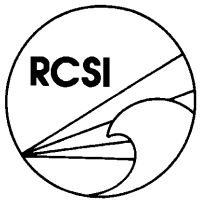

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Their Contribution to the Quality of the Environment - 1971

By: Herman S. Forest, W. C. Grow, & Tracy E. Maxwell
June 1972

THE ROCHESTER COMMITTEE FOR SCIENTIFIC INFORMATION
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Water Pollution June 1972

Some Sources of Input to Canandaigua Lake and Their Contribution to the Quality of the Environment - 1971*

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Herman S. Forest, W. C. Grow, and Tracy E. Maxwell

Summary Bulletin

Summary

Studies of selected chemical, physical, and biological characteristics of Canandaigua Lake were conducted in the summer and fall of 1971. Plankton populations were typical of waters with low productivity in the region. In respect to the attached vegetation, most of the lake may be characterized as infertile, but there were striking increases in productivity associated with stream mouths, and polluted areas were clearly marked by the changed nature of the plant community. Chemical and physical characteristics of the open waters were similar to those found 50 years ago. While the lake has been considered relatively high among the infertile Finger Lakes in dissolved nitrogen compounds, the source is not known. Except for local trouble spots, such as Cottage City, the condition of the lake may be termed as good. However, the need for watershed land use studies in the immediate future was determined to be imperative for intelligent environmental management decisions.

Introduction

Canandaigua Lake is intermediate in size between the largest and the smaller Finger Lakes. Geographically it lies between Seneca Lake on the east and Honeoye Lake. Its perimeter and watershed is within Ontario County except for a small southeastern portion in Yates County. Classical studies of limnology were conducted by Birge and Juday (1) and limnological information was summarized by Berg in Frey (2). More recent unpublished studies by K. M. Stewart extended over three years (1967-70) with frequent collection of data.

The two principal inlet streams, West River and Naples Creek, were subjected to a water quality survey during the summer and fall of 1970 by Grow (3). In the investigation summarized here, the study was extended to include six additional streams, and selected shore and open water areas of the lake. Physical, chemical, and biological sampling was conducted at a number of sites, chosen with the advice of the Watershed Committee and Board of Directors of the Canandaigua Lake Pure Waters Ltd.: Fall Brook, Vine Valley, Menteith Point, Cottage City, Cook's (Hawk's) Point, Seneca Point, and the inlet area of West River. Sampling dates were June 22, July 8, August 12, 16, 24, September 2, and October 9, 1971.

* A report with this title was prepared under a contract between the Canandaigua Lake Pure Waters Ltd. and the Environmental Resources Center. Copies of the complete report may be obtained from Special Services Librarian, S.U.N.Y. College, Geneseo, New York 14454 or from Richard B. DeMallie, Jr., Secretary, Canandaigua Lake Pure Waters Ltd., P. O. Box A-1, Canandaigua, New York 14424.

Results

1. Physical and Oxygen Profile

No marked changes were found between present values and those available from past years. The lake was stratified into warm surface and cold deeper waters, as is characteristic in summer, but the oxygen content to the instrumental limit (15 meters or about 49 feet) was still near saturation. The clarity of the water was generally about 4 meters: within the range of expectancy for the lake.

2. Chemical Profile

Particular attention was paid to conductivity, a summative measure of dissolved minerals, to test whether it would provide a rough-and-ready index to the nutritional condition of the water. Values in the open lake were even lower than those recorded in earlier times (under 200 micromohs, compared with 271 cited by Berg in Frey, 1961), but the difference is not meaningful.

Conductivity dramatically indicated the influence of streams, particularly polluted streams. For example in the collection of June 22, the stream at Cottage City had a conductivity of 475 compared with less than 200 for the open lake. The streams at Vine Valley and Fall Brook had considerably elevated levels, and other streams some elevation. Conductivity appeared to be a useful index in these cases, but mixing of waters and other factors produces a non-uniform value in the open waters of the lake, from place to place and time to time.

Phosphorus values were rather capricious and no pattern could be discerned. In the open waters of the lake an approximate value for total phosphate is 1 ppm and the total ortho phosphate about 20% as much.

Nitrate values were markedly lower than the 1.7 ppm recorded by Berg (Frey), indeed only about 10% of that amount. No interpretation should be made from these limited data, however. If the earlier figure is correct, Canandaigua would be the third highest of the Finger Lakes in nitrate, but well below Cayuga and Seneca. The discrepancy may be due simply to the normal seasonal difference in the Finger Lakes, where the winter values are considerably higher than summer ones.

The pH of slightly above 8.0 matched the earlier figures. It is a bit higher (more alkaline) than most Finger Lakes.

3. Plankton

The diatom, Fragilaria crotonensis Kitt. was the conspicuous alga throughout the lake on August 12. Its density averaged about 2500/cc, but it was less abundant in two of nine sites. A second species of the genus Diatoma was present in numbers at a single site. Among the zooplankters, rotifers were the most frequent, but the micro-crustacea Daphnia and Bosmina were present at all stations except Seneca Creek. In substance, the plankton was not indicative of polluted or fertilized waters.

4. Rooted Plants

This phase of the study unquestionably proved to be the most productive of significant results. Figures I, II, and III show the pattern of typical communities, identify the species, and present a comparison among three communities. Communities were classified as U (unenriched) E (enriched) and D (disturbed). Only very limited communities near the mouth of West River and Cottage City (a disturbed community) even approach the amount of crop produced in a fertile lake such as Conesus. As a whole the rooted plants illustrate the relatively low fertility of the lake.

The effect of streams on the plant communities was pronounced and astonishingly consistent. The streams almost always enrich coves to their north side (toward the lake's outlet), the enrichment being greater there than directly off the stream mouth.

The community characteristics included the following details:

a. U - Unenriched communities characteristically were composed of Najas (the Niad) and Chara (the stonewort, a large alga). These are widespread in areas of low fertility, usually in fairly sparse communities. The less favorable sites in the lake, because of steep slope or exposure to current action are absolutely sterile. The community type may be found almost anywhere except within a few yards (50-100) of a local enrichment source such as a stream, storm erosion, or septic tank drainage.

b. E - Enriched communities were almost always located to the north of streams, in coves. The characteristic plants were Vallisneria (eel grass), Potamogeton Richardsonii (Richardson's pondweed), and Elodea, but as many as ten species might be present. The community composition was much like that which blankets the rooted zone of a fertile lake (Conesus). However, the total crop is much smaller in Canandaigua, and the communities are strictly local.

c. D - Disturbed areas were clearly marked by the conspicuous presence of Myriophyllum exalbescens (Milfoil, as in Seneca Lake) as well as the prominent species of the enriched community. The rooted plants proved to be the best integrator of nutrition and pollution, their growth being representative of long range averages without being subject to short term fluctuations such as currents or weather. The most conspicuous disturbed area was Cottage City, where the source is evidently human waste. The disturbed area at Vine Valley is probably mixed human and agricultural waste. Disturbed areas were also found at Fall Brook and at the northern end of the lake, but all of the western Finger Lakes show this weedy development at the north (outlet) end. A particularly interesting discovery was a D-type community at Hick's Point, where no pollution is evident. Interestingly, the effect seems to have been produced not by sewage or fertilizer but by a storm in 1965 which washed 4 inches of top soil into the lake through the stream mouth. This case illustrates the polluting effect of erosion.

5. Watershed Information

Geographic sources, soil surveys, and information on depth and flow of input streams were summarized. Earlier limnological studies were cited as a basis for comparison with current information.

6. Human Ecology and Environmental Management

The use of the lake as a reservoir, and the particular problem of pollution by septage were reviewed. The conclusion was stated that a watershed inspector alone could achieve only very limited improvement of faulty discharges. The possible role of the new office of County Environmental Coordinator was suggested, but the prospect for regulation of non-point pollution sources such as erosion and farm chemicals appeared remote. The special problem of vineyard fertilization was examined, with the conclusion that there is no concrete relationship with the relatively high nitrogen content reported for the lake in the past, but a recommendation was made that the problem deserved special attention and study in the future.

Other Studies and Actions

Both scientific studies and development of management practices are continuing in Ontario County and the Canandaigua Lake Basin. The County Environmental Management Council is staffed by a full time Environmental Coordinator. A model ordinance to establish uniform regulations for the watershed has been completed by a committee of towns and villages, with the aid of the New York State Department of Health. A beginning has been made at septic tank inspection.

Dr. Stephen W. Eaton, Professor of Biology at St. Bonaventure College, and summer resident on the lake, has undertaken an extended study with attention directed to zooplankton, bottom organisms, and the "sow belly" fish.

Analysis is being undertaken of limnological data collected on the lake through three years by Dr. Kenton M. Stewart, Biology Department, S.U.N.Y. Buffalo. However, information on Canandaigua will probably not be published as a unit.

Delta Laboratories of Webster, N.Y. has announced a program of water quality monitoring for the summer of 1972, to include water chemistry, microbiology, and pesticide residues.

A land use study supported by the Canandaigua Lake Pure Waters Inc. began in the late spring, 1972. The project is directed by Dr. Phyllis Thompson, Resource Geographer of the S.U.N.Y. College, Geneseo, N.Y. The field work is being accomplished by high school students, with the cooperation of the Grange and other adult groups. This study had been recommended in the 1971 report.

References

(1) E. A. Birge and Chauncey Juday, "A Limnological Study of the Finger Lakes of New York," Bull. U. S. Bureau Fisheries, 32, 525-614. (1914) and "Further Limnological Observations on the Finger Lakes of New York", Ibid., 37, 210-252 (1921).

(2) D. G. Frey (Editor), "Limnology in North America," University of Wisconsin Press (1961). Article by Clifford O. Berg includes New York.

(3) W. C. Grow, "A Water Quality Survey of West River, Naples Creek and the Inlet Area of Canandaigua Lake," MS Study Report, Biology Department, S.U.N.Y. College, Geneseo, New York. May, 1971.