NATICOOK LAKE

LAKES LAY MONITORING PROGRAM

1985

Freshwater Biology Group (FBG)

University of New Hampshire

Durham

by

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LAKES LAY MONITORING PROGRAM

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This is a LEVEL II report. (See last page for definition.)

All data in this report are available to any person or organization upon request and payment of costs involved.

PREFACE

Importance of long-term monitoring

Lake monitoring carried out weekly over the course of several consecutive summers benefits the lake in a number of ways. The resulting data not only indicate the lake's condition for a particular summer, but they also suggest what it was like in the past, and make it possible to predict its condition in the future.

For this reason, it is important to distinguish between short-term and long-term results. As an example, a 30 year time-span may provide evidence for a long-term trend towards eutrophy (Fig. 1). Yet, if one looks at data over a 1-5 year time-span, one sees only short-term fluctuations; there are no apparent trends nor is it possible to separate the "signal" from "noise". Chlorophyll, water transparency, and phosphorus may fluctuate from year to year in response to annual variations in climate and activity on the lake, and may be unrelated to long-term trends. The more such "noise" in the data, whether due to real or analytical variations, the longer a monitoring program must continue to demonstrate long-term trends.

Use of long-term trends

Long-term trends serve several important functions. From them, past deterioration of the lake can be recognized. They can also be used to forecast the future condition of the lake, and if necessary, management techniques can be implemented to keep

They can also be used to forecast the future condition of the lake, and if necessary, management techniques can be implemented to keep potential problems from becoming worse. Finally, long-term trends provide a basis for evaluation of existing management programs so that necessary changes may be brought about.

It takes a great deal of motivation, perseverance, and a love for one's lake to be a lay monitor. Sometimes it may seem to be an inconvenience, or to be discouraging when it's unclear just what a year's worth of hard work means with respect to the "big picture" of the lake. Yet, each observation by a lay monitor is a significant contribution.

Thus, continuation of data collection is important. The LLMP data base is becoming more comprehensive and valuable each year. We are pleased with the interest and commitment of lakeshore volunteers. Keep up the great work!

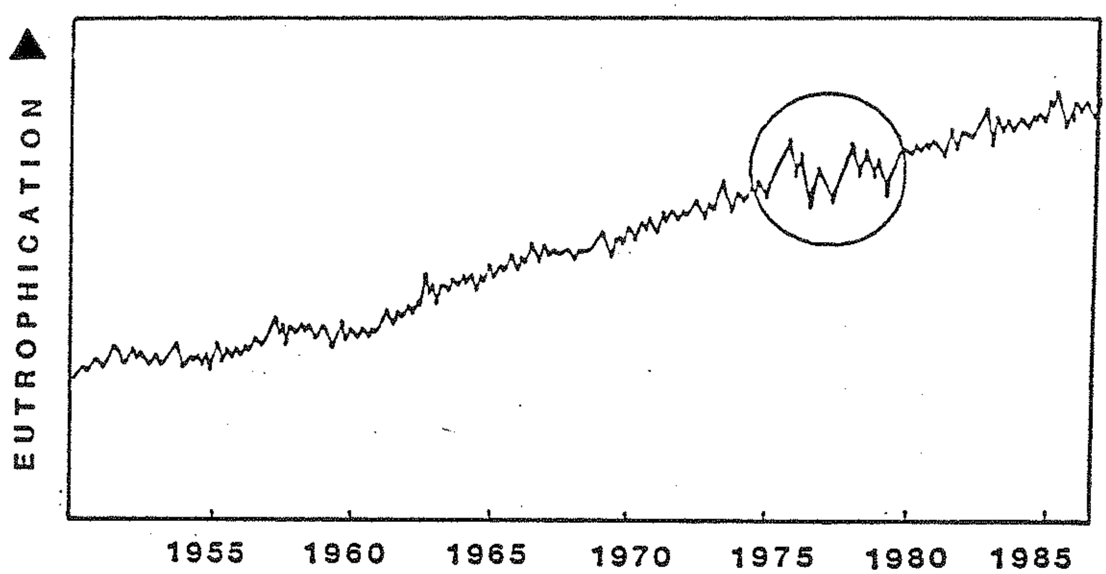

Figure 1. Long-term vs. short-term trends in a hypothetical lake approaching eutrophication.

ACKNOWLEDGEMENTS

Naticook Lake has participated in the Lakes Lay Monitoring Program since 1983. The program continued strongly in 1985 under the direction of Mr. David Soule and with the help of Mr. George May. Weekly monitoring was carried our by Laura Jaynes and also by Melissa Goodwin and Diana Roscoe.

The Freshwater Biology Group congratulates the monitors on the quality of their work and the time and effort put forth. We encourage them and other interested members of the Naticook Lake Association to continue monitoring during the 1986 season. We would also like to thank Mr. Soule and Mr. May for their continued dedication to the maintenance and organization of the LLMP for the lake.

Members of the Freshwater Biology Group (FBG) included Kim Babbitt, Henry Burke, Tracy Kenealy, Sandra Lord, Elizabeth Trieff, Celia Acacia, and Deb Thunburg. Kim was the LLMP Coordinator, and was responsible for arranging the field trips and supervising the research team. Liz and Sandy were responsible for phosphorous, Henry for equipment production and upkeep, Celia for phytoplankton, and Deb for zooplankton. Tracy was responsible for data entry and analysis, and for writing the reports in the fall. All members of the FBG participated in the field work and lab analyses.

We would also like to recognize the UNH Office of Computer Services for their provision of computer time and data storage space. The final text is available on an IBM-compatible diskette.

NON-TECHNICAL SUMMARY OF LAY MONITOR DATA

1) Both water transparancies and chlorophyll a concentrations indicate that Naticook Lake is oligotrophic. Seasonal readings for secchi disk and chlorophyll suggest that the lake is nutrient poor and contains relatively few planktonic algae.

2) This year, alkalinity was measured frequently on the lake. Alkalinity indicates the ability of water to buffer acids. Naticook Lake has sufficient alkalinity to resist changes in pH which are often brought about by acid rain.

3) Levels of total phosphorus varied depending on the site from which they were taken. Most samples taken from the lake indicate low levels of total phosphorus, while samples taken from the inlet to the lake suggest that nutrient loading may be occuring.

4) The seasonal mean for dissolved water color was relatively low, indicating that the water is not highly stained from dissolved humic substances (dark-colored organic matter). Both water color and the density of algae will affect the water transparency; in Naticook, the water

color appears to have less of an effect on the water transparency than do populations of planktonic algae.

5) The water in 1985 was more transparent and contained less green coloring from suspended algae than 1984, but similar to 1983. Short-term fluctuations such as these are common, possibly due to changes in weather from year to year.

COMMENTS AND RECOMENDATIONS

1) We recommend that the Naticook Lake Association continue its long-term monitoring program in 1986. The association has established a three-year data base which can be strengthened through further monitoring. A data base resulting from several years of monitoring will be a valuable resource in the future as trends in the chemistry and biology of the lake become evident.

2) Phosphorus sampling should be continued in 1986. While most levels fell in the oligotrophic range, high values from the inlet to the lake, as well as high results from the FBG suggest that the lake may be susceptible to some forms of nutrient loading throughout the year. The frequency of sampling from the four sites was excellent in 1985; yet in order to better assess what factors cause levels to be elevated at certain times, monitors should keep a record of circumstances surrounding the sampling period. This should include information such as the weather preceding fhe day of sampling (storm action, wind, waves), water level in the lake, appearance of the inlet stream, etc.

3) Although the lake has sufficient alkalinity to buffer acids at present, alkalinity testing should be continued in 1986. Alkalinity measurements provide a reliable way to detect changes in buffering capacith and to predict changes in acidty and pH.

4) As a general addition to our Lakes Lay Monitoring Program, we are suggesting that each lake in the Program begin monitoring the condition of the fish taken from the lake. The "Fish Monitoring" will require that at least one lay monitor record the species, length and weight and collect a sample of fish scales for each fish examined. In most lakes this will involve periodic creel census of sport fishermen on the lake. Equipment required will cost approximately $100. Special instruction will be given to the lay monitors who chose to measure this parameter.

Length-to-weight ratios give a measure of the nutritional condition of the fish. Analysis of the fish scales (to be done at UNH) will tell how old each fish is. Together, these data will be extremely useful indicators of the health of the fish populations in the lake, and, of course, the "health" of the lake.

METHODS OF LAY MONITORS

This year data were collected on 6 parameters: thermal stratification, water clarity (secchi disk depth), chlorophyll a concentration, alkalinity, total phosphorous and dissolved water color. Whenever possible, testing was done weekly between the hours of 9 am and 3 pm, the period of maximum sunlight penetration into the water. All samples and data were mailed to the FBG at UNH for analysis.

Thermal (temperature) profiles were obtained by collecting lakewater samples at several successive depths using a modified Meyer bottle (Lind, 1979). A weighted, empty bottle with a stopper was lowered to a specific depth. At that depth, the stopper was pulled, allowing the bottle to be filled with water. The bottle was quickly pulled back up to the surface where the temperature of the sample was taken with a Taylor pocket thermometer, and recorded in degrees Celsius. This procedure was repeated at one meter intervals through the epilimnion and hypolimnion, and at one-half meter intervals throughout the metalimnion.

Water clarity was measured by lowering a secchi disk (approximately 20 cm. or 8 inches) through the water off the shady side of the boat, and noting the average depth at which it disappeared upon lowering and reappeared when being raised (the cord attached to the secchi disk was marked in one-half meters). This process was done while holding a view-scope just below the surface to eliminate effects of surface reflection and wave action. This was repeated two or three times, and an average to the nearest one-tenth of a meter was recorded.

Chlorophyll a concentration was used as an index of algal biomass that is useful in determining the trophic state of the lake. A weighted plastic tube (10 meters in length) was lowered through the epilimnion, or "upper lake" to the top of the metalimnion, or "middle lake" (the depths of the epilimnion and metalinmion are determined from the temperature profile). The end of the tube above water is folded to shut off the water flow into or out of the tube. The weighted end of the tube is pulled up out of the water with an attached cord, trapping an integrated sample of water representing the "upper lake" in the tube. This sample is poured into a plastic 2.5 liter bottle and stored for chlorophyll filtration and alkalinity determination.

Water samples for chlorophyll a filtration were filtered through a 0.45 micron membrane filter. Damp filters, containing chlorophyll-bearing algae, were air-dried for at least 15 minutes, out of the sun, to prevent decomposition or bleaching of the chlorophyll on the filter. These filters were sent to UNH where members of the FBG analyzed them for chlorophyll a (see Methods of the Freshwater Biology Group).

Dissolved water color was determined by saving the filtrate from the the chlorophyll filtration and storing it frozen in a 50 ml plastic bottle. The bottles were sent to UNH and the color was analyzed by reading the absorbance of the samples at two different wavelengths (440 and 493).

To determine the alkalinity, a two-endpoint titration was done with 0.002 N sulfuric acid to a ph of 4.5 and 5.1. The endpoint indicator was methyl red/bromocresol green. The amount of titrant used (dilute sulfuric acid) was recorded to the nearest 0.1 ml, representing the equivalent milligrams of calcium carbonate per liter.

Samples for total phosphorous analysis were collected in two ways. For determination of epilimnetic phosphorous, water was taken from the integrated sample collected with the tube-sampler. On parts of the lake where it was suspected that phosphorous might be high, (eg. sites along the shoreline, inlets or outlets), surface samples were taken by dipping a bottle into the water and letting it fill. All samples were collected in acid-washed 250 ml bottles, fixed with 1.0 ml of concentrated sulfuric acid, and stored frozen until analysis by the FBG team. (See Methods by the Fresh-water Biology Group.)

METHODS OF THE FRESHWATER BIOLOGY GROUP

The Freshwater Biology Group (FBG) research team took 3 trips to the lake and conducted several tests which included measurements of sunlight penetration into the water, dissolved oxygen, alkalinity, free (unbound) carbon dioxide, pH, specific conductivity, chlorophyll a, total phosphorous, and a survey of the microscopic plants (phytoplankton) and animals (zooplankton) present. The FBG was also responsible for chlorophyll a and phosphorus analysis of lay monitor samples, as well as filing and analyzing 1985 data, performing statistical tests, and determining possible trends based on past data.

Field and Laboratory Methods

On the lake, a dissolved oxygen and temperature profile was taken using a Yellow Springs Instruments Model 54A Oxygen/Temperature meter with a submersible probe. Readings were taken at one-meter intervals throughout the epilimnion and hypolimnion, and at one-half meter intervals through the metalimnion.

Sunlight and skylight penetration into the water was measured with a Whitney submersible photometer model LMA-8A, off the sunny side of the boat. From the relative light intensities which were recorded, the coefficient of light extinction was later determined.

Samples for water chemistry (dissolved oxygen, alkalinity, free (unbound) carbon dioxide, pH, and specific conductivity) were collected with a 3-liter Van Dorn bottle at depths which represented the surface, mid-epilimnion, metalimnion, and hypolimnion. Alkalinity, free carbon dioxide, and pH samples were stored on ice in 250 milliliter polyethylene bottles and were analyzed in the field within 1 to 2 hours of sampling. Specific conductivity samples were analyzed in the FBG lab at room temperature.

In addition to the oxygen profile taken, the dissolved oxygen (DO) concentration of specific lakewater samples (epilimnetic and hypolimnetic) was determined chemically using the Winkler method for dissolved oxygen. The precision of the method allows us to to check the accuracy of the electronic probe, so that adjustments could be made in the probe readings if necessary. In the Winkler method, water is collected in Biological Oxygen Demand (BOD) bottles and fixed with manganese sulfate and alkali-iodine-azide. A loose precipitate (floc) of manganous hydroxide is formed that will absorb any dissolved oxygen present. The sample is then acidified with concentrated sulfuric acid in the presence of of iodide, and iodine is released in a quantity equal to the amount of dissolved oxygen present.

To determine the alkalinity, a two-endpoint titration was done with 0.002 N sulfuric acid to a pH of 4.5 and 5.1. The endpoint indicator used was methyl red/bromocresol green. The amount of titrant used (dilute sulfuric acid) was recorded to the nearest 0.1 ml, representing the equivalint milligrams of calcium carbonate per liter.

Free carbon dioxide concentration was determined by titrating the fresh lakewater samples with 0.0027 N NaOH to a final pH of 8.3, using the dye phenolphthalein as the end-point indicator.

Lakewater pH was measured with a digital pH meter (Orion model 231) equipped with a combination probe (Orion Co.)

Specific conductivity was measured with a Barnstead Conductivity Bridge Model PM-70CB , with a model B-10 probe (cell constant = 1.0). Corrections were made for sample temperatures with a standard curve.

Samples to be analyzed for chlorophyll a, total phosphorus, phytoplankton, and zooplankton were collected with a vertical tube sampler into a 2.5 liter plastic bottle. Chlorophyll samples were filtered through a 0.45 micron membrane filter and air-dried until analysis. The chlorophyll a content was analyzed by extracting the chlorophyll with a 95% acetone solution saturated with magnesium carbonate. The samples were then centrifuged and their light absorbances read at two standard wavelengths (663 and 750 nanometers).

Phosphorus samples were fixed with 1.0 milliliter of concentrated sulfuric acid and stored refrigerated until analysis. Also, phosphorus samples from lay monitors were received by the FBG in a refrigerated or frozen state, and stored cold until analysis. To determine the total phosphorus content, ammonium persulfate and 11 N sulfuric acid was added to digest the total phosphorous, and the samples were auto-claved for one hour. A single-reagent method was employed using potassium antimony tartrate, ammonium molybdate, and a fresh solution of ascorbic acid (E.P.A. 1979). Absorbance of the blue phosphorous complex was measured spectrophotometrically at 650 nm. Each sample was analyzed twice and an average of the two values taken as the phosphorous content in parts per billion.

Phytoplankton samples were fixed with iodine (Lugol's solution) immediately after collection. The preserved samples were later counted with an inverted microscope after settling for 24 hours in counting chambers. At least 200 individual algal "units" were counted with a modified scan technique (Baker, 1973).

Zooplankton samples were collected by taking a plankton tow through the oxygenated portion of the water (>0.5 ppm oxygen) using a 30 cm diameter, 150 micron porosity plankton net. Samples were immediately preserved in a 4% formalin-sucrose solution (Haney and Hall, 1973) and subsampled with a 1-milliliter Hensen-Stemple pipet. Sufficient subsamples were taken to insure that at least 100 zooplankters were counted.

How the data are analyzed

Incoming data are received through the mail during the sampling season and are first filed in an "incoming data" book. This provides temporary storage until the corresponding chlorophyll and/or phosphorous sample for each data sheet is analyzed. All data, including date, lake, site, secchi disk depth, chlorophyll a and phosphorous content, alkalinity, and color measurements, are filed and stored on a computerized data-management system of the University of New Hampshire. Data can be easily retrieved by lake, sampling station or date, and used for individual reports and for each year.

Statistical treatment of the data for each lake includes a comparison of seasonal tendencies found throughout the year, monthly means for the different parameters tested, and confidence levels for each site. The same comparisons mentioned above are made on a yearly basis if the lake has been in the program for two years or more. If sufficient data are available from several years, regression analyses and other statistical tests are performed. Such analyses may identify trends and help explain variations in the data (eg. secchi disk depth, chlorophyll a, color). In addition, data is compared with other lakes in the program and to published water quality classifications. Trophic boundaries of Forsberg and Ryding (1980) are used to classify each lake.

RESULTS AND DISCUSSION OF LAY MONITOR DATA

Results from the lay monitors are presented separately from those obtained by the Freshwater Biology Group, as the two groups conducted separate research.

In 1985, weekly monitoring was done from site 1, a deep site on the lake (Fig. 2) where tests were done for water transparency, chlorophyll a concentration, phosphorus, dissolved water color, and alkalinity. In addition, three extra sites were established this year for frequent phosphorus sampling. See Appendix A for lay monitor data from 1983-1985.

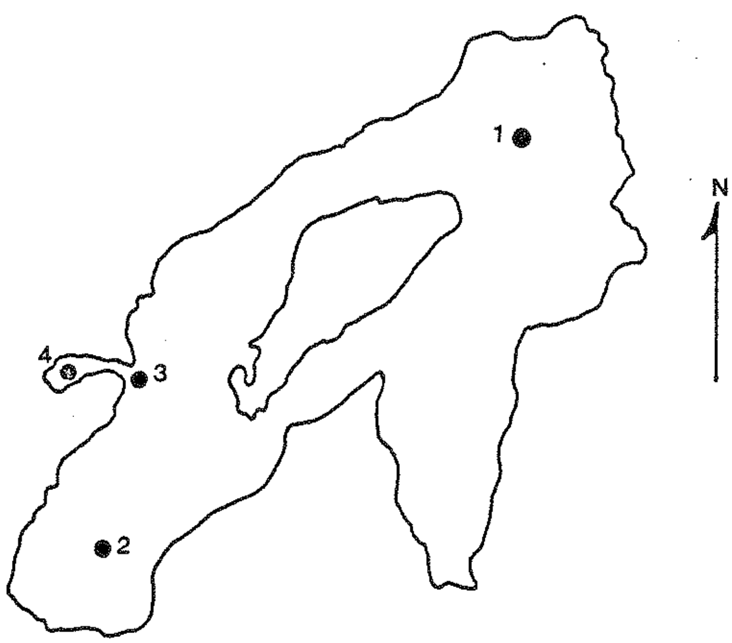

Figure 2. Naticook Lake, Town of Merrimack, New Hampshire. Outline map and location of 1985 sampling sites.

Water Transparency, Chlorophyll a and Dissolved Water Color

Water transparency (secchi disk depth), was in the range of 4.3 to 6.0 meters, with an average of 4.8 meters. The chlorophyll *a* concentration was in the range of 0.3 to 4.0 milligrams per cubic meter, and averaged 1.5 mg per cubic meter. Water transparency was highest in June, decreased in July and August, and increased slightly in September and October. During the same time, the chlorophyll *a* concentration was relatively low in June, increased during July and August, and decreased in September and October. This inverse relationship indicates that the water transparency may be regulated largly by the phytoplankton populations.

The dissolved water color, which is the brown coloring of lakewater due primarily to dissolved humic acids, is measured as the absorbance of light per 5 centimeters at 440 nanometers. Unlike the chlorophyll *a* concentration, the water color didn't vary inversely to the secchi disk depth. Water color was highest in June, with an average of 0.03, and averaged 0.16 during the rest of the summer. The range of values (0.01-0.03) is consistent with most of the lakes in the LLMP.

Water transparency and chlorophyll *a* concentrations indicate that Naticook Lake is oligotrophic. The water transparency in 1985 was the highest and the chlorophyll concentrations were the lowest since 1983 when Naticook first entered the LLMP. Results for 1985 are similar to those found in 1983. In 1984, the average secchi disk depth was only 3.8 meters which falls in the mesotrophic range, and the average chlorophyll a concentration was relatively high (2.1 mg per cubic meter).

The monthly and yealy variations in water quality may be due to changes in weather and/or use of the lake. Three years of data do not provide enough information on trends towards increasing or decreasing water quality, but the yearly fluctuations do indicate that monitoring should continue in order to detect changes as they occur.

Alkalinity

Lay monitor alkalinity testing began on Sept. 1 and was continued weekly until Oct. 3, 1985. Values at the pH 4.5 endpoint (pink) were moderate, ranging from 10.9-14.2 milligrams calcium carbonate per liter, with an average of 12.5.. The average alkalinity for New Hampshire lakes is about 9 milligrams per liter. The results from Naticook Lake indicate that the lake has sufficient buffering capacity, thus changes in the pH of the lake due to the addition of acids (eg, acid rain) may be minor at this time. However, alkalinity should be monitored annually. Alkalinity on Naticook has decreased since 1979 when the New Hampshire Water Supply and Pollution Control Commission measured the epilimnetic alkalinity to be 13.3 milligrams per liter. Once the buffering capacity of a lake is gone, decreases in pH occur rapidly. At a pH of 5.5 or lower, some species of fish and crustaceans fail to reproduce.

Phosphorus

Naticook Lake was sampled for total phosphorus from 4 sites (Fig. 2) betweem mid-June and mid-September. During that time, 33 samples were taken. Based on an average total phosphorus concentration of 7.4 parts per billion (ppb), the lake would be classified as oligotrophic. However, the phosphorus concentrations appear to vary depending on the site. Phosphorus levels from sites 1 and 2 were consistently low; all values except for one from site 1 (deep site) and one from site 2 (boat access and beach area) fall in the oligotrophic range. Most of the samples taken from site 4 fall in the mesotrophic range; this site represents the only inlet into the lake. In addition, phosphorus levels at site 3, representing the area where the inlet enters the lake, were slightly higher than at sites 1 and 2. The higher levels at sites 3 and 4 suggest that the inlet stream may be a potential site of nutrient loading.

It is also interesting to note that at all four sites, highest phosphorus levels were found in September. Temperature profiles for September indicate the occurance of fall turnover, as the temperature gradient (thermocline) was no longer present. When a lake turns over, phosphorus which has been released from the sediments into an anoxic hypolimnion (during middle or late summer) is brought up into the surface waters. Such elevated phosphorus concentrations are only temporary, since the phosphorus eventually resettles back to the sediments.

RESULTS AND DISCUSSION OF FBG DATA

The Freshwater Biology Group (FBG) visited Naticook Lake on June 14, July 16, and August 21, 1985.

Temperature and Dissolved Oxygen

Temperature profiles for the three testing dates indicate that summer stratification had not yet occured by June 14, but that Naticook Lake was thermally stratified on July 16 and August. In August, the epilimnion extended to 5.5 meters (one half meter from the bottom), and the thermocline was less pronounced than in July.

In June, sufficient oxygen (above 7.5 ppm) was present throughout the entire water column to 6 meters. By July, oxygen was high at the surface (9 ppm) but was very low at 5 meters and near depletion at the bottom. In August, the deeper epilimnion allowed oxygenated water to mix to a greater depth (5.5 meters), but oxygen was depleted at the bottom.

Water Transparency

The average secchi disk depth measured by the FBG was 4.6 meters. The water was more transparent in June and August (5.5 m and 5.1 m) than in July (3.3 m). These data indicate olitotrophy in June and August, and mesotrophy in July. Similar results were found by the lay monitors.

Chlorophyll a and Dissolved Water Color

Water transparency is regulated by three major factors: the planktonic algae in the water column (assessed by the chlorophyll a concentration), the dissolved water color, and suspended particles in the water. By measuring two of these parameters, the chlorophyll a concentration and dissolved water color, the FBG can estimate the relative effect each has in influencing the secchi disk depth.

The chlorophyll a concentrations were 2.9 mg per cubic meter in June, 4.3 in July, and 1.4 in August. The higher concentration in July corresponds to the lower water transparency in that month. This value falls in the mesotrophic range, while the June and August concentrations indicate oligotrophy.

The dissolved water color averaged 0.02, which is the same as that found by the lay monitors. This is slightly lower than what was found in 1983 and 1984, and may attribute to the higher water transparency in 1985. The lower the dissolved water color, the more light can penetrate the water column, which increases the water clarity.

Total Phosphorus

The FBG found total phosphorus concentrations which were higher than lay monitor results on two out of three field trips. While lay data for the deep sampling site ranged from 1.8 to 6.9 ppb, with one high value of 30 ppb, the FBG found concentrations of 42.4, 37, and 1.3 ppb in June, July, and August respectively. The first two values usually suggest eutrophic conditions. However, taking into account the trophic state of the lake based on water transparency, chlorophyll, and lay monitor phosphorus data, all of which suggest oligotrophy, it is likely that results from the FBG are high due to reasons other than consistent nutrient loading. It is possible that the water level of Naticook was higher than normal at the time of sampling during the June and July test dates. When this is the case, more nutrients enter the water from along the lakeshore, as well as from inlet streams to the lake.

Alkalinity, pH, and Free Carbon Dioxide

Alkalinity measurements taken by the FBG were comparable to data from the lay monitors, with an average of 12.6 milligrams per liter. In June and August, alkalinity was consistent throughout the entire water column; in July, it was slightly higher at the bottom. The pH of surface water was between 7.1 and 7.3 for the three test dates, and like alkalinity, was constant throughout the water column in

June and August. It decreased towards the bottom in July as a result of relatively high levels of carbon dioxide near the sediments. Carbon dioxide levels near the surface were very low for all three test dates (approximately 1 milligram per liter), and increased slightly towards the bottom. Free carbon dioxide which accumulates in the hypolimnion is an indicator of increased productivity in the trophogenic zone. This increase was most pronounced in July, when production was highest (as seen by low water transparency, relatively high chlorophyll a concentrations, and high counts of phytoplankton (see below)).

Specific Conductivity

Naticook Lake has a high specific conductivity (average 179 micromhos). Values in this range usually indicate that the lake receives large amounts of raw sewage or road salt. However, sewage inputs would be reflected by consistently high phosphorus concentrations. The relatively low phosphorus content of Naticook suggest that the high specific conductivity is due to salt from roads rather than sewage.

Phytoplankton

Phytoplankton counts were low in June (1224 cells per milliliter, or cells/ml), high in July (5616 cells/ml), and moderate in August (3948 cells/ml). For all three dates sampled, the Chrysophyceae were the dominant group as seen by high populations of *Mallomonas* in June and *Chrysochromulina* in July and August. In addition, the Chlorophyceae were abundant for all three dates, and the Cryptomonads (*Cryptomonas*) were important in June and August.

Zooplankton

The density of herbivorous zooplankton was low on Naticook Lake, with 4.4 animals per liter. *Daphnia galeata mendotae* was the dominant organism. Animals such as *Daphnia* are important, as they filter phytoplankton from the water and provide a food source for small fish.

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APPENDIX A

LLMP -- Lay Monitor Data: Naticook Jan-06-86 13:09.48

Date	Lake	Site	SDD	Chl
Jun-24-83	Naticook	1 Deep	5.40	.82
Jun-29-83	Naticook	1 Deep	5.50	.71
Jul-06-83	Naticook	1 Deep	4.50	.92
Jul-13-83	Naticook	1 Deep	3.60	3.31
Jul-20-83	Naticook	1 Deep	4.00	1.55
Jul-31-83	Naticook	1 Deep	3.60	2.50
Aug-03-83	Naticook	1 Deep	4.50	1.96
Aug-21-83	Naticook	1 Deep	4.40	1.64
Aug-28-83	Naticook	1 Deep	4.00	1.61
Jul-05-84	Naticook	1 Deep	3.60	3.07
Jul-11-84	Naticook	1 Deep	4.30	3.05
Jul-19-84	Naticook	1 Deep	3.30	1.93
Jul-25-84	Naticook	1 Deep	3.50	1.43
Aug-03-84	Naticook	1 Deep	3.90	2.07
Aug-08-84	Naticook	1 Deep	3.60	2.35
Aug-15-84	Naticook	1 Deep	3.70	2.68
Aug-24-84	Naticook	1 Deep	4.40	1.03
Sep-16-84	Naticook	1 Deep	---	1.22
Jun-02-85	Naticook	1 Deep	6.00	2.00
Jun-09-85	Naticook	1 Deep	6.00	1.02
Jun-14-85	Naticook	1 Deep	---	---
Jun-25-85	Naticook	1 Deep	4.60	2.14
Jun-25-85	Naticook	1 Deep	---	---
Jul-02-85	Naticook	1 Deep	5.25	.80
Jul-11-85	Naticook	1 Deep	4.25	.89
Jul-11-85	Naticook	1 Deep	---	---
Jul-24-85	Naticook	1 Deep	3.25	3.12
Jul-24-85	Naticook	1 Deep	---	---
Aug-01-85	Naticook	1 Deep	---	---
Aug-01-85	Naticook	1 Deep	3.00	4.05
Aug-01-85	Naticook	1 Deep	---	---
Aug-09-85	Naticook	1 Deep	---	---
Aug-22-85	Naticook	1 Deep	---	---
Sep-01-85	Naticook	1 Deep	5.50	.31
Sep-14-85	Naticook	1 Deep	---	---
Sep-14-85	Naticook	1 Deep	5.25	.80
Sep-22-85	Naticook	1 Deep	4.30	1.07
Oct-03-85	Naticook	1 Deep	5.60	.36

Jul-11-85	Naticook	2 Natck	---	---
Jul-24-85	Naticook	2 Natck	---	---
Aug-01-85	Naticook	2 Natck	---	---
Aug-09-85	Naticook	2 Natck	---	---
Aug-22-85	Naticook	2 Natck	---	---
Sep-01-85	Naticook	2 Natck	---	---
Sep-14-85	Naticook	2 Natck	---	---
Sep-21-85	Naticook	2 Natck	---	---
Jul-11-85	Naticook	3 Natck	---	---
Jul-24-85	Naticook	3 Natck	---	---
Aug-01-85	Naticook	3 Natck	---	---
Aug-09-85	Naticook	3 Natck	---	---
Aug-22-85	Naticook	3 Natck	---	---
Sep-01-85	Naticook	3 Natck	---	---
Sep-14-85	Naticook	3 Natck	---	---
Sep-21-85	Naticook	3 Natck	---	---
Jul-24-85	Naticook	4 Natck	---	---
Aug-01-85	Naticook	4 Natck	---	---
Aug-22-85	Naticook	4 Natck	---	---
Sep-01-85	Naticook	4 Natck	---	---
Sep-14-85	Naticook	4 Natck	---	---
Sep-21-85	Naticook	4 Natck	---	---
Jul-02-85	Naticook	-1	---	---

>>> END OF LIST <<<

APPENDIX B

LLMP -- Lay Monitor Data: Naticook Feb-20-86 17:11.16

Date	Lake	Site	Alk (ppm)	Tot-P
Jun-14-85	Naticook	1 Deep	---	5.6
Jun-25-85	Naticook	1 Deep	---	7.6
Jul-11-85	Naticook	1 Deep	---	4.1
Jul-24-85	Naticook	1 Deep	---	3.0
Aug-01-85	Naticook	1 Deep	---	1.8
Aug-01-85	Naticook	1 Deep	---	5.9
Aug-09-85	Naticook	1 Deep	---	2.8
Aug-22-85	Naticook	1 Deep	---	7.1
Sep-01-85	Naticook	1 Deep	14.2	26.9
Sep-14-85	Naticook	1 Deep	12.6	---
Sep-14-85	Naticook	1 Deep	---	6.9
Sep-22-85	Naticook	1 Deep	12.1	---
Oct-03-85	Naticook	1 Deep	10.9	---
Jul-11-85	Naticook	2 Natck	---	5.9
Jul-24-85	Naticook	2 Natck	---	2.5
Aug-01-85	Naticook	2 Natck	---	5.6
Aug-09-85	Naticook	2 Natck	---	3.3
Aug-22-85	Naticook	2 Natck	---	158.7
Sep-01-85	Naticook	2 Natck	---	4.9
Sep-14-85	Naticook	2 Natck	---	6.1
Sep-21-85	Naticook	2 Natck	---	7.6
Jul-11-85	Naticook	3 Natck	---	5.6
Jul-24-85	Naticook	3 Natck	---	4.6
Aug-01-85	Naticook	3 Natck	---	4.6
Aug-09-85	Naticook	3 Natck	---	6.1
Aug-22-85	Naticook	3 Natck	---	5.4
Sep-01-85	Naticook	3 Natck	---	4.3
Sep-14-85	Naticook	3 Natck	---	8.4
Sep-21-85	Naticook	3 Natck	---	9.4
Jul-24-85	Naticook	4 Natck	---	2.3
Aug-01-85	Naticook	4 Natck	---	4.9
Aug-22-85	Naticook	4 Natck	---	14.7
Sep-01-85	Naticook	4 Natck	---	15.7
Sep-14-85	Naticook	4 Natck	---	20.5
Sep-21-85	Naticook	4 Natck	---	16.7
Jul-02-85	Naticook	No Label!	---	7.1

NOTE

There are three levels of reports available to participating lake associations in the LLMP. They are differentiated as follows:

LEVEL I - This is a basic report that includes sections on the methods employed, comments and recommendations, and a brief summary of results. It also contains an appendix listing data from the present and past years.

LEVEL II - This is a mid-level report that includes methods employed, a non-technical summary of lay monitor and FBG data, comments and recommendations and an in-depth results and discussion section. It contains an appendix listing data from the present and past years.

LEVEL III - This is a full report which includes the following sections: methods employed, a non-technical summary, comments and recommendations, a technical summary, and a complete results and discussion section supplemented by computerized graphics. It also contains 3-4 appendixes: a listing of present-year and past data, limnological concepts and technical terms, and a glossary.