NIPPO LAKE
1989
LAKES LAY MONITORING PROGRAM

by

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edited by

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NEW HAMPSHIRE LAKES LAY MONITORING PROGRAM

NH LLMP

FRESHWATER BIOLOGY GROUP
University of New Hampshire
Durham

UNIVERSITY OF NEW HAMPSHIRE COOPERATIVE EXTENSION
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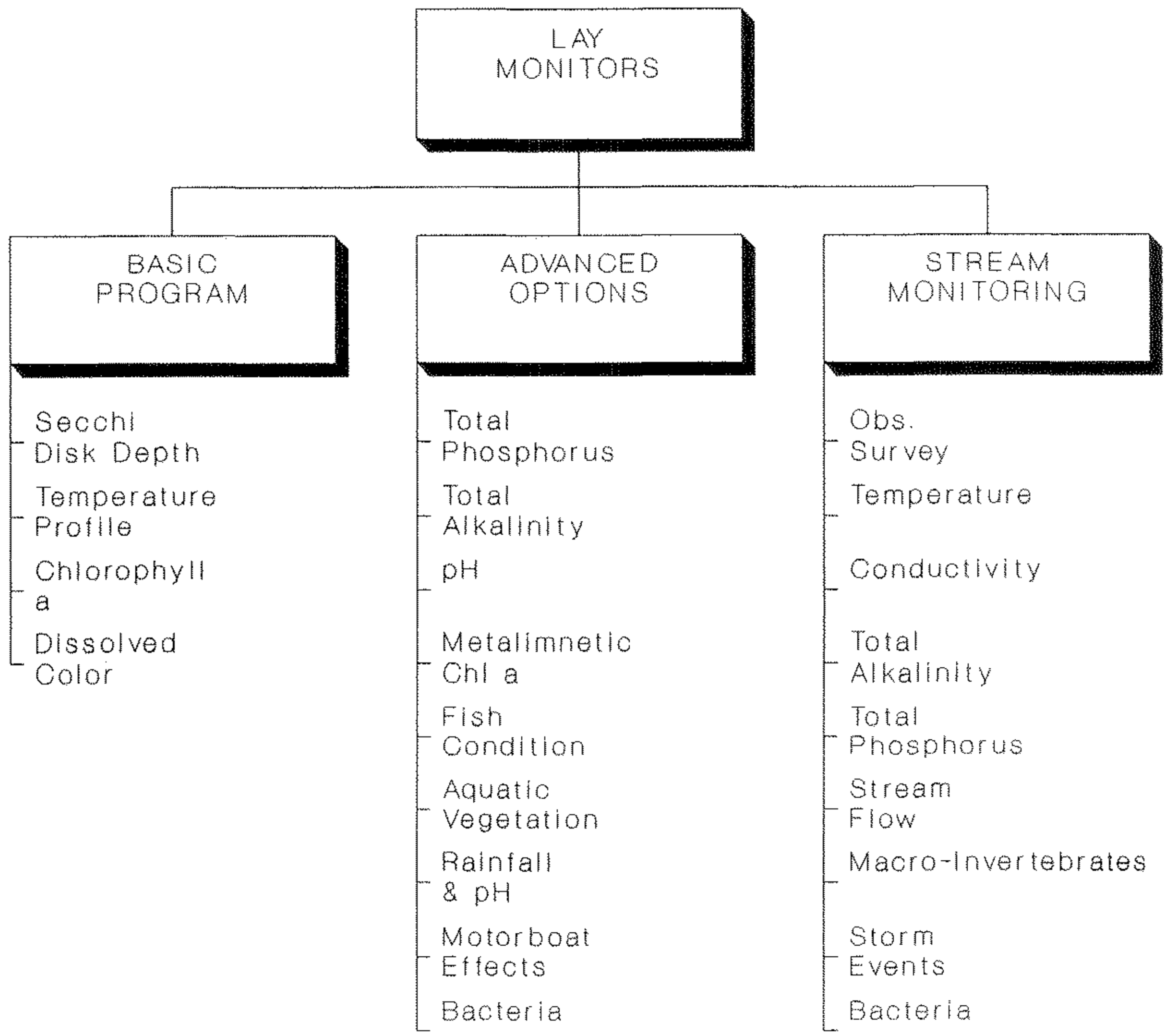
To obtain more information about the NH Lakes Lay Monitoring Program (NH LLMP) contact the Coordinator (J.Schloss) at (603) 862-3848
Dr. Baker at 862-3845 or Dr. Haney at 862-2106

PARAMETERS SAMPLED

NH LAKES LAY MONITORING PROGRAM



FBG Team corraborate tests above and sample plankton

PREFACE

This report contains the findings of a water quality survey of Nippo Lake, New Hampshire, conducted in the summer of 1989 by the Freshwater Biology Group (**FBG**) of the University of New Hampshire and the Nippo Lake Association.

The report is written with the concerned lake resident in mind and contains a brief, non-technical summary of 1989 results as well as more detailed "Introduction" and "Discussion" sections. Graphic display of data is included, in addition to listings of data in appendices, to aid visual perspective.

ACKNOWLEDGEMENTS

This was the fourth year of participation in the Lakes Lay Monitoring Program (**LLMP**) for the Nippo Lake monitors. The Lay Monitor and coordinator for Nippo Lake was William 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 1990 season.

The Freshwater Biology Group is a not-for-profit research program co-supervised by Dr. Alan Baker and Dr. James Haney and coordinated by Jeffrey Schloss. Members of the **FBG** summer field team included Jeffrey Schloss, Kathleen Maroney, Beth Ferrari, Barent Rice, Maura Callahan, Elizabeth LaPointe and David Cederholm. Other **FBG** staff assisting in the fall were: Bonnie Bruce, Roger Caron, Robert Craycraft and John Ferraro.

The **FBG** acknowledges the University of New Hampshire Cooperative Extension for funding and furnishing office, laboratory and storage space. The Department of Plant Biology provided accounting support and the UNH Office of Computer Services provided computer time and data storage allocations.

Participating groups in the **LLMP** include: The New Hampshire Audubon Society, Derry Conservation Commission, Dublin Garden Club, 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 Pemaquid Watershed Study Group, the associations of Baboosic Lake, Beaver Lake, Berry Bay, Big Island Pond, Bow Lake Camp Owners, Lake Chocorua, Crystal Lake, Dublin Lake, Goose Pond, Great East Lake, Lake Kanasatka Watershed, Langdon Cove, Long Island Landowners, Lovell Lake, Mascoma Lake, Mendum's Pond, Merrymeeting Lake, Moultonbouro Bay, Lake

Winnipesaukee, Naticook Lake, Newfound Lake, Nippo Lake, Perkins Pond, Pleasant Lake, Silver Lake (Hollis), Silver Lake (Harrisville), Silver Lake (Madison), Squam Lakes, Lake Sunapee, Sunset Lake, Lake Winona, and Wentworth Lake and the towns of Alton, Amherst, Hollis, Madison, Merrimack, Strafford and Wolfeboro.

NIPPO LAKE

1989 NON-TECHNICAL SUMMARY

Weekly monitoring was undertaken at Nippo Lake by the volunteer monitors.

1) Water transparency at Nippo Lake was moderate, the sign of a somewhat productive lake. The secchi disk was visible as far down as 5.5 meters (18 feet) but averaged only 4.3 meters. This indicates the deep-water site on the lake is moderate to low in dissolved color and/or suspended matter such as algae and particulates. Secchi disk depths averaged a full meter less in 1989 compared to the previous year. High chlorophyll levels (see below) suggest algal blooms are responsible for this decrease in water transparency.

2) Chlorophyll a concentrations for the surface waters of Nippo Lake were low to moderate. Peaks in chlorophyll concentration occurred in late June, early July and again in late August. Chlorophyll levels indicate the extent of algae growth in the water. Concentrations in the mixed layer of water averaged 3.1 milligrams per cubic meter (mg m^{-3}, equivalent to about 3.1 parts chlorophyll per billion parts water). Generally, concentrations below 3 mg m^{-3} are common to less productive, clear lakes and values above 7 mg m^{-3} are common in productive lakes. The 1989 chlorophyll was higher than the 1988 average.

3) The alkalinity of the lake is low, and about 2 units less than the average alkalinity of 6 units for other LLMP program lakes. The data indicate that Nippo Lake has a low buffering capacity at this time to resist fluctuations in pH due to acid loadings.

4) Monitor temperature profiles at the deep site disclosed the typical temperature stratification patterns for medium depth northern temperate lakes.

5) For all measurements considered and averaged for the season, Nippo Lake would be classified as having intermediate productivity, a moderately clear, mesotrophic lake. Early warming of the lake waters due to the limited snow-melt in the winter of 1988-89 might have caused the increase in algal growth this past summer as many program lakes displayed higher chlorophylls in this year compared to past years. As lake transparency has decreased and the lake algal levels have increased since 1986, continued monitoring will be important to track the extent and the rate of decline in water quality occurring.

INTRODUCTION

The New Hampshire Lakes Lay Monitoring Program

During the past decade the NH Lakes Lay Monitoring Program has grown from a university class project on Chocorua Lake to a comprehensive state-wide program with over 500 volunteer monitors and more than 75 lakes participating. Originally developed to establish a data-base for determining long-term trends of lake water quality for science and management, the program has expanded by taking advantage of the many resources that citizen monitors can provide. Current projects include: use of volunteer generated data for non-point pollution studies using a geographic based information system (GIS) in conjunction with the NH Office of State Planning, intensive watershed monitoring for the development of lake nutrient budgets, investigations of water quality and indicator organisms (fish condition, and stream invertebrates), and ground-truthing for remote sensing studies. Key ingredients responsible for the success of the program include innovative funding and cost reduction, assurance of credibility of data, practical sampling protocols and, most importantly, the interest and motivation of our volunteer monitors.

Importance of Long-term Monitoring

A major goal of a monitoring program is to identify any short or long-term changes in the water quality of the lake. Of major concern is the detection of cultural eutrophication: increases in the productivity of the lake, the amount of algae and plant growth, 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, as New Hampshire receives large amounts of acid precipitation, yet most of our lakes contain little mineral content to neutralize this type of pollution.

For over a decade, data collected weekly from lakes participating in the **New Hampshire Lakes Lay Monitoring Program** have indicated there is quite a variation in water quality indicators through the open water season on the majority of lakes. Short-term differences may be due to variations in weather, lake use, or other chance events. Monthly sampling of a lake during a single summer provides some useful information, but there is a greater chance that important short-term events such as algal blooms or the lake response to storm run-off will be missed. These short-term fluctuations may be unrelated to the actual long-term trend of a lake or they may be indicative of the changing status or "health" of a lake.

To determine if a change in water quality is occurring, a lake must be sampled on a frequent basis over a substantial amount of time. A poorly designed sampling program may even mislead the investigator away from the actual trend: Consider the hypothetical lake in Figure 1. Sampling only once a year during August from 1982 to 1981 would produce a plot (Fig. 2) suggesting a decrease in eutrophication. The actual long-term trend of the lake, increasing eutrophy, can only be clearly discerned by sampling additional times a year for a ten year period (Fig. 1). Frequent monitoring carried out 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, the lake must establish a long-term data base.

The number of seasons it takes to distinguish 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. In addition, different areas of a lake may show a different response. 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 the location of 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 in the NH Lakes Lay Monitoring Program. 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.

We are pleased with the interest and commitment of our lay monitors and are proud that their work is what makes the **NH LLMP** the most extensive, and we believe, the best volunteer program of its kind.

Purpose and Scope of This Study

This was the fourth year that monitoring of Nippo Lake was undertaken by the Freshwater Biology Group and the Nippo Lake Association. The program of sampling was designed to continue adding data to the long-term data base established. Sampling emphasis was placed on one open water deep station. A more in-depth study of the deep lake site was undertaken by the FBG in a previous year.

The primary purpose of this report is to discuss results of the 1989 monitoring with emphasis on current conditions of Nippo Lake including the extent of eutrophication and the lake's susceptibility to increasing acid precipitation. This information is part of a large data base of historical and more recent data compiled and entered onto computer files for New Hampshire lakes that include New Hampshire Fish and Game surveys of the 1930's, the surveys by the New Hampshire Water Supply and Pollution Control Commission and the FBG surveys. Care must be taken when comparing current results with early studies. Many complications arise due to methodological differences of the various testing facilities and technological improvements in testing.

DISCUSSION OF LAKE MONITORING MEASUREMENTS

The section below details the important concepts involved for the various testing procedures used in the New Hampshire Lakes Lay Monitoring Program. Where appropriate, summary statistics of 1989 results from all participating lakes are included. Certain tests or sampling performed at the time of the optional Freshwater Biology Group field trip are indicated by an asterisk (*).

Thermal Stratification in the Deep Water Sites

Lakes in New Hampshire display distinct patterns of temperature stratification, that develop as the summer months progress, where a layer of warmer water (the **epilimnion**) overlies a deeper layer of cold water (**hypolimnion**). The layer that separates the two regions characterized by a sharp drop in temperature with depth is called the **thermocline** or **metalimnion**. Some shallow lakes may be continually mixed by wind action and will never stratify. Other lakes may only contain a developed epilimnion and metalimnion.

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.

In the shallow areas of many lakes, the secchi disk will hit bottom before it is able to disappear from view (what is referred to as a "Bottom Out" condition). Thus, Secchi disk measurements are generally taken over the deepest sites of a lake. Transparency values of greater than 4 meters are typical of clear, less productive lakes.

Values less than 2.5 meters are generally an indication of a very productive lake. In 1989 the average transparency for lakes participating in the NH LLMP was 6.2 meters with a range of 1.4 to 12.5 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. Characteristics include accumulated organic matter in the lake basin and lower dissolved oxygen in the bottom waters. Summer chlorophyll a concentrations average above 7 mg m^{-3} (7 milligrams per cubic meter; 7 parts 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}. These lakes generally have cleaner bottoms and high dissolved oxygen levels throughout. **Mesotrophic** lakes are intermediate in productivity with concentrations of chlorophyll a generally between 3 mg m^{-3} and 7 mg m^{-3}. In 1989 the average chlorophyll for lakes participating in the NH LLMP was 2.8 mg m^{-3} with a range of 0.1 to 54.4 mg m^{-3}.

Testing is sometimes done to check for **metalimnetic algal populations**, algae that layer out at the thermocline and generally go undetected if only epilimnetic (point or integrated) sampling is undertaken. Chlorophyll concentrations of a water sample collected in the thermocline is compared to the integrated epilimnetic sample. Greater chlorophyll levels of the point sample, in conjunction with microscopic examination of the samples (see Phytoplankton section below), confirm the presence of such a population of algae. These populations should be monitored as they may be an indication of increased nutrient loading into the lake.

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. Increases in dissolved watercolor can be an indication of increased development within the watershed as many land clearing activities (construction, deforestation, and the resulting increased run-off) add additional organic material to lakes. Natural fluctuations of dissolved color occur when storm events increase drainage from wetlands areas within the watershed. As suspended sediment is a difficult and expensive test to undertake, both dissolved color and chlorophyll information is important when interpreting the secchi disk transparency.

Dissolved color is measured on a comparative scale that uses standard chloroplatinate dyes and is designated as a color unit or ptu. Lakes with color below 10 ptu are very clear, 10 to 20 ptu are slightly colored, 20 to 40 ptu are lightly tea colored, 40 to 80 ptu are tea colored and greater than 80 ptu indicates highly colored waters. Generally the majority of New Hampshire lakes have color between 20 to 30 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 arise primarily through human related 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. As little as 15 parts per billion of phosphorus in a lake can cause an algal bloom.

Generally, in the more pristine lakes, phosphorus values are higher after spring melt when the lake receives the majority of runoff from its surrounding watershed. The nutrient is used by the algae and plants which in turn die and sink to the lake bottom causing phosphorus to decrease as the summer progresses. Lakes with nutrient loading from human activities and sources (Agriculture, Sediment Erosion, Septic Systems, etc) will show greater concentrations of nutrients as the summer progresses or after major storm events. Circulation of nutrients from the bottom waters of more productive lakes in late fall can result in algal blooms.

pH *

The pH is a way of expressing the acidic level of lake water, and is generally 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 a ten times 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.

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 and soils of lake watersheds.

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 by Schindler, 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.

The analysis of alkalinity employed by the **Freshwater Biology Group** includes use of a dilute titrant allowing an order of magnitude greater sensitivity and precision than the standard method. Two endpoints are recorded during each analysis. The first endpoint (grey color of dye; pH endpoint of 5.1) approximates low level alkalinity values, while the second endpoint (pink dye color; pH endpoint of 4.6) approximates the alkalinity values recorded historically, such as NH Fish and Game data, with the methyl-orange endpoint method.

The average alkalinity of lakes throughout New Hampshire is low, approximately 9 mg per liter (calcium carbonate alkalinity), while the average alkalinity of the lakes studied by the **Freshwater Biology Group** in the NH LLMP is approximately 6.0 mg per liter. When alkalinity falls below 2 mg per liter the pH of waters can greatly fluctuate. Alkalinity levels are most critical in the spring when acid loadings from snowmelt and run-off are high, and many aquatic species are in their early, and most susceptible, stages of their life cycle.

Specific Conductivity *

The specific conductance of a water sample indicates concentrations of dissolved salts. Leaking septic systems and deicing salt runoff from highways can cause high conductivity values. Fertilizers and other pollutants can also increase the conductivity of the water. Conductivity is measured in **micromhos** (the opposite of the measurement of resistance **ohms**) per centimeter, more commonly referred to as micro-Siemans.

<u>Dissolved Oxygen and Free Carbon Dioxide</u> *

Oxygen is an essential component for the survival of aquatic life. Submergent plants and algae take in free carbon dioxide and create oxygen through **photosynthesis** by day. **Respiration** by both animals and plants uses up oxygen continually and creates **carbon dioxide**. Dissolved oxygen profiles determine the extent of declining oxygen concentrations in the lower waters. High carbon dioxide values are indicative of low oxygen conditions and accumulating organic matter. For both gases, as the temperature of the water decreases, more gas can be dissolved in the water.

The typical pattern of clear, unproductive lakes is a slight decline in hypolimnetic oxygen as the summer progresses. Oxygen in the lower waters is important for maintaining a fit, reproducing, cold water fishery. Trout and salmon generally require oxygen concentrations above 5 mg per liter (parts per million) in the cool deep waters. On the other hand, carp and catfish can survive very low oxygen conditions. Oxygen above the lake bottom is important in limiting the release of nutrients from the sediments and minimizing the collection of undecomposed organic matter.

Bacteria, fungi and other **decomposers** in the bottom waters break down organic matter originating from the watershed or generated by the lake. This process uses up oxygen and produces carbon dioxide. In lakes where organic matter accumulation is high, oxygen depletion can occur. In highly stratified eutrophic lakes the entire hypolimnion can remain unoxygenated or **anaerobic** until fall mixing occurs.

The oxygen peaks occurring at surface and mid-lake depths during the day are quite common in many lakes. These characteristic **heterograde oxygen curves** are the result of the large amounts of oxygen, the by-product of photosynthesis, collecting in regions of high algal concentrations. If the peak occurs in the thermocline of the lake, metalimnetic algal populations (discussed above) may be present.

Underwater Light *

Underwater light available to photosynthetic organisms is measured with an **underwater photometer** which is much like the light meter of a camera (only waterproofed !). The **photic zone** of a lake is the volume of water capable of supporting photosynthesis. It is generally considered to be delineated by the water's surface and the level where light is reduced, by the absorption and scattering properties of the lake water, to one percent of the surface intensity. The one percent depth is sometimes termed the **compensation depth.** Knowledge of light penetration is important when considering lake productivity and in studies of submerged vegetation. Discontinuity (abrupt changes in the slope) of the profiles could be due to metalimnetic layering of algae or other particulates (discussed above). The underwater photometer allows the investigator to measure light at depths below the Secchi disk depth to supplement the transparency information.

Indicator Bacteria *

Coliform bacteria in water indicate the possibility of fecal contamination. Although they are usually considered harmless to humans, they are much easier to test for than harmful pathogenic enteric bacteria (**Salmonella, Shigella** etc.) and viruses that may be present in fecal material. **Total coliform** includes all coliform bacteria which arise from the gut of animals or from vegetative materials. **Fecal coliform** are those specific organisms that inhabit the gut of warm blooded animals. Another indicator organism **Fecal streptococcus** (sometimes referred to as **enterococcus**) also can be monitored. The ratio of fecal coliform to fecal strep may be useful in suggesting the type of animal source responsible for the contamination. Desirable levels for a Class A water body is less than 50 total coliform organisms per 100 milliliters. If the coliform level rises above 150 organisms per 100ml swimming should be prohibited.

Ducks and geese are often a common cause of high concentrations of coliform at specific lake sites. While waterfowl are important components to the natural and aesthetic qualities of lakes that we all enjoy, it is poor management practice to encourage these birds by feeding them. The lake and surrounding area provides enough healthy and natural food for the birds and feeding them stale bread or crackers does nothing more than import additional nutrients into the lake and allows for increased plant growth. As birds also are a host to the parasite that causes "swimmers itch" waterfowl roosting areas offer a greater chance for infestation to occur. Thus while leaving offerings for our feathered friends is enticing, the results can prove to be detrimental to the lake system and to human health.

Phytoplankton *

The planktonic community includes microbial organisms that represent diverse life forms, containing photosynthetic as well as non-photosynthetic types, and including bacteria, algae, crustaceans and insect larvae (the zooplankton are discussed below in a separate section). Because planktonic algae or "phytoplankton" tend to undergo rapid seasonal cycles on a time scale of days and weeks, the levels of populations found should be considered to be most representative of the time of collection and not necessarily of other times during the ice-free season, especially the early spring and late fall periods.

The composition and concentration of phytoplankton can be indicative of the trophic status of a lake. Seasonal patterns do occur and must be considered. For example **diatoms**, tend to be most abundant in April-June and October-November, in example **diatoms**, tend to be most abundant in April-June and October-November, in the surface or epilimnetic layers of New Hampshire lakes. As the summer progresses, the dominant types might shift to **green algae** or **golden algae.** By late season **Blue-green bacteria** generally dominate. In nutrient rich lakes, nuisance green algae and/or bluegreen bacteria might dominate continually. After fall mixing diatoms might again be found to bloom.

Zooplankton *

There are three groups of zooplankton that are generally prevalent in lakes: the **protozoa, rotifers** and **crustaceans.** Most research has been devoted to the last two groups although protozoa may be found in substantial amounts. Of the rotifers and the crustaceans, time and budgetary constraints usually make it necessary to sample only the larger zooplankton (macrozooplankton; larger than 80 or 150 microns; 1 million microns make up a meter). Thus, zooplankton analysis is generally restricted only to the larger crustaceans. Crustacean zooplankton are very sensitive to pollutants and are commonly used to indicate the presence of toxic substances in water. The crustaceans can be divided into two groups, the **cladocerans** (which include the "water fleas") and the **copepods.**

Macrozooplankton are an important component in the lake system. The filter feeding of the herbivorous ("grazing") species may control the population size of selected species of phytoplankton. The larger zooplankton can be an important food source for juvenile and adult planktivorous fish. All zooplankton play a part in the recycling of nutrients within the lake.

As discussed above for phytoplankton, zooplankton undergo seasonal population cycles and the results discussed below are most representative of the collection dates and not necessarily of other times during the ice-free season, especially during the early spring and late fall.

Fish Condition

As with the plankton discussed above, the health of the fish species of a lake will be indicative of the overall water quality. Condition is determined by comparing the length of the fish to its weight. As would be expected, the heavier the fish for its length, the better its condition will be. By also examining a scale collected from the fish under a microscope, the approximate age and growth history can also be determined.

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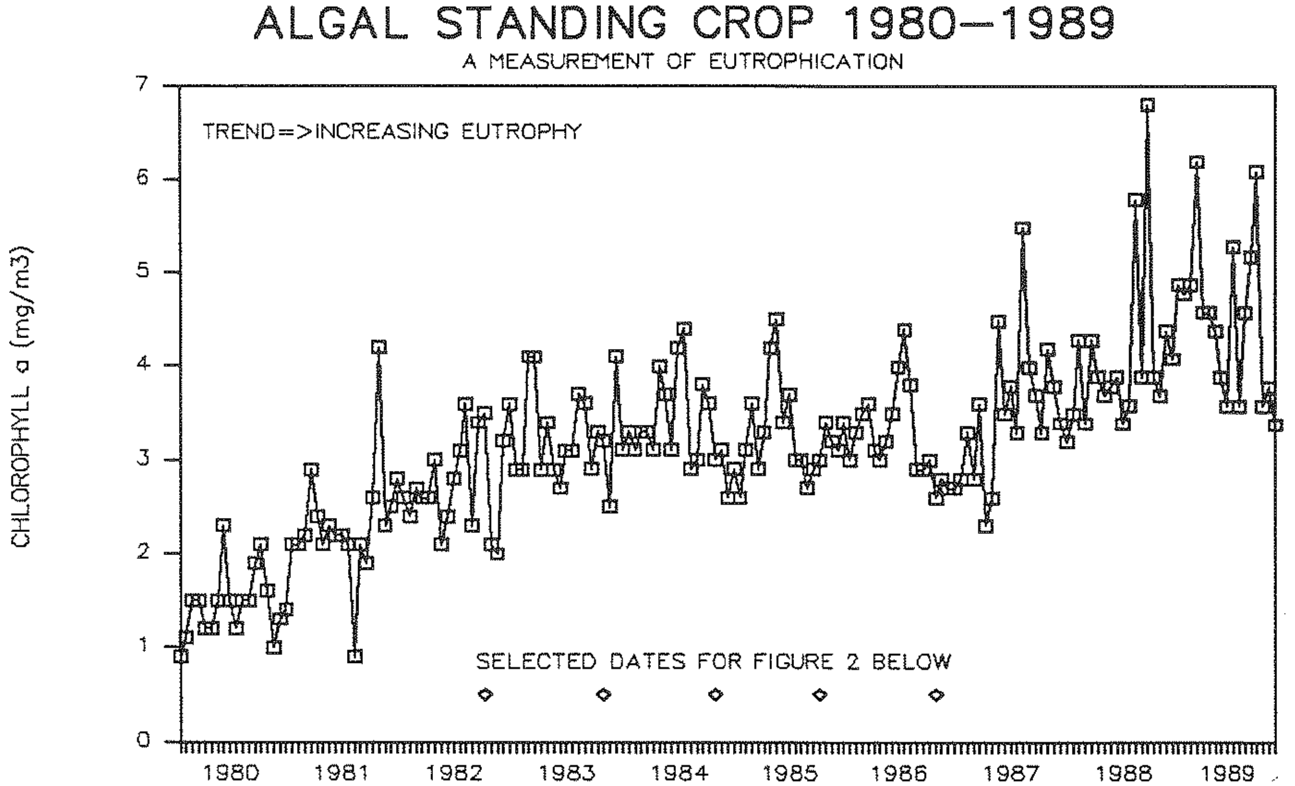
FIGURES



.Figure 1. The upper graph depicts weekly chlorophyll concentrations of a model lake measured weekly during ice-free conditions. The long-term trend is that of increased eutrophication (lake has become "greener"). Diamonds below the curve represent late summer (August) dates the data set was subsampled to create Figure 2.

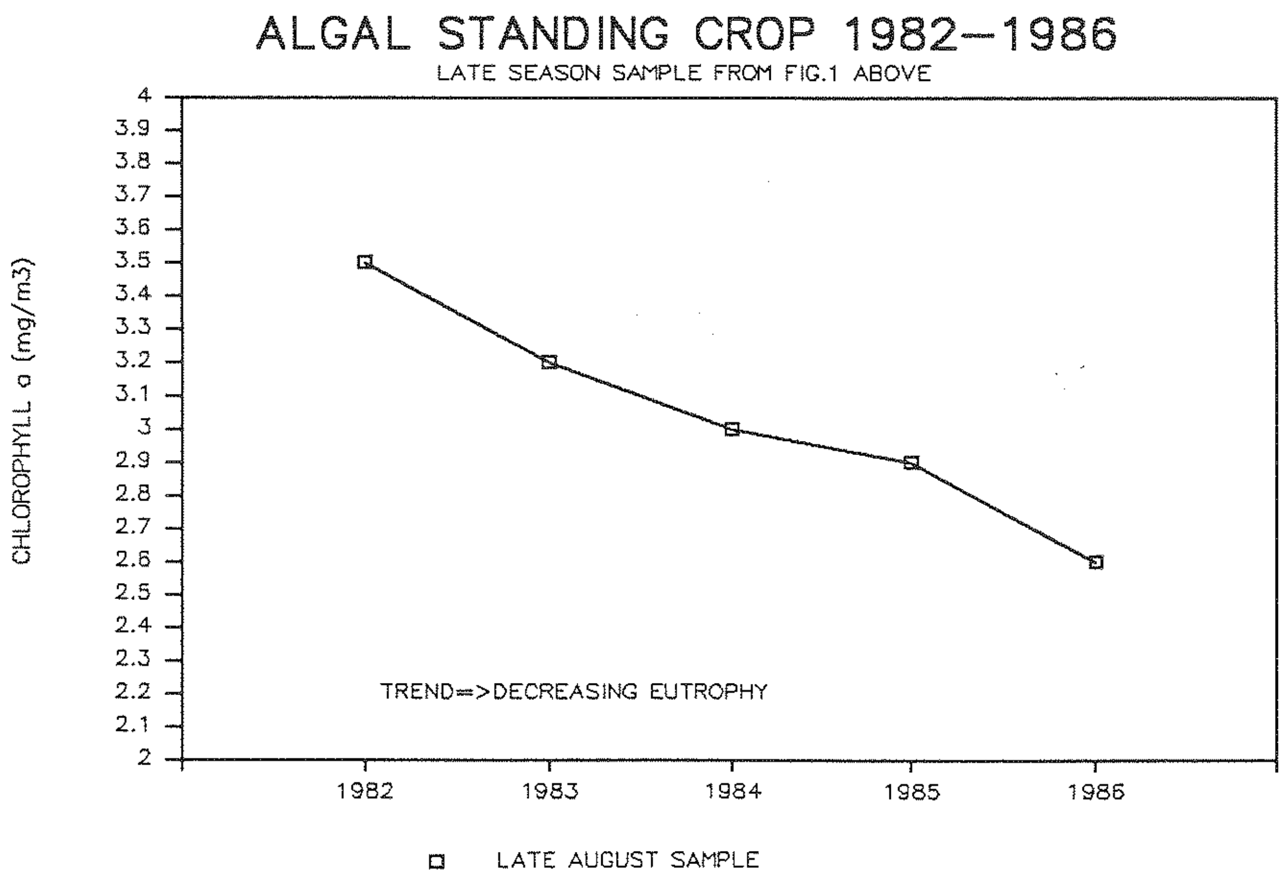
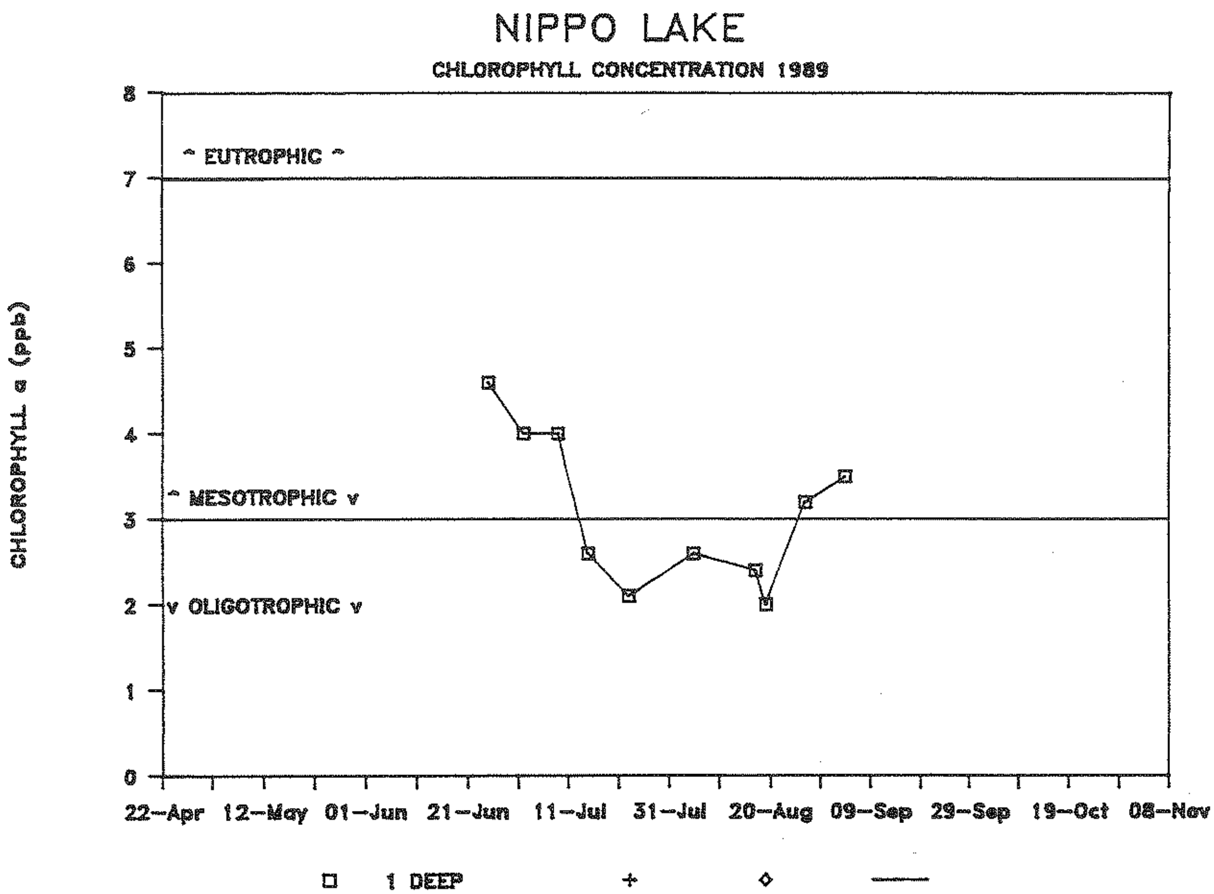


Figure 2. The lower graph depicts late summer chlorophyll data of the model lake in Figure 1. Note how limited sampling over a five year period suggests a much different trend, that of decreasing eutrophy. Thus, limited sampling can mislead the investigator of long-term trends.


NIPPO LAKE
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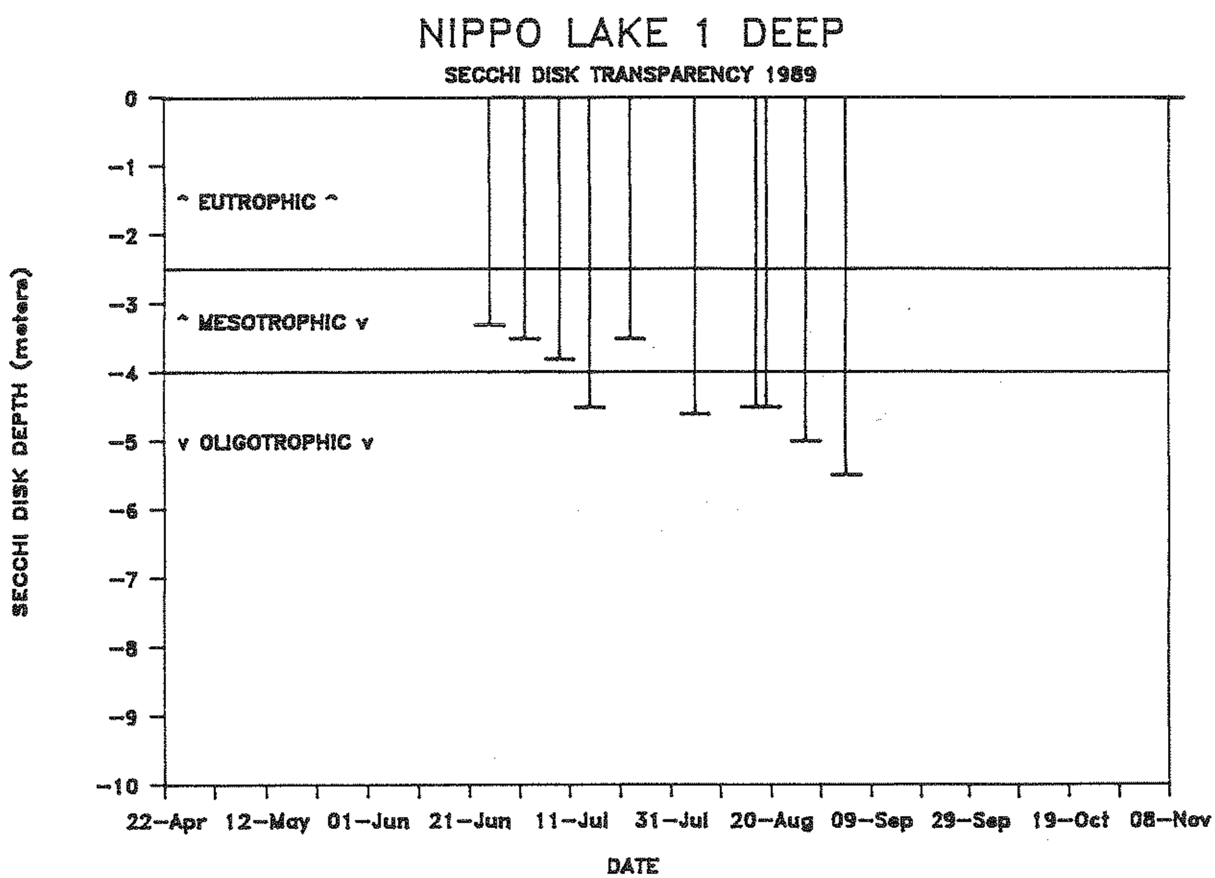
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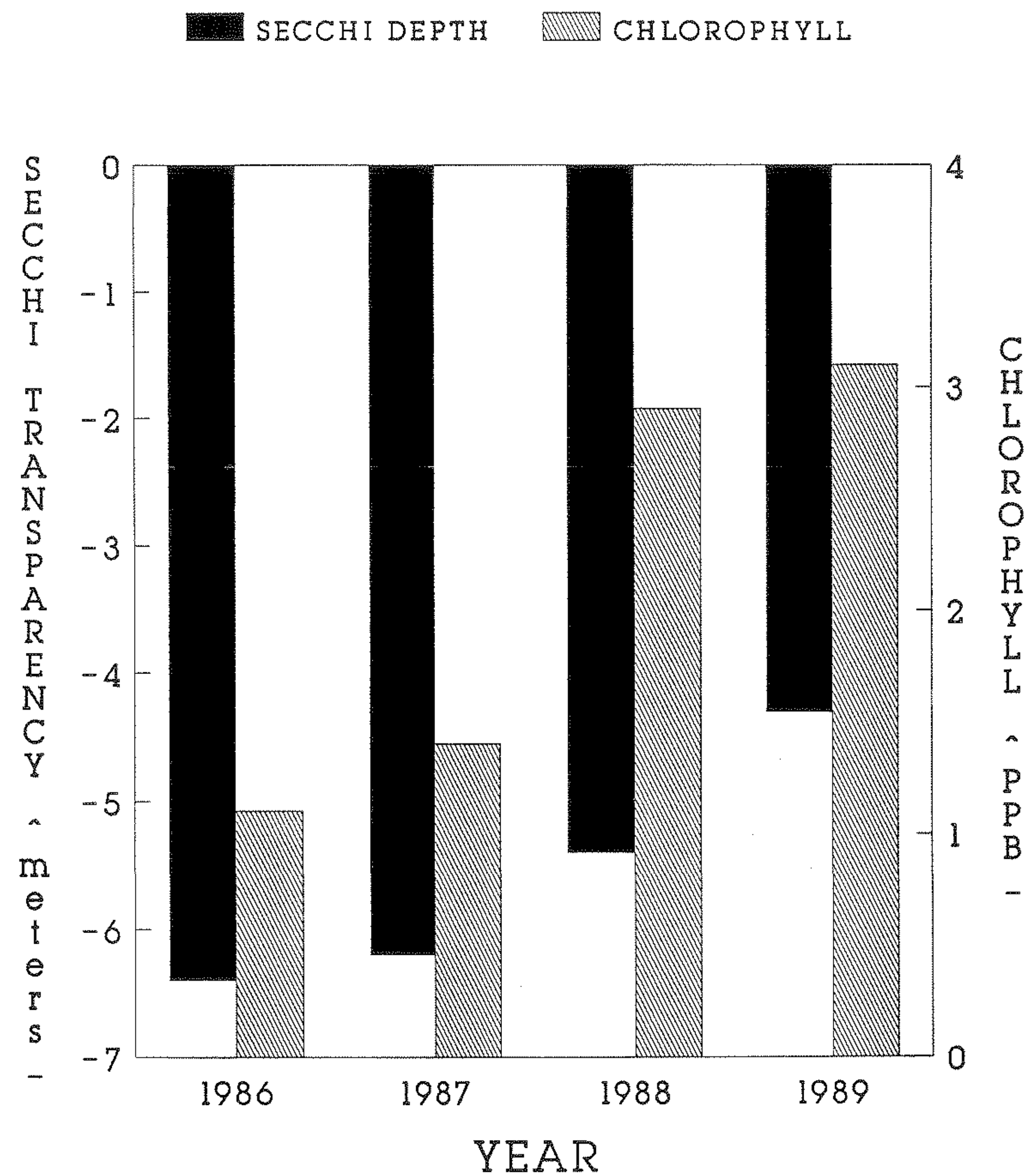
NIPPO LAKE


SECCHI DEPTH
CHLOROPHYLL
SECCHI TRANSPARENCY ^ meters -
0
-1
-2
-3
-4
-5
-6
-7
CHLOROPHYLL ^ PPB -
4
3
2
1
0
1986
1987
1988
1989
YEAR

NIPPO LAKE Data on file as of 02/06/1990

Lakes Lay Monitoring Program, U.N.H.

[Lay Monitor Data]

NIPPO LAKE, N.H. -- subset of trophic indicators, all sites, 1989

1989 SUMMARY

Average transparency:	4.3	(1989:	10	values;	3.3	-	5.5	range)
Average chlorophyll:	3.1	(1989:	10	values;	2.0	-	4.6	range)
Average alk (gray):	3.7	(1989:	10	values;	3.5	-	4.0	range)
Average alk (pink):	4.3	(1989:	10	values;	4.2	-	4.5	range)

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	06/25/1989	3.3	4.6	---	3.8	4.4	---
1 Deep	07/02/1989	3.5	4.0	---	3.5	4.2	---
1 Deep	07/09/1989	3.8	4.0	---	3.8	4.5	---
1 Deep	07/15/1989	4.5	2.6	---	3.5	4.2	---
1 Deep	07/23/1989	3.5	2.1	---	4.0	4.5	---
1 Deep	08/05/1989	4.6	2.6	---	3.7	4.2	---
1 Deep	08/17/1989	4.5	2.4	---	3.8	4.3	---
1 Deep	08/19/1989	4.5	2.0	---	3.7	4.2	---
1 Deep	08/27/1989	5.0	3.2	---	3.8	4.5	---
1 Deep	09/04/1989	5.5	3.5	---	3.7	4.2	---

<< End of 1989 listing, 10 records >>