

NOAA Data Report ERL GLERL-10



OSWEGO HARBOR, NEW YORK, CHEMICAL AND PHYSICAL
CHARACTERISTICS DATA FOR 1972

Gerald L. Bell

Great Lakes Environmental Research Laboratory
Ann Arbor, Michigan
January 1980

Data available on microfiche
Contact: pubs@glerl.noaa.gov

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**UNITED STATES
DEPARTMENT OF COMMERCE**
Philip M. Klutznick, Secretary

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ATMOSPHERIC ADMINISTRATION**
Richard A. Frank, Administrator

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DATA FOR 1972*

Gerald L. Bell

Water samples at standard depths, bottom sediment, and meteorological data were collected in Oswego Harbor, N.Y., at established stations in the course of 33 one-day harbor cruises during the 1972 open-water season. The sampling program and analytical methods are described. Chemical characteristics of the water and bottom sediment are listed by cruise for each station and sampling depth. Wind, wave, and sediment data are listed by cruise for each station.

1. INTRODUCTION

This basic data report presents data collected aboard the Research Vessel *Shenehon* in Oswego Harbor, N.Y., by the Water Characteristics Branch of the Lake Survey Center, U.S. Department of Commerce, NOAA, National Ocean Survey, between 1 May and 10 November 1972.

As part of the International Field Year for the Great Lakes (IFYGL) Chemistry and Biology Program, data was collected systematically to define the chemical and physical characteristics of the Oswego River discharge in the harbor and the area of mixing in the adjacent portion of Lake Ontario. The objectives of the program were to determine the effects of the water and sediment influx on the adjacent lake, to estimate the time for water-borne effects to be dissipated, to describe the areal distribution under varying conditions, and to relate distribution to causative forces.

The Oswego River is one of the four major tributaries discharging into Lake Ontario. Knowledge of the chemical and physical characteristics, loadings and areal extent of the Oswego River water mixing zone is required to understand the impact of this water-mass on Lake Ontario. These data will provide input into simulation models for forecasting water quality, and for use in management and development of the lake. Between surveys at Oswego, the *Shenehon* was used for heat advection studies on the Lower Niagara and Upper St. Lawrence Rivers, for lake current studies by the Water Motion Branch, and for providing water temperature and meteorological data at each of the American IFYGL buoys for calibration purposes. The *Shenehon* also took part in two IFYGL calibration studies near Rochester, N.Y.

Interpretations of the data are not within the scope of this report and will be presented in a subsequent publication. Meteorological conditions, as well as profiles of water temperature and transparency

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recorded at each station, are not included in this report. Two reports have been based on these data (Bell, 1978; Bell and Eadie, 1979).

2. METHODS

2.1 Sampling Program

Water characteristics, bottom sediment, and meteorological data were collected at 46 established stations (Figure 1, Table 1) during 33 one-day cruises in five periods (Table 2). The sampling pattern and analyses were varied on a daily basis to best define the plume. Owing to time limitations, the number of stations sampled during a cruise averaged between 20 and 25. Sampling during storm periods was restricted to the harbor and river area. Stations in the lake were spaced at 0.8-km intervals in a 2.4 by 5.6-km grid approximately parallel to the shore. Stations around the harbor entrance were spaced on a 0.4- and 0.8-km radius from station 7, except where additional stations were required to monitor the shifting plume. Shipboard and laboratory determinations made during each cruise are summarized in Table 3.

Water samples from the surface, mid-depth, and near bottom were collected in Fjarlie bottles with protected reversing thermometers attached. During bottom sediment sampling cruises, water samples were taken from the ship's intake at a depth of 1.5 m. Water samples to be analyzed in the Detroit laboratory were preserved with chloroform and stored in a dark area below deck. Bottom sediment samples were collected with a Shipek Sampler, described, analyzed for pH and Eh, and then treated with concentrated sulphuric acid. All meters were calibrated daily.

Water transparency was measured with a Secchi disc and a G.M. Mfg. Deep-Water Turbidity Meter, Model 17-M-11. Transparency as determined by the Turbidity Meter relates light transmission along a 1-m water path to 100 percent transmission along the same path through air, expressed as a percent.

Temperature profiles were determined with a Guildline, Marine Advisors, and Yellow Springs Electronic Bathythermographs. Sonic water depths were determined with a Raytheon Fathometer and water sample depths with a meter wheel to the nearest meter. The ship was navigated and the stations located by Decca, radar, a gyro compass, and visual fixes.

Meteorological observations were recorded automatically at 0.1-hr intervals at the 3- and 10-m levels by a digital system employing solid state gathering modules. Wind and wave observations were made while on station. The wave direction was not reported at all stations and in such cases the wind direction was used. Wave height observations are estimations. The period is based on an average time of 10 successive waves.

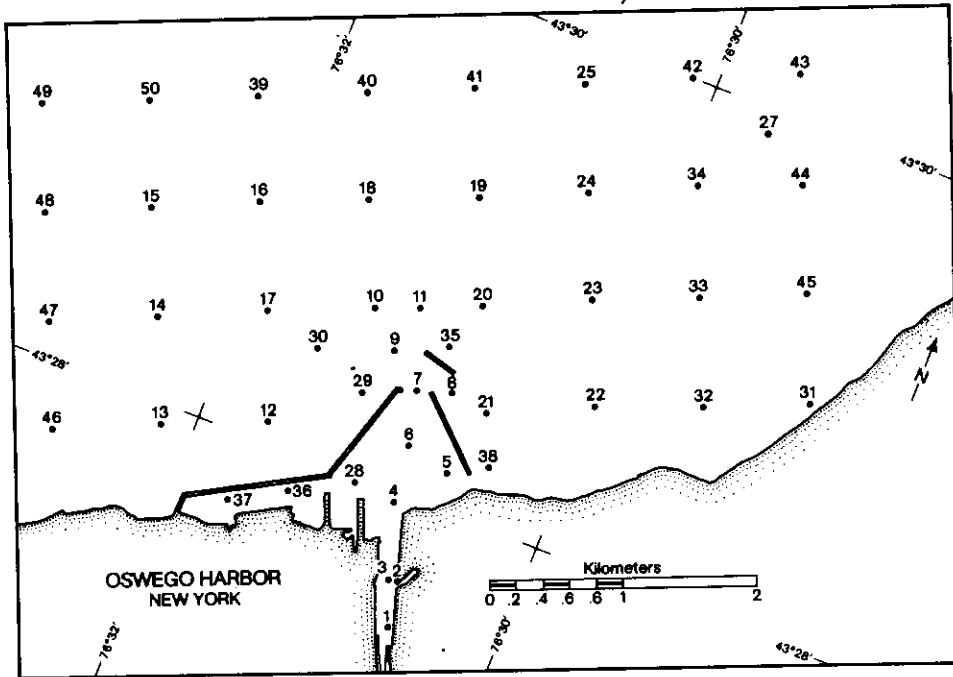


Figure 1. Station locations at Oswego Harbor, N.Y., during 1972.

Table 1. Station Locations at Oswego Harbor During 1972
(by Latitude and Longitude)

Station	Latitude	Longitude	Station	Latitude	Longitude
1	43.458°N	76.510°W	26	43.508°N	76.474°W
2	43.461°N	76.511°W	27	43.498°N	76.494°W
3	43.461°N	76.512°W	28	43.466°N	76.518°W
4	43.466°N	76.514°W	29	43.472°N	76.520°W
5	43.469°N	76.510°W	30	43.474°N	76.526°W
6	43.470°N	76.514°W	31	43.482°N	76.481°W
7	43.474°N	76.516°W	32	43.480°N	76.491°W
8	43.474°N	76.512°W	33	43.486°N	76.494°W
9	43.476°N	76.519°W	34	43.493°N	76.498°W
10	43.478°N	76.522°W	35	43.477°N	76.514°W
11	43.479°N	76.518°W	36	43.464°N	76.523°W
12	43.468°N	76.527°W	37	43.462°N	76.528°W
13	43.465°M	76.536°W	38	43.471°N	76.507°W
14	43.472°N	76.540°W	39	43.488°N	76.539°W
15	43.479°N	76.544°W	40	43.491°N	76.530°W
16	43.482°N	76.535°W	41	43.494°N	76.521°W
17	43.475°N	76.531°W	42	43.500°N	76.502°W
18	43.484°N	76.526°W	43	43.503°N	76.493°W
19	43.487°N	76.517°W	44	43.496°N	76.489°W
20	43.481°N	76.513°W	45	43.489°N	76.485°W
21	43.474°N	76.509°W	46	43.462°N	76.545°W
22	43.477°N	76.500°W	47	43.469°N	76.549°W
23	43.484°N	76.504°W	48	43.476°N	76.553°W
24	43.490°N	76.508°W	49	43.483°N	76.557°W
25	43.497°N	76.511°W	50	43.485°N	76.548°W

Table 2. Cruise Schedule

Cruise	Date	Cruise	Date
1	1 May	18	22 Aug.
2	2 May	19	23 Aug.
3	3 May	20	24 Aug.
4	4 May	21	25 Aug.
5	5 May	22	17 Oct.
6	13 June	23	19 Oct.
7	14 June	24	20 Oct.
8	15 June	25	21 Oct.
9	16 June	26	24 Oct.
10	17 June	27	25 Oct.
11	19 June	28	26 Oct.
12	20 June	29	27 Oct.
13	21 June	30	7 Nov.
14	22 June	31	8 Nov.
15	23 June	32	9 Nov.
16	19 Aug.	33	10 Nov.
17	21 Aug.		

2.2 Chemical Analyses

The methods used in the water analysis are those described in Standard Methods (American Public Health Association, 1965), Rainwater and Thatcher (1960), Fishman and Skougstad (1965), and Perkin-Elmer Corporation (1971).

Water samples were analyzed immediately in the *Shenehon* laboratory for dissolved oxygen, specific conductance, phenolphthalein and total alkalinity, pH, Eh (oxidation-reduction potential), the pH and Eh of the interstitial water of the bottom sediment, and total coliforms.

Dissolved oxygen values were determined with a Beckman Dissolved Oxygen Analyzer Model 777, calibrated daily in air. After two separate tests were made on each sample, the highest partial pressure and the lowest sample temperature readings were used for calculating the dissolved oxygen. *In situ* temperature was recorded by the reversing thermometer at the sampling depth.

Two separate tests for specific conductance were made on each sample with an Industrial Instruments Conductivity Bridge, Model RC-16B2J, and the average expressed in micromhos at 25°C.

*Table 3. Shipboard and Laboratory Measurements
in Connection with Limnological Studies*

Shipboard Measurements

Meteorological data (printout each 6 min)

Wind speed (m/sec) (3 and 10 m above water)
 Wind direction (3 and 10 m above water)
 Barometric pressure (millibars) (3 m above water)
 Air temperature (°C) (3 and 10 m above water)
 Water temperature (1.5 m below water surface)
 Solar radiation (incident) (Gram-calories per sq. cm)
 (10 m above water)
 Solar radiation (reflected and incident) (3 m above water)
 Relative humidity (3 m above water)
 Dew point

On station

Water

Water temperature (°C)
 Reversing thermometers at sample depth
 Electronic bathythermograph
 Infrared thermometer for surface temperature
 Air-water interface temperatures
 Transparency (relative to 100 in air)
 Secchi disc (m)
 pH
 Eh (volts)
 Total and phenolphthalein alkalinity (mg/l CaCO₃)
 Specific conductance (micromhos at 25°C)
 Dissolved oxygen (mg/l and pct. sat.)
 Coliform bacteria (membrane filter proc.)

Waves

Height (m)
 Period (sec)
 Direction (nearest 10°)

Bottom sediment

Description (physical)
 pH
 Eh

Chemistry Laboratory

Dissolved ions

Nitrate¹ (Brucine method, A.P.H.A.², 1965)
 Phosphate¹ (Ammonium molybdate method, U.S.G.S.³, 1965)
 Sulfate¹ (Turbidimetric method, A.P.H.A.², 1965)
 Silica¹ (Molybdate blue method, U.S.G.S.³, 1960)
 Magnesium⁴ (Atomic Absorption tech., P.E.⁵, 1971)
 Calcium⁴ (Atomic Absorption tech., P.E.⁵, 1971)
 Sodium⁴ (Atomic Absorption tech., P.E.⁵, 1971)
 Potassium⁴ (Atomic Absorption tech., P.E.⁵, 1971)
 Chloride (AgNO₃ titration)

Suspended sediment (mg/l)

Bottom sediment

Percent solids
 Percent volatiles
 Oil and grease
 COD

¹ Beckman DU-2 Spectrophotometer.

² American Public Health Association.

³ U.S. Geological Survey.

⁴ Perkin-Elmer Atomic Absorption Spectrophotometer.

⁵ Perkin-Elmer Corporation

Chloride concentrations were determined by the argentometric method and titration of a 50-ml sample of lake water. The silver nitrate was standardized and the reagent blank value determined at the beginning of each day.

Phenolphthalein and total alkalinity values were determined by titrating 100-ml water samples with standard acid (H_2SO_4) to the end-points of pH 8.2 and 4.5, respectively. The end-points were determined with the pH meter and the results expressed in mg/l of calcium carbonate.

Measurements of pH and Eh were made with a Beckman Zeromatic pH Meter, a glass pH electrode, calomel fiber junction reference electrode, and a platinum Eh electrode. As a means of avoiding contamination, the electrodes were rinsed in a sample of the lake water to be tested. Between tests, the electrodes were immersed in distilled water. Tests of the interstitial water of the bottom sediment were made by inserting the electrodes into the soft sample. The meter was standardized using pH 4.0 and 7.0 buffers.

At the end of each cruise or survey period, preserved water samples in 500-ml plastic bottles were transferred to the Great Lakes Research Center laboratory in Detroit, Mich. A Beckman DU-2 Spectrophotometer with flame attachment was used to analyze for nitrate, phosphate, sulfate, and silica, and a Perkin-Elmer Atomic Absorption Spectrophotometer was used for calcium, magnesium, sodium, and potassium. Standard curves were constructed for each test and cruise. Tests for nitrate and phosphate were made on unfiltered samples upon arrival at the laboratory. Anion concentrations were determined by computer application of the absorbancy values to a standard curve adjusted by paired test standards run after each set of 10 to 20 samples to compensate for any change or drift in the spectrophotometer response. Cation concentrations were also adjusted by paired test standards and read directly from a recorder strip chart.

The bottom sediment was dried overnight at 100-105°C and the weight expressed as a percentage of the wet weight. Volatiles were determined by burning at 600°C for 1 hr and reported as a percentage of the dry solids. The concentration of hexane extractable hydrocarbons was determined by distillation and the weight reported as a percentage of the dry solids. The chemical oxygen demand (COD) was determined by refluxing samples of the bottom material.

3. PRECISION LIMITS

Degrees of precision (Table 4) were determined for nitrate, phosphate, sulfate, and silica by a computer comparison of pairs of test standards to the standard curve used to determine the sample concentrations. A pair of test standards was run after each set of 10 samples

Table 4. Measurement Precision

Variable	Units	Estimated precision	Average deviation*
Nitrate-N**	mg/l		±0.004
Phosphate-P**	mg/l		±0.0003
Sulfate	mg/l		±0.15
Silica	mg/l		±0.03
Calcium	mg/l	±0.5	
Magnesium	mg/l	±0.1	
Sodium	mg/l	±0.5	
Potassium	mg/l	±0.1	
Chloride	mg/l	±0.5	
Specific conductance	micromhos at 25°C		±1.6
Total alkalinity	mg/l CaCO ₃	±0.5	
Dissolved oxygen	mg/l	±0.1	
Dissolved oxygen	percent sat.	±1.0	

* Average of the deviations of the test standards from the standard curve.
 ** Analysis of unfiltered samples which were CHCl₃ poisoned and stored for variable lengths of time.

for nitrate and after each set of 20 samples for phosphate, sulfate, and silica. Analyses for calcium, magnesium, sodium, and potassium were run in sets of 10 samples followed by one standard and at least one additional standard bracketing the concentration range after each 20 samples. For both chloride and alkalinity, the estimated precision is based on the change in concentration produced by one drop (0.05 ml) of titrant and on the assumption that the end-point was within \pm one drop. Two readings were made on each sample for specific conductance and deviations from the mean of each pair were used to compute the average deviation. Of the 117 sample pairs randomly selected, 74 percent were within 1 micromho of the mean. The estimated precision of the dissolved oxygen determinations is based on the assumption that the partial pressure is accurate to 1 mm of mercury. The average difference in the two partial pressure readings for each sample was less than 1 mm of mercury.

Tests for nitrate and phosphate were made on unfiltered samples. From the end of a cruise to the analysis date there was an interval ranging from 1 to 11 days for phosphate and from 6 to 14 days for nitrate. These samples were preserved (CHCl_3) to fix the phosphorus and nitrogen, but were not refrigerated.

4. DATA PRESENTATION

The limnological data are summarized by cruise for each sampling depth at a given station (Appendix A). Nitrogen concentrations were calculated from nitrate by multiplying by a factor of 0.226. Phosphorus concentrations were calculated from phosphate by multiplying by a factor of 0.326.

The wind, wave, and bottom sediment data, with the exception of pH and Eh, are summarized by cruise and station (Appendix B).

5. ACKNOWLEDGMENTS

The program was formulated and directed by A. P. Pinsak. *Shenehon* operations were under the direction of R. E. Ruh.

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