NIPPO LAKE

LAKES LAY MONITORING PROGRAM

1987

Freshwater Biology Group (FBG)

University of New Hampshire

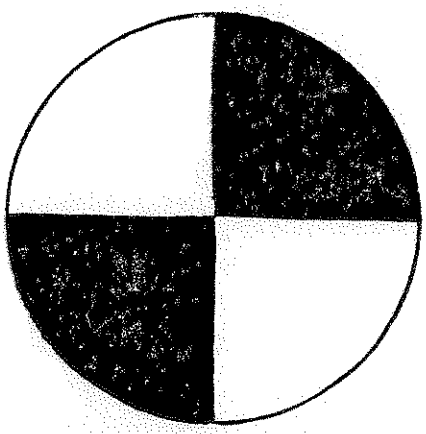
Durham

by

Jeffrey A. Schloss

Coauthored and edited by

A.L. Baker J.F. Haney



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.

PREFACE

This report contains the findings of a water quality survey of Nippo Lake, New Hampshire, conducted jointly by the Freshwater Biology Group (FBG) of the University of New Hampshire and the Nippo Lake Association in the summer of 1987.

The report is written with the concerned lake resident in mind and contains a brief, non-technical summary of 1987 results an "Introduction" to explain the program philosophy and a brief explanation of the various water quality tests that are taken. The description of methods and materials used by the lay monitors and the Freshwater Biology Group has been included in an appendix. While it is common practice to exclude this type of section from a "general" writing such as this, it is our goal to provide the association with a complete report which can stand on its own for comparison to past as well as future lake studies.

This is a Level I program report with a data listing and a brief summary. A more extensive report (Level II or III) is recommended after the lake has participated in the program for five years. While not generally included in reports of this level, some graphic data display has been included in the appendix to aid visual perspective. In addition, listings of data with statistical summaries appear in appendices. The more adventurous reader is referred to these last sections, as well as the materials cited in the references section, if there is interest in learning more about the dynamics of fresh water systems.

TABLE OF CONTENTS

ACKNOWLEDGEMENTS

This was the second year of participation in the Lakes Lay Monitoring Program (LLMP) for the Nippo Lake Association. The Lay Monitor was Bill Totherow. The Freshwater Biology Group (FBG) congratulates Bill on the quality of his work, and the time and effort put forth. We encourage other interested members of the Nippo Lake Association to continue monitoring during the 1988 season. We also thank Linda Brushett for her support.

The Freshwater Biology Group (FBG) is co-supervised by Dr. Alan Baker and Dr. James Haney and coordinated by Jeffrey Schloss. Members of the FBG summer field team included Jeff Schloss, Leanne Hussey Doerthe Fuhlendorf, Paul Schofield and Camilla Girgus. Jeff was responsible for arranging the field trips, training lay monitors, supervising the research team, data interpretation and report writing. Leanne and Camilla were responsible for the preparation of chemical solutions, chlorophyll analysis, and data entry. Paul was responsible for phosphorus chemistry and analysis. All team members participated in field work and chemical analyses. In the fall, Elizabeth Ferrari assisted in sample processing, data organization and data entry, Dan Helsel processed phosphorus samples and Annette Grace counted zooplankton and assisted the coordinator. The FBG also acknowledges Ann Meade for her time volunteered.

The FBG would like to thank the Institute for Marine Science and Ocean Engineering of the University of New Hampshire for the partial funding of the coordinator position. Eileen Wong of the Department Zoology provided accounting and secretarial service. The College of Life Science and Agriculture provided lab and storage facilities. 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 1987 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, Big Island Pond, Bow Lake Camp Owners, Lake Chocorua, Great East Lake, Lake Kanasatka Watershed, Langdon Cove, Long Island Landowners, Mendum's Pond, Merrymeeting Lake, Moultonbouro Bay, Lake Winnipesaukee, Naticook Lake, Newfound Lake, Nippo Lake, Pleasant Lake, Silver Lake (Madison), Squam Lake, Sunset Lake, Lake Winona, and Wentworth Lake and the towns of Alton, Amherst, Hollis, Merrimack and Strafford.

NON-TECHNICAL SUMMARY

As in previous years the general water quality of Nippo Lake was excellent.

1) Water transparency at the deep sites of the lake, measured by secchi disk was high, a sign of a clear, unproductive lake. The secchi disk was visible as far down as 7.0 meters (23 feet). This indicates the deepwater site on the lake is usually low in dissolved color and suspended matter such as algae and particulates. Transparency averages in 1987 were slightly lower than the previous year sampled.

2) Chlorophyll a concentrations for the surface waters of the deep sites of Nippo Lake were low and similar to levels measured for the previous year. Chlorophyll levels indicate the extent of algae growth in the water. Concentrations in the mixed layer of water (the upper 3.5 to 5 meters) averaged 1.4 milligrams per cubic meter (mg m^{-3}, equivalent to 1.4 parts chlorophyll per billion parts water). Generally, concentrations below 3 mg m^{-3} are indicative of less productive, clear lakes. Chlorophyll concentration approached more productive levels in early July and then generally decreased as the summer progressed.

3) Total phosphorus (nutrient) levels were low throughout Nippo Lake on the July date sampled. All sites had phosphorus concentrations well below the 15 parts per billion (ppb) level, commonly thought of as the boundary between less productive and more productive lakes.

4) The total alkalinity, the lakes ability to buffer acid input, remains low. Last year alkalinity values reached higher levels at the beginning of every month sampled. This year this only seemed to occur once, in mid-August. The alkalinity of Nippo Lake is less than half the average of all surveyed New Hampshire lakes. With low buffering capacity, Nippo Lake may be subject to pH stress during spring melt when acid loading is high.

INTRODUCTION

General Overview

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. 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 50 lakes throughout New Hampshire.

As a long-term research project, the LLMP is investigating the extent of lake degradation caused by perturbations such as acid rain, septic and agricultural runoff, and lakeshore development. Essentially, the volunteer 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. The long-term data base permits the detection of both short and long-term changes of the water quality of the lakes. Results from the program are presented at national and international meetings and published in international journals.

As part of its commitment to education through the University, the LLMP trains several undergraduate and graduate students each year to collect and analyze lakewater samples for physical, chemical and biological parameters, and to interpret water quality data. In addition, more than 350 "lay" monitors have been educated about lake water quality and trained to monitor their own lakes.

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 and support services provided by the University.

Program Philosophy

Frequent sampling over many years is required to resolve long-term trends and make predictions on the water quality of our lakes. Consider the hypothetical lake in Figure 1. Sampling only once a year during June from 1975 to 1981 would produce a plot (Fig. 1A) suggesting a decrease in eutrophication (the "greening" of a lake). The actual long-term trend of the lake, increasing eutrophy, can only be clearly discerned by sampling more frequently for a longer

INTRODUCTION

General Overview

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. 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 50 lakes throughout New Hampshire.

As a long-term research project, the LLMP is investigating the extent of lake degradation caused by perturbations such as acid rain, septic and agricultural runoff, and lakeshore development. Essentially, the volunteer 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. The long-term data base permits the detection of both short and long-term changes of the water quality of the lakes. Results from the program are presented at national and international meetings and published in international journals.

As part of its commitment to education through the University, the LLMP trains several undergraduate and graduate students each year to collect and analyze lakewater samples for physical, chemical and biological parameters, and to interpret water quality data. In addition, more than 350 "lay" monitors have been educated about lake water quality and trained to monitor their own lakes.

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 and support services provided by the University.

Program Philosophy

Frequent sampling over many years is required to resolve long-term trends and make predictions on the water quality of our lakes. Consider the hypothetical lake in Figure 1. Sampling only once a year during June from 1975 to 1981 would produce a plot (Fig. 1A) suggesting a decrease in eutrophication (the "greening" of a lake). The actual long-term trend of the lake, increasing eutrophy, can only be clearly discerned by sampling more frequently for a longer

EXPLANATION OF WATER TESTS

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. Secchi disk depths greater than 4 meters are typical of clear, less productive lakes. In 1987 values of water transparency at LLMP lakes were in the range 2.5 to 12 meters with a weighted average (by lake) of 6.4 meters.

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 concentrations of algae and aquatic plants due to nutrient enrichment. Summer chlorophyll a concentrations average above 7 mg m^{-3} (one milligram per liter is equivalent to 1 part per billion) **Oligotrophic** lakes have low productivity and low nutrient levels and average summer chlorophyll a concentrations are generally less than 3 mg m^{-3}. **Mesotrophic** lakes are intermediate in productivity with concentrations of chlorophyll a generally between 3 mg m^{-3} and 7 mg m^{-3}. In 1987 chlorophyll a concentrations in LLMP lakes were in the

range 0.1 to 7.1 mg m^{-3} with a weighted average (by lake) of 1.5 mg m^{-3}.

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. Color is commonly expressed in units of a platinum color standard (ptu). To put the color concentrations in perspective, New Hampshire Lakes studied in 1987 by the Freshwater Biology Group had a range of dissolved color of from essentially 0 ptu to 137 ptu with an unweighted average of 17 ptu.

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

EXPLANATION OF WATER TESTS

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. Secchi disk depths greater than 4 meters are typical of clear, less productive lakes. In 1987 values of water transparency at LLMP lakes were in the range 2.5 to 12 meters with a weighted average (by lake) of 6.4 meters.

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 concentrations of algae and aquatic plants due to nutrient enrichment. Summer chlorophyll a concentrations average above 7 mg m^{-3} (one milligram per liter is equivalent to 1 part per billion) **Oligotrophic** lakes have low productivity and low nutrient levels and average summer chlorophyll a concentrations are generally less than 3 mg m^{-3}. **Mesotrophic** lakes are intermediate in productivity with concentrations of chlorophyll a generally between 3 mg m^{-3} and 7 mg m^{-3}. In 1987 chlorophyll a concentrations in LLMP lakes were in the

range 0.1 to 7.1 mg m^{-3} with a weighted average (by lake) of 1.5 mg m^{-3}.

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. Color is commonly expressed in units of a platinum color standard (ptu). To put the color concentrations in perspective, New Hampshire Lakes studied in 1987 by the Freshwater Biology Group had a range of dissolved color of from essentially 0 ptu to 137 ptu with an unweighted average of 17 ptu.

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

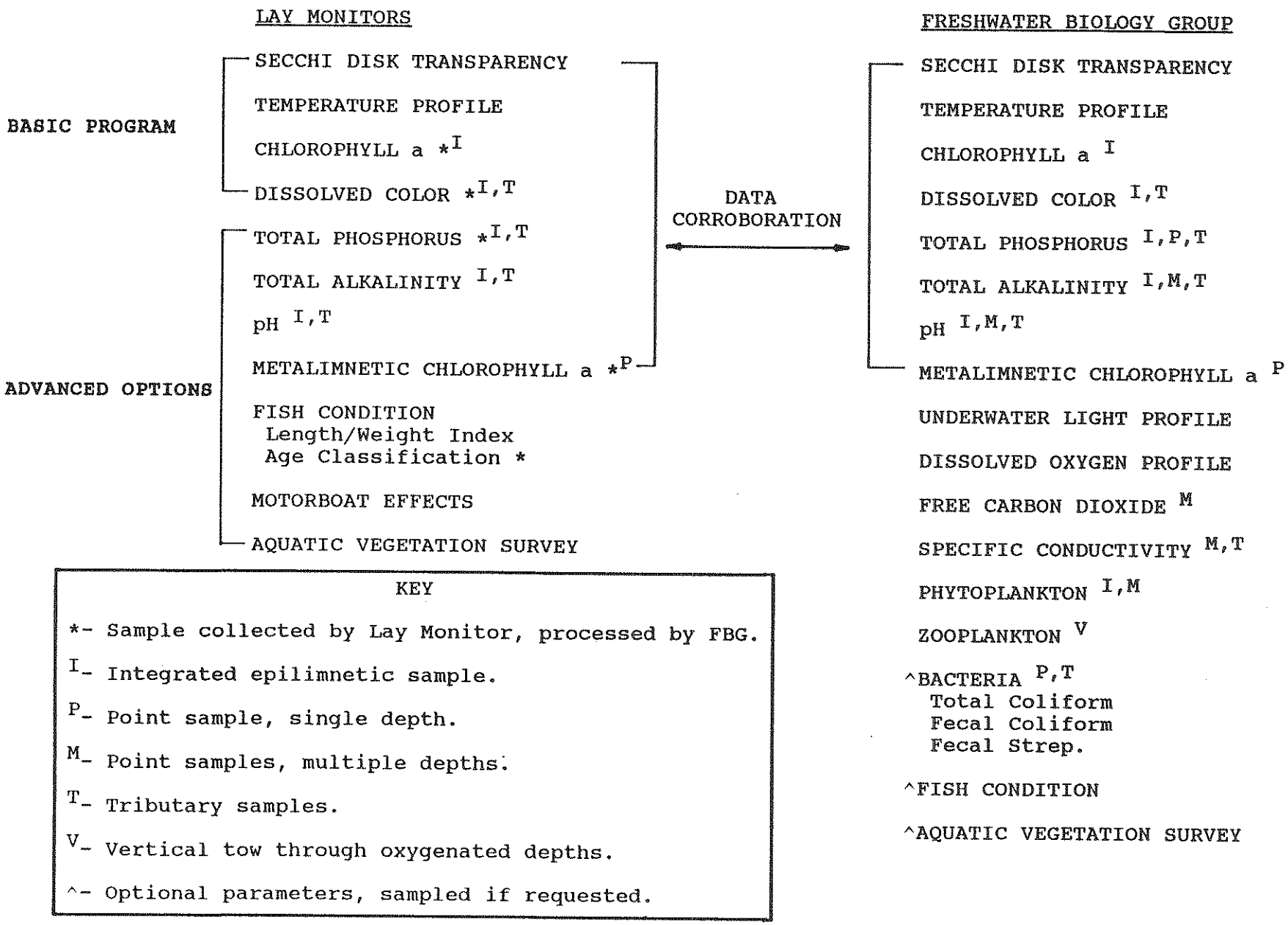
oxygen during the day, but respire at night along with the aquatic animals and bacteria. Carbon dioxide usually accumulates in the bottom waters of more productive systems where large amounts of organic material, produced within and around the lake, support large bacterial populations. Breakdown of organic matter, respiration and fermentation, by the bacteria in the water and sediments, consumes oxygen and releases carbon dioxide. Increases in dissolved carbon dioxide result in the decrease of the lakewater pH.

oxygen during the day, but respire at night along with the aquatic animals and bacteria. Carbon dioxide usually accumulates in the bottom waters of more productive systems where large amounts of organic material, produced within and around the lake, support large bacterial populations. Breakdown of organic matter, respiration and fermentation, by the bacteria in the water and sediments, consumes oxygen and releases carbon dioxide. Increases in dissolved carbon dioxide result in the decrease of the lakewater pH.

Figure 1. Hypothetical example of a situation where limited sampling of a lake can be very deceptive. The upper graph (A) depicts the results of sampling only once a year during June. The indicated trend seems to be that of decreasing eutrophy. However, weekly sampling of the same lake over a longer period of time lake would produce the lower graph (B). The actual long-term trend is that of increasing eutrophy. The circled area in the lower graph is an enlagerment of the data-set used to produce the upper graph.

Figure 1. Hypothetical example of a situation where limited sampling of a lake can be very deceptive. The upper graph (A) depicts the results of sampling only once a year during June. The indicated trend seems to be that of decreasing eutrophy. However, weekly sampling of the same lake over a longer period of time lake would produce the lower graph (B). The actual long-term trend is that of increasing eutrophy. The circled area in the lower graph is an enlagerment of the data-set used to produce the upper graph.

LAKES LAY MONITORING PROGRAM - PARAMETERS SAMPLED



KEY

*- Sample collected by Lay Monitor, processed by FBG.

I- Integrated epilimnetic sample.

P- Point sample, single depth.

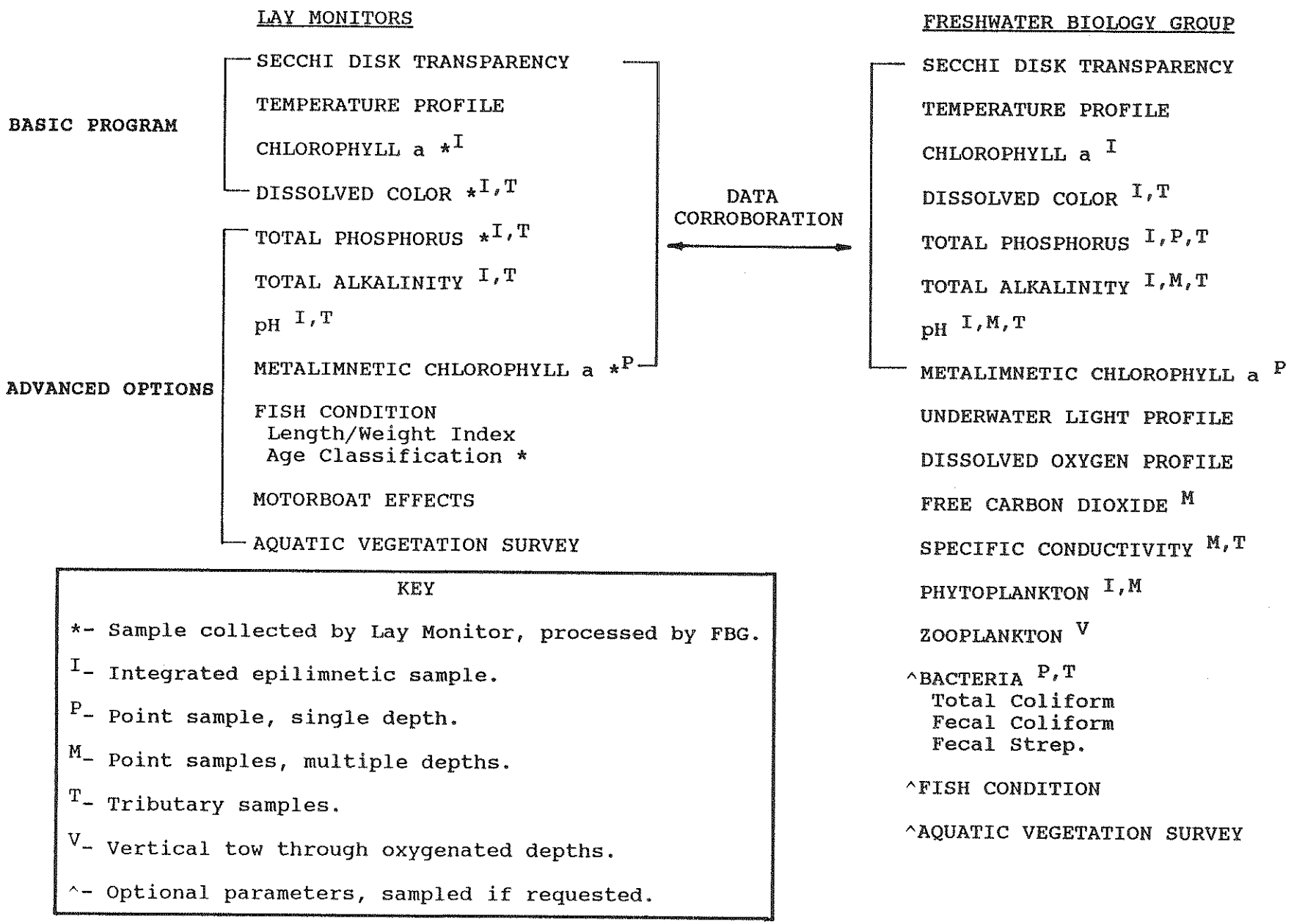
M- Point samples, multiple depths.

T- Tributary samples.

V- Vertical tow through oxygenated depths.

^- Optional parameters, sampled if requested.

LAKES LAY MONITORING PROGRAM - PARAMETERS SAMPLED



KEY

*- Sample collected by Lay Monitor, processed by FBG.

I- Integrated epilimnetic sample.

P- Point sample, single depth.

M- Point samples, multiple depths.

T- Tributary samples.

V- Vertical tow through oxygenated depths.

^- Optional parameters, sampled if requested.

Nippo Lake Data on file as of 04/16/1988

Lakes Lay Monitoring Program, U.N.H.

[Lay Monitor Data]

Nippo Lake
-- subset of trophic indicators, all sites, 1986

1986 SUMMARY

Average transparency:	6.4	(1986:	8 values)
Average chlorophyll:	1.1	(1986:	7 values)
Average phosphorus:	0.8	(1986:	3 values)
Average alk (gray):	5.4	(1986:	7 values)
Average alk (pink):	5.9	(1986:	7 values)

Site	Date	Trans-parency (m)	Chl a (ppb)	Total Phos (ppb)	Alk. (gray) ph 5.1	Alk. (pink) ph 4.6	Color Pt-Co units
1 Deep	07/05/1986	6.6	1.9	---	9.2	10.0	---
1 Deep	07/11/1986	6.0	1.5	---	4.0	4.5	---
1 Deep	07/18/1986	6.5	0.7	0.5	3.6	4.0	---
1 Deep	07/25/1986	6.5	---	---	3.9	4.4	---
1 Deep	08/01/1986	6.4	0.8	---	10.0	10.6	---
1 Deep	08/08/1986	6.0	0.9	---	---	---	---
1 Deep	08/15/1986	6.8	0.5	---	3.8	4.1	---
1 Deep	08/22/1986	6.3	1.5	---	3.6	3.9	---
2 South	07/18/1986	---	---	1.5	---	---	---
3 North	07/18/1986	---	---	0.5	---	---	---

<< End of 1986 listing, 10 records >>

Nippo Lake Data on file as of 04/16/1988

Lakes Lay Monitoring Program, U.N.H.

[Lay Monitor Data]

Nippo Lake
-- subset of trophic indicators, all sites, 1987

1987 SUMMARY

Average transparency:	6.2	(1987:	10 values)
Average chlorophyll:	1.4	(1987:	10 values)
Average alk (gray):	3.8	(1987:	10 values)
Average alk (pink):	4.3	(1987:	10 values)

Site	Date	Trans-parency (m)	Chl a (ppb)	Total Phos (ppb)	Alk. (gray) ph 5.1	Alk. (pink) ph 4.6	Color Pt-Co units
1 Deep	06/28/1987	6.0	2.3	---	3.0	3.4	---
1 Deep	07/04/1987	6.5	2.6	---	3.6	3.9	---
1 Deep	07/11/1987	5.6	1.1	---	3.7	4.2	---
1 Deep	07/17/1987	5.5	1.5	---	3.4	3.8	---
1 Deep	07/24/1987	6.3	2.0	---	3.6	4.5	---
1 Deep	08/01/1987	6.0	0.7	---	3.6	4.2	---
1 Deep	08/09/1987	6.5	0.6	---	3.5	4.1	---
1 Deep	08/14/1987	7.0	0.7	---	6.4.	6.9	---
1 Deep	08/21/1987	6.0	1.0	---	3.6	4.1	---
1 Deep	08/30/1987	7.0	1.4	---	3.3	3.8	---

<< End of 1987 listing, 10 records >>

Nippo Lake Data on file as of 04/16/1988

Lakes Lay Monitoring Program, U.N.H.

[Lay Monitor Data]

Nippo Lake
-- subset of trophic indicators, all sites, 1986

1986 SUMMARY

Average transparency:	6.4	(1986:	8 values)
Average chlorophyll:	1.1	(1986:	7 values)
Average phosphorus:	0.8	(1986:	3 values)
Average alk (gray):	5.4	(1986:	7 values)
Average alk (pink):	5.9	(1986:	7 values)

Site	Date	Trans-parency (m)	Chl a (ppb)	Total Phos (ppb)	Alk. (gray) ph 5.1	Alk. (pink) ph 4.6	Color Pt-Co units
1 Deep	07/05/1986	6.6	1.9	---	9.2	10.0	---
1 Deep	07/11/1986	6.0	1.5	---	4.0	4.5	---
1 Deep	07/18/1986	6.5	0.7	0.5	3.6	4.0	---
1 Deep	07/25/1986	6.5	---	---	3.9	4.4	---
1 Deep	08/01/1986	6.4	0.8	---	10.0	10.6	---
1 Deep	08/08/1986	6.0	0.9	---	---	---	---
1 Deep	08/15/1986	6.8	0.5	---	3.8	4.1	---
1 Deep	08/22/1986	6.3	1.5	---	3.6	3.9	---
2 South	07/18/1986	---	---	1.5	---	---	---
3 North	07/18/1986	---	---	0.5	---	---	---

<< End of 1986 listing, 10 records >>

Nippo Lake Data on file as of 04/16/1988

Lakes Lay Monitoring Program, U.N.H.

[Lay Monitor Data]

Nippo Lake
-- subset of trophic indicators, all sites, 1987

1987 SUMMARY

Average transparency:	6.2	(1987:	10	values)
Average chlorophyll:	1.4	(1987:	10	values)
Average alk (gray):	3.8	(1987:	10	values)
Average alk (pink):	4.3	(1987:	10	values)

Site	Date	Trans-parency (m)	Chl a (ppb)	Total Phos (ppb)	Alk. (gray) ph 5.1	Alk. (pink) ph 4.6	Color Pt-Co units
1 Deep	06/28/1987	6.0	2.3	---	3.0	3.4	---
1 Deep	07/04/1987	6.5	2.6	---	3.6	3.9	---
1 Deep	07/11/1987	5.6	1.1	---	3.7	4.2	---
1 Deep	07/17/1987	5.5	1.5	---	3.4	3.8	---
1 Deep	07/24/1987	6.3	2.0	---	3.6	4.5	---
1 Deep	08/01/1987	6.0	0.7	---	3.6	4.2	---
1 Deep	08/09/1987	6.5	0.6	---	3.5	4.1	---
1 Deep	08/14/1987	7.0	0.7	---	6.4.	6.9	---
1 Deep	08/21/1987	6.0	1.0	---	3.6	4.1	---
1 Deep	08/30/1987	7.0	1.4	---	3.3	3.8	---

<< End of 1987 listing, 10 records >>

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. A sample of the filtrate was poured into a 60 ml plastic bottle for the determination of dissolved water color. These filters and bottles were delivered to UNH where members of the FBG analyzed them for chlorophyll a and dissolved water color (see Methods of the Freshwater Biology Group).

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. A sample of the filtrate was poured into a 60 ml plastic bottle for the determination of dissolved water color. These filters and bottles were delivered to UNH where members of the FBG analyzed them for chlorophyll a and dissolved water color (see Methods of the Freshwater Biology Group).

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. Phytoplankton are reported both as species and classes. Crustacean zooplankton were classified into one of four categories depending on their size (large or small) and their feeding preferences (herbivore or predator) with a modified version of criteria from Sprules (1980). The

differences in abundance between the different groups allow for a more complete description of the zooplankton community and the trophic classification of lakes.

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. Phytoplankton are reported both as species and classes. Crustacean zooplankton were classified into one of four categories depending on their size (large or small) and their feeding preferences (herbivore or predator) with a modified version of criteria from Sprules (1980). The

differences in abundance between the different groups allow for a more complete description of the zooplankton community and the trophic classification of lakes.