SUNSET LAKE

LAKE LAY MONITORING PROGRAM

1984

Freshwater Biology Group (FBG)

University of New Hampshire

Durham

by

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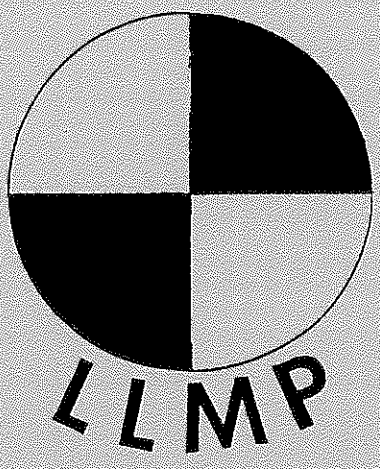

To obtain more information about the Lake Lay Monitoring Program (LLMP) please contact Dr. Baker at (603)-862-2060 or Dr. Haney at (603)-862-2100.

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ACKNOWLEDGMENTS

The Lake Lay Monitoring Program (LLMP) came into existence on Sunset Lake in 1984. Through the direction of Mrs. Martha Johnson the program developed strongly on Sunset Lake. Members of the Sunset Lake Association Water Quality Committee were: Chris Wasp, Elaine and Woody Rodrick and Martha Johnson. Woody Rodrick was the sole monitor on the lake.

We congratulate the lay monitors on the quality of their work and anticipate that the monitors will continue their efforts next year. We would like to express our appreciation to Ms. Johnson for her efforts in coordinating the program and to Woody Rodrick for his time and effort in collecting samples.

The Office of Computer Services kindly provided computer time and data storage space for the Lake Lay Monitoring Program. The final text was set with Wordstar on Northstar and Zenith microcomputers, and printed on a letter-quality Spinwriter.

SUMMARY FOR SUNSET LAKE 1984

1) Sunset Lake is oligotrophic based on low chlorophyll *a* concentration (avg. 1.5 milligrams per cubic meter), and meso-oligotrophic based on Secchi disk depth (3.0-5.5 meters).

2) The highest chlorophyll *a* concentration (2.9 milligrams per cubic meter) is on the meso-oligotrophic borderline. This high value may reflect a pulse of algal activity at that time, and may indicate eutrophic tendencies.

3) A sample for total phosphorus was taken at site 5 on August 17. The phosphorus concentration was low (4.6 micrograms per liter). This value would place Sunset lake in the oligotrophic range, however because it is only one sample it may not be indicative of lakewater quality at Sunset Lake.

COMMENTS AND RECOMMENDATIONS

1) The consistency of data collection from the lay monitors has been excellent throughout the 1984 season. The data base obtained during 1984 will serve as a good starting point for future monitoring. With such a data base, comparisons can be made between years as a continuous check on water quality. Next year samples for chlorophyll *a* should be taken throughout the entire sampling season. Variations in trophic indicators (Secchi disk depth, total phosphorus and chlorophyll *a*) occur throughout the entire season. In order to monitor these variations properly, data should be collected throughout the entire sampling season.

2) We suggest the lay monitors collect samples for dissolved lake water color. This is important to know for water color decreases the water transparency, and thus effects the Secchi disk depth. A more accurate assessment of water quality based on Secchi disk depth can be made by knowing both the chlorophyll *a* concentration and the amount of dissolved water color, and this can be done with essentially no additional cost. Water color samples consist of the filtrate from the chlorophyll *a* sample. Details on the method for collecting dissolved water color samples will be provided on request.

3) The program of lay monitor phosphorus sampling should be expanded at Sunset Lake next year. Samples should be taken after storm events, when inputs of phosphorus are likely to be greatest. The major inlet streams, as well as areas that may serve as point sources of inputs (such as faulty septic systems) should be monitored.

4) If feasible, one or more trips should be made by the Freshwater Biology Group (FBG) field team to verify and therefore strengthen lay monitor data. The FBG, by providing a wider range of tests, may also be able to detect early signs of changes in lake quality that the lay monitors cannot pick up in their sampling.

5) Samples for alkalinity (buffering capacity) and pH should be taken to assess the effects of acid precipitation on the lake. It is important to establish a data base for alkalinity and pH in order to detect changes in these parameters as early as possible. This could be accomplished by training at least one lay monitor in the use of the pH meter and the chemical test for alkalinity. A workshop on "Testing for the Effects of Acid Precipitation" will be offered by the Freshwater Biology Group at the University of New Hampshire.

METHODS OF LAY MONITORS

Lay monitors collected data on four parameters: thermal stratification, water clarity total phosphorus and chlorophyll *a* concentration. Data were collected at weekly intervals whenever possible.

Thermal profiles were obtained by collecting lakewater samples at several depths with a modified Meyer bottle (Lind, 1979). Samples were obtained by lowering the empty but weighted bottle and sampling (by pulling out the stopper) at 1-meter intervals. The temperature of the samples was measured with Taylor pocket thermometers, and recorded in degrees Celsius.

Water clarity was measured while lowering an 8-inch (20 cm) Secchi disk and holding a view-scope just below the surface to eliminate the effects of surface reflection and wave-action. When the Secchi Disk disappeared the depth mark on the plastic suspension line was noted. The disk was raised until it just came into sight, and again the depth on the line was noted. The process was repeated two to three times, and an average between the two marks on the line (the point of disappearance and the point of re-appearance) was considered to be the Secchi Disk Depth (SDD), measured to the nearest one-tenth meter (0.1 meter) -- as for example, 5.2 meters. Readings were generally taken between 9 a.m. and 3 p.m., the period of maximum light penetration.

Chlorophyll *a* concentration was used as an estimator of algal biomass. A weighted tube 33 feet (10 meters) in length was used to collect an integrated water sample from the 'upper-lake' (epilimnion). The weighted end of the tube was slowly lowered to the interface of the epilimnion and the 'middle-lake' (metalimnion). The end of the tube was then bent double to shut off flow of air and water, and the weighted end of the tube (presently at the base of the epilimnion) was pulled up to the surface with a plastic line attached to it. The water in the tube (epilimnetic lakewater sample) was poured into a plastic bottle by placing the weighted end of the tube into the neck of the bottle and, while keeping the bent-off end above the weighted end, unbending the upper end (allowing the sample to discharge into the bottle).

Water samples were filtered through a membrane filter with a porosity of 0.45 microns. The damp filters containing chlorophyll-bearing algae were air dried for at least 15 minutes to prevent decomposition. Filtration and drying were done in the shade to minimize destruction (by bleaching) of chlorophyll. The dried filters were then sent to UNH for analysis. [In Durham, members of the Freshwater Biology Group extracted chlorophyll in 90% acetone saturated with magnesium carbonate, and read the absorbance of the sample at standard wavelengths (663 and 750 nanometers).

Samples for total phosphorus were collected with an integrated water sampler, in the same manner as chlorophyll *a*, or were collected as a dip sample at stream sites. Water samples were stored in acid-washed 250ml polyethylene bottles, and were fixed within 1 to 2 hours with 1.0ml concentrated sulfuric acid. The samples were frozen until brought to UNH for analysis. [In Durham, the total phosphorus was digested by adding ammonium persulfate and 5N sulfuric acid and autoclaving the samples for at least 30 minutes. Finally, the phosphorus content of the sample was analyzed with the single reagent method that included a fresh solution of ascorbic acid and potassium antimony tartrate (E.P.A. 1979). Absorbance of the blue phosphorus complex was measured spectrophotometrically at 650nm].

RESULTS AND DISCUSSION

The water clarity on Sunset Lake was moderate, with an average Secchi disk depth of 4.1 meters for the entire sampling season. The deepest Secchi disk value (5.5 meters) was found on September 30, the shallowest (3.0 meters) on May 21 and June 22 (Table 1). Secchi disk depths were shallowest in the early part of the season (May-June) and also in mid-August. Higher water clarity was found in July to early August and late August-September.

Table 1. Monthly mean Secchi disk depth (SDD) and Chlorophyll *a* (Chl *a*) for Sunset Lake, 1984.
(SDD=meters, Chl *a*=milligrams/cubic meter)

	SDD	Chl *a*
May	3.0	---
June	3.3	---
July	4.3	1.4
August	4.0	2.0
September	4.8	1.0

Samples for chlorophyll *a* concentration were taken from July to September. Concentrations ranged from 0.9-2.9, averaging 1.5 milligrams per cubic meter. The highest chlorophyll *a* concentration (2.9 milligrams per cubic meter) was found on August 17. This accounts for the higher monthly chlorophyll *a* average in August (Table 1).

Sunset Lake would be classed as oligotrophic based on chlorophyll *a* concentration and oligo-mesotrophic based on Secchi disk depth. Lower Secchi disk depths in the spring and early summer may be due to algal productivity or to higher inputs of humic acids during that period. Without chlorophyll *a* data from that period, neither explanation can be ruled out.

Seasonal averages are useful, but are limited in their interpretive value. The high chlorophyll a value found in August (2.9 milligrams per cubic meter) is on the mesotrophic-oligotrophic borderline and may represent a pulse in algal growth at that time. Such a pulse may be more indicative of lakewater quality than monthly or seasonal averages. In many lakes pulses of algal growth (also called blooms) indicate eutrophic tendencies. More data is needed to determine if this is the case at Sunset Lake. Peaks in algal growth may be short lived (1-2 weeks) and may occur at different times of the year depending on such factors as nutrient availability, light, temperature and time of stratification. Sampling during the entire season is important to ensure that these peaks are not overlooked.

Total phosphorus is usually the most limiting (least abundant) nutrient to algae in freshwater systems. Phosphorus regulates algal productivity and therefore regulates chlorophyll a concentration and indirectly (through chlorophyll a) influences water transparency. Increase in algal growth may occur with increases in phosphorus loading. A phosphorus concentration of 4.6 was found at site 5 on August 17. This value is low, and would place Sunset Lake in the oligotrophic range, however it only represents one point in the season.

Because this is the first year of testing, no comparisons with previous lay data can be made. On July 22, 1976, the New Hampshire Water Supply and Pollution Control Commission measured a Secchi disk depth of 3.9 meters and a chlorophyll a concentration of 5.0 milligrams per cubic meter. These data represent only single samples rather than data from an entire season, and thus trend in lakewater quality cannot be established.

REFERENCES

Lind, O. T. 1979. Handbook of common methods in limnology. C. V. Mosby, St. Louis.

New Hampshire Water Supply and Pollution Control Commission 1981. Classification and priority listing of New Hampshire Lakes. Staff report no. 121. Concord, New Hampshire.

U.S. Environmental Protection Agency. 1979. A manual of methods for chemical analysis of water and wastes. Office of Technology Transfer, Cincinnati. PA-600/4-79-020.

APPENDIX A

LLMP 1984 -- Lay Monitor Data: Sunset Jan-29-85 14:52.12

Date	Lake	Site	SDD	Chl
May-21-84	Sunset	5 Center	3.00	---
Jun-08-84	Sunset	5 Center	3.60	---
Jun-22-84	Sunset	5 Center	3.00	---
Jul-02-84	Sunset	5 Center	3.90	---
Jul-10-84	Sunset	5 Center	4.50	1.21
Jul-20-84	Sunset	5 Center	4.50	1.52
Aug-03-84	Sunset	5 Center	4.30	1.78
Aug-10-84	Sunset	5 Center	3.50	---
Aug-17-84	Sunset	5 Center	3.50	2.86
Aug-26-84	Sunset	5 Center	4.50	1.21
Sep-08-84	Sunset	5 Center	4.50	1.07
Sep-18-84	Sunset	5 Center	4.50	1.93
Sep-30-84	Sunset	5 Center	5.50	.09

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