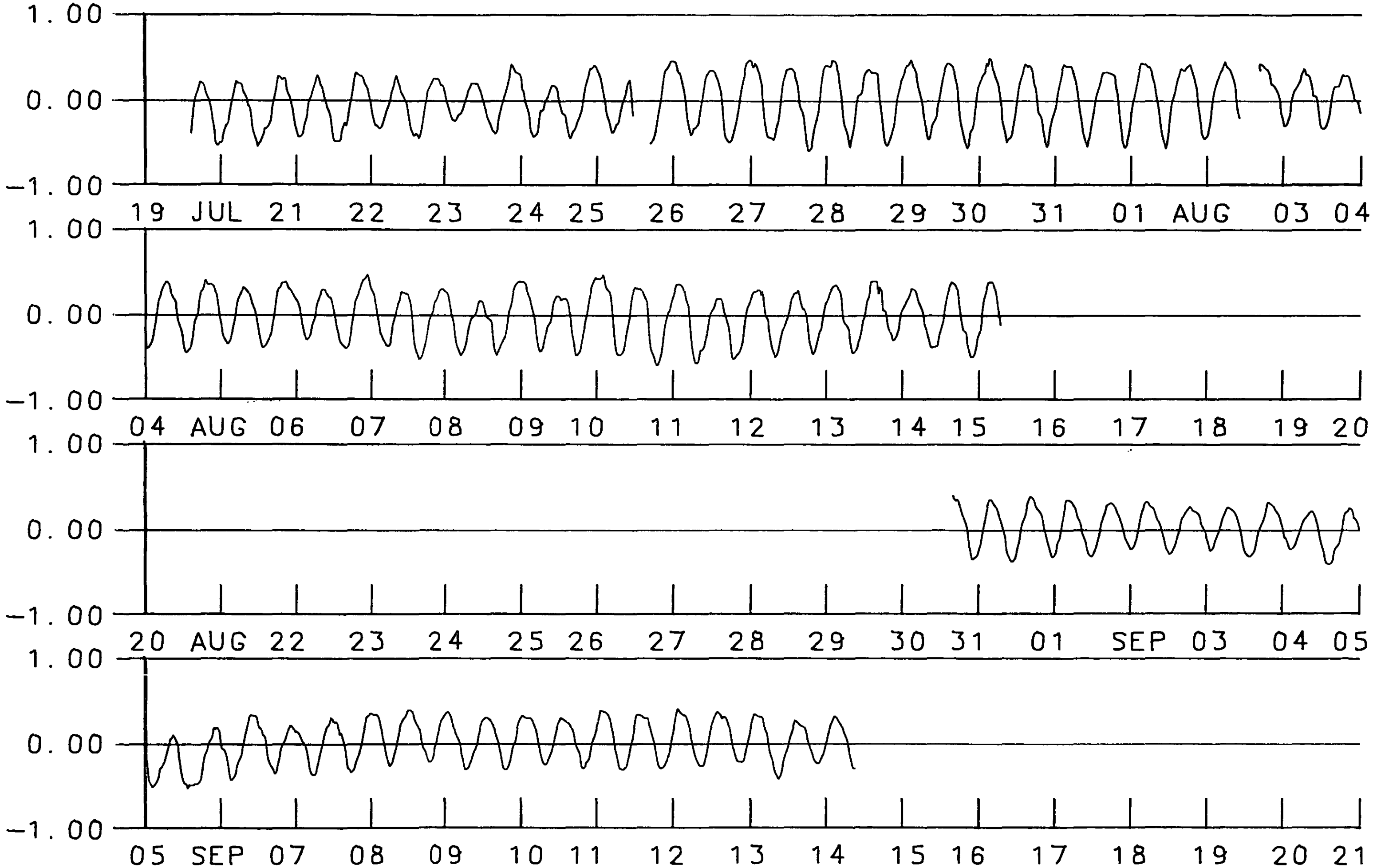
1988 YORK RIVER HYPOXIA SURVEY
YORK 0.0 KM FROM MOUTH DEPTH = 15.7 M
LONGITUDINAL COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB



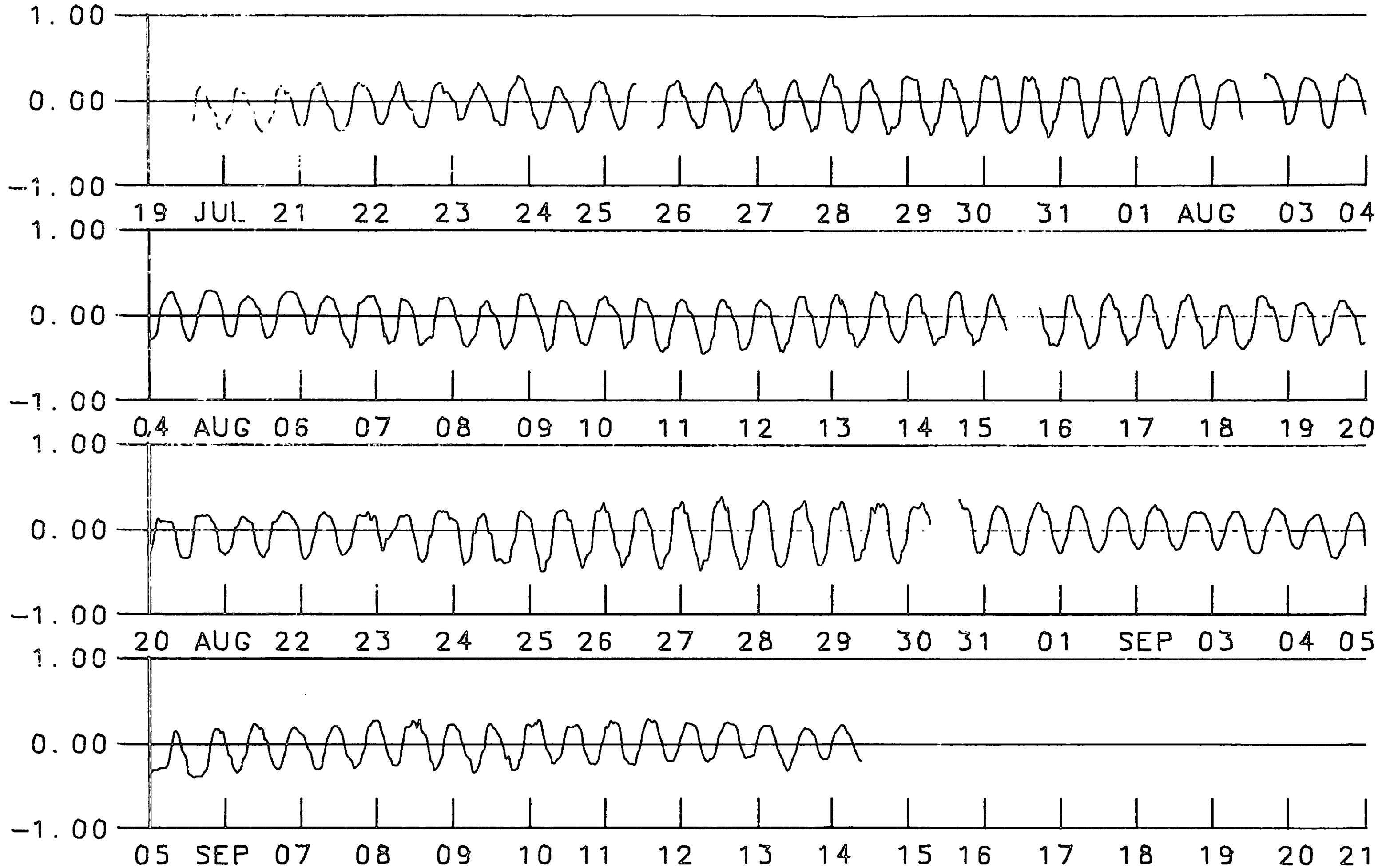
1988 YORK RIVER HYPOXIA SURVEY
YORK 3.9 KM FROM MOUTH DEPTH = 1.5 M
LONGITUDINAL COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB



1988 YORK RIVER HYPOXIA SURVEY
YORK 3.9 KM FROM MOUTH DEPTH = 6.5 M
LONGITUDINAL COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB



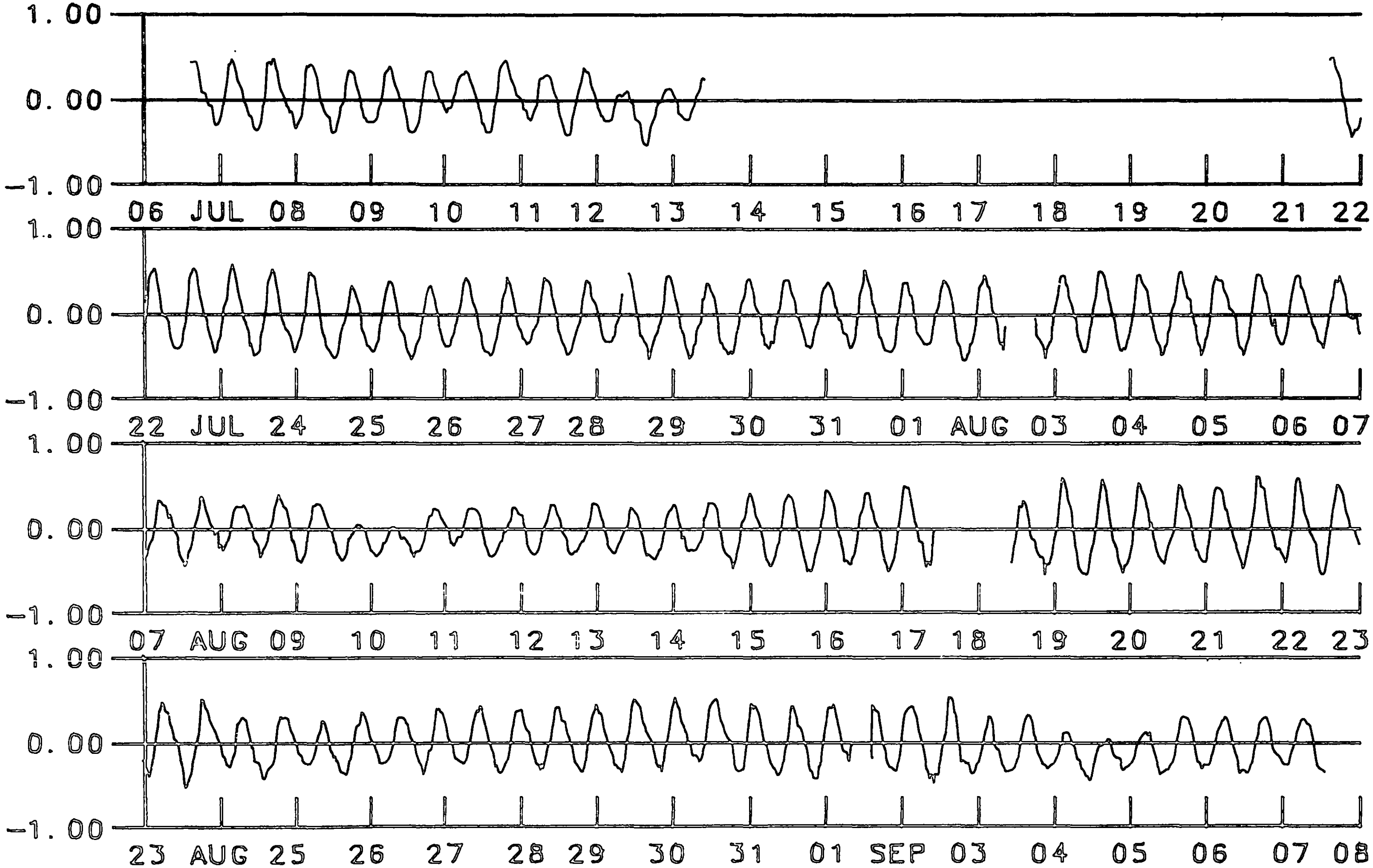
1988 YORK RIVER HYPOXIA SURVEY
YORK 3.9 KM FROM MOUTH DEPTH = 11.5 M
LONGITUDINAL COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB



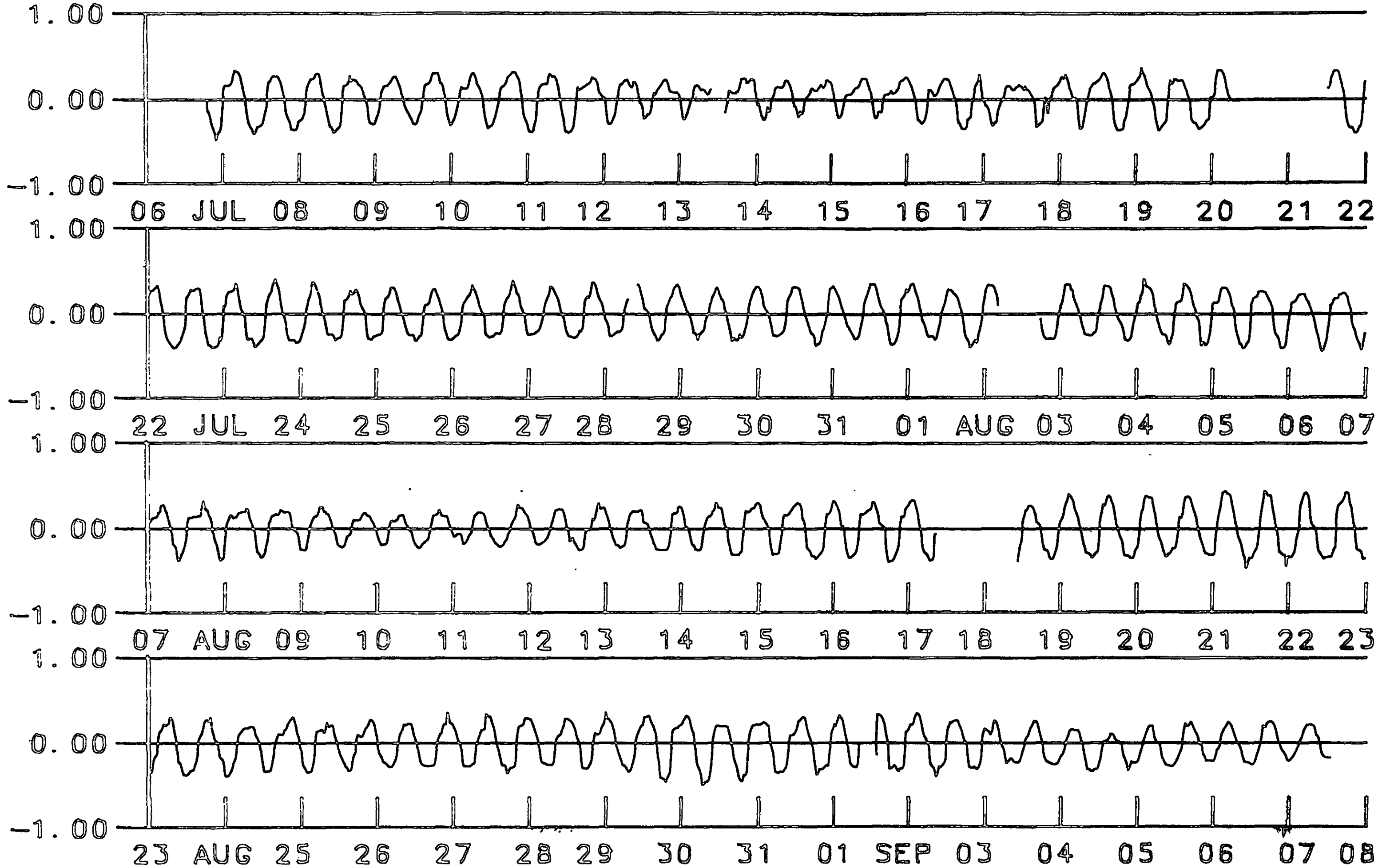
1988 YORK RIVER HYPOXIA SURVEY
YORK 3.9 KM FROM MOUTH DEPTH = 15.1 M
LONGITUDINAL COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB

APPENDIX C2

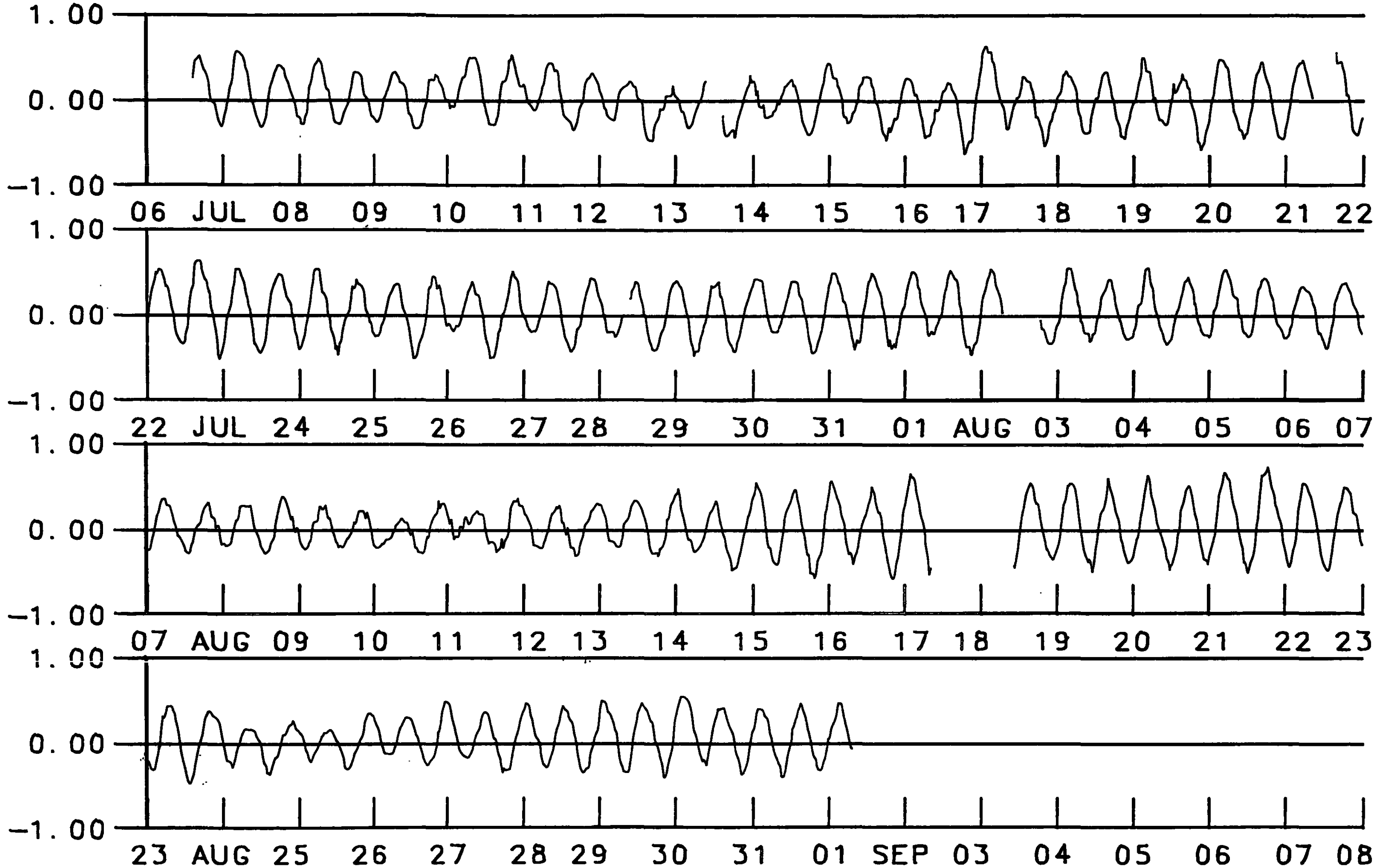
LONGITUDINAL COMPONENTS OF CURRENTS (1989)



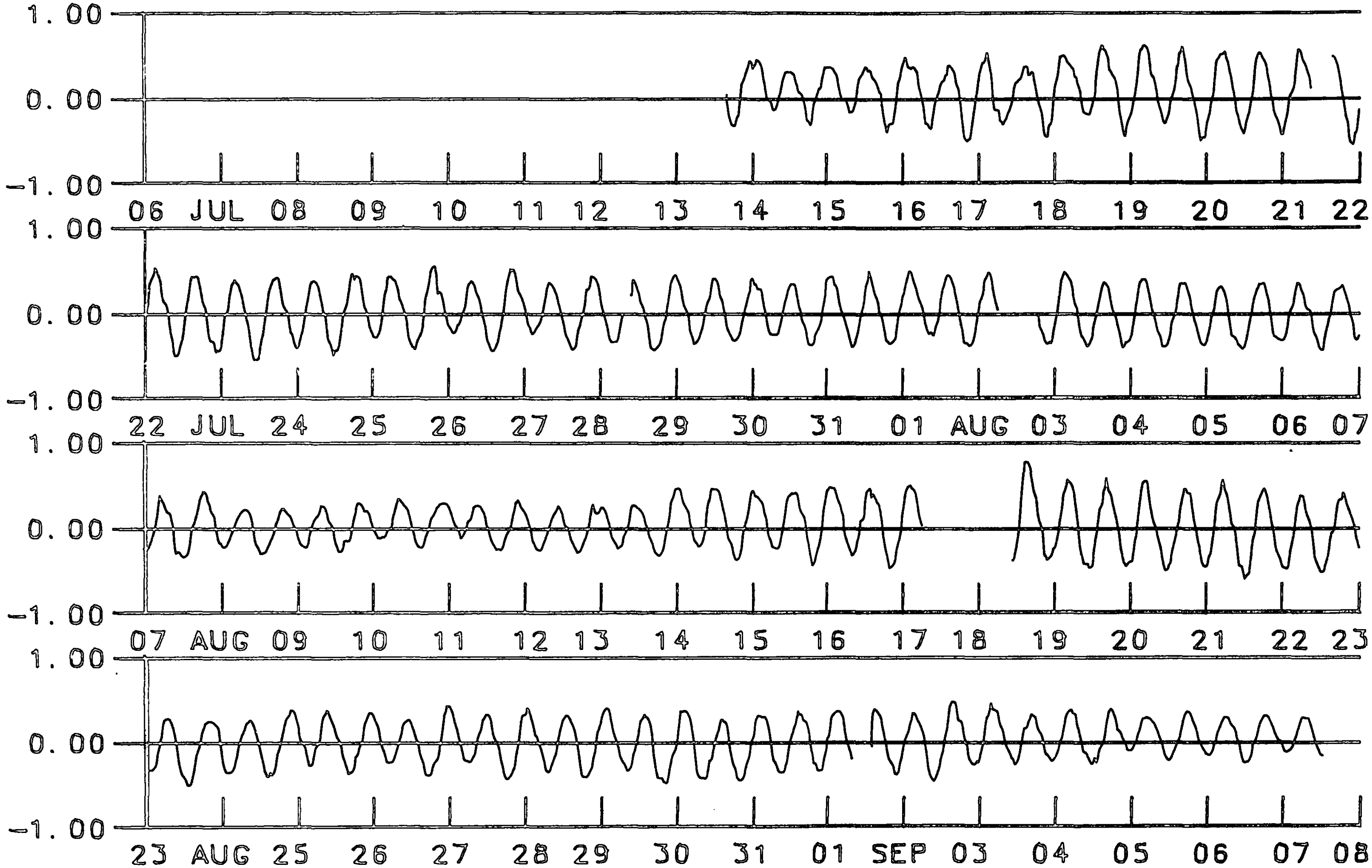
1989 YORK RIVER HYPOXIA SURVEY
STATION = N2 DEPTH = 1 M
LONGITUDINAL COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB



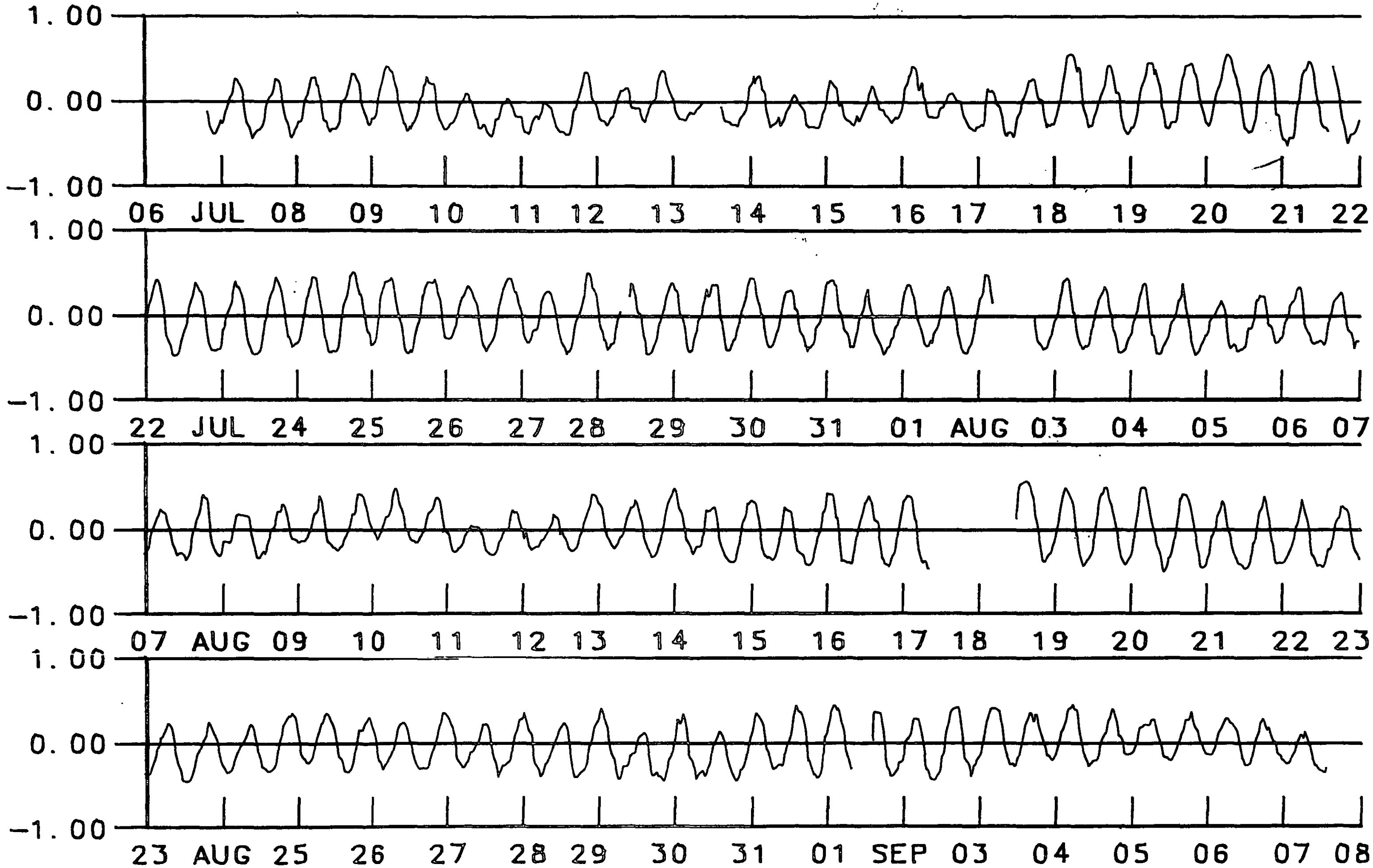
1989 YORK RIVER HYPOXIA SURVEY
STATION = N2 DEPTH = 7 M
LONGITUDINAL COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB



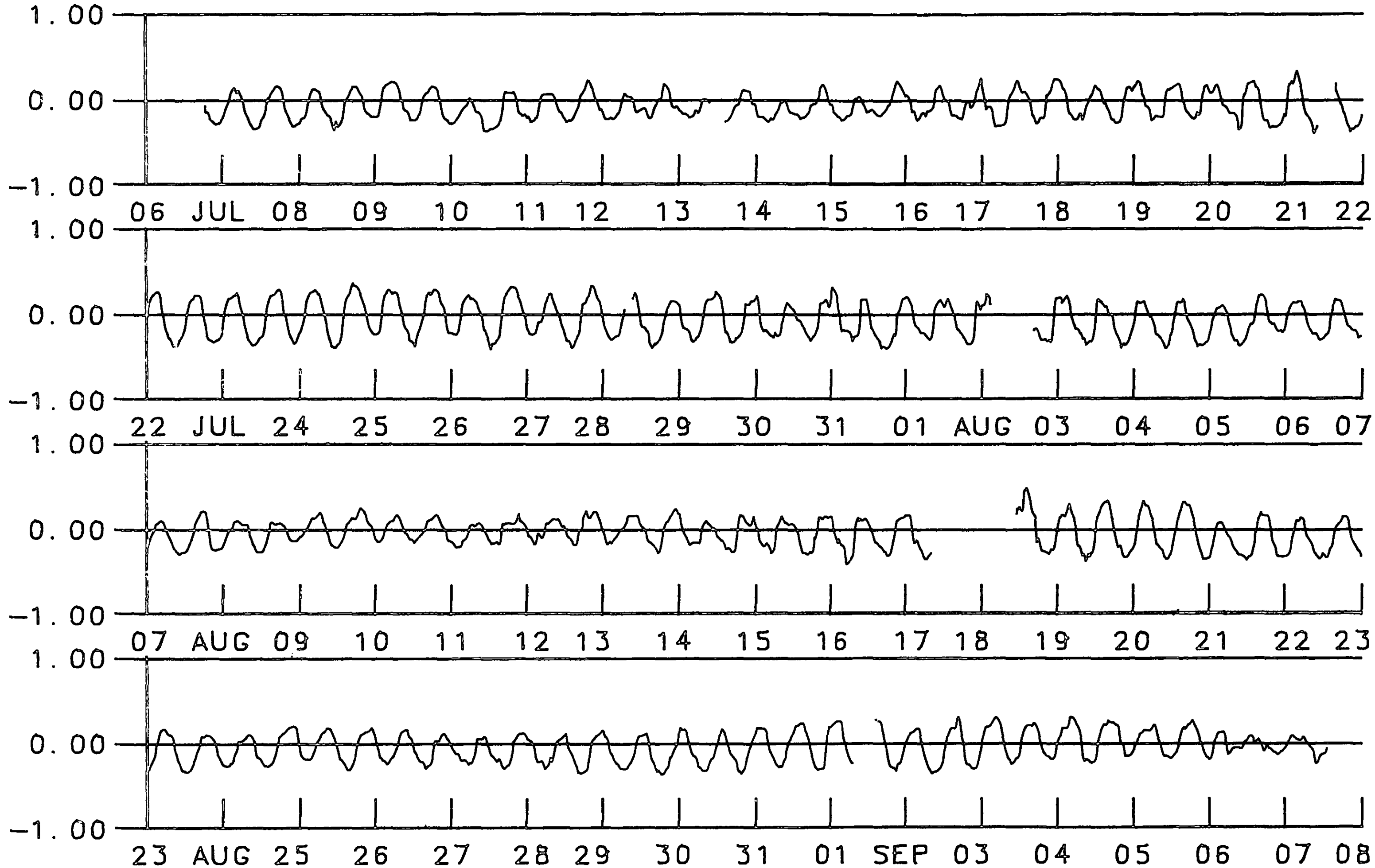
1989 YORK RIVER HYPOXIA SURVEY
STATION = RB DEPTH = 1 M
LONGITUDINAL COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB



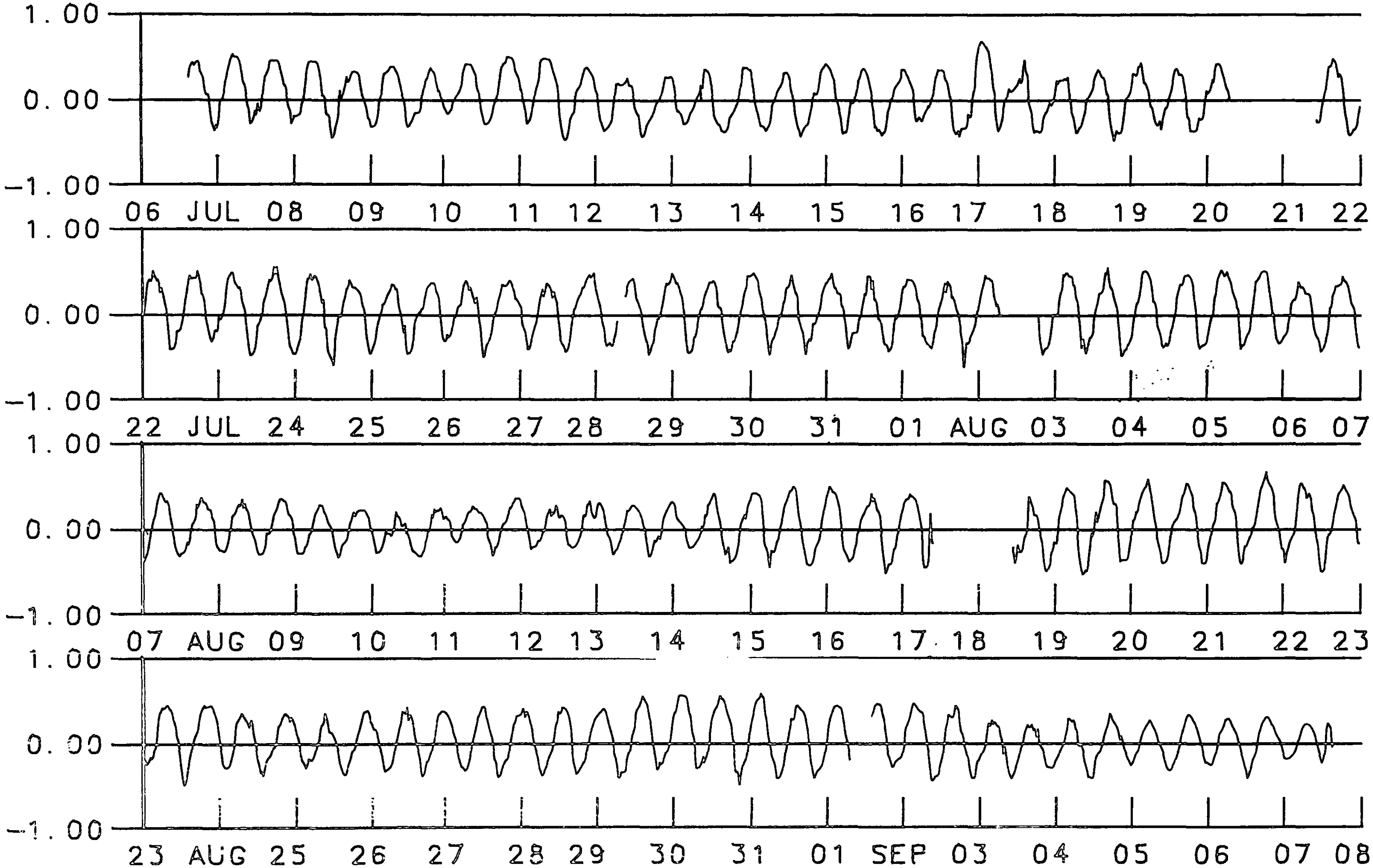
1989 YORK RIVER HYPOXIA SURVEY
STATION = RB DEPTH = 6 M
LONGITUDINAL COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB



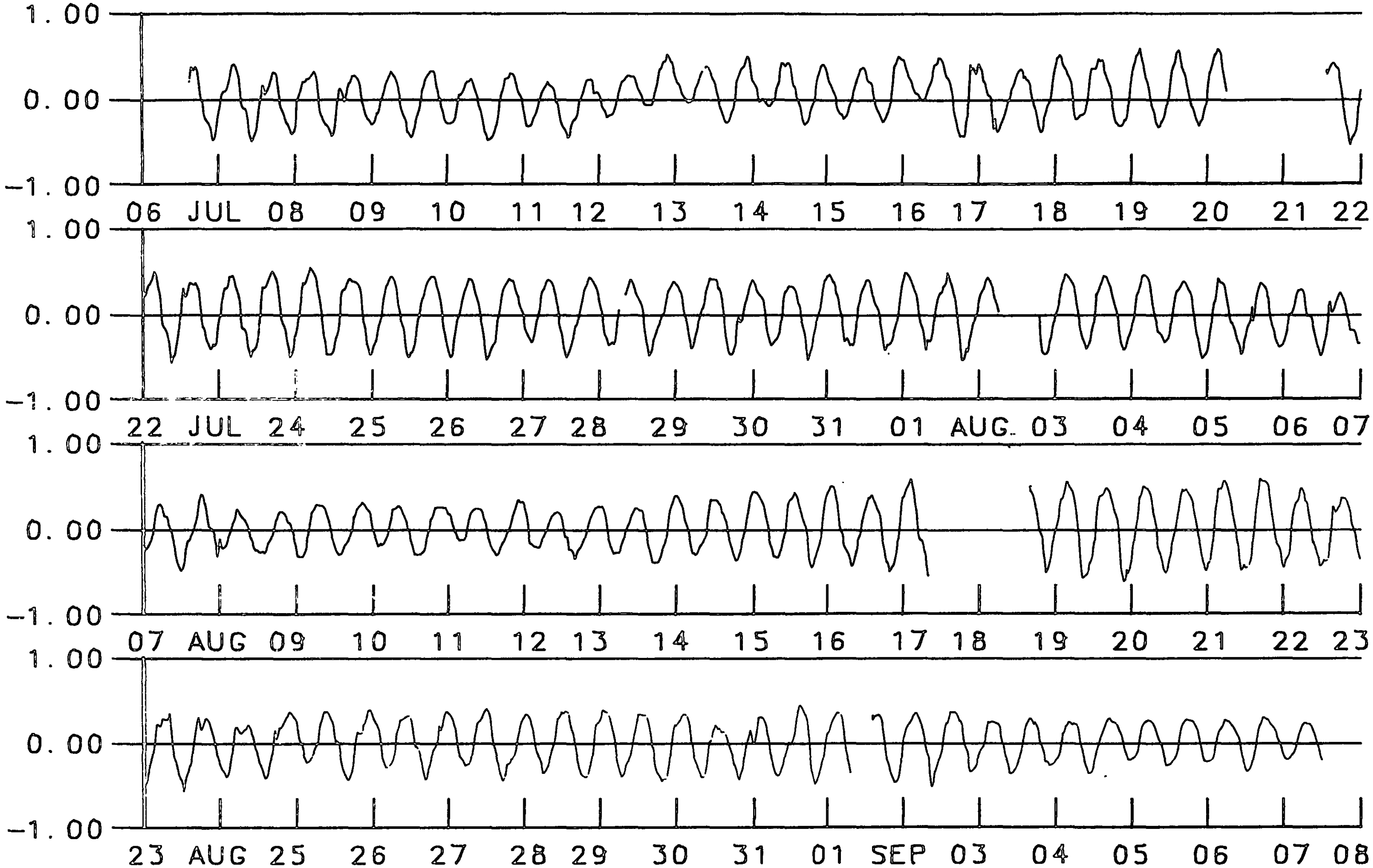
1989 YORK RIVER HYPOXIA SURVEY
STATION = RB DEPTH = 11 M
LONGITUDINAL COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB



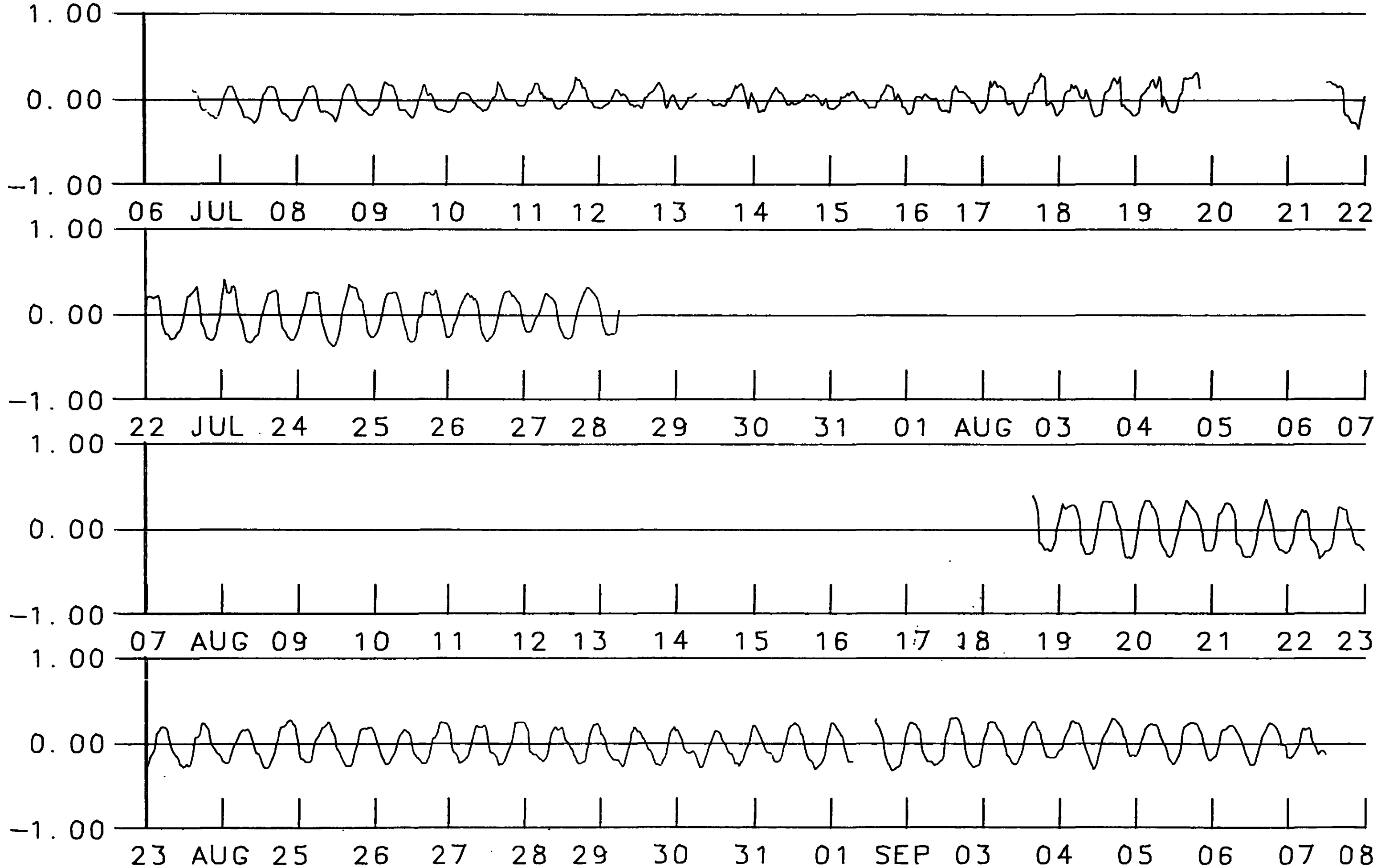
1989 YORK RIVER HYPOXIA SURVEY
STATION = RB DEPTH = 16 M
LONGITUDINAL COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB



1989 YORK RIVER HYPOXIA SURVEY
STATION = TUE DEPTH = 1 M
LONGITUDINAL COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB



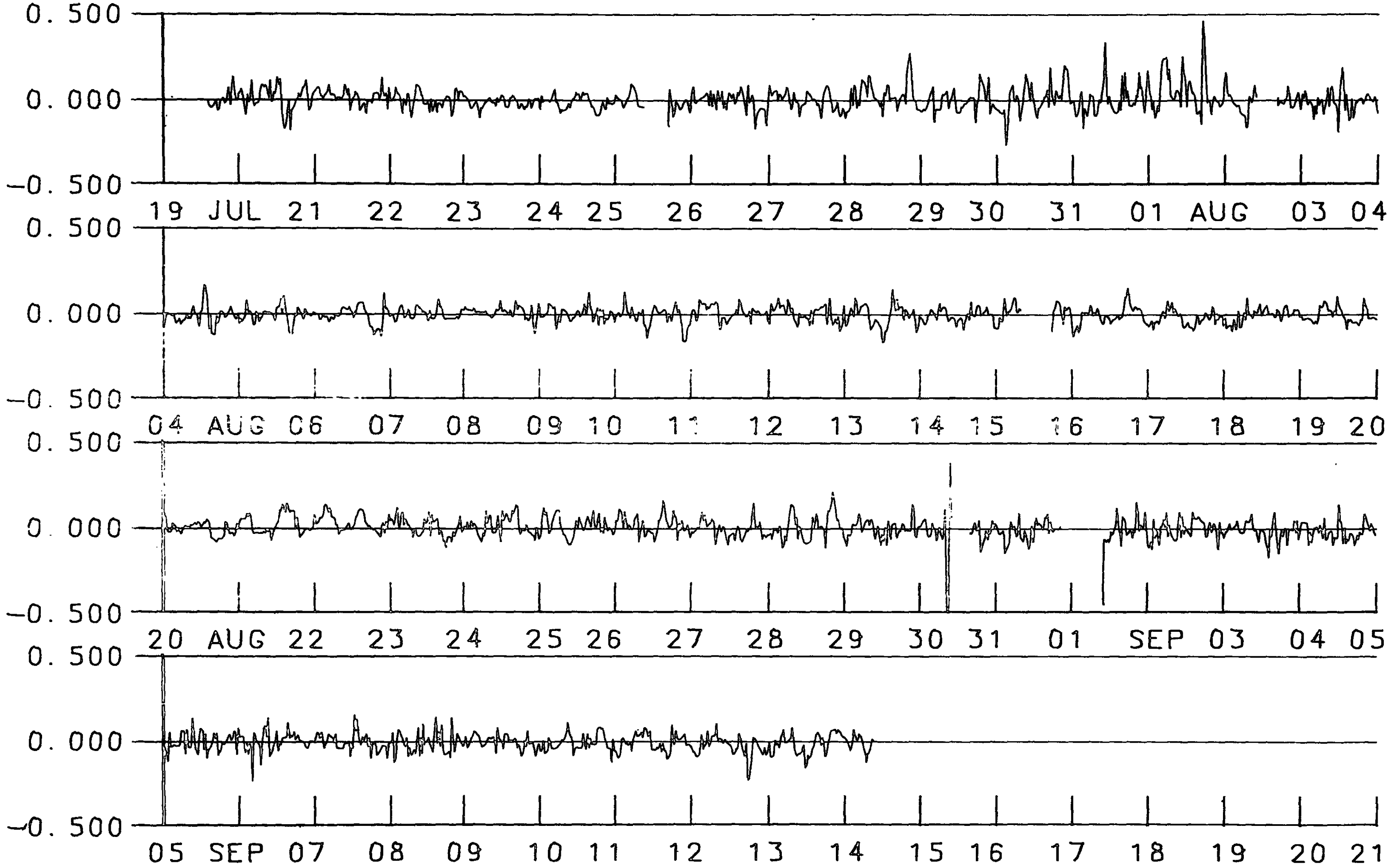
1989 YORK RIVER HYPOXIA SURVEY
STATION = TUE DEPTH = 6 M
LONGITUDINAL COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB



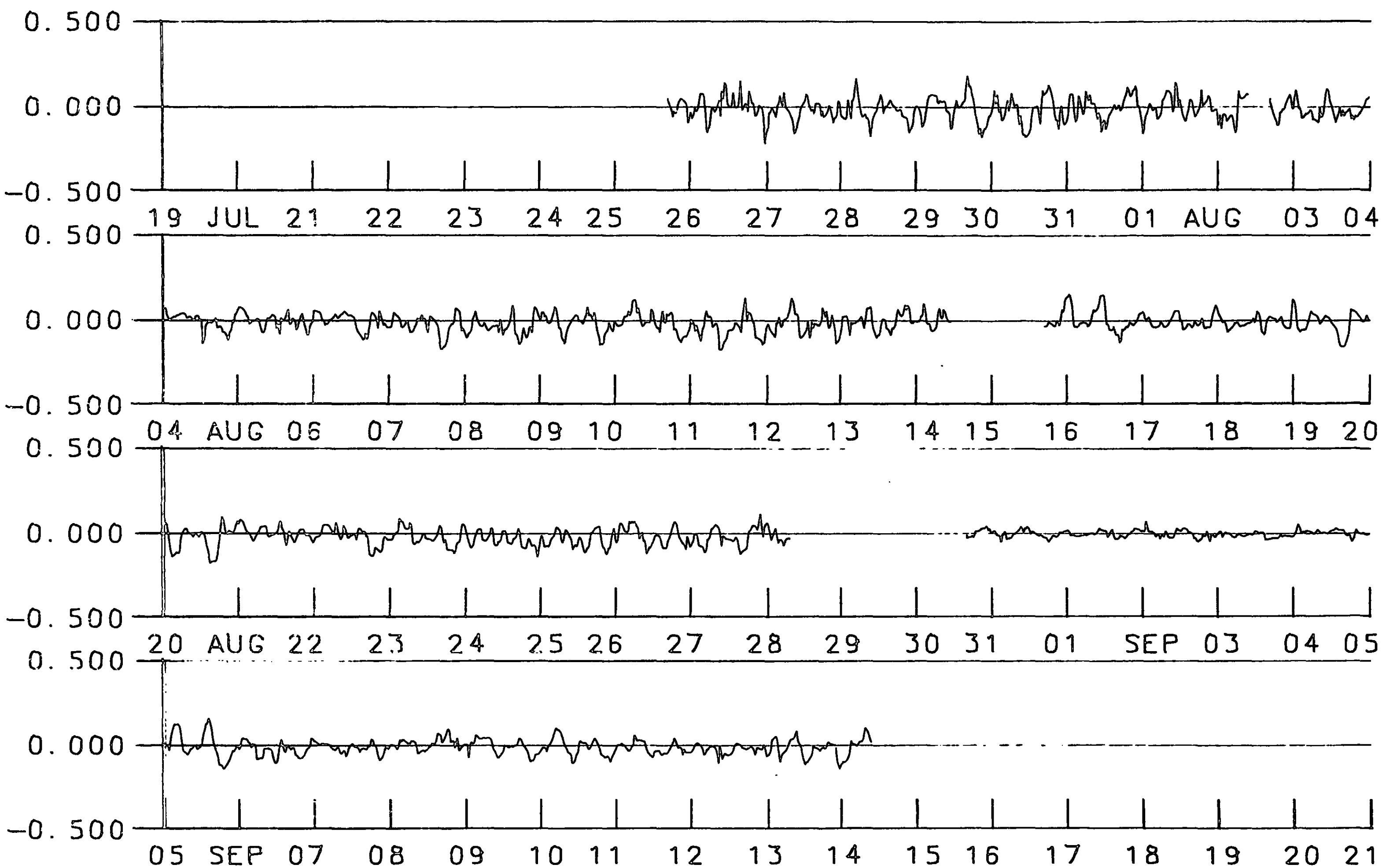
1989 YORK RIVER HYPOXIA SURVEY
STATION = TUE DEPTH = 10 M
LONGITUDINAL COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB

APPENDIX D1

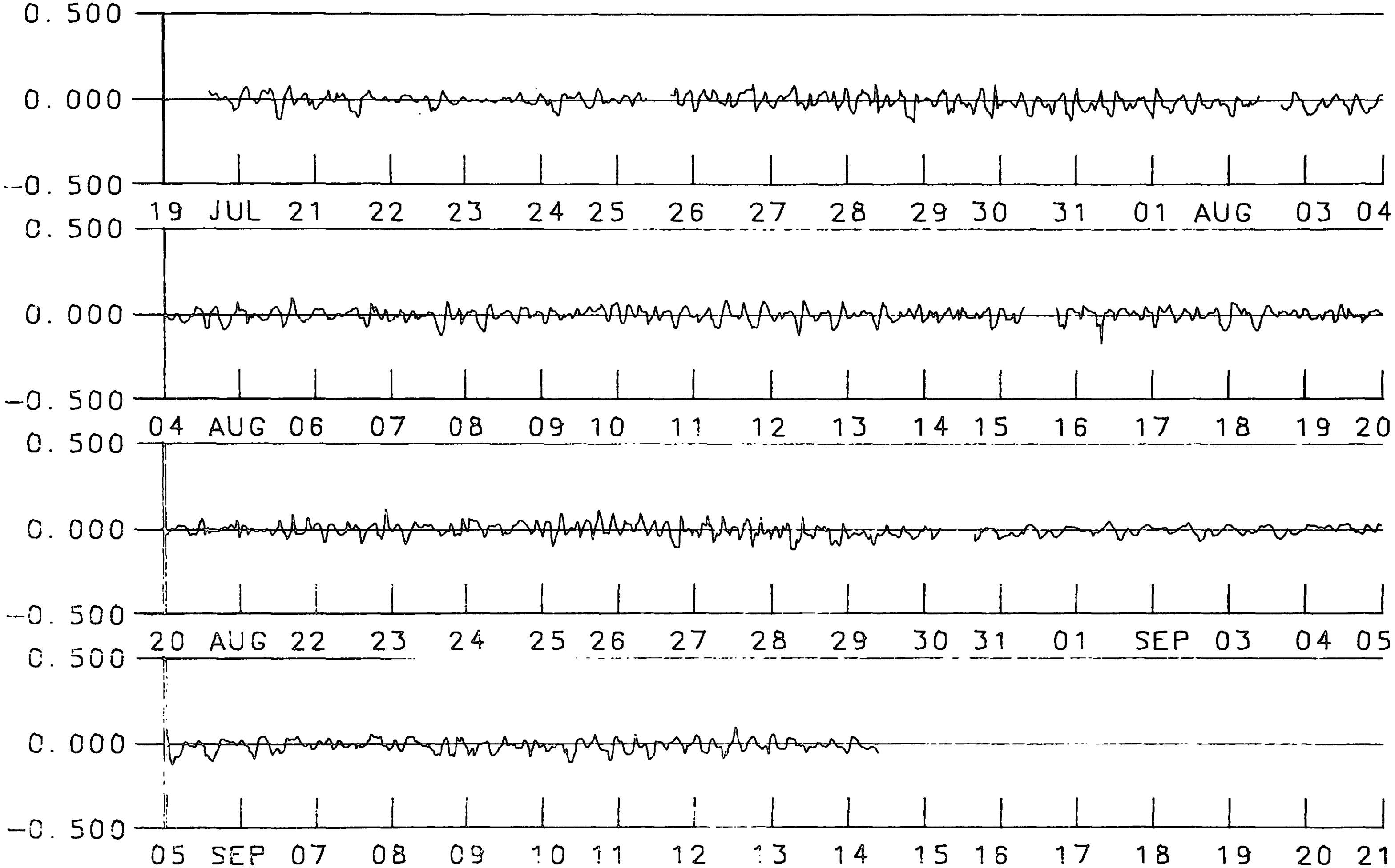
TRANSVERSE COMPONENTS OF CURRENTS (1988)



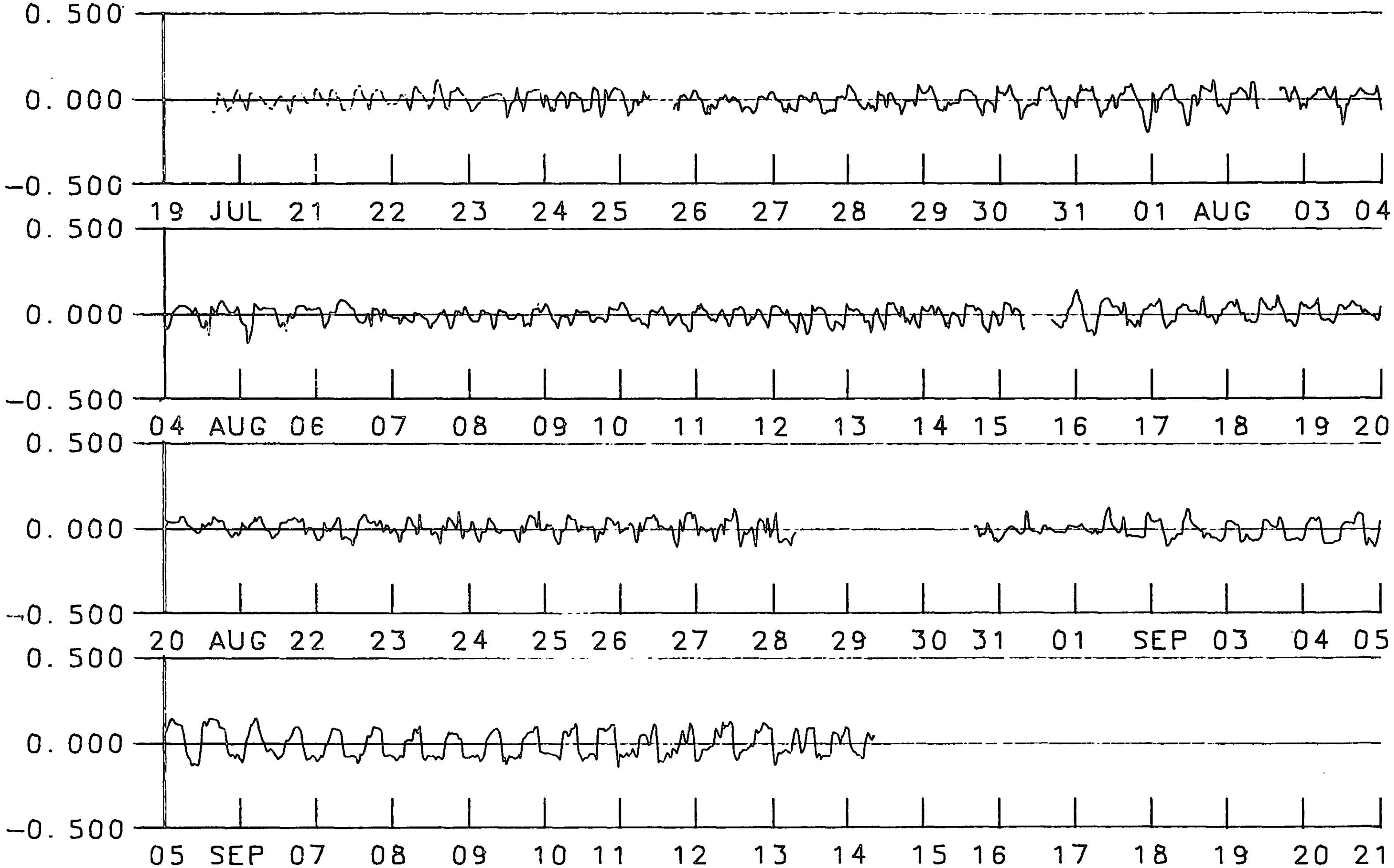
1988 YORK RIVER HYPOXIA SURVEY
YORK 0.0 KM FROM MOUTH DEPTH = 1.5 M
TRANSVERSE COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB MINUS 90 DEG.



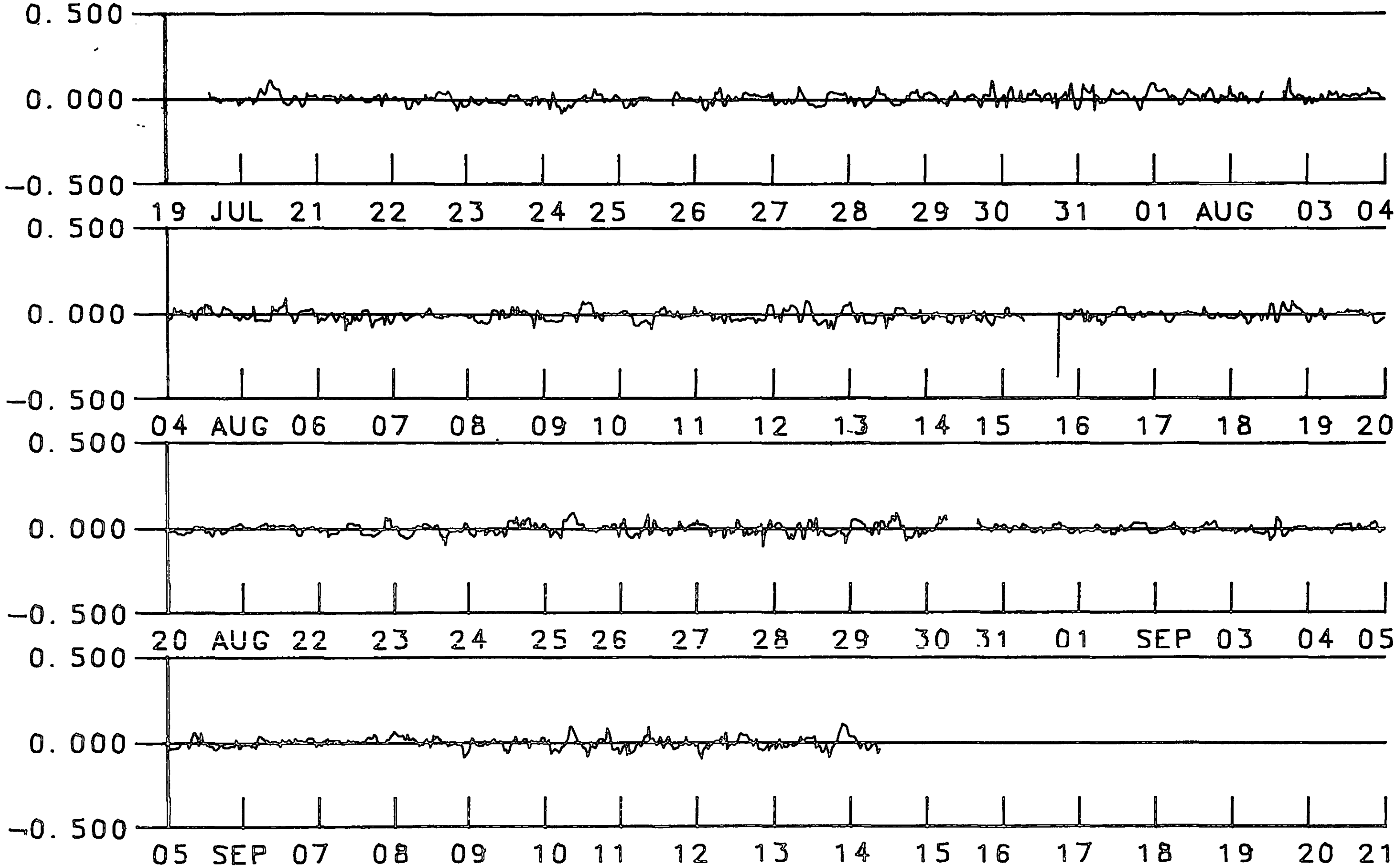
1988 YORK RIVER HYPOXIA SURVEY
YORK 0.0 KM FROM MOUTH DEPTH = 6.5 M
TRANSVERSE COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB MINUS 90 DEG.



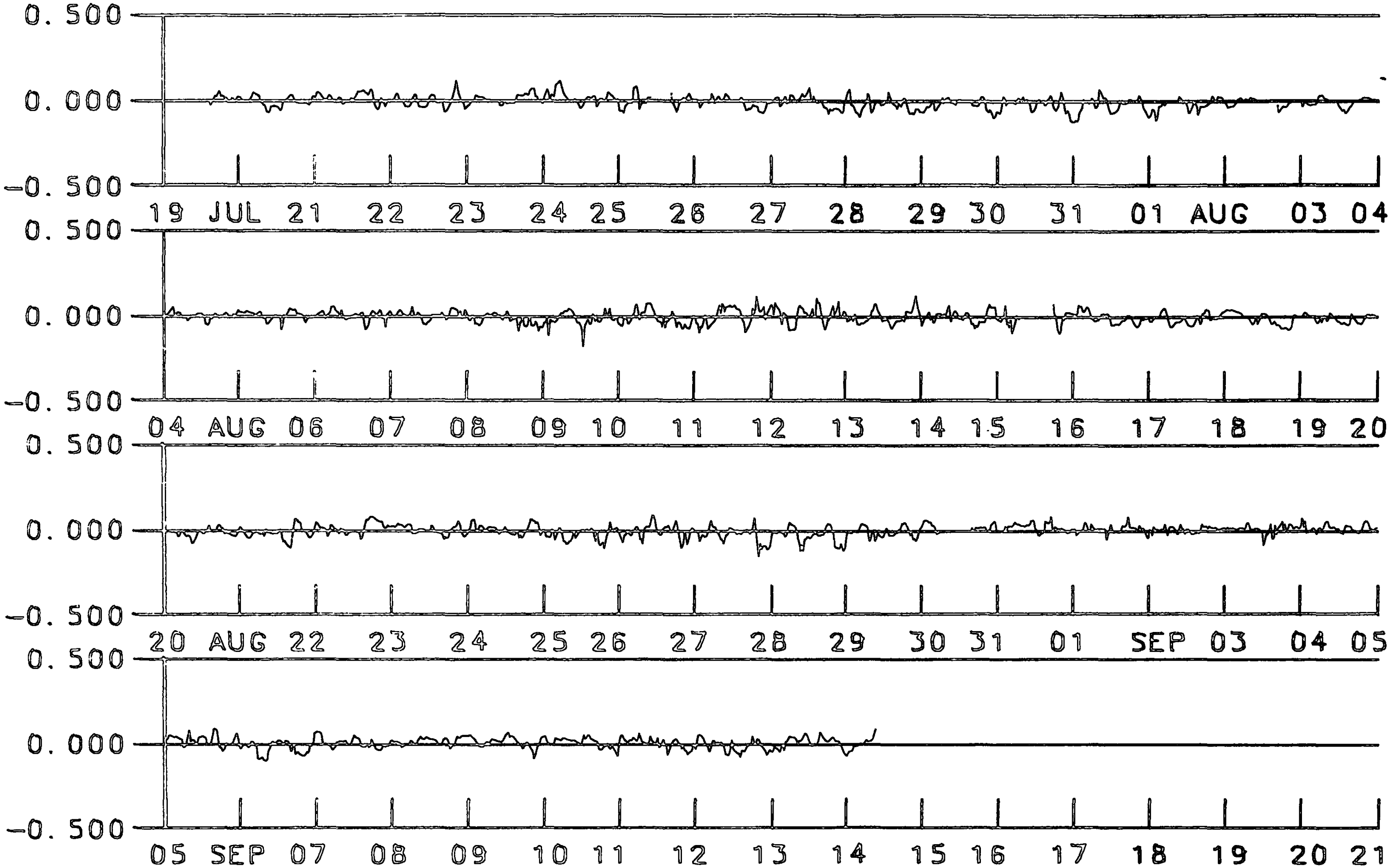
1988 YORK RIVER HYPOXIA SURVEY
YORK 0.0 KM FROM MOUTH DEPTH = 11.5 M
TRANSVERSE COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB MINUS 90 DEG.



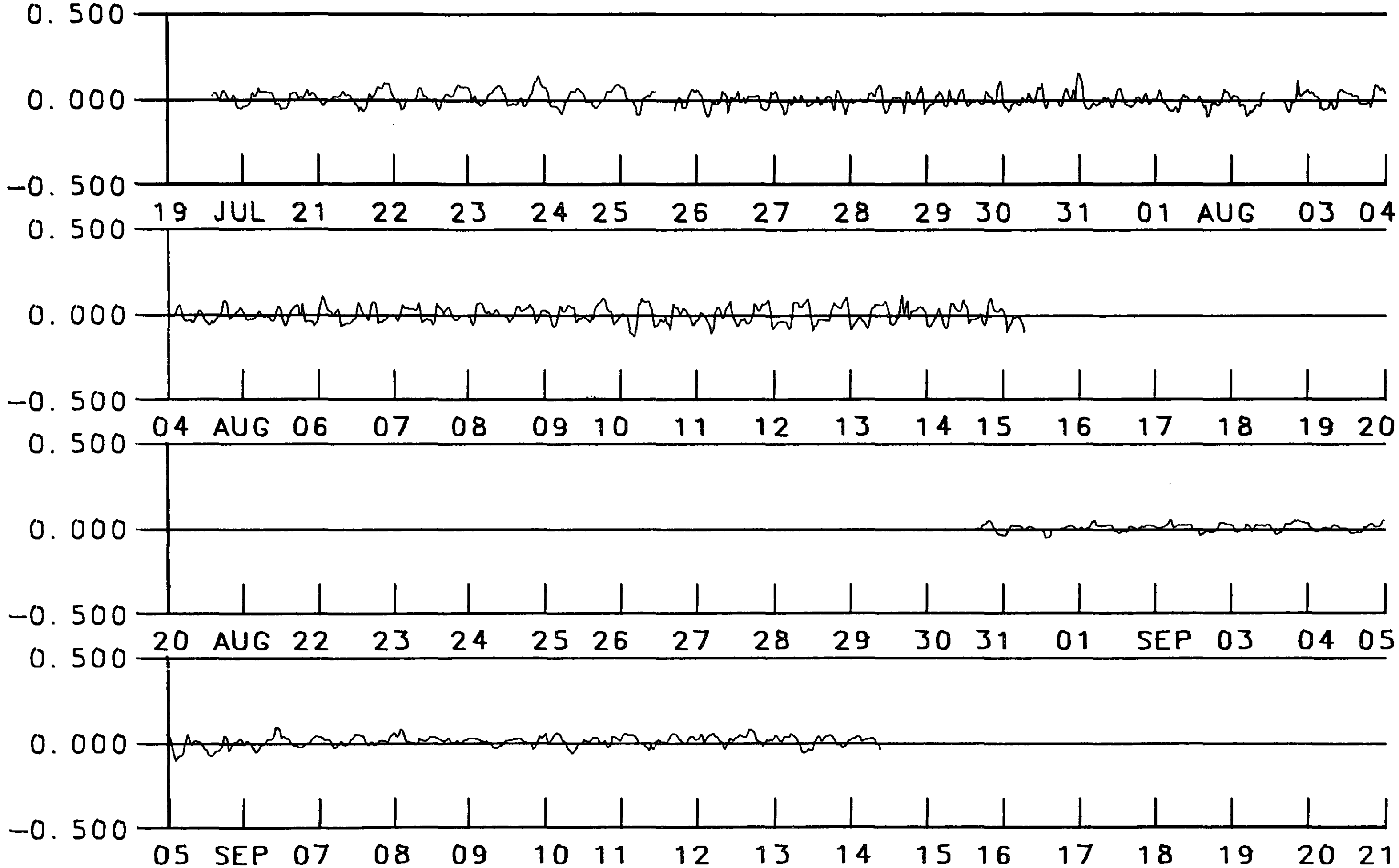
1988 YORK RIVER HYPOXIA SURVEY
YORK 0.0 KM FROM MOUTH DEPTH = 15.7 M
TRANSVERSE COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB MINUS 90 DEG.



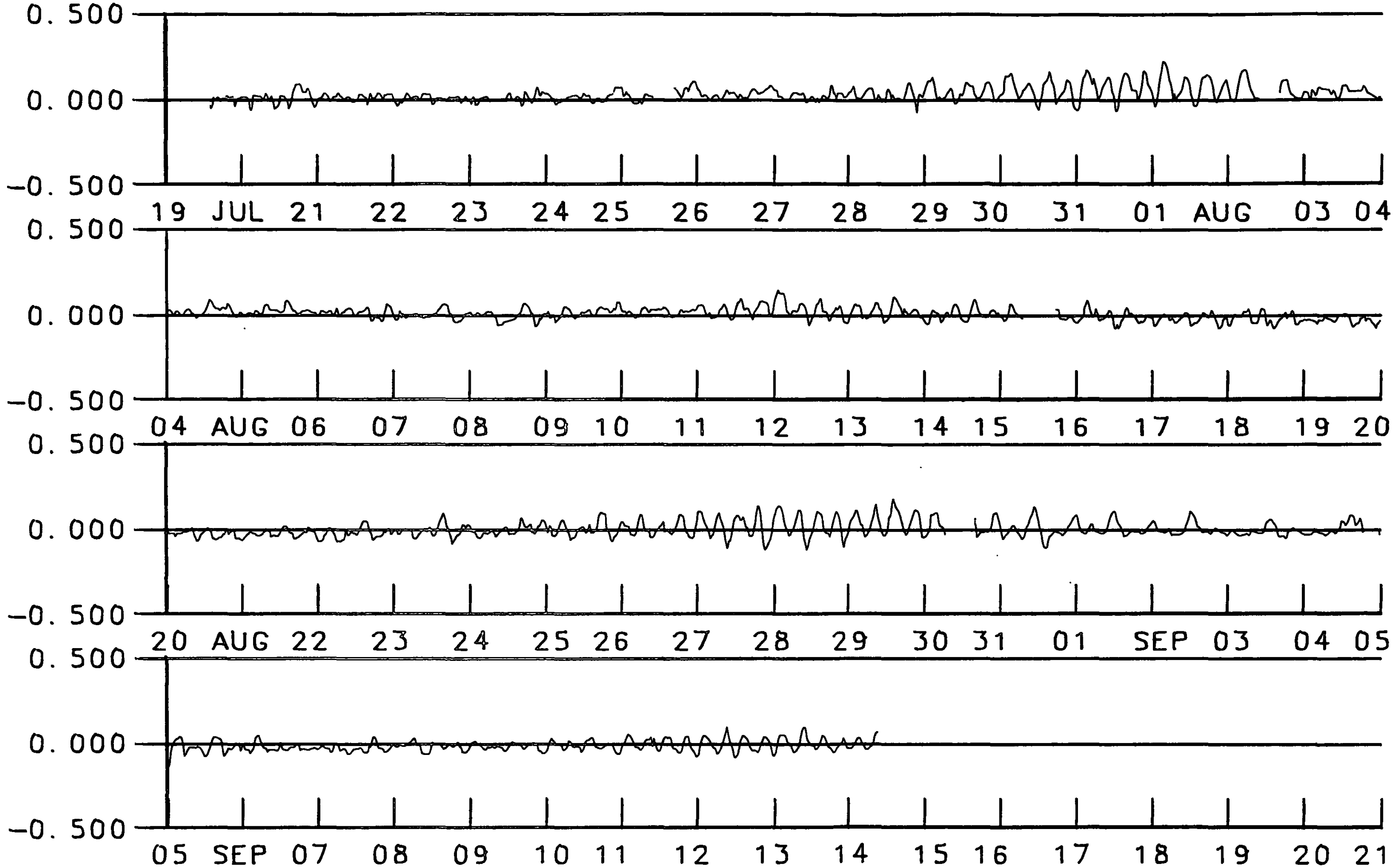
1988 YORK RIVER HYPOXIA SURVEY
YORK 3. 9 KM FROM MOUTH DEPTH = 1. 5 M
TRANSVERSE COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB MINUS 90 DEG.



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.



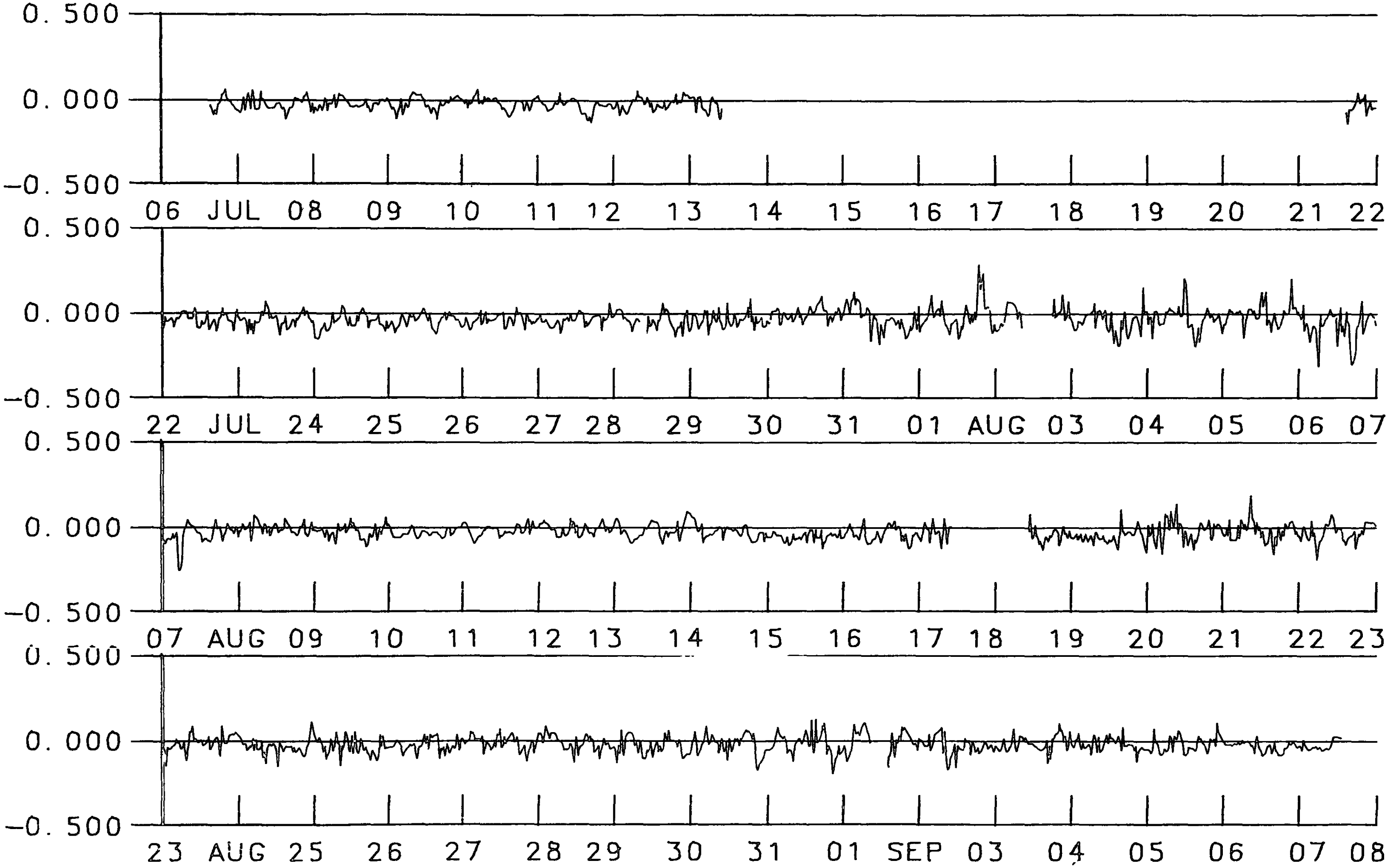
1988 YORK RIVER HYPOXIA SURVEY
YORK 3.9 KM FROM MOUTH DEPTH = 11.5 M
TRANSVERSE COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB MINUS 90 DEG.



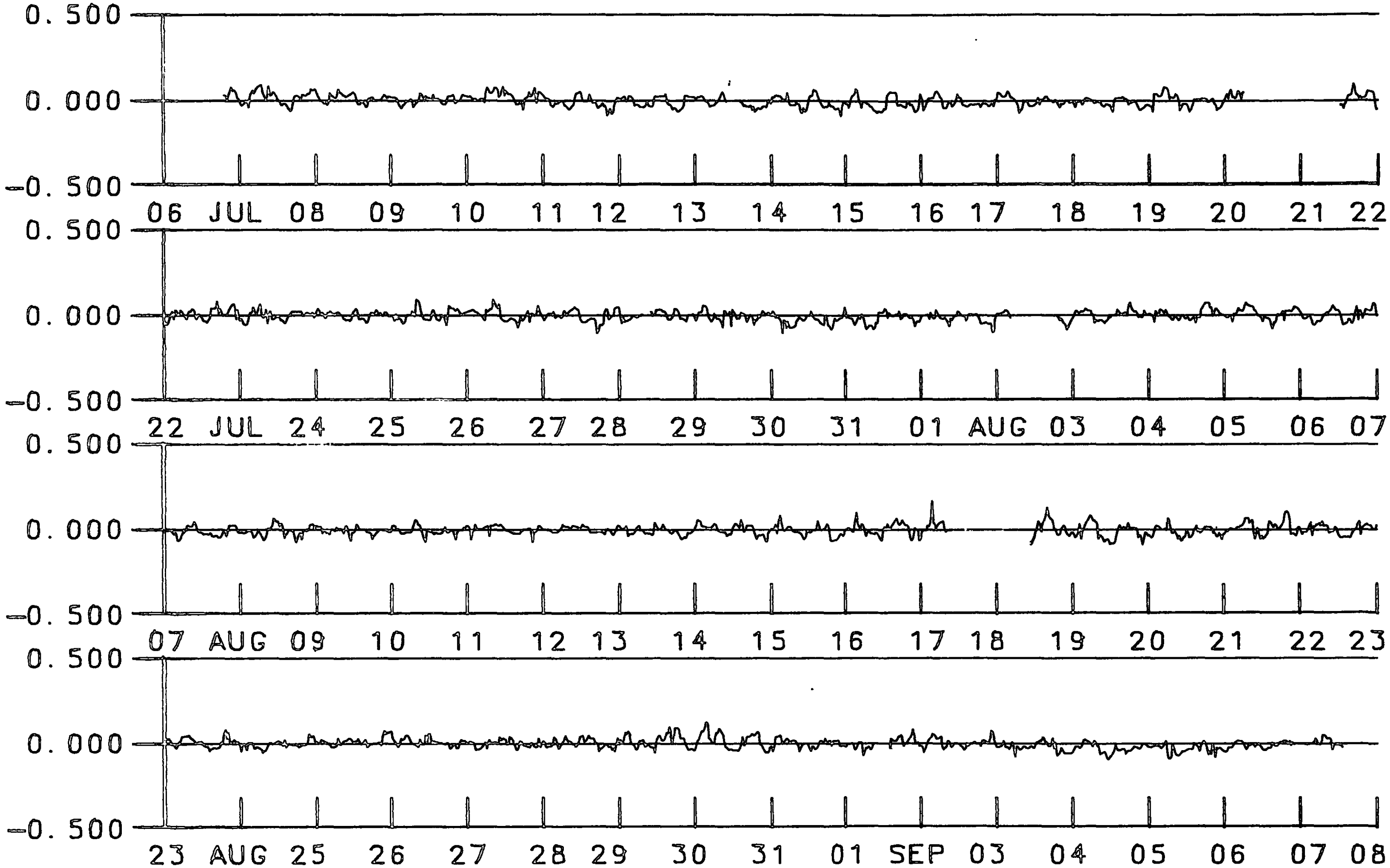
1988 YORK RIVER HYPOXIA SURVEY
YORK 3.9 KM FROM MOUTH DEPTH = 15.1 M
TRANSVERSE COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB MINUS 90 DEG.

APPENDIX D2

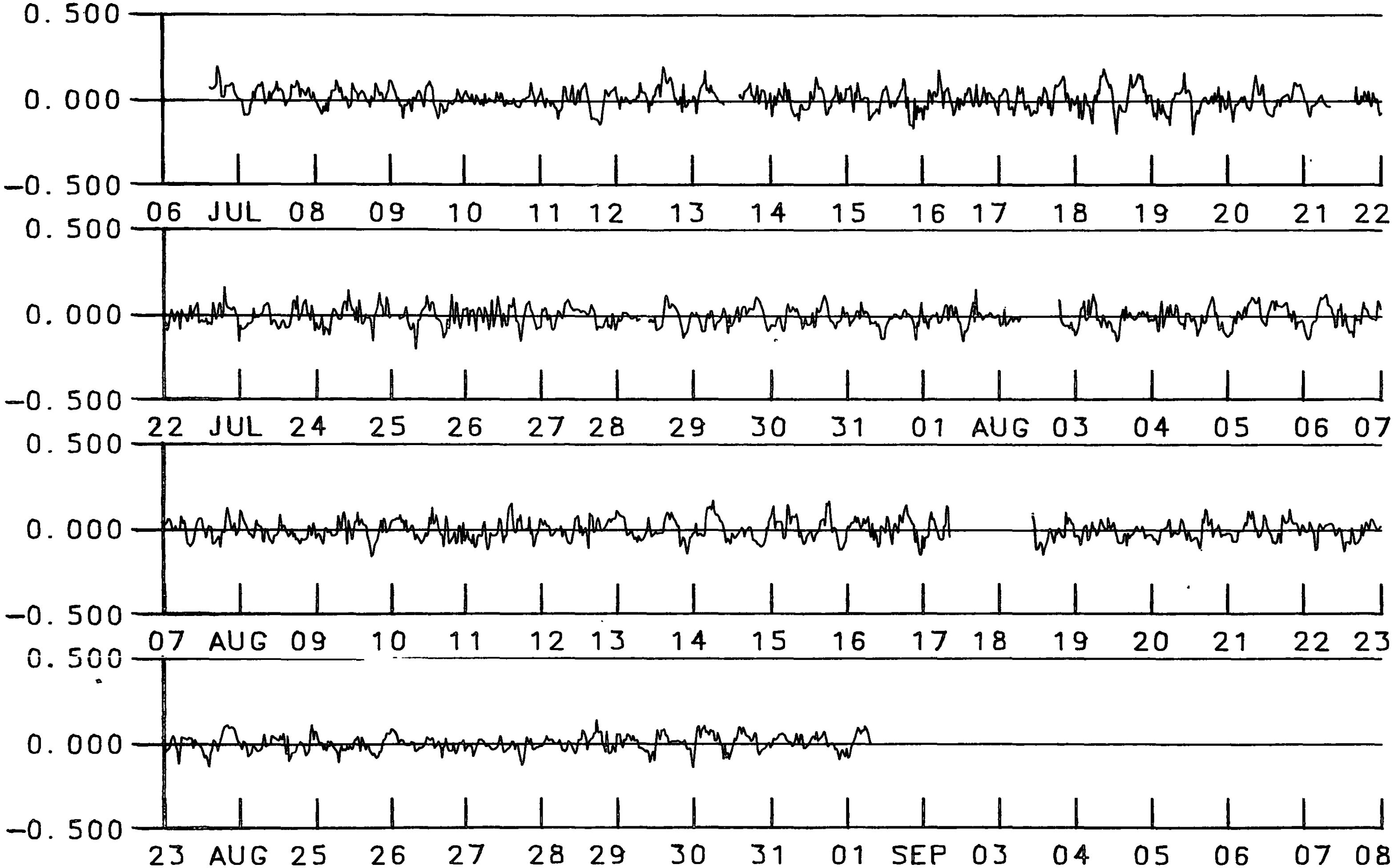
TRANSVERSE COMPONENTS OF CURRENTS (1998)



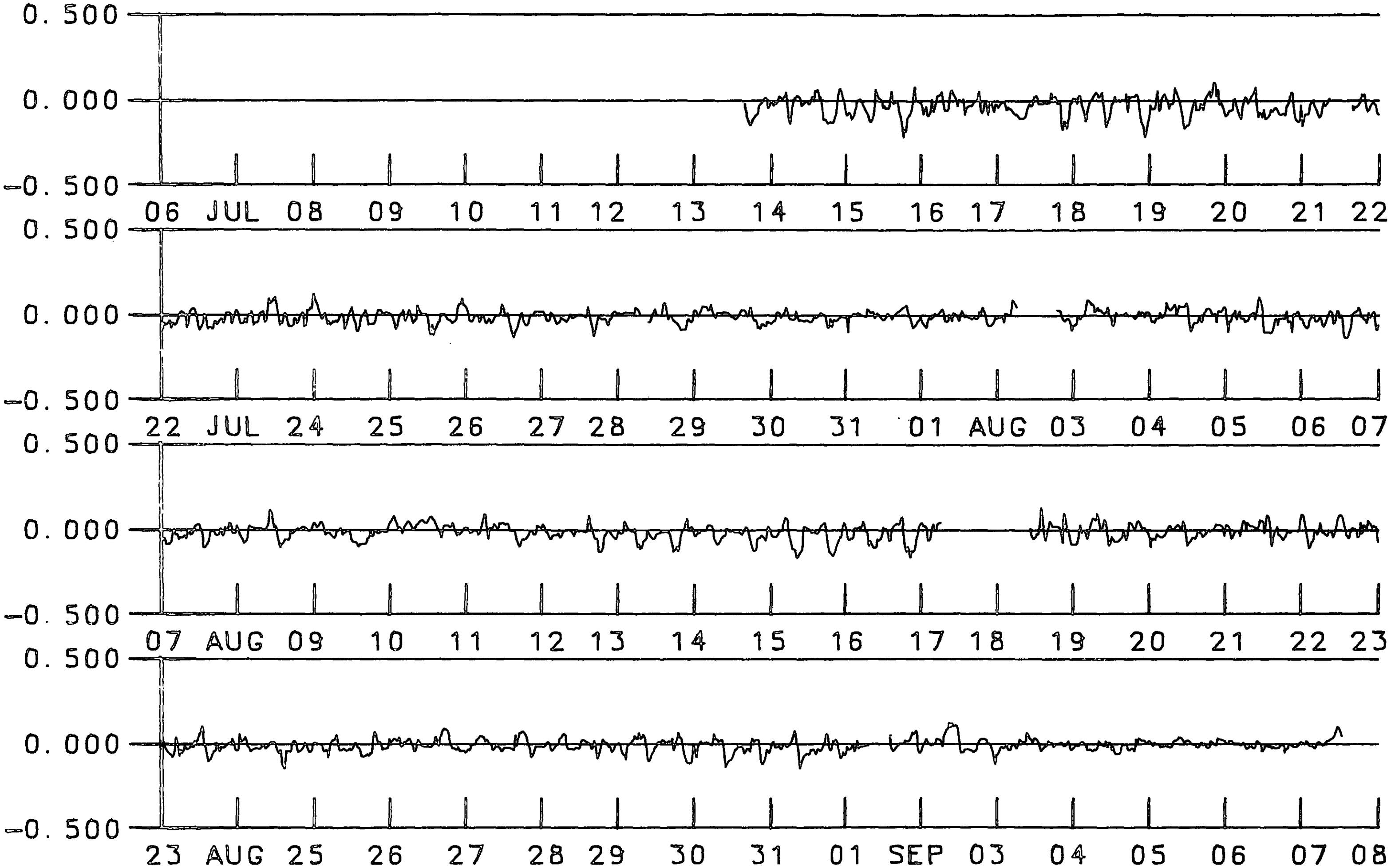
1989 YORK RIVER HYPOXIA SURVEY
STATION = N2 DEPTH = 1 M
TRANSVERSE COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB MINUS 90 DEG.



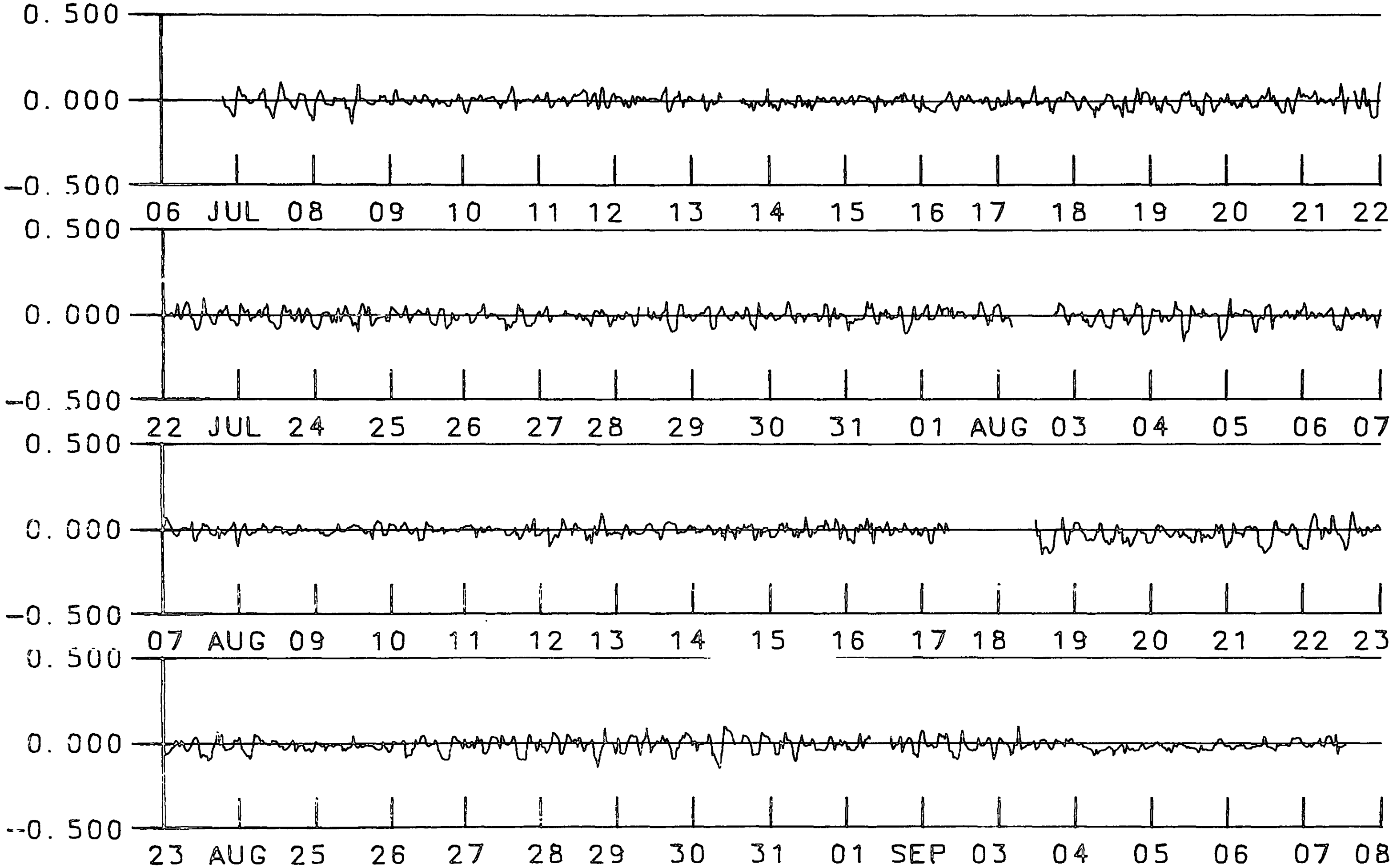
1989 YORK RIVER HYPOXIA SURVEY
STATION = N2 DEPTH = 7 M
TRANSVERSE COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB MINUS 90 DEG.



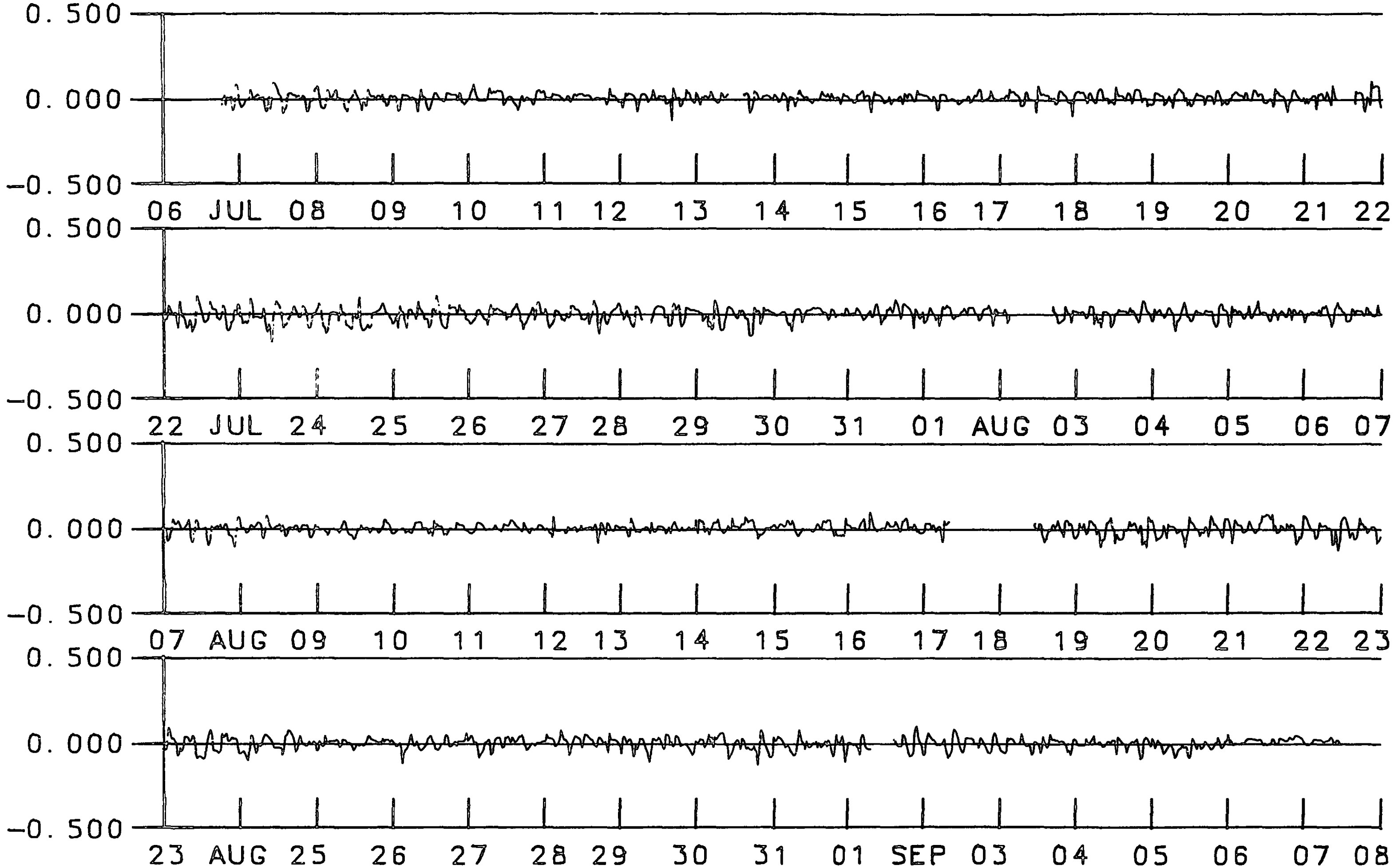
1989 YORK RIVER HYPOXIA SURVEY
STATION = RB DEPTH = 1 M
TRANSVERSE COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB MINUS 90 DEG.



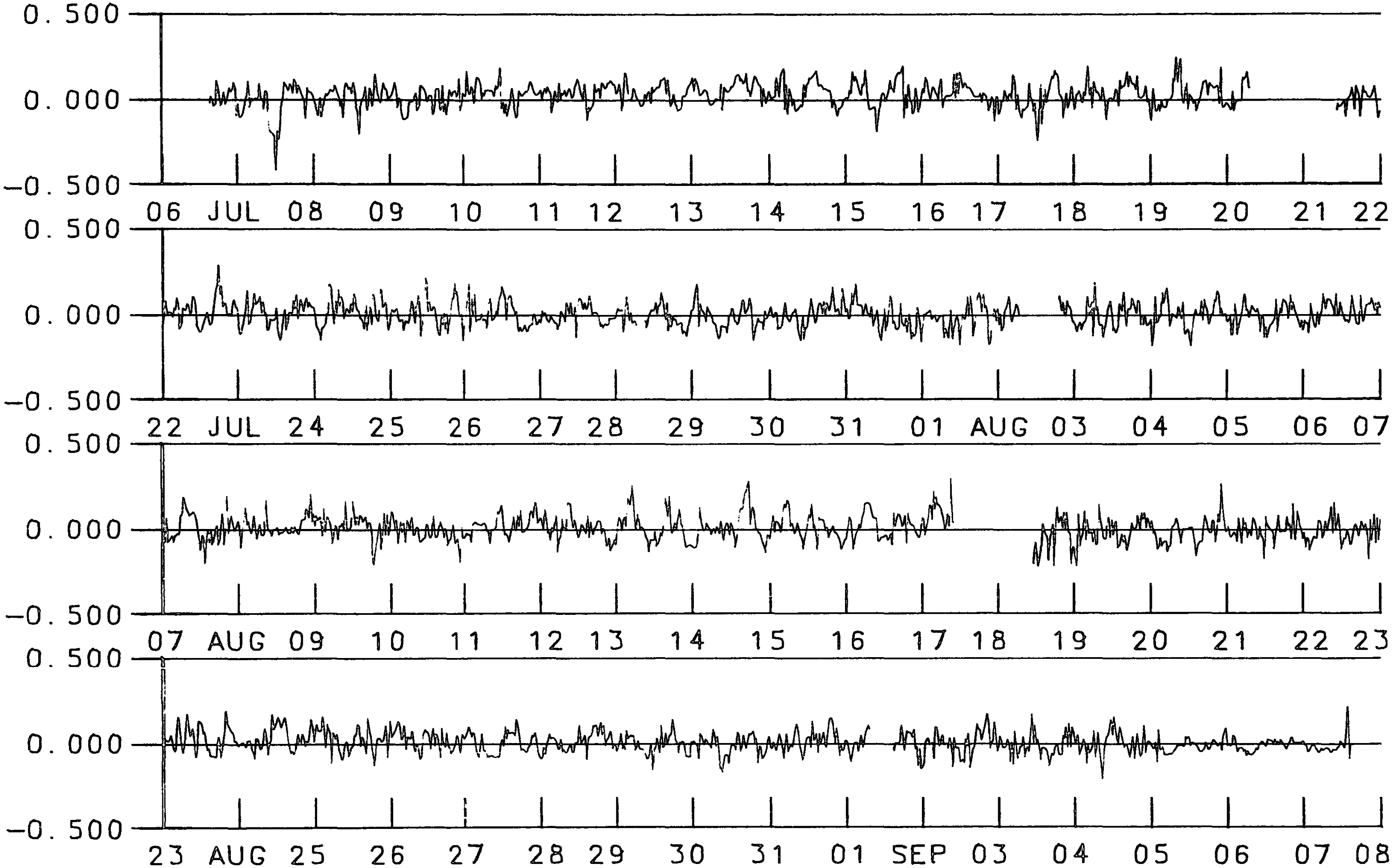
1989 YORK RIVER HYPOXIA SURVEY
STATION = RB DEPTH = 6 M
TRANSVERSE COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB MINUS 90 DEG.



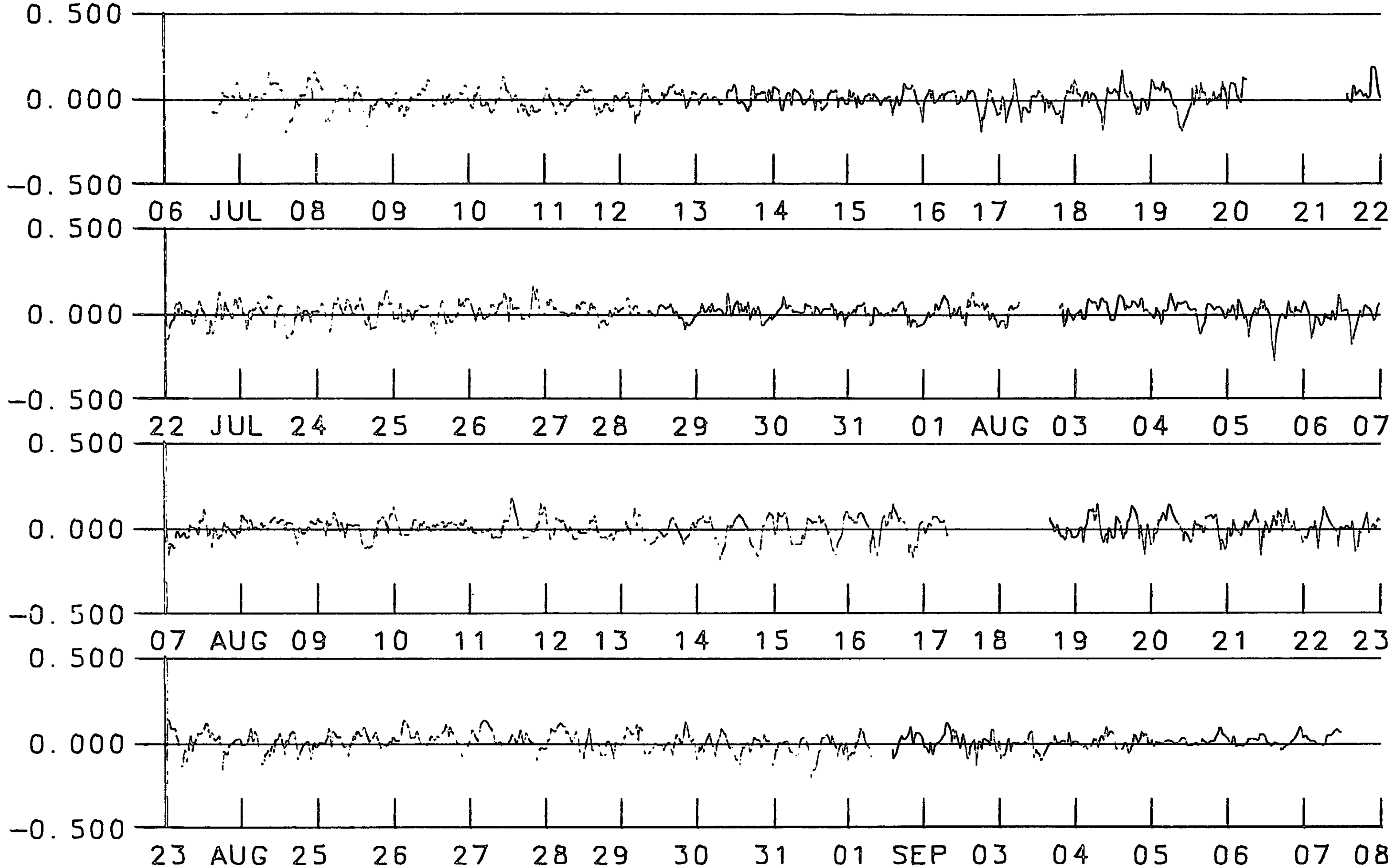
1989 YORK RIVER HYPOXIA SURVEY
STATION = RB DEPTH = 11 M
TRANSVERSE COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB MINUS 90 DEG.



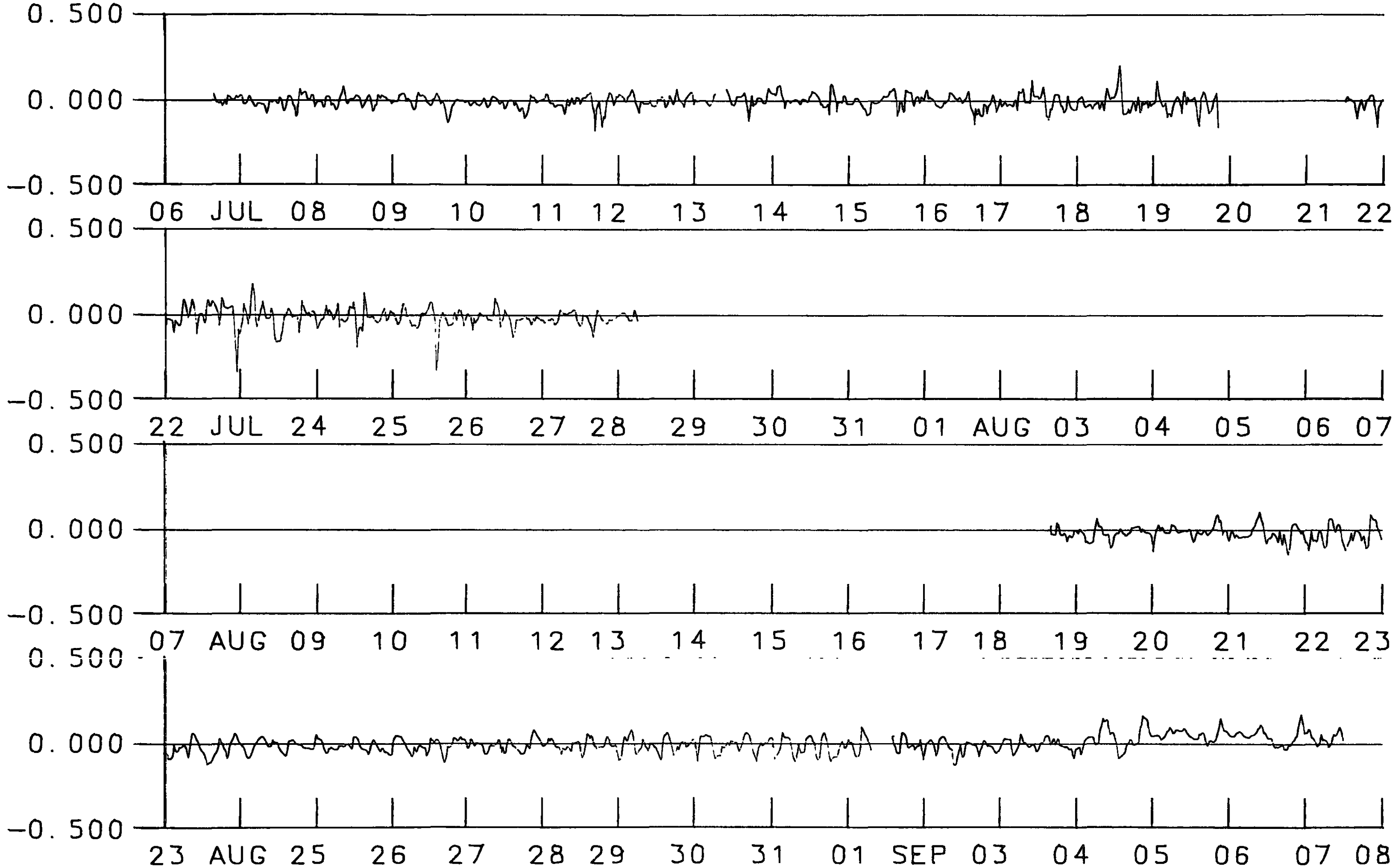
1989 YORK RIVER HYPOXIA SURVEY
STATION = RB DEPTH = 16 M
TRANSVERSE COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB MINUS 90 DEG.



1989 YORK RIVER HYPOXIA SURVEY
STATION = TUE DEPTH = 1 M
TRANSVERSE COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB MINUS 90 DEG.



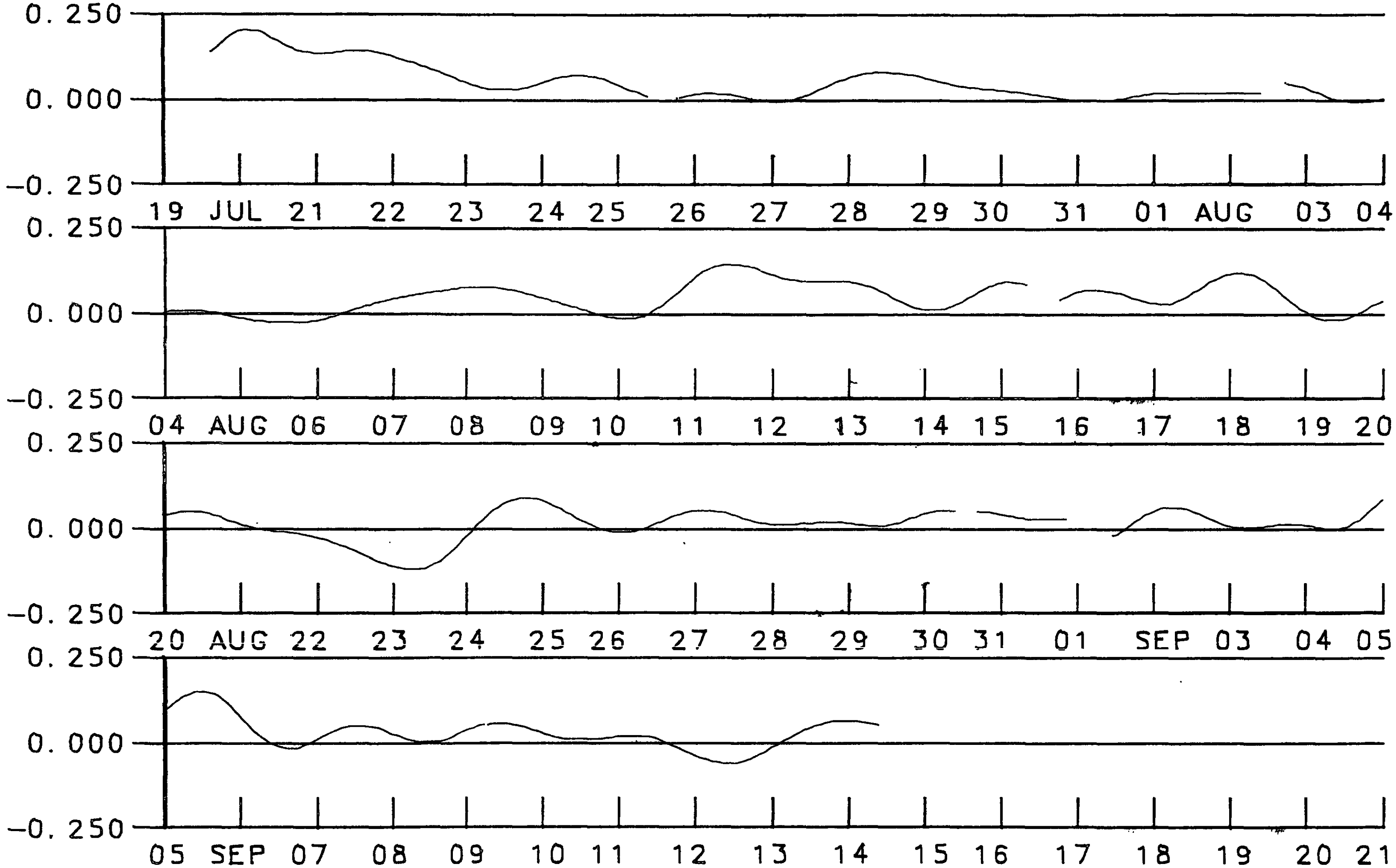
1989 YORK RIVER HYPOXIA SURVEY
STATION = TUE DEPTH = 6 M
TRANSVERSE COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB MINUS 90 DEG.



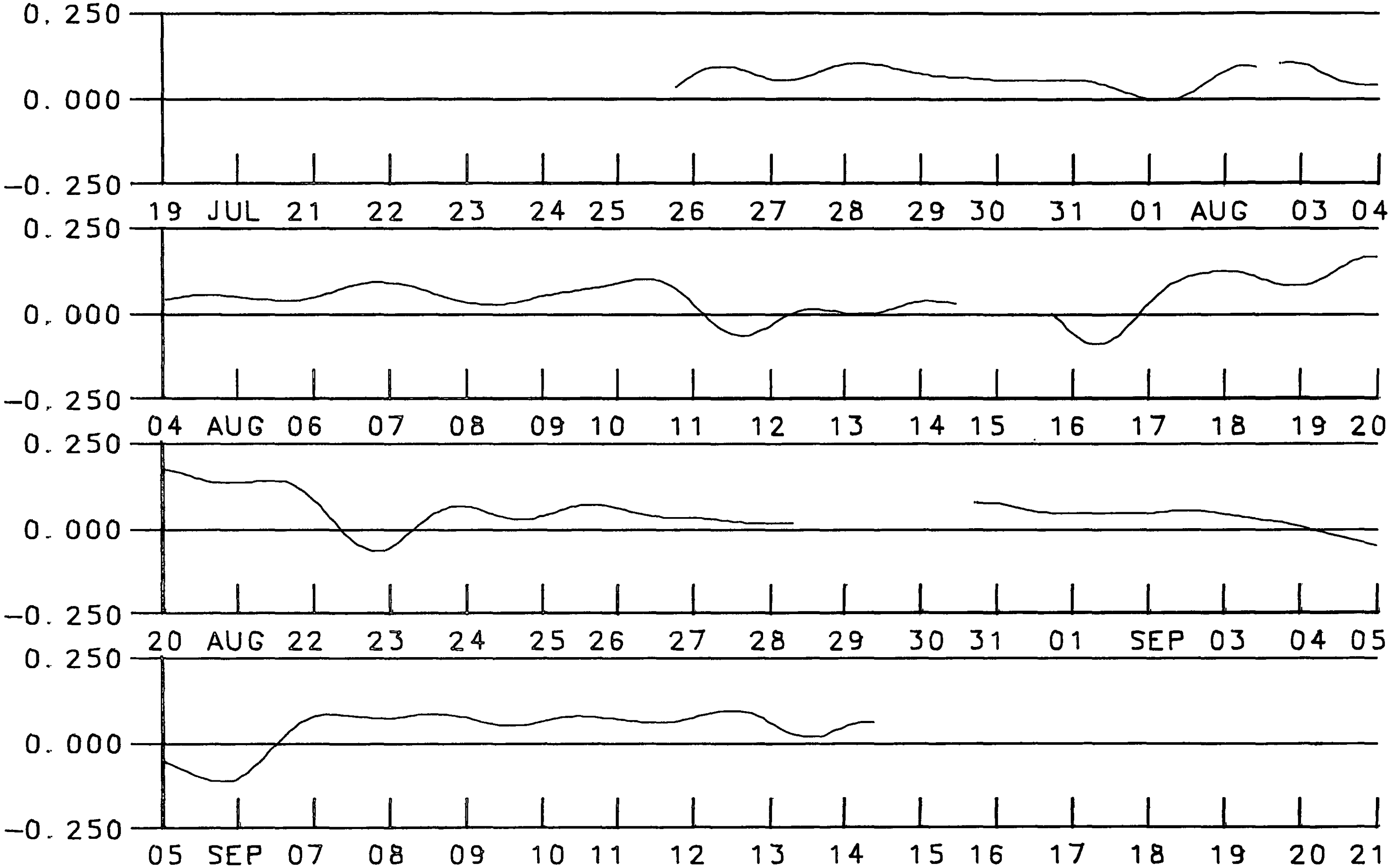
1989 YORK RIVER HYPOXIA SURVEY
STATION = TUE DEPTH = 10 M
TRANSVERSE COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB MINUS 90 DEG.

APPENDIX E1

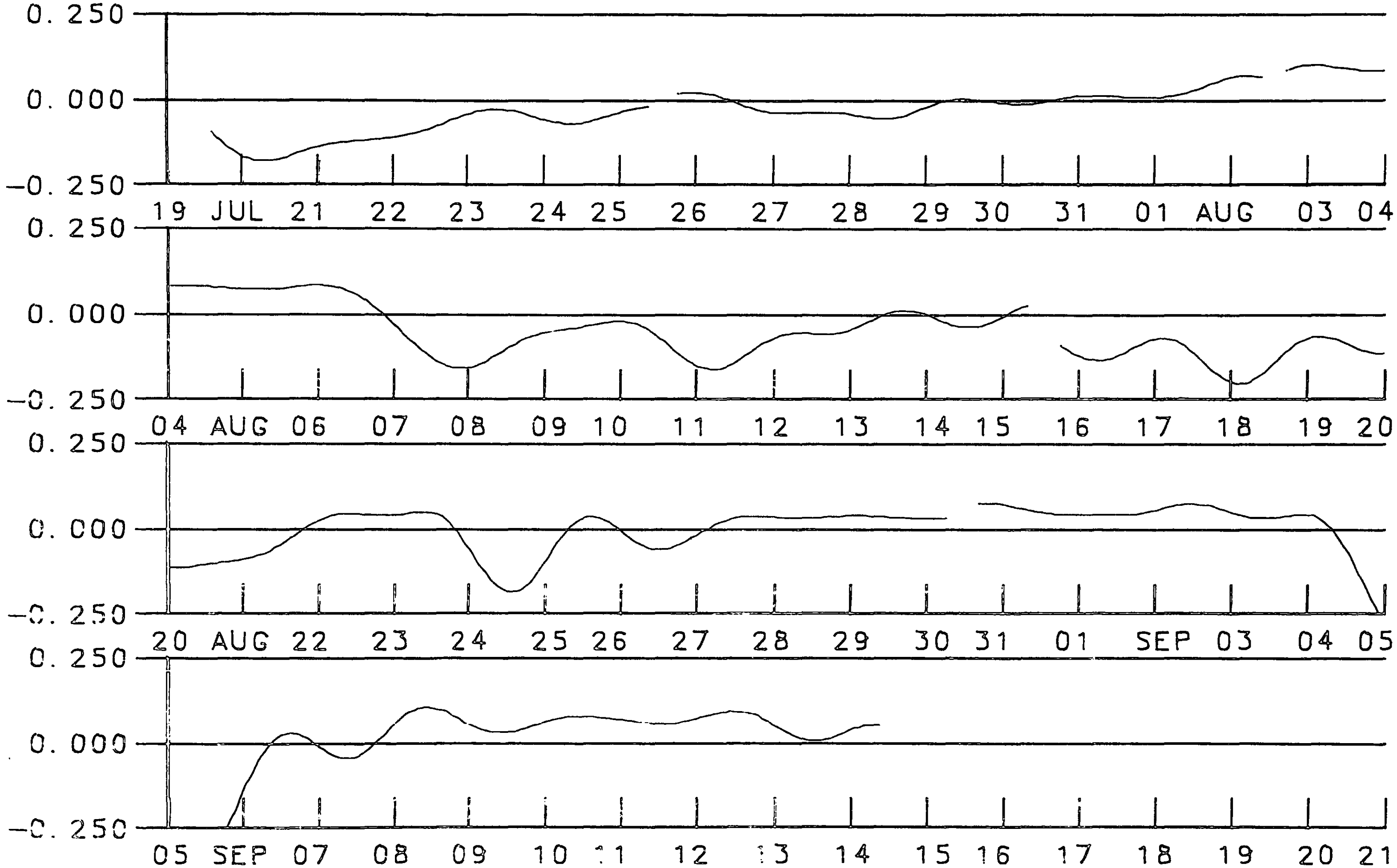
LOW PASS FILTERED LONGITUDINAL COMPONENTS OF CURRENTS (1988)



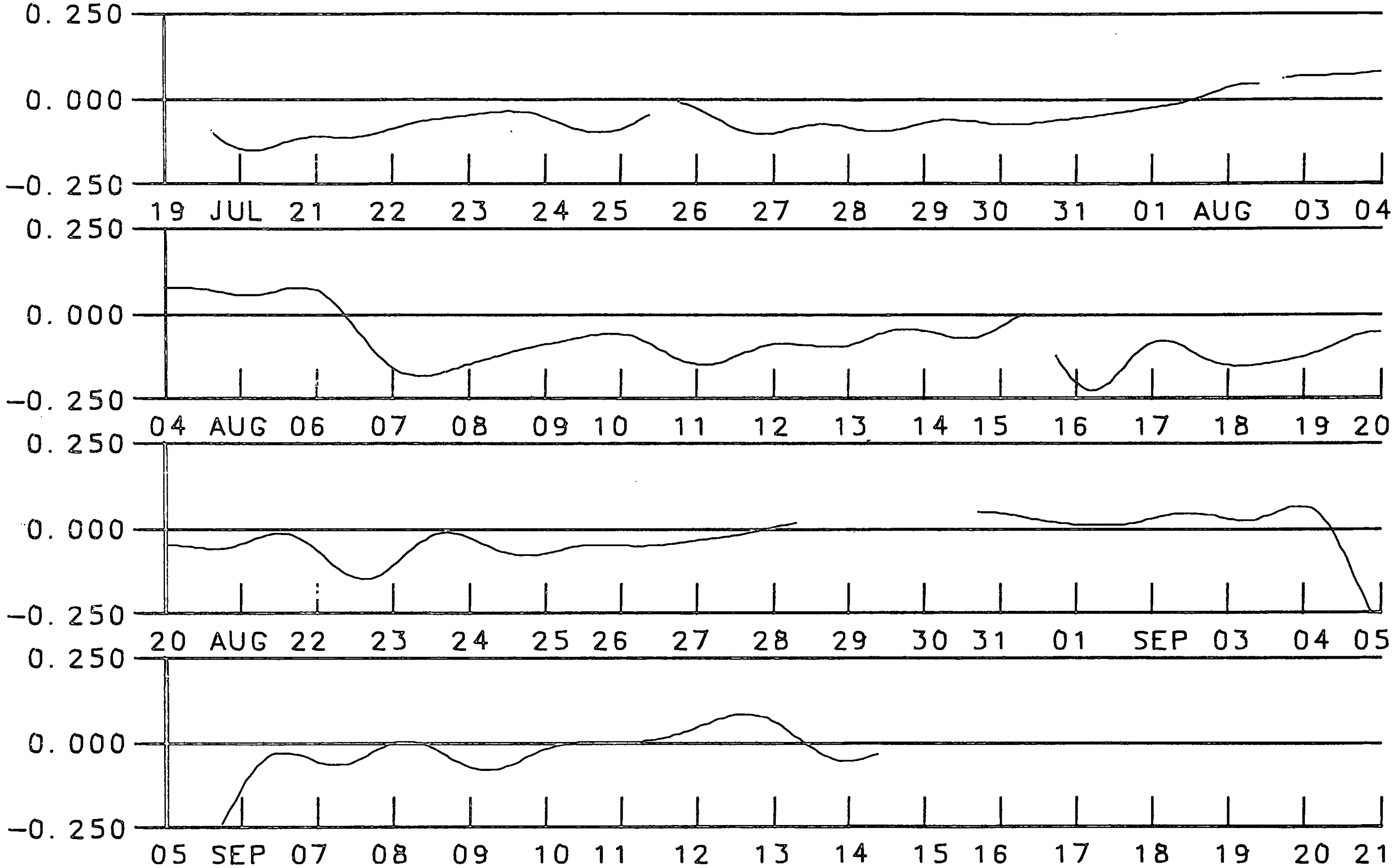
1988 YORK RIVER HYPOXIA SURVEY
YORK 0.0 KM FROM MOUTH DEPTH = 1.5 M
LONGITUDINAL COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB
CUT OFF PERIOD FOR FILTER = 36 HOURS



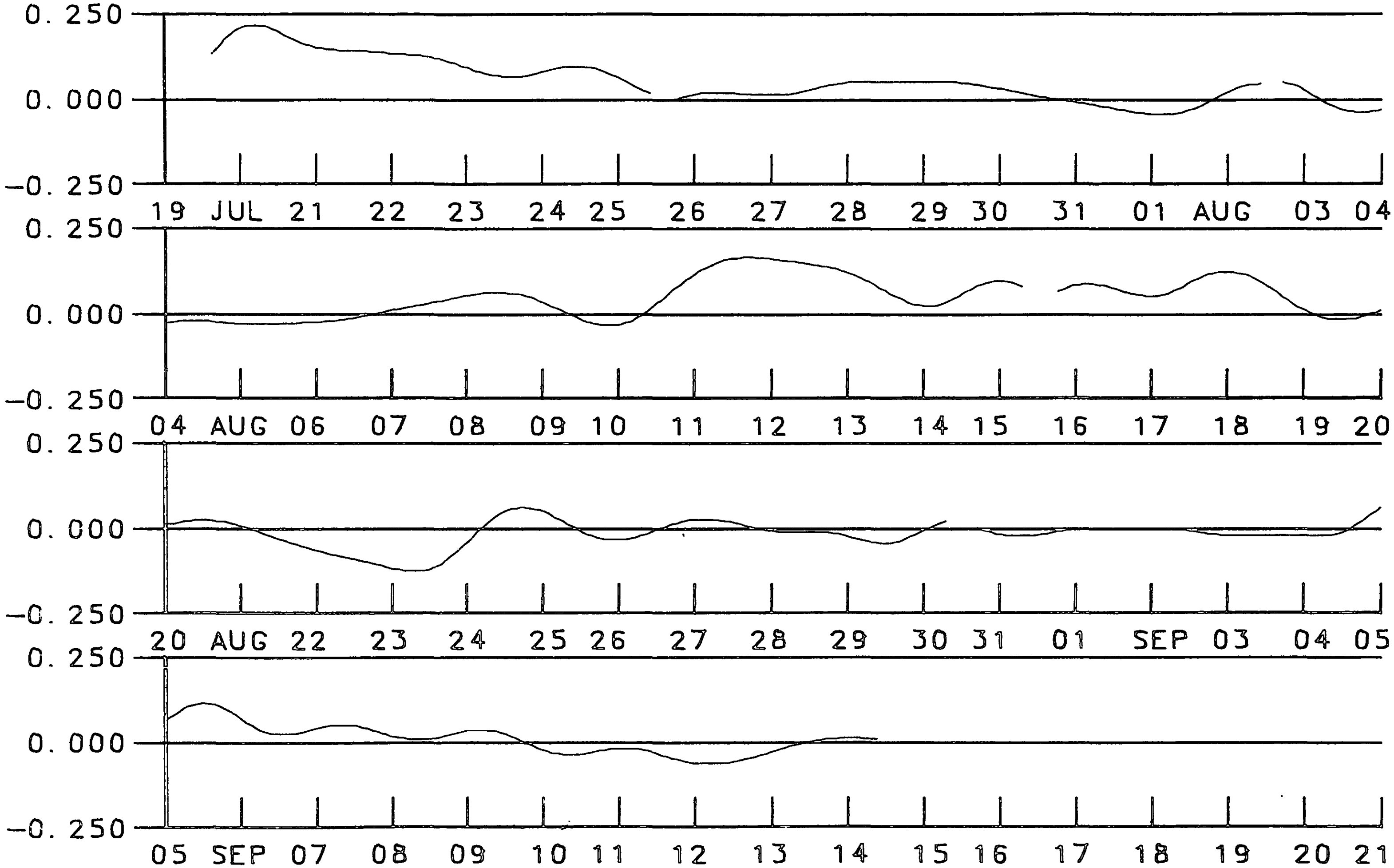
1988 YORK RIVER HYPOXIA SURVEY
YORK 0.0 KM FROM MOUTH DEPTH = 6.5 M
LONGITUDINAL COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB
CUT OFF PERIOD FOR FILTER = 36 HOURS



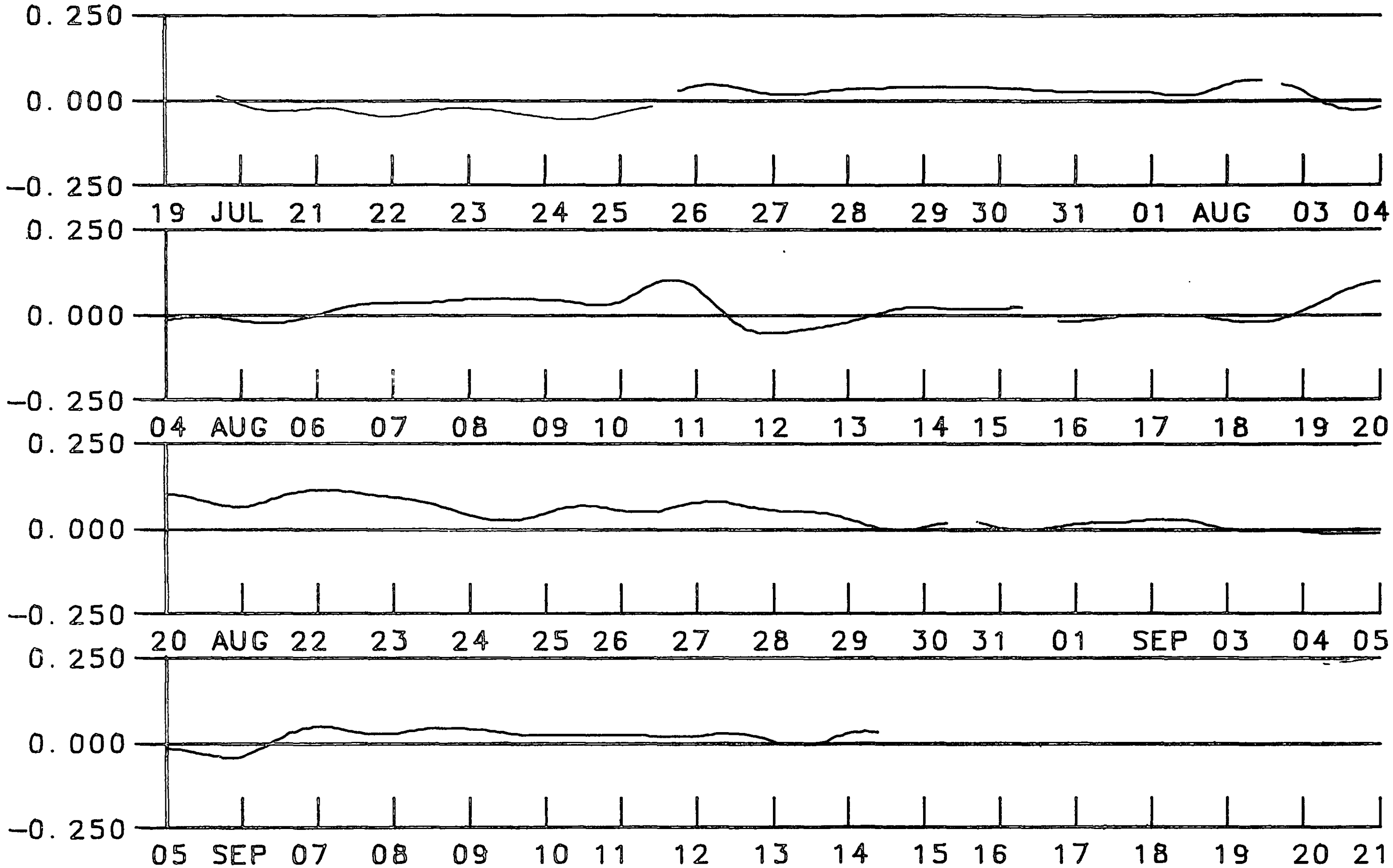
1988 YORK RIVER HYPOXIA SURVEY
YORK 0.0 KM FROM MOUTH DEPTH = 11.5 M
LONGITUDINAL COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB
CUT OFF PERIOD FOR FILTER = 36 HOURS



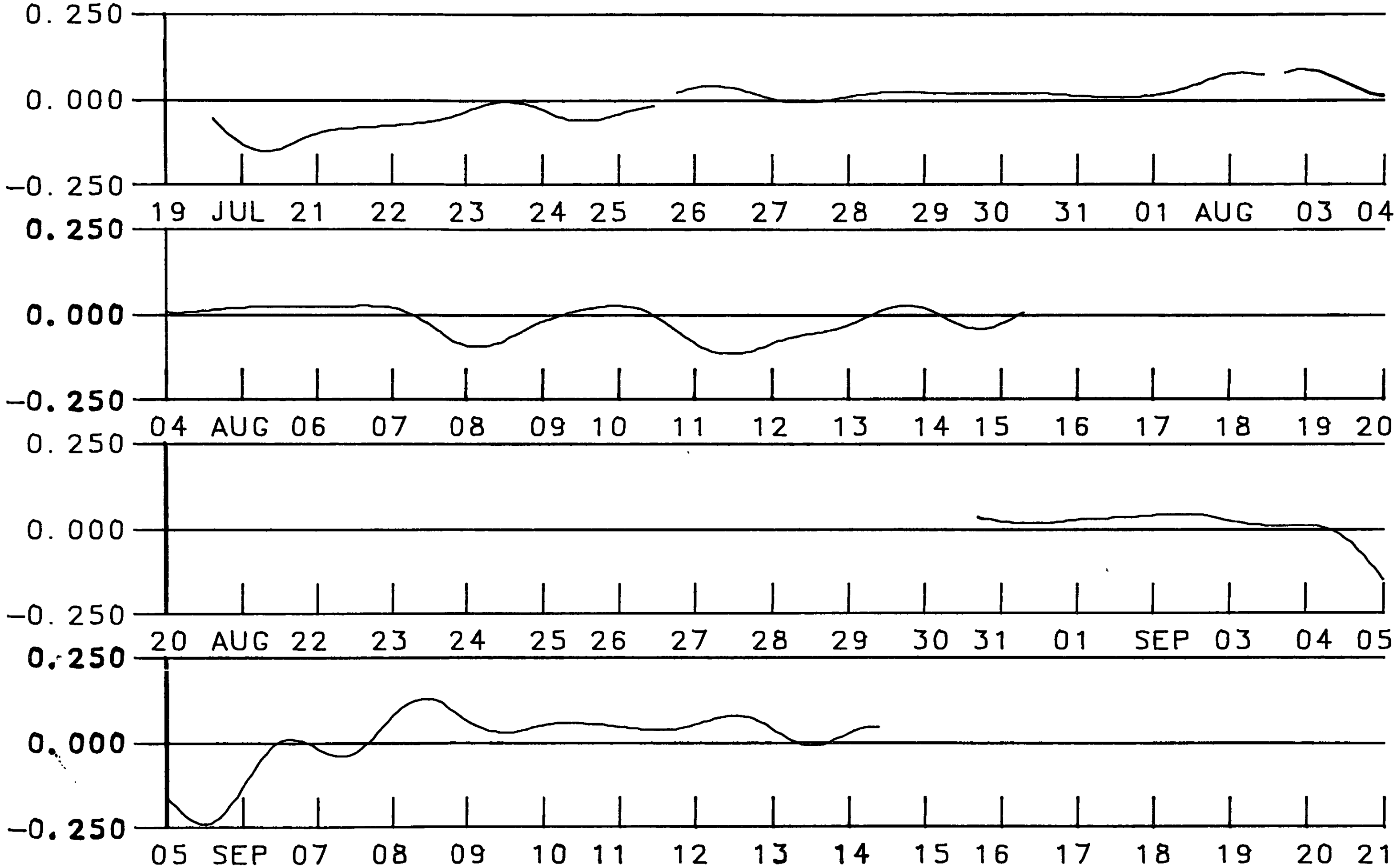
1988 YORK RIVER HYPOXIA SURVEY
YORK 0.0 KM FROM MOUTH DEPTH = 15.7 M
LONGITUDINAL COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB
CUT OFF PERIOD FOR FILTER = 36 HOURS



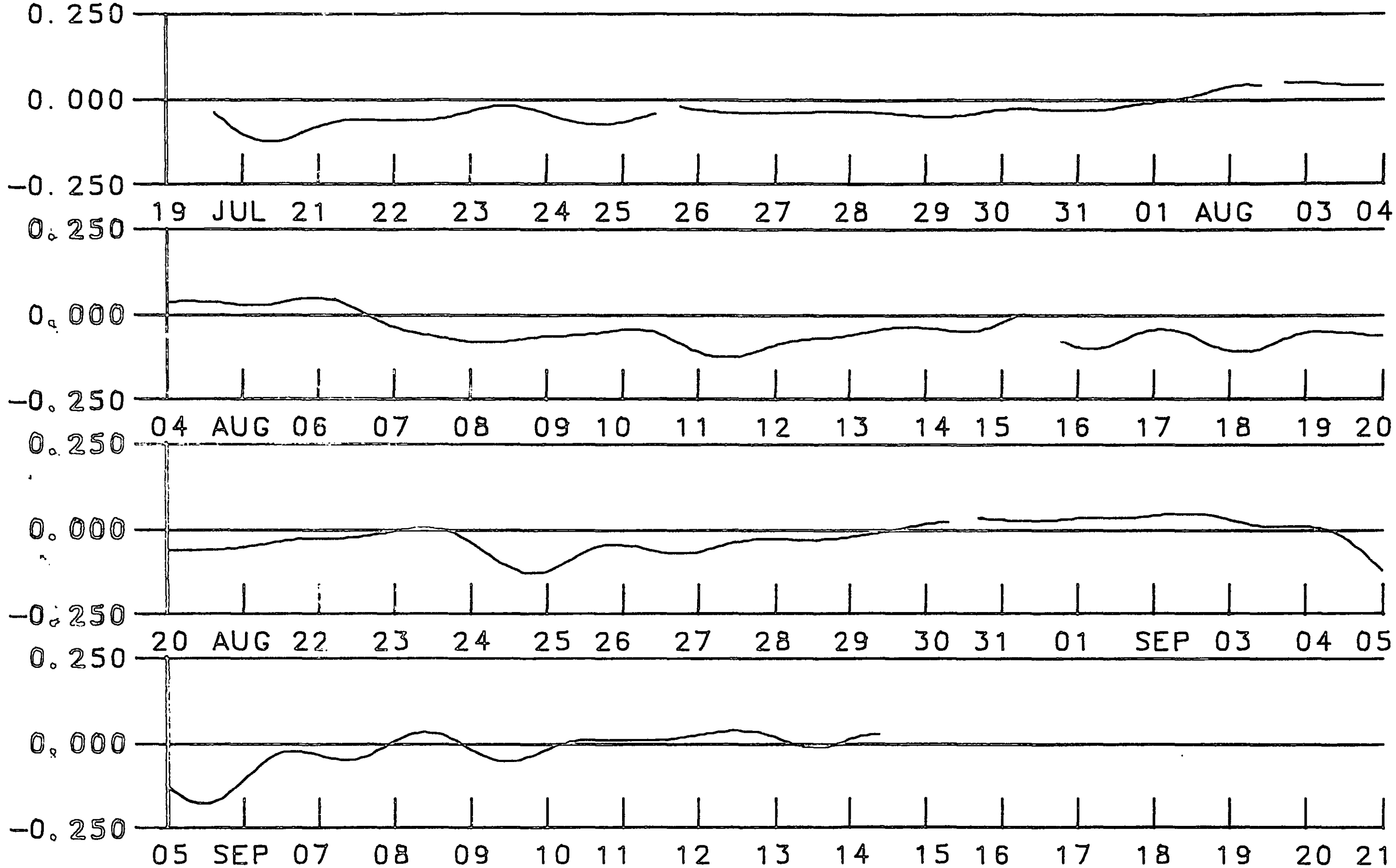
1988 YORK RIVER HYPOXIA SURVEY
YORK 3.9 KM FROM MOUTH DEPTH = 1.5 M
LONGITUDINAL COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB
CUT OFF PERIOD FOR FILTER = 36 HOURS



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



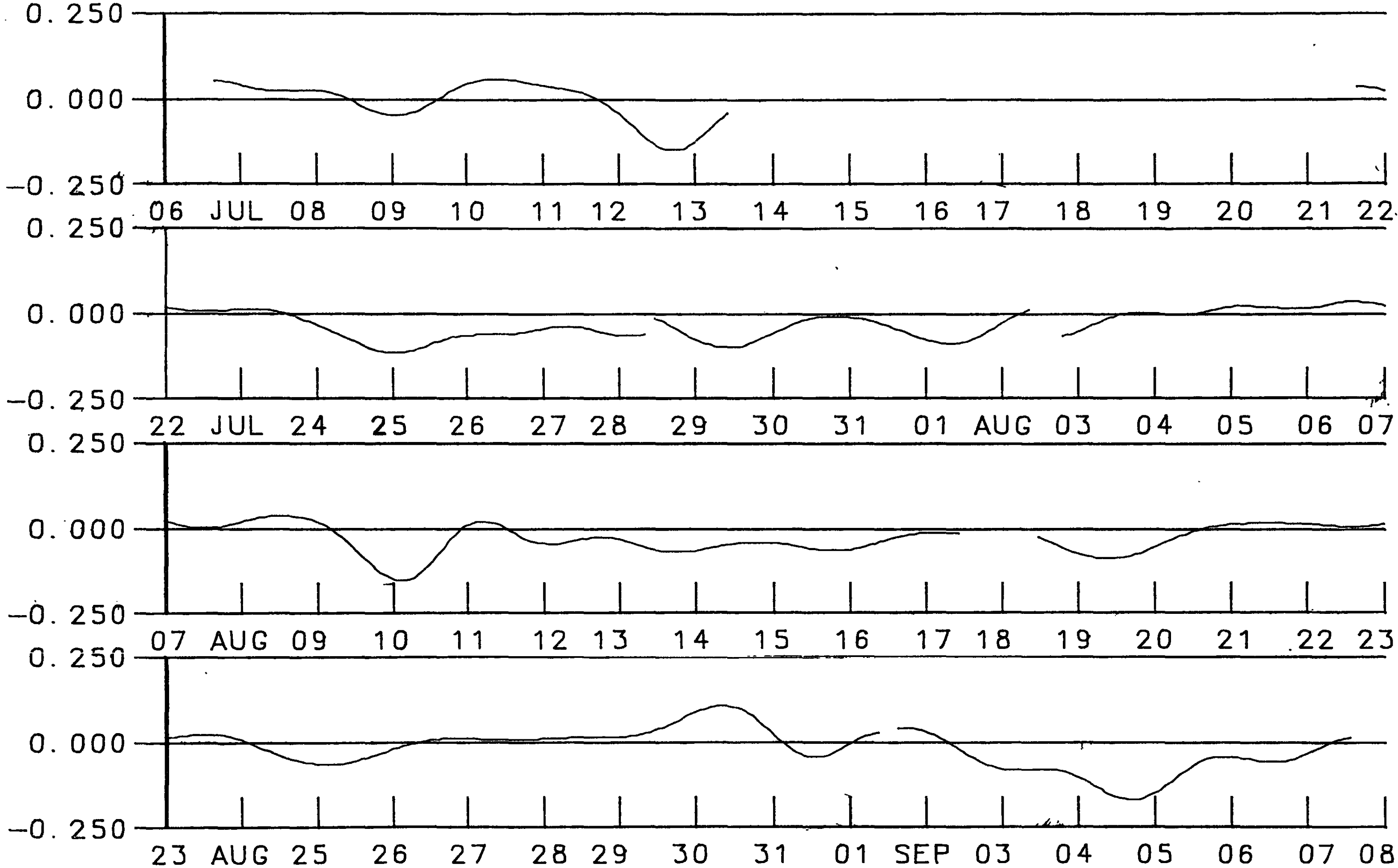
1988 YORK RIVER HYPOXIA SURVEY
YORK 3.9 KM FROM MOUTH DEPTH = 11.5 M
LONGITUDINAL COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB
CUT OFF PERIOD FOR FILTER = 36 HOURS



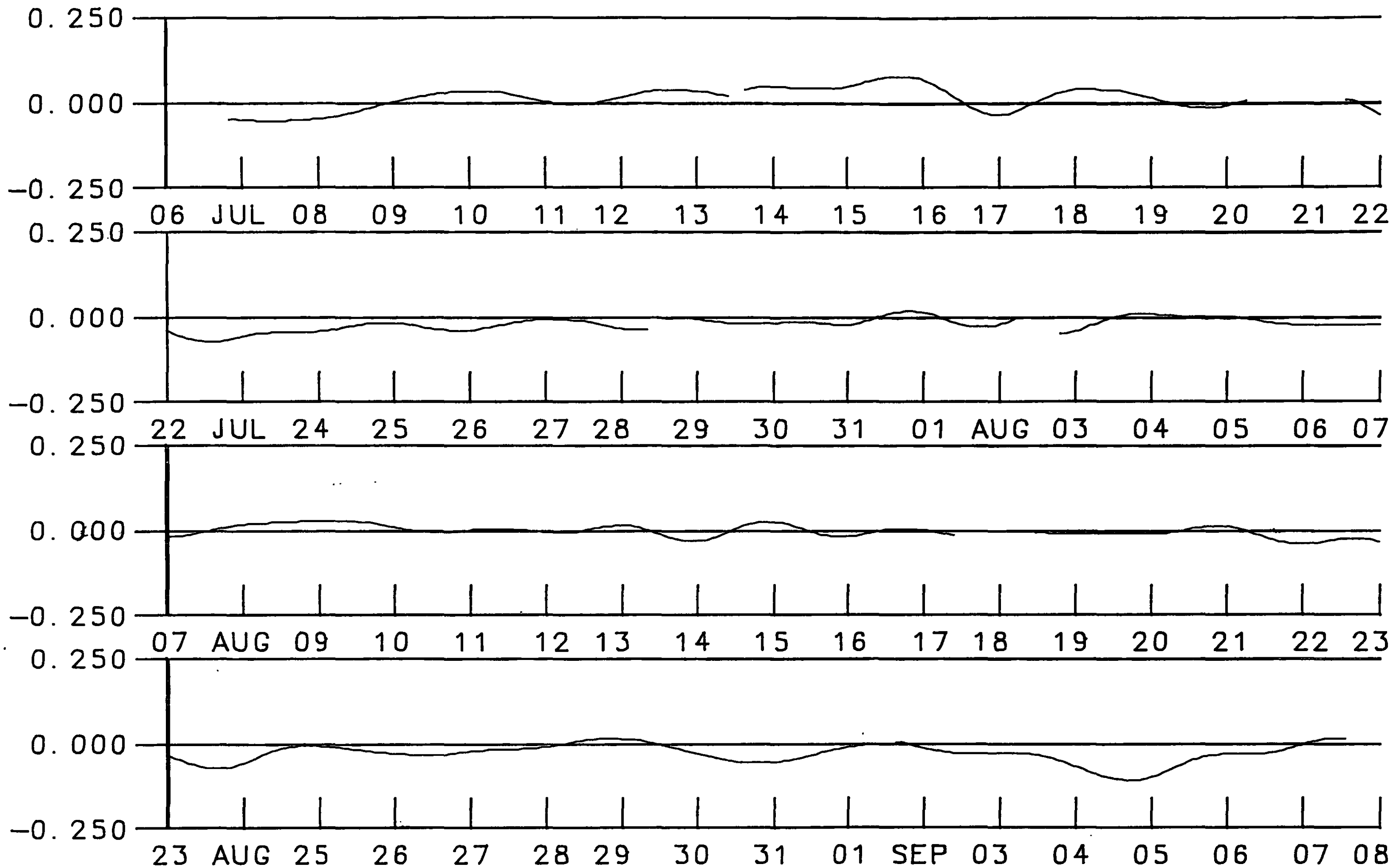
1988 YORK RIVER HYPOXIA SURVEY
YORK 3.9 KM FROM MOUTH DEPTH = 15.1 M
LONGITUDINAL COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB
CUT OFF PERIOD FOR FILTER = 36 HOURS

APPENDIX E2

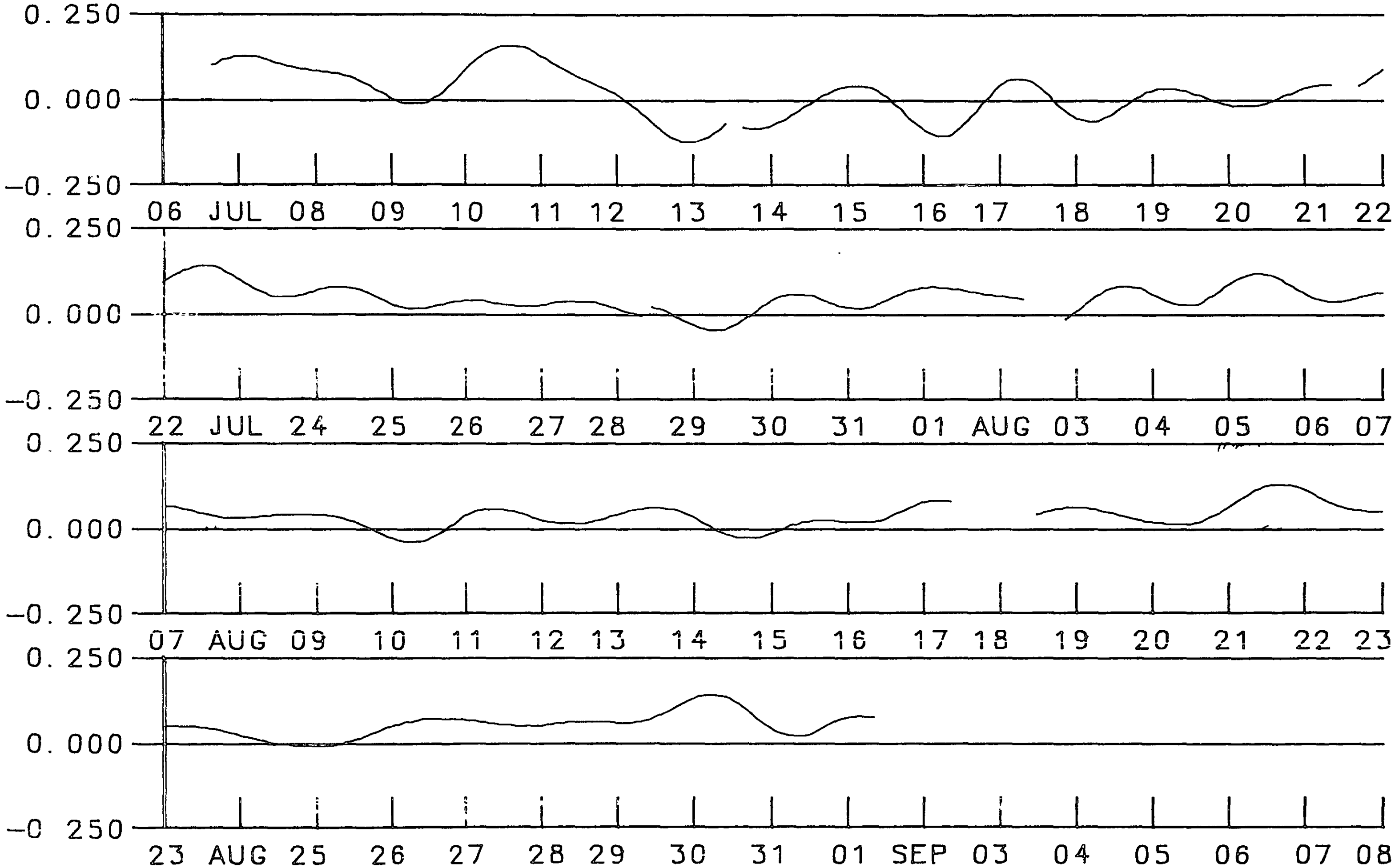
LOW PASS FILTERED LONGITUDINAL COMPONENTS OF CURRENTS (1989)



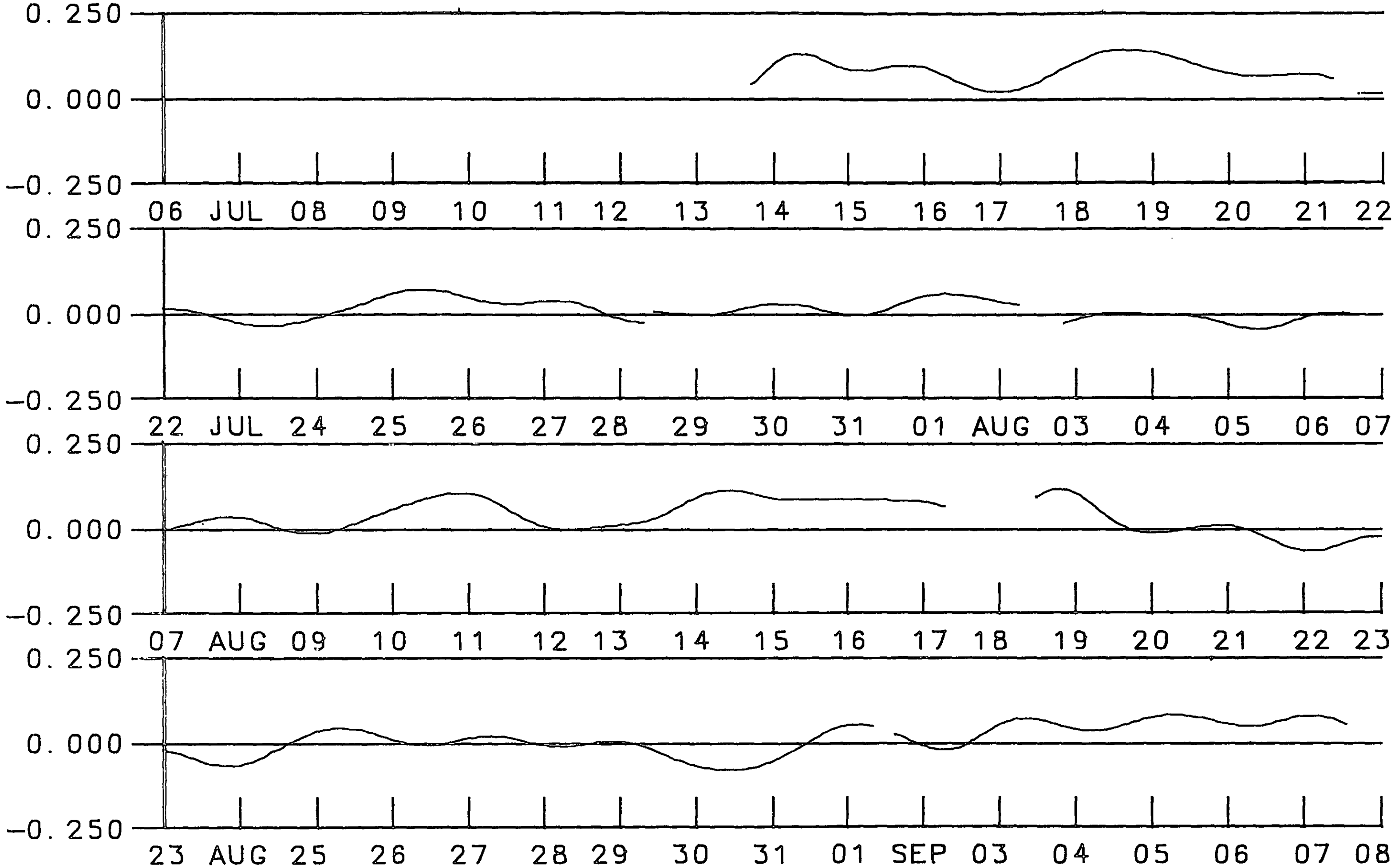
1989 YORK RIVER HYPOXIA SURVEY
STATION = N2 DEPTH = 1 M
LONGITUDINAL COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB
CUT OFF PERIOD FOR FILTER = 36 HOURS



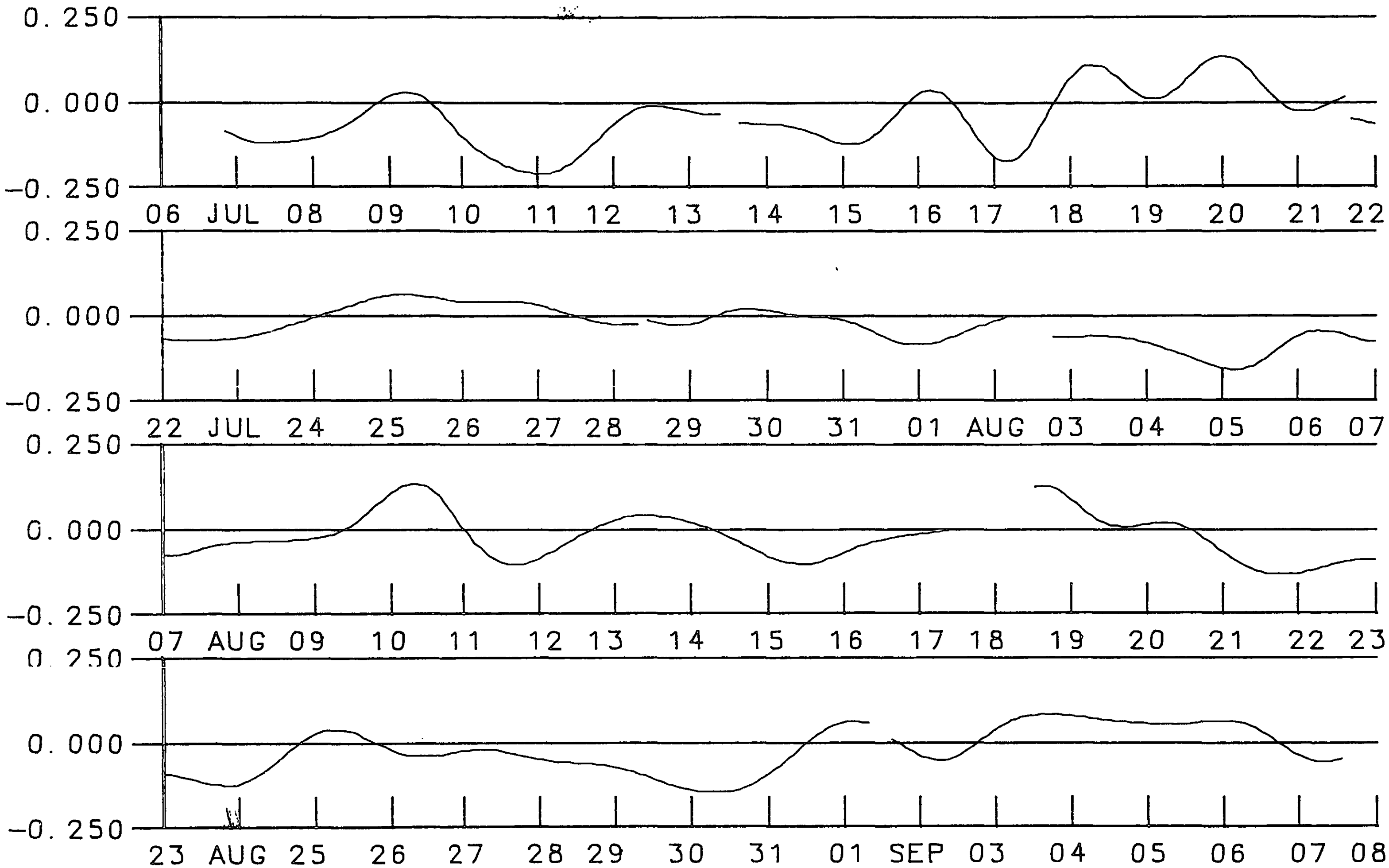
1989 YORK RIVER HYPOXIA SURVEY
STATION = N2 DEPTH = 7 M
LONGITUDINAL COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB
CUT OFF PERIOD FOR FILTER = 36 HOURS



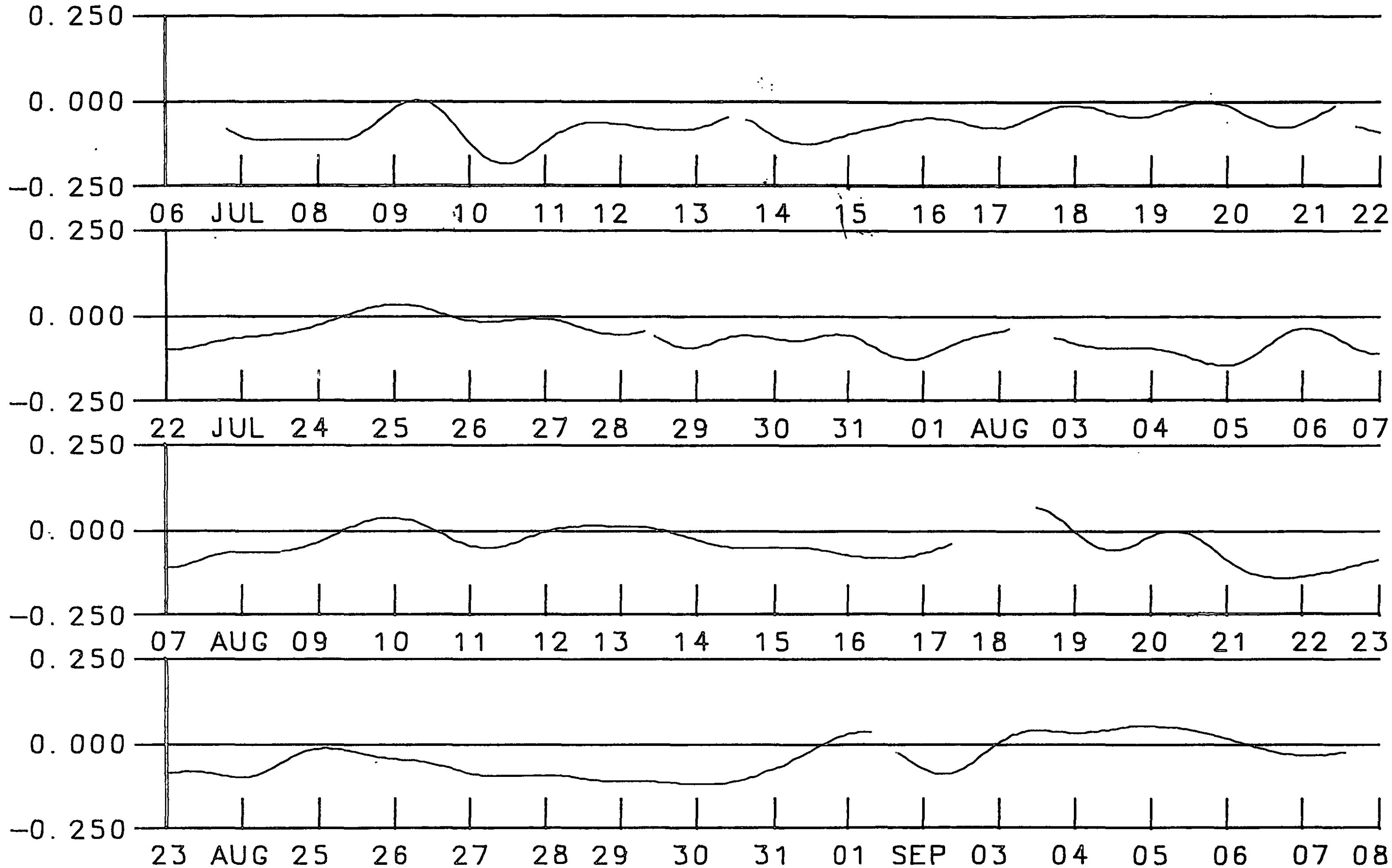
1989 YORK RIVER HYPOXIA SURVEY
STATION = RB DEPTH = 1 M
LONGITUDINAL COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB
CUT OFF PERIOD FOR FILTER = 36 HOURS



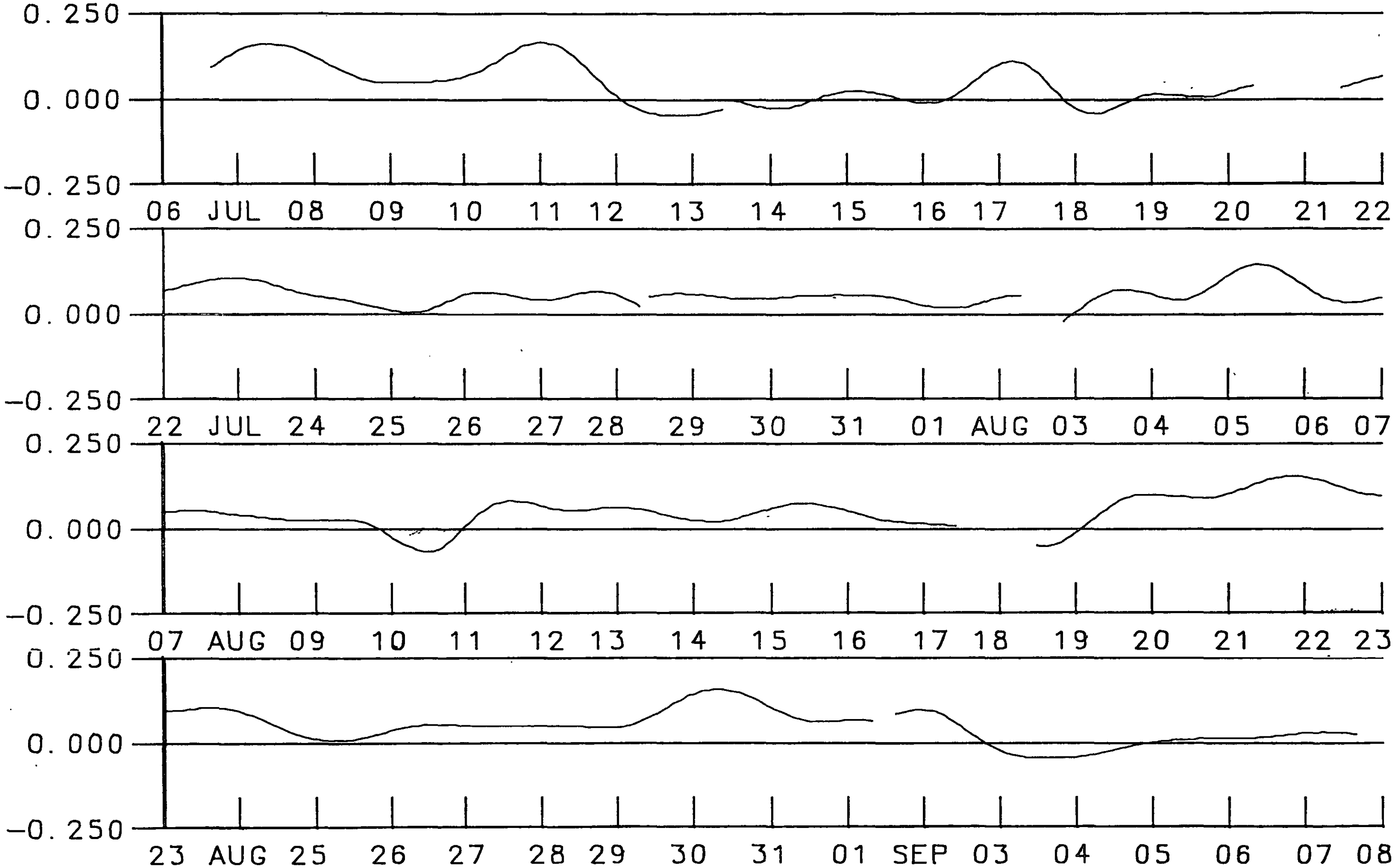
1989 YORK RIVER HYPOXIA SURVEY
STATION = RB DEPTH = 6 M
LONGITUDINAL COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB
CUT OFF PERIOD FOR FILTER = 36 HOURS



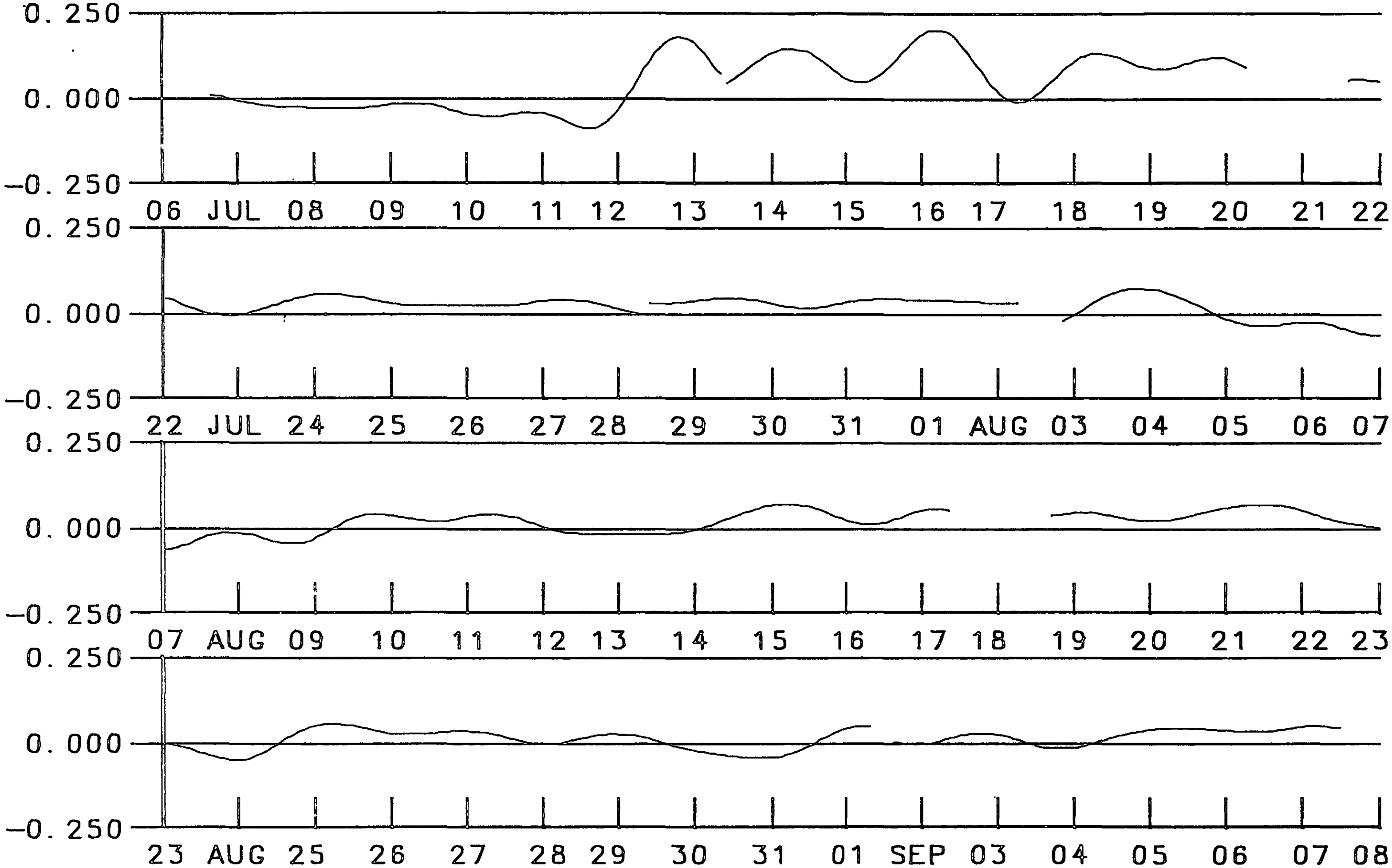
1989 YORK RIVER HYPOXIA SURVEY
STATION = RB DEPTH = 11 M
LONGITUDINAL COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB
CUT OFF PERIOD FOR FILTER = 36 HOURS



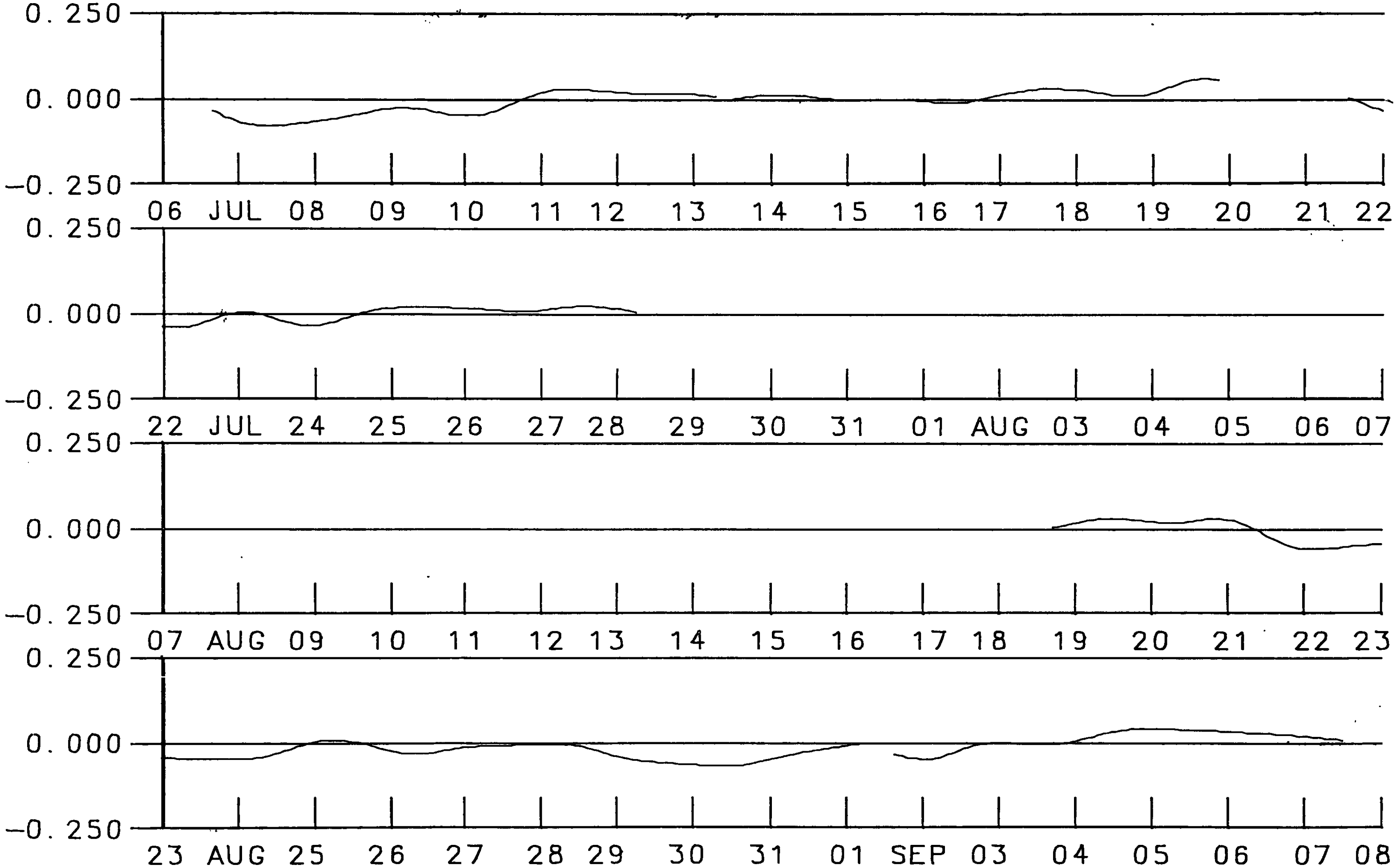
1989 YORK RIVER HYPOXIA SURVEY
STATION = RB DEPTH = 16 M
LONGITUDINAL COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB
CUT OFF PERIOD FOR FILTER = 36 HOURS



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



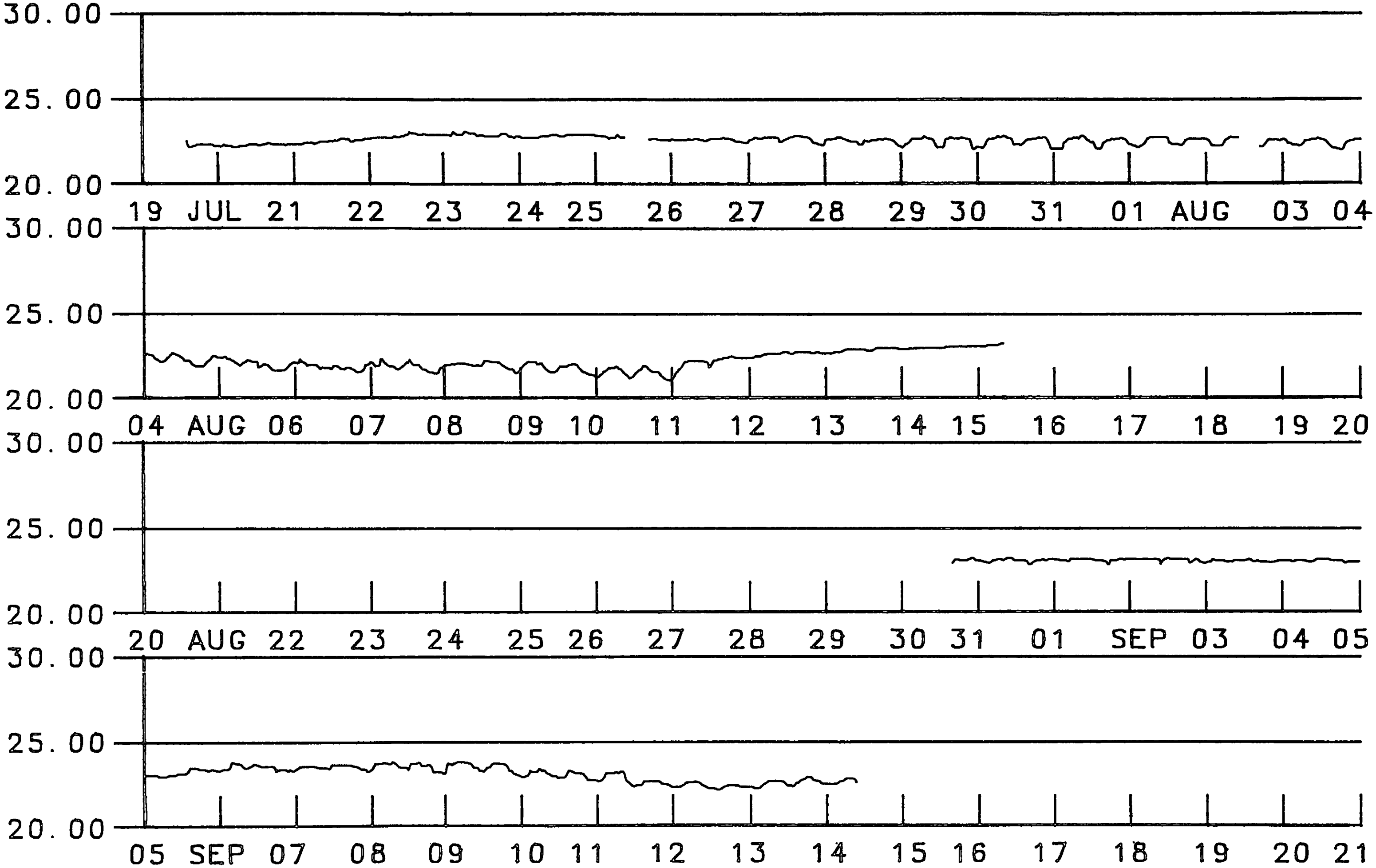
1989 YORK RIVER HYPOXIA SURVEY
STATION = TUE DEPTH = 6 M
LONGITUDINAL COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB
CUT OFF PERIOD FOR FILTER = 36 HOURS



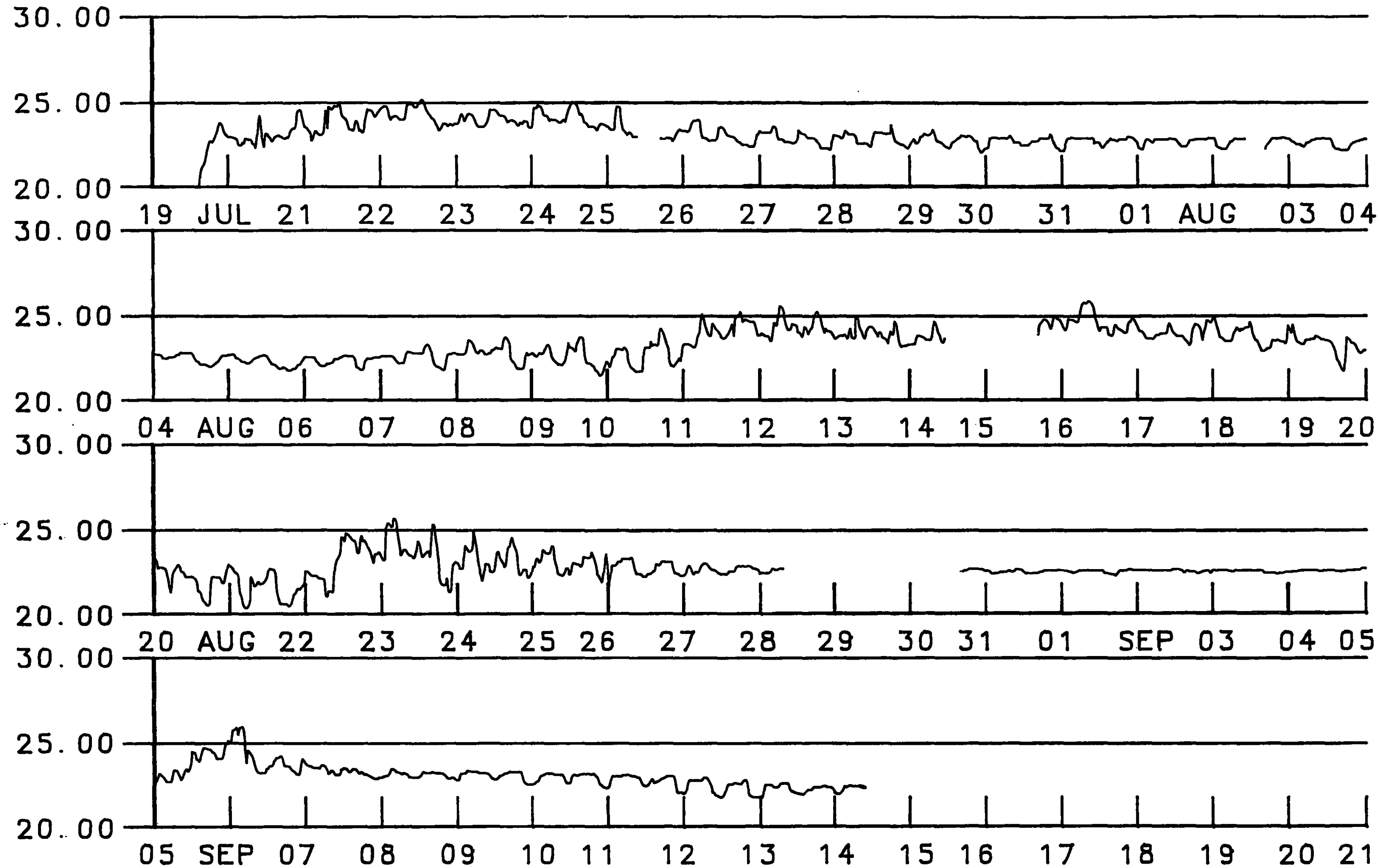
1989 YORK RIVER HYPOXIA SURVEY
STATION = TUE DEPTH = 10 M
LONGITUDINAL COMPONENTS (M/S)
POSITIVE Y AXIS IS EBB
CUT OFF PERIOD FOR FILTER = 36 HOURS

APPENDIX F1

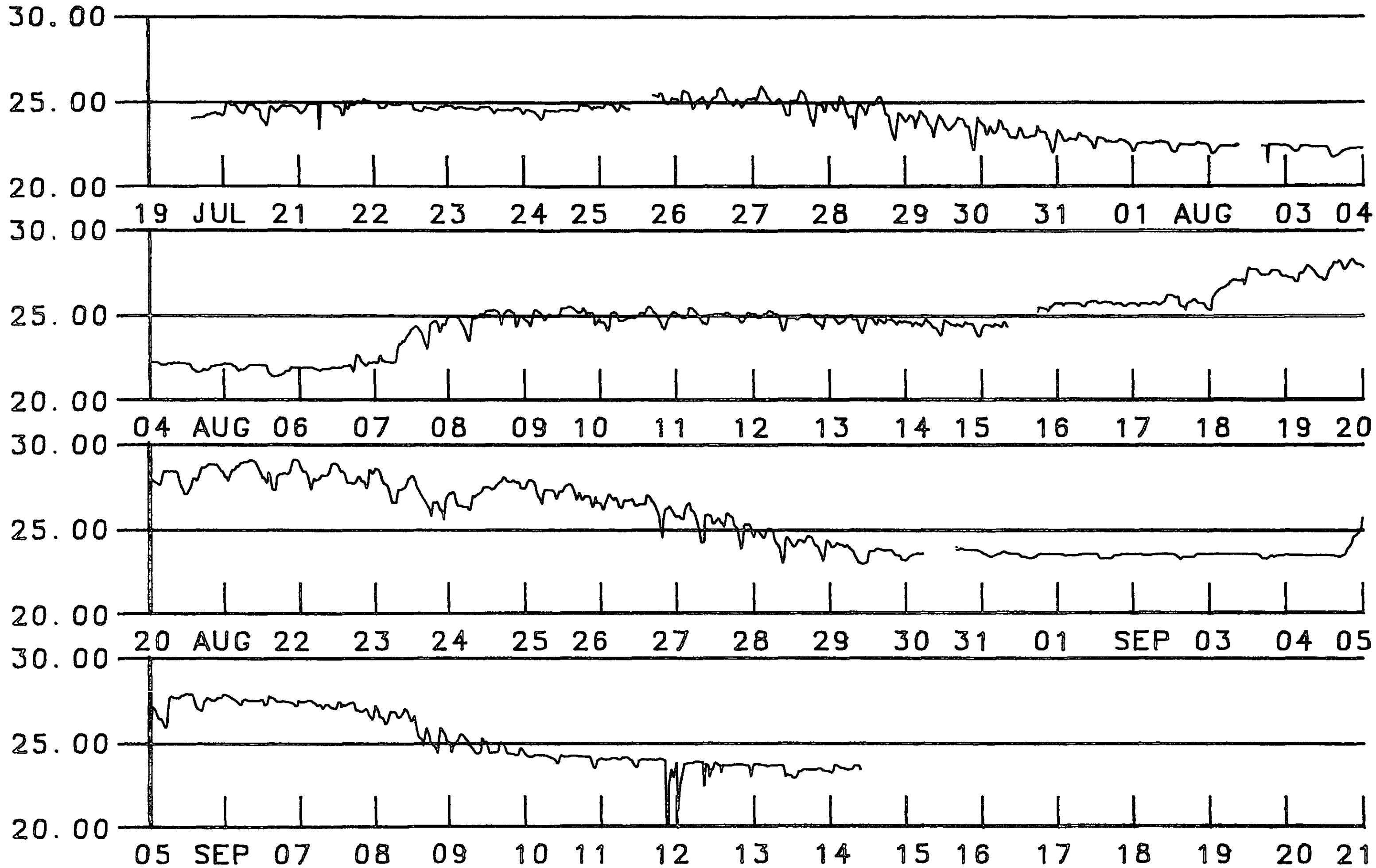
OBSERVED SALINITIES (1988)



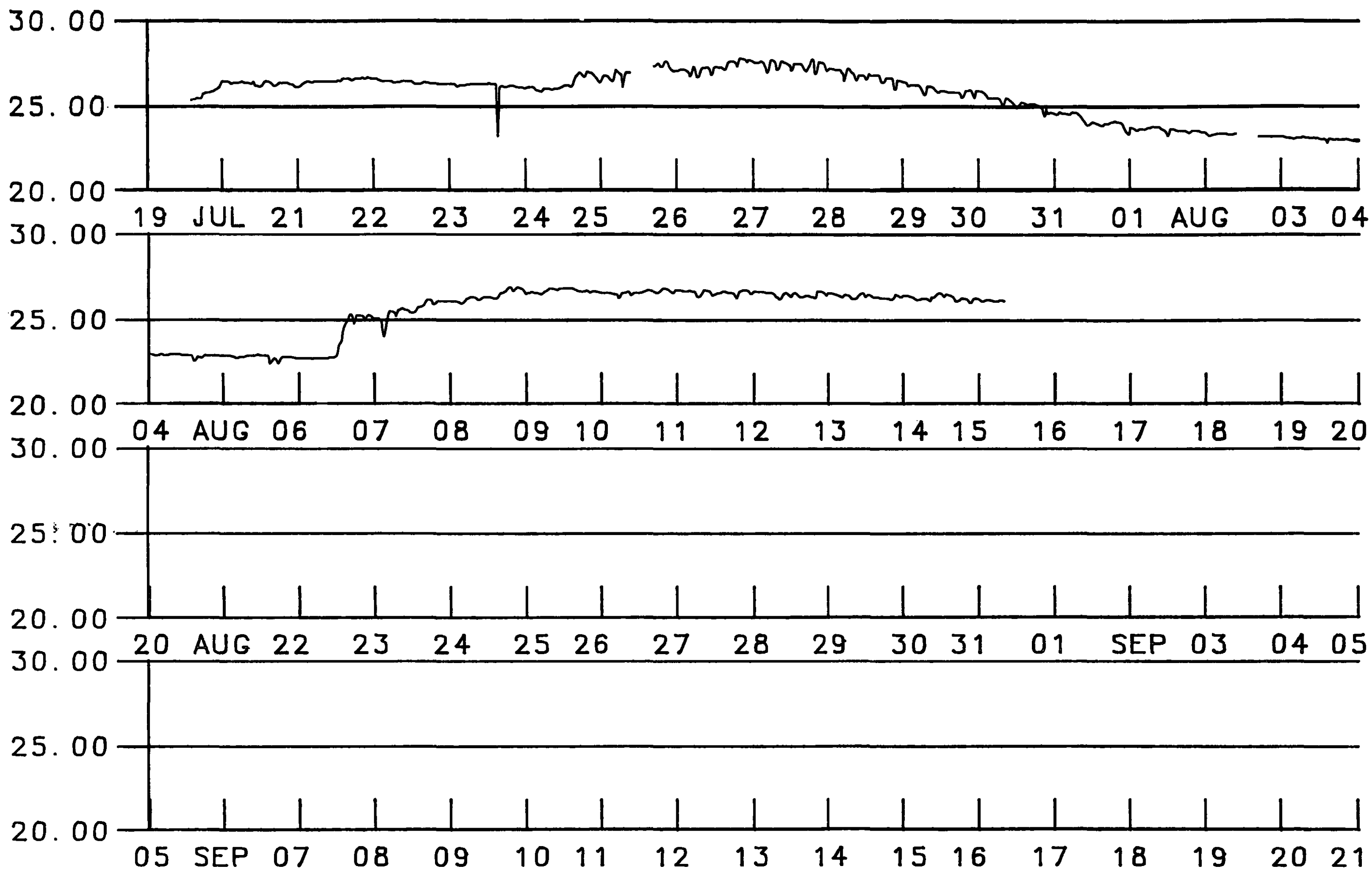
1988 YORK RIVER HYPOXIA SURVEY
SALINITY (PPT)
YORK 0.0 KM FROM MOUTH DEPTH = 1.5 M



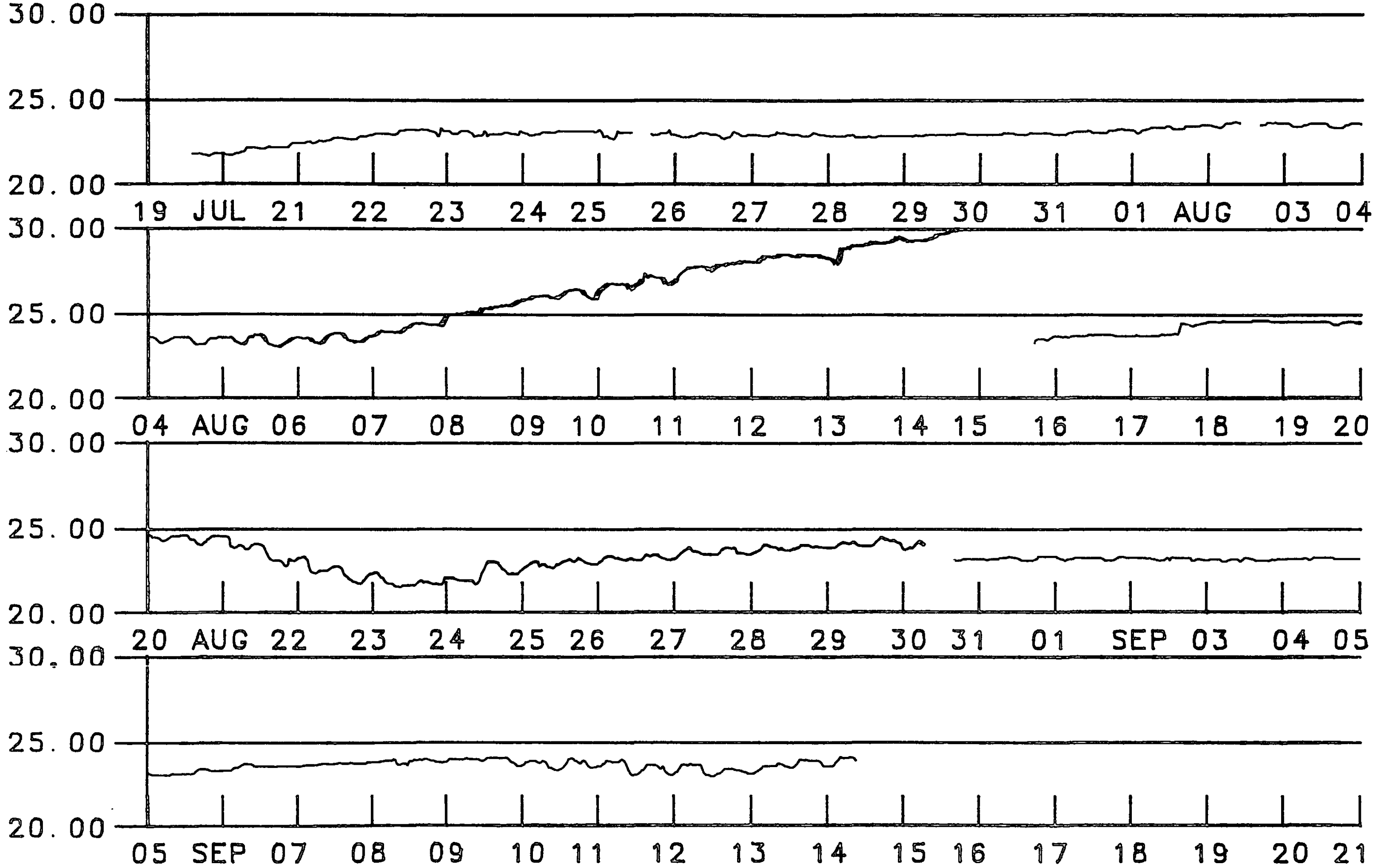
1988 YORK RIVER HYPOXIA SURVEY
SALINITY (PPT)
YORK 0.0 KM FROM MOUTH DEPTH = 6.5 M



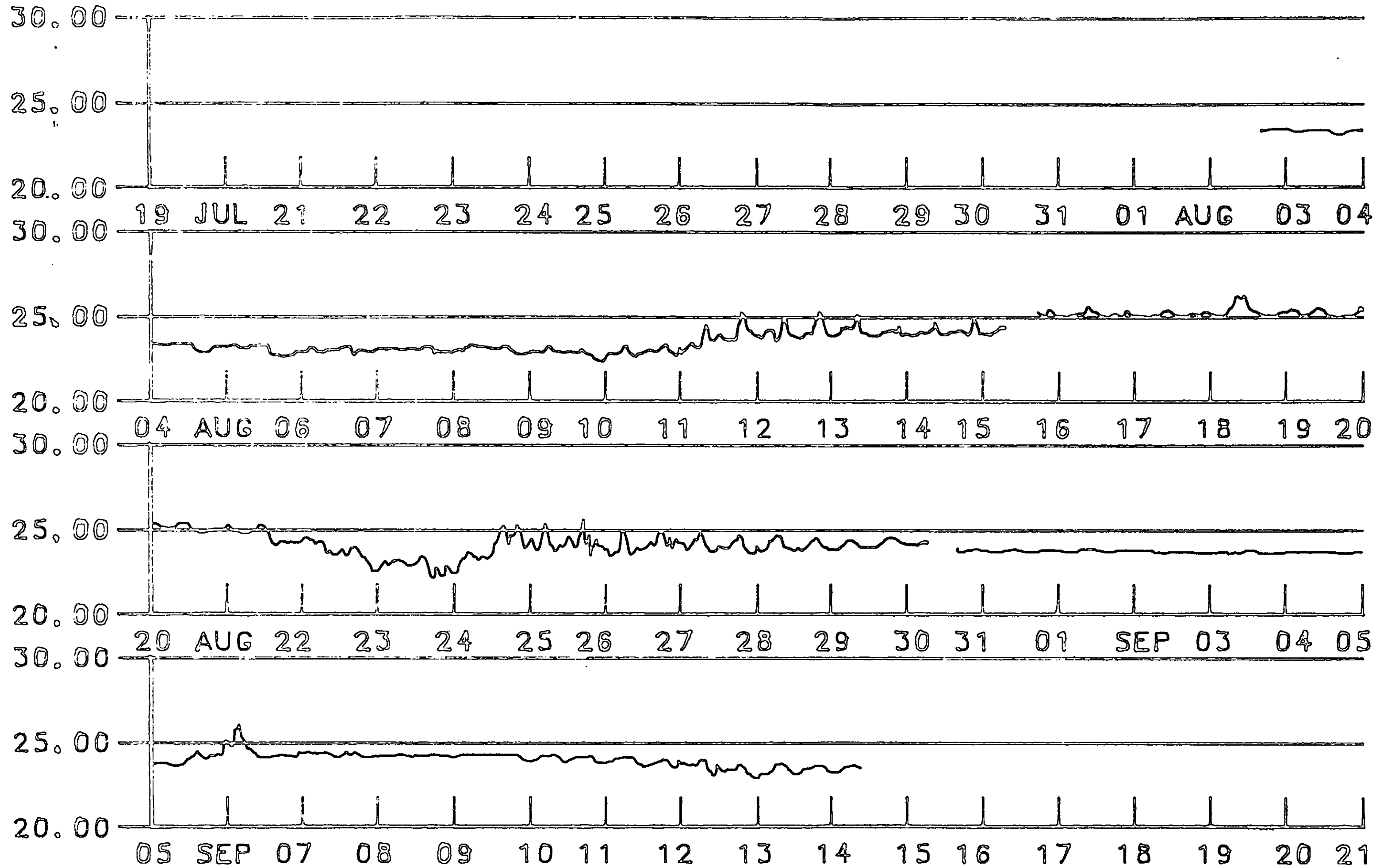
1988 YORK RIVER HYPOXIA SURVEY
SALINITY (PPT)
YORK 0.0 KM FROM MOUTH DEPTH = 11.5 M



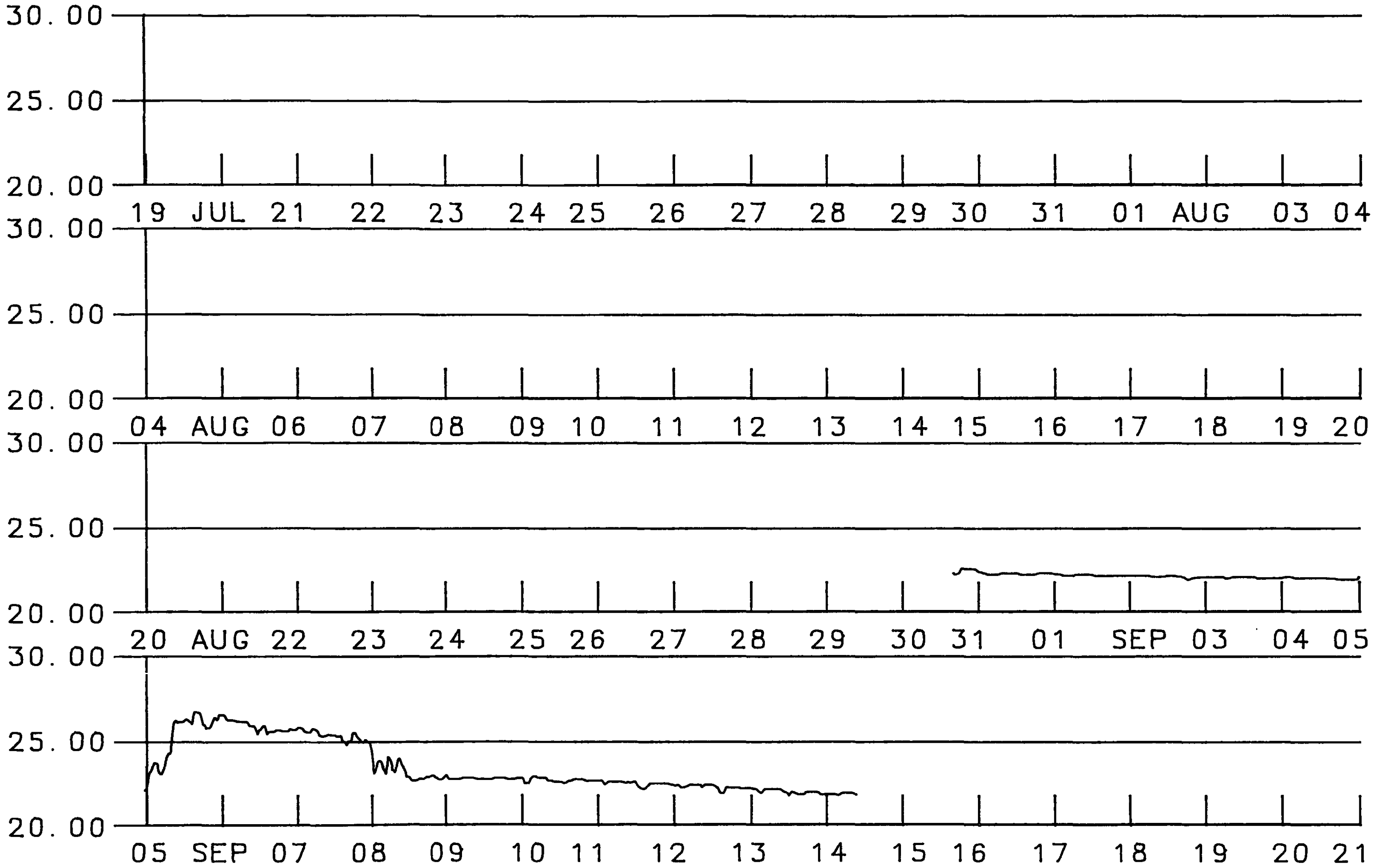
1988 YORK RIVER HYPOXIA SURVEY
SALINITY (PPT)
YORK 0.0 KM FROM MOUTH DEPTH = 15.7 M



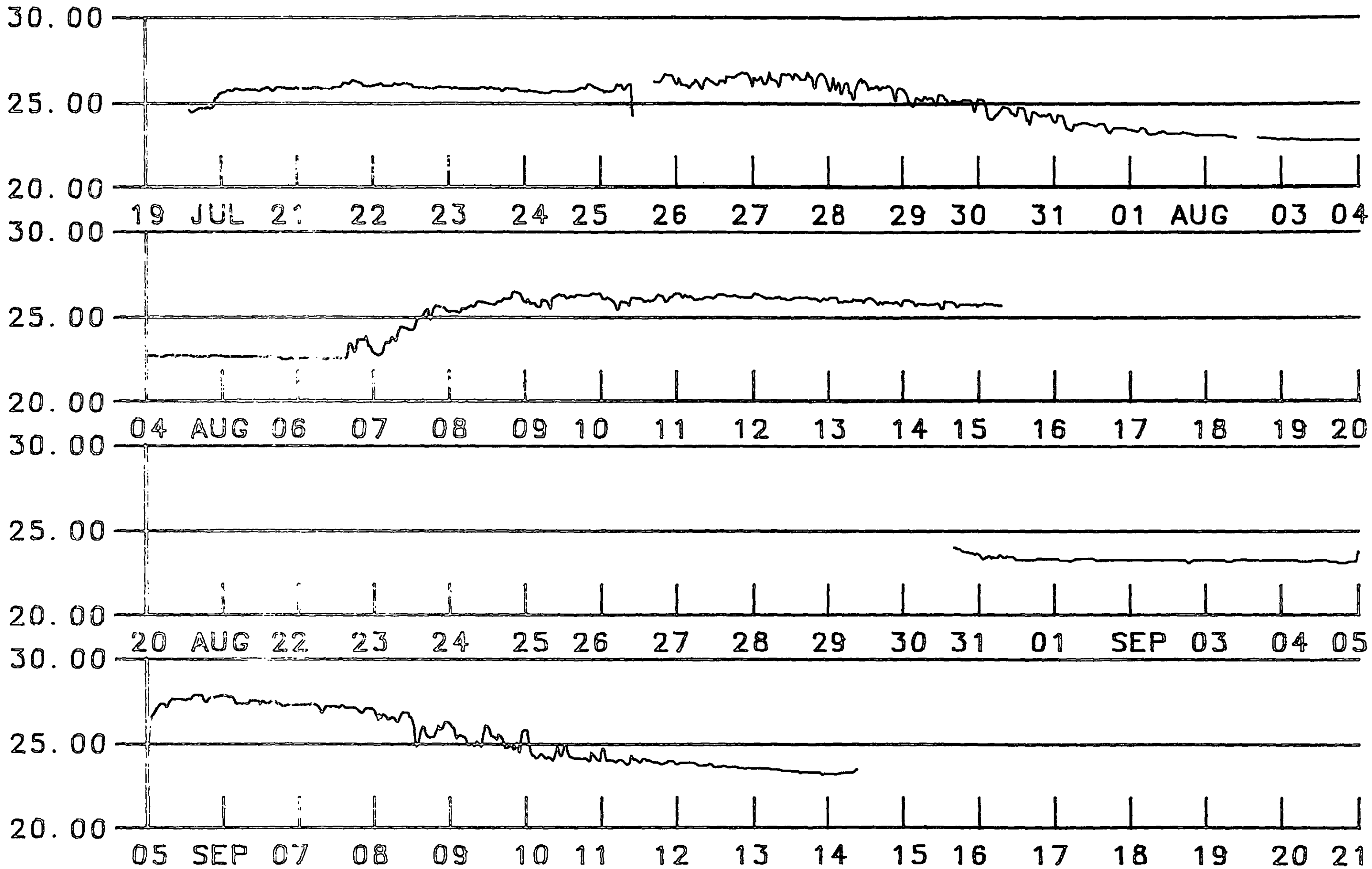
1988 YORK RIVER HYPOXIA SURVEY
SALINITY (PPT)
YORK 3.9 KM FROM MOUTH DEPTH = 1.5 M



1988 YORK RIVER HYPOXIA SURVEY
SALINITY (PPT)
YORK 3.9 KM FROM MOUTH DEPTH = 6.5 M



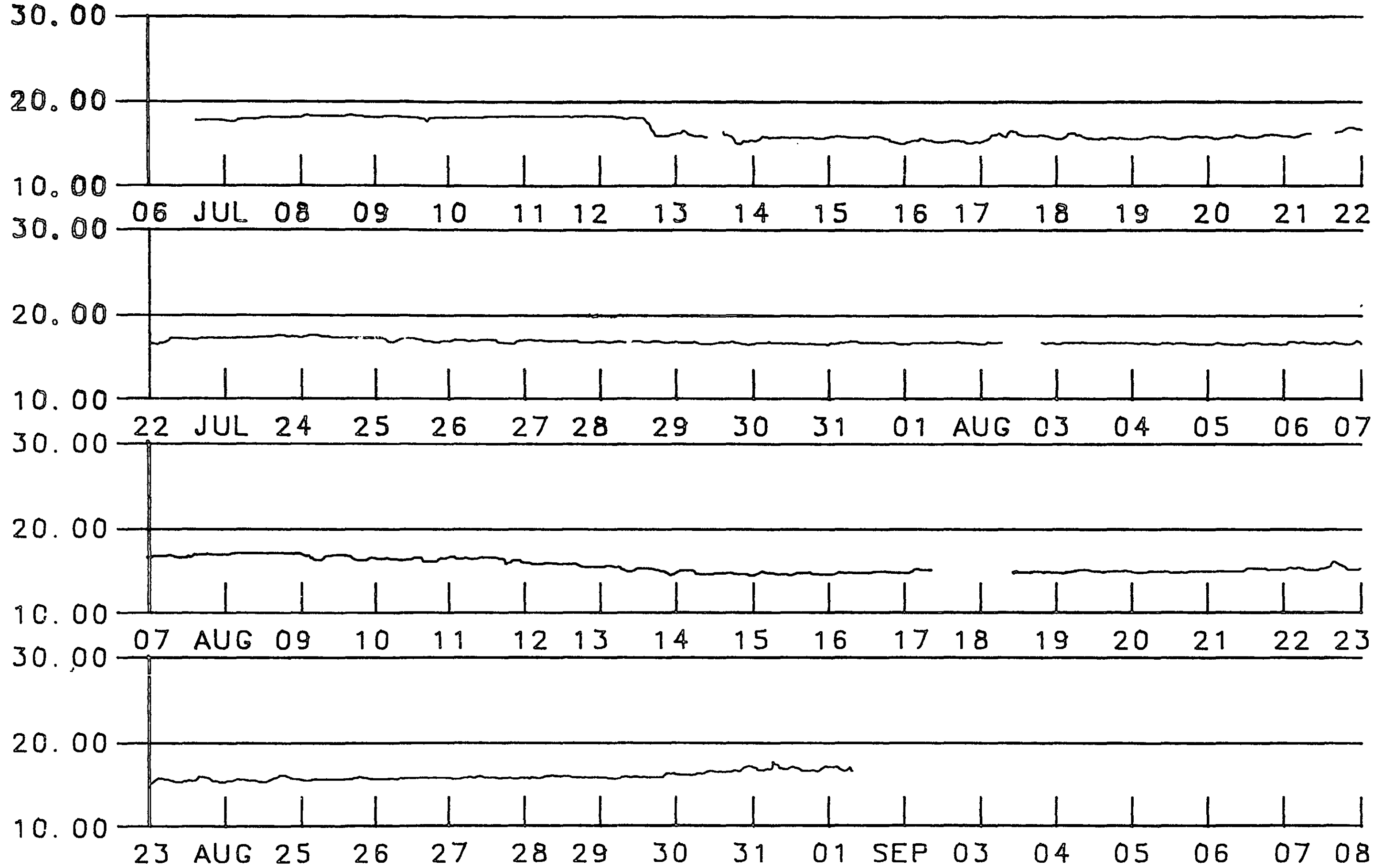
1988 YORK RIVER HYPOXIA SURVEY
SALINITY (PPT)
YORK 3.9 KM FROM MOUTH DEPTH = 11.5 M



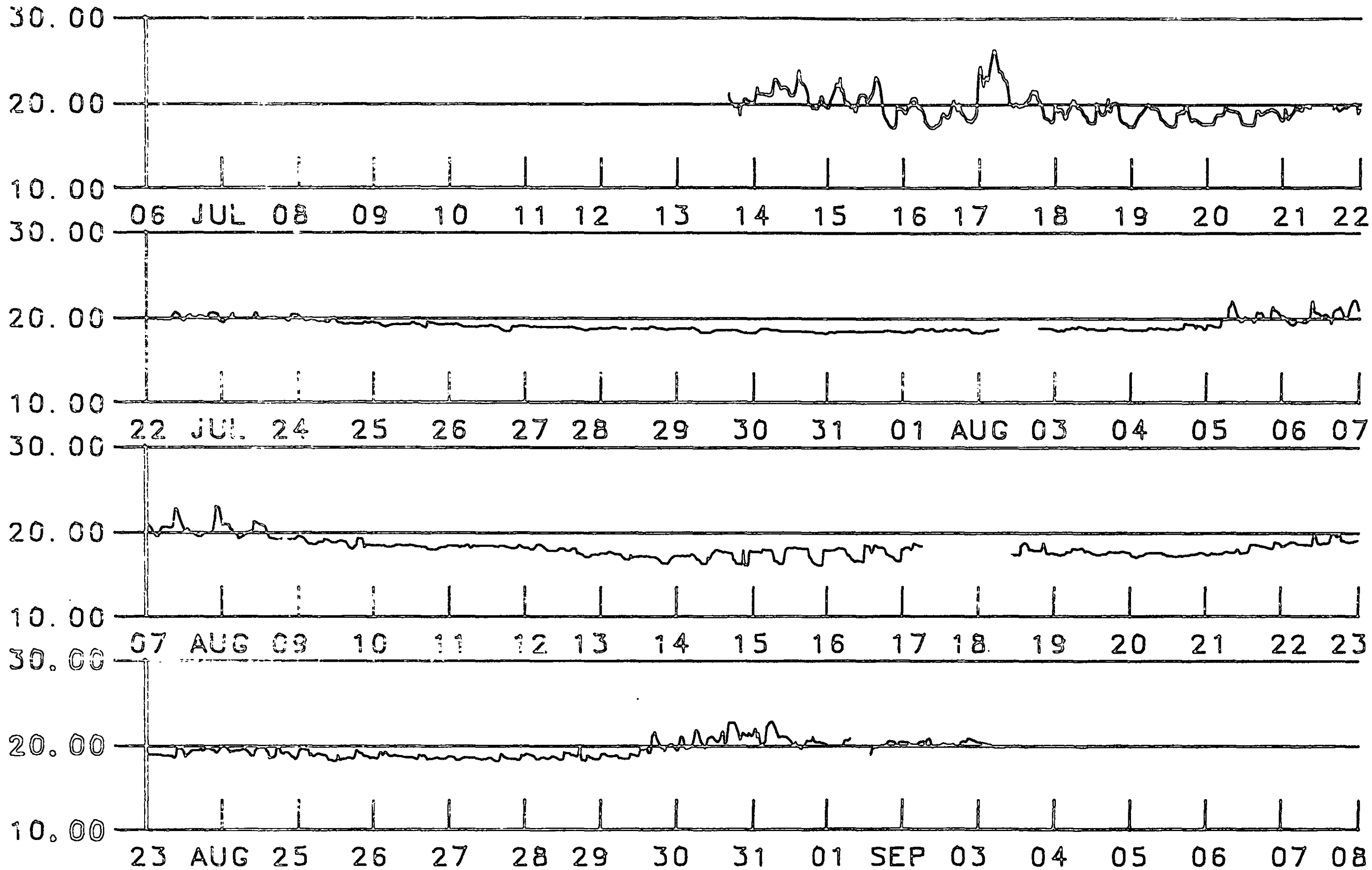
1988 YORK RIVER HYPOXIA SURVEY
SALINITY (PPT)
YORK 3.9 KM FROM MOUTH DEPTH = 15.1 M

APPENDIX F2

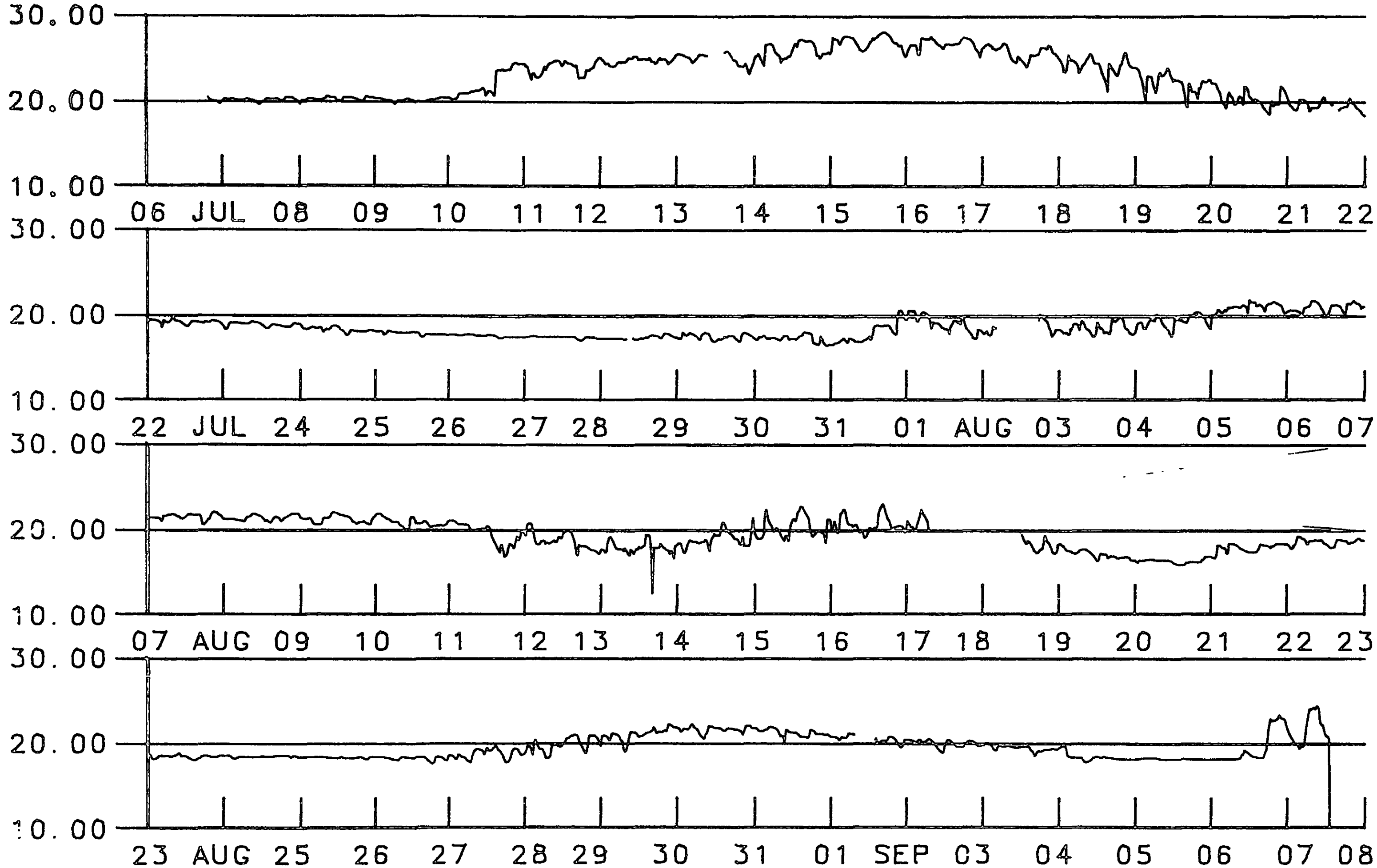
OBSERVED SALINITIES (1989)



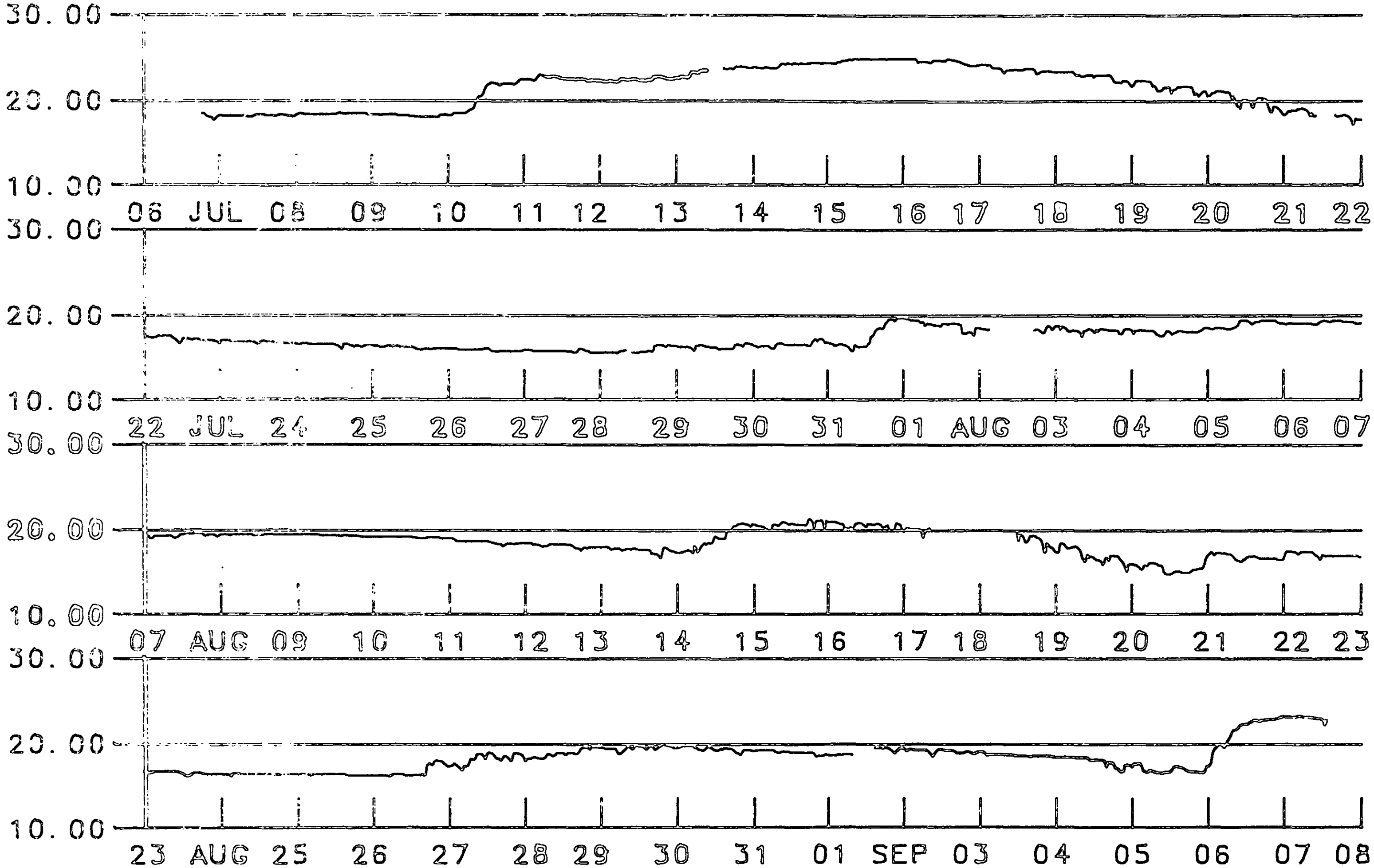
1989 YORK RIVER HYPOXIA SURVEY
SALINITY (PPT)
STATION = RB DEPTH = 1 M



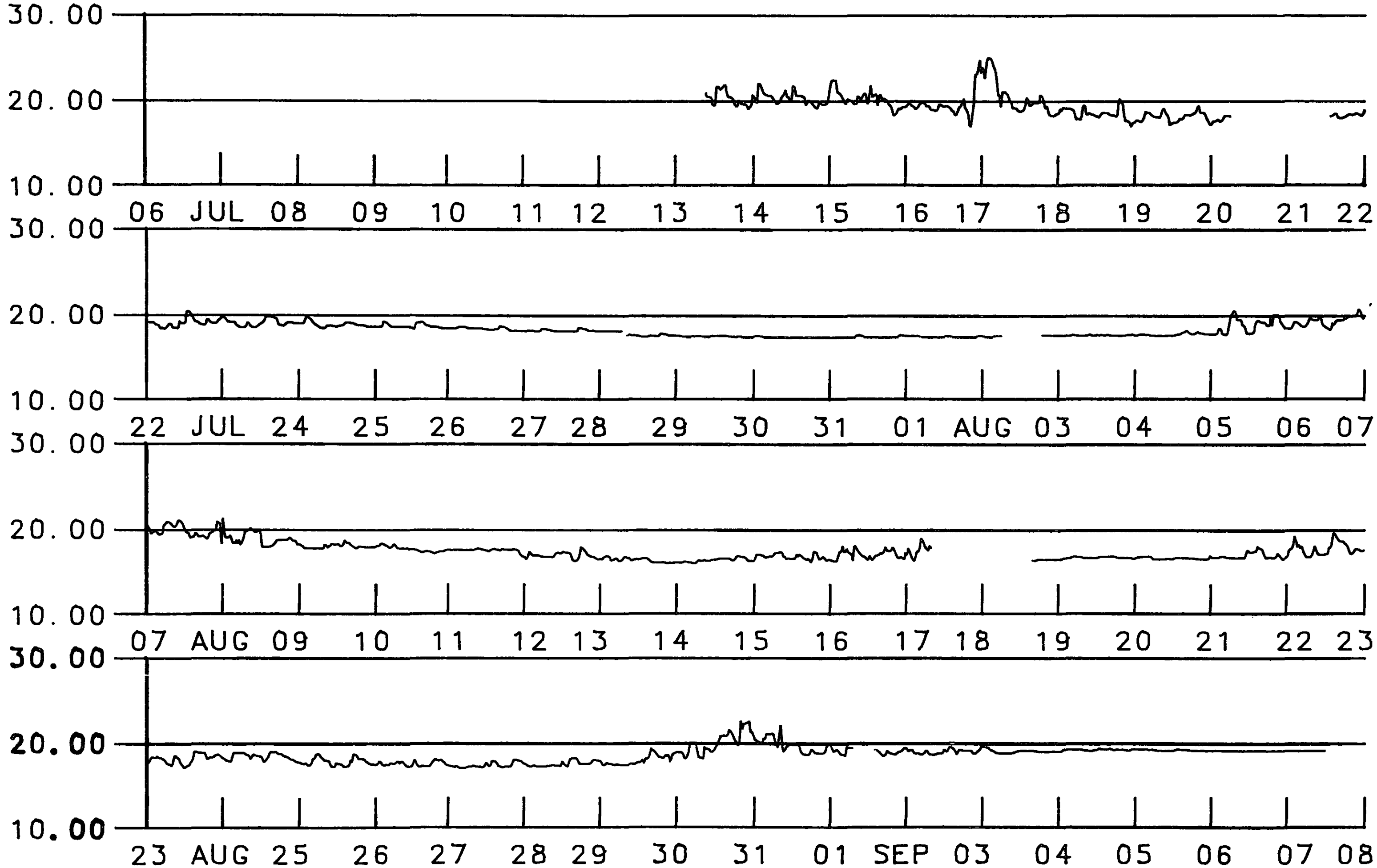
1989 YORK RIVER HYPOXIA SURVEY
SALINITY (PPT)
STATION = RB DEPTH = 6 M



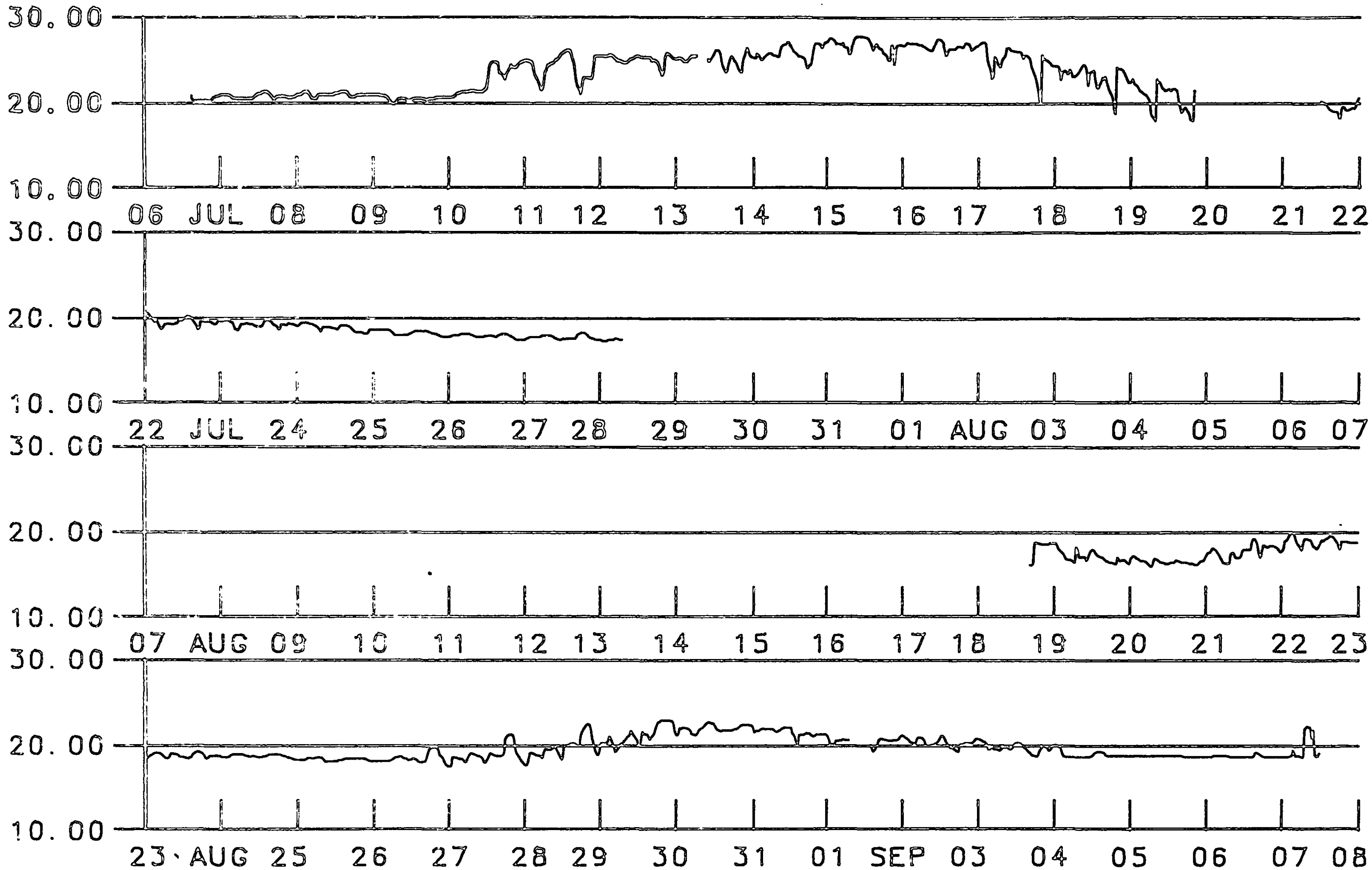
1989 YORK RIVER HYPOXIA SURVEY
SALINITY (PPT)
STATION = RB DEPTH = 11 M



1989 YORK RIVER HYPOXIA SURVEY
SALINITY (PPT)
STATION = RB DEPTH = 16 M



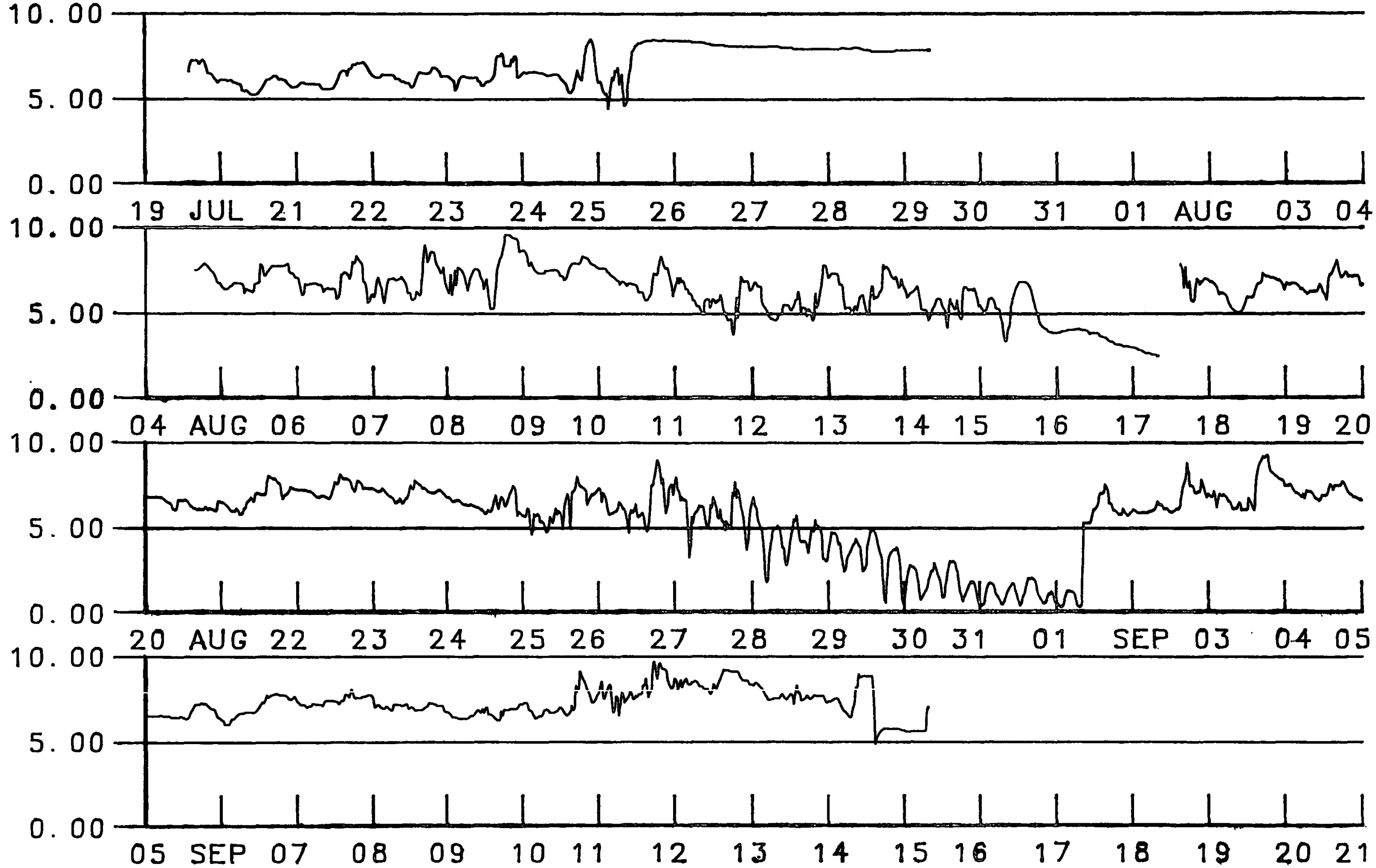
1989 YORK RIVER HYPOXIA SURVEY
SALINITY (PPT)
STATION = TUE DEPTH = 6 M



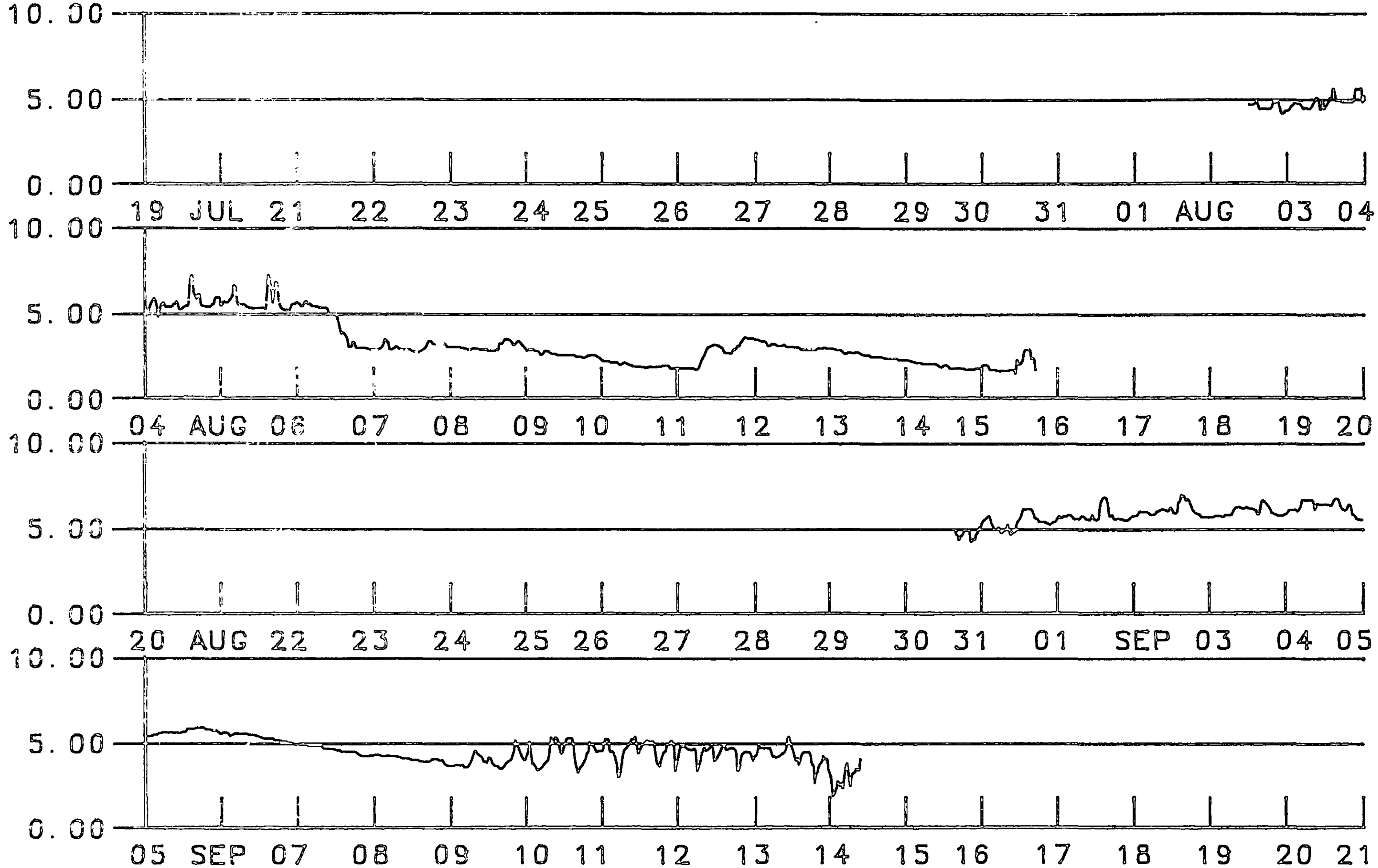
1989 YORK RIVER HYPOXIA SURVEY
SALINITY (PPT)
STATION = TUE DEPTH = 10 M

APPENDIX G1

OBSERVED DISSOLVED OXYGEN (1988)



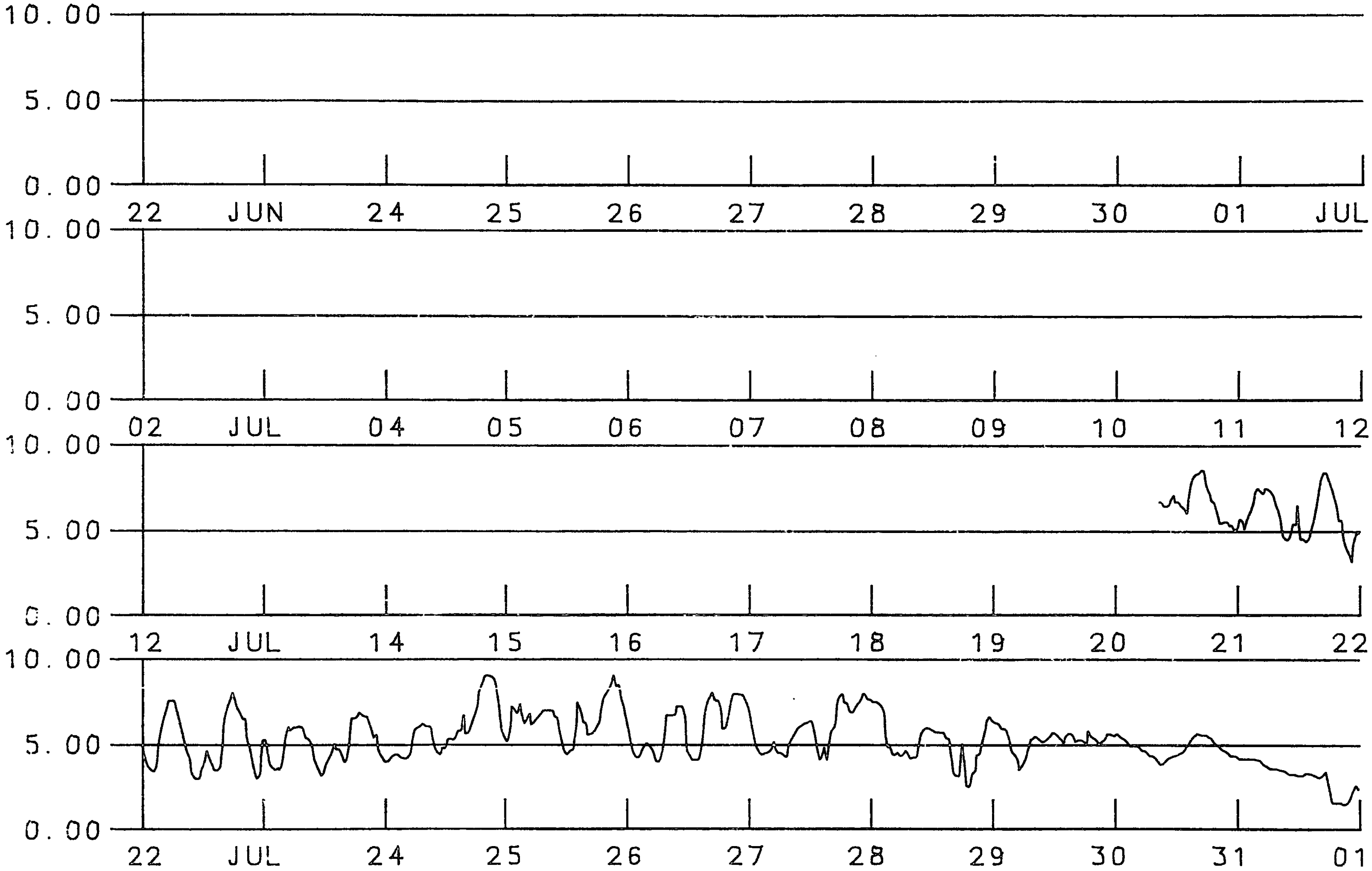
1988 YORK RIVER HYPOXIA SURVEY
DISSOLVED OXYGEN (MG/L)
YORK 0.0 KM FROM MOUTH DEPTH = 2.8 M



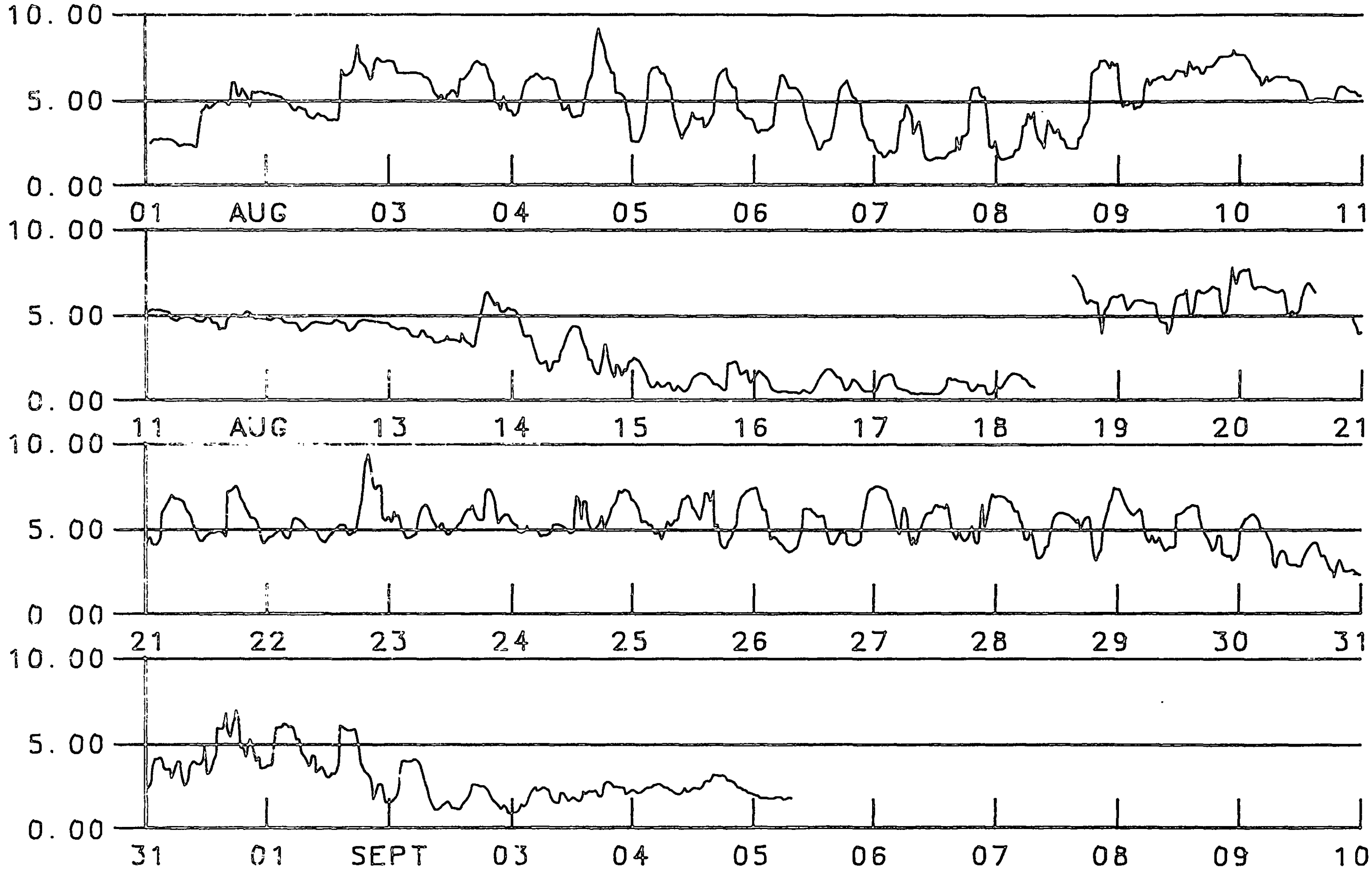
1988 YORK RIVER HYPOXIA SURVEY
DISSOLVED OXYGEN (MG/L)
YORK 0.0 KM FROM MOUTH DEPTH = 14.9 M

APPENDIX G2

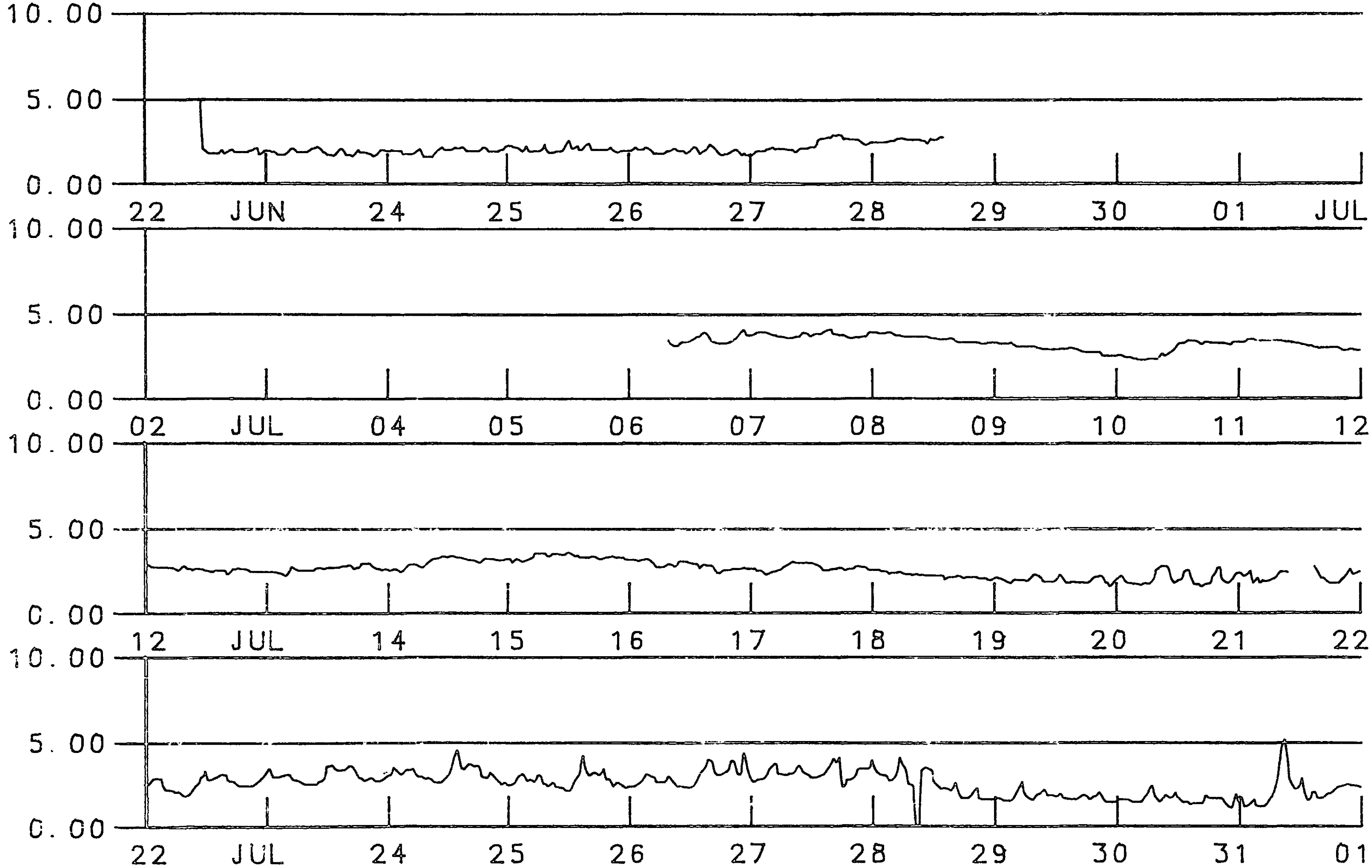
OBSERVED DISSOLVED OXYGEN (1989)



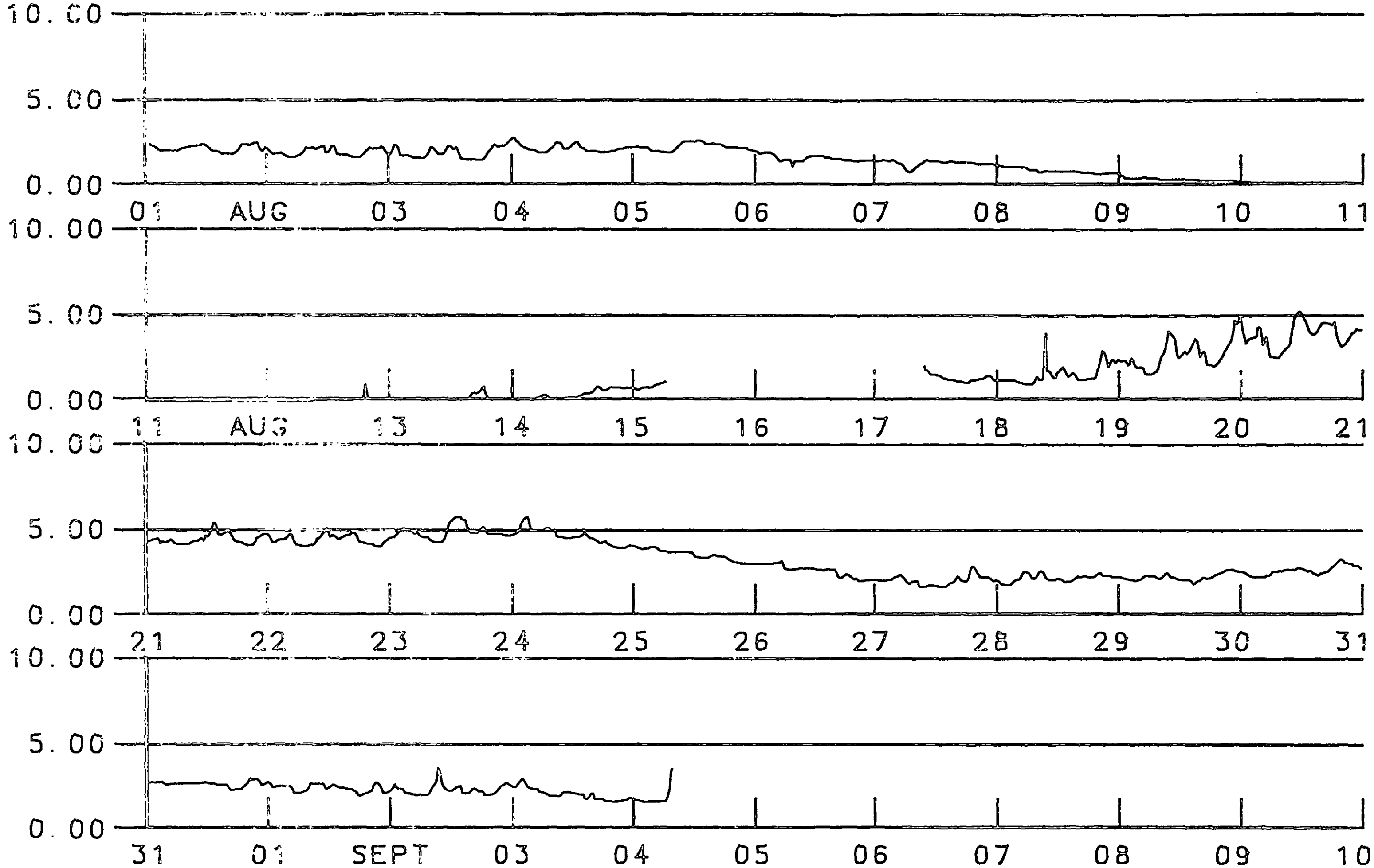
1989 YORK RIVER HYPOXIA SURVEY
DISSOLVED OXYGEN (MG/L)
STATION = N2. FROM 07/20/89 TO 07/31/89
DEPTH= 5.3 meters



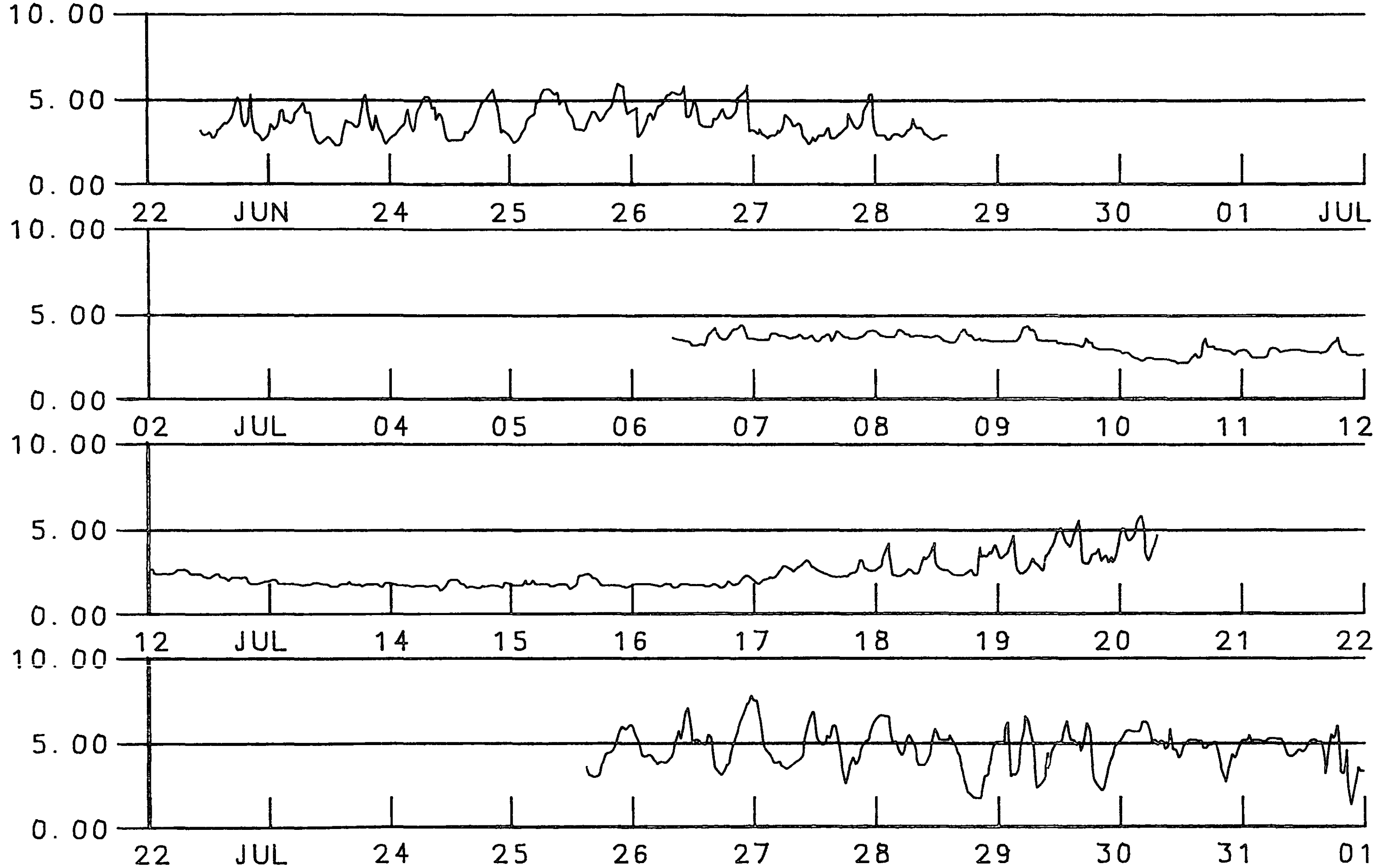
1989 YORK RIVER HYPOXIA SURVEY
DISSOLVED OXYGEN (MG/L)
STATION = N2. FROM 08/01/89 TO 09/05/89
DEPTH= 5.3 meters



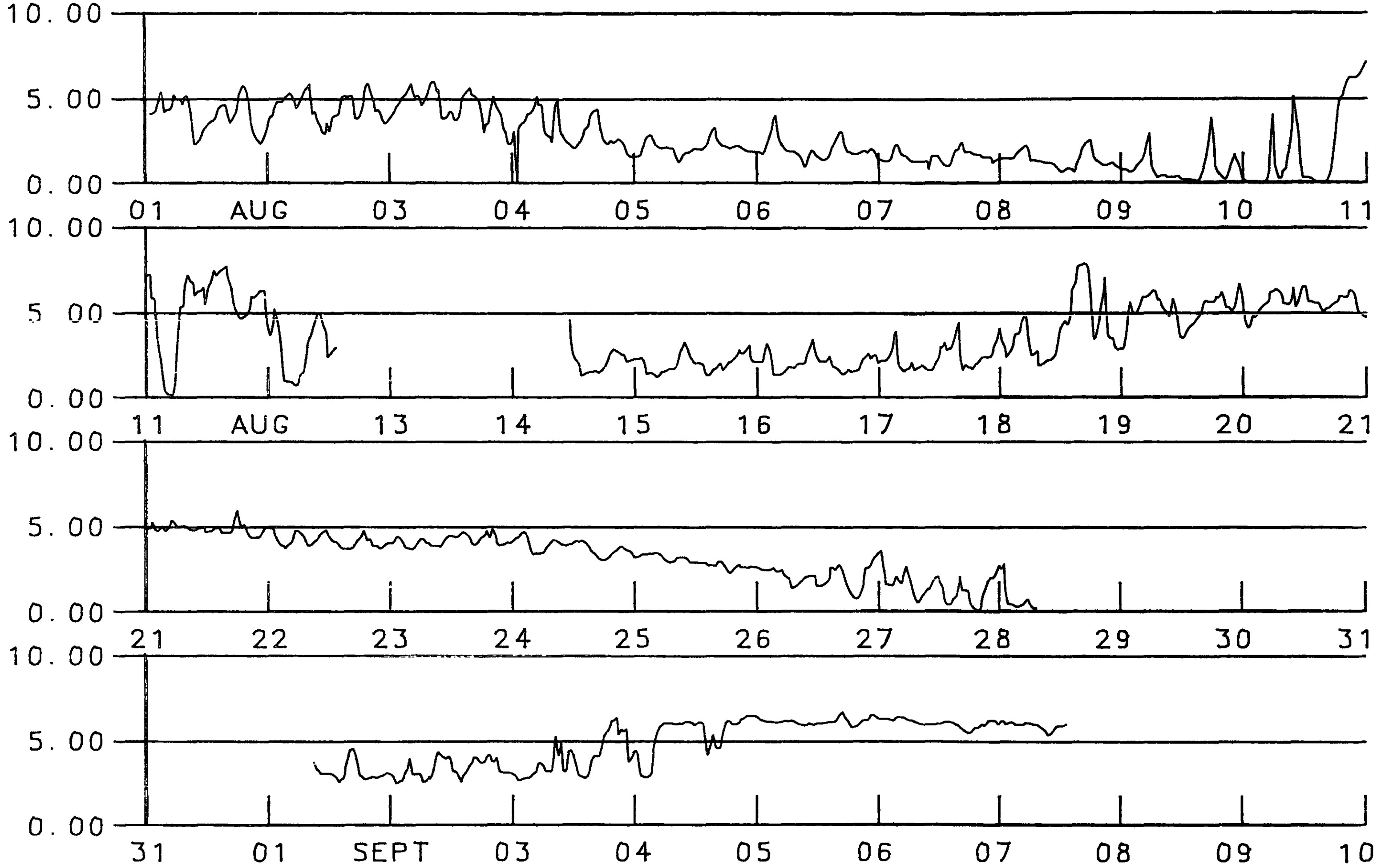
1989 YORK RIVER HYPOXIA SURVEY
DISSOLVED OXYGEN (MG/L)
STATION = RB. FROM 06/22/89 TO 07/31/89
DEPTH= 15.3 meters



1989 YORK RIVER HYPOXIA SURVEY
DISSOLVED OXYGEN (MG/L)
STATION = RB. FROM 08/01/89 TO 09/04/89
DEPTH= 15.3 meters



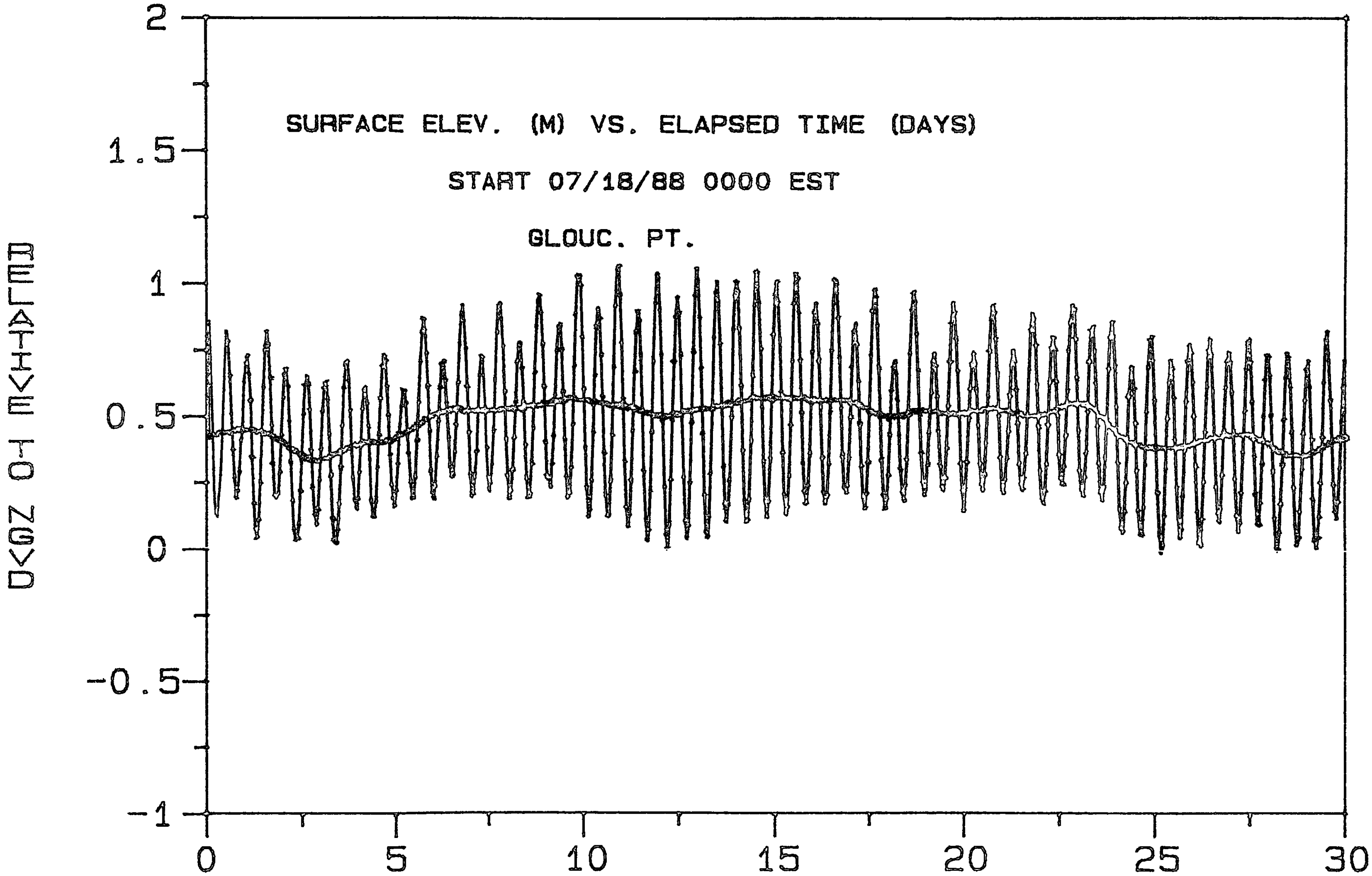
1989 YORK RIVER HYPOXIA SURVEY
DISSOLVED OXYGEN (MG/L)
STATION = TUE FROM 06/22/89 TO 07/31/89
DEPTH= 10.1 meters



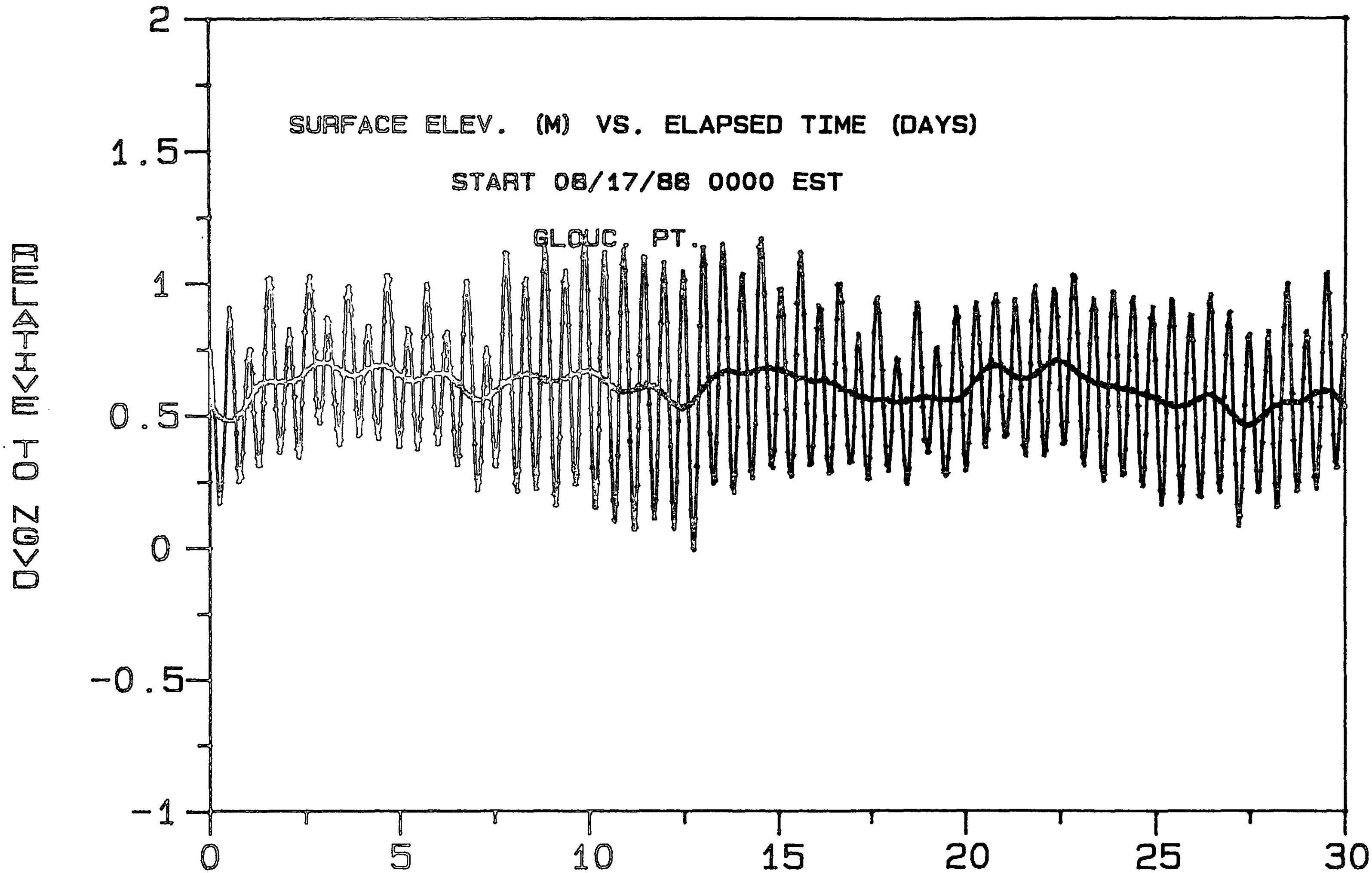
1989 YORK RIVER HYPOXIA SURVEY
DISSOLVED OXYGEN (MG/L)
STATION = TUE FROM 08/01/89 TO 09/07/89
DEPTH= 10.1 meters

APPENDIX H1

OBSERVED AND LOW PASS FILTERED SURFACE ELEVATIONS (1988)



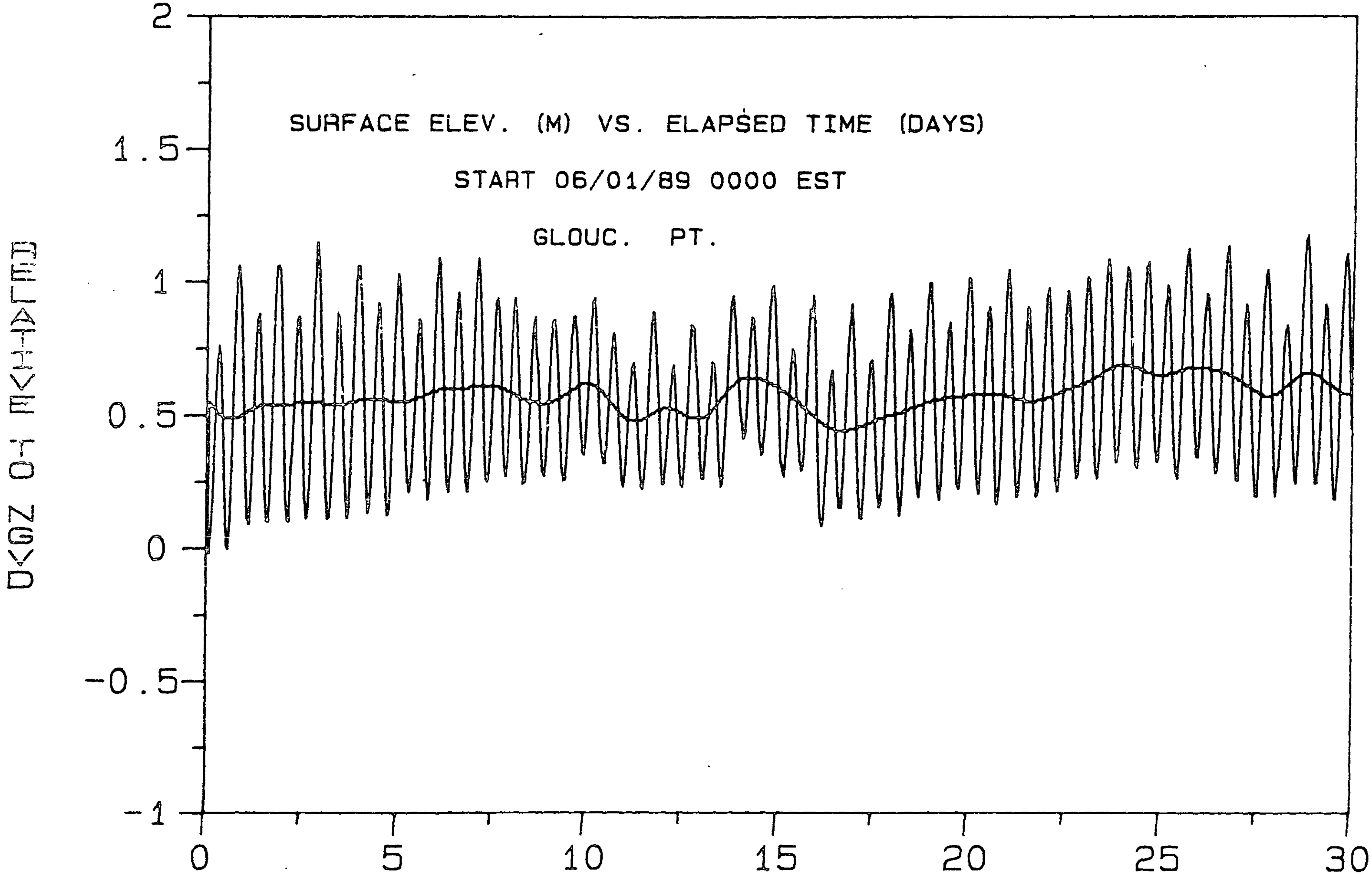
SURFACE ELEV. (M) VS. ELAPSED TIME (DAYS)
START 07/18/88 0000 EST
GLOUC. PT.
RELATIVE TO NGVD
2
1.5
1
0.5
0
-0.5
-1
0
5
10
15
20
25
30



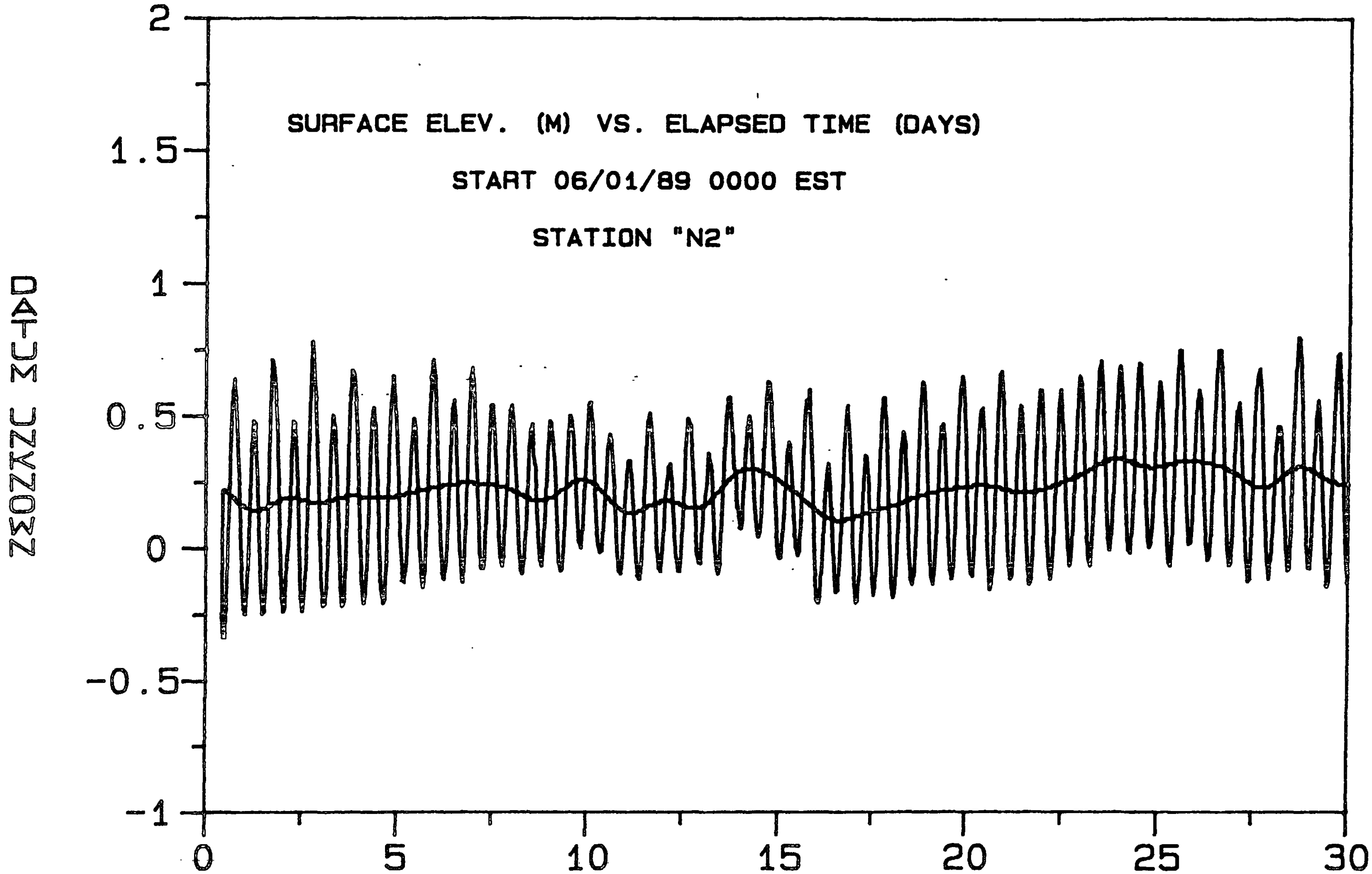
SURFACE ELEV. (M) VS. ELAPSED TIME (DAYS)
START 08/17/88 0000 EST
GLOUC. PT.
RELATIVE TO NGVD
2
1.5
1
0.5
0
-0.5
-1
0
5
10
15
20
25
30

APPENDIX H2

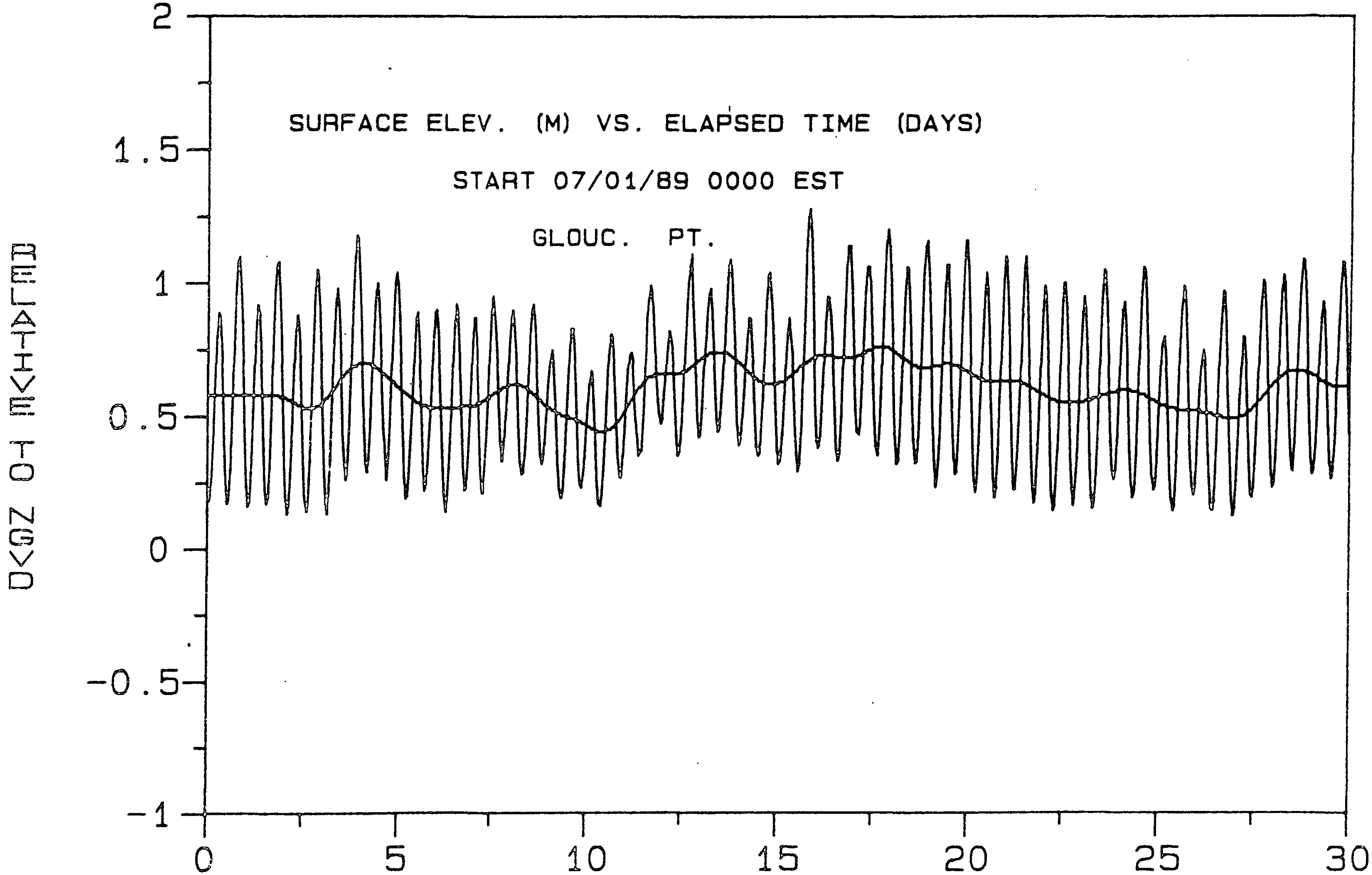
OBSERVED AND LOW PASS FILTERED SURFACE ELEVATIONS (1989)

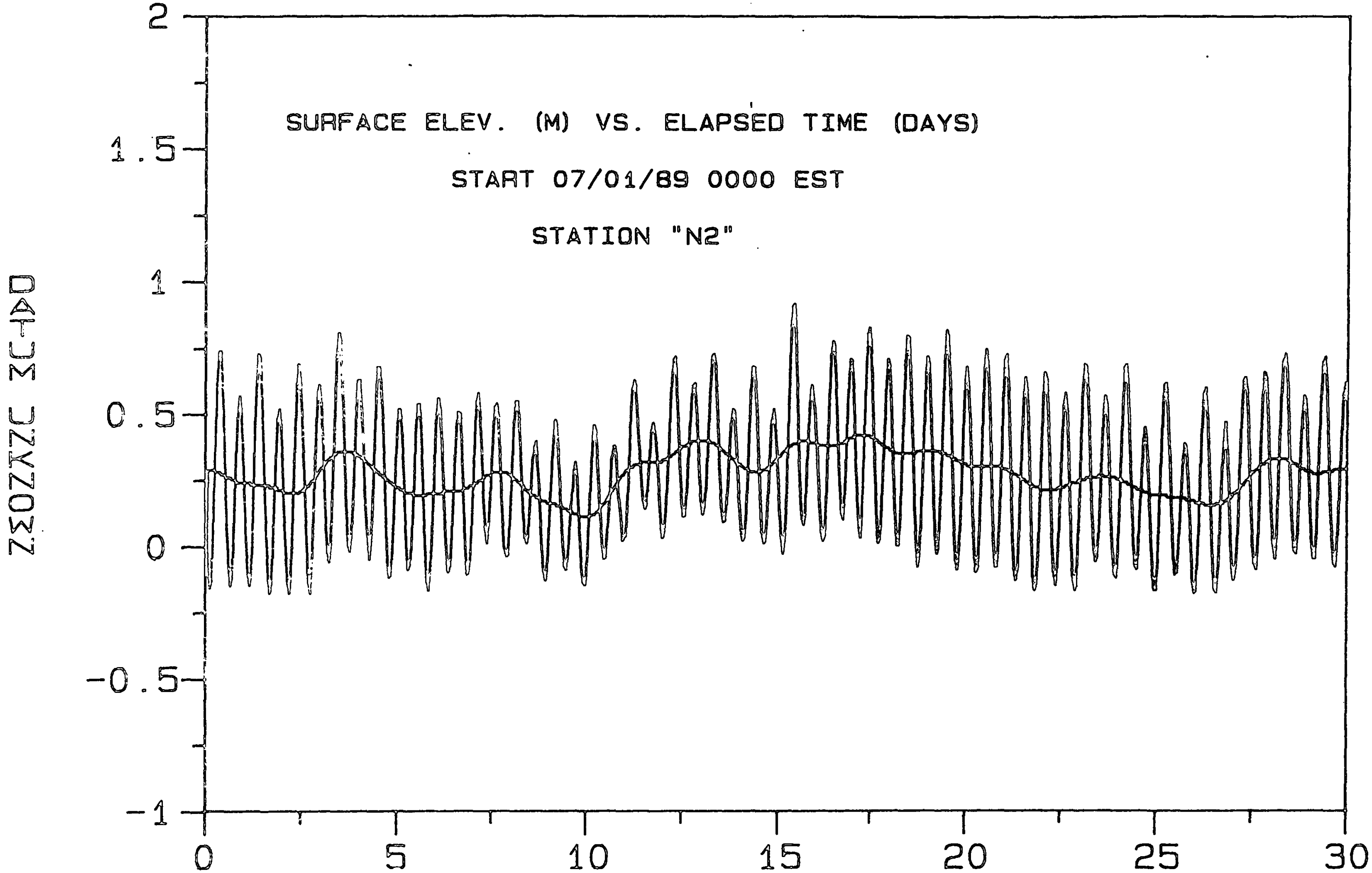


SURFACE ELEV. (M) VS. ELAPSED TIME (DAYS)
START 06/01/89 0000 EST
GLOUC. PT.
2
1.5
1
0.5
0
-0.5
-1
0
5
10
15
20
25
30

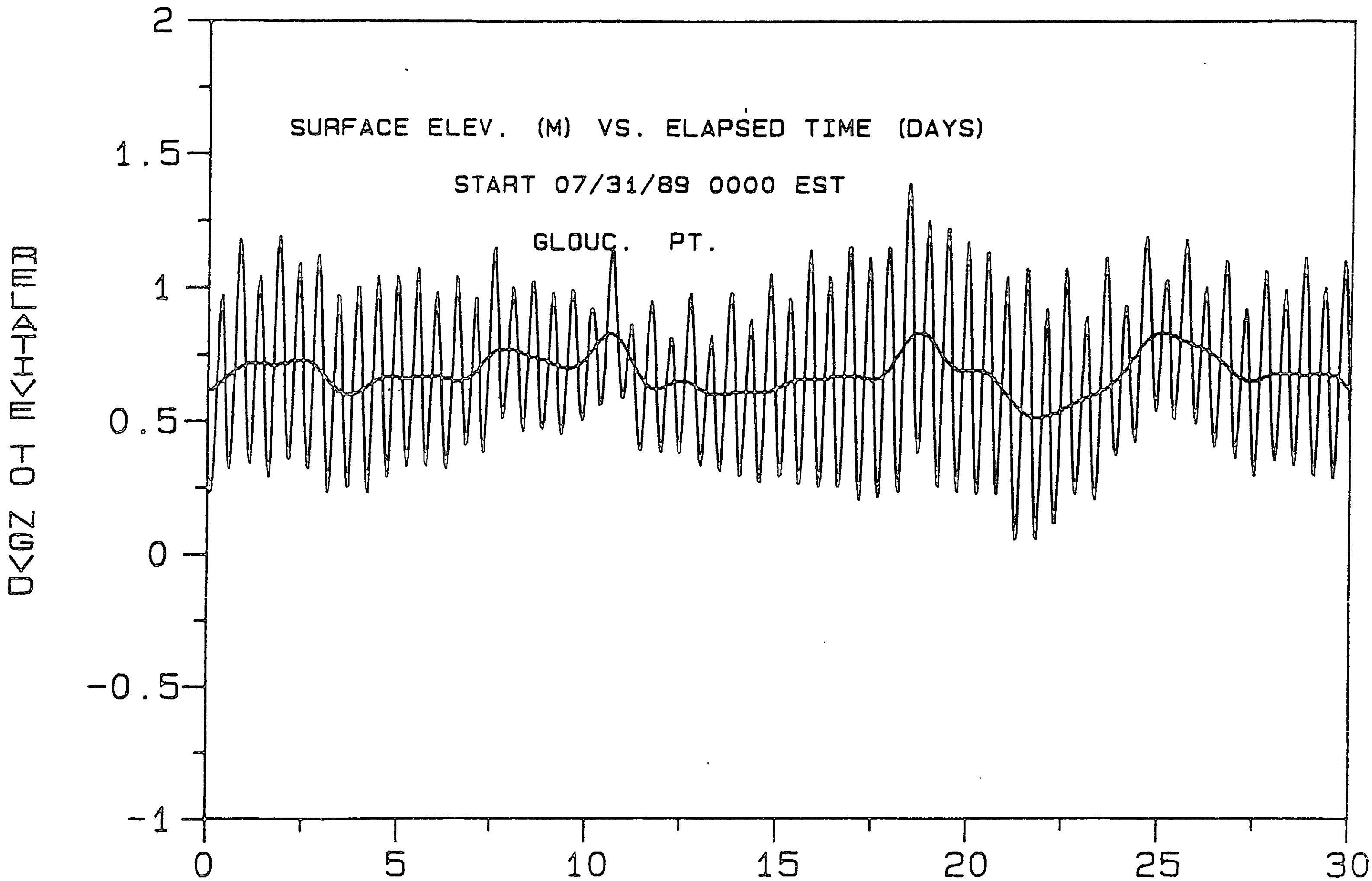


SURFACE ELEV. (M) VS. ELAPSED TIME (DAYS)
START 06/01/89 0000 EST
STATION "N2"
2
1.5
1
0.5
0
-0.5
-1
0
5
10
15
20
25
30

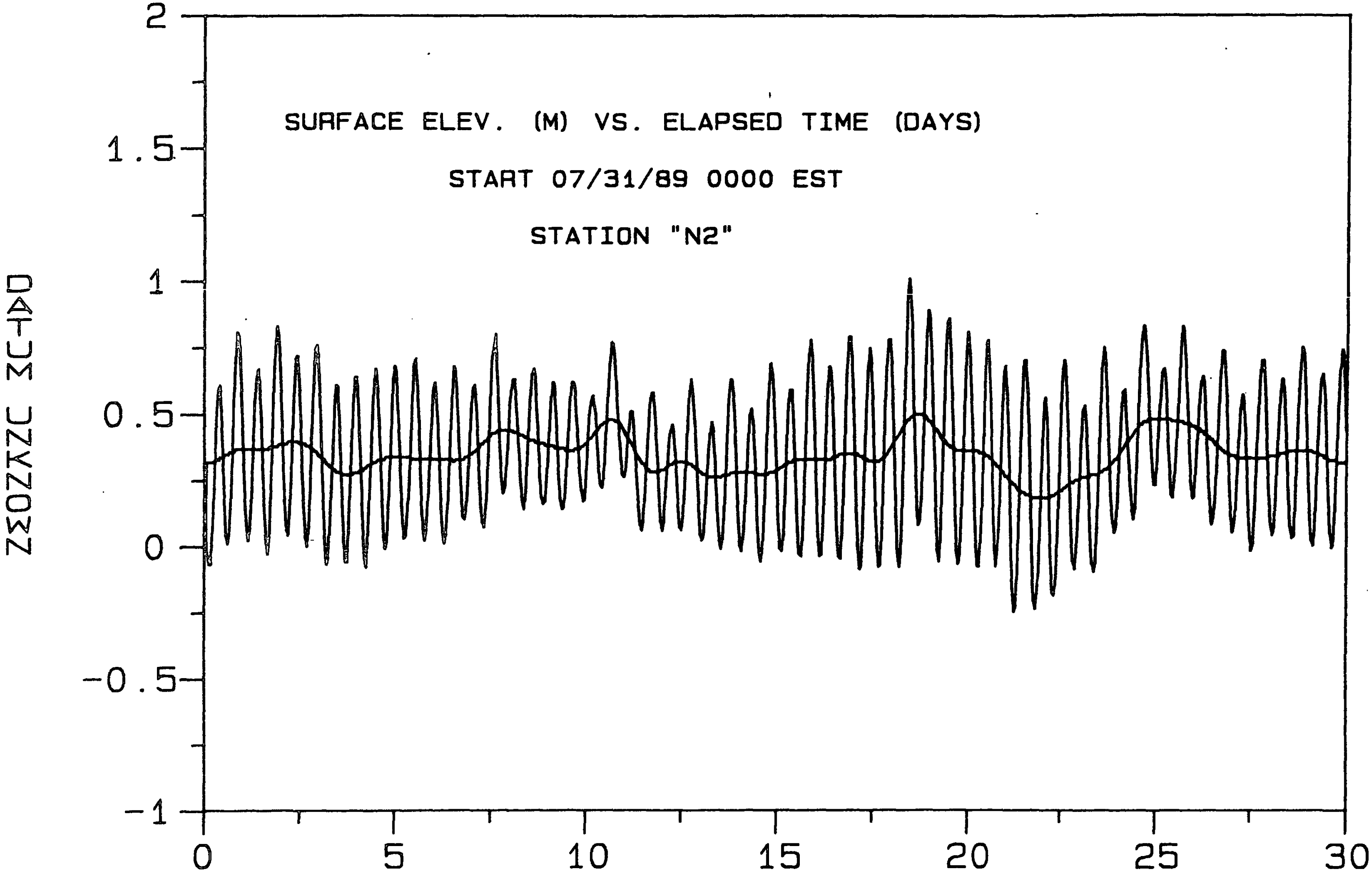

SURFACE ELEV. (M) VS. ELAPSED TIME (DAYS)
START 07/01/89 0000 EST
GLOUC. PT.
2
1.5
1
0.5
0
-0.5
-1
0
5
10
15
20
25
30



SURFACE ELEV. (M) VS. ELAPSED TIME (DAYS)
START 07/01/89 0000 EST
STATION "N2"
2
1.5
1
0.5
0
-0.5
-1
0
5
10
15
20
25
30

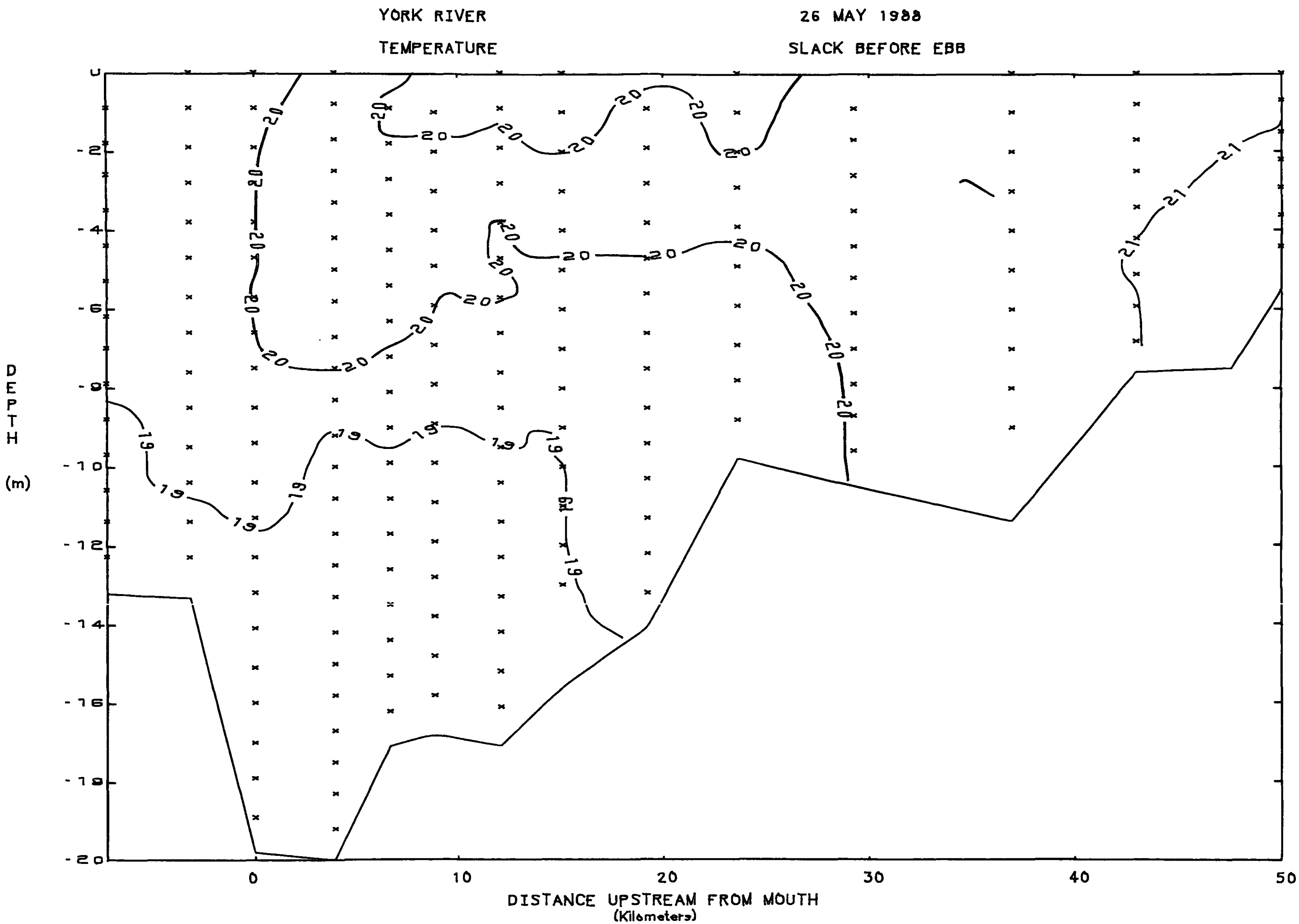


SURFACE ELEV. (M) VS. ELAPSED TIME (DAYS)
START 07/31/89 0000 EST
GLOUC. PT.
RELATIVE TO NGVD
2
1.5
1
0.5
0
-0.5
-1
0
5
10
15
20
25
30

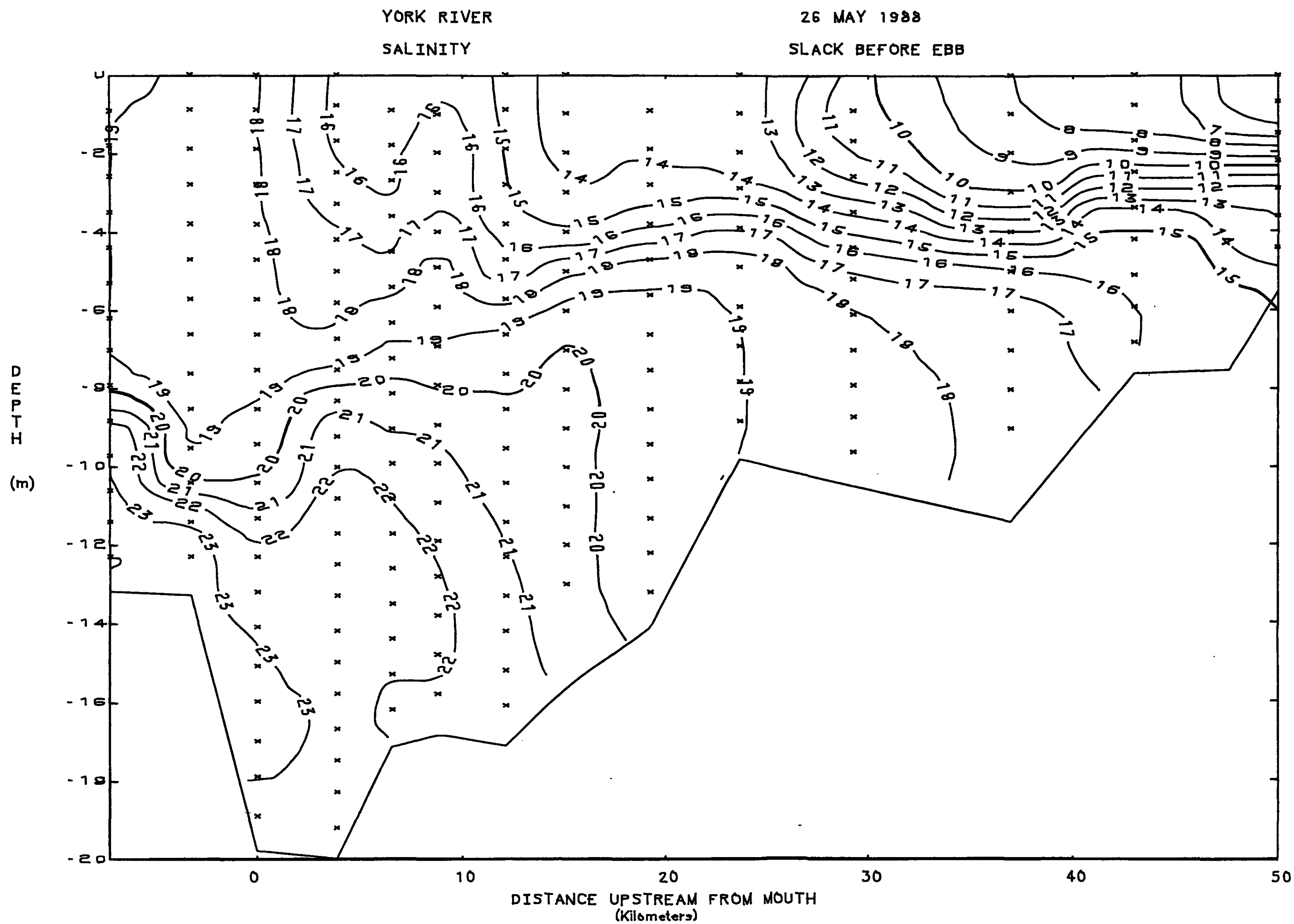

SURFACE ELEV. (M) VS. ELAPSED TIME (DAYS)
START 07/31/89 0000 EST
STATION "N2"
2
1.5
1
0.5
0
-0.5
-1
0
5
10
15
20
25
30

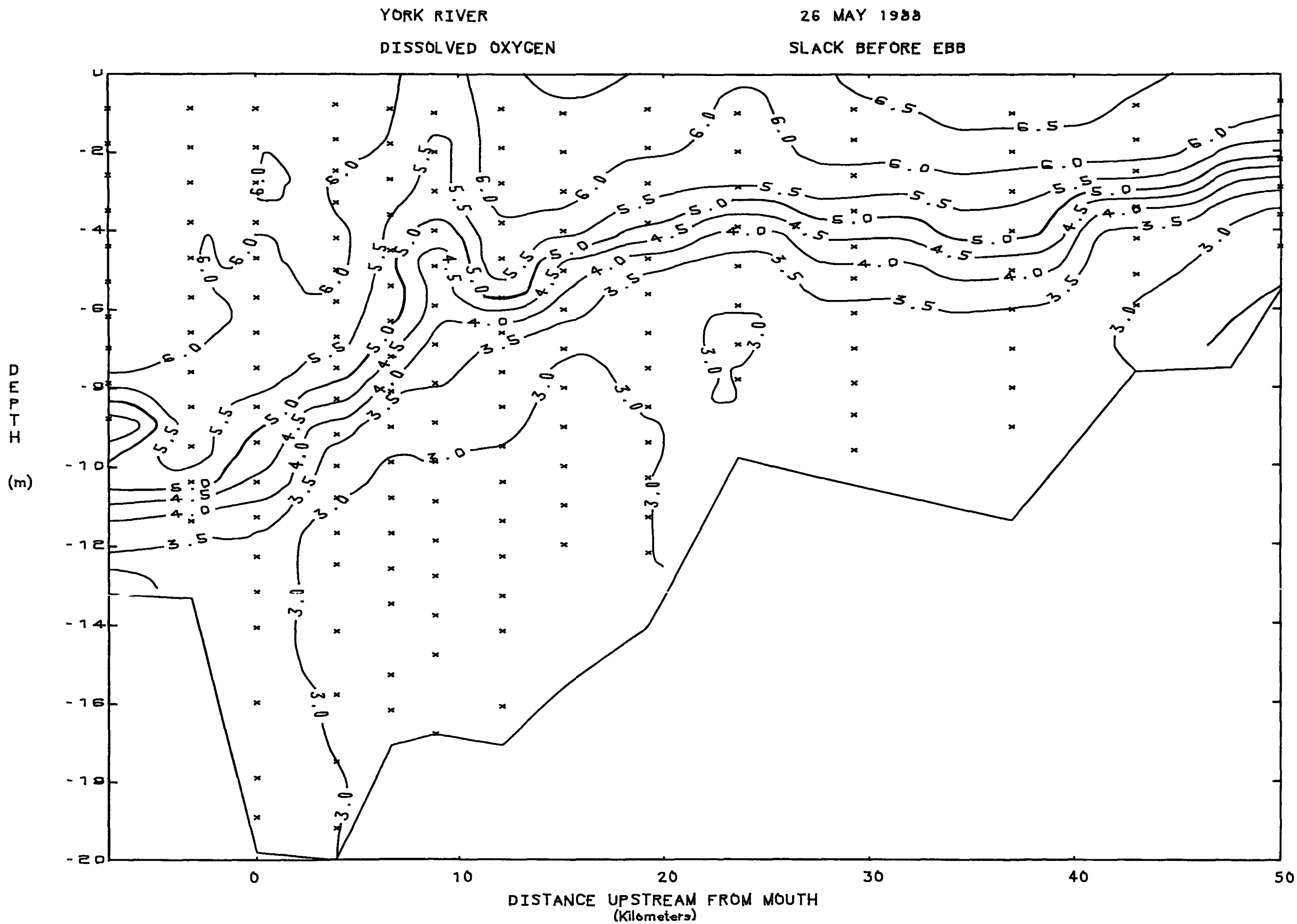
APPENDIX I1

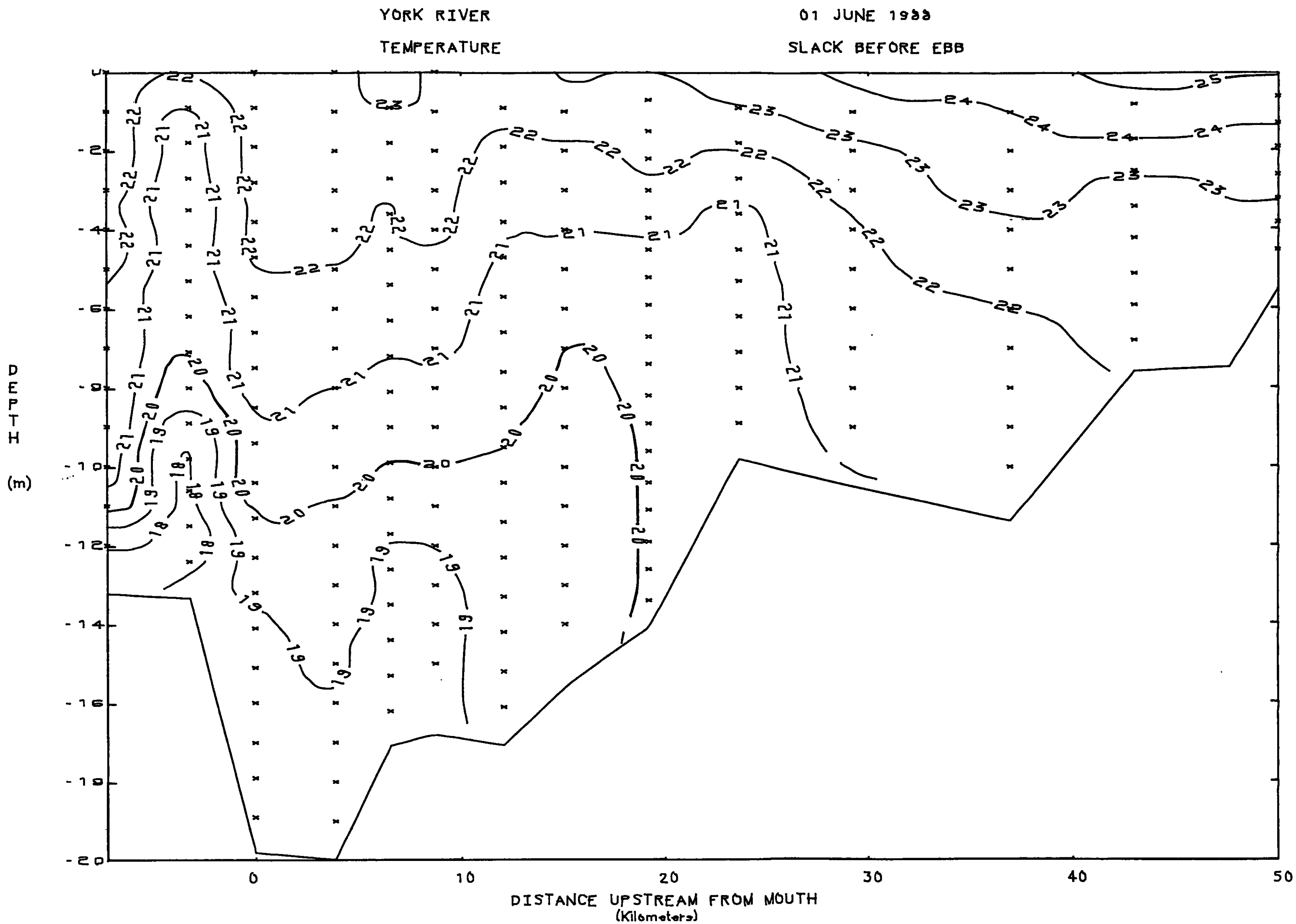
SLACKWATER SURVEYS (1988)

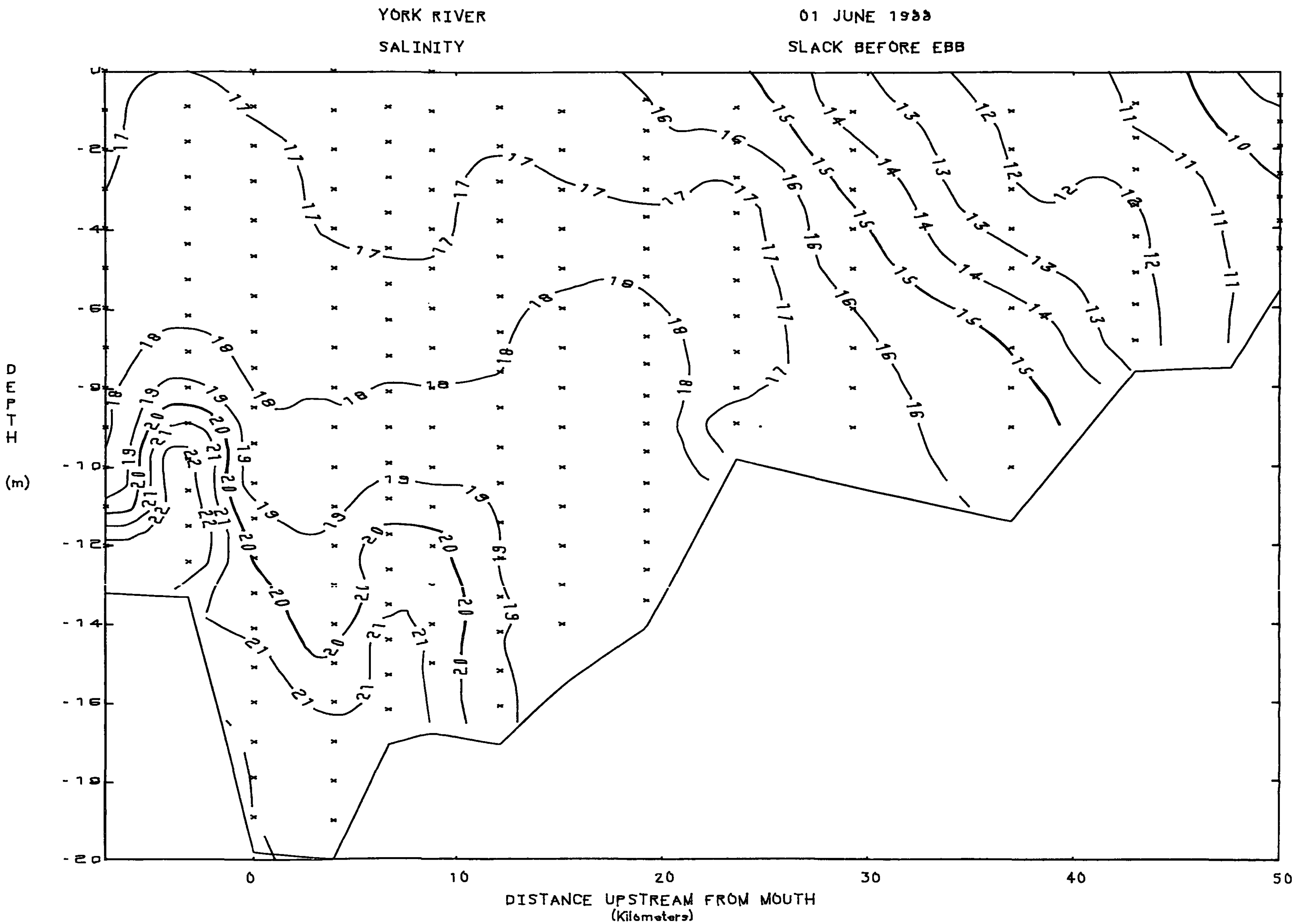


YORK RIVER
26 MAY 1988
TEMPERATURE
SLACK BEFORE EBB
DEPTH
(m)
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
0
10
20
30
40
50
DISTANCE UPSTREAM FROM MOUTH
(Kilometers)


YORK RIVER
SALINITY
26 MAY 1988
SLACK BEFORE EBB
DEPTH
(m)
DISTANCE UPSTREAM FROM MOUTH
(Kilometers)
0
10
20
30
40
50
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20

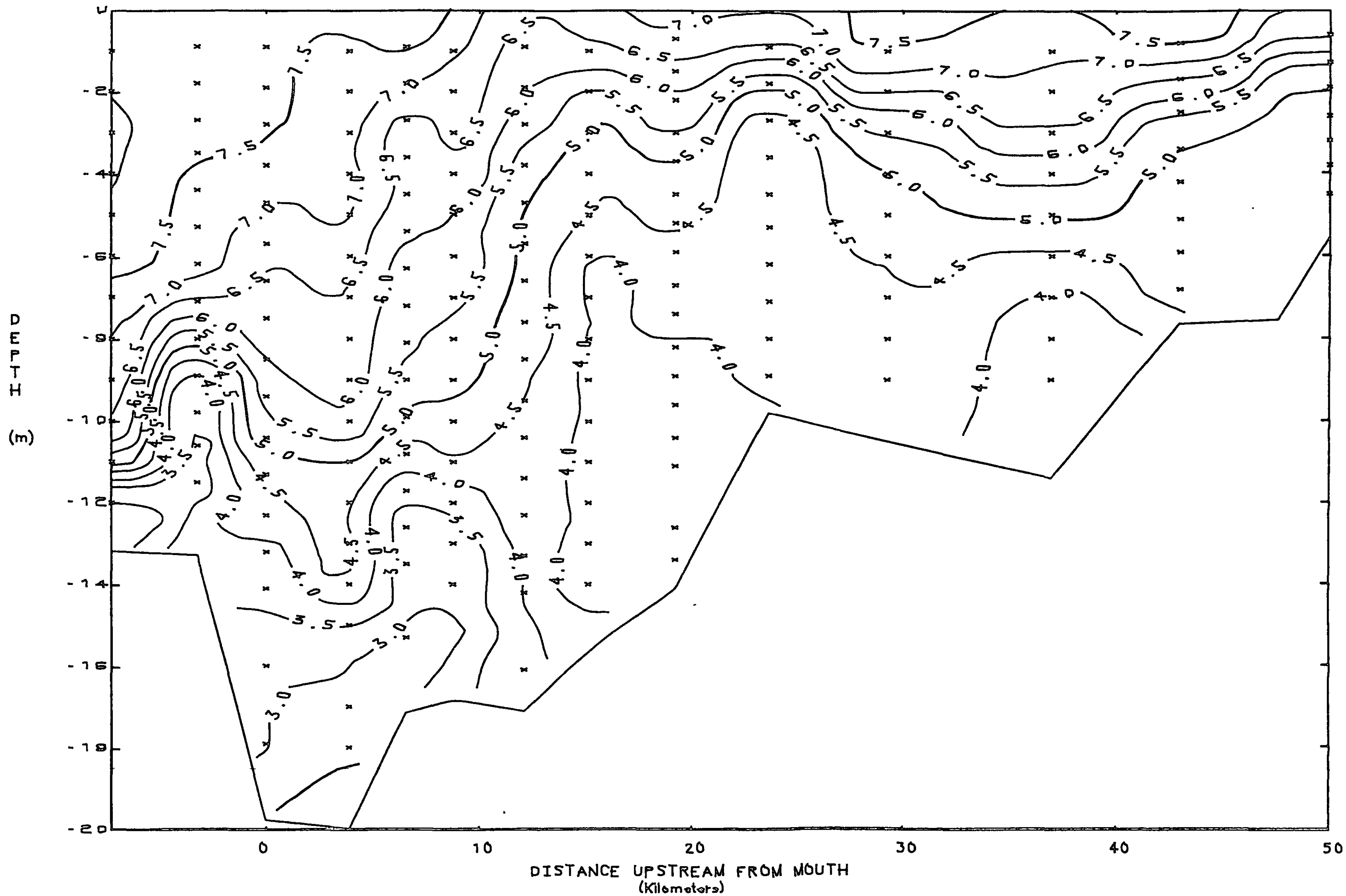

YORK RIVER
26 MAY 1988
DISSOLVED OXYGEN
SLACK BEFORE EBB
DEPTH
(m)
DISTANCE UPSTREAM FROM MOUTH
(Kilometers)

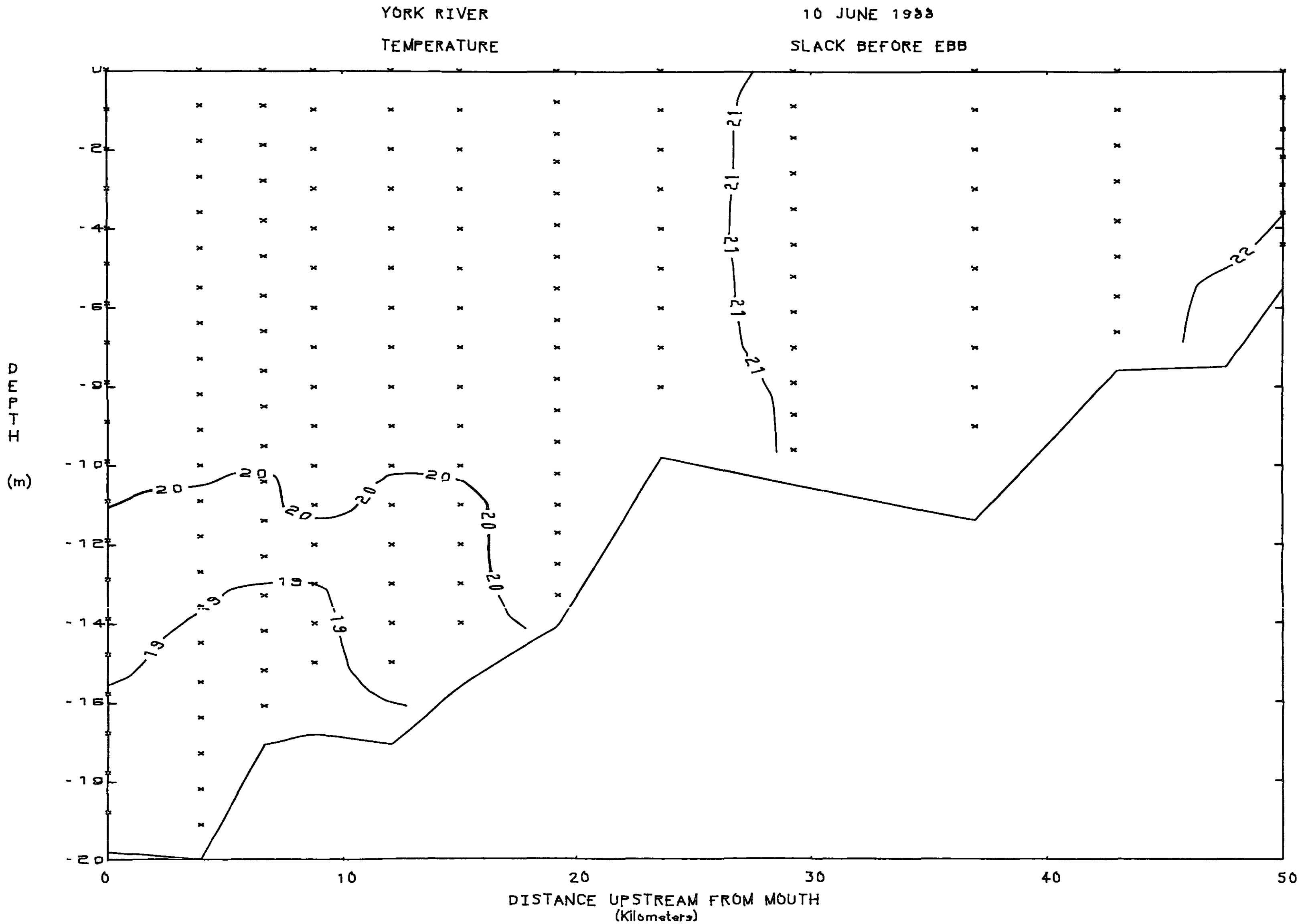

YORK RIVER
TEMPERATURE
01 JUNE 1988
SLACK BEFORE EBB
DEPTH
(m)
DISTANCE UPSTREAM FROM MOUTH
(Kilometers)
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
10
20
30
40
50
18
19
20
21
22
23
24
25


YORK RIVER
SALINITY
01 JUNE 1988
SLACK BEFORE EBB
DEPTH
(m)
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
0
10
20
30
40
50
DISTANCE UPSTREAM FROM MOUTH
(Kilometers)

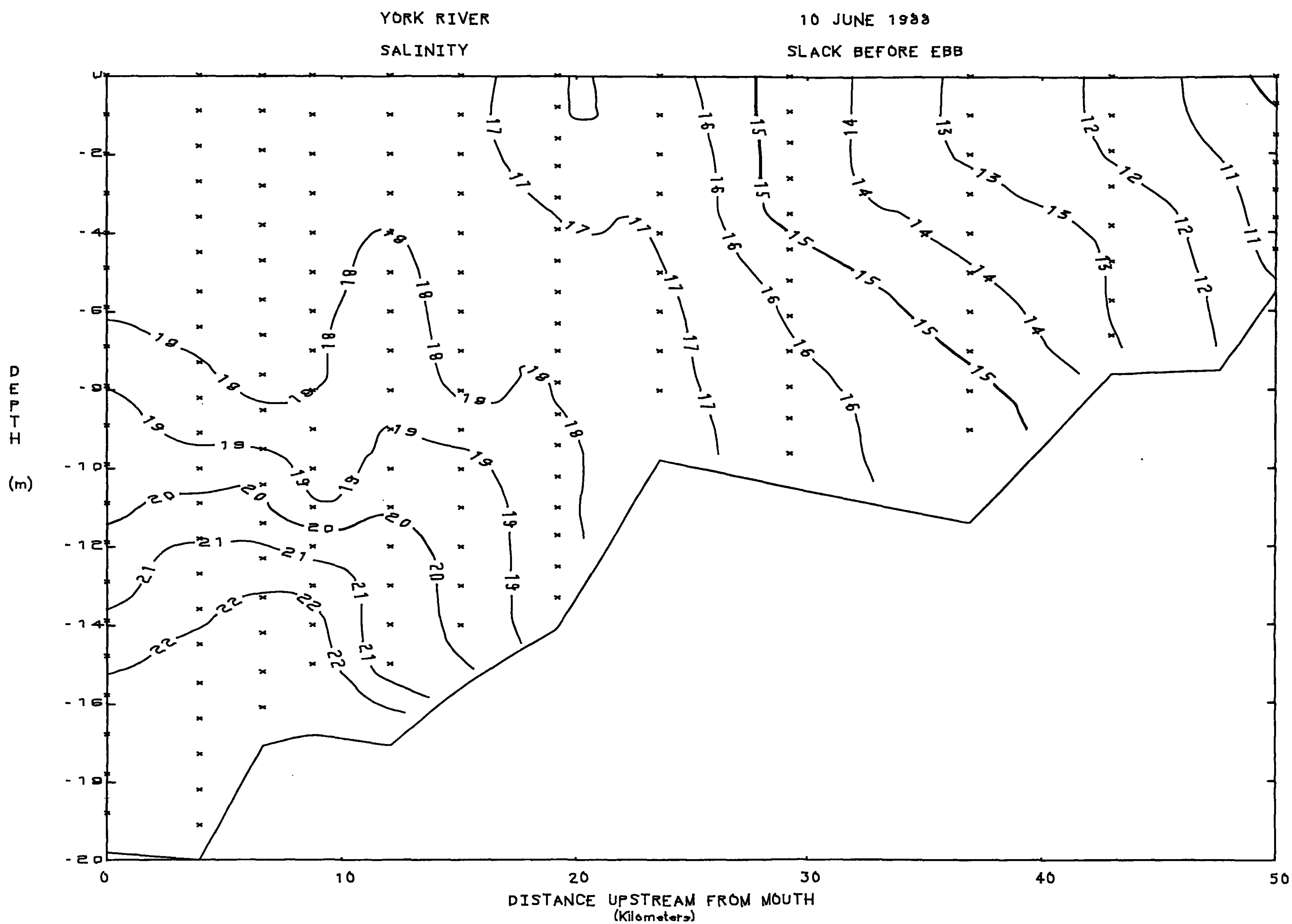
YORK RIVER 01 JUNE 1988

DISSOLVED OXYGEN SLACK BEFORE EBB



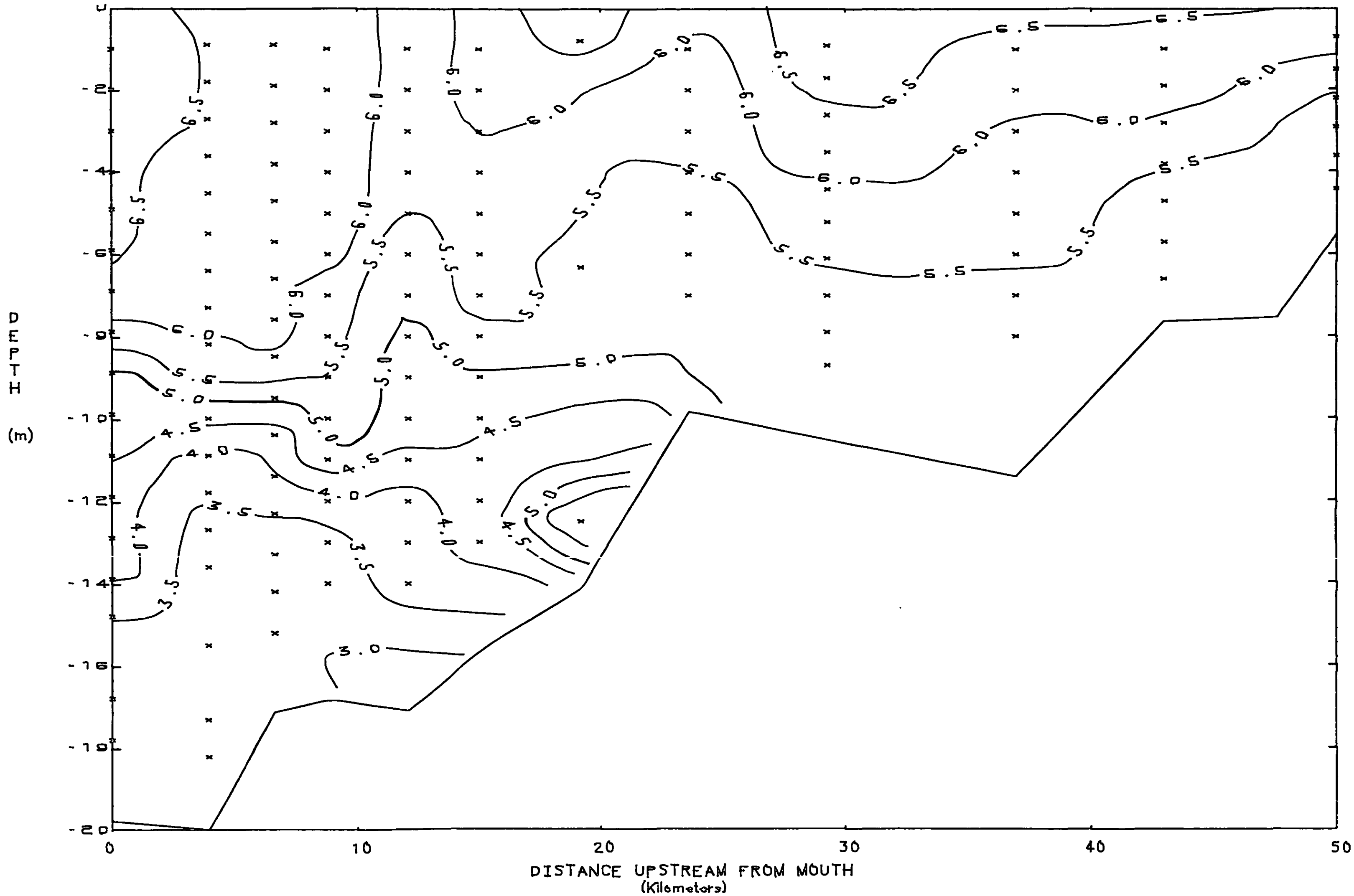


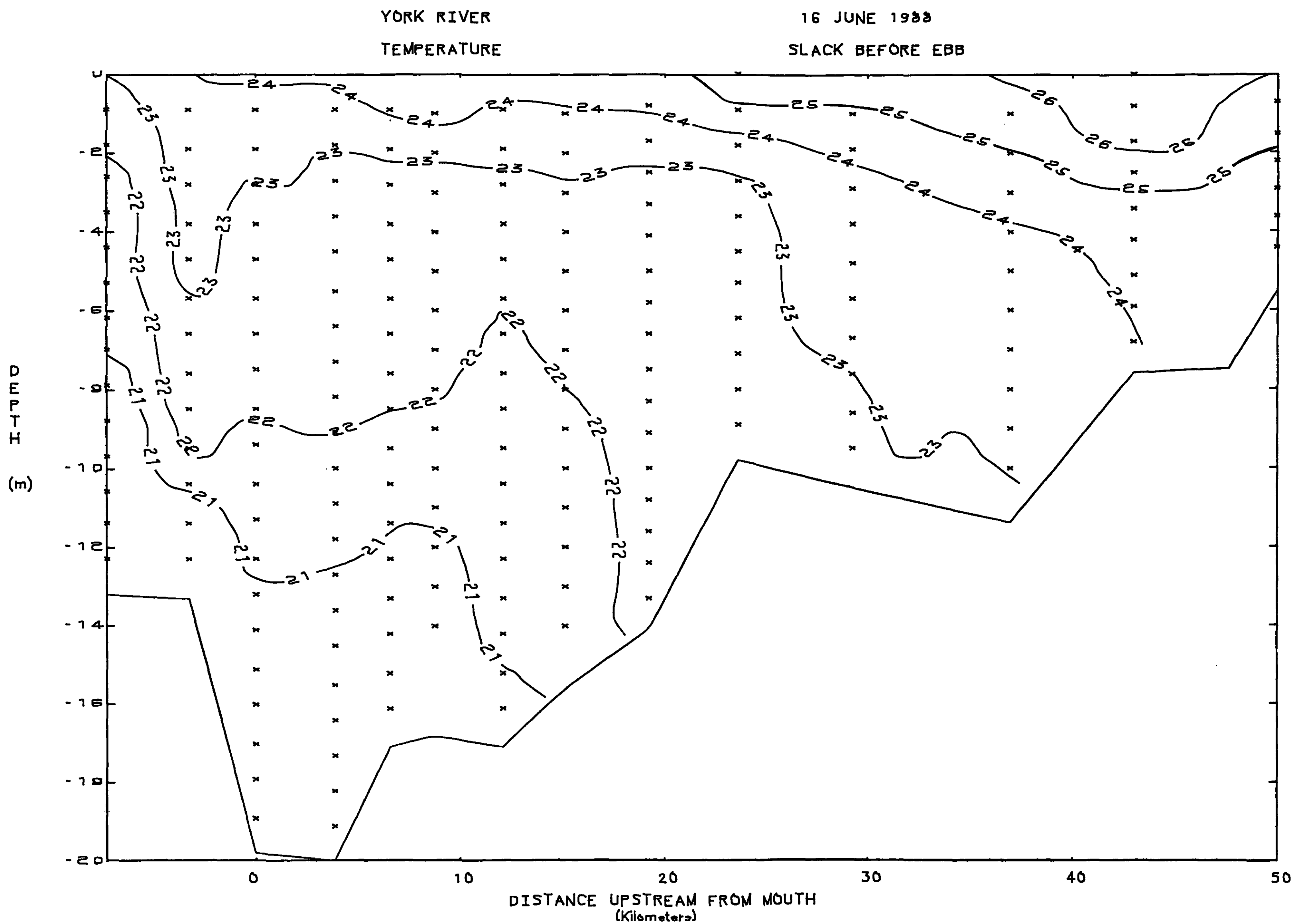
YORK RIVER
TEMPERATURE
10 JUNE 1988
SLACK BEFORE EBB
DEPTH
(m)
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
0
10
20
30
40
50
DISTANCE UPSTREAM FROM MOUTH
(Kilometers)
19
20
21
22


YORK RIVER
SALINITY
10 JUNE 1988
SLACK BEFORE EBB
DEPTH
(m)
DISTANCE UPSTREAM FROM MOUTH
(Kilometers)

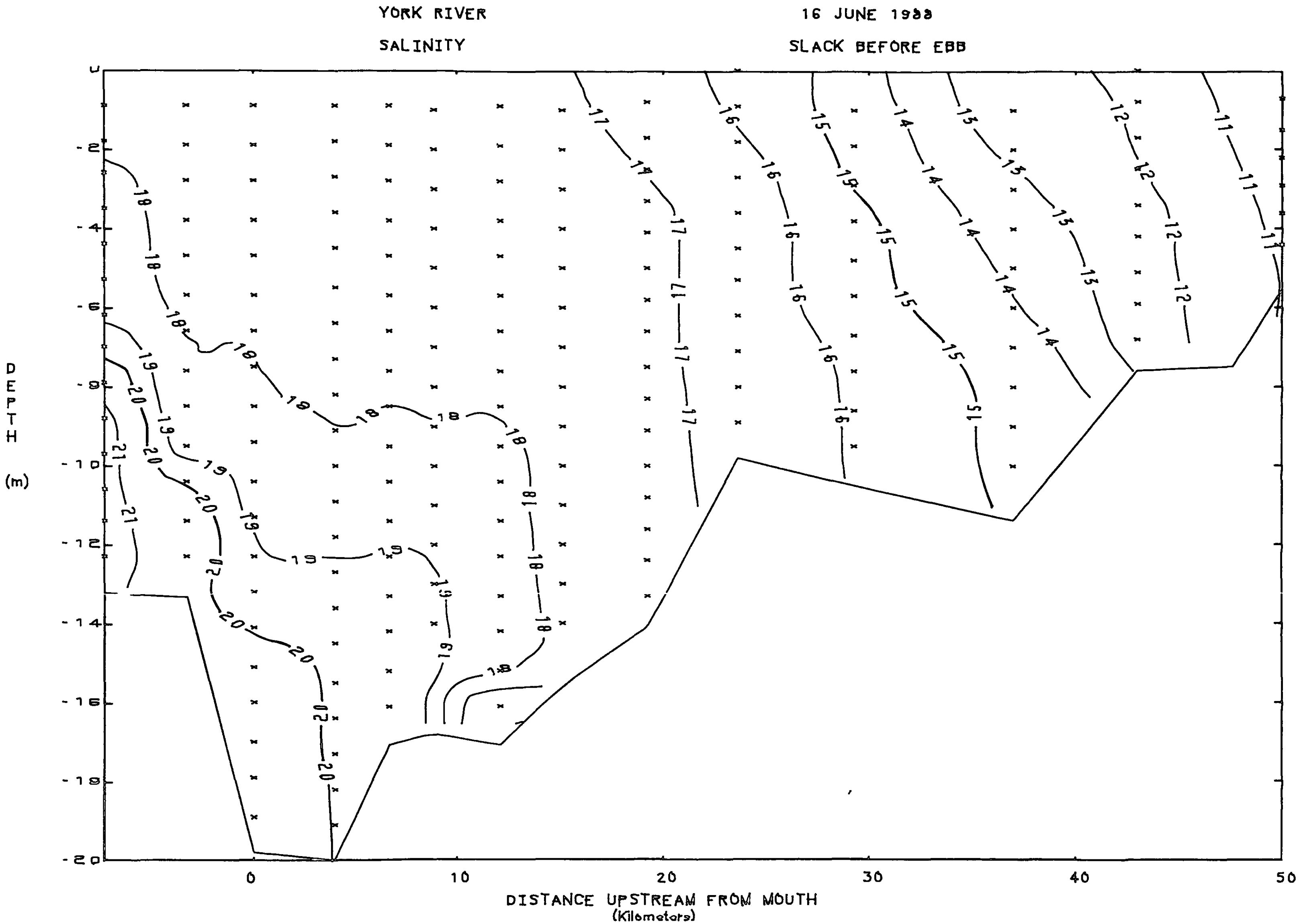
YORK RIVER 10 JUNE 1988

DISSOLVED OXYGEN SLACK BEFORE EBB





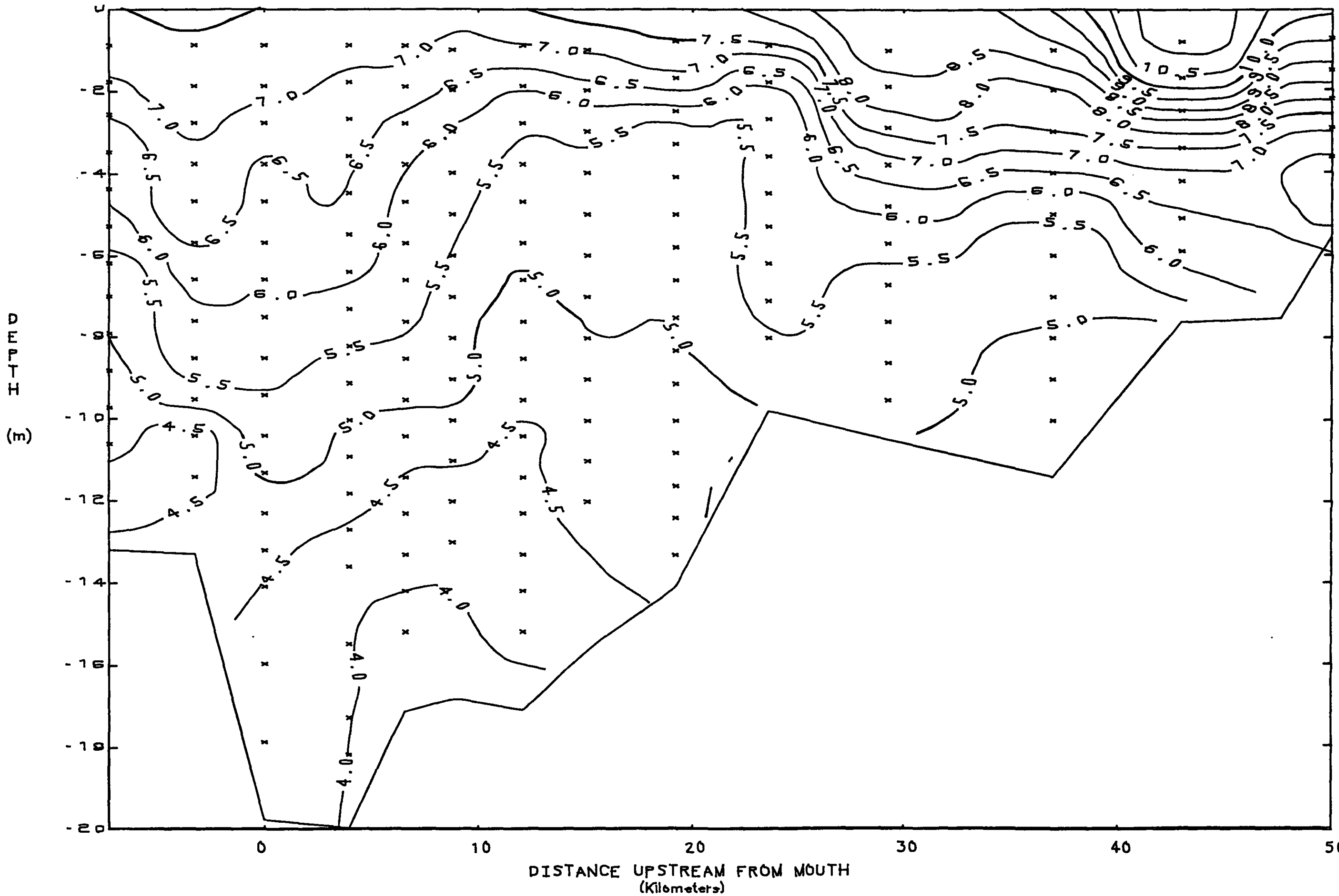
YORK RIVER
TEMPERATURE
16 JUNE 1988
SLACK BEFORE EBB
DEPTH
(m)
DISTANCE UPSTREAM FROM MOUTH
(Kilometers)
0
10
20
30
40
50
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
21
22
23
24
25
26

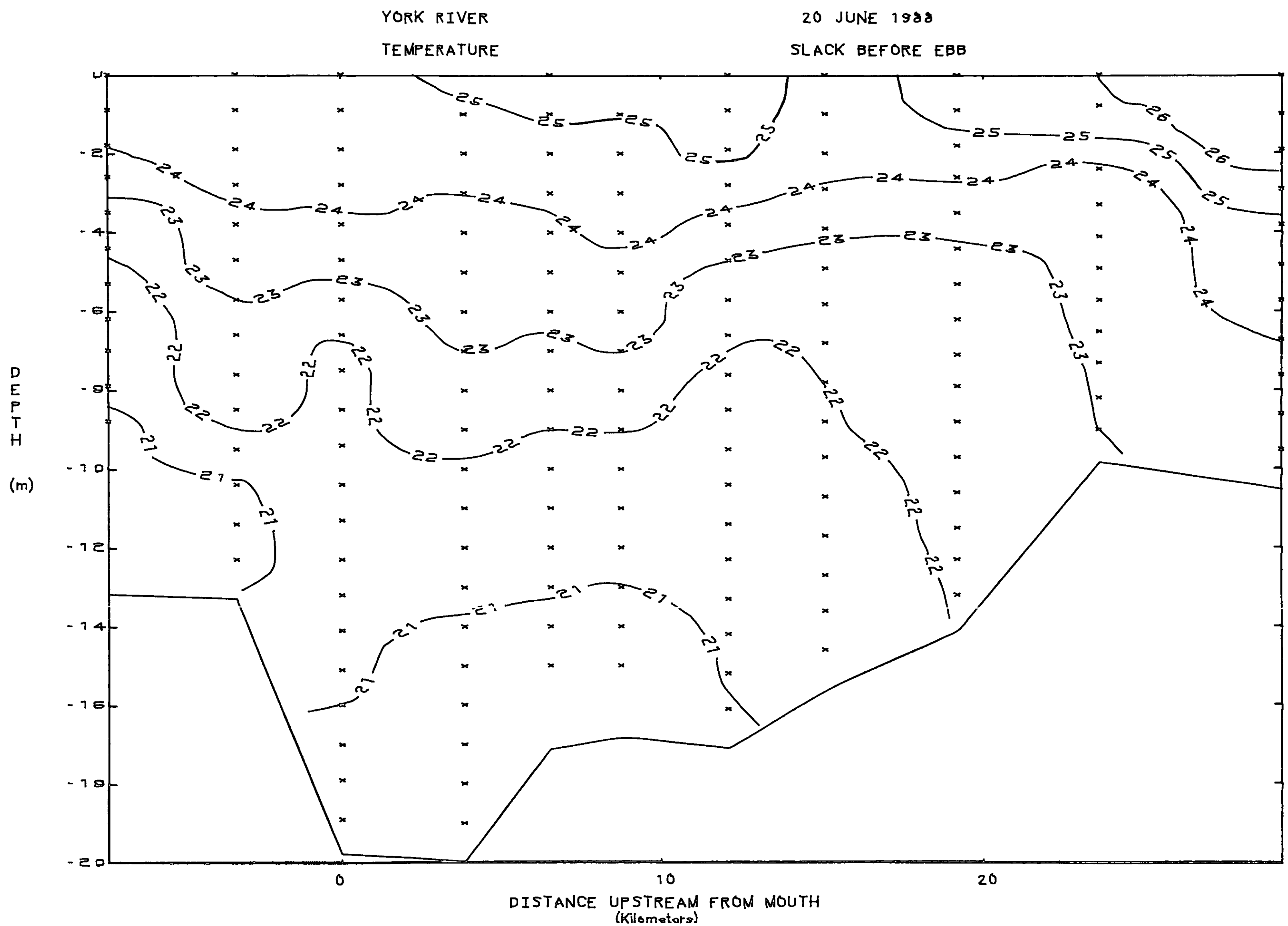


YORK RIVER
SALINITY
16 JUNE 1988
SLACK BEFORE EBB
DEPTH (m)
DISTANCE UPSTREAM FROM MOUTH
(Kilometers)

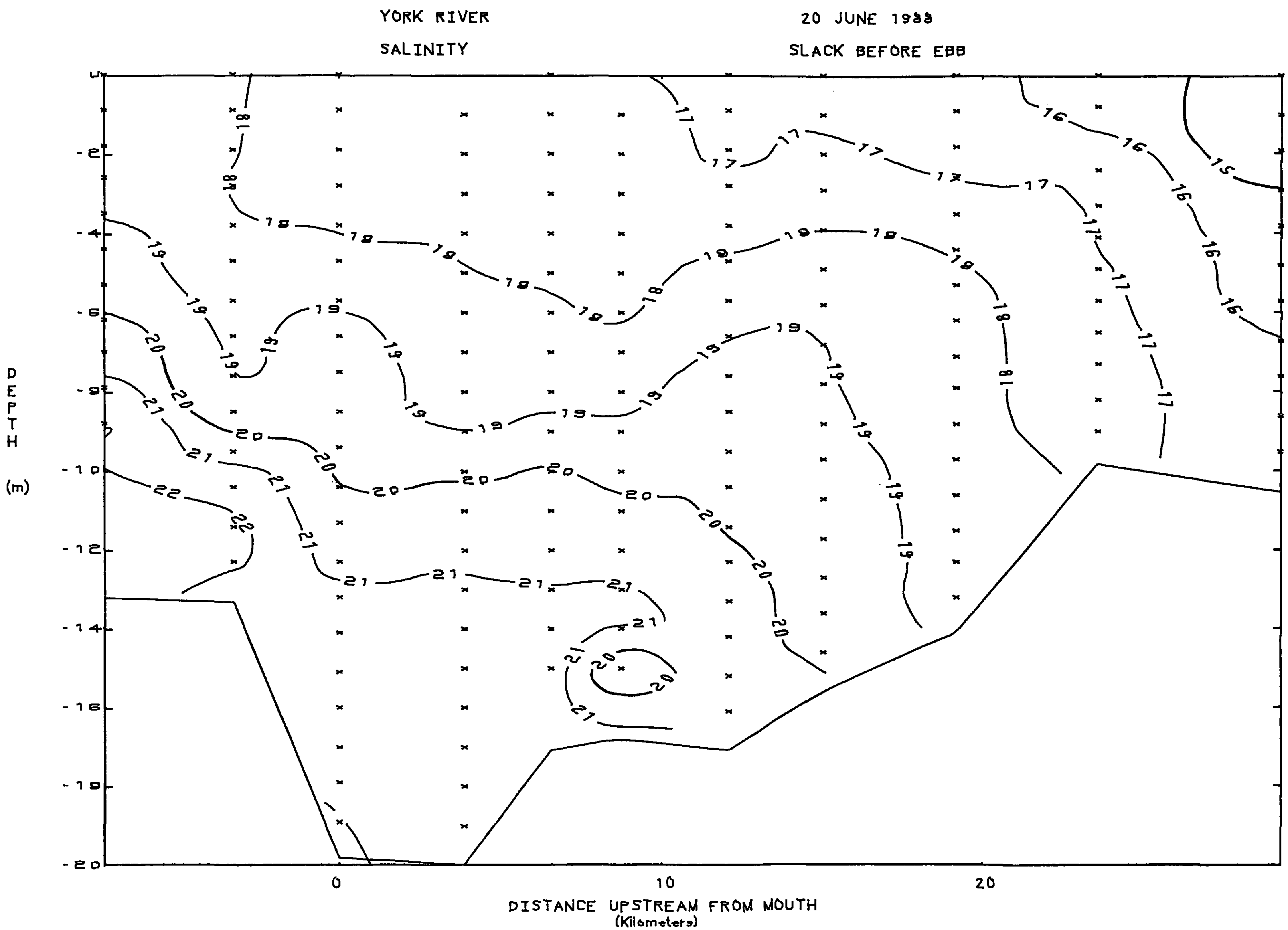
YORK RIVER — 16 JUNE 1988

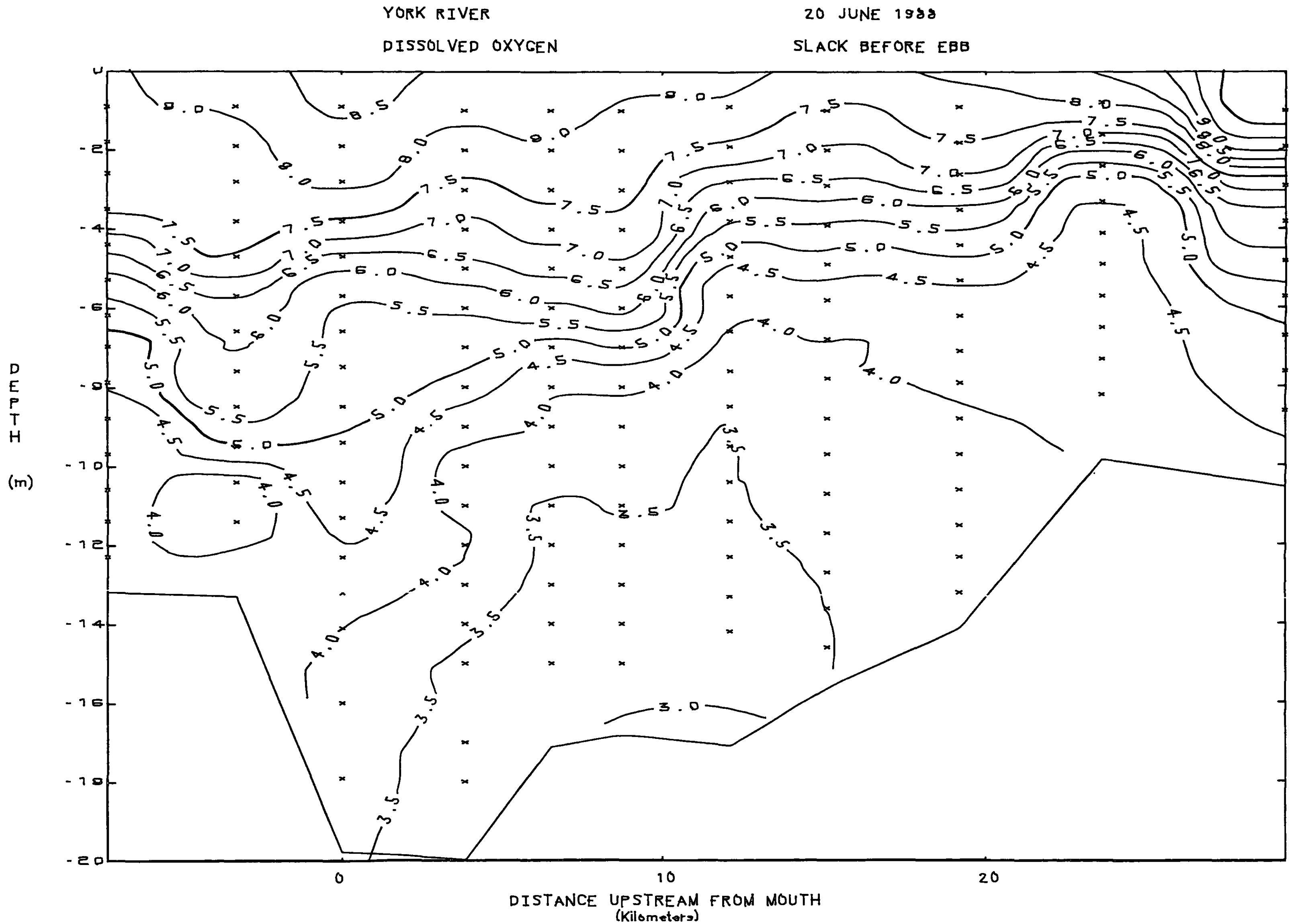
DISSOLVED OXYGEN — SLACK BEFORE EBB



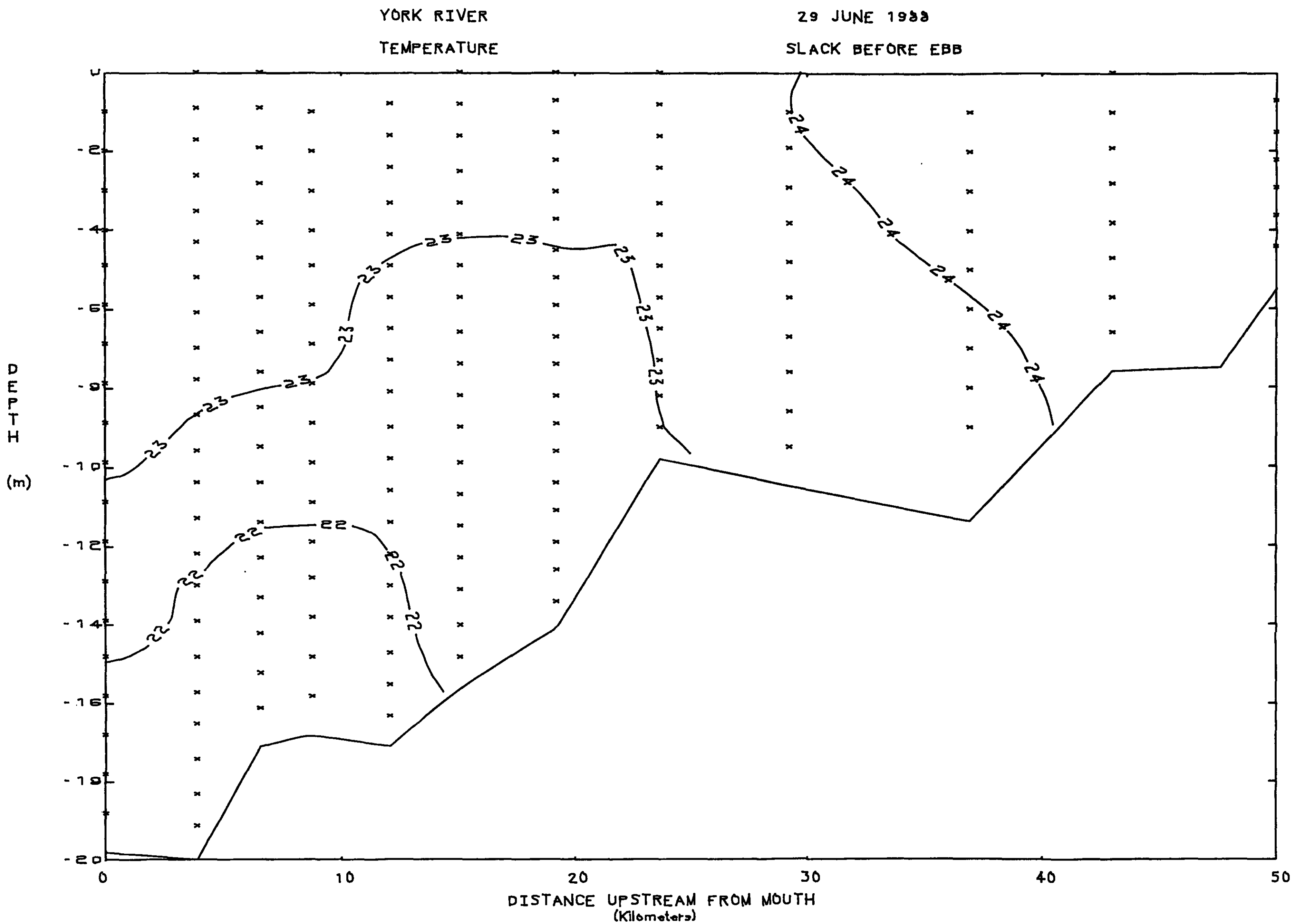


YORK RIVER
TEMPERATURE
20 JUNE 1988
SLACK BEFORE EBB
DEPTH
(m)
DISTANCE UPSTREAM FROM MOUTH
(Kilometers)


YORK RIVER
20 JUNE 1988
SALINITY
SLACK BEFORE EBB
DEPTH
(m)
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
0
10
20
DISTANCE UPSTREAM FROM MOUTH
(Kilometers)



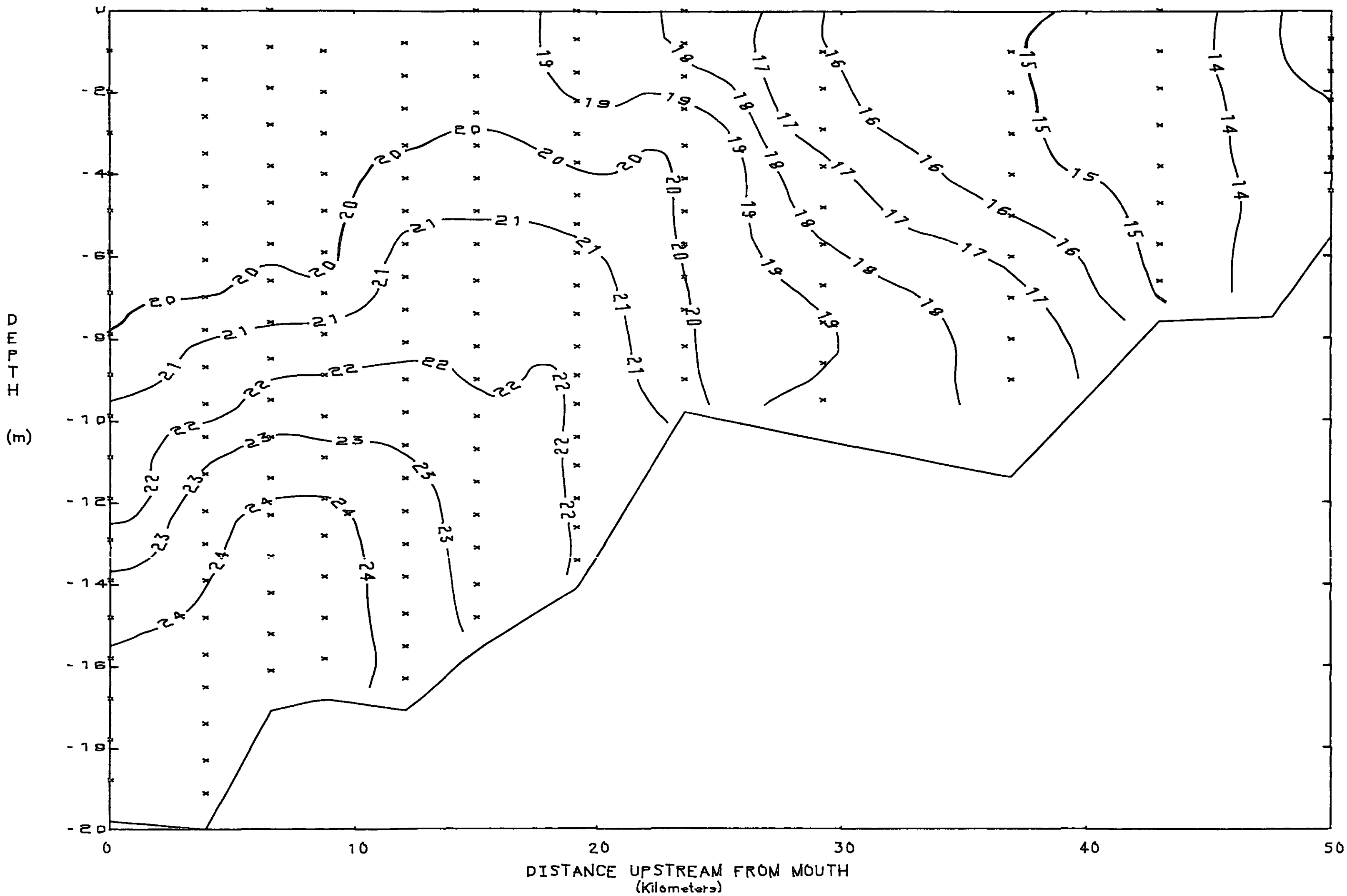
YORK RIVER
20 JUNE 1988
DISSOLVED OXYGEN
SLACK BEFORE EBB
DEPTH
(m)
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
0
10
20
DISTANCE UPSTREAM FROM MOUTH
(Kilometers)



YORK RIVER
29 JUNE 1988
TEMPERATURE
SLACK BEFORE EBB
DEPTH
(m)
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
24
23
22
0
10
20
30
40
50
DISTANCE UPSTREAM FROM MOUTH
(Kilometers)

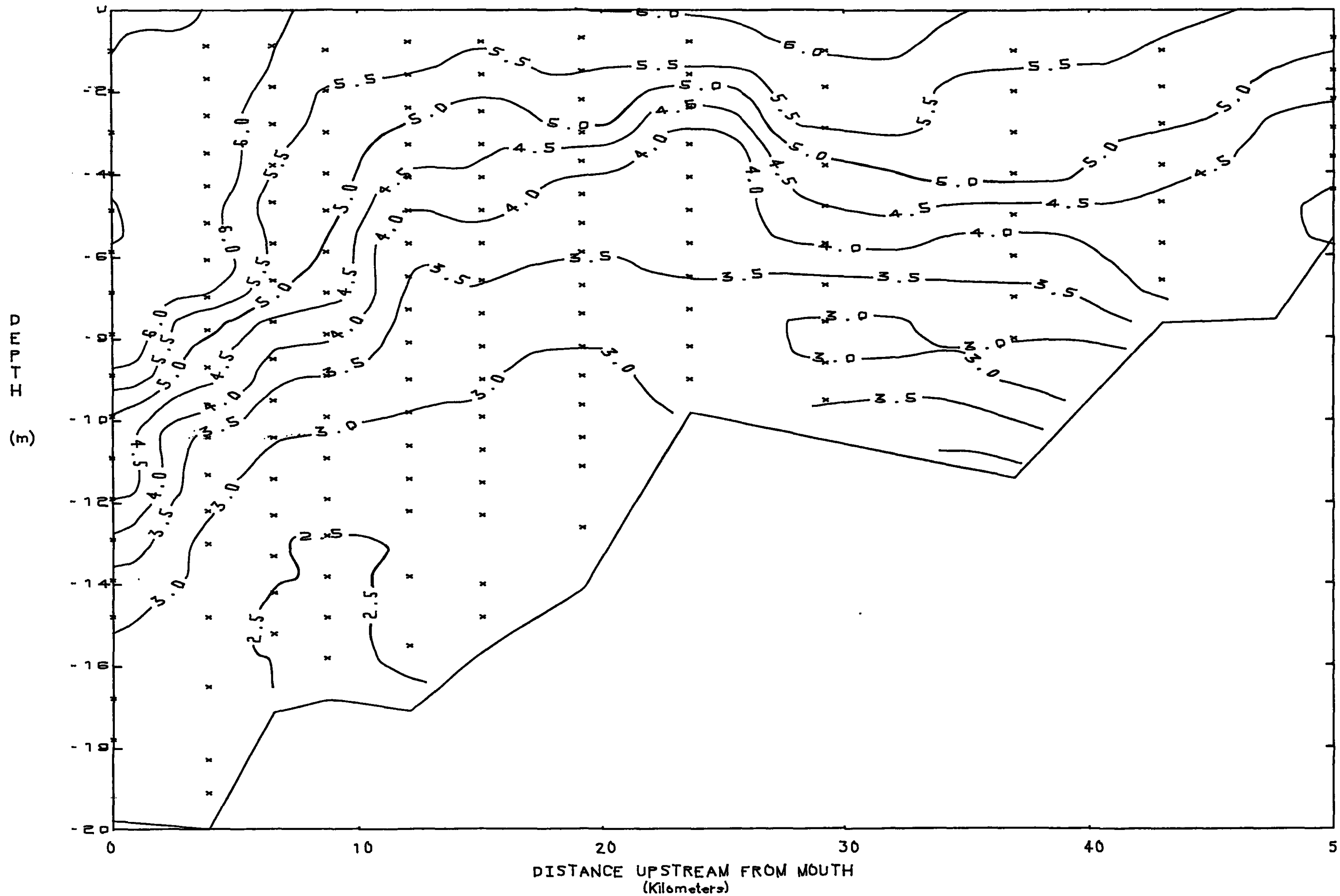
YORK RIVER — 29 JUNE 1988

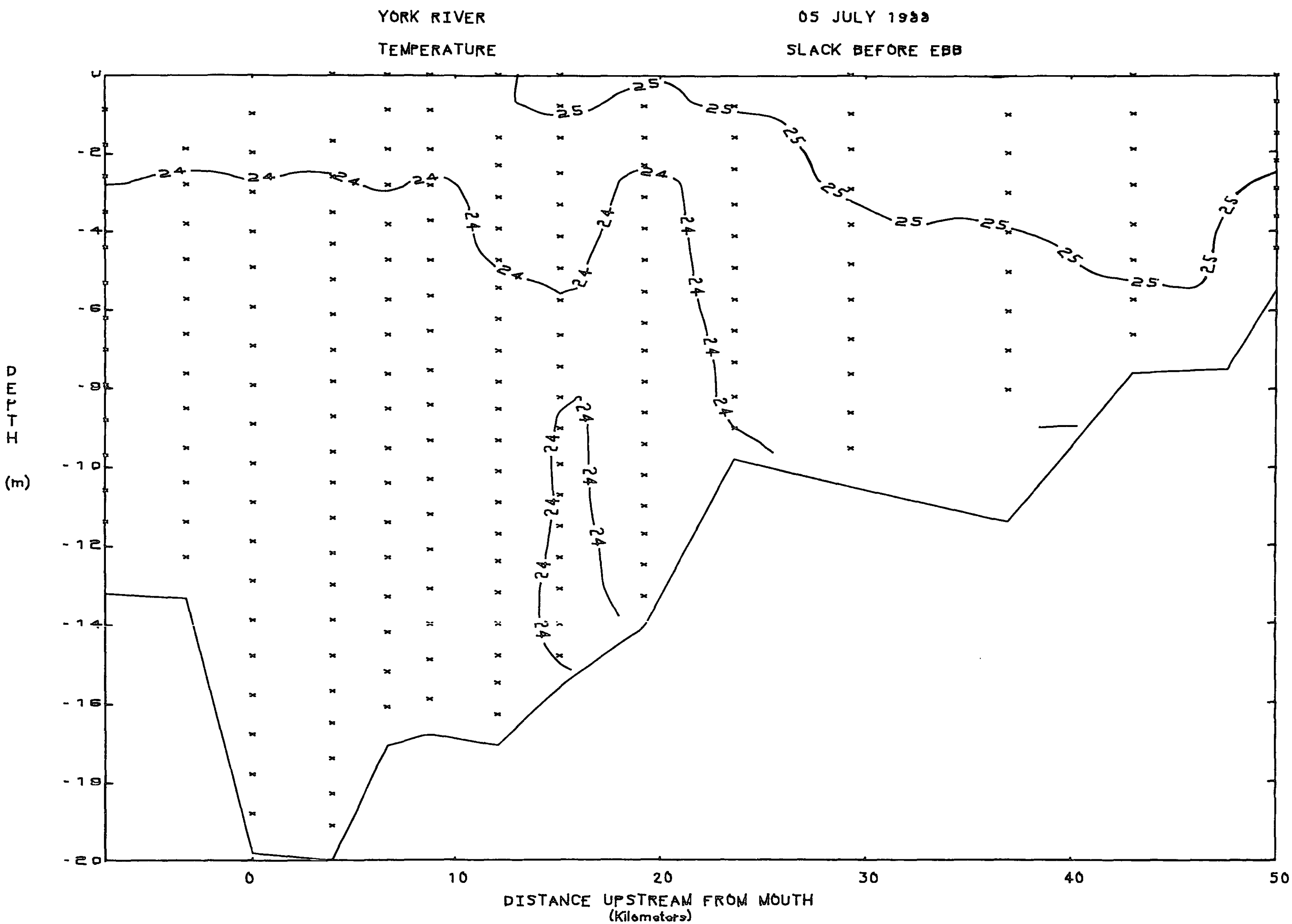
SALINITY — SLACK BEFORE EBB



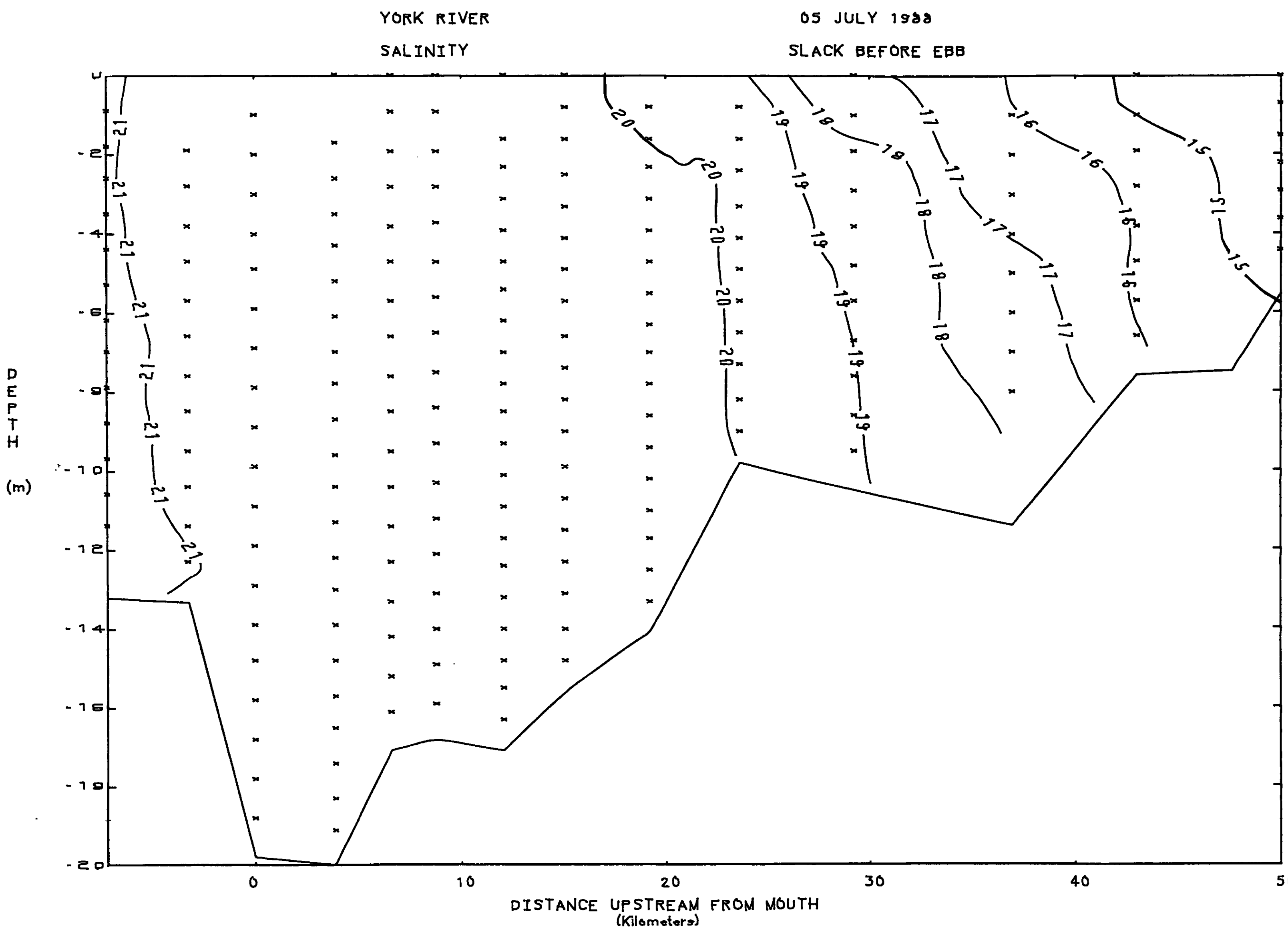
YORK RIVER — 29 JUNE 1988

DISSOLVED OXYGEN — SLACK BEFORE EBB



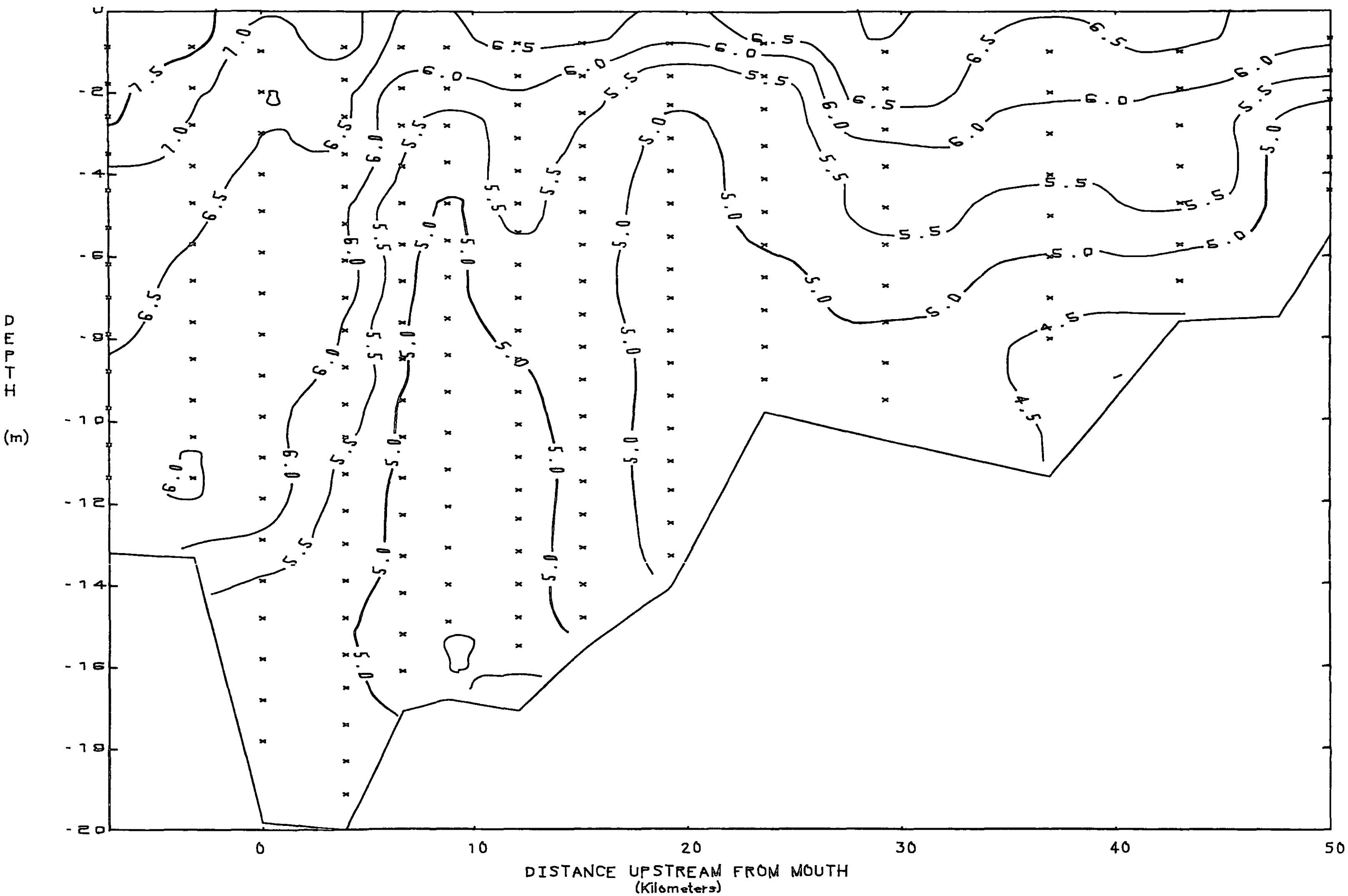


YORK RIVER
TEMPERATURE
05 JULY 1989
SLACK BEFORE EBB
DEPTH
(m)
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
25
24
0
10
20
30
40
50
DISTANCE UPSTREAM FROM MOUTH
(Kilometers)


YORK RIVER
05 JULY 1988
SALINITY
SLACK BEFORE EBB
DEPTH (m)
DISTANCE UPSTREAM FROM MOUTH
(Kilometers)

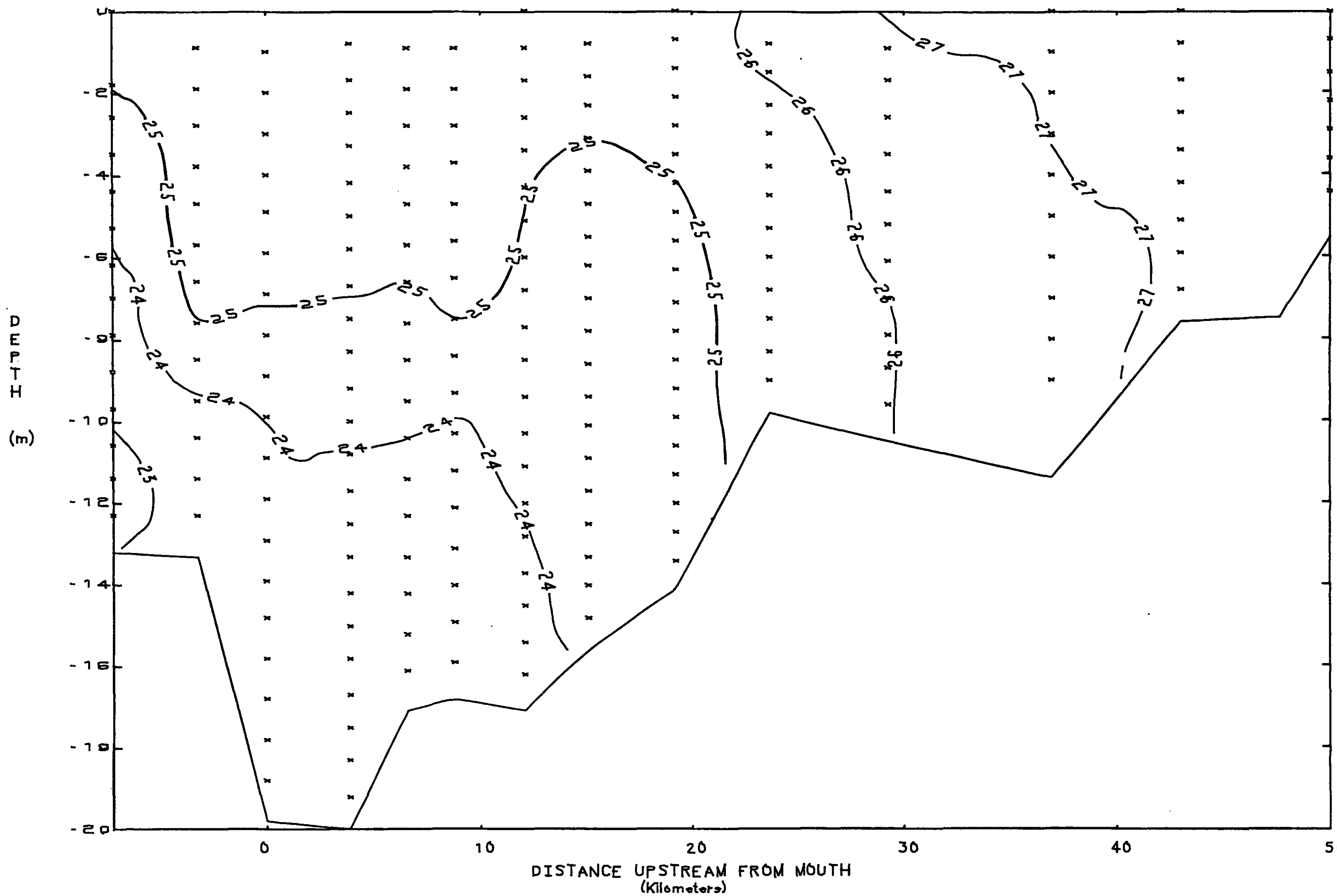
YORK RIVER 05 JULY 1988

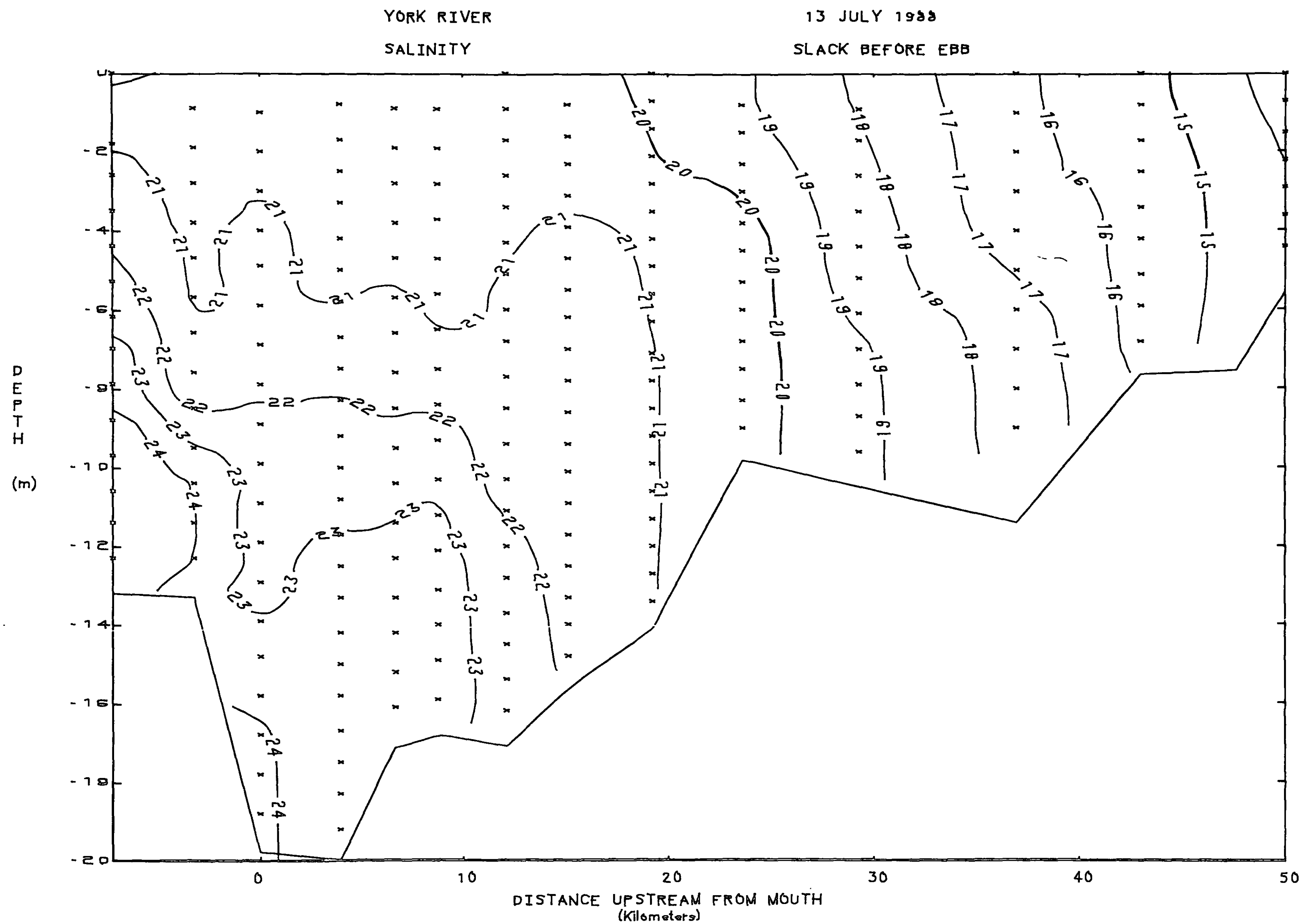
DISSOLVED OXYGEN SLACK BEFORE EBB

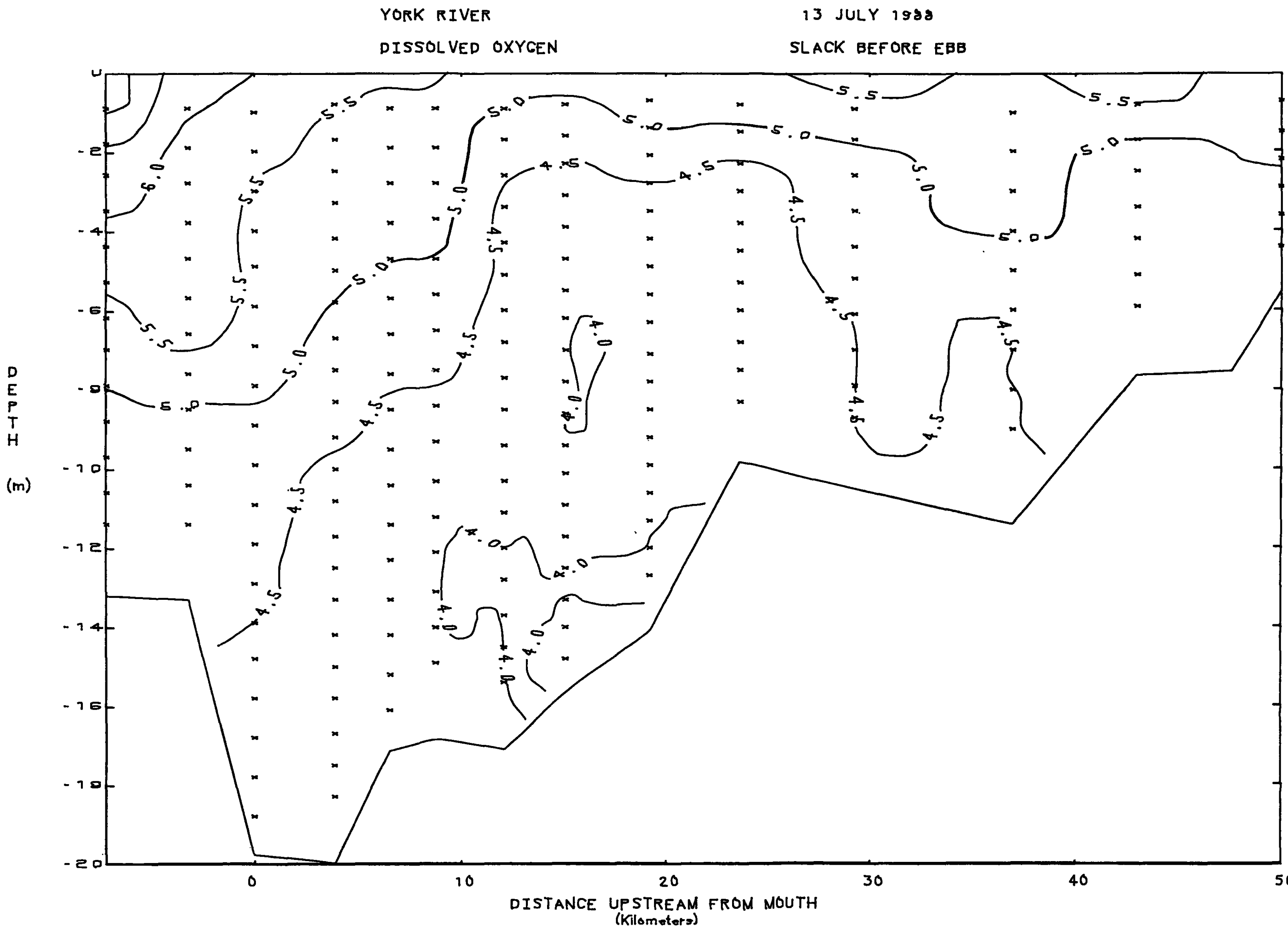


YORK RIVER 13 JULY 1988

TEMPERATURE SLACK BEFORE EBB



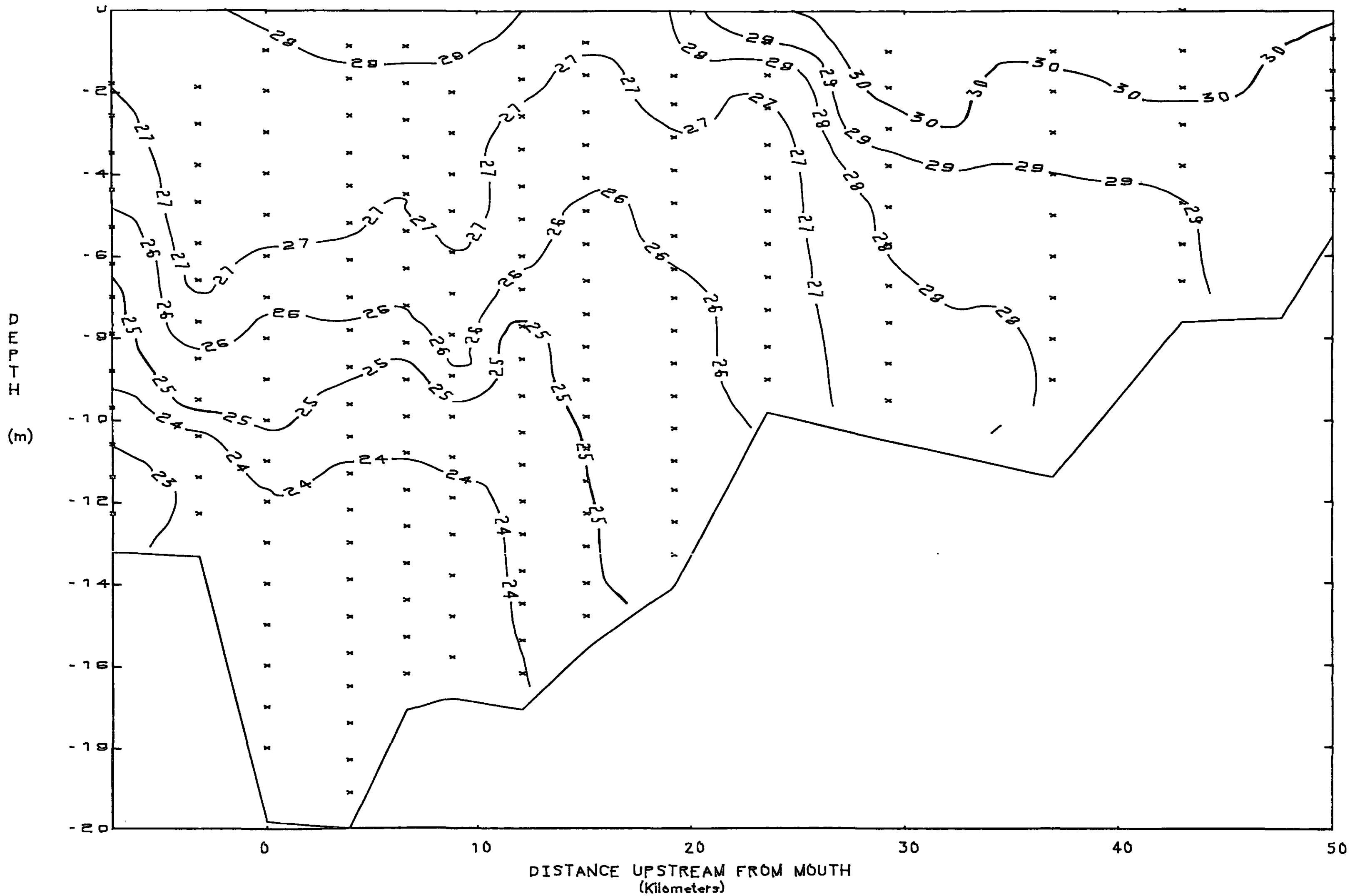

YORK RIVER
13 JULY 1988
SALINITY
SLACK BEFORE EBB
DEPTH
(m)
DISTANCE UPSTREAM FROM MOUTH
(Kilometers)
0
10
20
30
40
50
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20



YORK RIVER
13 JULY 1988
DISSOLVED OXYGEN
SLACK BEFORE EBB
DEPTH (m)
DISTANCE UPSTREAM FROM MOUTH
(Kilometers)
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
0
10
20
30
40
50
6.0
5.5
5.0
4.5
4.0

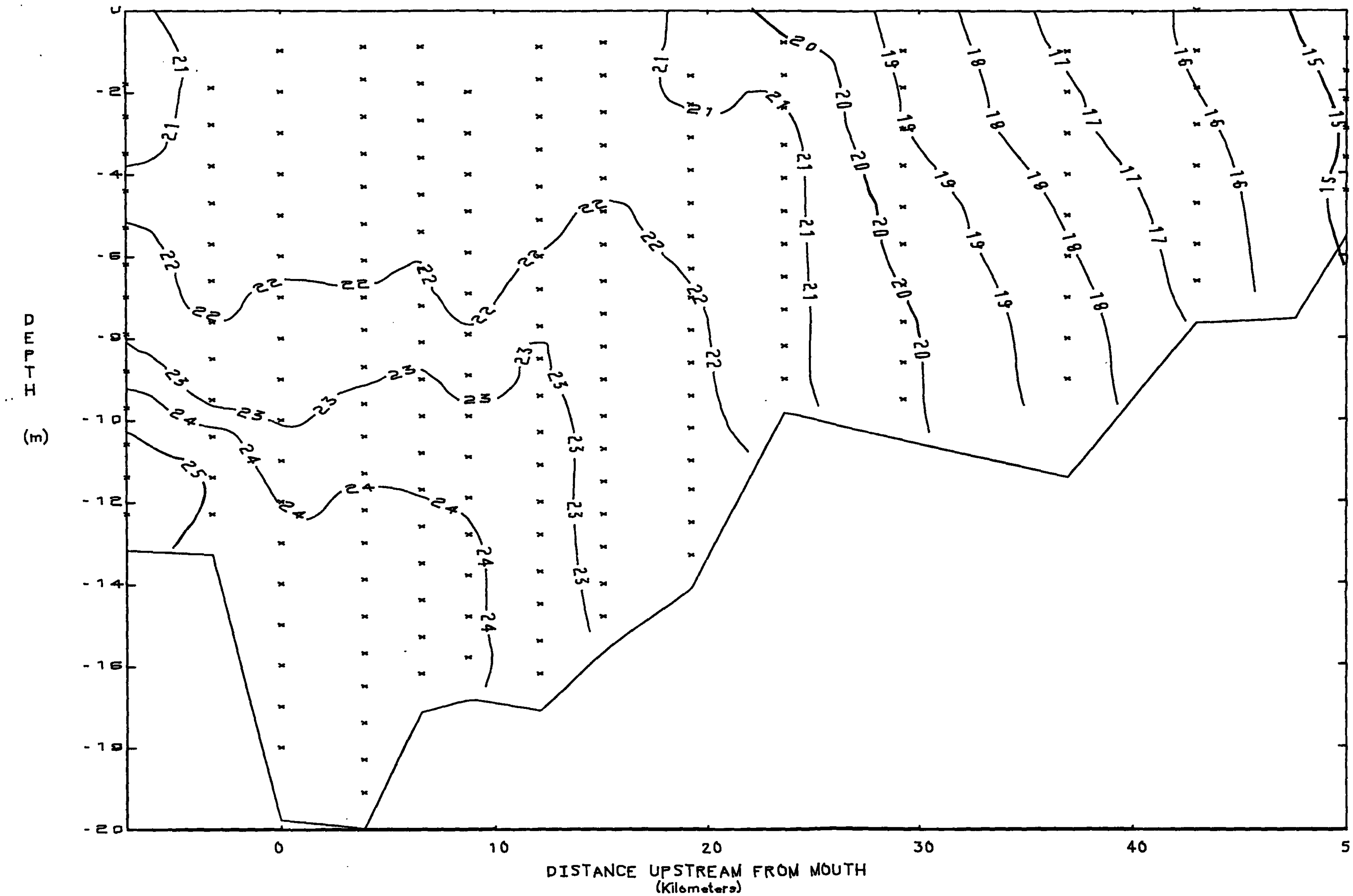
YORK RIVER 18 JULY 1988

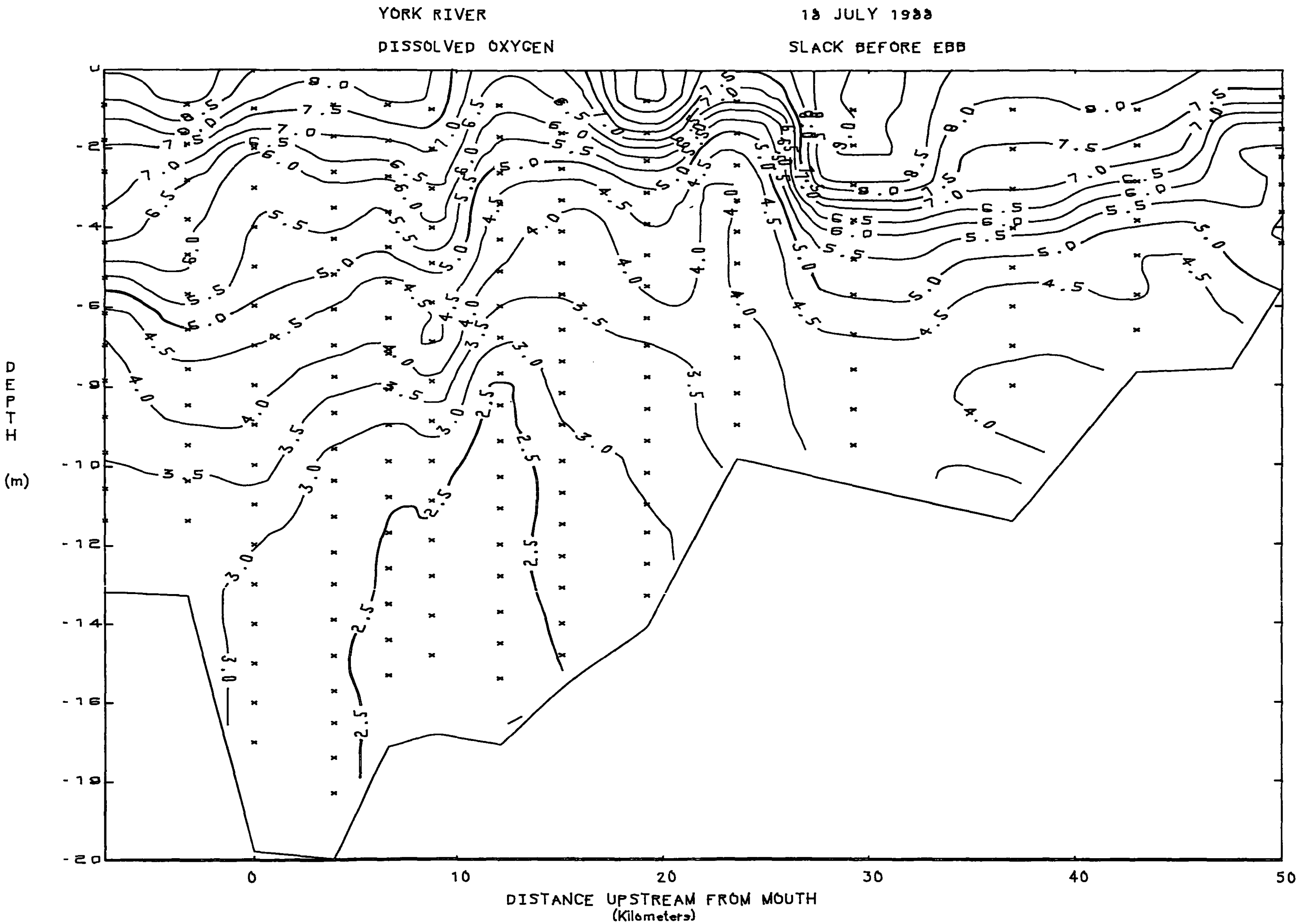
TEMPERATURE SLACK BEFORE EBB



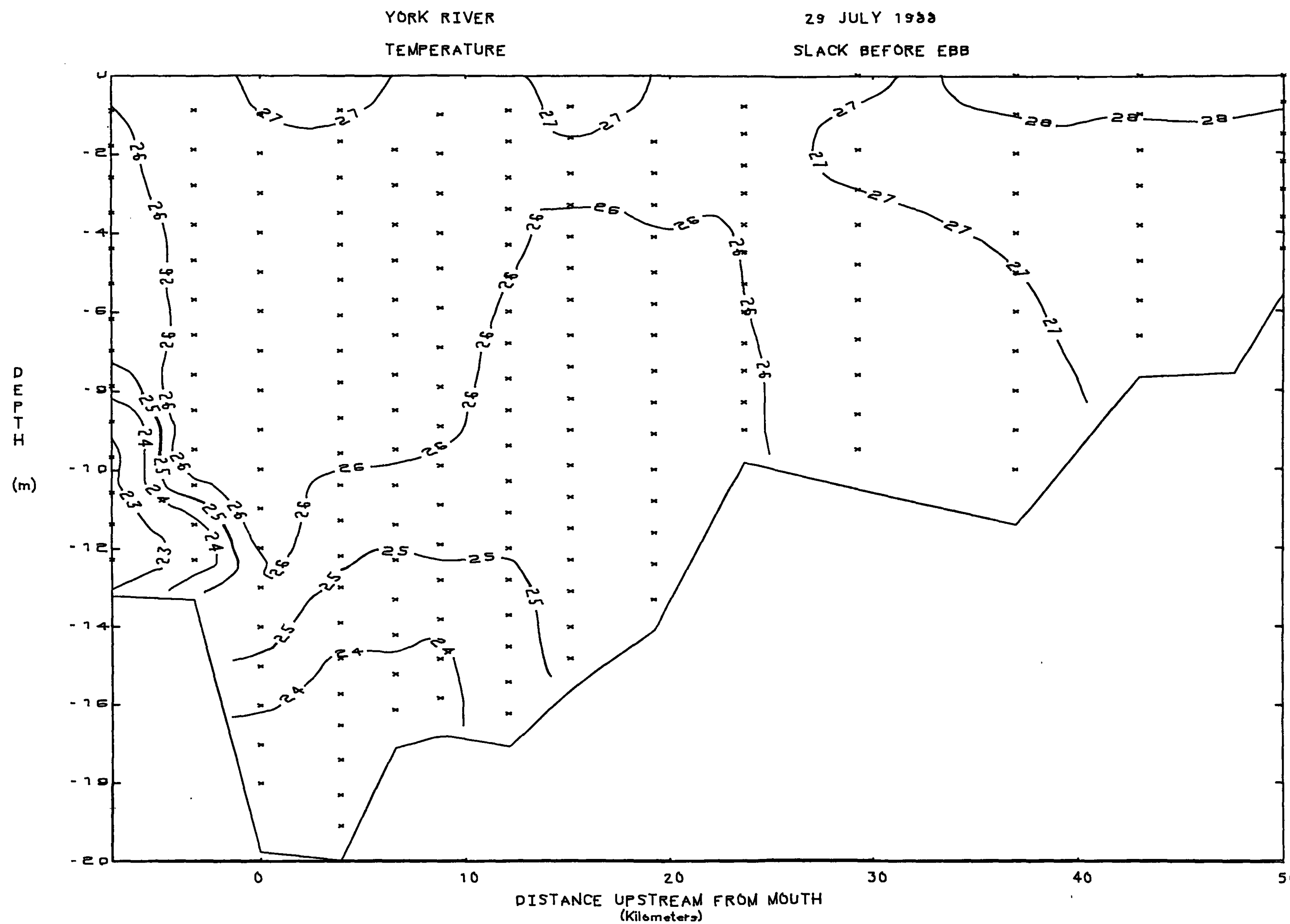
YORK RIVER 18 JULY 1988

SALINITY SLACK BEFORE EBB



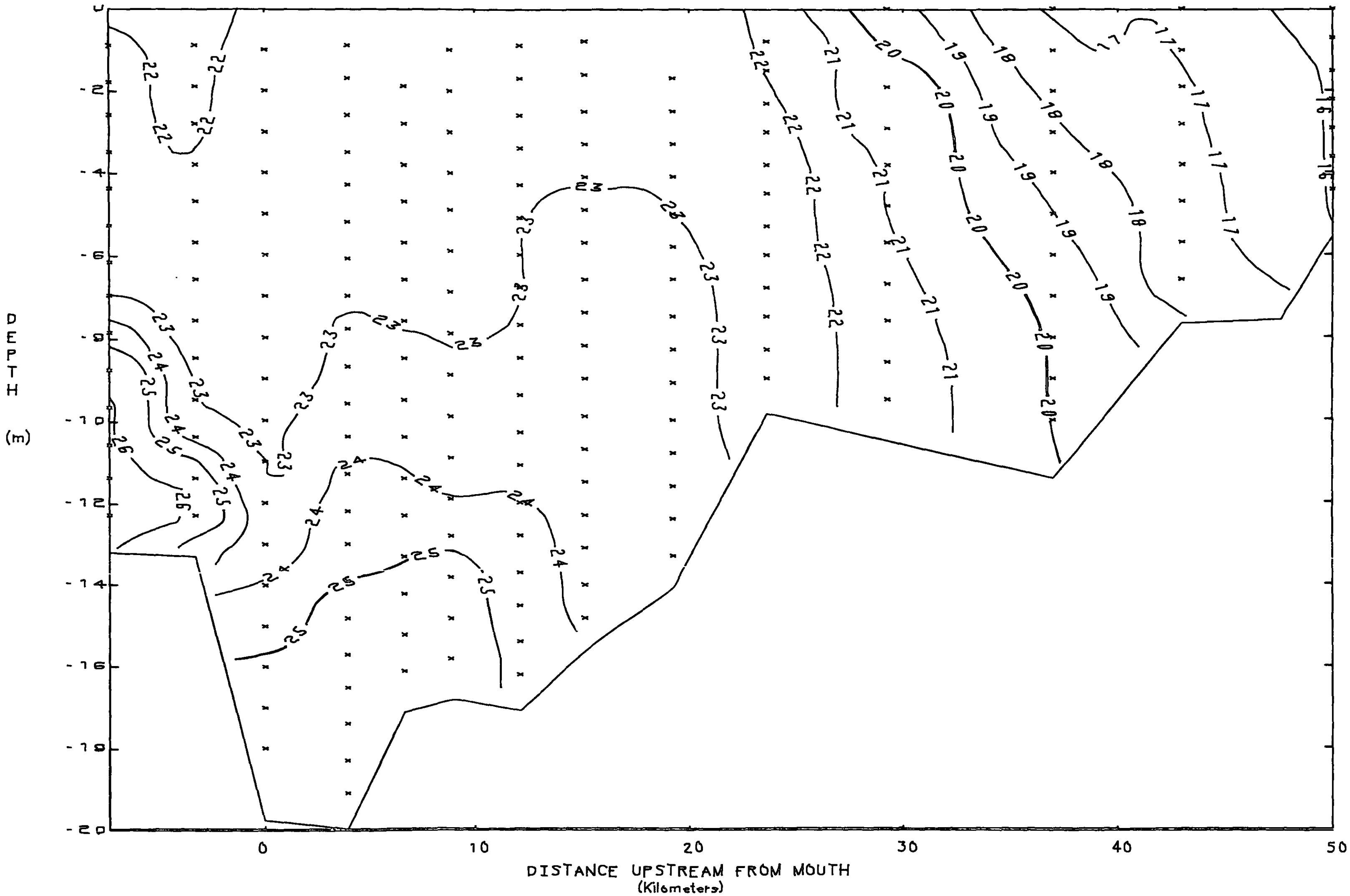


YORK RIVER
18 JULY 1988
DISSOLVED OXYGEN
SLACK BEFORE EBB
DEPTH
(m)
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
0
10
20
30
40
50
DISTANCE UPSTREAM FROM MOUTH
(Kilometers)


YORK RIVER
TEMPERATURE
29 JULY 1988
SLACK BEFORE EBB
DEPTH
(m)
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
0
10
20
30
40
50
DISTANCE UPSTREAM FROM MOUTH
(Kilometers)
23
24
25
26
27
28

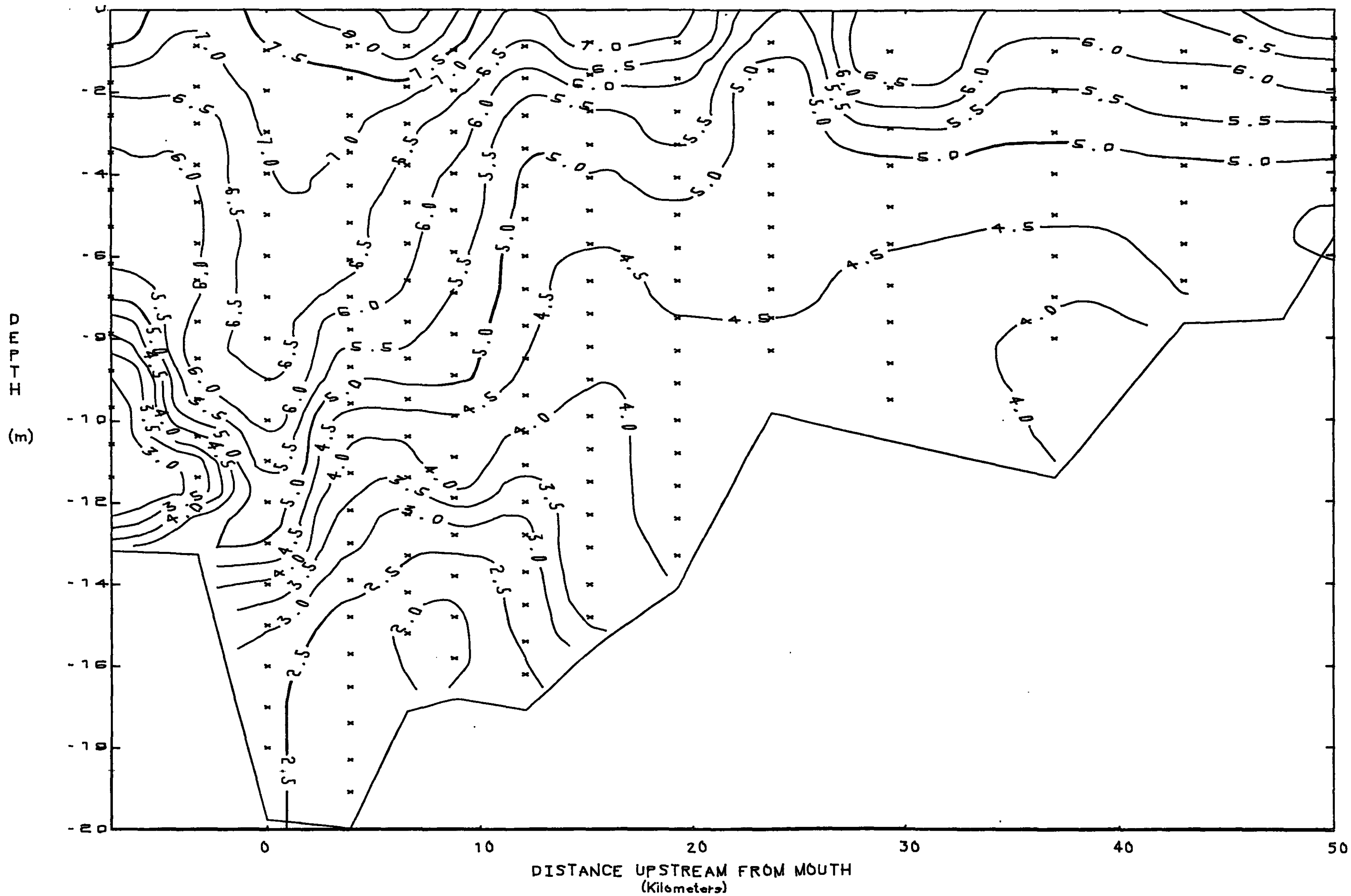
YORK RIVER   29 JULY 1988

SALINITY   SLACK BEFORE EBB



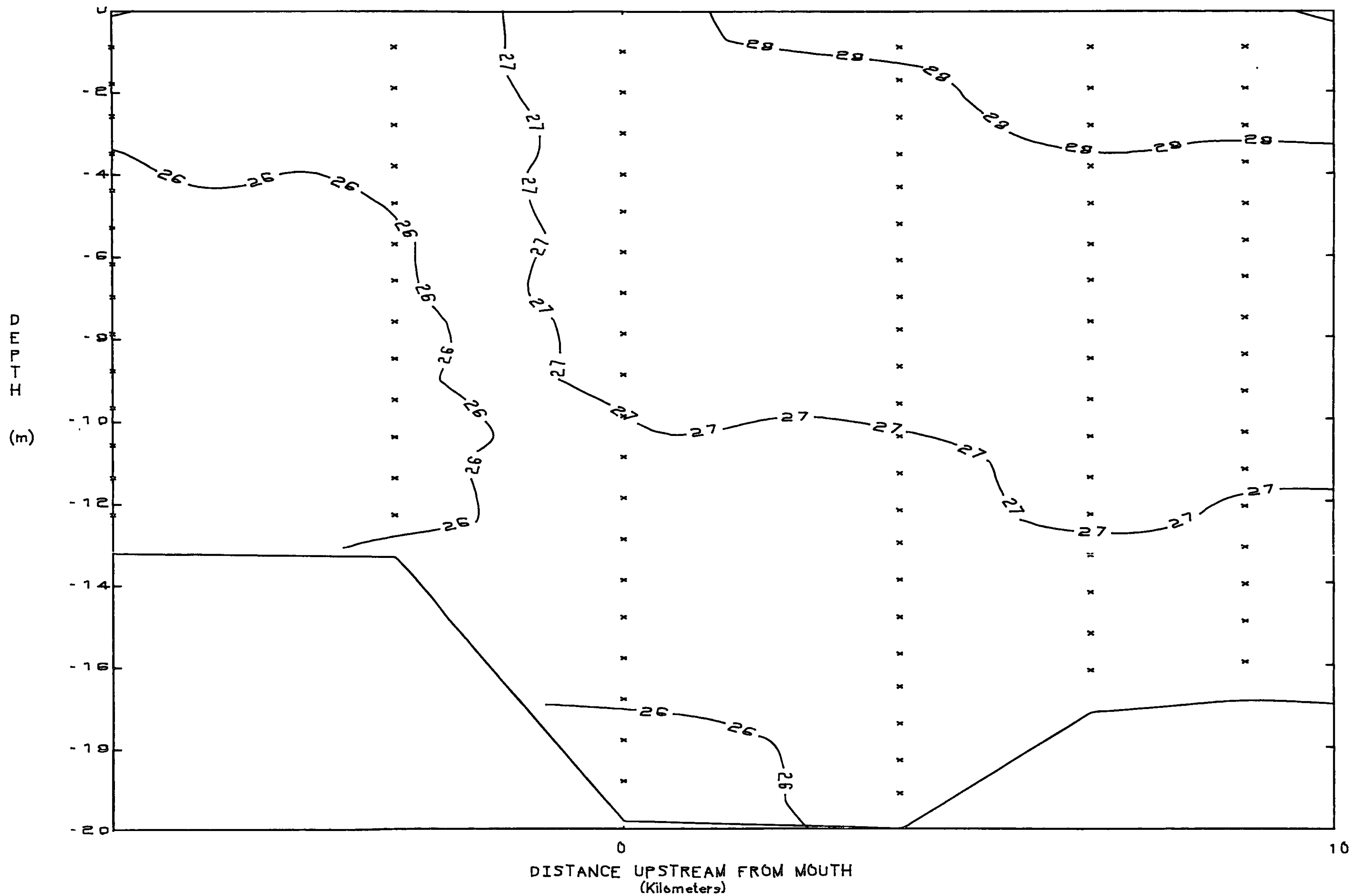
YORK RIVER 29 JULY 1988

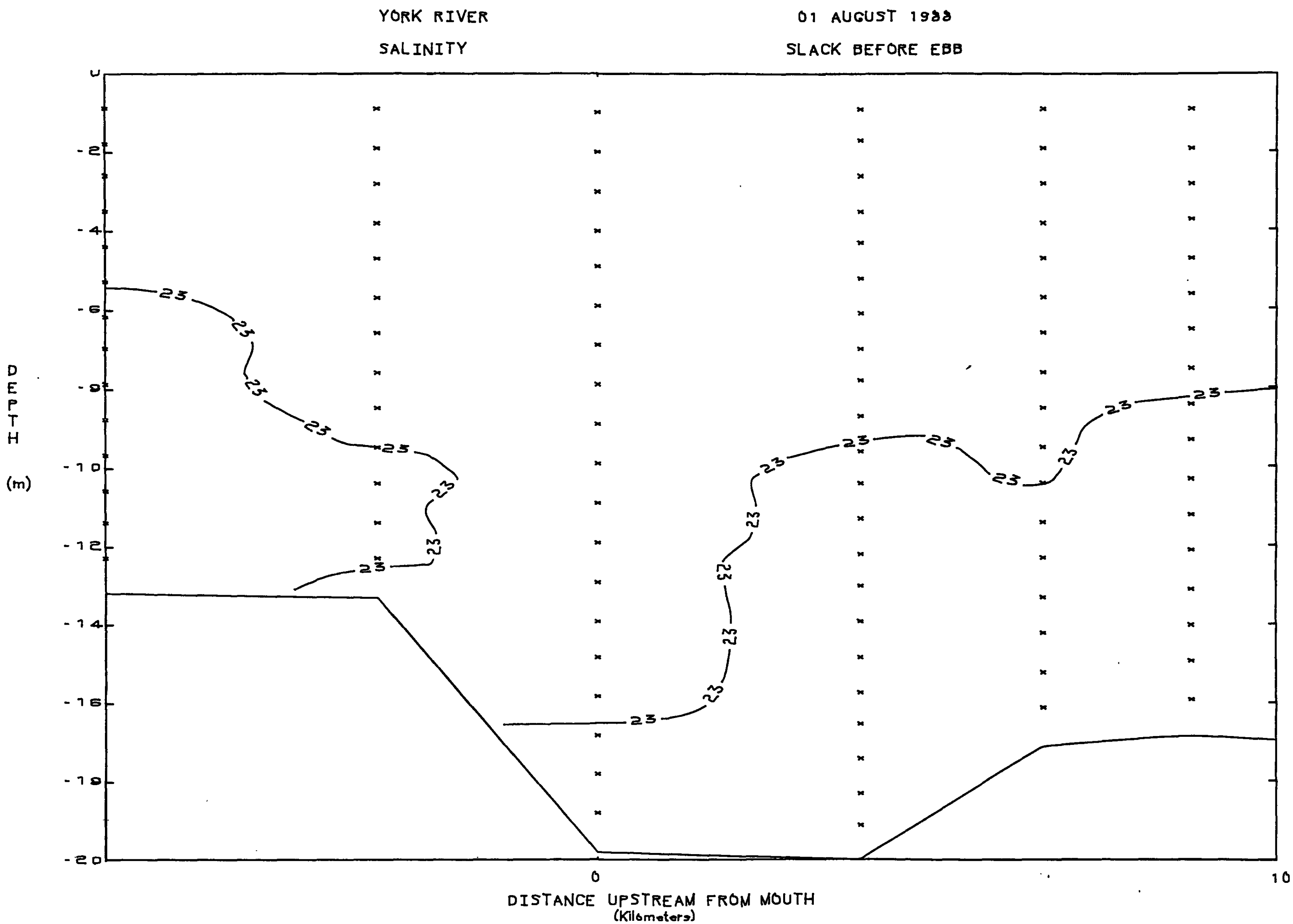
DISSOLVED OXYGEN SLACK BEFORE EBB



YORK RIVER — 01 AUGUST 1988

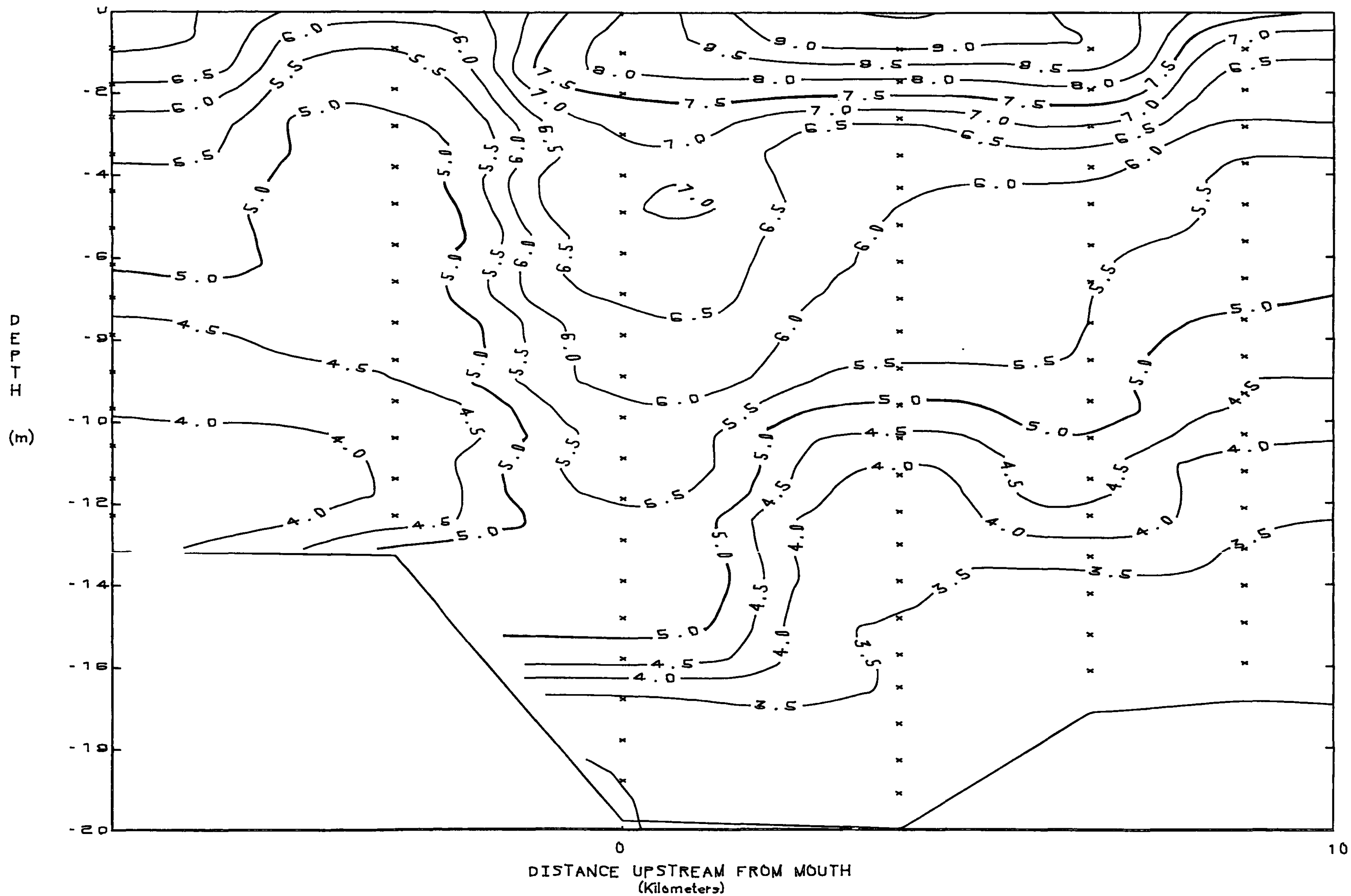
TEMPERATURE — SLACK BEFORE EBB




YORK RIVER
SALINITY
01 AUGUST 1988
SLACK BEFORE EBB
DEPTH
(m)
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
23
0
10
DISTANCE UPSTREAM FROM MOUTH
(Kilometers)

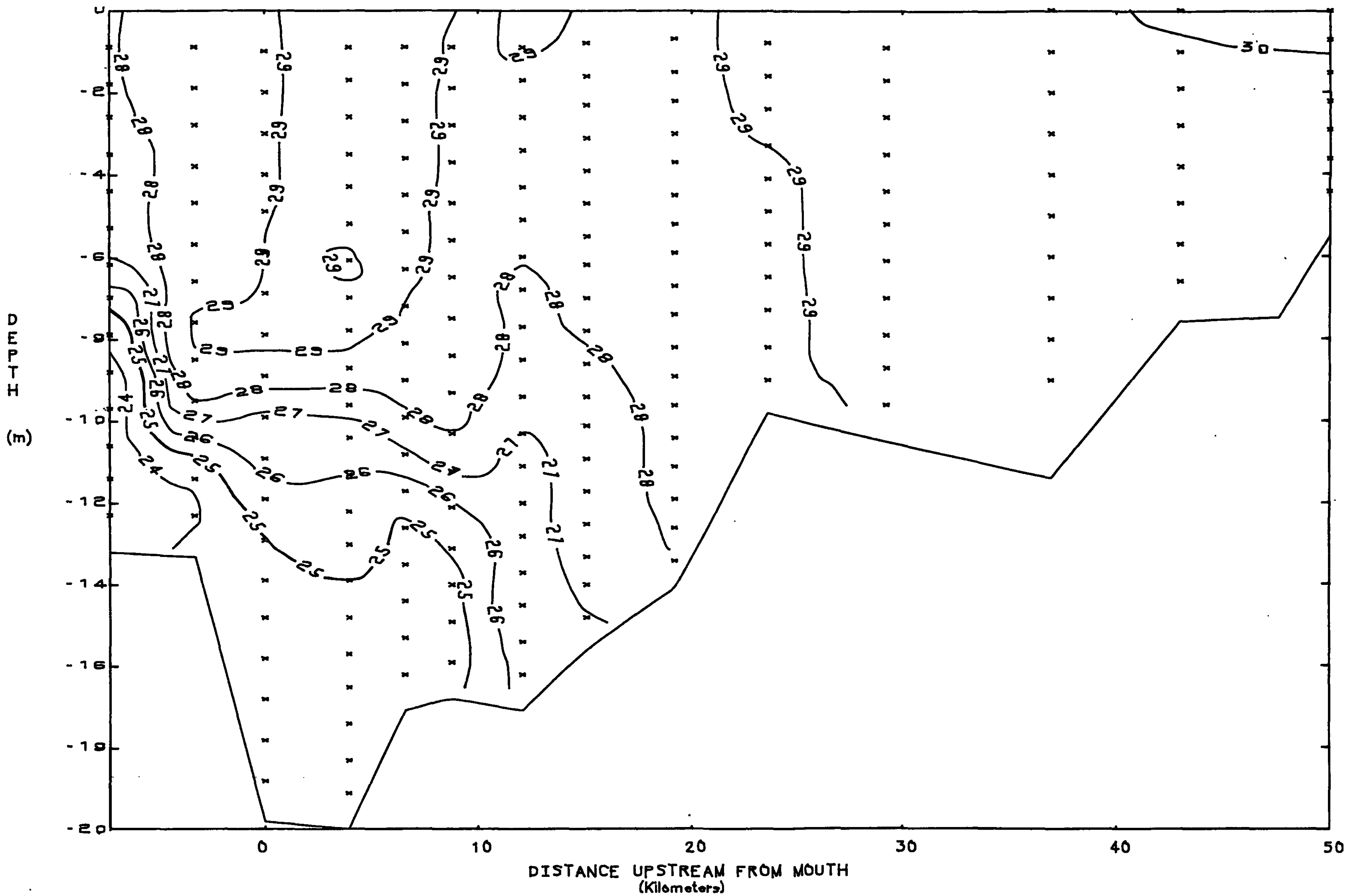
YORK RIVER 01 AUGUST 1988

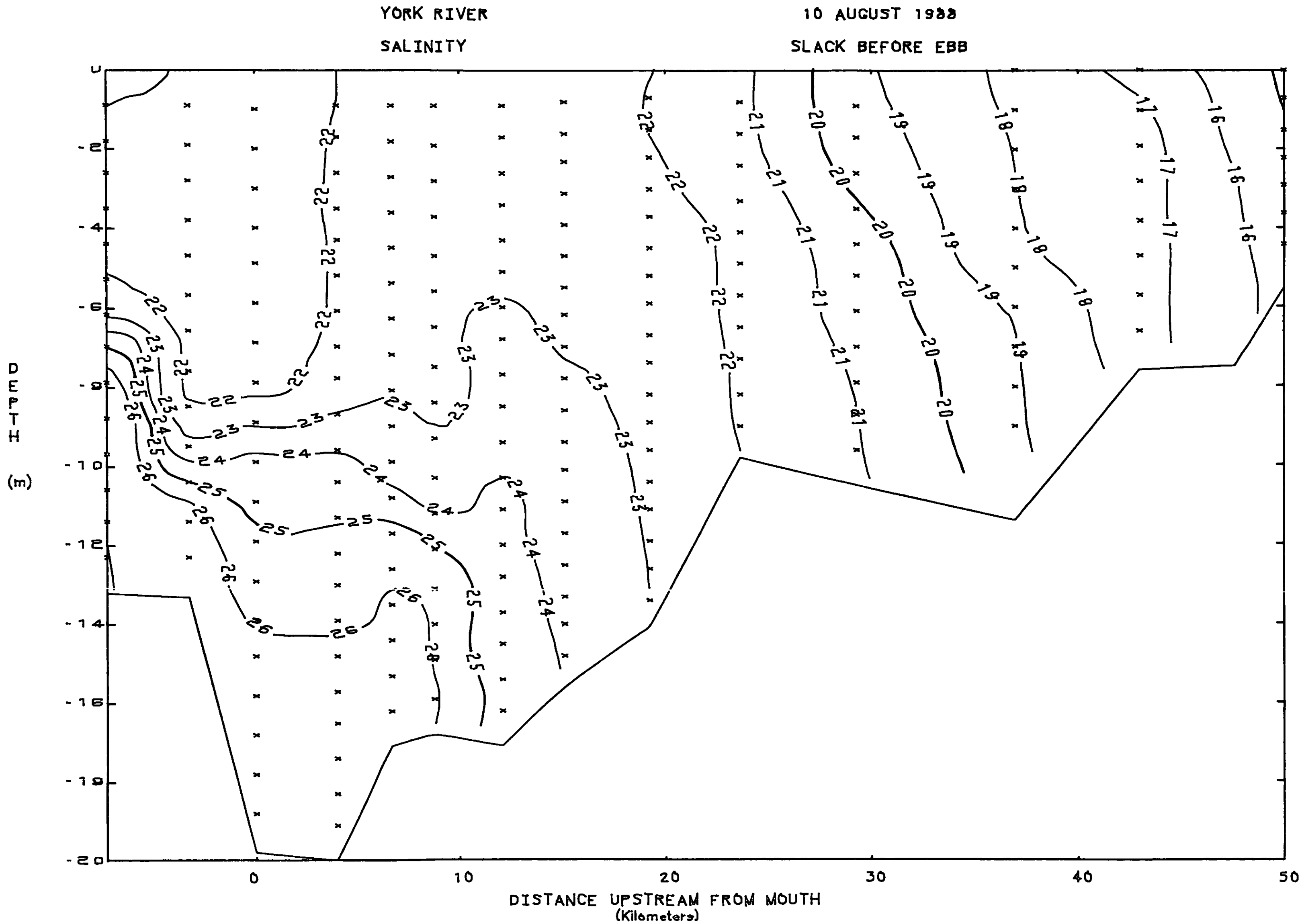
DISSOLVED OXYGEN SLACK BEFORE EBB



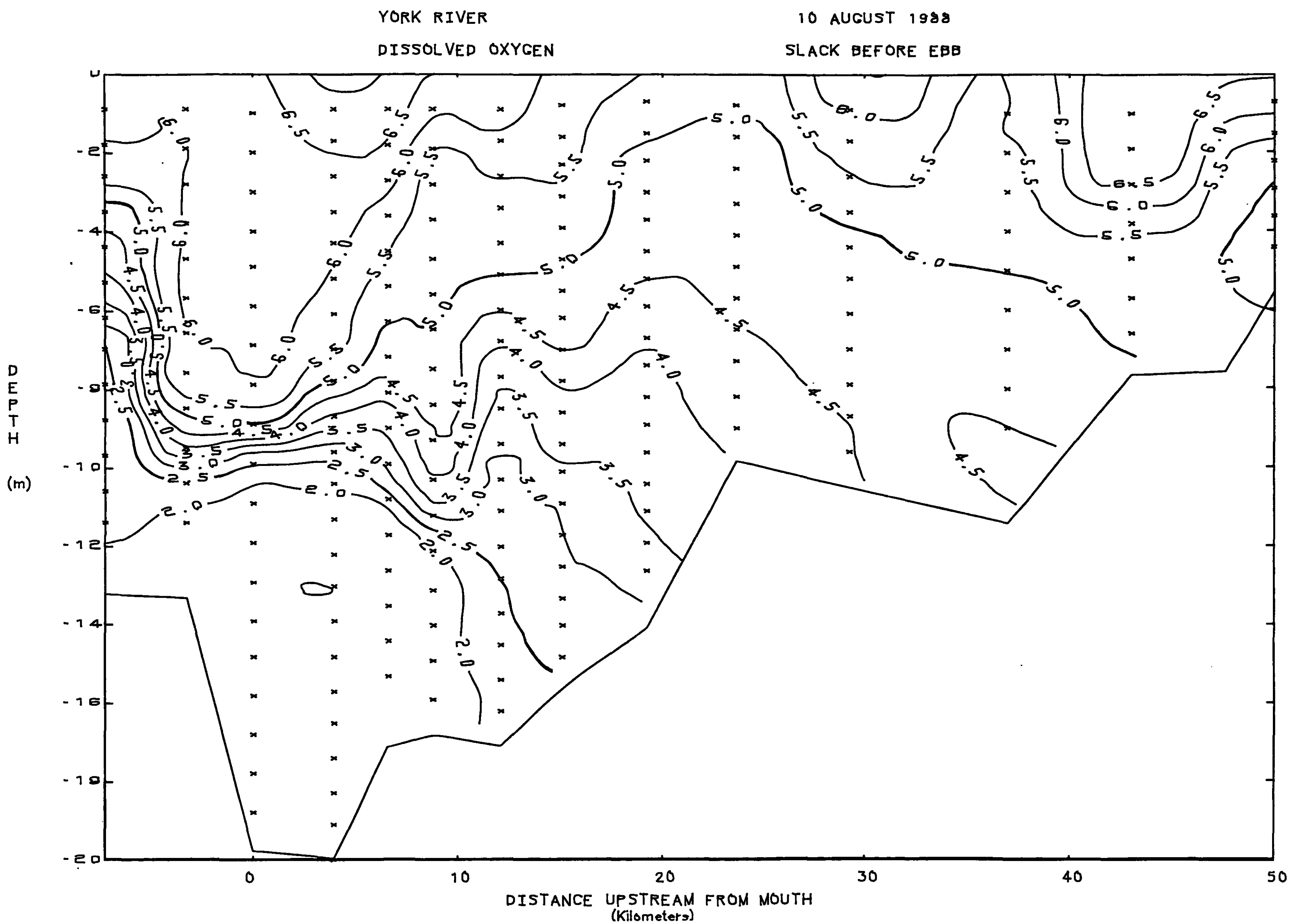
YORK RIVER — 10 AUGUST 1988

TEMPERATURE — SLACK BEFORE EBB

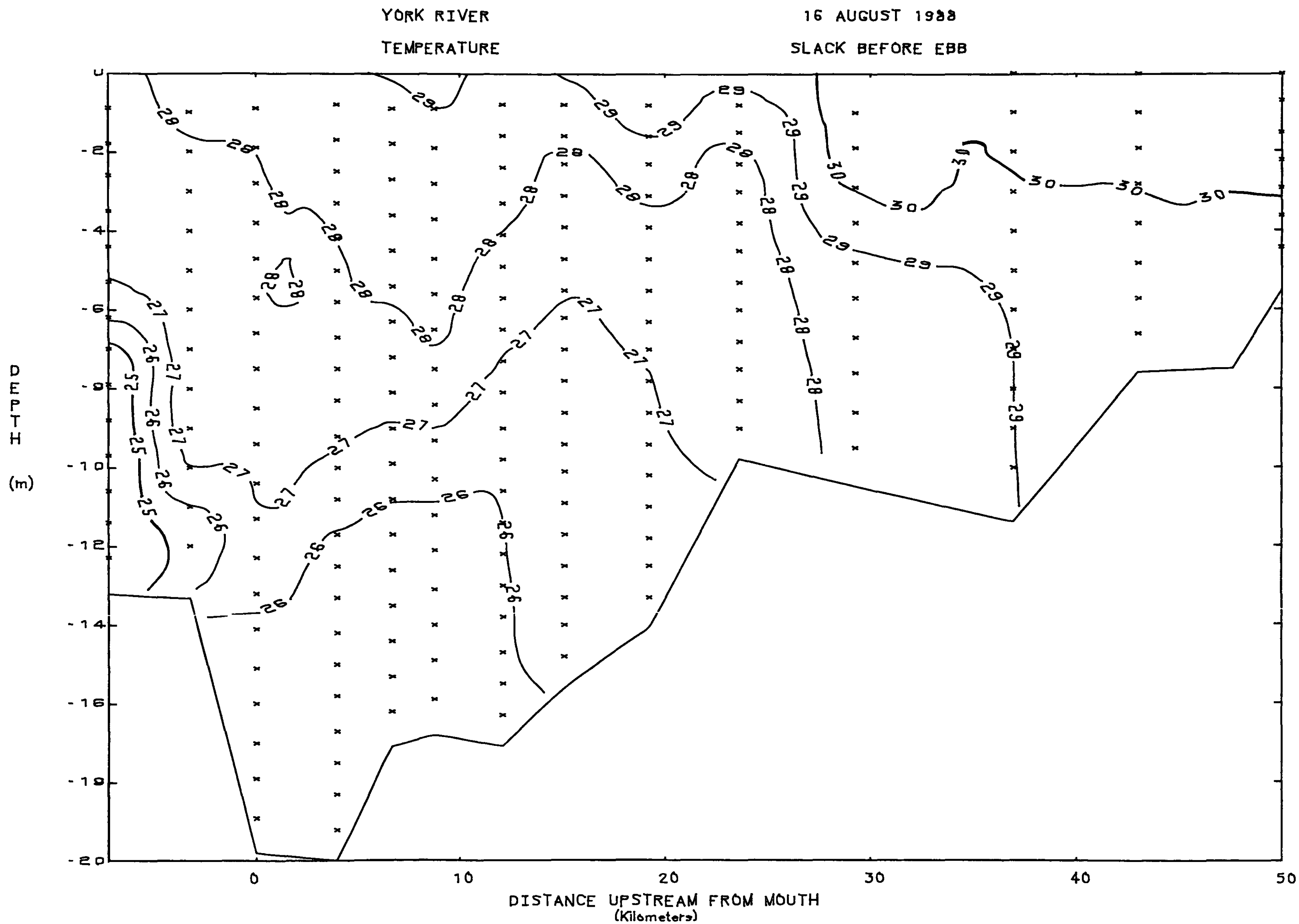




YORK RIVER
SALINITY
10 AUGUST 1988
SLACK BEFORE EBB
DEPTH (m)
DISTANCE UPSTREAM FROM MOUTH (Kilometers)

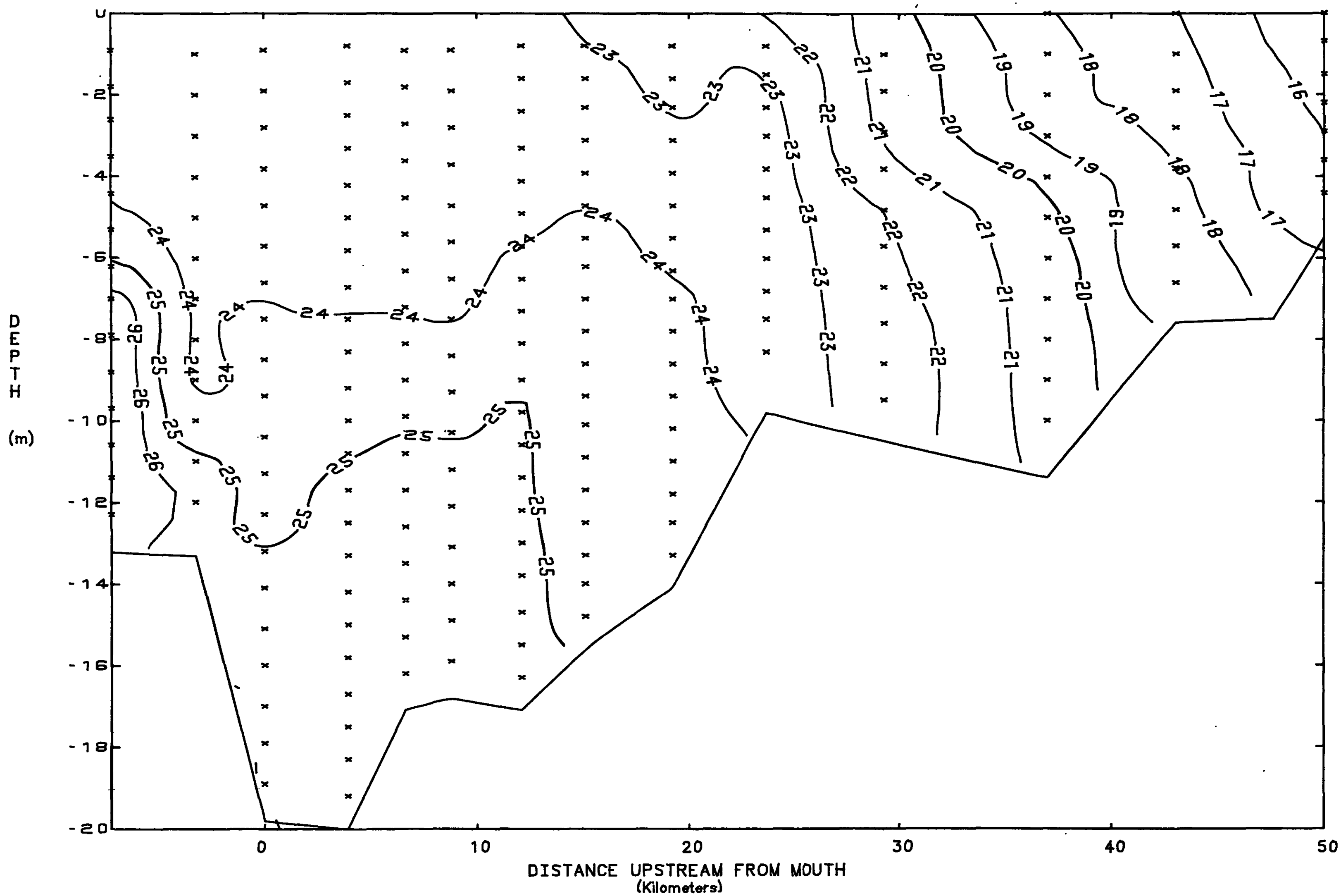


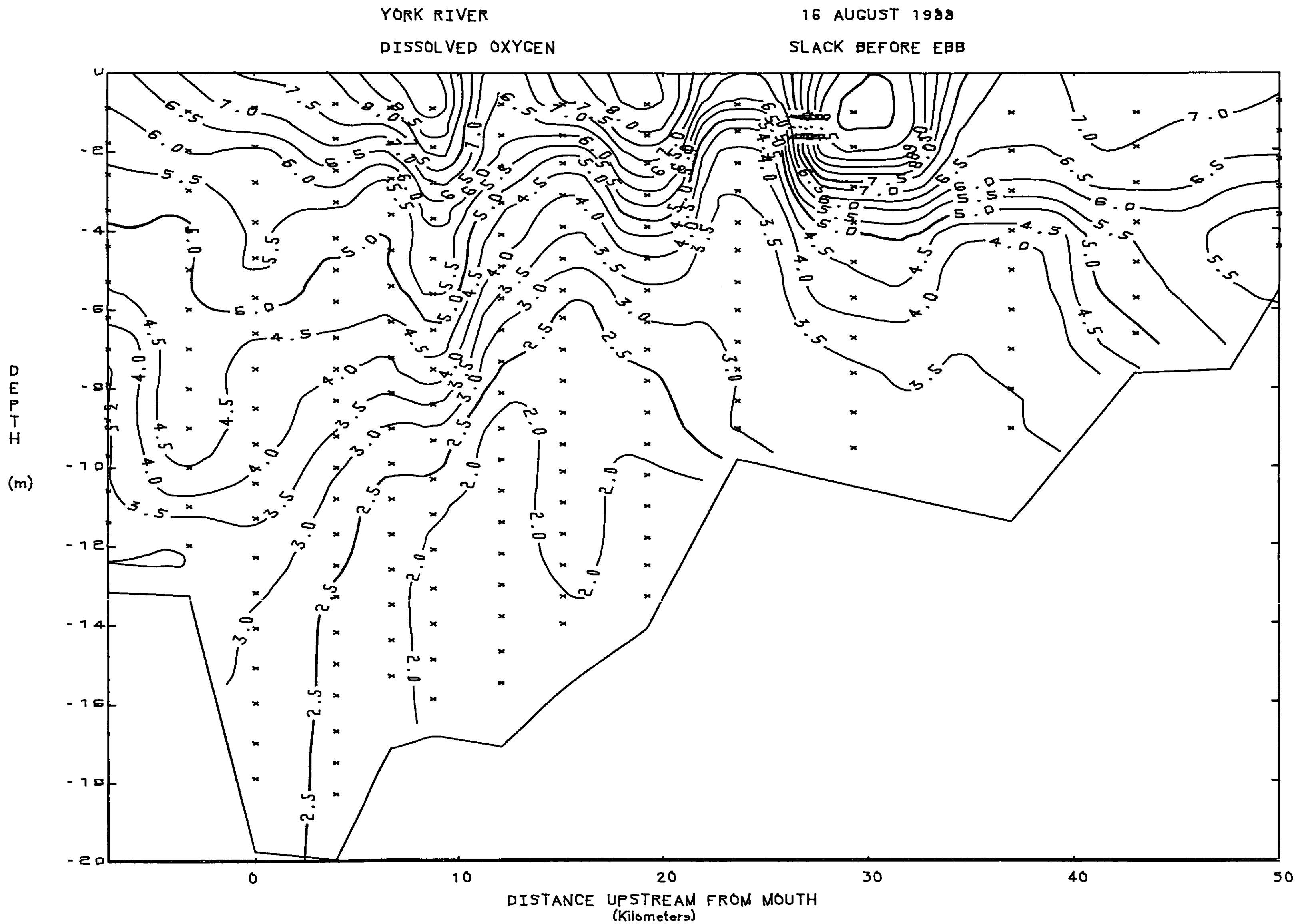
YORK RIVER
DISSOLVED OXYGEN
10 AUGUST 1988
SLACK BEFORE EBB
DEPTH
(m)
DISTANCE UPSTREAM FROM MOUTH
(Kilometers)

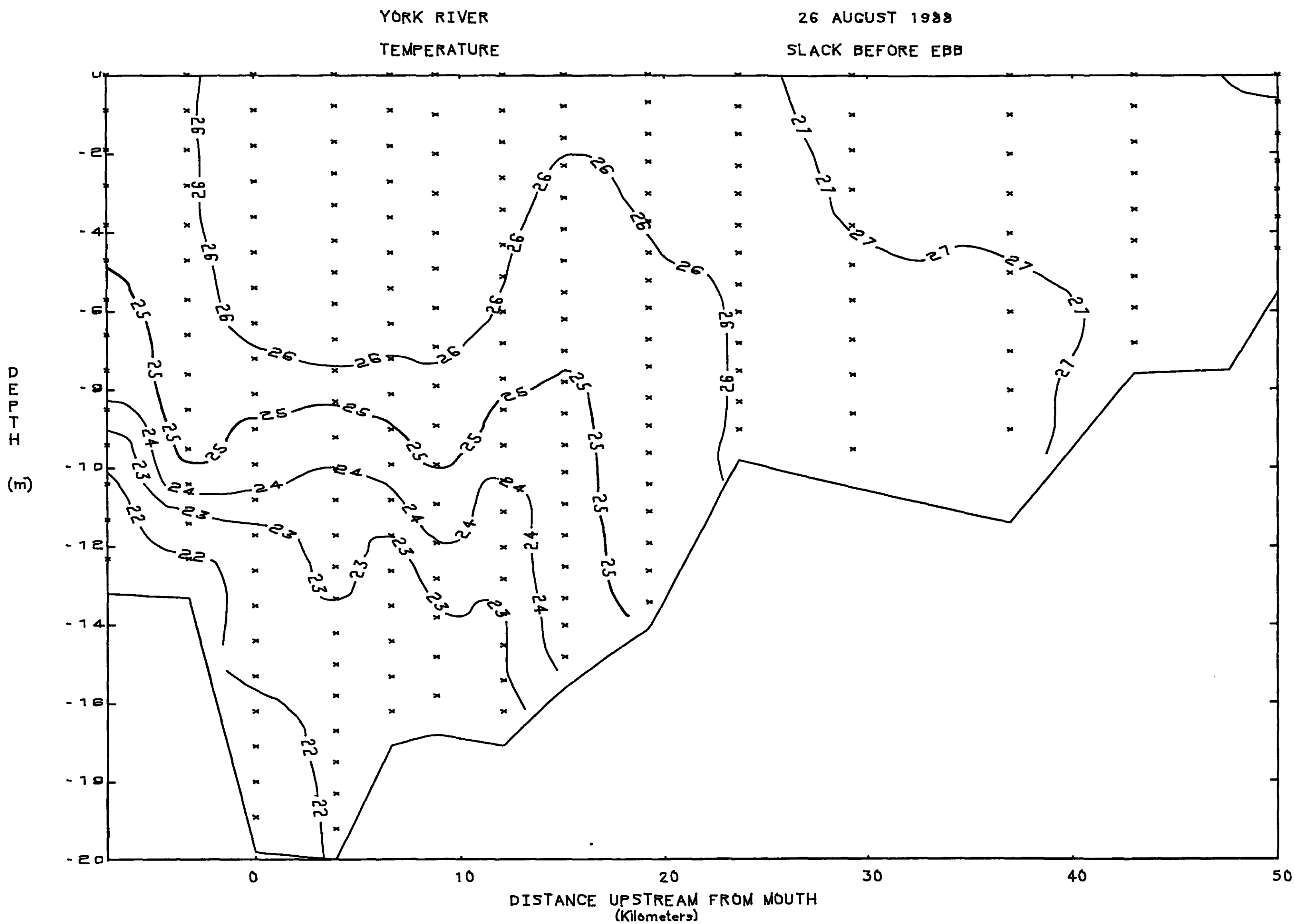

YORK RIVER
16 AUGUST 1988
TEMPERATURE
SLACK BEFORE EBB
DEPTH
(m)
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
0
10
20
30
40
50
DISTANCE UPSTREAM FROM MOUTH
(Kilometers)
25
26
27
28
29
30

YORK RIVER 16 AUGUST 1988

SALINITY SLACK BEFORE EBB

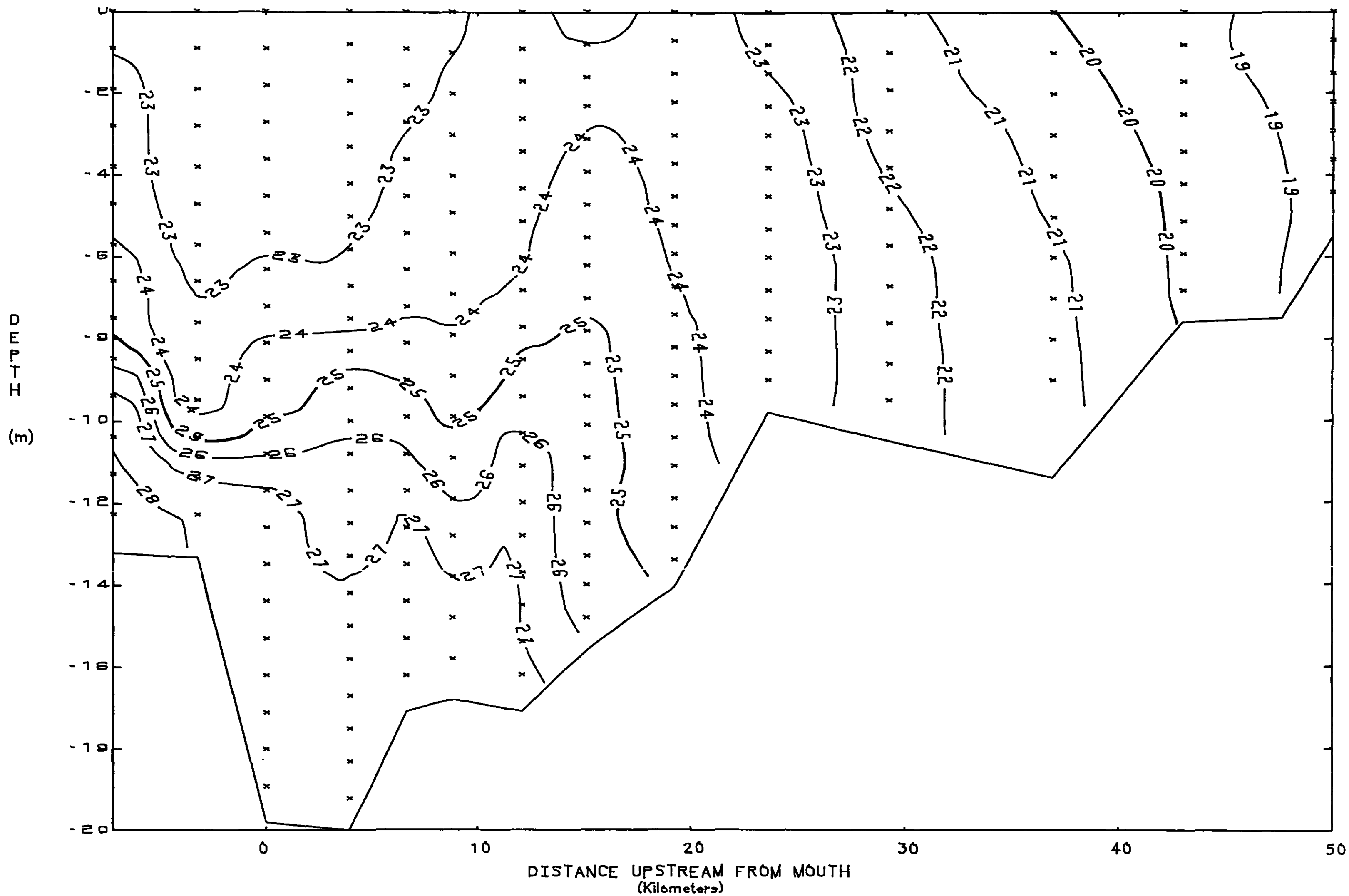



YORK RIVER
16 AUGUST 1988
DISSOLVED OXYGEN
SLACK BEFORE EBB
DEPTH (m)
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
0
10
20
30
40
50
DISTANCE UPSTREAM FROM MOUTH
(Kilometers)


YORK RIVER
TEMPERATURE
26 AUGUST 1988
SLACK BEFORE EBB
DEPTH
(m)
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
0
10
20
30
40
50
DISTANCE UPSTREAM FROM MOUTH
(Kilometers)
22
23
24
25
26
27

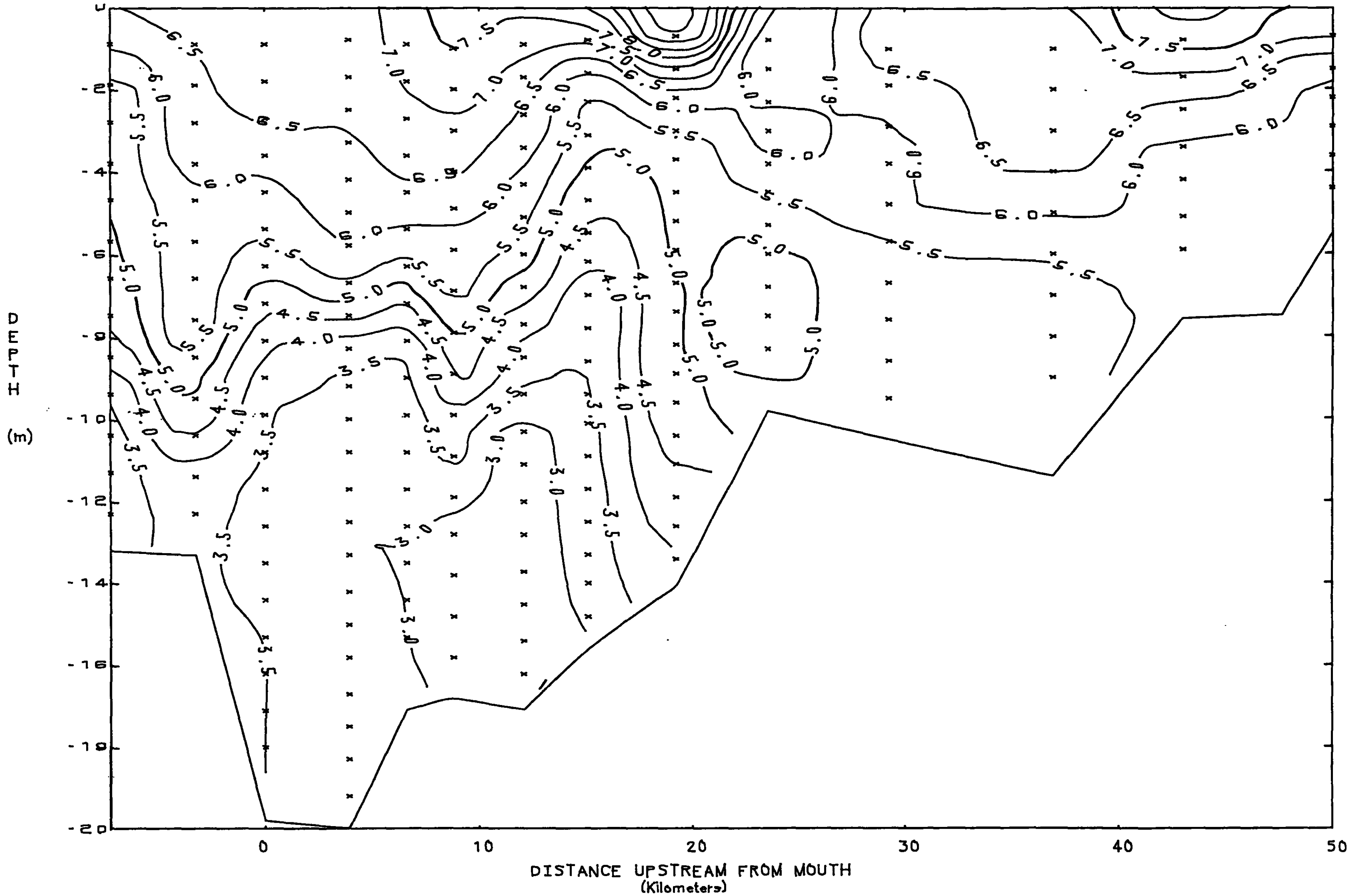
YORK RIVER 26 AUGUST 1988

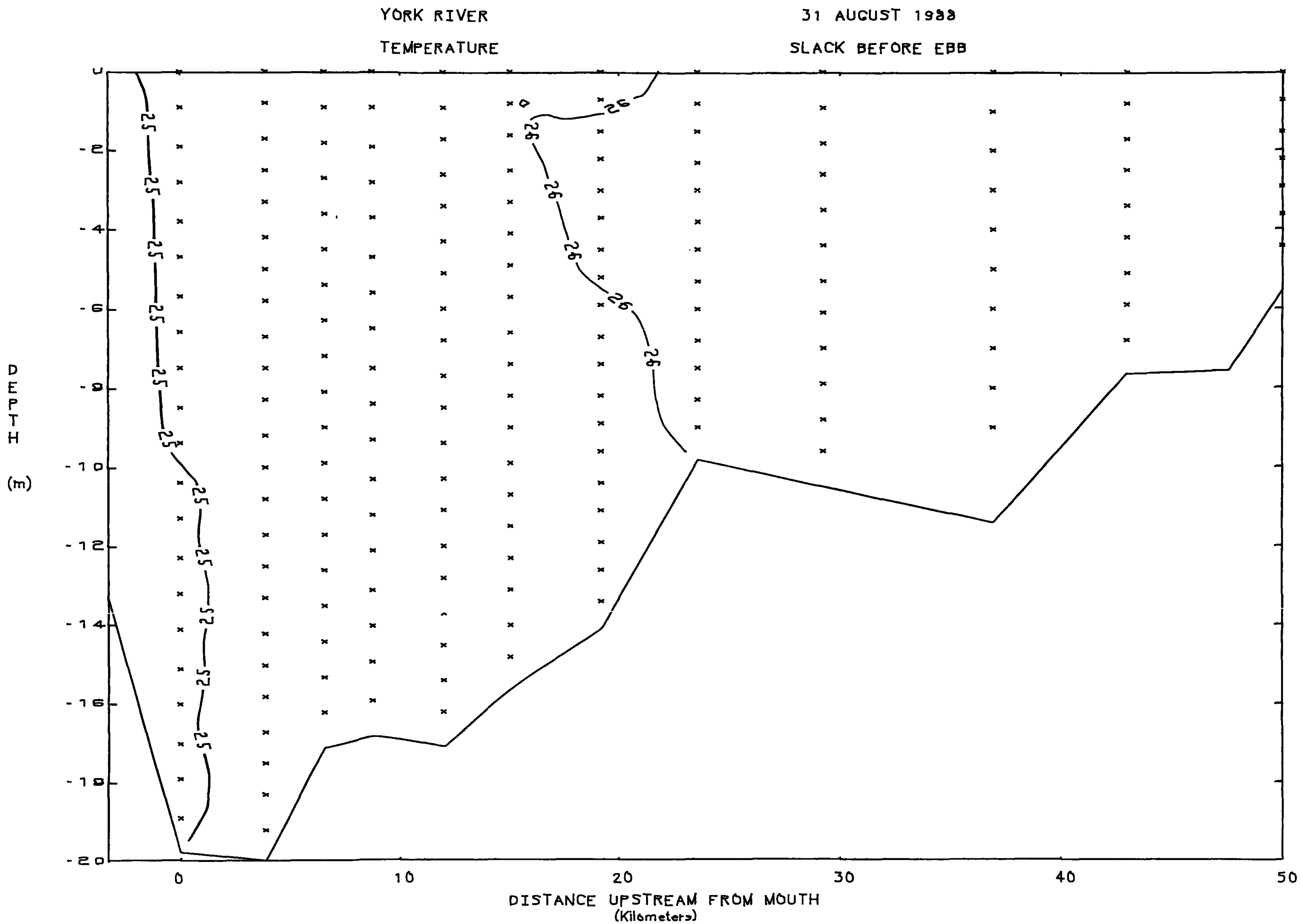
SALINITY SLACK BEFORE EBB



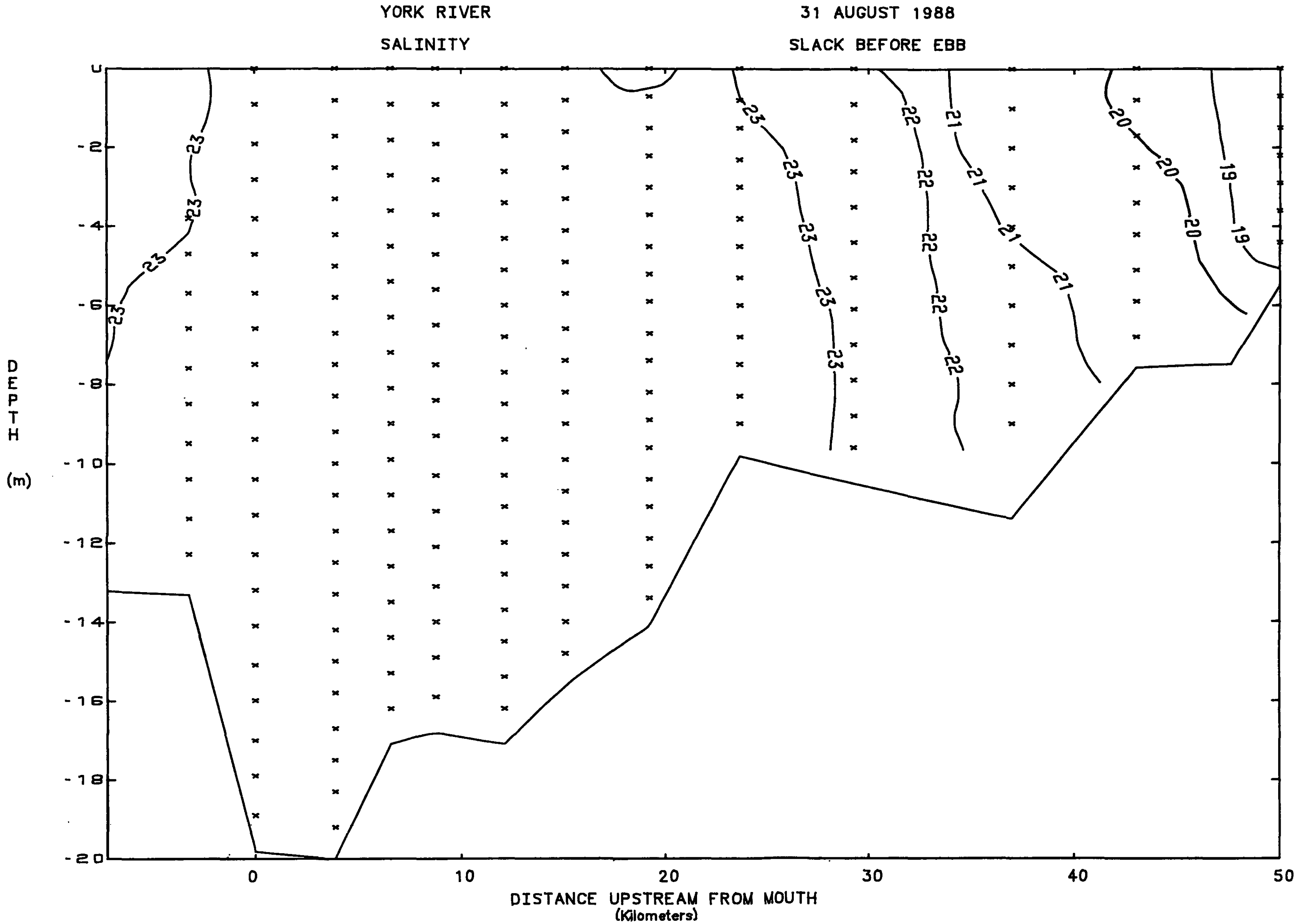
YORK RIVER — 26 AUGUST 1988

DISSOLVED OXYGEN — SLACK BEFORE EBB





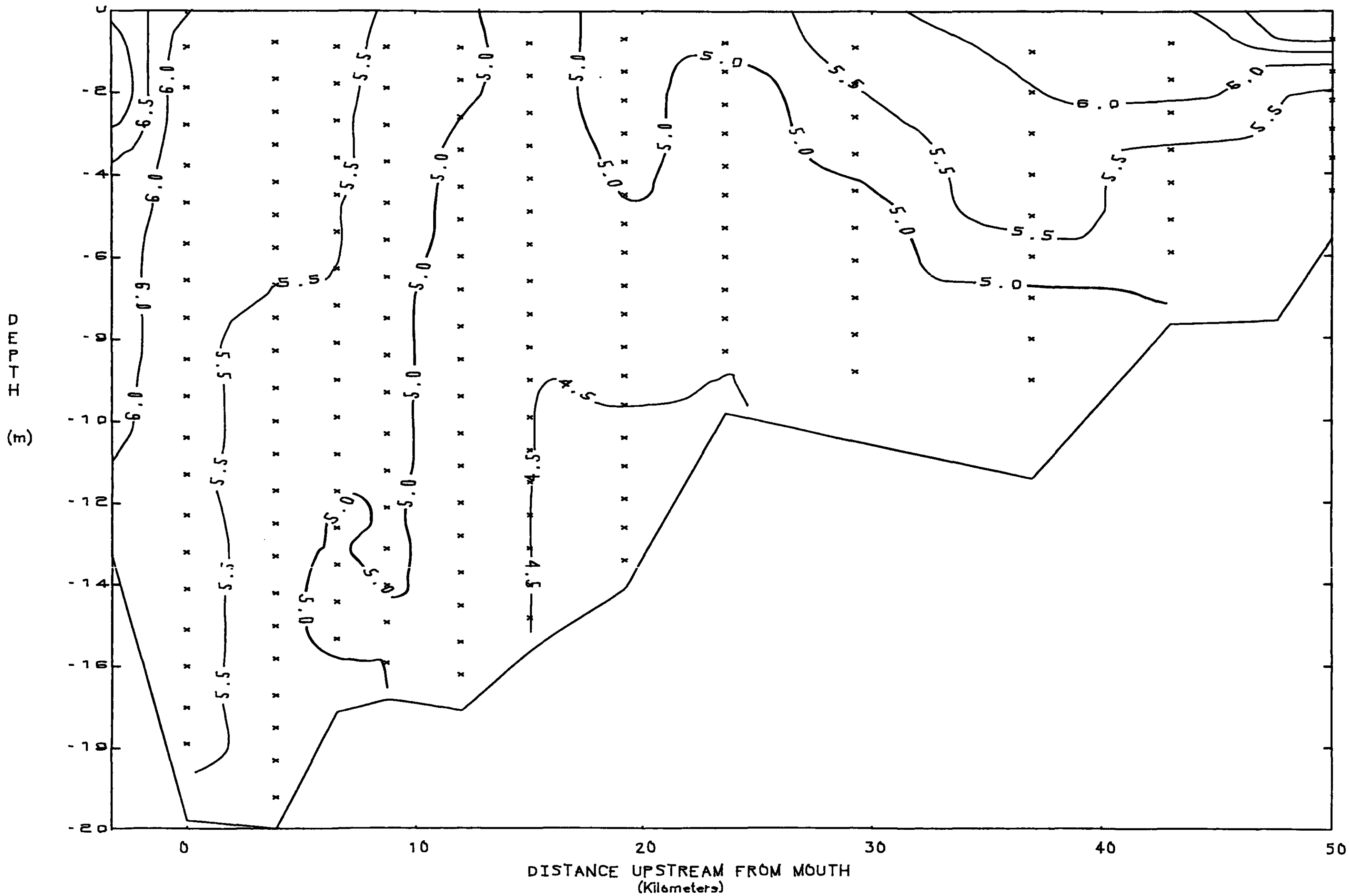
YORK RIVER
TEMPERATURE
31 AUGUST 1988
SLACK BEFORE EBB
DEPTH
(m)
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
25
26
0
10
20
30
40
50
DISTANCE UPSTREAM FROM MOUTH
(Kilometers)

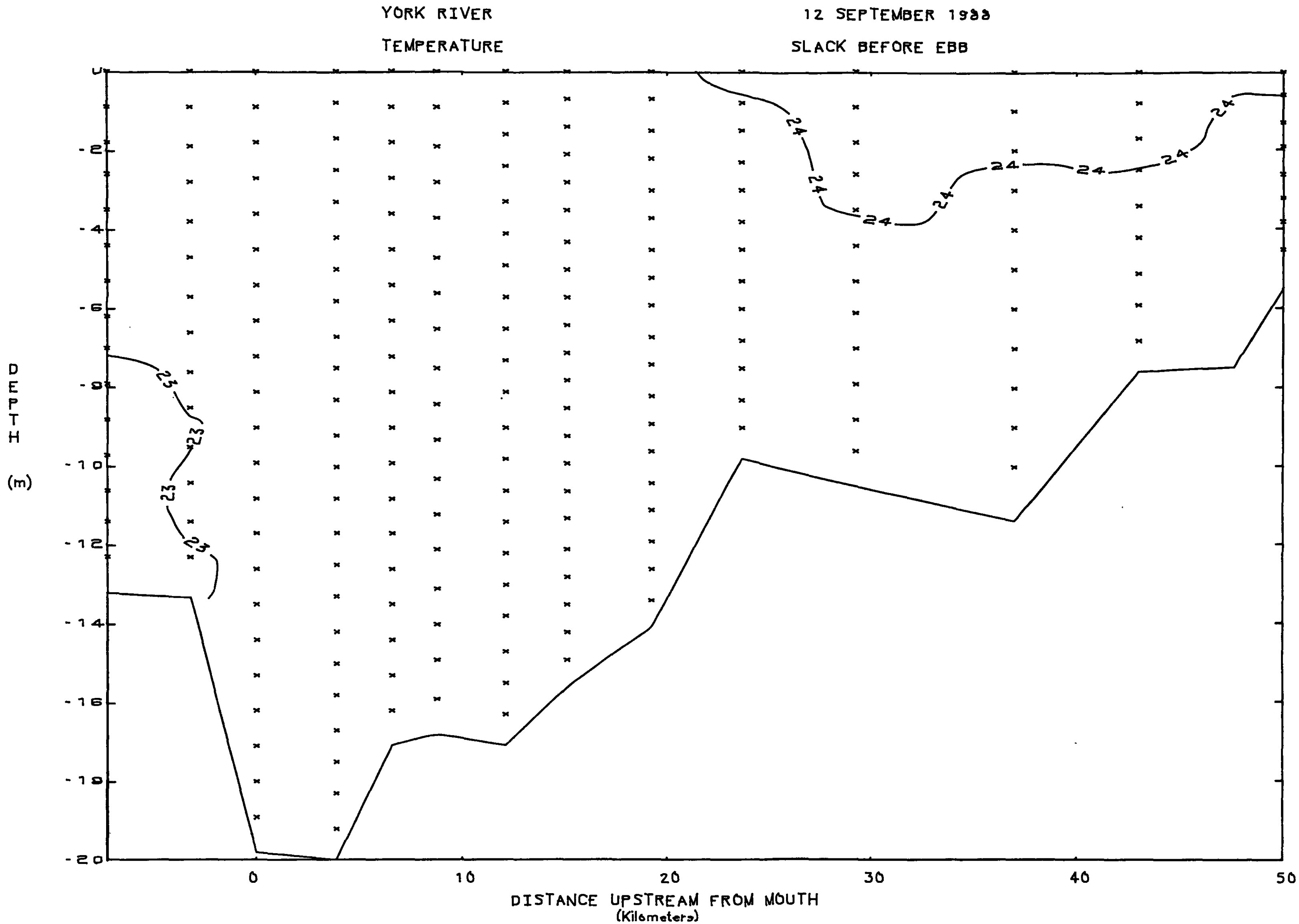


YORK RIVER
SALINITY
31 AUGUST 1988
SLACK BEFORE EBB
DEPTH
(m)
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
23
22
21
20
19
0
10
20
30
40
50
DISTANCE UPSTREAM FROM MOUTH
(Kilometers)

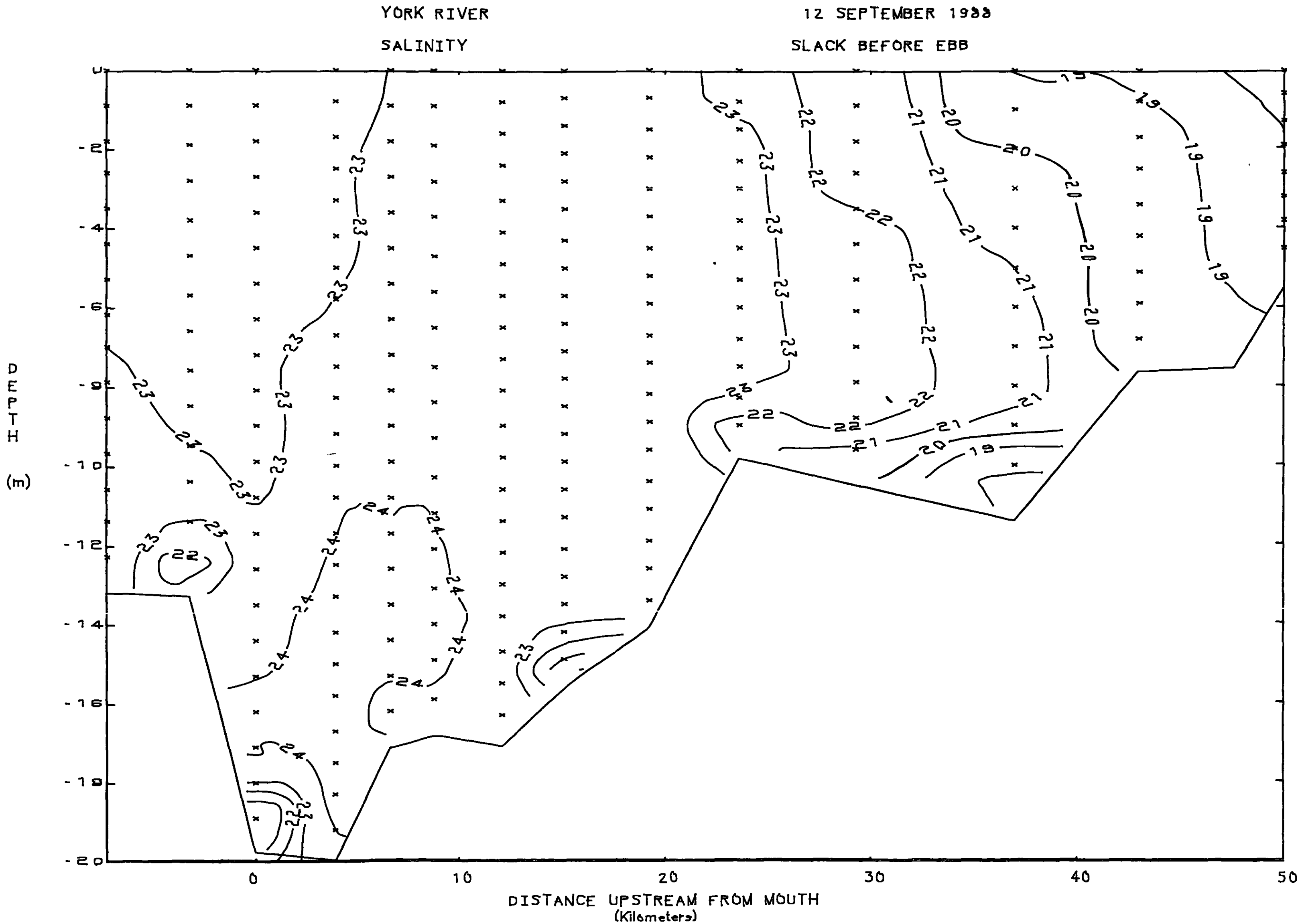
YORK RIVER 31 AUGUST 1988

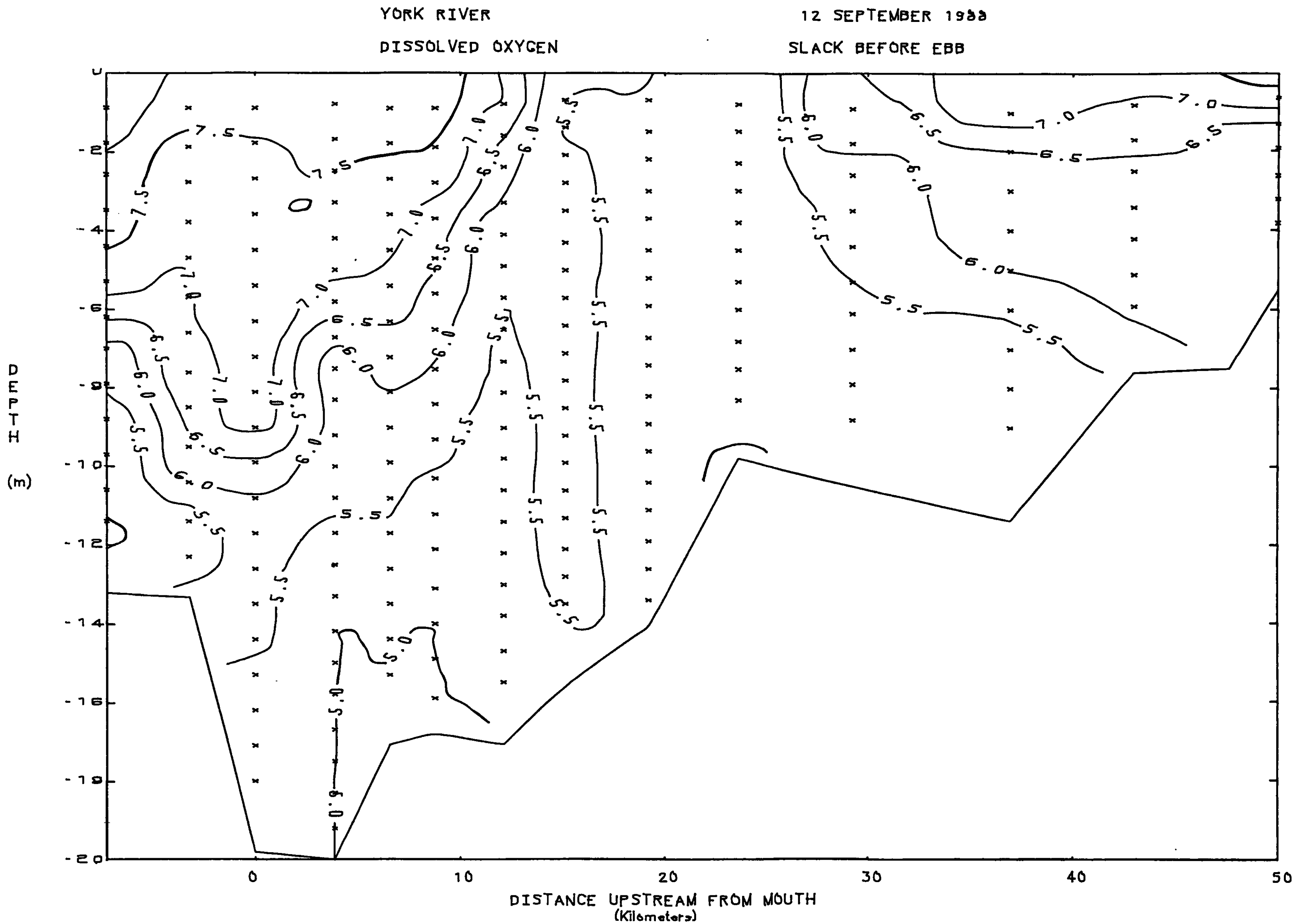
DISSOLVED OXYGEN SLACK BEFORE EBB





YORK RIVER
TEMPERATURE
12 SEPTEMBER 1988
SLACK BEFORE EBB
DEPTH
(m)
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
0
10
20
30
40
50
DISTANCE UPSTREAM FROM MOUTH
(Kilometers)
23
24

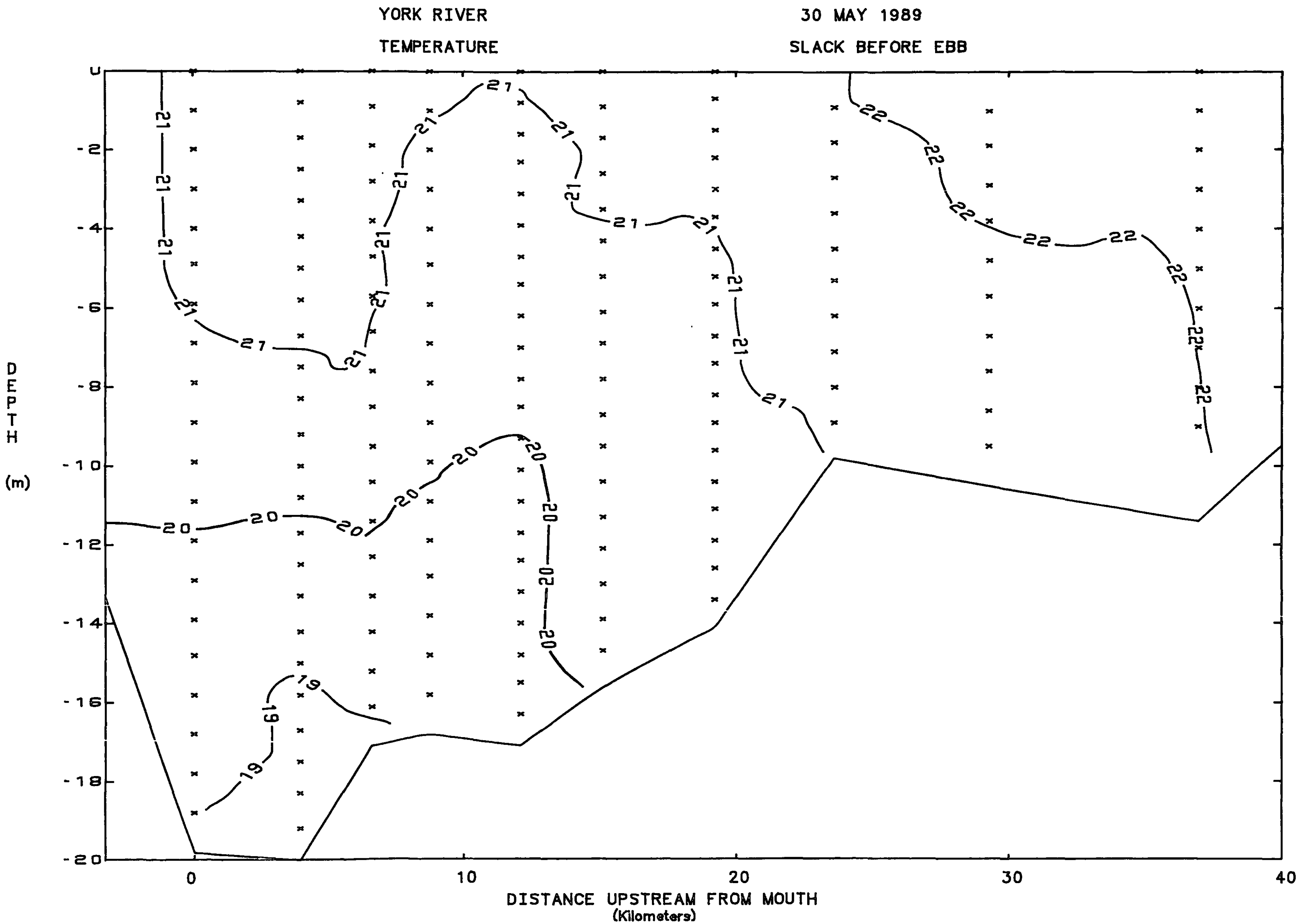

YORK RIVER
SALINITY
12 SEPTEMBER 1988
SLACK BEFORE EBB
DEPTH
(m)
DISTANCE UPSTREAM FROM MOUTH
(Kilometers)
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
10
20
30
40
50
24
23
22
21
20
19



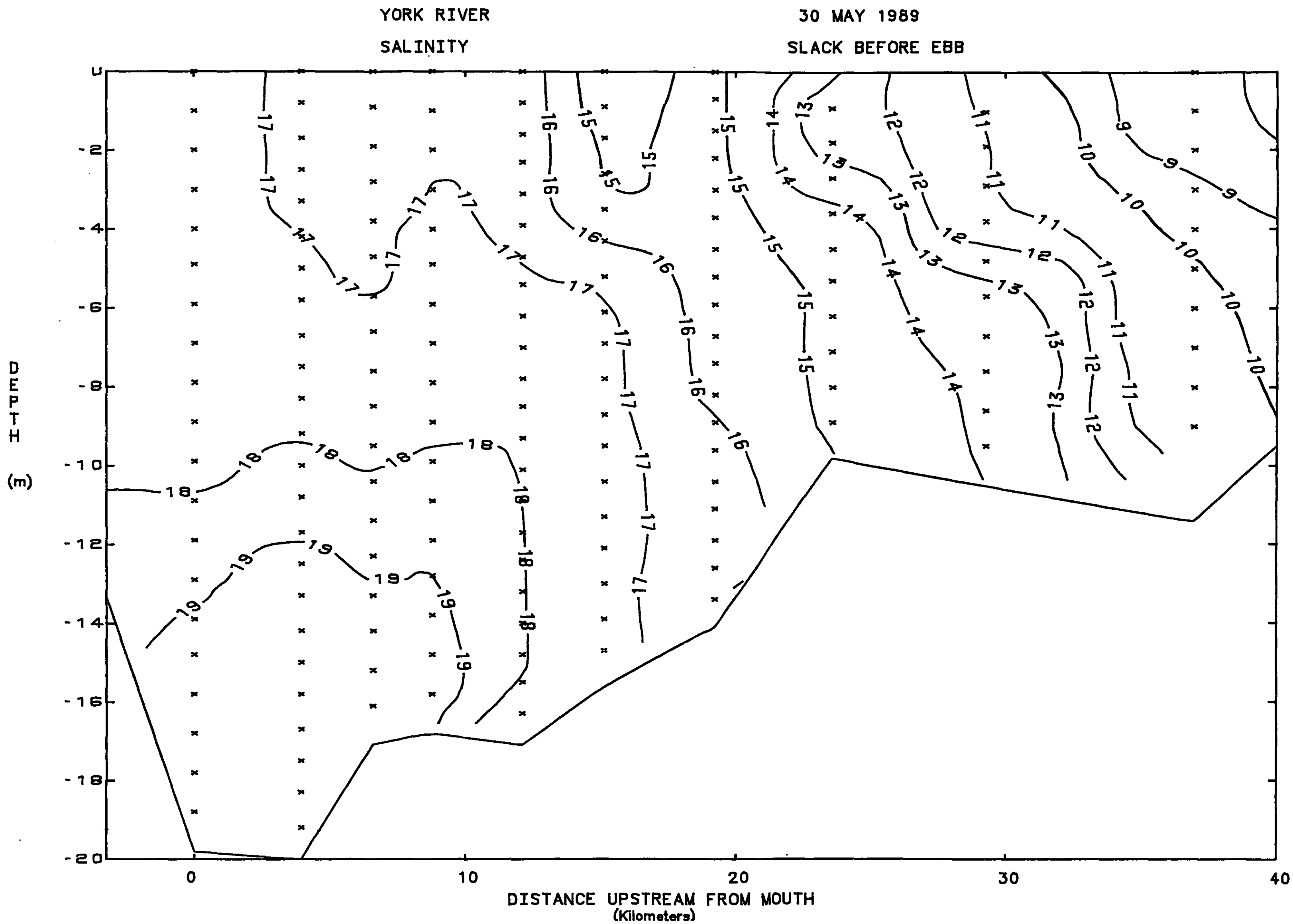
YORK RIVER
DISSOLVED OXYGEN
12 SEPTEMBER 1988
SLACK BEFORE EBB
DEPTH (m)
DISTANCE UPSTREAM FROM MOUTH (Kilometers)
0
10
20
30
40
50
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
7.5
7.0
6.5
6.0
5.5
5.0

APPENDIX I2

SLACKWATER SURVEYS (1989)



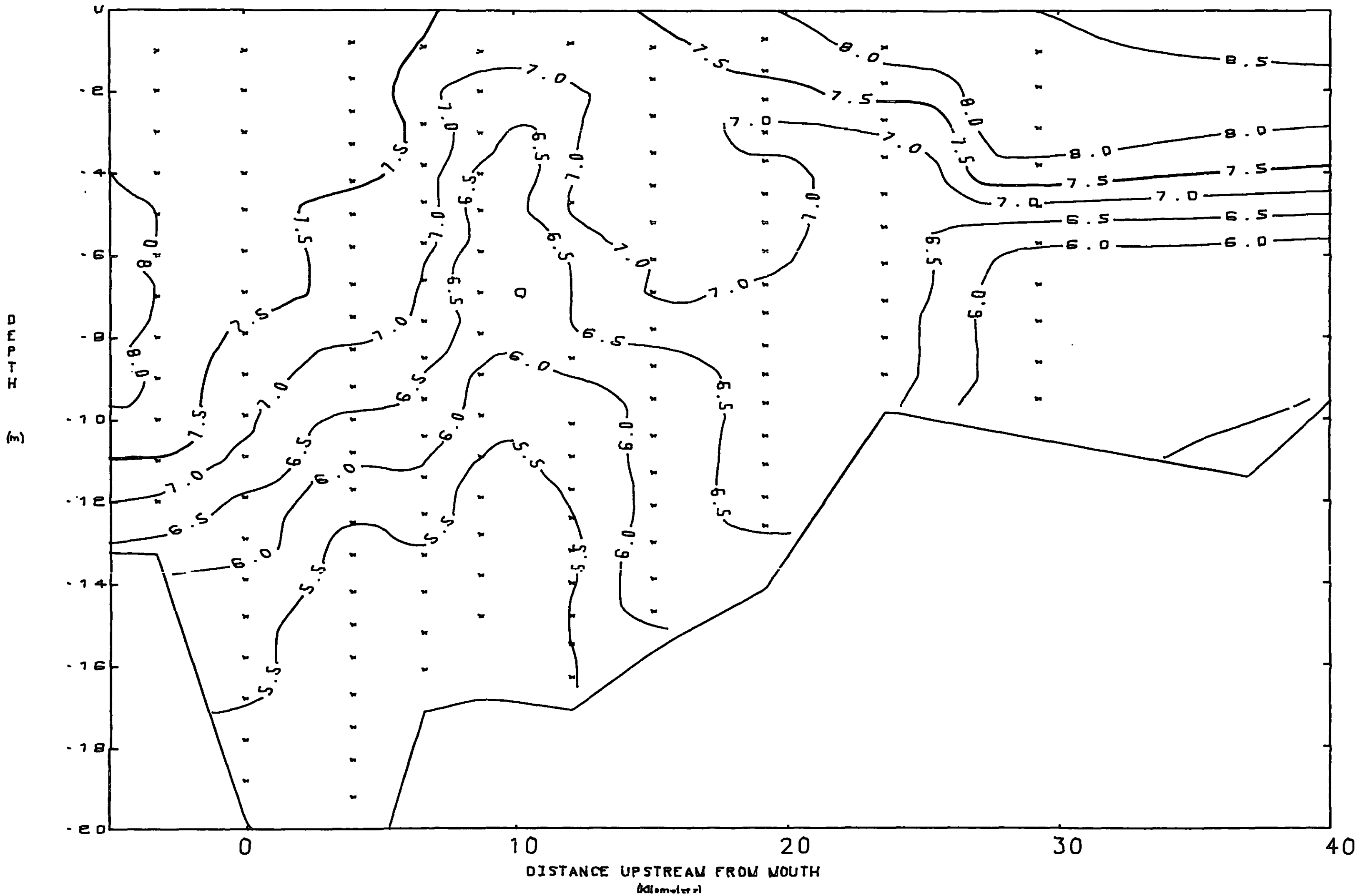
YORK RIVER
TEMPERATURE
30 MAY 1989
SLACK BEFORE EBB
DEPTH
(m)
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
0
10
20
30
40
DISTANCE UPSTREAM FROM MOUTH
(Kilometers)
19
20
21
22

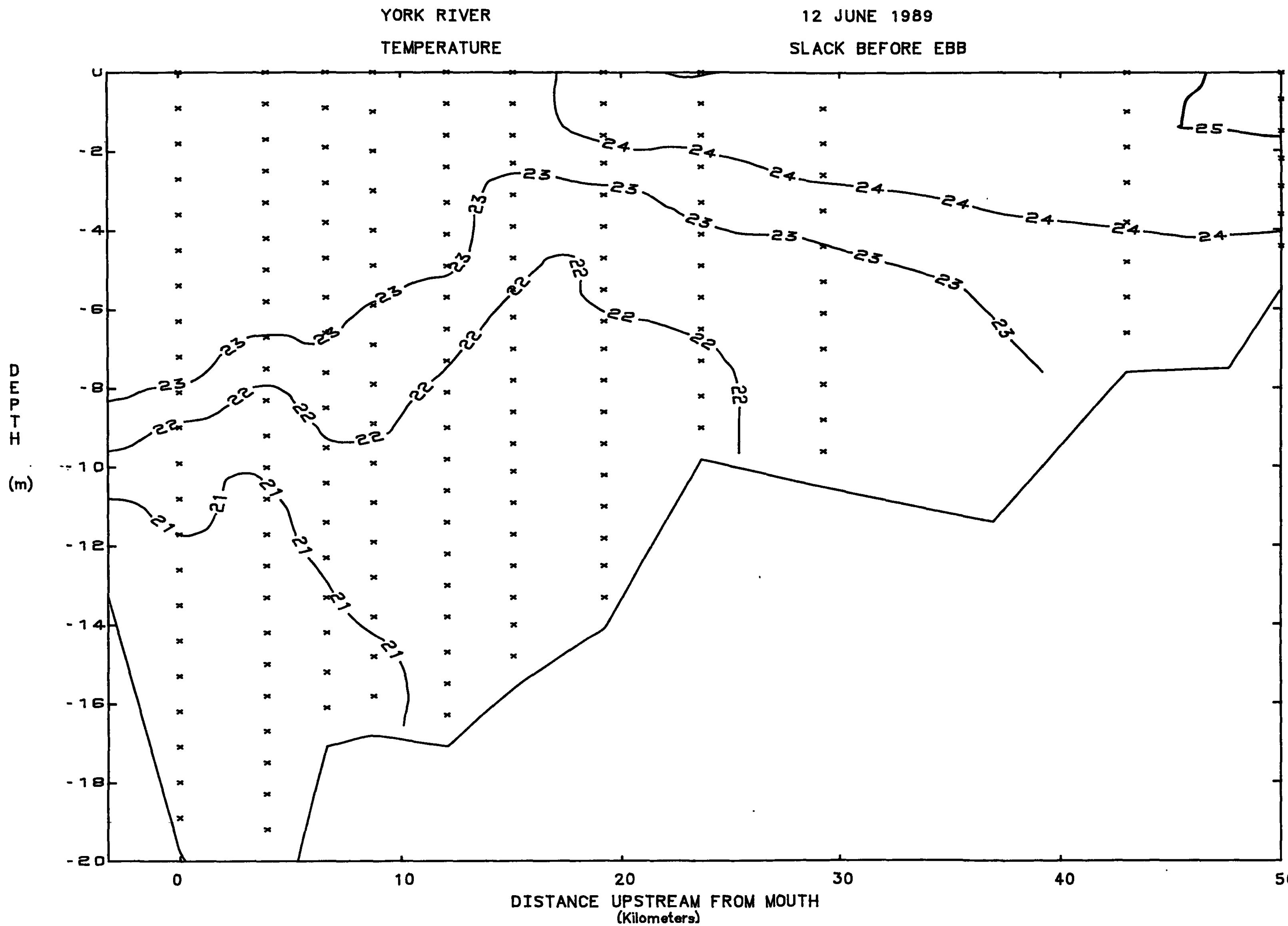


YORK RIVER
SALINITY
30 MAY 1989
SLACK BEFORE EBB
DEPTH
(m)
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
0
10
20
30
40
DISTANCE UPSTREAM FROM MOUTH
(Kilometers)

YORK RIVER 30 MAY 1989

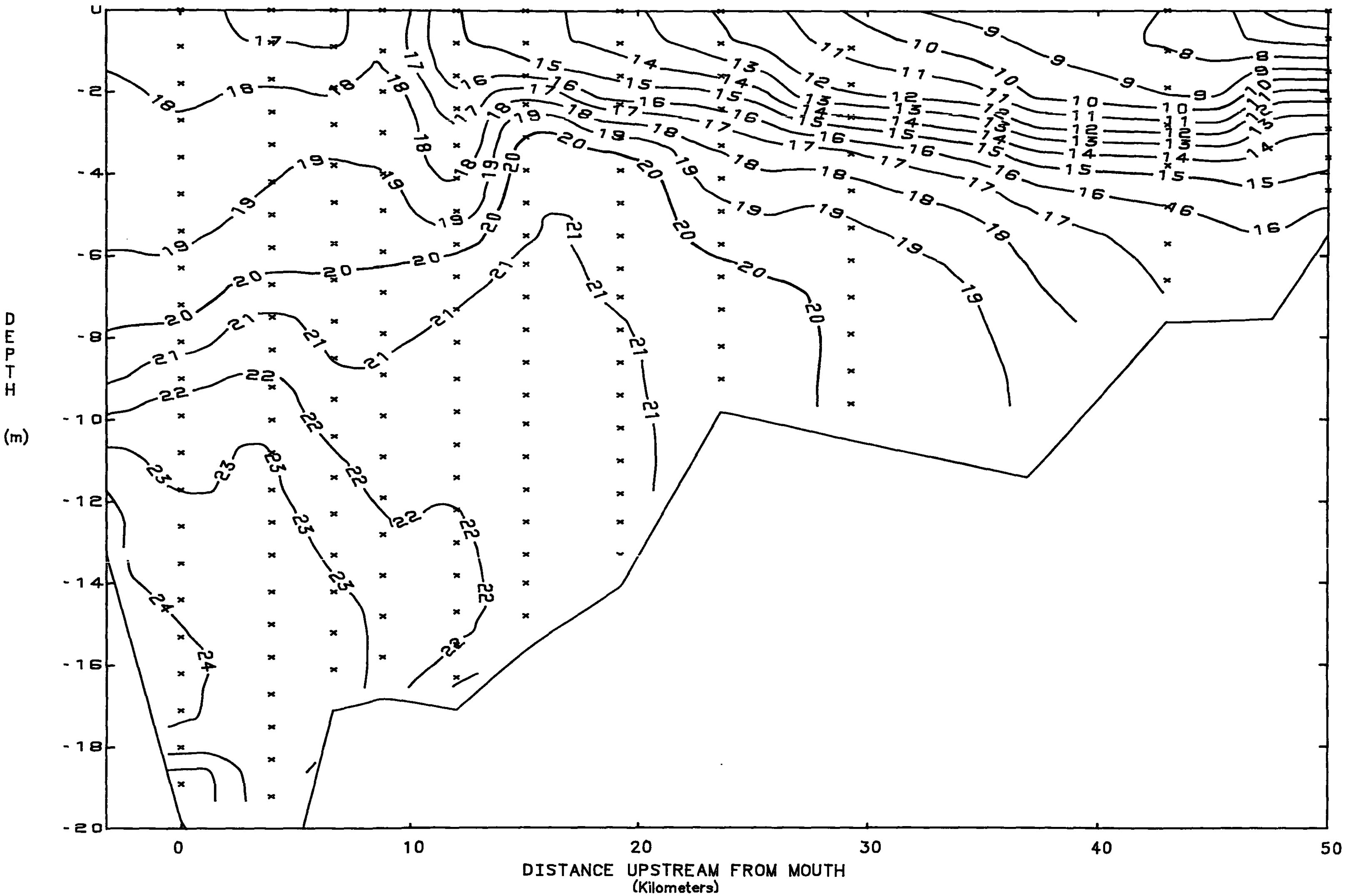
DISSOLVED OXYGEN SLACK BEFORE EBB

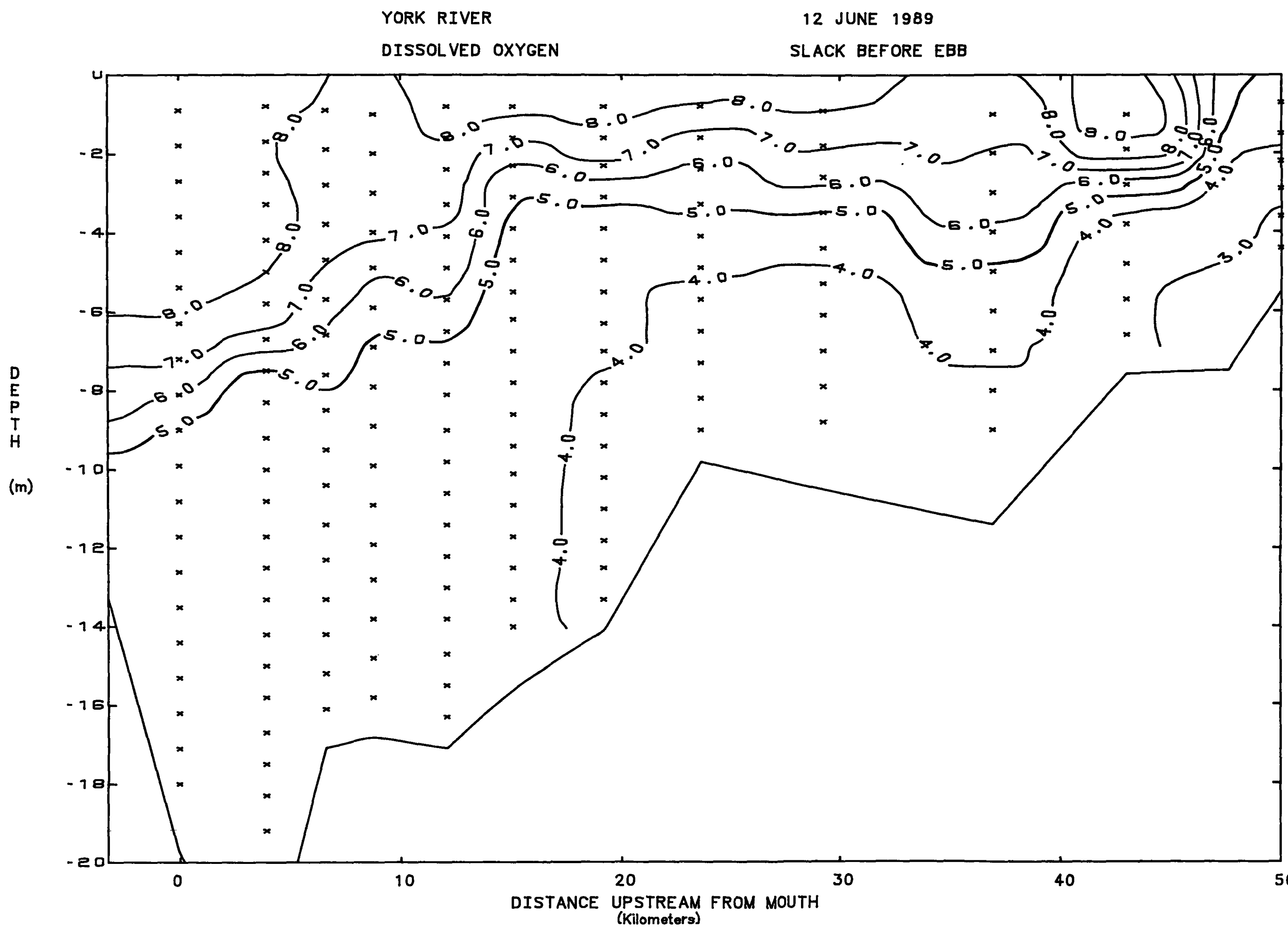



YORK RIVER
TEMPERATURE
12 JUNE 1989
SLACK BEFORE EBB
DEPTH
(m)
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
0
10
20
30
40
50
DISTANCE UPSTREAM FROM MOUTH
(Kilometers)
21
22
23
24
25

YORK RIVER 12 JUNE 1989

SALINITY SLACK BEFORE EBB

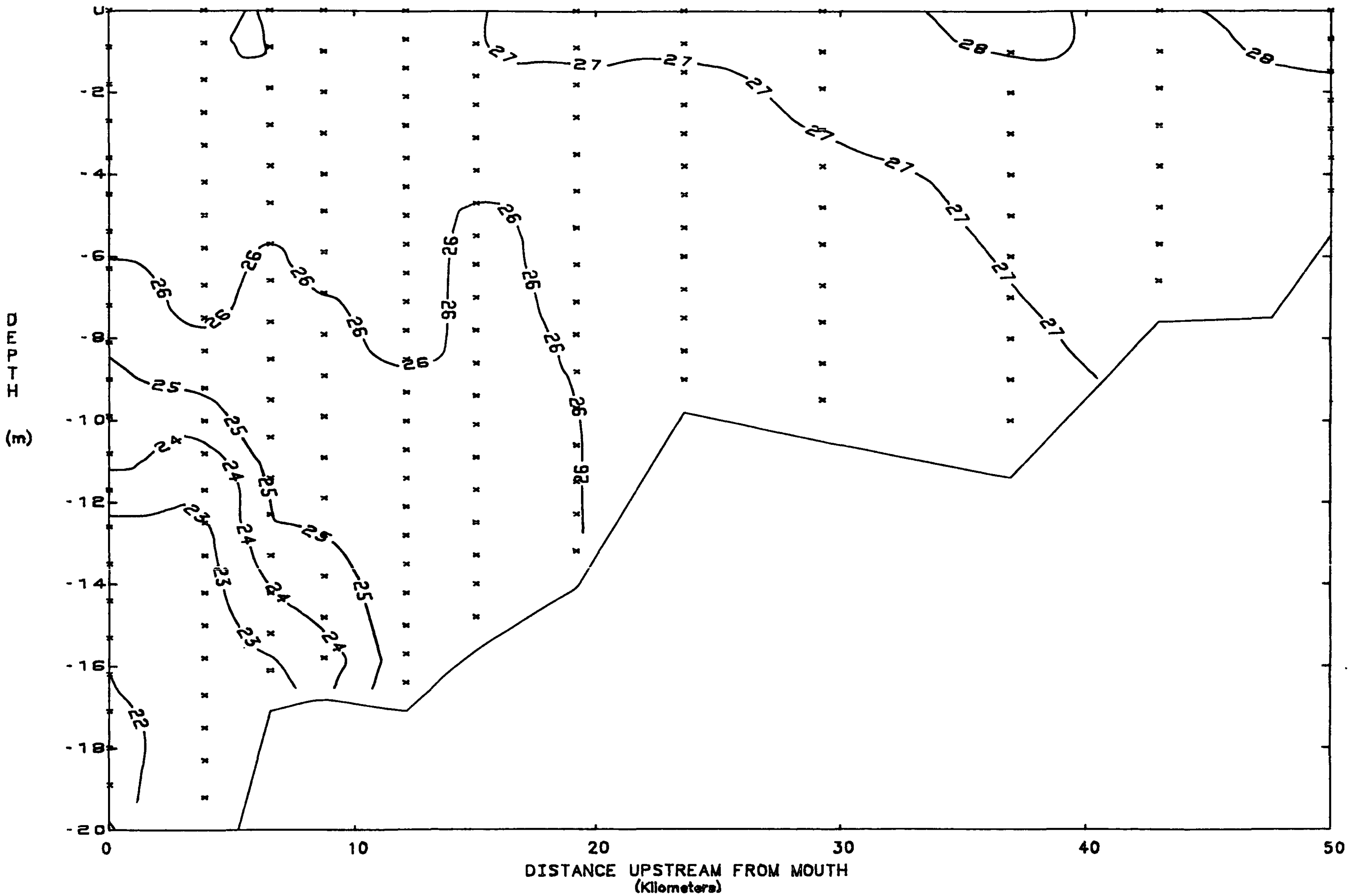




YORK RIVER
12 JUNE 1989
DISSOLVED OXYGEN
SLACK BEFORE EBB
DEPTH (m)
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
0
10
20
30
40
50
DISTANCE UPSTREAM FROM MOUTH
(Kilometers)
8.0
7.0
6.0
5.0
4.0
3.0
9.0

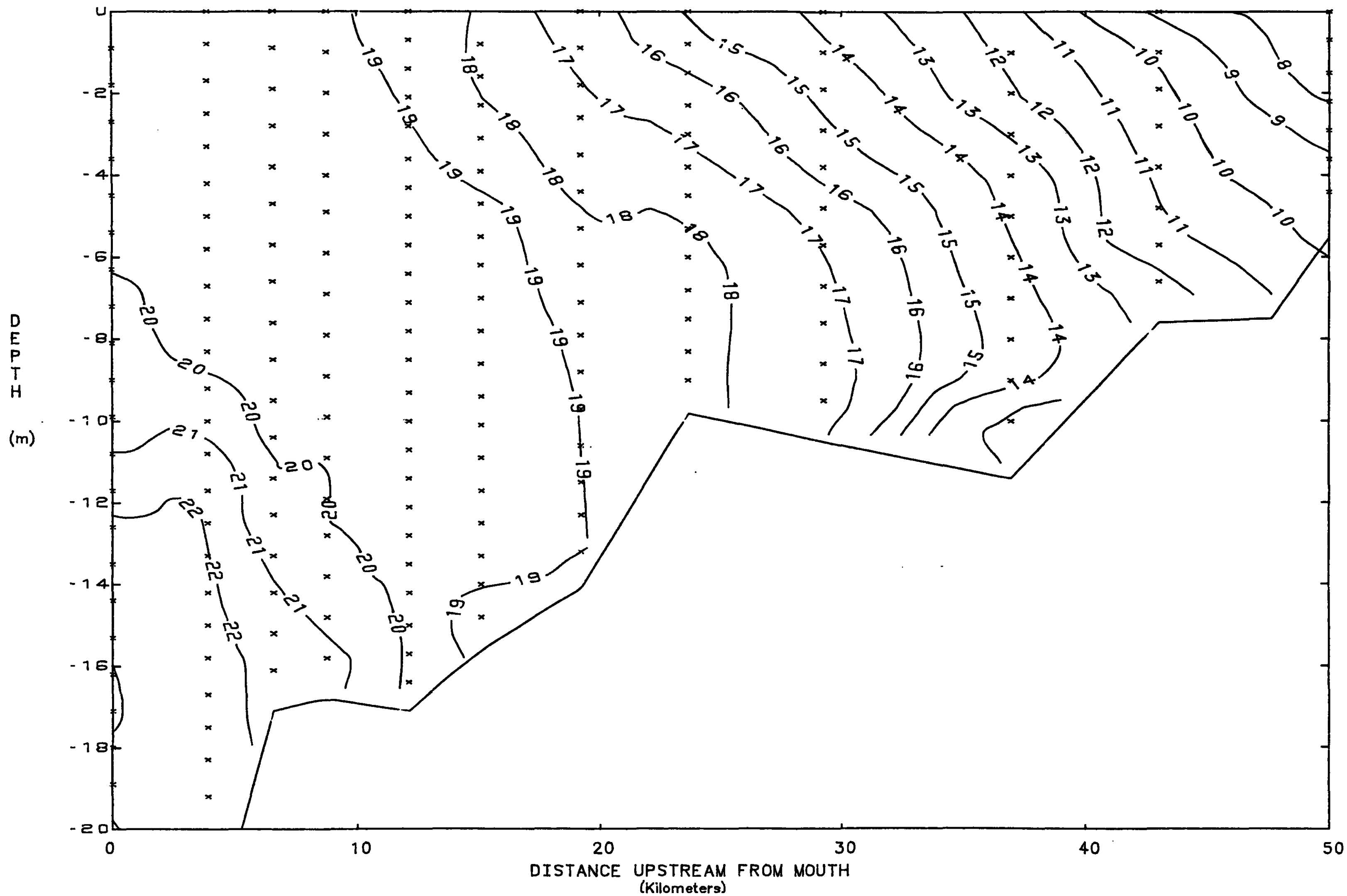
YORK RIVER 27 JUNE 1989

TEMPERATURE SLACK BEFORE EBB



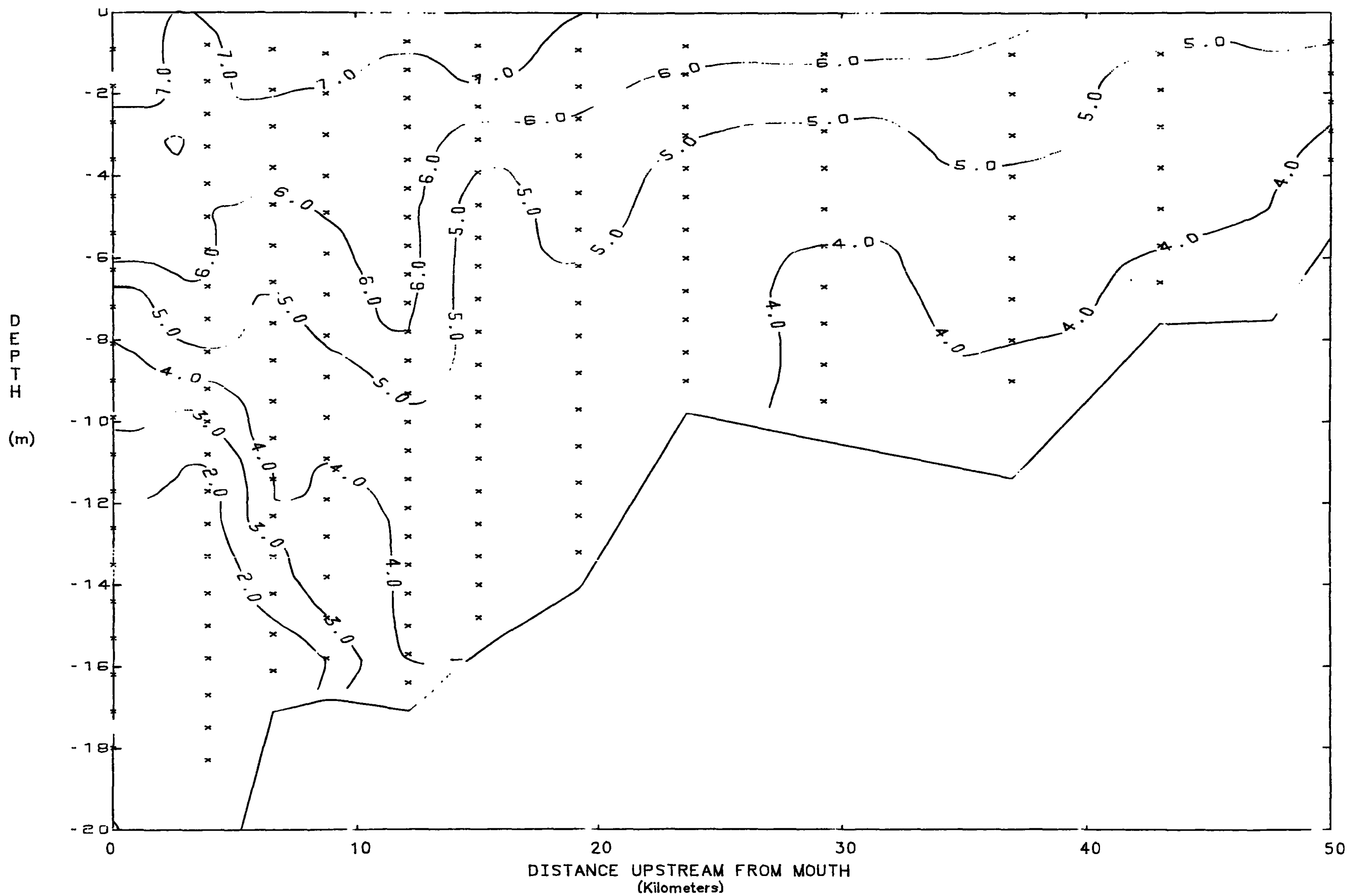
YORK RIVER 27 JUNE 1989

SALINITY SLACK BEFORE EBB



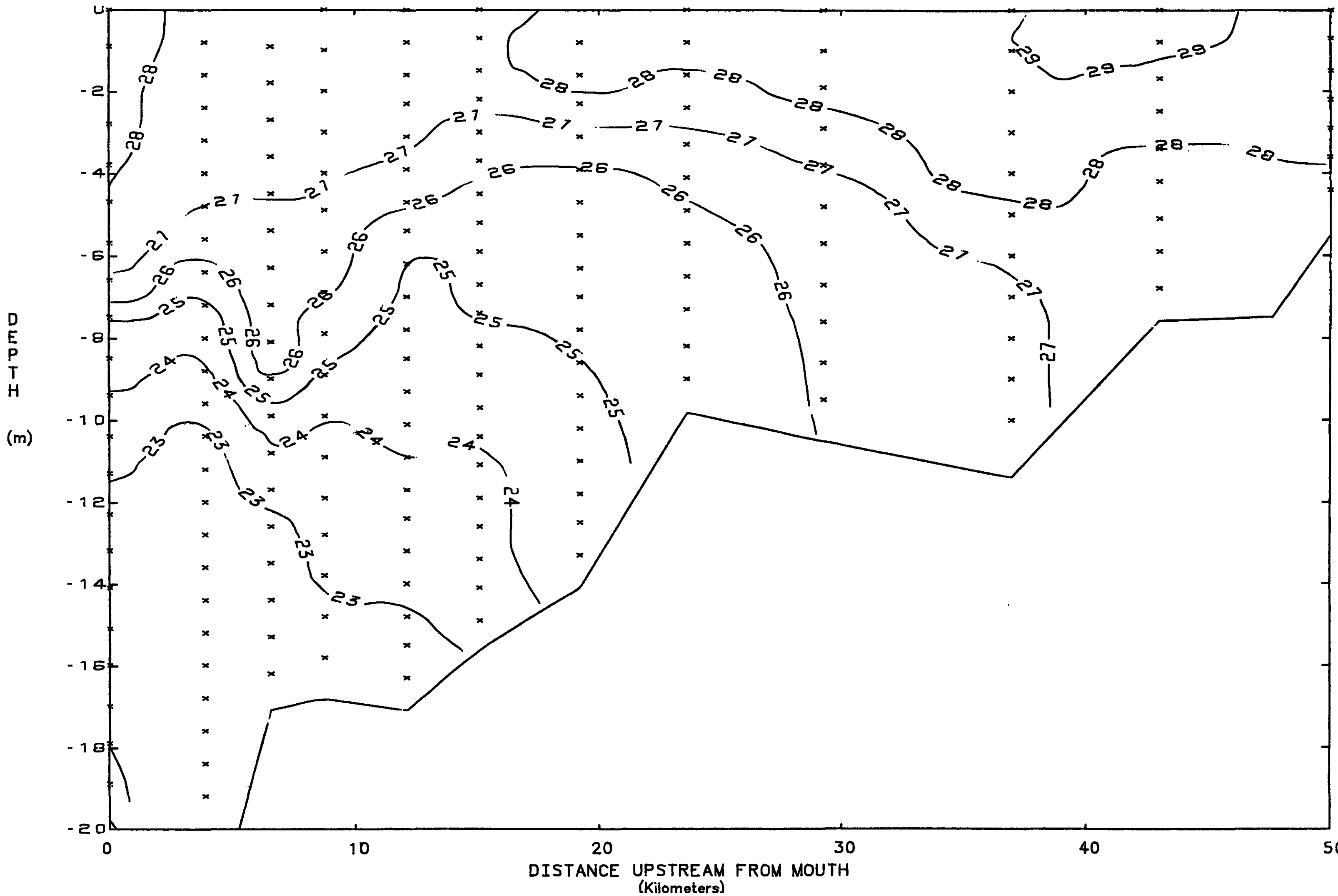
YORK RIVER 27 JUNE 1989

DISSOLVED OXYGEN SLACK BEFORE EBB



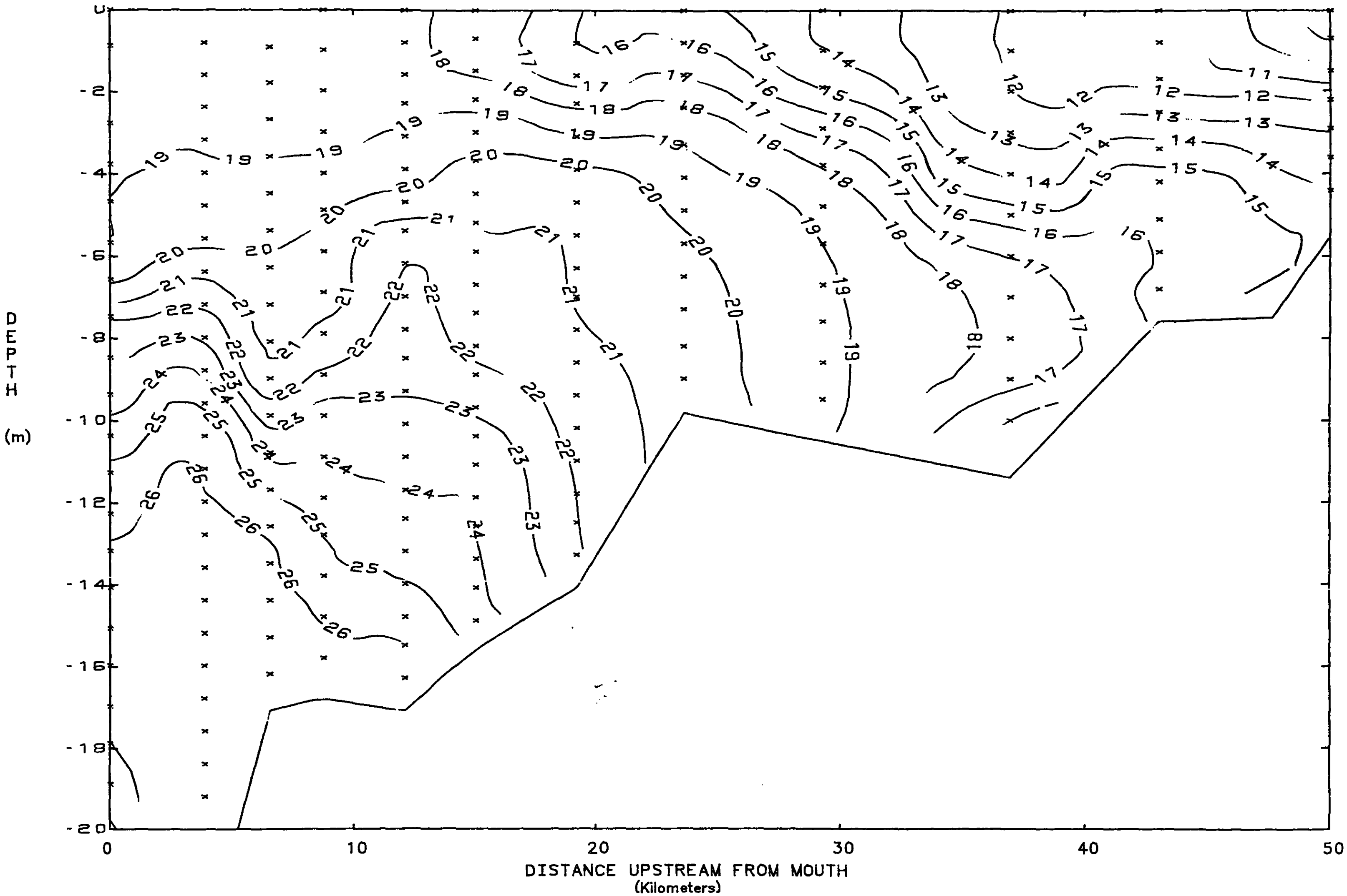
YORK RIVER 12 JULY 1989

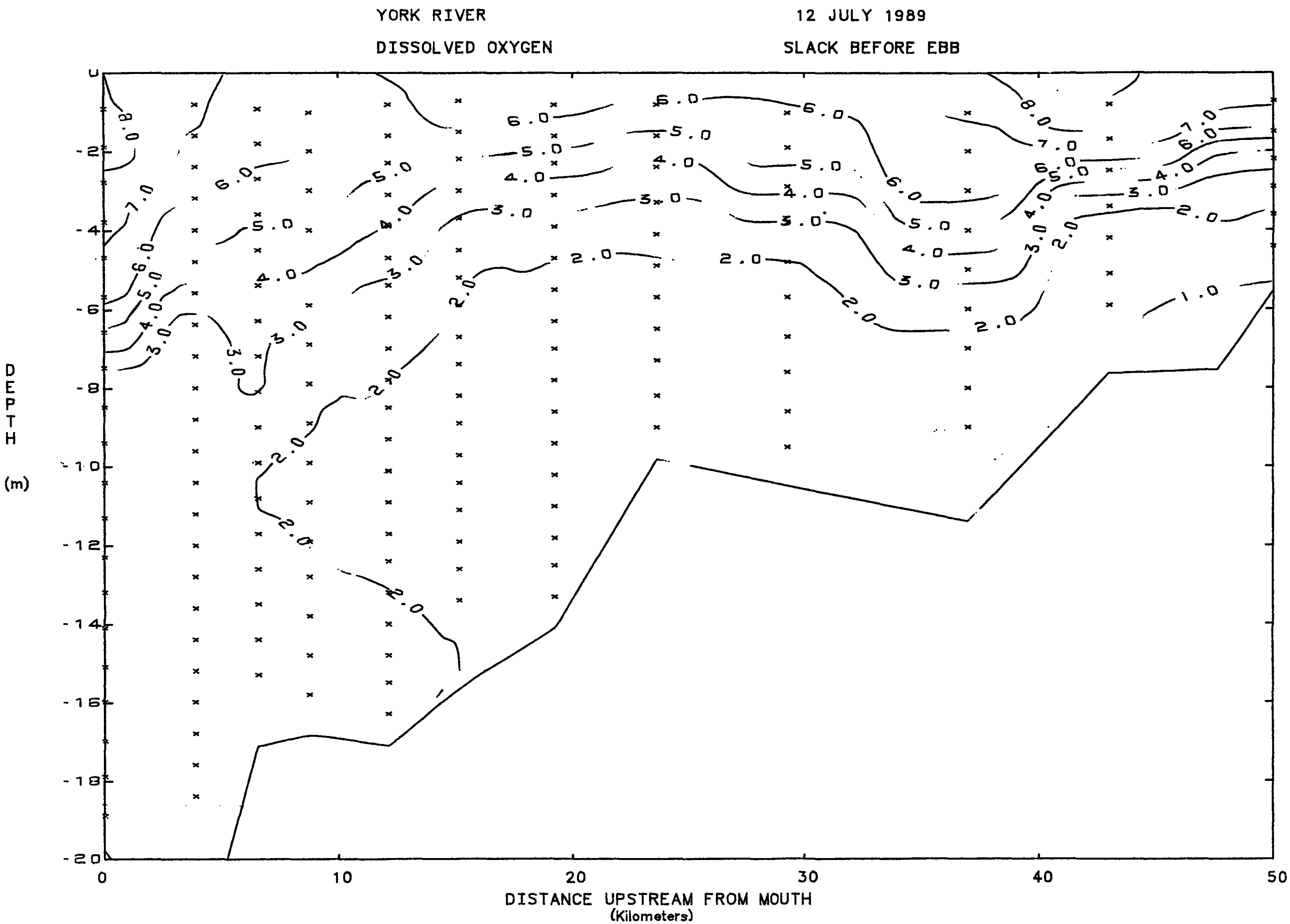
TEMPERATURE SLACK BEFORE EBB



YORK RIVER 12 JULY 1989

SALINITY SLACK BEFORE EBB

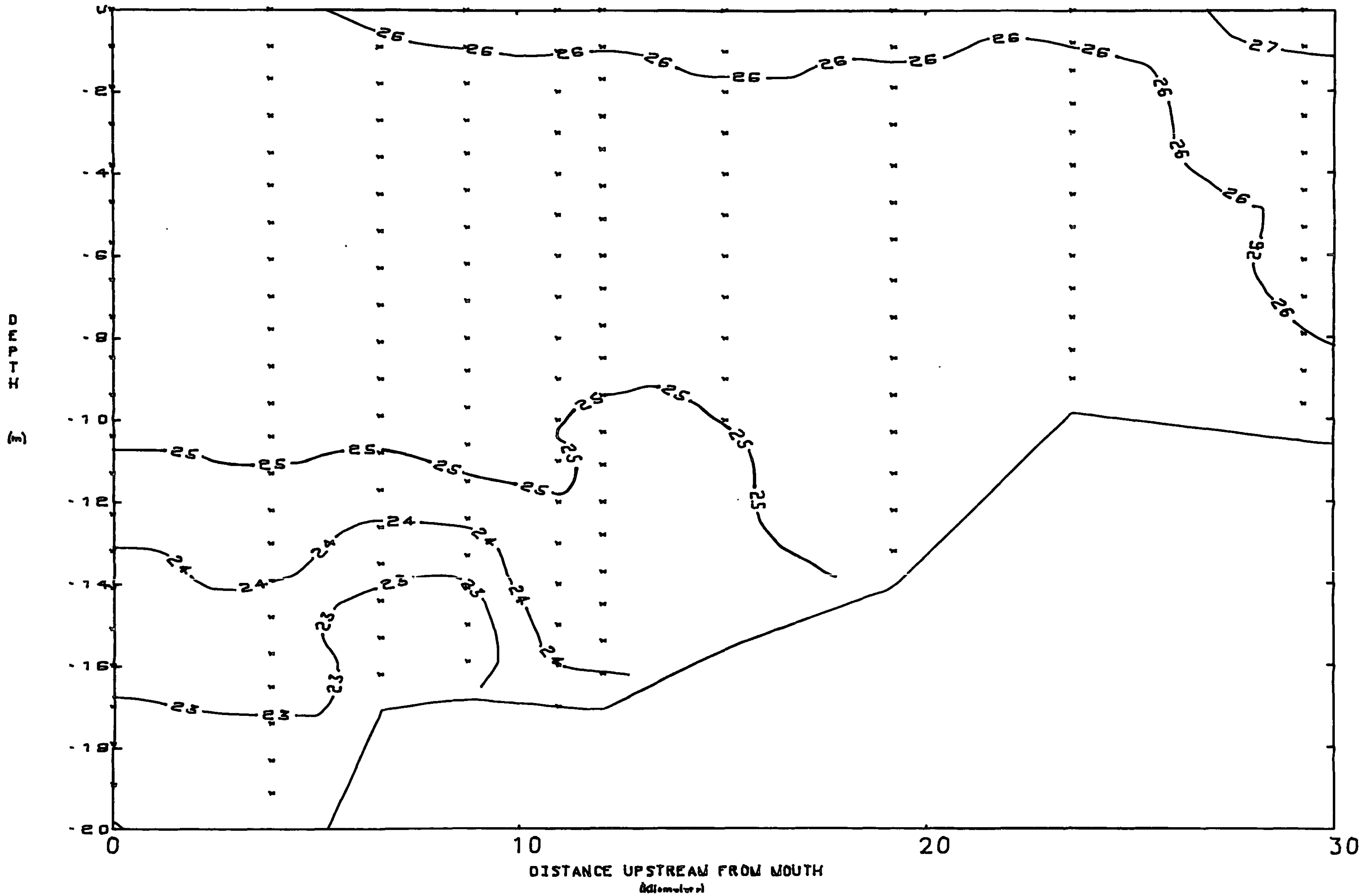


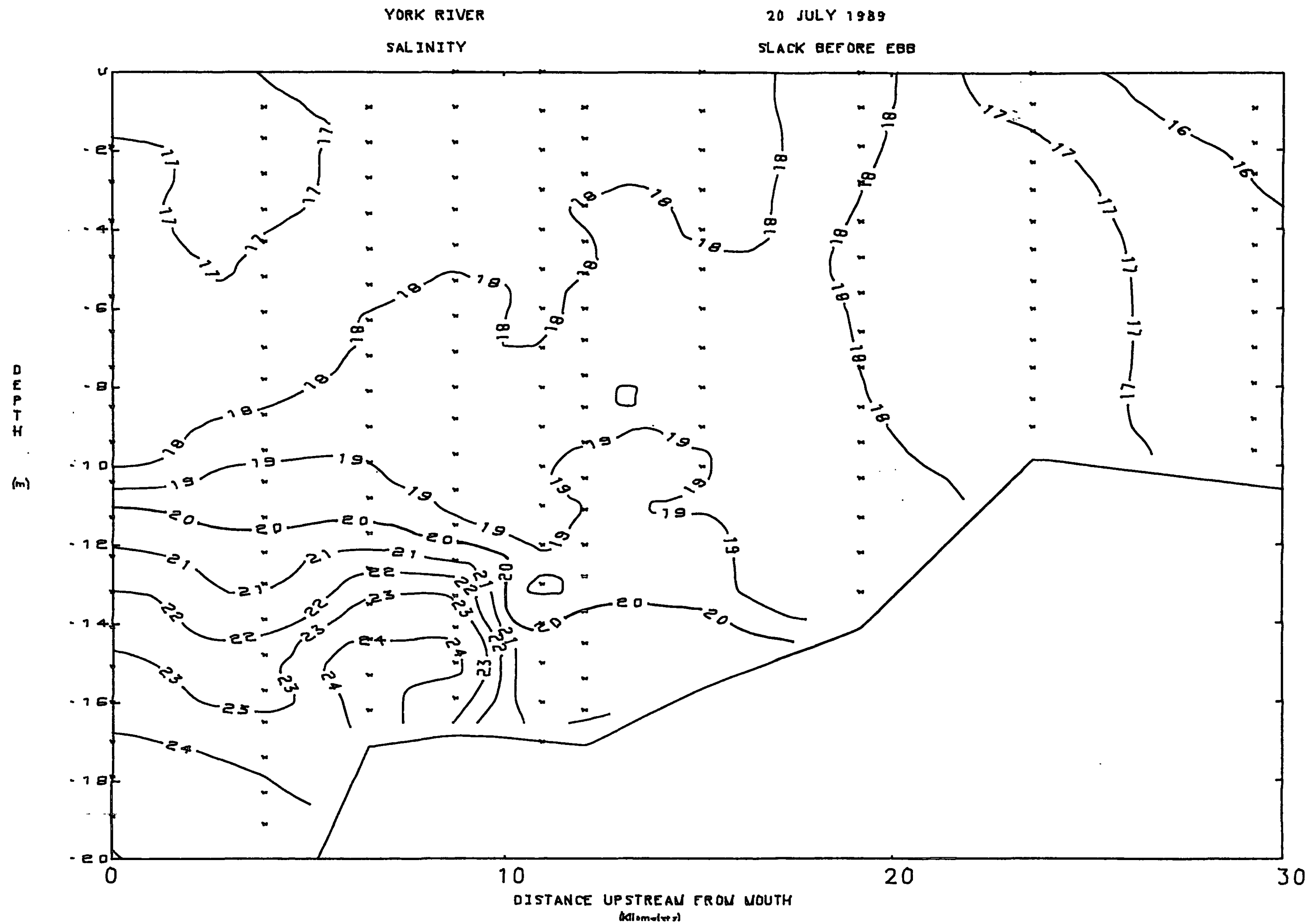


YORK RIVER
12 JULY 1989
DISSOLVED OXYGEN
SLACK BEFORE EBB
DEPTH
(m)
DISTANCE UPSTREAM FROM MOUTH
(Kilometers)

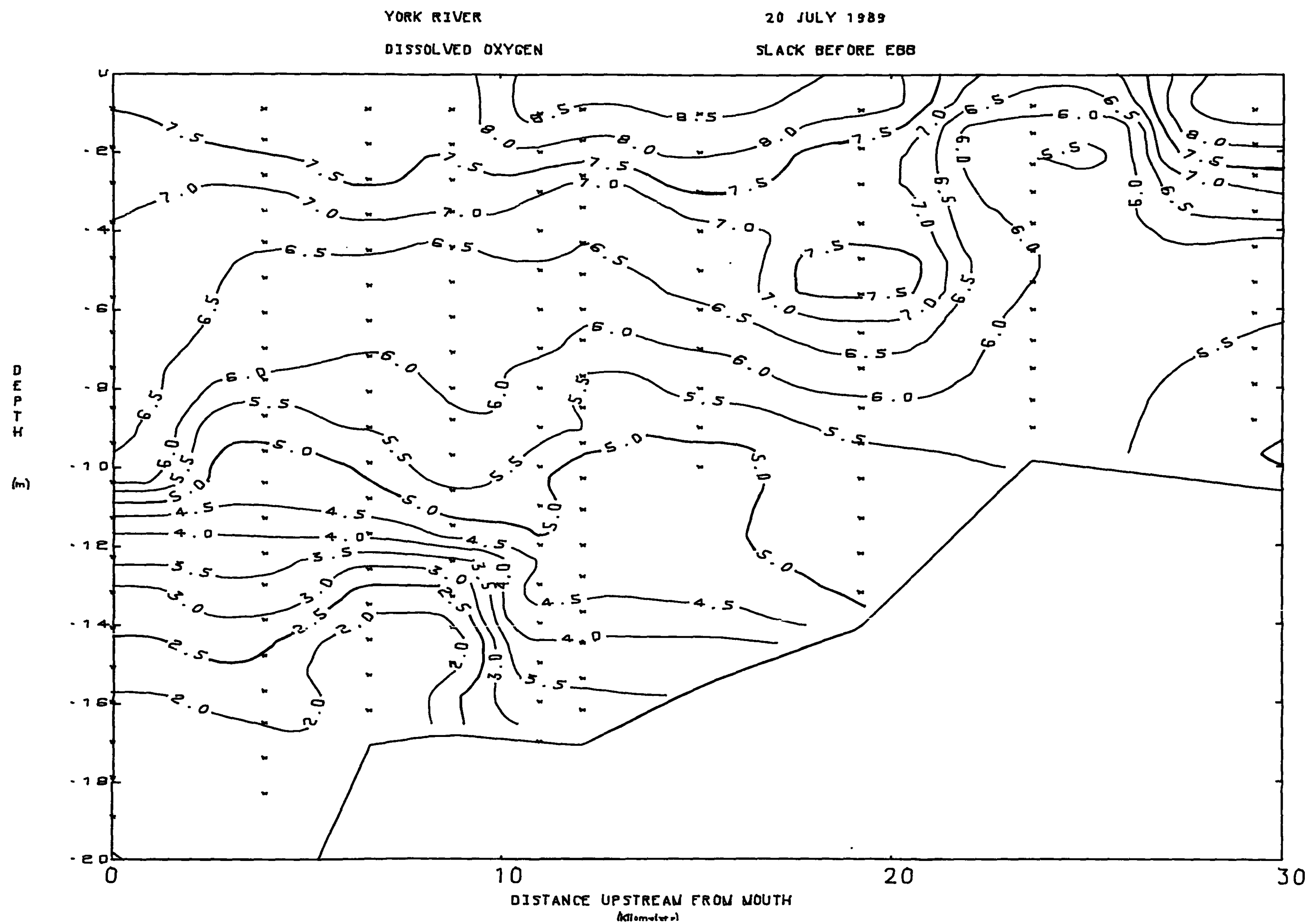
YORK RIVER 20 JULY 1989

TEMPERATURE SLACK BEFORE EBB

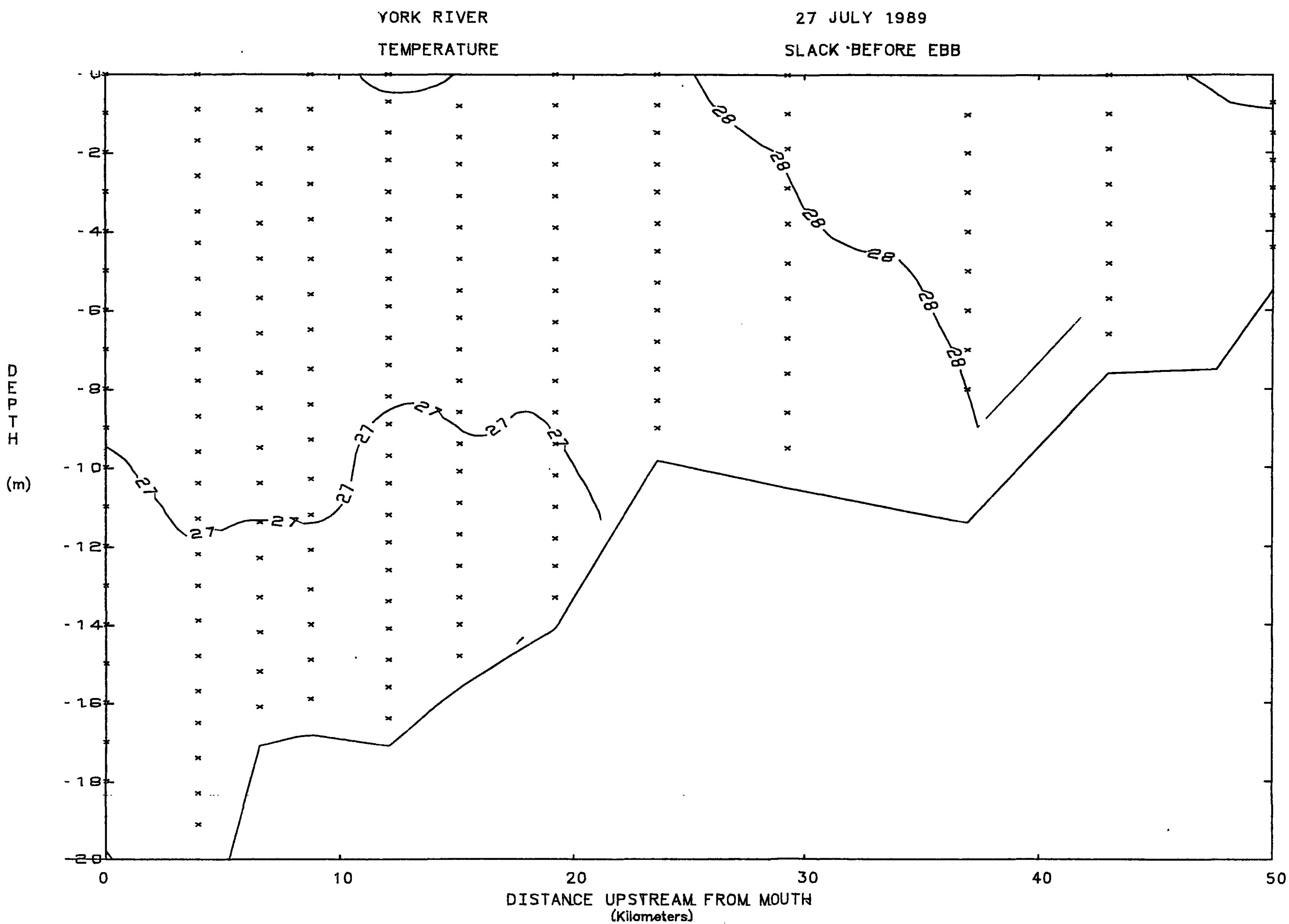




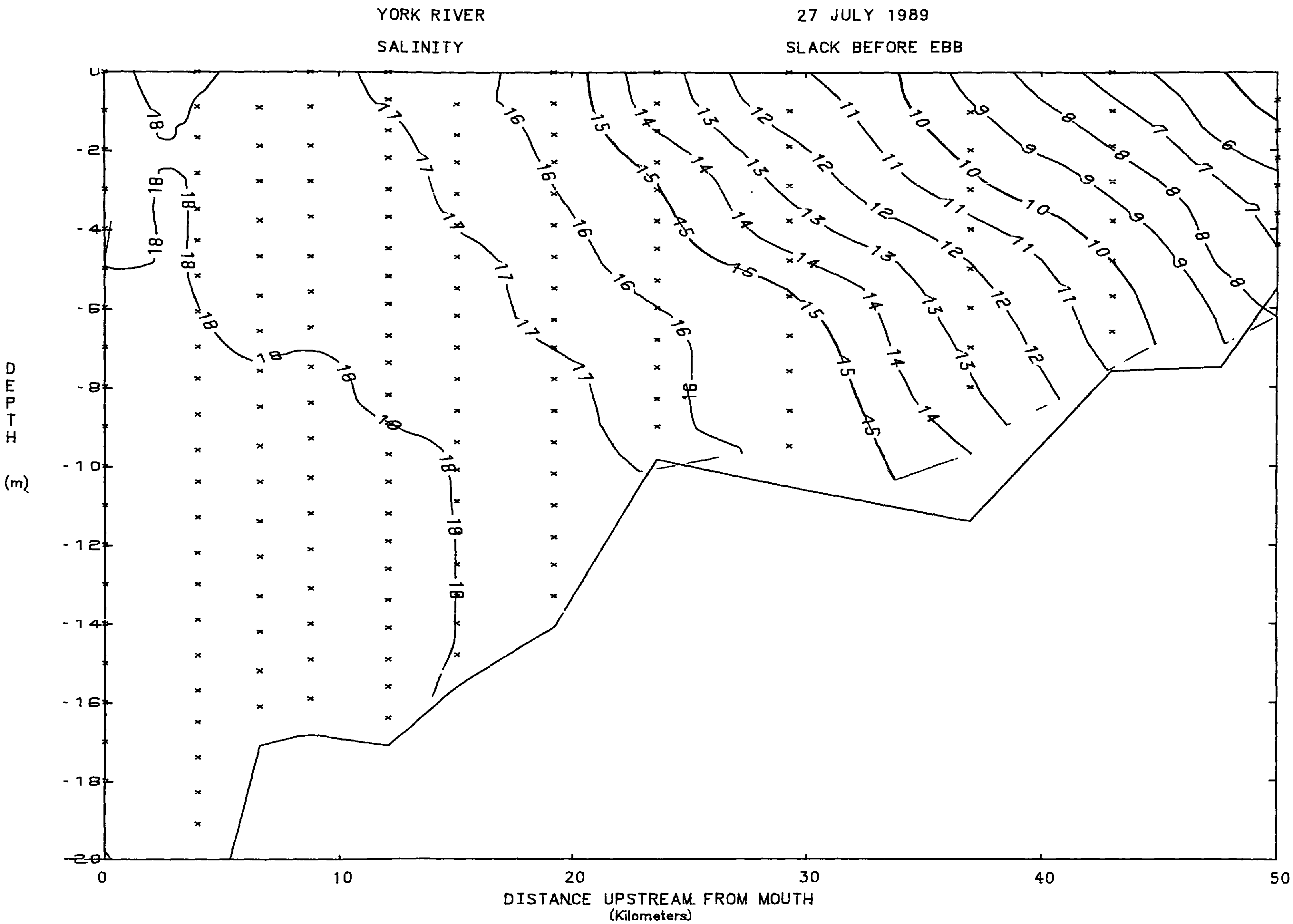
YORK RIVER
20 JULY 1989
SALINITY
SLACK BEFORE EBB
DEPTH
(m)
DISTANCE UPSTREAM FROM MOUTH
(kilometers)
0
10
20
30
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20



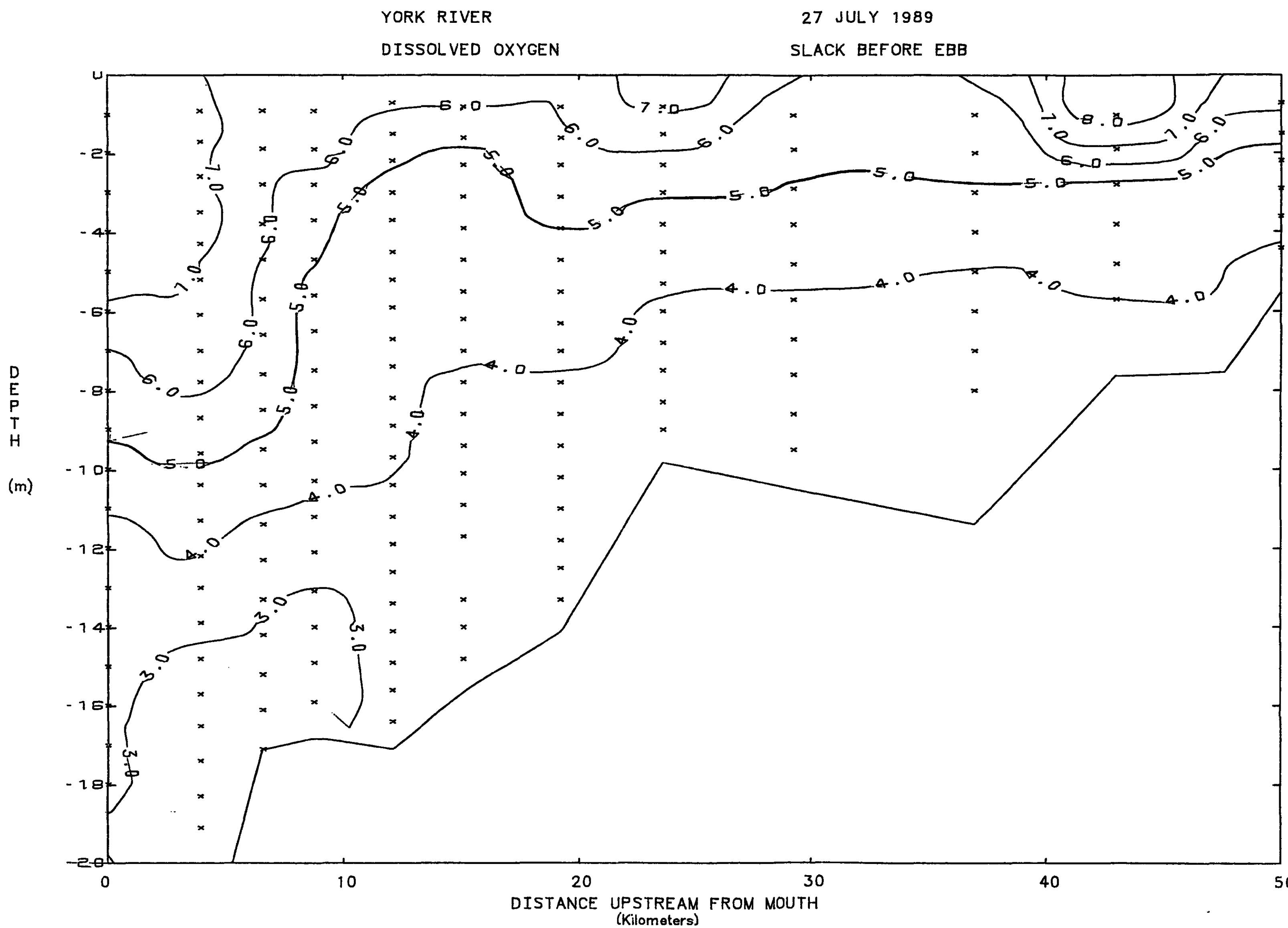
YORK RIVER
20 JULY 1989
DISSOLVED OXYGEN
SLACK BEFORE EBB
DEPTH
(m)
DISTANCE UPSTREAM FROM MOUTH
(kilometers)

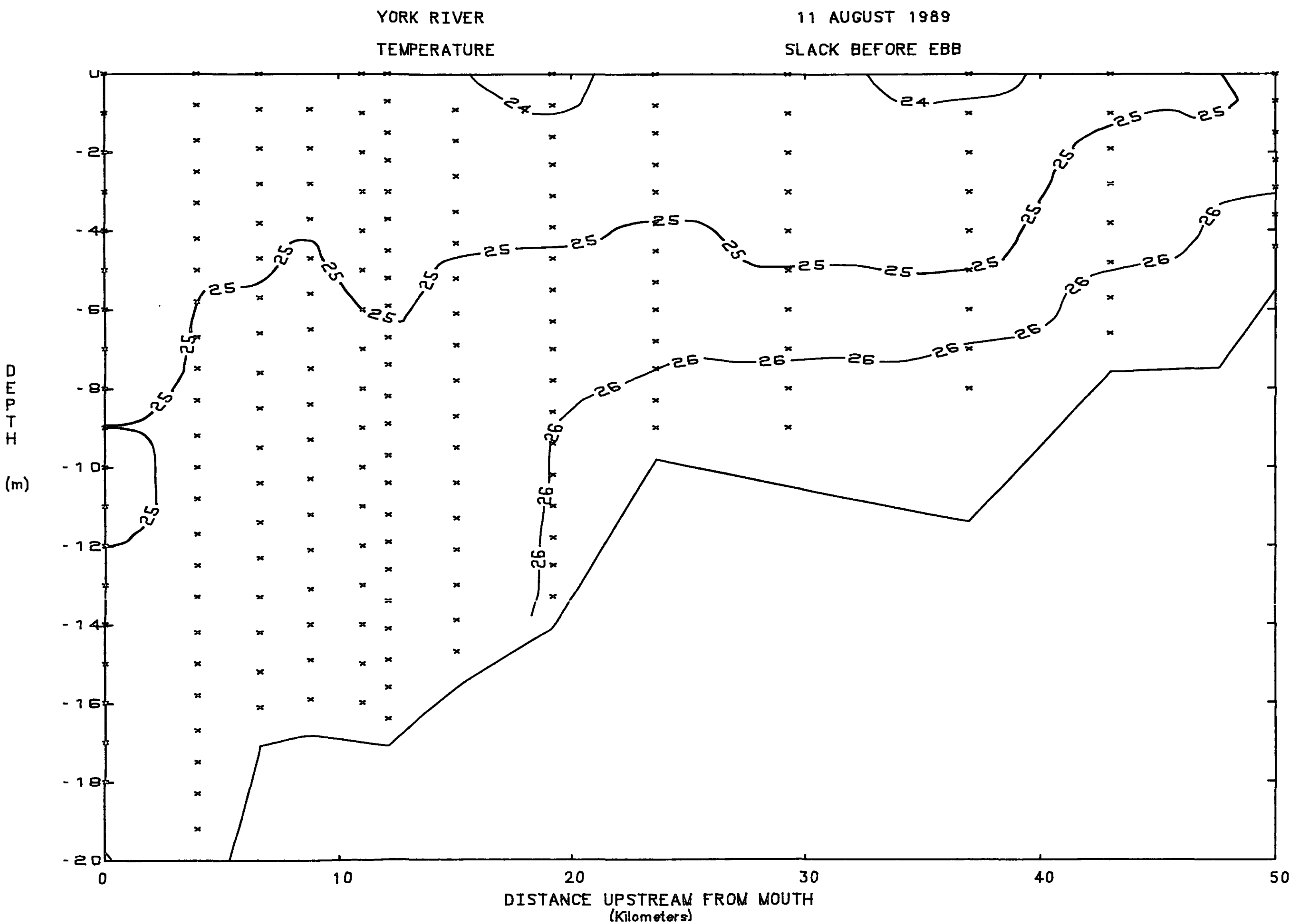


YORK RIVER
TEMPERATURE
27 JULY 1989
SLACK BEFORE EBB
DEPTH
(m)
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
0
10
20
30
40
50
DISTANCE UPSTREAM FROM MOUTH
(Kilometers)
27
28

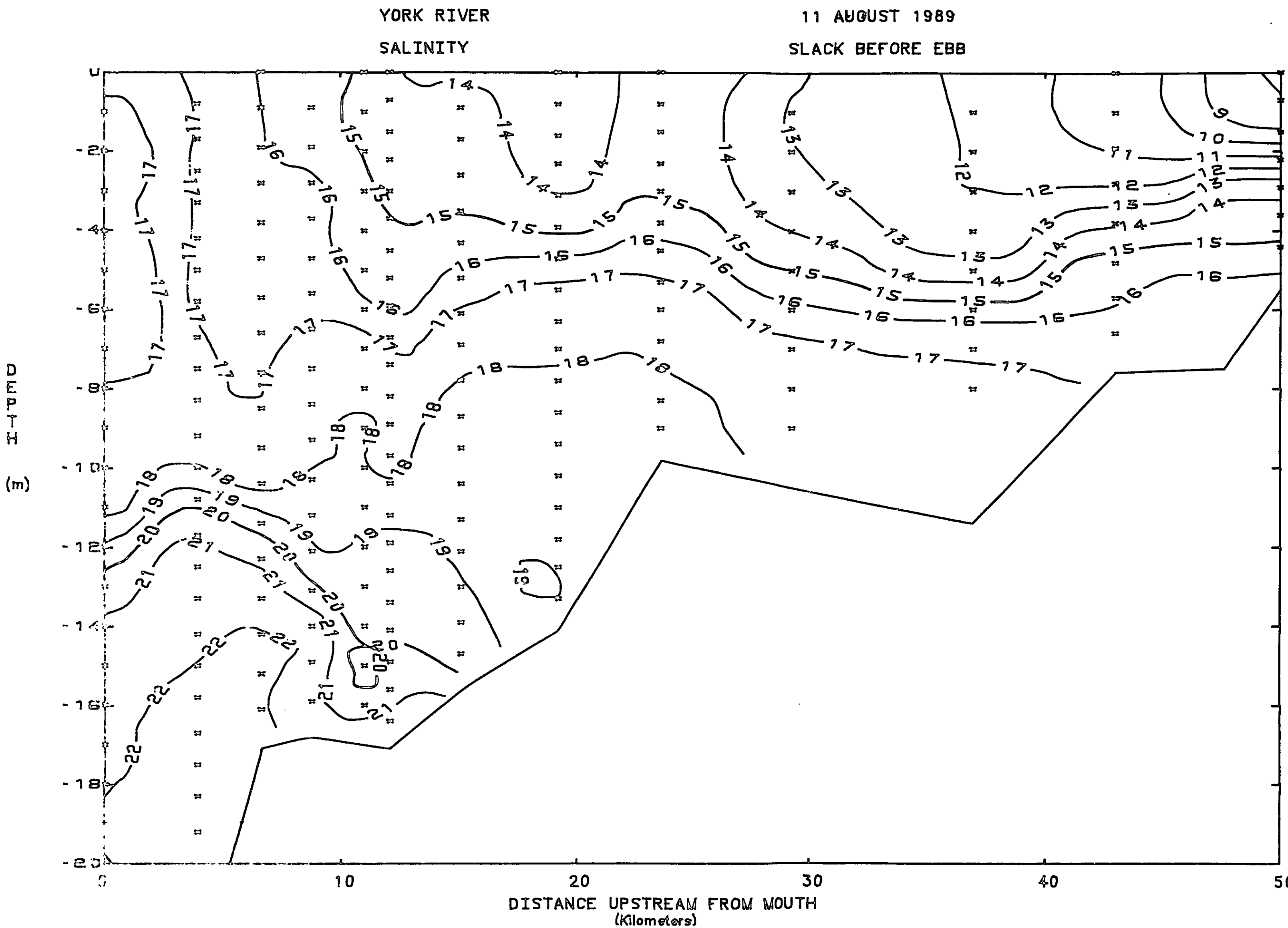


YORK RIVER
27 JULY 1989
SALINITY
SLACK BEFORE EBB
DEPTH
(m)
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
0
10
20
30
40
50
DISTANCE UPSTREAM FROM MOUTH
(Kilometers)


YORK RIVER
27 JULY 1989
DISSOLVED OXYGEN
SLACK BEFORE EBB
DEPTH (m)
DISTANCE UPSTREAM FROM MOUTH
(Kilometers)
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
0
10
20
30
40
50
3.0
4.0
5.0
6.0
7.0
8.0



YORK RIVER
11 AUGUST 1989
TEMPERATURE
SLACK BEFORE EBB
DEPTH
(m)
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
0
10
20
30
40
50
DISTANCE UPSTREAM FROM MOUTH
(Kilometers)
24
25
26



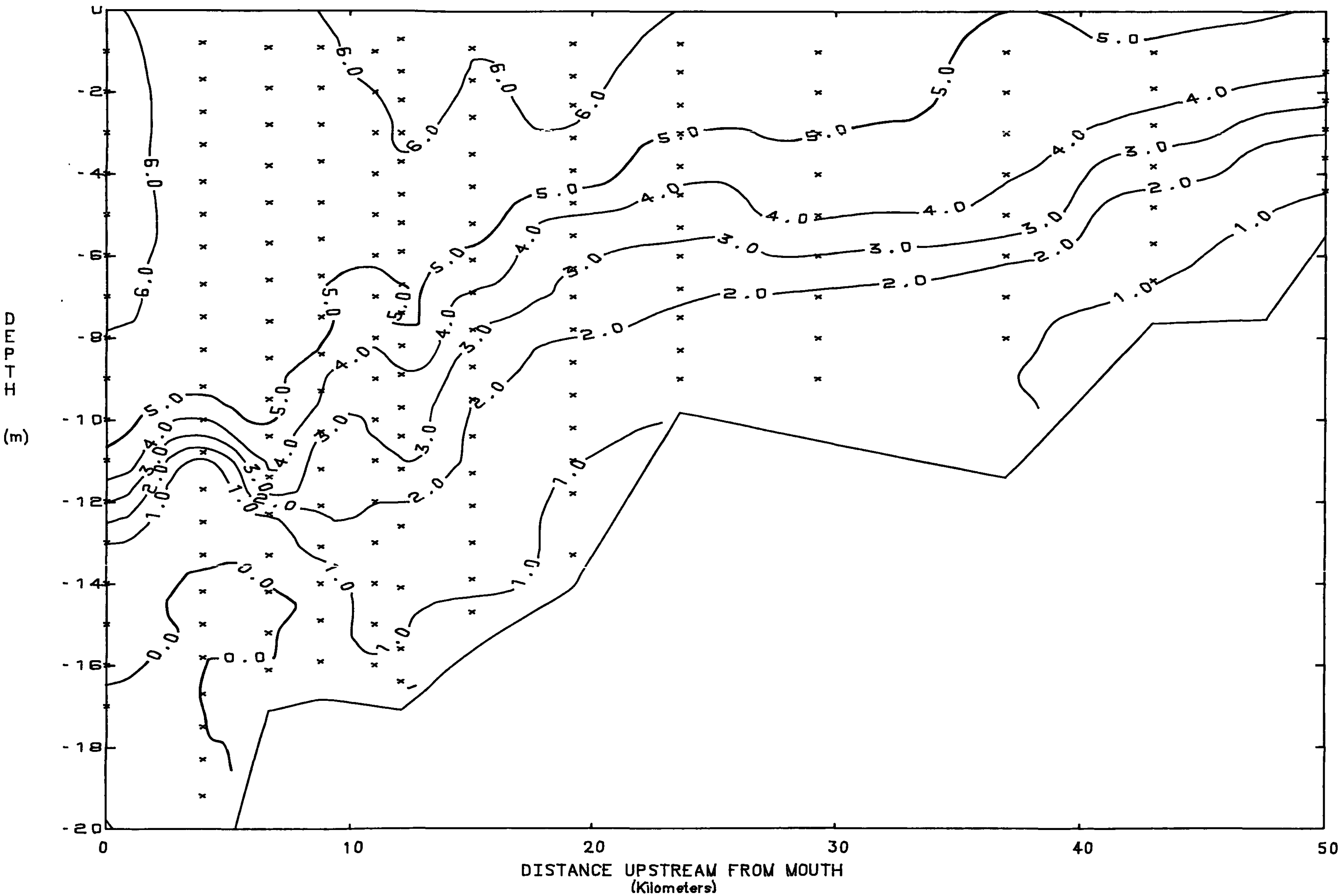
YORK RIVER
SALINITY
11 AUGUST 1989
SLACK BEFORE EBB
DEPTH
(m)
DISTANCE UPSTREAM FROM MOUTH
(Kilometers)
0
10
20
30
40
50
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20

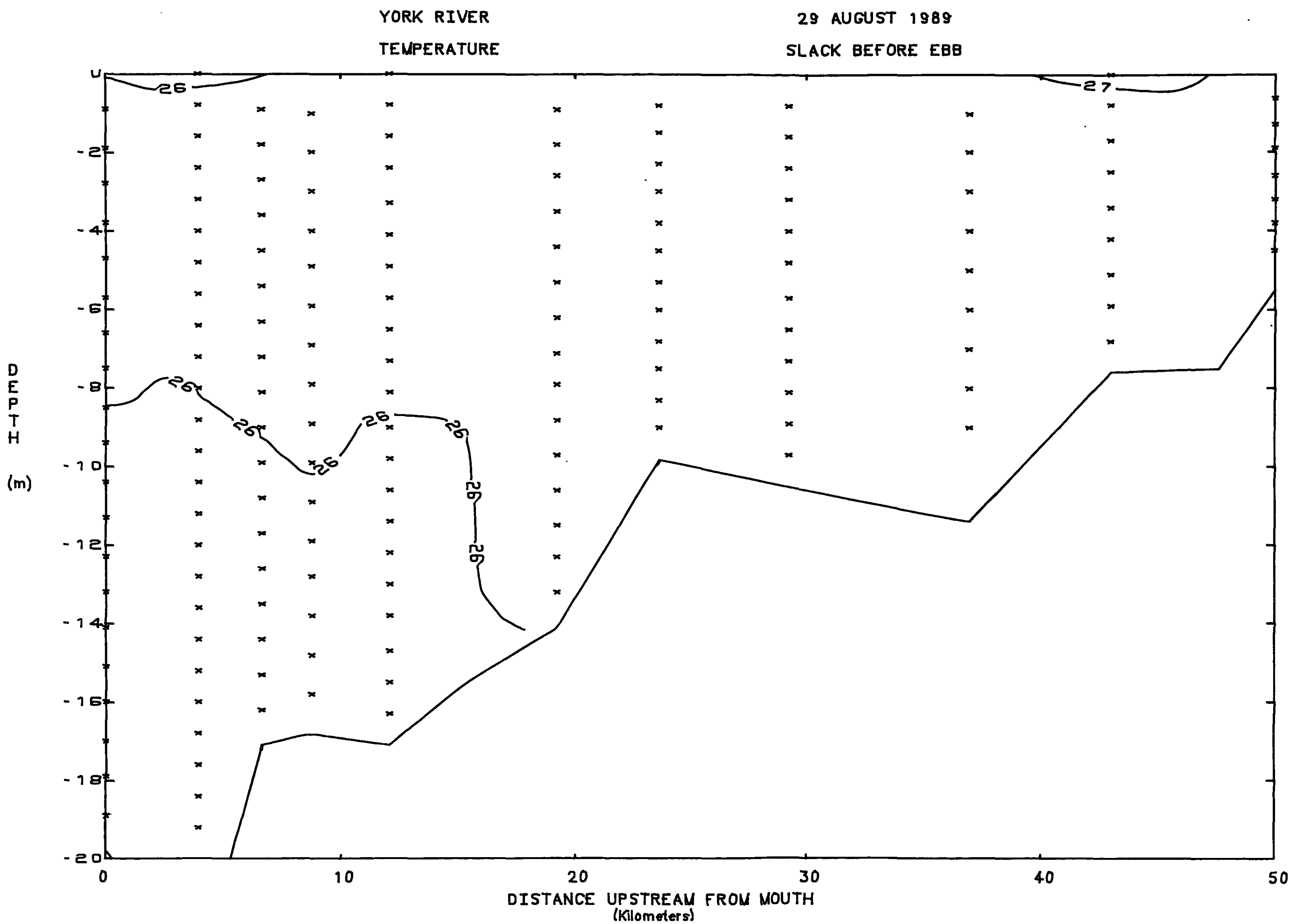
YORK RIVER

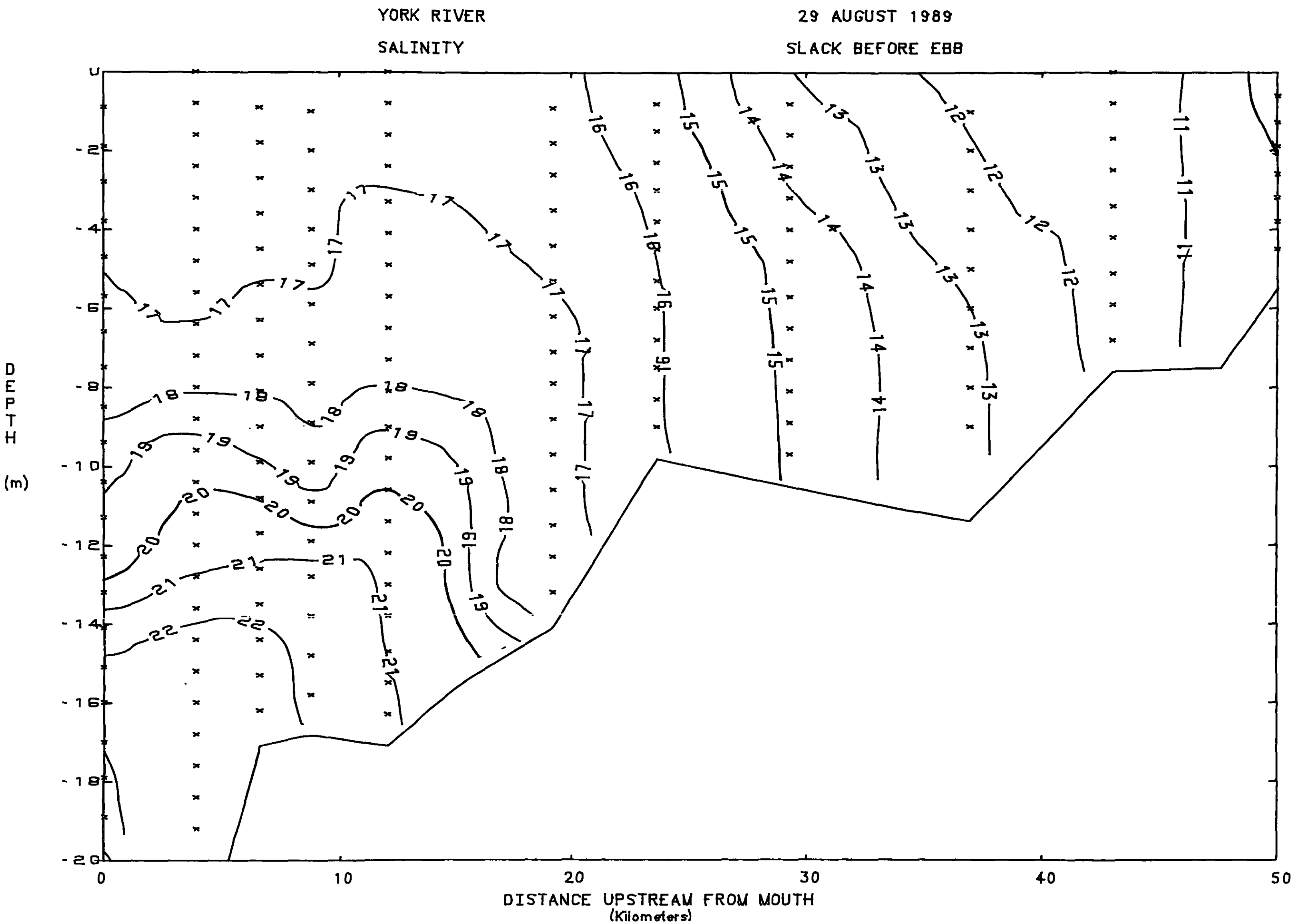
DISSOLVED OXYGEN

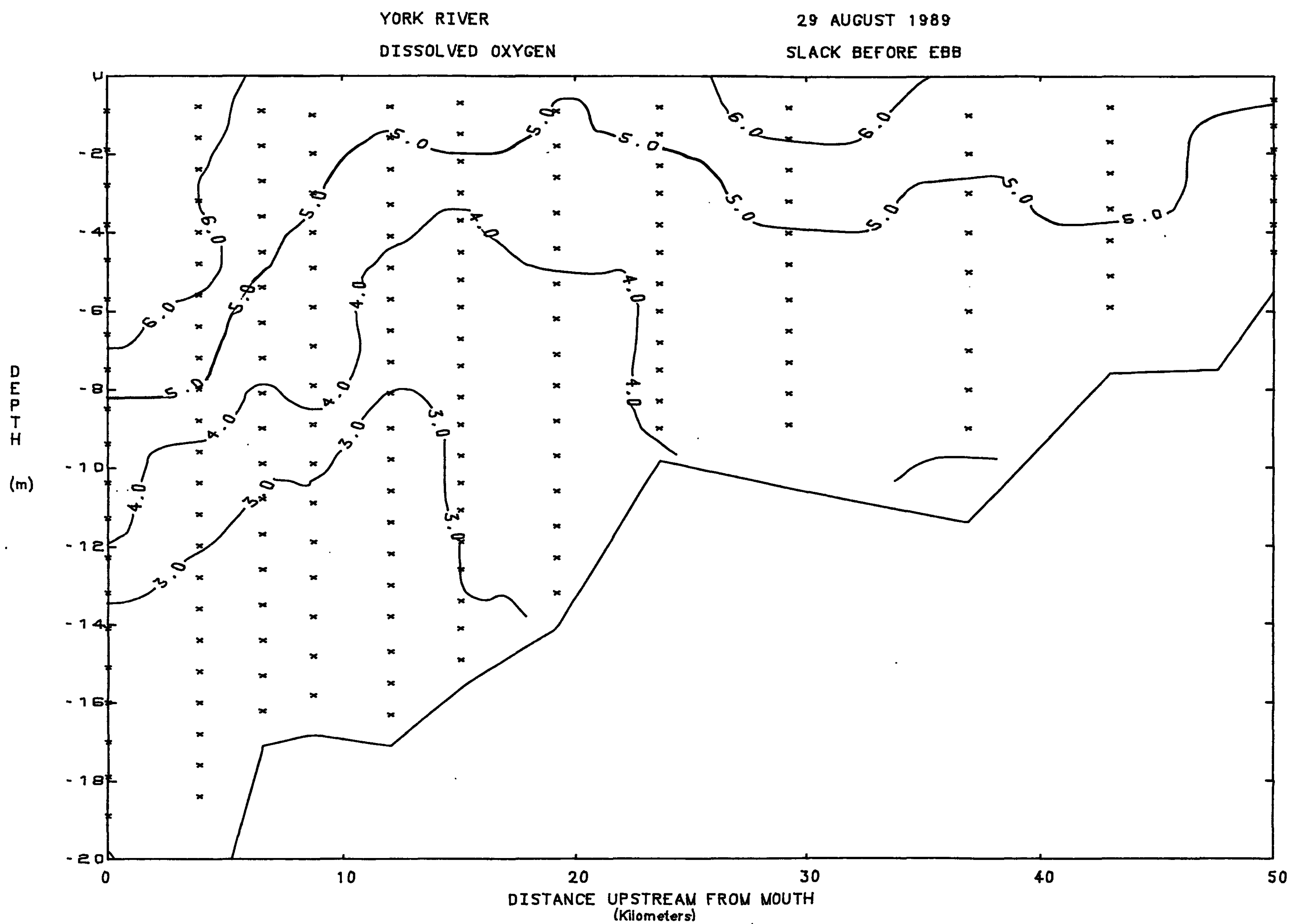
11 AUGUST 1989

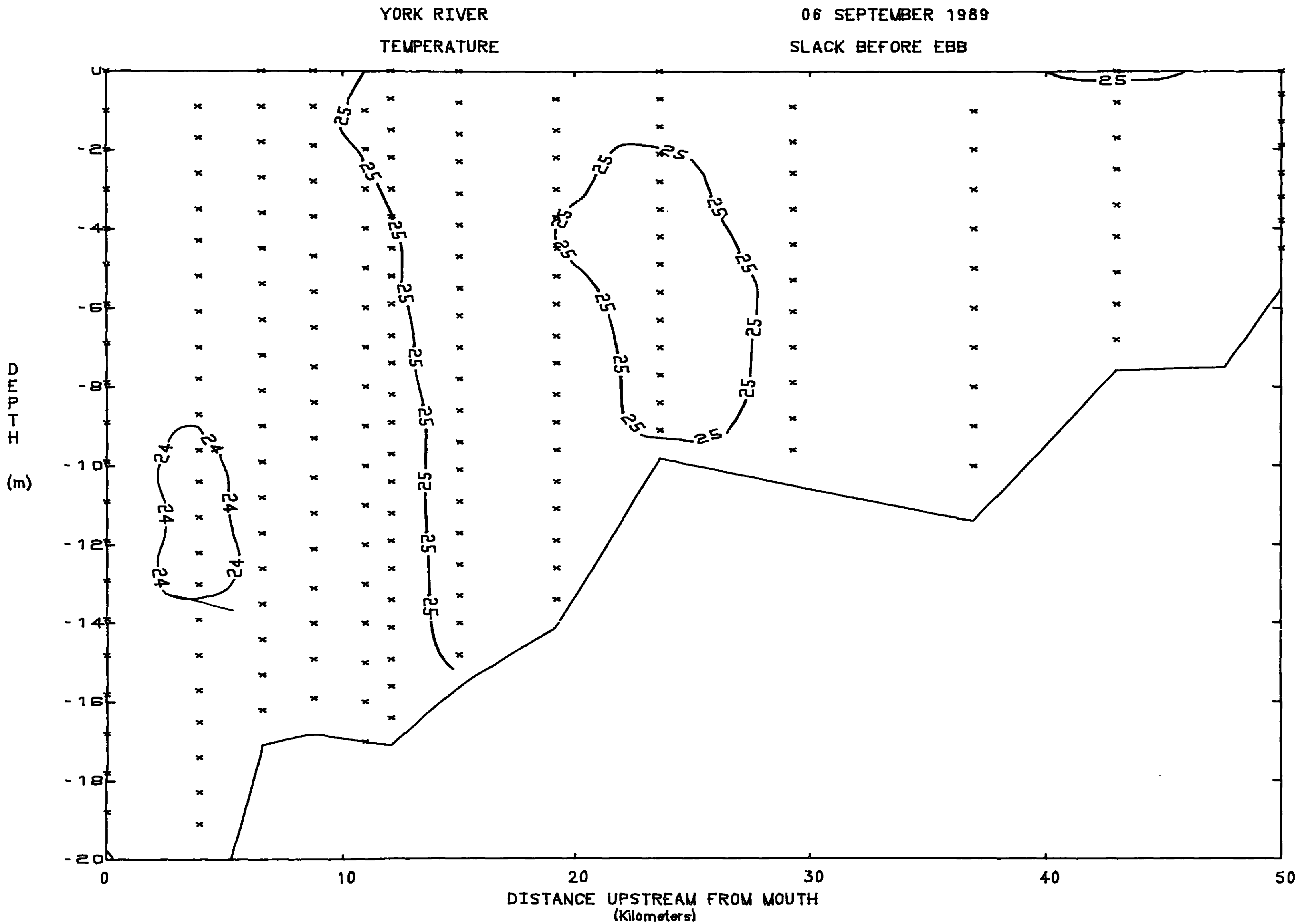
SLACK BEFORE EBB



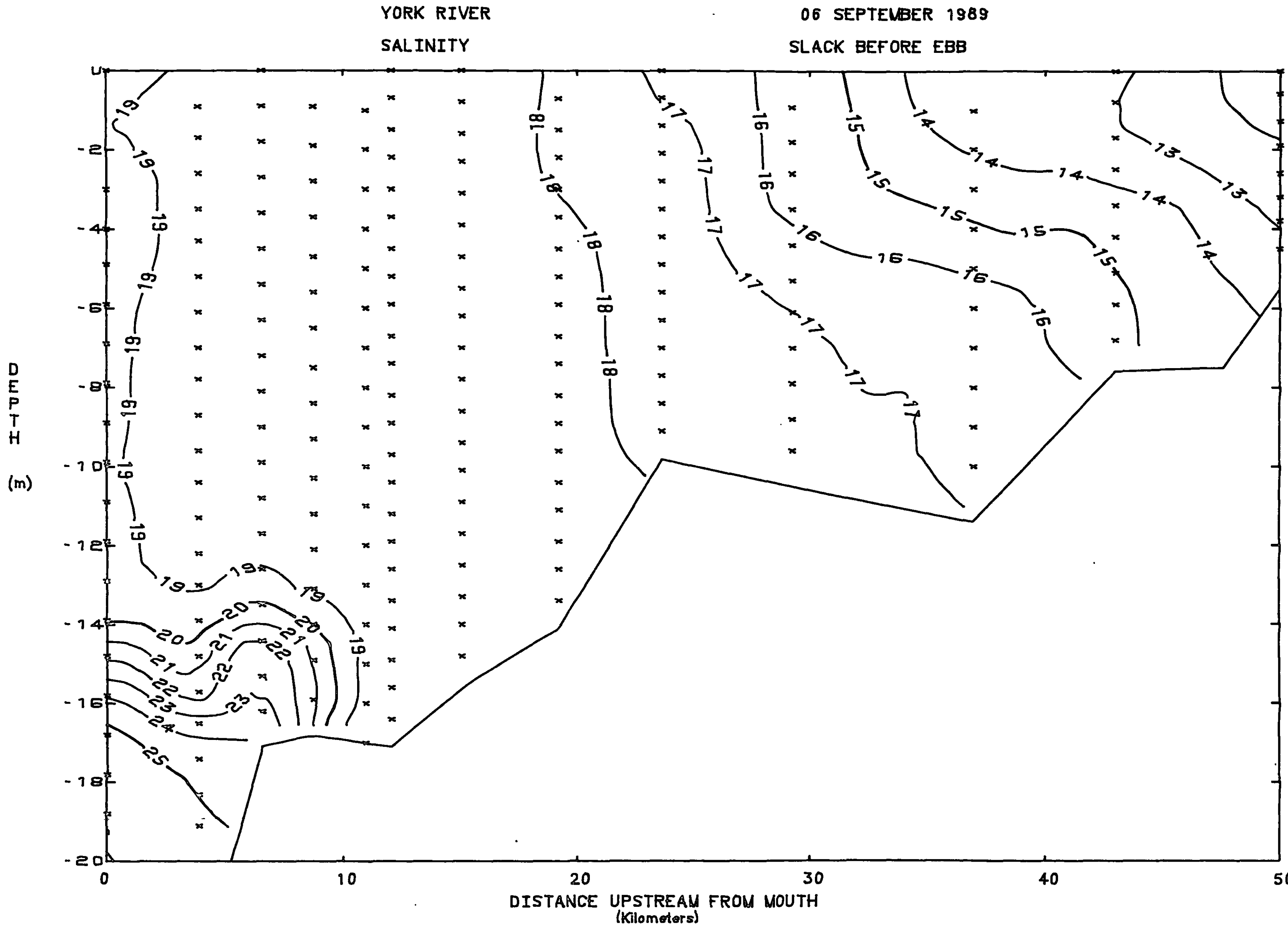

YORK RIVER
TEMPERATURE
29 AUGUST 1989
SLACK BEFORE EBB
26
27
DEPTH
(m)
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
0
10
20
30
40
50
DISTANCE UPSTREAM FROM MOUTH
(Kilometers)


YORK RIVER
SALINITY
29 AUGUST 1989
SLACK BEFORE EBB
DEPTH
(m)
DISTANCE UPSTREAM FROM MOUTH
(Kilometers)

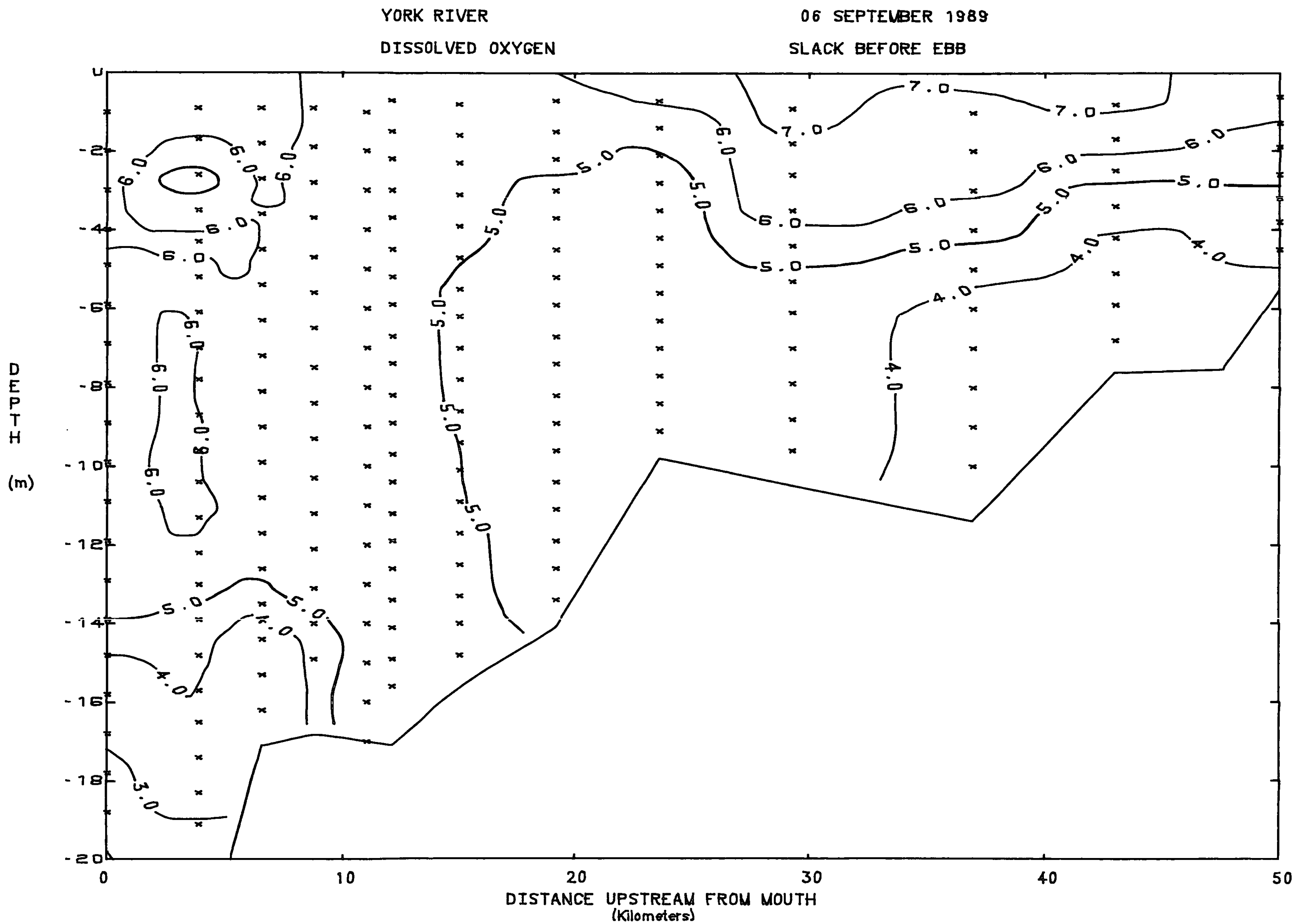

YORK RIVER
DISSOLVED OXYGEN
29 AUGUST 1989
SLACK BEFORE EBB
DEPTH
(m)
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
0
10
20
30
40
50
DISTANCE UPSTREAM FROM MOUTH
(Kilometers)
6.0
5.0
4.0
3.0



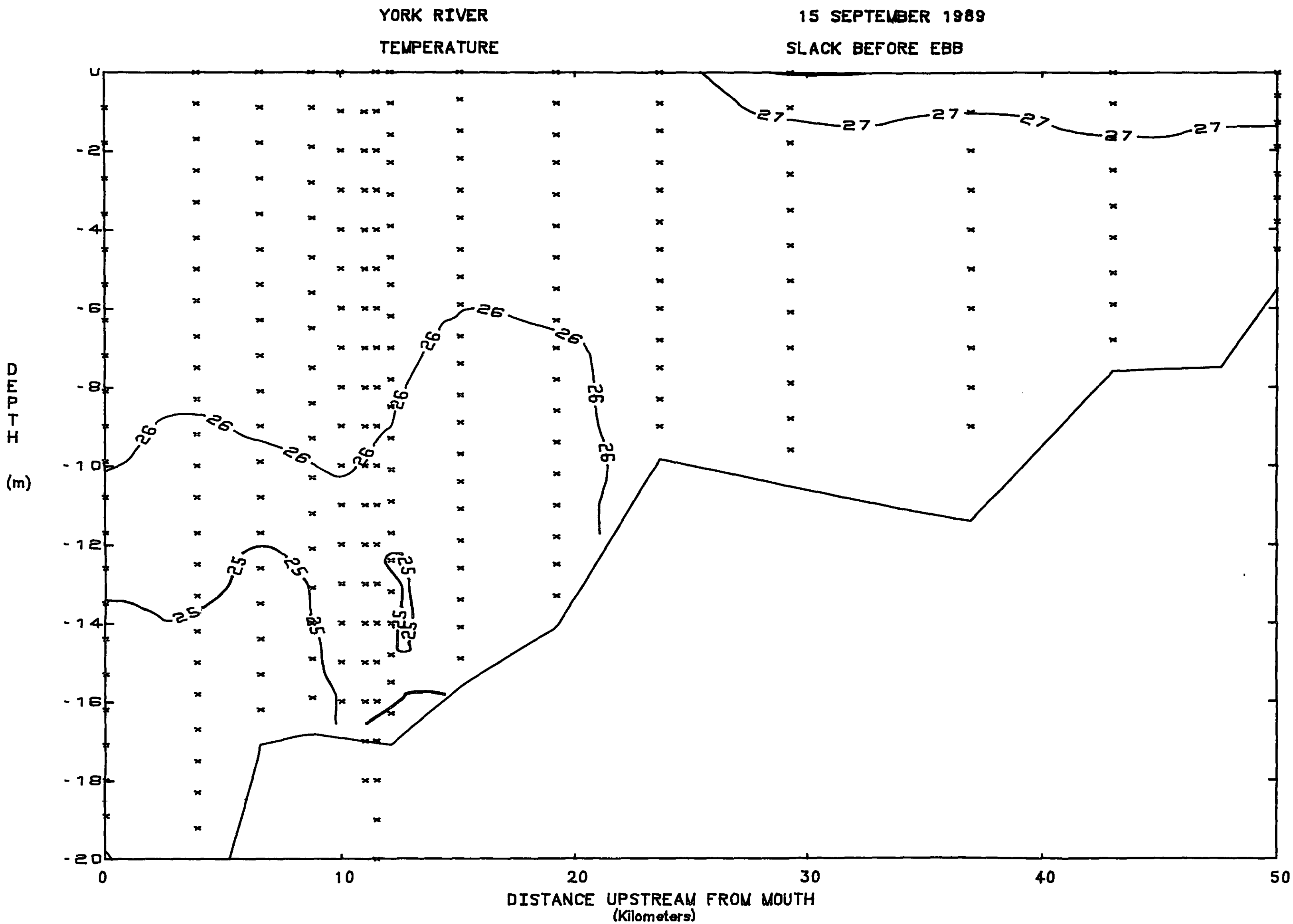
YORK RIVER
TEMPERATURE
06 SEPTEMBER 1989
SLACK BEFORE EBB
DEPTH
(m)
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
24
25
0
10
20
30
40
50
DISTANCE UPSTREAM FROM MOUTH
(Kilometers)



YORK RIVER
06 SEPTEMBER 1989
SALINITY
SLACK BEFORE EBB
DEPTH
(m)
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
0
10
20
30
40
50
DISTANCE UPSTREAM FROM MOUTH
(Kilometers)



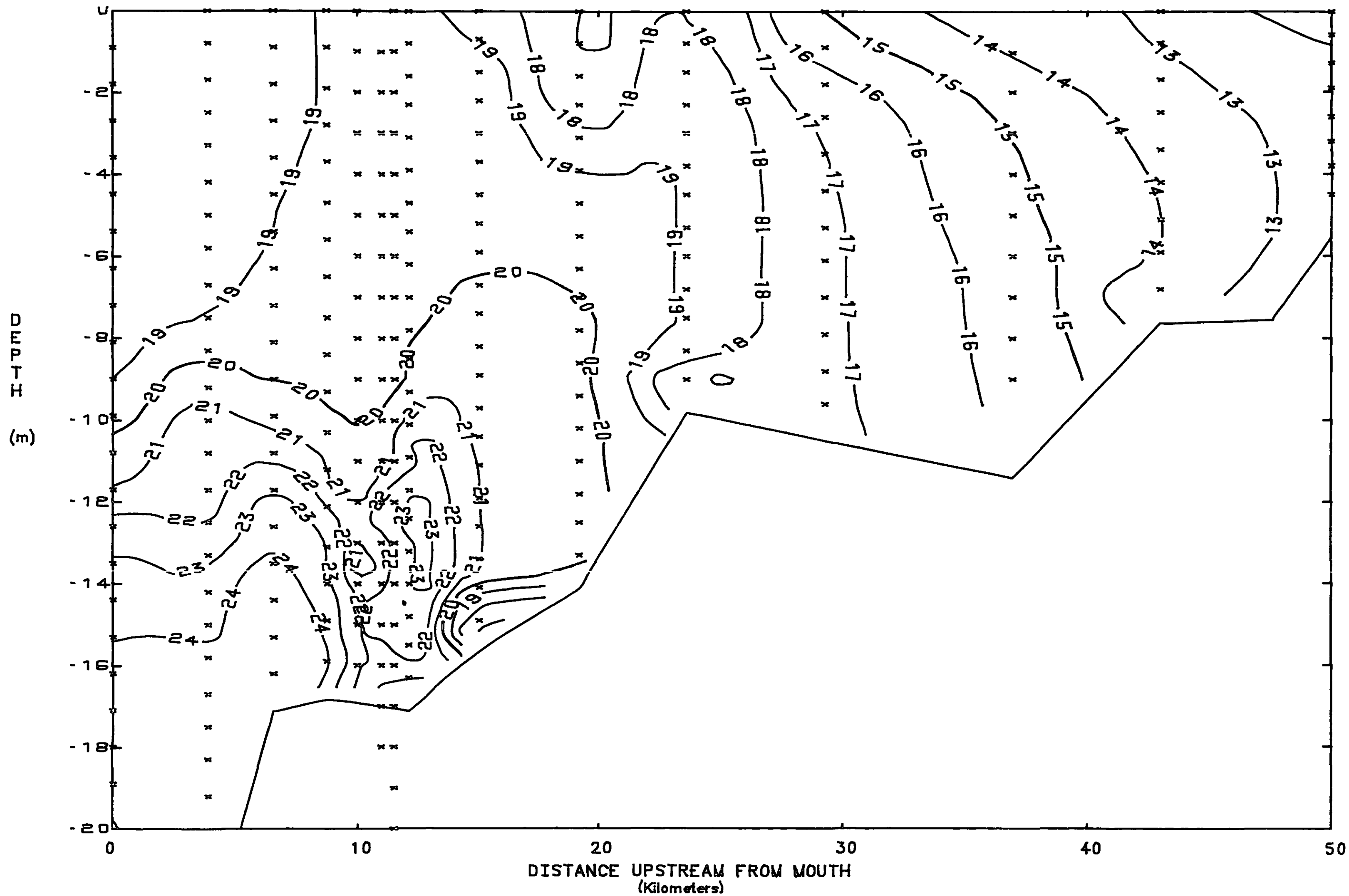
YORK RIVER
06 SEPTEMBER 1989
DISSOLVED OXYGEN
SLACK BEFORE EBB
DEPTH
(m)
DISTANCE UPSTREAM FROM MOUTH
(Kilometers)

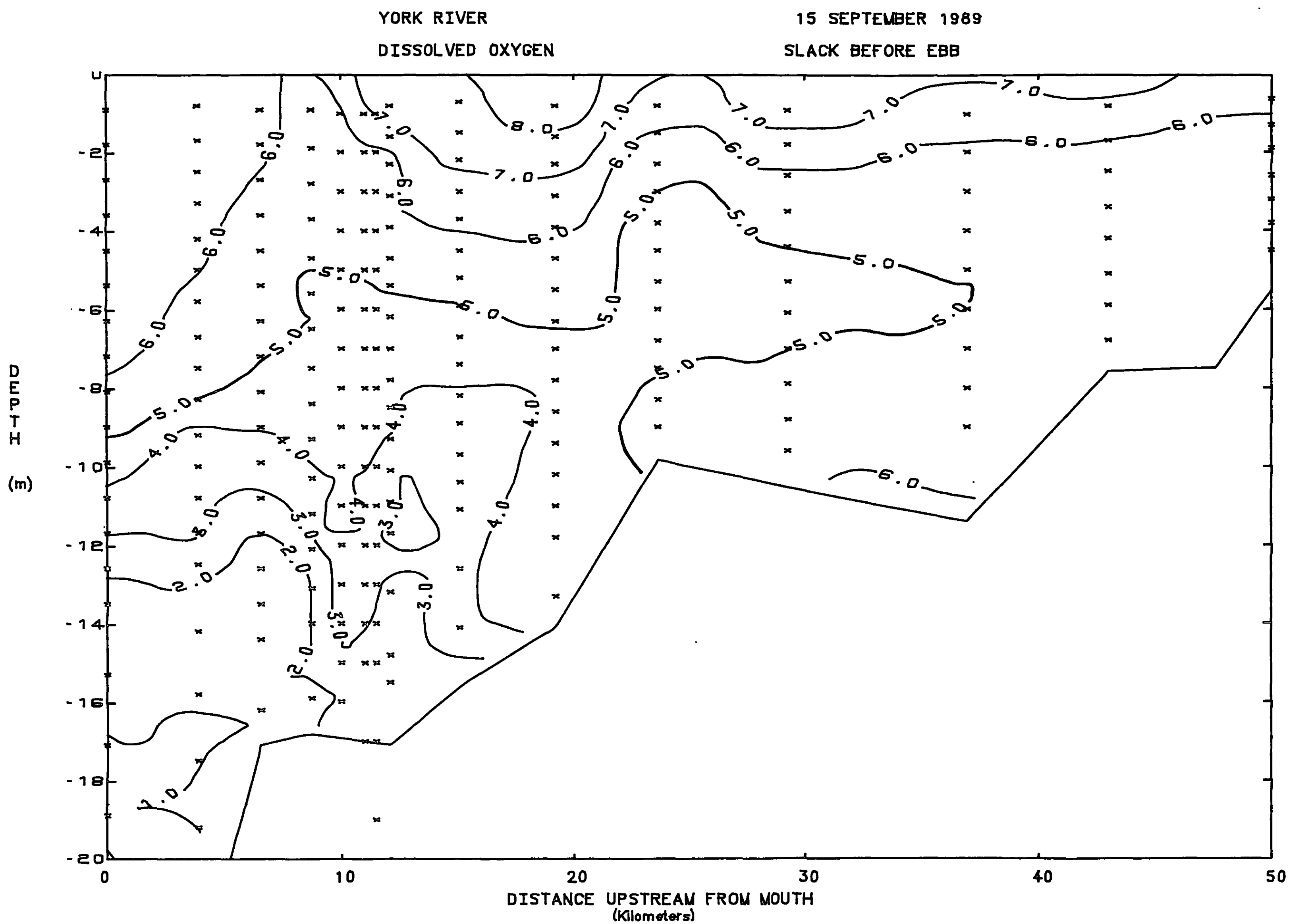


YORK RIVER
TEMPERATURE
15 SEPTEMBER 1989
SLACK BEFORE EBB
DEPTH
(m)
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
0
10
20
30
40
50
DISTANCE UPSTREAM FROM MOUTH
(Kilometers)
27
26
25

YORK RIVER 15 SEPTEMBER 1989

SALINITY SLACK BEFORE EBB




YORK RIVER
15 SEPTEMBER 1989
DISSOLVED OXYGEN
SLACK BEFORE EBB
DEPTH
(m)
DISTANCE UPSTREAM FROM MOUTH
(Kilometers)
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
0
10
20
30
40
50
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0