ON THE HEALTH OF OTTY LAKE

Young unoccupied lakes typically have clear, bateriologically pure water (low total coliform, low fecal coliform and low fecal streptococci counts). In general, they are sufficiently rich in oxygen that game fish can survive from year to year in the deep water.

Older occupied lakes become contaminated, filled with weeds and slimy algae growth - become like swamps, with patches of green curd floating on the surface. Deep water game fish disappear - coarse fish and maybe even sludge worms become the main water inhabitants. Some lakes have dramatically changed from young to old in the life span of individual people.

Through measurements, experiments and background knowledge, we have learned that man's unintentional polluting activities often endanger his health and also accelerate the ageing rate of a lake - as much as 1000 times the natural rate; that is, a lake may turn slimy and unpleasant in a few decades, rather than in a normal span of hundreds of years, due to man's nutrifying and ecology-changing activities. This rate of ageing depends also upon the rate of water flow, the total volume of water, the surface area, and the shoreline cover and steepness.

Environmental experts, from experience, have decided that, in general, a lake's natural ageing rate can be retained if there are at least 10 acres of water per waterfront habitation. Otty Lake has now less than 4 acres per shore-line cottage or home.

It seems distinctly possible that a lake can be kept to its natural ageing rate and still be used for recreation if man finds out what he must do and do it, before it is too late to repair the damage - to get rid of the slime and bring back the game fish. And so departmental groups have recommended a hold in development to give the environmentalists time to find the right procedures.

The government has limited the use of phosphates in detergents, because phosphates and nitrates are the main nutrients which promote slimy algae growth. We have learned that each human deposits about a pound of phosphates and nitrogen products each year in feces and urine. These nutrients from sewage and wash water are not removed from the effluent of most existing sewage systems - and inevitably find their way down the slope into the ground water - and into our lakes and rivers. The government is now ruling on the effectiveness of waste disposal systems.

The study processes on lake health are well on their way. They have involved ways:

...../2

to determine how old a lake is in relation to others;

to learn how much faster the ageing process is, due to the activities of man; and

to learn what can be done about slowing up the ageing process - or even to reverse it and clean up the mess.

The main types of measurements are:

a) The regular testing of water clarity by finding how deep one can see a Secchi disk (a 10 inch black and white painted metal disk) and by measuring the amount of algae filtered from measured samples of the water. These tests give water clarity and the chlorophyll a concentration. (Chlorophyll is the green pigment in most plants and algae.)

b) The regular testing for total, fecal and fecal streptococci coliforms, which are always associated with sewage and tell if sewage is getting into the lake and how serious it is to human health.

c) The measurement of phosphorus, nitrogen and oxygen (and other elements) in the water. The oxygen content tells us about the decay of dead algae and other vegetation which has sunk to the bottom.

Figure 1 - is a graph of Secchi disk depth versus chlorophyll a concentration showing the results of measurements from many Ontario lakes. Data from three graphs provided by the Ministry of the Environment have been combined on this one to show how the degree of enrichment and the water clarity of Otty Lake compares with other lakes. Points numbered 1, 2, 3, 19, and 20 are for Otty Lake (from 1971 to 1974). Otty Lake is middle-aged among the other lakes tested so far.

The Ontario Ministry of the Environment would like the measurements to be continued for several years more to determine the trend and rate of ageing.

Figure 2 - is a representation of bacteriological samples taken from regular water tests in 1973 and 1974. They show a trend from year to year as well as a typical peaking during the summer season. Besides indicating danger of exposure to disease-causing bacteria, the presence of fecal coliform is positive identification of fresh raw sewage - and positive inference that sewage nutrients as well as the bacteria, are getting into the lake.

Figure 3 - is a plot of three oxygen measurements made in 1974. It shows that the oxygen content of Otty Lake is low near the bottom during summer and winter. This is due to the decay of bottom sediments. Lake trout need at least 4 parts per million (oxygen/water) to live in their favorite deep spots. There are no lake trout as far as we know now in Otty Lake.

Figure 4 - is drawn from applications of model conditions based on studies of European and Ontario lakes where it checks out very well. This one was

...../3

provided by the Ontario Ministry of the Environment. It stems from the model work of Dr. R.A. Vollenweider, now Chief of Great Lakes Division, Canada Centre for Inland Waters, Burlington, Ontario. It compares the input of grams of phosphorus per square meter of water per year against the mean depth divided by the flushing rate (rate at which water in the lake is changed). This plot indicates that, in view of Otty Lake's present environmental factors and flushing rate, a fairly small increase in nutrients from more cottages (or more use of lake dwelling systems year round) or increased land drainage, will shift the lake's ageing situation towards the danger zone.

In summary, although Otty Lake is still satisfactory as a recreational lake, it has less water area per cottage than is recommended. It is also middle-aged. It has so much decaying matter on the bottom that the oxygen gets used up, so deep water game fish can no longer survive. It shows some contamination by sewage - and is therefore getting nutrients from waste water as well as from natural run-off. It thus seems essential that every step should be taken to prevent any further increase in loading and indeed, to lower the present rate, so that Otty Lake can be kept a fine healthy recreational lake for many years to come.

F.D. Green
April 1975

NOTE

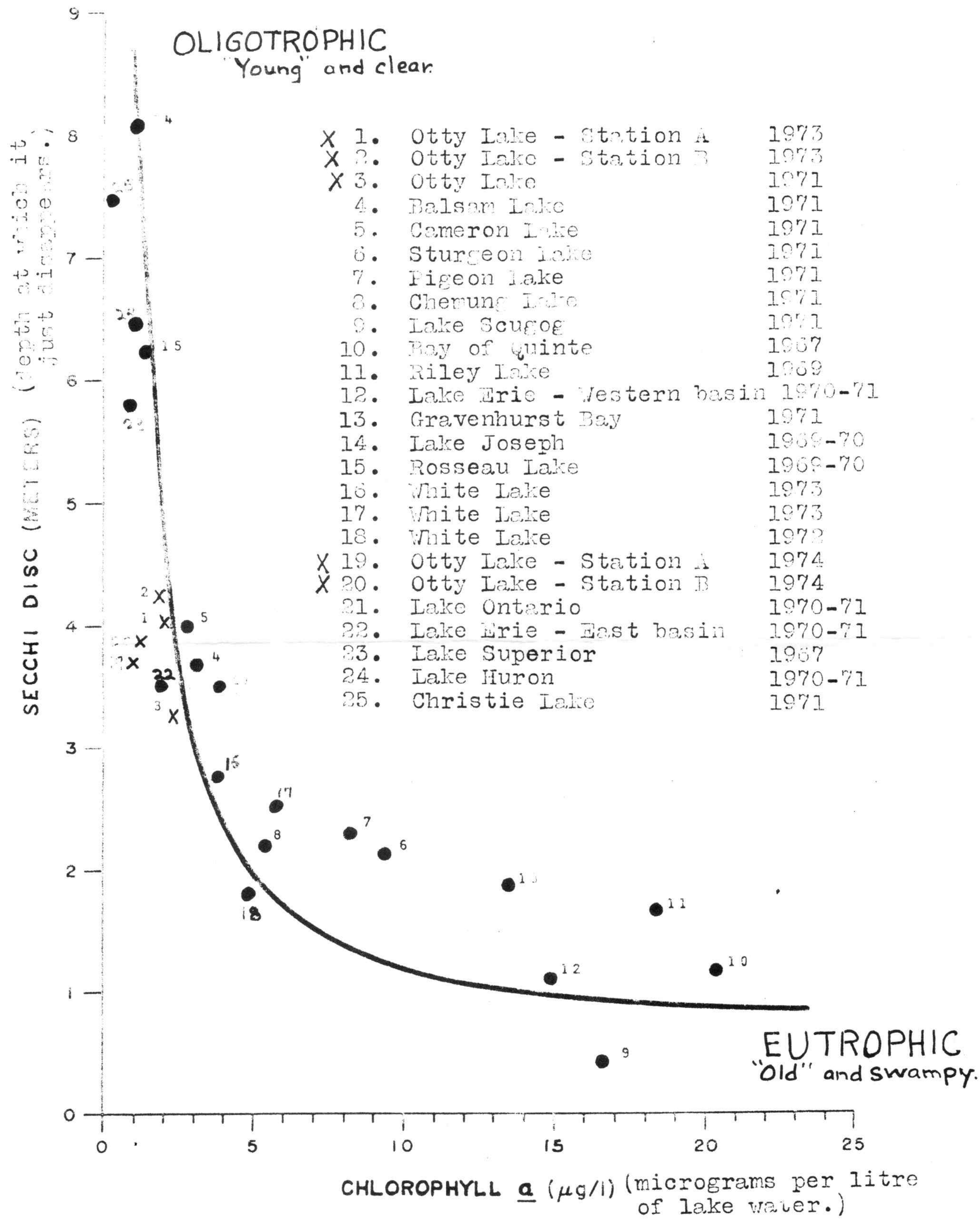
The following reports were used for source material. Each may be obtained by request to the issuing organization:

"Enrichment Status of Otty Lake, Lanark County, 1973" by G.M. Robinson, Limnology and Toxicity Section, Water Resources Branch, Ministry of the Environment, Toronto, Ontario. (A 1974 report will be ready soon).

"Cottage Pollution Control Program", Interim Report 1971/72. Private Waste and Water Branch, Ministry of the Environment, Toronto, Ontario.

"Report on Water Quality in Otty Lake, 1971". Ontario Water Resources Commission (now Water Resources Branch), Ministry of the Environment, Toronto, Ontario.

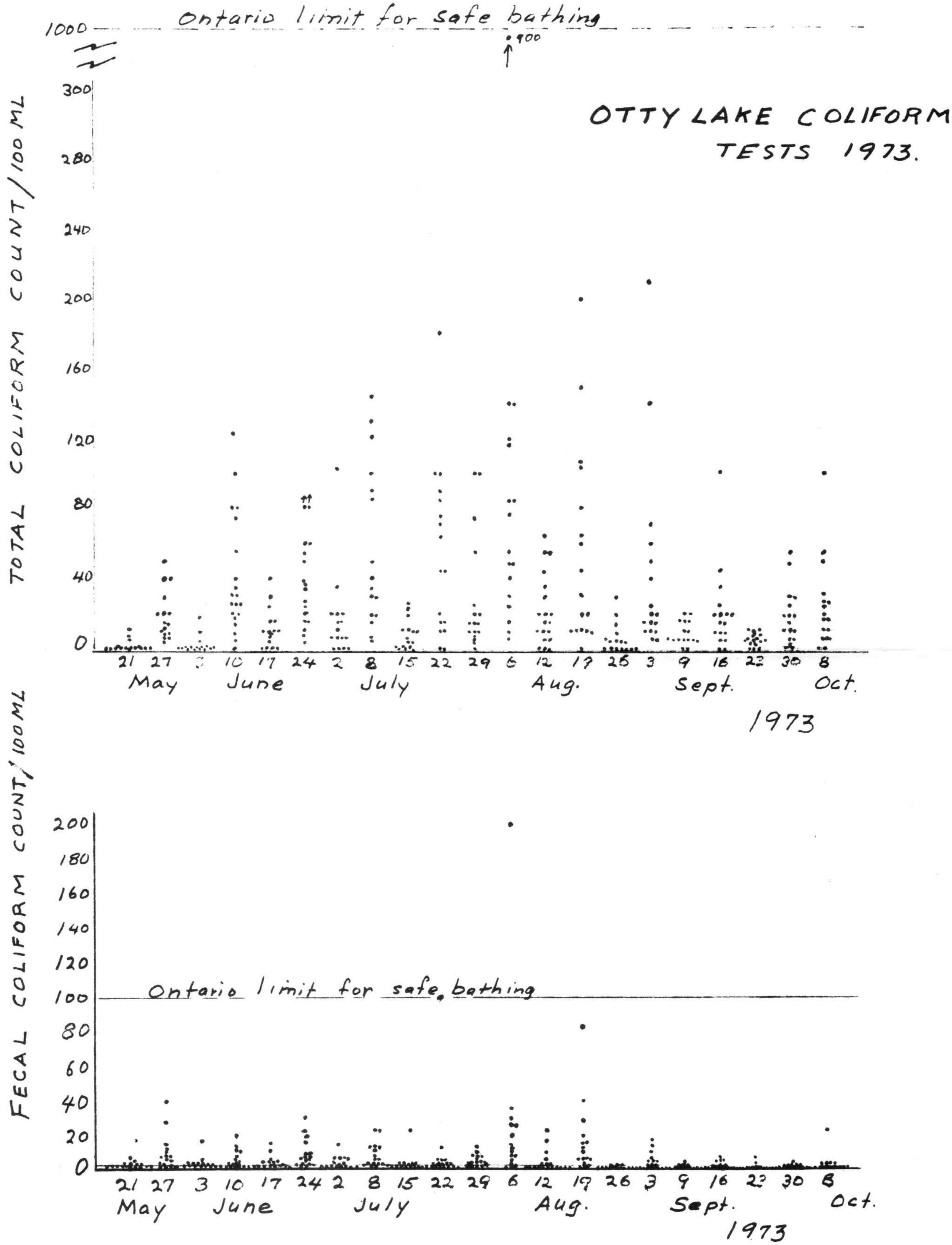
"The Application of the Phosphorus Loading Concept to Eutrophication", by R.A. Vollenweider and P.J. Dillon, NRCC No. 13690, Associate Committee on Scientific Criteria for Environmental Quality, June 1974, National Research Council, Ottawa, Ontario.



X The relationship between Secchi disc and chlorophyll a for Otty Lake, Lanark County. Values are based on means of values collected during the summers of 1974, 1973 and 1971. Also, information from a number of other lakes is included as an indication of the relative status of the lake.

Figure 1.

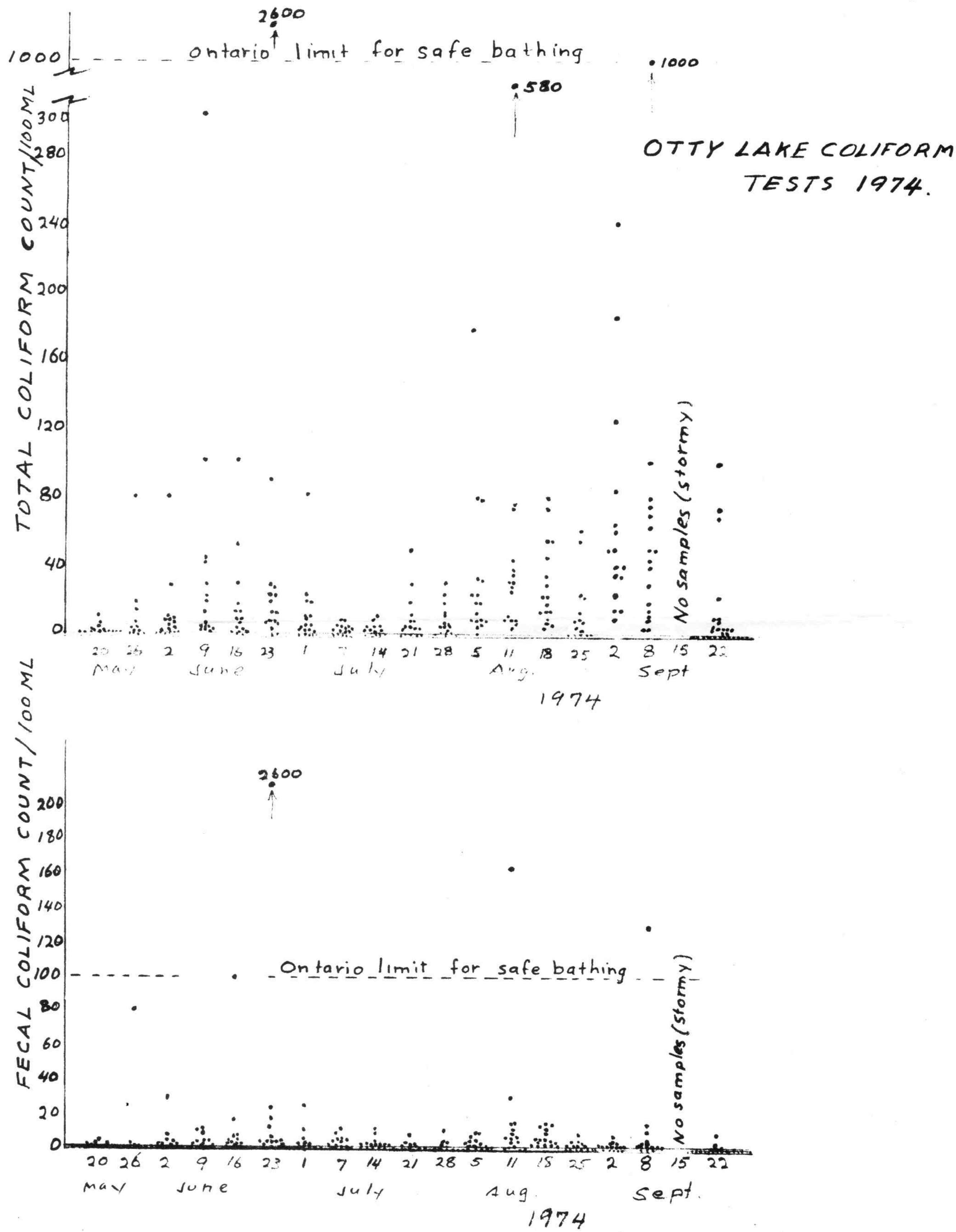
1974



South and north halves of the lake (16 stations) were sampled on alternate weekends.

Figure 2. (a)

F D Green
1974



South and north halves of the lake (16 stations) were sampled on alternate weekends, except for all on Sept. 22.

Figure 2. (b)

FDGreen
1974

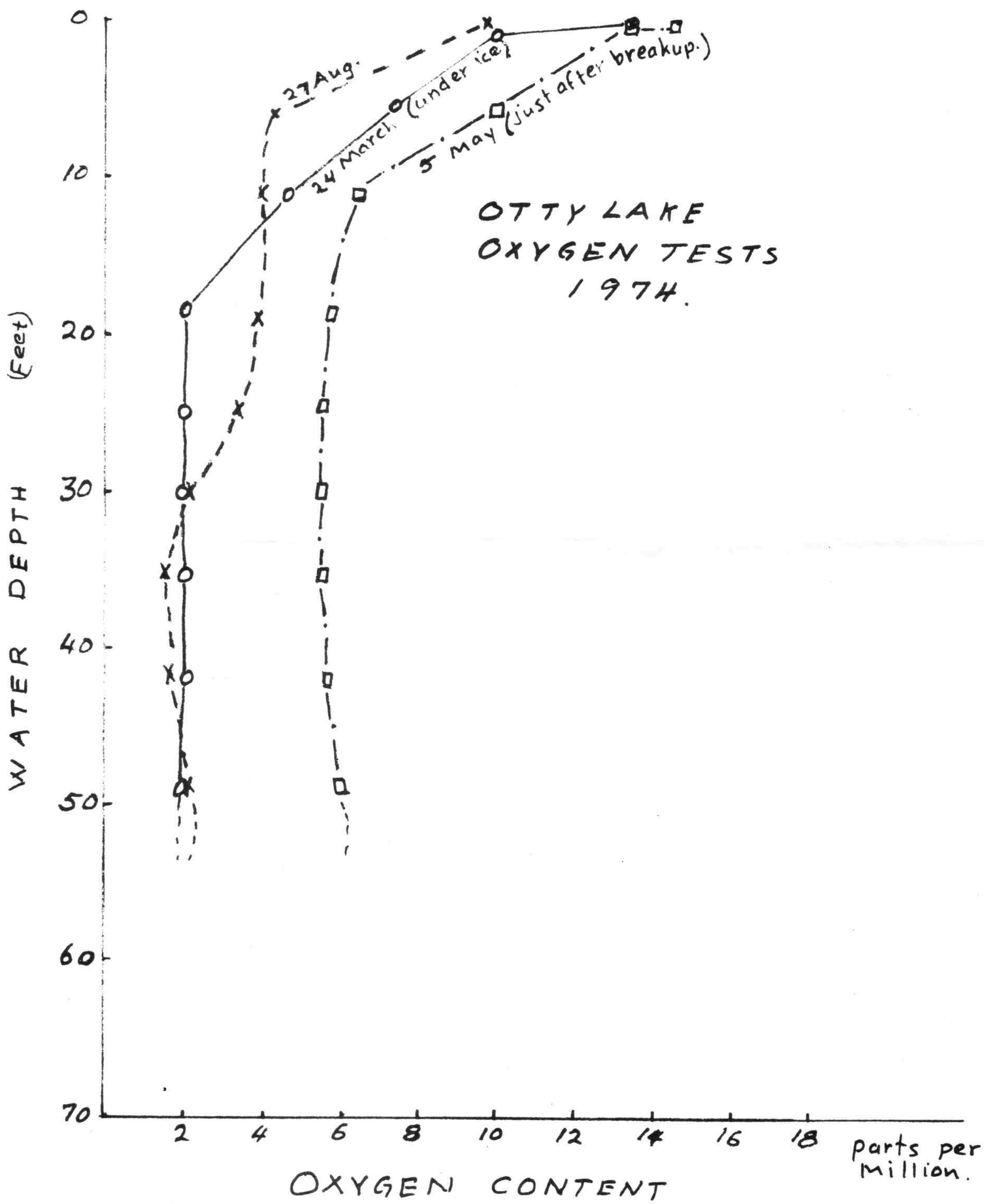


Figure 3.

F D Green
1974

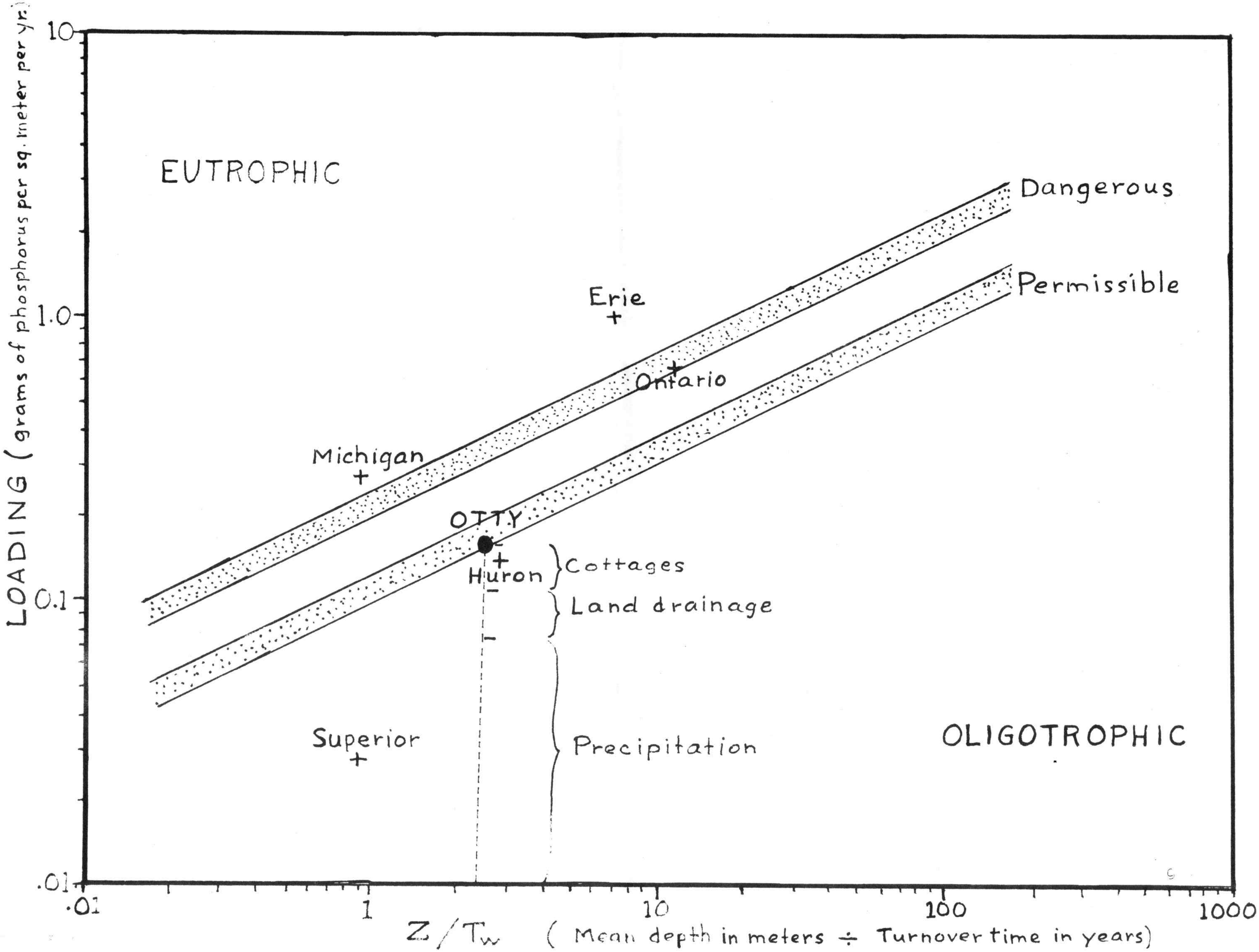

LOADING (grams of phosphorus per sq. meter per yr.)
10
1.0
0.1
.01
EUTROPHIC
Dangerous
Permissible
Erie
Ontario
Michigan
OTTY
Huron
Cottages
Land drainage
Precipitation
Superior
OLIGOTROPHIC
.01
1
10
100
1000
Z / Tw (Mean depth in meters ÷ Turnover time in years)

Figure 4.