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Bay Observations - Hydrography  
Cruises of Nov. 27, 1961 and  
Nov. 20, 1962

VIRGINIA INSTITUTE OF MARINE SCIENCE

DATA REPORT 1

1965

Virginia Institute of Marine Science

Gloucester Point, Virginia

BAY OBSERVATIONS - HYDROGRAPHY

Cruises of November 27, 1961

and November 20, 1962

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Data Report 1

W. J. Hargis, Jr.

Director

January 1965

## BAY OBSERVATIONS - HYDROGRAPHY

This report presents data obtained on training cruises in the lower Chesapeake Bay. The purpose of these cruises was to study the physical and chemical characteristics of estuarine water in a section from the York River mouth to Cape Charles. In 1961 the observations were carried out aboard the R/V Pathfinder; in 1962 measurements were made from the R/V Langley. Personnel contributing to the 1961 cruise include: W. Dillon, R. Fournier, W. Leon, R. Miller, C. Rutherford, R. Stone and J. Whitcomb. In 1962 participants include: P. Chanley, J. Faunce, A. Lawler, M. Lynch, J. McCain, R. Morales, W. Smith, D. Tuck, S. Wilson.

### METHODS

Stations were positioned by ranging, sextant bearings and depth sounding. Locations are given in Figure 1. Water samples were taken at 10-foot depth intervals with water bottles of the Nansen, or Frautschy types. Salinity was determined by Mohr titrations of the chloride ion. Dissolved oxygen concentrations were analysed by the standard Winkler method. The pH was recorded immediately upon recovery of the sample, with Beckman model G and N pH meters. Subsurface current velocities and direction were obtained with a Pritchard drag; surface currents were measured with a spar float and stop watch. Drift bottles and Woodhead bottom drifters were released in groups of five at the central Bay stations (4, 5, 6). Disk visibility was estimated by lowering a 20cm secchi disc.

Temperature profiles were obtained with a portable temperature indicator equipped with a cable mounted thermistor. On the 1962 cruise both temperature and salinity were measured with a portable salinometer of the RS-5 series (Industrial Instruments, Inc.). Temperature data were supplemented with bathythermograph lowerings. Surface bucket temperatures and chlorinity titrations provided a check on the mechanical units and these data were used, where necessary, to correct values taken at depth intervals.

## RESULTS

Values obtained on the 1961 cruise are listed in Table 1; results for the 1962 cruise are given in Table 2.

Vertical distributions showed a small vertical temperature gradient; differences between surface and bottom were less than  $1.2^{\circ}\text{C}$  (Fig. 2). In the 1962 cruise, coolest water was encountered at the surface just off the York River mouth (station 2) whereas slightly warmer water ( $11.0^{\circ}\text{C}$ ) occurred in bottom water to the east.

Vertical patterns of salinity exhibit haline stratification characteristic of many estuarine systems (Fig. 3). In 1961 concentrations varied from  $19.2$  ‰ in the surface of the York River to  $29.79$  ‰ near the bay floor off Cape Charles.

Vertical variations of density (Fig. 4) conform to patterns of salinity with less dense freshened water in the surface layer and more dense salty water in the lower layer.

In the 1961 observations, dissolved oxygen concentrations varied within narrow limits from place to place and with depth at each station (Fig. 5). Values ranged about 2.00 mg/l in 1962. Concentrations were higher (10.00 mg/l) at the surface of the York River than elsewhere. The pH ranged less than 0.4 pH units both areally and vertically on both cruises (Fig. 6).

Current velocities (Tables 1 and 2) are representative of water movement in Chesapeake Bay produced by the oscillatory motion of the tide (Haight et al. 1930). Three of the 15 drift bottles released in the central Bay on the 1962 cruise were recovered within 11 days near Currituck Beach, N. C. and one was found at New Point Comfort, Va. (Fig. 1). Two of the 18 bottom drifters released at corresponding stations were recovered within 32 days near Dyer Creek (Fig. 1).

#### DISCUSSION

The broad pattern of hydrographic measurements of the 1962 cruise resemble those of the 1961 cruise. Greatest differences occurred in concentrations of dissolved oxygen. Salinity averaged about 1 ‰ higher in 1962 than in 1961. These differences may be attributed to varying hydrologic and meteorologic conditions at the time of, and preceding, the observations periods.

The observations made during these cruises are in general agreement with patterns and variations reported by Stroup and Lynn (1963). The slight positive temperature gradient is typical of lower bay water influenced by cooling and mixing in the fall season. Distributions of salinity are consistent with patterns of estuarine

flow, with seaward flowing freshened water in the surface layer and upstream flowing salty water in the lower layer.

REFERENCES

- Haight, F. J., H. E. Finnegen, and G. L. Anderson. 1930. Tides and currents in Chesapeake Bay and tributaries. U. S. Coast and Geodetic Survey, Spec. Publ. 162, 143 p.
- Stroup, E. D. and R. J. Lynn. 1963. Atlas of salinity and temperature distribution in Chesapeake Bay 1952 - 1961 and seasonal averages 1949 - 1961. Chesapeake Bay Institute, Graphical Summary Report 2, 409 p.

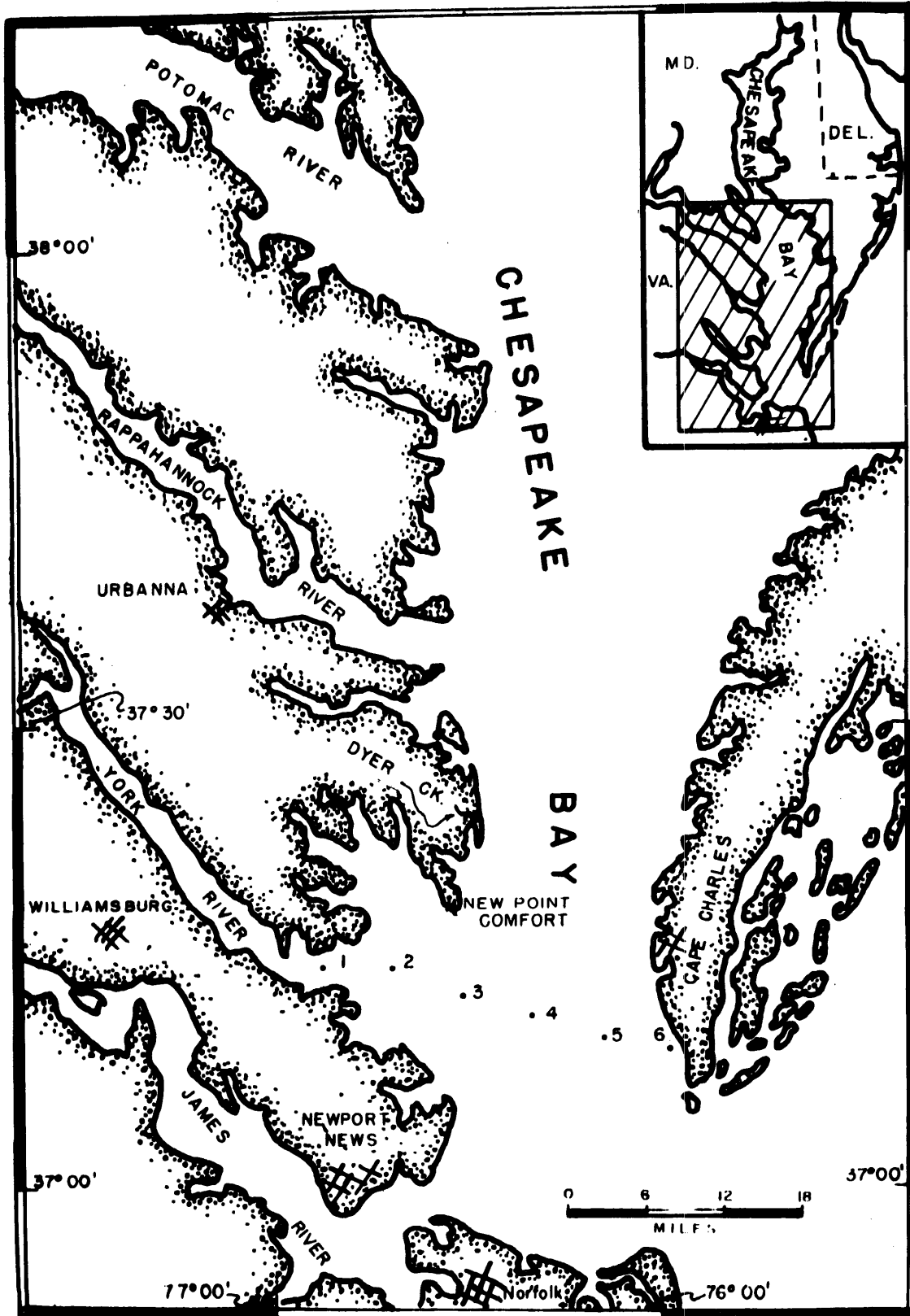


Figure 1. Location of stations, lower Chesapeake Bay, Virginia



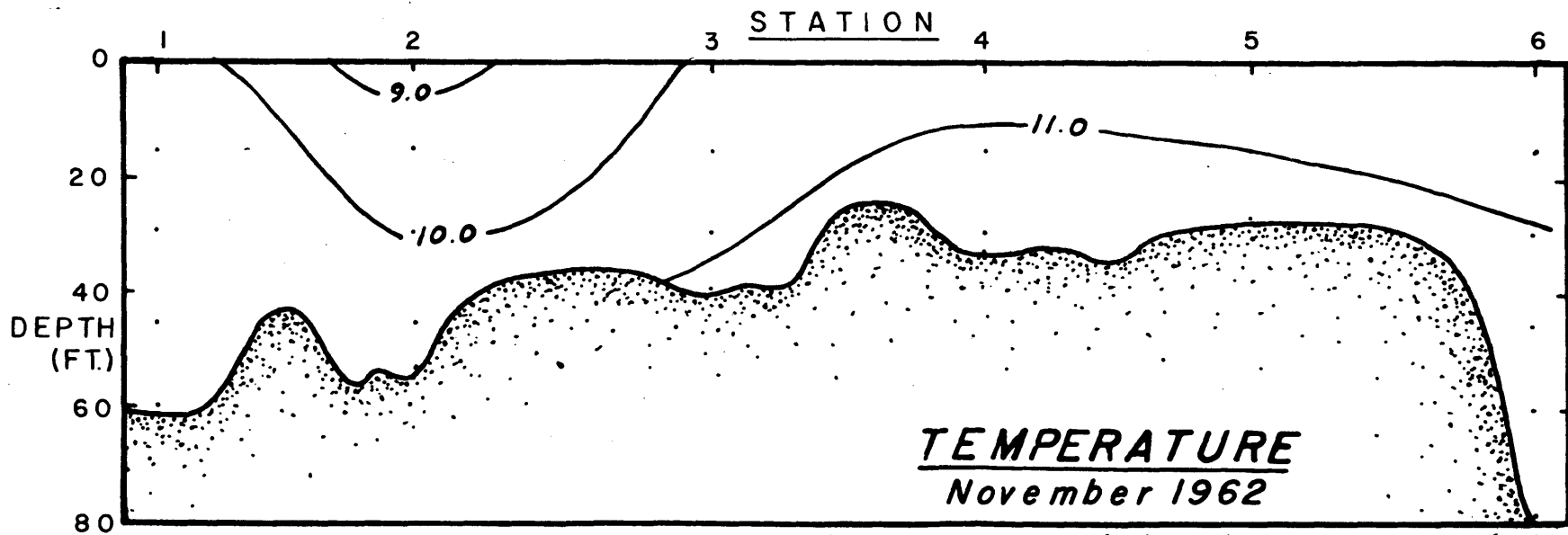
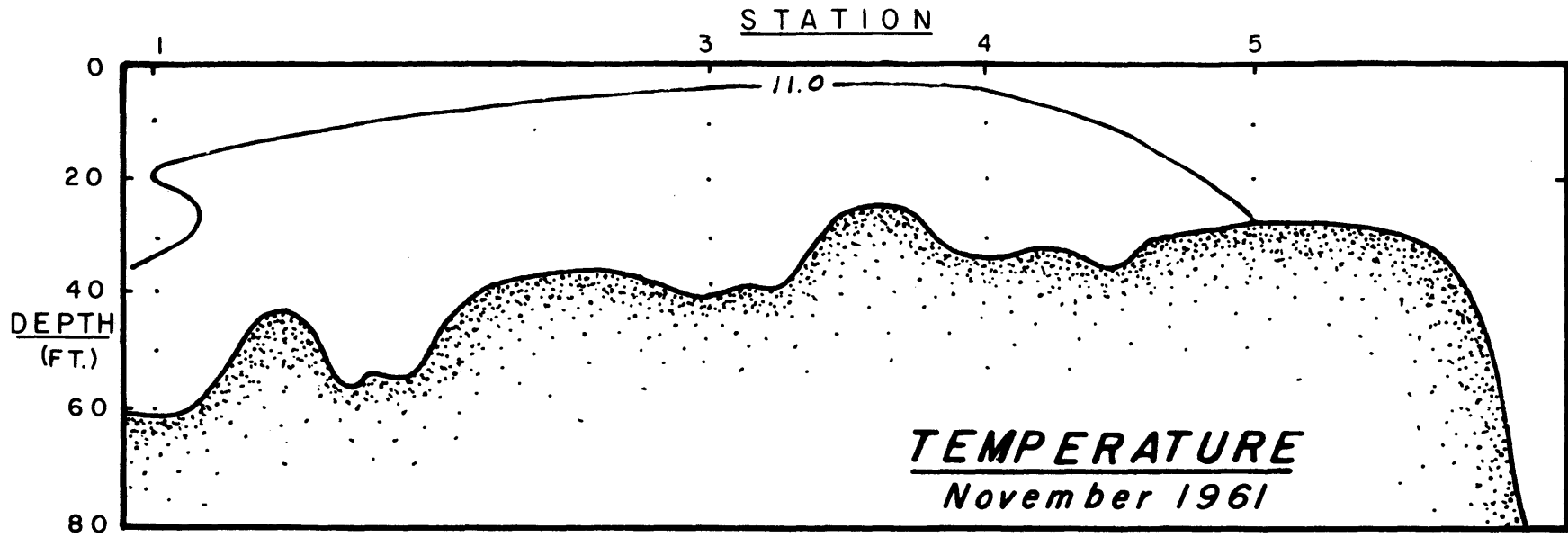


Figure 2. Vertical distribution of temperature, °C, November 20, 1961 (upper), November 27, 1962 (lower) across Chesapeake Bay from the mouth of the York River.

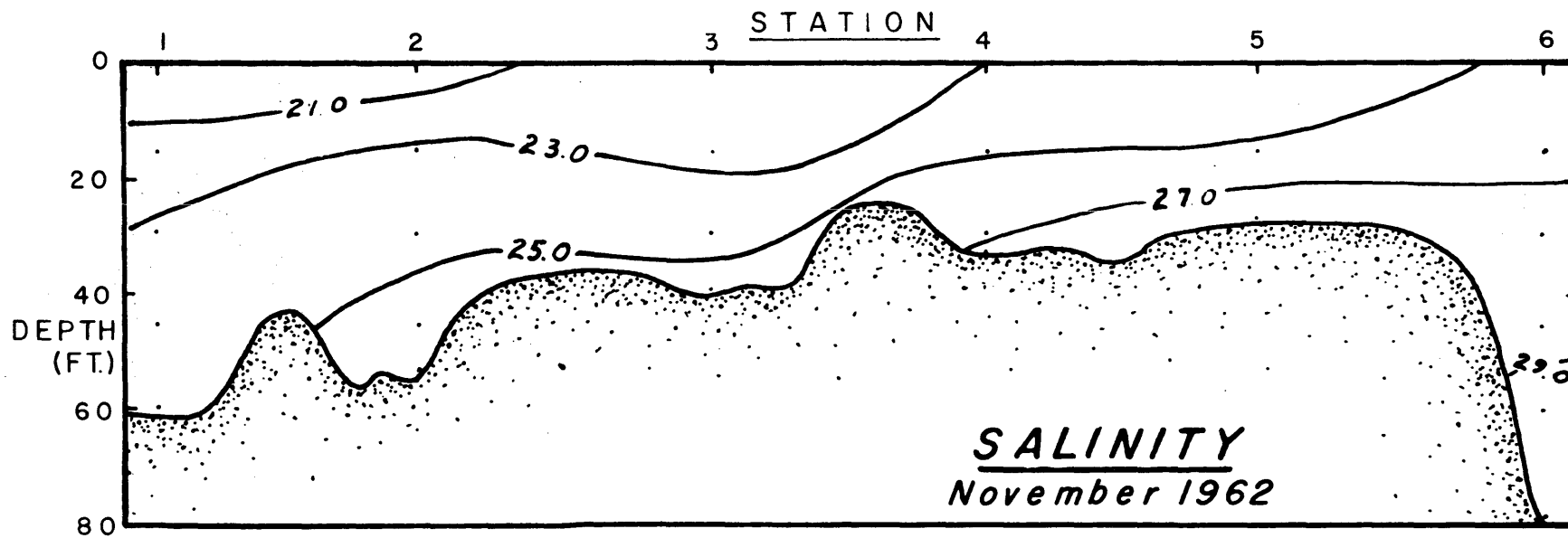
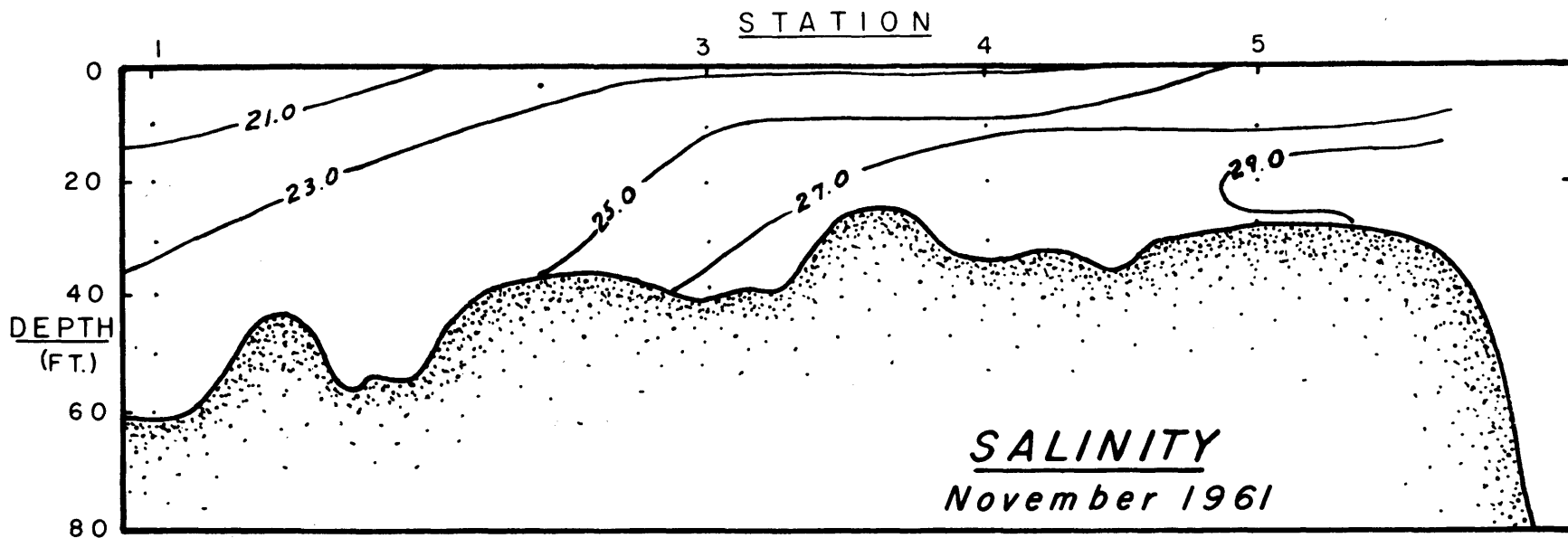


Figure 3. Vertical distribution of salinity. ‰ November 20, 1961 (upper) and November 27, 1962 (lower) across Chesapeake Bay from the mouth of the York River.







Table 1. Hydrographic data, cruise of R/V Pathfinder November 27, 1961. Weather: Partly cloudy, NW winds 3-8 mph. Tide: Predominately flood:

YORK RIVER - CHESAPEAKE BAY

STATION	TIME (EST)	DEPTH (ft)	DISK VISIBILITY (ft)	CURRENT VELOCITY (knts)	TEMP (°C)	SALINITY (‰)	DENSITY ( $\sigma_t$ )	pH	OXYGEN (mg/l)	(% sat.)
1 37°13.8'N 76°26.8'W	0900	0	5	0.54	10.70	19.20	14.61	7.43	8.03	83.88
		10			10.88	20.53	15.61	8.09	7.77	82.05
		20		11.00	21.94	16.68	8.05	7.79	83.21	
		30		0.68	10.93	22.92	17.45	8.09	7.70	82.54
		40		11.11	23.31	17.72	8.09	7.73	83.55	
		50		11.13	23.53	17.89	8.09	7.61	82.64	
		60		0.61	11.15	23.69	18.02	8.02	7.73	83.88
3 37°12.0'N 76°16.3'W	1045	0	7	0.39	10.60	22.12	16.88	8.15	8.30	88.03
		10			11.09	23.80	18.10	8.24	7.84	85.12
		20		0.93	11.15	26.78	20.41	8.14	7.57	83.46
		30		11.20	25.34	19.82	8.21	7.51	82.45	
		38		0.77	11.22	27.14	20.68	8.20	7.53	83.65
4 37°10.5'N 76°11.5'W	1210	0	8	0.75	10.63	22.39	17.08	8.39	8.39	89.28
		10			11.01	23.57	17.94	7.69	8.11	87.72
		20		11.31	28.12	21.41	7.81	7.74	86.72	
		30		0.84	11.30	28.21	21.48	8.01	7.67	85.92
5 37°10.7'N 76°01.1'W	1325	0	8	1.24	10.87	25.26	19.27	7.90	8.30	90.43
		10			10.75	25.44	19.42	7.92	8.23	89.30
		20		10.69	29.72	22.74	7.98	7.93	88.66	
		28		0.75	10.65	29.00	29.00	8.01	7.93	88.09

Table 2. Hydrographic data, cruise of R/V Langley, November 20, 1962. Weather: Overcast, intermittent precipitation, Tide: Flood to ebb.

YORK RIVER - CHESAPEAKE BAY

STATION	TIME (EST)	DEPTH (ft)	DISK VISIBILITY (ft)	CURRENT		TEMP (°C)	SALINITY (‰)	DENSITY ( $\sigma_t$ )	pH	OXYGEN	
				VELOCITY (knts)	DIRECTION (°true)					(mg/l)	(% sat)
1 37°13.8'N 46°26.8'W	0800	0	7	0.65	270	10.23	19.61	14.91	7.90	10.24	118.0
		15		0.29	270	10.96	22.66	17.24	7.90	9.16	98.5
		30		0.39	270	11.04	23.32	17.74	8.00	8.75	94.6
		45		0.44	270	11.42	24.78	18.81	8.00	8.25	90.0
		60				11.42	24.78	18.81	8.05	8.14	89.6
2 37°14.7'N 76°16.3'W	0920	0	8	0.71	270	9.36	20.77	16.01	8.10	9.38	95.7
		15		0.20	270	- -	23.10	- -	8.10	9.55	- -
		30		0.22	270	9.88	24.98	19.20	8.20	9.39	99.8
		45		0.12	270	10.16	25.38	19.47	8.20	8.43	90.4
		53		0.17	270	10.36	25.10	19.23	8.20	8.19	88.1
3 37°12.0'N 76°16.3'W	1045	0	9	0.45	135	10.04	22.21	17.03	8.20	9.41	98.6
		15		0.45	200	10.44	22.23	16.99	8.30	9.31	98.5
		30		0.12	270	10.88	24.08	18.36	8.30	8.62	93.3
		38		0.27	290	11.12	25.61	19.50	8.30	8.43	92.4
4 37°10.5'N 37°10.5'N 76°11.5'W (Oxygen at 1600 only)	1151	0	9	0.80	200	10.52	23.19	17.73	8.10	8.15	- -
		15		0.19	240	11.04	25.53	19.45	8.10	- -	- -
		30		0.15	140	11.08	27.13	20.69	8.10	8.72	- -
		34		0.17	190	11.20	27.30	20.80			- -
5 37°10.7'N 76°06.2'W	1250	0	10	0.27	210	10.50	23.78	18.17	8.30	9.41	101.0
		15		0.20	180	11.00	25.06	19.10	8.30	9.60	105.0
		28		0.00	- -	11.28	27.83	21.20	8.30	8.72	97.5
6 37°10.8'N 76°01.1'W	1400	0	9	0.57	000	10.72	25.40	19.40	8.24	9.38	102.0
		15		0.42	000	10.80	25.76	19.67	8.19	9.23	101.0
		30		0.44	000	11.00	27.59	21.05	8.16	9.02	100.0
		45		0.51	000	11.00	28.47	21.47	8.29	9.07	101.0
		60		0.57	000	11.04	29.79	22.75	8.33	8.79	99.0
		80		0.63	000	10.96	29.79	22.76	8.22	8.69	97.9