

LAKE CHOCORUA

LAKES LAY MONITORING PROGRAM

1986

Freshwater Biology Group (FBG)

University of New Hampshire

Durham

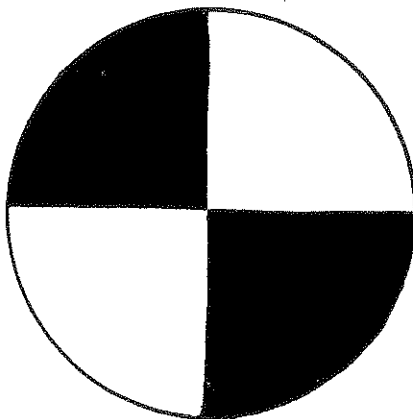
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LAKES LAY MONITORING PROGRAM

To obtain more information about the Lakes Lay Monitoring Program (LLMP) contact the LLMP Coordinator (J. Schloss) at (603) 862-3848, Dr. Baker at 862-3845 or Dr. Haney at 862-2106.

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ACKNOWLEDGEMENTS

This was the sixth year of participation in the Lakes Lay Monitoring Program (LLMP) for Lake Chocorua. The sole Lay Monitor was Dr. Arthur Baldwin. The Freshwater Biology Group (FBG) congratulates Dr. Baldwin on the quality of his work, and the time and effort put forth. We encourage interested members of the Lake Chocorua Association to continue monitoring during the 1987 season. We would also like to acknowledge Dr. Baldwin for his dedication to the organization and maintenance of the LLMP for Lake Chocorua.

The Freshwater Biology Group (FBG) is co-supervised by Dr. Alan Baker and Dr. James Haney. Members of the FBG summer field team included Tracy Kenealy, Jeff Schloss, Patricia McCarthy, Lori Sommer, Steve Thomas and Zhanyang Guo. Tracy and Jeff shared coordination of the program and were responsible for arranging the field trips, training lay monitors, and supervising the research team. Patricia and Lori were responsible for the preparation of chemical solutions, chlorophyll analysis and data entry. Steve was responsible for phosphorus chemistry and analysis. All team members participated in field work and chemical analyses. In the fall, Alice Hibberd assisted in data organization and data entry and Jeff continued as LLMP Coordinator responsible for data interpretation and report writing.

The **FBG** would like to thank the University of New Hampshire Undesignated Gifts Committee for the partial funding of the coordinator position. Eileen Wong of the Department Zoology provided accounting and secretarial service. The Department of Botany and Plant Pathology provided lab and storage space. We would also like to recognize the UNH Office of Computer Services for the provision of computer time and data storage space.

Participating groups in the **LLMP** for 1986 included: The New Hampshire Audubon Society, Derry Conservation Commission, Nashua Regional Planning Commission, Center Harbor Bay Conservation Commission, Governor's Island Club Inc., Little Island Pond Rod and Gun Club, Walker's Pond Conservation Society, United Associations of Alton, the associations of Baboosic Lake, Beaver Lake, Berry Bay, Bow Lake Camp Owners, Lake Chocorua, Flint Pond, Lake Kanasatka Watershed, Langdon Cove, Long Island Landowners, Moultonbouro Bay, Lake Winnipесаaukee, Naticook Lake, Newfound Lake, Nippo Lake, Scruton Pond, Silver Lake (Hollis), Silver Lake (Madison), Squam Lake, Sunset Lake, Lake Winona, and Wentworth Lake and the towns of Alton, Amherst, Hollis, Merrimack and Strafford.

PROGRAM DESCRIPTION

The Lakes Lay Monitoring Program

The New Hampshire Lakes Lay Monitoring Program (LLMP) is a research and educational function of the Freshwater Biology Group (FBG) at the University of New Hampshire co-directed by Professors Alan Baker, Department of Botany and Plant Pathology, and James Haney, Department of Zoology and coordinated by Jeffrey Schloss. The program involves the cooperative participation of lake residents, lake associations, conservation and planning commissions and local governments with University faculty and students. Developed in 1978 around Squam Lake, the program has grown to include more than 30 lakes throughout New Hampshire.

As a research project, the LLMP has investigated the extent of lake degradation caused by perturbations such as acid rain, septic and agricultural runoff, and lakeshore development. Essentially the monitors in the program collect data once each week. The data are stored on a computer, the results are analyzed periodically, and interpretive reports are written that include graphics and statistical analyses. A major goal is to detect any short or long-term changes in the water quality of the lakes. To that end a long-term data base has been established.

As an educational tool, several students are trained each year to collect and analyze lakewater samples for physical, chemical and biological parameters, and to interpret water quality data. In addition, more than 200 "lay" monitors have been trained to monitor their own lakes and educated about lake water quality.

As a service to the state and to local communities, the reports of the LLMP are available at cost, and should prove useful to lake residents, conservationists, developers and land-use planners. Also, LLMP staff members conduct workshops, lectures and informal talks on various lake related topics and hold advisory positions on many municipal and private conservation and planning boards. The LLMP is a not-for-profit organization with funding derived primarily from the participating groups.

COMMENTS AND RECOMMENDATIONS

1) We recommend that each association, including the Lake Chocorua Association continue to develop their data base on lake water quality through continuation of the long term monitoring program. The data base will provide information on the short and long-term cyclic variability that occurs in the lake and eventually will enable more reliable predictions of water quality trends.

2) We recommend of phosphorus testing to be taken during the summer months. As early as possible for the initial sampling combined with sampling of the lake during a times of heavy use (ie: 4 July, Labor Day) or late in the season when septic systems have been put through a full seasons use.

3) We suggest that lay monitors initiate dissolved color testing on a weekly basis. There is no additional expense for this test. It requires the collection of filtrate from the chlorophyll processing, in small bottles that will be provided. The Freshwater Biology Group will analyze the filtrate by spectrophotometry.

4) As the development of a metalimnetic population of algae is suspected, occasional chlorophyll samples from the thermocline is suggested to monitor this phenomenon.

5) As a general addition to our Lakes Lay Monitoring Program, we recommend that each lake in the Program begin monitoring the condition of the fish taken from the lake. The "Fish Monitoring" will require at least one lay monitor to 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. The required equipment, supplies and analytical costs will be approximately \$100. Explanation of procedures and fish identification will be given to monitors who decide to measure this parameter.

Length-to-weight ratios give a measure of the nutritional condition of the fish. Age analysis of the fish scales (to be done at UNH) will tell how old each fish is. Together, these variables can help to track changes in the condition of the fish populations in the lake, and, of course, the "health" of the lake.

NON-TECHNICAL SUMMARY OF LAY MONITOR DATA

1) Both water transparencies and chlorophyll a concentrations indicate that Lake Chocorua has remained a clear lake with low productivity (oligotrophic). Seasonal readings for secchi disk and chlorophyll suggest that the lake is nutrient-poor and contains relatively few planktonic algae.

2) Limited results from dissolved water color testing indicate that Lake Chocorua has moderate brown coloring from dissolved humic substances (dark-colored organic matter). The lower the water color, the more light can penetrate into the water, and the higher the water transparency.

3) Levels of total phosphorus were low in Lake Chocorua. Phosphorus is the nutrient that limits lake productivity the most. Low levels such as those found in Chocorua indicate that the lake is relatively unproductive and that nutrient loading is limited.

4) Lake Chocorua has a relatively high pH and like most New Hampshire Lakes, the lake has low buffering capacity (alkalinity). The pH is generally lower in those lakes with little alkalinity. The pH in Lake Chocorua has remained stable over the past several years. This suggests

that adverse effects of acid precipitation may be minor at this time, yet may become a problem in the future if the alkalinity becomes much lower.

5) The water in 1986 was less transparent and contained slightly more green coloring from suspended algae than 1981-85. Short-term fluctuations such as these are common, possibly due to changes in the weather from year to year. Continued monitoring will determine if this is a long-term trend.

INTRODUCTION

Importance of long term monitoring

A major goal of this program is to identify any short or long-term changes in the water quality of the lakes. Of major concern, is the detection of cultural eutrophication; increases in the productivity of the lake due to the addition of nutrients from human activities. Changes in the natural buffering capacity of the lakes in the program is also a topic of great concern since New Hampshire receives large amounts of acid precipitation. Weekly sampling of a lake during a single summer provides information only on the variation that occurs. Short-term differences may be due to variations in weather or lake activity, or other chance events. The resulting short-term fluctuations may be unrelated to the actual long-term trend.

As an example, a 30 year study of a lake may indicate a long-term trend toward eutrophy (Fig. 1). Yet if only the data from a five year period (ie: Fig 1, years 1975-80) are examined, no apparent trends can be seen. If only two years are examined, the data suggest a decrease in eutrophy! Monitoring carried out weekly over the course of many summers can provide the information required to distinguish between short-term fluctuation ("noise") and long-term

trends ("signal"). To that end, each lake must establish a long-term data base.

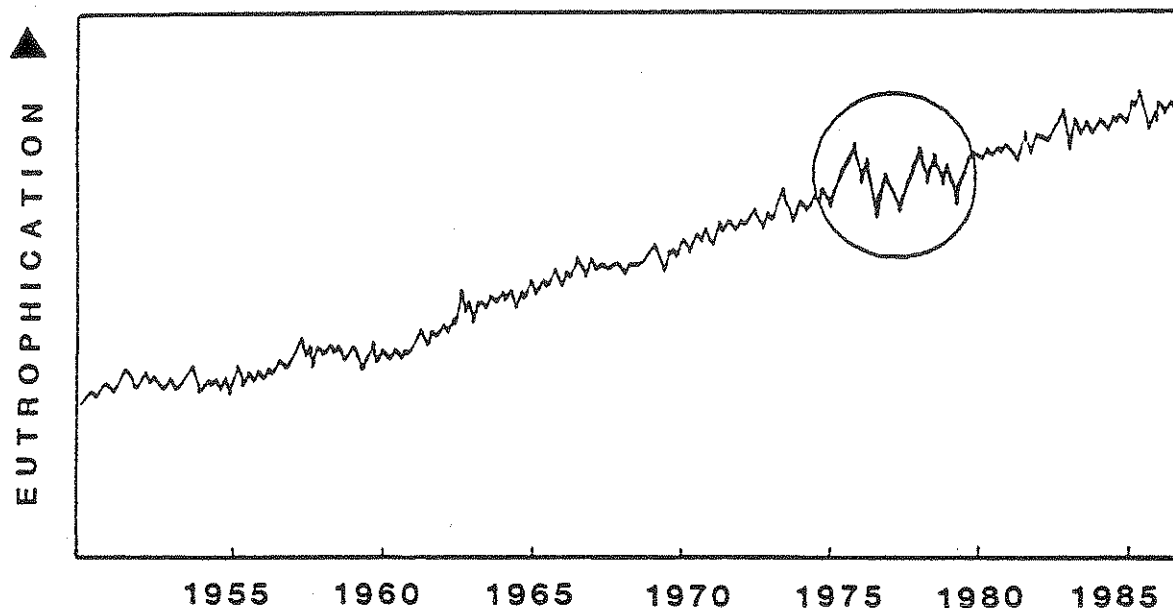


Figure 1. Eutrophication of a hypothetical lake over time. Circled area is enlarged for comparison between short and long-term trends.

The number of seasons it takes to discern between the noise and the signal is not the same for each lake. Evaluation and interpretation of a long term data base will indicate that the water quality of the lake has worsened, improved, or remained the same. As more data is collected prediction of current and future trends can be made. No matter what the outcome, this information is essential for the intelligent management of the lake.

There are also short-term uses for lay monitoring data. The examination of different stations in a lake can disclose specific problems and corrective action can be initiated to handle the situation before it becomes more serious. On a lighter note, some associations post their weekly data for use in determining the best depths for finding fish!

It takes a considerable amount of effort as well as a deep concern for one's lake to be a lay monitor. Many times a monitor has to brave inclement weather or heavy boat traffic to collect samples. Sometimes it even may seem that one week's data is just the same as the next. Yet every sampling provides important information on the variability of the lake.

Every data sheet the LLMP receives is significant to further the understanding of the lakes in the program. We are pleased with the interest and commitment of our lay monitors and are proud that their work is what makes the LLMP the most extensive, and we believe, the best volunteer program of its kind.

METHODS OF LAY MONITORS

Lay monitors receive their initial training either on-site or on campus from a member of the FBG. Workshops covering new techniques are usually offered on a yearly basis and updates may be held on-site during an FBG sampling trip.

This year data were collected on seven parameters: thermal stratification, water clarity (secchi disk depth), chlorophyll a concentration, total phosphorus, dissolved color, pH and total alkalinity. 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 or hand delivered 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, stoppered, empty bottle 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 C. This procedure was repeated at one meter intervals through the epilimnion (upper water column), at one-half meter

intervals throughout the metalimnion (depths at which the temperature change is greater than 1 degree C per meter) and at one meter intervals through the hypolimnion (depths below the metalimnion).

Water clarity was measured by lowering a secchi disk (approximately 20 cm. or 8 inches) through the water off the shaded side of the boat, and noting the average of the depths at which it disappeared upon lowering and reappeared when being raised (the cord attached to the secchi disk is marked in one tenth of a meter for the first half meter and in one-half meters thereafter). Water clarity was determined 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 to the top of the metalimnion (the depths of the epilimnion and metalimnion 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 blue plastic 2.5 liter bottle and stored in the shade until chlorophyll filtration could be done.

Water samples for chlorophyll a filtration were filtered through a 0.45 micron membrane filter under low vacuum. Damp filters, containing chlorophyll-bearing algae, were air-dried for at least 15 minutes, in the dark, 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 the **FBG** team (see Methods of the Freshwater Biology Group).

To determine the alkalinity, lake water samples were titrated with 0.002 N sulphuric acid in the presence of the indicator methyl red/bromocresol green to a pH of 5.1 (grey endpoint) and 4.6 (pink endpoint). The amount of titrant used (dilute sulphuric acid) was recorded to the nearest 0.1 ml, equivalent to milligrams of calcium carbonate per liter. Values reported can be converted to microequivalents of calcium carbonate using a multiplication factor of 20.

Samples for total phosphorus analysis were collected in two ways. For determination of epilimnetic phosphorus, water was taken from the integrated sample collected with the tube-sampler. On parts of the lake where it was suspected that phosphorus might be high (ie: sites along the shoreline, inlets or outlets), sub-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 of the Freshwater Biology Group).

METHODS OF THE FRESHWATER BIOLOGY GROUP

The FBG processed chlorophyll a, dissolved color, and phosphorus samples provided by the lay monitors. The input, storage and analysis of all LLMP data is also the responsibility of the FBG.

Laboratory Methods

The chlorophyll a content was analyzed by extracting the chlorophyll filters with a 95% acetone solution saturated with magnesium carbonate. The samples were then centrifuged and their light absorbance read at two standard wavelengths (663 and 750 nanometers) with a Baush and Lomb model 710 spectrophotometer equipped with 50mm cuvettes. An absorptivity value of $84 \text{ gm liter}^{-1} \text{ cm}^{-1}$ (Vollenweider 1969) was used for calculating the concentrations.

Dissolved color samples of the filtrate from lay monitor chlorophyll filtrations was determined by reading the absorbance of the samples at two different wavelengths (440 and 493 nanometers) in a 50mm light path. The two readings were converted to the more widely used platinum cobalt color values (ptu) using standard curves of the absorbance of chloroplatinate.

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 phosphorus, and the samples were autoclaved for thirty minutes at 250 to 260 degrees C. Reagents included potassium antimony tartrate, ammonium molybdate, and a solution of ascorbic acid mixed fresh before each sample run (E.P.A. 1979). Absorbance of the blue phosphorus complex was measured with a spectrophotometer at 650 nanometers. A standard curve of the absorbance of a potassium phosphate (monobasic) solution was used to convert the readings to total phosphorus concentrations. Each sample was analyzed twice and an average of the two values taken as the phosphorus content in parts per billion (ppb).

Data analysis

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 phosphorus sample for each data sheet is analyzed. All data, including date, lake, site, secchi disk depth, chlorophyll a and phosphorus concentrations, alkalinity, and color measurements, are filed and stored on the FBG computerized data-management system that utilizes a mainframe DEC VAX-8650 computer and an IBM compatible microcomputer (Zenith Data Systems 158). With full use of relational data bases, such as S1032 and Dbase III+ data can be easily retrieved by lake, date,

station or by parameter and used for individual reports and program summaries for each year.

Statistical treatment of the data from each lake, produced for level III reports, 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 are made on a yearly basis if the lake has been in the program for two years or more. Where sufficient data are available from several years, regression analyses and other statistical tests can be performed. Such analyses may identify trends and help explain variations in the data (eg. secchi disk depth, chlorophyll a, color). In addition, data from a lake may be compared with other lakes in the program, other computerized data bases (New Hampshire Water Supply and Pollution Control, New Hampshire Fish and Game, EPA Surface Water Survey and others) and to published water quality classifications.

Trophic boundaries of Forsberg and Ryding (1980) of transparency, chlorophyll a, and total phosphorus are used as criteria in discussions of the trophic state of the program lakes.

RESULTS AND DISCUSSION OF LAY MONITOR DATA

Monitoring of Lake Chocorua was done at one location, site 1 South. This year, sampling for temperature, secchi disk depth, chlorophyll a, color, pH and alkalinity took place bi-weekly from 26 May through 12 October. See figure 2 for the sampling site locations and Appendix A for the 1980-86 Lay monitor data.

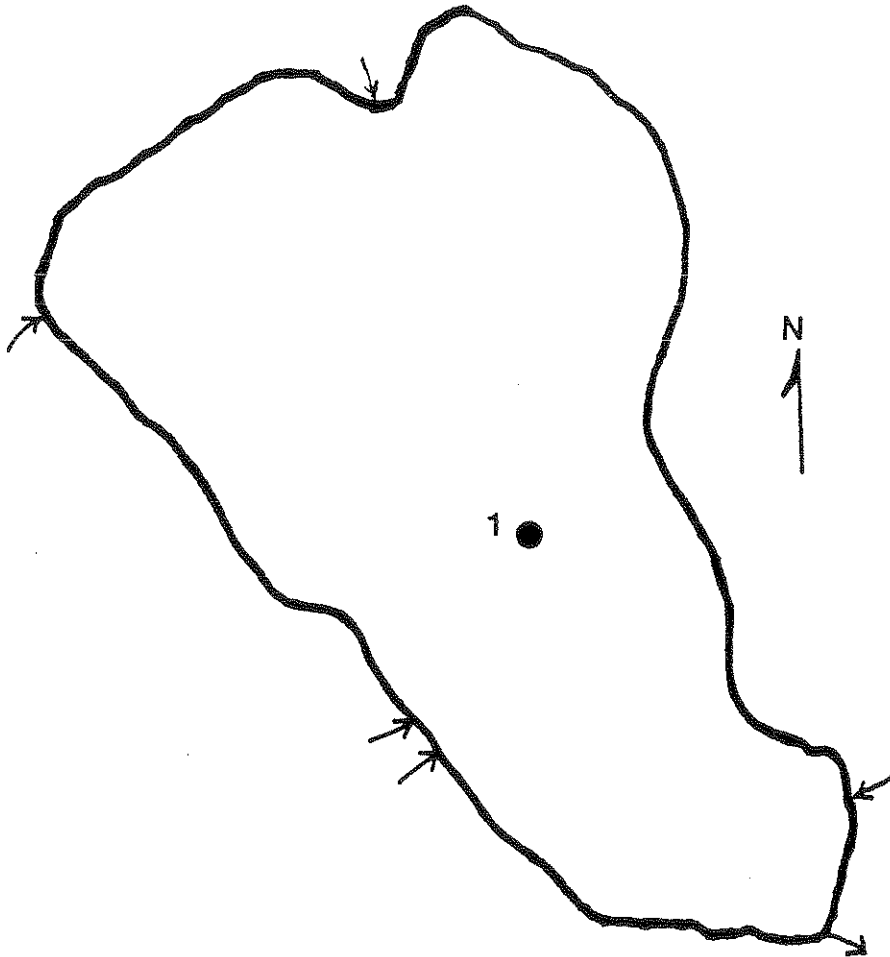


Figure 2. Location of sampling sites on Lake Chocorua, Town of Tamworth, New Hampshire.

Water Transparency

Secchi Disk depth is a measure of the water transparency. The deeper the depth of secchi disk disappearance, the more transparent the lake water; light penetrates deeper if there is little dissolved and/or particulate matter (which includes both living and non-living particles) to absorb and scatter it.

Average secchi disk transparency was 4.5 meters with a range of 3.2 to 6.3 meters. Average secchi disk transparencies of previous years were in the range of 4.8 to 5.6 meters. Thus, average transparency in 1986 was lower than in previous years. Future monitoring will determine whether this is a short-term occurrence or a long-term trend. Transparency fluctuated around values common to less productive (oligotrophic) lakes (Fig. 3A) with August values approaching transparencies more common to moderately productive lakes.

Chlorophyll a

The chlorophyll a concentration is a measurement of the standing crop of phytoplankton and is often used to classify lakes into categories of productivity called trophic states. **Eutrophic** lakes are highly productive with large amounts of algae and aquatic plants due to nutrient enrichment. **Oligotrophic** lakes have low productivity and lower nutrient

levels and mesotrophic lakes are intermediate in productivity.

The average 1986 chlorophyll concentration was 1.9 mg m⁻³. Average chlorophyll a concentrations from previous years were in the range of 1.0 (1985) to 2.3 (1982) mg m⁻³. The average chlorophyll concentration for Lake Chocorua would classify it as oligotrophic. Chlorophyll concentrations increased at the end of the summer (Fig. 3B). Increased chlorophyll could be due to pulses of nutrients into the lake, the surfacing of mid-level (metalimnetic) populations of algae or other extraneous factors. The slightly higher chlorophyll concentrations in 1986 could account for some of the decrease in transparency. There seems to be good correspondence between sechi disk depth and chlorophyll (an inverse relationship is expected).

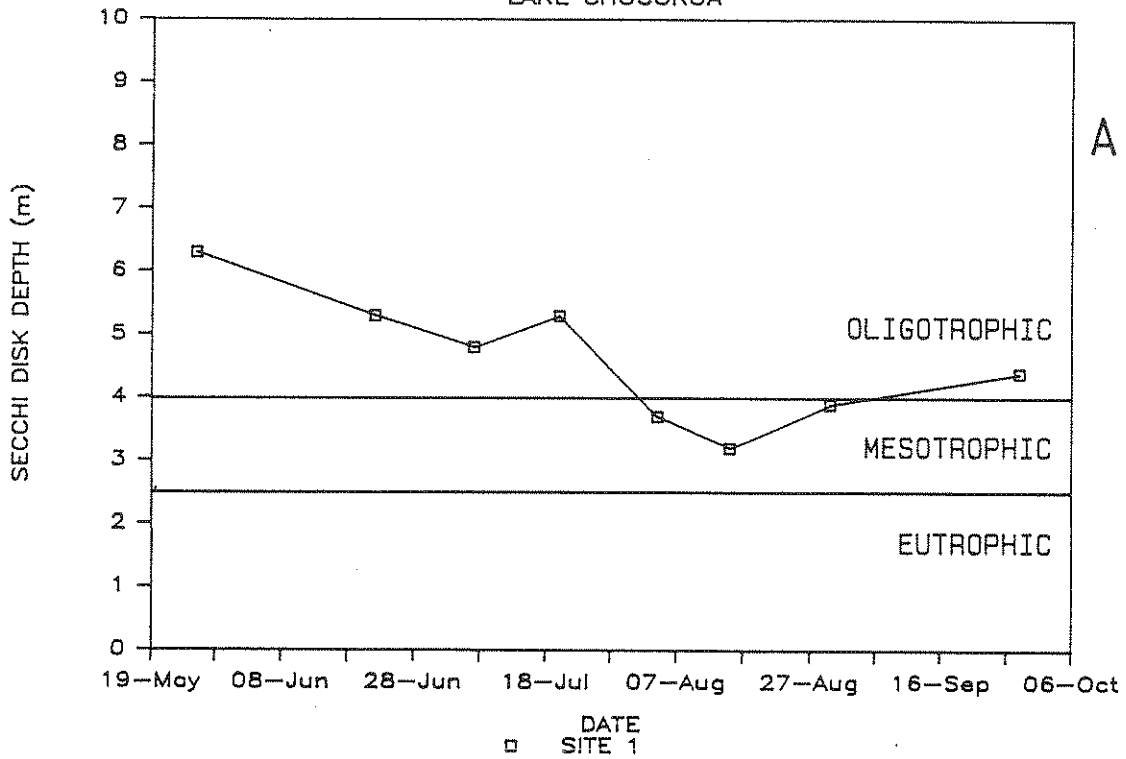
Dissolved Color

The dissolved color of lakes is generally due to dissolved organic matter from humic substances, which are naturally-occurring polyphenolic compounds leached from decayed vegetation. Highly colored or "stained" lakes have a "tea" color. Such substances generally do not threaten water quality except as they diminish sunlight penetration into deep waters.

Figure 3. - Seasonal trends for secchi disk depth (water transparency) (A) and chlorophyll a concentration (B) for Lake Chocorua determined from lay monitor data. Solid lines on the plots border the ranges common to oligotrophic, mesotrophic and eutrophic lakes.

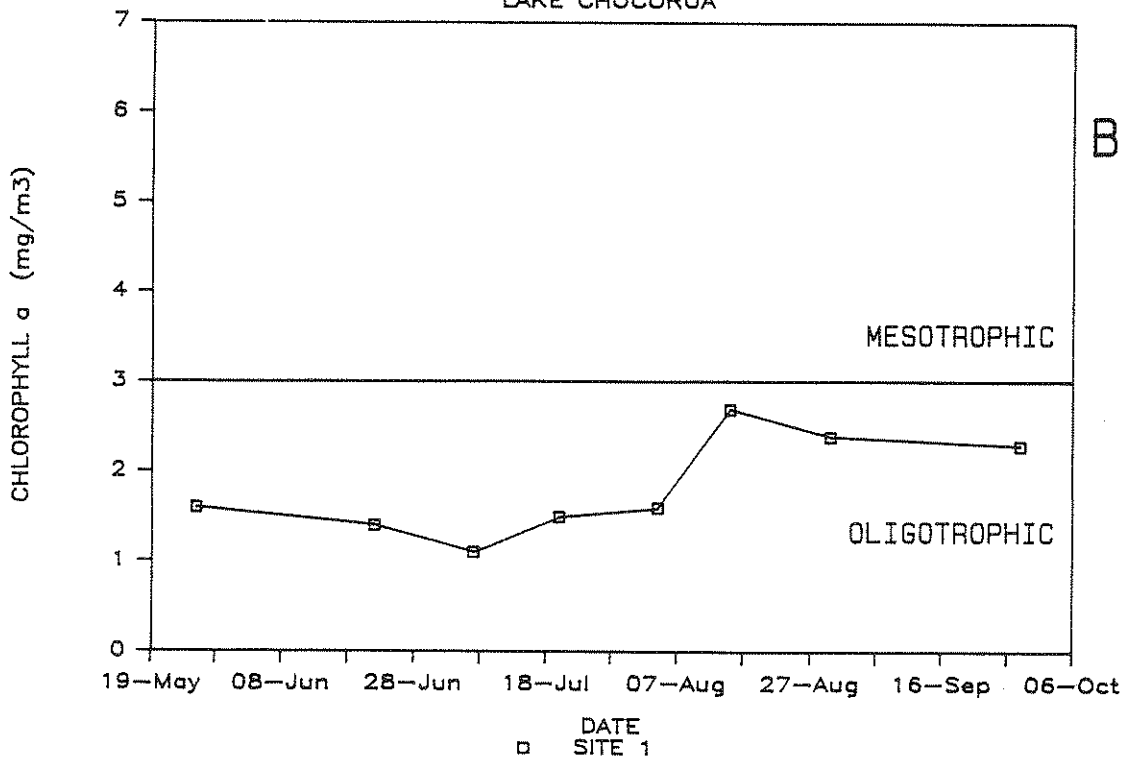
SECCHI DISK TRANSPARENCY

LAKE CHOCORUA



CHLOROPHYLL-a CONCENTRATION

LAKE CHOCORUA



A dissolved color of 32 ptu was measured on 20 July. To put the color level in perspective, dissolved color concentrations of all lakes participating in the LLMP in 1986 were in the range <1 to 117 ptu with an average of 18.5. Thus, Chocorua dissolved color was above average compared to all lakes in the program. The color values measured by the FBG on 2 August 1983 were 7.5 ptu. Measurements of color on a bi-weekly basis will allow for the determination of the extent of variation that occurs throughout the sampling season. With this knowledge the interpretation of secchi disk measurements is made easier.

Total Phosphorus

Of the two "nutrients" most important to the growth of aquatic plants, nitrogen and phosphorus, it is generally observed that phosphorus is the more limiting to plant growth, and therefore the more important to monitor and control. Phosphorus is generally present in lower concentrations, and its sources primarily originate from anthropogenic activity in a watershed. Nitrogen can be fixed from the atmosphere by many bloom-forming blue-green bacteria, and thus it is difficult to control. The total phosphorus includes all dissolved phosphorus as well as phosphorus contained in or adhered to suspended particulates such as sediment and plankton.

Phosphorus was measured as 10 ppb on 10 June at site 2 North near the inlet of the lake. This concentration is within the range common to oligotrophic lakes (less than 15 ppb). The concentration at this site was similar to June and July concentrations measured by the FBG in 1980 (6 to 10 ppb) but less than August 1983 concentrations measured at sites 1 and 2 (20 and 18 ppb respectively). To detect if nutrient loading is occurring at Chocorua, a sample taken early in the summer should be compared to a sample taken late in the summer when septic systems have been put through a full season's use.

Alkalinity

Alkalinity is a measure of the buffering capacity of the lake water. The higher the value the more acid that can be neutralized. Typically lakes in New Hampshire have low alkalinities due to the absence of carbonates and other natural buffering minerals in the bedrock of lake watersheds.

Alkalinities were in the range of 2.7 to 3.8 mg CaCO₃ liter⁻¹. These fall below the average of New Hampshire Lakes (9.0 mg CaCO₃ liter⁻¹) and the 1986 average of lakes participating in the LLMP program (6.0 mg CaCO₃ liter⁻¹). Decreasing alkalinity over a period of a few years can have serious effects on the lake ecosystem. In a study on an experimental acidified lake in Canada (Schindler et al 1985)

gradual lowering of the pH from 6.8 to 5.0 in an 8-year period resulted in the disappearance of some aquatic species, an increase in nuisance species of algae and a decline in the condition and reproduction rate of fish. During the first year of Schindler's study the pH remained unchanged while the alkalinity declined to 20 percent of the pre-treatment value. The decline in alkalinity was sufficient to trigger the disappearance of zooplankton species, which in turn caused a decline in the "condition" of fish species that fed on the zooplankton.

pH

The pH is a way of expressing the acidic level of lake water, and is measured with an electrical probe sensitive to hydrogen ion activity. The pH scale has a range of 1 (very acidic) to 14 (very "basic" or alkaline) and is logarithmic (ie: changes in 1 pH unit reflect an order of magnitude difference in hydrogen ion concentration). Most aquatic organisms tolerate a limited range of pH and most fish species require a pH of 5.5 or higher for successful growth and reproduction.

Lay monitor measured pH ranged from 6.2 to 6.8 pH units. Thus, the pH of Lake Chocorua is well within the optimum range for most aquatic organisms.

Dr. Baldwin also measured the pH and alkalinity of some local waters. The results are very interesting and are listed in Table 1.

TABLE 1- ADDITIONAL ALKALINITY TESTS

<u>Site</u>	<u>pH</u>	<u>ALKALINITY</u>
Waters near Chocorua:		
Slope deep in woods 1/4 mile from lake.	5.1	1.1 mg CaCO ₃ liter ⁻¹
Stratton Brook (Chocorua tributary)	6.1	3.4
Waters in Ossipee Range:		
Lovell River	6.5	4.6
Cold Brook	6.9	8.0
Bearcamp River	6.6	8.8

Note the higher pH values and greater alkalinity in the watershed containing the Ossipee Range.

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Lake Chocorua Data on file as of 05/03/1987

Lakes Lay Monitoring Program, U.N.H.

[Lay Monitor Data]

Lake Chocorua

-- subset of trophic indicators, all sites, 1982

1982 SUMMARY

Average transparency: 4.8 (1982: 4 values)
Average chlorophyll: 2.3 (1982: 2 values)

SITE	DA	SDD	CHL	TP	ALKG	ALKP	COLOR
1 South	08/16/1982	6.0	---	---	---	---	---
1 South	08/22/1982	4.6	---	---	---	---	---
1 South	08/28/1982	4.5	1.8	---	---	---	---
1 South	09/05/1982	4.0	2.7	---	---	---	---

<< End of 1982 listing, 4 records >>

Lake Chocorua Data on file as of 05/03/1987

Lakes Lay Monitoring Program, U.N.H.

[Lay Monitor Data]

Lake Chocorua

-- subset of trophic indicators, all sites, 1983

1983 SUMMARY

Average transparency: 4.8 (1983: 15 values)
 Average chlorophyll: 1.5 (1983: 18 values)

SITE	DA	SDD	CHL	TP	ALKG	ALKP	COLOR
1 South	04/08/1983	5.5	0.9	---	---	---	---
1 South	05/01/1983	---	1.1	---	---	---	---
1 South	05/16/1983	5.3	1.0	---	---	---	---
1 South	05/29/1983	---	0.3	---	---	---	---
1 South	06/12/1983	4.5	0.4	---	---	---	---
1 South	06/17/1983	3.3	3.7	---	---	---	---
1 South	06/23/1983	3.3	4.4	---	---	---	---
1 South	06/28/1983	---	1.3	---	---	---	---
1 South	07/01/1983	3.1	2.6	---	---	---	---
1 South	07/04/1983	5.4	0.6	---	---	---	---
1 South	07/10/1983	6.4	0.6	---	---	---	---
1 South	07/11/1983	3.5	5.4	---	---	---	---
1 South	07/16/1983	4.6	1.0	---	---	---	---
1 South	07/25/1983	5.5	0.9	---	---	---	---
1 South	08/10/1983	5.6	0.5	---	---	---	---
1 South	09/02/1983	6.0	0.7	---	---	---	---
1 South	09/25/1983	5.6	1.4	---	---	---	---
1 South	10/10/1983	5.0	1.0	---	---	---	---

<< End of 1983 listing, 18 records >>

Lake Chocorua Data on file as of 05/03/1987

Lakes Lay Monitoring Program, U.N.H.

[Lay Monitor Data]

Lake Chocorua

-- subset of trophic indicators, all sites, 1984

1984 SUMMARY

Average transparency: 4.8 (1984: 7 values)
 Average chlorophyll: 1.1 (1984: 6 values)

SITE	DA	SDD	CHL	TP	ALKG	ALKP	COLOR
1 South	07/05/1984	5.0	1.4	---	---	---	---
1 South	07/15/1984	4.0	1.6	---	---	---	---
1 South	07/21/1984	3.5	1.1	---	---	---	---
1 South	08/22/1984	5.0	---	---	---	---	---
1 South	08/30/1984	5.3	0.3	---	---	---	---
1 South	09/16/1984	5.5	1.0	---	---	---	---
1 South	10/07/1984	5.0	1.0	---	---	---	---

<< End of 1984 listing, 7 records >>

Lake Chocorua Data on file as of 05/03/1987

Lakes Lay Monitoring Program, U.N.H.

[Lay Monitor Data]

Lake Chocorua

-- subset of trophic indicators, all sites, 1985

1985 SUMMARY

Average transparency:	5.6	(1985:	9	values)
Average chlorophyll:	1.0	(1985:	9	values)
Average phosphorus:	15.9	(1985:	2	values)
Average alk (gray):	4.2	(1985:	5	values)
Average alk (pink):	4.9	(1985:	5	values)

SITE	DA	SDD	CHL	TP	ALKG	ALKP	COLOR
1 South	06/23/1985	6.4	0.6	---	---	---	---
1 South	06/24/1985	---	---	26.4	---	---	---
1 South	07/07/1985	6.2	1.1	---	---	---	---
1 South	07/19/1985	6.5	0.9	---	---	---	---
1 South	07/27/1985	5.9	0.7	---	4.8	5.4	---
1 South	08/06/1985	5.7	1.4	---	3.8	4.6	---
1 South	08/19/1985	5.2	1.6	---	---	---	---
1 South	08/28/1985	4.8	1.1	5.4	3.8	4.4	---
1 South	09/14/1985	4.9	0.6	---	4.0	4.8	---
1 South	10/12/1985	4.4	0.9	---	4.5	5.5	---

<< End of 1985 listing, 10 records >>

Lake Chocorua Data on file as of 05/03/1987

Lakes Lay Monitoring Program, U.N.H.

[Lay Monitor Data]

Lake Chocorua

-- subset of trophic indicators, all sites, 1986

1986 SUMMARY

Average transparency:	4.5	(1986:	9	values)
Average chlorophyll:	1.9	(1986:	9	values)
Average phosphorus:	9.5	(1986:	1	values)
Average alk (gray):	3.3	(1986:	8	values)
Average alk (pink):	4.0	(1986:	8	values)

SITE	DA	SDD	CHL	TP	ALKG	ALKP	COLOR
1 South	05/26/1986	6.3	1.6	---	---	---	---
1 South	06/22/1986	5.3	1.4	---	3.2	4.8	---
1 South	07/07/1986	4.8	1.1	---	3.2	4.0	---
1 South	07/20/1986	5.3	1.5	---	3.4	3.8	32.4
1 South	08/04/1986	3.7	1.6	---	3.2	3.9	---
1 South	08/15/1986	3.2	2.7	---	2.7	3.1	---
1 South	08/30/1986	3.9	2.4	---	3.5	4.0	---
1 South	09/28/1986	4.4	2.3	---	3.4	3.9	---
1 South	10/12/1986	3.3	2.4	---	3.8	4.4	---
2 North	06/10/1986	---	---	9.5	---	---	---

<< End of 1986 listing, 10 records >>