

1971 HUDSON RIVER SURVEY

conducted by the

INTERSTATE SANITATION COMMISSION

## 1971 HUDSON RIVER SURVEY

### INTRODUCTION

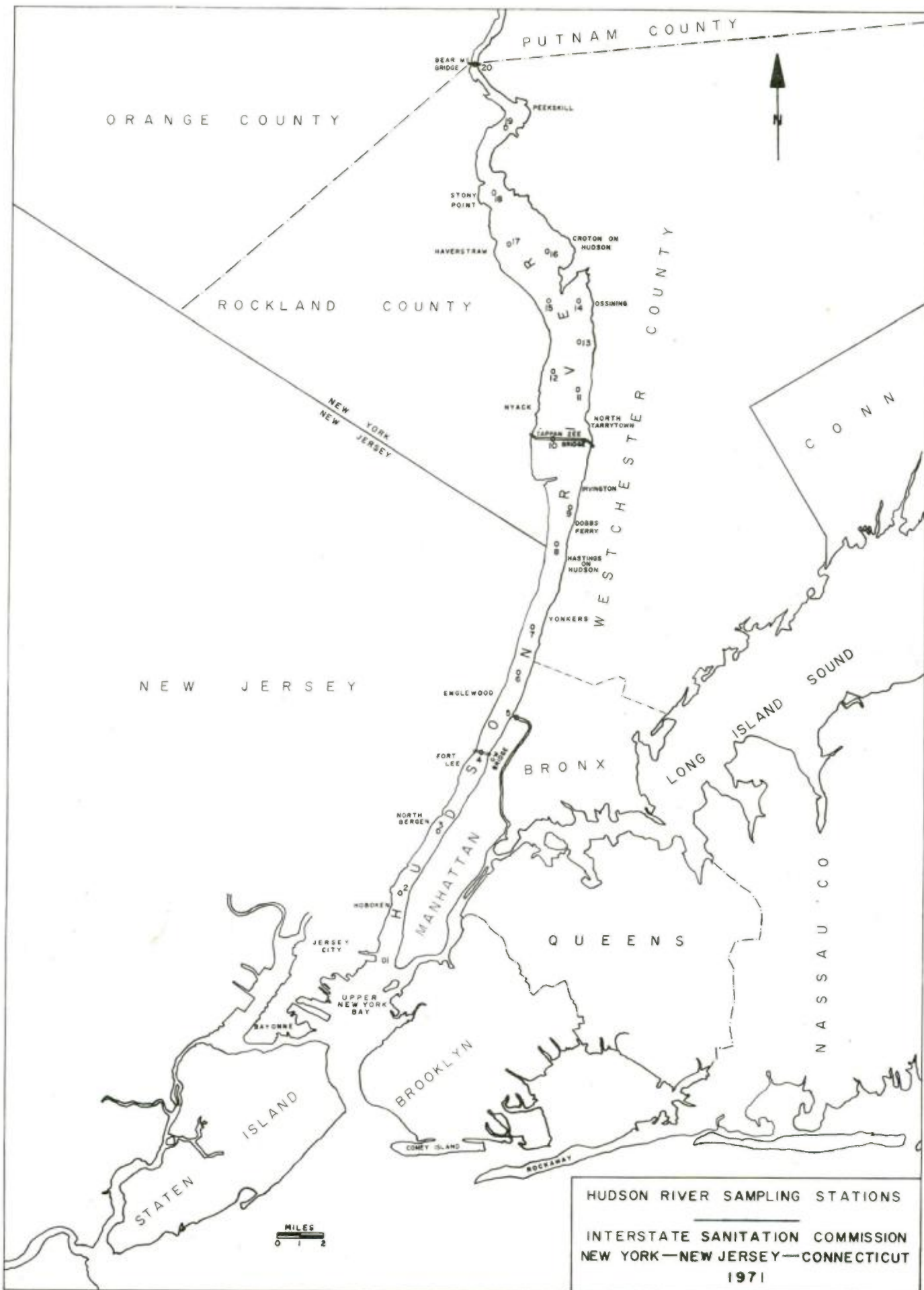
The Hudson River is approximately 306 miles long and runs southward from Henderson Lake in Essex County, New York, to the Upper New York Bay. The southernmost 40 nautical miles of the Hudson River lie within the Interstate Sanitation District; this is the portion of the river that was studied. This section of the river is bounded on the south by the Upper New York Bay and on the north by the Bear Mountain Bridge. The purposes of the study were to determine the present condition of the waters and to establish a baseline for future studies.

### PROCEDURE

Nineteen sampling stations were selected in the Hudson River and one station (Station 5) was selected in the Harlem River where it meets the Hudson. The stations are shown on the survey map on the following page and a description of each station is given at the end of this report.

Five boats were used to collect samples on eight days between August 2, 1971, and August 12, 1971. All samples were taken during daylight hours. Each station was sampled three times a day approximately five feet below the surface. Determinations were made for the following parameters: temperature, chlorides, dissolved oxygen, fecal coliform density, pH, biochemical oxygen demand, turbidity, orthophosphate phosphorus, nitrate, nitrite, ammonia, nitrogen, total carbon, total organic carbon, chlorophyll A, chromium (hexavalent), copper, nickel, zinc, cadmium, mercury, and lead. All tests were made using instrumental techniques or according to Standard Methods for the Examination of Water and Wastewater.

The data for each station were analyzed and arithmetic means were calculated for each parameter except fecal coliform density and pH. The geometric mean was computed for fecal coliform density and logarithmic averages were used for pH.



## RESULTS

The results obtained at each station are summarized in the table on the following page.

### Dissolved Oxygen

The average dissolved oxygen values ranged from a low of 2.26 mg/l at Station 1 to a high of 6.93 mg/l at Station 12. The minimum dissolved oxygen values ranged from 1.56 mg/l at Station 1 to 6.15 mg/l at Station 10. The values obtained at Station 5 in the Harlem River for average and minimum dissolved oxygen are 3.04 mg/l and 1.95 mg/l, respectively. Chart 1 shows the dissolved oxygen profile along the Hudson River.

### Fecal Coliform Density

The average fecal coliform density ranged from a maximum value of "less than" 2500 organisms/100 ml to a minimum value of 45 organisms/100 ml. In the Harlem River (Station 5), the average fecal coliform density was "greater than" 1000 organisms/100 ml. The fecal coliform density profile along the Hudson River is shown in Chart 2.

### Other Parameters

Temperature and pH showed little variation from station to station. Chlorides showed decreasing values, as the stations sampled were farther upstream. Turbidity ranged from 2.8 JTU at Station 1 to 5.4 JTU at Station 10 with no trend being observed between stations.

Ortho-phosphate phosphorus, one of the nutrients measured, decreased, as the stations sampled were farther upstream. The other nutrients yielded the following results: nitrate nitrogen values increased from Stations 1 to 18 and then decreased slightly; nitrite nitrogen showed no variation at any of the stations; and ammonia nitrogen had a high value of 1.14 mg/l at Station 18 and a low value of 0.48 mg/l at Station 9.

# SUMMARY OF RESULTS (A)

STATION	TEMPERATURE	CHLORIDES	D. O.	D.O. (MIN)	FECAL COLIFORM		pH	B.O.D.	ORTHO-PO <sub>4</sub> -P	NO <sub>3</sub> -N	NO <sub>2</sub> -N	NH <sub>3</sub> -N
					DENSITY	(B)						
1	24.0	11000	2.26	1.56	< 2500		7.0	3.53	0.23	0.67	0.08	0.96
2	24.4	9230	2.41	1.88	> 1900		7.2	3.57	0.22	0.61	0.07	1.04
3	24.5	8400	2.65	1.92	> 1400		7.3	3.84	0.20	0.65	0.08	0.88
4	24.8	7060	3.23	2.40	760		7.3	2.72	0.17	0.73	0.07	1.01
5(D)	24.4	6370	3.04	1.95	> 1000		7.1	3.24	0.19	0.71	0.08	0.94
6	24.6	5130	4.43	2.95	250		7.3	3.39	0.14	0.84	0.07	0.61
7	24.7	4620	4.89	3.75	180		7.4	3.32	0.14	0.77	0.07	0.60
8	24.8	3820	5.68	4.92	99		7.4	3.20	0.11	0.83	0.06	0.76
9	24.2	3220	6.22	5.60	140		6.9	3.41	0.10	0.86	0.05	0.48
10	24.2	2790	6.57	6.15	45		7.0	2.99	0.10	0.86	0.06	0.56
11	24.6	2360	6.63	6.10	< 85		7.0	3.32	0.08	0.92	0.06	0.53
12	24.1	2410	6.93	6.10	< 68		7.0	3.29	0.09	0.90	0.06	0.78
13	24.6	1920	6.45	5.68	< 71		6.9	3.08	0.08	0.90	0.06	0.58
14	24.7	1810	6.53	5.50	79		7.0	4.22	0.08	0.91	0.06	0.64
15	24.8	1650	6.54	5.48	210		6.9	3.20	0.07	0.95	0.06	0.68
16	25.0	1470	6.60	5.62	> 160		7.0	3.09	0.07	0.93	0.07	1.01
17	25.2	1110	6.16	5.80	> 190		6.9	2.69	0.07	0.99	0.08	1.03
18	25.1	800	5.90	5.50	> 350		7.0	2.25	0.06	1.01	0.09	1.14
19	25.1	430	5.86	5.40	> 800		7.0	2.63	0.06	0.89	0.08	1.04
20	25.2	230	6.06	5.60	> 200		7.0	2.39	0.06	0.95	0.07	0.98

NOTES: (A) All values are averages except the column headed "D.O. (MIN)" which is the minimum dissolved oxygen value obtained at each station. All units are mg/l except Temperature which is °C, Fecal Coliform Density which is the number of organisms per 100 ml, Turbidity which is JTU, and pH.

(B) Geometric Mean

(C) Logarithmic Average

(D) Station is located in the Harlem River.

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SUMMARY OF RESULTS (A) continued

STATION	TURBIDITY	TOTAL CARBON	TOTAL ORGANIC CARBON	CHLOROPHYLL A	CHROMIUM	COPPER	NICKEL	ZINC	CADMIUM	MERCURY	LEAD
1	2.8	35.7	11.3	0.0178	< 0.01	0.071	0.021	0.050	0.0005	< 0.00011	0.003
2	3.2	33.6	11.9	0.0175	< 0.01	0.060	0.021	0.023	0.0007	< 0.00012	0.003
3	3.4	32.9	12.8	0.0231	< 0.01	0.063	0.019	0.026	0.0006	< 0.00008	0.003
4	3.9	30.1	11.5	0.0280	< 0.01	0.067	0.018	0.024	0.0006	< 0.00009	0.003
5(D)	3.9	32.6	13.4	0.0177	< 0.01	0.068	0.020	0.048	0.0007	< 0.00006	0.003
6	3.9	28.5	10.9	0.0285	< 0.01	0.072	0.018	0.032	0.0009	< 0.00005	0.003
7	3.8	27.2	11.1	0.0331	< 0.01	0.067	0.015	0.033	0.0009	< 0.00009	0.003
8	4.2	27.8	11.8	0.0321	< 0.01	0.063	0.014	0.029	0.0007	< 0.00006	0.003
9	4.0	25.3	10.1	0.0368	< 0.01	0.055	0.017	0.026	0.0010	< 0.00008	0.003
10	5.4	24.6	10.1	0.0395	< 0.01	0.056	0.014	0.024	0.0009	< 0.00009	0.004
11	4.2	24.4	10.5	0.0341	< 0.01	0.046	0.015	0.029	0.0008	< 0.00013	0.003
12	5.0	23.9	9.8	0.0389	< 0.01	0.054	0.013	0.024	0.0008	< 0.00010	0.003
13	4.2	26.3	12.2	0.0361	< 0.01	0.062	0.014	0.042	0.0016	< 0.00008	0.004
14	4.4	24.8	10.3	0.0398	< 0.01	0.057	0.013	0.031	0.0010	< 0.00006	0.005
15	3.7	28.4	14.1	0.0321	< 0.01	0.055	0.012	0.028	0.0010	< 0.00006	0.003
16	3.8	24.4	10.6	0.0280	< 0.01	0.055	0.011	0.029	0.0010	< 0.00007	0.004
17	3.7	22.6	8.7	0.0300	< 0.01	0.060	0.014	0.027	0.0008	< 0.00011	0.003
18	4.1	26.3	12.1	0.0185	< 0.01	0.067	0.011	0.058	0.0009	< 0.00009	0.003
19	3.7	23.9	10.1	0.0139	< 0.01	0.047	0.010	0.038	0.0011	< 0.00008	0.003
20	4.4	24.6	11.2	0.0129	< 0.01	0.044	0.009	0.022	0.0009	< 0.00008	0.004

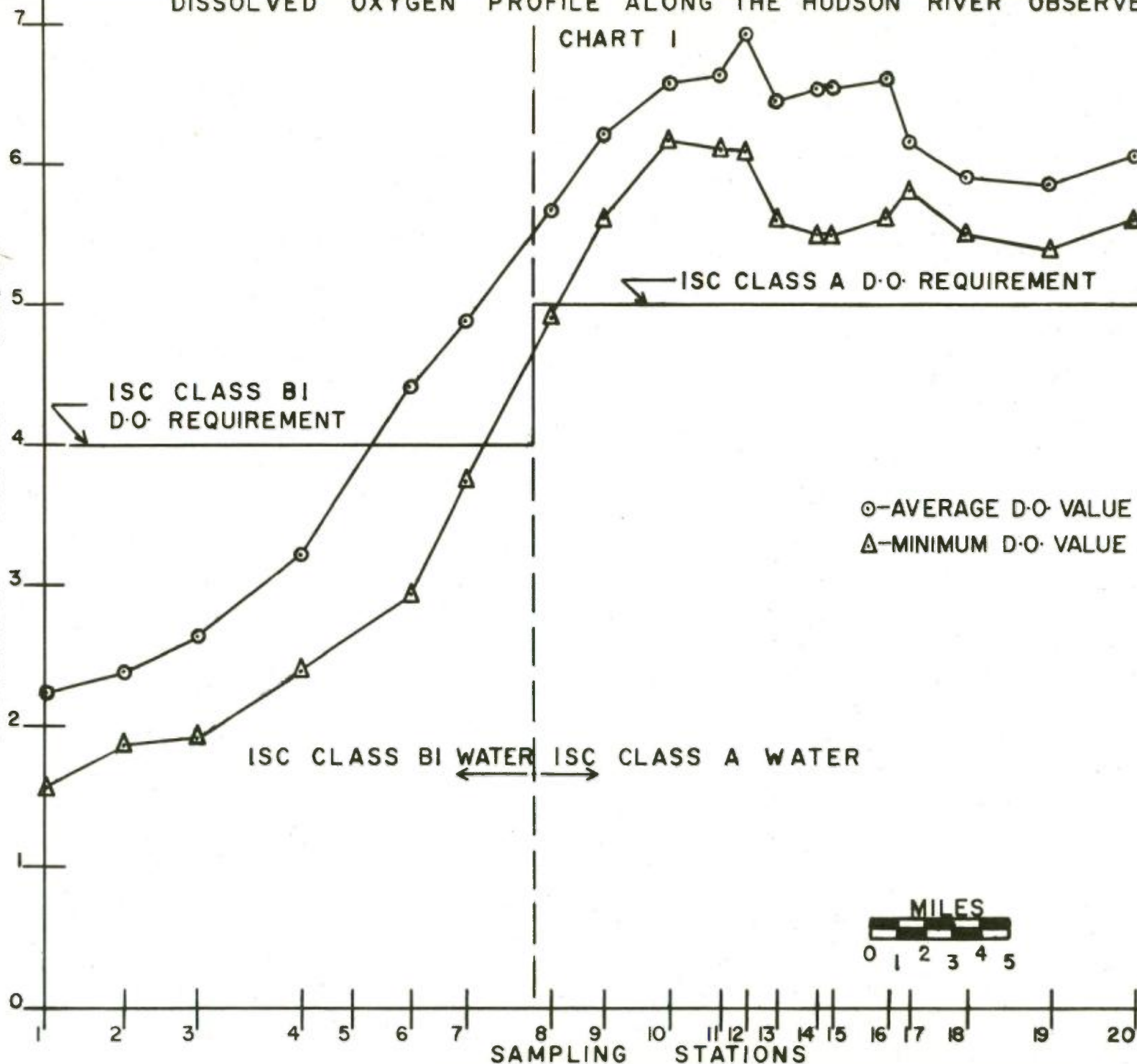
NOTES: (A) All values are averages except the column headed "D.O.(MIN)" which is the minimum dissolved oxygen value obtained at each station. All units are mg/l except Temperature which is °C, Fecal Coliform Density which is the number of organisms per 100 ml, Turbidity which is JTU, and pH.

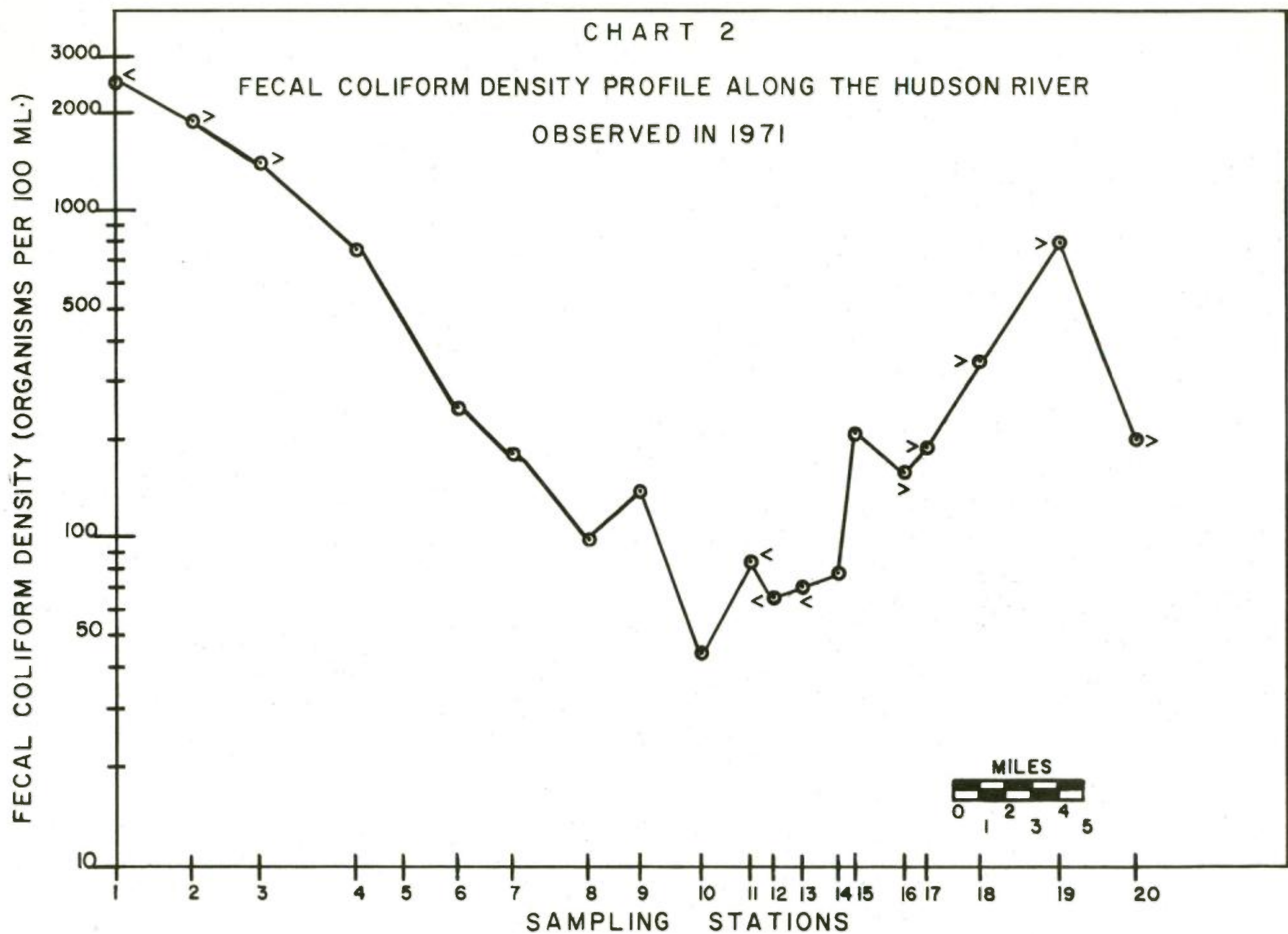
(D) Station is located in the Harlem River.

# DISSOLVED OXYGEN PROFILE ALONG THE HUDSON RIVER OBSERVED IN 1971

CHART I

DISSOLVED OXYGEN (MG./L.)





Total carbon yielded higher results at Stations 1 through 4 with the highest value (35.7 mg/l) occurring at Station 1. The other stations showed little variation in the values. Total organic carbon showed little variation at any of the stations.

Chlorophyll A values ranged from 0.0129 mg/l at Station 20 to 0.0398 mg/l at Station 14 and showed a general increasing trend from Stations 1 to 14 and a decreasing trend from Stations 14 to 20.

All chromium (hexavalent) values measured at all stations were "less than" 0.01 mg/l. The other metals measured (copper, nickel, zinc, cadmium, mercury, and lead) showed little variation between stations and no upward or downward trend throughout the range of the stations.

Biochemical oxygen demand values were calculated using three dilutions: 0% dilution water, 33.3% dilution water, and 66.7% dilution water. In general, the biochemical oxygen demand value increased in the higher dilutions. It was not determined whether this "sliding scale" was due to dilution of naturally occurring salinity or due to toxic substances present in the river. The biochemical oxygen demand values shown in the Summary of Results are averages of the values obtained with the highest dilution.

## DISCUSSION

The minimum dissolved oxygen observed at Stations 1 through 8 do not meet the Interstate Sanitation Commission's dissolved oxygen requirements (see Chart 1).

The dissolved oxygen and the fecal coliform density values show a need for improvement in the lower portion of the Hudson River. These values can be expected to improve when new waste treatment facilities presently under construction and older plants being upgraded are completed. Improvements can also be expected when means are found to lessen the impact of the combined sewer systems emptying into the Hudson River.

Except for the aforementioned parameters (such as dissolved oxygen and ortho-phosphate phosphorus) showing trends, the other parameters do not show any appreciable trends throughout the section of the Hudson River which was surveyed. The magnitude of the chlorophyll A values do not indicate the presence of algal blooms.

#### SUMMARY AND CONCLUSIONS

- (1) A baseline for many parameters has been established for future reference.
- (2) The dissolved oxygen requirements of the States of New York and New Jersey and the Interstate Sanitation Commission are not met at Stations 1 through 8.
- (3) Dissolved oxygen and fecal coliform density values cannot be expected to improve until new and upgraded treatment facilities and improved combined sewer systems are completed along the Hudson River.

### DESCRIPTION OF SAMPLING STATIONS

- STATION 1 Mid-channel of Hudson River
- North-South Range --  
Line of black buoys
- East-West Range --  
Fire boat pier (N.Y.) and railroad pier (N.J.)
- STATION 2 Mid-channel of Hudson River
- East-West Range --  
Helicopter (N.Y.) and Seatrain pier (N.J.)
- STATION 3 Mid-channel of Hudson River
- East-West Range --  
Soldiers and Sailors Monument (N.Y.) and circular apartment building (N.J.)
- STATION 4 Mid-channel of Hudson River
- Under George Washington Bridge
- STATION 5 Mid-channel of Spuyten Duyvil Creek
- Under Henry Hudson Bridge
- STATION 6 Mid-channel of Hudson River
- East-West Range --  
Opposite green spire at Mount St. Vincent (N.Y.) and mooring buoy (N.J.)
- STATION 7 Mid-channel of Hudson River
- East-West Range --  
Opposite Phelps Dodge (Yonkers)
- STATION 8 Mid-channel of Hudson River
- East-West Range --  
Opposite marina at Hastings (N.Y.) and rock slide (N.J.)

STATION 9 West of south end of Weyerhaeuser Lumberyard dock, about 500 yards from shore

STATION 10 100 feet south of Tappan Zee Bridge, pile number 160

STATION 11 North-South Range --  
1 mile north of buoy number 2A

East-West Range --  
Line of four apartment houses (N.J.) and two-story red brick structure adjacent to railroad tracks (N.Y.)

STATION 12 500 yards due east of white house at water's edge and southeast of foot of Hook Mountain

STATION 13 At flashing buoy number 6

STATION 14 North-South Range --  
Line of smoke stack at Sing Sing Prison and Teller Point (Croton)

East-West Range --  
Line of flashing buoy number 6 and stack at Croton-Harmon Yards of Penn Central Railroad

STATION 15 Mid-channel of Hudson River

Buoy number 10

STATION 16 North-South Range --  
Line of buoy number 10 and east of 2 towers at F.D.R. Veterans Hospital (Montrose)

East-West Range --  
Consolidated Edison stack at West Haverstraw and smoke stack at Croton-Harmon Yards of Penn Central Railroad

STATION 17 Mid-channel of Hudson River

Buoy number 14

STATION 18 Mid-channel of Hudson River

East-West Range --  
Stony Point and Montrose Point

STATION 19      Mid-channel of Hudson River  
                 East-West Range --  
                 Jones Point and Lovett Power Plant stack

STATION 20      Mid-channel of Hudson River  
                 Under Bear Mountain Bridge