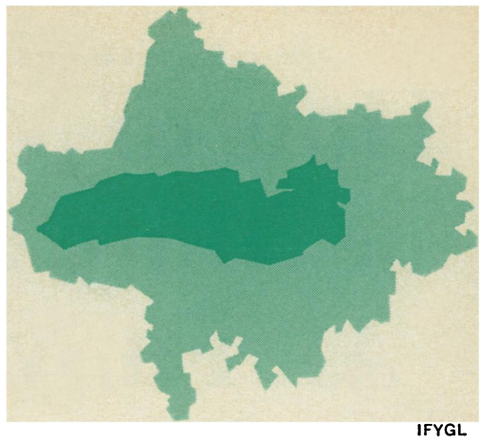
Science focuses on Lake Ontario

The International Field Year for the Great Lakes, now under way, places Lake Ontario under intense monitoring



IFYGL

Target for IFYGL: Ontario and its basin.

by Louise A. Purrett

The Laurentian Great Lakes system contains a fifth of the world's freshwater. About 35 million people inhabit its basins, and one of the lakes, Superior, has the largest surface area of any lake in the world. But the Great Lakes are more than limnological curiosities. They influenced the development of two nations and now both divide and join them. It was along these waters that the first explorers and trappers traveled. The chain of lakes later became an important route of commerce, and major concentrations of inland industry have developed on the shores of the lakes.

Two ideas regarding the lakes have become apparent in the past century. One is that civilization, with its pollutants, is stealing the life from the lakes that have nurtured it for so long. The other is that the lakes are a joint responsibility and a zone of interaction as well as a political and geographic boundary between the United States and Canada. What each side does to the lakes affects the other side. Poisons dumped at Toledo may eventually reach Toronto.

This April marked two major events officially acknowledging this understanding: the signing of a treaty setting limits to Great Lakes pollution and the beginning of an intensive joint U.S.-Canadian study of Lake Ontario.

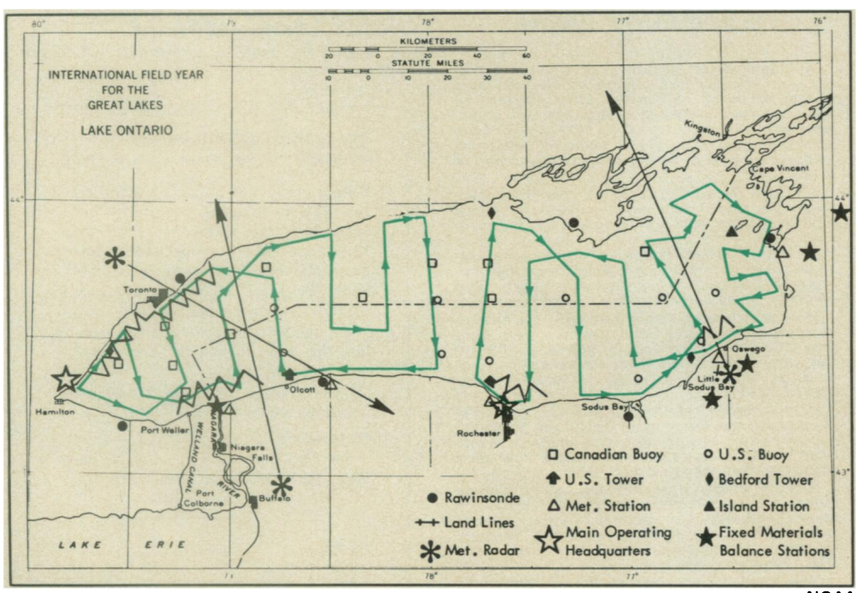
These events were, of course, neither unforeshadowed nor unprecedented. A 1909 treaty between the United States and Canada contains a little-heeded joint commitment not to pollute the Great Lakes. The treaty also created the International Joint Commission to define the rights and responsibilities of the two nations bordering the lakes. On an unofficial level, Canadian and U.S. limnologists have been informally exchanging research findings about the lakes for some time, at first on an individual basis and then through occasional conferences.

The first conference on Great Lakes research was held in July 1953. Thereafter conferences were held irregularly until 1961 when it was decided they should be annual. In 1966, the attending scientists decided to form an organization, the International Association for Great Lakes Research.

At the fifteenth conference, held last month in Madison, Wis., some 150 papers were presented. Most reported the results of basic research but many were concerned with various pollutants and their effects. One session included papers on mercury concentrations in Great Lakes fish, effects of paper plant pollution on an invertebrate community in Lake Ontario, and ways of diagnosing pesticide poisoning in fish. Another was devoted almost exclusively to effects of thermal pollution by power plants. Though some reports were optimistic—researchers from Cleveland's John Carroll University reported, for example, that levels of mercury in Lake Erie are not rising as fast as originally feared—the level of concern was still high.

The most ambitious cooperative effort yet, however, began April 1, with the official commencement of the International Field Year for the Great Lakes, an intensive joint study of Lake Ontario and its 30,000-square-mile drainage basin. The basic goals of IFYGL are to determine the present condition of the lake, describe its processes and the hydrological, chemical and biological interrelationships, and to develop computer models to predict the effects of changes in uses of the lake or in its environment. To do so, just about every factor that could affect a lake will be monitored. Six hundred scientists and technicians, four Canadian and five U.S. government agencies, plus a number of universities on both sides of the border will be involved. The Field Year is sponsored by the Canadian and U.S. national committees for the International Hydrological Decade, through the National Research Council of Canada and the U.S. National Academy of Sciences.

Lake Ontario was chosen because, with the exception of Lake Erie, which is shallower than the others, it is well



NOAA

Ships, aircraft and buoys will record data to quantitatively describe the lake.

The largest of the five ships that will crisscross Lake Ontario during the IFYGL will be NOAA's Researcher.

NOAA

representative of the lakes. It is one of the most heavily populated and industrialized lakes, especially on the Canadian side; the western end of the Ontario basin contains 25 percent of Canada's population and the main concentration of its industry. Because of this and because, as the last lake in the line, it receives the cumulative pollution of the other lakes, it is deteriorating rapidly. Finally, it is conveniently located and can be studied at a reasonable cost.

Studying a lake is a painfully complicated problem. Most of the scientific disciplines, including hydrology, meteorology, geology, chemistry and biology, are involved, and they are all interrelated in many, sometimes subtle, ways. To make the problem manageable, the IFYGL will look at the lake in terms of its uses and the problems from which it suffers. For example, the lake's waters are used to cool power plants but are also the spawning ground for fish and a recreation area for people. The lake influences, and is influenced by, the weather. Its characteristics determine its ability to cope with pollution.

A large part of the project is concerned with inputs and outputs of water, heat and pollutants from the lake. Water flows into the lake from the Niagara River, which connects it with Lake Erie. But there are more than 45 minor tributaries, and water is also added by precipitation and groundwater. Water leaves the lake via the St. Lawrence River and evaporation. To make an accounting of how much water enters or leaves by these various doors, hydrologists will try to improve methods of measuring inflow from the Niagara River. Radar at Buffalo and Oswego, N.Y., and at Toronto, backed up by a network of conventional rain gauges will measure precipitation. Remote sensing by aircraft will indicate locations of springs that contribute groundwater, and geological studies of the water-bearing qualities of rocks in the basin will tell how much of this water is likely to reach the lake. The amount of water leaving the lake is regulated by the locks at Cornwall, Ontario, and is determined on a weekly basis by an international agreement between the United States and Canada. Evaporation is almost impossible to measure directly, but can be inferred from the water budget, wind and water circulation and the energy budget.

River currents, power plant discharges, solar radiation and precipitation all affect the lake's energy budget—the inflow and outflow of heat. On May 1 a research vessel began to take detailed water velocity and temperature readings at 16 sites on the St. Lawrence River, to find out, for example, the over-all heat loss through the river.

Dyes, drogues and buoys will measure water circulation and diffusion within the lake. These determine the distribution of wastes and affect fisheries and plankton growth. Water circulation is in turn affected by the thermal structure of the lake, which will be measured by ship and buoy. Wind speed and direction, surface temperature, snowpack, water levels in wells, air temperature and humidity will also be recorded.

Studies of the lake's meteorology have a dual purpose. There will of course be the obvious effect of improving local weather forecasting. But the lake is also large enough to serve as a model ocean on which large-scale interactions of wind and water can be studied.

The entire Lake Ontario study will run from 1972 to 1975. The first year will be devoted to collection of data and the rest to its reduction and analysis. Total cost is estimated at $15 million.

The point of all this is to understand Lake Ontario, and other lakes, well enough that the effects of changes can be foreseen, and decisions made accordingly. As Robert White, head of the National Oceanic and Atmospheric Administration, the U.S.'s lead agency on IFYGL, points out: "Parts of our lake regions today stand witness to the effects of the accumulation of many individual and unrelated decisions taken in the past. Their environmental quality has deteriorated to alarming levels." With the results from the IFYGL, it is hoped that Canada and the United States can make intelligent, joint decisions.

A major step in this direction came April 15 when President Nixon and Canadian Prime Minister Pierre Elliott Trudeau signed the Great Lakes Water Quality Agreement. Though the pact is mostly a statement of decisions already made and actions already taken, and calls for no new legislation, its very existence is significant. It represents the first time two nations have agreed to solve an environmental problem jointly and is a sort of bill of rights for lakes. It lists five freedoms for lakes: freedom from objectionable sludge deposits or other substances that can harm fish or fowl; freedom from substances causing color or odors; freedom from floating debris, oil and scum; freedom from toxic concentrations of substances; freedom from an excess of nutrients that cause overgrowth of weeds and algae. There is also a list of specific objectives and programs. For example, U.S. sewage treatment facilities on Lake Erie are to be completed in three years.

The most controversial part of the agreement is the limit on phosphorus, which is to be reduced to 16,000 tons in 1976. Canada has already ordered that the phosphate content of detergents be reduced from 20 percent in 1970 to 5 percent by the end of this year. The agreement was the result of a six-year study by the International Joint Commission. The IJC had originally recommended a limit of 11,000 tons of phosphorus for Lake Erie, but William Ruckelshaus, director of the Environmental Protection Agency had said that this goal was impossible to reach by 1976.

The pact contains no cost figures but U.S. officials estimate that the United States will have to spend between $2.7 billion and $3 billion by 1976. Canada, whose contribution to the pollution is less, will contribute less to the cleanup —several hundred million dollars. A Great Lakes Water Quality Board, composed of representatives from the eight states and two provinces bordering the lakes, will monitor cleanup.

At the Madison conference, a panel composed of a number of IFYGL officials and other prominent limnologists was asked how long it will take to clean up the Great Lakes. Cleanup, they answered, is relative, and depends on the definition of "clean." But the consensus was that the effort will probably continue as long as there are people living around the lakes. □