# CHEMICAL AND BIOLOGICAL QUALITY OF SELECTED LAKES IN OHIO, 1978 and 1979

By Clifford G. Angelo, U.S. Geological Survey, and
John D. Youger, Ohio Environmental Protection Agency

---

U.S. GEOLOGICAL SURVEY
Open-File Report 84-249

Prepared in cooperation with the
OHIO ENVIRONMENTAL PROTECTION AGENCY

Columbus, Ohio

1985

UNITED STATES DEPARTMENT OF THE INTERIOR

DONALD PAUL HODEL, Secretary

GEOLOGICAL SURVEY

Dallas L. Peck, Director

For additional information
write to:

District Chief
Water Resources Division
U.S. Geological Survey
975 West Third Avenue
Columbus, Ohio 43212

Copies of this report can
be purchased from:

Open-File Services Section
Western Distribution Branch
U.S. Geological Survey
Box 25425, Federal Center
Denver, Colorado 80225
(Telehone: (303) 234-5888)

CONTENTS

CONTENTS--Continued



ILLUSTRATIONS

## TABLES

TABLES--Continued

## CONVERSION FACTORS

For the benefit of readers who prefer to use the International System of units (SI), conversion factors for terms used in this report are listed below:

| Multiply inch-pound units | By | To obtain SI units |
|---|---|---|
| inch (in.) | 25.40 | millimeter (mm) |
| foot (ft) | 0.3048 | meter (m) |
| mile (mi) | 1.609 | kilometer (km) |
| acre-foot (ac-ft) | 0.001233 | hectometer3 (hm3) |
| square mile (mi2) | 2.590 | kilometer (km2) |
| foot per second (ft/s) | 0.02832 | meter per second (m/s) |
| ton (short) | 0.9072 | megagram (mg) |
| tons per square mile per year [(ton/mi2)/yr] | 0.03753 | megagram per square kilometer per year [(mg/km2)/yr] |

# CHEMICAL AND BIOLOGICAL QUALITY OF SELECTED LAKES IN OHIO - 1978 AND 1979

By Clifford G. Angelo and John D. Youger


## ABSTRACT

Twenty-eight Ohio lakes were sampled by the U.S. Geological Survey and the Ohio Environmental Protection Agency for water-quality characteristics during the spring and summer of 1978 and 1979. This report is the third in a series covering a lake-sampling program that began in 1975. Data include water-column profiles of temperature, dissolved oxygen, pH, and specific conductance. Chemical, physical, and biological properties were measured at specific points in the water column, and selected physical and chemical properties also were measured in the principal inflows.

The lakes were predominantly hard (120-180 milligrams per liter) to very hard water, although several soft-water lakes were found in southeastern Ohio. Calcium, bicarbonate, and sulfate were the principal dissolved constituents. Specific conductance ranged from 103 micromhos per centimeter (at 25 degrees Celsius) at Tycoon Lake, 1978, to 2,250 micromhos per centimeter at West Fork Mill Creek Lake, 1978. Thirteen lakes had trace-element concentrations that were above the limits for exceptional warm-water habitat recommended by the Ohio Enivronmental Protection Agency.

Seasonal thermal gradients developed in most lakes deeper than 17 feet. Oxygen concentrations were zero or near zero during the summer sampling of the bottom waters of all lakes having definite thermal gradients. Most anaerobic zones contained hydrogen sulfide and high concentrations of ammonia.

All lakes were evaluated and classified by Carlson's trophic state index. Most of the lakes were classified as eutrophic. Blue-green algae (Cyanophyta) dominated the summer algal communities. Fecal coliform counts were within Ohio standards, although high (more than 1,000 colonies per 100 milliliters) fecal coliform and fecal streptococcus counts were observed in West Fork Mill Creek Lake after significant runoff.

# INTRODUCTION

In 1975, the U.S. Geological Survey and the Ohio Environmental Protection Agency began a water-quality reconnaissance of inland lakes and reservoirs in Ohio to establish a general statewide data base. Different lakes have been sampled yearly since 1975, in spring and late summer, to determine chemical, biological, and physical properties.

Seventeen lakes were sampled in 1975 (fig. 1). Data, methods of collection and analysis, discussions of individual lakes, and general limnological concepts were presented in the first report of this series (Tobin and Youger, 1977).

Most of the 14 lakes sampled in 1976 (fig. 2) were in the eastern half of Ohio, an area of generally moderate to moderately low sediment yields (fig. 3). Lakes were sampled throughout the entire State in 1977 (fig. 4). The report for the 1976 and 1977 field work was published in 1979 (Tobin and Youger, 1979). This report is the third in the series, and presents data for 14 lakes and reservoirs sampled in 1978 (fig. 5) and 14 lakes and reservoirs sampled in 1979 (fig. 6).

The sampling schedule shown in table 1 was used. It differs from the 1977 schedule in that hydrogen sulfide ($H_2S$) was changed from a laboratory to a field determination. The number of phytoplankton samplings was increased to include euphotic-zone composites and zones of maximum dissolved-oxygen saturation. In addition, chlorophyll _a_ was determined in 1978 and 1979. A list of selected earlier investigations of the lakes is presented in table 2.

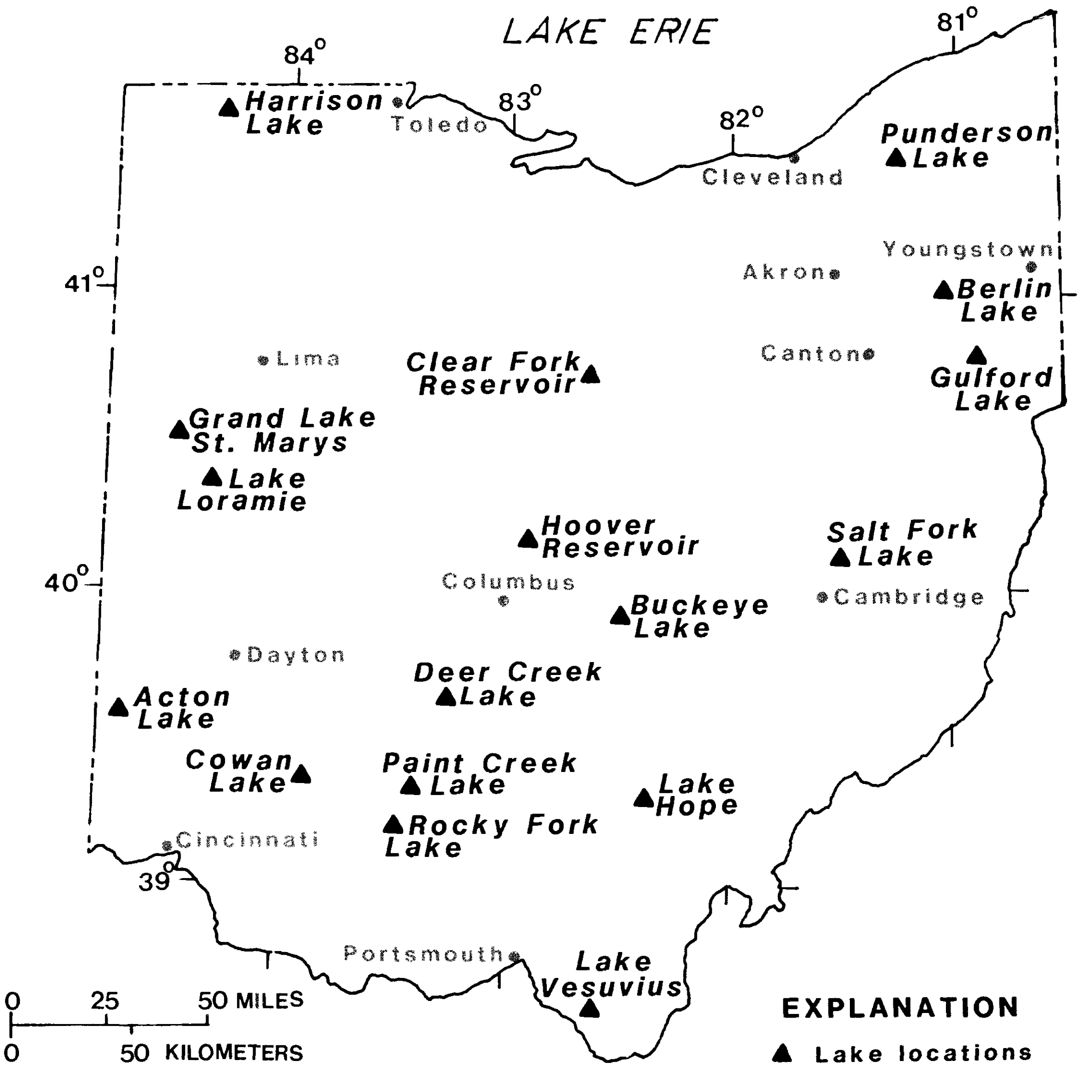
# TYPES OF DATA COLLECTED

Three basic types of data were collected: physical, chemical, and biological. They are discussed in detail in the first report (Tobin and Youger, 1977) and are summarized here.

## Physical Properties

_Temperature_.--Temperature is an important physical property of water. Differences in water temperature, which determine water density, reduce vertical mixing and may lead to stratification (fig. 7).

_Light_.--Light penetration influences temperature, photosynthetic rates, photochemical reactions, and biological activities. Lake zones have been defined on the basis of light penetration (fig. 8). Secchi-disk extinction depths, when multiplied by a factor of 2.5 to 5.0, have been used to estimate the depth of the compensation level (Verduin, 1956).

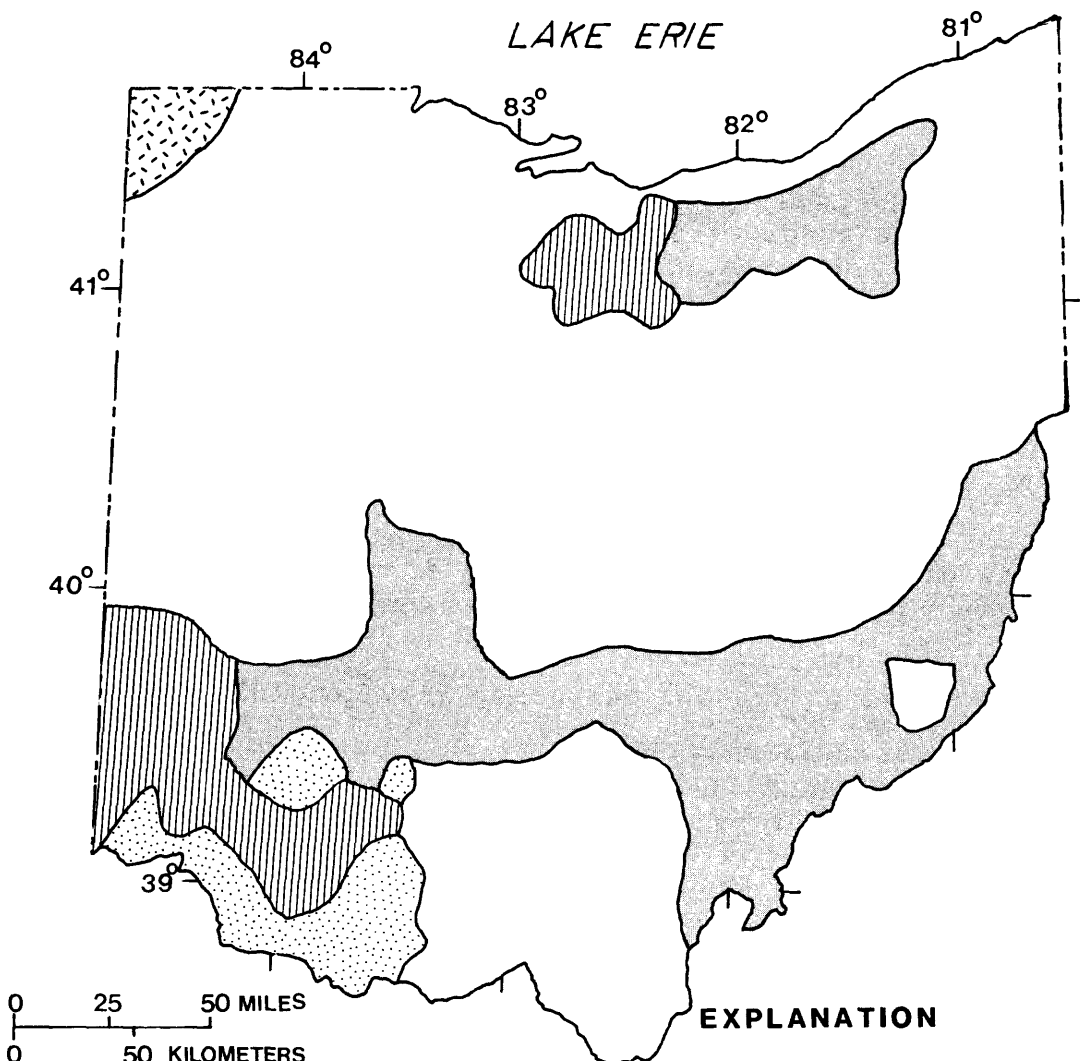



From Tobin and Youger, 1979

Figure 1.--Lakes sampled in Ohio during 1975.


From Tobin and Youger, 1979

Figure 2.--Lakes sampled in Ohio during 1976.




**EXPLANATION**

| (TONS/SQUARE MILE)/YEAR | YIELD |
|---|---|
| Less than 100 | Low |
| 100-200 | Moderately Low |
| 200-350 | Moderate |
| 350-500 | Moderately High |
| Greater than 500 | High |

Modified from Anttila and Tobin, 1976

Figure 3.--Estimates of sediment yields for major drainage basins in Ohio.


From Tobin and Youger, 1977

Figure 4.--Lakes sampled in Ohio during 1977.

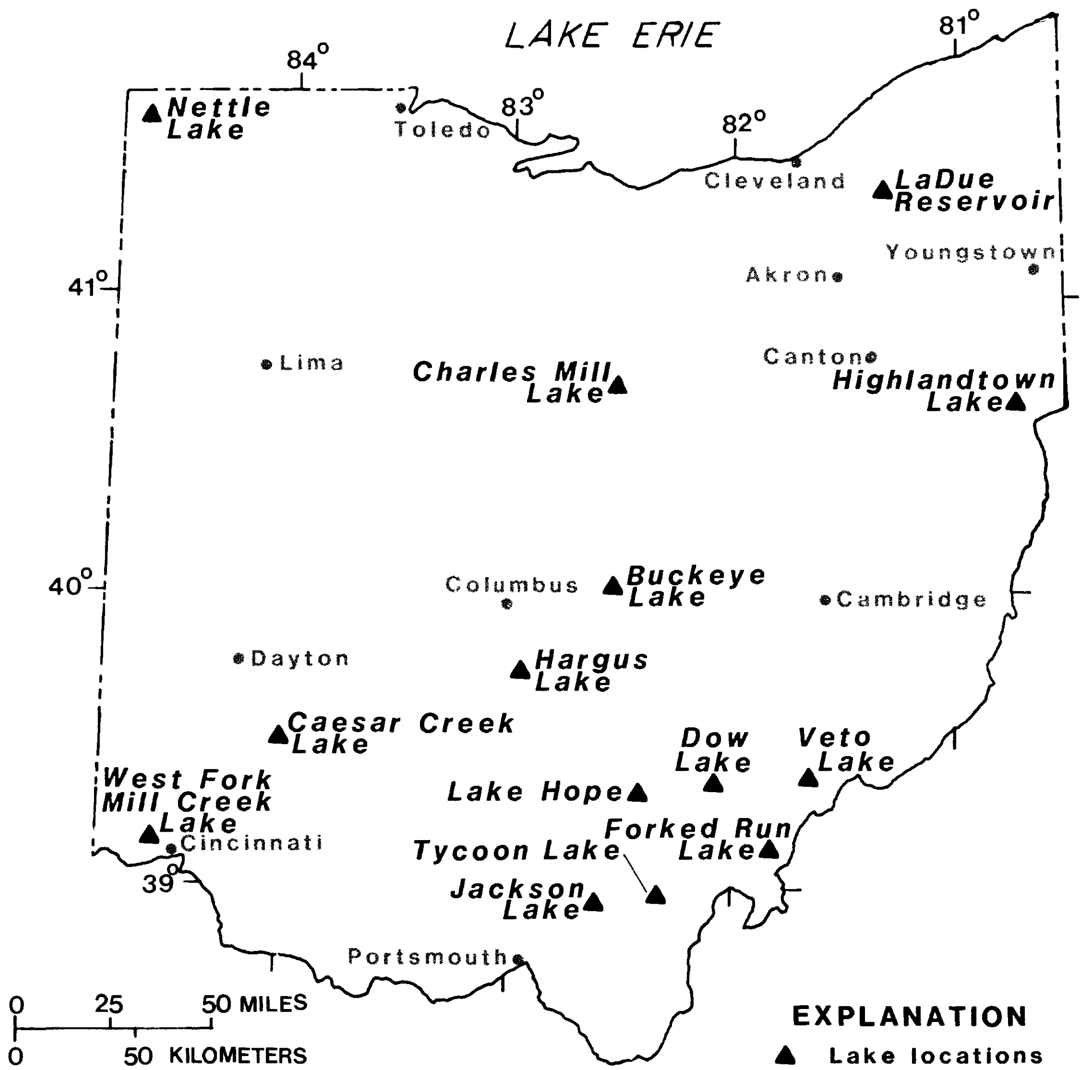



Figure 5.--Lakes sampled in Ohio during 1978.


Figure 6.--Lakes sampled in Ohio during 1979.

Table 1.--Sampling schedule of Ohio lakes study, 1978 and 1979

["x" means that the property, constituent, or set of constituents listed was determined for the depth and season in the column heading]

| Property or constituent | Location within water column | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Spring Sampling | | | | Late-summer sampling | | | |
| | Profile (continuous with depth) | Near surface (2 ft deep | Water-column composite | Near bottom (1-3 ft from bed) | Profile (continuous with depth) | Near surface (2 ft deep) | Water-column composite | Near bottom (1-3 ft from bed) |
| Temperature, dissolved oxygen, pH, and specific conductance[1] | x | | | | x | | | |
| Nutrients: | | | | | | | | |
| Major, ($HCO_3$, TOC, N, P, $SiO_2$) | | x | | x | | x | | x |
| Trace (B, Co, Cu, Fe, Mn, Mo, Zn) | | | x | | | | | [2]x |
| Oxygen demand: | | | | | | | | |
| Biological | | x | | x | | x | | x |
| Chemical | | x | | x | | x | | x |
| Biological and physical characteristics: | | | | | | | | |
| Fecal coliform and streptococci[1] | | x | | x | | x | | x |
| Phytoplankton identification and count | | [3]x | x | | | [3]x | x | |
| Turbidity | | x | | x | | x | | x |
| Secchi-disk transparency | [4]x | | | | [4]x | | | |
| Color | | x | | x | | x | | x |
| Suspended solids | | | x | | | | | |
| Chlorophyll *a* | | x | | x | | x | | x |
| Major chemical constituents (Ca, Mg, K, Na, $SO_4$, Cl, Cl, F dissolved solids) | | x | | | | | | |
| Toxic and undesirable substances: As, Ba, Cd, Cr, Pb, Hg, Ni, Se, Ag, MBAS | | | x | | | | | [2]x |
| $H_2S$[1] | | x | | x | | x | | x |

[1]Field determinations.
[2]Selected constituents taken from additional information.
[3]Taken from the depth of maximum dissolved oxygen.
[4]Secchi disk was submerged to the point at which it was no longer visible.

Table 2.--Publications on selected lakes in Ohio

| |
|---|
| Buckeye Lake |
| Detmers, 1912 |
| Salisbury, 1931 |
| Tressler and others, 1940 |
| U.S. Environmental Protection Agency, 1975a |
| Charles Mill Reservoir |
| U.S. Environmental Protection Agency, 1975b |
| Dow Lake |
| Keller, 1960 |
| Stanley, 1961 |
| Ward and others, 1963 |
| Meander Creek |
| Roach, 1949 |
| Tycoon Lake |
| Crawford and others, 1972 |
| General |
| Hahn, 1955 |
| Kettelle and Uttormark, 1971 |
| Roach, 1933 |
| Sanderson, 1948 |
| U.S. Environmental Protection Agency, 1977 |
| U.S. Environmental Protection Agency, 1978 |
| Vallentyne, 1974 |
| Wickliff and Roach, 1937a |
| Wickliff and Roach, 1937b |
| Youger, 1980 |

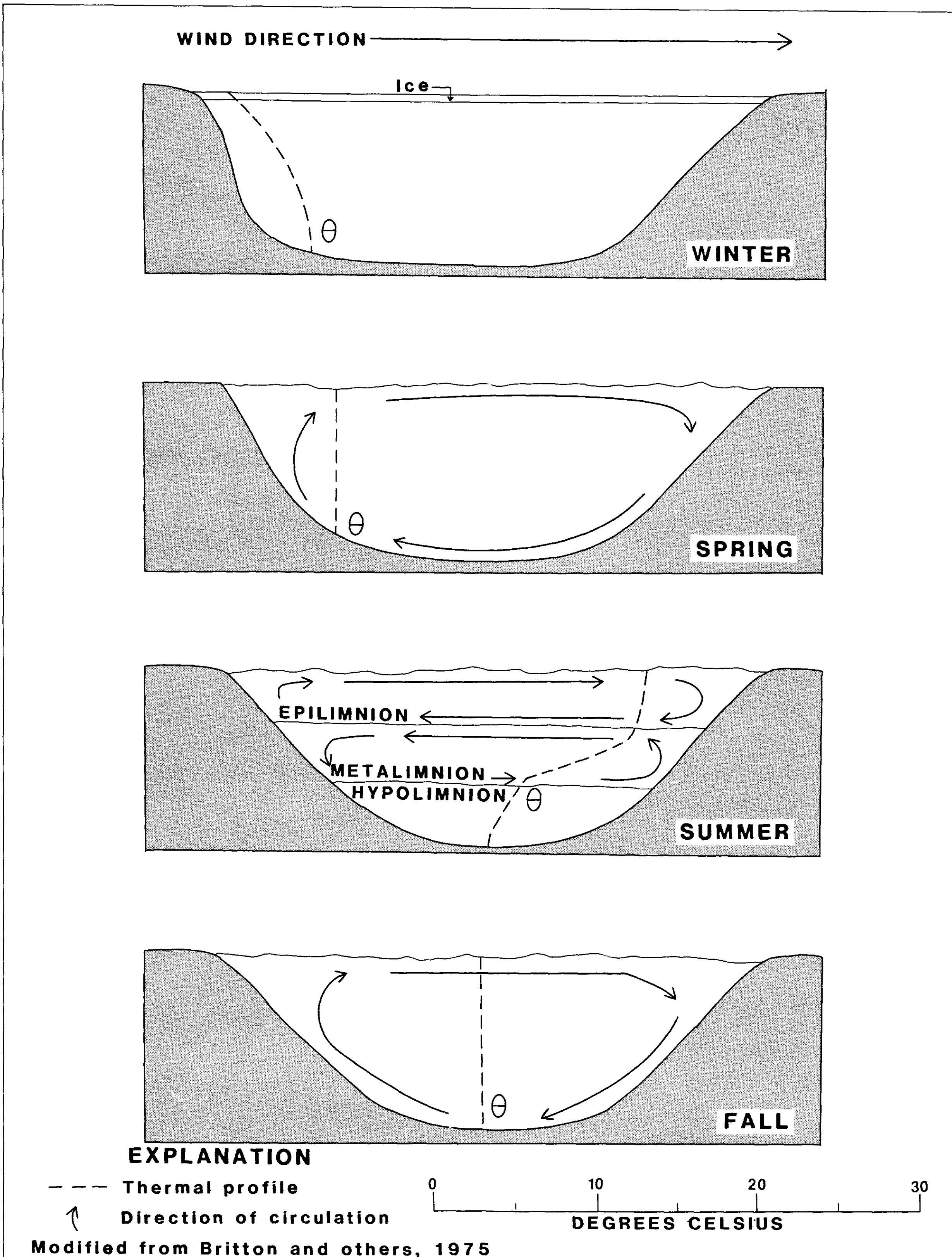
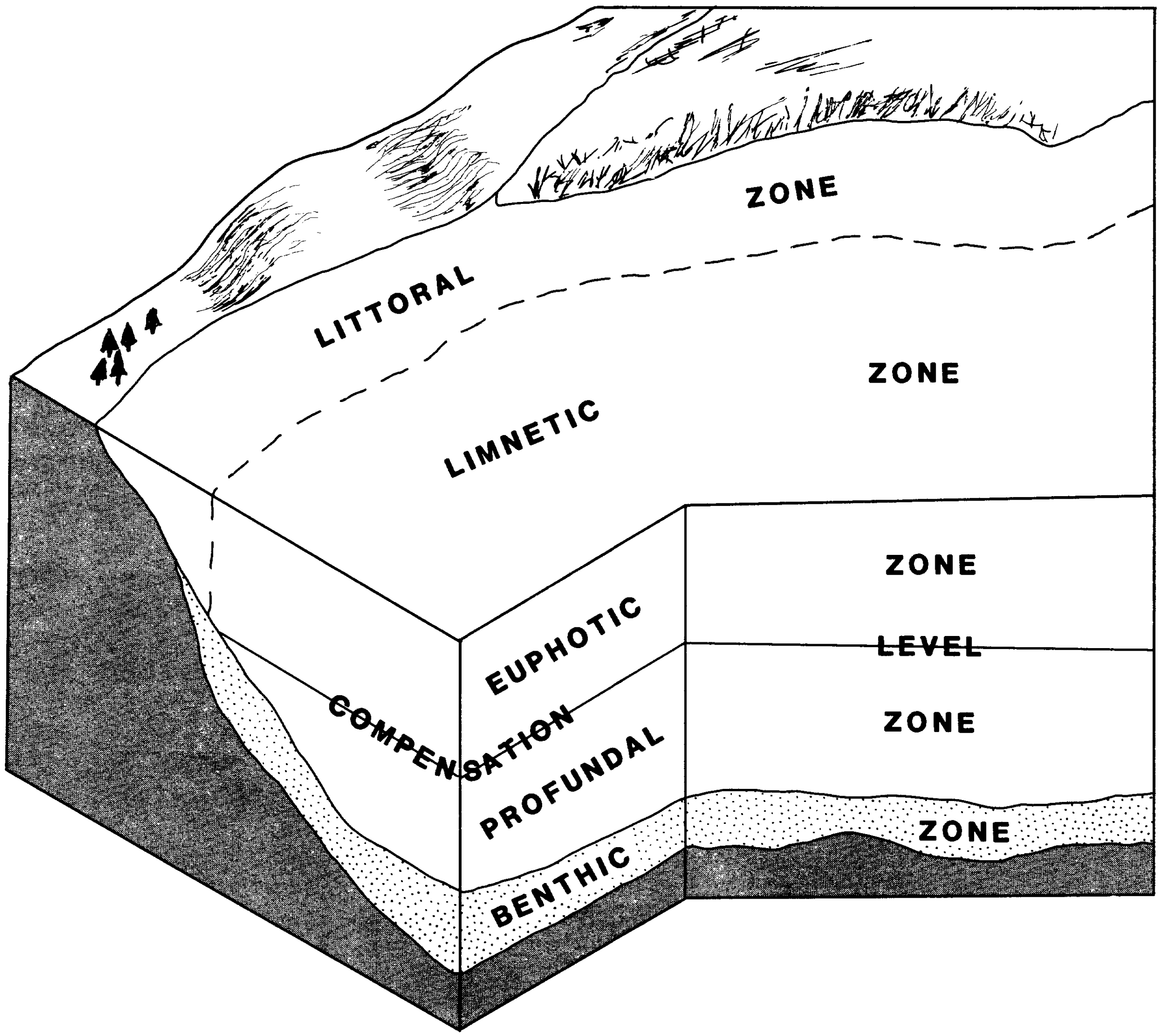



Figure 7.--Seasonal thermal profiles (θ) and circulation patterns in a temperate-zone lake.




## EXPLANATION

Littoral Zone----------Shallow water area with sufficient light to support attached vegetation.

Limnetic Zone---------Open water area whose base is defined by the 1 percent light-intensity level.

Euphotic Zone---------The combined littoral and limnetic zones.

Profundal Zone--------Zone of deep water where the light intensity is less than 1 percent of the surface light. Little or no photosynthesis takes place in this zone.

Benthic Zone----------Lake bottom.

Compensation Level----Level at which oxygen production equals oxygen uptake.

Modified from Britton and others, 1975

Figure 8.--Major life zones in a lake.

Turbidity and suspended solids.--Turbidity is the qualitative measurement of the light-scattering ability of suspended matter in water. Suspended solids is the quantitative measurement of suspended matter. High values of either can effect the physiological functions of aquatic life (McKee and Wolf, 1971, p. 290).

## Chemical Characteristics

Major constituents.--Major constituents in natural water are derived mainly from the action of water containing atmospheric and (or) biologically recycled carbon dioxide ($CO_2$) on minerals and rocks (Hem, 1970, p. 28). The most common major constituents are listed below:

| Cations (positive charge) | Anions (negative charge) |
|---|---|
| Calcium (Ca) | Bicarbonate ($HCO_3$) |
| Magnesium (Mg) | Carbonate ($CO_3$) |
| Potassium (K) | Sulfate ($SO_4$) |
| Sodium (Na) | Chloride (Cl) |
| | Fluoride (F) |

Concentrations of cations and anions are used in calculating hardness and in determining chemical type of water (table 3).

General organic indicators.--Organic substances are compounds built around the carbon (C) atom. Although natural waters contain many compounds of carbon, the concentrations are normally low and are reported in micrograms per liter (µg/L). Total organic carbon (TOC) is used as a broad-spectrum constituent to approximate the organic concentration in water.

Specific conductance.--Specific conductance is a measure of the ability of water to conduct an electrical current, and is reported in micromhos per centimeter at 25°C (µmho/cm). This property is sometimes used to estimate the dissolved-solids concentration of similar water types (Hem, 1970, p. 99).

Hydrogen ion activity (pH).--The pH of water is a measure of the acid-base characteristics. Water free of dissolved matter has a pH of 7.0. Natural waters containing dissolved material normally range between 5.0 on the acid side to 9.0 on the basic side (Hem, 1970, p. 86-96).

Nutrients.--Nutrients are those substances needed in large quantities (macro nutrients) and small quantities (micro nutrients) for biological growth. A list of the common nutrients is presented in table 4. In aquatic environments, nutrients can exert control over the growth of phytoplankton through excesses or limitations. A deficiency of any essential nutrient will limit algal growth in conformity to Liebig's law of the minimum.

Table 3.--Criteria used in the chemical classification of Ohio's lakes

| Hardness[a] | | Major ions[b] | |
|---|---|---|---|
| Description | Bivalent cations (mg/L as $CaCO_3$) | Cations (meq/L) | Anions (meq/L) |
| Soft------- | 0- 60 | Single cation used when it amounts to 50 percent or more of the total cations; when the above does not exist, then the two cations having the highest percentages are used. | Single anion used when it amounts to 50 percent or more of the total anions; when the above does not exist, then the two having the highest percentages are used. |
| Moderately hard----- | 61-120 | | |
| Hard------- | 121-180 | | |
| Very hard-- | >180 | | |

[a]Modified from Durfor and Becker, 1964, p. 27.
[b]Modified from Piper and others, 1953, p. 26.

Table 4.--Common forms, minimum requirements, and some sources of elements essential to the growth of algae (modified from Britton and others, 1975, p. 7.)

[The minimum nutrient requirements of algae in the aquatic environment are difficult to determine, and this uncertainty is shown by the wide range of concentrations in the table. "Trace" quantities generally refer to concentrations less than 1 mg/L and more exact concentration requirements for these elements have not been determined. "Quantities always sufficient in surrounding medium" refers to those elements that are never below minimum concentrations so as to limit algal growth]

| Element | Symbol | Some common forms in water | Minimum requirements | Examples of natural sources | Examples of manmade sources |
|---|---|---|---|---|---|
| Aluminum.... | Al | $Al^{+3}$, $AlSO_4$, $AlO_2$, (salts of aluminum) | Probably trace quantities | Clay minerals, silicate rock minerals | Domestic sewage, industrial wastes, mine drainage. |
| Boron ....... | B | B, $H_3BO_3$ | 100 $\mu$g/L | Evaporite deposits, igneous rock minerals, springs, volcanic gases | Cleaning aids, detergents, industrial wastes, irrigation, sewage. |
| Calcium ..... | Ca | $Ca^{+2}$, $CaCO_3$, $CaSO_4$ | 20 mg/L | Igneous rock minerals, rainwater, sedimentary rocks, soil | Industrial wastes (metallurgy, steelmaking), treatment plant wastes. |
| Carbon ...... | C | $CO_2$, $CO_3$, $HCO_3$, $H_2CO_3$, $CaCO_3$ | Quantities always sufficient in surrounding medium | Atmosphere, organic compounds and decay products, rainwater, soil | Industrial wastes (carbonation, metallurgy, pulp and paper, soda, and steelmaking), domestic sewage. |
| Chlorine ..... | Cl | $Cl^{-1}$, (oxides of chlorine) | Trace quantities | Evaporite deposits, igneous rock minerals, ocean water, rainwater, sedimentary rocks, volcanic gases | Chlorinated hydrocarbon process, cleaning aids, industrial wastes (petroleum and refining), irrigation, salt mining. |
| Cobalt ....... | Co | Co | 500 $\mu$g/L | Coal ash, soil, ultramafic rocks | Manufacturing wastes (tools and instruments), metallurgy. |
| Copper ...... | Cu | $Cu^{+2}$, Cu, $CuSO_4$ | 6.0 $\mu$g/L | Crustal rocks, ground water, marine animals | Industrial wastes (fabrication of pipes, refining, smelting), manufacturing wastes (electrical, foods), mill tailings, mine wastes, ore dumps, treatment plant wastes. |
| Hydrogen .... | H | $H^+$, $H_2S$, $H_2O$, $HCO_3$, $H_2CO_3$, OH | Quantities always sufficient in surrounding medium | Atmosphere, oxidation processes, rainwater, volcanic activity | Industrial wastes (hydrocarbon process), oils. |
| Iron......... | Fe | $Fe^{+2}$, $Fe^{+3}$, $FeSO_4$, $Fe(OH)_2$ | 0.65–6,000 $\mu$g/L | Ground water, igneous rock minerals, iron minerals, organic decomposition, soil | Acid drainage from mines, industrial wastes (steelmaking), iron ore mining, manufacturing wastes, oxides of iron metals (car bodies, refigerators). |
| Magnesium ... | Mg | $Mg^{+2}$, $MgSO_4$ | Trace quantities | Igneous rock minerals, ground water, rainwater, sedimentary rocks | Irrigation, manufacturing wastes (transportation vehicles). |
| Manganese ... | Mn | $Mn^{+2}$, $MnO_2$ | 5.0 $\mu$g/L | Ground water, plants, rocks, soil, tree leaves | Acid drainage from coal mines, industrial wastes (steelmaking). |

Table 4.--Common forms, minimum requirements, and some sources of elements essential to the growth of algae (modified from Britton and others, 1975, p. 7.)--Continued

| Element | Symbol | Some common forms in water | Minimum requirements | Examples of natural sources | Examples of manmade sources |
|---|---|---|---|---|---|
| Molybdenum . . | Mo | Mo, $MoO_4$ | Trace quantities | Ground water, rocks, soil | Industrial wastes (electrical devices, metallurgy, steelmaking), manufacturing wastes (alloys). |
| Nitrogen . . . . . | N | N, $NO_2$, $NO_3$, organic nitrogen, $NH_3$ | Trace quantities to 5.3 mg/L | Atmosphere, bacterial and plant fixation, limestone, rainwater, soil | Agricultural wastes (feedlots, fertilizers), domestic sewage, industrial wastes, storm drainage. |
| Oxygen . . . . . . | O | $O_2$, $H_2O$, oxides | Quantities always sufficient in surrounding medium | Atmosphere, oxidation processes, photosynthesis, rainwater | Industry (metallurgy). |
| Phosphorus . . . | P | $P^{+5}$, $PO_4$, $HPO_3$, organic phosphorus | 0.002–0.09 mg/L | Ground water, igneous and marine sediments, rainwater, soil, waterfowl | Agricultural wastes (feedlots, fertilizers), domestic sewage (detergents), industrial wastes. |
| Potassium . . . . | K | $K^+$ (salts of potassium) | Trace quantities | Evaporite deposits, igneous rock minerals, plant ash, sedimentary rocks | Agricultural wastes (feedlots, fertilizers), industrial wastes (preservatives, pulp ash). |
| Silicon . . . . . . . | Si | $Si^{+4}$, $SiO_2$ | 0.5–0.8 mg/L | Diatom shells, igneous rock minerals, metamorphic rocks | Domestic sewage, industrial wastes. |
| Sodium . . . . . . | Na | $Na^+$, Na salts (NaCl, $NaCO_3$ | 5.0 mg/L | Ground water, igneous rock minerals, ocean water, soil | Industrial wastes (paper and pulp, rubber, soda, water softeners), manufacturing wastes (dyes and drugs). |
| Sulfur . . . . . . . | S | $SO_2$, HS, $H_2S$, $SO_4$ | 5.0 mg/L | Animal and plant decomposition, igneous rocks, rainwater, sedimentary rocks, springs, volcanic activity | Agricultural wastes (fertilizers), industrial wastes (fuels, paper and pulp). |
| Vanadium . . . . | V | $V^{+2}$, $V^{+3}$, $V^{+4}$, $V^{+5}$ (salts and oxides of vanadium) | Trace quantities | Ground water, plant ash | Industrial wastes. |
| Zinc . . . . . . . . . | Zn | $Zn^{+2}$ (salts of zinc), $ZnO_2$ | 10–100 µg/L | Igneous and carbonate rock minerals | Industrial wastes (piping, refining), mine wastes. |

This law states that growth is limited by the substance that is present in minimal quantity with respect to the needs of the organism (algae).

The requirements of these essential nutrients can be expressed in ratios relative to a given dry weight of algal cells. Comparison of the ratios of these essential nutrients in the dry algal tissue with that found in the environment (lake) can be used as an indicator as to which nutrient(s) is (are) limiting or potentially limiting to a plant community. Vallentyne (1974) considered phosphorus (P) and nitrogen (N) the principal nutrients that limit algal growth; he found they are present in the ratio of 1P:7N:100 dry weight of algal tissue. This 7:1 ratio is used in this report with respect to total nitrogen and total phosphorus in determining which of these nutrients is potentially limiting algal growth.

Lakes having ratios of N to P greater than 7:1 were considered to be low in phosphorus, whereas lakes having N to P ratios less than 7:1 were considered to be low in nitrogen. All lakes sampled in 1978 and 1979 had ratios of N to P greater than 7:1 and were considered to be low (or deficient) in phosphorus on the basis of water samples collected in the spring at the 2-foot depth. The authors realize that this technique is only a general indicator of nutrient deficiency, that the technique is less positive as the 7:1 ratio is approached, and that whether the nutrient is deficient will depend on the algal quantity in the lake.

Other authors have used other forms or other ratios of nitrogen and phosphorus to determine nutrient deficiency. The National Eutrophication Survey (U.S. Environmental Protection Agency, 1975) for example, used the ratio of inorganic nitrogen to total phosphorous to determine nutrient deficiency. Lakes having a ratio of inorganic nitrogen to total phosphorus greater than 14:1 were considered to be phosphorus deficient; lakes having a ratio below 10 were considered to be nitrogen deficient; and those having a ratio between 10 and 14 were considered to be transitional. Precise determinations of deficient nutrient(s) would need to be done during a period of peak algal productivity and would need to include algal assays and analyses of available N and P.

Toxics and undesirable substances.--These are substances whose presence at certain concentrations in water can produce harmful or degrading effects on organisms that live in or use the water. The Ohio Environmental Protection Agency (1978), in its water quality standards (Chapter 3745.1 of the Ohio Administrative Code), has listed the following criteria for selected constituents in exceptional warmwater habitats:

"The following chemical substances shall not exceed the specified concentrations at any time:"

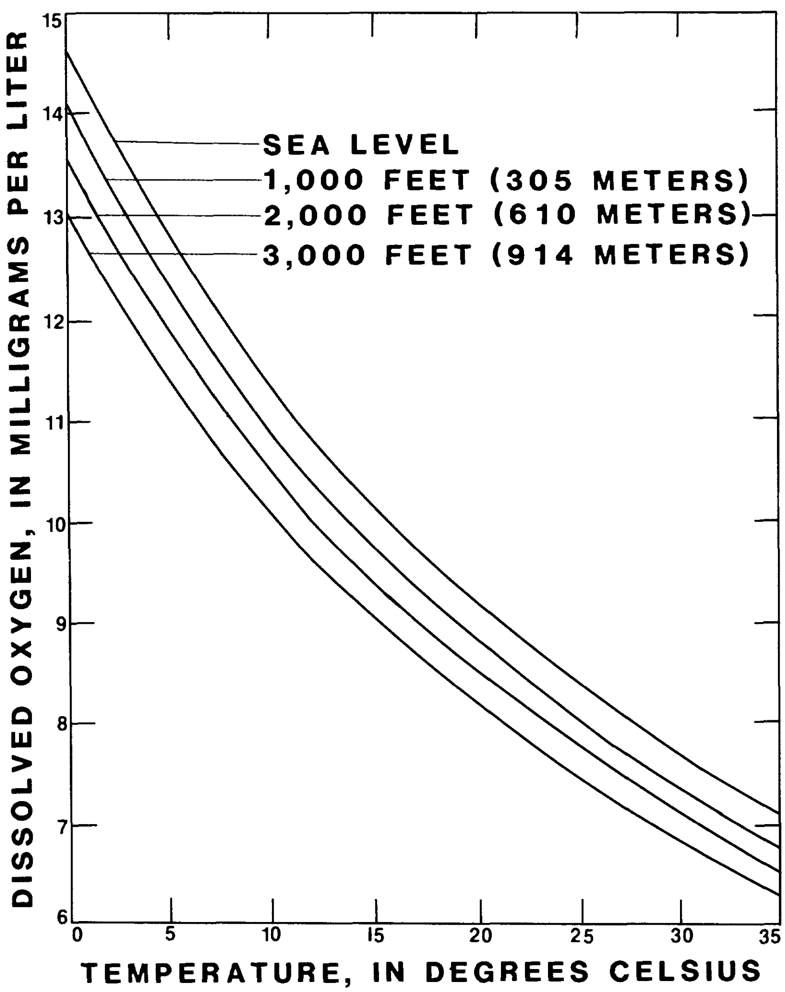
| Constituent | Concentration | |
|---|---|---|
| | mg/L | µg/L |
| Ammonia ------------------------- | varies with pH | -- |
| Cadmium ------------------------ | -- | 1.2 |
| Chromium ----------------------- | -- | 50 |
| Copper -------------------------- | -- | 5 |
| Cyanide (free) ------------------- | 0.005 | -- |
| Foaming agents (MBAS) ------------ | .5 | -- |
| Iron (dissolved) ----------------- | 1.0 | -- |
| Lead ----------------------------- | -- | 30 |
| Mercury ------------------------- | -- | 0.2 |
| Nickel --------------------------- | -- | 25 |
| Oil and grease (hexane soluble) -- | 5.0 | -- |
| Phenols ------------------------- | -- | 1 |
| Zinc ----------------------------- | -- | 30 |

Dissolved oxygen.--Dissolved oxygen is an important chemical constituent and symptomatic indicator of water quality. Oxygen concentrations in water are governed by water temperature, salinity, and barometric pressure (fig. 9). Oxygen is fundamental to all aerobic forms of life. A recommended minimum concentration of 5.0 mg/L is suggested for all water supporting fish life (U.S. Environmental Protection Agency, 1976). Oxygen concentrations may be significantly decreased in water by ambient biological and chemical processes. These processes are artificially measured by determinations of biochemical oxygen demand (BOD) and chemical oxygen demand (COD).

Other dissolved gases.--This category includes gases that originate primarily from biogeochemical recycling (Odum, 1971, p. 91) of gases such as carbon dioxide ($CO_2$), ammonia ($NH_3$), and hydrogen sulfide ($H_2S$).

## Biological Determinations

Phytoplankton.--Phytoplankton (algae) are passive floating or weakly motile microscopic plants that inhabit the open waters of lakes and streams. Algae are primary producers, and their populations and cell densities may reflect and affect environmental conditions and nutrient availability (Hutchinson, 1967, p. 355-394). The taxonomic classification used in this report follows Prescott (1970) and is listed in the table that follows.




Based on data from Whipple and Whipple, 1911

Figure 9.--Equilibrium concentrations of dissolved oxygen in low salinity (less than 300 mg/L $Cl^-$) water at different elevations (pressures) and temperatures.

| | |
|---|---|
| Chlorophyta -------------------- | green algae |
| Cyanophyta --------------------- | blue-green algae |
| Chrysophyta -------------------- | yellow-green or yellow-brown algae (includes diatoms) |
| Euglenophyta ------------------- | euglenoids |
| Cryptophyta -------------------- | cryptomonads (Cryptophyceae by some authors) |
| Pyrrophyta --------------------- | dinoflagellates |
| Rhodophyta --------------------- | red algae |

A measure of the community diversity, as presented in Wilhm and Dorris (1968) and discussed in Slack and others (1973, p. 24), is used in this report. The diversity index, $d$, is formulated as

$$\bar{d} = \sum_{i=1}^{s} \frac{n_i}{n} \log \frac{n_i}{n}$$

where $n_i$ is the number of individuals per taxon, $n$ is the total number of individuals in the sample, and $s$ is the number of identifiable groups or taxa. The higher the values of $d$ are, the greater the diversity within the sampled community.

The size of a plankton cell varies greatly among different phyla and within a given phylum. Consequently, the small cell size common in the phylum Cyanophyta may account, in part, for the very high algae densities observed in some lakes.

*Chlorophyll a*.--Chlorophyll *a* is the primary photosynthetic pigment in all green plants and makes up 1 to 2 percent of the dry weight of the organic matter in algae. Because chlorophyll *a* is present in all species of algae and is easy to measure, it is widely used as an indicator of biomass. In 1978 and 1979, the dry weights of chlorophyll *a* were determined for phytoplankton filtered from water samples from euphotic zone composites at 2 feet and other selected depths. The summer chlorophyll-*a* value at 2 feet was used in this report to determine each lake's trophic level.

*Trophic state*.--A method described by Carlson (1977) was used to determine the trophic state of the lakes and reservoirs included in this report. Carlson's trophic state index (TSI) is based on the interrelations of weight of chlorophyll *a*, Secchi-disk depth readings, and total phosphorus. Each of these measures correlates with biological productivity and, therefore, with trophic state. Data that indicate a lake's trophic state can be calculated by the following equations:

a) Chlorophyll *a* (Chl*a*), in $mg/m^3$
$$TSI (Chla) = 10 [6-(2.04-0.68 \ln Chla)/\ln 2]$$

b) Secchi-disk depth reading or transparency (SD), in meters
$$TSI (SD) = 10(6-\ln SD/\ln 2)$$

c) Total phosphorus (TP), in $mg/m^3$
$$TSI (TP) = 10 [6-\ln(48/TP)/\ln 2]$$

The TSI ranges from 0 to 100. The greater the TSI, the higher the trophic level. Table 5 relates TSI to traditional trophic-level terminology (Youger, 1980).

Table 5.--Carlson's trophic state index for lakes

| Trophic state index | Trophic classification |
|---|---|
| Below 40 | Oligotrophic |
| 40-50 | Mesotrophic |
| 50-70 | Eutrophic |
| greater than 70 | Hypereutrophic |

In this survey the summer chlorophyll-*a* concentration at the 2-foot depth, the summer Secchi-disk transparency, and the spring total-phosphorus concentration at 2-foot depth were used with Carlson's equations to determine trophic state indexes.

Bacteria.--The bacteria groups, fecal coliform and fecal streptococci, are used as indicators of sanitary conditions. Their ratio, FC/FS, may indicate their source (Federal Water Quality Administration, 1971).

The Ohio Environmental Protection Agency (1978) has set the following criteria for recreational water designed for primary contact.

"These are waters suitable for full body contact recreation, such as, but not limited to, swimming and scuba diving with minimal threat to public health as a result of water quality, during the recreation season.

*Fecal coliform*.--"Geometric mean fecal coliform content (either MPN or MF), based on not less than five samples within a 30-day period shall not exceed 1,000 per 100 ml (milliters) and shall not exceed 2,000 per 100 ml in more than 10 percent of the samples taken during any 30-day period."

## PRESENTATION OF THE DATA

The 28 Ohio lakes (14 per year) surveyed for water quality in 1978 and 1979 are listed in tables 6 through 10. The accompanying physical data were taken from various State and Federal reports and U.S. Geological Survey topographic maps. Identification numbers of primary lake and inflow sampling sites were generated from the latitude and longitude of their locations. For example, 410202080595100 is the identification number for a site at 41°02'02" latitude and 80°59'51" longitude. For convenience, however, primary lake sites are identified as L-1. Secondary sites are designated L-2 and L-3. Inflow sites are labeled I-1 and I-2.

The sampling in spring was scheduled to gather data from well mixed lakes after the runoff of winter and early spring. Sampling in late summer provided an opportunity to re-examine the same lakes for the effects of physical and biological stresses that occur during summer.

Data for the primary lake sites are presented in profile form and as tabulations for discrete water columns or water-column composites. Data from secondary lake sampling sites are shown in profile form only. Computed saturation concentrations for dissolved oxygen are also included for comparison. Analytical data from the water-column composites were used for general chemical classification and background information.

Data for phytoplankton identification (genus) and cell counts for each lake are included. The data are from water-column composites of the euphotic zone and point samples from zones of maximum dissolved-oxygen concentration. Chlorophyll-*a* concentrations were determined by the Biomonitoring Laboratory of the Ohio Environmental Protection Agency.

Table 6.--Morphometric data for lakes sampled in Ohio, 1978 and 1979

[Type: I = impoundment, Lk = lake, U = upground reservoir; Use: F = flood control, W = water supply, R = recreation; C/I = Capacity divided by mean annual inflow (decreasing values indicate shorter hydraulic retention time)]

| Name and primary site identification number | Location (county) | Type[a] | Date of origin | Use[b] | Surface area (acres) | Depth (feet) | |
|---|---|---|---|---|---|---|---|
| | | | | | | Maximum | Mean |
| Lakes sampled in 1978 | | | | | | | |
| Buckeye Lake 395548082271300---------- | Perry | I | 1825 | R | 3,800 | 16 | 5.2 |
| Caesar Creek Lake 392910084033500---------- | Greene | I | 1977 | F, R | 2,830 | 100 | 36 |
| Charles Mill Lake 404428082214600---------- | Ashland | I | 1936 | F, R | 1,350 | 15 | 5.5 |
| Dow Lake 392014082010500---------- | Athens | I | 1958 | R | 161 | 43 | 15 |
| Forked Run Lake 390531081460500---------- | Meigs | I | 1952 | R | 104 | 40 | 16 |
| Hargus Lake 393735082530900---------- | Pickaway | I | 1956 | R | 130 | 53 | 18 |
| Highlandtown Reservoir 403815080450100---------- | Columbiana | I | 1968 | R | 170 | 39 | 7.2 |
| Jackson Lake 385331082360500---------- | Jackson | I | 1940 | R | 242 | 18 | 7.0 |
| LaDue Reservoir 412414081110900---------- | Geauga | I | 1961 | R, W | 1,400 | 28 | 13 |
| Lake Hope 391914082211800---------- | Vinton | I | 1939 | R | 127 | 27 | 9.0 |
| Nettle Lake 414055084433700---------- | Williams | Lk | Natural lake | R | 94 | 30 | 8 |
| Tycoon Lake 385539082211200---------- | Gallia | I | 1961 | R | 204 | 20 | 9.8 |
| Veto Lake 392041081385400---------- | Washington | I | 1954 | R | 138 | 22 | 7.3 |
| West Fork Mill Creek Lake 391537084295000---------- | Hamilton | I | 1953 | R, F | 183 | 20 | 8.4 |

Table 6.--Morphometric data for lakes sampled in Ohio, 1978 and 1979 -- Continued

| Name and primary site identification number | Shoreline (miles) | Capacity (acre-feet) | Drainage area (square miles) | Mean annual inflow (acre-feet) | Capacity-inflow ratio (C/I) |
|---|---|---|---|---|---|
| Lakes sampled in 1978: | | | | | |
| Buckeye Lake 395548082271300---------- | 32 | 19,940 | 47 | 30,700 | 0.65 |
| Caesar Creek Lake 392910084033500---------- | 40 | 102,000 | 237 | 170,630 | .60 |
| Charles Mill Lake 404428082214600---------- | 33 | 7,400 | 215 | 131,860 | .06 |
| Dow Lake 392014082010500---------- | 7 | 2,496 | 7.3 | 5,940 | .42 |
| Forked Run Lake 390531081460500---------- | 8.5 | 1,700 | 8.9 | 7,590 | .22 |
| Hargus Lake 393735082530900---------- | 5 | 2,325 | 6.5 | 4,330 | .55 |
| Highlandtown Reservoir 403815080450100---------- | 6.5 | 1,230 | 6.0 | 4,480 | .27 |
| Jackson Lake 385331082360500---------- | 11 | 1,700 | 19 | 15,200 | .11 |
| LaDue Reservoir 412414081110900---------- | 20 | 13,100 | 35.1 | 28,080 | .64 |
| Lake Hope 391914082211800---------- | 5.4 | 1,555 | 10 | 7,730 | .20 |
| Nettle Lake 414055084433700---------- | 3.5 | 752 | 20.2 | 7,540 | .10 |
| Tycoon Lake 385539082211200---------- | 3.64 | 2,000 | 1.4 | 1,120 | 1.8 |
| Veto Lake 392041081385400---------- | 6 | 1,010 | 20 | 17,600 | .06 |
| West Fork Mill Creek Lake 391537084295000---------- | 10 | 1,531 | 30.0 | 19,200 | .08 |

Table 6.-- Morphometric data for lakes sampled in Ohio, 1978 and 1979 -- Continued

| Name and primary site identification number | Location (county) | Type[a] | Date of origin | Use[b] | Surface area (acres) | Depth (feet) | |
|---|---|---|---|---|---|---|---|
| | | | | | | Maximum | Mean |
| **Lakes sampled in 1979:** | | | | | | | |
| William H. Harsha (East Fork) Lake 390116084091300---------- | Clermont | I | 1978 | W, R, F | 2,160 | 110 | 42 |
| Findlay City Reservoir 410135083340000---------- | Hancock | U | 1971 | R, W | 886 | 27 | 18 |
| Griggs Reservoir 400100083054000---------- | Franklin | I | 1905 | R, W | 385 | 32 | 13 |
| Hammertown Lake 390320082410000---------- | Jackson | I | 1955 | R, W | 186 | 55 | 23 |
| Lake Clark 395652082410000---------- | Clark | I | 1957 | R | 100 | 14 | 4.5 |
| Lake Milton 410736080583900---------- | Mahoning | I | 1916 | W, R, F | 1,685 | 40 | 17 |
| Lake Rupert 391033082311000---------- | Vinton | I | 1968 | R, W | 325 | 28 | 8.6 |
| Lake White 390638083400000---------- | Pike | I | 1935 | R | 339 | 34 | 11 |
| Madison Lake 395159083223600---------- | Madison | I | 1946 | R | 106 | 14 | 5.6 |
| Meander Creek Reservoir 410910080464500---------- | Trumbull | I | 1930 | W | 2,150 | 50 | 17 |
| North Branch Reservoir 403024082345100---------- | Knox | I | 1972 | R, F | 154 | 16 | 6.5 |
| Ross Lake 392005082542200---------- | Ross | I | 1968 | R | 140 | 34 | 12 |
| Snowden Lake 391459082112000---------- | Athens | I | 1970 | W, R, F | 131 | 47 | 16 |
| Willard City Reservoir 410350082393000---------- | Huron | U | 1969 | R, W | 340 | 64 | 36 |

Table 6.--Morphometric data for lakes sampled in Ohio, 1978 and 1979 -- Continued

| Name and primary site identification number | Shore-line (miles) | Capacity (acre-feet) | Drain-age area (square miles) | annual inflow (acre-feet) | Capacity-inflow ratio (C/I) |
|---|---|---|---|---|---|
| **Lakes sampled in 1979:** | | | | | |
| William H. Harsha East Fork Lake 390116084091300 | 34 | 90,400 | 342 | 264.460 | .34 |
| Findlay City Reservoir 410135083340000 | 4.5 | 16,368 | -- | -- | -- |
| Griggs Reservoir 400100083054000 | 15 | 5,070 | 1,044 | 556,760 | .01 |
| Hammertown Lake 390320082410000 | 8.4 | 4,200 | 3.14 | 2,430 | 1.72 |
| Lake Clark 395652082410000 | 3 | 456 | 7 | 4,850 | .09 |
| Lake Milton 410736080583900 | 21 | 28,743 | 276 | 183,990 | .16 |
| Lake Rupert 391033082311000 | 8.5 | 2,860 | 22.2 | 17,170 | .17 |
| Lake White 390638083400000 | 8.3 | 3,746 | 34.98 | 27,050 | .14 |
| Madison Lake 395159083223600 | 4 | 594 | 55 | 32,260 | .02 |
| Meander Creek Reservoir 410910080464500 | 35.2 | 35,700 | 83.9 | 53,690 | .66 |
| North Branch Reservoir 403024082345100 | 3.4 | 1,000 | 44.5 | 33,220 | .03 |
| Ross Lake 392005082542200 | 3.3 | 1,745 | 3.82 | 2,850 | .61 |
| Snowden Lake 391459082112000 | 6.9 | 2,131 | 4.04 | 3,230 | .66 |
| Willard City Reservoir 410350082393000 | 2.3 | 7,985 | -- | -- | -- |

Table 7.--Summary of physical and chemical characteristics for the primary sites (L-1) of selected lakes in Ohio, 1978

| Lake name and site location | Maximum observed depth (feet) | Secchi-disk transparency (feet) | | Thermal stratification | | Dissolved oxygen[1] (mg/L) | | pH[1] | |
|---|---|---|---|---|---|---|---|---|---|
| | | Spring | Summer | Spring | Summer | Spring | Summer | Spring | Summer |
| Buckeye Lake at midpoint | 15 | 1.8 | 3.7 | No | No | 11.5- 7.8 | 8.8-7.4 | 8.4-7.9 | 8.1-7.8 |
| Caesar Creek Lake above dam | 75 | 4.8 | 14.0 | Slight | Yes | 10.5- 7.0 | 7.5-0 | 7.8-7.0 | 7.9-7.0 |
| Charles Mill Reservoir above dam | 7 | 1.5 | 1.1 | No | Slight | 14.5-11.2 | 10.6-4.4 | 8.7-8.4 | 8.3-7.6 |
| Dow Lake above dam | 40 | 5.5 | 10.0 | Slight | Yes | 10.9- 0.9 | 9.9-0 | 7.7-6.8 | 8.0-6.8 |
| Forked Run Lake above dam | 35 | 4.5 | 7.5 | Yes | Yes | 11.3- 2.5 | 8.4-0 | 7.4-6.3 | 7.6-6.3 |
| Hargus Lake above dam | 40 | 3.5 | 6.0 | Yes | Yes | 10.3- 4.7 | 8.9-0 | 8.1-7.3 | 8.2-7.2 |
| Highlandtown Lake above dam | 28 | 6.0 | 6.0 | Slight | Yes | 13.0-11.7 | 9.0-0 | 7.0-6.4 | 9.2-6.5 |
| Lake Hope above dam | 20 | 9.0 | 2.5 | No | Yes | 10.4- 6.6 | 9.9-0 | 4.9-4.7 | 7.5-5.2 |
| Jackson Lake above dam | 12.5 | 4.8 | 3.6 | Slight | Yes | 15.7-11.7 | 7.6-0 | 7.7-6.2 | 7.0-6.5 |
| LaDue Reservoir above dam | 20 | 4.5 | 6.0 | No | Slight | 10.8-10.7 | 9.3-0 | 7.8-7.7 | 8.2-7.0 |
| Nettle Lake at midpoint | 30 | 3.5 | 3.8 | Yes | Yes | 14.6- 0 | 13.5-0 | 8.3-7.3 | 8.4-7.1 |
| Tycoon Lake at midpoint | 13 | 6.5 | 6.0 | No | Slight | 10.6-10.1 | 8.0-1 | 7.1-6.9 | 7.5-6.7 |
| Veto Lake above dam | 20 | 1.5 | 2.0 | Slight | Yes | 10.2- 1.6 | 10.9-0 | 7.3-6.8 | 8.2-6.9 |
| West Fork Lake above site L-1 | 20 | 2.0 | 1.8 | Yes | Yes | 13.0- 0 | 6.9-0 | 8.4-6.9 | 8.0-6.8 |

Table 7.--Summary of physical and chemical characteristics for the primary sites (L-1) of selected lakes in Ohio, 1978--Continued

| Lake name and site location | 5-day BOD[1] (mg/L) | | Total organic carbon[1] (mg/L) | | Specific conductance[1] (umho/cm) | | Chemical typing[2] (spring only) | |
|---|---|---|---|---|---|---|---|---|
| | Spring | Summer | Spring | Summer | Spring | Summer | Hardness | Major ions |
| Buckeye Lake at midpoint-------------- | 6.1- 4.9 | 3.7- 2.3 | 9.2- 9.3 | 8.6- 8.6 | 318- 328 | 325- 330 | Hard | $CaHCO_3$ |
| Caesar Creek Lake above dam------------- | 1.2- 0.6 | 0.8- 0.9 | 9.4- 9.3 | 9.1- 8.5 | 355- 300 | 472- 365 | Hard | $CaHCO_3$ |
| Charles Mill Reservoir above dam-------- | 6.6- 5.4 | 4.3- 3.1 | 11.0-10.0 | 8.0- 8.6 | 435- 450 | 450 | Very hard | $CaHCO_3$ |
| Dow Lake above dam------ | 1.0- 1.2 | .9- 4.1 | 5.8- 4.9 | 8.3- 4.4 | 258- 265 | 260- 285 | Mod. hard | $CaHCO_3$ |
| Forked Run Lake above dam------------- | 1.2- .9 | .6- 4.5 | 5.1-11.0 | 8.7- 5.6 | 125- 150 | 140- 200 | Soft | $CaHCO_3$ |
| Hargus Lake above dam--- | 0.8 | 9.9- .8 | 7.3- 9.0 | 5.6-17.0 | 383- 450 | 388- 445 | Very hard | $CaHCO_3$ |
| Highlandtown Lake above dam------------- | 1.3- .7 | 2.4- 1.2 | 8.5- 8.1 | 6.3- 6.6 | 172- 177 | 155- 240 | Soft | $CaSO_4$ |
| Lake Hope above dam----- | .5- .4 | 1.8- .8 | 4.8- 6.9 | 6.2-10.0 | 158- 168 | 155- 188 | Soft | $CaMgSO_4$ |
| Jackson Lake above dam-- | 2.1- 1.4 | 1.4- 1.6 | 6.7- 9.2 | 5.2- 8.3 | 160- 165 | 140- 310 | Soft | $CaMgSO_4$ |
| LaDue Reservoir above dam------------- | 1.7- 1.6 | 1.2- 1.3 | 14.0-17.0 | 5.9- 6.2 | 265 | 275- 310 | Mod. hard | $CaHCO_3Cl$ |
| Nettle Lake at midpoint-------------- | 2.8- 2.7 | 2.2- 1.3 | 8.5- 9.7 | 6.9-11.0 | 450- 470 | 450- 500 | Very hard | $CaHCO_3$ |
| Tycoon Lake at midpoint-------------- | 1.4 | 1.2- 1.1 | 6.4- 8.7 | .7- 3.4 | 103- 105 | 103- 105 | Soft | $CaSO_4HCO_3$ |
| Veto Lake above dam----- | 2.6- 1.8 | 3.0- 3.3 | 7.1- 7.2 | 6.1-11.0 | 300- 325 | 290- 350 | Mod. hard | $CaHCO_3$ |
| West Fork Lake above site L-1-------------- | 5.6-20 | 3.5-26.0 | 4.6- 5.7 | 7.2- 3.7 | 580-3150 | 213-2250 | Very hard | NaCl |

Table 7.--Summary of physical and chemical characteristics for the primary sites (L-1) of selected lakes in Ohio, 1978--Continued

| Lake name and site location | Substances at or above accepted limits | Total nitrogen (maximum concentration, in mg/L) | Total phosphorus (maximum concentration, in mg/L) | Hydrogen sulfide present |
|---|---|---|---|---|
| Buckeye Lake at midpoint | None | 2.2 | 0.15 | No |
| Caesar Creek Lake above dam | None | 4.7 | .16 | No |
| Charles Mill Reservoir above dam | Lead, iron, cadmium | 1.4 | .14 | No |
| Dow Lake above dam | Cadmium | 1.7 | .23 | Yes |
| Forked Run Lake above dam | Cadmium, copper, nickel | 3.0 | .07 | Yes |
| Hargus Lake above dam | Cadmium | 2.5 | .07 | Yes |
| Highlandtown Lake above dam | None | 2.2 | .04 | Yes |
| Lake Hope above dam | Cadmium, lead, zinc | 1.2 | .01 | Yes |
| Jackson Lake above dam | None | .76 | .08 | No |
| LaDue Reservoir above dam | None | 1.0 | .07 | No |
| Nettle Lake at midpoint | None | 3.3 | .30 | Yes |
| Tycoon Lake at midpoint | Cadmium, nickel, zinc | .65 | .02 | No |
| Veto Lake above dam | Cadmium | 3.4 | .49 | No |
| West Fork Lake above site L-1 | Lead | 16.0 | .19 | Yes |

[1]Water column data -- near-surface values shown first; single value used when near-surface and near-bottom values were equal.
[2]Refer to table 3.
[3]Ohio EPA Regulation EP-1 -- Water Quality Standards.

1

Table 8.--Summary of physical and chemical characteristics for the primary sites(L-1) of selected lakes in Ohio, 1979

| Lake name and site location | Maximum observed depth (feet) | Secchi-disk transparency (feet) | | Thermal stratification | | Dissolved oxygen[1] (mg/L) | | pH[1] | |
|---|---|---|---|---|---|---|---|---|---|
| | | Spring | Summer | Spring | Summer | Spring | Summer | Spring | Summer |
| William H. Harsha (East Fork Lake ) above dam | 95 | 4.1 | 3.7 | Yes | Yes | 7.8- 4.0 | 7.2-0.3 | 8.5-7.7 | 8.5-7.2 |
| Findlay City Reservoir, north side | 27 | 11 | 4.8 | Yes | Slight | 7.2- 1.6 | 8.0-3.2 | 9.0-8.0 | 8.6-7.6 |
| Griggs Reservoir above dam | 25 | 3.0 | 2.2 | Yes | Yes | 8.2- 0.8 | 7.5-1.2 | 7.2-6.7 | 8.6-7.3 |
| Hammertown Lake above dam | 50 | 16 | 15.8 | Yes | Yes | 7.4- 3.4 | 6.7-1.7 | 8.4-7.3 | 8.8-6.6 |
| Lake Clark above dam | 9 | 5.6 | 7.0 | Yes | Slight | 12.0- 3.6 | 8.4-1.1 | 9.4-7.7 | 9.3-6.7 |
| Lake Milton above dam | 35 | 5.4 | 3.7 | Yes | Yes | 6.7- 2.4 | 6.9- .6 | 8.6-7.7 | 7.6-6.9 |
| Lake Rupert above dam | 25 | 6.9 | 5.1 | Yes | Yes | 7.0- .6 | 7.9- .4 | 8.0-7.1 | 8.0-7.2 |
| Lake White above dam | 25 | 4.4 | 5.2 | Yes | Yes | 8.2- 1.2 | 8.6-1.7 | 6.7-7.1 | 8.0-6.9 |
| Madison Lake above dam | 7 | 1.2 | 1.7 | Slight | Slight | 8.5- .9 | 7.4- .7 | 8.8-7.8 | 7.5-6.7 |
| Meander Creek Reservoir above dam | 50 | 7.0 | 5.7 | Yes | Yes | 6.6- 1.4 | 7.4- .6 | 8.9-7.8 | 8.8-7.1 |
| North Branch Reservoir above dam | 16 | 1.7 | 1.7 | Yes | Slight | 7.5- 1.6 | 6.7- .9 | 8.9-8.3 | 8.6-7.6 |
| Ross Lake above dam | 29 | 6.7 | 10.1 | Yes | Yes | 8.1- 1.7 | 6.1- .6 | 9.3-7.9 | 9.1-7.1 |
| Snowden Lake above dam | 44 | 10.5 | 6.0 | Yes | Yes | 7.9- 1.3 | 6.4- .5 | 9.1-7.7 | 8.9-6.8 |
| Willard City Reservoir | 40 | 21.3 | 5.1 | Yes | Yes | 5.6- 1.8 | 7.5- .5 | 9.0-8.1 | 8.5-7.3 |

Table 8.--Summary of physical and chemical characteristics for the primary sites(L-1) of selected lakes in Ohio, 1979--Continued

| Lake name and site location | 5-day BOD[1] (mg/L) | | Total organic carbon[1] (mg/L) | | Specific conductance (umho/cm) | | Chemical typing[2] (spring only) | |
|---|---|---|---|---|---|---|---|---|
| | Spring | Summer | Spring | Summer | Spring | Summer | Hardness | Major ions |
| William H. Harsha East Fork Lake above dam | 1.1-0.5 | 2.5-1.2 | 7.6- 7.1 | 7.7- 6.5 | 270-250 | 269-261 | Mod. hard | $CaHCO_3$ |
| Findlay City Reservoir, north side | 0.7-1.1 | 2.0-1.1 | 7.6- 9.2 | 7.0- 9.4 | 430-450 | 415-430 | Very hard | $CaHCO_3SO_4$ |
| Griggs Reservoir above dam | 1.2-1.5 | 3.8-4.4 | 7.6- 7.0 | 12.0-10.0 | 605-590 | 460-585 | Very hard | $CaSO_4$ |
| Hammertown Lake above dam | .6- .7 | 0.8-0.9 | 2.0 | 3.6- 9.6 | 105 | 105-150 | Soft | $CaMgSO_4$ |
| Lake Clark above dam | 1.3-3.8 | .6-6.9 | 4.5- 3.8 | 0.6-24.0 | 305-430 | 324-790 | Hard | $CaHCO_3$ |
| Lake Milton above dam | 1.5-3.3 | 1.1-1.7 | 5.3- 7.5 | 8.4- 8.8 | 370-380 | 410-430 | Hard | $CaSO_4$ |
| Lake Rupert above dam | .6- .8 | 1.2- .8 | 5.8- 3.9 | 9.1- 4.9 | 160-180 | 134-241 | Soft | $CaSO_4HCO_3$ |
| Lake White above dam | .5- .9 | .8-1.7 | 6.0- 5.6 | 5.6- 7.7 | 260-220 | 220-234 | Mod. hard | $CaMgSO_4$ |
| Madison Lake above dam | 5.6-2.0 | 3.0-2.9 | 5.3-13.0 | 6.4- 5.6 | 510-520 | 575-234 | Very hard | $CaSO_4$ |
| Meander Creek Reservoir above dam | 1.1-5.8 | .8-1.2 | 6.4- 4.2 | 8.3- 6.9 | 410-430 | 400-430 | Hard | $CaSO_4$ |
| North Branch Reservoir above dam | 3.0-3.8 | 3.0-3.0 | 3.1- 2.9 | 5.5- 6.1 | 380-450 | 395-468 | Very hard | $CaSO_4$ |
| Ross Lake above dam | 1.1-1.9 | 1.1-3.8 | 9.4-11.0 | 5.5- 9.3 | 300-290 | 265-308 | Mod. hard | $CaSO_4$ |
| Snowden Lake above dam | .9- .8 | 1.8-4.0 | 3.9- 3.4 | 4.2- 7.8 | 210 | 180-238 | Hard | $CaSO_4$ |
| Willard City Reservoir | .3- .2 | 1.2-2.9 | 7.7- 6.7 | 6.4- 6.3 | 300-310 | 524-564 | Very hard | $CaSO_4$ |

Table 8.--Summary of physical and chemical characteristics for the primary sites (L-1) of selected lakes in Ohio, 1979--Continued

| Lake name and site location | Substances at or above accepted limits | Total nitrogen (maximum concentration in mg/L) | Total phosphorus (maximum concentration in mg/L) | Hydrogen sulfide present |
|---|---|---|---|---|
| William H. Harsha East Fork Lake above dam | Cadmium | 2.3 | 0.21 | Yes |
| Findlay City Reservoir, north side | Nickel | 1.6 | .04 | No |
| Griggs Reservoir above dam | None | 13.0 | 1.2 | Yes |
| Hammertown Lake above dam | None | 1.5 | .02 | Yes |
| Lake Clark above dam | None | 7.8 | .31 | Yes |
| Lake Milton above dam | Cadmium | 2.4 | .22 | Yes |
| Lake Rupert above dam | None | 2.6 | .08 | Yes |
| Lake White above dam | None | 2.5 | .88 | Yes |
| Madison Lake above dam | Copper | 7.5 | .09 | Yes |
| Meander Creek Reservoir above dam | Nickel | 2.2 | .32 | Yes |
| North Branch Reservoir above dam | None | 3.0 | .11 | No |
| Ross Lake above dam | None | 3.6 | .22 | Yes |
| Snowden Lake above dam | None | 2.6 | .20 | Yes |
| Willard City Reservoir | None | 1.8 | .16 | Yes |

[1]Water column data -- near-surface values shown first; single value used when near-surface and near-bottom values were equal.
[2]Refer to table 3.
[3]Ohio EPA Regulation EP-1 Water Quality Standards.

Table 9.--Summary of biological characteristics for the primary sites (L-1) of selected lakes in Ohio, 1978

| Lake name and site location | Bacteria[1] (colonies per 100 ml) Fecal coliform Spring | Fecal coliform Summer | Fecal streptococci Spring | Fecal streptococci Summer | Chlorophyll *a* (ug/L) | Phytoplankton: Dominant phylum and *genus*, and percent of total cell count, spring sampling (euphotic zone) Cells per ml | Composites from euphotic zone | Percent |
|---|---|---|---|---|---|---|---|---|
| Buckeye Lake at midpoint------------- | 2- 20 | 30- 28 | 34-428 | 12- 16 | 87.7 | 3,000,000 | Cyanophyta | 85 |
| | | | | | | | *Anacystis* | 67 |
| Caesar Creek Lake above dam---------- | 24- 16 | 12- 40 | 80-550 | 12- 30 | 5.9 | 680 | Euglenophyta | 59 |
| | | | | | | | (*Cryptomonads*) | 59 |
| Charles Mill Reservoir above dam----- | 4- 2 | 4- 4 | 74- 66 | 16-140 | 90.5 | 350,000 | Chrysophyta | 43 |
| | | | | | | | *Cyclotella* | 40 |
| Dow Lake above dam------------------- | 6- 4 | 4- 92 | 46- 94 | 8-140 | 10.2 | 23,000 | Cyanophyta | 96 |
| | | | | | | | *Oscillatoria* | 69 |
| Forked Run Lake above dam------------ | 2- 2 | 30- 26 | 40- 2 | 26- 30 | -- | 560 | Chlorophyta | 57 |
| | | | | | | | *Ankistrodesmus* | 54 |
| Hargus Lake above dam---------------- | 167- 12 | 4- 12 | 330- 24 | 4- 4 | 8.7 | 8,400 | Chrysophyta | 56 |
| | | | | | | | *Ochromonas* | 37 |
| Highlandtown Reservoir above dam----- | 24- 18 | 2- 2 | 42- 48 | 2- 4 | 4.7 | 950 | Chrysophyta | 55 |
| | | | | | | | *Cyclotella* | 27 |
| Jackson Lake above dam--------------- | 2- 2 | 32- 12 | 2- 10 | 104- 54 | 18.3 | 1,600 | Cyanophyta | 40 |
| | | | | | | | *Anacystis* | 33 |
| LaDue Reservoir above dam------------ | 2- 2 | 2- 2 | 24- 12 | 2- 2 | 8.8 | 5,700 | Chrysophyta | 84 |
| | | | | | | | *Asterionella* | 43 |
| Lake Hope above dam------------------ | 2- 2 | 12- 76 | 2- 2 | 88- 76 | 2.0 | 660 | Pyrrhophyta | 67 |
| | | | | | | | (*Dinoflagellates*) | 64 |
| Nettle Lake near midpoint------------ | 2- 2 | 6- 4 | 10- 58 | 18-120 | 21.9 | 8,100 | Chrysophyta | 35 |
| | | | | | | | *Asterionella* | 15 |
| Tycoon Lake near midpoint------------ | 2- 4 | 2- 4 | 2- 2 | 32- 32 | 6.4 | 2,200 | Chlorophyta | 58 |
| | | | | | | | *Cyclotella* | 17 |
| Veto Lake above dam------------------ | 58- 26 | 22- 30 | 200- 80 | 20- 52 | 19.7 | 1,100 | Cyanophyta | 45 |
| | | | | | | | *Anacystis* | 45 |
| West Fork Mill Creek Lake above dam-- | 15-290 | 900-1,600 | 24-200 | 240-680 | 45.4 | 16,000 | Cyanophyta | 83 |
| | | | | | | | *Oscillatoria* | 71 |

Table 9.--Summary of biological characteristics for the primary sites (L-1) of selected lakes in Ohio, 1978 -- Continued

| Lake name and site location | Phytoplankton, summer sampling: dominant phylum and *genus*, and percent of total cell count — Euphotic zone: Chlorophyll *a* (ug/L) | Euphotic zone: Cells per ml | Euphotic zone: Composites from euphotic zone | Euphotic zone: percent | Zone of maximum dissolved oxygen: Chlorophyll *a* (ug/L) | Zone of maximum dissolved oxygen: Cells per ml | Zone of maximum dissolved oxygen: Samples from zone of maximum dissolved oxygen | Zone of maximum dissolved oxygen: percent |
|---|---|---|---|---|---|---|---|---|
| Buckeye Lake at midpoint------------- | 52.9 | 24,000 | Chrysophyta | 79 | 60.8 | 12,000 | Chrysophyta | 79 |
| | | | *Melosira* | 79 | | | *Melosira* | 67 |
| Caesar Creek Lake above dam---------- | 9.5 | 70,000 | Cyanophyta | 81 | 85 | 11,000 | Chlorophyta | 100 |
| | | | *Gomphosphaeria* | 81 | | | *Sphaerocystis* | 100 |
| Charles Mill Reservoir above dam----- | 57.5 | 8,000 | Chrysophyta | 70 | 68.8 | 33,000 | Cyanophyta | 39 |
| | | | *Cyclotella* | 41 | | | *Agmenellum* | 39 |
| Dow Lake above dam------------------- | 8.3 | 32,000 | Cyanophyta | 99 | 6.2 | 30,000 | Cyanophyta | 99 |
| | | | *Gomphosphaeria* | 50 | | | *Gomphosphaeria* | 44 |
| Forked Run Lake above dam------------ | 24.4 | 6,900 | Cyanophyta | 90 | -- | 910 | Cyanophyta | 84 |
| | | | *Agmenellum* | 67 | | | *Oscillatoria* | 84 |
| Hargus Lake above dam---------------- | 4.6 | 3,300 | Cyanophyta | 71 | 3.6 | 510 | Cyanophyta | 78 |
| | | | *Raphidiopsis* | 38 | | | *Raphidiopsis* | 78 |
| Highlandtown Reservoir above dam----- | 43.6 | 110,000 | Cyanophyta | 98 | -- | 41,000 | Cyanophyta | 95 |
| | | | *Oscillatoria* | 64 | | | *Anabaena* | 76 |
| Jackson Lake above dam--------------- | -- | 73,000 | Cyanophyta | 97 | 10.2 | 15,000 | Cyanophyta | 69 |
| | | | *Oscillatoria* | 41 | | | *Anacystis* | 43 |
| LaDue Reservoir above dam------------ | 11.3 | 13,000 | Cyanophyta | 99 | 11.1 | 9,600 | Cyanophyta | 100 |
| | | | *Anacystis* | 96 | | | *Anacystis* | 84 |
| Lake Hope above dam------------------ | 27.9 | 32,000 | Chlorophyta | 100 | 30.1 | 140,000 | Chlorophyta | 100 |
| | | | *Cosmarium* | 67 | | | *Cosmarium* | 75 |
| Nettle Lake near midpoint------------ | 11.9 | 88,000 | Cyanophyta | 54 | 19.5 | 8,600 | Cyanophyta | 47 |
| | | | *Anacystis* | 35 | | | *Raphidiopsis* | 38 |
| Tycoon Lake near midpoint------------ | 12.1 | 110,000 | Cyanophyta | 97 | 10.1 | 72,000 | Cyanophyta | 96 |
| | | | *Anacystis* | 65 | | | *Anacystis* | 69 |
| Veto Lake above dam------------------ | 13.8 | 9,500 | Cyanophyta | 79 | 14.4 | 20,000 | Cyanophyta | 82 |
| | | | *Anacystis* | 35 | | | *Anacystis* | 51 |
| West Fork Mill Creek Lake above dam-- | 18.8 | 160,000 | Cyanophyta | 96 | 35.7 | 180,000 | Cyanophyta | 99 |
| | | | *Oscillatoria* | 93 | | | *Oscillatoria* | 94 |

[1]Water column data: Near surface values shown first; single value used when near-surface and near-bottom values were equal.

Table 10.--Summary of biological characteristics for the primary sites of selected lakes in Ohio, 1979

| Lake name and site location | Bacteria[1] (colonies per 100 ml): Fecal coliform, Spring | Fecal coliform, Summer | Fecal streptococci, Spring | Fecal streptococci, Summer | Phytoplankton, spring sampling: dominant phylum and genus, and percent of total cell count — Euphotic zone: Chlorophyll a (ug/L) | Euphotic zone: Cells per ml | Euphotic zone: Composites from euphotic zone | Percent | Zone of maximum dissolved oxygen: Chlorophyll a (ug/L) | Zone of maximum dissolved oxygen: Cells per ml | Samples from zone of maximum dissolved oxygen | Percent |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| William H. Harsha (East Fork Lake) above dam---------- | 4- 4 | 0- 50 | 22- 10 | 0- 20 | 5.7 | 1,400 | Chlorophyta<br>Coelastrum | 98<br>37 | 8.5 | 2,500 | Chlorophyta<br>Schroederia | 100<br>51 |
| Findlay City Reservoir, north side--- | 2- 2 | 4- 82 | 2- 2 | 0- 30 | 5.4 | 230,000 | Cyanophyta<br>Anacystis | 100<br>100 | 6.1 | -- | -- | -- |
| Griggs Reservoir above dam---------- | 10-14 | 8-152 | 28- 54 | 54- 38 | 6.3 | 200 | Chlorophyta<br>Chlamydomonas | 80<br>80 | 5.7 | 180 | Chlorophyta<br>Chlamydomonas<br>Cryptomonas | 64<br>36<br>36 |
| Hammertown Lake above dam---------- | 2- 2 | 2- 4 | 4- 6 | 4- 6 | 3.1 | 530 | Chlorophyta<br>Coelastrum | 41<br>29 | 3.5 | 65 | Euglenophyta<br>Trachelomonas | 100<br>100 |
| Lake Clark above dam---------------- | 2- 2 | 2- 6 | 10- 16 | 6- 6 | 14.2 | 240 | Cryptophyta<br>Cryptomonas | 89<br>89 | 11.2 | 2,600 | Cyanophyta<br>Oscillatoria | 87<br>87 |
| Lake Milton above dam---------------- | 6- 2 | 4- 8 | 6- 10 | 80- 8 | 8.2 | 2,100 | Cryptophyta<br>Chroomonas<br>Dinobryon | 31<br>30<br>30 | 8.9 | 4,700 | Cyanophyta<br>Oscillatoria | 78<br>78 |
| Lake Rupert above dam---------------- | 4-10 | 8-258 | 6- 12 | 6- 20 | 5.7 | 850 | Cyanophyta<br>Anacystis | 48<br>48 | 3.5 | 1,300 | Chlorophyta<br>Crucigenia | 67<br>32 |
| Lake White above dam---------------- | 4- 4 | 8- 8 | 18- 4 | 8- 22 | 3.9 | 470 | Chlorophyta<br>Melosira | 53<br>39 | 3.9 | 470 | Chlorophyta<br>Oocystis | 61<br>58 |
| Madison Lake above dam---------------- | 14-76 | 106-124 | 8- 28 | 72-136 | 32.9 | 3,000 | Chlorophyta<br>Scenedesmus | 72<br>60 | 47.3 | 4,700 | Chlorophyta<br>Scenedesmus | 44<br>33 |
| Meander Creek Reservoir above dam----- | 2- 6 | 2- 10 | 8-170 | 10- 30 | 4.7 | 780 | Chlorophyta<br>Shaeprophyta | 90<br>70 | 4.4 | 1,400 | Chlorophyta<br>Coelastrum | 97<br>76 |
| North Branch Reservoir above dam----- | 10-10 | 6- 48 | 12- 28 | 10-140 | 9.8 | 1,700 | Chlorophyta<br>Coelastrum | 51<br>30 | -- | 340 | Chrysophyta<br>Melosira | 100<br>96 |
| Ross Lake above dam-- | 4- 6 | 4- 10 | 26- 30 | 40- 70 | 12.5 | 4,300 | Cyanophyta<br>Oscillatoria | 91<br>91 | -- | 2,000 | Chrysophyta<br>Cyclotella | 47<br>36 |
| Snowden Lake above dam---------------- | 16- 4 | 0- 12 | 20- 8 | 8- 50 | 3.2 | 1,300 | Chlorophyta<br>Sphaerocystis | 60<br>55 | 4.4 | 1,400 | Chrysophyta<br>Cyclotella | 67<br>66 |
| Willard City Reservoir---------- | 2- 2 | 14- 12 | 2- 22 | 2- 4 | 2.1 | -- | -- | - | 1.4 | -- | -- | -- |

Table 10.--Summary of biological characteristics for the primary sites of selected lakes in Ohio, 1979--Continued

| Lake name and site location | Phytoplankton, summer sampling: dominant phylum and genus, and percent of total cell count | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Euphotic zone | | | | Zone of maximum dissolved oxygen | | | |
| | Chlorophyll a (ug/L) | Cells per ml | Composites from euphotic zone | | Chlorophyll a (ug/L) | Cells per ml | Samples from zone of maximum dissolved oxygen | |
| William H. Harsha (East Fork) Lake above dam | 21.1 | 9,900 | Cyanophyta<br>*Oscillatoria* | 100<br>51 | 38.1 | 26,000 | Cyanophyta<br>*Anabena* | 90<br>57 |
| Findlay City Reservoir, north side | 25.2 | 290,000 | Cyanophyta<br>*Agmentellum* | 100<br>59 | -- | 510,000 | Cyanophyta<br>*Gomphosphaeria* | 100<br>45 |
| Griggs Reservoir above dam | 29.2 | 53,000 | Cyanophyta<br>*Oscillatoria* | 99<br>99 | 39.8 | 94,000 | Cyanophyta<br>*Oscillatoria* | 99<br>98 |
| Hammertown Lake above dam | 3.3 | 830 | Chrysophyta<br>*Fragilaria* | 95<br>88 | 12.4 | 2,100 | Chrysophyta<br>*Fragilaria* | 93<br>92 |
| Lake Clark above dam | 34.3 | 26,000 | Cyanophyta<br>*Oscillatoria* | 94<br>54 | 2.5 | 13 | Cryptophyta<br>*Cryptomonas* | 100<br>100 |
| Lake Milton above dam | 8.1 | 2,800 | Cyanophyta<br>*Oscillatoria* | 66<br>66 | 8.4 | 2,600 | Cyanophyta<br>*Oscillatoria* | 50<br>26 |
| Lake Rupert above dam | 14.3 | 6,500 | Cyanophyta<br>*Anacystis* | 94<br>37 | 7.8 | 2,800 | Chlorophyta<br>*Chlorella* | 43<br>39 |
| Lake White above dam | 11.3 | 8,400 | Cyanophyta<br>*Anabaena* | 66<br>41 | 7.1 | 13,000 | Cyanophyta<br>*Aphanizomenon* | 86<br>47 |
| Madison Lake above dam | 20.7 | 5,200 | Cyanophyta<br>*Agmenellum* | 47<br>31 | -- | 7,900 | Cyanophyta<br>*Agmenellum* | 65<br>55 |
| Meander Creek Reservoir above dam | 7.4 | 9,700 | Chlorophyta<br>*Sphaerocystis* | 81<br>57 | 8.8 | 6,200 | Chlorophyta<br>*Sphaerocystis* | 76<br>72 |
| North Branch Reservoir above dam | 35.2 | 15,000 | Cyanophyta<br>*Agmenellum* | 65<br>38 | 46.1 | 22,000 | Cyanophyta<br>*Agmenellum* | 74<br>46 |
| Ross Lake above dam | 22.6 | 6,200 | Cyanophyta<br>*Oscillatoria* | 92<br>38 | 4.3 | 16,000 | Cyanophyta<br>*Aphanizomenon* | 99<br>86 |
| Snowden Lake above dam | 14.9 | 20,000 | Chlorophyta<br>*Volvox* | 61<br>60 | 17.4 | 84,000 | Chlorophyta<br>*Volvox* | 78<br>77 |
| Willard City Reservoir | 2.2 | 2,200 | Cyanophyta<br>*Lyngbya* | 99<br>99 | 9.2 | 41 | Chlorophyta<br>*Sphaerocystis* | 88<br>50 |

## SUMMARIES OF CHEMICAL AND BIOLOGICAL DATA FOR LAKES SAMPLED IN 1978

### Buckeye Lake

Location: Licking, Fairfield, and Perry Counties (Millersport 7.5-minute quadrangle map)

Type: Impoundment on South Fork Licking River

Use: Built as a water source for the Ohio Canal system in the 1830's; currently used for recreation.

Physical characteristics at summer pool level (table 6):

| Date of origin (year) | Surface area (acres) | Capacity (acre-(feet) | Capacity-inflow ratio (C/I) |
|---|---|---|---|
| 1832 | 3,136 | 19,940 | 0.65 |

Drainage-basin characteristics:

| Drainage area ($mi^2$) | Type | Estimated sediment yield (from fig. 3) |
|---|---|---|
| 47 | Agricultural, summer cottage. | Moderately low |

Lake data (figs. 10 and 11; tables 11-14): Buckeye Lake was sampled in the rain on May 16 and under sunny skies on August 22. The spring Secchi-disk transparency (1.8 feet) at site L-1 was comparable to transparency in 1975 (1.6 feet) (Tobin and Youger, 1977). The August Secchi-disk transparency was 3.7 feet, high compared to other shallow lakes in Ohio.

Profile and analytical data show the following lake characteristics:

| Date | Stratification (gradient) | | Chemical type | Trophic state index (Carlson) | | | Trophic class | Substances at or above State limits | | Phyto-plankton, dominant division(s) |
|---|---|---|---|---|---|---|---|---|---|---|
| | Thermal | Chemical | | Chl a | SD | T.P. | | Toxicants | Bacteria | |
| 7-16-78 | No | No | Hard; Ca, $HCO_3$ | -- | -- | 76 | Hyper-eutrophic | Cd, Pb | No | Cyanophyta |
| 8-22-78 | No | No | -- | 71 | 58 | -- | -- | -- | No | Chrysophyta |

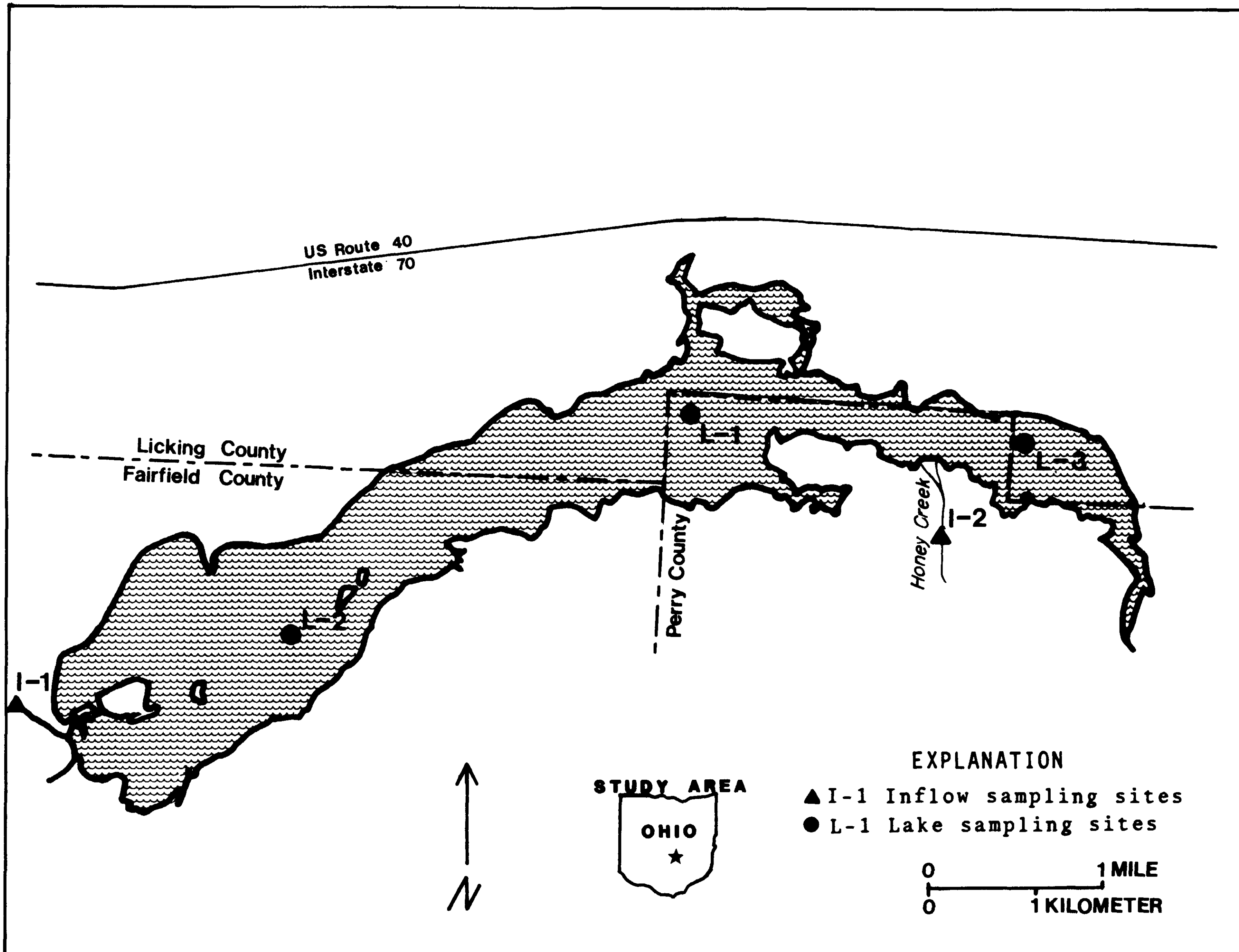



Figure 10.--Buckeye Lake and inflow sampling sites.

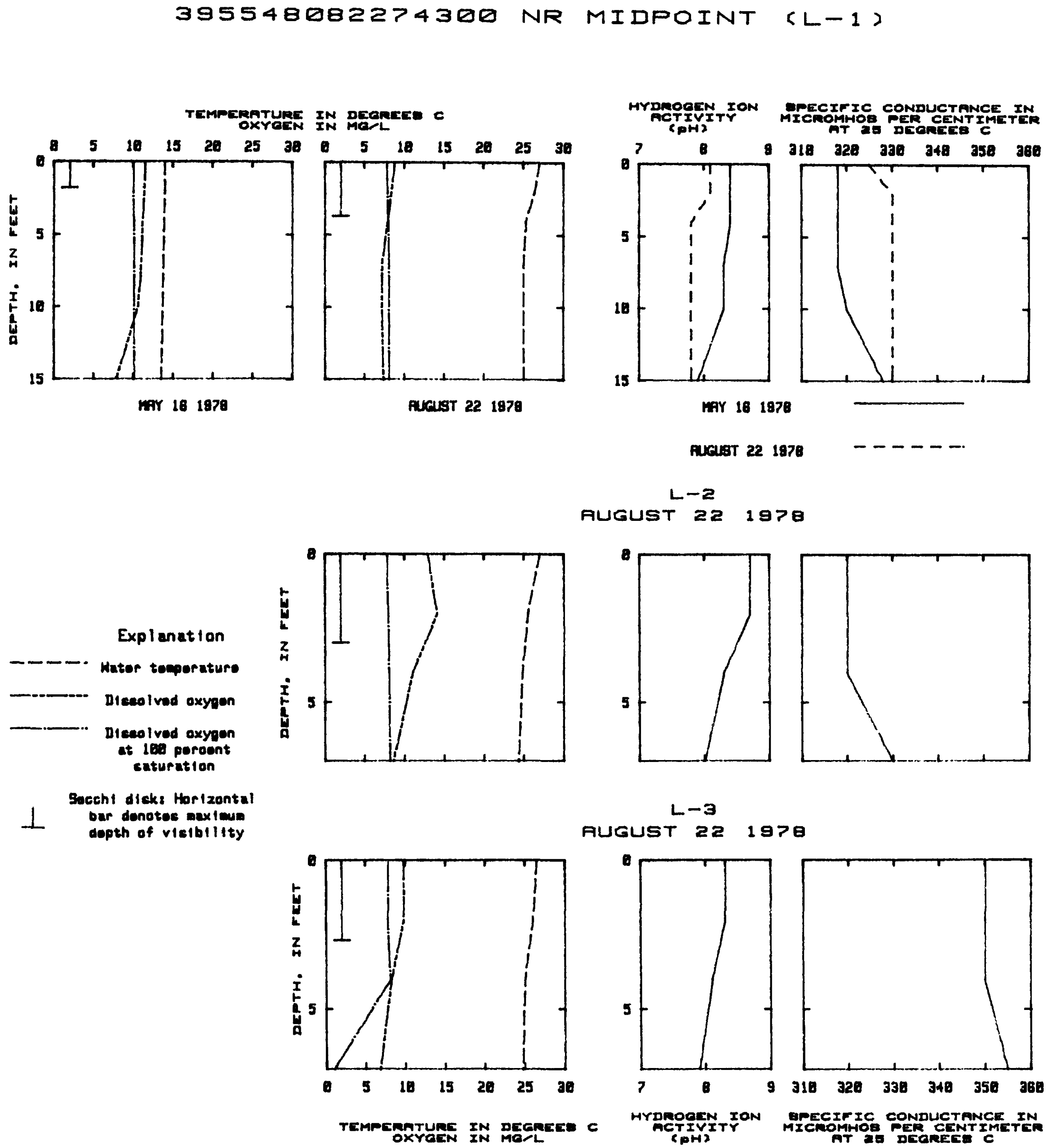



Figure 11.--Data profiles for Buckeye Lake

Table 11.--Profile data for the primary lake site, Buckeye Lake, Ohio

395548082274300 - BUCKEYE LK AT MIDPOINT NR BUCKEYE LAKE OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1977 TO SEPTEMBER 1978

| DATE | TIME | SAMPLING DEPTH (FT) | TEMPERATURE (DEG C) | OXYGEN, DISSOLVED (MG/L) | OXYGEN, DISSOLVED (PERCENT SATURATION) | SPECIFIC CONDUCTANCE (MICROMHOS) | PH (UNITS) | CARBONATE (MG/L AS CO3) | BICARBONATE (MG/L AS HCO3) | CARBON DIOXIDE DISSOLVED (MG/L AS CO2) | HYDROGEN SULFIDE DISS. (MG/L AS H2S) | TRANSPARENCY (SECCHI DISK) (IN) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MAY | | | | | | | | | | | | |
| 16... | 1230 | .0 | 14.0 | 11.5 | 115 | 318 | 8.4 | -- | -- | -- | -- | -- |
| 16... | 1235 | 2.0 | 14.0 | 11.4 | 114 | 318 | 8.4 | 3 | 106 | .7 | .0 | 22 |
| 16... | 1240 | 4.0 | 13.9 | 11.2 | 111 | 318 | 8.4 | -- | -- | -- | -- | -- |
| 16... | 1245 | 7.0 | 13.8 | 11.0 | 109 | 318 | 8.3 | -- | -- | -- | -- | -- |
| 16... | 1248 | 10 | 13.7 | 10.6 | 105 | 320 | 8.3 | -- | -- | -- | -- | -- |
| 16... | 1250 | 15 | 13.5 | 7.8 | 77 | 328 | 7.9 | 0 | 116 | 2.3 | .0 | -- |
| AUG | | | | | | | | | | | | |
| 22... | 1300 | .0 | 27.0 | 8.8 | 110 | 325 | 8.1 | -- | -- | -- | -- | -- |
| 22... | 1305 | 2.0 | 26.4 | 8.4 | 110 | 330 | 8.1 | 0 | 136 | 1.8 | .3 | 44 |
| 22... | 1310 | 4.0 | 25.3 | 7.9 | 99 | 330 | 7.8 | -- | -- | -- | -- | -- |
| 22... | 1315 | 7.0 | 25.0 | 7.2 | 89 | 330 | 7.8 | -- | -- | -- | -- | -- |
| 22... | 1320 | 10 | 25.0 | 7.2 | 89 | 330 | 7.8 | -- | -- | -- | -- | -- |
| 22... | 1325 | 15 | 25.0 | 7.4 | 91 | 330 | 7.8 | 0 | 144 | 3.6 | 1.1 | -- |

Table 12.--Chemical analyses of water column composite samples, Buckeye Lake, Ohio

395548082274300 - BUCKEYE LK AT MIDPOINT NR BUCKEYE LAKE OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1977 TO SEPTEMBER 1978

| DATE | TIME | CALCIUM DIS- SOLVED (MG/L AS CA) | MAGNE- SIUM, DIS- SOLVED (MG/L AS MG) | POTAS- SIUM, DIS- SOLVED (MG/L AS K) | SODIUM, DIS- SOLVED (MG/L AS NA) | SULFATE DIS- SOLVED (MG/L AS SO4) | CHLO- RIDE, DIS- SOLVED (MG/L AS CL) | FLUO- RIDE, DIS- SOLVED (MG/L AS F) | HARD- NESS (MG/L AS CACO3) | SOLIDS, RESIDUE AT 180 DEG. C DIS- SOLVED (MG/L) |
|---|---|---|---|---|---|---|---|---|---|---|
| MAY 16... | 1245 | 34 | 11 | 2.2 | 9.1 | 39 | 20 | .1 | 130 | 223 |
| AUG 22... | 1325 | -- | -- | -- | -- | -- | -- | -- | -- | -- |

| DATE | SOLIDS, RESIDUE AT 105 DEG. C, SUS- PENDED (MG/L) | SOLIDS, RESIDUE AT 105 DEG. C, TOTAL (MG/L) | BARIUM, TOTAL RECOV- ERABLE (UG/L AS BA) | CADMIUM TOTAL RECOV- ERABLE (UG/L AS CD) | CHRO- MIUM, TOTAL RECOV- ERABLE (UG/L AS CR) | LEAD, TOTAL RECOV- ERABLE (UG/L AS PB) | MERCURY TOTAL RECOV- ERABLE (UG/L AS HG) | NICKEL, TOTAL RECOV- ERABLE (UG/L AS NI) | SELE- NIUM, TOTAL (UG/L AS SE) | SILVER, TOTAL RECOV- ERABLE (UG/L AS AG) |
|---|---|---|---|---|---|---|---|---|---|---|
| MAY 16... | 52 | 275 | 0 | 6 | 10 | 67 | <.5 | 6 | 0 | 0 |
| AUG 22... | -- | -- | -- | -- | -- | 3 | -- | -- | -- | -- |

| DATE | ARSENIC TOTAL (UG/L AS AS) | METHY- LENE BLUE ACTIVE SUB- STANCE (MG/L) | BORON, TOTAL RECOV- ERABLE (UG/L AS B) | COBALT, TOTAL RECOV- ERABLE (UG/L AS CO) | COPPER, TOTAL RECOV- ERABLE (UG/L AS CU) | IRON, TOTAL RECOV- ERABLE (UG/L AS FE) | MANGA- NESE, TOTAL RECOV- ERABLE (UG/L AS MN) | MOLYB- DENUM, TOTAL RECOV- ERABLE (UG/L AS MO) | ZINC, TOTAL RECOV- ERABLE (UG/L AS ZN) |
|---|---|---|---|---|---|---|---|---|---|
| MAY 16... | <10 | <.05 | 30 | 0 | 1 | 470 | 180 | 4 | 20 |
| AUG 22... | -- | -- | -- | -- | -- | 250 | 80 | -- | -- |

Table 13.--Chemical, physical, and biological analyses of water samples from selected depths, Buckeye Lake, Ohio

395548082274300 - BUCKEYE LK AT MIDPOINT NR BUCKEYE LAKE OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1977 TO SEPTEMBER 1978

| DATE | TIME | SAMPLING DEPTH (FT) | NITROGEN, NITRITE TOTAL (MG/L AS N) | NITROGEN, NITRATE TOTAL (MG/L AS N) | NITROGEN, NO2+NO3 TOTAL (MG/L AS N) | NITROGEN, AMMONIA TOTAL (MG/L AS N) | NITROGEN, ORGANIC TOTAL (MG/L AS N) | NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N) | PHOSPHORUS, ORTHO. TOTAL (MG/L AS P) |
|---|---|---|---|---|---|---|---|---|---|
| MAY | | | | | | | | | |
| 16... | 1235 | 2.0 | .03 | .27 | .30 | .24 | 1.2 | 1.4 | .00 |
| 16... | 1250 | 15 | .02 | .28 | .30 | .49 | 1.4 | 1.9 | .01 |
| AUG | | | | | | | | | |
| 22... | 1305 | 2.0 | .03 | .20 | .23 | .58 | 1.3 | 2.0 | .01 |
| 22... | 1325 | 15 | .03 | .18 | .21 | .56 | 1.3 | 1.9 | .02 |

| DATE | PHOSPHORUS, TOTAL (MG/L AS P) | SILICA, DISSOLVED (MG/L AS SIO2) | TURBIDITY (JTU) | COLOR (PLATINUM-COBALT UNITS) | CARBON, ORGANIC TOTAL (MG/L AS C) | OXYGEN DEMAND, BIOCHEMICAL, 5 DAY (MG/L) | OXYGEN DEMAND, CHEMICAL (HIGH LEVEL) (MG/L) | COLIFORM, FECAL, 0.45 UM-MF (COLS./100 ML) | STREPTOCOCCI FECAL, (COLS. PER 100 ML) |
|---|---|---|---|---|---|---|---|---|---|
| MAY | | | | | | | | | |
| 16... | .15 | .1 | 6 | 40 | 9.2 | 6.1 | 30 | <2 | 34 |
| 16... | .13 | .3 | 15 | 50 | 9.3 | 4.9 | 40 | 20 | 428 |
| AUG | | | | | | | | | |
| 22... | .10 | 2.9 | 10 | 10 | 8.6 | 3.7 | 30 | 30 | 12 |
| 22... | .08 | 1.0 | 10 | 40 | 8.6 | 2.3 | 37 | 28 | 16 |

Table 14.--Phytoplankton identified in Buckeye Lake, Ohio (1978)

| Sample description | | | Total cells (per ml) | Diversity index (genus) $\bar{d}$ | Chlorophyll *a* (µg/L) | Division(s) present (in order of dominance) | Percent of total cell count | Dominant taxa within division and percent (%)* of total cell count |
|---|---|---|---|---|---|---|---|---|
| Location | Date | Location in water column | | | | | | |
| L-1 at midpoint | 5-16 | Euphotic zone composite | 3,000,000 | 2.0 | 87.7 | Cyanophyta | 85 | Anacystis (67), Lyngbya (10), Agmenellum (8), Gomphosphaeria (1) |
| | | | | | | Chlorophyta | 11 | Kirchneriella (4), Dictyosphaerium (2), Tetrastrum (1), Scenedesmus (1), Oocystis (1), Actinastrum (1), Micractinium, Chodatella, Golenkinia, Chlamydomonas, Ankistrodesmus, Tetraedron, Staurastrum |
| | | | | | | Chrysophyta | 4 | Rhizosolenia (3), Cyclotella (1), Synedra, Ochromonas, Navicula, Nitzschia, Cocconeis, Surirella |
| | | | | | | Euglenophyta | | Trachelomonas, Chroomonas |
| L-1 at midpoint | 8-22 | Near-surface sample | 12,000 | 1.8 | 33.7 | Chrysophyta | 79 | Melosira (67), Mallomonas (7), Ochromonas (5) |
| | | | | | | Chlorophyta | 14 | Oocystis (7), Schroederia (5), Chlamydomonas (1), Staurastrum (1) |
| | | | | | | Cyanophyta | 8 | Anacystis |
| L-1 at midpoint | 8-22 | Euphotic zone composite | 24,000 | 1.4 | 52.9 | Chrysophyta | 80 | Melosira (79), Ochromonas (1) |
| | | | | | | Chlorophyta | 18 | Sphaerocystis (7), Oocystis (5), Schroederia (3), Coelastrum (1), Crucigenia (1), Chlamydomonas, Scenedesmus, Ankistrodesmus, Staurastrum |
| | | | | | | Cryptophyta | 1 | Cryptomonas (1) |
| | | | | | | Cyanophyta | 1 | Agmenellum (1) |
| | | | | | | Euglenophyta | | Trachelomonas |

*Less than 1 percent not given.

Lake profiles indicate that the entire water column is mixed. The supersaturated oxygen concentrations, high BOD, and high pH suggest that biological activity in the lake is considerable.

The secondary profiles at L-2 and L-3 were similar to the profile at L-1. Oxygen concentration and pH at site L-2 exceeded those at all other stations.

The spring near-surface, total-phosphorus concentration was 0.15 mg/L. The spring total-nitrogen to total-phosphorus ratio, 11.3, indicates that phosphorus may be limiting algal growth in Buckeye Lake.

Buckeye Lake had Carlson TSIs of 71 for chlorophyll a (summer), 58 for Secchi-disk transparency (summer), and 76 for total phosphorus (spring). The lake was classified as hypereutrophic on the basis of the high chlorophyll-a and total-phosphorus concentrations.

Buckeye Lake was sampled in 1975, the first year of the lake survey program (Tobin, 1977) and was sampled again in 1978 because of certain activities in the lake's basin. The spring total-phosphorus concentration increased between 1975 and 1978, whereas the total-nitrogen concentration did not change. Cadmium and lead exceeded Ohio water-quality standards in 1978. Concentrations of these constituents were below their limits in 1975.

Phytoplankton counts were high in the spring but declined in the summer. Blue-green algae (Cyanophyta) dominated the spring algal community. Yellow-green algae (Chrysophyta) dominated the summer algal community. This succession is the reverse of what is normal in Ohio lakes. Aquatic macrophytes were plentiful in the shallow, protected area in the lake.

Inflow data (fig. 10; table 15): Two major inflows were sampled. The Reservoir feeder at site I-1 has a drainage area of 16.8 $mi^2$. Honey Creek at site I-2 drains 6.8 $mi^2$. Both inflows drain predominantly rural and agricultural lands within an area of moderately low sediment yield (fig. 6). Together, they represent 50 percent of the total drainage for Buckeye Lake. A qualitative comparison of stream versus lake data is shown below:

| Inflow sampling site | Sampling date (1978) | Estimated discharge ($ft^3/s$) | Water body (stream or lake at 2-foot depth) having higher concentration | | | |
|---|---|---|---|---|---|---|
| | | | $NO_2$+ $NO_3$ | Total P | TOC | (Specific conductance) |
| Reservoir feeder at Site I-1 | May 16 | 25 | Stream | Stream | Stream | Stream |
| | Aug 22 | 21 | Stream | Stream | Stream | Stream |
| Honey Creek at site I-2 | May 16 | 10 | Stream | Stream | Stream | Stream |
| | Aug 22 | 2.0 | Stream | Stream | Stream | Stream |

Table 15.--Physical and chemical data for selected inflows, Buckeye Lake, Ohio

395501082260200 - HONEY C AB BUCKEYE LK NR FAIRFIELD BEACH OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1977 TO SEPTEMBER 1978

| DATE | TIME | STREAM-FLOW, INSTAN-TANEOUS (CFS) | TEMPER-ATURE (DEG C) | OXYGEN, DIS-SOLVED (MG/L) | PH (UNITS) | SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS) | TUR-BID-ITY (JTU) | COLOR (PLAT-INUM-COBALT UNITS) | CARBON, ORGANIC TOTAL (MG/L AS C) | NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N) | NITRO-GEN,AM-MONIA + ORGANIC TOTAL (MG/L AS N) | PHOS-PHORUS, TOTAL (MG/L AS P) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MAY | | | | | | | | | | | | |
| 16... | 1030 | E10 | 11.5 | 11.0 | 7.6 | 480 | 3 | 20 | 10 | 3.0 | .28 | .08 |
| AUG | | | | | | | | | | | | |
| 22... | 1100 | E2.0 | 20.0 | 9.8 | 7.5 | 890 | 3 | 20 | 4.9 | .76 | .35 | .09 |

395426082320300 - RESERVOIR FEEDER AB BUCKEYE LK NR MILLERSPORT OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1977 TO SEPTEMBER 1978

| DATE | TIME | STREAM-FLOW, INSTAN-TANEOUS (CFS) | TEMPER-ATURE (DEG C) | OXYGEN, DIS-SOLVED (MG/L) | PH (UNITS) | SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS) | TUR-BID-ITY (JTU) | COLOR (PLAT-INUM-COBALT UNITS) | CARBON, ORGANIC TOTAL (MG/L AS C) | NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N) | NITRO-GEN,AM-MONIA + ORGANIC TOTAL (MG/L AS N) | PHOS-PHORUS, TOTAL (MG/L AS P) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MAY | | | | | | | | | | | | |
| 16... | 1130 | E25 | 11.5 | 10.7 | 7.2 | 455 | 15 | 30 | 12 | 5.5 | .87 | .07 |
| AUG | | | | | | | | | | | | |
| 22... | 1120 | E21 | 22.0 | 7.5 | 7.7 | 845 | 15 | 30 | 7.2 | 1.4 | .95 | .12 |

## Caesar Creek Lake

Location: Warren County
(Oregonia 7.5-minute quadrangle map)

Type: Impoundment on Caesar Creek

Use: Flood control, recreation, and water supply

Physical characteristics at summer pool level (table 6):

| Date of origin (year) | Surface area (acres) | Capacity (acre-feet) | Capacity-inflow ratio (C/I) |
|---|---|---|---|
| 1977 | 2,830 | 102,000 | 0.60 |

Drainage basin characteristics:

| Drainage area ($mi^2$) | Type | Estimated sediment yield (from fig. 3) |
|---|---|---|
| 237 | Agricultural, rural | Moderately low |

Lake data (figs. 12, 13; tables 16-19): Caesar Creek Lake is one of the deepest lakes in Ohio and has a maximum normal pool depth exceeding 110 feet. Equipment restrictions limited sampling to the top 75 feet. Caesar Creek Lake was sampled in the rain on April 25 and under sunny skies on July 26. Secchi-disk transparency was 4.8 feet in April and 14 feet in July. These were among the highest values recorded for the lakes sampled in 1978.

Profile and analytical data show the following lake characteristics:

| Date | Stratification (gradient) Thermal | Chemical | Chemical type | Trophic state index (Carlson) Chl a | SD | T.P. | Trophic class | Substances at or above State limits Toxicants | Bacteria | Phytoplankton, dominant division(s) |
|---|---|---|---|---|---|---|---|---|---|---|
| 4-25-78 | Slight | Slight | Hard; Ca, $HCO_3$ | -- | -- | 73 | Eutrophic | No | No | Euglenophyta, Chlorophyta |
| 7-26-78 | Yes | Yes | -- | 52 | 39 | -- | -- | No | No | Cyanophyta |

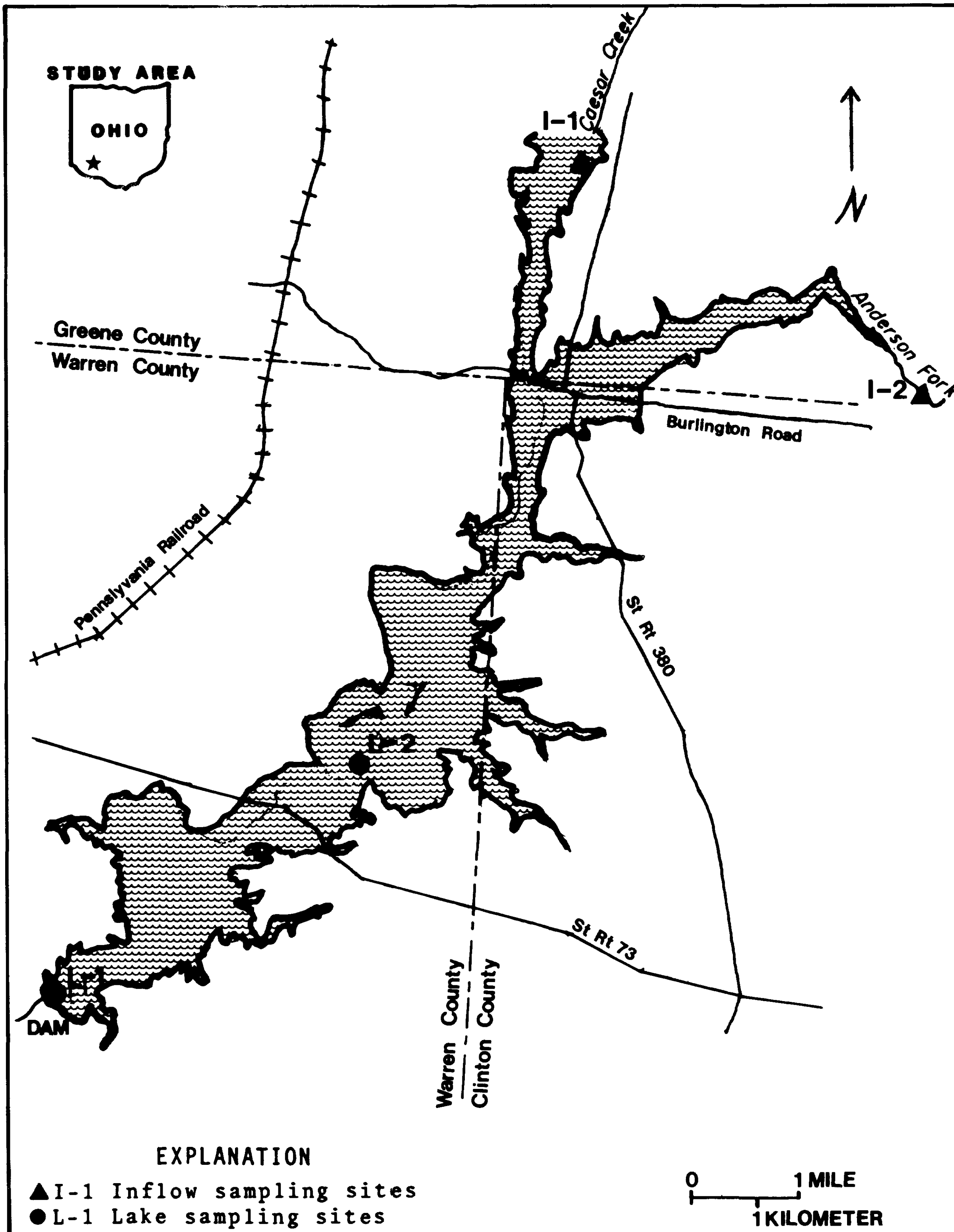



**Figure 12.--Caesar Creek Lake and inflow sampling sites.**

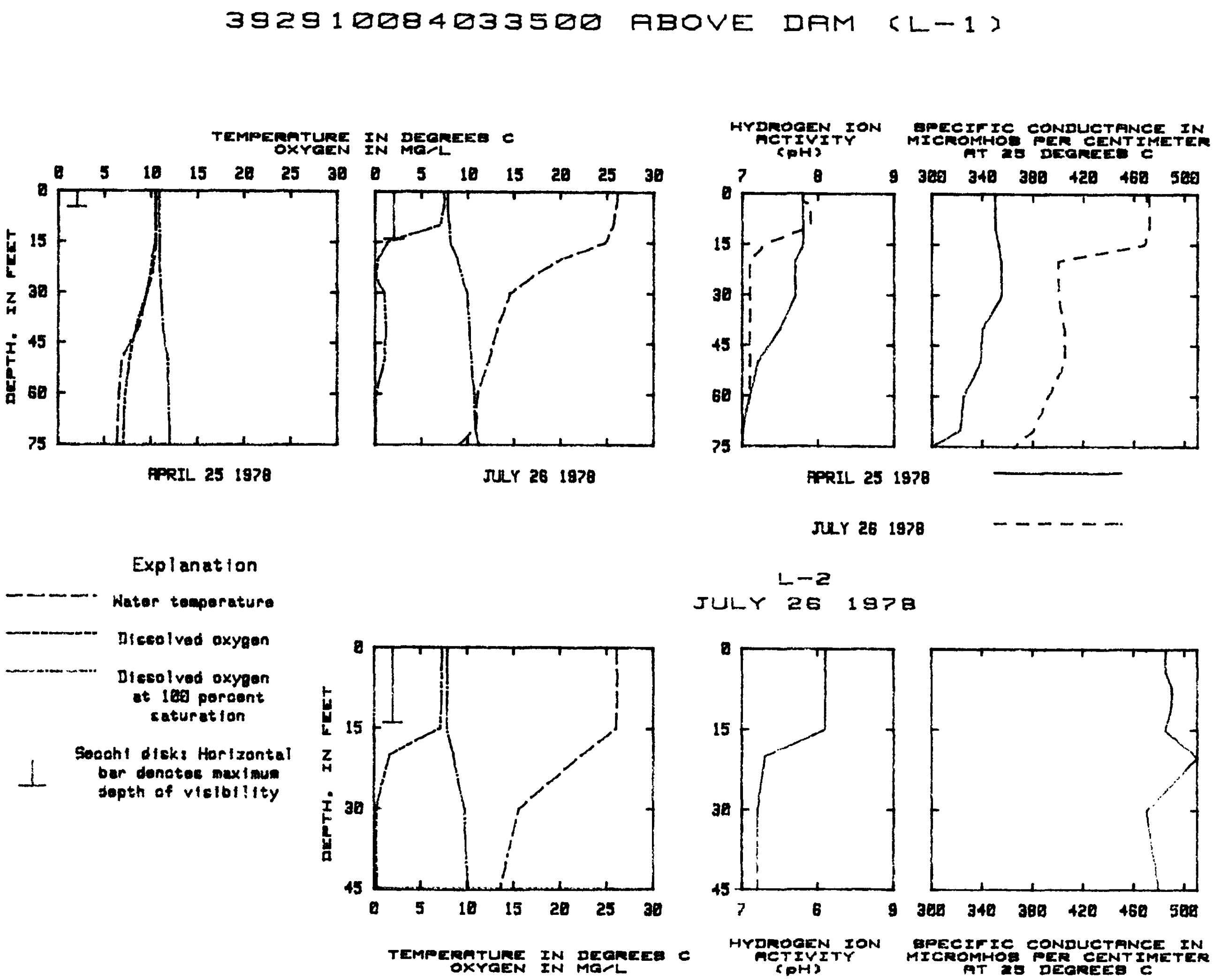



Figure 13.--Data profiles for Caesar Creek Lake.

Table 16.--Profile data for the primary lake site, Caesar Creek Lake Ohio

392910084033500 - CAESAR C LK AB DAM AT SITE L-1 NR HAREYSBURG OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1977 TO SEPTEMBER 1978

| DATE | TIME | SAMPLING DEPTH (FT) | TEMPERATURE (DEG C) | OXYGEN, DISSOLVED (MG/L) | OXYGEN, DISSOLVED (PERCENT SATURATION) | SPECIFIC CONDUCTANCE (MICROMHOS) | PH (UNITS) | CARBONATE (MG/L AS CO3) | BICARBONATE (MG/L AS HCO3) | CARBON DIOXIDE DISSOLVED (MG/L AS CO2) | HYDROGEN SULFIDE DISS. (MG/L AS H2S) | TRANSPARENCY (SECCHI DISK) (IN) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| APR | | | | | | | | | | | | |
| 25... | 1400 | .0 | 10.5 | 10.5 | 97 | 350 | 7.8 | -- | -- | -- | -- | -- |
| 25... | 1405 | 2.0 | 10.5 | 10.6 | 98 | 350 | 7.8 | 0 | 138 | 3.5 | .0 | 58 |
| 25... | 1410 | 4.0 | 10.5 | 10.5 | 97 | 350 | 7.8 | -- | -- | -- | -- | -- |
| 25... | 1415 | 7.0 | 10.5 | 10.5 | 97 | 350 | 7.8 | -- | -- | -- | -- | -- |
| 25... | 1420 | 10 | 10.5 | 10.5 | 97 | 350 | 7.8 | -- | -- | -- | -- | -- |
| 25... | 1425 | 15 | 10.5 | 10.4 | 96 | 353 | 7.8 | -- | -- | -- | -- | -- |
| 25... | 1430 | 20 | 10.3 | 10.1 | 93 | 355 | 7.7 | -- | -- | -- | -- | -- |
| 25... | 1432 | 25 | 10.1 | 9.9 | 90 | 355 | 7.7 | -- | -- | -- | -- | -- |
| 25... | 1434 | 30 | 9.5 | 9.5 | 86 | 355 | 7.7 | -- | -- | -- | -- | -- |
| 25... | 1436 | 40 | 8.7 | 8.4 | 74 | 340 | 7.5 | -- | -- | -- | -- | -- |
| 25... | 1438 | 50 | 6.8 | 7.6 | 64 | 338 | 7.2 | -- | -- | -- | -- | -- |
| 25... | 1440 | 60 | 6.5 | 7.2 | 60 | 325 | 7.1 | -- | -- | -- | -- | -- |
| 25... | 1445 | 70 | 6.4 | 7.0 | 58 | 322 | 7.0 | -- | -- | -- | -- | -- |
| 25... | 1450 | 75 | 6.3 | 7.0 | 58 | 300 | 7.0 | 0 | 128 | 20 | .0 | -- |
| JUL | | | | | | | | | | | | |
| 26... | 1315 | .0 | 26.1 | 7.4 | 95 | 472 | 7.8 | -- | -- | -- | -- | -- |
| 26... | 1320 | 2.0 | 26.1 | 7.5 | 96 | 472 | 7.8 | 0 | 208 | 5.2 | .0 | 168 |
| 26... | 1325 | 4.0 | 26.0 | 7.4 | 95 | 472 | 7.9 | -- | -- | -- | -- | -- |
| 26... | 1330 | 7.0 | 25.8 | 7.2 | 91 | 472 | 7.9 | -- | -- | -- | -- | -- |
| 26... | 1335 | 10 | 25.6 | 7.0 | 88 | 472 | 7.9 | -- | -- | -- | -- | -- |
| 26... | 1340 | 15 | 24.8 | 1.3 | 16 | 468 | 7.3 | -- | -- | -- | -- | -- |
| 26... | 1345 | 20 | 20.0 | .3 | 3 | 400 | 7.1 | -- | -- | -- | -- | -- |
| 26... | 1347 | 25 | 17.0 | .1 | 1 | 400 | 7.1 | -- | -- | -- | -- | -- |
| 26... | 1350 | 30 | 14.5 | 1.0 | 10 | 400 | 7.1 | -- | -- | -- | -- | -- |
| 26... | 1355 | 40 | 13.2 | 1.2 | 12 | 405 | 7.1 | -- | -- | -- | -- | -- |
| 26... | 1400 | 50 | 12.2 | 1.0 | 10 | 405 | 7.1 | -- | -- | -- | -- | -- |
| 26... | 1405 | 60 | 11.0 | .1 | 1 | 392 | 7.1 | -- | -- | -- | -- | -- |
| 26... | 1407 | 70 | 10.8 | .0 | 0 | 380 | 7.0 | -- | -- | -- | -- | -- |
| 26... | 1410 | 75 | 9.0 | .0 | 0 | 365 | 7.0 | 0 | 154 | 24 | .0 | -- |

Table 17.--Chemical analyses of water column composite samples, Caesar Creek Lake, Ohio

392910084033500 - CAESAR C LK AB DAM AT SITE L-1 NR HAREYSBURG OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1977 TO SEPTEMBER 1978

| DATE | TIME | CALCIUM DIS-SOLVED (MG/L AS CA) | MAGNE-SIUM, DIS-SOLVED (MG/L AS MG) | POTAS-SIUM, DIS-SOLVED (MG/L AS K) | SODIUM, DIS-SOLVED (MG/L AS NA) | SULFATE DIS-SOLVED (MG/L AS SO4) | CHLO-RIDE, DIS-SOLVED (MG/L AS CL) | FLUO-RIDE, DIS-SOLVED (MG/L AS F) | HARD-NESS (MG/L AS CACO3) | SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L) |
|---|---|---|---|---|---|---|---|---|---|---|
| APR 25... | 1430 | 40 | 14 | 2.4 | 6.0 | 27 | 18 | .2 | 160 | 199 |

| DATE | SOLIDS, RESIDUE AT 105 DEG. C, SUS-PENDED (MG/L) | SOLIDS, RESIDUE AT 105 DEG. C, TOTAL (MG/L) | BARIUM, TOTAL RECOV-ERABLE (UG/L AS BA) | CADMIUM TOTAL RECOV-ERABLE (UG/L AS CD) | CHRO-MIUM, TOTAL RECOV-ERABLE (UG/L AS CR) | LEAD, TOTAL RECOV-ERABLE (UG/L AS PB) | MERCURY TOTAL RECOV-ERABLE (UG/L AS HG) | NICKEL, TOTAL RECOV-ERABLE (UG/L AS NI) | SELE-NIUM, TOTAL (UG/L AS SE) | SILVER, TOTAL RECOV-ERABLE (UG/L AS AG) |
|---|---|---|---|---|---|---|---|---|---|---|
| APR 25... | 35 | 235 | 0 | 1 | <10 | 8 | <.5 | 7 | 0 | 0 |

| DATE | ARSENIC TOTAL (UG/L AS AS) | METHY-LENE BLUE ACTIVE SUB-STANCE (MG/L) | BORON, TOTAL RECOV-ERABLE (UG/L AS B) | COBALT, TOTAL RECOV-ERABLE (UG/L AS CO) | COPPER, TOTAL RECOV-ERABLE (UG/L AS CU) | IRON, TOTAL RECOV-ERABLE (UG/L AS FE) | MANGA-NESE, TOTAL RECOV-ERABLE (UG/L AS MN) | MOLYB-DENUM, TOTAL RECOV-ERABLE (UG/L AS MO) | ZINC, TOTAL RECOV-ERABLE (UG/L AS ZN) |
|---|---|---|---|---|---|---|---|---|---|
| APR 25... | <10 | .12 | 20 | 4 | 5 | 520 | 10 | 2 | 10 |

Table 18.--Chemical, physical, and biological analyses of water samples from selected depths, Caesar Creek Lake, Ohio

392910084033500 - CAESAR C LK AB DAM AT SITE L-1 NR HAREYSBURG OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1977 TO SEPTEMBER 1978

| DATE | TIME | SAMPLING DEPTH (FT) | NITROGEN, NITRITE TOTAL (MG/L AS N) | NITROGEN, NITRATE TOTAL (MG/L AS N) | NITROGEN, NO2+NO3 TOTAL (MG/L AS N) | NITROGEN, AMMONIA TOTAL (MG/L AS N) | NITROGEN, ORGANIC TOTAL (MG/L AS N) | NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N) | PHOSPHORUS, ORTHO. TOTAL (MG/L AS P) |
|---|---|---|---|---|---|---|---|---|---|
| APR | | | | | | | | | |
| 25... | 1405 | 2.0 | .04 | 3.8 | 3.8 | .29 | .59 | .88 | .10 |
| 25... | 1450 | 75 | .04 | 3.6 | 3.6 | .39 | .43 | .82 | .12 |
| JUL | | | | | | | | | |
| 26... | 1320 | 2.0 | .08 | 3.3 | 3.4 | .08 | .49 | .57 | .00 |
| 26... | 1410 | 75 | .03 | 2.5 | 2.5 | .56 | .54 | 1.1 | .12 |

| DATE | PHOSPHORUS, TOTAL (MG/L AS P) | SILICA, DISSOLVED (MG/L AS SIO2) | TURBIDITY (JTU) | COLOR (PLATINUM-COBALT UNITS) | CARBON, ORGANIC TOTAL (MG/L AS C) | OXYGEN DEMAND, BIOCHEMICAL, 5 DAY (MG/L) | OXYGEN DEMAND, CHEMICAL (HIGH LEVEL) (MG/L) | COLIFORM, FECAL, 0.45 UM-MF (COLS./100 ML) | STREPTOCOCCI FECAL, (COLS. PER 100 ML) |
|---|---|---|---|---|---|---|---|---|---|
| APR | | | | | | | | | |
| 25... | .12 | 4.1 | 5 | 10 | 9.4 | 1.2 | 15 | 24 | 80 |
| 25... | .15 | 4.8 | 40 | 30 | 9.3 | .6 | 15 | 16 | 550 |
| JUL | | | | | | | | | |
| 26... | .01 | 2.4 | 1 | 10 | 9.1 | .8 | 18 | 12 | 8 |
| 26... | .16 | 5.1 | 2 | 50 | 8.5 | .9 | 23 | 40 | 30 |

Table 19.--Phytoplankton identified in Caesars Creek Lake, Ohio (1978)

| Sample description | | | Total cells (per ml) | Diversity index (genus) $\bar{d}$ | Chlorophyll a (µg/L) | Division(s) present (in order of dominance) | Percent of total percent count | Dominant taxa within division and (%)* of total cell count |
|---|---|---|---|---|---|---|---|---|
| Location | Date | Location in water column | | | | | | |
| Site L-1 above dam | 4-25 | Euphotic zone composite | 680 | -- | 5.9 | Cryptophyta | 59 | Cryptomonads (59) |
| | | | | | | Chlorophyta | 35 | Westella (35) |
| | | | | | | Chrysophyta | 6 | Synedra (6) |
| Site L-1 above dam | 7-26 | Euphotic zone composite | 70,000 | -- | 9.6 | Cyanophyta | 81 | Gomphosphaeria (81) |
| | | | | | | Chlorophyta | 19 | Sphaerocystis (18), Oocystis (1), Mougeotia, Schroederia, Chlamydomonas |
| | | | | | | Chrysophyta | | Achnanthes, Cyclotella |
| | | | | | | Cryptophyta | | Cryptomonas |
| Site L-1 above dam | 7-26 | 2-ft depth composite | 11,000 | -- | 0.0 | Chlorophyta | 100 | Sphaerocystis (100) |
| | | | | | | Chrysophyta | | Ochromonas |

*Less than 1 percent not given

Caesar Creek Lake at L-1 had developed distinct thermal stratification by the July 26 sampling. Water temperature at 75 feet increased from 6.3°C to 9°C between the spring and summer samplings. Oxygen deficits were noted in the water column in the spring and summer. Anaerobic conditions were found in the summer at 70 feet.

The spring near-surface, total phosphorus concentration was 0.12 mg/L. The spring total-nitrogen to total-phosphorus ratio, 39 to 1, indicates that phosphorus may be limiting algal productivity in Caesar Creek Lake.

Caesar Creek Lake had Carlson TSIs of 52 for chlorophyll a (summer), 39 for Secchi-disk transparency (summer), and 73 for total phosphorus (spring). The lake was classified as eutrophic on the basis of the chlorophyll-a and total phosphorus concentrations. The chlorophyll a and Secchi-disk measurements are lower than normal with respect to the high total-phosphorus concentration.

No chemical-quality constituents or properties exceeded Ohio water-quality standards.

Phytoplankton counts were low in the spring and were dominated by Cryptomonads (Cryptophyta). The summer composite count was high and was dominated by blue-green algae (Cyanophyta). The point-sample collected at the depth of maximum dissolved oxygen (2 feet) was dominated by *Sphaerocystis* (Chlorophyta).

Inflow data (fig. 12; table 20): Two major inflows, Caesar Creek (I-1) and Anderson Fork (I-2), were sampled. A qualitative comparison of stream versus lake data is shown below.

| Inflow sampling site | Sampling date (1978) | Estimated discharge ($ft^3/s$) | Water body (stream or lake at 2-foot depth) having higher concentration | | | |
|---|---|---|---|---|---|---|
| | | | $NO_2+NO_3$ | Total P | TOC | (Specific conductance) |
| Caesar Creek | Apr 25 | -- | Stream | Equal | Stream | Stream |
| | Aug 26 | 8.0 | Lake | Stream | Lake | Stream |
| Anderson Fork | Apr 25 | -- | Stream | Stream | Stream | Stream |
| | Aug 22 | 2.0 | Lake | Stream | Lake | Stream |

Table 20.--Physical and chemical data for selected inflows, Caesar Creek Lake, Ohio

393559083575400 - CAESAR C AB CAESAR C LK AT SITE I-1 OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1977 TO SEPTEMBER 1978

| DATE | TIME | STREAM-FLOW, INSTAN-TANEOUS (CFS) | TEMPER-ATURE (DEG C) | OXYGEN, DIS-SOLVED (MG/L) | PH (UNITS) | SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS) | TUR-BID-ITY (JTU) | COLOR (PLAT-INUM-COBALT UNITS) | CARBON, ORGANIC TOTAL (MG/L AS C) | NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N) | NITRO-GEN,AM-MONIA + ORGANIC TOTAL (MG/L AS N) | PHOS-PHORUS, TOTAL (MG/L AS P) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| APR | | | | | | | | | | | | |
| 25... | 1145 | -- | 11.0 | 10.5 | 8.0 | 580 | 40 | 10 | 10 | 5.2 | .76 | .12 |
| JUL | | | | | | | | | | | | |
| 26... | 1130 | E8.0 | 22.0 | 7.5 | 7.8 | 730 | 5 | 10 | 5.7 | 1.3 | .45 | .05 |

393359083541001 - ANDERSON F AB CAESAR C LK AT SITE I-2 OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1977 TO SEPTEMBER 1978

| DATE | TIME | STREAM-FLOW, INSTAN-TANEOUS (CFS) | TEMPER-ATURE (DEG C) | OXYGEN, DIS-SOLVED (MG/L) | PH (UNITS) | SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS) | TUR-BID-ITY (JTU) | COLOR (PLAT-INUM-COBALT UNITS) | CARBON, ORGANIC TOTAL (MG/L AS C) | NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N) | NITRO-GEN,AM-MONIA + ORGANIC TOTAL (MG/L AS N) | PHOS-PHORUS, TOTAL (MG/L AS P) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| APR | | | | | | | | | | | | |
| 25... | 1115 | -- | 10.5 | 10.7 | 8.0 | 600 | 50 | 20 | 11 | 5.7 | .95 | .15 |
| JUL | | | | | | | | | | | | |
| 26... | 1100 | E2.0 | 23.0 | 7.9 | 7.8 | 720 | 5 | 25 | 3.4 | 1.4 | .44 | .03 |

## Charles Mill Lake

Location: Ashland County
(Perrysville 7.5-minute quadrangle)

Type: Impoundment

Use: Recreation, flood control

Physical characteristics at summer pool level (table 6):

| Date of origin (year) | Surface area (acres) | Capacity (acre-feet) | Capacity-inflow ratio (C/I) |
|---|---|---|---|
| 1936 | 1,350 | 7,400 | 0.06 |

Drainage-basin characteristics:

| Drainage area ($mi^2$) | Type | Estimated sediment yield (from fig. 3) |
|---|---|---|
| 215 | Agricultural, rural | Moderately low |

Lake data (fig. 14, 15; tables 21-24): Charles Mill Lake was sampled in the rain on May 12 and under partly cloudy skies on August 8. Thunderstorms had occurred within the basin on August 8. Secchi-disk transparency at site L-1 was 1.5 feet in May and was 1.1 feet in August, low compared to other Ohio lakes sampled in 1978.

Profile and analytical data show the following lake characteristics:

| Date | Stratification (gradient) Thermal | Stratification (gradient) Chemical | Chemical type | Trophic state index (Carlson) Chl a | SD | T.P. | Trophic class | Substances at or above State limits Toxicants | Bacteria | Phyto-plankton, dominant division(s) |
|---|---|---|---|---|---|---|---|---|---|---|
| 5-12-78 | No | Slight | Very hard; Ca, $HCO_3$ | -- | -- | 72 | Hyper-eutrophic | Fe, Pb | No | Chrysophyta, Chlorophyta |
| 8-08-78 | Slight | Slight | -- | 72 | 76 | -- | -- | Cd, Pb | No | Chrysophyta, |

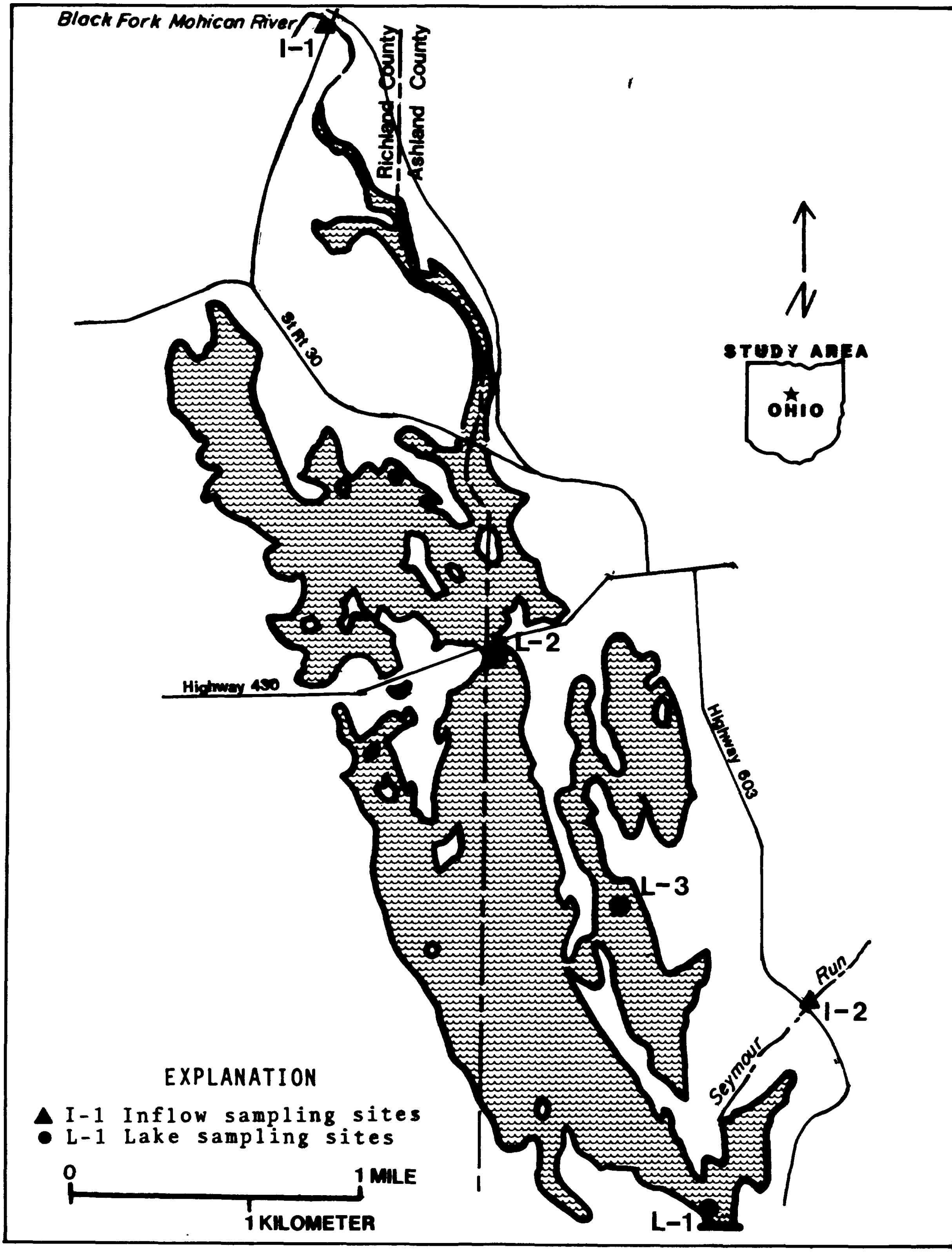



**Figure 14.--Charles Mill Lake and inflow sampling sites.**

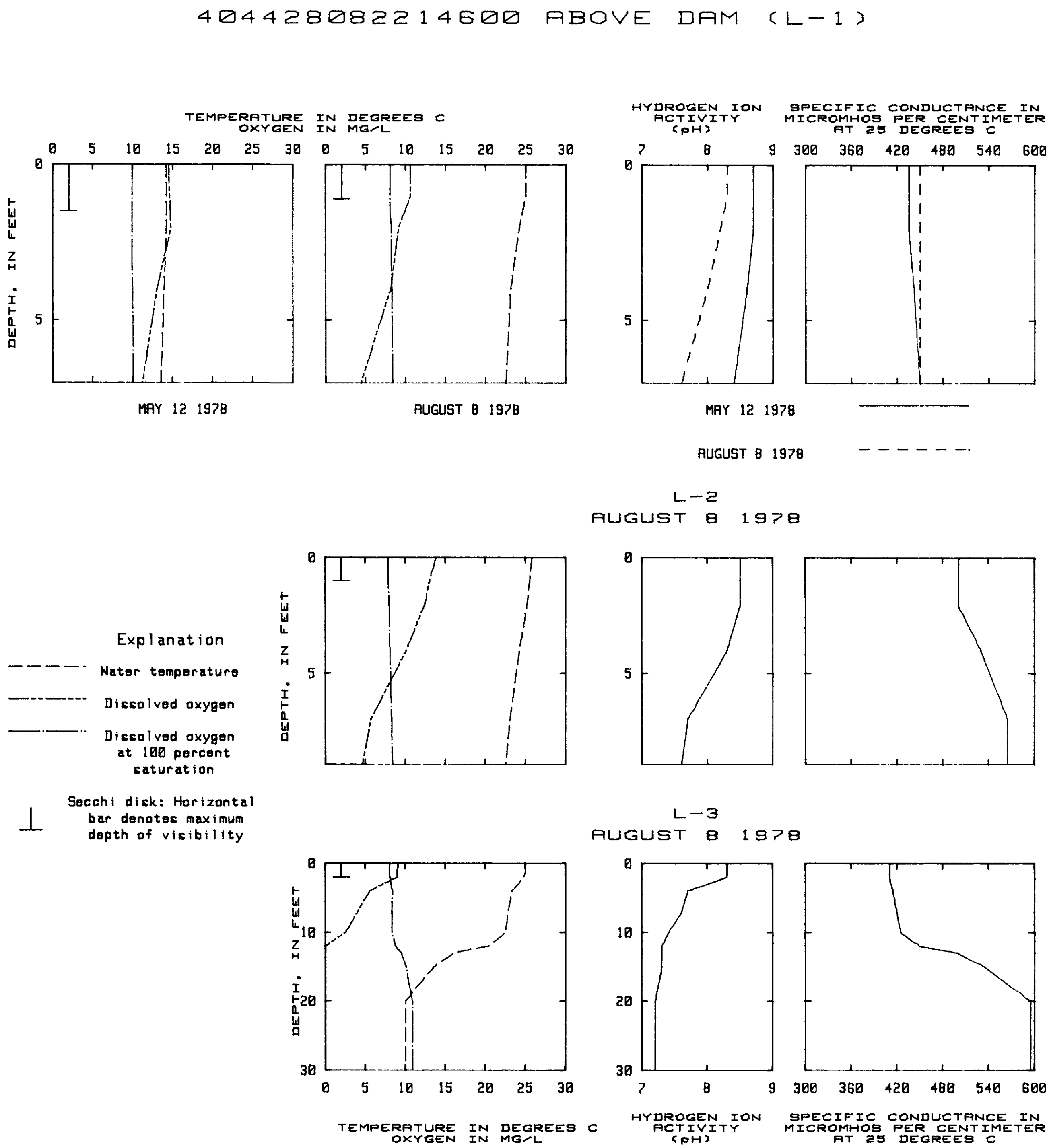



**Figure 15.--Data profiles for Charles Mill Lake.**

Table 21.--Profile data for the primary lake site, Charles Mill Lake, Ohio

404428082214600 - CHARLES MILL LK AB DAM AT SITE L-1 OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1977 TO SEPTEMBER 1978

| DATE | TIME | SAMPLING DEPTH (FT) | TEMPERATURE (DEG C) | OXYGEN, DISSOLVED (MG/L) | OXYGEN, DISSOLVED (PERCENT SATURATION) | SPECIFIC CONDUCTANCE (MICROMHOS) | PH (UNITS) | CARBONATE (MG/L AS CO3) | BICARBONATE (MG/L AS HCO3) | CARBON DIOXIDE DISSOLVED (MG/L AS CO2) | HYDROGEN SULFIDE DISS. (MG/L AS H2S) | TRANSPARENCY (SECCHI DISK) (IN) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MAY | | | | | | | | | | | | |
| 12... | 1310 | .0 | 14.2 | 14.5 | 146 | 435 | 8.7 | -- | -- | -- | -- | -- |
| 12... | 1315 | 2.0 | 14.2 | 14.8 | 150 | 435 | 8.7 | 10 | 134 | .5 | .0 | 18 |
| 12... | 1325 | 4.0 | 13.9 | 13.0 | 130 | 442 | 8.6 | -- | -- | -- | -- | -- |
| 12... | 1335 | 7.0 | 13.5 | 11.2 | 111 | 450 | 8.4 | 2 | 156 | 1.0 | .1 | -- |
| AUG | | | | | | | | | | | | |
| 08... | 1315 | .0 | 25.0 | 10.6 | 130 | 450 | 8.3 | -- | -- | -- | -- | -- |
| 08... | 1318 | 1.0 | 25.0 | 10.6 | 130 | 450 | 8.3 | -- | -- | -- | -- | -- |
| 08... | 1320 | 2.0 | 24.2 | 9.1 | 110 | 450 | 8.2 | 0 | 168 | 1.7 | .0 | 13 |
| 08... | 1325 | 4.0 | 23.1 | 8.1 | 98 | 450 | 8.0 | -- | -- | -- | -- | -- |
| 08... | 1330 | 7.0 | 22.5 | 4.4 | 52 | 450 | 7.6 | 0 | 170 | 6.8 | .0 | -- |

Table 22.--Chemical analyses of water column composite samples, Charles Mill Lake, Ohio

404428082214600 - CHARLES MILL LK AB DAM AT SITE L-1 OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1977 TO SEPTEMBER 1978

| DATE | TIME | CALCIUM DIS- SOLVED (MG/L AS CA) | MAGNE- SIUM, DIS- SOLVED (MG/L AS MG) | POTAS- SIUM, DIS- SOLVED (MG/L AS K) | SODIUM, DIS- SOLVED (MG/L AS NA) | SULFATE DIS- SOLVED (MG/L AS SO4) | CHLO- RIDE, DIS- SOLVED (MG/L AS CL) | FLUO- RIDE, DIS- SOLVED (MG/L AS F) | HARD- NESS (MG/L AS CACO3) | SOLIDS, RESIDUE AT 180 DEG. C DIS- SOLVED (MG/L) |
|---|---|---|---|---|---|---|---|---|---|---|
| MAY | | | | | | | | | | |
| 12... | 1325 | 50 | 16 | 2.4 | 13 | 66 | 24 | .2 | 190 | 294 |
| AUG | | | | | | | | | | |
| 08... | 1330 | -- | -- | -- | -- | -- | -- | -- | -- | -- |

| DATE | SOLIDS, RESIDUE AT 105 DEG. C, SUS- PENDED (MG/L) | SOLIDS, RESIDUE AT 105 DEG. C, TOTAL (MG/L) | BARIUM, TOTAL RECOV- ERABLE (UG/L AS BA) | CADMIUM TOTAL RECOV- ERABLE (UG/L AS CD) | CHRO- MIUM, TOTAL RECOV- ERABLE (UG/L AS CR) | LEAD, TOTAL RECOV- ERABLE (UG/L AS PB) | MERCURY TOTAL RECOV- ERABLE (UG/L AS HG) | NICKEL, TOTAL RECOV- ERABLE (UG/L AS NI) | SELE- NIUM, TOTAL (UG/L AS SE) | SILVER, TOTAL RECOV- ERABLE (UG/L AS AG) |
|---|---|---|---|---|---|---|---|---|---|---|
| MAY | | | | | | | | | | |
| 12... | 72 | 366 | 0 | 0 | 10 | 23 | <.5 | 8 | 0 | 0 |
| AUG | | | | | | | | | | |
| 08... | -- | -- | 100 | 6 | 20 | 37 | -- | -- | 0 | 0 |

| DATE | ARSENIC TOTAL (UG/L AS AS) | METHY- LENE BLUE ACTIVE SUB- STANCE (MG/L) | BORON, TOTAL RECOV- ERABLE (UG/L AS B) | COBALT, TOTAL RECOV- ERABLE (UG/L AS CO) | COPPER, TOTAL RECOV- ERABLE (UG/L AS CU) | IRON, TOTAL RECOV- ERABLE (UG/L AS FE) | MANGA- NESE, TOTAL RECOV- ERABLE (UG/L AS MN) | MOLYB- DENUM, TOTAL RECOV- ERABLE (UG/L AS MO) | ZINC, TOTAL RECOV- ERABLE (UG/L AS ZN) |
|---|---|---|---|---|---|---|---|---|---|
| MAY | | | | | | | | | |
| 12... | <10 | <.05 | 170 | 0 | 1 | 1200 | 150 | 4 | 10 |
| AUG | | | | | | | | | |
| 08... | -- | -- | -- | -- | -- | -- | -- | -- | -- |

Table 23.--Chemical, physical, and biological analyses of water samples from selected depths, Charles Mill Lake, Ohio

404428082214600 - CHARLES MILL LK AB DAM AT SITE L-1 OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1977 TO SEPTEMBER 1978

| DATE | TIME | SAMPLING DEPTH (FT) | NITROGEN, NITRITE TOTAL (MG/L AS N) | NITROGEN, NITRATE TOTAL (MG/L AS N) | NITROGEN, NO2+NO3 TOTAL (MG/L AS N) | NITROGEN, AMMONIA TOTAL (MG/L AS N) | NITROGEN, ORGANIC TOTAL (MG/L AS N) | NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N) | PHOSPHORUS, ORTHO. TOTAL (MG/L AS P) |
|---|---|---|---|---|---|---|---|---|---|
| MAY | | | | | | | | | |
| 12... | 1315 | 2.0 | .01 | .13 | .14 | .19 | .81 | 1.0 | .00 |
| 12... | 1335 | 7.0 | .01 | .22 | .23 | .18 | .82 | 1.0 | .00 |
| AUG | | | | | | | | | |
| 08... | 1320 | 2.0 | .00 | .00 | .00 | .01 | 1.4 | 1.4 | .01 |
| 08... | 1330 | 7.0 | .01 | .03 | .04 | .11 | 1.3 | 1.4 | .02 |

| DATE | PHOSPHORUS, TOTAL (MG/L AS P) | SILICA, DISSOLVED (MG/L AS SIO2) | TURBIDITY (JTU) | COLOR (PLATINUM-COBALT UNITS) | CARBON, ORGANIC TOTAL (MG/L AS C) | OXYGEN DEMAND, BIOCHEMICAL, 5 DAY (MG/L) | OXYGEN DEMAND, CHEMICAL (HIGH LEVEL) (MG/L) | COLIFORM, FECAL, 0.45 UM-MF (COLS./100 ML) | STREPTOCOCCI FECAL, (COLS. PER 100 ML) |
|---|---|---|---|---|---|---|---|---|---|
| MAY | | | | | | | | | |
| 12... | .11 | .1 | 5 | 15 | 11 | 6.6 | 30 | 4 | 74 |
| 12... | .14 | .1 | 7 | 20 | 10 | 5.4 | 30 | 2 | 66 |
| AUG | | | | | | | | | |
| 08... | .14 | .1 | 10 | 10 | 8.6 | 4.3 | 24 | 4 | 16 |
| 08... | .12 | .8 | 15 | 30 | 8.0 | 3.1 | 44 | 4 | 140 |

Table 24.--Phytoplankton identified in Charles Mill Lake, Ohio (1978)

| Sample description: Location | Sample description: Date | Sample description: Location in water column | Total cells (per ml) | Diversity index (genus) $\bar{d}$ | Chlorophyll a (µg/L) | Division(s) present (in order of dominance) | Percent of total cell count | Dominant taxa within division and percent (%)* of total cell count |
|---|---|---|---|---|---|---|---|---|
| Site L-1 above dam | 5-12 | Euphotic zone composite | 350,000 | 2.8 | -- | Chrysophyta | 43 | Cyclotella (40), Melosira (2), Nitzschia (1) |
| | | | | | | Chlorophyta | 40 | Kirchneriella (10), Scenedesmus (9), Chlamydomonas (9), Micractinium (7), Actinastrum (2), Selenastrum (1), Tetrastrum (1), Golenkinia (1), Scenedesmus (1), Carteria (1) |
| | | | | | | Cyanophyta | 17 | Agmenellum (17), Anacystis, |
| | | | | | | Euglenophyta | | Trachelomonas (less than 1) |
| Site L-1 above dam | 8-08 | 1-ft depth | 33,000 | -- | 51.9 | Chrysophyta | 39 | Melosira (31), Cyclotella (6), Nitzschia (1) |
| | | | | | | Cyanophyta | 39 | Agmenellum (39) |
| | | | | | | Chlorophyta | 21 | Crucigenia (9), Scenedesmus (6), Dictyosphaerium (2), Quadrigula (1), Tetrastrum (1), Ankistrodesmus (1), Closteriopsis, Tetraedron |
| | | | | | | Euglenophyta | | Trachelomonas (1), Euglena Phacus |
| Site L-1 above dam | 8-08 | Euphotic zone | 180,000 | 2.4 | 5.57 | Chrysophyta | 70 | Melosira (41), Cyclotella (25), Nitzschia (4), Gyrosigma (1) |
| | | | | | | Chlorophyta | 29 | Scenedesmus (13), Crucigenia (6), Dictyosphaerium (6), Tetrastrum (2), Ankistrodesmus (2) |
| | | | | | | Euglenophyta | 1 | Euglena (1) |

*Less than 1 percent not given.

Charles Mill Lake at L-1 was shallow (7 feet) and had developed only a slight thermal and chemical gradient by the August 8 sampling. Oxygen was at supersaturation through the entire water column in the spring and in the upper 2 feet in the summer. Site L-2 had thermal and chemical profiles similar to those at L-1.

Site L-3 may once have been a borrow pit or rock quarry. This 30-foot deep "hole" was thermally and chemically stratified. Oxygen deficits were found below 4 feet; anaerobic conditions were found at 12 feet and below. The odor of hydrogen sulfide was detected in the water sampled at 15 feet.

The spring near-surface, total-phosphorus concentration was 0.11 mg/L. The spring total-nitrogen to total-phosphorus ratio, 11 to 1, indicates that nitrogen may be limiting algal productivity in Charles Mill Lake.

Charles Mill Lake had Carlson TSIs of 71 for chlorophyll a, 76 for Secchi-disk transparency, and 72 for total phosphorus (spring). Carlson TSIs in this range indicate hypereutrophic lakes.

Iron and lead exceeded Ohio water quality standards in the spring; cadmium and lead exceeded Ohio water quality standards in the summer.

Phytoplankton counts were high in the spring; diatoms (Chrysophyta) and green algae (Chlorophyta) dominated the algal community. Summer counts were much lower; yellow green algae (Chrysophyta) and blue green algae (Cyanophyta) dominated the algal population.

Inflow data (fig. 14; table 25): Two inflows were sampled: Black Fork Mochican River (site I-1), which drains 172 $mi^2$, and Seymour Run (site I-2), which drains 6.41 $mi^2$. Their combined areas account for 83 percent of the drainage basin of Charles Mill Lake. A qualitative comparison of stream versus lake data is shown below.

| Inflow sampling site | Sampling date (1978) | Estimated discharge ($ft^3/s$) | Water body (stream or lake at 2-foot depth) having higher concentration | | | |
|---|---|---|---|---|---|---|
| | | | $NO_2+NO_3$ | Total P | TOC | (Specific conductance) |
| Black Fork Mochican | May 12 | 35 | Stream | Stream | Lake | Stream |
| | Aug 8 | 15 | Stream | Stream | Lake | Stream |
| Seymour Run | May 12 | 6.0 | Stream | Lake | Stream | Lake |
| | Aug 8 | 2.5 | Stream | Lake | Lake | Stream |

Table 25.--Physical and chemical data for selected inflows, Charles Mill Lake, Ohio

404848082244300 - BLACK FORK MOHICAN R AB CHARLES MILL RE OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1977 TO SEPTEMBER 1978

| DATE | TIME | STREAM-FLOW, INSTAN-TANEOUS (CFS) | TEMPER-ATURE (DEG C) | OXYGEN, DIS-SOLVED (MG/L) | PH (UNITS) | SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS) | TUR-BID-ITY (JTU) | COLOR (PLAT-INUM-COBALT UNITS) | CARBON, ORGANIC TOTAL (MG/L AS C) | NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N) | NITRO-GEN,AM-MONIA + ORGANIC TOTAL (MG/L AS N) | PHOS-PHORUS, TOTAL (MG/L AS P) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MAY | | | | | | | | | | | | |
| 12... | 1045 | E35 | 15.0 | 8.1 | 7.3 | 505 | 40 | 30 | 9.9 | 1.2 | 1.0 | .17 |
| AUG | | | | | | | | | | | | |
| 08... | 1030 | E15 | 20.5 | 4.5 | 7.2 | 1000 | 25 | 30 | 7.5 | .67 | .99 | .15 |

404507082212000 - SEYMOUR RN AB CHARLES MILL LK AT SITE I-2 OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1977 TO SEPTEMBER 1978

| DATE | TIME | STREAM-FLOW, INSTAN-TANEOUS (CFS) | TEMPER-ATURE (DEG C) | OXYGEN, DIS-SOLVED (MG/L) | PH (UNITS) | SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS) | TUR-BID-ITY (JTU) | COLOR (PLAT-INUM-COBALT UNITS) | CARBON, ORGANIC TOTAL (MG/L AS C) | NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N) | NITRO-GEN,AM-MONIA + ORGANIC TOTAL (MG/L AS N) | PHOS-PHORUS, TOTAL (MG/L AS P) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MAY | | | | | | | | | | | | |
| 12... | 1110 | E6.0 | 13.0 | 11.2 | 7.8 | 400 | 2 | 30 | 12 | .83 | .23 | .02 |
| AUG | | | | | | | | | | | | |
| 08... | 1100 | E2.5 | 18.0 | 9.2 | 8.0 | 580 | 1 | 30 | 3.0 | .54 | .23 | .02 |

## Dow Lake

Location: Athens County
(Athens 7.5-minute quadrangele map)

Type: Impoundment

Use: Recreation

Physical characteristics at summer pool level (table 6):

| Date of origin (year) | Surface area (acres) | Capacity (acre-feet) | Capacity-inflow ratio (C/I) |
|---|---|---|---|
| 1884 | 154 | 1,844 | 0.42 |

Drainage-basin characteristics:

| Drainage area ($mi^2$) | Type | Estimated sediment yield (from fig. 3) |
|---|---|---|
| 7.3 | Agricultural | Moderately |

Lake data (figs. 16, 17; tables 26-29): Dow Lake was sampled in the rain on May 8 and during intermittent rain on August 32. Secchi-disk transparency measurements at L-1 were 10 feet on May 8 and 5.5 feet on August 31, high compared to other lake sampled in 1978. Turbidity was low.

Profile and analytical data show the following lake characteristics:

| Date | Stratification (gradient) | | Chemical type | Trophic state index (Carlson) | | | Trophic class | Substances at or above State limits | | Phyto-plankton, dominant division(s) |
|---|---|---|---|---|---|---|---|---|---|---|
| | Thermal | Chemical | | Chl *a* | SD | T.P. | | Toxicants | Bacteria | |
| 5-08-78 | Slight | Yes | Moderately hard; Ca, $HCO_3$ | -- | -- | 37 | Meso-trophic | Cd, Pb | No | Cyanophyta |
| 7-31-78 | Yes | Yes | -- | 48 | 44 | -- | -- | Cd | No | Cyanophyta |

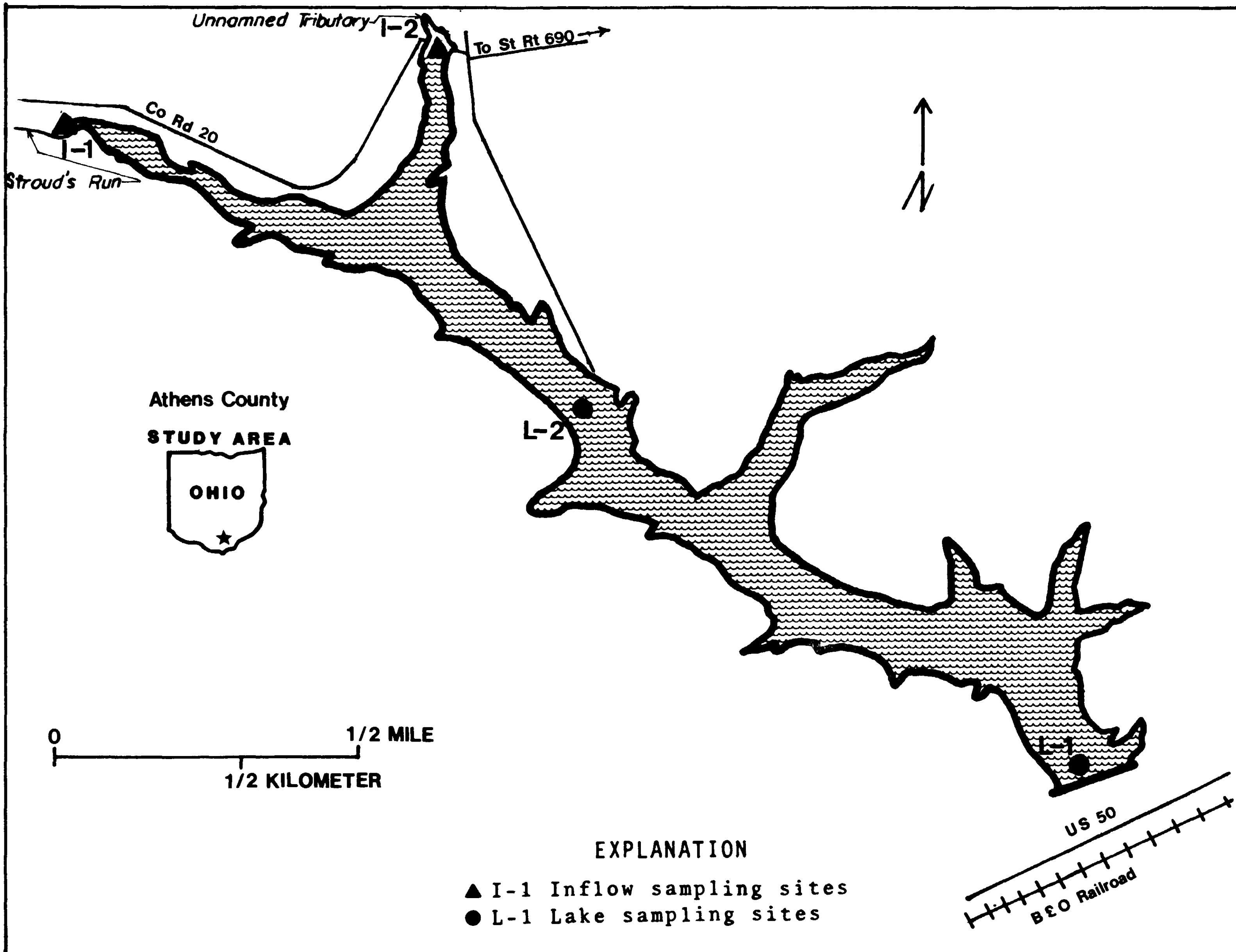



Figure 16.--Dow Lake and inflow sampling sites.

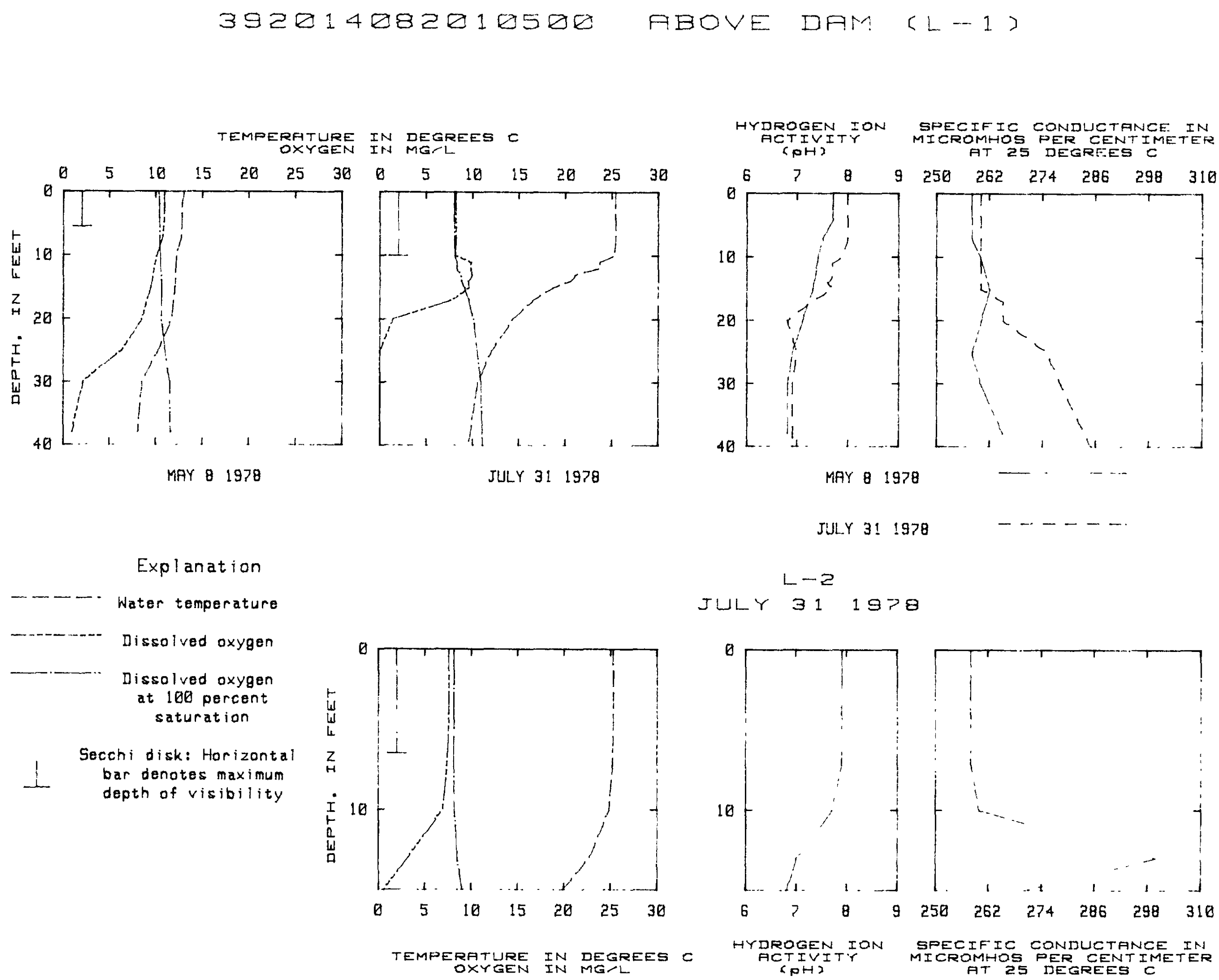



**Figure 17.--Data profiles for Dow Lake.**

Table 26.--Profile data for the primary lake site, Dow Lake, Ohio

392014082010500 - DOW LK AB DAM AT SITE L-1 NR ATHENS OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1977 TO SEPTEMBER 1978

| DATE | TIME | SAMP-LING DEPTH (FT) | TEMPER-ATURE (DEG C) | OXYGEN, DIS-SOLVED (MG/L) | OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION) | SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS) | PH (UNITS) | CAR-BONATE (MG/L AS CO3) | BICAR-BONATE (MG/L AS HCO3) | CARBON DIOXIDE DIS-SOLVED (MG/L AS CO2) | HYDRO-GEN SULFIDE DISS. (MG/L AS H2S) | TRANS-PAR-ENCY (SECCHI DISK) (IN) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MAY | | | | | | | | | | | | |
| 08... | 1430 | .0 | 13.0 | 10.9 | 105 | 258 | 7.7 | -- | -- | -- | -- | -- |
| 08... | 1435 | 2.0 | 12.8 | 10.9 | 105 | 258 | 7.7 | 0 | 80 | 2.5 | .0 | 66 |
| 08... | 1437 | 4.0 | 12.8 | 10.9 | 105 | 258 | 7.7 | -- | -- | -- | -- | -- |
| 08... | 1440 | 7.0 | 12.7 | 10.7 | 103 | 258 | 7.5 | -- | -- | -- | -- | -- |
| 08... | 1443 | 10 | 12.2 | 10.1 | 96 | 260 | 7.4 | -- | -- | -- | -- | -- |
| 08... | 1446 | 15 | 12.0 | 9.4 | 89 | 262 | 7.3 | -- | -- | -- | -- | -- |
| 08... | 1450 | 20 | 11.7 | 8.5 | 80 | 260 | 7.1 | -- | -- | -- | -- | -- |
| 08... | 1455 | 25 | 10.2 | 6.3 | 57 | 258 | 6.9 | -- | -- | -- | -- | -- |
| 08... | 1500 | 30 | 8.5 | 2.1 | 18 | 260 | 6.8 | -- | -- | -- | -- | -- |
| 08... | 1510 | 38 | 8.0 | .9 | 8 | 265 | 6.8 | 0 | 88 | 22 | .2 | -- |
| JUL | | | | | | | | | | | | |
| 31... | 1440 | .0 | 25.4 | 18.2 | 100 | 260 | 8.0 | -- | -- | -- | -- | -- |
| 31... | 1445 | 2.0 | 25.4 | 8.2 | 100 | 260 | 8.0 | 0 | 88 | 1.4 | .0 | 120 |
| 31... | 1450 | 4.0 | 25.4 | 8.2 | 100 | 260 | 8.0 | -- | -- | -- | -- | -- |
| 31... | 1455 | 7.0 | 25.4 | 8.2 | 100 | 260 | 8.0 | -- | -- | -- | -- | -- |
| 31... | 1500 | 10 | 25.3 | 8.1 | 100 | 260 | 7.9 | -- | -- | -- | -- | -- |
| 31... | 1501 | 11 | 23.7 | 9.8 | 120 | 260 | 7.7 | -- | -- | -- | -- | -- |
| 31... | 1502 | 12 | 23.7 | 9.8 | 120 | 260 | 7.7 | -- | -- | -- | -- | -- |
| 31... | 1503 | 13 | 21.0 | 9.9 | 110 | 260 | 7.7 | -- | -- | -- | -- | -- |
| 31... | 1504 | 14 | 20.5 | 9.5 | 110 | 260 | 7.6 | -- | -- | -- | -- | -- |
| 31... | 1505 | 15 | 18.7 | 9.6 | 100 | 260 | 7.7 | -- | -- | -- | -- | -- |
| 31... | 1507 | 17 | 16.5 | 7.8 | 81 | 265 | 7.3 | -- | -- | -- | -- | -- |
| 31... | 1510 | 20 | 14.3 | 1.4 | 14 | 265 | 6.8 | -- | -- | -- | -- | -- |
| 31... | 1515 | 25 | 12.0 | .0 | 0 | 275 | 7.0 | -- | -- | -- | -- | -- |
| 31... | 1520 | 30 | 10.5 | .0 | 0 | 278 | 6.9 | -- | -- | -- | -- | -- |
| 31... | 1525 | 40 | 9.5 | .0 | 0 | 285 | 6.9 | 0 | 154 | 31 | 3.1 | -- |

Table 27.--Chemical analyses of water column composite samples, Dow Lake, Ohio

392014082010500 - DOW LK AB DAM AT SITE L-1 NR ATHENS OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1977 TO SEPTEMBER 1978

| DATE | TIME | CALCIUM DIS-SOLVED (MG/L AS CA) | MAGNE-SIUM, DIS-SOLVED (MG/L AS MG) | POTAS-SIUM, DIS-SOLVED (MG/L AS K) | SODIUM, DIS-SOLVED (MG/L AS NA) | SULFATE DIS-SOLVED (MG/L AS SO4) | CHLO-RIDE, DIS-SOLVED (MG/L AS CL) | FLUO-RIDE, DIS-SOLVED (MG/L AS F) | HARD-NESS (MG/L AS CACO3) | SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L) |
|---|---|---|---|---|---|---|---|---|---|---|
| MAY 08... | 1450 | 33 | 6.7 | 1.6 | 6.0 | 54 | 6.5 | .1 | 110 | 163 |
| JUL 31... | 1445 | -- | -- | -- | -- | -- | -- | -- | -- | -- |

| DATE | SOLIDS, RESIDUE AT 105 DEG. C, SUS-PENDED (MG/L) | SOLIDS, RESIDUE AT 105 DEG. C, TOTAL (MG/L) | BARIUM, TOTAL RECOV-ERABLE (UG/L AS BA) | CADMIUM TOTAL RECOV-ERABLE (UG/L AS CD) | CHRO-MIUM, TOTAL RECOV-ERABLE (UG/L AS CR) | LEAD, TOTAL RECOV-ERABLE (UG/L AS PB) | MERCURY TOTAL RECOV-ERABLE (UG/L AS HG) | NICKEL, TOTAL RECOV-ERABLE (UG/L AS NI) | SELE-NIUM, TOTAL (UG/L AS SE) | SILVER, TOTAL RECOV-ERABLE (UG/L AS AG) |
|---|---|---|---|---|---|---|---|---|---|---|
| MAY 08... | 52 | 215 | 100 | 4 | 10 | 75 | <.5 | 4 | 0 | 0 |
| JUL 31... | -- | -- | 0 | 2 | <10 | 19 | <.5 | -- | 0 | 0 |

| DATE | ARSENIC TOTAL (UG/L AS AS) | METHY-LENE BLUE ACTIVE SUB-STANCE (MG/L) | BORON, TOTAL RECOV-ERABLE (UG/L AS B) | COBALT, TOTAL RECOV-ERABLE (UG/L AS CO) | COPPER, TOTAL RECOV-ERABLE (UG/L AS CU) | IRON, TOTAL RECOV-ERABLE (UG/L AS FE) | MANGA-NESE, TOTAL RECOV-ERABLE (UG/L AS MN) | MOLYB-DENUM, TOTAL RECOV-ERABLE (UG/L AS MO) | ZINC, TOTAL RECOV-ERABLE (UG/L AS ZN) |
|---|---|---|---|---|---|---|---|---|---|
| MAY 08... | <10 | <.05 | 70 | 0 | 1 | 290 | 560 | 0 | 10 |
| JUL 31... | -- | -- | -- | -- | -- | -- | -- | -- | -- |

Table 28.--Chemical, physical, and biological analyses of water samples from selected depths, Dow Lake, Ohio

392014082010500 - DOW LK AB DAM AT SITE L-1 NR ATHENS OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1977 TO SEPTEMBER 1978

| DATE | TIME | SAMPLING DEPTH (FT) | NITROGEN, NITRITE TOTAL (MG/L AS N) | NITROGEN, NITRATE TOTAL (MG/L AS N) | NITROGEN, NO2+NO3 TOTAL (MG/L AS N) | NITROGEN, AMMONIA TOTAL (MG/L AS N) | NITROGEN, ORGANIC TOTAL (MG/L AS N) | NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N) | PHOSPHORUS, ORTHO. TOTAL (MG/L AS P) |
|---|---|---|---|---|---|---|---|---|---|
| MAY | | | | | | | | | |
| 08... | 1435 | 2.0 | .01 | .13 | .14 | .02 | .27 | .29 | .00 |
| 08... | 1510 | 38 | .02 | .15 | .17 | .42 | .27 | .69 | .00 |
| JUL | | | | | | | | | |
| 31... | 1445 | 2.0 | .01 | .00 | .01 | 2.0 | .00 | 1.7 | .05 |
| 31... | 1525 | 40 | .00 | .00 | .00 | .00 | .32 | .32 | .00 |

| DATE | PHOSPHORUS, TOTAL (MG/L AS P) | SILICA, DISSOLVED (MG/L AS SIO2) | TURBIDITY (JTU) | COLOR (PLATINUM-COBALT UNITS) | CARBON, ORGANIC TOTAL (MG/L AS C) | OXYGEN DEMAND, BIOCHEMICAL, 5 DAY (MG/L) | OXYGEN DEMAND, CHEMICAL (HIGH LEVEL) (MG/L) | COLIFORM, FECAL, 0.45 UM-MF (COLS./100 ML) | STREPTOCOCCI FECAL, (COLS. PER 100 ML) |
|---|---|---|---|---|---|---|---|---|---|
| MAY | | | | | | | | | |
| 08... | .01 | 4.0 | 3 | 20 | 5.8 | 1.0 | 10 | 6 | 46 |
| 08... | .03 | 5.4 | 6 | 40 | 4.9 | 1.2 | 15 | 4 | 94 |
| JUL | | | | | | | | | |
| 31... | .23 | 7.5 | 1 | 10 | 4.4 | .9 | 27 | 4 | 8 |
| 31... | .00 | 2.0 | 30 | 50 | 8.3 | 3.1 | 10 | 92 | 140 |

Table 29.--Phytoplankton identified in Dow Lake, Ohio (1978)

| Sample description | | | Total cells (per ml) | Diversity index (genus) $\bar{d}$ | Chlorophyll a (µg/L) | Division(s) present (in order of dominance) | Percent of total cell count | Dominant genera within division and percent (%)* of total cell count |
|---|---|---|---|---|---|---|---|---|
| Location | Date | Location in water column | | | | | | |
| Site L-1 above dam | 5-05 | Euphotic zone composite | 23,000 | -- | 10.2 | Cyanophyta | 96 | Oscillatoria (69), Aphanizomenon (27) |
| | | | | | | Chrysophyta | 3 | Synedra (2), Asterionella (1), Nitzschia, Stephanodiscus |
| | | | | | | Cryptophyta | 1 | Cryptomonads (1) |
| | | | | | | Chlorophyta | | Kirchneriella, Chlamydomonas |
| Site L-1 above dam | 7-31 | Euphotic zone composite | 32,000 | 2 | 8.3 | Cyanophyta | 99 | Gomphosphaeria (50), Aphanizomenon (19), Anabaena (11), Anacystis (10), Agmenellum (8) |
| | | | | | | Chlorophyta | 1 | Sphaerocystis (1), Oocystis Characium, Chlamydomonas |
| | | | | | | Euglenophyta | | Trachelomonas |
| | | | | | | Chrysophyta | | Cyclotella |
| Site L-1 above dam | 7-31 | 12-ft depth | 30,000 | 1.9 | 7.6 | Cyanophyta | 99 | Gomphosphaeria (44), Anabaena (24), Aphanizomenon (23), Anacystis (8), Agmenellum (1) |
| | | | | | | Chlorophyta | | Oocystis (1) |
| | | | | | | Euglenophyta | | Trachelomonas |

*Less than 1 percent not given.

Dow Lake had developed distinct thermal stratification by the July 31 sampling. The bottom water increased from 8°C to 9.5°C between the spring and summer sampling dates. Oxygen deficits were found below 25 feet at the July 31 sampling.

The thermal and chemical profiles at site L-2 were similar to those found at L-1.

The spring total-phosphorus concentration (0.01 mg/L) was the second lowest obsrved in 1978. The spring total-nitrogen to total phosphorus ratio, 43 to 1, indicates phosphorus may be limiting algal productivity in Dow Lake.

Dow Lake had Carlson TSIs of 48 for chlorophyll *a* (summer), 44 for Secchi-disk transparency (summer), and 37 for total phosphorus (spring). Carlson TSIs in this range indicate mesotrophic lakes.

Cadmium and lead concentrations exceeded Ohio water-quality standards in the spring; cadmium exceeded Ohio water-quality standards in the summer. Hydrogen sulfide was found in the hypoilimnion in the summer.

Algal counts were low in the spring and summer samplings. Blue-green algae (Cyanophyta) dominated the algal community. Growths of aquatic macrophytes in Dow Lake were not excessive.

Inflow data (fig. 16; table 30): Two inflows were sampled: Strouds Run (site I-1), which drains 2.88 $mi^2$, and an unnamed tributary (site I-2) draining 1.56 $mi^2$. Their combined areas account for 61 percent of the drainage basin of Dow Lake. A qualitative comparison of stream versus lake data is shown below.

| Inflow sampling site | Sampling date (1978) | Estimated discharge ($ft^3/s$) | Water body (stream or lake at 2-foot depth) having higher concentration | | | |
|---|---|---|---|---|---|---|
| | | | $NO_2$+ $NO_3$ | Total P | TOC | (Specific conductance) |
| Strouds Run | May 8 | 4.0 | Lake | Stream | Lake | Stream |
| | July 31 | 1.5 | Stream | Stream | Lake | Stream |
| Unnamed tributary | May 8 | 6.0 | Stream | Stream | Stream | Stream |
| | July 31 | 1.0 | Stream | Stream | Stream | Stream |

Table 30.--Physical and chemical data for selected inflows, Dow Lake, Ohio

392108082025200 - STROUDS RN AB DOW LK AT SITE I-1 OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1977 TO SEPTEMBER 1978

| DATE | TIME | STREAM-FLOW, INSTAN-TANEOUS (CFS) | TEMPER-ATURE (DEG C) | OXYGEN, DIS-SOLVED (MG/L) | PH (UNITS) | SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS) | TUR-BID-ITY (JTU) | COLOR (PLAT-INUM-COBALT UNITS) | CARBON, ORGANIC TOTAL (MG/L AS C) | NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N) | NITRO-GEN,AM-MONIA + ORGANIC TOTAL (MG/L AS N) | PHOS-PHORUS, TOTAL (MG/L AS P) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MAY | | | | | | | | | | | | |
| 08... | 1315 | E4.0 | 12.0 | 10.9 | 7.4 | 312 | 8 | 30 | 3.4 | .05 | .18 | .03 |
| JUL | | | | | | | | | | | | |
| 31... | 1315 | E1.5 | 20.0 | 8.1 | 7.5 | 525 | 20 | 30 | 4.9 | .23 | .32 | .04 |

392115082021700 - UNNAMED TR AB DOW LK AT SITE I-2 OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1977 TO SEPTEMBER 1978

| DATE | TIME | STREAM-FLOW, INSTAN-TANEOUS (CFS) | TEMPER-ATURE (DEG C) | OXYGEN, DIS-SOLVED (MG/L) | PH (UNITS) | SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS) | TUR-BID-ITY (JTU) | COLOR (PLAT-INUM-COBALT UNITS) | CARBON, ORGANIC TOTAL (MG/L AS C) | NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N) | NITRO-GEN,AM-MONIA + ORGANIC TOTAL (MG/L AS N) | PHOS-PHORUS, TOTAL (MG/L AS P) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MAY | | | | | | | | | | | | |
| 08... | 1345 | E6.0 | 12.0 | 10.5 | 7.5 | 302 | 40 | 20 | 6.1 | .10 | .40 | .10 |
| JUL | | | | | | | | | | | | |
| 31... | 1330 | E1.0 | 20.0 | 8.1 | 7.4 | 470 | 15 | 20 | 12 | .19 | .37 | .02 |

## Forked Run Lake

Location: Meigs County
(Portland 7.5-minute quadrangle map)

Type: Impoundment on Forked Run

Use: Recreation

Physical characteristics at summer pool level (table 6):

| Date of origin (year) | Surface area (acres) | Capacity (acre-feet) | Capacity-inflow ratio (C/I) |
|---|---|---|---|
| 1952 | 107 | 1,700 | 0.22 |

Drainage-basin characteristics:

| Drainage area ($mi^2$) | Type | Estimated sediment yield (from fig. 3) |
|---|---|---|
| 8.9 | Rural, agricultural | Moderate |

Lake data (figs. 18, 19; tables 31-34): Forked Run Lake was sampled in the rain on May 4 and under partly cloudy skies on August 25. Secchi-disk transparency at L-1 was 4.5 feet, in May and 7.5 feet in August, comparatively high values for an Ohio lake.

Profile and analytical data show the following lake characteristics:

| Date | Stratification (gradient) Thermal | Chemical | Chemical type | Trophic state index (Carlson) Chl a | SD | T.P. | Trophic class | Substances at or above State limits Toxicants | Bacteria | Phyto-plankton, dominant division(s) |
|---|---|---|---|---|---|---|---|---|---|---|
| 5-04-78 | Yes | Yes | Soft; Ca, $HCO_3$ | -- | -- | 37 | Meso-trophic | Cd, Cu, Ni | -- | Chlorophyta, Chrysophyta |
| 8-25-78 | Yes | Yes | -- | -- | 48 | -- | -- | -- | -- | Cyanohpyta |

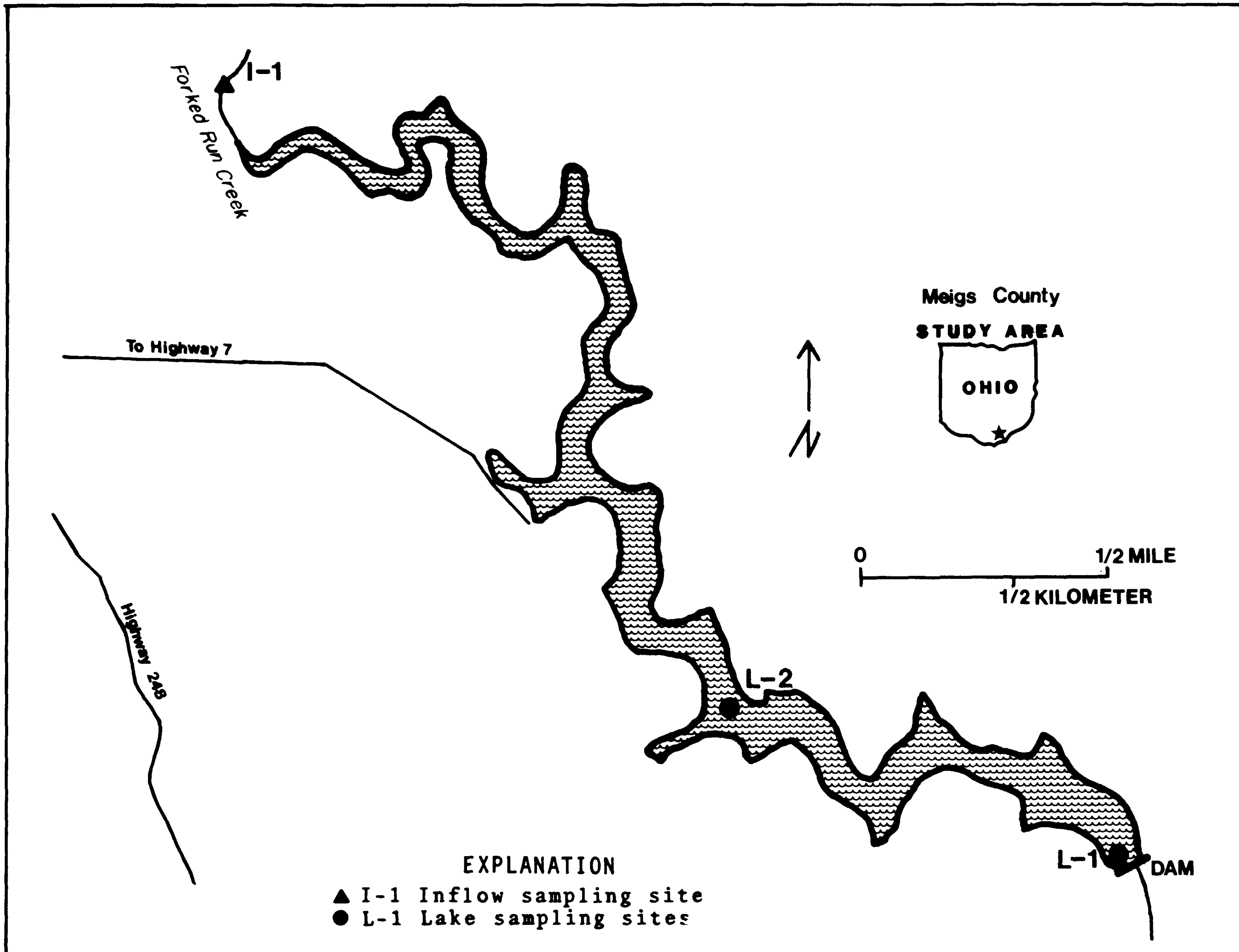



Figure 18.--Forked Run Lake and inflow sampling site.

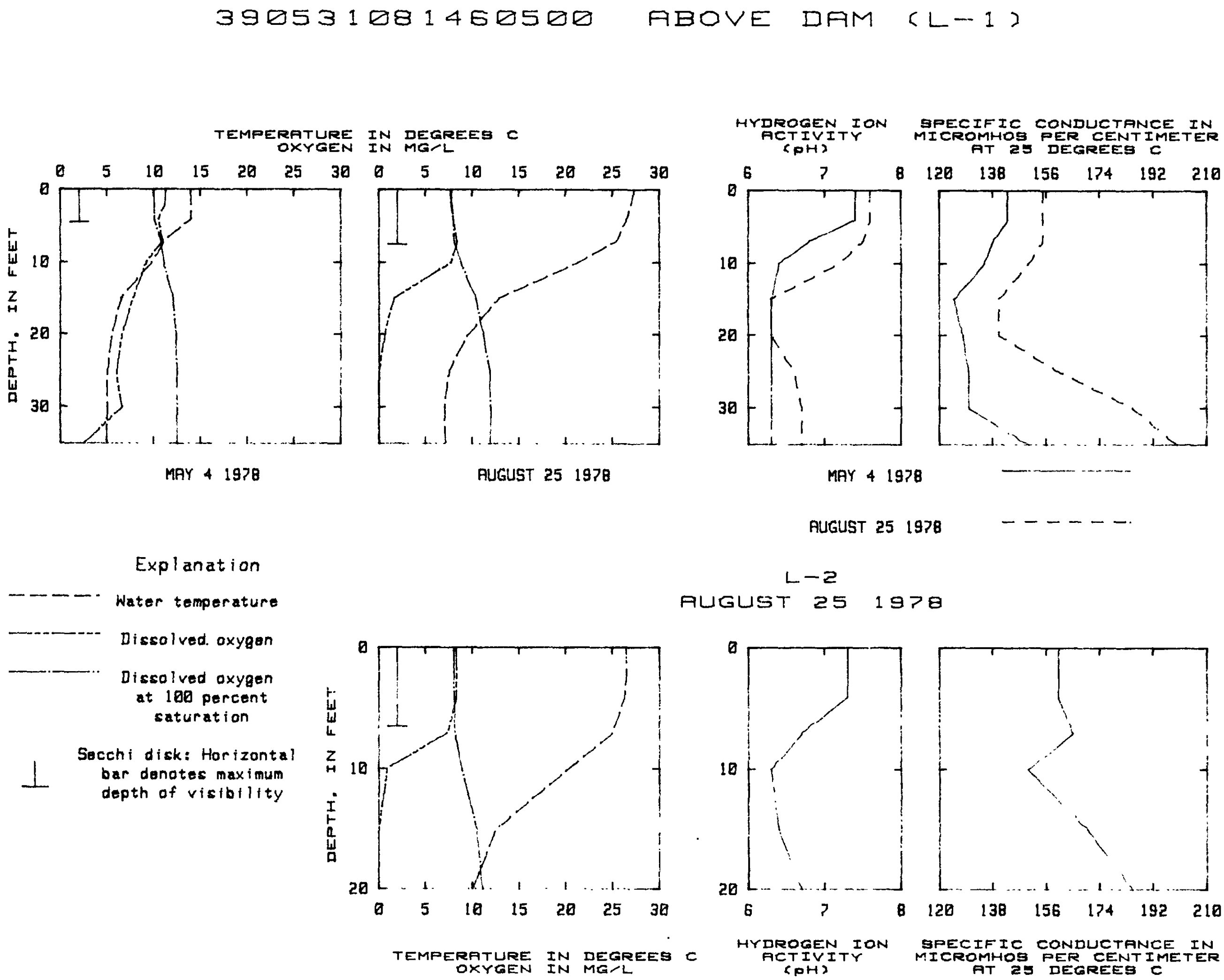



Figure 19.--Data profiles for Forked Run Lake.

Table 31.--Profile data for the primary lake site, Forked Run Lake, Ohio

390531081460500 - FORKED RUN LK AB DAM AT SITE L-1 NR POMEROY OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1977 TO SEPTEMBER 1978

| DATE | TIME | SAMPLING DEPTH (FT) | TEMPERATURE (DEG C) | OXYGEN, DISSOLVED (MG/L) | OXYGEN, DISSOLVED (PERCENT SATURATION) | SPECIFIC CONDUCTANCE (MICROMHOS) | PH (UNITS) | CARBONATE (MG/L AS CO3) | BICARBONATE (MG/L AS HCO3) | CARBON DIOXIDE DISSOLVED (MG/L AS CO2) | HYDROGEN SULFIDE DISS. (MG/L AS H2S) | TRANSPARENCY (SECCHI DISK) (IN) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MAY | | | | | | | | | | | | |
| 04... | 1445 | .0 | 14.0 | 11.3 | 111 | 143 | 7.4 | -- | -- | -- | -- | -- |
| 04... | 1450 | 2.0 | 14.0 | 11.2 | 110 | 143 | 7.4 | 0 | 32 | 2.0 | .0 | 54 |
| 04... | 1455 | 4.0 | 14.0 | 10.9 | 107 | 143 | 7.4 | -- | -- | -- | -- | -- |
| 04... | 1500 | 7.0 | 11.2 | 11.0 | 102 | 138 | 6.8 | -- | -- | -- | -- | -- |
| 04... | 1505 | 10 | 9.8 | 9.2 | 83 | 135 | 6.4 | -- | -- | -- | -- | -- |
| 04... | 1507 | 15 | 6.5 | 7.8 | 65 | 125 | 6.3 | -- | -- | -- | -- | -- |
| 04... | 1510 | 20 | 5.5 | 6.6 | 53 | 128 | 6.3 | -- | -- | -- | -- | -- |
| 04... | 1513 | 25 | 5.0 | 6.0 | 50 | 130 | 6.3 | -- | -- | -- | -- | -- |
| 04... | 1515 | 30 | 5.0 | 6.6 | 53 | 130 | 6.3 | 0 | 28 | 22 | .1 | -- |
| 04... | 1520 | 35 | 4.9 | 2.5 | 20 | 150 | 6.3 | -- | -- | -- | -- | -- |
| AUG | | | | | | | | | | | | |
| 25... | 1200 | .0 | 27.3 | 7.7 | 99 | 155 | 7.6 | -- | -- | -- | -- | -- |
| 25... | 1205 | 2.0 | 27.0 | 7.8 | 99 | 155 | 7.6 | 0 | 52 | 2.0 | .0 | 90 |
| 25... | 1210 | 4.0 | 26.5 | 8.0 | 100 | 155 | 7.6 | -- | -- | -- | -- | -- |
| 25... | 1215 | 7.0 | 25.5 | 8.4 | 100 | 155 | 7.5 | -- | -- | -- | -- | -- |
| 25... | 1220 | 10 | 21.3 | 7.7 | 88 | 150 | 7.2 | -- | -- | -- | -- | -- |
| 25... | 1225 | 15 | 12.8 | 1.6 | 15 | 140 | 6.3 | -- | -- | -- | -- | -- |
| 25... | 1230 | 20 | 9.5 | .6 | 5 | 140 | 6.3 | -- | -- | -- | -- | -- |
| 25... | 1235 | 25 | 7.5 | .0 | 0 | 160 | 6.6 | -- | -- | -- | -- | -- |
| 25... | 1240 | 30 | 7.0 | .0 | 0 | 185 | 6.7 | -- | -- | -- | -- | -- |
| 25... | 1245 | 35 | 7.2 | .0 | 0 | 200 | 6.7 | 0 | 86 | 27 | .7 | -- |

Table 32.--Chemical analyses of water column composite samples, Forked Run Lake, Ohio

390531081460500 - FORKED RUN LK AB DAM AT SITE L-1 NR POMEROY OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1977 TO SEPTEMBER 1978

| DATE | TIME | CALCIUM DIS-SOLVED (MG/L AS CA) | MAGNE-SIUM, DIS-SOLVED (MG/L AS MG) | POTAS-SIUM, DIS-SOLVED (MG/L AS K) | SODIUM, DIS-SOLVED (MG/L AS NA) | SULFATE DIS-SOLVED (MG/L AS SO4) | CHLO-RIDE, DIS-SOLVED (MG/L AS CL) | FLUO-RIDE, DIS-SOLVED (MG/L AS F) | HARD-NESS (MG/L AS CACO3) | SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L) |
|---|---|---|---|---|---|---|---|---|---|---|
| MAY | | | | | | | | | | |
| 04... | 1505 | 12 | 3.8 | 1.5 | 5.9 | 26 | 4.8 | .1 | 46 | 84 |

| DATE | SOLIDS, RESIDUE AT 105 DEG. C, SUS-PENDED (MG/L) | SOLIDS, RESIDUE AT 105 DEG. C, TOTAL (MG/L) | BARIUM, TOTAL RECOV-ERABLE (UG/L AS BA) | CADMIUM TOTAL RECOV-ERABLE (UG/L AS CD) | CHRO-MIUM, TOTAL RECOV-ERABLE (UG/L AS CR) | LEAD, TOTAL RECOV-ERABLE (UG/L AS PB) | MERCURY TOTAL RECOV-ERABLE (UG/L AS HG) | NICKEL, TOTAL RECOV-ERABLE (UG/L AS NI) | SELE-NIUM, TOTAL (UG/L AS SE) | SILVER, TOTAL RECOV-ERABLE (UG/L AS AG) |
|---|---|---|---|---|---|---|---|---|---|---|
| MAY | | | | | | | | | | |
| 04... | 34 | 118 | 100 | 2 | <10 | 10 | <.5 | 60 | 0 | 0 |

| DATE | ARSENIC TOTAL (UG/L AS AS) | METHY-LENE BLUE ACTIVE SUB-STANCE (MG/L) | BORON, TOTAL RECOV-ERABLE (UG/L AS B) | COBALT, TOTAL RECOV-ERABLE (UG/L AS CO) | COPPER, TOTAL RECOV-ERABLE (UG/L AS CU) | IRON, TOTAL RECOV-ERABLE (UG/L AS FE) | MANGA-NESE, TOTAL RECOV-ERABLE (UG/L AS MN) | MOLYB-DENUM, TOTAL RECOV-ERABLE (UG/L AS MO) | ZINC, TOTAL RECOV-ERABLE (UG/L AS ZN) |
|---|---|---|---|---|---|---|---|---|---|
| MAY | | | | | | | | | |
| 04... | <10 | <.05 | 40 | 0 | 5 | 390 | 50 | 0 | 20 |

Table 33.--Chemical, physical, and biological analyses of water samples from selected depths, Forked Run Lake, Ohio

390531081460500 - FORKED RUN LK AB DAM AT SITE L-1 NR POMEROY OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1977 TO SEPTEMBER 1978

| DATE | TIME | SAMPLING DEPTH (FT) | NITROGEN, NITRITE TOTAL (MG/L AS N) | NITROGEN, NITRATE TOTAL (MG/L AS N) | NITROGEN, NO2+NO3 TOTAL (MG/L AS N) | NITROGEN, AMMONIA TOTAL (MG/L AS N) | NITROGEN, ORGANIC TOTAL (MG/L AS N) | NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N) | PHOSPHORUS, ORTHO. TOTAL (MG/L AS P) |
|---|---|---|---|---|---|---|---|---|---|
| MAY | | | | | | | | | |
| 04... | 1450 | 2.0 | .01 | .37 | .38 | .01 | .37 | .38 | .00 |
| 04... | 1515 | 30 | .00 | .74 | .74 | .01 | .30 | .31 | .00 |
| AUG | | | | | | | | | |
| 25... | 1205 | 2.0 | .00 | .00 | .00 | .02 | .39 | .41 | .00 |
| 25... | 1245 | 35 | -- | -- | -- | -- | -- | -- | -- |

| DATE | PHOSPHORUS, TOTAL (MG/L AS P) | SILICA, DISSOLVED (MG/L AS SIO2) | TURBIDITY (JTU) | COLOR (PLATINUM-COBALT UNITS) | CARBON, ORGANIC TOTAL (MG/L AS C) | OXYGEN DEMAND, BIOCHEMICAL, 5 DAY (MG/L) | OXYGEN DEMAND, CHEMICAL (HIGH LEVEL) (MG/L) | COLIFORM, FECAL, 0.45 UM-MF (COLS./100 ML) | STREPTOCOCCI FECAL, (COLS. PER 100 ML) |
|---|---|---|---|---|---|---|---|---|---|
| MAY | | | | | | | | | |
| 04... | .01 | 4.9 | 5 | 20 | 8.7 | 1.2 | 8 | <2 | 40 |
| 04... | .01 | 5.4 | 15 | 20 | 5.6 | .9 | 10 | <2 | <2 |
| AUG | | | | | | | | | |
| 25... | .01 | 4.0 | 2 | 10 | 5.1 | .6 | 14 | 30 | 26 |
| 25... | -- | -- | 75 | 30 | -- | 4.5 | -- | 26 | 30 |

Table 34.--Phytoplankton identified in Forked Run, Ohio (1978)

| Sample description | | | Total cells (per ml) | Diversity index (genus) $\bar{d}$ | Chlorophyll a (μg/L) | Division(s) present (in order of dominance) | Peercent of total cell count | Dominant taxa within division and percent (%)* of total cell count |
|---|---|---|---|---|---|---|---|---|
| Location | Date | Location in water column | | | | | | |
| Site L-1 above dam | 5-04 | Euphotic zone composite | 560 | 1.8 | -- | Chlorophyta | 57 | Ankistrodesmus (53), Tetraedron (4) |
| | | | | | | Chrysophyta | 39 | Synedra (25), Cyclotella (11), Stephanodiscus (4) |
| | | | | | | Pyrrophyta | 4 | Gloeodinium (4) |
| Site L-1 above dam | 8-25 | 10-foot depth | 910 | -- | -- | Cyanophyta | 84 | Oscillatoria (84) |
| | | | | | | Chlorophyta | 11 | Scenedesmus (5), Crucigenia (4), Ankistrodesmus (2) |
| | | | | | | Euglenophyta | 3 | Trachelomonas (3) |
| | | | | | | Cryptophyta | 2 | Cryptomonas (2) |
| | | | | | | Chrysophyta | 1 | Cyclotella (1) |
| Site L-1 above dam | 8-25 | Euphotic zone composite | 6,900 | 1.4 | 7.6 | Cyanophyta | 90 | Agmenellum (67), Anacystis (22) |
| | | | | | | Chlorophyta | 7 | Scenedesmus (4), Crucigenia (3) Ankistrodesmus |
| | | | | | | Cryptophyta | 3 | Chroomonas (3), Cryptomonas |
| | | | | | | Chrysophyta | | Cyclotella |

*Less than 1 percent not given.

Forked Run Lake at L-1 had developed distinct thermal stratification by the August 25 sampling. Temperature of the bottom water increased from 4.9°C to 7.2°C between the spring and summer sampling dates. Oxygen deficits were noted at the spring sampling; anaerobic conditions had developed in the hypolimnion below 25 feet by the summer sampling. The low specific conductance and pH are typical of lakes in the sandstone bedrock areas of southeastern Ohio.

The thermal and chemical profiles at site L-2 were similar to those found at L-1.

The spring near-surface, total-phosphorus concentration (0.01 mg/L) was the second lowest observed in 1978. The total-nitrogen to total-phosphorus ratio, 41 to 1, indicates phosphorus may be limiting algal productivity in Forked Run Lake.

Forked Run Lake had Carlson TSIs of 48 for Secchi-disk transparency and 37 for total phosphorus (spring). Carlson TSIs in this range indicate mesotrophic lakes.

Cadmium, copper, and nickel concentrations in the May 4 samples exceeded Ohio water-quality standards.

Phytoplankton counts were low compared to other Ohio lakes sampled in 1978. Algal populations were dominated by green algae (Chlorophyta) and yellow-green algae (Chrysophyta) in May and by blue-green algae (Cyanophyta) in August. Growths of aquatic macrophytes were not excessive.

Inflow data (fig. 18; table 35): Forked Run, the principal tributary to Forked Run Lake, was sampled at site I-1. Drainage area at the site is 4.91 $mi^2$ which is 55 percent of the lake's drainage basin. A qualitative comparison of stream versus lake data is shown below.

| Inflow sampling site | Sampling date (1978) | Estimated discharge ($ft^3/s$) | Water body (stream or lake at 2-foot depth) having higher concentration | | | |
|---|---|---|---|---|---|---|
| | | | $NO_2+NO_3$ | Total P | TOC | (Specific conductance) |
| Forked Run at I-1 | May 4 | 5.0 | Lake | Equal | Lake | Stream |
| | Aug 25 | 1.0 | Stream | Equal | Lake | Stream |

Table 35.--Physical and chemical data for selected inflows, Forked Run Lake, Ohio

390703081475600 - FORKED RUN AB FORKED RUN LK AT SITE I-1 OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1977 TO SEPTEMBER 1978

| DATE | TIME | STREAM-FLOW, INSTAN-TANEOUS (CFS) | TEMPER-ATURE (DEG C) | OXYGEN, DIS-SOLVED (MG/L) | PH (UNITS) | SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS) | TUR-BID-ITY (JTU) | COLOR (PLAT-INUM-COBALT UNITS) | CARBON, ORGANIC TOTAL (MG/L AS C) | NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N) | NITRO-GEN,AM-MONIA + ORGANIC TOTAL (MG/L AS N) | PHOS-PHORUS, TOTAL (MG/L AS P) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MAY | | | | | | | | | | | | |
| 04... | 1330 | E5.0 | 11.0 | 10.8 | 7.2 | 230 | 10 | 20 | 9.2 | .05 | .11 | .01 |
| AUG | | | | | | | | | | | | |
| 25... | 1010 | E1.0 | 21.0 | 7.6 | 7.1 | 440 | 2 | 15 | 2.2 | .09 | .27 | .01 |

## Hargus Lake

Location: Pickaway County
(Ashville 7.5-minute quadrangle map)

Type: Impoundment on Hargus Creek

Use: Recreation

Physical characteristics at summer pool level (table 6):

| Date of origin (year) | Surface area (acres) | Capacity (acre-feet) | Capacity-inflow ratio (C/I) |
|---|---|---|---|
| 1956 | 146 | 2,325 | 0.55 |

Drainage-basin characteristics:

| Drainage area ($mi^2$) | Type | Estimated sediment yield (from fig. 3) |
|---|---|---|
| 6.5 | Agricultural, rural | Moderate |

Lake data (figs. 20, 21; tables 36-39): Hargus Lake was sampled in the rain on April 20 and under clear skies (after 2 days of rain) on August 4. Secchi-disk transparency at L-1 was 3.5 feet in April and 6.0 feet in August.

Profile and analytical data show the following lake characteristics:

| Date | Stratification (gradient) | | Chemical type | Trophic state index (Carlson) | | | Trophic class | Substances at or above State limits | | Phyto-plankton, dominant division(s) |
|---|---|---|---|---|---|---|---|---|---|---|
| | Thermal | Chemical | | Chl a | SD | T.P. | | Toxicants | Bacteria | |
| 4-20-78 | Yes | Yes | Very hard; Ca, $HCO_3$ | -- | -- | 61 | Meso-trophic | Cd | No | Chysophyta, Chlorophyta |
| 8-04-78 | Yes | Yes | -- | 43 | 51 | -- | -- | -- | No | Cyanophyta |

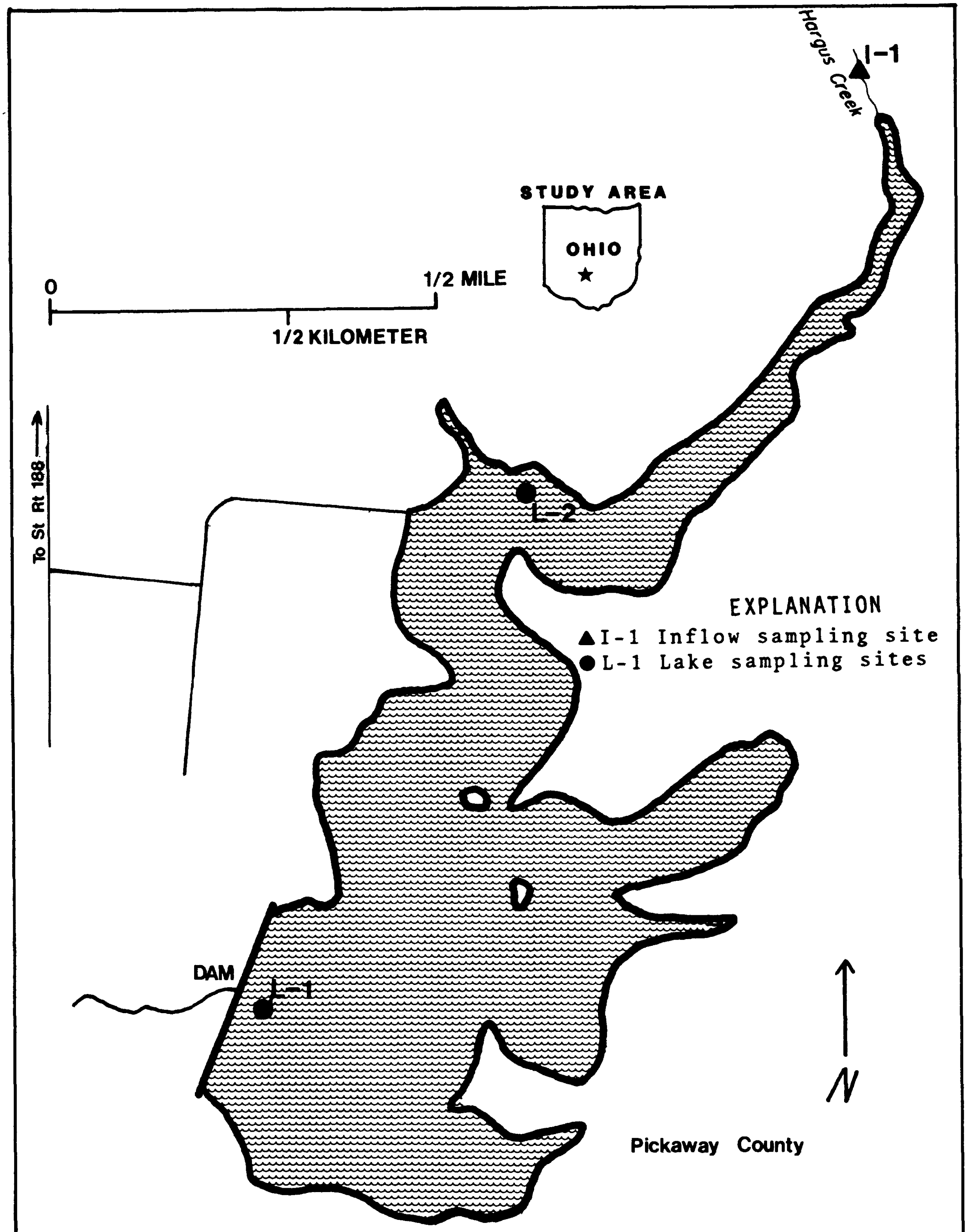



**Figure 20.--Hargus Lake and inflow sampling site.**

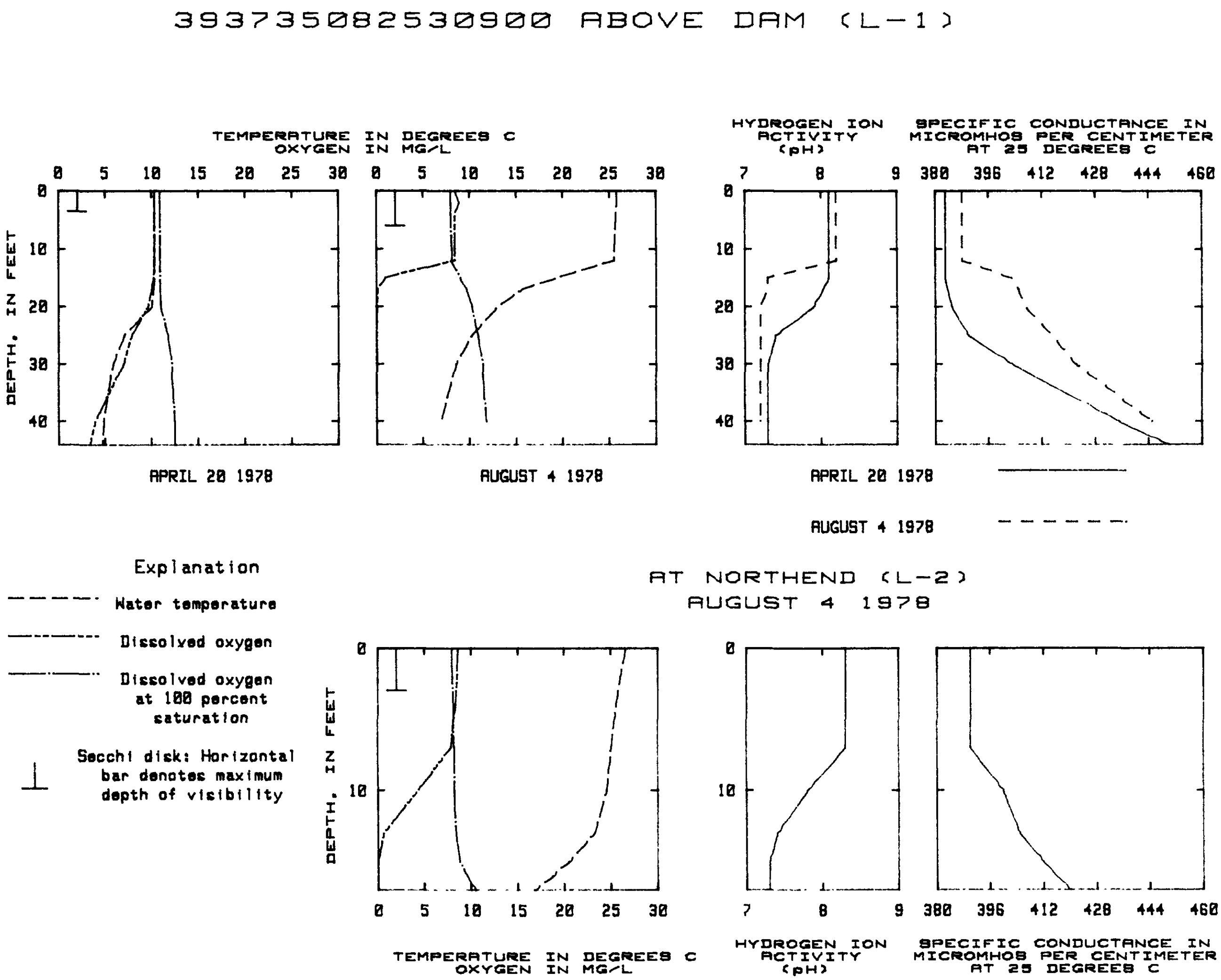



Figure 21.--Data profiles for Hargus Lake.

Table 36.--Profile data for the primary lake site, Hargus Lake Ohio

393735082530900 - HARGUS LK AB DAM AT SITE L-1 NR CIRCLEVILLE OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1977 TO SEPTEMBER 1978

| DATE | TIME | SAMPLING DEPTH (FT) | TEMPERATURE (DEG C) | OXYGEN, DISSOLVED (MG/L) | OXYGEN, DISSOLVED (PERCENT SATURATION) | SPECIFIC CONDUCTANCE (MICROMHOS) | PH (UNITS) | CARBONATE (MG/L AS CO3) | BICARBONATE (MG/L AS HCO3) | CARBON DIOXIDE DISSOLVED (MG/L AS CO2) | HYDROGEN SULFIDE DISS. (MG/L AS H2S) | TRANSPARENCY (SECCHI DISK) (IN) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| APR | | | | | | | | | | | | |
| 20... | 1315 | .0 | 10.3 | 10.3 | 94 | 383 | 8.1 | -- | -- | -- | -- | -- |
| 20... | 1320 | 2.0 | 10.3 | 10.3 | 94 | 383 | 8.1 | 0 | 164 | 2.1 | .0 | 42 |
| 20... | 1325 | 4.0 | 10.3 | 10.3 | 94 | 383 | 8.1 | -- | -- | -- | -- | -- |
| 20... | 1330 | 7.0 | 10.3 | 10.3 | 94 | -- | -- | -- | -- | -- | -- | -- |
| 20... | 1335 | 10 | 10.3 | 10.3 | 94 | 383 | 8.1 | -- | -- | -- | -- | -- |
| 20... | 1340 | 15 | 10.3 | 10.2 | 93 | 383 | 8.1 | -- | -- | -- | -- | -- |
| 20... | 1345 | 20 | 10.0 | 9.6 | 87 | 385 | 7.9 | -- | -- | -- | -- | -- |
| 20... | 1350 | 25 | 7.0 | 7.8 | 66 | 390 | 7.4 | -- | -- | -- | -- | -- |
| 20... | 1355 | 30 | 5.8 | 6.9 | 57 | 403 | 7.3 | -- | -- | -- | -- | -- |
| 20... | 1400 | 40 | 4.8 | 3.9 | 31 | 435 | 7.3 | 0 | 194 | 15 | .0 | -- |
| 20... | 1405 | 44 | 4.7 | 3.3 | 26 | 450 | 7.3 | -- | -- | -- | -- | -- |
| AUG | | | | | | | | | | | | |
| 04... | 1300 | .0 | 25.8 | 8.5 | 110 | 388 | 8.2 | -- | -- | -- | -- | -- |
| 04... | 1305 | 2.0 | 25.8 | 8.9 | 110 | 388 | 8.2 | 0 | 162 | 1.6 | .0 | 72 |
| 04... | 1310 | 4.0 | 25.7 | 8.4 | 100 | 388 | 8.2 | -- | -- | -- | -- | -- |
| 04... | 1315 | 7.0 | 25.5 | 8.4 | 100 | 388 | 8.2 | -- | -- | -- | -- | -- |
| 04... | 1320 | 10 | 25.5 | 8.4 | 100 | 388 | 8.2 | -- | -- | -- | -- | -- |
| 04... | 1322 | 12 | 25.5 | 8.4 | 100 | 388 | 8.2 | -- | -- | -- | -- | -- |
| 04... | 1325 | 15 | 19.4 | .9 | 10 | 403 | 7.3 | -- | -- | -- | -- | -- |
| 04... | 1327 | 17 | 15.6 | .1 | 1 | 405 | 7.3 | -- | -- | -- | -- | -- |
| 04... | 1330 | 20 | 13.0 | .0 | 0 | 407 | 7.2 | -- | -- | -- | -- | -- |
| 04... | 1335 | 25 | 10.2 | .0 | 0 | 415 | 7.2 | -- | -- | -- | -- | -- |
| 04... | 1340 | 30 | 8.5 | .0 | 0 | 422 | 7.2 | -- | -- | -- | -- | -- |
| 04... | 1345 | 40 | 6.9 | .0 | 0 | 445 | 7.2 | 0 | 228 | 23 | 1.1 | -- |

Table 37.--Chemical analyses of water column composite samples, Hargus Lake, Ohio

393735082530900 - HARGUS LK AB DAM AT SITE L-1 NR CIRCLEVILLE OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1977 TO SEPTEMBER 1978

| DATE | TIME | CALCIUM DIS-SOLVED (MG/L AS CA) | MAGNE-SIUM, DIS-SOLVED (MG/L AS MG) | POTAS-SIUM, DIS-SOLVED (MG/L AS K) | SODIUM, DIS-SOLVED (MG/L AS NA) | SULFATE DIS-SOLVED (MG/L AS SO4) | CHLO-RIDE, DIS-SOLVED (MG/L AS CL) | FLUO-RIDE, DIS-SOLVED (MG/L AS F) | HARD-NESS (MG/L AS CACO3) | SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L) |
|---|---|---|---|---|---|---|---|---|---|---|
| APR 20... | 1345 | 47 | 17 | 3.2 | 6.3 | 48 | 14 | .2 | 190 | 214 |

| DATE | SOLIDS, RESIDUE AT 105 DEG. C, SUS-PENDED (MG/L) | SOLIDS, RESIDUE AT 105 DEG. C, TOTAL (MG/L) | BARIUM, TOTAL RECOV-ERABLE (UG/L AS BA) | CADMIUM TOTAL RECOV-ERABLE (UG/L AS CD) | CHRO-MIUM, TOTAL RECOV-ERABLE (UG/L AS CR) | LEAD, TOTAL RECOV-ERABLE (UG/L AS PB) | MERCURY TOTAL RECOV-ERABLE (UG/L AS HG) | NICKEL, TOTAL RECOV-ERABLE (UG/L AS NI) | SELE-NIUM, TOTAL (UG/L AS SE) | SILVER, TOTAL RECOV-ERABLE (UG/L AS AG) |
|---|---|---|---|---|---|---|---|---|---|---|
| APR 20... | 68 | 282 | 100 | 4 | <10 | 4 | <.5 | 9 | 0 | 0 |

| DATE | ARSENIC TOTAL (UG/L AS AS) | METHY-LENE BLUE ACTIVE SUB-STANCE (MG/L) | BORON, TOTAL RECOV-ERABLE (UG/L AS B) | COBALT, TOTAL RECOV-ERABLE (UG/L AS CO) | COPPER, TOTAL RECOV-ERABLE (UG/L AS CU) | IRON, TOTAL RECOV-ERABLE (UG/L AS FE) | MANGA-NESE, TOTAL RECOV-ERABLE (UG/L AS MN) | MOLYB-DENUM, TOTAL RECOV-ERABLE (UG/L AS MO) | ZINC, TOTAL RECOV-ERABLE (UG/L AS ZN) |
|---|---|---|---|---|---|---|---|---|---|
| APR 20... | <10 | .05 | 40 | 0 | 4 | 360 | 80 | 8 | 10 |

Table 38.--Chemical, physical, and biological analyses of water samples from selected depths, Hargus Lake, Ohio

393735082530900 - HARGUS LK AB DAM AT SITE L-1 NR CIRCLEVILLE OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1977 TO SEPTEMBER 1978

| DATE | TIME | SAMPLING DEPTH (FT) | NITROGEN, NITRITE TOTAL (MG/L AS N) | NITROGEN, NITRATE TOTAL (MG/L AS N) | NITROGEN, NO2+NO3 TOTAL (MG/L AS N) | NITROGEN, AMMONIA TOTAL (MG/L AS N) | NITROGEN, ORGANIC TOTAL (MG/L AS N) | NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N) | PHOSPHORUS, ORTHO, TOTAL (MG/L AS P) |
|---|---|---|---|---|---|---|---|---|---|
| APR | | | | | | | | | |
| 20... | 1320 | 2.0 | .02 | 1.4 | 1.4 | .13 | .50 | .63 | .01 |
| 20... | 1400 | 40 | .02 | 1.5 | 1.5 | .31 | .55 | .86 | .01 |
| AUG | | | | | | | | | |
| 04... | 1305 | 2.0 | .03 | .89 | .92 | .03 | .64 | .67 | .00 |
| 04... | 1345 | 40 | .00 | .01 | .01 | 1.3 | .70 | 2.5 | .00 |

| DATE | PHOSPHORUS, TOTAL (MG/L AS P) | SILICA, DISSOLVED (MG/L AS SIO2) | TURBIDITY (JTU) | COLOR (PLATINUM-COBALT UNITS) | CARBON, ORGANIC TOTAL (MG/L AS C) | OXYGEN DEMAND, BIOCHEMICAL, 5 DAY (MG/L) | OXYGEN DEMAND, CHEMICAL (HIGH LEVEL) (MG/L) | COLIFORM, FECAL, 0.45 UM-MF (COLS./100 ML) | STREPTOCOCCI FECAL, (COLS. PER 100 ML) |
|---|---|---|---|---|---|---|---|---|---|
| APR | | | | | | | | | |
| 20... | .05 | 4.0 | 5 | 10 | 7.3 | .8 | 15 | 167 | 330 |
| 20... | .04 | 6.0 | 8 | 20 | 9.0 | .8 | 15 | 12 | 24 |
| AUG | | | | | | | | | |
| 04... | .01 | 2.8 | 2 | 20 | 5.6 | .9 | 16 | <4 | <4 |
| 04... | .07 | 7.5 | 2 | 80 | 17 | .8 | 20 | 12 | <4 |

Table 39.--Phytoplankton identified in Hargus Lake, Ohio (1978)

| Sample description | | | Total cells (per ml) | Diversity index (genus) $\bar{d}$ | Chlorophyll a (µg/L) | Division(s) present (in order of dominance) | Percent of total cell count | Dominant taxa within division and percent (%)* of total cell count |
|---|---|---|---|---|---|---|---|---|
| Location | Date | Location in water column | | | | | | |
| Site L-1 above dam | 4-20 | Euphotic zone composite | 8,400 | 2.3 | 8.7 | Chrysophyta | 55 | Ochromonas (36), Synedra (14), Cyclotella (5) |
| | | | | | | Chlorophyta | 43 | Chlamydomonas (26), Scenedesmus (15) Ankistrodesmus (1), Schroederia (1) |
| | | | | | | Euglenophyta | 2 | Trachelomonas (2) |
| Site L-1 | 8-04 | Euphotic zone composite | 3,300 | 2.1 | 4.6 | Cyanophyta | 71 | Raphidiopsis (38), Anacystis (33) |
| | | | | | | Chlorophyta | 21 | Chlamydomonas (19), Carteria (2) |
| | | | | | | Chrysophyta | 6 | Ochromonas (4), Cyclotella (1), Achnanthes (1) |
| | | | | | | Cryptophyta | 1 | Cryptomonas (1) |
| Site L-1 | 8-04 | 7-foot depth | 510 | 1.3 | -- | Cyanophyta | 78 | Raphidiopsis (78) |
| | | | | | | Chlorophyta | 14 | Scenedesmus (8), Sphaerocystis (2) Tetrastrum (2), Ankistrodesmus (1) |
| | | | | | | Chrysophyta | 8 | Synedra (6), Cyclotella (1), Navicula (1) |
| | | | | | | Euglenophyta | 1 | Trachelomonas (1) |

*Less than 1 percent not given.

Hargus Lake at L-1 had developed distinct thermal stratification by the August 4 sampling date. Temperature of the bottom water increased from 4.7°C to 6.9°C between the spring and summer sampling sites. Oxygen deficits were noted in the water column at the spring sampling; anaerobic conditions had developed in the hypolimnion below 20 feet by the summer sampling.

Similar thermal and chemical profiles were found at the secondary sampling site, L-2. Anaerobic conditions were found at L-2 below 15 feet in August.

The spring near-surface, total phosphorus concentration was 0.05 mg/L. The spring total-nitrogen to total-phosphorus ratio, 40 to 1, indicates phosphorus was limiting algal productivity in Hargus Lake.

Hargus Lake had Carlson TSIs of 43 for chlorophyll *a* (summer), 51 for Secchi-disk transparency (summer), and 61 for total phosphorus (spring). The lake was classified as eutrophic on the basis of the Secchi-disk and total-phosphorus TSIs.

The cadmium concentration exceeded Ohio water quality standards at the April 20 sampling.

Spring and summer algal counts were low compared to the other lakes sampled in 1978. Algal populations were dominated by unicellular green algae (Chlorophyta) in the spring and by blue-green algae (Cyanophyta) in the summer. Growths of aquatic macrophytes in the lake were not excessive.

Inflow data (fig. 20; table 40): Hargus Creek, the prncipal tributary to Hargus Lake, was sampled at site I-1. Drainage area at the site is 2.85 $mi^2$, which is 48 percent of the lake's drainage basin. A qualitative comparison of stream versus lake data is shown below:

| Inflow sampling site | Sampling date (1978) | Estimated discharge ($ft^3/s$) | Water body (stream or lake at 2-foot depth) having higher concentration | | | |
|---|---|---|---|---|---|---|
| | | | $NO_2$+ $NO_3$ | Total P | TOC | (Specific conductance) |
| Hargus Creek at Site I-1 | Apr 20 | 4.0 | Lake | Lake | Stream | Stream |
| | Aug 4 | 0.50 | Lake | Lake | Lake | Stream |

Table 40.--Physical and chemical data for selected inflow, Hargus Lake, Ohio

393813082523500 - HARGUS C AB HARGUS LK AT SITE I-1 OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1977 TO SEPTEMBER 1978

| DATE | TIME | STREAM-FLOW, INSTAN-TANEOUS (CFS) | TEMPER-ATURE (DEG C) | OXYGEN, DIS-SOLVED (MG/L) | PH (UNITS) | SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS) | TUR-BID-ITY (JTU) | COLOR (PLAT-INUM-COBALT UNITS) | CARBON, ORGANIC TOTAL (MG/L AS C) | NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N) | NITRO-GEN,AM-MONIA + ORGANIC TOTAL (MG/L AS N) | PHOS-PHORUS, TOTAL (MG/L AS P) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| APR | | | | | | | | | | | | |
| 20... | 1230 | E4.0 | 8.0 | 10.9 | 7.8 | 530 | 20 | 30 | 11 | 1.0 | .59 | .03 |
| AUG | | | | | | | | | | | | |
| 04... | 1230 | E.50 | 23.0 | 9.4 | 7.7 | 870 | 2 | 25 | 2.5 | .04 | .37 | .00 |

## Highlandtown Reservoir

Location: Columbiana County
(Wellsville 7.5-minute quadrangle map)

Type: Impoundment on Little Yellow Creek

Use: Recreation

Physical characteristics at summer pool level (table 6):

| Date of origin (year) | Surface area (acres) | Capacity (acre-feet) | Capacity-inflow ratio (C/I) |
|---|---|---|---|
| 1968 | 170 | 1,230 | 0.27 |

Drainage-basin characteristics:

| Drainage area ($mi^2$) | Type | Estimated sediment yield (from fig. 3) |
|---|---|---|
| 6.0 | Rural, agricultural | Moderately low |

Lake data (figs. 22, 23; tables 41-44): Highlandtown Lake was sampled in the rain on May 15 and under sunny skies on August 21. Secchi-disk transparency was 6 feet on both dates, comparatively high for Ohio lakes.

Profile and analytical data show the following characteristics:

| Date | Stratification (gradient) | | Chemical type | Trophic state index (Carlson) | | | Trophic class | Substances at or above State limits | | Phyto-plankton, dominant division(s) |
|---|---|---|---|---|---|---|---|---|---|---|
| | Thermal | Chemical | | Chl a | SD | T.P. | | Toxicants | Bacteria | |
| 5-15-78 | Slight | Slight | Very hard; Ca, $SO_4$ | -- | -- | 47 | Eutrophic | No | No | Chrysophyta |
| 8-21-78 | Yes | Yes | -- | 67 | 51 | -- | -- | No | No | Cyanophyta |

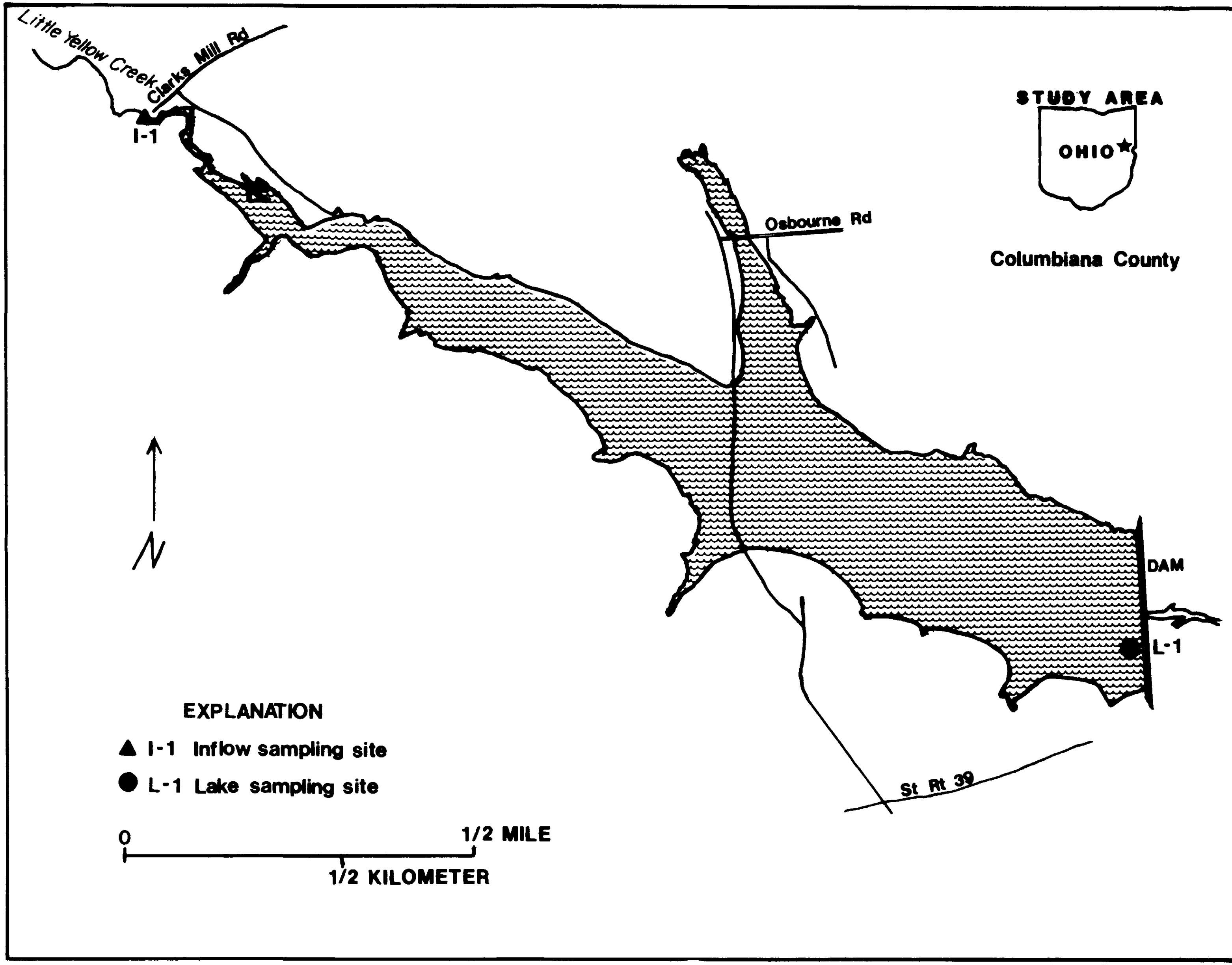



Figure 22.--Highlandtown Lake and infow sampling site.

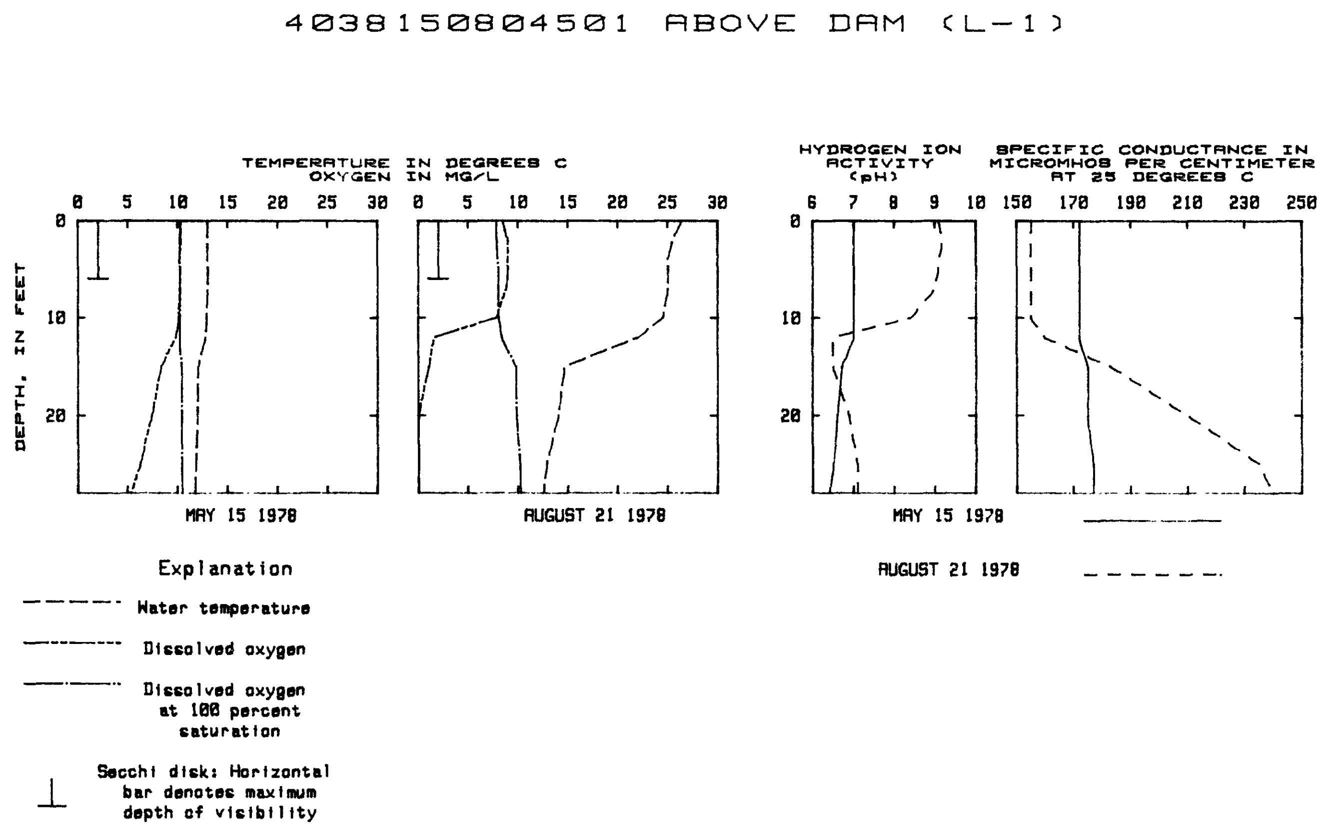



Figure 23.--Data profiles for Highlandtown Reservoir.

Table 41.--Profile data for the primary lake site, Highlandtown Reservoir, Ohio

403815080450100 - HIGHLANDTOWN RE AB DAM AT SITE L-1 OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1977 TO SEPTEMBER 1978

| DATE | TIME | SAMPLING DEPTH (FT) | TEMPERATURE (DEG C) | OXYGEN, DISSOLVED (MG/L) | OXYGEN, DISSOLVED (PERCENT SATURATION) | SPECIFIC CONDUCTANCE (MICROMHOS) | PH (UNITS) | CARBONATE (MG/L AS CO3) | BICARBONATE (MG/L AS HCO3) | CARBON DIOXIDE DISSOLVED (MG/L AS CO2) | HYDROGEN SULFIDE DISS. (MG/L AS H2S) | TRANSPARENCY (SECCHI DISK) (IN) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MAY | | | | | | | | | | | | |
| 15... | 1500 | .0 | 13.0 | 10.3 | 101 | 172 | 7.0 | -- | -- | -- | -- | -- |
| 15... | 1505 | 2.0 | 13.0 | 10.3 | 101 | 172 | 7.0 | 0 | 28 | 4.4 | .0 | 72 |
| 15... | 1510 | 4.0 | 13.0 | 10.2 | 100 | 172 | 7.0 | -- | -- | -- | -- | -- |
| 15... | 1515 | 7.0 | 13.0 | 10.2 | 100 | 172 | 7.0 | -- | -- | -- | -- | -- |
| 15... | 1520 | 10 | 12.9 | 10.1 | 99 | 172 | 7.0 | -- | -- | -- | -- | -- |
| 15... | 1525 | 15 | 12.0 | 8.3 | 80 | 175 | 6.7 | -- | -- | -- | -- | -- |
| 15... | 1530 | 20 | 12.0 | 7.4 | 71 | 175 | 6.6 | -- | -- | -- | -- | -- |
| 15... | 1533 | 25 | 11.8 | 6.2 | 59 | 177 | 6.5 | -- | -- | -- | -- | -- |
| 15... | 1535 | 28 | 11.7 | 5.3 | 51 | 177 | 6.4 | 0 | 28 | 18 | .1 | -- |
| AUG | | | | | | | | | | | | |
| 21... | 1400 | .0 | 26.4 | 8.5 | 110 | 155 | 9.1 | -- | -- | -- | -- | -- |
| 21... | 1405 | 2.0 | 25.5 | 9.0 | 110 | 155 | 9.2 | 7 | 22 | .0 | .0 | 72 |
| 21... | 1410 | 4.0 | 25.0 | 9.0 | 110 | 155 | 9.1 | -- | -- | -- | -- | -- |
| 21... | 1415 | 7.0 | 25.0 | 8.8 | 110 | 155 | 9.0 | -- | -- | -- | -- | -- |
| 21... | 1420 | 10 | 24.5 | 7.8 | 96 | 155 | 8.4 | -- | -- | -- | -- | -- |
| 21... | 1425 | 12 | 22.0 | 1.6 | 19 | 160 | 6.5 | -- | -- | -- | -- | -- |
| 21... | 1430 | 15 | 14.6 | 1.0 | 10 | 183 | 6.5 | -- | -- | -- | -- | -- |
| 21... | 1435 | 20 | 14.0 | .0 | 0 | 210 | 6.9 | -- | -- | -- | -- | -- |
| 21... | 1440 | 25 | 12.8 | .0 | 0 | 235 | 7.1 | -- | -- | -- | -- | -- |
| 21... | 1445 | 28 | 12.5 | .0 | 0 | 240 | 7.1 | 0 | 105 | 13 | .4 | -- |

Table 42.--Chemical analyses of water column composite samples, Highlandtown Reservoir, Ohio

403815080450100 - HIGHLANDTOWN RE AB DAM AT SITE L-1 OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1977 TO SEPTEMBER 1978

| DATE | TIME | CALCIUM DIS-SOLVED (MG/L AS CA) | MAGNE-SIUM, DIS-SOLVED (MG/L AS MG) | POTAS-SIUM, DIS-SOLVED (MG/L AS K) | SODIUM, DIS-SOLVED (MG/L AS NA) | SULFATE DIS-SOLVED (MG/L AS SO4) | CHLO-RIDE, DIS-SOLVED (MG/L AS CL) | FLUO-RIDE, DIS-SOLVED (MG/L AS F) | HARD-NESS (MG/L AS CACO3) | SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L) |
|---|---|---|---|---|---|---|---|---|---|---|
| MAY 15... | 1520 | 15 | 5.2 | 1.5 | 6.1 | 36 | 11 | .1 | 59 | 126 |

| DATE | SOLIDS, RESIDUE AT 105 DEG. C, SUS-PENDED (MG/L) | SOLIDS, RESIDUE AT 105 DEG. C, TOTAL (MG/L) | BARIUM, TOTAL RECOV-ERABLE (UG/L AS BA) | CADMIUM TOTAL RECOV-ERABLE (UG/L AS CD) | CHRO-MIUM, TOTAL RECOV-ERABLE (UG/L AS CR) | LEAD, TOTAL RECOV-ERABLE (UG/L AS PB) | MERCURY TOTAL RECOV-ERABLE (UG/L AS HG) | NICKEL, TOTAL RECOV-ERABLE (UG/L AS NI) | SELE-NIUM, TOTAL (UG/L AS SE) | SILVER, TOTAL RECOV-ERABLE (UG/L AS AG) |
|---|---|---|---|---|---|---|---|---|---|---|
| MAY 15... | 39 | 165 | 0 | 1 | <10 | 6 | <.5 | 9 | 0 | 0 |

| DATE | ARSENIC TOTAL (UG/L AS AS) | METHY-LENE BLUE ACTIVE SUB-STANCE (MG/L) | BORON, TOTAL RECOV-ERABLE (UG/L AS B) | COBALT, TOTAL RECOV-ERABLE (UG/L AS CO) | COPPER, TOTAL RECOV-ERABLE (UG/L AS CU) | IRON, TOTAL RECOV-ERABLE (UG/L AS FE) | MANGA-NESE, TOTAL RECOV-ERABLE (UG/L AS MN) | MOLYB-DENUM, TOTAL RECOV-ERABLE (UG/L AS MO) | ZINC, TOTAL RECOV-ERABLE (UG/L AS ZN) |
|---|---|---|---|---|---|---|---|---|---|
| MAY 15... | <10 | <.05 | 9 | 0 | 0 | 270 | 320 | 0 | 10 |

Table 43.--Chemical, physical, and biological analyses of water samples from selected depths, Highlandtown Reservoir, Ohio

403815080450100 - HIGHLANDTOWN RE AB DAM AT SITE L-1 OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1977 TO SEPTEMBER 1978

| DATE | TIME | SAMPLING DEPTH (FT) | NITROGEN, NITRITE TOTAL (MG/L AS N) | NITROGEN, NITRATE TOTAL (MG/L AS N) | NITROGEN, NO2+NO3 TOTAL (MG/L AS N) | NITROGEN, AMMONIA TOTAL (MG/L AS N) | NITROGEN, ORGANIC TOTAL (MG/L AS N) | NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N) | PHOSPHORUS, ORTHO. TOTAL (MG/L AS P) |
|---|---|---|---|---|---|---|---|---|---|
| MAY | | | | | | | | | |
| 15... | 1505 | 2.0 | .00 | .31 | .31 | .08 | .41 | .49 | .00 |
| 15... | 1535 | 28 | .01 | .28 | .29 | .10 | .35 | .45 | .00 |
| AUG | | | | | | | | | |
| 21... | 1405 | 2.0 | .00 | .00 | .00 | .02 | .47 | .49 | .00 |
| 21... | 1445 | 28 | .00 | .00 | .00 | 1.4 | .80 | 2.2 | .00 |

| DATE | PHOSPHORUS, TOTAL (MG/L AS P) | SILICA, DISSOLVED (MG/L AS SIO2) | TURBIDITY (JTU) | COLOR (PLATINUM-COBALT UNITS) | CARBON, ORGANIC TOTAL (MG/L AS C) | OXYGEN DEMAND, BIOCHEMICAL, 5 DAY (MG/L) | OXYGEN DEMAND, CHEMICAL (HIGH LEVEL) (MG/L) | COLIFORM, FECAL, 0.45 UM-MF (COLS./100 ML) | STREPTOCOCCI FECAL, (COLS. PER 100 ML) |
|---|---|---|---|---|---|---|---|---|---|
| MAY | | | | | | | | | |
| 15... | .02 | 3.1 | 3 | 5 | 8.5 | 1.3 | 15 | 24 | 42 |
| 15... | .02 | 4.4 | 2 | 15 | 8.1 | 7.0 | 15 | 18 | 48 |
| AUG | | | | | | | | | |
| 21... | .01 | 2.4 | 4 | -- | 6.3 | 2.4 | 13 | 2 | 2 |
| 21... | .04 | 8.1 | 10 | -- | 6.6 | 1.2 | 39 | 2 | 4 |

Table 44.--Phytoplankton identified in Highlandtown Reservoir, Ohio (1978)

| Sample description | | | Total cells (per ml) | Diversity index (genus) $\bar{d}$ | Chlorophyll a (µg/L) | Division(s) present (in order of dominance) | Percent of total cell count | Dominant taxa within division and percent (%)* of total cell count |
|---|---|---|---|---|---|---|---|---|
| Location | Date | Location in water column | | | | | | |
| Site L-1 above dam | 5-15 | Euphotic zone composite | 960 | 1.8 | 47 | Chrysophyta | 55 | Cyclotella (27), Asterionella (20), Dinobryon (8) |
| | | | | | | Chlorophyta | 20 | Kirchneriella (15), Scenedesmus (3) Carteria (2) |
| | | | | | | Cyanophyta | 17 | Anacystis (17) |
| | | | | | | Euglenophyta | 7 | Trachelomonas (7) |
| Site L-1 above dam | 8-21 | 4-foot depth | 41,000 | 1.2 | 42.5 | Cyanophyta | 95 | Anabaena (76), Aphanizomenon (18), Oscillatoria (1) |
| | | | | | | Chlorophyta | 5 | Sphaerocystis (2), Oocystis (1), Chlamydomonas (1), Gloeocystis, Scenedesmus, Kirchneriella, Ankistrodesmus |
| | | | | | | Chrysophyta | | Achnanthes |
| | | | | | | Cryptophyta | | Cryptomonas |
| | | | | | | Pyrrophyta | | Ceratium |
| Site L-1 above dam | 8-21 | Euphotic zone composite | 110,000 | 1.6 | 43.6 | Cyanophyta | 98 | Oscillatoria (64), Anabaena (20), Aphanizomenon (11), Anacystis (2) Agmenellum (1) |
| | | | | | | Chlorophyta | 2 | Gloeocystis (1), Chlamydomonas Kirchneriella, Cosmarium |
| | | | | | | Euglenophyta | 1 | Trachelomonas (1) Euglena |

*Less than 1 percent not given.

Highlandtown Lake at L-1 had developed distinct thermal stratification by the August 21 sampling. Temperature of the bottom water increased from 11.7°C to 12.5°C between the spring and summer sampling dates, which indicates minimal circulation in the interim. Oxygen deficits were noted in the water column at the spring sampling; anaerobic conditions had developed in the hypolimnion by the summer sampling.

The spring near-surface, total-phosphorus concentration was 0.02 mg/L. The spring total-nitrogen to total-phosphorus ratio, 40 to 1, indicates phosphorus may be limiting algal growth in Highlandtown Lake.

Highlandtown Lake had Carlson TSIs of 51 for chlorophyll a (summer), 67 for Secchi-disk transparency (summer), and 47 for total phosphorus (spring). Carlson TSIs in this range indicate eutrophic lakes.

No chemical-quality constituents on properties exceeded Ohio water-quality standards, although trace amounts of hydrogen sulfide were found in the hypolimnion in August.

Spring phytoplankton counts were low compared to other lakes sampled in 1978; yellow-brown algae (Chrysophyta) were dominant. Summer algal counts were high, and were dominated by filamentous blue-green algae (Cyanophyta). Growths of aquatic macrophytes were not excessive.

Inflow data (fig. 22; table 45): Little Yellow Creek, the principal tributary to Highlandtown Reservoir, was sampled at site I-1. Drainage area at the site is 2.87 $mi^2$, which is 50 percent of the lake drainage basin. A qualitative comparison of stream versus lake data is shown below.

| Inflow sampling site | Sampling date (1978) | Estimated discharge ($ft^3/s$) | Water body (stream or lake at 2-foot depth) having higher concentration | | | |
|---|---|---|---|---|---|---|
| | | | $NO_2+NO_3$ | Total P | TOC | (Specific conductance) |
| Yellow Creek at Site L-1 | May 15 | 12 | Equal | Stream | Stream | Stream |
| | Aug 21 | 1.0 | Stream | Stream | Stream | Stream |

Table 45.--Physical and chemical data for selected inflows, Highlandtown Reservoir, Ohio

403902080463300 - L YELLOW C AB HIGHLANDTOWN RE AT SITE I-1 OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1977 TO SEPTEMBER 1978

| DATE | TIME | STREAM-FLOW, INSTAN-TANEOUS (CFS) | TEMPER-ATURE (DEG C) | OXYGEN, DIS-SOLVED (MG/L) | PH (UNITS) | SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS) | TUR-BID-ITY (JTU) | COLOR (PLAT-INUM-COBALT UNITS) | CARBON, ORGANIC TOTAL (MG/L AS C) | NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N) | NITRO-GEN,AM-MONIA + ORGANIC TOTAL (MG/L AS N) | PHOS-PHORUS, TOTAL (MG/L AS P) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MAY | | | | | | | | | | | | |
| 15... | 1400 | E12 | 11.0 | 10.8 | 7.0 | 175 | 20 | 15 | 11 | .31 | .41 | .04 |
| AUG | | | | | | | | | | | | |
| 21... | 1315 | E1.0 | 22.5 | 7.6 | 6.9 | 395 | 5 | 10 | 6.6 | .01 | .49 | .02 |

## Jackson Lake

Location: Jackson County
(Oak Hill 7.5-minute quadrangle map)

Type: Impoundment on Black Fork Creek

Use: Recreation

Physical characteristics at summer pool level (table 6):

| Date of origin (year) | Surface area (acres) | Capacity (acre-feet) | Capacity-inflow ratio (C/I) |
|---|---|---|---|
| 1940 | 243 | 1,700 | 0.11 |

Drainage-basin characteristics:

| Drainage area ($mi^2$) | Type | Estimated sediment yield (from fig. 3) |
|---|---|---|
| 19 | Impoundment | Moderately low |

Lake data (figs. 24, 25; tables 46-49): Jackson Lake at L-1 exhibited a slight thermal and chemical gradient in the spring. At the summer sampling, the lake, although only 12 feet deep, had a surface-to-bottom temperature differential of 9°C. The chemical gradient was also steep; oxygen was near saturation at the surface and undetectable below 10 feet. Specific conductance at the bottom was twice that recorded at the surface (310 and versus 140 µmho/cm, respectively).

Profile and analytical data show the following lake characteristics:

| Date | Stratification (gradient) Thermal | Stratification (gradient) Chemical | Chemical type | Trophic state index (Carlson) Chl a | Trophic state index (Carlson) SD | Trophic state index (Carlson) T.P. | Trophic class | Substances at or above State limits Toxicants | Substances at or above State limits Bacteria | Phyto-plankton, dominant division(s) |
|---|---|---|---|---|---|---|---|---|---|---|
| 5-01-78 | Slight | Slight | Soft; Ca, Mg, $SO_4$ | -- | -- | 47 | Eutrophic | No | No | Chrysophyta |
| 8-18-78 | Yes | Yes | -- | 53 | 59 | -- | -- | No | No | Cyanophyta |

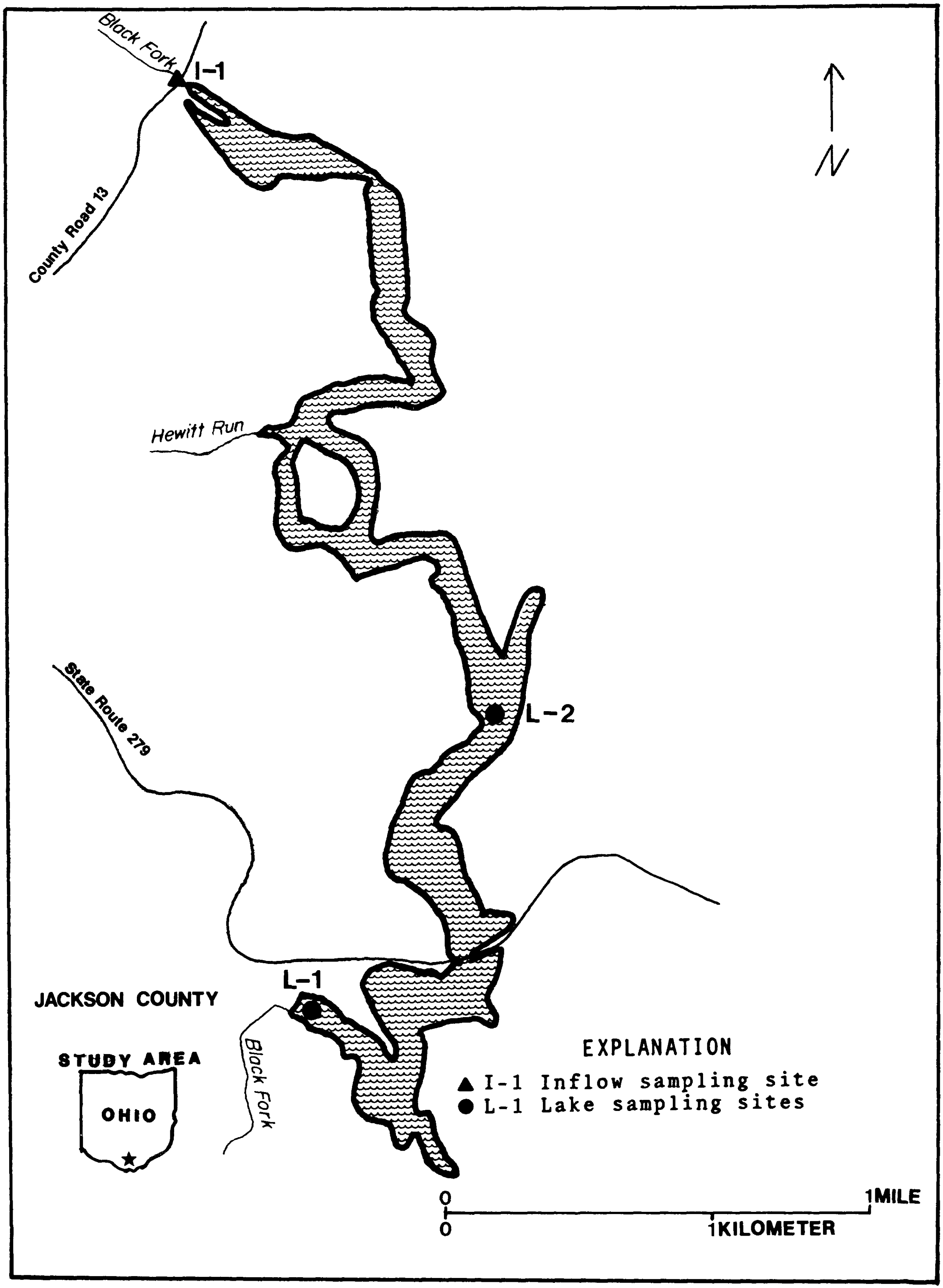



**Figure 24.--Jackson Lake and inflow sampling site.**

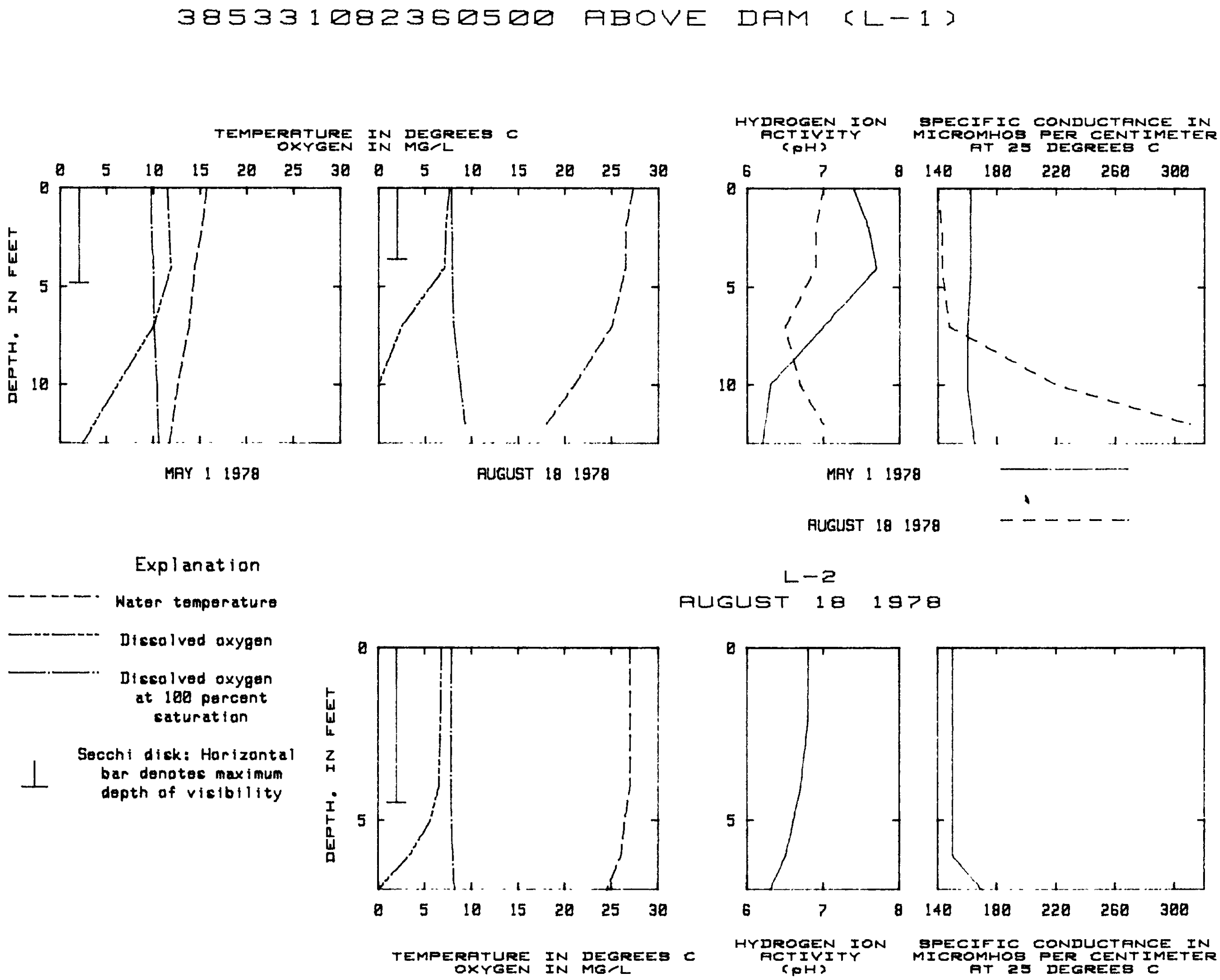



Figure 25.--Data profiles for Jackson Lake.

Table 46.--Profile data for the primary lake site, Jackson Lake, Ohio

385331082360500 - JACKSON LK AB DAM AT SITE L-1 NR OAK HILL OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1977 TO SEPTEMBER 1978

| DATE | TIME | SAMPLING DEPTH (FT) | TEMPERATURE (DEG C) | OXYGEN, DISSOLVED (MG/L) | OXYGEN, DISSOLVED (PERCENT SATURATION) | SPECIFIC CONDUCTANCE (MICROMHOS) | PH (UNITS) | CARBONATE (MG/L AS CO3) | BICARBONATE (MG/L AS HCO3) | CARBON DIOXIDE DISSOLVED (MG/L AS CO2) | HYDROGEN SULFIDE DISS. (MG/L AS H2S) | TRANSPARENCY (SECCHI DISK) (IN) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MAY | | | | | | | | | | | | |
| 01... | 1400 | .0 | 15.7 | 11.5 | 118 | 162 | 7.4 | -- | -- | -- | -- | -- |
| 01... | 1405 | 2.0 | 15.2 | 11.7 | 119 | 162 | 7.6 | 0 | 16 | .6 | .0 | 58 |
| 01... | 1410 | 4.0 | 14.4 | 11.9 | 119 | 162 | 7.7 | -- | -- | -- | -- | -- |
| 01... | 1420 | 7.0 | 13.8 | 10.0 | 99 | 160 | 7.0 | -- | -- | -- | -- | -- |
| 01... | 1425 | 10 | 12.6 | 6.2 | 60 | 160 | 6.3 | -- | -- | -- | -- | -- |
| 01... | 1430 | 12 | 11.7 | 2.4 | 23 | 165 | 6.2 | 0 | 22 | 22 | .0 | -- |
| AUG | | | | | | | | | | | | |
| 18... | 1200 | .0 | 27.3 | 7.6 | 97 | 140 | 7.0 | -- | -- | -- | -- | -- |
| 18... | 1205 | 2.0 | 26.5 | 7.2 | 91 | 143 | 6.9 | 0 | 24 | 4.8 | .0 | 43 |
| 18... | 1210 | 4.0 | 26.5 | 7.1 | 90 | 143 | 6.9 | -- | -- | -- | -- | -- |
| 18... | 1215 | 7.0 | 25.0 | 2.5 | 31 | 148 | 6.5 | -- | -- | -- | -- | -- |
| 18... | 1220 | 10 | 21.0 | .0 | 0 | 220 | 6.7 | -- | -- | -- | -- | -- |
| 18... | 1225 | 12 | 18.0 | .0 | 0 | 310 | 7.0 | 0 | 42 | 6.7 | .0 | -- |

Table 47.--Chemical analyses of water column composite samples, Jackson Lake, Ohio

385331082360500 - JACKSON LK AB DAM AT SITE L-1 NR OAK HILL OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1977 TO SEPTEMBER 1978

| DATE | TIME | CALCIUM DIS-SOLVED (MG/L AS CA) | MAGNE-SIUM, DIS-SOLVED (MG/L AS MG) | POTAS-SIUM, DIS-SOLVED (MG/L AS K) | SODIUM, DIS-SOLVED (MG/L AS NA) | SULFATE DIS-SOLVED (MG/L AS SO4) | CHLO-RIDE, DIS-SOLVED (MG/L AS CL) | FLUO-RIDE, DIS-SOLVED (MG/L AS F) | HARD-NESS (MG/L AS CACO3) | SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L) |
|---|---|---|---|---|---|---|---|---|---|---|
| MAY 01... | 1420 | 13 | 5.1 | 2.2 | 4.1 | 47 | 5.9 | .1 | 53 | 110 |
| AUG 18... | 1225 | -- | -- | -- | -- | -- | -- | -- | -- | -- |

| DATE | SOLIDS, RESIDUE AT 105 DEG. C, SUS-PENDED (MG/L) | SOLIDS, RESIDUE AT 105 DEG. C, TOTAL (MG/L) | BARIUM, TOTAL RECOV-ERABLE (UG/L AS BA) | CADMIUM TOTAL RECOV-ERABLE (UG/L AS CD) | CHRO-MIUM, TOTAL RECOV-ERABLE (UG/L AS CR) | LEAD, TOTAL RECOV-ERABLE (UG/L AS PB) | MERCURY TOTAL RECOV-ERABLE (UG/L AS HG) | NICKEL, TOTAL RECOV-ERABLE (UG/L AS NI) | SELE-NIUM, TOTAL (UG/L AS SE) | SILVER, TOTAL RECOV-ERABLE (UG/L AS AG) |
|---|---|---|---|---|---|---|---|---|---|---|
| MAY 01... | 18 | 128 | 0 | 2 | 20 | 8 | <.5 | 5 | 0 | 1 |
| AUG 18... | -- | -- | 200 | 0 | <10 | 2 | -- | -- | 0 | 0 |

| DATE | ARSENIC TOTAL (UG/L AS AS) | METHY-LENE BLUE ACTIVE SUB-STANCE (MG/L) | BORON, TOTAL RECOV-ERABLE (UG/L AS B) | COBALT, TOTAL RECOV-ERABLE (UG/L AS CO) | COPPER, TOTAL RECOV-ERABLE (UG/L AS CU) | IRON, TOTAL RECOV-ERABLE (UG/L AS FE) | MANGA-NESE, TOTAL RECOV-ERABLE (UG/L AS MN) | MOLYB-DENUM, TOTAL RECOV-ERABLE (UG/L AS MO) | ZINC, TOTAL RECOV-ERABLE (UG/L AS ZN) |
|---|---|---|---|---|---|---|---|---|---|
| MAY 01... | <10 | .05 | 30 | 0 | 4 | 520 | 950 | 0 | 10 |
| AUG 18... | -- | -- | -- | -- | -- | -- | -- | -- | -- |

Table 48.--Chemical, physical, and biological analyses of water samples from selected depths, Jackson Lake, Ohio

385331082360500 - JACKSON LK AB DAM AT SITE L-1 NR OAK HILL OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1977 TO SEPTEMBER 1978

| DATE | TIME | SAMP-LING DEPTH (FT) | NITRO-GEN, NITRITE TOTAL (MG/L AS N) | NITRO-GEN, NITRATE TOTAL (MG/L AS N) | NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N) | NITRO-GEN, AMMONIA TOTAL (MG/L AS N) | NITRO-GEN, ORGANIC TOTAL (MG/L AS N) | NITRO-GEN,AM-MONIA + ORGANIC TOTAL (MG/L AS N) | PHOS-PHORUS, ORTHO. TOTAL (MG/L AS P) |
|---|---|---|---|---|---|---|---|---|---|
| MAY | | | | | | | | | |
| 01... | 1405 | 2.0 | .00 | .05 | .05 | .11 | .30 | .41 | .00 |
| 01... | 1430 | 12 | .00 | .09 | .09 | .28 | .26 | .54 | .00 |
| AUG | | | | | | | | | |
| 18... | 1205 | 2.0 | .00 | .00 | .00 | .02 | .74 | .76 | .01 |
| 18... | 1225 | 12 | .00 | .01 | .01 | 1.6 | 1.5 | 3.1 | .02 |

| DATE | PHOS-PHORUS, TOTAL (MG/L AS P) | SILICA, DIS-SOLVED (MG/L AS SIO2) | TUR-BID-ITY (JTU) | COLOR (PLAT-INUM-COBALT UNITS) | CARBON, ORGANIC TOTAL (MG/L AS C) | OXYGEN DEMAND, BIO-CHEM-ICAL, 5 DAY (MG/L) | OXYGEN DEMAND, CHEM-ICAL (HIGH LEVEL) (MG/L) | COLI-FORM, FECAL, 0.45 UM-MF (COLS./ 100 ML) | STREP-TOCOCCI FECAL, (COLS. PER 100 ML) |
|---|---|---|---|---|---|---|---|---|---|
| MAY | | | | | | | | | |
| 01... | .02 | 3.0 | 2 | 10 | 6.7 | 2.1 | 10 | <2 | <2 |
| 01... | .02 | 4.5 | 5 | 20 | 9.2 | 1.4 | 15 | <2 | 10 |
| AUG | | | | | | | | | |
| 18... | .03 | 4.8 | 5 | 20 | 5.2 | 1.4 | 15 | 32 | 104 |
| 18... | .08 | 12 | 5 | 40 | 8.3 | 1.6 | 87 | 12 | 54 |

Table 49.--Phytoplankton identified in Jackson Lake, Ohio (1978)

| Sample description | | | Total cells (per ml) | Diversity index (genus) $\bar{d}$ | Chlorophyll a (µg/L) | Division(s) present (in order of dominance) | Percent of total cell count | Dominant taxa within division and percent (%)* of total cell count |
|---|---|---|---|---|---|---|---|---|
| Location | Date | Location in water column | | | | | | |
| Site L-1 above dam | 5-01 | Euphotic zone composite | 1,600 | 3.2 | 15.8 | Cyanophyta | 40 | Anacystis (33), Oscillatoria (7) |
| | | | | | | Chlorophyta | 33 | Chlamydomonas (15), Ankistrodesmus (8), Dictyosphaerium (6), Franceia (3), Staurastrum (1) |
| | | | | | | Euglenophyta | 17 | Chroomonas (9), Trachelomonas (5), Cryptomonas (3) |
| | | | | | | Chrysophyta | 10 | Synedra (4), Centritractus (3), Navicula (1), Dinobryon (1), Ophiocytium (1) |
| Site L-1 above dam | 8-18 | Near surface sample | 15,000 | 3.0 | -- | Cyanophyta | 69 | Anacystis (43), Agmenellum (19), Oscillatoria (4), Anabaena (3) |
| | | | | | | Chlorophyta | 22 | Oocystis (5), Tetrastrum (4), Ankistrodesmus (3), Dictyosphaerium (2), Crucigenia (2), Tetradesmus (2), Kirchneriella (2), Scenedesmus (1), Chlamydomonas (1) |
| | | | | | | Chrysophyta | 6 | Cyclotella (4), Dinobryon (1), Nitzschia, Ochromonas, Synedra |
| | | | | | | Euglenophyta | 3 | Trachelomonas (2), Euglena |
| Site L-1 above dam | 8-18 | Euphotic zone composite | 73,000 | 2.1 | -- | Cyanophyta | 97 | Oscillatoria (41), Gomphosphaeria (30), Anacystis (19), Agmenellum (3), Anabaena (3) |
| | | | | | | Chlorophyta | 3 | Sphaerocystis (1), Tetrastrum, Crucigenia, Kirchneriella, Ankistrodesmus, Chlamydomonas, Dictyosphaerium, Oocystis, Quadrigula, Scenedesmus, Cosmarium, Selenastrum |
| | | | | | | Chrysophyta | 1 | Cyclotella (1), Dinobryon, Ochromonas |
| | | | | | | Euglenophyta | | Trachelomonas, Phacus |

*Less than 1 percent not given.

Similar thermal and chemical profiles were found in the summer at the secondary sampling site, L-2. Anaerobic conditions were also found near the bottom at L-2.

The spring near-surface, total-phosphorus concentration was 0.02 mg/L. The spring total-nitrogen to total-phosphorus ratio, 23 to 1, indicates phosphorus may be limiting algal productivity. Jackson Lake had Carlson TSIs of 53 for chlorophyll a (summer), 59 for Secchi-disk transparency (summer), and 47 for total phosphorus (spring). Lakes that have TSIs in this range are considered eutrophic.

The concentration of cadmium (total) exceeded Ohio water-quality standards in the spring.

Blue-green algae (Cyanophyta) dominated the spring and summer algal collections. Aquatic macrophytes were profuse in the shallow inlets of the lake.

Inflow data (fig. 24; table 50): Black Fork, the principal tributary to Jackson Lake, was sampled at site I-1. Drainage area at the site is 9.8 $mi^2$, which is 51 percent of the lake's drainage basin. A qualitative comparison of stream versus lake data is shown below.

| Inflow sampling site | Sampling date (1978) | Estimated discharge ($ft^3/s$) | Water body (stream or lake at 2-foot depth) having higher concentration | | | |
|---|---|---|---|---|---|---|
| | | | $NO_2$+ $NO_3$ | Total P | TOC | (Specific conductance) |
| Black Fork | May 1 | 5.0 | Lake | Stream | Stream | Lake |
| at Site L-1 | Aug 18 | 5.0 | Stream | Stream | Stream | Stream |

Table 50.--Physical and chemical data for selected inflows, Jackson Lake, Ohio

385524082362500 - BLACK FORK AB JACKSON LK AT SITE I-1 OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1977 TO SEPTEMBER 1978

| DATE | TIME | STREAM-FLOW, INSTAN-TANEOUS (CFS) | TEMPER-ATURE (DEG C) | OXYGEN, DIS-SOLVED (MG/L) | PH (UNITS) | SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS) | TUR-BID-ITY (JTU) | COLOR (PLAT-INUM-COBALT UNITS) | CARBON, ORGANIC TOTAL (MG/L AS C) | NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N) | NITRO-GEN,AM-MONIA + ORGANIC TOTAL (MG/L AS N) | PHOS-PHORUS, TOTAL (MG/L AS P) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MAY | | | | | | | | | | | | |
| 01... | 1250 | E5.0 | 14.0 | 6.7 | 6.3 | 150 | 2 | 30 | 9.0 | .01 | .49 | .04 |
| AUG | | | | | | | | | | | | |
| 18... | 1030 | E5.0 | 22.0 | .9 | 6.2 | 280 | 5 | 25 | 16 | .00 | 1.3 | .07 |

## La Due Reservoir

Location: Geauga County
(Burton 7.5-minute quadrangle map)

Type: Impoundment on Bridge Creek

Use: Water supply

Physical characteristics at summer pool level (table 6):

| Date of origin (year) | Surface area (acres) | Capacity (acre-feet) | Capacity-inflow ratio (C/I) |
|---|---|---|---|
| 1960 | 1,500 | 14,000 | 0.64 |

Drainage-basin characteristics:

| Drainage area ($mi^2$) | Type | Estimated sediment yield (from fig. 3) |
|---|---|---|
| 35.1 | Agricultural | Moderate |

Lake data (figs. 26, 27; tables 51-54): La Due Reservoir at L-1 was thermally and chemically mixed on May 11. In the summer the surface-to-bottom temperature differential was only 3.3°C. Oxygen depletion was noted below 15 feet, and anaerobic conditions were found in the bottom water (22 feet).

Profile and analytical data show the following lake characteristics:

| Date | Stratification (gradient) | | Chemical type | Trophic state index (Carlson) | | | Trophic class | Substances at or above State limits | | Phyto-plankton, dominant division(s) |
|---|---|---|---|---|---|---|---|---|---|---|
| | Thermal | Chemical | | Chl a | SD | T.P. | | Toxicants | Bacteria | |
| 5-11-78 | No | No | Moderately hard; Ca, $HCO_3$, Cl | -- | -- | 61 | Eutrophic | No | No | Cyanophyta |
| 8-07-78 | Slight | Slight | -- | 54 | 51 | -- | -- | No | No | Cyanophyta |

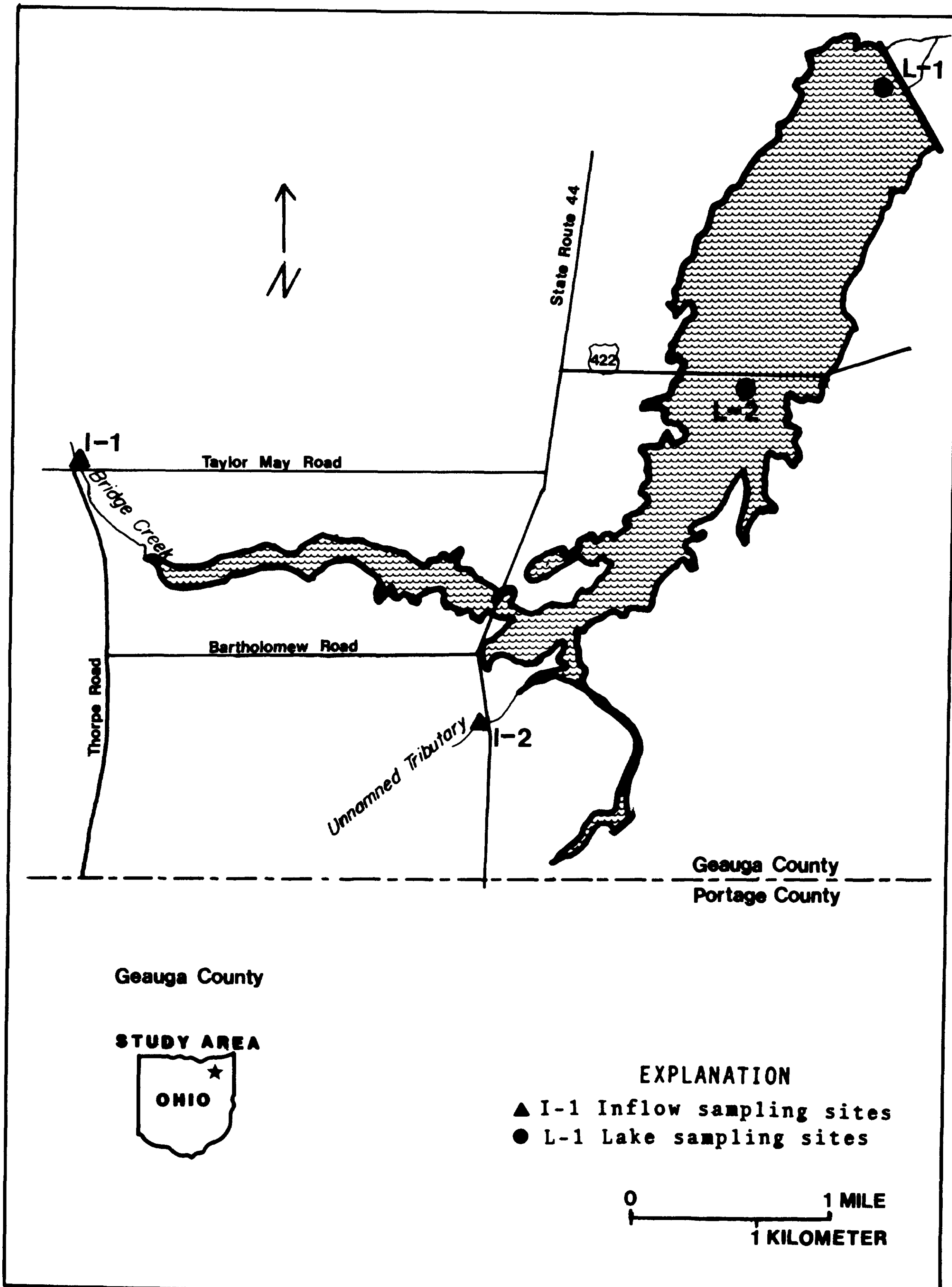



**Figure 26.--LaDue Reservoir and inflow sampling sites.**

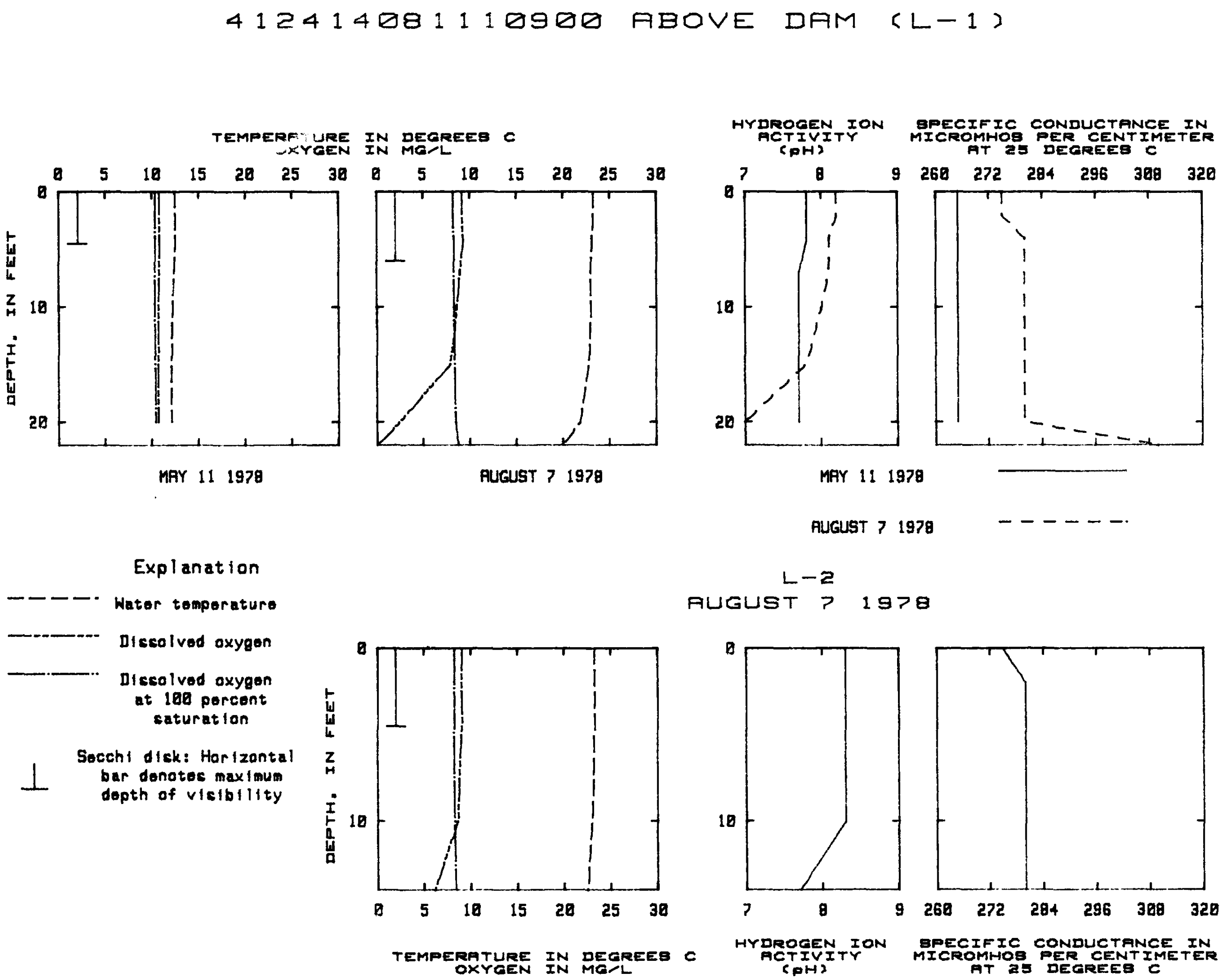



Figure 27.--Data profiles for La Due Reservoir.

Table 51.--Profile data for the primary lake site, La Due Reservoir, Ohio

412414081110900 - LA DUE RE AB DAM AT SITE L-1 NR BURTON OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1977 TO SEPTEMBER 1978

| DATE | TIME | SAMPLING DEPTH (FT) | TEMPERATURE (DEG C) | OXYGEN, DISSOLVED (MG/L) | OXYGEN, DISSOLVED (PERCENT SATURATION) | SPECIFIC CONDUCTANCE (MICROMHOS) | PH (UNITS) | CARBONATE (MG/L AS CO3) | BICARBONATE (MG/L AS HCO3) | CARBON DIOXIDE DISSOLVED (MG/L AS CO2) | HYDROGEN SULFIDE DISS. (MG/L AS H2S) | TRANSPARENCY (SECCHI DISK) (IN) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MAY | | | | | | | | | | | | |
| 11... | 1515 | .0 | 12.5 | 10.8 | 105 | 265 | 7.8 | -- | -- | -- | -- | -- |
| 11... | 1520 | 2.0 | 12.5 | 10.8 | 105 | 265 | 7.8 | 0 | 62 | 1.6 | .0 | 54 |
| 11... | 1525 | 4.0 | 12.5 | 10.8 | 105 | 265 | 7.8 | -- | -- | -- | -- | -- |
| 11... | 1530 | 7.0 | 12.4 | 10.8 | 105 | 265 | 7.7 | -- | -- | -- | -- | -- |
| 11... | 1535 | 10 | 12.2 | 10.7 | 104 | 265 | 7.7 | -- | -- | -- | -- | -- |
| 11... | 1540 | 15 | 12.1 | 10.7 | 103 | 265 | 7.7 | -- | -- | -- | -- | -- |
| 11... | 1545 | 20 | 12.1 | 10.7 | 103 | 265 | 7.7 | 0 | 62 | 2.0 | .1 | -- |
| AUG | | | | | | | | | | | | |
| 07... | 1645 | .0 | 23.3 | 9.2 | 110 | 275 | 8.2 | -- | -- | -- | -- | -- |
| 07... | 1650 | 2.0 | 23.2 | 9.2 | 110 | 275 | 8.2 | 0 | 80 | .8 | .0 | 72 |
| 07... | 1655 | 4.0 | 23.1 | 9.3 | 110 | 280 | 8.1 | -- | -- | -- | -- | -- |
| 07... | 1700 | 7.0 | 23.0 | 8.9 | 110 | 280 | 8.1 | -- | -- | -- | -- | -- |
| 07... | 1705 | 10 | 23.0 | 8.6 | 100 | 280 | 8.0 | -- | -- | -- | -- | -- |
| 07... | 1710 | 15 | 22.8 | 7.9 | 94 | 280 | 7.8 | -- | -- | -- | -- | -- |
| 07... | 1715 | 20 | 21.8 | 2.5 | 29 | 280 | 7.0 | 0 | 86 | 14 | .0 | -- |
| 07... | 1717 | 22 | 20.0 | .0 | 0 | 310 | 7.0 | -- | -- | -- | -- | -- |

Table 52.--Chemical analyses of water column composite samples, La Due Reservoir, Ohio

412414081110900 - LA DUE RE AB DAM AT SITE L-1 NR BURTON OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1977 TO SEPTEMBER 1978

| DATE | TIME | CALCIUM DIS-SOLVED (MG/L AS CA) | MAGNE-SIUM, DIS-SOLVED (MG/L AS MG) | POTAS-SIUM, DIS-SOLVED (MG/L AS K) | SODIUM, DIS-SOLVED (MG/L AS NA) | SULFATE DIS-SOLVED (MG/L AS SO4) | CHLO-RIDE, DIS-SOLVED (MG/L AS CL) | FLUO-RIDE, DIS-SOLVED (MG/L AS F) | HARD-NESS (MG/L AS CACO3) | SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L) |
|---|---|---|---|---|---|---|---|---|---|---|
| MAY 11... | 1535 | 27 | 5.5 | 1.9 | 14 | 32 | 26 | .1 | 90 | 183 |

| DATE | SOLIDS, RESIDUE AT 105 DEG. C, SUS-PENDED (MG/L) | SOLIDS, RESIDUE AT 105 DEG. C, TOTAL (MG/L) | BARIUM, TOTAL RECOV-ERABLE (UG/L AS BA) | CADMIUM TOTAL RECOV-ERABLE (UG/L AS CD) | CHRO-MIUM, TOTAL RECOV-ERABLE (UG/L AS CR) | LEAD, TOTAL RECOV-ERABLE (UG/L AS PB) | MERCURY TOTAL RECOV-ERABLE (UG/L AS HG) | NICKEL, TOTAL RECOV-ERABLE (UG/L AS NI) | SELE-NIUM, TOTAL (UG/L AS SE) | SILVER, TOTAL RECOV-ERABLE (UG/L AS AG) |
|---|---|---|---|---|---|---|---|---|---|---|
| MAY 11... | 8 | 191 | 0 | 0 | <10 | 9 | <.5 | 6 | 0 | 0 |

| DATE | ARSENIC TOTAL (UG/L AS AS) | METHY-LENE BLUE ACTIVE SUB-STANCE (MG/L) | BORON, TOTAL RECOV-ERABLE (UG/L AS B) | COBALT, TOTAL RECOV-ERABLE (UG/L AS CO) | COPPER, TOTAL RECOV-ERABLE (UG/L AS CU) | IRON, TOTAL RECOV-ERABLE (UG/L AS FE) | MANGA-NESE, TOTAL RECOV-ERABLE (UG/L AS MN) | MOLYB-DENUM, TOTAL RECOV-ERABLE (UG/L AS MO) | ZINC, TOTAL RECOV-ERABLE (UG/L AS ZN) |
|---|---|---|---|---|---|---|---|---|---|
| MAY 11... | <10 | .09 | 60 | 0 | 0 | 310 | 100 | 1 | 10 |

Table 53.--Chemical, physical, and biological analyses of water samples from selected depths, La Due Reservoir, Ohio

412414081110900 - LA DUE RE AB DAM AT SITE L-1 NR BURTON OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1977 TO SEPTEMBER 1978

| DATE | TIME | SAMPLING DEPTH (FT) | NITROGEN, NITRITE TOTAL (MG/L AS N) | NITROGEN, NITRATE TOTAL (MG/L AS N) | NITROGEN, NO2+NO3 TOTAL (MG/L AS N) | NITROGEN, AMMONIA TOTAL (MG/L AS N) | NITROGEN, ORGANIC TOTAL (MG/L AS N) | NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N) | PHOSPHORUS, ORTHO. TOTAL (MG/L AS P) |
|---|---|---|---|---|---|---|---|---|---|
| MAY | | | | | | | | | |
| 11... | 1520 | 2.0 | .01 | .41 | .42 | .09 | .39 | .48 | .00 |
| 11... | 1545 | 20 | .01 | .41 | .42 | .08 | .50 | .58 | .00 |
| AUG | | | | | | | | | |
| 07... | 1650 | 2.0 | .00 | .00 | .00 | .01 | .72 | .73 | .00 |
| 07... | 1715 | 20 | .01 | .00 | .01 | .17 | .60 | .77 | .00 |

| DATE | PHOSPHORUS, TOTAL (MG/L AS P) | SILICA, DISSOLVED (MG/L AS SIO2) | TURBIDITY (JTU) | COLOR (PLATINUM-COBALT UNITS) | CARBON, ORGANIC TOTAL (MG/L AS C) | OXYGEN DEMAND, BIOCHEMICAL, 5 DAY (MG/L) | OXYGEN DEMAND, CHEMICAL (HIGH LEVEL) (MG/L) | COLIFORM, FECAL, 0.45 UM-MF (COLS./100 ML) | STREPTOCOCCI FECAL, (COLS. PER 100 ML) |
|---|---|---|---|---|---|---|---|---|---|
| MAY | | | | | | | | | |
| 11... | .05 | .1 | 3 | 10 | 14 | 1.7 | 20 | <2 | 24 |
| 11... | .07 | .1 | 3 | 30 | 17 | 1.6 | 20 | <2 | 12 |
| AUG | | | | | | | | | |
| 07... | .02 | 1.2 | 2 | 20 | 5.9 | 1.2 | 34 | 2 | <2 |
| 07... | .02 | 1.3 | 1 | 50 | 6.2 | 1.3 | 36 | <2 | <2 |

Table 54.--Phytoplankton identified in LaDue Reservoir, Ohio (1978)

| Sample description | | | Total cells (per ml) | Diversity index (genus) $\bar{d}$ | Chlorophyll *a* (µg/L) | Division(s) present (in order of dominance) | Percent of total cell count | Dominant taxa within division and percent (%)* of total cell count |
|---|---|---|---|---|---|---|---|---|
| Location | Date | Location in water column | | | | | | |
| Site L-1 above dam | 5-11 | Euphotic zone composite | 5,700 | 2.3 | 8.8 | Chrysophyta | 84 | Asterionella (43), Melosira (28), Fragilaria (13), Ochromonas (1), Cyclotella |
| | | | | | | Chlorophyta | 9 | Scenedesmus (6), Chlamydomonas (2), Tetrastrum (1), Ankistrodesmus |
| | | | | | | Cryptophyta | 3 | Cryptomonas (3) |
| | | | | | | Euglenophyta | 1 | Trachelomonas (1) |
| | | | | | | Cyanophyta | 3 | Anacystis (3) |
| Site L-1 above dam | 8-07 | Euphotic zone composite | 13,000 | 0.3 | 11.3 | Cyanophyta | 99 | Anacystis (96), Anabaena (3), |
| | | | | | | Chlorophyta | 1 | Chlamydomonas (1) |
| | | | | | | Euglenophyta | 1 | Trachelomonas |
| Site L-1 Above dam | 8-07 | 4-foot depth | 9,600 | 0.7 | 12.5 | Cyanophyta | 100 | Anacystis (84), Anabaena (16), |
| | | | | | | Euglenophyta | | Trachelomonas |

*Less than 1 percent not given.

The thermal profile at L-2 was similar to that found at L-1. The hypolimnic oxygen level at L-2 was only slightly depressed in contrast to the anaerobic conditions that existed L-1. The spring near-surface, total-phosphorus concentration was 0.05 mg/L. The spring total-nitrogen to total-phosphorus ratio, 18 to 1, indicates phosphorus was limiting algal productivity in La Due Reservoir.

La Due Reservoir had Carlson TSIs of 54 for chlorophyll *a* (summer), 52 for Secchi-disk transparency (summer), and 61 for total phosphorus (spring). Carlson TSIs in this range correspond to eutrophic lakes.

No chemical constituents or properties exceeded Ohio water-quality standards.

Algal counts were low at both spring and summer samplings. Diatoms (Chrysophyta), principally *Asterionella* and *Melosira*, dominated the spring algal flora. Blue-green algae (Cyanophyta), predominantly *Anacystis*, dominated the summer algal community. An algal scum (*Anacystis*) was noted along the windward margin of the lake. Nuisance growths of aquatic macrophytes were not found.

Inflow data (fig. 26; table 55): Two inflows were sampled: Bridge Creek (site I-1), the principal tributary, which drains 13.9 $mi^2$, and an unnamed tributary (site I-2), draining 2.89 $mi^2$. Their combined areas account for 48 percent of the drainage basin of La Due Reservoir. A qualitative comparison of stream versus lake data is shown below.

| Inflow sampling site | Sampling date (1978) | Estimated discharge ($ft^3/s$) | Water body (stream or lake at 2-foot depth) having higher concentration | | | |
|---|---|---|---|---|---|---|
| | | | $NO_2+NO_3$ | Total P | TOC | (Specific conductance) |
| Bridge Creek | May 11 | 20 | Lake | Lake | Stream | Lake |
| | Aug 7 | 3.0 | Stream | Stream | Stream | Stream |
| Unnamed tributary | May 11 | 3.0 | Lake | Lake | Lake | Stream |
| | Aug 7 | 1.0 | Stream | Stream | Lake | Stream |

Table 55.--Physical and chemical data for selected inflows, La Due Reservoir, Ohio

412238081155100 - BRIDGE C AB LA DUE RE AT SITE I-1 OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1977 TO SEPTEMBER 1978

| DATE | TIME | STREAM-FLOW, INSTAN-TANEOUS (CFS) | TEMPER-ATURE (DEG C) | OXYGEN, DIS-SOLVED (MG/L) | PH (UNITS) | SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS) | TUR-BID-ITY (JTU) | COLOR (PLAT-INUM-COBALT UNITS) | CARBON, ORGANIC TOTAL (MG/L AS C) | NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N) | NITRO-GEN,AM-MONIA + ORGANIC TOTAL (MG/L AS N) | PHOS-PHORUS, TOTAL (MG/L AS P) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MAY | | | | | | | | | | | | |
| 11... | 1410 | E20 | 16.0 | 11.8 | 7.6 | 260 | 2 | 40 | 15 | .24 | .47 | .04 |
| AUG | | | | | | | | | | | | |
| 07... | 1515 | E3.0 | 20.5 | 10.1 | 7.6 | 505 | 2 | 45 | 7.3 | .81 | .35 | .04 |

412130081132500 - UNNAMED TRI AB LA DUE RE AT SITE I-2 OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1977 TO SEPTEMBER 1978

| DATE | TIME | STREAM-FLOW, INSTAN-TANEOUS (CFS) | TEMPER-ATURE (DEG C) | OXYGEN, DIS-SOLVED (MG/L) | PH (UNITS) | SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS) | TUR-BID-ITY (JTU) | COLOR (PLAT-INUM-COBALT UNITS) | CARBON, ORGANIC TOTAL (MG/L AS C) | NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N) | NITRO-GEN,AM-MONIA + ORGANIC TOTAL (MG/L AS N) | PHOS-PHORUS, TOTAL (MG/L AS P) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MAY | | | | | | | | | | | | |
| 11... | 1345 | E3.0 | 19.0 | 12.0 | 7.8 | 270 | 2 | 30 | 13 | .16 | .48 | .03 |
| AUG | | | | | | | | | | | | |
| 07... | 1500 | E1.0 | 19.0 | 9.4 | 7.5 | 530 | 3 | 30 | 4.1 | .28 | .18 | .04 |

## Lake Hope

Location: Vinton County
(Mineral 7.5-minute quadrangle map)

Type: Impoundment on Sandy Run

Use: Recreation

Physical characteristics at summer pool level (table 6):

| Date of origin (year) | Surface area (acres) | Capacity (acre-feet) | Capacity-inflow ratio (C/I) |
|---|---|---|---|
| 1939 | 126 | 1,555 | 0.20 |

Drainage-basin characteristics:

| Drainage area ($mi^2$) | Type | Estimated sediment yield (from fig. 3) |
|---|---|---|
| 9.9 | Forest | Moderately low |

Lake data are presented in figures 28 and 29 and in tables 56-59. Profile and analytical data show the following lake characteristics:

| Date | Stratification (gradient) | | Chemical type | Trophic state index (Carlson) | | | Trophic class | Substances at or above State limits | | Phyto-plankton, dominant division(s) |
|---|---|---|---|---|---|---|---|---|---|---|
| | Thermal | Chemical | | Chl *a* | SD | T.P. | | Toxicants | Bacteria | |
| 4-27-78 | No | Slight | Soft; Ca, Mg, $SO_4$ | -- | -- | -- | Meso-trophic | Cd, Zn | No | Pyrrophyta |
| 8-01-78 | Yes | Yes | -- | 43 | 51 | -- | -- | Cd, Pb | No | Chlorophyta |

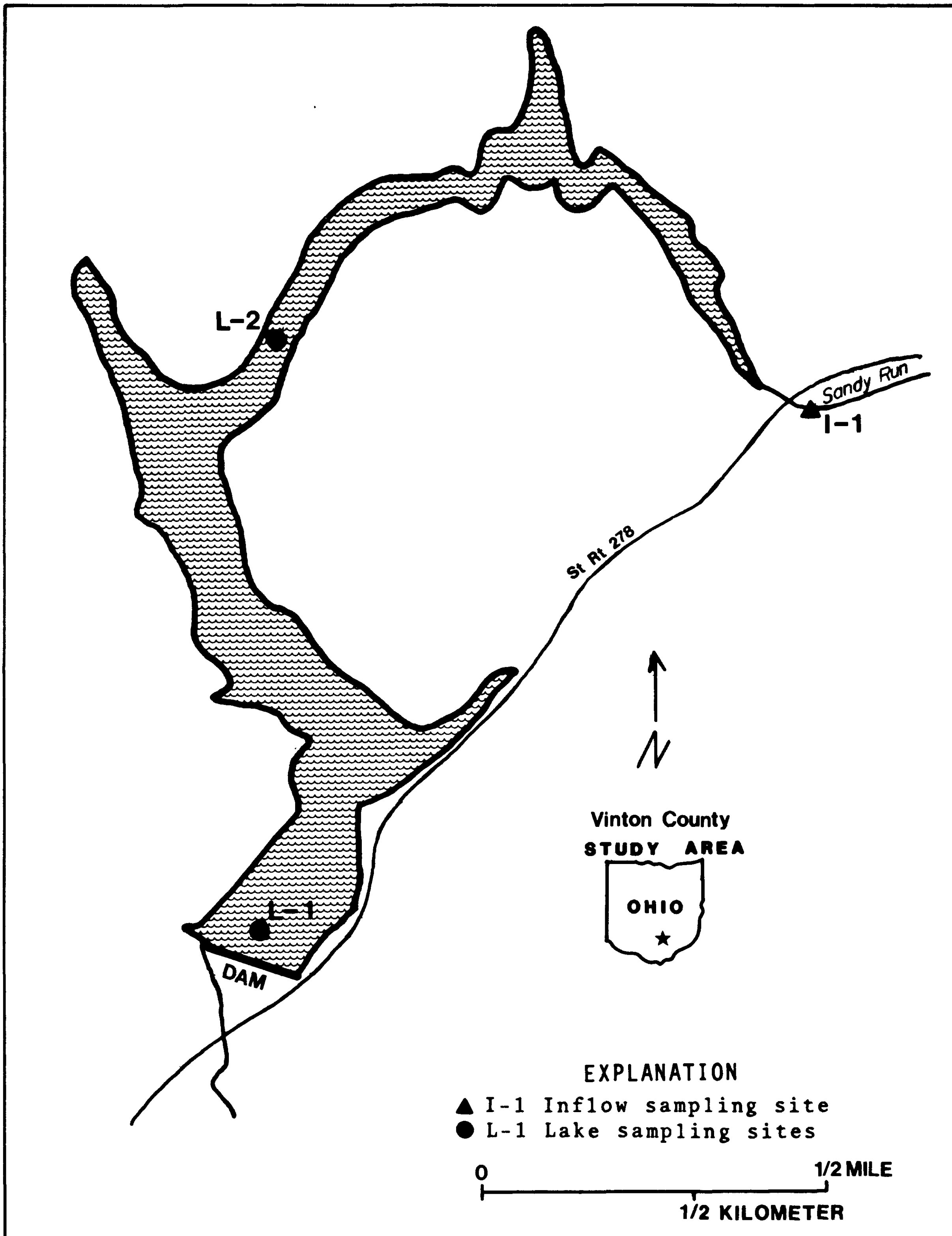



**Figure 28.--Lake Hope and inflow sampling site.**

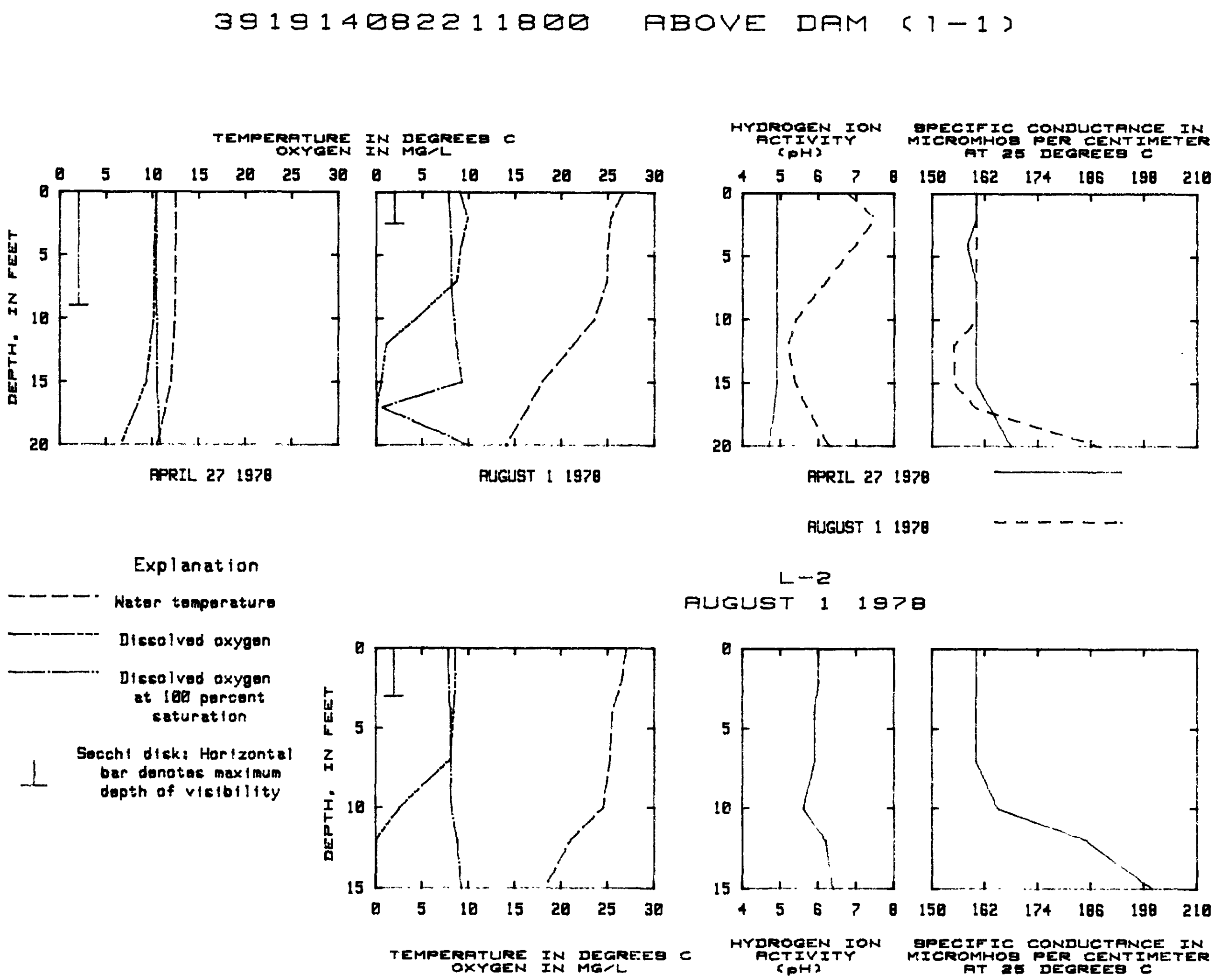



Figure 29.--Data profiles for Lake Hope.

Table 56.--Profile data for the primary lake site, Lake Hope, Ohio

391914082211800 - LAKE HOPE AB DAM NR ZALESKI OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1977 TO SEPTEMBER 1978

| DATE | TIME | SAMPLING DEPTH (FT) | TEMPERATURE (DEG C) | OXYGEN, DISSOLVED (MG/L) | OXYGEN, DISSOLVED (PERCENT SATURATION) | SPECIFIC CONDUCTANCE (MICROMHOS) | PH (UNITS) | CARBONATE (MG/L AS CO3) | BICARBONATE (MG/L AS HCO3) | CARBON DIOXIDE DISSOLVED (MG/L AS CO2) | HYDROGEN SULFIDE DISS. (MG/L AS H2S) | TRANSPARENCY (SECCHI DISK) (IN) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| APR | | | | | | | | | | | | |
| 27... | 1330 | .0 | 12.5 | 10.4 | 100 | 160 | 4.9 | -- | -- | -- | -- | -- |
| 27... | 1335 | 2.0 | 12.5 | 10.3 | 99 | 160 | 4.9 | 0 | <1 | -- | .0 | 108 |
| 27... | 1340 | 4.0 | 12.5 | 10.2 | 98 | 158 | 4.9 | -- | -- | -- | -- | -- |
| 27... | 1345 | 7.0 | 12.5 | 10.2 | 98 | 160 | 4.9 | -- | -- | -- | -- | -- |
| 27... | 1350 | 10 | 12.4 | 10.1 | 97 | 160 | 4.9 | -- | -- | -- | -- | -- |
| 27... | 1355 | 15 | 12.0 | 9.3 | 88 | 160 | 4.9 | -- | -- | -- | -- | -- |
| 27... | 1400 | 20 | 10.5 | 6.6 | 60 | 168 | 4.7 | 0 | <1 | -- | .0 | -- |
| AUG | | | | | | | | | | | | |
| 01... | 1300 | .0 | 26.6 | 9.1 | 120 | 160 | 6.8 | -- | -- | -- | -- | -- |
| 01... | 1305 | 2.0 | 25.3 | 9.9 | 120 | 160 | 7.5 | 0 | 3 | .2 | .0 | 30 |
| 01... | 1310 | 4.0 | 25.0 | 9.2 | 110 | 160 | 7.0 | -- | -- | -- | -- | -- |
| 01... | 1315 | 7.0 | 24.9 | 8.7 | 110 | 160 | 6.2 | -- | -- | -- | -- | -- |
| 01... | 1320 | 10 | 23.5 | 4.3 | 51 | 160 | 5.4 | -- | -- | -- | -- | -- |
| 01... | 1322 | 12 | 21.3 | 1.1 | 13 | 155 | 5.2 | -- | -- | -- | -- | -- |
| 01... | 1325 | 15 | 17.9 | .5 | 5 | 155 | 5.4 | -- | -- | -- | -- | -- |
| 01... | 1327 | 17 | 16.3 | .0 | 0 | 160 | 5.7 | -- | -- | -- | -- | -- |
| 01... | 1330 | 20 | 14.0 | .0 | 0 | 188 | 6.3 | 0 | 52 | 41 | 1.8 | -- |

Table 57.--Chemical analyses of water column composite samples, Lake Hope, Ohio

391914082211800 - LAKE HOPE AB DAM NR ZALESKI OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1977 TO SEPTEMBER 1978

| DATE | TIME | CALCIUM DIS-SOLVED (MG/L AS CA) | MAGNE-SIUM, DIS-SOLVED (MG/L AS MG) | POTAS-SIUM, DIS-SOLVED (MG/L AS K) | SODIUM, DIS-SOLVED (MG/L AS NA) | SULFATE DIS-SOLVED (MG/L AS SO4) | CHLO-RIDE, DIS-SOLVED (MG/L AS CL) | FLUO-RIDE, DIS-SOLVED (MG/L AS F) | HARD-NESS (MG/L AS CACO3) | SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L) |
|---|---|---|---|---|---|---|---|---|---|---|
| APR 27... | 1350 | 12 | 5.2 | 1.6 | 4.8 | 54 | 7.5 | .1 | 51 | 99 |
| AUG 01... | 1330 | -- | -- | -- | -- | -- | -- | -- | -- | -- |

| DATE | SOLIDS, RESIDUE AT 105 DEG. C, SUS-PENDED (MG/L) | SOLIDS, RESIDUE AT 105 DEG. C, TOTAL (MG/L) | BARIUM, TOTAL RECOV-ERABLE (UG/L AS BA) | CADMIUM TOTAL RECOV-ERABLE (UG/L AS CD) | CHRO-MIUM, TOTAL RECOV-ERABLE (UG/L AS CR) | LEAD, TOTAL RECOV-ERABLE (UG/L AS PB) | MERCURY TOTAL RECOV-ERABLE (UG/L AS HG) | NICKEL, TOTAL RECOV-ERABLE (UG/L AS NI) | SELE-NIUM, TOTAL (UG/L AS SE) | SILVER, TOTAL RECOV-ERABLE (UG/L AS AG) |
|---|---|---|---|---|---|---|---|---|---|---|
| APR 27... | 31 | 130 | 0 | 2 | 10 | 17 | <.5 | 13 | 0 | 0 |
| AUG 01... | -- | -- | 0 | 2 | 10 | 39 | -- | -- | 0 | 0 |

| DATE | ARSENIC TOTAL (UG/L AS AS) | METHY-LENE BLUE ACTIVE SUB-STANCE (MG/L) | BORON, TOTAL RECOV-ERABLE (UG/L AS B) | COBALT, TOTAL RECOV-ERABLE (UG/L AS CO) | COPPER, TOTAL RECOV-ERABLE (UG/L AS CU) | IRON, TOTAL RECOV-ERABLE (UG/L AS FE) | MANGA-NESE, TOTAL RECOV-ERABLE (UG/L AS MN) | MOLYB-DENUM, TOTAL RECOV-ERABLE (UG/L AS MO) | ZINC, TOTAL RECOV-ERABLE (UG/L AS ZN) |
|---|---|---|---|---|---|---|---|---|---|
| APR 27... | <10 | <.05 | 30 | 7 | 4 | 210 | 480 | 1 | 30 |
| AUG 01... | -- | -- | -- | -- | -- | -- | -- | -- | -- |

Table 58.--Chemical, physical, and biological analyses of water samples from selected depths, Lake Hope, Ohio

391914082211800 - LAKE HOPE AB DAM NR ZALESKI OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1977 TO SEPTEMBER 1978

| DATE | TIME | SAMPLING DEPTH (FT) | NITROGEN, NITRITE TOTAL (MG/L AS N) | NITROGEN, NITRATE TOTAL (MG/L AS N) | NITROGEN, NO2+NO3 TOTAL (MG/L AS N) | NITROGEN, AMMONIA TOTAL (MG/L AS N) | NITROGEN, ORGANIC TOTAL (MG/L AS N) | NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N) | PHOSPHORUS, ORTHO. TOTAL (MG/L AS P) |
|---|---|---|---|---|---|---|---|---|---|
| APR | | | | | | | | | |
| 27... | 1335 | 2.0 | .00 | .28 | .28 | .08 | .11 | .19 | .00 |
| 27... | 1400 | 20 | .00 | .20 | .20 | .24 | .04 | .28 | .00 |
| AUG | | | | | | | | | |
| 01... | 1305 | 2.0 | .00 | .01 | .01 | .00 | .50 | .50 | .00 |
| 01... | 1330 | 20 | .00 | .00 | .00 | .98 | .22 | 1.2 | .00 |

| DATE | PHOSPHORUS, TOTAL (MG/L AS P) | SILICA, DISSOLVED (MG/L AS SIO2) | TURBIDITY (JTU) | COLOR (PLATINUM-COBALT UNITS) | CARBON, ORGANIC TOTAL (MG/L AS C) | OXYGEN DEMAND, BIOCHEMICAL, 5 DAY (MG/L) | OXYGEN DEMAND, CHEMICAL (HIGH LEVEL) (MG/L) | COLIFORM, FECAL, 0.45 UM-MF (COLS./100 ML) | STREPTOCOCCI FECAL, (COLS. PER 100 ML) |
|---|---|---|---|---|---|---|---|---|---|
| APR | | | | | | | | | |
| 27... | .00 | 8.8 | 1 | 5 | 4.8 | .5 | 8 | <2 | <2 |
| 27... | .00 | 9.1 | 2 | 20 | 6.9 | .4 | 8 | <2 | 2 |
| AUG | | | | | | | | | |
| 01... | .01 | 7.3 | 6 | 10 | 6.2 | 1.8 | 25 | 12 | 88 |
| 01... | .01 | 10 | 45 | 150 | 10 | .8 | 31 | 76 | 76 |

Table 59.--Phytoplankton identified in Lake Hope, Ohio (1978)

| Sample description: Location | Date | Location in water column | Total cells (per ml) | Diversity index (genus) $\bar{d}$ | Chlorophyll a (µg/L) | Divisions(s) present in (order of dominance) | Percent of total cell count | Dominant taxa within division and percent (%)* of total cell count |
|---|---|---|---|---|---|---|---|---|
| Site L-1 above dam | 4-27 | Euphotic zone composite | 660 | -- | 2.0 | Pyrrhophyta | 67 | Dinophyceae (67) |
| | | | | | | Chlorophyta | 33 | Chlamydomonadaceae (30), *Ankistrodesmus* (3) |
| Site L-1 above dam | 8-01 | Euphotic zone composite | 140,000 | 0.8 | 27.9 | Chlorophyta | 100 | *Cosmarium* (75), *Arthrodesmus* (25) |
| | | | | | | Pyrrophyta | | *Peridinium* |
| Site L-1 Above dam | 8-01 | 7-foot depth | 32,000 | 0.9 | -- | Chlorophyta | 100 | *Cosmarium* (67), *Arthrodesmus* (33) |

*Less than 1 percent not given.

Although it is only 20 feet deep, Lake Hope at L-1 had developed thermal and chemical stratification by the August 1 sampling. The bottom temperature was 14°C, comparatively high for a stratified lake; Dow Lake, Forked Run Lake, and Hargus Lake had respective bottom temperatures of 9.5°C, 7.2°C, and 6.9°C at the summer sampling. There were oxygen deficits at L-1 in April and anaerobic conditions below 17 feet in August.

Similar thermal and chemical profiles were found at the secondary sampling site, L-2. Anaerobic conditions were found at L-2 below 12 feet in August.

The spring near-surface, total-phosphorus concentration was below detectibility, which indicates that phosphorus was limiting algal productivity in Lake Hope.

Lake Hope had Carlson TSIs of 43 for chlorophyll a and 51 for Secchi-disk transparency. The lake was classified as mesotrophic on the basis of the chlorophyll-a index and the low spring total-phosphorus concentration.

The cadmium and zinc concentrations exceeded Ohio water-quality standards in the spring; cadmium and lead exceeded Ohio water-quality standards in the summer. Hydrogen sulfide was found in the hypolimnion in the summer.

Spring phytoplankton counts were low (660 cells/m) and dominated by dinoflagellates (Pyrrhophyta). The summer sample was collected during an algal bloom, thus, the count was much higher (140,000 cells/m); green algae (Chlorophyta) dominated the algal community. Growths of aquatic macrophytes were not excessive.

Results of the 1978 samplings were generally comparable to those of 1975. Thermal and chemical stratification developed each year. BOD and pH were higher in 1978, possibly reflecting higher biological productivity in 1978. Silica concentrations were high in both years. Lead concentrations increased from 2 µg/L (1975) to 17 µg/L (1978) in the spring and from 9 µg/L (1975) to 39 µg/L (1978) in the summer. Cadmium, below detectable limits in 1975, increased to 2 µg/L in 1978.

Algal counts were much higher in the summer of 1978. Chlorophyta dominated the spring and summer algal community in 1975. In 1978, Pyrrhophyta dominated the spring algal community and Chlorophyta dominated the summer algal community. Chrysophyta were collected in 1975, but were not found in 1978.

Inflow data (fig. 28; table 60): Sandy Run, the principal tributary to Lake Hope, was sampled at site I-1. Drainage area at the site is 5.3 $mi^2$ which is 53 percent of the lake drainage basin. A qualitative comparison of stream versus lake data is shown below.

| Inflow sampling site | Sampling date (1978) | Estimated discharge ($ft^3/s$) | Water body (stream or lake at 2-foot depth) having higher concentration | | | |
|---|---|---|---|---|---|---|
| | | | $NO_2+NO_3$ | Total P | TOC | (Specific conductance) |
| Sandy Run at site L-1 | Apr 27 | <5.0 | Lake | Equal | Lake | Stream |
| | Aug 1 | 0.50 | Stream | Lake | Lake | Stream |

Table 60.--Physical and chemical data for selected inflows, Lake Hope, Ohio

391952082202500 - SANDY RUN C AB LK HOPE NR ZALESKI OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1977 TO SEPTEMBER 1978

| DATE | TIME | STREAM-FLOW, INSTAN-TANEOUS (CFS) | TEMPER-ATURE (DEG C) | OXYGEN, DIS-SOLVED (MG/L) | PH (UNITS) | SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS) | TUR-BID-ITY (JTU) | COLOR (PLAT-INUM-COBALT UNITS) | CARBON, ORGANIC TOTAL (MG/L AS C) | NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N) | NITRO-GEN,AM-MONIA + ORGANIC TOTAL (MG/L AS N) | PHOS-PHORUS, TOTAL (MG/L AS P) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| APR | | | | | | | | | | | | |
| 27... | 1215 | <5.0 | 11.5 | 10.6 | 4.5 | 225 | 4 | 40 | 4.0 | .10 | .23 | .00 |
| AUG | | | | | | | | | | | | |
| 01... | 1115 | E.50 | 19.0 | 8.3 | 4.1 | 670 | 1 | 30 | 3.4 | .16 | .18 | .00 |

## Nettle Lake

Location: Williams County
(Nettle Lake 7.5-minute quadrangle map)

Type: Natural lake; Nettle Creek flows into and out of the lake.

Use: Recreation

Physical characteristics at summer pool level (table 6):

| Date of origin (year) | Surface area (acres) | Capacity (acre-feet) | Capacity-inflow ratio (C/I) |
|---|---|---|---|
| ---- | 94 | 752 | 0.10 |

Drainage basin characteristics:

| Drainage area ($mi^2$) | Type | Estimated sediment yield (from fig. 3) |
|---|---|---|
| 20.2 | Agricultural | Low |

Lake data are presented in figures 30 and 31 and in tables 61-64. Profile and analytical data show the following lake characteristics:

| Date | Stratification (gradient) | | Chemical type | Trophic state index (Carlson) | | | Trophic class | Substances at or above State limits | | Phyto-plankton, dominant division(s) |
|---|---|---|---|---|---|---|---|---|---|---|
| | Thermal | Chemical | | Chl a | SD | T.P. | | Toxicants | Bacteria | |
| 5-22-78 | Yes | Yes | Very hard; Ca, $HCO_3$ | -- | -- | 57 | Eutrophic | No | No | Chrysophyta, Chlorophyta |
| 8-14-78 | Yes | Yes | -- | 60 | 58 | -- | -- | No | No | Cyanophyta |

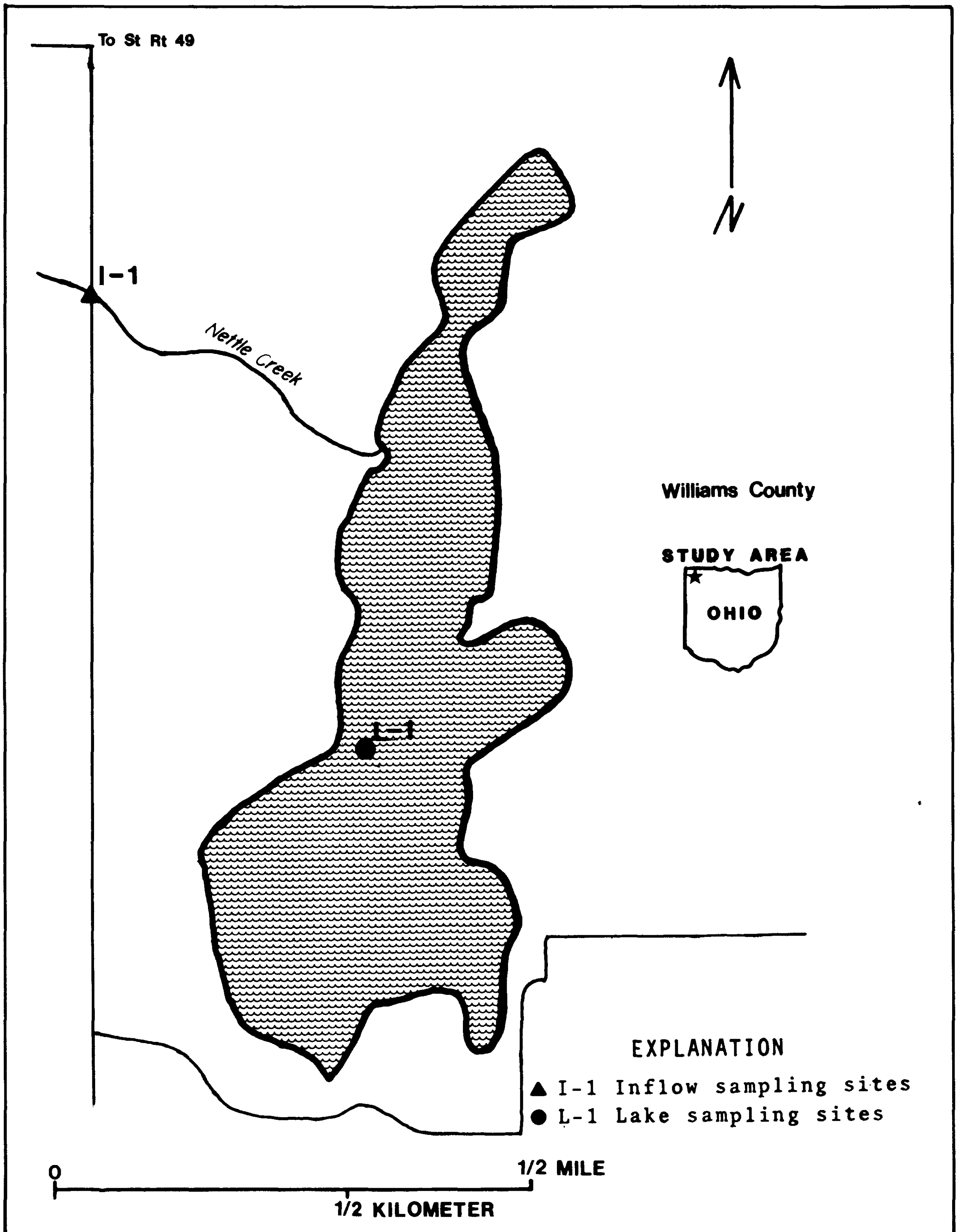



Figure 30.--Nettle Lake and inflow sampling site.

414055084433700 NEAR MIDPOINT (L-1)

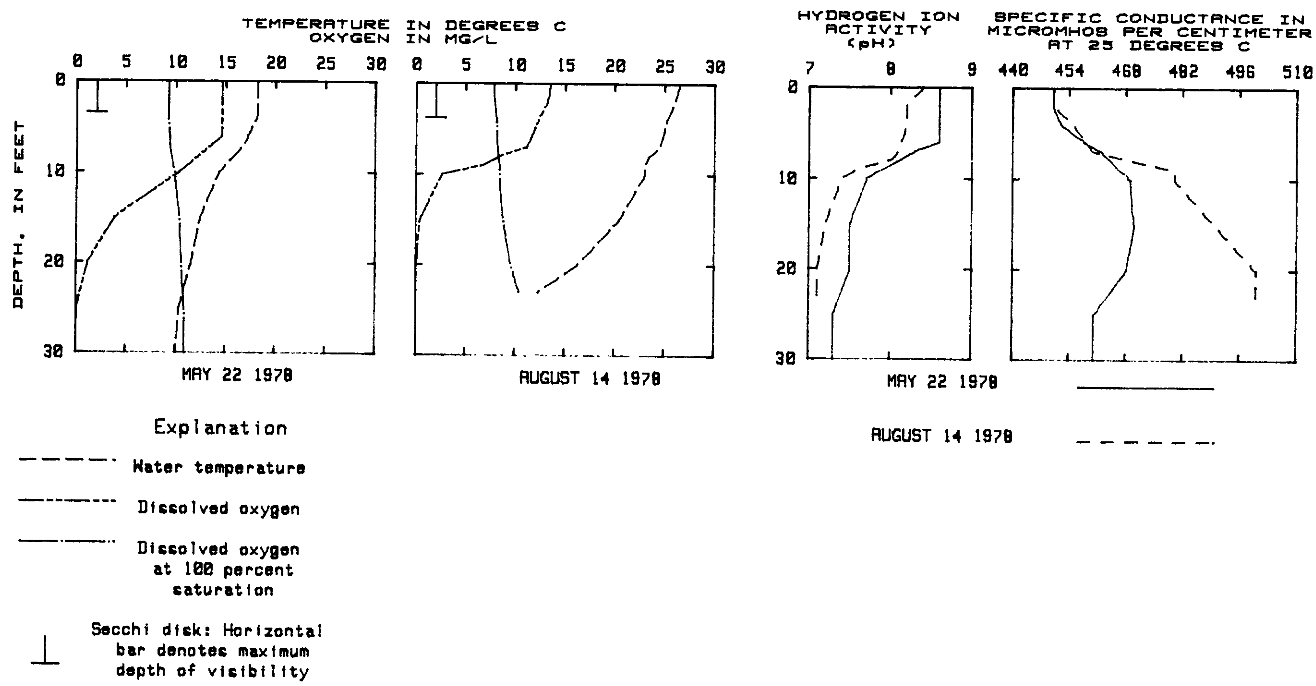



**Figure 31.--Data profiles for Nettle Lake.**

Table 61.--Profile data for the primary lake site, Nettle Lake, Ohio

414055084433700 - NETTLE LK NR MIDPOINT AT SITE L-1 OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1977 TO SEPTEMBER 1978

| DATE | TIME | SAMPLING DEPTH (FT) | TEMPERATURE (DEG C) | OXYGEN, DISSOLVED (MG/L) | OXYGEN, DISSOLVED (PERCENT SATURATION) | SPECIFIC CONDUCTANCE (MICROMHOS) | PH (UNITS) | CARBONATE (MG/L AS CO3) | BICARBONATE (MG/L AS HCO3) | CARBON DIOXIDE DISSOLVED (MG/L AS CO2) | HYDROGEN SULFIDE DISS. (MG/L AS H2S) | TRANSPARENCY (SECCHI DISK) (IN) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MAY | | | | | | | | | | | | |
| 22... | 1550 | .0 | 18.2 | 14.6 | 159 | 450 | 8.6 | -- | -- | -- | -- | -- |
| 22... | 1555 | 2.0 | 18.2 | 14.6 | 159 | 450 | 8.6 | 11 | 188 | .8 | .0 | 42 |
| 22... | 1603 | 5.5 | 17.2 | 14.6 | 156 | 458 | 8.6 | -- | -- | -- | -- | -- |
| 22... | 1605 | 7.0 | 16.8 | 13.6 | 144 | 462 | 8.3 | -- | -- | -- | -- | -- |
| 22... | 1610 | 10 | 14.3 | 10.3 | 104 | 469 | 7.7 | -- | -- | -- | -- | -- |
| 22... | 1615 | 15 | 12.4 | 3.8 | 37 | 470 | 7.5 | -- | -- | -- | -- | -- |
| 22... | 1620 | 20 | 11.5 | 1.1 | 10 | 468 | 7.5 | -- | -- | -- | -- | -- |
| 22... | 1625 | 25 | 10.3 | .0 | 0 | 460 | 7.3 | -- | -- | -- | -- | -- |
| 22... | 1630 | 30 | 10.0 | .0 | 0 | 460 | 7.3 | 0 | 226 | 18 | .3 | -- |
| AUG | | | | | | | | | | | | |
| 14... | 1530 | .0 | 26.5 | 13.5 | 170 | 450 | 8.4 | -- | -- | -- | -- | -- |
| 14... | 1535 | 2.0 | 26.0 | 13.2 | 170 | 450 | 8.2 | 0 | 216 | 2.2 | .0 | 46 |
| 14... | 1540 | 4.0 | 25.2 | 12.3 | 150 | 455 | 8.2 | -- | -- | -- | -- | -- |
| 14... | 1545 | 7.0 | 24.5 | 11.1 | 140 | 460 | 8.1 | -- | -- | -- | -- | -- |
| 14... | 1547 | 8.0 | 23.4 | 8.3 | 100 | 470 | 8.0 | -- | -- | -- | -- | -- |
| 14... | 1549 | 9.0 | 23.0 | 6.7 | 80 | 480 | 7.6 | -- | -- | -- | -- | -- |
| 14... | 1550 | 10 | 23.0 | 2.6 | 30 | 480 | 7.4 | -- | -- | -- | -- | -- |
| 14... | 1555 | 15 | 20.4 | .4 | 4 | 490 | 7.2 | -- | -- | -- | -- | -- |
| 14... | 1600 | 20 | 16.2 | .0 | 0 | 500 | 7.1 | -- | -- | -- | -- | -- |
| 14... | 1605 | 23 | 12.3 | .0 | 0 | 500 | 7.1 | 0 | 230 | 29 | .4 | -- |

Table 62.--Chemical analyses of water column composite samples, Nettle Lake, Ohio

414055084433700 - NETTLE LK NR MIDPOINT AT SITE L-1 OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1977 TO SEPTEMBER 1978

| DATE | TIME | CALCIUM DIS-SOLVED (MG/L AS CA) | MAGNE-SIUM, DIS-SOLVED (MG/L AS MG) | POTAS-SIUM, DIS-SOLVED (MG/L AS K) | SODIUM, DIS-SOLVED (MG/L AS NA) | SULFATE DIS-SOLVED (MG/L AS SO4) | CHLO-RIDE, DIS-SOLVED (MG/L AS CL) | FLUO-RIDE, DIS-SOLVED (MG/L AS F) | HARD-NESS (MG/L AS CACO3) | SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L) |
|---|---|---|---|---|---|---|---|---|---|---|
| MAY 22... | 1610 | 66 | 14 | 2.6 | 4.6 | 56 | 11 | .1 | 220 | 322 |

| DATE | SOLIDS, RESIDUE AT 105 DEG. C, SUS-PENDED (MG/L) | SOLIDS, RESIDUE AT 105 DEG. C, TOTAL (MG/L) | BARIUM, TOTAL RECOV-ERABLE (UG/L AS BA) | CADMIUM TOTAL RECOV-ERABLE (UG/L AS CD) | CHRO-MIUM, TOTAL RECOV-ERABLE (UG/L AS CR) | LEAD, TOTAL RECOV-ERABLE (UG/L AS PB) | MERCURY TOTAL RECOV-ERABLE (UG/L AS HG) | NICKEL, TOTAL RECOV-ERABLE (UG/L AS NI) | SELE-NIUM, TOTAL (UG/L AS SE) | SILVER, TOTAL RECOV-ERABLE (UG/L AS AG) |
|---|---|---|---|---|---|---|---|---|---|---|
| MAY 22... | 11 | 333 | 0 | 0 | <10 | 6 | <.5 | 6 | 0 | 0 |

| DATE | ARSENIC TOTAL (UG/L AS AS) | METHY-LENE BLUE ACTIVE SUB-STANCE (MG/L) | BORON, TOTAL RECOV-ERABLE (UG/L AS B) | COBALT, TOTAL RECOV-ERABLE (UG/L AS CO) | COPPER, TOTAL RECOV-ERABLE (UG/L AS CU) | IRON, TOTAL RECOV-ERABLE (UG/L AS FE) | MANGA-NESE, TOTAL RECOV-ERABLE (UG/L AS MN) | MOLYB-DENUM, TOTAL RECOV-ERABLE (UG/L AS MO) | ZINC, TOTAL RECOV-ERABLE (UG/L AS ZN) |
|---|---|---|---|---|---|---|---|---|---|
| MAY 22... | <10 | .07 | 70 | 0 | 4 | 310 | 170 | 5 | 20 |

Table 63.--Chemical, physical, and biological analyses of water samples from selected depths, Nettle Lake, Ohio

414055084433700 - NETTLE LK NR MIDPOINT AT SITE L-1 OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1977 TO SEPTEMBER 1978

| DATE | TIME | SAMPLING DEPTH (FT) | NITROGEN, NITRITE TOTAL (MG/L AS N) | NITROGEN, NITRATE TOTAL (MG/L AS N) | NITROGEN, NO2+NO3 TOTAL (MG/L AS N) | NITROGEN, AMMONIA TOTAL (MG/L AS N) | NITROGEN, ORGANIC TOTAL (MG/L AS N) | NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N) | PHOSPHORUS, ORTHO. TOTAL (MG/L AS P) |
|---|---|---|---|---|---|---|---|---|---|
| MAY | | | | | | | | | |
| 22... | 1555 | 2.0 | .03 | .58 | .61 | .16 | .74 | .90 | .00 |
| 22... | 1630 | 30 | .01 | .18 | .19 | .65 | .75 | 1.4 | .00 |
| AUG | | | | | | | | | |
| 14... | 1535 | 2.0 | .04 | .60 | .64 | .05 | .95 | 1.0 | .00 |
| 14... | 1605 | 23 | .01 | .00 | .00 | 1.8 | 1.5 | 3.3 | .16 |

| DATE | PHOSPHORUS, TOTAL (MG/L AS P) | SILICA, DISSOLVED (MG/L AS SIO2) | TURBIDITY (JTU) | COLOR (PLATINUM-COBALT UNITS) | CARBON, ORGANIC TOTAL (MG/L AS C) | OXYGEN DEMAND, BIOCHEMICAL, 5 DAY (MG/L) | OXYGEN DEMAND, CHEMICAL (HIGH LEVEL) (MG/L) | COLIFORM, FECAL, 0.45 UM-MF (COLS./100 ML) | STREPTOCOCCI FECAL, (COLS. PER 100 ML) |
|---|---|---|---|---|---|---|---|---|---|
| MAY | | | | | | | | | |
| 22... | .04 | .8 | 3 | 10 | 8.5 | 2.8 | 30 | 2 | 10 |
| 22... | .05 | 5.6 | 6 | 20 | 9.7 | 2.7 | 30 | 2 | 58 |
| AUG | | | | | | | | | |
| 14... | .04 | 2.2 | 5 | 20 | 6.9 | 2.2 | 22 | 6 | 18 |
| 14... | .30 | 9.3 | 55 | 90 | 11 | 1.3 | 35 | 4 | 120 |

Table 64.--Phytoplankton identified in Nettle Lake, Ohio (1978)

| Sample description | | | Total cells (per ml) | Diversity index (genus) $\bar{d}$ | Chlorophyll a (µg/L) | Division(s) present (in order of dominance) | Percent of total cell count | Dominant taxa within division and percent (%)* of total cell count |
|---|---|---|---|---|---|---|---|---|
| Location | Date | Location in water column | | | | | | |
| Site L-1 near midpoint | 5-22 | Euphotic zone composite | 12,000 | 3.6 | 21.9 | Chrysophyta | 41 | Asterionella (16), Ochromonas (16) Nitzschia (15), Cyclotella (2), Synedra (1), Navicula (1) |
| | | | | | | Chlorophyta | 26 | Chlamydomonas (9), Scenedesmus (7), Ankistrodesmus (3), Carteria (2), Golenkinia (2), Micractinium (1), Chlorella (1), Chodatella (1) |
| | | | | | | Chryptophyta | 11 | Chroomonas (7), Cryptomonas (4) |
| | | | | | | Pyrrophyta | 1 | Glenodinium (1) |
| | | | | | | Cyanophyta | 12 | Anacystis (12) |
| Site L-1 near midpoint | 5-22-78 | 5.5 ft depth | 8,100 | 3.6 | 21.4 | Chrysophyta | 35 | Asterionella (15), Nitzschia (11), Ochromonas (7), Cyclotella (2), Dinobryon (1) |
| | | | | | | Chlorophyta | 30 | Crucigenia (12), Arteria (4), Ankistrodesmus (4), Chlamydomonas (4), Dictyosphaerium (3), Scendesmus (2), Kirchneriella (1) |
| | | | | | | Cryptophyta | 21 | Cryptomonas (13), Chroomonas (8) |
| | | | | | | Pyrrophyta | 1 | Glenodinium (1) |
| | | | | | | Cyanophyta | 12 | Anacystis (12) |
| | | | | | | Euglenophyta | 1 | Euglena (1) |
| Site L-1 near midpoint | 8-14 | Euphotic zone | 88,000 | 2.8 | 11.9 | Cyanophyta | 54 | Anacystis (35), Raphidiopsis (10), Agmenellum (6), Oscillatoria (3) |
| | | | | | | Chlorophyta | 37 | Chlamydomonas (11), Scenedesmus (10), Crucigenia (9), Golenkinia (3) Schroederia (1), Selenastrum (1) |
| | | | | | | Chrysophyta | 8 | Dinobryon (6), Ochromonas (2) |
| | | | | | | Cryptophyta | 2 | Cryptomonas (2) |
| Site L-1 near midpoint | 8-14 | Near surface sample | 88,000 | 2.9 | 18.3 | Cyanophyta | 47 | Raphidiopsis (38), Anacystis (9) |
| | | | | | | Chlorophyta | 44 | Crucigenia (12), Scenedesmus (11), Coelastrum (9), Chlamydomonas (6), Dictyosphaerium (4), Kirchneriella (1), Ankistrodesmus |
| | | | | | | Chrysophyta | 5 | Nitzschia (3), Ochromonas (1), Cyclotella, Dinobryon |
| | | | | | | Euglenophyta | 4 | Lepocinclis (2), Trachelomonas (2) Phacus |

*Less than 1 percent not given.

Nettle Lake at L-1 had developed chemical and thermal stratification by the May 22 sampling. The lake was still stratified at the August 14 sampling. The oxygen profile indicates supersaturated conditions above 10 feet and oxygen deficits below 15 feet in May. The August oxygen profile was similar; oxygen deficits were found below 9 feet and supersaturated conditions above 7 feet. Anaerobic conditions were found below 25 feet in the spring and below 20 feet in the summer.

The spring near-surface, total-phosphorus concentration was 0.04 mg/L. The spring total-nitrogen to total-phosphorus ratio, 37.5 to 1, indicates phosphorus may be limiting phytoplankton productivity.

Nettle Lake had Carlson TSIs of 69 for chlorophyll a (summer), 58 for Secchi-disk transparency (summer), and 57 for total phosphorus (spring). These TSIs are typical of eutrophic lakes.

No constituents or properties exceeded Ohio water-quality standards, although trace amounts of hydrogen sulfide were noted in the hypolimnion at the spring and summer samplings.

The algal community was dominated by yellow-green algae (Chrysophyta) and green algae (Chlorophyta) in the spring. Blue-green algae (Cyanophyta) dominated the summer algal population. The supersaturated oxygen levels indicate very favorable growing conditions in the lake at this time. Growths of aquatic macrophytes in the lake were not excessive.

Inflow data (fig. 30; table 65): Nettle Creek, the principal tributary to Nettle Lake, was sampled at site I-1. Drainage area at the site is 18 $mi^2$, which is 89 percent of the lake's drainage basin. A qualitative comparison of stream versus lake data is shown below.

| Inflow sampling site | Sampling date (1978) | Estimated discharge ($ft^3/s$) | Water body (stream or lake at 2-foot depth) having higher concentration | | | |
|---|---|---|---|---|---|---|
| | | | $NO_2+NO_3$ | Total P | TOC | (Specific conductance) |
| Nettle Creek at site L-1 | May 22 | 5.0 | Stream | Stream | Lake | Stream |
| | Aug 14 | 1.0 | Lake | Stream | Stream | Stream |

Table 65.--Physical and chemical data for selected inflows, Nettle Lake, Ohio

414120084435800 - NETTLE C AB NETTLE LK AT SITE I-1 OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1977 TO SEPTEMBER 1978

| DATE | TIME | STREAM-FLOW, INSTAN-TANEOUS (CFS) | TEMPER-ATURE (DEG C) | OXYGEN, DIS-SOLVED (MG/L) | PH (UNITS) | SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS) | TUR-BID-ITY (JTU) | COLOR (PLAT-INUM-COBALT UNITS) | CARBON, ORGANIC TOTAL (MG/L AS C) | NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N) | NITRO-GEN,AM-MONIA + ORGANIC TOTAL (MG/L AS N) | PHOS-PHORUS, TOTAL (MG/L AS P) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MAY | | | | | | | | | | | | |
| 22... | 1500 | E5.0 | 17.0 | 11.0 | 7.3 | 505 | 7 | 25 | 4.9 | .72 | .89 | .05 |
| AUG | | | | | | | | | | | | |
| 14... | 1430 | E1.0 | 24.0 | 10.0 | 7.6 | 855 | 10 | 20 | 7.7 | .46 | 1.1 | .05 |

## Tycoon Lake

Location: Gallia County
(Vinton 7.5-minute quadrangle map)

Type: Impoundment on an abandoned channel of Raccoon Creek

Use: Recreation

Physical characteristics at summer pool level (table 6):

| Date of origin (year) | Surface area (acres) | Capacity (acre-feet) | Capacity-inflow ratio (C/I) |
|---|---|---|---|
| 1960 | 204 | 2,000 | 1.8 |

Drainage-basin characteristics:

| Drainage area ($mi^2$) | Type | Estimated sediment yield (from fig. 3) |
|---|---|---|
| 1.4 | Agricultural, vacant | Moderately low |

Lake data are presented in figures 32 and 33 and in tables 66-69. Profile and analytical data show the following lake characteristics.

| Date | Stratification (gradient) Thermal | Chemical | Chemical type | Trophic state index (Carlson) Chl a | SD | T.P. | Trophic class | Substances at or above State limits Toxicants | Bacteria | Phyto-plankton, dominant division(s) |
|---|---|---|---|---|---|---|---|---|---|---|
| 5-02-78 | No | No | Ca, Soft, $SO_4$, $HCO_3$ | -- | -- | 47 | Eutrophic | Cd, Ni, Zn | No | Chlorophyta, Chrysophyta |
| 8-24-78 | Slight | Slight | -- | 53 | 51 | -- | -- | -- | No | Cyanophyta |

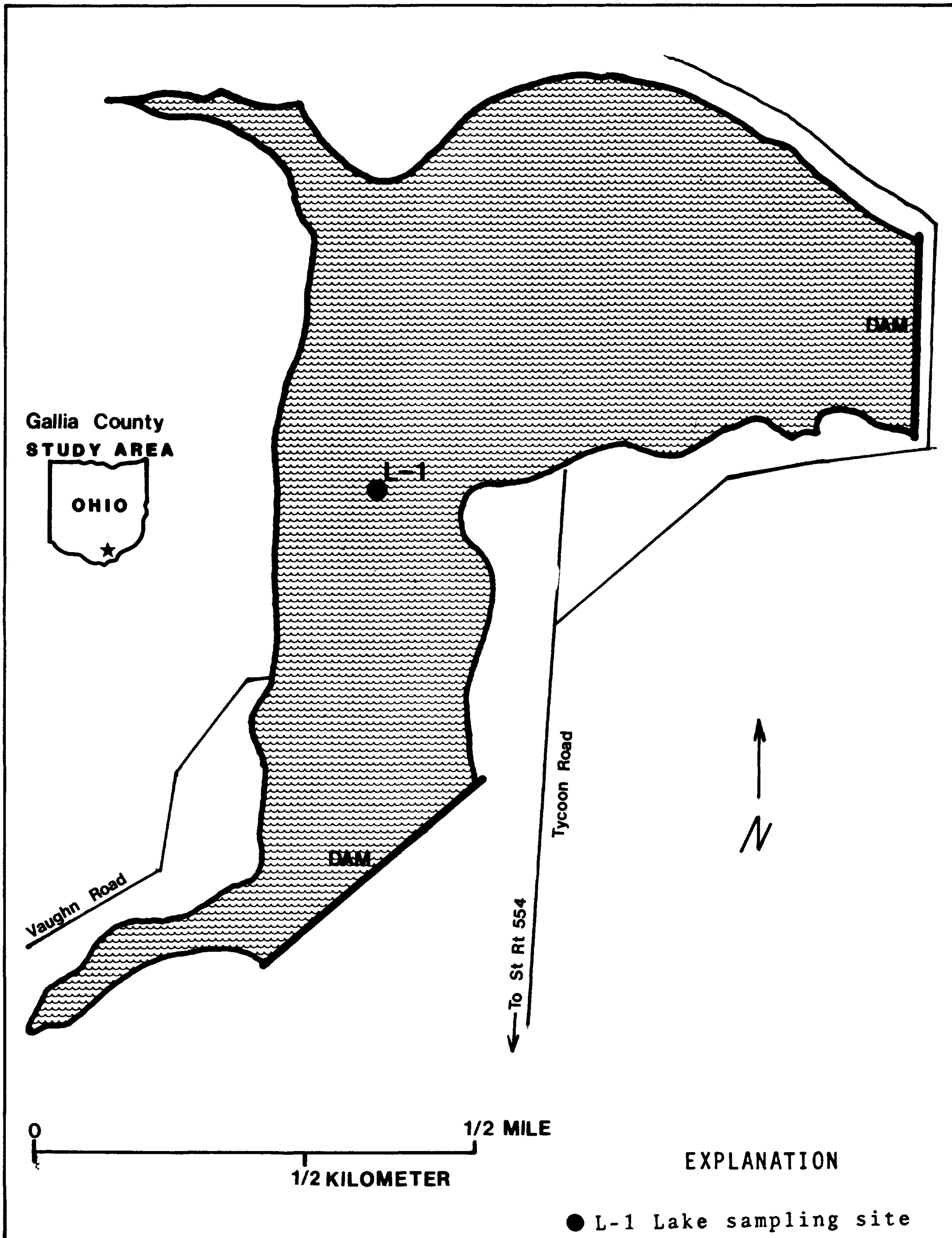



**Figure 32.--Tycoon Lake sampling site.**

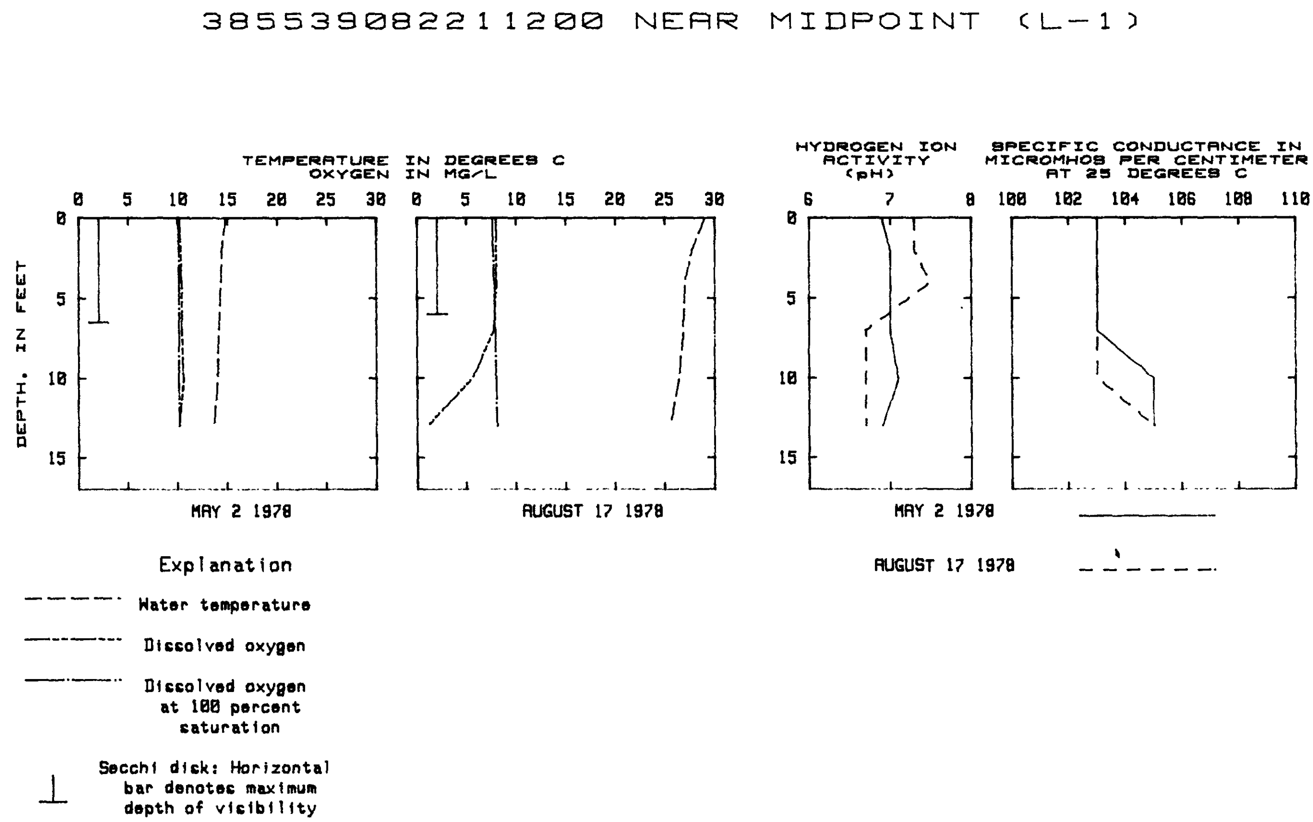



**Figure 33.--Data profiles for Tycoon Lake.**

Table 66.--Profile data for the primary lake site, Tycoon Lake, Ohio

385539082211200 - TYCOON LK NR MIDPOINT AT SITE L-1 NR VINTON OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1977 TO SEPTEMBER 1978

| DATE | TIME | SAMPLING DEPTH (FT) | TEMPERATURE (DEG C) | OXYGEN, DISSOLVED (MG/L) | OXYGEN, DISSOLVED (PERCENT SATURATION) | SPECIFIC CONDUCTANCE (MICROMHOS) | PH (UNITS) | CARBONATE (MG/L AS CO3) | BICARBONATE (MG/L AS HCO3) | CARBON DIOXIDE DISSOLVED (MG/L AS CO2) | HYDROGEN SULFIDE DISS. (MG/L AS H2S) | TRANSPARENCY (SECCHI DISK) (IN) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MAY | | | | | | | | | | | | |
| 02... | 1205 | .0 | 14.8 | 10.2 | 102 | 103 | 6.9 | -- | -- | -- | -- | -- |
| 02... | 1210 | 2.0 | 14.4 | 10.3 | 102 | 103 | 7.0 | 0 | 25 | 4.0 | .0 | 78 |
| 02... | 1215 | 4.0 | 14.3 | 10.4 | 103 | 103 | 7.0 | -- | -- | -- | -- | -- |
| 02... | 1220 | 7.0 | 14.1 | 10.4 | 103 | 103 | 7.0 | -- | -- | -- | -- | -- |
| 02... | 1225 | 10 | 14.0 | 10.6 | 105 | 105 | 7.1 | -- | -- | -- | -- | -- |
| 02... | 1230 | 13 | 13.6 | 10.1 | 99 | 105 | 6.9 | 0 | 26 | 5.2 | .0 | -- |
| AUG | | | | | | | | | | | | |
| 17... | 1330 | .0 | 29.0 | 8.0 | 100 | 103 | 7.3 | -- | -- | -- | -- | -- |
| 17... | 1335 | 2.0 | 27.7 | 8.0 | 100 | 103 | 7.3 | 0 | 31 | 2.5 | .0 | 72 |
| 17... | 1340 | 4.0 | 27.0 | 8.0 | 100 | 103 | 7.5 | -- | -- | -- | -- | -- |
| 17... | 1345 | 7.0 | 26.8 | 7.7 | 97 | 103 | 6.7 | -- | -- | -- | -- | -- |
| 17... | 1350 | 10 | 26.4 | 5.6 | 70 | 103 | 6.7 | -- | -- | -- | -- | -- |
| 17... | 1355 | 13 | 25.5 | 1.0 | 12 | 105 | 6.7 | 0 | 32 | 10 | .0 | -- |

Table 67.--Chemical analyses of water column composite samples, Tycoon Lake, Ohio

385539082211200 - TYCOON LK NR MIDPOINT AT SITE L-1 NR VINTON OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1977 TO SEPTEMBER 1978

| DATE | TIME | CALCIUM DIS-SOLVED (MG/L AS CA) | MAGNE-SIUM, DIS-SOLVED (MG/L AS MG) | POTAS-SIUM, DIS-SOLVED (MG/L AS K) | SODIUM, DIS-SOLVED (MG/L AS NA) | SULFATE DIS-SOLVED (MG/L AS SO4) | CHLO-RIDE, DIS-SOLVED (MG/L AS CL) | FLUO-RIDE, DIS-SOLVED (MG/L AS F) | HARD-NESS (MG/L AS CACO3) | SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L) |
|---|---|---|---|---|---|---|---|---|---|---|
| MAY 02... | 1220 | 9.4 | 2.9 | 1.8 | 3.4 | 20 | 3.5 | .1 | 35 | 79 |
| AUG 17... | 1355 | -- | -- | -- | -- | -- | -- | -- | -- | -- |

| DATE | SOLIDS, RESIDUE AT 105 DEG. C, SUS-PENDED (MG/L) | SOLIDS, RESIDUE AT 105 DEG. C, TOTAL (MG/L) | BARIUM, TOTAL RECOV-ERABLE (UG/L AS BA) | CADMIUM TOTAL RECOV-ERABLE (UG/L AS CD) | CHRO-MIUM, TOTAL RECOV-ERABLE (UG/L AS CR) | LEAD, TOTAL RECOV-ERABLE (UG/L AS PB) | MERCURY TOTAL RECOV-ERABLE (UG/L AS HG) | NICKEL, TOTAL RECOV-ERABLE (UG/L AS NI) | SELE-NIUM, TOTAL (UG/L AS SE) | SILVER, TOTAL RECOV-ERABLE (UG/L AS AG) |
|---|---|---|---|---|---|---|---|---|---|---|
| MAY 02... | 23 | 102 | 0 | 2 | 20 | 11 | <.5 | 300 | 0 | 0 |
| AUG 17... | -- | -- | 100 | 1 | 20 | 14 | -- | -- | 0 | 0 |

| DATE | ARSENIC TOTAL (UG/L AS AS) | METHY-LENE BLUE ACTIVE SUB-STANCE (MG/L) | BORON, TOTAL RECOV-ERABLE (UG/L AS B) | COBALT, TOTAL RECOV-ERABLE (UG/L AS CO) | COPPER, TOTAL RECOV-ERABLE (UG/L AS CU) | IRON, TOTAL RECOV-ERABLE (UG/L AS FE) | MANGA-NESE, TOTAL RECOV-ERABLE (UG/L AS MN) | MOLYB-DENUM, TOTAL RECOV-ERABLE (UG/L AS MO) | ZINC, TOTAL RECOV-ERABLE (UG/L AS ZN) |
|---|---|---|---|---|---|---|---|---|---|
| MAY 02... | <10 | .06 | 30 | 0 | 8 | 200 | 50 | 0 | 30 |
| AUG 17... | -- | -- | -- | -- | -- | -- | -- | -- | -- |

Table 68.--Chemical, physical, and biological analyses of water samples from selected depths, Tycoon Lake, Ohio

385539082211200 - TYCOON LK NR MIDPOINT AT SITE L-1 NR VINTON OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1977 TO SEPTEMBER 1978

| DATE | TIME | SAMP-LING DEPTH (FT) | NITRO-GEN, NITRITE TOTAL (MG/L AS N) | NITRO-GEN, NITRATE TOTAL (MG/L AS N) | NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N) | NITRO-GEN, AMMONIA TOTAL (MG/L AS N) | NITRO-GEN, ORGANIC TOTAL (MG/L AS N) | NITRO-GEN,AM-MONIA + ORGANIC TOTAL (MG/L AS N) | PHOS-PHORUS, ORTHO. TOTAL (MG/L AS P) |
|---|---|---|---|---|---|---|---|---|---|
| MAY | | | | | | | | | |
| 02... | 1210 | 2.0 | .00 | .04 | .04 | .07 | .34 | .41 | .00 |
| 02... | 1230 | 13 | .00 | .04 | .04 | .08 | .34 | .42 | .00 |
| AUG | | | | | | | | | |
| 17... | 1335 | 2.0 | .00 | .00 | .00 | .04 | .61 | .65 | .01 |
| 17... | 1355 | 13 | .00 | .00 | .00 | .17 | .46 | .63 | .01 |

| DATE | PHOS-PHORUS, TOTAL (MG/L AS P) | SILICA, DIS-SOLVED (MG/L AS SIO2) | TUR-BID-ITY (JTU) | COLOR (PLAT-INUM-COBALT UNITS) | CARBON, ORGANIC TOTAL (MG/L AS C) | OXYGEN DEMAND, BIO-CHEM-ICAL, 5 DAY (MG/L) | OXYGEN DEMAND, CHEM-ICAL (HIGH LEVEL) (MG/L) | COLI-FORM, FECAL, 0.45 UM-MF (COLS./100 ML) | STREP-TOCOCCI FECAL, (COLS. PER 100 ML) |
|---|---|---|---|---|---|---|---|---|---|
| MAY | | | | | | | | | |
| 02... | .02 | 1.3 | 3 | 5 | 6.4 | 1.4 | 15 | <2 | <2 |
| 02... | .02 | 1.3 | 3 | 20 | 8.7 | 1.4 | 15 | 4 | <2 |
| AUG | | | | | | | | | |
| 17... | .02 | 2.4 | 5 | 20 | 3.4 | 1.2 | 9 | 2 | 32 |
| 17... | .03 | 2.8 | 5 | 80 | .7 | 1.1 | 13 | 4 | 32 |

Table 69.--Phytoplankton identified in Tycoon Lake, Ohio (1978)

| Sample description | | | Total cells (per ml ) | Diversity index (genus) $\overline{d}$ | Chlorophyll a (µg/L) | Division(s) present (in order of dominance) | Percent of total cell count | Dominant taxa within division and percent (%)* of total cell count |
|---|---|---|---|---|---|---|---|---|
| Location | Date | Location in water column | | | | | | |
| Site L-1 near midpoint | 5-02 | Euphotic zone composite | 2,200 | 3.5 | 6.4 | Chlorophyta | 58 | Selenastrum (14), Kirchneriella (11), Chlamydomonas (10), Scenedesmus (9), Sphaerocystis (7), Ankistrodesmus (3), Tetradesmus (3), Tetrastrum (1) |
| | | | | | | Chrysophyta | 28 | Cyclotella (17), Ochromonas (9), Dinobryon (3), Amphora (1) |
| | | | | | | Euglenophyta | 13 | Trachelomonas (10), Chroomonas (3) |
| Site L-1 near midpoint | 8-17 | 4-ft depth | 72,000 | 1.3 | 13.5 | Cyanophyta | 96 | Anacystis (69), Anabaena (26), Agmenellum (1) |
| | | | | | | Chlorophyta | 3 | Oocystis (1), Kirchneriella (1), Quadrigula, Micractinium, Scenedesmus, Sphaerocystis, Cosmarium, Staurastrum |
| | | | | | | Chrysophyta | 1 | Melosira (1) |
| | | | | | | Euglenophyta | 1 | Trachelomonas (1), Euglena |
| | | | | | | Cryptophyta | | Cryptomonas |
| Site L-1 near midpoint | 8-17 | Euphotic zone composite | 110,000 | 1.1 | 12.1 | Cyanophyta | 57 | Anacystis (65), Anabaena (32) |
| | | | | | | Chlorophyta | 1 | Oocystis (1), Dictyosphaerium, Arthrodesmus, Elaktothrix, Cosmarium, Schroederia |
| | | | | | | Chrysophtya | 1 | Melosira (1), Cyclotella |
| | | | | | | Euglenophyta | | Trachelomonas (1), |
| | | | | | | Cryptophyta | | Cryptomonas |

*Less than 1 percent not given.

Tycoon Lake at L-1 was well mixed at the May 2 sampling. The slight surface-to-bottom temperature difference on August 17 (3.5°C) is typical of a shallow lake. Oxygen deficits were found in the water column below 7 feet, however, anaerobic conditions were not found.

The spring near-surface, total-phosphorus concentration was 0.02 mg/L. The spring total-nitrogen to total-phosphorus ratio, 22.5 to 1, indicates phosphorus may be limiting phytoplankton productivity.

Tycoon Lake had Carlson TSIs of 53 for chlorophyll a (summer), 51 for Secchi-disk transparency (summer), and 47 for total phosphorus (spring). These TSIs are typical of eutrophic lakes.

Cadmium, nickel, and zinc concentrations exceeded Ohio water-quality standards in the spring.

The algal community showed the typical seasonal succession pattern for temperate lakes; green algae (Chlorophyta) and yellow-green algal (Chrysophyta) dominated in the spring, whereas blue-green algae (Cyanophyta) dominated in the summer. Growths of aquatic macrophytes in the lake were not excessive.

Inflow data: No inflows were sampled.

## Veto Lake

Location: Washington County
(Little Hocking 7.5-minute quadrangle map)

Type: Impoundment on Little Hocking River

Use: Recreation

Physical characteristics at summer pool level (table 6):

| Date of origin (year) | Surface area (acres) | Capacity (acre-feet) | Capacity-inflow ratio (C/I) |
|---|---|---|---|
| 1953 | 158 | 1,010 | 0.06 |

Drainage-basin characteristics:

| Drainage area ($mi^2$) | Type | Estimated sediment yield (from fig. 3) |
|---|---|---|
| 20 | Agricultural, forest | Moderate |

Lake data (figs. 34, 35; tables 70-73): Veto Lake was sampled under partly cloudy and very windy conditions on May 9; it had rained the previous day. On August 24, skies were partly cloudy. Secchi-disk transparency readings were 1.5 feet in May and 2.0 feet in August; these were among the lowest found in 1978.

Profile and analytical data show the following characteristics:

| Date | Stratification (gradient) Thermal | Chemical | Chemical type | Trophic state index (Carlson) Chl *a* | SD | T.P. | Trophic class | Substances at or above State limits Toxicants | Bacteria | Phytoplankton, dominant division(s) |
|---|---|---|---|---|---|---|---|---|---|---|
| 5-09-78 | Slight | Yes | Moderately hard; Ca, $HCO_3$ | -- | -- | 65 | Eutrophic | Cd | No | Cyanophyta, Chlorophyta |
| 8-17-78 | Yes | Yes | -- | 57 | 67 | -- | -- | No | No | Cyanophyta |

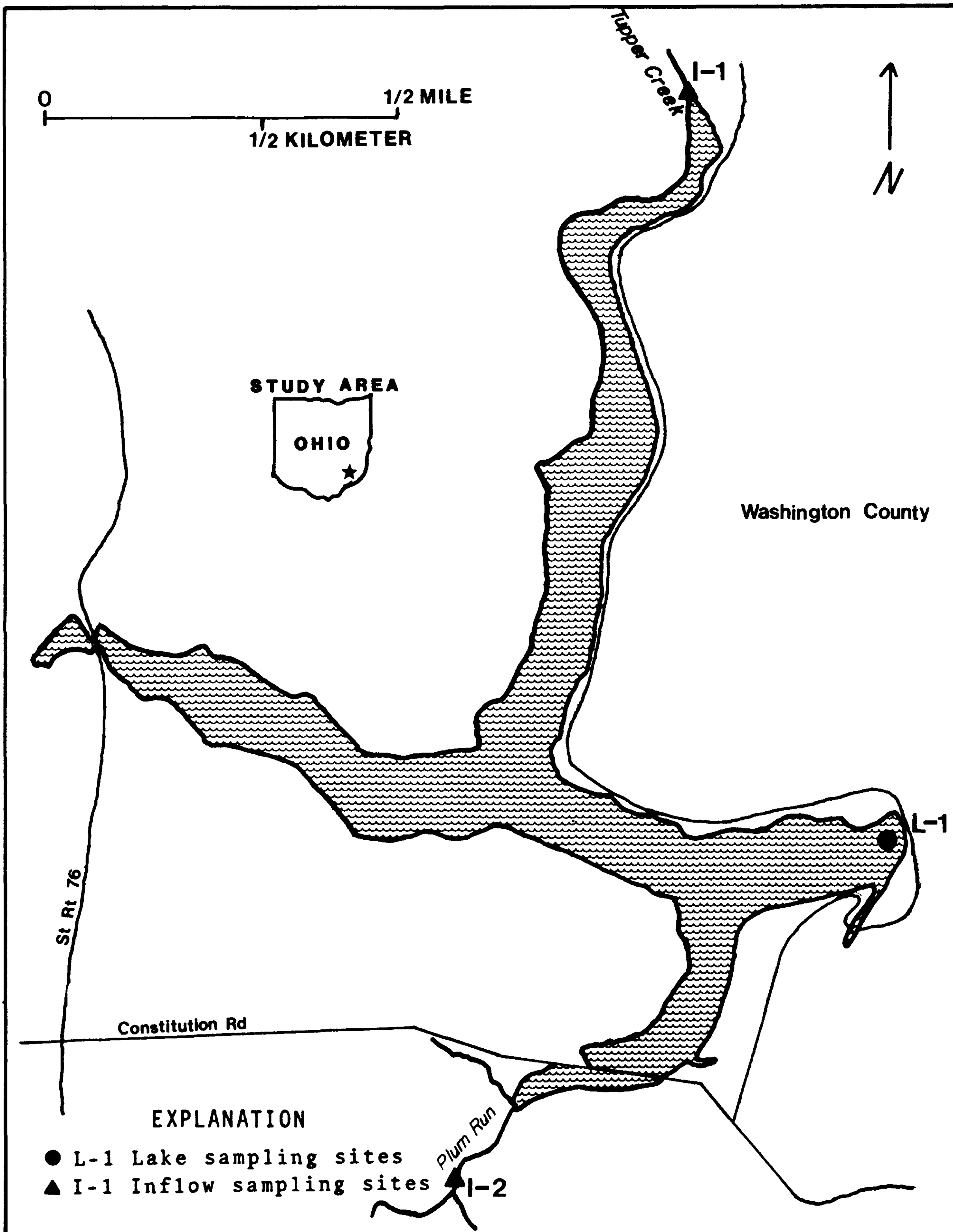



Figure 34.--Veto Lake and inflow sampling sites.

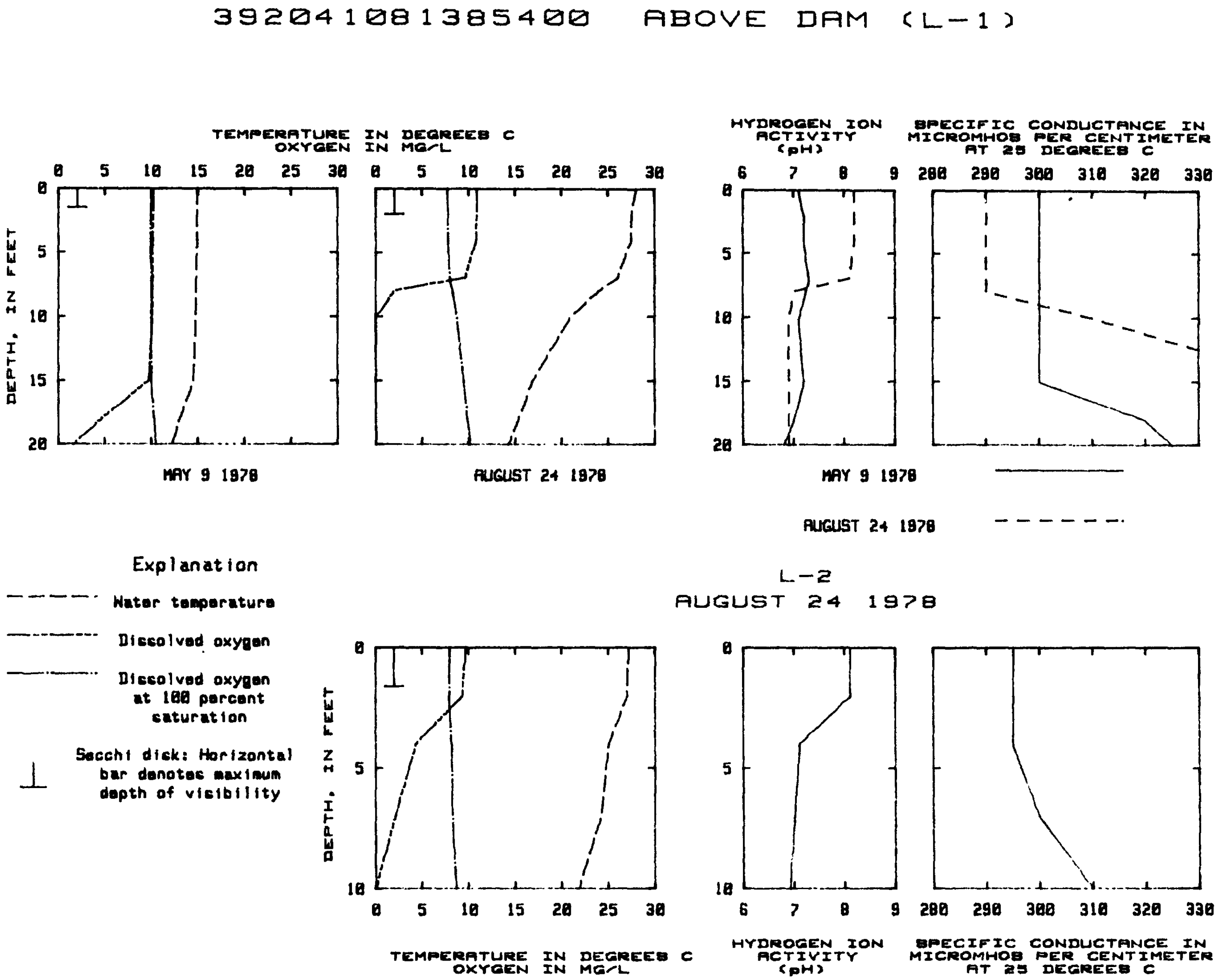



Figure 35.--Data profiles for Veto Lake.

Table 70.--Profile data for the primary lake site, Veto Lake, Ohio

392041081385400 - VETO LK AB DAM AT SITE L-1 NR VETO OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1977 TO SEPTEMBER 1978

| DATE | TIME | SAMPLING DEPTH (FT) | TEMPERATURE (DEG C) | OXYGEN, DISSOLVED (MG/L) | OXYGEN, DISSOLVED (PERCENT SATURATION) | SPECIFIC CONDUCTANCE (MICROMHOS) | PH (UNITS) | CARBONATE (MG/L AS CO3) | BICARBONATE (MG/L AS HCO3) | CARBON DIOXIDE DISSOLVED (MG/L AS CO2) | HYDROGEN SULFIDE DISS. (MG/L AS H2S) | TRANSPARENCY (SECCHI DISK) (IN) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MAY | | | | | | | | | | | | |
| 09... | 1315 | .0 | 14.9 | 10.2 | 103 | 300 | 7.1 | -- | -- | -- | -- | -- |
| 09... | 1320 | 2.0 | 14.9 | 10.2 | 103 | 300 | 7.2 | 0 | 100 | 10 | .0 | 18 |
| 09... | 1325 | 4.0 | 14.9 | 10.1 | 102 | 300 | 7.2 | -- | -- | -- | -- | -- |
| 09... | 1330 | 7.0 | 14.8 | 10.1 | 101 | 300 | 7.3 | -- | -- | -- | -- | -- |
| 09... | 1335 | 10 | 14.8 | 10.1 | 101 | 300 | 7.1 | -- | -- | -- | -- | -- |
| 09... | 1340 | 15 | 14.5 | 9.7 | 97 | 300 | 7.2 | -- | -- | -- | -- | -- |
| 09... | 1345 | 18 | 13.0 | 4.6 | 44 | 320 | 7.0 | 0 | 98 | 16 | .0 | -- |
| 09... | 1350 | 20 | 12.2 | 1.6 | 15 | 325 | 6.8 | -- | -- | -- | -- | -- |
| AUG | | | | | | | | | | | | |
| 24... | 1500 | .0 | 28.0 | 10.9 | 140 | 290 | 8.2 | -- | -- | -- | -- | -- |
| 24... | 1505 | 2.0 | 27.5 | 10.9 | 140 | 290 | 8.2 | 0 | 100 | 1.0 | .0 | 24 |
| 24... | 1510 | 4.0 | 27.5 | 10.8 | 140 | 290 | 8.2 | -- | -- | -- | -- | -- |
| 24... | 1515 | 7.0 | 26.0 | 9.6 | 120 | 290 | 8.1 | -- | -- | -- | -- | -- |
| 24... | 1516 | 8.0 | 24.0 | 2.0 | 24 | 290 | 7.0 | -- | -- | -- | -- | -- |
| 24... | 1520 | 10 | 21.0 | .0 | 0 | 310 | 6.9 | -- | -- | -- | -- | -- |
| 24... | 1525 | 15 | 16.8 | .0 | 0 | 350 | 6.9 | -- | -- | -- | -- | -- |
| 24... | 1530 | 20 | 14.2 | .0 | 0 | 350 | 6.9 | 0 | 206 | 41 | .0 | -- |

Table 71-Chemical analyses of water column composite samples, Veto Lake, Ohio

392041081385400 - VETO LK AB DAM AT SITE L-1 NR VETO OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1977 TO SEPTEMBER 1978

| DATE | TIME | CALCIUM DIS-SOLVED (MG/L AS CA) | MAGNE-SIUM, DIS-SOLVED (MG/L AS MG) | POTAS-SIUM, DIS-SOLVED (MG/L AS K) | SODIUM, DIS-SOLVED (MG/L AS NA) | SULFATE DIS-SOLVED (MG/L AS SO4) | CHLO-RIDE, DIS-SOLVED (MG/L AS CL) | FLUO-RIDE, DIS-SOLVED (MG/L AS F) | HARD-NESS (MG/L AS CACO3) | SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L) |
|---|---|---|---|---|---|---|---|---|---|---|
| MAY 09... | 1335 | 30 | 9.3 | 2.1 | 14 | 63 | 13 | .1 | 110 | 199 |

| DATE | SOLIDS, RESIDUE AT 105 DEG. C, SUS-PENDED (MG/L) | SOLIDS, RESIDUE AT 105 DEG. C, TOTAL (MG/L) | BARIUM, TOTAL RECOV-ERABLE (UG/L AS BA) | CADMIUM TOTAL RECOV-ERABLE (UG/L AS CD) | CHRO-MIUM, TOTAL RECOV-ERABLE (UG/L AS CR) | LEAD, TOTAL RECOV-ERABLE (UG/L AS PB) | MERCURY TOTAL RECOV-ERABLE (UG/L AS HG) | NICKEL, TOTAL RECOV-ERABLE (UG/L AS NI) | SELE-NIUM, TOTAL (UG/L AS SE) | SILVER, TOTAL RECOV-ERABLE (UG/L AS AG) |
|---|---|---|---|---|---|---|---|---|---|---|
| MAY 09... | 42 | 241 | 100 | 2 | 10 | 18 | <.5 | 8 | 0 | 0 |

| DATE | ARSENIC TOTAL (UG/L AS AS) | METHY-LENE BLUE ACTIVE SUB-STANCE (MG/L) | BORON, TOTAL RECOV-ERABLE (UG/L AS B) | COBALT, TOTAL RECOV-ERABLE (UG/L AS CO) | COPPER, TOTAL RECOV-ERABLE (UG/L AS CU) | IRON, TOTAL RECOV-ERABLE (UG/L AS FE) | MANGA-NESE, TOTAL RECOV-ERABLE (UG/L AS MN) | MOLYB-DENUM, TOTAL RECOV-ERABLE (UG/L AS MO) | ZINC, TOTAL RECOV-ERABLE (UG/L AS ZN) |
|---|---|---|---|---|---|---|---|---|---|
| MAY 09... | <10 | .06 | 20 | 0 | 3 | 920 | 570 | 0 | 10 |

Table 72.--Chemical, physical, and biological analyses of water samples from selected deths, Veto Lake, Ohio

392041081385400 - VETO LK AB DAM AT SITE L-1 NR VETO OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1977 TO SEPTEMBER 1978

| DATE | TIME | SAMPLING DEPTH (FT) | NITROGEN, NITRITE TOTAL (MG/L AS N) | NITROGEN, NITRATE TOTAL (MG/L AS N) | NITROGEN, NO2+NO3 TOTAL (MG/L AS N) | NITROGEN, AMMONIA TOTAL (MG/L AS N) | NITROGEN, ORGANIC TOTAL (MG/L AS N) | NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N) | PHOSPHORUS, ORTHO. TOTAL (MG/L AS P) |
|---|---|---|---|---|---|---|---|---|---|
| MAY | | | | | | | | | |
| 09... | 1320 | 2.0 | .01 | .09 | .10 | .10 | .38 | .48 | .00 |
| 09... | 1345 | 18 | .01 | .09 | .10 | .27 | .64 | .91 | .00 |
| AUG | | | | | | | | | |
| 24... | 1505 | 2.0 | .00 | .00 | .00 | .07 | .62 | .69 | .00 |
| 24... | 1530 | 20 | .01 | .00 | .01 | 2.2 | 1.2 | 3.4 | .27 |

| DATE | PHOSPHORUS, TOTAL (MG/L AS P) | SILICA, DISSOLVED (MG/L AS SIO2) | TURBIDITY (JTU) | COLOR (PLATINUM-COBALT UNITS) | CARBON, ORGANIC TOTAL (MG/L AS C) | OXYGEN DEMAND, BIOCHEMICAL, 5 DAY (MG/L) | OXYGEN DEMAND, CHEMICAL (HIGH LEVEL) (MG/L) | COLIFORM, FECAL, 0.45 UM-MF (COLS./100 ML) | STREPTOCOCCI FECAL, (COLS. PER 100 ML) |
|---|---|---|---|---|---|---|---|---|---|
| MAY | | | | | | | | | |
| 09... | .05 | 3.5 | 15 | 5 | 7.1 | 2.6 | 15 | 58 | 200 |
| 09... | .07 | 4.3 | 40 | 20 | 7.2 | 1.8 | 15 | 26 | 80 |
| AUG | | | | | | | | | |
| 24... | .05 | 3.6 | 8 | 10 | 6.1 | 3.0 | 30 | 22 | 20 |
| 24... | .49 | 10 | 45 | 70 | 11 | 3.3 | 59 | 30 | 52 |

Table 73.--Phytoplankton identified in Veto Lake, Ohio (1978)

| Sample description | | | Total cells (per ml) | Diversity index (genus) $\bar{d}$ | Chlorophyll $\underline{a}$ (µg/L) | Division(s) present (in order of dominance) | Percent of total cell count | Dominant taxa within division and percent (%)* of total cell count |
|---|---|---|---|---|---|---|---|---|
| Location | Date | Location in water column | | | | | | |
| Site L-1 | 5-09 | Euphotic zone composite | 11,000 | 1.7 | 19.7 | Cyanophyta | 45 | Anacystis incerta (45) |
| | | | | | | Chlorophyta | 40 | Dictyosphaerium (16), Ankistrodesmus (7), Selanastrum (5), Schroederia (5), Scenedesmus (2), Chodatella (1), Treubaria (1), Kirchneriella (1) |
| | | | | | | Cryptophyta | 9 | Cryptomonadales (9) |
| | | | | | | Chrysophyta | 4 | Cyclotella (2), Melosira (1), Chrysococcus |
| Site L-1 | 8-24 | Euphotic zone composite | 9,500 | 2.8 | 13.8 | Cyanophyta | 79 | Anacystis (35), Lyngbya (19) Anabaena (17), Agmenellum (8), Dactylococcopsis |
| | | | | | | Chlorophyta | 16 | Crucigenia (5), Pediastrum (4), Chlamydomonas (3), Scenedesmus (2), Sphaerocystis (1), Kirchneriella, Micractinium, Dictyosphaerium, Ankistrodesmus |
| | | | | | | Chrysophyta | 3 | Melosira (3) |
| | | | | | | Euglenophyta | 2 | Trachelomonas (1), Euglena, Phacus |
| Site L-1 | 8-24 | 2-ft depth | 20,000 | 2.2 | 14.4 | Cyanophyta | 82 | Anacystis (51), Anabaena (24), Agmenellum (7) |
| | | | | | | Chlorophyta | 13 | Chlamydomonas (7) Crucigenia (2), Sphaerocystis (2), Ankistrodesmus, Chodatella, Kirchneriella, Scenedesmus, |
| | | | | | | Euglenophyta | 4 | Trachelomonas (4), Euglena, |
| | | | | | | Chrysophyta | 1 | Melosira (1) |

*Less than 1 percent not given.

Veto Lake at L-1 had developed a slight thermal gradient by May 9 and distinct thermal stratification by August 24. Oxygen deficits were found below 15 feet in May and below 8 feet in August; anaerobic conditions were found below 10 feet in August.

The thermal and chemical profiles at L-2 were similar to those at L-1. Oxygen deficits were found below 4 feet; anaerobic conditions were found below 10 feet.

The spring near-surface, total-phosphorus concentration was 0.05 mg/L. The spring total-nitrogen to total-phosphorus ratio was 11.6 to 1.

Veto Lake had Carlson TSIs of 57 for chlorophyll a (summer), 67 for Secchi-disk transparency (summer), and 65 for total phosphorus (spring). These TSIs are typical of eutrophic lakes.

The concentration of cadmium exceeded Ohio water-quality standards at the May samplings.

Green algae (Chlorophyta) and blue-green algae (Cyanophyta) dominated the spring algal community. The summer algal flora were dominated by blue-green algae. Growths of aquatic macrophytes were not excessive.

Inflow data (fig. 34, table 74): Two inflows were sampled: Tupper Creek (site I-1), the principal tributary, which drains 8.75 $mi^2$, and Plum Run (site I-2), which drains 2.11 $mi^2$. Their combined areas account for 54 percent of the drainage basin of Veto Lake. A qualitative comparison of stream versus lake data is shown below.

| Inflow sampling site | Sampling date (1978) | Estimated discharge ($ft^3/s$) | Water body (stream or lake at 2-foot depth) having higher concentration | | | |
|---|---|---|---|---|---|---|
| | | | $NO_2+NO_3$ | Total P | TOC | (Specific conductance) |
| Tupper Creek | May 9 | 20 | Stream | Stream | Stream | Lake |
| | Aug 24 | 1.0 | Stream | Lake | Lake | Stream |
| Plum Run | May 9 | 5.0 | Equal | Lake | Lake | Lake |
| | Aug 24 | 1.0 | Stream | Lake | Lake | Stream |

Table 74-Physical and chemical data for selected inflows, Veto Lake, Ohio

392151081390800 - TUPPER C AB VETO LK AT SITE I-1 OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1977 TO SEPTEMBER 1978

| DATE | TIME | STREAM-FLOW, INSTAN-TANEOUS (CFS) | TEMPER-ATURE (DEG C) | OXYGEN, DIS-SOLVED (MG/L) | PH (UNITS) | SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS) | TUR-BID-ITY (JTU) | COLOR (PLAT-INUM-COBALT UNITS) | CARBON, ORGANIC TOTAL (MG/L AS C) | NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N) | NITRO-GEN,AM-MONIA + ORGANIC TOTAL (MG/L AS N) | PHOS-PHORUS, TOTAL (MG/L AS P) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MAY | | | | | | | | | | | | |
| 09... | 1130 | E20 | 14.0 | 10.2 | 7.2 | 280 | 30 | 15 | 7.2 | .41 | .54 | .07 |
| AUG | | | | | | | | | | | | |
| 24... | 1320 | E1.0 | 24.0 | 9.2 | 7.9 | 790 | 10 | 15 | 2.8 | .01 | .65 | .04 |

392016081394100 - PLUM RUN AB VETO LK AT SITE I-2 OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1977 TO SEPTEMBER 1978

| DATE | TIME | STREAM-FLOW, INSTAN-TANEOUS (CFS) | TEMPER-ATURE (DEG C) | OXYGEN, DIS-SOLVED (MG/L) | PH (UNITS) | SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS) | TUR-BID-ITY (JTU) | COLOR (PLAT-INUM-COBALT UNITS) | CARBON, ORGANIC TOTAL (MG/L AS C) | NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N) | NITRO-GEN,AM-MONIA + ORGANIC TOTAL (MG/L AS N) | PHOS-PHORUS, TOTAL (MG/L AS P) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MAY | | | | | | | | | | | | |
| 09... | 1045 | E5.0 | 14.5 | 10.9 | 7.4 | 260 | 25 | 20 | 4.9 | .10 | .40 | .04 |
| AUG | | | | | | | | | | | | |
| 24... | 1340 | E1.0 | 22.3 | 5.6 | 7.5 | 630 | 4 | 15 | 3.5 | .03 | .41 | .02 |

## West Fork Mill Creek Lake

Location: Hamilton County
(Glendale 7.5-minute quadrangle map)

Type: Impoundment on West Fork Mill Creek

Use: Flood control, recreation

Physical characteristics at summer pool level (table 6).

| Date of origin (year) | Surface area (acres) | Capacity (acre-(feet) | Capacity-inflow ratio C/I) |
|---|---|---|---|
| 1952 | 183 | 1,531 | 0.08 |

Drainage-basin characteristics:

| Drainage area ($mi^2$) | Type | Estimated sediment yield (from fig. 3) |
|---|---|---|
| 30 | Urban | High |

Lake data (figs 36, 37; tables 75-78): West Fork Mill Creek Lake was sampled under partly cloudy skies on April 24. The lake was sampled on July 25 under cloudy skies; rain had occurred the previous day. Comparatively low Secchi-disk transparencies of 2.0 feet and 1.8 feet were noted in April and July, respectively. Water samples taken below 8 feet gave off a nauseating odor.

Profile and analytical data show the following characteristics:

| Date | Stratification (gradient) Thermal | Chemical | Chemical type | Trophic state index (Carlson) Chl a | SD | T.P. | Trophic class | Substances at or above State limits Toxicants | Bacteria | Phyto-plankton, dominant division(s) |
|---|---|---|---|---|---|---|---|---|---|---|
| 4-24-78 | Yes | Yes | Very hard; Na, Cl | -- | -- | 72 | Eutrophic | Pb | No | Cyanophyta |
| 7-25-78 | Yes | Yes | -- | 66 | 69 | -- | -- | -- | No | Cyanophyta |

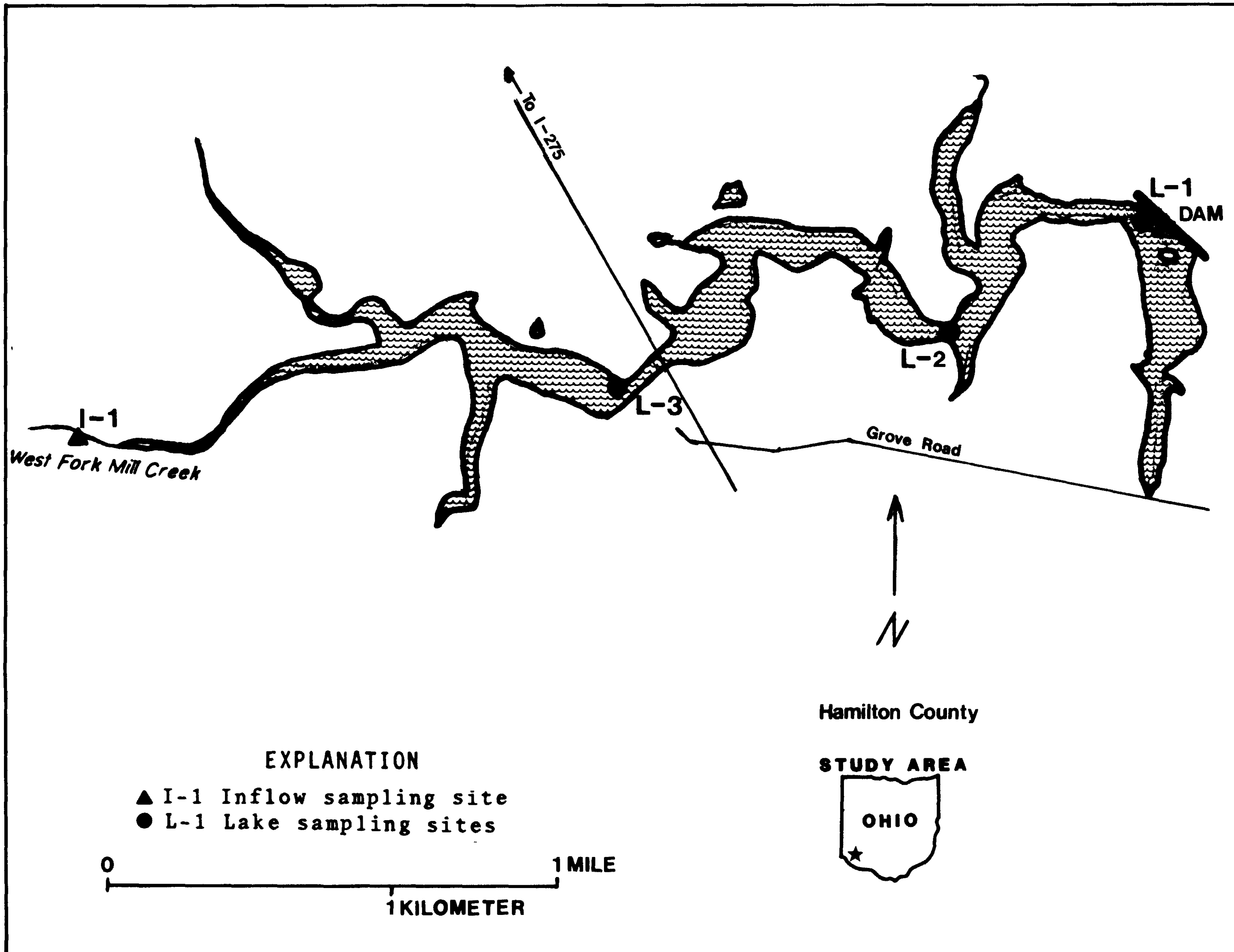



**Figure 36.--West Fork Mill Creek Lake and inflow sampling site.**

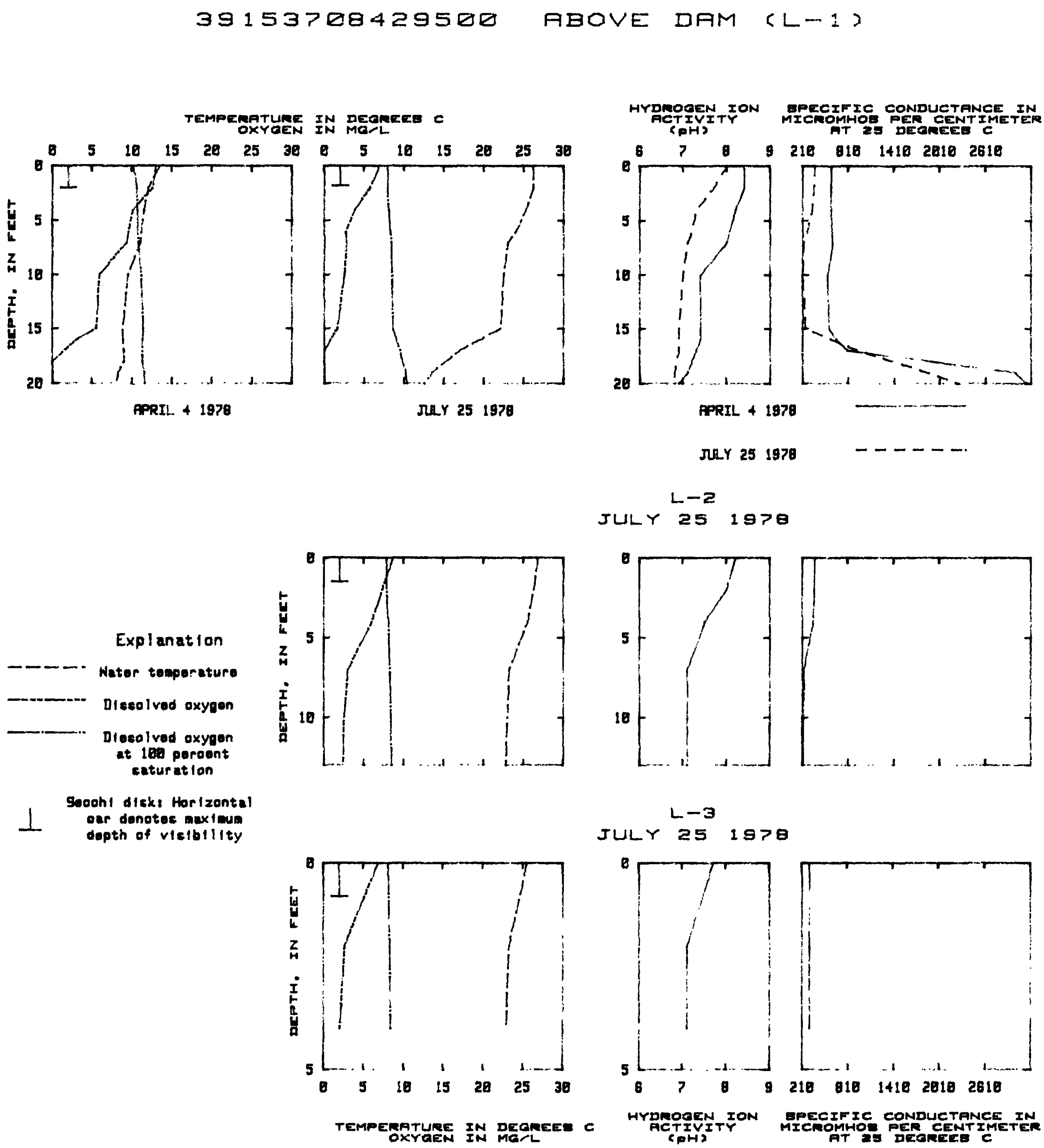



Figure 37.--Data profiles for West Fork Mill Creek Lake.

Table 75-Profile data for the primary lake site, West Fork Mill Creek, Ohio

391537084295000 - W F MILL C LK AT SITE L-1 NR CINCINNATI OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1977 TO SEPTEMBER 1978

| DATE | TIME | SAMP-LING DEPTH (FT) | TEMPER-ATURE (DEG C) | OXYGEN, DIS-SOLVED (MG/L) | OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION) | SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS) | PH (UNITS) | CAR-BONATE (MG/L AS CO3) | BICAR-BONATE (MG/L AS HCO3) | CARBON DIOXIDE DIS-SOLVED (MG/L AS CO2) | HYDRO-GEN SULFIDE DISS. (MG/L AS H2S) | TRANS-PAR-ENCY (SECCHI DISK) (IN) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| APR | | | | | | | | | | | | |
| 24... | 1520 | .0 | 13.5 | 13.0 | 127 | 583 | 8.4 | -- | -- | -- | -- | -- |
| 24... | 1525 | 2.0 | 12.0 | 12.6 | 119 | 580 | 8.4 | 2 | 164 | 1.1 | .0 | 24 |
| 24... | 1530 | 40 | 11.5 | 10.1 | 95 | 585 | 8.2 | -- | -- | -- | -- | -- |
| 24... | 1535 | 7.0 | 11.0 | 9.3 | 86 | 600 | 8.0 | -- | -- | -- | -- | -- |
| 24... | 1540 | 10 | 9.5 | 5.9 | 53 | 535 | 7.4 | -- | -- | -- | -- | -- |
| 24... | 1545 | 15 | 8.8 | 5.5 | 48 | 558 | 7.4 | -- | -- | -- | -- | -- |
| 24... | 1547 | 17 | 9.0 | 1.5 | 13 | 800 | 7.3 | -- | -- | -- | -- | -- |
| 24... | 1548 | 18 | 9.0 | .0 | 0 | 1900 | 7.2 | -- | -- | -- | -- | -- |
| 24... | 1550 | 19 | 8.2 | .0 | 0 | 3000 | 7.1 | 0 | 352 | 44 | 3.4 | -- |
| 24... | 1557 | 20 | 8.0 | .0 | 0 | 3150 | 6.9 | -- | -- | -- | -- | -- |
| JUL | | | | | | | | | | | | |
| 25... | 1440 | .0 | 26.2 | 6.9 | 87 | 365 | 8.0 | -- | -- | -- | -- | -- |
| 25... | 1445 | 2.0 | 26.2 | 5.7 | 72 | 360 | 7.7 | 0 | 118 | 3.8 | .0 | 22 |
| 25... | 1450 | 4.0 | 25.3 | 3.8 | 47 | 333 | 7.3 | -- | -- | -- | -- | -- |
| 25... | 1453 | 5.5 | 24.0 | 2.7 | 32 | 265 | 7.2 | -- | -- | -- | -- | -- |
| 25... | 1455 | 7.0 | 23.0 | 2.8 | 33 | 218 | 7.1 | -- | -- | -- | -- | -- |
| 25... | 1500 | 10 | 22.5 | 2.5 | 29 | 213 | 7.0 | -- | -- | -- | -- | -- |
| 25... | 1505 | 15 | 22.1 | 1.6 | 19 | 250 | 6.9 | -- | -- | -- | -- | -- |
| 25... | 1507 | 17 | 17.0 | .0 | 0 | 930 | 6.9 | -- | -- | -- | -- | -- |
| 25... | 1510 | 19 | 13.5 | .0 | 0 | 1850 | 6.8 | 0 | 444 | 112 | 2.4 | -- |
| 25... | 1515 | 20 | 12.5 | .0 | 0 | 2250 | 6.8 | -- | -- | -- | -- | -- |

Table 76-Chemical analyses of water column composite samples, West Fork Mill Creek, Ohio

391537084295000 - W F MILL C LK AT SITE L-1 NR CINCINNATI OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1977 TO SEPTEMBER 1978

| DATE | TIME | CALCIUM DIS-SOLVED (MG/L AS CA) | MAGNE-SIUM, DIS-SOLVED (MG/L AS MG) | POTAS-SIUM, DIS-SOLVED (MG/L AS K) | SODIUM, DIS-SOLVED (MG/L AS NA) | SULFATE DIS-SOLVED (MG/L AS SO4) | CHLO-RIDE, DIS-SOLVED (MG/L AS CL) | FLUO-RIDE, DIS-SOLVED (MG/L AS F) | HARD-NESS (MG/L AS CACO3) | SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L) |
|---|---|---|---|---|---|---|---|---|---|---|
| APR | | | | | | | | | | |
| 24... | 1525 | 56 | 13 | 2.4 | 40 | 54 | 68 | .2 | 190 | -- |
| 24... | 1540 | 71 | 15 | 2.7 | 190 | 48 | 300 | .2 | 240 | 799 |
| 24... | 1550 | 130 | 23 | 4.3 | 500 | 41 | 830 | .2 | 420 | -- |
| JUL | | | | | | | | | | |
| 25... | 1510 | -- | -- | -- | -- | -- | -- | -- | -- | -- |

| DATE | SOLIDS, RESIDUE AT 105 DEG. C, SUS-PENDED (MG/L) | SOLIDS, RESIDUE AT 105 DEG. C, TOTAL (MG/L) | BARIUM, TOTAL RECOV-ERABLE (UG/L AS BA) | CADMIUM TOTAL RECOV-ERABLE (UG/L AS CD) | CHRO-MIUM, TOTAL RECOV-ERABLE (UG/L AS CR) | LEAD, TOTAL RECOV-ERABLE (UG/L AS PB) | MERCURY TOTAL RECOV-ERABLE (UG/L AS HG) | NICKEL, TOTAL RECOV-ERABLE (UG/L AS NI) | SELE-NIUM, TOTAL (UG/L AS SE) | SILVER, TOTAL RECOV-ERABLE (UG/L AS AG) |
|---|---|---|---|---|---|---|---|---|---|---|
| APR | | | | | | | | | | |
| 24... | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 24... | 37 | 836 | 100 | 1 | <10 | 26 | <.5 | 4 | 0 | 0 |
| 24... | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| JUL | | | | | | | | | | |
| 25... | -- | -- | 200 | 1 | 10 | 260 | -- | -- | -- | 0 |

| DATE | ARSENIC TOTAL (UG/L AS AS) | METHY-LENE BLUE ACTIVE SUB-STANCE (MG/L) | BORON, TOTAL RECOV-ERABLE (UG/L AS B) | COBALT, TOTAL RECOV-ERABLE (UG/L AS CO) | COPPER, TOTAL RECOV-ERABLE (UG/L AS CU) | IRON, TOTAL RECOV-ERABLE (UG/L AS FE) | MANGA-NESE, TOTAL RECOV-ERABLE (UG/L AS MN) | MOLYB-DENUM, TOTAL RECOV-ERABLE (UG/L AS MO) | ZINC, TOTAL RECOV-ERABLE (UG/L AS ZN) |
|---|---|---|---|---|---|---|---|---|---|
| APR | | | | | | | | | |
| 24... | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 24... | <10 | .24 | 60 | 4 | 4 | 890 | 3200 | 3 | 20 |
| 24... | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| JUL | | | | | | | | | |
| 25... | -- | .22 | -- | -- | -- | -- | -- | -- | -- |

Table 77-Chemical, physical, and biological analyses of water samples from selected depths, West Fork Mill Creek, Ohio

391537084295000 - W F MILL C LK AT SITE L-1 NR CINCINNATI OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1977 TO SEPTEMBER 1978

| DATE | TIME | SAMPLING DEPTH (FT) | NITROGEN, NITRITE TOTAL (MG/L AS N) | NITROGEN, NITRATE TOTAL (MG/L AS N) | NITROGEN, NO2+NO3 TOTAL (MG/L AS N) | NITROGEN, AMMONIA TOTAL (MG/L AS N) | NITROGEN, ORGANIC TOTAL (MG/L AS N) | NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N) | PHOSPHORUS, ORTHO. TOTAL (MG/L AS P) |
|---|---|---|---|---|---|---|---|---|---|
| APR | | | | | | | | | |
| 24... | 1525 | 2.0 | .02 | .22 | .24 | .33 | .65 | .98 | .05 |
| 24... | 1550 | 19 | .01 | .00 | .01 | 7.5 | 1.9 | 9.5 | .15 |
| JUL | | | | | | | | | |
| 25... | 1445 | 2.0 | .01 | .03 | .04 | .04 | 1.4 | 1.4 | .04 |
| 25... | 1510 | 19 | .02 | .00 | .02 | 13 | 3.0 | 16 | 1.4 |

| DATE | PHOSPHORUS, TOTAL (MG/L AS P) | SILICA, DISSOLVED (MG/L AS SIO2) | TURBIDITY (JTU) | COLOR (PLATINUM-COBALT UNITS) | CARBON, ORGANIC TOTAL (MG/L AS C) | OXYGEN DEMAND, BIOCHEMICAL, 5 DAY (MG/L) | OXYGEN DEMAND, CHEMICAL (HIGH LEVEL) (MG/L) | COLIFORM, FECAL, 0.45 UM-MF (COLS./100 ML) | STREPTOCOCCI FECAL, (COLS. PER 100 ML) |
|---|---|---|---|---|---|---|---|---|---|
| APR | | | | | | | | | |
| 24... | .11 | 2.4 | 9 | 5 | 4.6 | 5.6 | 25 | 15 | 24 |
| 24... | .19 | 9.5 | 30 | 20 | 5.7 | 20 | 70 | 290 | 200 |
| JUL | | | | | | | | | |
| 25... | .16 | 4.4 | 20 | 10 | 7.2 | 3.5 | 40 | 900 | 240 |
| 25... | .95 | 12 | 60 | 40 | 3.7 | >26 | 110 | 1600 | 680 |

Table 78.--Phytoplankton identified in West Fork Mill Creek Lake, Ohio (1978)

| Sample description | | | Total cells (per ml ) | Diversity index (genus) $\bar{d}$ | Chlorophyll a (µg/L) | Division(s) present (in (order of dominance) | Percent of total cell count | Dominant taxa within division and percent (%)* of total cell count |
|---|---|---|---|---|---|---|---|---|
| Location | Date | Location in water column | | | | | | |
| Site L-1 above dam | 4-24 | Euphotic zone composite | 16,000 | 1.6 | 45.4 | Cyanophyta | 83 | *Oscillatoria* (71), *Lyngbya* (10), *Anacystis* (2) |
| | | | | | | Chrysophyta | 7 | *Cyclotella* (6), *Nitzschia*, *Synedra* |
| | | | | | | Euglenophyta | 7 | *Euglena* (6), *Trachelomonas*, |
| | | | | | | Chlorophyta | 4 | *Ankistrodesmus* (3), *Micractinium* (1), *Closteriopsis* |
| Site L-1 above dam | 7-25 | Euphotic zone composite | 160,000 | 0.5 | 37.6 | Cyanophyta | 96 | *Oscillatoria* (93), *Aphanizomenon* (3), |
| | | | | | | Chrysophyta | 3 | *Diatoma* (3), *Cyclotella*, *Nitzschia* |
| | | | | | | Chlorophyta | 1 | *Pediastrum*, *Oocystis*, *Schroederia*, *Chodatella*, *Closterium*, *Scenedesmus*, *Kirchneriella*, *Polyedriopsis* |
| | | | | | | Euglenophyta | | *Trachelomonas*, *Euglena* |
| Site L-1 above dam | 7-25 | 2-ft depth | 180,000 | 0.4 | 35.7 | Cyanophyta | 99 | *Oscillatoria* (94), *Anabaena* (3), *Aphanizomenon* (1), *Anacystis* (1) |
| | | | | | | Chlorophyta | 1 | *Scenedesmus*, *Oocystis*, *Chlamydomonas*, *Closterium*, *Ankistrodesmus*, *Schroederia* |
| | | | | | | Chrysophyta | | *Cyclotella* |

*Less than 1 percent not given.

West Fork Mill Creek Lake at L-1 had developed a thermal gradient by the April 24 sampling. Oxygen deficits were found below 4 feet. Anaerobic conditions existed below 18 feet.

Distinct thermal and chemical stratification was found on July 25. There were oxygen deficits in the entire water column. Anaerobic conditions were found below 17 feet. High specific conductance was found below 18 feet in the spring and summer.

Similar temperature profiles were found at L-2 and L-3. Oxygen deficits were found in the water column at these stations, but anaerobic conditions had not been reached.

The spring near-surface, total-phosphorus concentration was 0.11 mg/L. The spring total-nitrogen to total-phosphorus ratio, 10.9 to 1, indicates nitrogen is limiting algal productivity in West Fork Mill Creek Lake.

West Fork Mill Creek Lake had Carlson TSIs of 66 for chlorophyll *a* (summer), 69 for Secchi-disk transparency (summer), and 72 for total phosphorus (spring). These TSIs indicate a eutrophic lake.

The lead concentration exceeded Ohio water-quality standards at the April sampling. Several other constituents (boron, 60 μg/L; iron, 890 μg/L; manganese, 3,200 μg/L; and zinc, 20 μg/L) were found in high concentrations, although the concentrations did not exceed Ohio water-quality standards. Fecal coliform and fecal streptococcus cell counts in West Fork Mill Creek Lake were the highest of all lakes sampled in 1978. The high chemical and biological values are associated with combined sewer overflows and overloaded and deteriorated sanitary sewers in the basin. Improvements that should alleviate the problems are underway or planned.

Filamentous blue-green algae (Cyanophyta), chiefly *Oscillatoria*, dominated the algal community in the spring and summer. Growths of aquatic macrophytes were not excessive.

Inflow data (fig. 36; table 79): West Fork Mill Creek, the principal tributary to West Fork Mill Creek Lake, was sampled at site I-1. Drainage area at the site is 12.0 $mi^2$, which is 41 percent of the lake's drainage basin. A qualitative comparison of stream versus lake data is shown below.

| Inflow sampling site | Sampling date (1978) | Estimated discharge ($ft^3/s$) | Water body (stream or lake at 2-foot depth) having higher concentration | | | |
|---|---|---|---|---|---|---|
| | | | $NO_2$+ $NO_3$ | Total P | TOC | (Specific conductance) |
| West Fork Mill Creek at Site L-1 | Apr 24 | 8.0 | Stream | Stream | Stream | Lake |
| | Jul 25 | 8.0 | Stream | Stream | Lake | Stream |

Table 79-Physical and chemical data for selected inflows, West Fork Mill Creek, Ohio

391514084323000 - W F MILL C AB W F MILL C LK AT SITE I-1 OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1977 TO SEPTEMBER 1978

| DATE | TIME | STREAM-FLOW, INSTAN-TANEOUS (CFS) | TEMPER-ATURE (DEG C) | OXYGEN, DIS-SOLVED (MG/L) | PH (UNITS) | SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS) | TUR-BID-ITY (JTU) | COLOR (PLAT-INUM-COBALT UNITS) | CARBON, ORGANIC TOTAL (MG/L AS C) | NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N) | NITRO-GEN,AM-MONIA + ORGANIC TOTAL (MG/L AS N) | PHOS-PHORUS, TOTAL (MG/L AS P) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| APR | | | | | | | | | | | | |
| 24... | 1345 | E8.0 | 13.5 | 9.2 | 8.3 | 570 | 20 | 25 | 9.2 | .76 | .59 | .15 |
| JUL | | | | | | | | | | | | |
| 25... | 1315 | E8.0 | 22.5 | 7.1 | 7.6 | 515 | 35 | 30 | 4.8 | .90 | 1.2 | .44 |

## SUMMARIES OF CHEMICAL AND BIOLOGICAL DATA FOR LAKES SAMPLED IN 1979

### William H. Harsha (East Fork) Lake

Location: Clermont County
(Batavia 7.5-minute quadrangle map)

Type: Impoundment on the East Fork Little Miami River

Use: Flood control, recreation, and water supply.

Physical characteristics at summer pool level (table 6):

| Date of origin (year) | Surface area (acres) | Capacity (acre-feet) | Capacity-inflow ratio (C/I) |
|---|---|---|---|
| 1978 | 2,160 | 90,400 | 0.34 |

Drainage-basin characteristics:

| Drainage area ($mi^2$) | Type | Estimated sediment yield (from fig. 3) |
|---|---|---|
| 342 | Agricultural, rural | Moderately high |

Lake data (figs. 38, 39; tables 80-83): William H. Harsha Lake (formerly, East Fork Lake) is one of the deepest lakes in Ohio; its maximum normal pool depth exceeds 110 feet. William H. Harsha Lake was sampled under cloudy skies with slight breezes on June 1 and August 21.

Profile and analytical data show the following lake characteristics:

| Date | Stratification (gradient) | | Chemical type | Trophic state index (Carlson) | | | Trophic class | Substances at or above State limits | | Phyto-plankton, dominant division(s) |
|---|---|---|---|---|---|---|---|---|---|---|
| | Thermal | Chemical | | Chl a | SD | T.P. | | Toxicants | Bacteria | |
| 6-01-79 | Yes | Yes | Moderately hard; Ca, $HCO_3$ | -- | -- | 67 | Eutrophic | Cd | No | Chlorophyta |
| 8-21-79 | Yes | Yes | -- | 68 | 58 | -- | -- | -- | No | Cyanophyta |

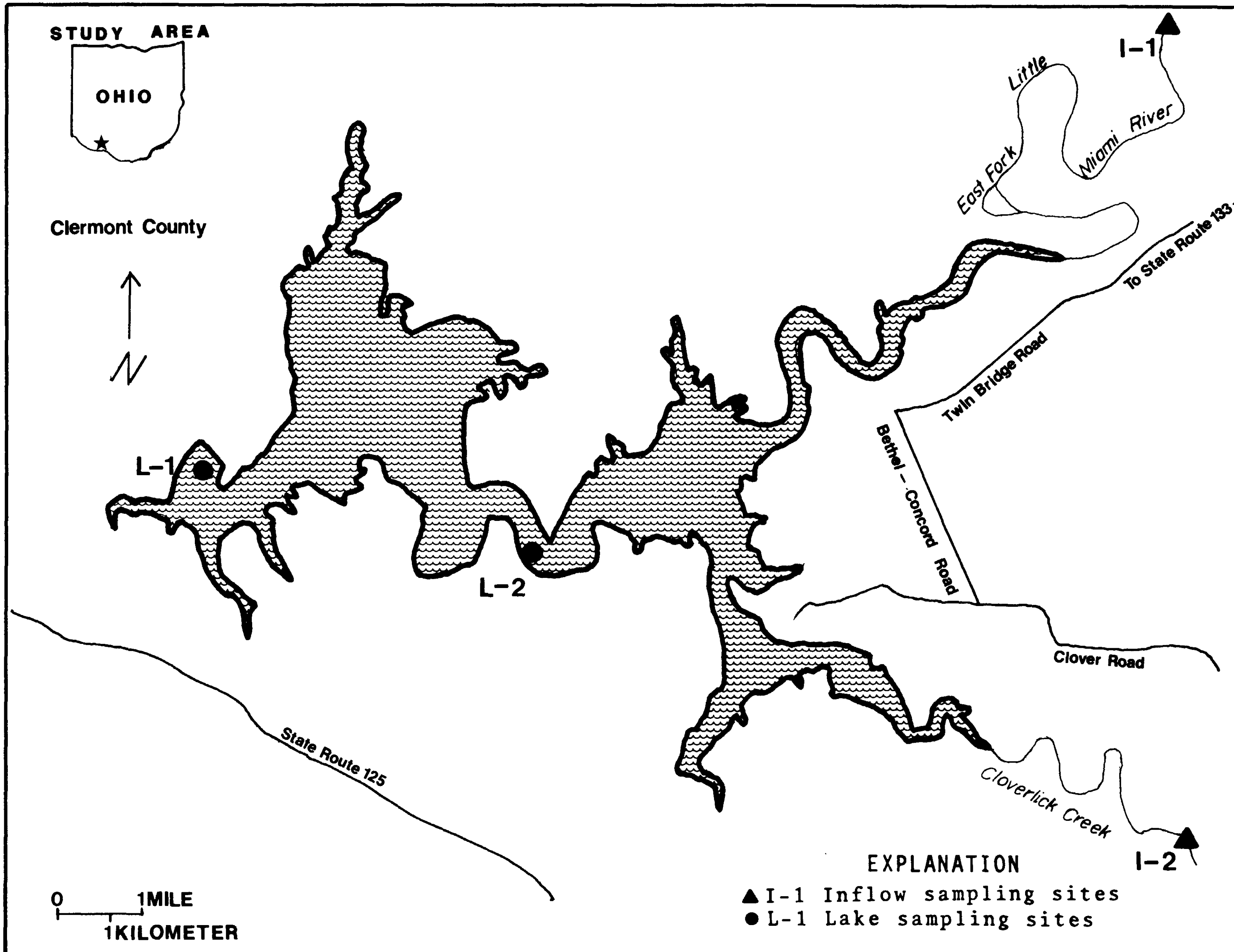



Figure 38.--William H. Harsha (East Fork) Lake and inflow sampling sites.

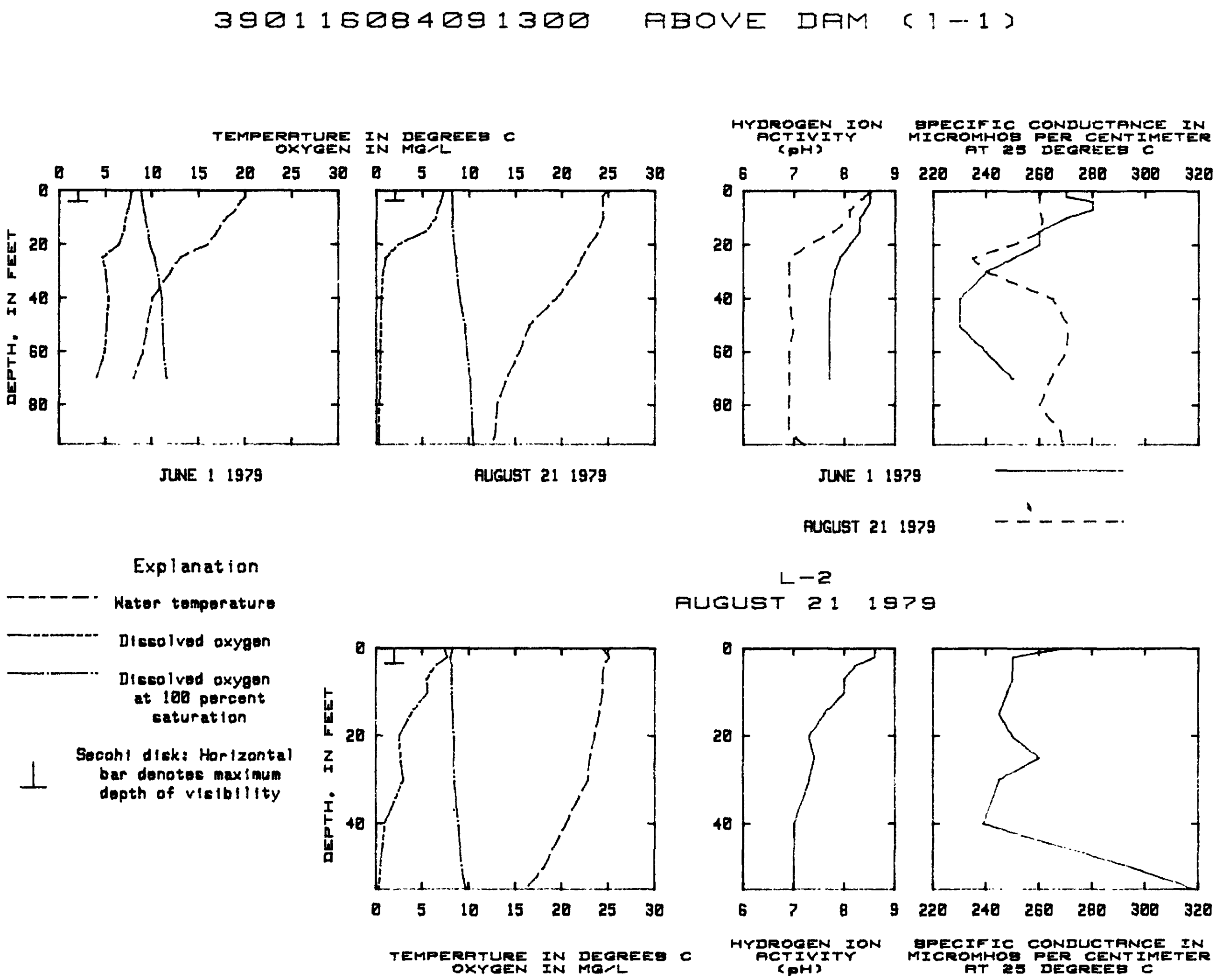



Figure 39.--Data profiles for William H. Harsha (East Fork) Lake.

Table 80.--Profile data for the primary lake site, William H. Harsha (East Fork) Lake, Ohio

390116084091300 - EAST FORK LAKE AB DAM (L-1) NR BETHEL OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

| DATE | TIME | SAMPLING DEPTH (FT) | TEMPERATURE (DEG C) | OXYGEN, DISSOLVED (MG/L) | OXYGEN, DISSOLVED (PERCENT SATURATION) | SPECIFIC CONDUCTANCE (MICROMHOS) | PH (UNITS) | CARBONATE (MG/L AS CO3) | BICARBONATE (MG/L AS HCO3) | CARBON DIOXIDE DISSOLVED (MG/L AS CO2) | HYDROGEN SULFIDE TOTAL (MG/L AS H2S) | TRANSPARENCY (SECCHI DISK) (IN) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| JUN | | | | | | | | | | | | |
| 01... | 1100 | .0 | 20.0 | 7.8 | 88 | 270 | 8.5 | -- | -- | -- | -- | -- |
| 01... | 1105 | 2.0 | 20.0 | 7.7 | 87 | 270 | 8.5 | 7 | 196 | 1.0 | .0 | 49 |
| 01... | 1110 | 4.0 | 19.5 | 7.6 | 84 | 280 | 8.5 | -- | -- | -- | -- | -- |
| 01... | 1115 | 7.0 | 19.0 | 7.4 | 81 | 280 | 8.4 | -- | -- | -- | -- | -- |
| 01... | 1120 | 10 | 18.0 | 7.2 | 76 | 270 | 8.3 | -- | -- | -- | -- | -- |
| 01... | 1125 | 15 | 17.0 | 7.0 | 73 | 260 | 8.3 | -- | -- | -- | -- | -- |
| 01... | 1130 | 20 | 16.0 | 6.4 | 65 | 260 | 8.1 | -- | -- | -- | -- | -- |
| 01... | 1135 | 25 | 13.0 | 4.7 | 46 | 250 | 7.9 | -- | -- | -- | -- | -- |
| 01... | 1140 | 30 | 12.0 | 5.0 | 47 | 240 | 7.8 | -- | -- | -- | -- | -- |
| 01... | 1145 | 40 | 10.0 | 5.3 | 48 | 230 | 7.7 | -- | -- | -- | -- | -- |
| 01... | 1150 | 50 | 9.5 | 5.1 | 46 | 230 | 7.7 | -- | -- | -- | -- | -- |
| 01... | 1155 | 60 | 9.0 | 4.9 | 43 | 240 | 7.7 | -- | -- | -- | -- | -- |
| 01... | 1200 | 70 | 8.0 | 4.0 | 34 | 250 | 7.7 | 0 | 256 | 8.2 | .2 | -- |
| AUG | | | | | | | | | | | | |
| 21... | 1200 | .0 | 24.8 | 7.2 | 89 | 261 | 8.5 | -- | -- | -- | -- | -- |
| 21... | 1205 | 2.0 | 24.4 | 7.1 | 87 | 260 | 8.4 | 2 | 60 | .4 | .0 | 44 |
| 21... | 1210 | 4.0 | 24.4 | 6.9 | 84 | 260 | 8.3 | -- | -- | -- | -- | -- |
| 21... | 1215 | 7.0 | 24.4 | 6.6 | 80 | 260 | 8.1 | -- | -- | -- | -- | -- |
| 21... | 1220 | 10 | 24.4 | 6.4 | 78 | 261 | 8.1 | -- | -- | -- | -- | -- |
| 21... | 1225 | 15 | 24.0 | 5.5 | 66 | 261 | 7.8 | -- | -- | -- | -- | -- |
| 21... | 1230 | 20 | 23.0 | 2.4 | 29 | 250 | 7.3 | -- | -- | -- | -- | -- |
| 21... | 1235 | 25 | 22.1 | 1.0 | 12 | 235 | 6.9 | -- | -- | -- | -- | -- |
| 21... | 1240 | 30 | 21.5 | .7 | 8 | 240 | 6.9 | -- | -- | -- | -- | -- |
| 21... | 1245 | 40 | 19.4 | .5 | 6 | 265 | 6.9 | -- | -- | -- | -- | -- |
| 21... | 1250 | 50 | 16.5 | .5 | 5 | 271 | 7.0 | -- | -- | -- | -- | -- |
| 21... | 1255 | 60 | 15.4 | .4 | 4 | 270 | 6.9 | -- | -- | -- | -- | -- |
| 21... | 1300 | 70 | 14.0 | .4 | 4 | 264 | 6.9 | -- | -- | -- | -- | -- |
| 21... | 1305 | 80 | 13.0 | .3 | 3 | 260 | 6.9 | -- | -- | -- | -- | -- |
| 21... | 1310 | 90 | 12.8 | .3 | 3 | 268 | 6.9 | -- | -- | -- | -- | -- |
| 21... | 1315 | 95 | 12.5 | .3 | 3 | 269 | 7.2 | 0 | 122 | 12 | .3 | -- |

Table 81.--Chemical analyses of water column composite samples, William H. Harsha (East Fork) Lake, Ohio

390116084091300 - EAST FORK LAKE AB DAM (L-1) NR BETHEL OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

| DATE | TIME | CALCIUM DIS-SOLVED (MG/L AS CA) | MAGNE-SIUM, DIS-SOLVED (MG/L AS MG) | POTAS-SIUM, DIS-SOLVED (MG/L AS K) | SODIUM, DIS-SOLVED (MG/L AS NA) | SULFATE DIS-SOLVED (MG/L AS SO4) | CHLO-RIDE, DIS-SOLVED (MG/L AS CL) | FLUO-RIDE, DIS-SOLVED (MG/L AS F) | HARD-NESS (MG/L AS CACO3) | SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L) |
|---|---|---|---|---|---|---|---|---|---|---|
| JUN 01... | 1200 | 31 | 8.7 | 2.8 | 6.3 | 30 | 12 | .1 | 110 | 162 |

| DATE | SOLIDS, RESIDUE AT 105 DEG. C, SUS-PENDED (MG/L) | SOLIDS, RESIDUE AT 105 DEG. C, TOTAL (MG/L) | BARIUM, TOTAL RECOV-ERABLE (UG/L AS BA) | CADMIUM TOTAL RECOV-ERABLE (UG/L AS CD) | CHRO-MIUM, TOTAL RECOV-ERABLE (UG/L AS CR) | LEAD, TOTAL RECOV-ERABLE (UG/L AS PB) | MERCURY TOTAL RECOV-ERABLE (UG/L AS HG) | NICKEL, TOTAL RECOV-ERABLE (UG/L AS NI) | SELE-NIUM, TOTAL (UG/L AS SE) | SILVER, TOTAL RECOV-ERABLE (UG/L AS AG) |
|---|---|---|---|---|---|---|---|---|---|---|
| JUN 01... | 52 | 214 | 0 | 2 | 30 | 0 | <.5 | 9 | 0 | 0 |

| DATE | ARSENIC TOTAL (UG/L AS AS) | METHY-LENE BLUE ACTIVE SUB-STANCE (MG/L) | BORON, TOTAL RECOV-ERABLE (UG/L AS B) | COBALT, TOTAL RECOV-ERABLE (UG/L AS CO) | COPPER, TOTAL RECOV-ERABLE (UG/L AS CU) | IRON, TOTAL RECOV-ERABLE (UG/L AS FE) | MANGA-NESE, TOTAL RECOV-ERABLE (UG/L AS MN) | MOLYB-DENUM, TOTAL RECOV-ERABLE (UG/L AS MO) | ZINC, TOTAL RECOV-ERABLE (UG/L AS ZN) |
|---|---|---|---|---|---|---|---|---|---|
| JUN 01... | <10 | <.05 | 20 | 2 | 5 | 550 | 50 | 2 | 20 |

Table 82. Chemical, physical, and biological analyses of water samples from selected depths, William H. Harsha (East Fork) Lake, Ohio

390116084091300 - EAST FORK LAKE AB DAM (L-1) NR BETHEL OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

| DATE | TIME | SAMPLING DEPTH (FT) | NITROGEN, NITRITE TOTAL (MG/L AS N) | NITROGEN, NITRATE TOTAL (MG/L AS N) | NITROGEN, NO2+NO3 TOTAL (MG/L AS N) | NITROGEN, AMMONIA TOTAL (MG/L AS N) | NITROGEN, ORGANIC TOTAL (MG/L AS N) | NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N) | PHOSPHORUS, ORTHO. TOTAL (MG/L AS P) |
|---|---|---|---|---|---|---|---|---|---|
| JUN | | | | | | | | | |
| 01... | 1105 | 2.0 | .03 | .94 | .97 | .08 | .59 | .67 | .00 |
| 01... | 1200 | 70 | .01 | 1.4 | 1.4 | .01 | .44 | .45 | .03 |
| AUG | | | | | | | | | |
| 21... | 1205 | 2.0 | .05 | 1.4 | 1.4 | .07 | .84 | .91 | .01 |
| 21... | 1315 | 95 | .01 | .37 | .38 | 1.0 | .20 | 1.2 | .07 |

| DATE | PHOSPHORUS, TOTAL (MG/L AS P) | SILICA, DISSOLVED (MG/L AS SIO2) | TURBIDITY (JTU) | COLOR (PLATINUM-COBALT UNITS) | CARBON, ORGANIC TOTAL (MG/L AS C) | OXYGEN DEMAND, BIOCHEMICAL, 5 DAY (MG/L) | OXYGEN DEMAND, CHEMICAL (HIGH LEVEL) (MG/L) | COLIFORM, FECAL, 0.45 UM-MF (COLS./100 ML) | STREPTOCOCCI FECAL, (COLS. PER 100 ML) |
|---|---|---|---|---|---|---|---|---|---|
| JUN | | | | | | | | | |
| 01... | .08 | 2.5 | 4 | 5 | 7.6 | 1.1 | 44 | 4 | 22 |
| 01... | .10 | 4.1 | 7 | 15 | 7.1 | .5 | 44 | 4 | 10 |
| AUG | | | | | | | | | |
| 21... | .04 | 2.8 | 3 | 5 | 7.7 | 2.5 | 27 | 0 | 0 |
| 21... | .21 | 5.1 | 20 | 25 | 6.5 | 1.2 | 27 | 50 | 20 |

Table 83.--Phytoplankton identified in William H. Harsha (East Fork) Lake, Ohio (1979)

| Sample description | | | Total cells (per ml) | Diversity index (genus) $\bar{d}$ | Chlorophyll a (µg/L) | Division(s) present (in order of dominance) | Percent of total cell count | Dominant taxa within phylum and percent (%)* of total cell count |
|---|---|---|---|---|---|---|---|---|
| Location | Date | Location in water column | | | | | | |
| Site L-1 above dam | 6-01 | Euphotic zone composite | 1,400 | 2.2 | 5.7 | Chlorophyta | 98 | Coelastrum (37), Schroederia (27), Sphaerocystis (22), Scenedesmus (7) Oocystis (4), Tetraedron (1) |
| | | | | | | Cryptophyta | 13 | Cryptomonas (13) |
| | | | | | | Euglenophyta | 13 | Trachelomonas (13) |
| Site L-1 above dam | 6-01 | 2-ft depth | 2,500 | 1.7 | 8.5 | Chlorophyta | 100 | Schroederia (51), Sphaerocystis (31) Scenedesmus (12), Elaktothrix (3), Ankistrodesmus (2), Chlamydomonas (2) |
| Site L-1 Above dam | 8-21 | Euphotic zone composite | 9,900 | 1.0 | 21.1 | Cyanophyta | 100 | Oscillatoria (51), Anabaena (49) |
| Site L-1 | 8-21 | 0-ft depth | 26,000 | 1.6 | 38.1 | Cyanophyta | 90 | Anabaena (57), Oscillatoria (29), Anacystis (4) |
| | | | | | | Chrysophyta | 9 | Melosira (8), Asterionella (1) Synedra |
| | | | | | | Chlorophyta | 1 | Scenedesmus (1), Chlamydomonas |
| Site L-1 | 8-21 | 2-ft depth | | | 47.0 | | | |

*Less than 1 percent not given.

Equipment limitations restricted sampling to the top 75 feet in June. The lake was sampled to 95 feet in August. Both sampling dates were preceded by heavy rains. Secchi-disk measurements at the primary station (L-1) were 4.1 feet in June and 3.7 feet in August.

William H. Harsha Lake at L-1 had developed distinct thermal stratification by the June 1 sampling. Thermal stratification was also found in August. Oxygen defecits were noted at all levels on both dates, although anaerobic conditions were not found. The spring near-surface, total-phosphorus concentration was 0.08 mg/L. The spring total-nitrogen to total-phosphorus ratio, 20 to 1, indicates phosphorus may be limiting algal productivity in William H. Harsha Lake.

William H. Harsha Lake had Carlson TSIs values of 68 for chlorophyll *a* (summer), 58 for Secchi-disk transparency (summer), and 67 for total phosphorus (spring). The lake was classified as eutrophic.

The cadmium concentration exceeded Ohio water-quality standards. Traces of hydrogen sulfide were found in the hypolimnion in both spring and summer.

Algal community successional changes were typical of temperate zone lakes; green algae (Chlorophyta) dominated the spring algal community, whereas blue-green algae (Cyanophyta) dominated in the summer.

Inflow data (fig. 38, table 84): East Fork Little Miami River, which drains 237 $mi^2$, and Cloverlick Creek, which drains 58.6 $mi^2$, were sampled at sites I-1 and I-2, respectively. Their combined areas represent 86 percent of the lake's drainage basin. A qualitative comparison of stream versus lake data is shown below.

| Inflow sampling site | Sampling date (1979) | Estimated discharge ($ft^3/s$) | Water body (stream or lake at 2-foot depth) having higher concentration | | | |
|---|---|---|---|---|---|---|
| | | | $NO_2$+ $NO_3$ | Total P | TOC | (Specific conductance) |
| East Fork Little Miami River at site I-1 | June 1 | 100 | Stream | Stream | Stream | Stream |
| | Aug 21 | 175 | Lake | Stream | Stream | Lake |
| Cloverlick Creek at site I-2 | June 1 | 20 | Stream | Stream | Stream | Stream |
| | Aug 21 | 15 | Lake | Stream | Stream | Lake |

Table 84.--Physical and chemical data for selected inflows, William H. Harsha (East Fork) Lake, Ohio

390332084030501 - E F L MIAMI R (I-1) AT WILLIAMSBURG OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

| DATE | TIME | STREAM-FLOW, INSTAN-TANEOUS (CFS) | TEMPER-ATURE (DEG C) | OXYGEN, DIS-SOLVED (MG/L) | PH (UNITS) | SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS) | TUR-BID-ITY (JTU) | COLOR (PLAT-INUM-COBALT UNITS) | CARBON, ORGANIC TOTAL (MG/L AS C) | NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N) | NITRO-GEN,AM-MONIA + ORGANIC TOTAL (MG/L AS N) | PHOS-PHORUS, TOTAL (MG/L AS P) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| JUN 01... | 0920 | 100 | 19.5 | 7.8 | 7.9 | 460 | 20 | 40 | 12 | 9.8 | 1.5 | .39 |
| AUG 21... | 1000 | 175 | 22.5 | 7.4 | 8.1 | 190 | 190 | 35 | 11 | .46 | 1.3 | .38 |

385908084031000 - CLOVERLICK C AB EAST FORK LK (I-2) NR BETHEL OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

| DATE | TIME | STREAM-FLOW, INSTAN-TANEOUS (CFS) | TEMPER-ATURE (DEG C) | OXYGEN, DIS-SOLVED (MG/L) | PH (UNITS) | SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS) | TUR-BID-ITY (JTU) | COLOR (PLAT-INUM-COBALT UNITS) | CARBON, ORGANIC TOTAL (MG/L AS C) | NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N) | NITRO-GEN,AM-MONIA + ORGANIC TOTAL (MG/L AS N) | PHOS-PHORUS, TOTAL (MG/L AS P) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| JUN 01... | 0945 | 20 | 19.5 | 7.9 | 7.7 | 480 | 45 | 30 | 13 | 13 | 2.3 | .23 |
| AUG 21... | 1030 | 15 | 22.2 | 8.1 | 7.8 | 165 | 8 | 50 | 14 | .22 | .81 | .19 |

## Findlay City Reservoir

Location: Hancock County
(Arcadia 7.5-minute quadrangle map)

Type: Upground (pumped-storage reservoir)

Use: Recreation, and water supply.

Physical characteristics at summer pool level (table 6):

| Date of origin (year) | Surface area (acres) | Capacity (acre-feet) | Capacity-inflow ratio (C/I) |
|---|---|---|---|
| 1971 | 886 | 16,368 | -- |

Lake data (figs. 40-41; tables 85-88): Findlay City Reservoir was sampled under sunny and windy conditions on June 27, and under calm, cloudy conditions on August 31. Very turbid water was being pumped into the reservoir during the August sampling. Secchi-disk transparencies at the primary sampling station (L-1) were 11 feet in June and 4.8 feet in August.

Profile and analytical data show the following lake characteristics:

| Date | Stratification (gradient) | | Chemical type | Trophic state index (Carlson) | | | Trophic class | Substances at or above State limits | | Phyto-plankton, dominant division(s) |
|---|---|---|---|---|---|---|---|---|---|---|
| | Thermal | Chemical | | Chl a | SD | T.P. | | Toxicants | Bacteria | |
| 6-27-79 | Yes | Yes | Very hard; Ca, $HCO_3$ | -- | -- | 37 | Eutrophic | Ni | No | Cyanophyta |
| 8-31-79 | Slight | Yes | -- | 59 | 55 | -- | -- | -- | No | Cyanophyta |

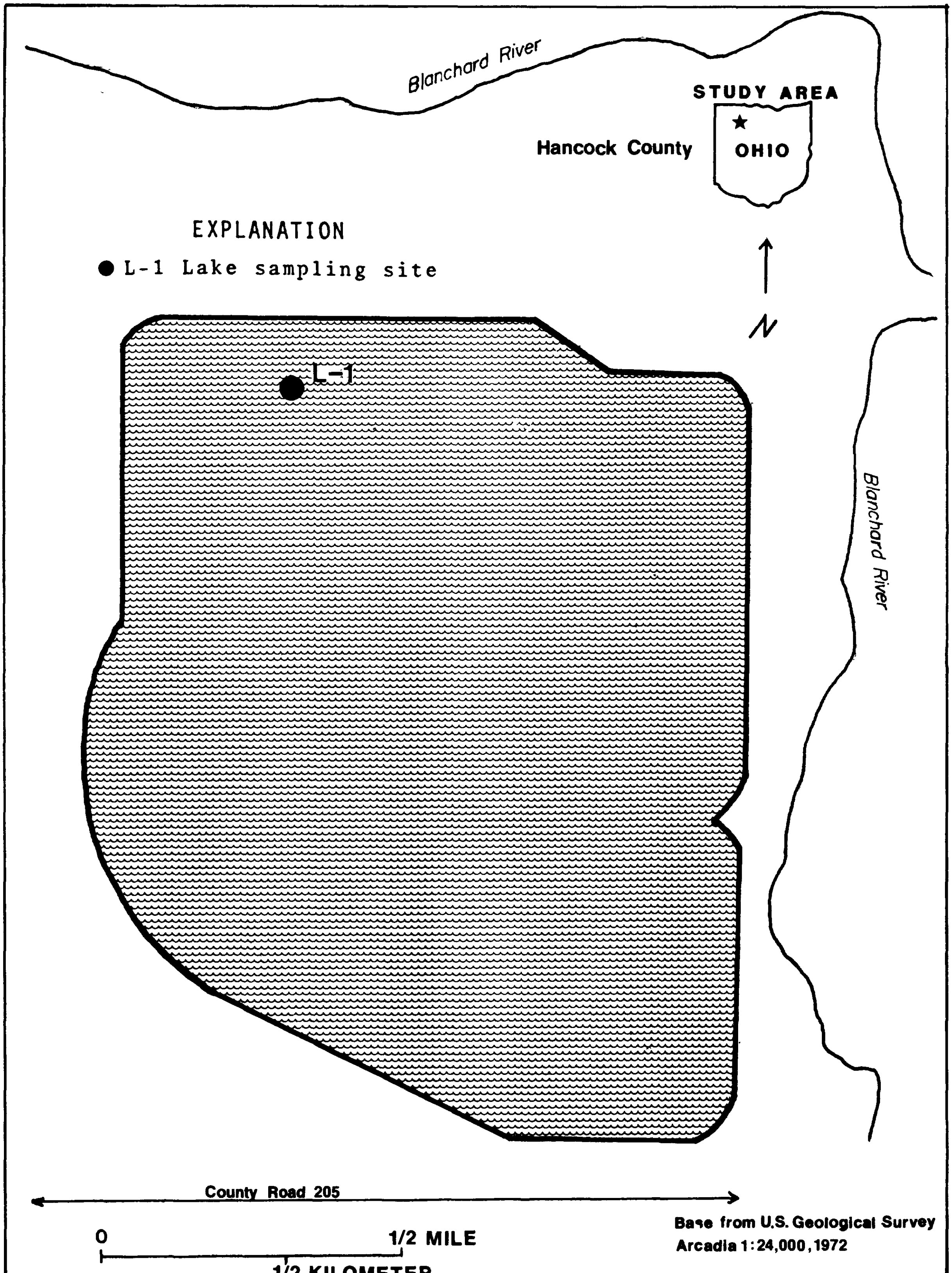



**Figure 40.--Findlay City Reservoir sampling site.**

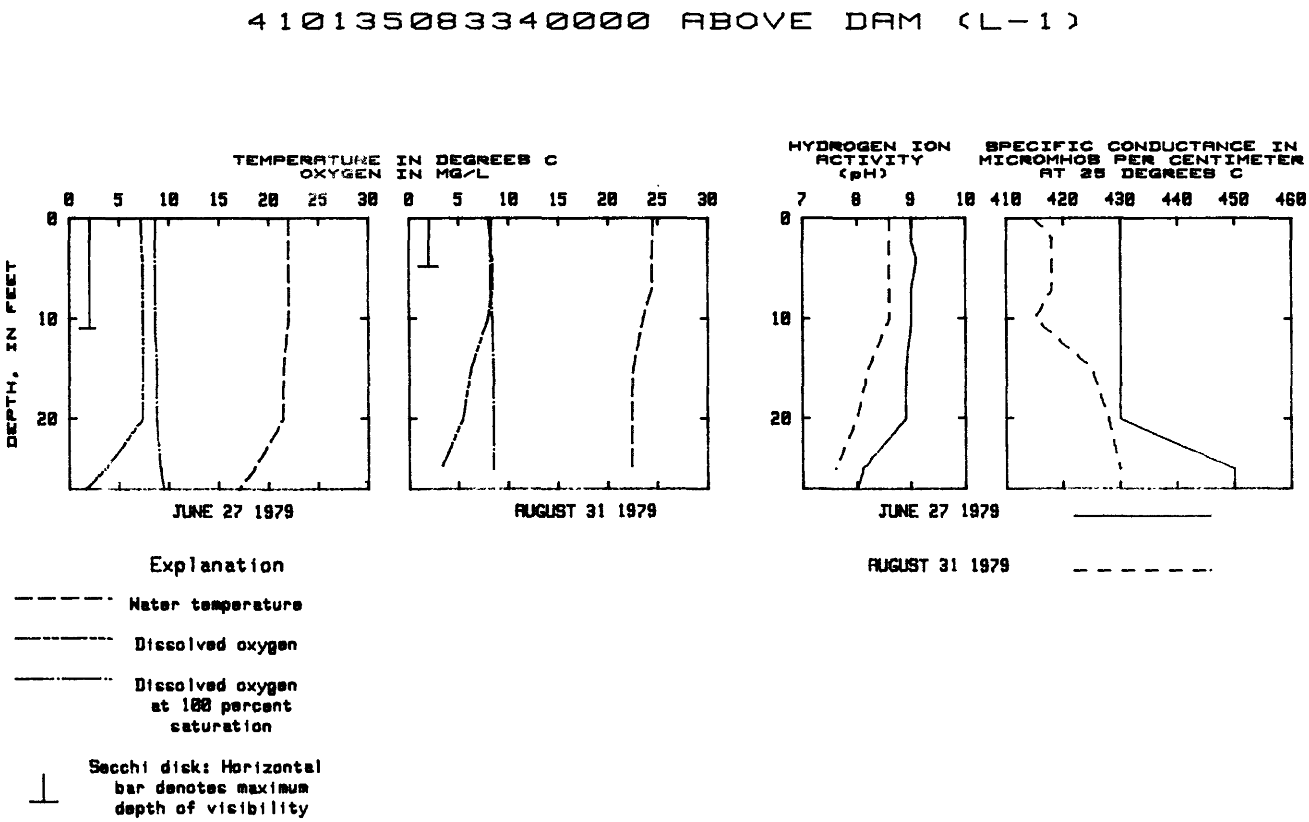



Figure 41.--Data profiles for Findlay City Reservoir.

Table 85.--Profile data for the primary lake site, Findlay City Reservoir, Ohio

410135083340000 - FINDLAY CITY RE N SIDE (L-1) NR FINDLAY OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

| DATE | TIME | SAMPLING DEPTH (FT) | TEMPERATURE (DEG C) | OXYGEN, DISSOLVED (MG/L) | OXYGEN, DISSOLVED (PERCENT SATURATION) | SPECIFIC CONDUCTANCE (MICROMHOS) | PH (UNITS) | CARBONATE (MG/L AS CO3) | BICARBONATE (MG/L AS HCO3) | CARBON DIOXIDE DISSOLVED (MG/L AS CO2) | HYDROGEN SULFIDE TOTAL (MG/L AS H2S) | TRANSPARENCY (SECCHI DISK) (IN) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| JUN | | | | | | | | | | | | |
| 27... | 1100 | .0 | 22.0 | 7.2 | 84 | 430 | 9.0 | -- | -- | -- | -- | -- |
| 27... | 1105 | 2.0 | 22.0 | 7.3 | 85 | 430 | 9.0 | 4 | 138 | .3 | .0 | 132 |
| 27... | 1110 | 4.0 | 22.0 | 7.4 | 86 | 430 | 9.1 | -- | -- | -- | -- | -- |
| 27... | 1115 | 7.0 | 22.0 | 7.4 | 86 | 430 | 9.0 | -- | -- | -- | -- | -- |
| 27... | 1120 | 10 | 22.0 | 7.4 | 86 | 430 | 9.0 | -- | -- | -- | -- | -- |
| 27... | 1125 | 15 | 21.5 | 7.4 | 84 | 430 | 8.9 | -- | -- | -- | -- | -- |
| 27... | 1130 | 20 | 21.5 | 7.4 | 84 | 430 | 8.9 | -- | -- | -- | -- | -- |
| 27... | 1135 | 25 | 18.5 | 3.6 | 39 | 450 | 8.1 | -- | -- | -- | -- | -- |
| 27... | 1140 | 27 | 17.0 | 1.6 | 17 | 450 | 8.0 | 0 | 178 | 1.8 | .0 | -- |
| AUG | | | | | | | | | | | | |
| 31... | 1100 | .0 | 24.5 | 8.0 | 98 | 415 | 8.6 | -- | -- | -- | -- | -- |
| 31... | 1105 | 2.0 | 24.5 | 8.2 | 100 | 418 | 8.6 | 8 | 164 | .7 | .0 | 58 |
| 31... | 1110 | 4.0 | 24.4 | 8.4 | 102 | 418 | 8.6 | -- | -- | -- | -- | -- |
| 31... | 1115 | 7.0 | 24.4 | 8.4 | 102 | 418 | 8.6 | -- | -- | -- | -- | -- |
| 31... | 1120 | 10 | 23.5 | 7.9 | 94 | 415 | 8.6 | -- | -- | -- | -- | -- |
| 31... | 1125 | 15 | 22.5 | 6.2 | 73 | 425 | 8.2 | -- | -- | -- | -- | -- |
| 31... | 1130 | 20 | 22.4 | 5.4 | 64 | 428 | 8.0 | -- | -- | -- | -- | -- |
| 31... | 1135 | 25 | 22.4 | 3.2 | 38 | 430 | 7.6 | 0 | 144 | 5.8 | .0 | -- |

Table 86.--Chemical analyses of water column composite samples, Findlay City Reservoir, Ohio

410135083340000 - FINDLAY CITY RE N SIDE (L-1) NR FINDLAY OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

| DATE | TIME | CALCIUM DIS-SOLVED (MG/L AS CA) | MAGNE-SIUM, DIS-SOLVED (MG/L AS MG) | POTAS-SIUM, DIS-SOLVED (MG/L AS K) | SODIUM, DIS-SOLVED (MG/L AS NA) | SULFATE DIS-SOLVED (MG/L AS SO4) | CHLO-RIDE, DIS-SOLVED (MG/L AS CL) | FLUO-RIDE, DIS-SOLVED (MG/L AS F) | HARD-NESS (MG/L AS CACO3) | SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L) |
|---|---|---|---|---|---|---|---|---|---|---|
| JUN 27... | 1140 | 54 | 18 | 3.0 | 7.8 | 78 | 22 | .2 | 210 | 310 |

| DATE | SOLIDS, RESIDUE AT 105 DEG. C, SUS-PENDED (MG/L) | SOLIDS, RESIDUE AT 105 DEG. C, TOTAL (MG/L) | BARIUM, TOTAL RECOV-ERABLE (UG/L AS BA) | CADMIUM TOTAL RECOV-ERABLE (UG/L AS CD) | CHRO-MIUM, TOTAL RECOV-ERABLE (UG/L AS CR) | LEAD, TOTAL RECOV-ERABLE (UG/L AS PB) | MERCURY TOTAL RECOV-ERABLE (UG/L AS HG) | NICKEL, TOTAL RECOV-ERABLE (UG/L AS NI) | SELE-NIUM, TOTAL (UG/L AS SE) | SILVER, TOTAL RECOV-ERABLE (UG/L AS AG) |
|---|---|---|---|---|---|---|---|---|---|---|
| JUN 27... | 31 | 341 | 0 | 0 | 10 | 1 | <.5 | 31 | 0 | 0 |

| DATE | ARSENIC TOTAL (UG/L AS AS) | METHY-LENE BLUE ACTIVE SUB-STANCE (MG/L) | BORON, TOTAL RECOV-ERABLE (UG/L AS B) | COBALT, TOTAL RECOV-ERABLE (UG/L AS CO) | COPPER, TOTAL RECOV-ERABLE (UG/L AS CU) | IRON, TOTAL RECOV-ERABLE (UG/L AS FE) | MANGA-NESE, TOTAL RECOV-ERABLE (UG/L AS MN) | MOLYB-DENUM, TOTAL RECOV-ERABLE (UG/L AS MO) | ZINC, TOTAL RECOV-ERABLE (UG/L AS ZN) |
|---|---|---|---|---|---|---|---|---|---|
| JUN 27... | <10 | <.05 | 50 | 0 | 6 | 50 | 40 | 1 | 10 |

Table 87.—Chemical, physical, and biological analyses of water samples from selected depths, Findlay City Reservoir, Ohio

410135083340000 - FINDLAY CITY RE N SIDE (L-1) NR FINDLAY OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

| DATE | TIME | SAMPLING DEPTH (FT) | NITROGEN, NITRITE TOTAL (MG/L AS N) | NITROGEN, NITRATE TOTAL (MG/L AS N) | NITROGEN, NO2+NO3 TOTAL (MG/L AS N) | NITROGEN, AMMONIA TOTAL (MG/L AS N) | NITROGEN, ORGANIC TOTAL (MG/L AS N) | NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N) | PHOSPHORUS, ORTHO, TOTAL (MG/L AS P) |
|---|---|---|---|---|---|---|---|---|---|
| JUN | | | | | | | | | |
| 27... | 1105 | 2.0 | .02 | 1.1 | 1.1 | .01 | .53 | .54 | .00 |
| 27... | 1140 | 27 | .03 | .30 | .33 | .17 | .73 | .90 | .00 |
| AUG | | | | | | | | | |
| 31... | 1105 | 2.0 | .00 | .37 | .37 | .03 | .62 | .65 | .00 |
| 31... | 1135 | 25 | .00 | .56 | .56 | .06 | .50 | .56 | .06 |

| DATE | PHOSPHORUS, TOTAL (MG/L AS P) | SILICA, DISSOLVED (MG/L AS SIO2) | TURBIDITY (JTU) | COLOR (PLATINUM-COBALT UNITS) | CARBON, ORGANIC TOTAL (MG/L AS C) | OXYGEN DEMAND, BIOCHEMICAL, 5 DAY (MG/L) | OXYGEN DEMAND, CHEMICAL (HIGH LEVEL) (MG/L) | COLIFORM, FECAL, 0.45 UM-MF (COLS./100 ML) | STREPTOCOCCI FECAL, (COLS. PER 100 ML) |
|---|---|---|---|---|---|---|---|---|---|
| JUN | | | | | | | | | |
| 27... | .01 | .7 | 1 | 5 | 7.6 | .7 | 59 | 2 | 2 |
| 27... | .02 | 3.4 | 10 | 10 | 9.2 | 1.1 | 35 | 2 | 2 |
| AUG | | | | | | | | | |
| 31... | .03 | 2.5 | 2 | 5 | 7.0 | 2.0 | 9 | 4 | 0 |
| 31... | .04 | 4.1 | 4 | 15 | 9.4 | 1.1 | 3 | 82 | 30 |

Table 88.--Phytoplankton identified in Findlay City Reservoir, Ohio (1979)

| Sample description: Location | Sample description: Date | Sample description: Location in water column | Total cells (per ml) | Diversity index (genus) $\bar{d}$ | Chlorophyll $\underline{a}$ (μg/L) | Division(s) present (in order of dominance) | Percent of total cell count | Dominant taxa within division and percent (%)* of total cell count |
|---|---|---|---|---|---|---|---|---|
| L-1 North side | 6-27 | Euphotic zone Composite | 230,000 | -- | 5.4 | Cyanophyta | 100 | Anacystis (100) |
| | | 2-ft depth | | | 3.9 | | | |
| L-1 North side | 6-27 | 10-ft depth | | | 6.1 | | | |
| L-1 North side | 8-31 | Euphotic zone Composite | 290,000 | 1.2 | 25.2 | Cyanophyta | 100 | Agmenellum (59), Anacystis (36), Gomphosphaeria (5) |
| | | | | | | Chlorophyta | | Schroederia, Ankistrodesmus, Chlamydomonas |
| | | 2-ft depth | -- | -- | 18.3 | | | |
| | | 7-ft depth | 510,000 | 1.4 | -- | Cyanophyta | 100 | Gomphosphaeria (45), Agmenellum (43), Anacystis |
| | | | | | | Chlorophyta | | Schroederia |

*Less than 1 percent not given.

Findlay City Reservoir had surface-to-bottom temperature differentials of 5°C in June and 2.1°C in August. These values are low compared to other Ohio lakes of approximately the same depth. Aerobic conditions were noted at all depths; oxygen levels exceeded 100 percent saturation between 2 and 7 feet in August.

The spring near-surface, total-phosphorus concentration was 0.01 mg/L. The spring total-nitrogen to total-phosphorus ratio, 160 to 1, indicates phosphorus may be limiting algal productivity in Findlay City Reservoir.

Findlay City Reservoir had Carlson TSIs of 59 for chlorophyll a (summer), 55 for Secchi-disk transparency (summer) and 37 for total phosphorus. Summer chlorophyll-a values were higher than normal for the low spring total-phosphorus concentration. Nickel exceeded Ohio water-quality standards in June. The blue-green algae (Cyanophyta) dominated the June and August algal communities. Total cell counts were high. Chlorophyll-a values were low.

Inflow data: Water pumped from the Blanchard River is used to supply Findlay City Reservoir. There is no other inflow.

## Griggs Reservoir

Location: Franklin County
(Northwest Columbus 7.5-minute quadrangle map)

Type: Impoundment on Scioto River

Use: Recreation and water supply

Physical characteristics at summer pool level (table 6):

| Date of origin (year) | Surface area (acres) | Capacity (acre-feet) | Capacity-inflow ratio (C/I) |
|---|---|---|---|
| 1905 | 385 | 5,070 | 0.01 |

Drainage basin characteristics:

| Drainage area ($mi^2$) | Type | Estimated sediment yield (from fig. 3) |
|---|---|---|
| 1,044 | Rural | Moderately low |

Lake data (figs. 42,43; tables 89-92): Griggs Reservoir was sampled under overcast, very windy conditions on May 24 and under calm, sunny conditions on August 6. Secchi-disk transparencies at the primary sampling station (L-1) were 3 feet in the spring and 2.2 feet in August.

Profile and analytical data show the following lake characteristics:

| Date | Stratification (gradient) | | Chemical type | Trophic state index (Carlson) | | | Trophic class | Substances at or above State limits | | Phytoplankton, dominant division(s) |
|---|---|---|---|---|---|---|---|---|---|---|
| | Thermal | Chemical | | Chl *a* | SD | T.P. | | Toxicants | Bacteria | |
| 5-24-79 | Yes | Yes | Very hard; Ca, $SO_3$ | -- | -- | 60 | Eutrophic | No | No | Chlorophyta |
| 8-06-79 | Yes | Yes | -- | 67 | 66 | -- | -- | No | No | Cyanophyta |

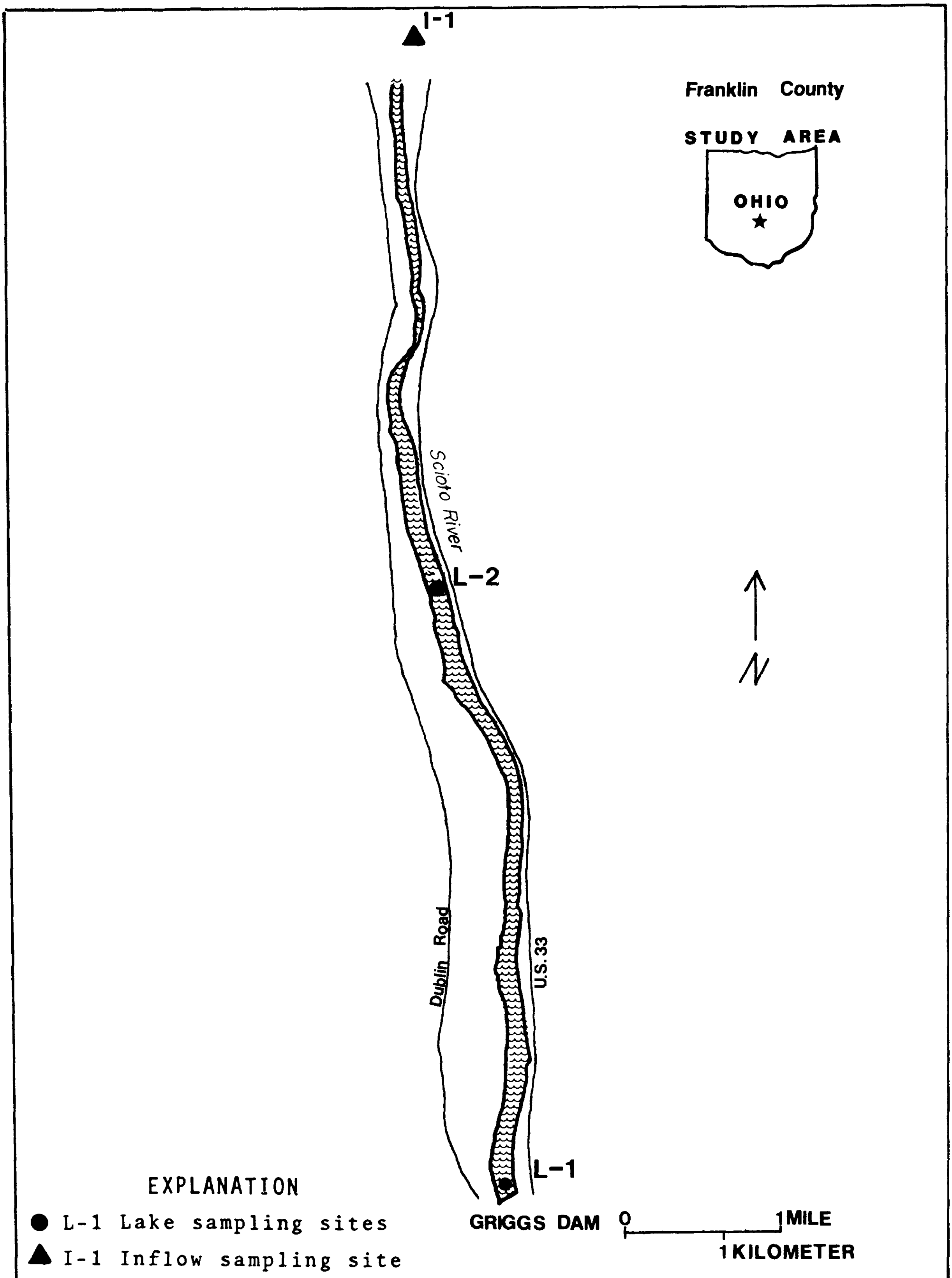



**Figure 42.--Griggs Reservoir and inflow sampling site.**

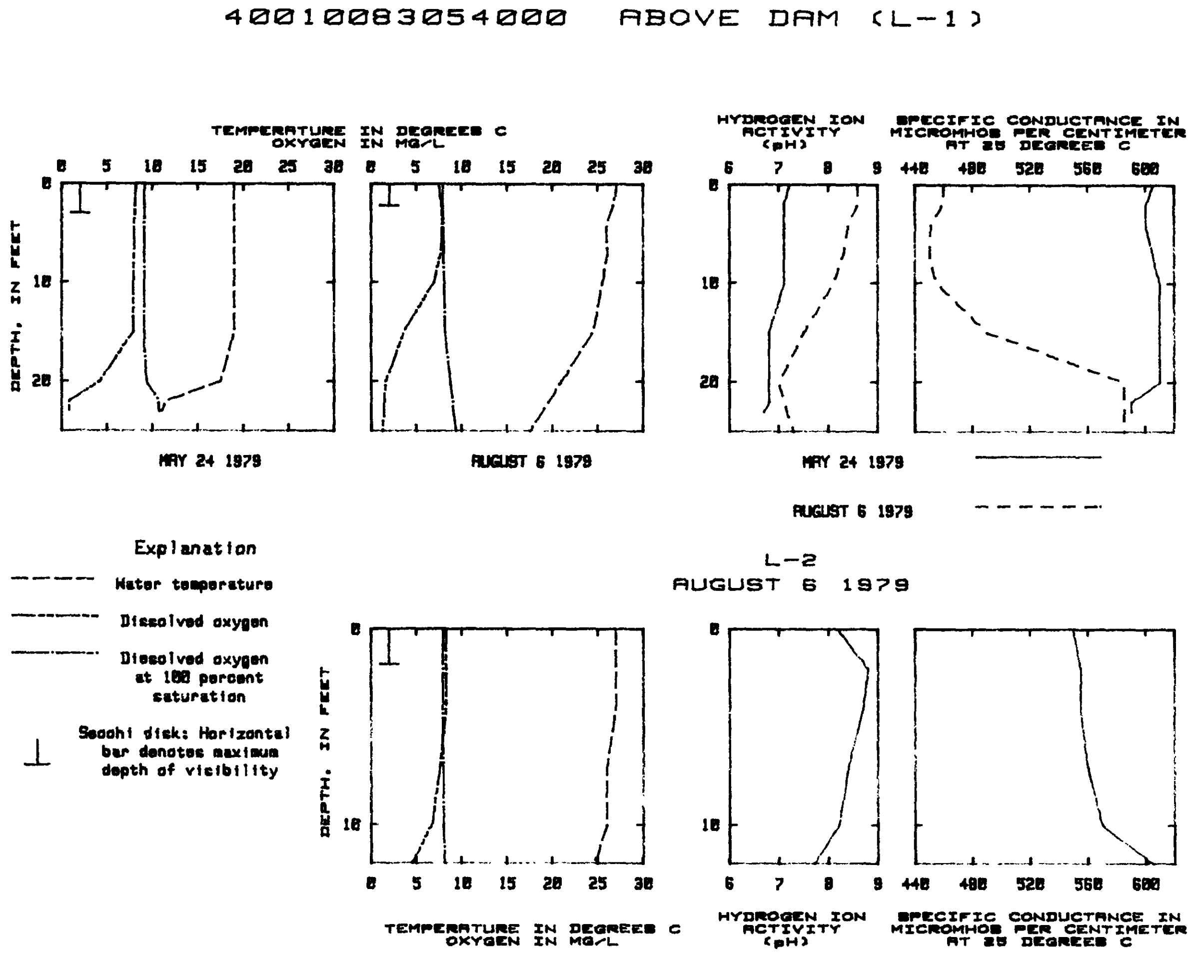



Figure 43.--Data profiles for Griggs Reservoir.

Table 89.--Profile data for the primary lake site, Griggs Reservoir, Ohio

400100083054000 - GRIGGS RE AB DAM (L-1) COLUMBUS OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

| DATE | TIME | SAMPLING DEPTH (FT) | TEMPERATURE (DEG C) | OXYGEN, DISSOLVED (MG/L) | OXYGEN, DISSOLVED (PERCENT SATURATION) | SPECIFIC CONDUCTANCE (MICROMHOS) | PH (UNITS) | CARBONATE (MG/L AS CO3) | BICARBONATE (MG/L AS HCO3) | CARBON DIOXIDE DISSOLVED (MG/L AS CO2) | HYDROGEN SULFIDE TOTAL (MG/L AS H2S) | TRANSPARENCY (SECCHI DISK) (IN) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MAY | | | | | | | | | | | | |
| 24... | 1200 | .0 | 19.0 | 8.2 | 90 | 605 | 7.2 | -- | -- | -- | -- | -- |
| 24... | 1210 | 2.0 | 19.0 | 8.1 | 89 | 600 | 7.1 | 0 | 45 | 5.4 | .3 | 36 |
| 24... | 1220 | 4.0 | 19.0 | 8.0 | 88 | 600 | 7.1 | -- | -- | -- | -- | -- |
| 24... | 1230 | 7.0 | 19.0 | 8.0 | 88 | 605 | 7.1 | -- | -- | -- | -- | -- |
| 24... | 1240 | 10 | 19.0 | 7.9 | 87 | 610 | 7.1 | -- | -- | -- | -- | -- |
| 24... | 1250 | 15 | 19.0 | 7.9 | 87 | 610 | 6.8 | -- | -- | -- | -- | -- |
| 24... | 1300 | 20 | 17.5 | 4.2 | 45 | 610 | 6.8 | -- | -- | -- | -- | -- |
| 24... | 1310 | 22 | 11.5 | .8 | 7 | 590 | 6.8 | 0 | 49 | 12 | .7 | -- |
| 24... | 1320 | 23 | 11.0 | .8 | 7 | 590 | 6.7 | -- | -- | -- | -- | -- |
| AUG | | | | | | | | | | | | |
| 06... | 1215 | .0 | 27.1 | 7.5 | 95 | 460 | 8.6 | -- | -- | -- | -- | -- |
| 06... | 1220 | 2.0 | 26.8 | 7.8 | 99 | 459 | 8.6 | 8 | 168 | .7 | .3 | 26 |
| 06... | 1225 | 4.0 | 26.0 | 7.9 | 99 | 451 | 8.4 | -- | -- | -- | -- | -- |
| 06... | 1230 | 7.0 | 26.1 | 7.7 | 99 | 450 | 8.3 | -- | -- | -- | -- | -- |
| 06... | 1235 | 10 | 25.5 | 6.9 | 85 | 455 | 8.1 | -- | -- | -- | -- | -- |
| 06... | 1240 | 15 | 24.5 | 3.6 | 44 | 490 | 7.5 | -- | -- | -- | -- | -- |
| 06... | 1245 | 20 | 21.0 | 1.6 | 18 | 585 | 7.0 | -- | -- | -- | -- | -- |
| 06... | 1250 | 25 | 17.5 | 1.2 | 13 | 585 | 7.3 | 0 | 390 | 31 | .7 | -- |

Table 90.--Chemical analyses of water column composite samples, Griggs Reservoir, Ohio

400100083054000 - GRIGGS RE AB DAM (L-1) COLUMBUS OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

| DATE | TIME | CALCIUM DIS-SOLVED (MG/L AS CA) | MAGNE-SIUM, DIS-SOLVED (MG/L AS MG) | POTAS-SIUM, DIS-SOLVED (MG/L AS K) | SODIUM, DIS-SOLVED (MG/L AS NA) | SULFATE DIS-SOLVED (MG/L AS SO4) | CHLO-RIDE, DIS-SOLVED (MG/L AS CL) | FLUO-RIDE, DIS-SOLVED (MG/L AS F) | HARD-NESS (MG/L AS CACO3) | SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L) |
|---|---|---|---|---|---|---|---|---|---|---|
| MAY | | | | | | | | | | |
| 24... | 1210 | -- | -- | -- | -- | 130 | 34 | .3 | -- | -- |
| 24... | 1310 | 79 | 28 | 2.9 | 18 | 92 | 35 | .3 | 310 | 444 |

| DATE | SOLIDS, RESIDUE AT 105 DEG. C, SUS-PENDED (MG/L) | SOLIDS, RESIDUE AT 105 DEG. C, TOTAL (MG/L) | BARIUM, TOTAL RECOV-ERABLE (UG/L AS BA) | CADMIUM TOTAL RECOV-ERABLE (UG/L AS CD) | CHRO-MIUM, TOTAL RECOV-ERABLE (UG/L AS CR) | LEAD, TOTAL RECOV-ERABLE (UG/L AS PB) | MERCURY TOTAL RECOV-ERABLE (UG/L AS HG) | NICKEL, TOTAL RECOV-ERABLE (UG/L AS NI) | SELE-NIUM, TOTAL (UG/L AS SE) | SILVER, TOTAL RECOV-ERABLE (UG/L AS AG) |
|---|---|---|---|---|---|---|---|---|---|---|
| MAY | | | | | | | | | | |
| 24... | -- | -- | 0 | 0 | 20 | 2 | <.5 | 13 | 1 | 0 |
| 24... | 49 | 493 | 0 | 0 | 20 | 4 | <.5 | 8 | 1 | 0 |

| DATE | ARSENIC TOTAL (UG/L AS AS) | METHY-LENE BLUE ACTIVE SUB-STANCE (MG/L) | BORON, TOTAL RECOV-ERABLE (UG/L AS B) | COBALT, TOTAL RECOV-ERABLE (UG/L AS CO) | COPPER, TOTAL RECOV-ERABLE (UG/L AS CU) | IRON, TOTAL RECOV-ERABLE (UG/L AS FE) | MANGA-NESE, TOTAL RECOV-ERABLE (UG/L AS MN) | MOLYB-DENUM, TOTAL RECOV-ERABLE (UG/L AS MO) | ZINC, TOTAL RECOV-ERABLE (UG/L AS ZN) |
|---|---|---|---|---|---|---|---|---|---|
| MAY | | | | | | | | | |
| 24... | -- | -- | 50 | 1 | 4 | 470 | 240 | 11 | 30 |
| 24... | <10 | .11 | 40 | 1 | 4 | 480 | 2200 | 9 | 20 |

Table 91.--Chemical, physical, and biological analyses of water samples from selected depths, Griggs Reservoir, Ohio

400100083054000 - GRIGGS RE AB DAM (L-1) COLUMBUS OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

| DATE | TIME | SAMPLING DEPTH (FT) | NITROGEN, NITRITE TOTAL (MG/L AS N) | NITROGEN, NITRATE TOTAL (MG/L AS N) | NITROGEN, NO2+NO3 TOTAL (MG/L AS N) | NITROGEN, AMMONIA TOTAL (MG/L AS N) | NITROGEN, ORGANIC TOTAL (MG/L AS N) | NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N) | PHOSPHORUS, ORTHO. TOTAL (MG/L AS P) |
|---|---|---|---|---|---|---|---|---|---|
| MAY | | | | | | | | | |
| 24... | 1210 | 2.0 | .03 | 2.9 | 2.9 | .16 | .72 | .88 | .02 |
| 24... | 1310 | 22 | .06 | 2.6 | 2.7 | .90 | .70 | 1.6 | .02 |
| AUG | | | | | | | | | |
| 06... | 1220 | 2.0 | .09 | 3.6 | 3.7 | .09 | 1.5 | 1.6 | .00 |
| 06... | 1250 | 25 | .01 | 3.7 | 3.7 | .05 | 9.5 | 9.5 | .68 |

| DATE | PHOSPHORUS, TOTAL (MG/L AS P) | SILICA, DISSOLVED (MG/L AS SIO2) | TURBIDITY (JTU) | COLOR (PLATINUM-COBALT UNITS) | CARBON, ORGANIC TOTAL (MG/L AS C) | OXYGEN DEMAND, BIOCHEMICAL, 5 DAY (MG/L) | OXYGEN DEMAND, CHEMICAL (HIGH LEVEL) (MG/L) | COLIFORM, FECAL, 0.45 UM-MF (COLS./100 ML) | STREPTOCOCCI FECAL, (COLS. PER 100 ML) |
|---|---|---|---|---|---|---|---|---|---|
| MAY | | | | | | | | | |
| 24... | .05 | -- | 5 | 10 | 7.6 | 1.2 | 13 | 10 | 28 |
| 24... | .08 | 2.4 | 20 | 20 | 7.0 | 1.5 | 18 | 14 | 54 |
| AUG | | | | | | | | | |
| 06... | .09 | 3.8 | 10 | 10 | 12 | 3.8 | 35 | 8 | 54 |
| 06... | 1.2 | 11 | 20 | 30 | 10 | 4.4 | 45 | 152 | 38 |

Table 92.--Phytoplankton identified in Griggs Reservoir, Ohio (1979)

| Sample description | | | Total cells (per ml) | Diversity index (genus) $\bar{d}$ | Chlorophyll *a* (µg/L) | Division(s) present (in order of dominance) | Percent of total cell count | Dominant taxa within division and percent (%)* of total cell count |
|---|---|---|---|---|---|---|---|---|
| Location | Date | Location in water column | | | | | | |
| L-1 Above dam | 5-24 | Euphotic zone Composite | 200 | 0.7 | 6.3 | Chlorophyta | 80 | *Chlamydomonas* (80) |
| | | | | | | Cryptophyta | 20 | *Cryptomonas* (20) |
| L-1 Above dam | 5-24 | 2-ft depth | 180 | | 5.7 | Chlorophyta | 64 | *Chlamydomonas* (36), *Scenedesmus* (29) |
| | | | | | | Cryptophyta | 36 | *Cryptomonas* (36) |
| L-1 Above dam | 8-06 | Euphotic zone Composite | 53,000 | 0.1 | 29.2 | Cyanophyta | 100 | *Oscillatoria* (99), *Anabaena* |
| | | | | | | Chlorophyta | | *Ankistrodesmus*, *Oocystis*, *Chlamydomonas*, *Phacotus* |
| L-1 Above dam | | 2-ft depth | -- | | 40.2 | Chrysophyta | | *Melosira* |
| | | | | | | Cryptophyta | | *Cryptomonas* |
| L-1 | 8-06 | 4-ft depth | 94,000 | 0.1 | 39.8 | Cyanophyta | 98 | *Oscillatoria* (98), *Anabaena* |
| | | | | | | Chlorophyta | | *Schroederia*, *Ankistrodesmus*, *Oocystis*, *Scenedesmus*, *Chlamydomonadaceae*, *Chlamydomonas*, *Phacotus* |
| | | | | | | Chrysophyta | | *Cyclotella*, *Melosira*, *Synedra* |
| | | | | | | Cryptophyta | | *Cryptomonas* |
| | | | | | | Euglenophyta | | *Trachelomonas* |

*Less than 1 percent not given.

Griggs Reservoir at L-1 was thermally and chemically stratified on both the spring and summer sampling dates. Oxygen deficits were noted at all depths. The hypolimnion was nearly anaerobic. Dissolved oxygen and pH values at L-2 were slightly higher than at L-1.

The spring near-surface, total-phosphorus concentration was .05 mg/L. The spring total-nitrogen to total-phosphorus ratio, 76 to 1, which indicates phosphorus may be limiting algal productivity in Griggs Reservoir.

Griggs Reservoir had Carlson TSIs of 67 for chlorophyll *a* (summer), 66 for Secchi-disk transparency (summer), and 60 for total phosphorus (spring). Carlson TSIs in this range indicate eutrophic lakes.

No chemical constituents or properties exceeded Ohio water-quality standards.

Phytoplankton counts were very low in the spring; the algal community was dominated by green algae (Chlorophyta), specifically *Chlamydomonas*. The chlorophyll-*a* concentration was likewise very low. The summer algal community was dominated by blue-green algae (Cyanophyta), chiefly, *Oscillatoria*. Algal counts in the summer were several hundred times higher than those found in the spring.

Inflow data (fig. 42, table 93): Scioto River, which drains 990 $mi^2$, was sampled at site I-1. It represents 95 percent of the drainage basin of Griggs Reservoir. A qualitative comparisonof stream versus lake data is shown below.

| Inflow sampling site | Sampling date (1979) | Estimated discharge ($ft^3/s$) | Water body (stream or lake at 2-foot depth) having higher concentration | | | |
|---|---|---|---|---|---|---|
| | | | $NO_2$+ $NO_3$ | Total P | TOC | (Specific conductance) |
| Scioto River at site I-1 | May 24 | 70 | Stream | Stream | Stream | Stream |
| | Aug 6 | 150 | Stream | Stream | Stream | Stream |

Table 93.--Physical and chemical data for selected inflows, Griggs Reservoir, Ohio

400630083064500 - SCIOTO R AT I-270 AB GRIGGS RE COLUMBUS OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

| DATE | TIME | STREAM-FLOW, INSTAN-TANEOUS (CFS) | TEMPER-ATURE (DEG C) | OXYGEN, DIS-SOLVED (MG/L) | PH (UNITS) | SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS) | TUR-BID-ITY (JTU) | COLOR (PLAT-INUM-COBALT UNITS) | CARBON, ORGANIC TOTAL (MG/L AS C) | NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N) | NITRO-GEN,AM-MONIA + ORGANIC TOTAL (MG/L AS N) | PHOS-PHORUS, TOTAL (MG/L AS P) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MAY | | | | | | | | | | | | |
| 24... | 1010 | 70 | 17.5 | 8.1 | 7.1 | 610 | 10 | 20 | 7.6 | 3.4 | .78 | .03 |
| AUG | | | | | | | | | | | | |
| 06... | 1045 | 150 | 25.1 | 7.4 | 8.1 | 500 | 4 | 20 | 7.9 | 3.9 | 1.3 | .11 |

## Hammertown Lake

Location: Jackson County
(Jackson 7.5-minute quadrangle map)

Type: Impoundment on an unnamed tributary to Little Salt Creek

Use: Recreation, and water supply.

Physical characteristics at summer pool level (table 6):

| Date of origin (year) | Surface area (acres) | Capacity (acre-feet) | Capacity-inflow ratio (C/I) |
|---|---|---|---|
| 1955 | 186 | 4,200 | 1.72 |

Drainage-basin characteristics:

| Drainage area ($mi^2$) | Type | Estimated sediment yield (from fig. 3) |
|---|---|---|
| 3.14 | Agricultural, rural | Moderately low |

Lake data (figs. 44, 45; tables 94-97): Hammertown Lake was sampled under sunny skies on May 14 and under partly cloudy skies on August 9. Secchi-disk measurements at the primary sampling station (L-1) were 16 feet in May and 15.8 feet in August. These measurements were the highest of the lakes sampled in 1979.

Profile and analytical data show the following lake characteristics:

| Date | Stratification (gradient) Thermal | Chemical | Chemical type | Trophic state index (Carlson) Chl a | SD | T.P. | Trophic class | Substances at or above State limits Toxicants | Bacteria | Phyto-plankton, dominant division(s) |
|---|---|---|---|---|---|---|---|---|---|---|
| 5-14-79 | Yes | Yes | Soft; Ca, Mg, $SO_4$ | -- | -- | 37 | Meso-trophic | No | No | Chlorophyta, Euglenophyta |
| 8-09-79 | Yes | Yes | -- | -- | -- | -- | -- | -- | -- | Chrysophyta |

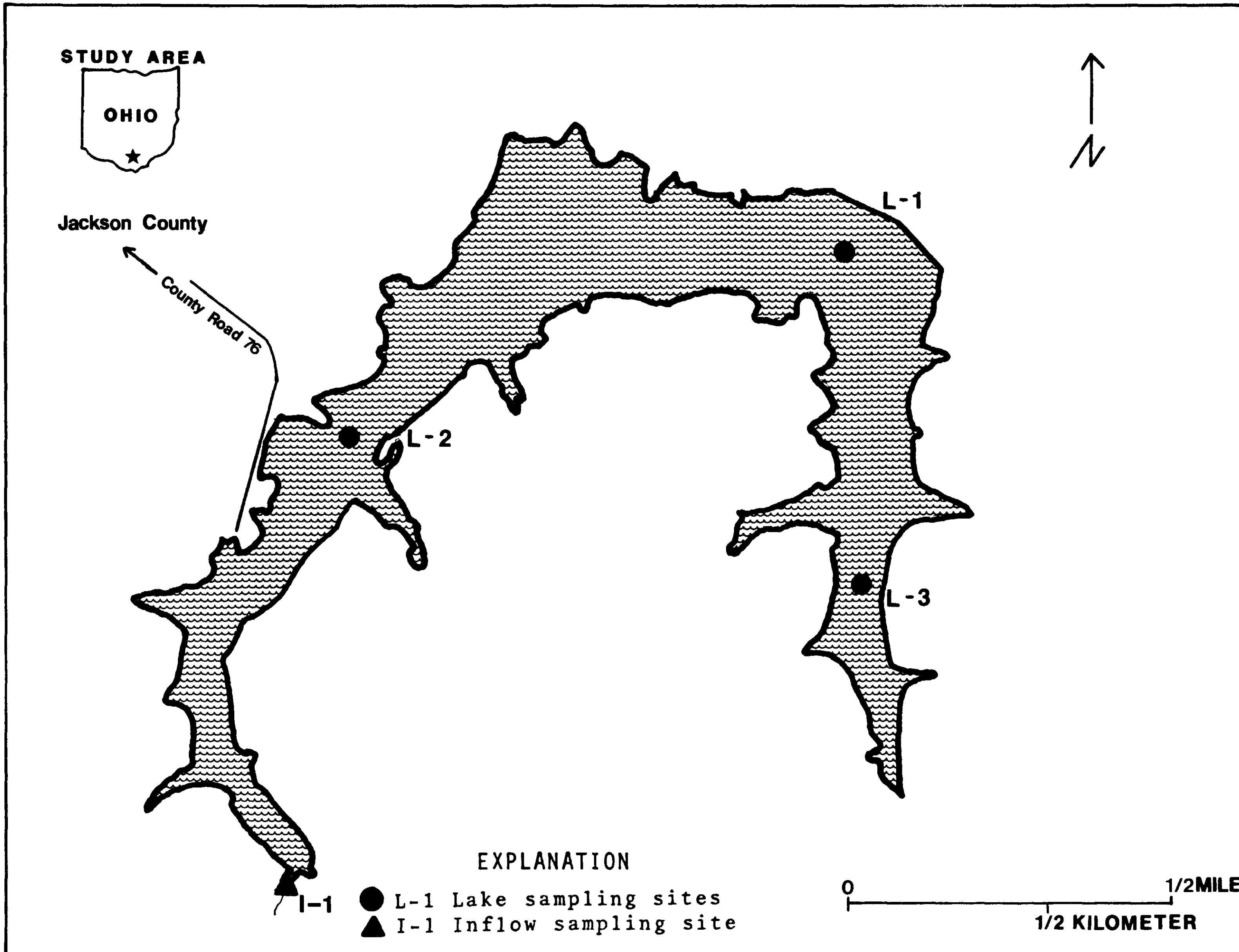



Figure 44.--Hammertown Lake and inflow sampling site.

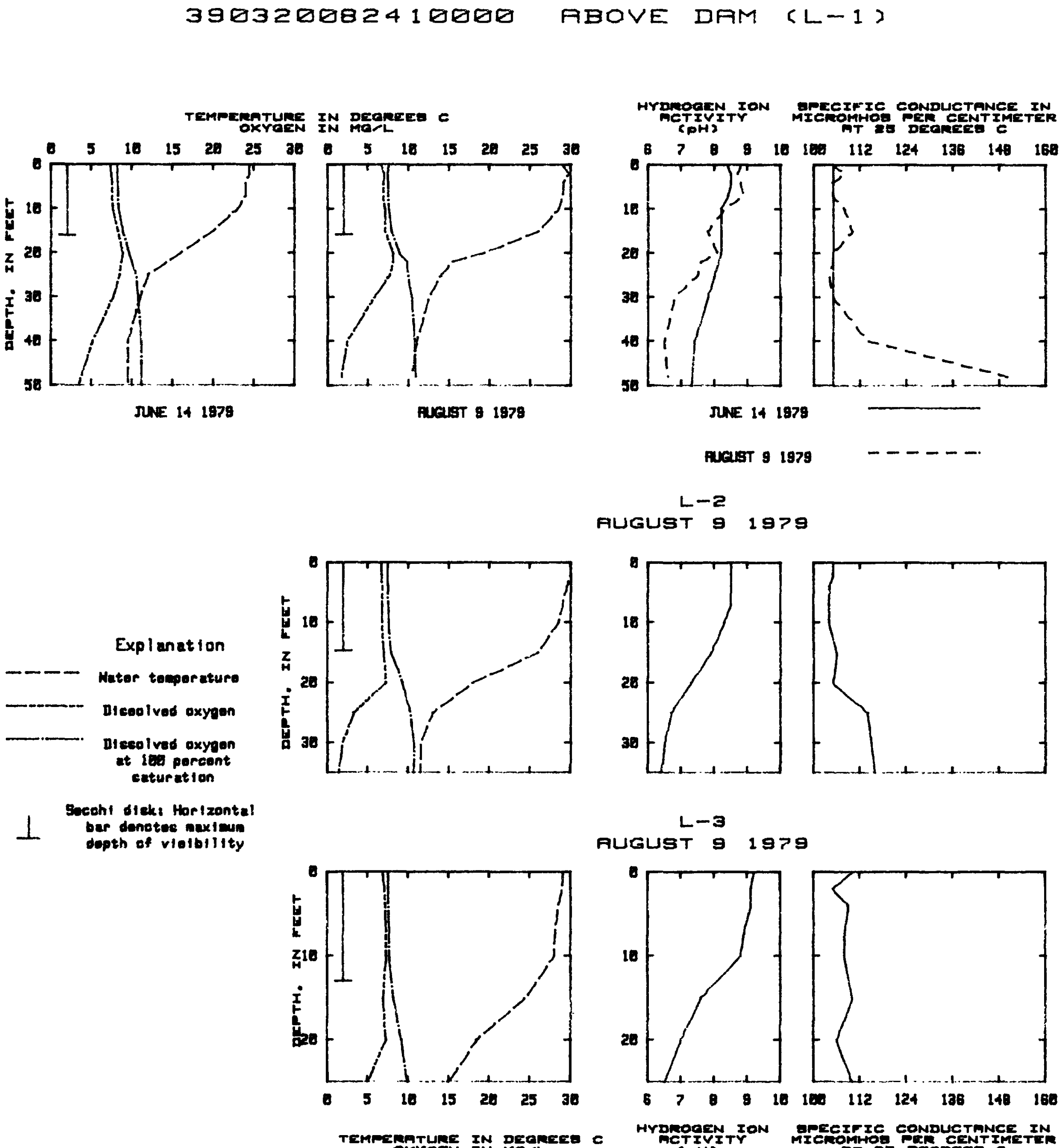



**Figure 45.--Data profiles for Hammertown Lake.**

Table 94.--Profile data for the primary lake site, Hammertown Lake, Ohio

390320082410000 - HAMMERTOWN LK AB DAM (L-1) NR JACKSON OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

| DATE | TIME | SAMPLING DEPTH (FT) | TEMPERATURE (DEG C) | OXYGEN, DISSOLVED (MG/L) | OXYGEN, DISSOLVED (PERCENT SATURATION) | SPECIFIC CONDUCTANCE (MICROMHOS) | PH (UNITS) | CARBONATE (MG/L AS CO3) | BICARBONATE (MG/L AS HCO3) | CARBON DIOXIDE DISSOLVED (MG/L AS CO2) | HYDROGEN SULFIDE TOTAL (MG/L AS H2S) | TRANSPARENCY (SECCHI DISK) (IN) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| JUN | | | | | | | | | | | | |
| 14... | 1230 | .0 | 24.5 | 7.4 | 90 | 105 | 8.4 | -- | -- | -- | -- | -- |
| 14... | 1335 | 2.0 | 24.5 | 7.5 | 91 | 105 | 8.5 | 3 | 64 | .3 | .3 | 192 |
| 14... | 1340 | 4.0 | 24.0 | 7.6 | 92 | 105 | 8.5 | -- | -- | -- | -- | -- |
| 14... | 1345 | 7.0 | 24.0 | 7.6 | 92 | 105 | 8.4 | -- | -- | -- | -- | -- |
| 14... | 1350 | 10 | 23.0 | 7.7 | 92 | 105 | 8.2 | -- | -- | -- | -- | -- |
| 14... | 1355 | 15 | 20.0 | 8.3 | 93 | 105 | 8.2 | -- | -- | -- | -- | -- |
| 14... | 1400 | 20 | 16.0 | 8.9 | 92 | 105 | 8.2 | -- | -- | -- | -- | -- |
| 14... | 1405 | 25 | 12.0 | 8.5 | 80 | 105 | 8.0 | -- | -- | -- | -- | -- |
| 14... | 1410 | 30 | 11.0 | 7.7 | 71 | 105 | 7.8 | -- | -- | -- | -- | -- |
| 14... | 1420 | 40 | 9.5 | 5.2 | 46 | 105 | 7.4 | -- | -- | -- | -- | -- |
| 14... | 1430 | 50 | 9.5 | 3.4 | 30 | 105 | 7.3 | 0 | 88 | 7.0 | .7 | -- |
| AUG | | | | | | | | | | | | |
| 09... | 1410 | .0 | 29.0 | 6.7 | 89 | 105 | 8.8 | -- | -- | -- | -- | -- |
| 09... | 1415 | 2.0 | 29.8 | 7.0 | 95 | 108 | 8.7 | 12 | 74 | 22 | .3 | 190 |
| 09... | 1420 | 4.0 | 29.1 | 6.9 | 92 | 105 | 8.8 | -- | -- | -- | -- | -- |
| 09... | 1425 | 7.0 | 29.0 | 6.9 | 92 | 105 | 8.9 | -- | -- | -- | -- | -- |
| 09... | 1430 | 10 | 28.5 | 7.1 | 93 | 108 | 8.3 | -- | -- | -- | -- | -- |
| 09... | 1435 | 15 | 26.1 | 7.1 | 90 | 110 | 7.8 | -- | -- | -- | -- | -- |
| 09... | 1440 | 20 | 19.4 | 8.1 | 91 | 105 | 8.1 | -- | -- | -- | -- | -- |
| 09... | 1442 | 22 | 15.4 | 8.1 | 83 | 105 | 7.6 | -- | -- | -- | -- | -- |
| 09... | 1445 | 25 | 14.0 | 7.7 | 77 | 104 | 7.5 | -- | -- | -- | -- | -- |
| 09... | 1450 | 30 | 12.5 | 5.8 | 56 | 105 | 6.8 | -- | -- | -- | -- | -- |
| 09... | 1455 | 40 | 11.0 | 2.5 | 23 | 114 | 6.5 | -- | -- | -- | -- | -- |
| 09... | 1500 | 48 | 10.4 | 1.7 | 16 | 150 | 6.6 | 0 | 62 | 25 | .7 | -- |

Table 95.--Chemical analyses of water column composite samples, Hammertown Lake, Ohio

390320082410000 - HAMMERTOWN LK AB DAM (L-1) NR JACKSON OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

| DATE | TIME | CALCIUM DIS-SOLVED (MG/L AS CA) | MAGNE-SIUM, DIS-SOLVED (MG/L AS MG) | POTAS-SIUM, DIS-SOLVED (MG/L AS K) | SODIUM, DIS-SOLVED (MG/L AS NA) | SULFATE DIS-SOLVED (MG/L AS SO4) | CHLO-RIDE, DIS-SOLVED (MG/L AS CL) | FLUO-RIDE, DIS-SOLVED (MG/L AS F) | HARD-NESS (MG/L AS CACO3) | SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L) |
|---|---|---|---|---|---|---|---|---|---|---|
| JUN 14... | 1430 | 7.9 | 5.2 | 1.6 | 2.2 | 27 | 2.0 | .1 | 41 | 84 |

| DATE | SOLIDS, RESIDUE AT 105 DEG. C, SUS-PENDED (MG/L) | SOLIDS, RESIDUE AT 105 DEG. C, TOTAL (MG/L) | BARIUM, TOTAL RECOV-ERABLE (UG/L AS BA) | CADMIUM TOTAL RECOV-ERABLE (UG/L AS CD) | CHRO-MIUM, TOTAL RECOV-ERABLE (UG/L AS CR) | LEAD, TOTAL RECOV-ERABLE (UG/L AS PB) | MERCURY TOTAL RECOV-ERABLE (UG/L AS HG) | NICKEL, TOTAL RECOV-ERABLE (UG/L AS NI) | SELE-NIUM, TOTAL (UG/L AS SE) | SILVER, TOTAL RECOV-ERABLE (UG/L AS AG) |
|---|---|---|---|---|---|---|---|---|---|---|
| JUN 14... | 15 | 99 | 100 | 0 | 30 | 5 | <.5 | 16 | 0 | 0 |

| DATE | ARSENIC TOTAL (UG/L AS AS) | METHY-LENE BLUE ACTIVE SUB-STANCE (MG/L) | BORON, TOTAL RECOV-ERABLE (UG/L AS B) | COBALT, TOTAL RECOV-ERABLE (UG/L AS CO) | COPPER, TOTAL RECOV-ERABLE (UG/L AS CU) | IRON, TOTAL RECOV-ERABLE (UG/L AS FE) | MANGA-NESE, TOTAL RECOV-ERABLE (UG/L AS MN) | MOLYB-DENUM, TOTAL RECOV-ERABLE (UG/L AS MO) | ZINC, TOTAL RECOV-ERABLE (UG/L AS ZN) |
|---|---|---|---|---|---|---|---|---|---|
| JUN 14... | <10 | <.05 | 20 | 0 | 5 | 140 | 300 | 2 | 20 |

Table 96.—Chemical, physical, and biological analyses of water samples from selected depths, Hammertown Lake, Ohio

390320082410000 - HAMMERTOWN LK AB DAM (L-1) NR JACKSON OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

| DATE | TIME | SAMPLING DEPTH (FT) | NITROGEN, NITRITE TOTAL (MG/L AS N) | NITROGEN, NITRATE TOTAL (MG/L AS N) | NITROGEN, NO2+NO3 TOTAL (MG/L AS N) | NITROGEN, AMMONIA TOTAL (MG/L AS N) | NITROGEN, ORGANIC TOTAL (MG/L AS N) | NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N) | PHOSPHORUS, ORTHO. TOTAL (MG/L AS P) |
|---|---|---|---|---|---|---|---|---|---|
| JUN | | | | | | | | | |
| 14... | 1335 | 2.0 | .01 | .12 | .13 | .02 | .09 | .11 | .00 |
| 14... | 1430 | 50 | .00 | .20 | .20 | .30 | .10 | .40 | .00 |
| AUG | | | | | | | | | |
| 09... | 1415 | 2.0 | .00 | .00 | .00 | .01 | .07 | .08 | .00 |
| 09... | 1500 | 48 | .00 | .03 | .03 | 1.0 | .50 | 1.5 | .00 |

| DATE | PHOSPHORUS, TOTAL (MG/L AS P) | SILICA, DISSOLVED (MG/L AS SIO2) | TURBIDITY (JTU) | COLOR (PLATINUM-COBALT UNITS) | CARBON, ORGANIC TOTAL (MG/L AS C) | OXYGEN DEMAND, BIOCHEMICAL, 5 DAY (MG/L) | OXYGEN DEMAND, CHEMICAL (HIGH LEVEL) (MG/L) | COLIFORM, FECAL, 0.45 UM-MF (COLS./100 ML) | STREPTOCOCCI FECAL, (COLS. PER 100 ML) |
|---|---|---|---|---|---|---|---|---|---|
| JUN | | | | | | | | | |
| 14... | .00 | 2.5 | 1 | 5 | -- | .6 | 16 | 2 | 4 |
| 14... | .00 | 3.4 | 1 | 10 | 2.0 | .7 | 23 | 2 | 6 |
| AUG | | | | | | | | | |
| 09... | .01 | .9 | 5 | 5 | 3.6 | .8 | 13 | 2 | 4 |
| 09... | .02 | 8.2 | 8 | 15 | 9.6 | .9 | 27 | 4 | 6 |

Table 97.--Phytoplankton identified in Hammertown Lake, Ohio (1979)

| Sample description | | | Total cells (per ml) | Diversity index (genus) $\bar{d}$ | Chlorophyll *a* (µg/L) | Division(s) present (in order of dominance) | Percent of total cell count | Dominant taxa within division and percent (%)* of total cell count |
|---|---|---|---|---|---|---|---|---|
| Location | Date | Location in water column | | | | | | |
| L-1 Above dam | 6-14 | Euphotic zone Composite | 530 | 2.4 | 3.1 | Chlorophyta | 41 | Coelastrum (29), Chlamydomonas (12) |
| | | | | | | Chrysophyta | 24 | Cyclotella (24) |
| | | | | | | Cyanophyta | 24 | Anacystis (24) |
| | | | | | | Cryptophyta | 5 | Cryptomonas (5) |
| | | | | | | Pyrrophyta | 5 | Glenodinium (2), Peridinium (2) |
| L-1 Above dam | 6-14 | 2-ft depth | -- | -- | 3.2 | | | |
| L-1 Above dam | 6-14 | 20-ft depth | 65 | -- | 3.5 | Euglenophyta | 100 | Trachelomonas (100) |
| L-1 Above dam | 8-09 | Euphotic zone Composite | 830 | 0.7 | 3.3 | Chrysophyta | 95 | Fragilaria (88), Cyclotella (8) |
| | | | | | | Chlorophyta | 3 | Scenedesmus (3) |
| | | | | | | Pyrrophyta | 2 | Peridinium (2) |
| L-1 Above dam | 8-09 | 2-ft depth | -- | -- | 2.7 | | | |
| L-1 Above dam | 8-09 | 22-ft depth | 2,100 | 0.5 | 12.4 | Chrysophyta | 93 | Fragilaria (92), Cyclotella (1) |
| | | | | | | Cryptophyta | 5 | Cryptomonas (5) |
| | | | | | | Chlorophyta | 2 | Scenedesmus (1), Tetraedron (1) |
| | | | | | | Euglenophyta | 1 | Euglena (1) |

*Less than 1 percent not given.

Hammertown Lake at L-1 had developed a distinct thermal stratification by the May 14 sampling date. This stratification continued into August. The slight chemical stratification noted in May became more pronounced in August. Oxygen was found at all depths in both spring and summer.

The secondary stations L-2 and L-3 exhibited similar thermal and chemical profiles.

The spring near-surface, total-phosphorus concentration was below detectibility, thus, a spring total-nitrogen to total-phosphorus ratio could not be calculated. The summer total-nitrogen to total-phosphorus ratio was 8 to 1.

Hammertown Lake had Carlson TSIs of 48 for chlorophyll a and 38 for Secchi-disk transparency (summer measurements). Carlson TSIs in this range indicate mesotrophic lakes.

No chemical-quality constituents or properties exceeded Ohio water-quality standards.

Phytoplankton counts were low relative to the other Ohio lakes sampled in 1979. Green algae (Chlorophyta), chiefly *Coelastrum*, dominated the spring collection. Diatoms (Chrysophyta), over 90 percent of which were *Fragilaria*, dominated the summer collection.

Inflow data (fig. 44; table 98): An unnamed tributary that drains 1.04 $mi^2$ was sampled at site I-1. The tributary represents 33 percent of the lake's drainage basin. A qualitative comparison of stream versus lake data is shown below.

| Inflow sampling site | Sampling date (1979) | Estimated discharge ($ft^3/s$) | Water body (stream or lake at 2-foot depth) having higher concentration | | | |
|---|---|---|---|---|---|---|
| | | | $NO_2$+ $NO_3$ | Total P | TOC | (Specific conductance) |
| Unnamed tributary at site I-1 | June 14 | 0.5 | Stream | Equal | Stream | Stream |

Table 98.--Physical and chemical data for selected inflows, Hammertown Lake, Ohio

390232082422700 - TR TO HAMMERTOWN LK (I-1) NR JACKSON OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

| DATE | TIME | STREAM-FLOW, INSTAN-TANEOUS (CFS) | TEMPER-ATURE (DEG C) | OXYGEN, DIS-SOLVED (MG/L) | PH (UNITS) | SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS) | TUR-BID-ITY (JTU) | COLOR (PLAT-INUM-COBALT UNITS) | CARBON, ORGANIC TOTAL (MG/L AS C) | NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N) | NITRO-GEN,AM-MONIA + ORGANIC TOTAL (MG/L AS N) | PHOS-PHORUS, TOTAL (MG/L AS P) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| JUN | | | | | | | | | | | | |
| 14... | 1300 | .50 | 17.5 | 8.3 | 7.4 | 140 | 1 | 20 | 4.4 | .17 | .00 | .00 |

## Lake Clark

Location: Clark County
(New Moorfield 7.5-minute quadrangle map)

Type: Impoundment on Sinking Creek

Use: Recreation

Physical characteristics at summer pool level (table 6):

| Date of origin (year) | Surface area (acres) | Capacity (acre-feet) | Capacity-inflow ratio (C/I) |
|---|---|---|---|
| 1957 | 100 | 456 | 0.09 |

Drainage-basin characteristics:

| Drainage area ($mi^2$) | Type | Estimated sediment yield (from fig. 3) |
|---|---|---|
| 7 | Agricultural, rural | Moderately low |

Lake data (figs. 46, 47; tables 99-102): Lake Clark was sampled under calm, clear skies on May 29 and under windy, clear skies on August 13. The Secchi-disk transparencies at the primary sampling station (L-1) were 5.6 feet in May and 7 feet in August.

These measurements are deceptively low because of the very abundant aquatic macrophytes that covered 80 percent of the lake surface and greatly restricted subsurface observations.

Profile and analytical data show the following lake characteristics:

| Date | Stratification (gradient) | | Chemical type | Trophic state index (Carlson) | | | Trophic class | Substances at or above State limits | | Phyto-plankton, dominant division(s) |
|---|---|---|---|---|---|---|---|---|---|---|
| | Thermal | Chemical | | Chl a | SD | T.P. | | Toxicants | Bacteria | |
| 5-29-79 | Yes | Yes | Hard; Ca, $HCO_3$ | -- | -- | 37 | Eutrophic | No | No | Cryptophyta |
| 8-18-79 | Slight | Yes | -- | 39 | 49 | -- | -- | -- | No | Cyanophyta |

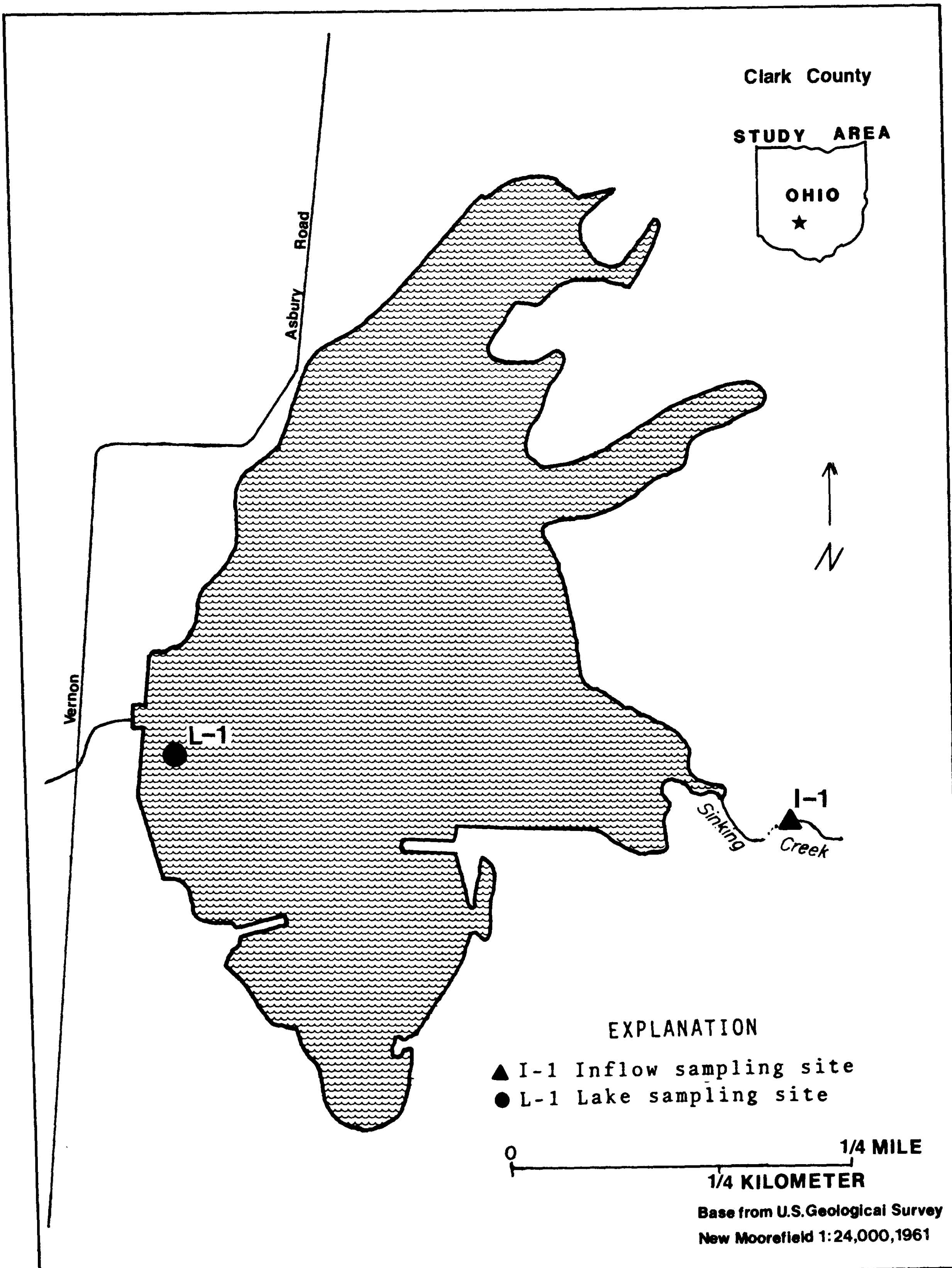



**Figure 46.--Lake Clark and inflow sampling site.**

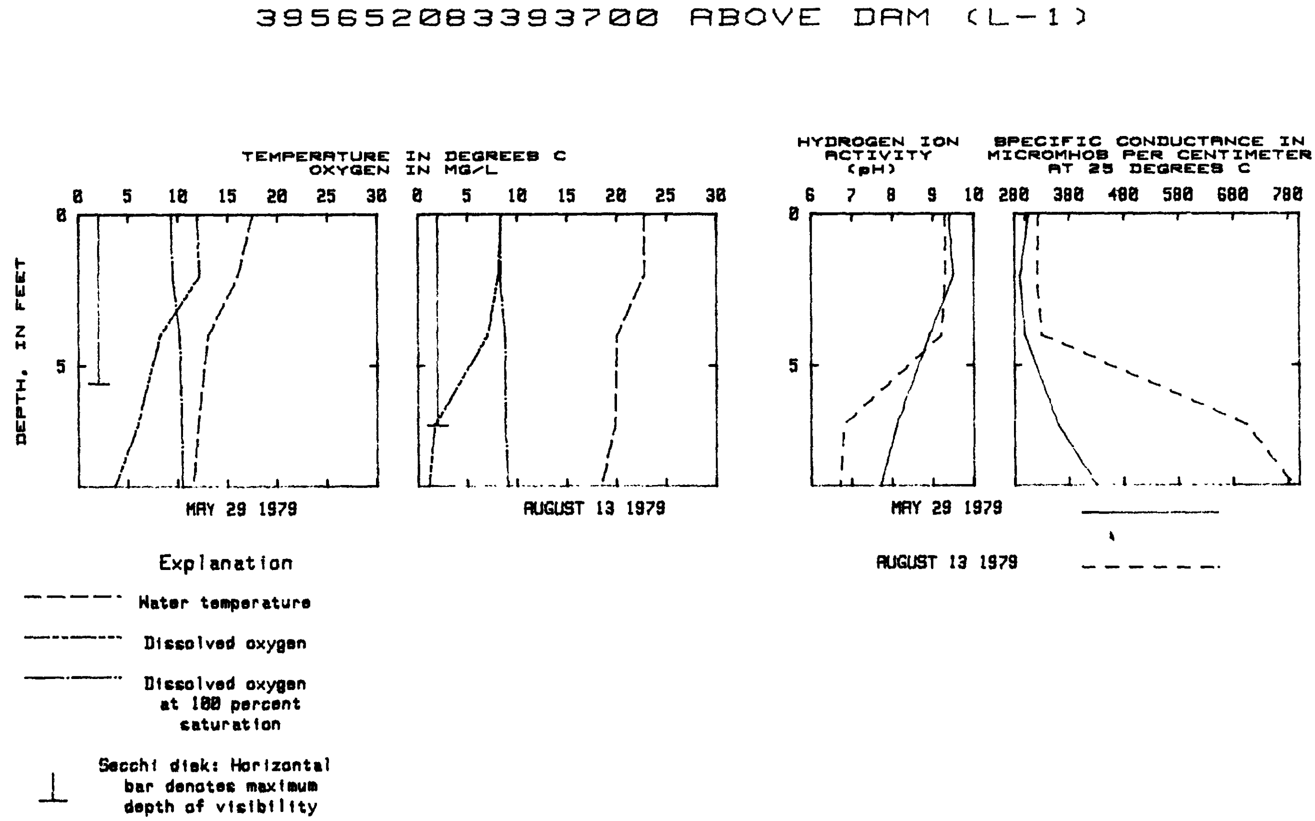



**Figure 47.--Data profiles for Lake Clark.**

Table 99.--Profile data for the primary lake site, Lake Clark, Ohio

395652083393700 - LAKE CLARK AB DAM (L-1)NR SPRINGFIELD OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

| DATE | TIME | SAMPLING DEPTH (FT) | TEMPERATURE (DEG C) | OXYGEN, DISSOLVED (MG/L) | OXYGEN, DISSOLVED (PERCENT SATURATION) | SPECIFIC CONDUCTANCE (MICROMHOS) | PH (UNITS) | CARBONATE (MG/L AS CO3) | BICARBONATE (MG/L AS HCO3) | CARBON DIOXIDE DISSOLVED (MG/L AS CO2) | HYDROGEN SULFIDE TOTAL (MG/L AS H2S) | TRANSPARENCY (SECCHI DISK) (IN) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MAY | | | | | | | | | | | | |
| 29... | 1300 | .0 | 17.5 | 12.0 | 129 | 305 | 9.4 | -- | -- | -- | -- | -- |
| 29... | 1305 | 2.0 | 16.0 | 12.2 | 128 | 290 | 9.5 | 31 | 63 | .0 | .5 | 67 |
| 29... | 1310 | 4.0 | 13.0 | 8.2 | 80 | 300 | 8.9 | -- | -- | -- | -- | -- |
| 29... | 1315 | 7.0 | 12.0 | 5.9 | 57 | 360 | 8.1 | -- | -- | -- | -- | -- |
| 29... | 1320 | 9.0 | 11.5 | 3.6 | 34 | 430 | 7.7 | 0 | 204 | 6.5 | 1.2 | -- |
| AUG | | | | | | | | | | | | |
| 13... | 1300 | .0 | 22.8 | 8.4 | 101 | 324 | 9.3 | -- | -- | -- | -- | -- |
| 13... | 1305 | 2.0 | 22.8 | 8.1 | 98 | 321 | 9.3 | 33 | 98 | .1 | .5 | 84 |
| 13... | 1310 | 4.0 | 20.0 | 7.0 | 80 | 330 | 9.2 | -- | -- | -- | -- | -- |
| 13... | 1315 | 7.0 | 19.8 | 1.7 | 19 | 704 | 6.8 | -- | -- | -- | -- | -- |
| 13... | 1320 | 9.0 | 18.4 | 1.1 | 12 | 790 | 6.7 | 0 | 524 | 166 | 1.2 | -- |

Table 100.--Chemical analyses of water column composite samples, Lake Clark, Ohio

395652083393700 - LAKE CLARK AB DAM (L-1) NR SPRINGFIELD OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

| DATE | TIME | CALCIUM DIS-SOLVED (MG/L AS CA) | MAGNE-SIUM, DIS-SOLVED (MG/L AS MG) | POTAS-SIUM, DIS-SOLVED (MG/L AS K) | SODIUM, DIS-SOLVED (MG/L AS NA) | SULFATE DIS-SOLVED (MG/L AS SO4) | CHLO-RIDE, DIS-SOLVED (MG/L AS CL) | FLUO-RIDE, DIS-SOLVED (MG/L AS F) | HARD-NESS (MG/L AS CACO3) | SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L) |
|---|---|---|---|---|---|---|---|---|---|---|
| MAY 29... | 1320 | 24 | 26 | .8 | 5.4 | 37 | 21 | .2 | 170 | 193 |

| DATE | SOLIDS, RESIDUE AT 105 DEG. C, SUS-PENDED (MG/L) | SOLIDS, RESIDUE AT 105 DEG. C, TOTAL (MG/L) | BARIUM, TOTAL RECOV-ERABLE (UG/L AS BA) | CADMIUM TOTAL RECOV-ERABLE (UG/L AS CD) | CHRO-MIUM, TOTAL RECOV-ERABLE (UG/L AS CR) | LEAD, TOTAL RECOV-ERABLE (UG/L AS PB) | MERCURY TOTAL RECOV-ERABLE (UG/L AS HG) | NICKEL, TOTAL RECOV-ERABLE (UG/L AS NI) | SELE-NIUM, TOTAL (UG/L AS SE) | SILVER, TOTAL RECOV-ERABLE (UG/L AS AG) |
|---|---|---|---|---|---|---|---|---|---|---|
| MAY 29... | 45 | 238 | 0 | 0 | 20 | 4 | <.5 | 7 | 0 | 0 |

| DATE | ARSENIC TOTAL (UG/L AS AS) | METHY-LENE BLUE ACTIVE SUB-STANCE (MG/L) | BORON, TOTAL RECOV-ERABLE (UG/L AS B) | COBALT, TOTAL RECOV-ERABLE (UG/L AS CO) | COPPER, TOTAL RECOV-ERABLE (UG/L AS CU) | IRON, TOTAL RECOV-ERABLE (UG/L AS FE) | MANGA-NESE, TOTAL RECOV-ERABLE (UG/L AS MN) | MOLYB-DENUM, TOTAL RECOV-ERABLE (UG/L AS MO) | ZINC, TOTAL RECOV-ERABLE (UG/L AS ZN) |
|---|---|---|---|---|---|---|---|---|---|
| MAY 29... | <10 | <.05 | 10 | 2 | 3 | 270 | 60 | 4 | 10 |

Table 101.—Chemical, physical, and biological analyses of water samples from selected depths, Lake Clark, Ohio

395652083393700 - LAKE CLARK AB DAM (L-1) NR SPRINGFIELD OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

| DATE | TIME | SAMPLING DEPTH (FT) | NITROGEN, NITRITE TOTAL (MG/L AS N) | NITROGEN, NITRATE TOTAL (MG/L AS N) | NITROGEN, NO2+NO3 TOTAL (MG/L AS N) | NITROGEN, AMMONIA TOTAL (MG/L AS N) | NITROGEN, ORGANIC TOTAL (MG/L AS N) | NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N) | PHOSPHORUS, ORTHO. TOTAL (MG/L AS P) |
|---|---|---|---|---|---|---|---|---|---|
| MAY | | | | | | | | | |
| 29... | 1305 | 2.0 | .01 | .28 | .29 | .05 | .46 | .51 | .01 |
| 29... | 1320 | 9.0 | .07 | 1.4 | 1.5 | .10 | .63 | .73 | .02 |
| AUG | | | | | | | | | |
| 13... | 1305 | 2.0 | .00 | .00 | .00 | .02 | .54 | .56 | .00 |
| 13... | 1320 | 9.0 | .00 | .02 | .02 | 5.8 | 2.0 | 7.8 | .04 |

| DATE | PHOSPHORUS, TOTAL (MG/L AS P) | SILICA, DISSOLVED (MG/L AS SIO2) | TURBIDITY (JTU) | COLOR (PLATINUM-COBALT UNITS) | CARBON, ORGANIC TOTAL (MG/L AS C) | OXYGEN DEMAND, BIOCHEMICAL, 5 DAY (MG/L) | OXYGEN DEMAND, CHEMICAL (HIGH LEVEL) (MG/L) | COLIFORM, FECAL, 0.45 UM-MF (COLS./100 ML) | STREPTOCOCCI FECAL, (COLS. PER 100 ML) |
|---|---|---|---|---|---|---|---|---|---|
| MAY | | | | | | | | | |
| 29... | .01 | .3 | 1 | 15 | 4.5 | 1.3 | 12 | 2 | 10 |
| 29... | .03 | 2.4 | 30 | 25 | 3.8 | 3.8 | 20 | 2 | 16 |
| AUG | | | | | | | | | |
| 13... | .01 | 3.1 | 1 | 15 | .6 | .6 | 9 | 2 | 6 |
| 13... | .31 | 12 | 30 | 50 | 24 | 6.9 | 150 | 6 | 6 |

Table 102.--Phytoplankton identified in Lake Clark, Ohio (1979)

| Sample description | | | Total cells (per mL) | Diversity index (genus) $\bar{d}$ | Chlorophyll *a* (µg/L) | Division(s) present (in order of dominance) | Percent of total cell count | Dominant taxa within division and percent (%)* of total cell count |
|---|---|---|---|---|---|---|---|---|
| Location | Date | Location in water column | | | | | | |
| L-1 Above dam | 5-29 | Euphotic zone Composite | 240 | 0.6 | 14.2 | Cryptophyta | 89 | *Cryptomonas* (89) |
| | | | | | | Chlorophyta | | *Staurastrum* (5) |
| | | | | | | Chrysophyta | | *Synedra* (5) |
| L-1 Above dam | 5-29 | 2-ft depth | 3,000 | 0.6 | 11.2 | Cyanophyta | 87 | *Oscillatoria* (87) |
| | | | | | | Cryptophyta | 13 | *Cryptomonas* (13) |
| | | | | | | Chlorophyta | 1 | *Cosmarium* (1) |
| L-1 Above dam | 8-13 | Euphotic zone Composite | 26,000 | 1.4 | 34.3 | Cyanophyta | 94 | *Oscillatoria* (54), *Coccochloris* (40) |
| L-1 Above dam | 8-13 | 0-ft depth | 13 | -- | 2.5 | Cryptophyta | 100 | *Cryptomonas* (100) |
| L-1 Above dam | 8-13 | 2-ft depth | -- | -- | 2.4 | | | |

*Less than 1 percent not given.

The spring temperature profile suggests surface warming under sunny skies in May. The summer temperature profile and small surface-to-bottom temperature differential (4.4°C) indicate a frequently mixed water column. Aerobic conditions were found throughout the water column on both dates. The supersaturated oxygen levels found above 2 feet in May and at the surface in August, as well as the high pH levels in the upper 2 feet of the water column, indicate considerable biological activity might have been taking place.

The spring near-surface, total-phosphorus concentration was 0.01 mg/L, low relative to other Ohio lakes. The spring total-nitrogen to total-phosphorus ratio, 80 to 1, indicates phosphorus may be limiting algal productivity in Lake Clark.

Lake Clark had Carlson TSIs values of 39 for chlorophyll-*a* (summer), 49 for Secchi-disk transparency (summer), and 37 for total phosphorus (spring). These TSIs correspond to a mesotrophic lake, however, Lake Clark was classified as eutrophic because of the aquatic macrophytes that covered nearly 80 percent of the lake's surface.

No constituents on properties exceeded Ohio water-quality standards. Hydrogen sulfide was detected in the water column. It might have been released from decaying masses of macrophytic vegetation that were disturbed by the boat and sampling apparatus.

Phytoplankton counts were low compared to other Ohio lakes. Cryptomonads (Cryptophyta) dominated the spring algal flora and blue-green algae (Cyanophyta) dominated the summer algal flora. The extensive growths of aquatic macrophytes observed in Lake Clark included *Myriophyllum* and *Ceratophyllum*. These macrophytes repeatedly fouled the boat propeller during sampling.

Inflow data (fig. 46, table 103): Sinking creek, which drains 3.08 $mi^2$, was sampled at site I-1. This represents 44 percent of the lake's drainage basin. A qualitative comparison of stream versus lake data is shown below.

| Inflow sampling site | Sampling date (1979) | Estimated discharge ($ft^3/s$) | Water body (stream or lake at 2-foot depth) having higher concentration: $NO_2$+ $NO_3$ | Total P | TOC | (Specific conductance) |
|---|---|---|---|---|---|---|
| Sinking Creek at site I-1 | May 29 | <2.0 | Stream | Lake | Stream | Stream |
| | Aug 13 | 3.0 | Stream | Lake | Stream | Lake |

Table 103.--Physical and chemical data for selected inflows, Lake Clark, Ohio

395650083390600 - SINKING C AB LK CLARK NR SPRINGFIELD OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

| DATE | TIME | STREAM-FLOW, INSTAN-TANEOUS (CFS) | TEMPER-ATURE (DEG C) | OXYGEN, DIS-SOLVED (MG/L) | PH (UNITS) | SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS) | TUR-BID-ITY (JTU) | COLOR (PLAT-INUM-COBALT UNITS) | CARBON, ORGANIC TOTAL (MG/L AS C) | NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N) | NITRO-GEN, AM-MONIA + ORGANIC TOTAL (MG/L AS N) | PHOS-PHORUS, TOTAL (MG/L AS P) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MAY | | | | | | | | | | | | |
| 29... | 1215 | <2.0 | 15.0 | 8.9 | 8.1 | 810 | 2 | 20 | 6.9 | 8.1 | .25 | .00 |
| AUG | | | | | | | | | | | | |
| 13... | 1230 | 3.0 | 17.5 | 8.4 | 8.1 | 620 | 1 | 10 | 2.5 | 4.2 | .40 | .01 |

# Lake Milton

Location: Mahoning County
(Newton Falls 7.5-minute quadrangle map)

Type: Impoundment on the Mahoning River

Use: Flood control, recreation, and water supply.

Physical characteristics at summer pool level (table 6):

| Date of origin (year) | Surface area (acres) | Capacity (acre-feet) | Capacity-inflow ratio (C/I) |
|---|---|---|---|
| 1916 | 1,685 | 28,743 | 0.16 |

Drainage-basin characteristics:

| Drainage area ($mi^2$) | Type | Estimated sediment yield (from fig. 3) |
|---|---|---|
| 276 | Agricultural, rural | Moderately low |

Lake data (figs. 48, 49; tables 104-107): Lake Milton was sampled under cloudy skies on June 21 and under partly cloudy skies on August 16. Secchi-disk transparencies at the primary sampling station (L-1) were 5.4 feet in June and 3.7 feet in August. The Secchi-disk transparency in August at L-2 was 1.6 feet.

Profile and analytical data show the following lake characteristics:

| Date | Stratification (gradient) Thermal | Stratification (gradient) Chemical | Chemical type | Trophic state index (Carlson) Chl a | Trophic state index (Carlson) SD | Trophic state index (Carlson) T.P. | Trophic class | Substances at or above State limits Toxicants | Substances at or above State limits Bacteria | Phyto-plankton, dominant division(s) |
|---|---|---|---|---|---|---|---|---|---|---|
| 6-21-79 | Yes | Yes | Soft; Ca, $SO_4$ | -- | -- | 47 | Eutrophic | Cd | No | Chrysophyta, Cyanophyta |
| 8-16-79 | Yes | Yes | -- | 57 | 58 | -- | -- | -- | No | Cyanophyta |

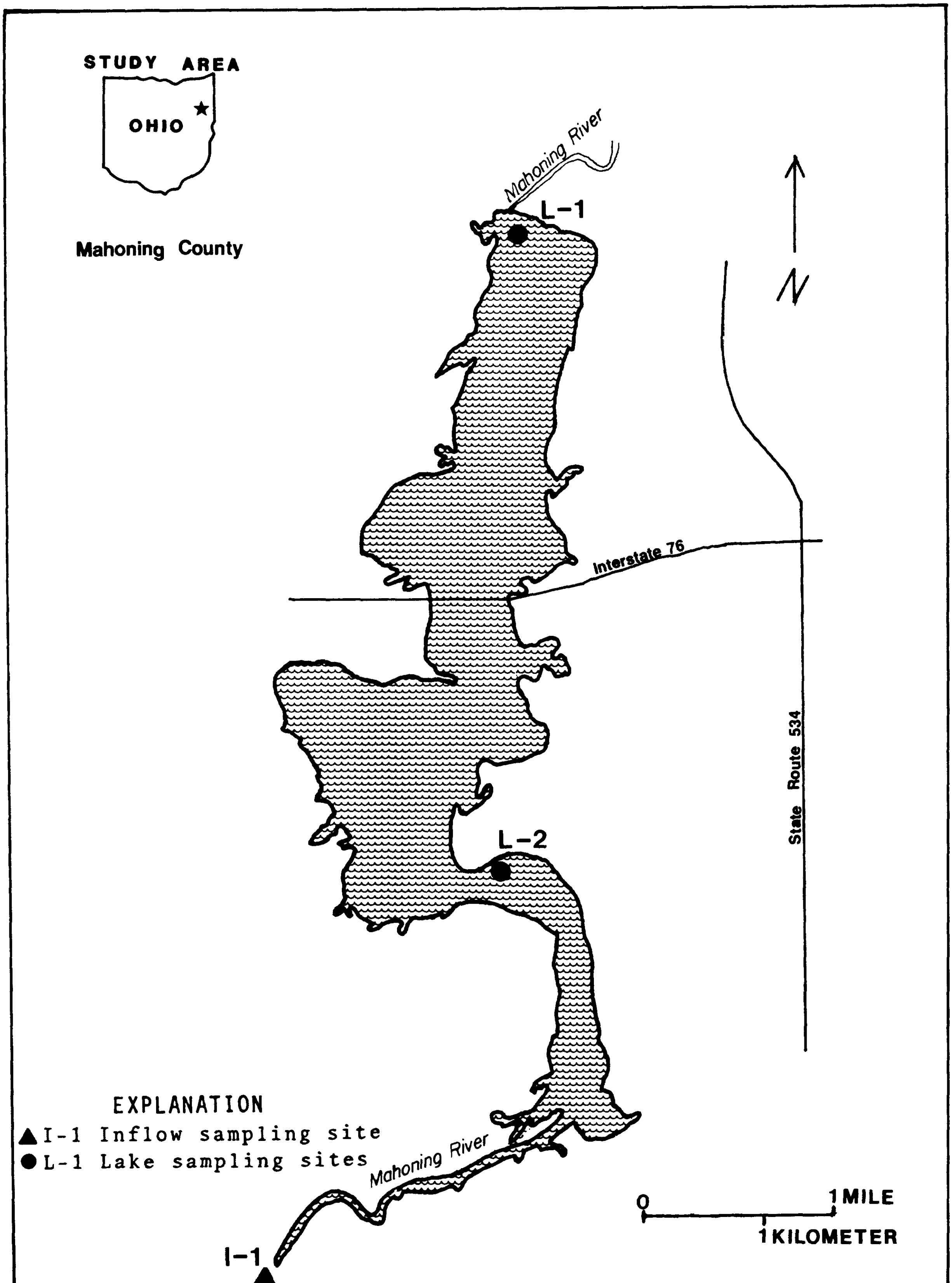



**Figure 48.--Lake Milton and inflow sampling site.**

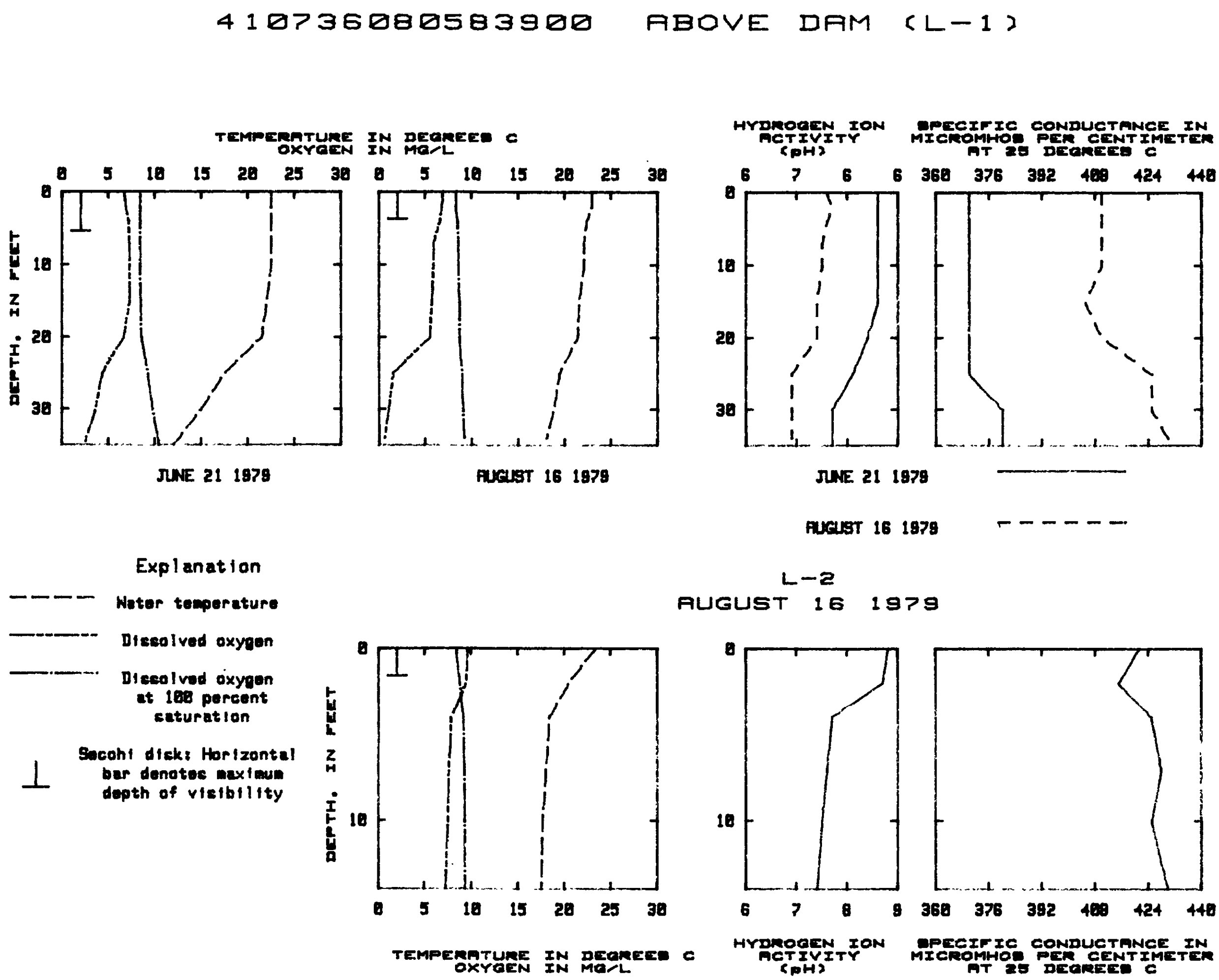



Figure 49.--Data profiles for Lake Milton.

Table 104.--Profile data for the primary lake site, Lake Milton, Ohio

410736080583900 - LK MILTON AB DAM (L-1) NR CRAIG BEACH OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

| DATE | TIME | SAMP-LING DEPTH (FT) | TEMPER-ATURE (DEG C) | OXYGEN, DIS-SOLVED (MG/L) | OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION) | SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS) | PH (UNITS) | CAR-BONATE (MG/L AS CO3) | BICAR-BONATE (MG/L AS HCO3) | CARBON DIOXIDE DIS-SOLVED (MG/L AS CO2) | HYDRO-GEN SULFIDE TOTAL (MG/L AS H2S) | TRANS-PAR-ENCY (SECCHI DISK) (IN) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| JUN | | | | | | | | | | | | |
| 21... | 1430 | .0 | 22.5 | 6.7 | 80 | 370 | 8.6 | -- | -- | -- | -- | -- |
| 21... | 1435 | 2.0 | 22.5 | 6.9 | 82 | 370 | 8.6 | 4 | 96 | .4 | .0 | 64 |
| 21... | 1440 | 4.0 | 22.5 | 7.2 | 86 | 370 | 8.6 | -- | -- | -- | -- | -- |
| 21... | 1445 | 7.0 | 22.5 | 7.3 | 87 | 370 | 8.6 | -- | -- | -- | -- | -- |
| 21... | 1450 | 10 | 22.5 | 7.3 | 87 | 370 | 8.6 | -- | -- | -- | -- | -- |
| 21... | 1455 | 15 | 22.0 | 7.3 | 86 | 370 | 8.6 | -- | -- | -- | -- | -- |
| 21... | 1500 | 20 | 21.5 | 6.6 | 77 | 370 | 8.4 | -- | -- | -- | -- | -- |
| 21... | 1505 | 25 | 17.5 | 4.3 | 46 | 370 | 8.1 | -- | -- | -- | -- | -- |
| 21... | 1510 | 30 | 15.0 | 3.6 | 37 | 380 | 7.7 | -- | -- | -- | -- | -- |
| 21... | 1515 | 35 | 12.0 | 2.4 | 23 | 380 | 7.7 | 0 | 44 | 1.4 | .0 | -- |
| AUG | | | | | | | | | | | | |
| 16... | 1400 | .0 | 23.0 | 6.9 | 83 | 410 | 7.6 | -- | -- | -- | -- | -- |
| 16... | 1405 | 2.0 | 23.0 | 6.8 | 82 | 410 | 7.7 | 0 | 90 | 2.9 | .0 | 44 |
| 16... | 1410 | 4.0 | 22.4 | 6.6 | 78 | 410 | 7.6 | -- | -- | -- | -- | -- |
| 16... | 1415 | 7.0 | 22.1 | 5.9 | 69 | 410 | 7.5 | -- | -- | -- | -- | -- |
| 16... | 1420 | 10 | 22.1 | 5.9 | 69 | 410 | 7.5 | -- | -- | -- | -- | -- |
| 16... | 1425 | 15 | 21.6 | 5.7 | 69 | 405 | 7.4 | -- | -- | -- | -- | -- |
| 16... | 1430 | 20 | 21.4 | 5.5 | 63 | 410 | 7.4 | -- | -- | -- | -- | -- |
| 16... | 1435 | 25 | 19.4 | 1.5 | 17 | 425 | 6.9 | -- | -- | -- | -- | -- |
| 16... | 1440 | 30 | 18.8 | 1.0 | 11 | 425 | 6.9 | -- | -- | -- | -- | -- |
| 16... | 1445 | 34 | 18.0 | .6 | 7 | 430 | 6.9 | 0 | 126 | 25 | .3 | -- |

Table 105.--Chemical analyses of water column composite samples, Lake Milton, Ohio

410736080583900 - LK MILTON AB DAM (L-1) NR CRAIG BEACH OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

| DATE | TIME | CALCIUM DIS-SOLVED (MG/L AS CA) | MAGNE-SIUM, DIS-SOLVED (MG/L AS MG) | POTAS-SIUM, DIS-SOLVED (MG/L AS K) | SODIUM, DIS-SOLVED (MG/L AS NA) | SULFATE DIS-SOLVED (MG/L AS SO4) | CHLO-RIDE, DIS-SOLVED (MG/L AS CL) | FLUO-RIDE, DIS-SOLVED (MG/L AS F) | HARD-NESS (MG/L AS CACO3) | SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L) |
|---|---|---|---|---|---|---|---|---|---|---|
| JUN 21... | 1515 | 39 | 11 | 3.7 | 16 | 70 | 29 | .2 | 140 | 263 |

| DATE | SOLIDS, RESIDUE AT 105 DEG. C, SUS-PENDED (MG/L) | SOLIDS, RESIDUE AT 105 DEG. C, TOTAL (MG/L) | BARIUM, TOTAL RECOV-ERABLE (UG/L AS BA) | CADMIUM TOTAL RECOV-ERABLE (UG/L AS CD) | CHRO-MIUM, TOTAL RECOV-ERABLE (UG/L AS CR) | LEAD, TOTAL RECOV-ERABLE (UG/L AS PB) | MERCURY TOTAL RECOV-ERABLE (UG/L AS HG) | NICKEL, TOTAL RECOV-ERABLE (UG/L AS NI) | SELE-NIUM, TOTAL (UG/L AS SE) | SILVER, TOTAL RECOV-ERABLE (UG/L AS AG) |
|---|---|---|---|---|---|---|---|---|---|---|
| JUN 21... | 8 | 271 | 0 | 20 | 10 | 3 | <.5 | 15 | 0 | 0 |

| DATE | ARSENIC TOTAL (UG/L AS AS) | METHY-LENE BLUE ACTIVE SUB-STANCE (MG/L) | BORON, TOTAL RECOV-ERABLE (UG/L AS B) | COBALT, TOTAL RECOV-ERABLE (UG/L AS CO) | COPPER, TOTAL RECOV-ERABLE (UG/L AS CU) | IRON, TOTAL RECOV-ERABLE (UG/L AS FE) | MANGA-NESE, TOTAL RECOV-ERABLE (UG/L AS MN) | MOLYB-DENUM, TOTAL RECOV-ERABLE (UG/L AS MO) | ZINC, TOTAL RECOV-ERABLE (UG/L AS ZN) |
|---|---|---|---|---|---|---|---|---|---|
| JUN 21... | <10 | .06 | 70 | 2 | 7 | 340 | 390 | 1 | 20 |

Table 106. Chemical, physical, and biological analyses of water samples from selected depths, Lake Milton, Ohio

410736080583900 - LK MILTON AB DAM (L-1) NR CRAIG BEACH OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

| DATE | TIME | SAMPLING DEPTH (FT) | NITROGEN, NITRITE TOTAL (MG/L AS N) | NITROGEN, NITRATE TOTAL (MG/L AS N) | NITROGEN, NO2+NO3 TOTAL (MG/L AS N) | NITROGEN, AMMONIA TOTAL (MG/L AS N) | NITROGEN, ORGANIC TOTAL (MG/L AS N) | NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N) | PHOSPHORUS, ORTHO. TOTAL (MG/L AS P) |
|---|---|---|---|---|---|---|---|---|---|
| JUN | | | | | | | | | |
| 21... | 1435 | 2.0 | .03 | .95 | .98 | .08 | .60 | .68 | .01 |
| 21... | 1515 | 35 | .01 | .53 | .54 | .78 | .62 | 1.4 | .01 |
| AUG | | | | | | | | | |
| 16... | 1405 | 2.0 | .03 | .46 | .49 | .17 | .55 | .72 | .00 |
| 16... | 1445 | 34 | .02 | .08 | .10 | 1.3 | 1.0 | 2.3 | .02 |

| DATE | PHOSPHORUS, TOTAL (MG/L AS P) | SILICA, DISSOLVED (MG/L AS SIO2) | TURBIDITY (JTU) | COLOR (PLATINUM-COBALT UNITS) | CARBON, ORGANIC TOTAL (MG/L AS C) | OXYGEN DEMAND, BIOCHEMICAL, 5 DAY (MG/L) | OXYGEN DEMAND, CHEMICAL (HIGH LEVEL) (MG/L) | COLIFORM, FECAL, 0.45 UM-MF (COLS./100 ML) | STREPTOCOCCI FECAL, (COLS. PER 100 ML) |
|---|---|---|---|---|---|---|---|---|---|
| JUN | | | | | | | | | |
| 21... | .02 | 2.8 | 1 | 15 | 5.3 | 1.5 | 24 | 6 | 6 |
| 21... | .06 | 5.5 | 8 | 25 | 7.5 | 3.3 | 41 | 2 | 10 |
| AUG | | | | | | | | | |
| 16... | .02 | 2.6 | 1 | 5 | 8.4 | 1.1 | 9 | 4 | 80 |
| 16... | .22 | 6.7 | 30 | 20 | 8.8 | 1.7 | 28 | 8 | 8 |

Table 107.--Phytoplankton identified in Lake Milton, Ohio (1979)

| Sample description | | | Total cells (per ml) | Diversity index (genus) $\bar{d}$ | Chloro-phyll a ($\mu g/L$) | Division(s) present (in order of dominance) | Percent of total cell count | Dominant taxa within division and percent (%)* of total cell count |
|---|---|---|---|---|---|---|---|---|
| Location | Date | Location in water column | | | | | | |
| L-1 Above dam | 6-21 | Euphotic zone Composite | 2,100 | 2.3 | 8.2 | Chrysophyta | 37 | Dinobryon (30), Melosira (6), Nitzschia (1) |
| | | | | | | Cryptophyta | 31 | Chroomonas (30), Cryptomonas (1) |
| | | | | | | Cyanophyta | 24 | Oscillatoria (24) |
| | | | | | | Chlorophyta | 7 | Oocystis (5), Ankistrodesmus (2) |
| | | | | | | Euglenophyta | 1 | Euglena (1) |
| L-1 Above dam | 6-21 | 2-ft depth | -- | -- | 9.3 | | | |
| L-1 Above dam | 6-21 | 10-ft depth | 4,700 | 1.2 | 8.9 | Cyanophyta | 78 | Oscillatoria (78) |
| | | | | | | Chlorophyta | 12 | Coelastrum (7), Oocystis (3), Sphaerocystis (2) |
| | | | | | | Cryptophyta | 10 | Chroomonas (9), Cryptomonas (1) |
| L-1 Above dam | 8-16 | Euphotic zone Composite | 2,800 | 1.7 | 8.1 | Cyanophyta | 66 | Oscillatoria (66) |
| | | | | | | Chrysophyta | 18 | Mallomonas (11), Cyclotella (3), Synedra (3), Nitzschia (1) |
| | | | | | | Chlorophyta | 16 | Coelastrum (12), Scenedesmus (3), Ankistrodesmus (1) |
| L-1 Above dam | 8-16 | 0-ft depth | 2,600 | 2.9 | 8.4 | Cyanophyta | 50 | Oscillatoria (26), Agmenellum (24) |
| | | | | | | Chrysophyta | 26 | Melosira (18), Cyclotella (4), Nitzschia (3), Synedra (1) |
| | | | | | | Chlorophyta | 18 | Scenedesmus (9), Dictyosphaerium (6) Chlamydomonas (3) |
| | | | | | | Euglenophyta | 6 | Euglena (3), Trachelomonas (3) |
| L-1 Above dam | 8-16 | 2-ft depth | -- | -- | 15.4 | | | |

*Less than 1 percent not given.

Lake Milton had developed a distinct thermal stratification at L-1 by the June 21 sampling. This thermal stratification continued into August. Chemical stratification was found at both samplings. Oxygen defecits at L-1 were recorded at all depths at both samplings; these deficits increased to nearly anaerobic conditions near the bottom in August.

The spring near-surface, total-phosphorus concentration was 0.02 mg/L. The spring total-nitrogen to total-phosphorus ratio, 83 to 1, indicates phosphorus may be limiting algal productivity in Lake Milton.

Lake Milton had Carlson TSIs of 57 for chlorophyll a (summer), 58 for Secchi-disk transparency (summer) and 47 for total phosphorus (spring). Carlson TSIs in this range indicate eutrophic lakes.

Cadmium exceeded Ohio water-quality standards in the spring. Blue-green algae (Cyanophyta) and yellow-green algae (Chrysophyta) dominated the spring algal community. Blue-green algae (Cyanophyta) dominated the summer algal community. Total cell counts were low compared to the other lakes sampled.

Inflow data (fig. 48, table 108): The Mahoning River, which drains 246 $mi^2$ of the lake's drainage basin, was sampled at site I-1. A qualitative comparison of stream versus lake data is shown below.

| Inflow sampling site | Sampling date (1979) | Estimated discharge ($ft^3/s$) | Water body (stream or lake at 2-foot depth) having higher concentration | | | |
|---|---|---|---|---|---|---|
| | | | $NO_2$+ $NO_3$ | Total P | TOC | (Specific conductance) |
| Mahoning River at site I-1 | June 21 | 180 | Stream | Stream | Lake | Lake |
| | Aug 16 | 275 | Stream | Stream | Lake | Lake |

Table 108.--Physical and chemical data for selected inflows, Lake Milton, Ohio

410254081000501 - MAHONING R AB LK MILTON NR CRAIG BEACH OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

| DATE | TIME | STREAM-FLOW, INSTAN-TANEOUS (CFS) | TEMPER-ATURE (DEG C) | OXYGEN, DIS-SOLVED (MG/L) | PH (UNITS) | SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS) | TUR-BID-ITY (JTU) | COLOR (PLAT-INUM-COBALT UNITS) | CARBON, ORGANIC TOTAL (MG/L AS C) | NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N) | NITRO-GEN,AM-MONIA + ORGANIC TOTAL (MG/L AS N) | PHOS-PHORUS, TOTAL (MG/L AS P) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| JUN | | | | | | | | | | | | |
| 21... | 1330 | 180 | 15.0 | 9.3 | 8.1 | 360 | 8 | 40 | 5.0 | 1.7 | 1.1 | .05 |
| AUG | | | | | | | | | | | | |
| 16... | 1300 | 275 | 20.0 | 6.9 | 7.7 | 395 | 30 | 40 | 6.0 | .57 | 1.2 | .07 |

## Lake Rupert

Location: Vinton County
(Hamden 7.5 minute quadrangle map)

Type: Impoundment on Little Raccoon Creek

Use: Recreation and water supply.

Physical characteristics at summer pool level (table 6):

| Date of origin (year) | Surface area (acres) | Capacity (acre-feet) | Capacity-inflow ratio (C/I) |
|---|---|---|---|
| 1968 | 325 | 2,860 | 0.17 |

Drainage-basin characteristics:

| Drainage area ($mi^2$) | Type | Estimated sediment yield (from fig. 3) |
|---|---|---|
| 22.2 | Agricultural, rural | Moderately low |

Lake data (figs. 50, 51; tables 109-112): Lake Rupert was sampled under cloudy, windy conditions on June 15 and under sunny skies on September 4. Secchi-disk transparencies at the primary sampling station (L-1) were 6.9 feet in June and 5.1 feet in September. These transparencies are greater than normal for Ohio lakes.

Profile and analytical data show the following lake characteristics:

| Date | Stratification (gradient) Thermal | Stratification (gradient) Chemical | Chemical type | Trophic state index (Carlson) Chl a | Trophic state index (Carlson) SD | Trophic state index (Carlson) T.P. | Trophic class | Substances at or above State limits Toxicants | Substances at or above State limits Bacteria | Phyto-plankton, dominant division(s) |
|---|---|---|---|---|---|---|---|---|---|---|
| 6-15-79 | Yes | Yes | Soft; Ca, $SO_4$, $HCO_3$ | -- | -- | 37 | Meso-trophic | No | No | Cyanophyta, Chlorophyta |
| 9-04-79 | Yes | Yes | -- | 50 | 54 | -- | -- | No | No | Cyanophyta |

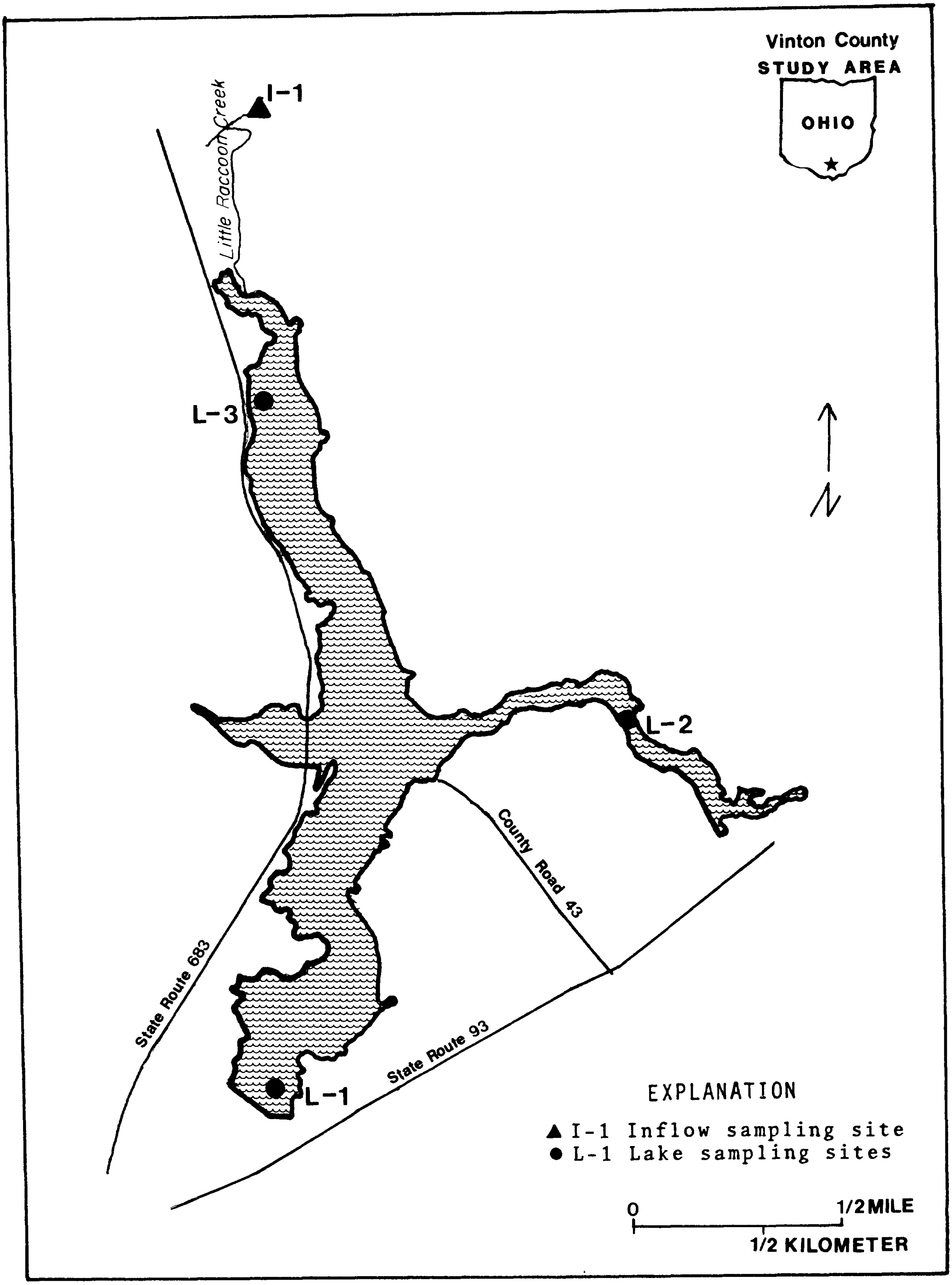



**Figure 50.--Lake Rupert and inflow sampling site.**

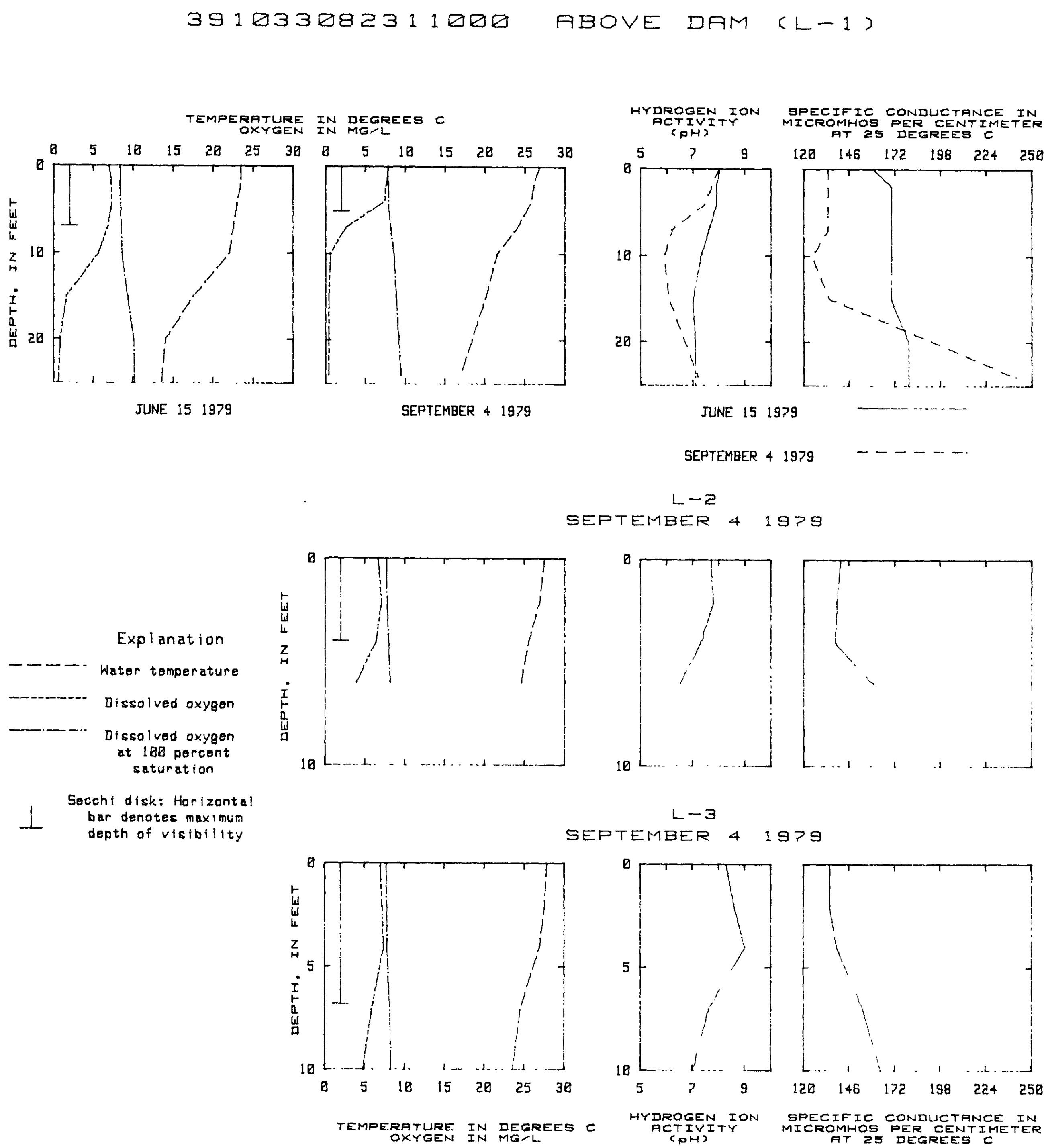



**Figure 51.--Data profiles for Lake Rupert.**

Table 109.--Profile data for the primary lake site, Lake Rupert, Ohio

391033082311000 - LK RUPERT AB DAM (L-1) NR HAMDEN OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

| DATE | TIME | SAMPLING DEPTH (FT) | TEMPERATURE (DEG C) | OXYGEN, DISSOLVED (MG/L) | OXYGEN, DISSOLVED (PERCENT SATURATION) | SPECIFIC CONDUCTANCE (MICROMHOS) | PH (UNITS) | CARBONATE (MG/L AS CO3) | BICARBONATE (MG/L AS HCO3) | CARBON DIOXIDE DISSOLVED (MG/L AS CO2) | HYDROGEN SULFIDE TOTAL (MG/L AS H2S) | TRANSPARENCY (SECCHI DISK) (IN) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| JUN | | | | | | | | | | | | |
| 15... | 1115 | .0 | 23.5 | 7.0 | 84 | 160 | 8.0 | -- | -- | -- | -- | -- |
| 15... | 1120 | 2.0 | 23.5 | 7.3 | 88 | 170 | 7.9 | 0 | 150 | 3.0 | .0 | 82 |
| 15... | 1125 | 4.0 | 23.0 | 7.3 | 87 | 170 | 7.9 | -- | -- | -- | -- | -- |
| 15... | 1130 | 7.0 | 22.5 | 6.8 | 80 | 170 | 7.6 | -- | -- | -- | -- | -- |
| 15... | 1135 | 10 | 22.0 | 5.6 | 65 | 170 | 7.3 | -- | -- | -- | -- | -- |
| 15... | 1140 | 15 | 17.5 | 1.6 | 10 | 170 | 7.0 | -- | -- | -- | -- | -- |
| 15... | 1145 | 20 | 14.0 | .8 | 7 | 180 | 7.1 | -- | -- | -- | -- | -- |
| 15... | 1150 | 25 | 13.5 | .6 | 6 | 180 | 7.1 | 0 | 279 | 35 | .2 | -- |
| SEP | | | | | | | | | | | | |
| 04... | 1300 | .0 | 26.8 | 7.9 | 101 | 134 | 8.0 | -- | -- | -- | -- | -- |
| 04... | 1305 | 2.0 | 26.1 | 7.6 | 96 | 134 | 7.7 | 0 | 60 | 1.9 | .0 | 61 |
| 04... | 1310 | 4.0 | 25.8 | 7.4 | 94 | 134 | 7.5 | -- | -- | -- | -- | -- |
| 04... | 1315 | 7.0 | 24.0 | 2.5 | 30 | 134 | 6.2 | -- | -- | -- | -- | -- |
| 04... | 1320 | 10 | 21.5 | .6 | 7 | 125 | 5.9 | -- | -- | -- | -- | -- |
| 04... | 1325 | 15 | 20.1 | .4 | 4 | 135 | 6.1 | -- | -- | -- | -- | -- |
| 04... | 1330 | 24 | 16.9 | .4 | 4 | 241 | 7.2 | 0 | 104 | 10 | .2 | -- |

Table 110.--Chemical analyses of water column composite samples, Lake Rupert, Ohio

391033082311000 - LK RUPERT AB DAM (L-1) NR HAMDEN OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

| DATE | TIME | CALCIUM DIS-SOLVED (MG/L AS CA) | MAGNE-SIUM, DIS-SOLVED (MG/L AS MG) | POTAS-SIUM, DIS-SOLVED (MG/L AS K) | SODIUM, DIS-SOLVED (MG/L AS NA) | SULFATE DIS-SOLVED (MG/L AS SO4) | CHLO-RIDE, DIS-SOLVED (MG/L AS CL) | FLUO-RIDE, DIS-SOLVED (MG/L AS F) | HARD-NESS (MG/L AS CACO3) | SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L) |
|---|---|---|---|---|---|---|---|---|---|---|
| JUN 15... | 1150 | 14 | 5.4 | 1.5 | 4.1 | 39 | 4.7 | .1 | 57 | 115 |

| DATE | SOLIDS, RESIDUE AT 105 DEG. C, SUS-PENDED (MG/L) | SOLIDS, RESIDUE AT 105 DEG. C, TOTAL (MG/L) | BARIUM, TOTAL RECOV-ERABLE (UG/L AS BA) | CADMIUM TOTAL RECOV-ERABLE (UG/L AS CD) | CHRO-MIUM, TOTAL RECOV-ERABLE (UG/L AS CR) | LEAD, TOTAL RECOV-ERABLE (UG/L AS PB) | MERCURY TOTAL RECOV-ERABLE (UG/L AS HG) | NICKEL, TOTAL RECOV-ERABLE (UG/L AS NI) | SELE-NIUM, TOTAL (UG/L AS SE) | SILVER, TOTAL RECOV-ERABLE (UG/L AS AG) |
|---|---|---|---|---|---|---|---|---|---|---|
| JUN 15... | 9 | 124 | 0 | 0 | 10 | 6 | <.5 | 10 | 0 | 0 |

| DATE | ARSENIC TOTAL (UG/L AS AS) | METHY-LENE BLUE ACTIVE SUB-STANCE (MG/L) | BORON, TOTAL RECOV-ERABLE (UG/L AS B) | COBALT, TOTAL RECOV-ERABLE (UG/L AS CO) | COPPER, TOTAL RECOV-ERABLE (UG/L AS CU) | IRON, TOTAL RECOV-ERABLE (UG/L AS FE) | MANGA-NESE, TOTAL RECOV-ERABLE (UG/L AS MN) | MOLYB-DENUM, TOTAL RECOV-ERABLE (UG/L AS MO) | ZINC, TOTAL RECOV-ERABLE (UG/L AS ZN) |
|---|---|---|---|---|---|---|---|---|---|
| JUN 15... | <10 | <.05 | 20 | 0 | 4 | 170 | 2500 | 2 | 20 |

Table 111. Chemical, physical, and biological analyses of water samples from selected depths, Lake Rupert, Ohio

391033082311000 - LK RUPERT AB DAM (L-1) NR HAMDEN OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

| DATE | TIME | SAMPLING DEPTH (FT) | NITROGEN, NITRITE TOTAL (MG/L AS N) | NITROGEN, NITRATE TOTAL (MG/L AS N) | NITROGEN, NO2+NO3 TOTAL (MG/L AS N) | NITROGEN, AMMONIA TOTAL (MG/L AS N) | NITROGEN, ORGANIC TOTAL (MG/L AS N) | NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N) | PHOSPHORUS, ORTHO. TOTAL (MG/L AS P) |
|---|---|---|---|---|---|---|---|---|---|
| JUN | | | | | | | | | |
| 15... | 1120 | 2.0 | .01 | .08 | .09 | .04 | .21 | .25 | .00 |
| 15... | 1150 | 25 | .01 | .00 | .00 | .78 | .32 | 1.1 | .00 |
| SEP | | | | | | | | | |
| 04... | 1305 | 2.0 | .00 | .02 | .02 | .04 | .27 | .31 | .00 |
| 04... | 1330 | 24 | .00 | .02 | .02 | 1.7 | .90 | 2.6 | .00 |

| DATE | PHOSPHORUS, TOTAL (MG/L AS P) | SILICA, DISSOLVED (MG/L AS SIO2) | TURBIDITY (JTU) | COLOR (PLATINUM-COBALT UNITS) | CARBON, ORGANIC TOTAL (MG/L AS C) | OXYGEN DEMAND, BIOCHEMICAL, 5 DAY (MG/L) | OXYGEN DEMAND, CHEMICAL (HIGH LEVEL) (MG/L) | COLIFORM, FECAL, 0.45 UM-MF (COLS./100 ML) | STREPTOCOCCI FECAL, (COLS. PER 100 ML) |
|---|---|---|---|---|---|---|---|---|---|
| JUN | | | | | | | | | |
| 15... | .01 | 6.5 | 2 | 20 | 5.8 | .6 | 30 | 4 | 6 |
| 15... | .01 | 7.2 | 30 | 40 | 3.9 | .8 | 36 | 10 | 12 |
| SEP | | | | | | | | | |
| 04... | .01 | 6.9 | 2 | 5 | 9.1 | 1.2 | 1 | 8 | 6 |
| 04... | .08 | 11 | 15 | 20 | 4.9 | .8 | 72 | 258 | 20 |

Table 112.--Phytoplankton identified in Lake Rupert, Ohio (1979)

| Sample description | | | Total cells (per ml) | Diversity index (genus) $\bar{d}$ | Chloro-phyll a (µg/L) | Division(s) present (in order of dominance) | Percent of total cell count | Dominant taxa within division and percent (%)* of total cell count |
|---|---|---|---|---|---|---|---|---|
| Location | Date | Location in water column | | | | | | |
| L-1 Above dam | 6-15 | Euphotic zone Composite | 850 | 2.2 | 5.7 | Cyanophyta | 48 | *Anacystis* (48) |
| | | | | | | Chlorophyta | 30 | *Chlamydomonas* (17), *Oocystis* (6), *Scenedesmus* (6), *Ankistrodesmus* (2) |
| | | | | | | Chrysophyta | 19 | *Cyclotella* (17), *Ochromonas* (2) |
| | | | | | | Cryptophyta | 2 | *Cryptomonas* (2) |
| | | | | | | Euglenophyta | 2 | *Trachelomonas* |
| L-1 Above dam | 6-15 | 2-ft depth | 1,300 | 2.5 | 3.5 | Chlorophyta | 67 | *Crucigenia* (32), *Kirchneriella* (22) *Chlamydomonadaceae* (9), *Crucigenia* (2), *Kirchneriella* (1) |
| | | | | | | Chrysophyta | 25 | *Cyclotella* (18), *Dinobryon* (3) |
| | | | | | | Cyanophyta | 8 | *Anacystis* (8) |
| L-1 Above dam | 9-04 | Euphotic zone Composite | 6,400 | 2.3 | 14.3 | Cyanophyta | 94 | *Anacystis* (37), *Oscillatoria* (28), *Schizothrix* (18), *Agmenellum* (9), *Raphidiopsis* (1) |
| | | | | | | Chrysophyta | 3 | *Cyclotella* (2), *Melosira* (1), *Achnanthes* (6) |
| | | | | | | Chlorophyta | 1 | *Pandorina* (1) |
| | | | | | | Chrysophyta | | *Dinobryon* |
| | | | | | | Cryptophyta | | *Cryptomonas* |
| | | | | | | Euglenophyta | | *Eutreptia*, *Phacus* |
| | | | | | | Pyrrophyta | | *Glenodinium* |
| | | 2-ft depth | -- | -- | 7.3 | | | |
| L-1 Above dam | 9-04 | 0-ft depth | 2,800 | 2.3 | 7.8 | Chlorophyta | 43 | *Chlorella* (39), *Scenedesmus* (3) *Chlorococcum* (1), *Cosmarium* (1) |
| | | | | | | Chrysophyta | 37 | *Cyclotella* (25), *Dinobryon* (8) *Achnanthes* (2), *Synedra* (1) *Nitzschia* (1), *Skeletonema* (1) |
| | | | | | | Cyanophyta | 20 | *Oscillatoria* (20) |

*Less than 1 percent not given.

Lake Rupert at L-1 had developed a distinct thermal stratification by the June 15 sampling. The thermal stratification continued into August. Chemical stratification was found on both dates. These were oxygen deficits at L-1 throughout the entire water column; anaerobic conditions were approached on both dates.

Dissolved oxygen, pH, and specific conductance were slightly lower at L-2 and L-3 than at L-1.

The spring near-surface, total-phosphorus concentration was 0.01 mg/L, a low value for Ohio lakes. The spring total-nitrogen to total-phosphorus ratio, 34 to 1, indicates phosphorus may be limiting algal productivity in Lake Rupert.

Lake Rupert had Carlson TSIs of 50 for chlorophyll *a* (summer), 54 for Secchi-disk transparency (summer), and 37 for total phosphorus (spring). The lake was classified as mesotrophic on the basis of the TSIs recorded for chlorophyll-*a* and total phosphorus. The chlorophyll *a* concentration was higher than normal for the low phosphorus concentration.

No chemical constituents or properties exceeded Ohio water-quality standards in the spring. The manganese concentration, however, was higher than is normal in Ohio lakes.

Blue-green algae (Cyanophyta) and green algae (Chlorophyta) dominated the spring and summer algal communities. The cell counts were lower than normal for Ohio lakes. Cattails (*Typha*) were abundant in the shallow areas of the lake.

Inflow data (fig. 50, table 113): Little Raccoon Creek, which drains 8.70 $mi^2$, was sampled at site I-1. It represents 39 percent of the lake basin. A qualitative comparison of stream versus lake data is shown below.

| Inflow sampling site | Sampling date (1979) | Estimated discharge ($ft^3/s$) | Water body (stream or lake at 2-foot depth) having higher concentration | | | |
|---|---|---|---|---|---|---|
| | | | $NO_2+NO_3$ | Total P | TOC | (Specific conductance) |
| Little Raccoon Creek at | June 15 | 3.0 | Stream | Equal | Lake | Stream |
| | Sept 4 | 5.0 | Stream | Equal | Lake | Stream |

Table 113.--Physical and chemical data for selected inflows, Lake Rupert, Ohio

391256082322700 - L RACCOON C AB LK RUPERT (I-1) NR HAMDEN OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

| DATE | TIME | STREAM-FLOW, INSTAN-TANEOUS (CFS) | TEMPER-ATURE (DEG C) | OXYGEN, DIS-SOLVED (MG/L) | PH (UNITS) | SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS) | TUR-BID-ITY (JTU) | COLOR (PLAT-INUM-COBALT UNITS) | CARBON, ORGANIC TOTAL (MG/L AS C) | NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N) | NITRO-GEN,AM-MONIA + ORGANIC TOTAL (MG/L AS N) | PHOS-PHORUS, TOTAL (MG/L AS P) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| JUN | | | | | | | | | | | | |
| 15... | 1000 | 3.0 | 22.8 | 8.3 | 7.3 | 195 | 1 | 20 | 3.1 | .12 | .04 | .00 |
| SEP | | | | | | | | | | | | |
| 04... | 1200 | 5.0 | 21.4 | 7.9 | 7.7 | 220 | 1 | 40 | 4.7 | .15 | .05 | .00 |

## Lake White

Location: Pike County
(Piketon 7.5-minute quadrangle map)

Type: Impoundment on Pee Pee Creek

Use: Recreation

Physical characteristics at summer pool level (table 6):

| Date of origin (year) | Surface area (acres) | Capacity (acre-feet) | Capacity-inflow ratio (C/I) |
|---|---|---|---|
| 1935 | 339 | 3,746 | 0.14 |

Drainage-basin characteristics:

| Drainage area ($mi^2$) | Type | Estimated sediment yield (from fig. 3) |
|---|---|---|
| 34.98 | Agricultural, rural | Moderately low |

Lake data (figs. 52, 53; tables 114-117): Lake White was sampled under partly cloudy skies on May 31 and in the rain on August 20. Secchi-disk transparencies at the primary sampling station (L-1) were 4.4 feet in May and 5.2 feet in August. These transparencies are greater than normal for Ohio lakes.

Profile and analytical data show the following lake characteristics:

| Date | Stratification (gradient) | | Chemical type | Trophic state index (Carlson) | | | Trophic class | Substances at or above State limits | | Phyto-plankton, dominant division(s) |
|---|---|---|---|---|---|---|---|---|---|---|
| | Thermal | Chemical | | Chl *a* | SD | T.P. | | Toxicants | Bacteria | |
| 4-24-78 | Yes | Yes | Very hard; Na, Cl | -- | -- | 72 | Eutrophic | Pb | No | Cyanophyta |
| 7-25-78 | Yes | Yes | -- | 66 | 69 | -- | -- | -- | No | Cyanophyta |

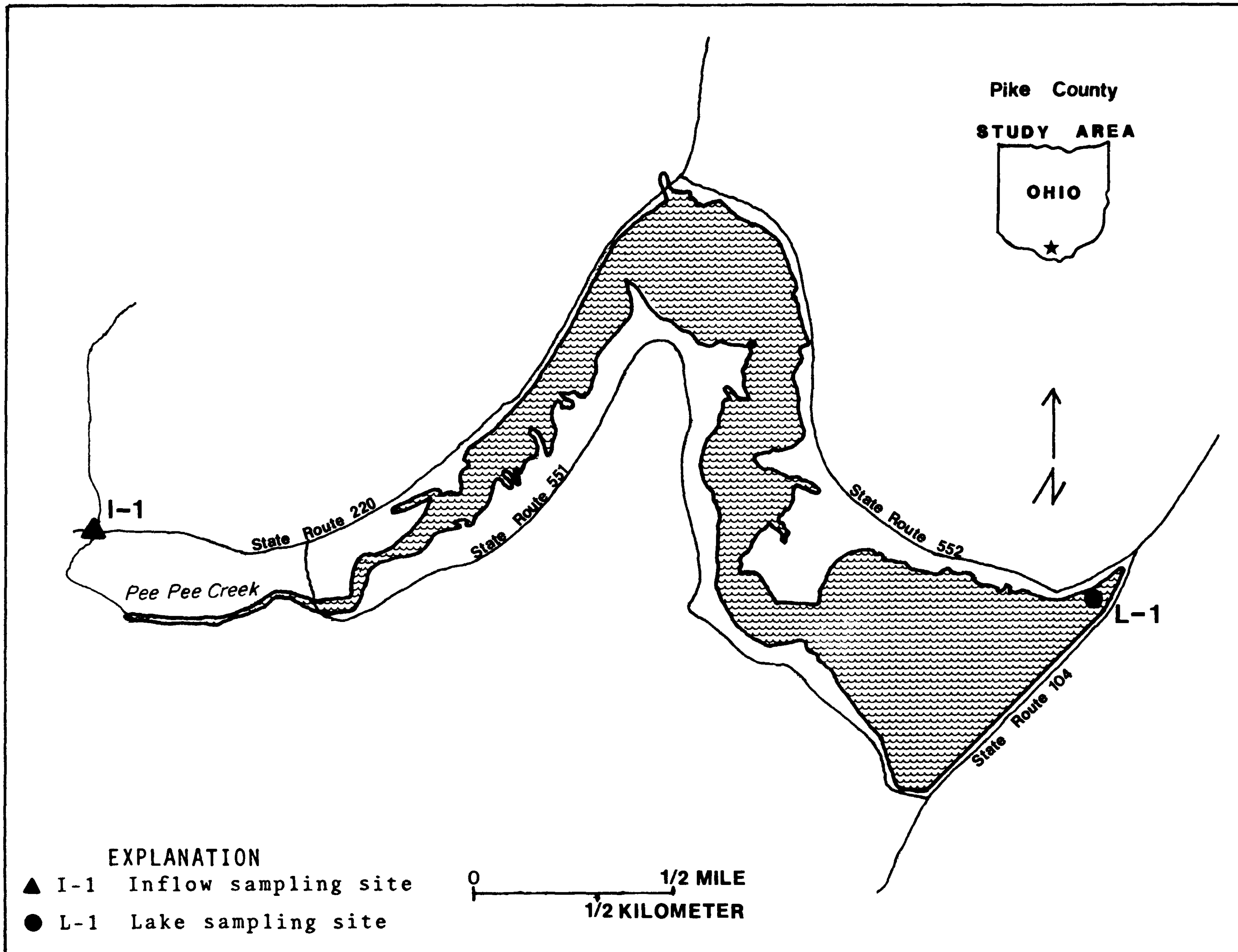



Figure 52.--Lake White and inflow sampling site.

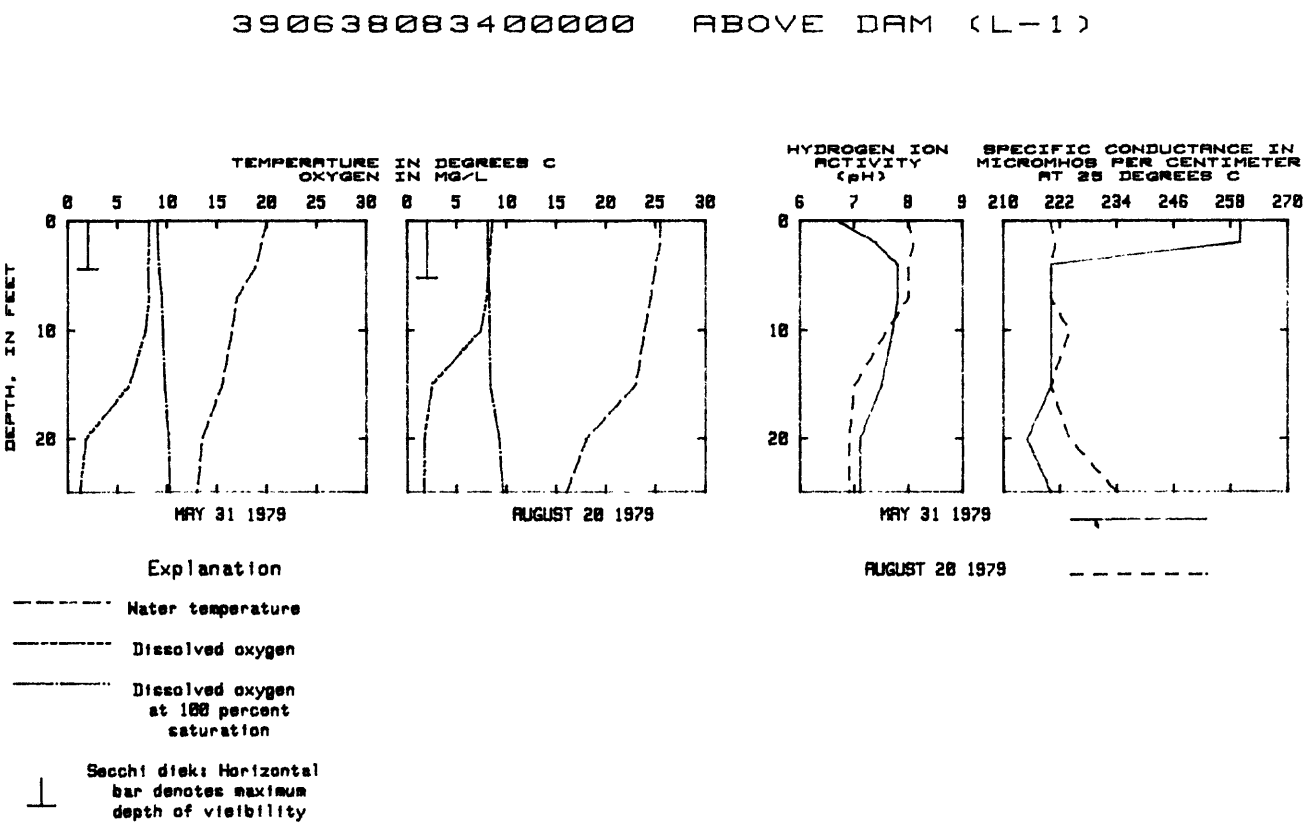



Figure 53.--Data profiles for Lake White.

Table 114.--Profile data for the primary lake site, Lake White, Ohio

390638083400000 - LAKE WHITE AB DAM (L-1) NR WAVERLY OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

| DATE | TIME | SAMPLING DEPTH (FT) | TEMPERATURE (DEG C) | OXYGEN, DISSOLVED (MG/L) | OXYGEN, DISSOLVED (PERCENT SATURATION) | SPECIFIC CONDUCTANCE (MICROMHOS) | PH (UNITS) | CARBONATE (MG/L AS CO3) | BICARBONATE (MG/L AS HCO3) | CARBON DIOXIDE DISSOLVED (MG/L AS CO2) | HYDROGEN SULFIDE TOTAL (MG/L AS H2S) | TRANSPARENCY (SECCHI DISK) (IN) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MAY | | | | | | | | | | | | |
| 31... | 1300 | .0 | 20.0 | 8.2 | 91 | 260 | 6.7 | -- | -- | -- | -- | -- |
| 31... | 1305 | 2.0 | 19.5 | 8.2 | 90 | 260 | 7.4 | 0 | 36 | 2.3 | .0 | 52 |
| 31... | 1310 | 4.0 | 19.0 | 8.1 | 88 | 220 | 7.8 | -- | -- | -- | -- | -- |
| 31... | 1315 | 7.0 | 17.0 | 8.2 | 86 | 220 | 7.8 | -- | -- | -- | -- | -- |
| 31... | 1320 | 10 | 16.5 | 7.8 | 81 | 220 | 7.7 | -- | -- | -- | -- | -- |
| 31... | 1325 | 15 | 15.5 | 6.2 | 63 | 220 | 7.5 | -- | -- | -- | -- | -- |
| 31... | 1330 | 20 | 13.5 | 1.8 | 18 | 215 | 7.1 | -- | -- | -- | -- | -- |
| 31... | 1335 | 25 | 13.0 | 1.2 | 12 | 220 | 7.1 | 0 | 37 | 4.7 | .3 | -- |
| AUG | | | | | | | | | | | | |
| 20... | 1300 | .0 | 25.5 | 8.6 | 106 | 220 | 8.0 | -- | -- | -- | -- | -- |
| 20... | 1305 | 2.0 | 25.5 | 8.4 | 104 | 221 | 8.1 | 0 | 38 | .4 | .0 | 62 |
| 20... | 1310 | 4.0 | 25.0 | 8.2 | 100 | 220 | 8.0 | -- | -- | -- | -- | -- |
| 20... | 1315 | 7.0 | 24.5 | 8.0 | 96 | 220 | 8.0 | -- | -- | -- | -- | -- |
| 20... | 1320 | 10 | 23.9 | 7.4 | 89 | 224 | 7.6 | -- | -- | -- | -- | -- |
| 20... | 1325 | 15 | 23.0 | 2.5 | 30 | 220 | 7.1 | -- | -- | -- | -- | -- |
| 20... | 1330 | 20 | 18.0 | 1.7 | 18 | 224 | 6.9 | -- | -- | -- | -- | -- |
| 20... | 1335 | 25 | 16.0 | 1.7 | 17 | 234 | 6.9 | 0 | 100 | 20 | .8 | -- |

Table 115.--Chemical analyses of water column composite samples, Lake White, Ohio

390638083400000 - LAKE WHITE AB DAM (L-1) NR WAVERLY OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

| DATE | TIME | CALCIUM DIS-SOLVED (MG/L AS CA) | MAGNE-SIUM, DIS-SOLVED (MG/L AS MG) | POTAS-SIUM, DIS-SOLVED (MG/L AS K) | SODIUM, DIS-SOLVED (MG/L AS NA) | SULFATE DIS-SOLVED (MG/L AS SO4) | CHLO-RIDE, DIS-SOLVED (MG/L AS CL) | FLUO-RIDE, DIS-SOLVED (MG/L AS F) | HARD-NESS (MG/L AS CACO3) | SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L) |
|---|---|---|---|---|---|---|---|---|---|---|
| MAY 31... | 1335 | 14 | 11 | 2.3 | 7.8 | 61 | 7.4 | .1 | 80 | 159 |

| DATE | SOLIDS, RESIDUE AT 105 DEG. C, SUS-PENDED (MG/L) | SOLIDS, RESIDUE AT 105 DEG. C, TOTAL (MG/L) | BARIUM, TOTAL RECOV-ERABLE (UG/L AS BA) | CADMIUM TOTAL RECOV-ERABLE (UG/L AS CD) | CHRO-MIUM, TOTAL RECOV-ERABLE (UG/L AS CR) | LEAD, TOTAL RECOV-ERABLE (UG/L AS PB) | MERCURY TOTAL RECOV-ERABLE (UG/L AS HG) | NICKEL, TOTAL RECOV-ERABLE (UG/L AS NI) | SELE-NIUM, TOTAL (UG/L AS SE) | SILVER, TOTAL RECOV-ERABLE (UG/L AS AG) |
|---|---|---|---|---|---|---|---|---|---|---|
| MAY 31... | 23 | 182 | 0 | 1 | 30 | 8 | <.5 | 15 | 0 | 0 |

| DATE | ARSENIC TOTAL (UG/L AS AS) | METHY-LENE BLUE ACTIVE SUB-STANCE (MG/L) | BORON, TOTAL RECOV-ERABLE (UG/L AS B) | COBALT, TOTAL RECOV-ERABLE (UG/L AS CO) | COPPER, TOTAL RECOV-ERABLE (UG/L AS CU) | IRON, TOTAL RECOV-ERABLE (UG/L AS FE) | MANGA-NESE, TOTAL RECOV-ERABLE (UG/L AS MN) | MOLYB-DENUM, TOTAL RECOV-ERABLE (UG/L AS MO) | ZINC, TOTAL RECOV-ERABLE (UG/L AS ZN) |
|---|---|---|---|---|---|---|---|---|---|
| MAY 31... | <10 | <.05 | 20 | 1 | 4 | 330 | 390 | 2 | 30 |

Table 116. Chemical, physical, and biological analyses of water samples from selected depths, Lake White, Ohio

390638083400000 - LAKE WHITE AB DAM (L-1) NR WAVERLY OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

| DATE | TIME | SAMPLING DEPTH (FT) | NITROGEN, NITRITE TOTAL (MG/L AS N) | NITROGEN, NITRATE TOTAL (MG/L AS N) | NITROGEN, NO2+NO3 TOTAL (MG/L AS N) | NITROGEN, AMMONIA TOTAL (MG/L AS N) | NITROGEN, ORGANIC TOTAL (MG/L AS N) | NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N) | PHOSPHORUS, ORTHO. TOTAL (MG/L AS P) |
|---|---|---|---|---|---|---|---|---|---|
| MAY | | | | | | | | | |
| 31... | 1305 | 2.0 | .01 | .45 | .46 | .05 | .37 | .42 | .00 |
| 31... | 1335 | 25 | .00 | .22 | .22 | .23 | .34 | .57 | .00 |
| AUG | | | | | | | | | |
| 20... | 1305 | 2.0 | .01 | .11 | .12 | .52 | .00 | .24 | .01 |
| 20... | 1335 | 25 | .00 | .02 | .02 | 1.3 | 1.2 | 2.5 | .01 |

| DATE | PHOSPHORUS, TOTAL (MG/L AS P) | SILICA, DISSOLVED (MG/L AS SIO2) | TURBIDITY (JTU) | COLOR (PLATINUM-COBALT UNITS) | CARBON, ORGANIC TOTAL (MG/L AS C) | OXYGEN DEMAND, BIOCHEMICAL, 5 DAY (MG/L) | OXYGEN DEMAND, CHEMICAL (HIGH LEVEL) (MG/L) | COLIFORM, FECAL, 0.45 UM-MF (COLS./100 ML) | STREPTOCOCCI FECAL, (COLS. PER 100 ML) |
|---|---|---|---|---|---|---|---|---|---|
| MAY | | | | | | | | | |
| 31... | .01 | 5.8 | 10 | 10 | 6.0 | .5 | 47 | 4 | 18 |
| 31... | .04 | 6.7 | 20 | 20 | 5.6 | .9 | 45 | 4 | 4 |
| AUG | | | | | | | | | |
| 20... | .01 | 2.3 | 1 | 5 | 5.6 | .8 | 18 | 8 | 8 |
| 20... | .04 | 8.0 | 10 | 20 | 7.7 | 1.7 | 39 | 8 | 22 |

Table 117.--Phytoplankton identified in Lake White, Ohio (1979)

| Sample description | | | Total cells (per ml) | Diversity index (genus) $\bar{d}$ | Chlorophyll a ($\mu g/L$) | Division(s) present (in order of dominance) | Percent of total cell count | Dominant taxa within division and percent (%)* of total cell count |
|---|---|---|---|---|---|---|---|---|
| Location | Date | Location in water column | | | | | | |
| L-1 Above dam | 5-31 | Euphotic zone Composite | 470 | 2.6 | 3.9 | Chlorophyta | 53 | Coelastrum (22), Oocystis (11), Ankistrodesmus (8), Selenastrum (6), Scenedesmus (6) |
| | | | | | | Chrysophyta | 44 | Melosira (39), Cyclotella (3), Cymbella (3) |
| | | | | | | Cryptophyta | 3 | Cryptomonas (3) |
| L-1 Above dam | 5-31 | 2-ft depth | 470 | 2.1 | 3.9 | Chlorophyta | 61 | Oocystis (58), Schroederia (3) |
| | | | | | | Cryptophyta | 20 | Chroomonas (14), Cryptomonas (6) |
| | | | | | | Chrysophyta | 17 | Cyclotella (6), Melosira (6), Nitzschia (3), Mallomonas (3) |
| | | | | | | Euglenophyta | 3 | Trachelomonas (3) |
| L-1 Above dam | 8-20 | Euphotic zone Composite | 8,400 | 2.8 | 11.3 | Cyanophyta | 62 | Anabaena (41), Oscillatoria (18), Agmenellum (3) |
| | | | | | | Chlorophyta | 18 | Coelastrum (10), Radiococcus (4), Sphaerocystis (4), Oocystis, Chlamydomonas |
| | | | | | | Chrysophyta | 14 | Cyclotella (5), Melosira (5), Nitzschia (2), Fragilaria (1), Synura |
| | | | | | | Euglenophyta | 1 | Trachelomonas |
| L-1 Above dam | 8-20 | 0-ft depth | 13,000 | 1.9 | 7.1 | Cyanophyta | 86 | Aphanizomenon (47), Oscillatoria (37), Agmenellum (2), Anacystis |
| | | 2-ft depth | -- | -- | 10.3 | Chrysophyta | 7 | Cyclotella (3), Melosira (3), Fragilaria (1), Nitzschia |
| | | | | | | Chlorophyta | 6 | Sphaerocystis (3), Oocystaceae (2), Schroederia, Oocystis, Scenedesmus, Elaktothrix |
| | | | | | | Chrysophyta | | Mallomonas |
| | | | | | | Cryptophyta | | Cryptomonas |

*Less than 1 percent not given.

Lake White had developed a distinct thermal stratification at L-1 by the May 31 sampling. This thermal stratification continued into August. Chemical stratification was evident on both dates. Oxygen defecits were noted at all depths in the spring and below 7 feet in the summer. Oxygen levels exceeded 1 part per million in the hypolimnion, which is unusual for a stratified lake in Ohio.

The spring near-surface, total-phosphorus concentration was 0.01 mg/L, which is low for Ohio lakes. The spring total-nitrogen to total-phosphorus ratio, 87 to 1, indicates phosphorus may be limiting algal productivity in Lake White.

Lake White had Carlson TSIs values of 53 for chlorophyll *a* (summer), 53 for Secchi-disk transparency (summer), and 37 for total phosphorus (spring). The lake was classified as eutrophic on the basis of the TSIs recorded for chlorophyll *a* and Secchi-disk transparency. The chlorophyll-*a* concentration was higher than normal for the low phosphorus concentration.

The total zinc concentration in the spring equaled the limit specified by Ohio water-quality standards.

Green algae (Chlorophyta) dominated the spring algal community. Blue-green algae (Cyanophyta) dominated the summer algal flora.

Inflow data (fig. 52, table 118): Pee Pee Creek is the principal inflow to Lake White. It was sampled at site I-1, where it represents 70 $mi^2$ or 79 percent of the drainage area of the lake. A qualitative comparison of stream versus lake data is shown below:

| Inflow sampling site | Sampling date (1979) | Estimated discharge ($ft^3/s$) | Water body (stream or lake at 2-foot depth) having higher concentration | | | |
|---|---|---|---|---|---|---|
| | | | $NO_2+NO_3$ | Total P | TOC | (Specific conductance) |
| Pee Pee Creek at site I-1 | May 31 | 4.0 | Stream | Equal | Stream | Equal |
| | Aug 20 | 30 | Stream | Lake | Lake | Lake |

Table 118.--Physical and chemical data for selected inflows, Lake White, Ohio

390620083030500 - PEE PEE C AB LAKE WHITE (I-1) NR WAVERLY OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

| DATE | TIME | STREAM-FLOW, INSTAN-TANEOUS (CFS) | TEMPER-ATURE (DEG C) | OXYGEN, DIS-SOLVED (MG/L) | PH (UNITS) | SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS) | TUR-BID-ITY (JTU) | COLOR (PLAT-INUM-COBALT UNITS) | CARBON, ORGANIC TOTAL (MG/L AS C) | NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N) | NITRO-GEN,AM-MONIA + ORGANIC TOTAL (MG/L AS N) | PHOS-PHORUS, TOTAL (MG/L AS P) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MAY | | | | | | | | | | | | |
| 31... | 1200 | 4.0 | 18.0 | 8.3 | 7.5 | 260 | 15 | 20 | 8.1 | .64 | .13 | .00 |
| AUG | | | | | | | | | | | | |
| 20... | 1200 | 30 | 23.0 | 8.4 | 7.5 | 265 | 1 | 50 | 3.5 | .38 | .18 | .00 |

## Madison Lake

Location: Madison County
(Walnut Run 7.5-minute quadrangle map)

Type: Impoundment on Deer Creek

Use: Recreation

Physical characteristics at summer pool level (table 6):

| Date of origin (year) | Surface area (acres) | Capacity (acre-feet) | Capacity-inflow ratio (C/I) |
|---|---|---|---|
| 1946 | 106 | 594 | .02 |

Drainage-basin characteristics:

| Drainage area ($mi^2$) | Type | Estimated sediment yield (from fig. 3) |
|---|---|---|
| 55 | Agricultural, rural | Moderate |

Lake data (figs. 54, 55; tables 119-122); Madison Lake was sampled under sunny and windy conditions on June 5 and on August 7. Secchi-disk transparencies at the primary sampling station (L-1) were 1.2 feet in June and 1.7 feet in August. Madison Lake was very turbid on both dates.

Profile and analytical data show the following lake characteristics:

| Date | Stratification (gradient) Thermal | Stratification (gradient) Chemical | Chemical type | Trophic state index (Carlson) Chl a | SD | T.P. | Trophic class | Substances at or above State limits Toxicants | Bacteria | Phyto-plankton, dominant division(s) |
|---|---|---|---|---|---|---|---|---|---|---|
| 6-05-79 | Slight | Yes | Very hard; Ca, $SO_4$ | -- | -- | 69 | Eutrophic | No | No | Chlorophyta |
| 8-07-79 | Slight | Yes | -- | 63 | 69 | -- | -- | No | No | Cyanophyta |

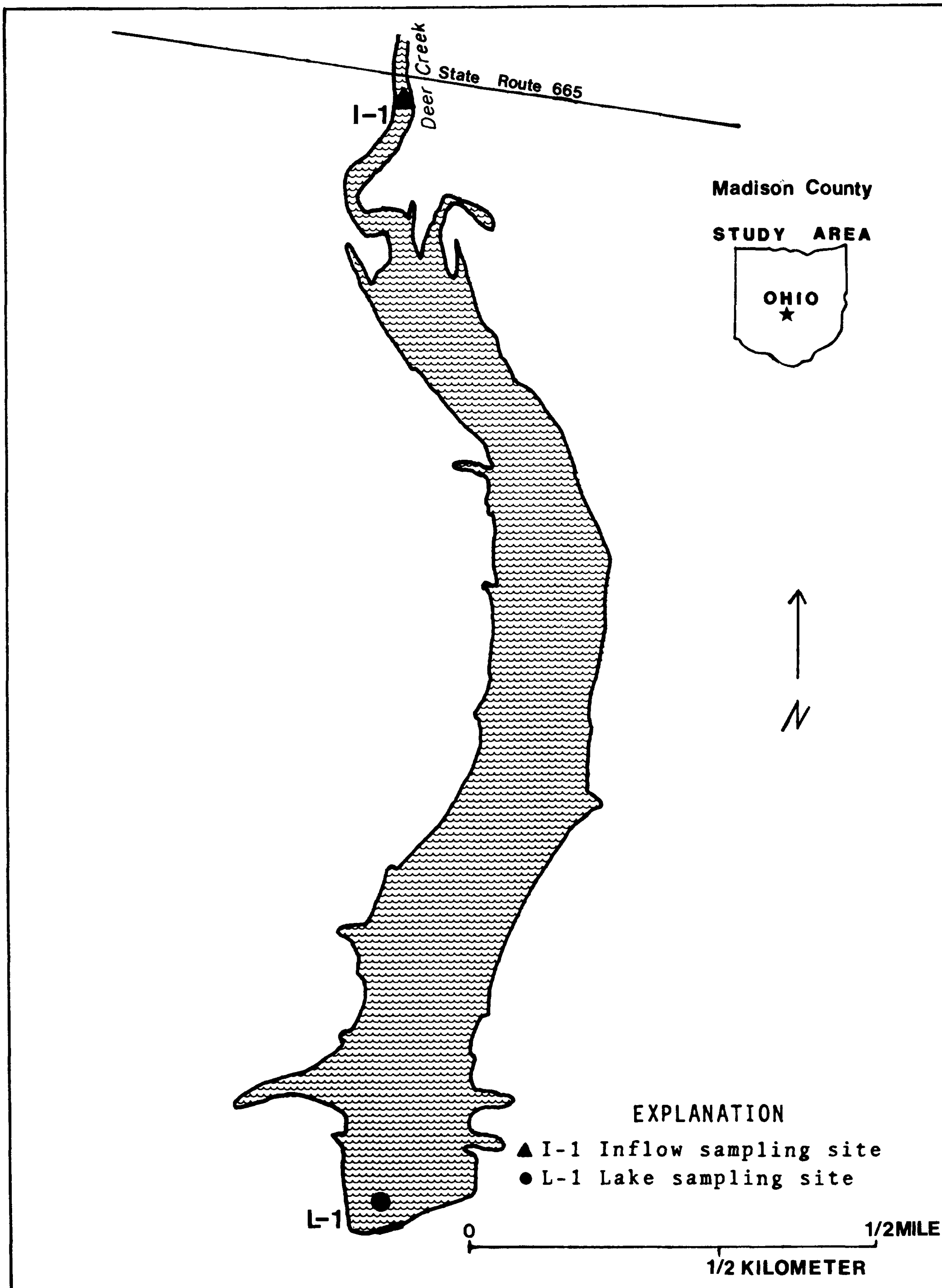



**Figure 54.--Madison Lake and inflow sampling site.**

395159083223600 ABOVE DAM (L-1)

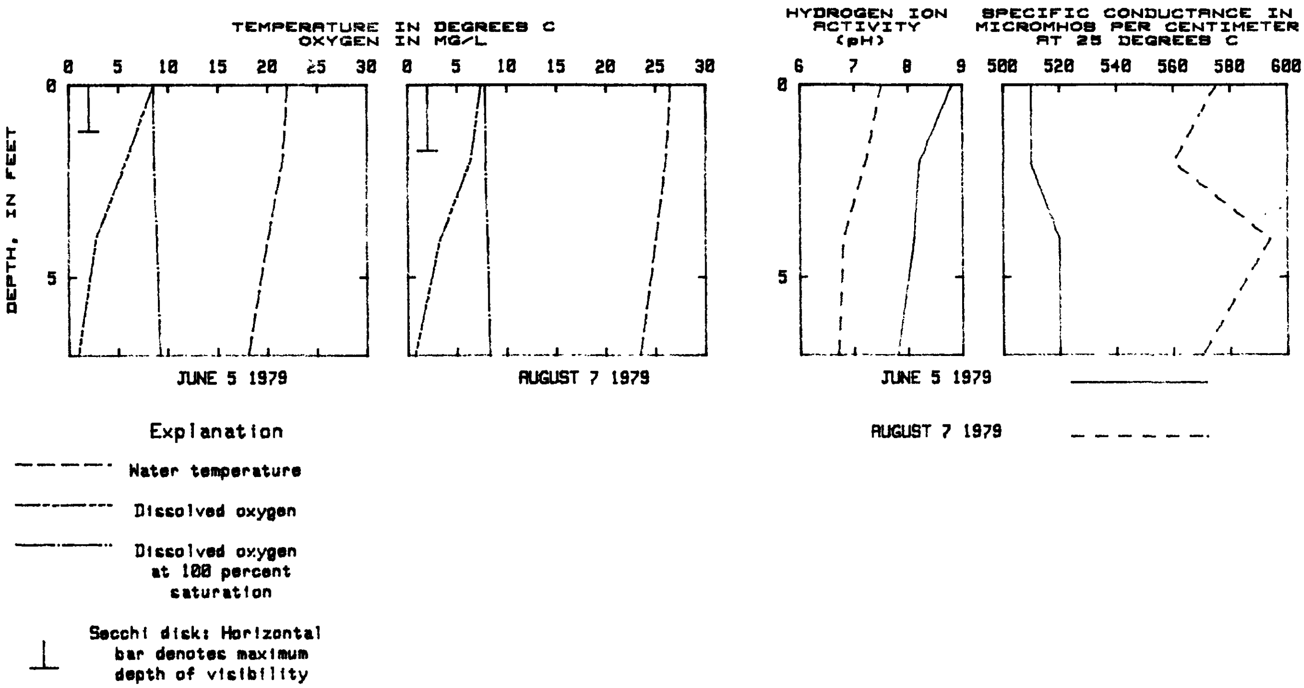



Figure 55.--Data profiles for Madison Lake.

Table 119.--Profile data for the primary lake site, Madison White, Ohio

395159083223600 - MADISON LK AB DAM (L-1) NR LONDON OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

| DATE | TIME | SAMP- LING DEPTH (FT) | TEMPER- ATURE (DEG C) | OXYGEN, DIS- SOLVED (MG/L) | OXYGEN, DIS- SOLVED (PER- CENT SATUR- ATION) | SPE- CIFIC CON- DUCT- ANCE (MICRO- MHOS) | PH (UNITS) | CAR- BONATE (MG/L AS CO3) | BICAR- BONATE (MG/L AS HCO3) | CARBON DIOXIDE DIS- SOLVED (MG/L AS CO2) | HYDRO- GEN SULFIDE TOTAL (MG/L AS H2S) | TRANS- PAR- ENCY (SECCHI DISK) (IN) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| JUN | | | | | | | | | | | | |
| 05... | 1300 | .0 | 22.0 | 8.5 | 100 | 510 | 8.8 | -- | -- | -- | -- | -- |
| 05... | 1305 | 2.0 | 21.5 | 5.7 | 66 | 510 | 8.2 | 0 | 99 | 1.0 | .5 | 14 |
| 05... | 1310 | 4.0 | 20.0 | 2.7 | 30 | 520 | 8.1 | -- | -- | -- | -- | -- |
| 05... | 1315 | 7.0 | 18.0 | .9 | 10 | 520 | 7.8 | 0 | 51 | 1.3 | .0 | -- |
| AUG | | | | | | | | | | | | |
| 07... | 1230 | .0 | 26.5 | 7.4 | 95 | 575 | 7.5 | -- | -- | -- | -- | -- |
| 07... | 1235 | 2.0 | 26.0 | 6.3 | 80 | 560 | 7.2 | 0 | 272 | 27 | .5 | 20 |
| 07... | 1240 | 4.0 | 25.0 | 3.3 | 41 | 594 | 6.8 | -- | -- | -- | -- | -- |
| 07... | 1245 | 7.0 | 23.4 | .7 | 8 | 570 | 6.7 | 0 | 276 | 87 | .0 | -- |

Table 120.--Chemical analyses of water column composite samples, Madison Lake, Ohio

395159083223600 - MADISON LK AB DAM (L-1) NR LONDON OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

| DATE | TIME | CALCIUM DIS-SOLVED (MG/L AS CA) | MAGNE-SIUM, DIS-SOLVED (MG/L AS MG) | POTAS-SIUM, DIS-SOLVED (MG/L AS K) | SODIUM, DIS-SOLVED (MG/L AS NA) | SULFATE DIS-SOLVED (MG/L AS SO4) | CHLO-RIDE, DIS-SOLVED (MG/L AS CL) | FLUO-RIDE, DIS-SOLVED (MG/L AS F) | HARD-NESS (MG/L AS CACO3) | SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L) |
|---|---|---|---|---|---|---|---|---|---|---|
| JUN 05... | 1315 | 65 | 29 | 2.0 | 9.1 | 45 | 24 | .3 | 280 | 367 |

| DATE | SOLIDS, RESIDUE AT 105 DEG. C, SUS-PENDED (MG/L) | SOLIDS, RESIDUE AT 105 DEG. C, TOTAL (MG/L) | BARIUM, TOTAL RECOV-ERABLE (UG/L AS BA) | CADMIUM TOTAL RECOV-ERABLE (UG/L AS CD) | CHRO-MIUM, TOTAL RECOV-ERABLE (UG/L AS CR) | LEAD, TOTAL RECOV-ERABLE (UG/L AS PB) | MERCURY TOTAL RECOV-ERABLE (UG/L AS HG) | NICKEL, TOTAL RECOV-ERABLE (UG/L AS NI) | SELE-NIUM, TOTAL (UG/L AS SE) | SILVER, TOTAL RECOV-ERABLE (UG/L AS AG) |
|---|---|---|---|---|---|---|---|---|---|---|
| JUN 05... | 56 | 423 | 0 | 1 | 20 | 4 | <.5 | 11 | 0 | 0 |

| DATE | ARSENIC TOTAL (UG/L AS AS) | METHY-LENE BLUE ACTIVE SUB-STANCE (MG/L) | BORON, TOTAL RECOV-ERABLE (UG/L AS B) | COBALT, TOTAL RECOV-ERABLE (UG/L AS CO) | COPPER, TOTAL RECOV-ERABLE (UG/L AS CU) | IRON, TOTAL RECOV-ERABLE (UG/L AS FE) | MANGA-NESE, TOTAL RECOV-ERABLE (UG/L AS MN) | MOLYB-DENUM, TOTAL RECOV-ERABLE (UG/L AS MO) | ZINC, TOTAL RECOV-ERABLE (UG/L AS ZN) |
|---|---|---|---|---|---|---|---|---|---|
| JUN 05... | <10 | .09 | -- | 0 | 6 | 890 | 180 | 6 | 20 |

Table 121.--Chemical, physical, and biological analyses of water samples from selected depths, Madison lake, Ohio

395159083223600 - MADISON LK AB DAM (L-1) NR LONDON OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

| DATE | TIME | SAMP-LING DEPTH (FT) | NITRO-GEN, NITRITE TOTAL (MG/L AS N) | NITRO-GEN, NITRATE TOTAL (MG/L AS N) | NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N) | NITRO-GEN, AMMONIA TOTAL (MG/L AS N) | NITRO-GEN, ORGANIC TOTAL (MG/L AS N) | NITRO-GEN, AM-MONIA + ORGANIC TOTAL (MG/L AS N) | PHOS-PHORUS, ORTHO. TOTAL (MG/L AS P) |
|---|---|---|---|---|---|---|---|---|---|
| JUN | | | | | | | | | |
| 05... | 1305 | 2.0 | .09 | 6.1 | 6.2 | .34 | .96 | 1.3 | .01 |
| 05... | 1315 | 7.0 | .21 | 5.5 | 5.7 | .21 | .99 | 1.2 | .01 |
| AUG | | | | | | | | | |
| 07... | 1235 | 2.0 | .06 | 1.7 | 1.8 | .24 | 7.6 | 1.0 | .00 |
| 07... | 1245 | 7.0 | .05 | .75 | .80 | .34 | 1.1 | 1.9 | .00 |

| DATE | PHOS-PHORUS, TOTAL (MG/L AS P) | SILICA, DIS-SOLVED (MG/L AS SIO2) | TUR-BID-ITY (JTU) | COLOR (PLAT-INUM-COBALT UNITS) | CARBON, ORGANIC TOTAL (MG/L AS C) | OXYGEN DEMAND, BIO-CHEM-ICAL, 5 DAY (MG/L) | OXYGEN DEMAND, CHEM-ICAL (HIGH LEVEL) (MG/L) | COLI-FORM, FECAL, 0.45 UM-MF (COLS./100 ML) | STREP-TOCOCCI FECAL, (COLS. PER 100 ML) |
|---|---|---|---|---|---|---|---|---|---|
| JUN | | | | | | | | | |
| 05... | .09 | 5.0 | 9 | 10 | 5.3 | 5.6 | 12 | 14 | 8 |
| 05... | .06 | 6.2 | 10 | 30 | 13 | 2.0 | 10 | 76 | 28 |
| AUG | | | | | | | | | |
| 07... | .08 | 6.8 | 25 | 5 | 6.4 | 3.0 | 34 | 106 | 72 |
| 07... | .08 | 11 | 30 | 20 | 5.6 | 2.9 | 37 | 124 | 136 |

Table 122.--Phytoplankton identified in Madison Lake, Ohio (1979)

| Sample description: Location | Sample description: Date | Sample description: Location in water column | Total cells (per ml) | Diversity index (genus) $\bar{d}$ | Chlorophyll a (µg/L) | Division(s) present (in order of dominance) | Percent of total cell count | Dominant taxa within division and percent (%)* of total cell count |
|---|---|---|---|---|---|---|---|---|
| L-1 Above dam | 6-05 | Euphotic zone Composite | 3,000 | 2.0 | 32.9 | Chlorophyta | 72 | Scenedesmus (60), Tetrastrum (8), Chlamydomonas (4) |
| | | | | | | Chrysophyta | 21 | Melosira (11), Stephanodiscus (4), Fragilaria (4), Nitzschia (2), |
| | | | | | | Euglenophyta | 6 | Euglena (6) |
| L-1 Above dam | 6-05 | 2-ft depth | 4,700 | 2.7 | 47.3 | Chlorophyta | 44 | Scenedesmus (33), Coelastrum (7), Chlamydomonas (5) |
| | | | | | | Chrysophyta | 35 | Melosira (29), Fragilaria (3), Cyclotella (2), Nitzschia (2) |
| | | | | | | Euglenophyta | 12 | Euglena (7), Trachelomonas (5) |
| L-1 Above dam | 8-07 | Euphotic zone Composite | 5,200 | 3.0 | 20.7 | Cyanophyta | 47 | Agmenellum (31), Oscillatoria (16) |
| | | | | | | Chlorophyta | 26 | Scenedesmus (12), Coelastrum (9), Crucigenia (2), Ankistrodesmus (2), Phacotus (1), Schroederia (1) |
| | | | | | | Chrysophyta | 19 | Melosira (16), Nitzschia (2), Cyclotella (1), Fragilaria |
| | | | | | | Euglenophyta | 9 | Euglena (3), Trachelomonas (3), Lepocinclis (2), Phacus (1) |
| L-1 Above dam | 8-07 | 0-ft depth | 7,900 | 2.6 | -- | Cyanophyta | 65 | Agmenellum (55), Anacystis (10) |
| | | | | | | Chlorophyta | 16 | Scenedesmus (5), Coelastrum (3), Crucigenia (2), Ankistrodesmus (2), Oocystis (2), Schroederia (1) Chlamydomonas, Kirchneriella |
| | | | | | | Chrysophyta | 12 | Melosira (9), Nitzschia (1), Cyclotella (1), Fragilaria, Synedra |
| | | | | | | Euglenophyta | 6 | Euglena (4), Trachelomonas (2), Lepocinclis |
| | | | | | | Cryptophyta | 1 | Cryptomonas (1) |
| | | | | | | Pyrrophyta | | Peridinium |
| L-1 Above dam | 8-07 | 2-ft depth | -- | -- | 26.3 | | | |

*Less than one percent not given

Madison Lake exhibited a slight thermal gradient at both the June 5 and August 7 samplings. Chemical stratification was found on both dates; oxygen levels approached zero near the bottom.

The spring near-surface, total-phosphorus concentration was 0.09 mg/L. The spring total-nitrogen to total-phosphorus ratio, 83 to 1, indicates phosphorus may be limiting algal productivity in Madison Lake.

Madison Lake had Carlson TSIs of 63 for chlorophyll *a* (summer), 69 for Secchi-disk transparency (summer), and 69 for total phosphorus (spring). Carlson TSIs in this range indicate eutrophic lakes.

No chemical constituents or properties exceeded Ohio water-quality standards.

Green algae (Chlorophyta) dominated the spring algal community. Blue-green algae (Cyanophyta) dominated the summer community.

Inflow data (fig. 54, table 123): Deer Creek is the major inflow to Madison Lake. The creek was sampled at site I-1, where it represents runoff from 54.1 $mi^2$ or 98 percent of the drainage area of Madison Lake. A qualitative comparison of stream versus lake data is shown below.

| Inflow sampling site | Sampling date (1979) | Estimated discharge ($ft^3/s$) | Water body (stream or lake at 2-foot depth) having higher concentration | | | |
|---|---|---|---|---|---|---|
| | | | $NO_2$+ $NO_3$ | Total P | TOC | (Specific conductance) |
| Deer Creek at site I-1 | June 5 | 30 | Stream | Stream | Lake | Stream |
| | Aug 7 | 20 | Stream | Stream | Lake | Lake |

Table 123.--Physical and chemical data for selected inflows, Lake Madison, Ohio

395309083223700 - MADISON LK AB DAM (L-1) NR LONDON OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

| DATE | TIME | STREAM-FLOW, INSTAN-TANEOUS (CFS) | TEMPER-ATURE (DEG C) | OXYGEN, DIS-SOLVED (MG/L) | PH (UNITS) | SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS) | TUR-BID-ITY (JTU) | COLOR (PLAT-INUM-COBALT UNITS) | CARBON, ORGANIC TOTAL (MG/L AS C) | NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N) | NITRO-GEN,AM-MONIA + ORGANIC TOTAL (MG/L AS N) | PHOS-PHORUS, TOTAL (MG/L AS P) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| JUN | | | | | | | | | | | | |
| 05... | 1100 | 30 | 21.0 | 8.5 | 8.2 | 610 | 10 | 30 | 4.8 | 6.6 | .67 | .05 |
| AUG | | | | | | | | | | | | |
| 07... | 1030 | 20 | 23.9 | 7.4 | 7.5 | 530 | 25 | 40 | 5.8 | 2.4 | .42 | .08 |

## Meander Creek Reservoir

Location: Trumbull County
(Warren 7.5-minute quadrangle map)

Type: Impoundment on Meander Creek

Use: Water supply.

Physical characteristics at summer pool level (table 6):

| Date of origin (year) | Surface area (acres) | Capacity (acre-feet) | Capacity-inflow ratio (C/I) |
|---|---|---|---|
| 1930 | 2150 | 35,700 | 0.66 |

Drainage-basin characteristics:

| Drainage area ($mi^2$) | Type | Estimated sediment yield (from fig. 3) |
|---|---|---|
| 83.9 | Agricultural, rural | Moderately low |

Lake data (figs. 56, 57; tables 124-127): Meander Creek Reservoir was sampled under partly cloudy and very windy conditions on June 2 and under partly cloudy conditions on August 17. Secchi-disk transparencies at the primary sampling station (L-1) were 7.0 feet in June and 5.7 feet in August.

Profile and analytical data show the following lake characteristics:

| Date | Stratification (gradient) | | Chemical type | Trophic state index (Carlson) | | | Trophic class | Substances at or above State limits | | Phyto-plankton, dominant division(s) |
|---|---|---|---|---|---|---|---|---|---|---|
| | Thermal | Chemical | | Chl a | SD | T.P. | | Toxicants | Bacteria | |
| 6-02-79 | Yes | Yes | Hard; Ca, $SO_4$ | -- | -- | 37 | Eutrophic | No | No | Chlorophyta |
| 8-17-79 | Yes | Yes | -- | 53 | 52 | -- | -- | No | No | Chlorophyta |

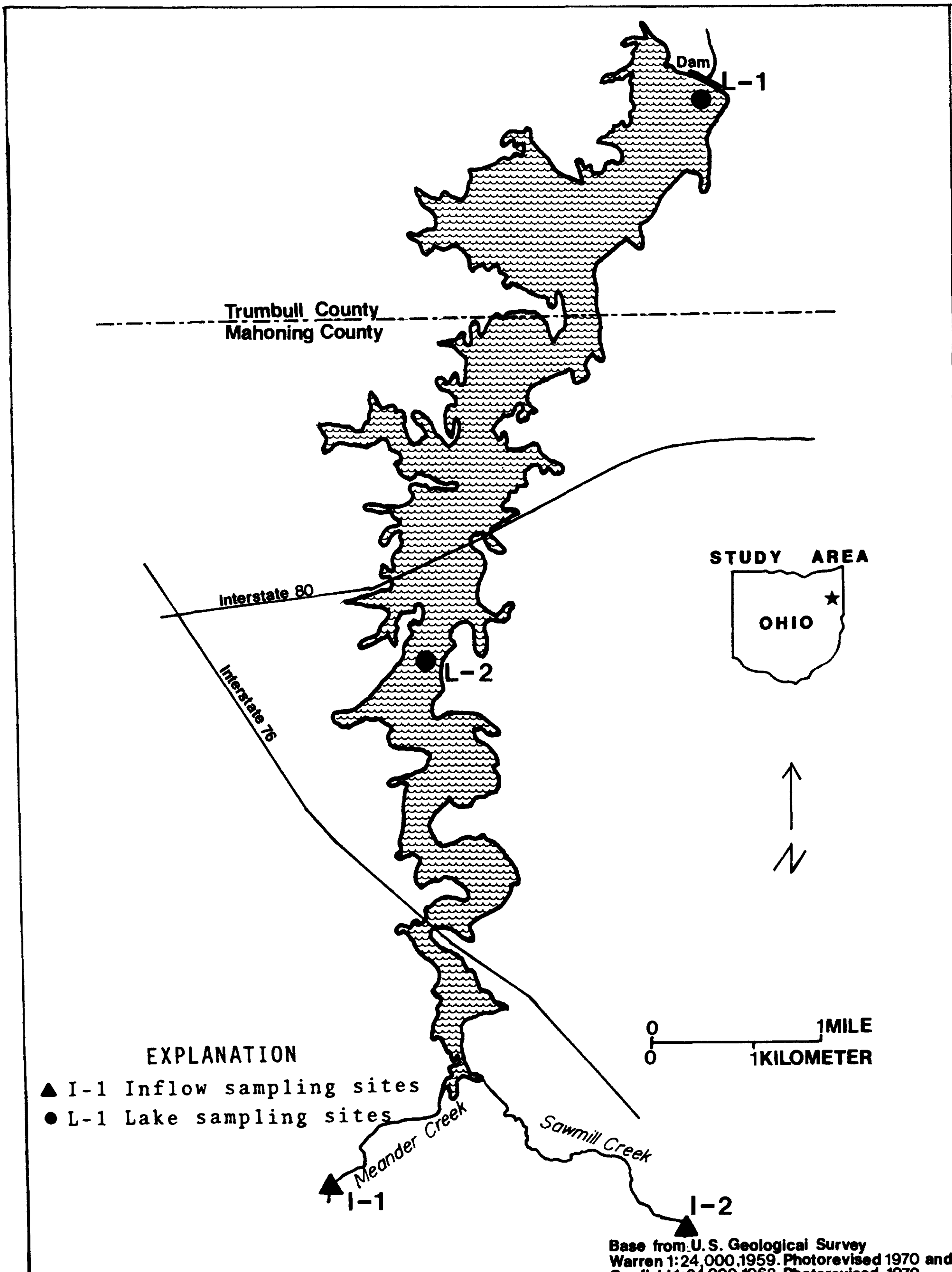



**Figure 56.--Meander Creek Reservoir and inflow sampling sites.**

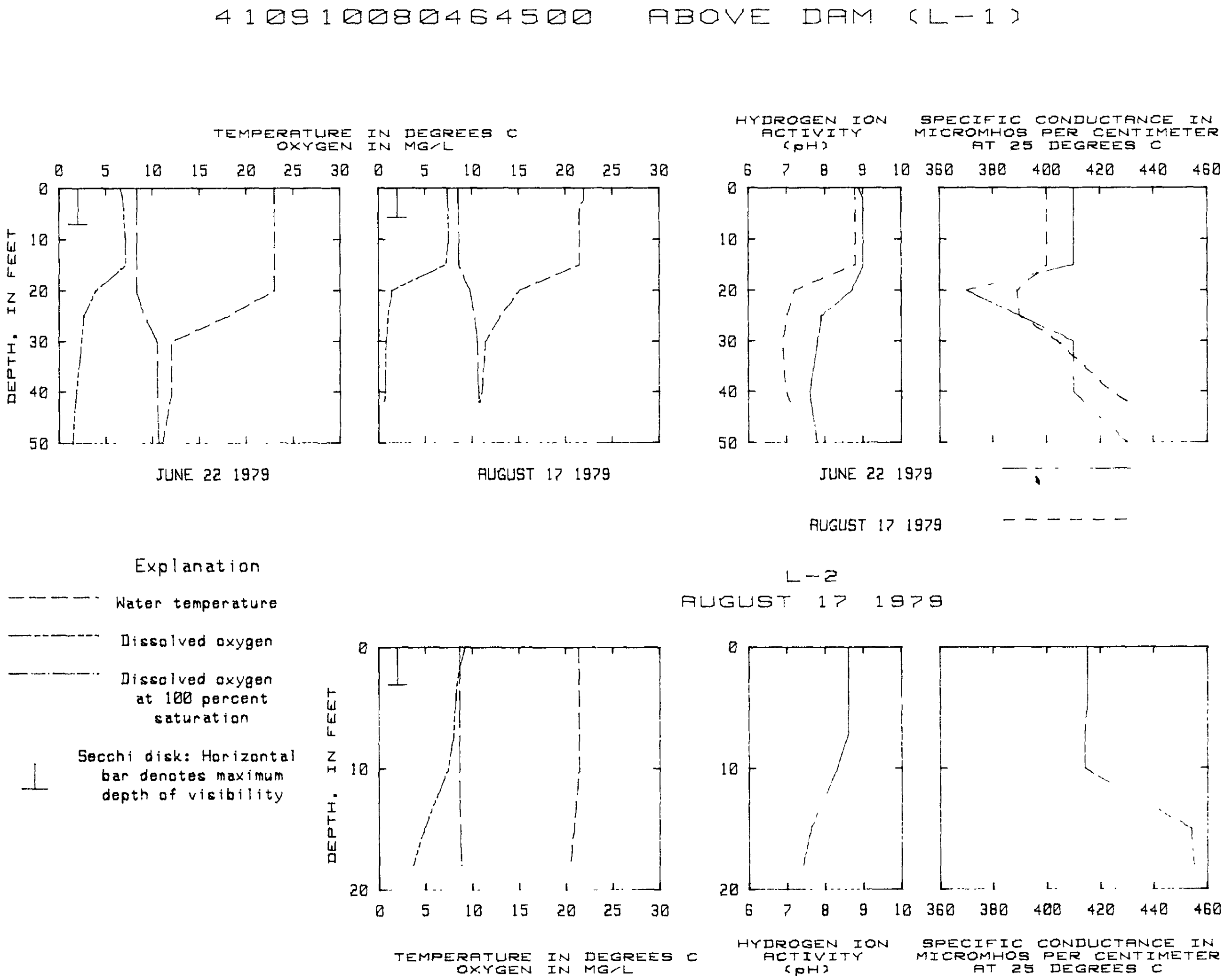



**Figure 57.--Data profiles for Meander Creek Reservoir.**

Table 124.--Profile data for the primary lake site, Meander Creek, Ohio

410910080464500 - MEANDER C RE AB DAM (L-1) NR MINERAL RIDGE OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

| DATE | TIME | SAMPLING DEPTH (FT) | TEMPERATURE (DEG C) | OXYGEN, DISSOLVED (MG/L) | OXYGEN, DISSOLVED (PERCENT SATURATION) | SPECIFIC CONDUCTANCE (MICROMHOS) | PH (UNITS) | CARBONATE (MG/L AS CO3) | BICARBONATE (MG/L AS HCO3) | CARBON DIOXIDE DISSOLVED (MG/L AS CO2) | HYDROGEN SULFIDE TOTAL (MG/L AS H2S) | TRANSPARENCY (SECCHI DISK) (IN) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| JUN | | | | | | | | | | | | |
| 22... | 1220 | .0 | 23.0 | 6.6 | 80 | 410 | 8.9 | -- | -- | -- | -- | -- |
| 22... | 1225 | 2.0 | 23.0 | 6.8 | 82 | 410 | 9.0 | 8 | 64 | .1 | .2 | 84 |
| 22... | 1230 | 4.0 | 23.0 | 6.9 | 83 | 410 | 9.0 | -- | -- | -- | -- | -- |
| 22... | 1235 | 7.0 | 23.0 | 7.0 | 84 | 410 | 9.0 | -- | -- | -- | -- | -- |
| 22... | 1240 | 10 | 23.0 | 7.1 | 86 | 410 | 9.0 | -- | -- | -- | -- | -- |
| 22... | 1245 | 15 | 23.0 | 7.1 | 86 | 410 | 9.0 | -- | -- | -- | -- | -- |
| 22... | 1250 | 20 | 23.0 | 3.9 | 47 | 370 | 8.7 | -- | -- | -- | -- | -- |
| 22... | 1255 | 25 | 18.0 | 2.6 | 28 | 390 | 7.9 | -- | -- | -- | -- | -- |
| 22... | 1300 | 30 | 12.0 | 2.4 | 23 | 410 | 7.8 | -- | -- | -- | -- | -- |
| 22... | 1305 | 40 | 12.0 | 1.8 | 17 | 410 | 7.6 | -- | -- | -- | -- | -- |
| 22... | 1310 | 50 | 11.0 | 1.4 | 13 | 430 | 7.8 | 0 | 156 | 3.9 | .3 | -- |
| AUG | | | | | | | | | | | | |
| 17... | 1200 | .0 | 22.0 | 7.4 | 87 | 400 | 8.8 | -- | -- | -- | -- | -- |
| 17... | 1205 | 2.0 | 22.0 | 7.4 | 87 | 400 | 8.8 | 11 | 62 | .2 | .0 | 68 |
| 17... | 1210 | 4.0 | 21.5 | 7.5 | 87 | 400 | 8.8 | -- | -- | -- | -- | -- |
| 17... | 1215 | 7.0 | 21.5 | 7.5 | 87 | 400 | 8.8 | -- | -- | -- | -- | -- |
| 17... | 1220 | 10 | 21.5 | 7.5 | 87 | 400 | 8.8 | -- | -- | -- | -- | -- |
| 17... | 1225 | 15 | 21.5 | 7.2 | 84 | 400 | 8.8 | -- | -- | -- | -- | -- |
| 17... | 1230 | 20 | 15.0 | 1.4 | 14 | 389 | 7.2 | -- | -- | -- | -- | -- |
| 17... | 1235 | 25 | 13.0 | 1.0 | 10 | 390 | 7.0 | -- | -- | -- | -- | -- |
| 17... | 1240 | 30 | 11.4 | .8 | 7 | 404 | 6.9 | -- | -- | -- | -- | -- |
| 17... | 1245 | 40 | 11.0 | .7 | 7 | 424 | 7.0 | -- | -- | -- | -- | -- |
| 17... | 1250 | 42 | 10.8 | .6 | 6 | 430 | 7.1 | 0 | 118 | 14 | 1.1 | -- |

Table 125.--Chemical analyses of water column composite samples, Meander Creek, Ohio

410910080464500 - MEANDER C RE AB DAM (L-1) NR MINERAL RIDGE OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

| DATE | TIME | CALCIUM DIS-SOLVED (MG/L AS CA) | MAGNE-SIUM, DIS-SOLVED (MG/L AS MG) | POTAS-SIUM, DIS-SOLVED (MG/L AS K) | SODIUM, DIS-SOLVED (MG/L AS NA) | SULFATE DIS-SOLVED (MG/L AS SO4) | CHLO-RIDE, DIS-SOLVED (MG/L AS CL) | FLUO-RIDE, DIS-SOLVED (MG/L AS F) | HARD-NESS (MG/L AS CACO3) | SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L) |
|---|---|---|---|---|---|---|---|---|---|---|
| JUN 22... | 1310 | 37 | 11 | 3.1 | 25 | 76 | 41 | .2 | 140 | 278 |

| DATE | SOLIDS, RESIDUE AT 105 DEG. C, SUS-PENDED (MG/L) | SOLIDS, RESIDUE AT 105 DEG. C, TOTAL (MG/L) | BARIUM, TOTAL RECOV-ERABLE (UG/L AS BA) | CADMIUM TOTAL RECOV-ERABLE (UG/L AS CD) | CHRO-MIUM, TOTAL RECOV-ERABLE (UG/L AS CR) | LEAD, TOTAL RECOV-ERABLE (UG/L AS PB) | MERCURY TOTAL RECOV-ERABLE (UG/L AS HG) | NICKEL, TOTAL RECOV-ERABLE (UG/L AS NI) | SELE-NIUM, TOTAL (UG/L AS SE) | SILVER, TOTAL RECOV-ERABLE (UG/L AS AG) |
|---|---|---|---|---|---|---|---|---|---|---|
| JUN 22... | 2 | 280 | 0 | 0 | 10 | 4 | <.5 | 160 | 0 | 0 |

| DATE | ARSENIC TOTAL (UG/L AS AS) | METHY-LENE BLUE ACTIVE SUB-STANCE (MG/L) | BORON, TOTAL RECOV-ERABLE (UG/L AS B) | COBALT, TOTAL RECOV-ERABLE (UG/L AS CO) | COPPER, TOTAL RECOV-ERABLE (UG/L AS CU) | IRON, TOTAL RECOV-ERABLE (UG/L AS FE) | MANGA-NESE, TOTAL RECOV-ERABLE (UG/L AS MN) | MOLYB-DENUM, TOTAL RECOV-ERABLE (UG/L AS MO) | ZINC, TOTAL RECOV-ERABLE (UG/L AS ZN) |
|---|---|---|---|---|---|---|---|---|---|
| JUN 22... | <10 | .06 | 70 | 2 | 9 | 360 | 340 | 0 | 20 |

Table 126 Chemical, physical, and biological analyses of water samples from selected depths, Meander Creek, Ohio

410910080464500 - MEANDER C RE AB DAM (L-1) NR MINERAL RIDGE OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

| DATE | TIME | SAMPLING DEPTH (FT) | NITROGEN, NITRITE TOTAL (MG/L AS N) | NITROGEN, NITRATE TOTAL (MG/L AS N) | NITROGEN, NO2+NO3 TOTAL (MG/L AS N) | NITROGEN, AMMONIA TOTAL (MG/L AS N) | NITROGEN, ORGANIC TOTAL (MG/L AS N) | NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N) | PHOSPHORUS, ORTHO, TOTAL (MG/L AS P) |
|---|---|---|---|---|---|---|---|---|---|
| JUN | | | | | | | | | |
| 22... | 1225 | 2.0 | .01 | .39 | .40 | .04 | .43 | .47 | .00 |
| 22... | 1310 | 50 | .01 | .27 | .28 | .68 | .72 | 1.4 | .00 |
| AUG | | | | | | | | | |
| 17... | 1205 | 2.0 | .01 | .04 | .05 | .04 | .48 | .52 | .00 |
| 17... | 1250 | 42 | .00 | .00 | .00 | 1.3 | .90 | 2.2 | .17 |

| DATE | PHOSPHORUS, TOTAL (MG/L AS P) | SILICA, DISSOLVED (MG/L AS SIO2) | TURBIDITY (JTU) | COLOR (PLATINUM-COBALT UNITS) | CARBON, ORGANIC TOTAL (MG/L AS C) | OXYGEN DEMAND, BIOCHEMICAL, 5 DAY (MG/L) | OXYGEN DEMAND, CHEMICAL (HIGH LEVEL) (MG/L) | COLIFORM, FECAL, 0.45 UM-MF (COLS./100 ML) | STREPTOCOCCI FECAL, (COLS. PER 100 ML) |
|---|---|---|---|---|---|---|---|---|---|
| JUN | | | | | | | | | |
| 22... | .01 | .1 | 2 | 20 | 6.4 | 1.1 | 36 | 2 | 8 |
| 22... | .05 | 5.8 | 10 | 50 | 4.2 | 5.8 | 39 | 6 | 170 |
| AUG | | | | | | | | | |
| 17... | .01 | 1.4 | 2 | 10 | 8.3 | .8 | 11 | 2 | 10 |
| 17... | .32 | 8.0 | 10 | 20 | 6.9 | 1.2 | 18 | 10 | 30 |

Table 127.--Phytoplankton identified in Meander Creek Reservoir, Ohio (1979)

| Sample description | | | Total cells (per ml) | Diversity index (genus) $\bar{d}$ | Chlorophyll a ($\mu g/L$) | Division(s) present (in order of dominance) | Percent of total cell count | Dominant taxa within division and percent (%)* of total cell count |
|---|---|---|---|---|---|---|---|---|
| Location | Date | Location in water column | | | | | | |
| L-1 Above dam | 6-22 | Euphotic zone Composite | 780 | 1.2 | 4.7 | Chlorophyta | 90 | Sphaerocystis (70), Oocystis (20) |
| | | | | | | Chrysophyta | 10 | Cyclotella (10) |
| | | 2-ft depth | -- | -- | 3.9 | | | |
| L-1 Above dam | 6-22 | 10-ft depth | 1,400 | .9 | 4.4 | Chlorophyta | 97 | Coelastrum (76), Sphaerocystis (22), |
| | | | | | | Chrysophyta | 3 | Cyclotella (3) |
| L-1 Above dam | 8-17 | Euphotic zone Composite | 9,700 | 1.7 | 7.4 | Chlorophyta | 81 | Sphaerocystis (57), Pediastrum (13), Coelastrum (7), Scenedesmus (2), Chlamydomonas (1) |
| | | 2-ft depth | -- | -- | 9.4 | Cyanophyta | 19 | Anacystis |
| L-1 Above dam | 8-17 | 7-ft depth | 6,200 | 1.3 | 8.8 | Chlorophyta | 76 | Sphaerocystis (72), Scenedesmus (3), Schroederia, Chlamydomonas |
| | | | | | | Cyanophyta | 23 | Anabaena (13), Anacystis (10) |
| | | | | | | Cryptophyta | | Cryptomonas |
| | | | | | | Pyrrophyta | | Ceratium |

*Less than 1 percent not given.

Meander Creek Reservoir had developed distinct thermal stratification at L-1 by the June 2 sampling. The decrease in temperature in the reservoir between June and August may have been the result of the lower temperatures of the inflows in August. Chemical stratification was found on both dates. Oxygen concentrations below saturation were found at all depths on both dates; anaerobic conditions were approached in the summer hypolimnion.

The thermal and chemical profiles at the secondary sampling station (L-2) were similar to those at L-1, except that the surface oxygen concentration was 107 percent of saturation.

The spring total-phosphorus concentration was 0.01 mg/L. The spring total-nitrogen to total-phosphorus ratio, 87 to 1, indicates phosphorus may be limiting algal productivity in Meander Creek Reservoir.

Meander Creek Reservoir had Carlson TSIs of 53 for chlorophyll *a* (summer), 52 for Secchi-disk transparency (summer), and 37 for total phosphorus (spring). Meander Creek Reservoir was judged to be eutrophic on the basis of the chlorophyll-*a* concentrations and Secchi-disk measurements.

The nickel concentration exceeded Ohio water-quality standards.

The spring and summer algal communities were dominated by green algae (Chlorophyta). Flowering rush, *Butomus umbellatus*, was seen growing along the eastern shore of the lake. This was the first sighting of this plant in Trumbull County.

Inflow data (fig. 56, table 128): Meander Creek, which drains 39.6 $mi^2$ and Sawmill Creek, which drains 5.02 $mi^2$, were sampled at sites I-1 and I-2, respectively. Their combined areas represent 53 percent of the reservoir's drainage basin. A qualitative comparison of stream versus lake data is shown below:

| Inflow sampling site | Sampling date (1979) | Estimated discharge ($ft^3/s$) | Water body (stream or lake at 2-foot depth) having higher concentration | | | |
|---|---|---|---|---|---|---|
| | | | $NO_2$+ $NO_3$ | Total P | TOC | (Specific conductance) |
| Meander Creek at site I-1 | June 22 | 3.0 | Lake | Stream | Stream | Stream |
| | Aug 17 | 5.0 | Lake | Stream | Lake | Stream |
| Sawmill Creek at site I-2 | June 22 | 3.0 | Lake | Stream | Lake | Stream |
| | Aug 17 | 7.0 | Stream | Stream | Lake | Stream |

Table 128.--Physical and chemical data for selected inflows, Meander Creek, Ohio

410343080492200 - MEANDER C AB M C RE (I-1) NR MINERAL RIDGE OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

| DATE | TIME | STREAM-FLOW, INSTAN-TANEOUS (CFS) | TEMPER-ATURE (DEG C) | OXYGEN, DIS-SOLVED (MG/L) | PH (UNITS) | SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS) | TUR-BID-ITY (JTU) | COLOR (PLAT-INUM-COBALT UNITS) | CARBON, ORGANIC TOTAL (MG/L AS C) | NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N) | NITRO-GEN,AM-MONIA + ORGANIC TOTAL (MG/L AS N) | PHOS-PHORUS, TOTAL (MG/L AS P) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| JUN | | | | | | | | | | | | |
| 22... | 1000 | 3.0 | 20.3 | 8.1 | 7.5 | 670 | 10 | 25 | 11 | .30 | .45 | .02 |
| AUG | | | | | | | | | | | | |
| 17... | 0910 | 5.0 | 17.0 | 8.0 | 7.6 | 700 | 1 | 30 | 4.4 | .05 | .37 | .02 |

410323080481700 - SAWMILL C AB M C RE (I-2) NR MINERAL RIDGE OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

| DATE | TIME | STREAM-FLOW, INSTAN-TANEOUS (CFS) | TEMPER-ATURE (DEG C) | OXYGEN, DIS-SOLVED (MG/L) | PH (UNITS) | SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS) | TUR-BID-ITY (JTU) | COLOR (PLAT-INUM-COBALT UNITS) | CARBON, ORGANIC TOTAL (MG/L AS C) | NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N) | NITRO-GEN,AM-MONIA + ORGANIC TOTAL (MG/L AS N) | PHOS-PHORUS, TOTAL (MG/L AS P) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| JUN | | | | | | | | | | | | |
| 22... | 1015 | 3.0 | 20.0 | 8.4 | 7.8 | 750 | 2 | 5 | 4.9 | .38 | .51 | .07 |
| AUG | | | | | | | | | | | | |
| 17... | 0930 | 7.0 | 14.6 | 8.2 | 7.5 | 930 | 15 | 30 | 2.6 | .07 | .30 | .03 |

## North Branch Reservoir

Location: Knox County
(Fulton 7.5-minute quadrangle map)

Type: Impoundment on the North Branch Kokosing River

Use: Flood control and recreation.

Physical characteristics at summer pool level (table 6):

| Date of origin (year) | Surface area (acres) | Capacity (acre-feet) | Capacity-inflow ratio (C/I) |
|---|---|---|---|
| 1972 | 154 | 1,000 | 0.03 |

Drainage-basin characteristics:

| Drainage area ($mi^2$) | Type | Estimated sediment yield (from fig. 3) |
|---|---|---|
| 44.5 | Agricultural, rural | Moderately low |

Lake data (figs. 58, 59; tables 129-132): North Branch Reservoir was sampled under cloudy and windy conditions on June 12 and on August 14. Secchi-disk measurements at the primary sampling station (L-1) were 1.7 feet on both sampling dates.

Profile and analytical data show the following characteristics:

| Date | Stratification (gradient) | | Chemical type | Trophic state index (Carlson) | | | Trophic class | Substances at or above State limits | | Phyto-plankton, dominant division(s) |
|---|---|---|---|---|---|---|---|---|---|---|
| | Thermal | Chemical | | Chl a | SD | T.P. | | Toxicants | Bacteria | |
| 6-12-79 | Yes | Yes | Very hard; Ca, $SO_4$ | -- | -- | 57 | Eutrophic | No | No | Chlorophyta, Chrysophyta |
| 8-14-79 | Slight | Yes | -- | 69 | 69 | -- | -- | No | No | Cyanophyta |

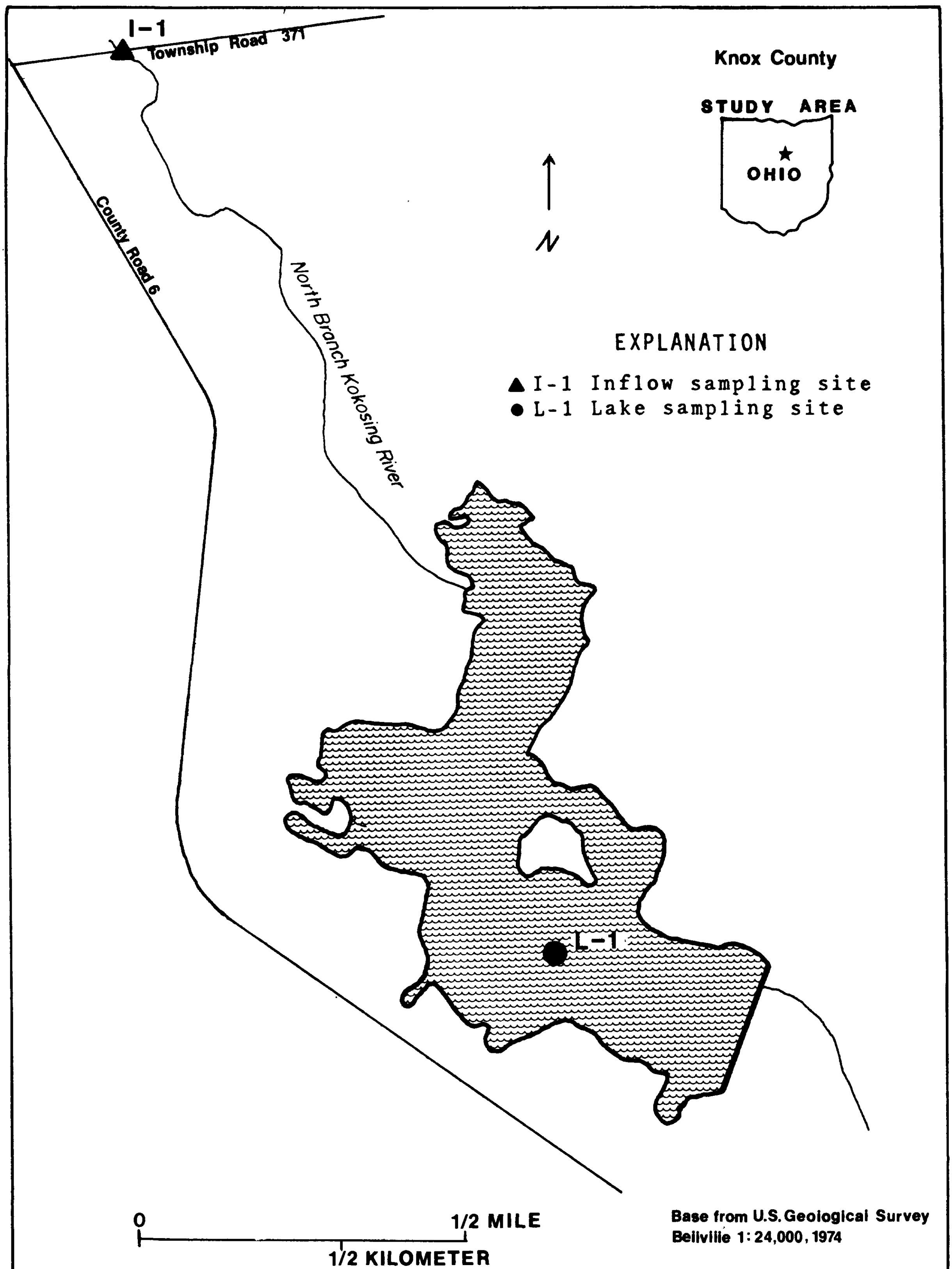



**Figure 58.--North Branch Reservoir and inflow sampling site.**

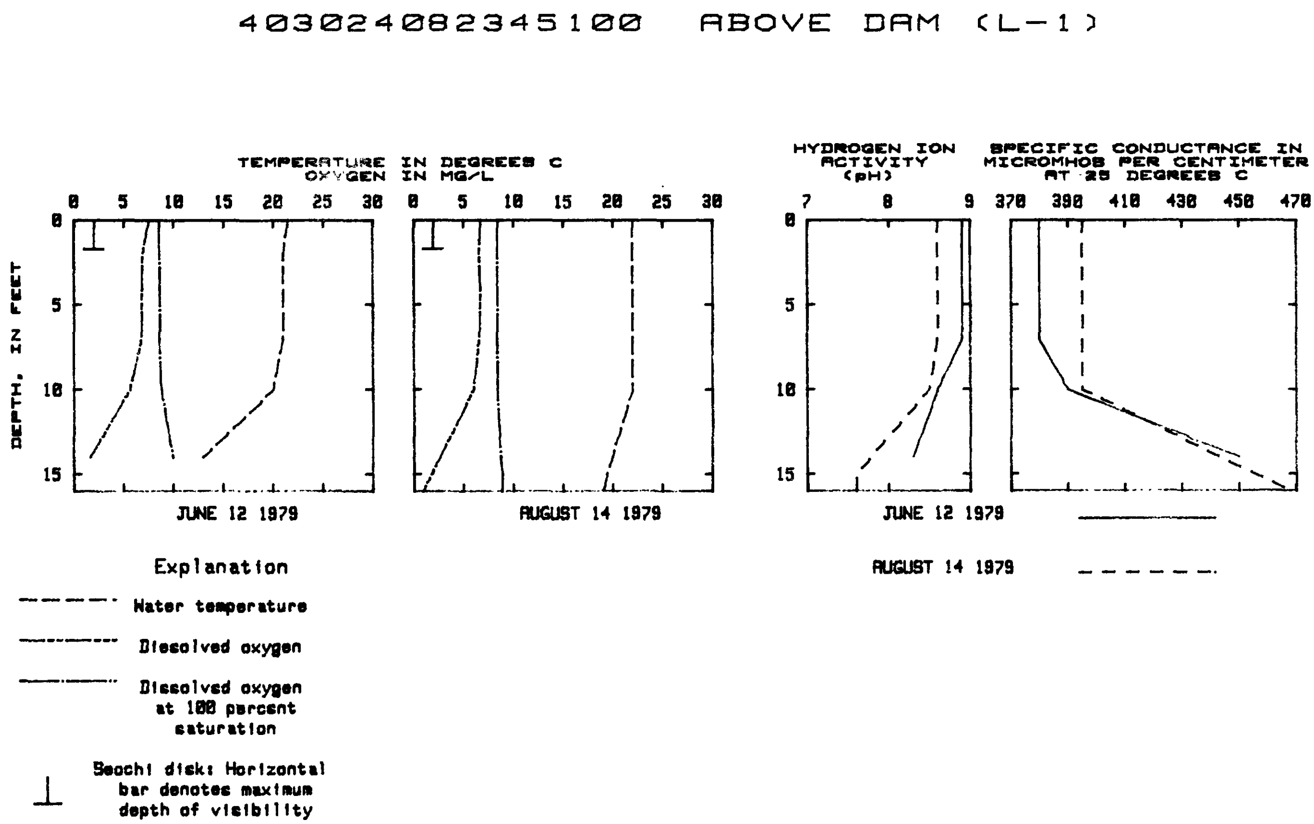



Figure 59.--Data profiles for North Branch Reservoir.

Table 129.--Profile data for the primary lake site, North Branch Reservoir, Ohio

403024082345100 - N B RE AB DAM (L-1) NR FREDERICKTOWN OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

| DATE | TIME | SAMP- LING DEPTH (FT) | TEMPER- ATURE (DEG C) | OXYGEN, DIS- SOLVED (MG/L) | OXYGEN, DIS- SOLVED (PER- CENT SATUR- ATION) | SPE- CIFIC CON- DUCT- ANCE (MICRO- MHOS) | PH (UNITS) | CAR- BONATE (MG/L AS CO3) | BICAR- BONATE (MG/L AS HCO3) | CARBON DIOXIDE DIS- SOLVED (MG/L AS CO2) | HYDRO- GEN SULFIDE TOTAL (MG/L AS H2S) | TRANS- PAR- ENCY (SECCHI DISK) (IN) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| JUN | | | | | | | | | | | | |
| 12... | 1200 | .0 | 21.5 | 7.5 | 88 | 380 | 8.9 | -- | -- | -- | -- | -- |
| 12... | 1205 | 2.0 | 21.0 | 6.9 | 80 | 380 | 8.9 | 16 | 42 | .1 | .0 | 20 |
| 12... | 1210 | 4.0 | 21.0 | 6.8 | 79 | 380 | 8.9 | -- | -- | -- | -- | -- |
| 12... | 1215 | 7.0 | 21.0 | 6.8 | 79 | 380 | 8.9 | -- | -- | -- | -- | -- |
| 12... | 1220 | 10 | 20.0 | 5.6 | 64 | 390 | 8.6 | -- | -- | -- | -- | -- |
| 12... | 1225 | 14 | 13.0 | 1.6 | 16 | 450 | 8.3 | 12 | 52 | .4 | .0 | -- |
| AUG | | | | | | | | | | | | |
| 14... | 1245 | .0 | 22.0 | 6.7 | 80 | 395 | 8.6 | -- | -- | -- | -- | -- |
| 14... | 1250 | 2.0 | 22.0 | 6.6 | 79 | 395 | 8.6 | 12 | 130 | .5 | .0 | 20 |
| 14... | 1255 | 4.0 | 22.0 | 6.7 | 80 | 395 | 8.6 | -- | -- | -- | -- | -- |
| 14... | 1300 | 7.0 | 22.0 | 6.6 | 79 | 395 | 8.6 | -- | -- | -- | -- | -- |
| 14... | 1305 | 10 | 22.0 | 6.0 | 71 | 395 | 8.5 | -- | -- | -- | -- | -- |
| 14... | 1310 | 15 | 19.4 | 1.8 | 20 | 455 | 7.6 | -- | -- | -- | -- | -- |
| 14... | 1315 | 16 | 19.0 | .9 | 10 | 468 | 7.6 | 0 | 165 | 6.6 | .0 | -- |

Table 130.--Chemical analyses of water column composite samples, North Branch Reservoir, Ohio

403024082345100 - N B RE AB DAM (L-1) NR FREDERICKTOWN OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

| DATE | TIME | CALCIUM DIS-SOLVED (MG/L AS CA) | MAGNE-SIUM, DIS-SOLVED (MG/L AS MG) | POTAS-SIUM, DIS-SOLVED (MG/L AS K) | SODIUM, DIS-SOLVED (MG/L AS NA) | SULFATE DIS-SOLVED (MG/L AS SO4) | CHLO-RIDE, DIS-SOLVED (MG/L AS CL) | FLUO-RIDE, DIS-SOLVED (MG/L AS F) | HARD-NESS (MG/L AS CACO3) | SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L) |
|---|---|---|---|---|---|---|---|---|---|---|
| JUN 12... | 1225 | 58 | 19 | 2.2 | 7.6 | 38 | 17 | .1 | 220 | 290 |

| DATE | SOLIDS, RESIDUE AT 105 DEG. C, SUS-PENDED (MG/L) | SOLIDS, RESIDUE AT 105 DEG. C, TOTAL (MG/L) | BARIUM, TOTAL RECOV-ERABLE (UG/L AS BA) | CADMIUM TOTAL RECOV-ERABLE (UG/L AS CD) | CHRO-MIUM, TOTAL RECOV-ERABLE (UG/L AS CR) | LEAD, TOTAL RECOV-ERABLE (UG/L AS PB) | MERCURY TOTAL RECOV-ERABLE (UG/L AS HG) | NICKEL, TOTAL RECOV-ERABLE (UG/L AS NI) | SELE-NIUM, TOTAL (UG/L AS SE) | SILVER, TOTAL RECOV-ERABLE (UG/L AS AG) |
|---|---|---|---|---|---|---|---|---|---|---|
| JUN 12... | 59 | 349 | 0 | 0 | 40 | 7 | <.5 | 10 | 0 | 0 |

| DATE | ARSENIC TOTAL (UG/L AS AS) | METHY-LENE BLUE ACTIVE SUB-STANCE (MG/L) | BORON, TOTAL RECOV-ERABLE (UG/L AS B) | COBALT, TOTAL RECOV-ERABLE (UG/L AS CO) | COPPER, TOTAL RECOV-ERABLE (UG/L AS CU) | IRON, TOTAL RECOV-ERABLE (UG/L AS FE) | MANGA-NESE, TOTAL RECOV-ERABLE (UG/L AS MN) | MOLYB-DENUM, TOTAL RECOV-ERABLE (UG/L AS MO) | ZINC, TOTAL RECOV-ERABLE (UG/L AS ZN) |
|---|---|---|---|---|---|---|---|---|---|
| JUN 12... | <10 | <.05 | 20 | 0 | 3 | 920 | 1700 | 5 | 20 |

Table 131. Chemical, physical, and biological analyses of water samples from selected depths, North Branch Reservoir, Ohio

403024082345100 - N B RE AB DAM (L-1) NR FREDERICKTOWN OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

| DATE | TIME | SAMPLING DEPTH (FT) | NITROGEN, NITRITE TOTAL (MG/L AS N) | NITROGEN, NITRATE TOTAL (MG/L AS N) | NITROGEN, NO2+NO3 TOTAL (MG/L AS N) | NITROGEN, AMMONIA TOTAL (MG/L AS N) | NITROGEN, ORGANIC TOTAL (MG/L AS N) | NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N) | PHOSPHORUS, ORTHO. TOTAL (MG/L AS P) |
|---|---|---|---|---|---|---|---|---|---|
| JUN | | | | | | | | | |
| 12... | 1205 | 2.0 | .06 | 2.3 | 2.4 | .14 | .50 | .64 | .01 |
| 12... | 1225 | 14 | .03 | .75 | .78 | .53 | .87 | 1.4 | .01 |
| AUG | | | | | | | | | |
| 14... | 1250 | 2.0 | .02 | .21 | .23 | .10 | .70 | .80 | .00 |
| 14... | 1315 | 16 | .04 | .13 | .17 | 1.1 | .70 | 1.8 | .00 |

| DATE | PHOSPHORUS, TOTAL (MG/L AS P) | SILICA, DISSOLVED (MG/L AS SIO2) | TURBIDITY (JTU) | COLOR (PLATINUM-COBALT UNITS) | CARBON, ORGANIC TOTAL (MG/L AS C) | OXYGEN DEMAND, BIOCHEMICAL, 5 DAY (MG/L) | OXYGEN DEMAND, CHEMICAL (HIGH LEVEL) (MG/L) | COLIFORM, FECAL, 0.45 UM-MF (COLS./100 ML) | STREPTOCOCCI FECAL, (COLS. PER 100 ML) |
|---|---|---|---|---|---|---|---|---|---|
| JUN | | | | | | | | | |
| 12... | .04 | 3.6 | 9 | 15 | 3.1 | 3.0 | 26 | 10 | 12 |
| 12... | .08 | 3.9 | 40 | -- | 2.9 | 3.8 | 37 | 10 | 28 |
| AUG | | | | | | | | | |
| 14... | .06 | 3.8 | 15 | 10 | 5.5 | 3.0 | 10 | 6 | 10 |
| 14... | .11 | 7.2 | 30 | 25 | 6.1 | 3.0 | 13 | 48 | 140 |

Table 132.--Phytoplankton identified in North Branch Reservoir, Ohio (1979)

| Sample description | | | Total cells (per ml) | Diversity index (genus) d | Chlorophyll a (ug/l) | Division(s) present (in order of dominance) | Percent of total cell count | Dominant taxa within division and percent (%)* of total cell count |
|---|---|---|---|---|---|---|---|---|
| Location | Date | Location in water column | | | | | | |
| L-1 Above dam | 6-12 | Euphotic zone Composite | 1,700 | 2.9 | 9.8 | Chlorophyta | 51 | Coelastrum (30), Chlamydomonas (8), Scenedesmus (6), Crucigenia (3), Ankistrodesmus (2), Actinastrum (2) |
| | | | | | | Chrysophyceae | 29 | Melosira (11), Cyclotella (10), Cymbella (1), Navicula (1), Chrysophycfae |
| | | | | | | Cyanophyta | 18 | Agmenellum (18) |
| | | | | | | Cryptophyta | 2 | Cryptomonas (2) |
| L-1 Above dam | 6-12 | 0-ft depth | 340 | 0.2 | -- | Chrysophyta | 100 | Melosira (96), Navicula (4) |
| L-1 Above dam | 6-12 | 2-ft depth | -- | -- | 14.1 | | | |
| L-1 above dam | 8-14 | Euphotic zone | 15,000 | 3.0 | 35.2 | Cyanophyta | 65 | Agmenellum (38), Oscillatoria (16), Anacystis (12) |
| | | | | | | Chlorophyta | 27 | Coelastrum (12), Crucigenia (4), Sphaerocystis (4), Chlamydomonas (2), Gloedactinium (1), Ankistrodesmus (1), Dictyosphaerium (1), Schroederia, Chodatella, Oocystis, Tetraedron, Scenedesmus |
| | | | | | | Chrysophyta | 7 | Melosira (4), Cyclotella (1) Nitzschia (1), Synedra |
| | | | | | | Pyrrophyta | 1 | Glenodinum (1) |
| | | | | | | Cryptophyta | | Chroomonas |
| | | | | | | Euglenophyta | | Euglena |
| L-1 Above dam | 8-14 | 2-ft depth | -- | -- | 48.4 | | | |
| L-1 Above dam | 8-14 | 4-ft depth | 22,000 | 2.6 | 46.1 | Cyanophyta | 74 | Agmenellum (46), Oscillatoria (24), Anacystis (4) |
| | | | | | | Chlorophyta | 19 | Coelastrum (7), Crucigenia (4), Scenedesmus (2), Sphaerocystis (2), Micractinium (1), Ankistrodesmus (1), Chlamydomonas (1), Schroederia, Dictyosphaerium, Oocystis, Treubaria, Cosmarium |
| | | | | | | Chrysophyta | 7 | Melosira (5), Cyclotella (2), |

*Less than 1 percent not given.

A distinct thermocline was noted in June at the primary sampling station (L-I) between 10 and 14 feet. Dissolved oxygen was found throughout the entire water column.

The spring near-surface, total-phosphorus concentration was 0.04 mg/L. The spring total-nitrogen to total-phosphorus ratio, 76 to 1, indicates that phosphorus may be limiting algal productivity in North Branch Reservoir.

North Branch Reservoir had Carlson TSIs of 69 for chlorophyll *a* (summer), 69 for Secchi-disk transparency (summer), and 57 for total phosphorus (spring). Carlson TSIs in this range indicate eutrophic lakes.

Green algae (Chlorophyta) and yellow-green algae (Chrysophyta) dominated the spring algal community. Blue-green algae (Cyanophyta) dominated the summer algal community.

No chemical constituents or properties exceeded Ohio water-quality standards.

Inflow data (fig. 58, table 133): North Branch Kokosing River is the major tributary to North Branch Reservoir. Site I-1 has a drainage area of 27.6 $mi^2$, accounting for 62 percent of the drainage to the reservoir. A qualitative comparison of stream versus lake data is shown below.

| Inflow sampling site | Sampling date (1979) | Estimated discharge ($ft^3/s$) | Water body (stream or lake at 2-foot depth) having higher concentration | | | |
|---|---|---|---|---|---|---|
| | | | $NO_2$+ $NO_3$ | Total P | TOC | (Specific conductance) |
| North Branch Kokosing River at Site I-1 | June 12 | 5.0 | Lake | equal | Lake | Stream |
| | Aug 14 | 10. | Stream | Stream | Lake | Stream |

Table 133.--Physical and chemical data for selected inflows, North Branch Reservoir, Ohio

403137082353700 - N B KOKOSING R (I-1) NR BATEMANTOWN OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

| DATE | TIME | STREAM-FLOW, INSTAN-TANEOUS (CFS) | TEMPER-ATURE (DEG C) | OXYGEN, DIS-SOLVED (MG/L) | PH (UNITS) | SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS) | TUR-BID-ITY (JTU) | COLOR (PLAT-INUM-COBALT UNITS) | CARBON, ORGANIC TOTAL (MG/L AS C) | NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N) | NITRO-GEN,AM-MONIA + ORGANIC TOTAL (MG/L AS N) | PHOS-PHORUS, TOTAL (MG/L AS P) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| JUN | | | | | | | | | | | | |
| 12... | 1330 | 5.0 | 21.0 | 8.3 | 8.1 | 460 | 2 | 10 | 2.2 | 2.1 | .44 | .01 |
| AUG | | | | | | | | | | | | |
| 14... | 1200 | 10 | 19.3 | 8.2 | 7.9 | 450 | 2 | 30 | 1.2 | .71 | .26 | .01 |

## Ross Lake

Location: Ross County
(Chillicothe 7.5-minute quadrangle map)

Type: Impoundment on unnamed stream

Use: Recreation

Physical characteristics at summer pool level (table 6):

| Date of origin (year) | Surface area (acres) | Capacity (acre-feet) | Capacity-inflow ratio (C/I) |
|---|---|---|---|
| 1968 | 140 | 1,745 | 0.61 |

Drainage-basin characteristics:

| Drainage area ($mi^2$) | Type | Estimated sediment yield (from fig. 3) |
|---|---|---|
| 3.82 | Agricultural, rural | Moderately low |

Lake data (figs. 60, 61; tables 134-137): Ross Lake was sampled under partly cloudy and windy conditions in June and under sunny and windy conditions on August 10. Secchi-disk transparencies at the primary sampling station (L-1) were 6.7 feet in June and 10.1 feet in August. These transparencies were among the highest of the lakes sampled in 1979.

Profile and analytical data show the following characteristics:

| Date | Stratification (gradient) | | Chemical type | Trophic state index (Carlson) | | | Trophic class | Substances at or above State limits | | Phytoplankton, dominant division(s) |
|---|---|---|---|---|---|---|---|---|---|---|
| | Thermal | Chemical | | Chl a | SD | T.P. | | Toxicants | Bacteria | |
| 6-07-79 | Yes | Yes | Moderately hard; Ca, $SO_4$ | -- | -- | 47 | Meso-trophic | No | No | Cyanophyta, Chrysophyta |
| 8-10-79 | Yes | Yes | -- | 45 | 44 | -- | -- | No | No | Cyanophyta |

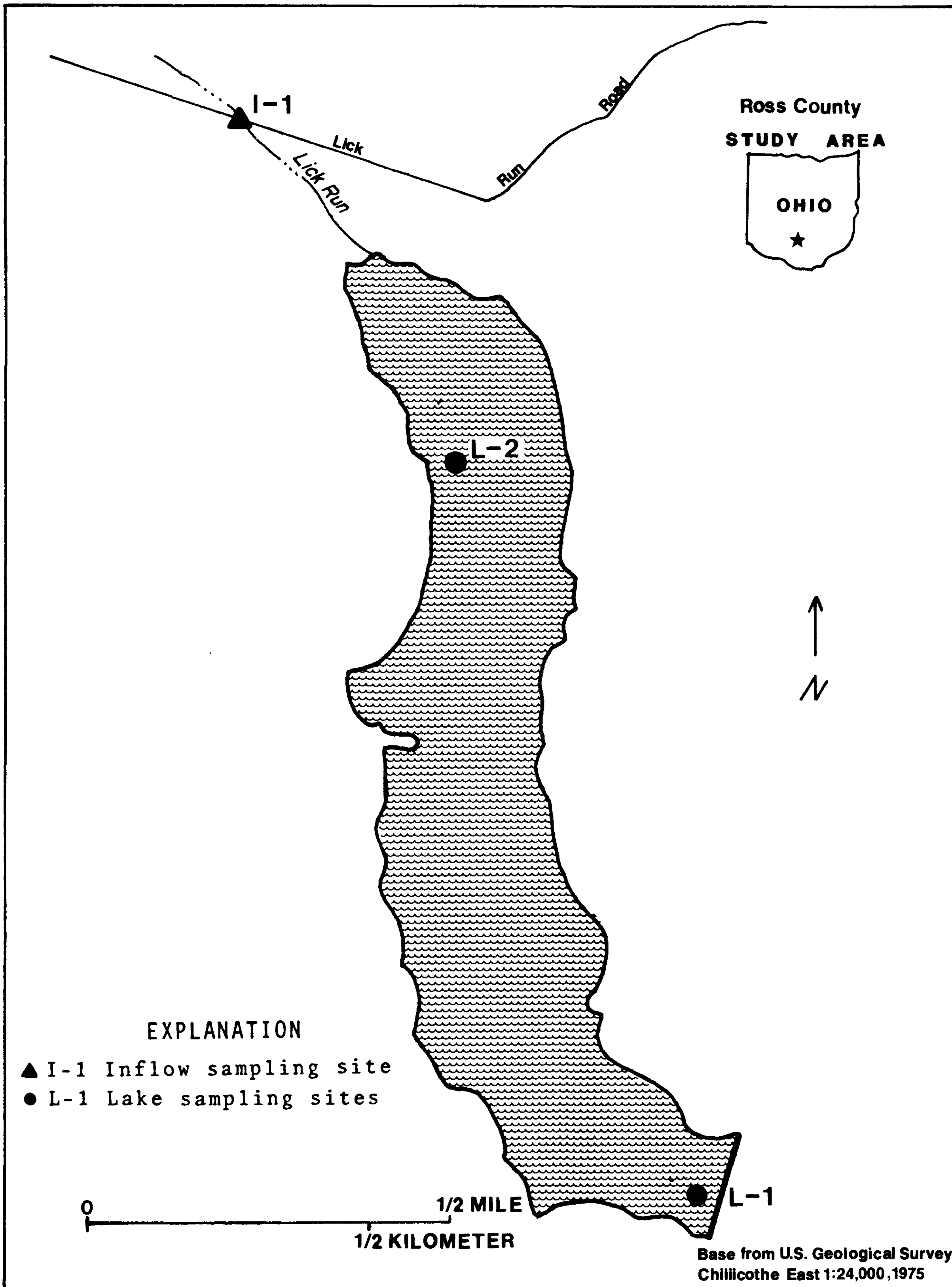



**Figure 60.--Ross Lake and inflow sampling site.**

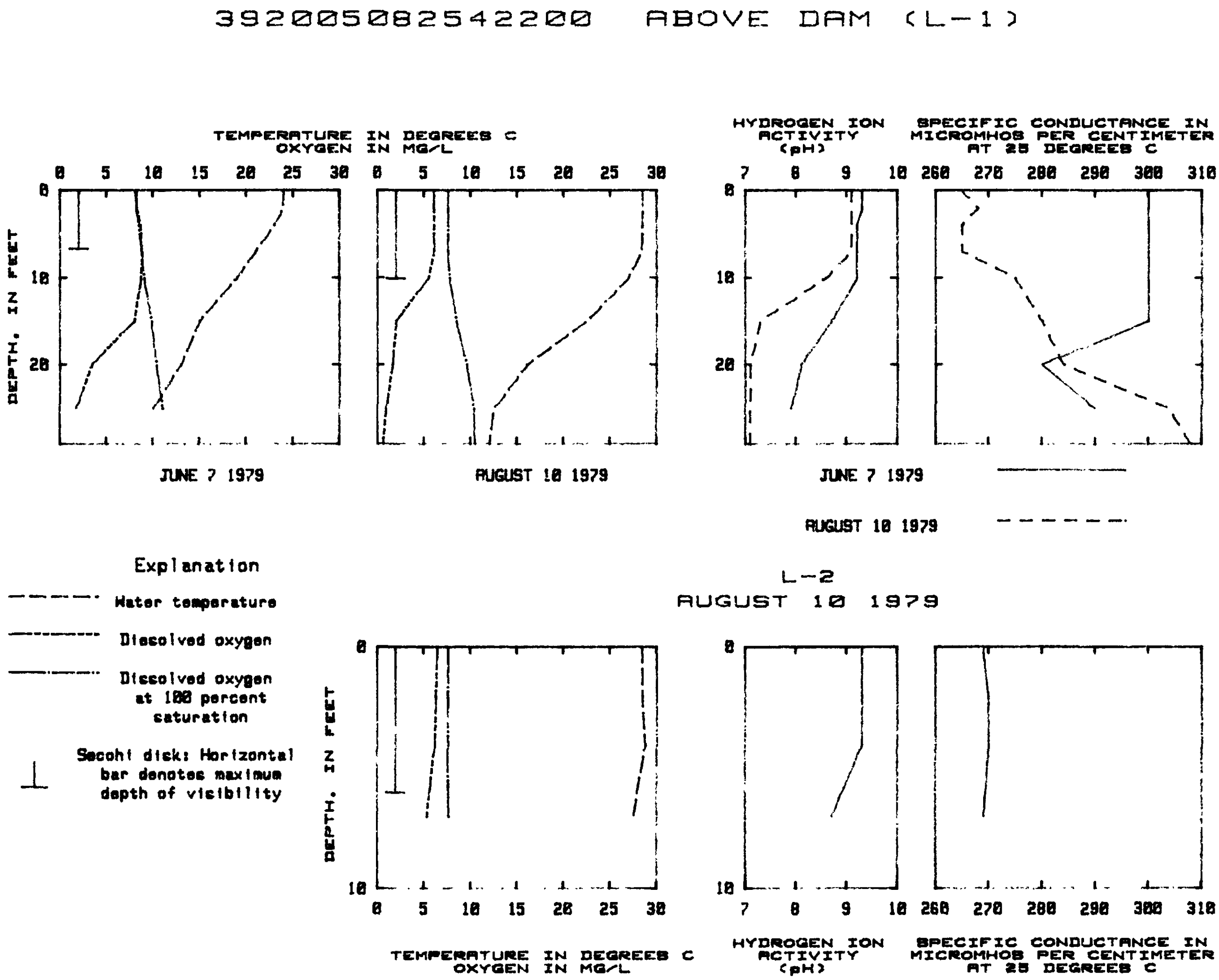



Figure 61.--Data profiles for Ross Lake.

Table 134.--Profile data for the primary lake site, Ross Lake, Ohio

392005082542200 - ROSS LK AB DAM (L-1) NR CHILLICOTHE OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

| DATE | TIME | SAMPLING DEPTH (FT) | TEMPERATURE (DEG C) | OXYGEN, DISSOLVED (MG/L) | OXYGEN, DISSOLVED (PERCENT SATURATION) | SPECIFIC CONDUCTANCE (MICROMHOS) | PH (UNITS) | CARBONATE (MG/L AS CO3) | BICARBONATE (MG/L AS HCO3) | CARBON DIOXIDE DISSOLVED (MG/L AS CO2) | HYDROGEN SULFIDE TOTAL (MG/L AS H2S) | TRANSPARENCY (SECCHI DISK) (IN) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| JUN | | | | | | | | | | | | |
| 07... | 1210 | .0 | 24.0 | 8.1 | 99 | 300 | 9.3 | -- | -- | -- | -- | -- |
| 07... | 1215 | 2.0 | 24.0 | 8.3 | 101 | 300 | 9.3 | 11 | 64 | .0 | .2 | 80 |
| 07... | 1220 | 4.0 | 23.0 | 8.7 | 102 | 300 | 9.2 | -- | -- | -- | -- | -- |
| 07... | 1225 | 7.0 | 21.0 | 8.9 | 101 | 300 | 9.2 | -- | -- | -- | -- | -- |
| 07... | 1230 | 10 | 19.0 | 8.7 | 96 | 300 | 9.2 | -- | -- | -- | -- | -- |
| 07... | 1235 | 15 | 15.0 | 8.0 | 81 | 300 | 8.7 | -- | -- | -- | -- | -- |
| 07... | 1240 | 20 | 13.0 | 3.4 | 33 | 280 | 8.1 | -- | -- | -- | -- | -- |
| 07... | 1250 | 25 | 10.0 | 1.7 | 15 | 290 | 7.9 | 0 | 157 | 3.1 | .4 | -- |
| AUG | | | | | | | | | | | | |
| 10... | 1130 | .0 | 28.5 | 6.1 | 80 | 265 | 9.1 | -- | -- | -- | -- | -- |
| 10... | 1135 | 2.0 | 28.5 | 6.1 | 80 | 268 | 9.1 | 15 | 67 | .1 | .0 | 121 |
| 10... | 1140 | 4.0 | 28.5 | 6.1 | 80 | 265 | 9.1 | -- | -- | -- | -- | -- |
| 10... | 1145 | 7.0 | 28.4 | 6.1 | 80 | 265 | 9.1 | -- | -- | -- | -- | -- |
| 10... | 1150 | 10 | 27.0 | 5.5 | 71 | 275 | 8.6 | -- | -- | -- | -- | -- |
| 10... | 1155 | 15 | 22.6 | 2.0 | 24 | 280 | 7.3 | -- | -- | -- | -- | -- |
| 10... | 1200 | 20 | 16.1 | 1.6 | 17 | 284 | 7.1 | -- | -- | -- | -- | -- |
| 10... | 1205 | 25 | 12.5 | .9 | 9 | 304 | 7.1 | -- | -- | -- | -- | -- |
| 10... | 1210 | 29 | 12.0 | .6 | 6 | 308 | 7.1 | 0 | 160 | 20 | 1.9 | -- |

Table 135.--Chemical analyses of water column composite samples, Ross Lake, Ohio

392005082542200 - ROSS LK AB DAM (L-1) NR CHILLICOTHE OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

| DATE | TIME | CALCIUM DIS- SOLVED (MG/L AS CA) | MAGNE- SIUM, DIS- SOLVED (MG/L AS MG) | POTAS- SIUM, DIS- SOLVED (MG/L AS K) | SODIUM, DIS- SOLVED (MG/L AS NA) | SULFATE DIS- SOLVED (MG/L AS SO4) | CHLO- RIDE, DIS- SOLVED (MG/L AS CL) | FLUO- RIDE, DIS- SOLVED (MG/L AS F) | HARD- NESS (MG/L AS CACO3) | SOLIDS, RESIDUE AT 180 DEG. C DIS- SOLVED (MG/L) |
|---|---|---|---|---|---|---|---|---|---|---|
| JUN 07... | 1250 | 22 | 6.7 | 2.2 | 5.9 | 38 | 6.4 | .1 | 83 | 198 |

| DATE | SOLIDS, RESIDUE AT 105 DEG. C, SUS- PENDED (MG/L) | SOLIDS, RESIDUE AT 105 DEG. C, TOTAL (MG/L) | BARIUM, TOTAL RECOV- ERABLE (UG/L AS BA) | CADMIUM TOTAL RECOV- ERABLE (UG/L AS CD) | CHRO- MIUM, TOTAL RECOV- ERABLE (UG/L AS CR) | LEAD, TOTAL RECOV- ERABLE (UG/L AS PB) | MERCURY TOTAL RECOV- ERABLE (UG/L AS HG) | NICKEL, TOTAL RECOV- ERABLE (UG/L AS NI) | SELE- NIUM, TOTAL (UG/L AS SE) | SILVER, TOTAL RECOV- ERABLE (UG/L AS AG) |
|---|---|---|---|---|---|---|---|---|---|---|
| JUN 07... | 11 | 209 | 0 | 0 | 20 | 5 | <.5 | 8 | 0 | 0 |

| DATE | ARSENIC TOTAL (UG/L AS AS) | METHY- LENE BLUE ACTIVE SUB- STANCE (MG/L) | BORON, TOTAL RECOV- ERABLE (UG/L AS B) | COBALT, TOTAL RECOV- ERABLE (UG/L AS CO) | COPPER, TOTAL RECOV- ERABLE (UG/L AS CU) | IRON, TOTAL RECOV- ERABLE (UG/L AS FE) | MANGA- NESE, TOTAL RECOV- ERABLE (UG/L AS MN) | MOLYB- DENUM, TOTAL RECOV- ERABLE (UG/L AS MO) | ZINC, TOTAL RECOV- ERABLE (UG/L AS ZN) |
|---|---|---|---|---|---|---|---|---|---|
| JUN 07... | <10 | .06 | -- | 0 | 2 | 100 | 520 | 0 | 20 |

Table 136.--Chemical, physical, and biological analyses of water samples from selected depths, Ross Lake, Ohio

392005082542200 - ROSS LK AB DAM (L-1) NR CHILLICOTHE OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

| DATE | TIME | SAMPLING DEPTH (FT) | NITROGEN, NITRITE TOTAL (MG/L AS N) | NITROGEN, NITRATE TOTAL (MG/L AS N) | NITROGEN, NO2+NO3 TOTAL (MG/L AS N) | NITROGEN, AMMONIA TOTAL (MG/L AS N) | NITROGEN, ORGANIC TOTAL (MG/L AS N) | NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N) | PHOSPHORUS, ORTHO. TOTAL (MG/L AS P) |
|---|---|---|---|---|---|---|---|---|---|
| JUN | | | | | | | | | |
| 07... | 1215 | 2.0 | .01 | .20 | .21 | .04 | .31 | .35 | .00 |
| 07... | 1250 | 25 | .00 | .00 | .00 | .94 | .56 | 1.5 | .00 |
| AUG | | | | | | | | | |
| 10... | 1135 | 2.0 | .00 | .01 | .01 | .01 | .32 | .33 | .00 |
| 10... | 1210 | 29 | .00 | .00 | .00 | 2.9 | .70 | 3.6 | .09 |

| DATE | PHOSPHORUS, TOTAL (MG/L AS P) | SILICA, DISSOLVED (MG/L AS SIO2) | TURBIDITY (JTU) | COLOR (PLATINUM-COBALT UNITS) | CARBON, ORGANIC TOTAL (MG/L AS C) | OXYGEN DEMAND, BIOCHEMICAL, 5 DAY (MG/L) | OXYGEN DEMAND, CHEMICAL (HIGH LEVEL) (MG/L) | COLIFORM, FECAL, 0.45 UM-MF (COLS./100 ML) | STREPTOCOCCI FECAL, (COLS. PER 100 ML) |
|---|---|---|---|---|---|---|---|---|---|
| JUN | | | | | | | | | |
| 07... | .02 | .7 | 1 | 10 | 9.4 | 1.1 | 170 | 4 | 26 |
| 07... | .05 | 7.5 | 3 | 15 | 11 | 1.9 | 19 | 6 | 30 |
| AUG | | | | | | | | | |
| 10... | .01 | 1.6 | 1 | 5 | 5.5 | 1.1 | 12 | 4 | 40 |
| 10... | .22 | 9.7 | 6 | 20 | 9.3 | 3.8 | 41 | 10 | 70 |

Table 137.--Phytoplankton identified in Ross Lake, Ohio (1979)

| Sample description | | | Total cells (per ml) | Diversity index (genus) $\bar{d}$ | Chloro-phyll $\underline{a}$ ($\mu g/L$) | Division(s) present (in order of dominance) | Percent of total cell count | Dominant taxa within division and percent (%)* of total cell count |
|---|---|---|---|---|---|---|---|---|
| Location | Date | Location in water column | | | | | | |
| L-1 Above dam | 6-07 | Euphotic zone Composite | 4,300 | 0.6 | 12.5 | Cyanophyta | 91 | Oscillatoria (91) |
| | | | | | | Chrysophyta | 6 | Cyclotella (5), Fragilaria (1), Navicula, Nitzschia |
| | | | | | | Chlorophyta | 2 | Scenedesmus (2) |
| | | | | | | Cryptophyta | | Cryptomonas |
| | | | | | | Euglenophyta | | Trachelomonas |
| L-1 Above dam | 6-07 | 7-ft depth | 2,000 | 2.5 | 10.0 | Chrysophyta | 47 | Cyclotella (36), Asterionella (11) |
| | | | | | | Cyanophyta | 21 | Agmenellum (21) |
| | | | | | | Chlorophyta | 20 | Scenedesmus (12), Selenastrum (7) Chlamydomonas (1) |
| | | | | | | Cryptophyta | 12 | Cryptomonas (11), Chroomonas (1) |
| L-1 Above dam | 8-10 | Euphotic zone Composite | 6,200 | 2.0 | 22.6 | Cyanophyta | 92 | Oscillatoria (38), Aphanizomenon (29) Anacystis (25) |
| | | | | | | Chrysophyta | 6 | Synedra (6), Cyclotella (1) |
| | | | | | | Chlorophyta | 1 | Scenedesmus (1) |
| | | | | | | Euglenophyta | 1 | Trachelomonas (1) |
| L-1 Above dam | 8-10 | 2-ft depth | 16,000 | 0.7 | 4.3 | Cyanophyta | 99 | Aphanizomenon (86), Anacystis (13) |
| | | | | | | Chrysophyta | | Cyclotella, Synedra |
| | | | | | | Pyrrhophyta | | Glenodinium, Peridinium |
| | | | | | | Chlorophyta | | Ankistrodesmus |
| | | | | | | Euglenophyta | | Trachelomonas |

*Less than 1 percent not given.

Ross Lake at L-1 had developed a distinct thermal stratification by June 7. Thermal stratification continued through August 10. There was chemical stratification on both dates. The near-surface oxygen concentrations were slightly above saturation in the spring. Summer oxygen concentrations were below saturation and approached anaerobic conditions in the summer hypolimnion. The thermal and chemical profiles at secondary sampling station L-2 were similar to those found at L-1.

The spring near-surface, total-phosphorus concentration was 0.02 mg/L. The spring total-nitrogen to total-phosphorus ratio, 28 to 1, indicates phosphorus may be limiting algal productivity in Ross Lake. A comparison of the surface and bottom total-phosphorus concentrations (summer sampling) indicates phosphorus is possibly being returned to the water column from the anaerobic lake sediments.

Ross Lake had Carlson TSIs of 45 for chlorophyll a (summer), 44 for Secchi-disk transparency (summer), and 47 for total phosphorus (spring). Carlson TSIs in this range indicate eutrophic lakes.

No chemical constituents or properties exceeded Ohio water-quality standards. Hydrogen sulfide was detected in the summer hypolimnion.

Blue-green algae (Cyanophyta) and yellow-green algae (Chrysophyta) dominated the spring algal community. Blue-green algae (Cyanophyta) dominated the summer algal community.

Inflow data (fig. 60, table 138): Lick Run is the principal Tributary to Ross Lake. It has a drainage area of 2.64 $mi^2$, which is 69 percent of the drainage area of the lake. Samples were taken at site I-1. A qualitative comparison of stream versus lake data is shown below.

| Inflow sampling site | Sampling date (1979) | Estimated discharge ($ft^3/s$) | Water body (stream or lake at 2-foot depth) having higher concentration | | | |
|---|---|---|---|---|---|---|
| | | | $NO_2$+ $NO_3$ | Total P | TOC | (Specific conductance) |
| Lick Run at site I-1 | June 7 | 2.0 | Stream | Stream | Lake | Stream |
| | Aug 10 | 1.0 | Stream | Stream | Lake | Stream |

Table 138.--Physical and chemical data for selected inflows, Ross Lake, Ohio

392107082545300 - LICK RN AB ROSS LK (I-1) NR CHILLICOTHE OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

| DATE | TIME | STREAM-FLOW, INSTAN-TANEOUS (CFS) | TEMPER-ATURE (DEG C) | OXYGEN, DIS-SOLVED (MG/L) | PH (UNITS) | SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS) | TUR-BID-ITY (JTU) | COLOR (PLAT-INUM-COBALT UNITS) | CARBON, ORGANIC TOTAL (MG/L AS C) | NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N) | NITRO-GEN,AM-MONIA + ORGANIC TOTAL (MG/L AS N) | PHOS-PHORUS, TOTAL (MG/L AS P) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| JUN | | | | | | | | | | | | |
| 07... | 1030 | 2.0 | 19.5 | 9.1 | 7.1 | 560 | 1 | 20 | 4.2 | .40 | .23 | .03 |
| AUG | | | | | | | | | | | | |
| 10... | 1000 | 1.0 | 23.0 | 8.9 | 6.7 | 510 | 1 | 5 | 2.6 | .23 | .18 | .06 |

## Snowden Lake

Location: Athens County
(Albany 7.5-minute quadrangle map)

Type: Impoundment on unnamed tributary

Use: Flood control, recreation, and water supply.

Physical characteristics at summer pool level (table 6):

| Date of origin (year) | Surface area (acres) | Capacity (acre-feet) | Capacity-inflow ratio (C/I) |
|---|---|---|---|
| 1970 | 131 | 2,131 | 0.66 |

Drainage-basin characteristics:

| Drainage area ($mi^2$) | Type | Estimated sediment yield (from fig. 3) |
|---|---|---|
| 4.04 | Agricultural, rural | Moderate |

Lake data (figs. 62, 63; tables 139-142): Snowden Lake was sampled under partly cloudy skies on June 8 and in the rain on September 5. Secchi-disk transparencies at the primary sampling station (L-1) were 10.5 feet in June and 6.0 feet in September. The transparencies were among the highest recorded in 1979.

Profile and analytical data show the following lake characteristics:

| Date | Stratification (gradient) Thermal | Chemical | Chemical type | Trophic state index (Carlson) Chl a | SD | T.P. | Trophic class | Substances at or above State limits Toxicants | Bacteria | Phyto-plankton, dominant division(s) |
|---|---|---|---|---|---|---|---|---|---|---|
| 6-15-79 | Yes | Yes | Soft; Ca, $SO_4$, $HCO_3$ | -- | -- | 37 | Meso-trophic | No | No | Cyanophyta, Chlorophyta |
| 9-04-79 | Yes | Yes | -- | 50 | 54 | -- | -- | No | No | Cyanophyta |

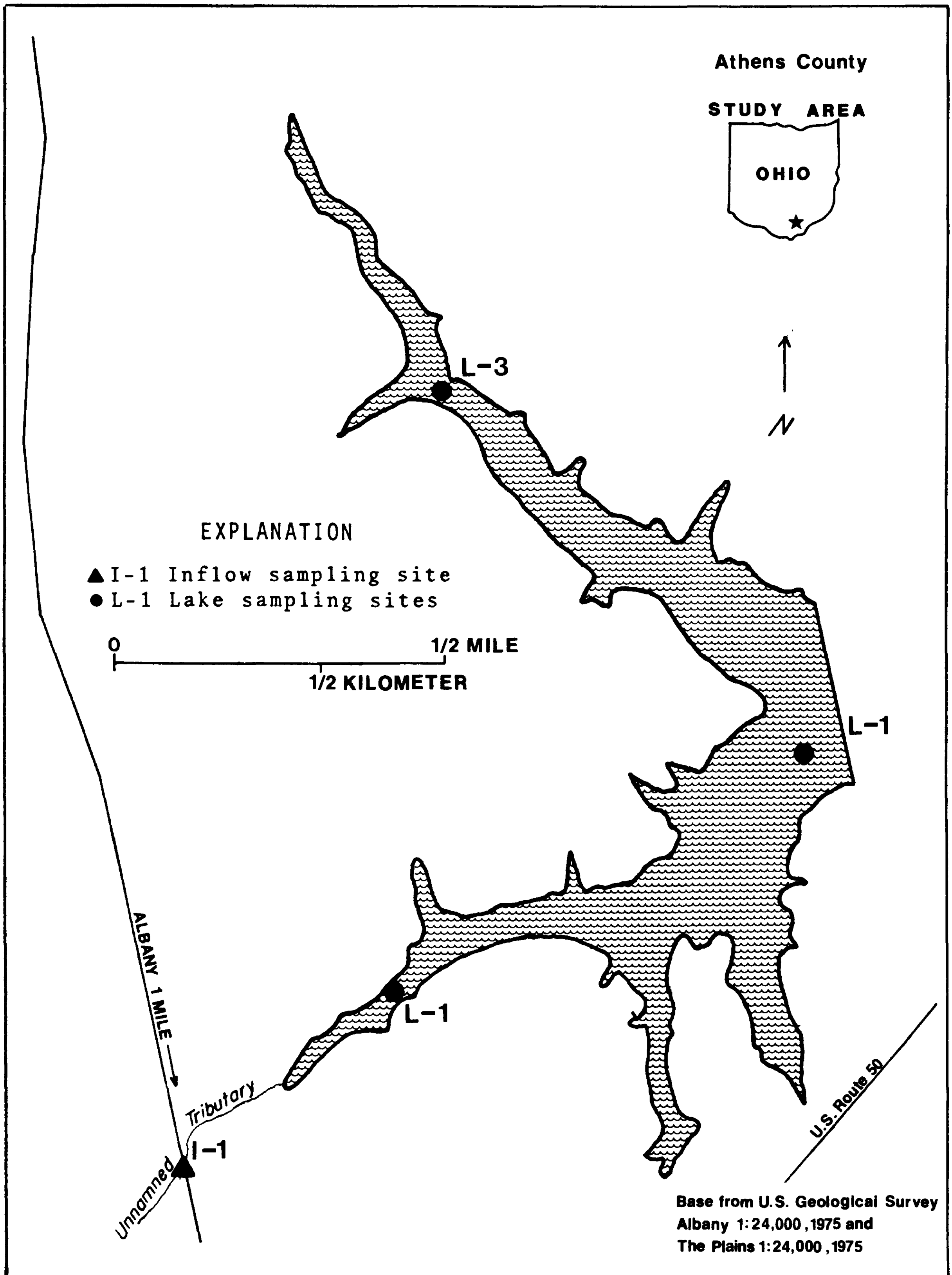



**Figure 62.--Snowden Lake and inflow sampling site.**

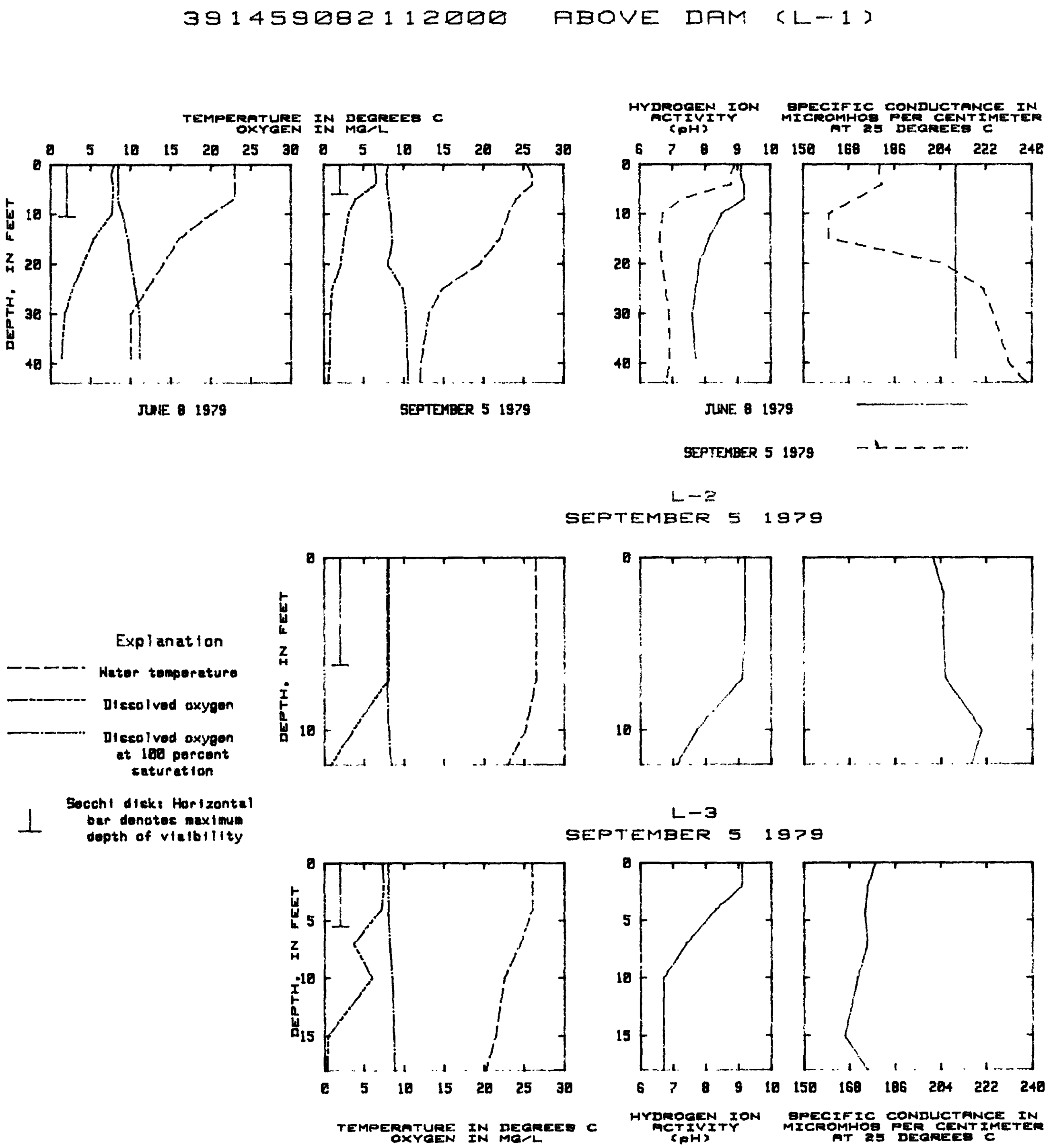



Figure 63.--Data profiles for Snowden Lake.

Table 139.--Profile data for the primary lake site, Snowden Lake, Ohio

391459082112000 - SNOWDEN LK AB DAM (L-1) NR ALBANY OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

| DATE | TIME | SAMPLING DEPTH (FT) | TEMPERATURE (DEG C) | OXYGEN, DISSOLVED (MG/L) | OXYGEN, DISSOLVED (PERCENT SATURATION) | SPECIFIC CONDUCTANCE (MICROMHOS) | PH (UNITS) | CARBONATE (MG/L AS CO3) | BICARBONATE (MG/L AS HCO3) | CARBON DIOXIDE DISSOLVED (MG/L AS CO2) | HYDROGEN SULFIDE TOTAL (MG/L AS H2S) | TRANSPARENCY (SECCHI DISK) (IN) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| JUN | | | | | | | | | | | | |
| 08... | 1100 | .0 | 23.0 | 7.9 | 94 | 210 | 9.1 | -- | -- | -- | -- | -- |
| 08... | 1105 | 2.0 | 23.0 | 7.6 | 90 | 210 | 9.1 | 13 | 58 | .0 | .1 | 126 |
| 08... | 1110 | 4.0 | 23.0 | 7.8 | 93 | 210 | 9.2 | -- | -- | -- | -- | -- |
| 08... | 1115 | 7.0 | 23.0 | 7.8 | 93 | 210 | 9.2 | -- | -- | -- | -- | -- |
| 08... | 1120 | 10 | 20.0 | 7.6 | 84 | 210 | 8.5 | -- | -- | -- | -- | -- |
| 08... | 1125 | 15 | 16.0 | 5.3 | 55 | 210 | 8.1 | -- | -- | -- | -- | -- |
| 08... | 1130 | 20 | 14.0 | 4.0 | 40 | 210 | 7.8 | -- | -- | -- | -- | -- |
| 08... | 1135 | 25 | 12.0 | 2.7 | 25 | 210 | 7.7 | -- | -- | -- | -- | -- |
| 08... | 1140 | 30 | 10.0 | 1.7 | 15 | 210 | 7.6 | -- | -- | -- | -- | -- |
| 08... | 1150 | 39 | 10.0 | 1.3 | 12 | 210 | 7.7 | 0 | 120 | 3.8 | .4 | -- |
| SEP | | | | | | | | | | | | |
| 05... | 1215 | .0 | 25.5 | 6.4 | 80 | 180 | 8.9 | -- | -- | -- | -- | -- |
| 05... | 1220 | 2.0 | 26.1 | 6.6 | 84 | 180 | 8.8 | 4 | 96 | .3 | .0 | 72 |
| 05... | 1225 | 4.0 | 26.1 | 6.6 | 84 | 181 | 8.8 | -- | -- | -- | -- | -- |
| 05... | 1230 | 7.0 | 24.1 | 4.0 | 49 | 171 | 7.3 | -- | -- | -- | -- | -- |
| 05... | 1235 | 10 | 23.1 | 3.1 | 37 | 160 | 6.7 | -- | -- | -- | -- | -- |
| 05... | 1240 | 15 | 22.0 | 2.5 | 29 | 160 | 6.6 | -- | -- | -- | -- | -- |
| 05... | 1245 | 20 | 19.5 | 2.1 | 23 | 205 | 6.7 | -- | -- | -- | -- | -- |
| 05... | 1250 | 25 | 14.8 | 1.0 | 10 | 221 | 6.8 | -- | -- | -- | -- | -- |
| 05... | 1255 | 30 | 13.1 | .8 | 7 | 225 | 6.9 | -- | -- | -- | -- | -- |
| 05... | 1300 | 40 | 12.1 | .7 | 7 | 231 | 6.9 | -- | -- | -- | -- | -- |
| 05... | 1305 | 44 | 12.0 | .5 | 5 | 238 | 6.8 | 0 | 114 | 29 | 1.5 | -- |

Table 140.--Chemical analyses of water column composite samples, Snowden Lake, Ohio

391459082112000 - SNOWDEN LK AB DAM (L-1) NR ALBANY OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

| DATE | TIME | CALCIUM DIS- SOLVED (MG/L AS CA) | MAGNE- SIUM, DIS- SOLVED (MG/L AS MG) | POTAS- SIUM, DIS- SOLVED (MG/L AS K) | SODIUM, DIS- SOLVED (MG/L AS NA) | SULFATE DIS- SOLVED (MG/L AS SO4) | CHLO- RIDE, DIS- SOLVED (MG/L AS CL) | FLUO- RIDE, DIS- SOLVED (MG/L AS F) | HARD- NESS (MG/L AS CACO3) | SOLIDS, RESIDUE AT 180 DEG. C DIS- SOLVED (MG/L) |
|---|---|---|---|---|---|---|---|---|---|---|
| JUN 08... | 1150 | 29 | 13 | 2.2 | 8.2 | 54 | 5.4 | .1 | 130 | 143 |

| DATE | SOLIDS, RESIDUE AT 105 DEG. C, SUS- PENDED (MG/L) | SOLIDS, RESIDUE AT 105 DEG. C, TOTAL (MG/L) | BARIUM, TOTAL RECOV- ERABLE (UG/L AS BA) | CADMIUM TOTAL RECOV- ERABLE (UG/L AS CD) | CHRO- MIUM, TOTAL RECOV- ERABLE (UG/L AS CR) | LEAD, TOTAL RECOV- ERABLE (UG/L AS PB) | MERCURY TOTAL RECOV- ERABLE (UG/L AS HG) | NICKEL, TOTAL RECOV- ERABLE (UG/L AS NI) | SELE- NIUM, TOTAL (UG/L AS SE) | SILVER, TOTAL RECOV- ERABLE (UG/L AS AG) |
|---|---|---|---|---|---|---|---|---|---|---|
| JUN 08... | 11 | 154 | 0 | 0 | 10 | 1 | <.5 | 9 | 0 | 0 |

| DATE | ARSENIC TOTAL (UG/L AS AS) | METHY- LENE BLUE ACTIVE SUB- STANCE (MG/L) | BORON, TOTAL RECOV- ERABLE (UG/L AS B) | COBALT, TOTAL RECOV- ERABLE (UG/L AS CO) | COPPER, TOTAL RECOV- ERABLE (UG/L AS CU) | IRON, TOTAL RECOV- ERABLE (UG/L AS FE) | MANGA- NESE, TOTAL RECOV- ERABLE (UG/L AS MN) | MOLYB- DENUM, TOTAL RECOV- ERABLE (UG/L AS MO) | ZINC, TOTAL RECOV- ERABLE (UG/L AS ZN) |
|---|---|---|---|---|---|---|---|---|---|
| JUN 08... | <10 | <.05 | -- | 0 | 2 | 280 | 530 | 2 | 20 |

Table 141.--Chemical, physical, and biological analyses of water samples from selected depths, Snowden Lake, Ohio

391459082112000 - SNOWDEN LK AB DAM (L-1) NR ALBANY OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

| DATE | TIME | SAMP-LING DEPTH (FT) | NITRO-GEN, NITRITE TOTAL (MG/L AS N) | NITRO-GEN, NITRATE TOTAL (MG/L AS N) | NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N) | NITRO-GEN, AMMONIA TOTAL (MG/L AS N) | NITRO-GEN, ORGANIC TOTAL (MG/L AS N) | NITRO-GEN,AM-MONIA + ORGANIC TOTAL (MG/L AS N) | PHOS-PHORUS, ORTHO. TOTAL (MG/L AS P) |
|---|---|---|---|---|---|---|---|---|---|
| JUN | | | | | | | | | |
| 08... | 1105 | 2.0 | .01 | .28 | .29 | .02 | .31 | .33 | .00 |
| 08... | 1150 | 39 | .00 | .47 | .47 | .21 | .34 | .55 | .00 |
| SEP | | | | | | | | | |
| 05... | 1220 | 2.0 | .00 | .00 | .00 | .02 | .41 | .43 | .00 |
| 05... | 1305 | 44 | .01 | .00 | .00 | 1.5 | 1.1 | 2.6 | .03 |

| DATE | PHOS-PHORUS, TOTAL (MG/L AS P) | SILICA, DIS-SOLVED (MG/L AS SIO2) | TUR-BID-ITY (JTU) | COLOR (PLAT-INUM-COBALT UNITS) | CARBON, ORGANIC TOTAL (MG/L AS C) | OXYGEN DEMAND, BIO-CHEM-ICAL, 5 DAY (MG/L) | OXYGEN DEMAND, CHEM-ICAL (HIGH LEVEL) (MG/L) | COLI-FORM, FECAL, 0.45 UM-MF (COLS./100 ML) | STREP-TOCOCCI FECAL, (COLS. PER 100 ML) |
|---|---|---|---|---|---|---|---|---|---|
| JUN | | | | | | | | | |
| 08... | .01 | 1.0 | 1 | 15 | 3.9 | .9 | 180 | 16 | 20 |
| 08... | .02 | 3.9 | 1 | 40 | 3.4 | .8 | 22 | 4 | 8 |
| SEP | | | | | | | | | |
| 05... | .02 | 3.1 | 1 | 5 | 4.2 | 1.8 | 6 | 0 | 8 |
| 05... | .20 | 7.6 | 40 | 10 | 7.8 | 4.0 | 70 | 12 | 50 |

Table 142.--Phytoplankton identified in Snowden Lake, Ohio (1979)

| Sample description: Location | Sample description: Date | Sample description: Location in water column | Total cells (per ml) | Diversity index (genus) $\bar{d}$ | Chlorophyll a (μg/L) | Division(s) present (in order of dominance) | Percent of total cell count | Dominant taxa within division and percent (%)* of total cell count |
|---|---|---|---|---|---|---|---|---|
| L-1 Above dam | 6-08 | Euphotic zone Composite | 1,300 | 1.4 | 3.2 | Chlorophyta | 60 | Sphaerocystis (55), Oocystis (4), Ankistrodesmus (1) |
| | | | | | | Chrysophyta | 38 | Cyclotella (38) |
| | | | | | | Cryptophyta | 2 | Chroomonas (2) |
| L-1 Above dam | 6-08 | 4-ft depth | 1,400 | 1.4 | 4.0 | Chrysophyta | 67 | Cyclotella (66), Nitzschia (1) |
| | | | | | | Chlorophyta | 23 | Sphaerocystis (23) |
| | | | | | | Cryptophyta | 10 | Chroomonas (5), Cryptomonas (5) |
| L-1 Above dam | 9-05 | Euphotic zone Composite | 20,000 | 1.5 | 14.9 | Chlorophyta | 61 | Volvox (60), Coelastrum (1), Oocystaceae, Staurastrum |
| | | | | | | Cyanophyta | 39 | Oscillatoria (20), Anabaena (19) |
| | | | | | | Chrysophyta | | Cyclotella, Asterionella, Synedra, Melosira, Navicula |
| | | 2-ft depth | -- | -- | 17.0 | | | |
| | | | | | | Euglenophyta | | Trachelomonas |
| L-1 Above dam | 9-05 | 4-ft depth | 84,000 | 1.1 | 17.4 | Chlorophyta | 78 | Volvox (77), Chlorococcum, Oocystis, Elaktothrix, Gloeocystis, Sphaerocystis Staurastrum |
| | | | | | | Cyanophyta | 22 | Anabaena (15), Oscillatoria (6), Lyngbya (2) |
| | | | | | | Chrysophyta | | Cyclotella, Asterionella, Synedra, Navicula |

*Less than 1 percent not given.

Snowden Lake at L-1 had developed distinct thermal stratification by June 8. Thermal stratification continued through September 5. There was chemical stratification on both dates. Dissolved-oxygen concentrations below saturation were noted at L-1 throughout the water column on both dates. Anaerobic conditions were approached in the summer hypolimnion.

The thermal and chemical profiles of the secondary sampling stations L-2 and L-3 were similar to those at L-1, although the epilimnic pH and oxygen levels at L-2 were somewhat higher than at stations L-1 and L-3.

The spring near-surface, total-phosphorus concentration was 0.01 mg/L. The total-nitrogen to total-phosphorus ratio, 62 to 1, indicates phosphorus may be limiting algal productivity in Snowden Lake. A comparison of the surface and bottom total-phosphorus concentrations (summer sampling) indicates phosphorus is possibly being returned to the water column from the anaerobic lake sediments.

Snowden Lake had Carlson TSIs of 58 for chlorophyll *a* (summer), 51 for Secchi-disk transparency (summer), and 37 for total phosphorus (spring). Snowden Lake was classified as eutrophic on the basis of of the high chlorophyll-*a* and Secchi-disk values. The chlorophyll-*a* concentration is higher than normal with respect to the low total-phosphorus concentration in the spring.

No chemical constituents or properties exceeded Ohio water-quality standards. Hydrogen sulfide was detected in the summer hypolimnion.

Green algae (Chlorophyta) dominated the spring and summer algal communities.

Inflow data (fig. 62, table 143): An unnamed tributary with a drainage area of 0.74 $mi^2$ furnishes 18 percent of the inflow to the lake. Samples were collected at site I-1. A qualitative comparison of stream versus lake data is shown below.

| Inflow sampling site | Sampling date (1979) | Estimated discharge ($ft^3/s$) | Water body (stream or lake at 2-foot depth) having higher concentration | | | |
|---|---|---|---|---|---|---|
| | | | $NO_2+NO_3$ | Total P | TOC | (Specific conductance) |
| Tributary to Snowden Lake at site I-1 | June 8 | 4.0 | Stream | Stream | Stream | Stream |
| | Sept 5 | 2.0 | Stream | Stream | Stream | Stream |

# Willard Reservoir

Location: Huron County
(Willard 7.5-minute quadrangle map)

Type: Upground (pumped-storage reservoir)

Use: Recreation and water supply.

Physical characteristics at summer pool level (table 6):

| Date of origin (year) | Surface area (acres) | Capacity (acre-feet) | Capacity-inflow ratio (C/I) |
|---|---|---|---|
| 1969 | 340 | 7,985 | -- |

Lake data (figs. 64, 65; tables 144-147): Willard City Reservoir was sampled under sunny skies on June 26 and on August 30. Secchi-disk transparencies at the primary sampling station (L-1) were 21.3 feet in June and 5.1 feet in August. The June transparency was the highest single Secchi-disk measurement in any lake in 1979.

Profile and analytical data show the following lake characteristics:

| Date | Stratification (gradient) | | Chemical type | Trophic state index (Carlson) | | | Trophic class | Substances at or above State limits | | Phyto-plankton, dominant division(s) |
|---|---|---|---|---|---|---|---|---|---|---|
| | Thermal | Chemical | | Chl a | SD | T.P. | | Toxicants | Bacteria | |
| 6-26-79 | Yes | Yes | Very hard; Ca, $SO_4$ | -- | -- | 37 | Eutrophic | Yes | Yes | Cyanophyta |
| 8-30-79 | Yes | Yes | -- | 52 | 54 | -- | -- | Yes | Yes | Chlorophyta |

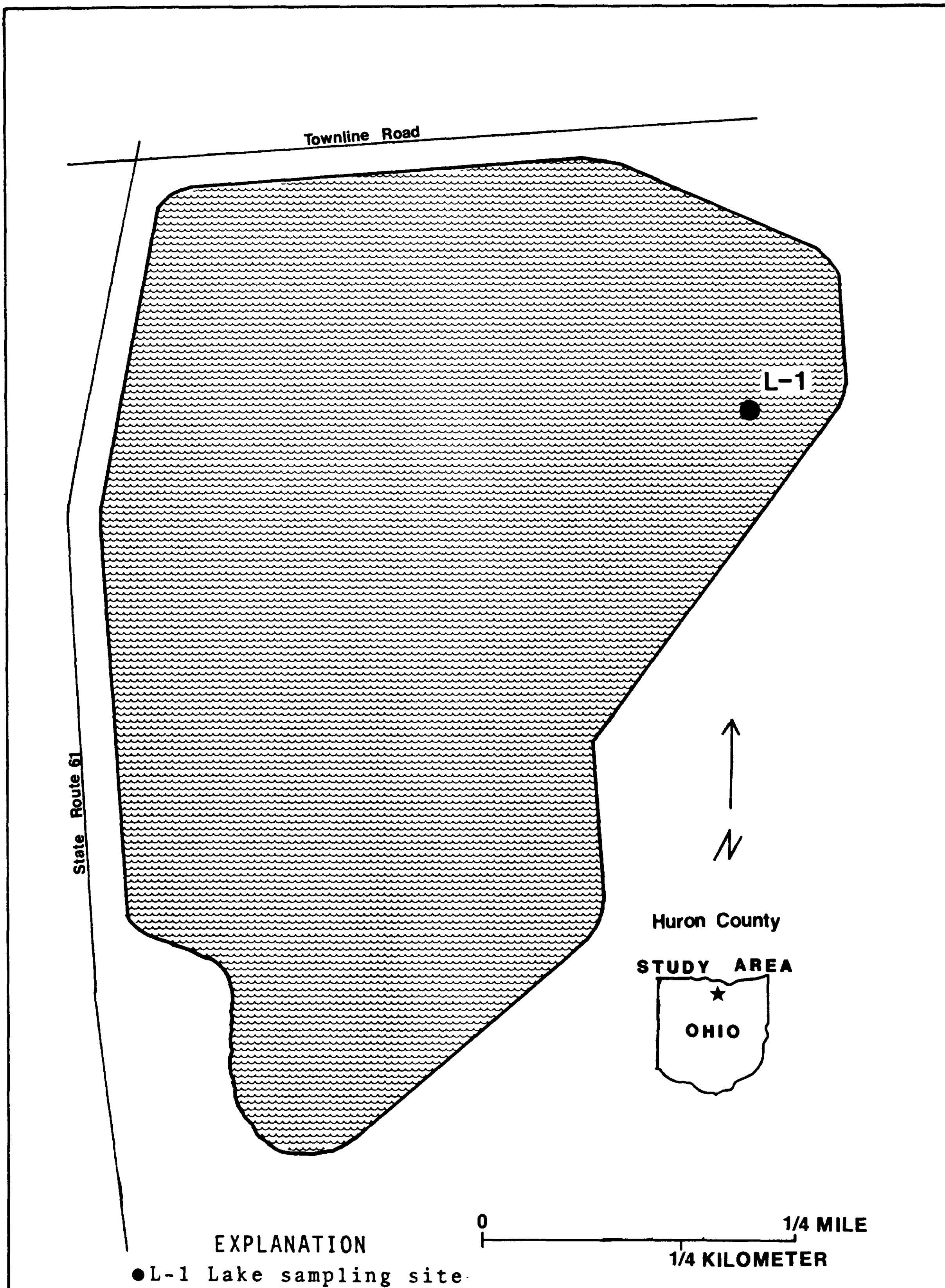



**Figure 64.--Willard City Reservoir sampling site.**

Table 143.--Physical and chemical data for selected inflows, Snowden Lake, Ohio

391427082122400 - TR TO SNOWDEN LK NR ALBANY OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

| DATE | TIME | STREAM-FLOW, INSTAN-TANEOUS (CFS) | TEMPER-ATURE (DEG C) | OXYGEN, DIS-SOLVED (MG/L) | PH (UNITS) | SPE-CIFIC CON-DUCT-ANCE (MICRO-MHOS) | TUR-BID-ITY (JTU) | COLOR (PLAT-INUM-COBALT UNITS) | CARBON, ORGANIC TOTAL (MG/L AS C) | NITRO-GEN, NO2+NO3 TOTAL (MG/L AS N) | NITRO-GEN,AM-MONIA + ORGANIC TOTAL (MG/L AS N) | PHOS-PHORUS, TOTAL (MG/L AS P) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| JUN | | | | | | | | | | | | |
| 08... | 1000 | 4.0 | 20.6 | 8.7 | 8.1 | 400 | 1 | 15 | 11 | 6.6 | 1.9 | .15 |
| SEP | | | | | | | | | | | | |
| 05... | 0935 | 2.0 | 22.0 | 8.3 | 7.9 | 365 | 1 | 20 | 4.8 | .91 | .41 | .02 |

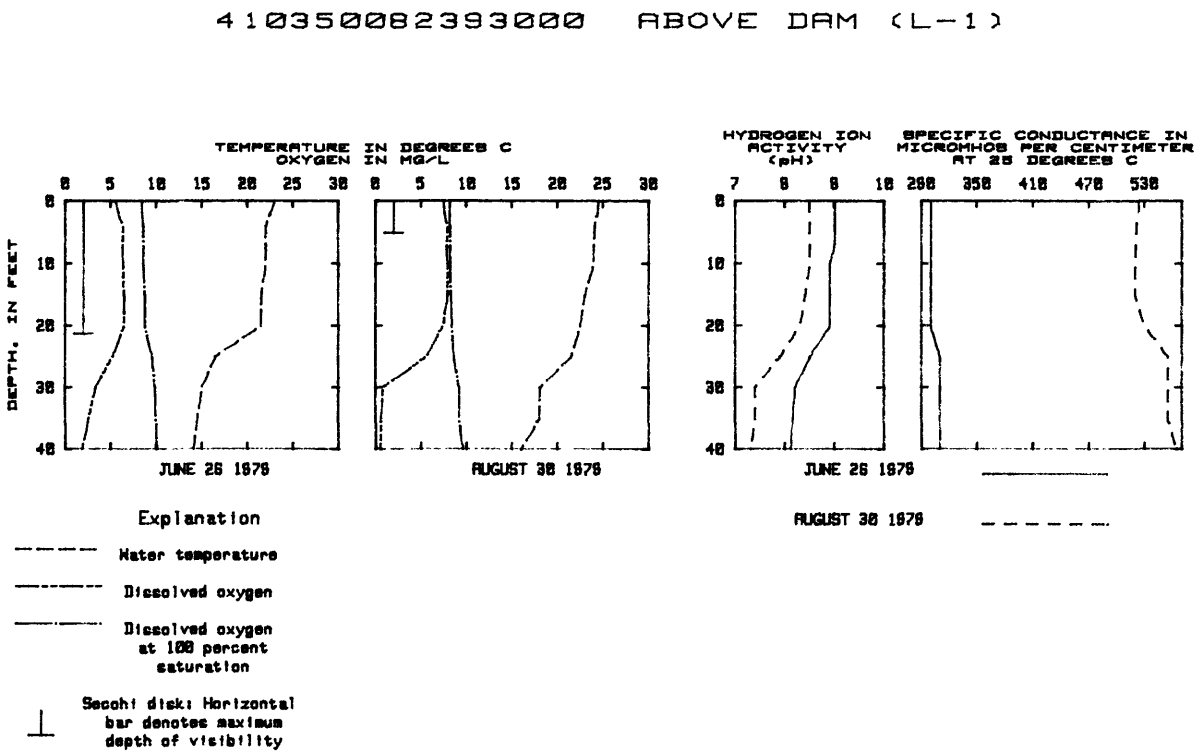



Figure 65.--Data profiles for Willard City Reservoir.

Table 144.--Profile data for the primary lake site, Willard City Reservoir, Ohio

410350082393000 - WILLARD CITY RE AB INTAKE (L-1) NR WILLARD OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

| DATE | TIME | SAMPLING DEPTH (FT) | TEMPERATURE (DEG C) | OXYGEN, DISSOLVED (MG/L) | OXYGEN, DISSOLVED (PERCENT SATURATION) | SPECIFIC CONDUCTANCE (MICROMHOS) | PH (UNITS) | CARBONATE (MG/L AS CO3) | BICARBONATE (MG/L AS HCO3) | CARBON DIOXIDE DISSOLVED (MG/L AS CO2) | HYDROGEN SULFIDE TOTAL (MG/L AS H2S) | TRANSPARENCY (SECCHI DISK) (IN) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| JUN | | | | | | | | | | | | |
| 26... | 1245 | .0 | 23.0 | 5.6 | 67 | 300 | 9.0 | -- | -- | -- | -- | -- |
| 26... | 1250 | 2.0 | 22.5 | 5.9 | 69 | 300 | 9.0 | 12 | 151 | .3 | .0 | 256 |
| 26... | 1255 | 4.0 | 22.0 | 6.2 | 72 | 300 | 9.0 | -- | -- | -- | -- | -- |
| 26... | 1300 | 7.0 | 22.0 | 6.3 | 73 | 300 | 9.0 | -- | -- | -- | -- | -- |
| 26... | 1305 | 10 | 22.0 | 6.4 | 74 | 300 | 8.9 | -- | -- | -- | -- | -- |
| 26... | 1310 | 15 | 21.5 | 6.5 | 74 | 300 | 8.9 | -- | -- | -- | -- | -- |
| 26... | 1315 | 20 | 21.5 | 6.5 | 74 | 300 | 8.9 | -- | -- | -- | -- | -- |
| 26... | 1320 | 25 | 16.5 | 5.2 | 54 | 310 | 8.5 | -- | -- | -- | -- | -- |
| 26... | 1325 | 30 | 15.0 | 3.3 | 33 | 310 | 8.2 | -- | -- | -- | -- | -- |
| 26... | 1335 | 40 | 14.0 | 1.8 | 18 | 310 | 8.1 | 0 | 161 | 2.1 | 2.6 | -- |
| AUG | | | | | | | | | | | | |
| 30... | 1230 | .0 | 24.5 | 7.5 | 93 | 524 | 8.5 | -- | -- | -- | -- | -- |
| 30... | 1235 | 2.0 | 24.4 | 7.6 | 94 | 524 | 8.5 | 6 | 190 | .9 | .0 | 61 |
| 30... | 1240 | 4.0 | 24.1 | 7.9 | 96 | 521 | 8.5 | -- | -- | -- | -- | -- |
| 30... | 1245 | 7.0 | 24.0 | 7.8 | 95 | 521 | 8.5 | -- | -- | -- | -- | -- |
| 30... | 1250 | 10 | 24.0 | 7.9 | 96 | 520 | 8.5 | -- | -- | -- | -- | -- |
| 30... | 1255 | 15 | 23.0 | 7.9 | 95 | 520 | 8.4 | -- | -- | -- | -- | -- |
| 30... | 1300 | 20 | 22.5 | 7.4 | 88 | 530 | 8.3 | -- | -- | -- | -- | -- |
| 30... | 1305 | 25 | 21.5 | 5.6 | 65 | 555 | 7.9 | -- | -- | -- | -- | -- |
| 30... | 1310 | 30 | 18.1 | .8 | 9 | 555 | 7.4 | -- | -- | -- | -- | -- |
| 30... | 1315 | 35 | 18.0 | .6 | 7 | 555 | 7.4 | -- | -- | -- | -- | -- |
| 30... | 1320 | 40 | 16.0 | .5 | 5 | 564 | 7.3 | 0 | 200 | 16 | 2.6 | -- |

Table 145.--Chemical analyses of water column composite samples, Willard City Reservoir, Ohio

410350082393000 - WILLARD CITY RE AB INTAKE (L-1) NR WILLARD OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

| DATE | TIME | CALCIUM DIS-SOLVED (MG/L AS CA) | MAGNE-SIUM, DIS-SOLVED (MG/L AS MG) | POTAS-SIUM, DIS-SOLVED (MG/L AS K) | SODIUM, DIS-SOLVED (MG/L AS NA) | SULFATE DIS-SOLVED (MG/L AS SO4) | CHLO-RIDE, DIS-SOLVED (MG/L AS CL) | FLUO-RIDE, DIS-SOLVED (MG/L AS F) | HARD-NESS (MG/L AS CACO3) | SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L) |
|---|---|---|---|---|---|---|---|---|---|---|
| JUN 26... | 1335 | 81 | 20 | 4.0 | 17 | 140 | 29 | .2 | 280 | 429 |

| DATE | SOLIDS, RESIDUE AT 105 DEG. C, SUS-PENDED (MG/L) | SOLIDS, RESIDUE AT 105 DEG. C, TOTAL (MG/L) | BARIUM, TOTAL RECOV-ERABLE (UG/L AS BA) | CADMIUM TOTAL RECOV-ERABLE (UG/L AS CD) | CHRO-MIUM, TOTAL RECOV-ERABLE (UG/L AS CR) | LEAD, TOTAL RECOV-ERABLE (UG/L AS PB) | MERCURY TOTAL RECOV-ERABLE (UG/L AS HG) | NICKEL, TOTAL RECOV-ERABLE (UG/L AS NI) | SELE-NIUM, TOTAL (UG/L AS SE) | SILVER, TOTAL RECOV-ERABLE (UG/L AS AG) |
|---|---|---|---|---|---|---|---|---|---|---|
| JUN 26... | 22 | 451 | 0 | 0 | 20 | 2 | <.5 | 13 | 0 | 0 |

| DATE | ARSENIC TOTAL (UG/L AS AS) | METHY-LENE BLUE ACTIVE SUB-STANCE (MG/L) | BORON, TOTAL RECOV-ERABLE (UG/L AS B) | COBALT, TOTAL RECOV-ERABLE (UG/L AS CO) | COPPER, TOTAL RECOV-ERABLE (UG/L AS CU) | IRON, TOTAL RECOV-ERABLE (UG/L AS FE) | MANGA-NESE, TOTAL RECOV-ERABLE (UG/L AS MN) | MOLYB-DENUM, TOTAL RECOV-ERABLE (UG/L AS MO) | ZINC, TOTAL RECOV-ERABLE (UG/L AS ZN) |
|---|---|---|---|---|---|---|---|---|---|
| JUN 26... | <10 | <.05 | 70 | 0 | 5 | 50 | 10 | 1 | 10 |

Table 146.--Chemical, physical, and biological analyses of water samples from selected depths, Willard City Reservoir, Ohio

410350082393000 - WILLARD CITY RE AB INTAKE (L-1) NR WILLARD OH

WATER QUALITY DATA, WATER YEAR OCTOBER 1978 TO SEPTEMBER 1979

| DATE | TIME | SAMPLING DEPTH (FT) | NITROGEN, NITRITE TOTAL (MG/L AS N) | NITROGEN, NITRATE TOTAL (MG/L AS N) | NITROGEN, NO2+NO3 TOTAL (MG/L AS N) | NITROGEN, AMMONIA TOTAL (MG/L AS N) | NITROGEN, ORGANIC TOTAL (MG/L AS N) | NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N) | PHOSPHORUS, ORTHO, TOTAL (MG/L AS P) |
|---|---|---|---|---|---|---|---|---|---|
| JUN | | | | | | | | | |
| 26... | 1250 | 2.0 | .02 | 1.3 | 1.3 | .02 | .44 | .46 | .00 |
| 26... | 1335 | 40 | .02 | .10 | .12 | .39 | .44 | .83 | .01 |
| AUG | | | | | | | | | |
| 30... | 1235 | 2.0 | .00 | .78 | .78 | .22 | .31 | .53 | .00 |
| 30... | 1320 | 40 | .00 | .00 | .00 | .03 | 1.7 | 1.7 | .14 |

| DATE | PHOSPHORUS, TOTAL (MG/L AS P) | SILICA, DISSOLVED (MG/L AS SIO2) | TURBIDITY (JTU) | COLOR (PLATINUM-COBALT UNITS) | CARBON, ORGANIC TOTAL (MG/L AS C) | OXYGEN DEMAND, BIOCHEMICAL, 5 DAY (MG/L) | OXYGEN DEMAND, CHEMICAL (HIGH LEVEL) (MG/L) | COLIFORM, FECAL, 0.45 UM-MF (COLS./100 ML) | STREPTOCOCCI FECAL, (COLS. PER 100 ML) |
|---|---|---|---|---|---|---|---|---|---|
| JUN | | | | | | | | | |
| 26... | .01 | 1.7 | 1 | 5 | 7.7 | .3 | 26 | 2 | 2 |
| 26... | .03 | 6.0 | 4 | 15 | 6.7 | .2 | 51 | 2 | 22 |
| AUG | | | | | | | | | |
| 30... | .01 | 2.3 | 2 | 5 | 6.4 | 1.2 | 4 | 14 | 2 |
| 30... | .16 | 7.6 | 2 | 15 | 6.3 | 2.9 | 5 | 12 | 4 |

Table 147.--Phytoplankton identified in Willard Reservoir, (1979)

| Sample description | | | Total cells (per ml) | Diversity index (genus) $\bar{d}$ | Chloro- phyll a (µg/L) | Division(s) present (in order of dominance) | Percent of total cell count | Dominant taxa within division and percent (%)* of total cell count |
|---|---|---|---|---|---|---|---|---|
| Location | Date | Location in water column | | | | | | |
| L-1 Above dam | 6-26 | Euphotic zone Composite | -- | -- | 2.1 | -- | -- | -- |
| L-1 Above dam | 6-26 | 2-ft depth | -- | -- | 1.9 | -- | -- | -- |
| 1-1 Above dam | 6-26 | 15-ft depth | -- | -- | 1.4 | -- | -- | -- |
| L-1 Above dam | 8-30 | Euphotic zone Composite | 2,200 | 0.1 | 2.2 | Cyanophyta | 99 | _Lyngbya_ (99) |
| | | | | | | Chlorophyta | 1 | _Dictyosphaerium_ (1), _Chlamydomonas_ |
| | | | | | | Euglenophyta | | _Euglena_ |
| L-1 Above dam | 8-30 | 2-ft depth | -- | -- | 8.8 | | | |
| L-1 Above dam | 8-30 | 15-ft depth | 41 | 1.8 | 9.2 | Chlorophyta | 88 | _Sphaerocystis_ (50), _Oocystis_ (25), _Chlorococcum_ (13) |
| | | | | | | Chrysophyta | 13 | _Cyclotella_ (13) |

*Less than 1 percent not given.

Willard City Reservoir at L-1 had developed distinct thermal stratification by June 26. This stratification continued through August 30. There was chemical stratification on both dates. Dissolved-oxygen concentrations below saturation were noted at L-1 throughout the water column on both dates. Anaerobic conditions were approached in the summer hypolimnion.

The spring near-surface, total-phosphorus concentration was 0.01 mg/L. The total-nitrogen to total-phosphorus ratio, 176 to 1, suggests that phosphorus was limiting algal productivity in Willard City Reservoir. A comparison of the surface and bottom total-phosphorus concentrations (summer sampling) suggests that phosphorus is possibly being returned to the water column from the anaerobic lake sediments.

Willard City Reservoir had Carlson TSIs of 52 for chlorophyll *a* (summer), 54 for Secchi-disk transparency (summer), and 57 for total phosphorus (spring). Williard City Reservoir was classified as eutrophic on the basis of the high chlorophyll *a* and Secchi-disk measurements. The chlorophyll-*a* concentration was higher than normal for the low spring total-phosphorus concentration.

No chemical constituents or properties exceeded Ohio water-quality standards. Hydrogen sulfide was detected in the spring and summer hypolimnion.

Blue-green algae (Cyanophyta) and green algae (Chlorophyta) dominated the summer algal community.

## SUMMARY AND CONCLUSIONS

A review of the data summaries presented in tables 7-10 indicates the following:

1. Lake depth is a major controlling influence on water quality. Stable thermal gradients, which limit vertical mixing, did not develop in wind-exposed shallow lakes (depths less than 15 feet). These lakes (Buckeye Lake, Charles Mill Lake, Tycoon Lake, Madison Lake, and Lake Clark) remained generally mixed. Lakes deeper than 15 feet developed seasonal thermal gradients. Charles Mill Lake, which was generally very shallow (7 feet) and well mixed, developed a distinct thermal stratification at a 30-foot deep secondary station.

2. Dissolved-oxygen supersaturation was common in the euphotic zones of the lakes sampled. The maximum recorded was 170 percent (13.5 mg/L) at Nettle Lake on August 14, 1978. Oxygen depletion with depth was noted at the summer sampling in all lakes sampled. Hydrogen sulfide was detected in lakes having anaerobic zones; the hydrogen-sulfide concentration was highest in West Fork Mill Creek Lake (3.4 mg/L, spring).

3. The pH of surface water (upper 4 feet) ranged from 4.9 in Lake Hope (spring) to 9.2 in Highlandtown Lake (summer). A pH of less than 7.0 was common in the hypolimnion of deep lakes.

4. Specific conductance ranged from 103 µmho/cm in Tycoon Lake to 3,150 µmho/cm in West Fork Mill Creek Lake (spring, bottom). Lakes in southeastern Ohio generally had lower specific conductances than those lakes surveyed in other sections of the state.

5. The 5-day biochemical oxygen demand (BOD) ranged from 0.4 mg/L Lake Hope (spring, bottom) to more than 26 mg/L in West Fork Mill Creek Lake (summer, bottom).

6. Light transparency (Secchi disk) ranged from 1.0 feet in Charles Mill Lake (summer) to 21 feet in Willard Reservoir (spring). Eight of the lakes sampled had Secchi-disk transparencies of 4 feet or less.

7. Concentrations of three trace elements exceeded Ohio water-quality standards--cadmium in nine lakes and lead and copper in three lakes each.

8. Nitrogen and phosphorus concentrations were generally high. The total-nitrogen concentration at the 2-foot depth ranged from 0.8 mg/L in Hammertown Lake (summer) to 7.5 mg/L in Madison Lake (spring), whereas total phosphorus concentration at the 2-foot depth ranged from below the detection limit in Lake Hope (spring), Hammertown Lake (spring), and Dow Lake (summer) to 0.16 mg/L in West Fork Mill Creek Lake (summer).

9. Using Carlson's (1977) trophic state index, the authors classified twenty lakes sampled as eutrophic, six as mesotrophic, and two as hypereutrophic.

10. Lakes in the southeastern part of Ohio tended to have lower TSIs numbers than lakes in other parts of the State. All the lakes determined to be mesotrophic in 1978 and 1979 were in southeastern Ohio.

11. As indicated by nitrogen to phosphorus (N:P) ratios, all the lakes sampled were phosphorus-limited or potentially phosphorus limited. (Productivity is limited by the nutrient present in the least amount at any given time.) The ratios ranged from 8:1 in Hammertown Lake to 400:1 in Dow Lake.

12. The fecal coliform counts at the primary lake sites were within Ohio water-quality standards. Higher counts (fecal coliform and fecal streptococcus) were recorded after runoff. The highest counts were recorded in West Fork Mill Creek Lake.

## SELECTED REFERENCES


American Public Health Association and others, 1971, Standard methods for the examination of water and wastewater (13th ed): New York, American Public Health Association, 874 p.

Anttila, Peter W., 1970, A proposed streamflow data program for Ohio: U.S. Geological Survey Open-File Report, 62 p.

Anttila, Peter W., and Tobin, Robert L., 1976, Fluvial sediment in Ohio: U.S. Geological Survey Water-Supply Paper 2045, 58 p.

Britton, L. J., Averett, R. C., and Ferreira, R. E., 1975, An introduction to the processes, problems, and management of urban lakes: U.S. Geological Survey Circular 601-K, 22 p.

Brune, G. M., 1953, Trap efficiency of reservoirs: American Geophysical Union Transactions, v. 34, no. 3, p. 407-418.

Carlson, Robert E., 1977, A trophic state index for lakes: Limnology and Oceanography, v. 22, no. 2, p. 361-369.

Crawford, E., Parker R., and Smith, R., 1972, Productivity determination of Tycoon Lake: Ohio State University Environmental Institute.

Detmers, F., 1912, An ecological study of Buckeye Lake: Proceedings, Ohio Academy of Science, Special Paper 19, 138 p.

Dunst, R. C., Born, S. M., Uttormark, P. D., Smith, S. A., and others, 1974, Survey of lake rehabilitation techniques and experiences: Wisconsin Department Natural Resources Techniques Bulletin 75, 179 p.

Durfor, C. N., and Becker, Edith, 1964, Public water suppies of the 100 largest cities in the United States, 1962: U.S. Geological Survey Water-Supply Paper 1812, 364 p.

Federal Water Quality Administration, 1971, Current practice in water microbiology: U.S. Department Interior Training Manual, Federal Water Quality Administration (various pagings).

Goerlitz, D. F., and Brown, Eugene, 1972, Methods for analysis of organic substances in water: U.S. Geological Survey Techniques Water-Resources Investigations, Book 5, chap. A3, 40 p.

Hahn, C. L., 1955, Reservoir sedimentation in Ohio: Ohio Department of Natural Resources, Division of Water Bulletin 24, 87 p.

Helms, J. W., 1970, Rapid measurement of organic pollution by total organic carbon and comparisons with other techniques: U.S. Geological Survey Open-File Report, 9 p.

Hem, J. D., 1970, Study and interpretation of the chemical characteristics of natural water (2d ed): U.S. Geological Survey Water-Supply Paper 1473, 363 p.

Hutchinson, G. E., 1957, A treatise on limnology--Volume 1, Geography, physics and chemistry: New York, Wiley, 1015 p.

_____ 1967, A treatise on limnology--Volume 2, Introduction to the lake biology and the limnoplankton: New York, Wiley, 1115 p.

Keller, D., 1960, An ecological plankton study of Dow Lake: Biological studies report for Department of Zoology, Ohio University, Athens, Ohio.

Ketelle, M. J., and Uttormark, P. D., 1971, Problem lakes in the United States: Office of Research and Monitoring, U.S. Environmental Protection Agency, 282 p.

Likens, G. E., ed., 1972, Proceedings of the symposium on nutrients and eutrophication: The limiting-nutrient controversy: American Society Limnology and Oceanography, v. 1, 328 p.

McKee, J. E., and Wolf, H. W., 1971, Water quality criteria (2d ed): California Water Resources Control Board Publication 3-A, 548 p.

Mackenthun, K. M., and Ingram, W. M., eds., 1967, Biological associated problems in freshwater environments--their identification, investigation and control: Federal Water Pollution Control Admnistration, 237 p.

National Academy of Sciences, 1973, Water quality criteria, 1972: Washington, D.C., U.S. Government Printing Office, 594 p.

Odum, E. P., 1971, Fundamentals of ecology (3d ed): Philadelphia, W. B. Saunders, 574 p.

Ohio Environmental Protection Agency, 1978, Water quality standards-Regulation EP-1: Columbus, Ohio Environmental Protection Agency, 117 p.

Piper, A. M., Garrett, A. A., and others, 1953, Native and contaminated ground waters in the Long Beach-Santa Ana area, California: U.S. Geological Survey Water Supply Paper 1136, 320 p.

Prescott, G. W., 1970, How to know the freshwater algae: Dubuque, Iowa, Wm. C. Brown Co., 348 p.

Roach, L. S., 1933, Some physical, chemical, and biological studies of impounded waters in Ohio: Transactions, American Fish Society, v. 63, p. 265-270.

_____ 1949, Lake management reports for Meander Creek Reservoir, Ohio: Report for Ohio Division Conservation of Natural Resources, 37 p.

Salisbury, L., 1931, The plankton algae of Buckeye Lake, Columbus, Ohio: The Ohio State University, Master's thesis, 32 p.

Sanderson, E. E., 1948, Sedimentation of reservoirs in Ohio: Ohio Water Resources Board Bulletin 17, p. 1-27.

Sawyer, C. N., 1947, Fertilization of lakes by agricultural and urban drainage: Journal of the New England Water Works Association, v. 61, p. 2-11.

Skougstad, M. W., Fishman, M. J., Friedman, L. C., Erdman, D. E., and Duncan, S. S., 1979, Methods for determination of inorganic substances in water and fluvial sediments: U.S. Geological Survey Techniques of Water-Resources Investigations, Book 5, chap. Al, 1626 p.

Slack, K. V., Averett, R. C., Greeson, P. E., and Lipscomb, R. G., 1973, Methods for collection and analysis of aquatic biological and microbiological samples: U.S. geological Survey Techniques of Water Resources Investigations, Book 5, chap. A4, 165 p.

Stanley, J. J., 1961, The aquatic insect fauna of Dow Lake: Ohio University, Master's thesis, 54 p.

Stumm, W. and Morgan, J. J., 1970, Aquatic chemistry, an introduction emphasizing chemical equilibria in natural waters: New York, Wiley-Interscience, 583 p.

Tobin, R. L., and Youger, J. D., 1977, Limnology of selected lakes in Ohio-1975: U.S. Geological Survey Water-Resources Investigations 77-105, 205 p.

_____ 1979, Chemical and biological quality of selected lakes in Ohio-1976 and 1977: U.S. Geological Survey Water-Resources Investigations 78-109, 291 p.

Tressler, W. T., Tiffany, L. H., and Spencer, W. P., 1940, Limnological studies of Buckeye Lake, Ohio: Ohio Journal Science, 40: p. 261-290.

U.S. Environmental Protection Agency, 1975a, Report on Buckeye Lake: Corvallis, Oreg., Pacific Northwest Environmental Research Center, Working Paper 396, 35 p.

_____ 1975b, Report on Charles Mill Reservoir: Corvallis, Oreg., Pacific Northwest Environmental Research Center, Working Paper 397, 35 p.

_____ 1975c, Report on O'Shaughnessy Reservoir: Corvallis, Oreg., Pacific Northwest Environmental Research Center, Working Paper 407, 38 p.

_____ 1977, Distribution of phytoplankton in Ohio lakes: Las Vegas, Nev., Environmental Monitoring and Support Laboratory, Working Paper 688.

Vallentyne, J. R., 1974, The algal bowl-lakes and man: Ottawa, Canada, Department of the Environment Miscellaneous Special Publication 22, 185 p.

_____ 1978, A compendium of lake and reservoir data colected by the National eutrophication Survey in the eastern, north-central and southeastern United States: Corvallis, Oreg., Corvallis Environmental Research Laboratory, Working Paper 475, 266 p.

Verduin, Jacob, 1956, Primary production in lakes: Limnology and Oceanography, v. 1, no. 2, p. 85-91.

Vollenweider, R. A., 1968, Scientific fundamentals of the eutrophication of lakes and flowing water with particular reference to nitrogen and phosphorus as factors in eutrophication: Paris, Organization for Economic Cooperation and Development, 252 p.

Ward, R. W. and Seibert, H. C., 1963, Investigations into limnology of Dow Lake, Athens County, Ohio: Ohio Journal of Science v. 63, p. 128-144.

Whipple, G. C., and Whipple, M. C., 1911, The solubility of oxygen in seawater: Journal of the American Chemical Society, v. 33, p. 362-365.

Wickliff, E. L., 1932, Are newly impounded waters in Ohio suitable for fish life: Transactions, American Fish Society v. 62, p. 275-277.

Wickliff, E. L., and Roach, L. S., 1937a, Management of impounded water in Ohio: Transactions, Second North American Wildlife Conference, v. 2, p. 428-437.

_____1937b, Some studies of impounded water in Ohio: Transactions, American Fish Society v. 66, p. 76-86.

Wilhm, J. L., and Dorris, T. C., 1968, Biological parameters for water-quality criteria: Bioscience, v. 18, p. 477-481.

Youger, J. D., 1980, Ohio lakes and reservoirs: Columbus, Ohio, Ohio Environmental Protection Agency, 1980 305(6) report, V. VIII, 51 p.

☆U.S. GOVERNMENT PRINTING OFFICE:1985/561-192/11922