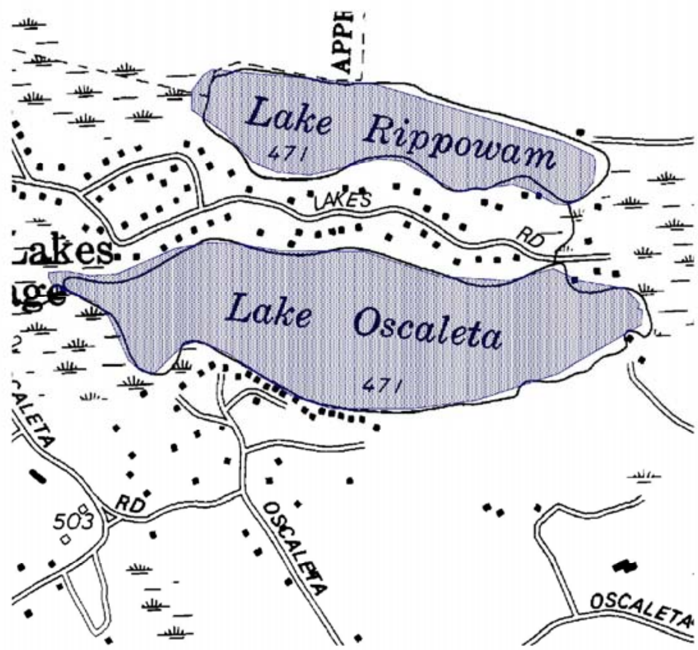
New York State Department of Environmental Conservation

Division of Water

New York
Citizens Statewide Lake Assessment Program
(CSLAP)

2008 Annual Report-Lake Oscaleta

April, 2009



New York State Department of Environmental Conservation

2008 INTERPRETIVE SUMMARY

NEW YORK
CITIZENS STATEWIDE
LAKE ASSESSMENT PROGRAM
(CSLAP)

LAKE OSCALETA

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NYS Department of Environmental Conservation
NY Federation of Lake Associations

April, 2009

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BACKGROUND AND ACKNOWLEDGMENT

The Citizens Statewide Lake Assessment Program (CSLAP) is a volunteer lake monitoring program conducted by the NYS Department of Environmental Conservation (NYSDEC) and the NYS Federation of Lake Associations (FOLA). Founded in 1986 with 25 pilot lakes, the program has involved more than 230 lakes, ponds, and reservoirs and 1,500 volunteers from eastern Long Island to the northern Adirondacks to the western-most lake in New York, and from 10-acre ponds to several Finger Lakes, Lake Ontario, Lake George, and lakes within state parks. In this program, lay volunteers trained by the NYSDEC and FOLA collect water samples, observations, and perception data every other week in a 15 week interval between May and October. Water samples are analyzed by certified laboratories. Analytical results are interpreted by the NYSDEC and FOLA and utilized for a variety of purposes by the State of New York, local governments, researchers, and, most importantly, participating lake associations. This report summarizes the 2008 sampling results for **Lake Oscaleta**.

Lake Oscaleta is a 65 acre, class B lake found in the Town of Lewisboro in Westchester County, just north of the New York City region of New York State. Lake Oscaleta was first sampled as part of CSLAP in 2006. The following volunteers have participated in CSLAP, and deserve most of the credit for the success of this program at **Lake Oscaleta: Paul Lewis, Shannon Robinette, Dick Karl, Barbara Posner, Paul Lewis, Leslie Daley, Jan Anderson and Lou Feeney.**

In addition, the authors wish to acknowledge the following individuals, without whom this project and report would never have been completed:

From the Department of Environmental Conservation, Dick Draper, and Margaret Novak for on-going support of the program; Jay Bloomfield and James Sutherland, for their work in developing and implementing the program, and the technical staff from the Lake Services Section and the Statewide Water Monitoring Section, for continued technical review of program design.

From the Federation of Lake Associations, Anne Saltman, Dr. John Colgan, Don Keppel, Nancy Mueller and the Board of Directors, for their continued strong support of CSLAP.

The New York State Department of Health (prior to 2002) and Upstate Freshwater Institute (since 2002), particularly Steve Effler, MaryGail Perkins, and Elizabeth Miller, provided laboratory materials and all analytical services, reviewed the raw data, and implemented the quality assurance/quality control program.

Finally, but most importantly, the authors would like to thank the more than 1,500 volunteers who have made CSLAP a model for lay monitoring programs throughout the country and the recipient of a national environmental achievement award. Their time and effort have served to greatly expand the efforts of the state and the public to protect and enhance the magnificent water resources of New York State.

WHAT'S NEW IN THE 2008 CSLAP REPORT?

In a never ending quest to make the CSLAP reports more useful and comprehensive, or at least more interesting and worthy of a cover-to-cover read, the NYSDEC makes small changes in the CSLAP report each year. Some of these changes are small and include fixing previous errors, based on corrections provided by readers or re-editing. Others are more substantial and reflect improvements in technology (better graphics or layout capabilities) or information about the lake or its watershed. For example, the 2005 CSLAP report included information about regulated activities in the area around the lake and a compendium of other state water quality data for the lake. The 2006 report included fish stocking, fisheries regulations, and fish consumption advisory information for the first time, as well as site location maps, information about rare, threatened, or endangered plant species in lake, and detailed discussions about lake use impacts and their implications for the state Priority Waterbody List. The 2007 report included RIBS water quality monitoring data, more detailed discussions about weather patterns and the implications of these patterns for water quality conditions in NYS lakes, historical aquatic plant identifications, more detailed discussions of nitrogen trends, expanded exotic plant distribution maps, and a "So What Have We Learned Through CSLAP" discussion.

The 2008 CSLAP report has been improved by the following new information:

- An expansion of the exotic plant distribution maps to include brittle naiad (*Najas minor*) and hydrilla (*Hydrilla verticillatum*), the latter of which was found for the first time in New York State in 2008.

- More detailed discussions about the connection between precipitation and water quality in CSLAP, and greater discussion about changes in water temperature and the potential connection between these findings and larger global climate change.

- An expanded discussion of most of the CSLAP sampling parameters, focusing on an "outstanding" question associated with each (usually in response to findings within the last few years)

- An expanded "So What Have We Learned Through CSLAP" section.

We hope this report satisfies the needs of lake associations and CSLAP participants, and we continue to welcome suggestions for improving the program, reporting, and other avenues for gaining greater knowledge about the lakes of New York State.

FINDINGS AND EXECUTIVE SUMMARY

Lake Oscaleta was sampled as part of the New York Citizens Statewide Lake Assessment Program in 2008. For all program waters, water-quality conditions and public perception of the lake each year and historically have been evaluated within annual reports issued after each sampling season. This report attempts to summarize both the 2008 CSLAP data and an historical comparison of the data collected within the 2008 sampling season and data collected at Lake Oscaleta prior to 2008.

The majority of the short- and long-term analyses of the water quality conditions in Lake Oscaleta are summarized in Table 2, divided into assessments of eutrophication indicators, other water quality indicators, and lake perception indicators. The CSLAP data from Lake Oscaleta indicate that the lake is best classified as *mesoeutrophic*, or moderately to highly productive. The lake was probably slightly less productive than normal in 2008, as manifested in lower phosphorus and algae levels (as contrasted with the increase in phosphorus in Lake Waccabuc). Water clarity readings were close to normal. It is premature to evaluate any long-term trends in these trophic indicators with only three years of water quality data. The nitrogen to phosphorus ratios indicate that algae levels in Lake Oscaleta are controlled by phosphorus, and it is likely that phosphorus inputs need to be addressed to improve water clarity and prevent algal blooms. Lake productivity appears to increase significantly later in the fall, coincident with decreasing deepwater phosphorus levels. Phosphorus levels in the lake regularly exceed the state phosphorus guidance value, although water transparency readings only rarely fail to reach the minimum recommended water clarity for swimming beaches. Deepwater phosphorus readings are slightly higher than those measured at the lake surface, suggesting that internal nutrient cycling (release of phosphorus from bottom sediments to the deep waters, and then eventually into the surface waters) is not as significant as in Lake Waccabuc. However, as in Waccabuc, this appears to trigger the fall rise in lake productivity.

The lake is weakly colored, and color readings are probably not high enough to influence the water transparency. The lake has water of intermediate hardness, alkaline (above neutral) pH readings, low nitrate, ammonia and total nitrogen readings. Neither nitrate nor ammonia levels appear to warrant a threat to the lake. pH readings occasionally exceed the NYS water quality standards (=6.5 to 8.5), particularly in 2008, but are probably adequate to support most aquatic organisms. The rise in pH is probably weather related, but should be watched. Conductivity readings are typical of lakes with intermediate hardness. Calcium levels are probably not high enough to support zebra mussel growth, based on open water readings, and zebra mussels have not been found in the lake.

The recreational suitability of Lake Oscaleta has most often been described as “excellent” to “slightly” impaired. This is coincident with lake conditions described as “not quite crystal clear”. Recreational assessments are slightly more favorable than in other lakes with similar water quality characteristics, although these assessments are more closely impacted by “excessive weed growth” than by “poor water clarity”. Long-term trends are not yet apparent in any of these indicators. Recreational assessments degrade through late summer, then improve later in the fall, coincident with seasonal changes in aquatic plant coverage.

The 2007 NYSDEC Priority Waterbody Listings (PWL) for the Lower Hudson River drainage basin indicate that *recreation* may be *stressed* by excessive weeds and algae in Lake Oscaleta. The CSLAP datasets indicate that these assessments may be warranted, and *aquatic life* may be *threatened* by deepwater anoxia and elevated pH. The next PWL review for the Lower Hudson River drainage basin will likely occur in 2012.

General Comments and Questions:

- ***What is the condition of Lake Oscaleta?***

Water quality conditions in Lake Oscaleta appear to be adequate to support most recreational uses of the lake during the summer. Recreational assessments are impacted by excessive weed growth, although it is not known if this is due to the curly leafed pondweed or native plants (since these impacts occurred mid to late summer, when curly leafed pondweed is usually not present in most NYS lakes).

- ***What about the dark and murky bottom waters of the lake?***

The deep waters of Lake Oscaleta have slightly higher phosphorus readings than those at the lake surface, and the depth profiles indicate deepwater oxygen deficits (below a depth of about 5-6 meters). The depressed deepwater oxygen levels probably contribute to the elevated deepwater phosphorus readings, which in turn lead to higher fall lake productivity, although this difference is not as significant as in Lake Waccabuc.

- ***How does this condition change from spring showers thru changing of the leaves?***

The productivity of Lake Oscaleta (as measured by clarity, nutrient and algae levels) appears to decrease slightly during the summer, but increases in the fall. The latter appears to be influenced by deepwater phosphorus levels. Recreational assessments degrade throughout the summer, but improve slightly in the fall, coincident with seasonally increasing aquatic plant coverage and despite increasing fall algae levels.

- ***How has the condition changed since CSLAP sampling began on the lake and/or relative to historical values?***

It is premature to evaluate any long-term trends with only three years of water quality and perception data. It is likely that the small variability in each of the water quality indicators is within the normal range of variability for the lake. Additional data will help to determine if the lower lake productivity, nitrogen, pH, and color readings in the last two years represent normal conditions for the lake.

- ***How does Lake Oscaleta compare to other similar lakes (nearby lakes,….)?***

Lake Oscaleta appears to be about as productive as other lakes classified for contact recreation (Class B), other nearby (Lower Hudson River drainage basin) lakes, and other NYS lakes. However, recreational assessments in Lake Oscaleta are highly dependent upon aquatic plant coverage, and may be less favorable than in these other lakes when weed coverage is high.

- ***Based on these data, what should be done to improve or maintain Lake Oscaleta?***

It is likely that the management of water quality conditions in Lake Oscaleta should focus on reducing nutrient and sediment loading to the lake, through pumping and maintaining septic systems, utilizing shoreline buffer zones, limiting use of lawn fertilizers, minimizing land disturbances in the near-lake watershed, and localized stormwater management. Deepwater nutrient levels are not as significant as in Lake Waccabuc, so aeration or other means for reducing internal nutrient loading may not be as effective as in Lake Waccabuc. Continued vigilance in controlling new infestations of exotic plants, including the Brazilian elodea from Lake Waccabuc, may be critical to protecting the lake from continued increases in aquatic plant coverage and resulting impacts to recreational uses of the lake.

Context and Qualifiers

The NY Citizens Statewide Lake Assessment Program (CSLAP) is intended to be a long-term, standardized, trophic-based, water-quality monitoring program to facilitate comparison of water-quality data from season to season, year to year, and from lake to lake. The data and information collected through CSLAP can be utilized to identify water-quality problems, detect seasonal and long-term patterns, and educate sampling volunteers and lake residents about water-quality conditions and stressors at their lakes. It is particularly useful in evaluating the over-enrichment of aquatic plant (algae and rooted plant) communities in a lake, and the response of the lake to these trophic stressors.

Shorefront residents, lake managers, and government agencies are increasingly tasked to better assess and evaluate water-quality conditions and lake uses in NYS lakes, including those sampled through CSLAP, whether to address localized problems, meet water-quality standards, satisfy state and federal environmental reporting requirements, or enhance and balance a suite of lake uses. CSLAP data should be a part of this process, but only a part. For some lakes, particularly small lakes and ponds with limited public access by those who don't reside on the lake shore, CSLAP may be the sole source of data used to assess lake conditions. In addition, studies conducted through CSLAP find strong similarities between sampling sites in many, but not all, large lakes, and generally find a strong convergence of perceptions about lake and recreational use conditions within most lakes, based on a local familiarity with "normal" conditions and factors that might affect lake use. For the purpose of broad water-quality evaluations and understanding the connection between measured water-quality indicators and the support of broadly based recreational uses of the lake, CSLAP can be a singularly effective tool for standardizing the lake-assessment process. CSLAP volunteers, lake associations, and others engaged in lake assessment and management should continue to utilize CSLAP in this context.

However, for large, multi-use lakes, or those lakes that are threatened by pollutants not captured in eutrophication-based monitoring programs, CSLAP becomes a less effective primary tool for assessing lake condition and use impairments. For example, CSLAP data have only limited utility in evaluating the following:

(a) contamination from bacteria or other biological toxins, particularly related to the safety of water use for potable intake or swimming
(b) contamination from inorganic (e.g., metals) and organic (e.g., PCBs, DDT) compounds
(c) portions of a lake not well mixed with the "open water" or otherwise distant from the primary sampling site(s), including the shoreline, bottom sediment and isolated coves
(d) rooted aquatic plant impacts in areas of the lake not evaluated by the sampling volunteers
(e) diverging perceptions of recreational-use impacts, particularly in lakes with shorelines or isolated coves exhibiting conditions very different from those sampled or evaluated by the sampling volunteers
(f) impacts to fish or other fauna due to factors unrelated to eutrophication
(g) PWL or 303(d) listings for other pollutants or portions of the lake not sampled through CSLAP

For these waterbodies, CSLAP can and should continue to be part of an extensive database used to comprehensively evaluate the entirety of the lake and its uses, but absent a more complete dataset, CSLAP data should be used with caution as a sole means for evaluating the lake. Water-quality evaluations, recommended PWL listings, and other extrapolations of the data and analyses should be utilized in this context and by no means should be considered "the last word" on the lake.

I. INTRODUCTION: CSLAP DATA AND YOUR LAKE

Lakes are dynamic and complex ecosystems. They contain a variety of aquatic plants and animals that interact and live with each other in their aquatic setting. As water-quality changes, so too will the plants and animals that live there, and these changes in the food web also may affect water-quality. Water-quality monitoring provides a window into the numerous and complex interactions of lakes. Even the most extensive and expensive monitoring program **cannot completely assess** the water-quality of a lake. However, by looking at some basic chemical, physical, and biological properties, it is possible to gain a greater understanding of the general condition of lakes. CSLAP monitoring is a basic step in overall water-quality monitoring.

Understanding Trophic States

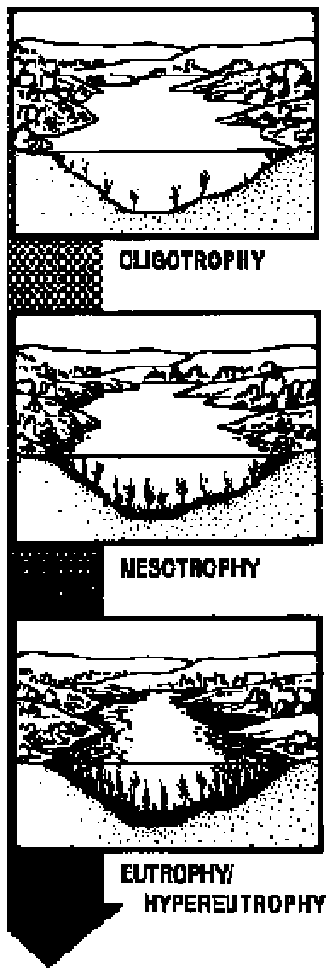


Figure 1- Eutrophication and Lake Succession

All lakes and ponds undergo **eutrophication,** an aging process, which involves stages of succession in biological productivity and water-quality (Figure 1). **Limnologists** (scientists who study freshwater systems) divide these stages into **trophic** states. Each trophic state can represent a wide range of biological, physical, and chemical characteristics and any lake may "naturally" be categorized within any of these trophic states. In general, the increase in productivity and decrease in clarity corresponds to an enrichment of nutrients, plant and animal life. Lakes with low biological productivity and high clarity are considered **oligotrophic**. Highly productive lakes with low clarity are considered **eutrophic**. Lakes that are **mesotrophic** have intermediate or moderate productivity and clarity. It is important to remember that eutrophication is a natural process and is not necessarily indicative of man-made pollution.

In fact, some lakes are thought to be "naturally" productive. Trophic classifications are not interchangeable with assessments of water-quality. Water-quality degradation from the perspective of one user may contrast with the perception of favorable conditions by a different lake user. For example, a eutrophic lake may support an excellent warm-water fishery because it is nutrient rich, but a swimmer may describe that same lake as polluted. A lake's trophic state is still important because it provides lake managers with a reference point to view changes in a lake's water-quality and they begin to understand how these changes may cause **use impairments** (threaten the use of a lake or swimming, drinking water or fishing)**.**

When human activities accelerate lake eutrophication, it is referred to as **cultural eutrophication**. Cultural eutrophication may result from shoreline erosion, agricultural and urban runoff, wastewater discharges or septic seepage, and other non-point source pollution sources. These can greatly accelerate the natural aging process of lakes, cause successional changes in the plant and animal life within the lake, shoreline and surrounding watershed, and impair the water-quality and value of a lake. They may ultimately extend aquatic plants and emergent vegetation throughout the lake, resulting in the transformation of the lake into a marsh, prairie, and forest. The extent of cultural eutrophication and the corresponding pollution problems can be signaled by significant changes in the trophic state over a short period.

Why is this important? New York State lakes can be affected by a variety of stressors, from acid rain to zebra mussels and almost everything in between. In any given part of the state, some of these stressors are more important than others. For example, there are probably more lakes affected by acid rain than any other pollutant, but these impacts are typically associated with a particular region (the Adirondacks and Catskills) and particular type of lake (small, high-elevation lakes in basins with thin soils and little buffering capacity). But for most lakes in New York, cultural eutrophication represents the most significant source of pollutants and threat to water-quality. As a result, water-quality indicators related to eutrophication comprise the foundation of most water-quality monitoring programs.

II. CSLAP SAMPLING PARAMETERS

CSLAP monitors several parameters related to the trophic state of a lake, including the clarity of the water, the amount of nutrients in the water, and the amount of algae resulting from those nutrients. Three parameters are the most important measures of eutrophication in most New York lakes: **total phosphorus, chlorophyll *a*** (estimating the amount of algae), and **Secchi disk transparency**. Because these parameters are closely linked to the growth of weeds and algae, they provide insight into "how the lake looks" and its suitability for recreation and aesthetics. Other CSLAP parameters help characterize water-quality at the lake. Each of these sampling parameters is outlined in Figure 3. In addition, CSLAP also uses the responses on the Field Observation Forms to gauge volunteer perceptions of lake water-quality. Most water-quality "problems" arise from impairment of accepted or desired lake uses, or the perception that such uses are somehow degraded. As such, any water-quality monitoring program should attempt to understand the link between perception and measurable quality.

The parameters analyzed in CSLAP provide valuable information for characterizing lakes. By adhering to a consistent sampling protocol provided in the <u>CSLAP Sampling Protocol</u> sampling volunteers collect and use data to assess both seasonal and yearly fluctuations in these parameters and to evaluate the water-quality conditions in their lake. By comparing a specific year's data to historical water-quality information, lake managers can pinpoint trends and determine whether water-quality is improving, degrading or remaining stable. Such a determination answers a first critical question posed in the lake-management process.

Ranges for Parameters Assessing Trophic Status and Lake Oscaleta

The relationship between phosphorus, chlorophyll *a*, and Secchi disk transparency has been explored by many researchers, to assess the trophic status (the degree of eutrophication) of lakes. Figure 2 shows the ranges for phosphorus, chlorophyll a, and Secchi disk transparency (summer median) that are representative for the major trophic classifications:

Figure 2. Trophic Status Indicators

Parameter	Eutrophic	Mesotrophic	Oligotrophic	Lake Oscaleta
Phosphorus (mg/l)	> 0.020	0.010 - 0.020	< 0.010	**0.022**
Chlorophyll a (µg/l)	> 8	2- 8	< 2	**11.2**
Secchi Disk Clarity (m)	< 2	2- 5	> 5	**2.8**

These classifications are valid for clear-water lakes only (with less than 30 platinum color units). Some humic or "tea color" lakes, for example, naturally have high levels of dissolved organic material, resulting in color readings that exceed 30 color units. This will cause the water transparency to be lower than expected, given low phosphorus and chlorophyll *a* levels in the lake. Water transparency can also be unexpectedly lower in shallow lakes due to influences from the bottom (or the inability to measure the maximum water clarity due to the visibility of the Secchi disk on the lake bottom). Even shallow lakes with high water clarity, low nutrient concentrations, and little algal growth may also have significant weed growth due to shallow water conditions. While such a lake may be considered unproductive by most water-quality standards, that same lake may experience severe aesthetic problems and recreational impairment related to weeds, not trophic state. Generally, however, the trophic relationships described above can be used as an accurate "first" gauge of productivity and overall water-quality.

Figure 3. CSLAP Parameters

PARAMETER	SIGNIFICANCE
Water Temperature (°C)	Water temperature affects many lake activities, including the rate of biological growth and the amount of dissolved oxygen. It also affects the length of the recreational season.
Secchi Disk Transparency (m)	Determined by measuring the depth at which a black and white disk disappears from sight, the Secchi disk transparency estimates the clarity of the water. In lakes with low color and rooted macrophyte ("weed") levels, it is related to algal productivity.
Conductivity (μmho/cm)	Specific conductance measures the electrical current that passes through water, and is used to estimate the number of ions (charged particles). It is somewhat related to both the hardness and alkalinity (acid-buffering capacity) of the water and may influence the degree to which nutrients remain in the water. Generally, lakes with conductivity of <100 μmho/cm are considered softwater, while conductivity readings >300 μmho/cm are found in hardwater lakes.
pH	pH is a measure of the (free) hydrogen ion concentration in solution. Most clearwater lakes must maintain a pH between 6 and 9 to support most types of plant and animal life. Low pH waters (<7) are acidic, while high pH waters (>7) are basic.
Color (true) (platinum color units)	The color of dissolved materials in water usually consists of organic matter, such as decaying macrophytes or other vegetation. It is not necessarily indicative of water-quality but may significantly influence water transparency or algae growth. Color in excess of 30 ptu indicates sufficient quantities of dissolved organic matter to affect clarity by imparting a tannic color to the water.
Phosphorus (total, mg/l)	Phosphorus is one of the major nutrients needed for plant growth. It is often considered the "limiting" nutrient in NYS lakes, for biological productivity is often limited if phosphorus inputs are limited. Nitrogen-to-phosphorus ratios of >25 generally indicate phosphorus limitation. Many lake management plans are centered on phosphorus controls. Phosphorus is reported as total phosphorus (TP)
Nitrogen (nitrate, ammonia, and total (dissolved), mg/l)	Nitrogen is another nutrient necessary for plant growth and can act as a limiting nutrient in some lakes, particularly in the spring and early summer. Nitrogen to phosphorus ratios <10 generally indicate nitrogen limitation (for algae growth). For much of the sampling season, many CSLAP lakes have very low or undetectable levels of one or more forms of nitrogen. It is measured in CSLAP in three forms_ nitrate/nitrite (NO_x) ammonia ($NH_{3/4}$), and total nitrogen (TN or TDN).
Chlorophyll *a* (μg/l)	The measurement of chlorophyll *a*, the primary photosynthetic pigment found in green plants, provides an estimate of phytoplankton (algal) productivity, which may be strongly influenced by phosphorus.
Calcium (mg/l)	Calcium is a required nutrient for most aquatic fauna and is required for the shell growth for zebra mussels (at least 8-10 mg/l) and other aquatic organisms. It is naturally contributed to lakes from limestone deposits and is often strongly correlated with lake buffering capacity and conductivity.

By the Secchi disk transparency trophic standards described above, the lake would be considered *mesotrophic,* or moderately productive, while by the total phosphorus and chlorophyll *a* standards, the lake would be considered *eutrophic*, or highly productive. The most appropriate trophic designation for the lake is probably *mesoeutrophic*, or moderately to highly productive. Phosphorus readings in 2007 and 2008, and chlorophyll *a* readings in 2007 were typical of *mesotrophic*, or highly productive lakes. The trophic condition of Lake Oscaleta will be discussed in greater detail later in this report.

III. CSLAP LAKES

CSLAP sampling began in 1986 on 25 lakes generally distributed throughout the state, and in the following 23 years has expanded to more than 220 lakes. The program was developed primarily to identify water-quality problems, develop long-term databases, and educate lakefront property owners on small lakes with little historical information and few other contemporary studies. However, the program has been utilized by lake residents, lake associations and managers, municipalities, state and federal government and environmental organizations to gain insights about small ponds, large high-profile lakes and multi-use reservoirs from eastern Long Island to the northern Adirondacks, to the western border of New York State. A map showing each of the lakes sampled through CSLAP since 1986 is shown in Figure 4. The distribution of lakes roughly matches the distribution of lake associations in the state (or at least those affiliated with the NY Federation of Lake Associations, the largest lake association organization in the state). The relative paucity of CSLAP lakes in the Finger Lakes region reflects the small number of lakes in a region dominated by very large lakes, while the small number of lakes sampled in the Catskills, Long Island, and western NY reflects the shortage of organized lake associations in those areas.

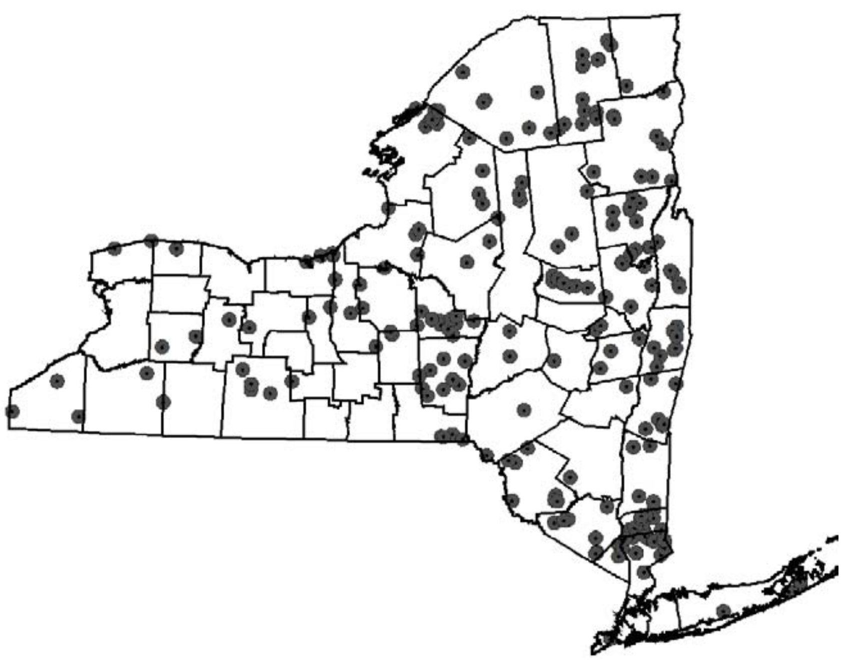


Figure 4: CSLAP Sampling Sites, 1986-2008

CSLAP lakes have ranged from the very small (three acre Black Pond in the Greenbelt region of Long Island) to the great (two state park beaches on Lake Ontario). It has included perhaps the clearest lake in New York State (Skaneateles Lake, one of the Finger Lakes, with as much as 50 feet of water transparency) and several lakes with clarity as low as one foot. There are a large number of lakes used for potable water, as well as those classified only for fishing and non-contact recreation. Some lakes (those on Long Island) sit just above sea level, while others are perched high in the clouds, including Summit Lake in central NY and Twitchell Lake in the Adirondacks, more than 2,000 feet above sea level.

Figures 5a and 5b summarize the variety of lakes sampled through CSLAP. In short, these lakes constitute a reprehensive cross-section of the lake conditions, uses, and settings encountered in New York State.

The typical CSLAP lake is slightly larger than the typical New York State lake and is more likely to be found in the Adirondacks, downstate, and central New York (generally the region bound by the Adirondacks, Finger Lakes, and the downstate region). Specifically, the "average" CSLAP lake is about 125 acres in size, at an elevation of about 1000 feet (300 meters), and can be found in Otsego County in the Leatherstocking region of New York State, the approximate geographic center of the CSLAP lake population. The typical New York state lake, on the other hand, would be in Fulton County in the southern Adirondacks, and would be about 20 acres in size and perched at an elevation of about 1700 feet (530 meters). The vast majority of lakes in New York state are small, and an inordinate number of lakes are found in the Adirondacks, although there are many other lake-rich regions in the state.

However, this CSLAP profile, as well as the preponderance toward "mid-elevation" regions, is probably more typical of the "lake community" regions of the state. This corresponds to those regions in which large numbers of lakes are heavily populated, which in turn represents lower elevation waterbodies that support siting septic systems and have close proximity to roads and other non-lake communities (comprised of visitors and seasonal lake residents). The relatively higher percentage of Class B lakes in CSLAP and Class C lakes in the rest of the state reflects the large number of uninhabited Class C lakes in the Adirondacks. These lakes have been classified as Class C lakes, often by default, due in part to the lack of information about historical or contemporary lake uses and water-quality conditions. On the other hand, most of the more densely populated lakes closer to the major population centers of the state have been designated as Class B lakes, owing to their long-standing use for contact recreation. As noted in the individual summary reports for many of the Class C lakes, it is likely that these lakes actively support swimming and other contact recreation, and the state classification system will eventually "catch up" to these recreational uses.

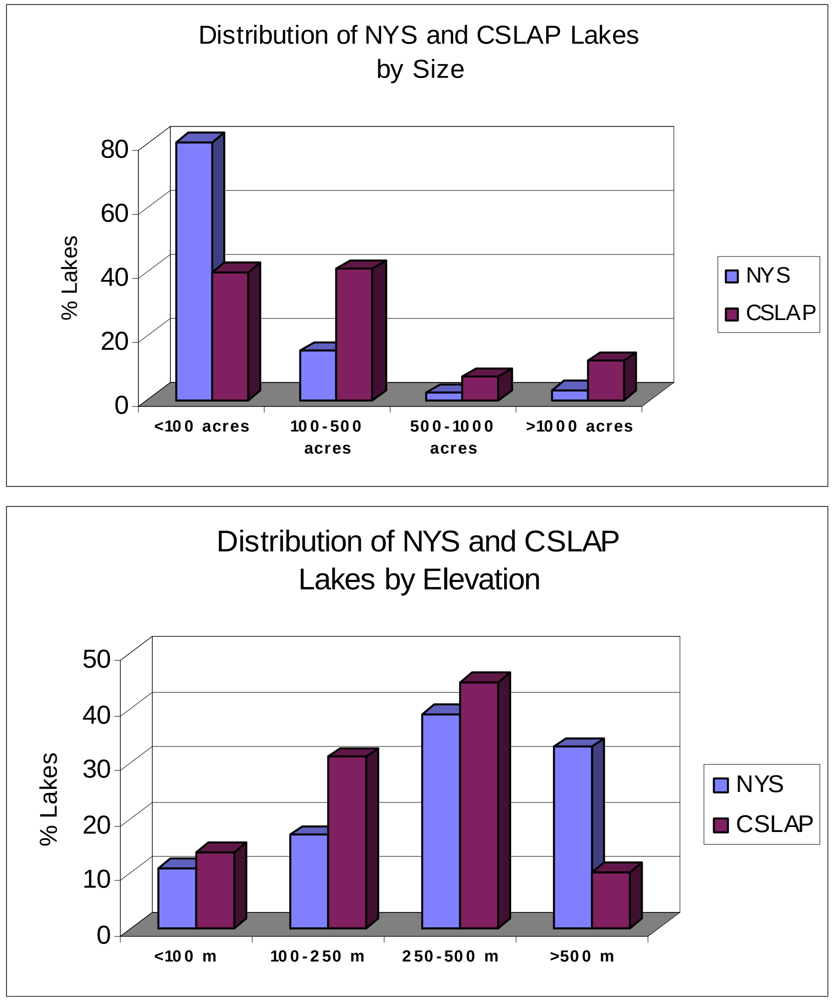


Figure 5a- Comparison of CSLAP and New York State Lakes by Size and Elevation

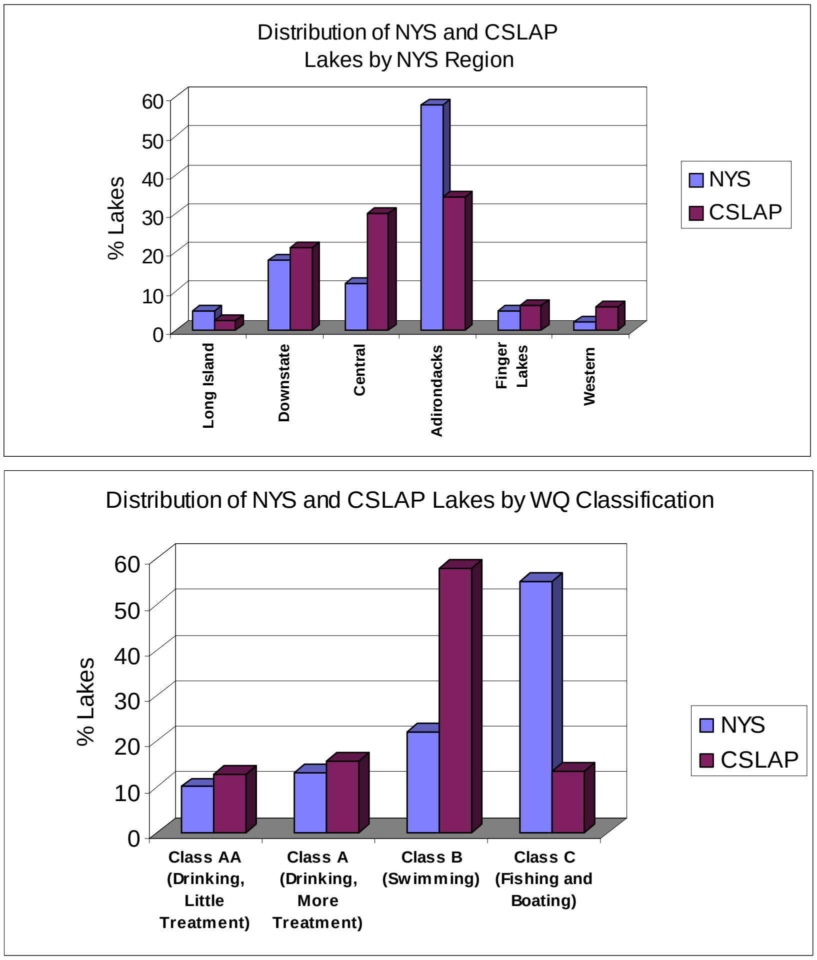


Figure 5b- Comparison of CSLAP and New York State Lakes by New York State Region and Water Quality Classification

However, many of the lake distribution categories displayed in Figures 5a and 5b indicate similar cross-sections of lakes. There are relatively few lakes in Long Island, Western New York and the Finger Lakes region, whether looking at the entirety of New York state or just those lakes in CSLAP. There are also few Class AA and A lakes—those used for potable water intake—in New York state or within the CSLAP database.

The distribution of lakes in these categories does suggest that CSLAP lakes are mostly comparable to other New York State lakes, and that an evaluation of CSLAP data may serve as a reasonable surrogate for statewide water-quality evaluations, particularly since CSLAP serves as the primary long-term database maintained and supported by New York State.

IV: LAKE OSCALETA- BACKGROUND INFORMATION

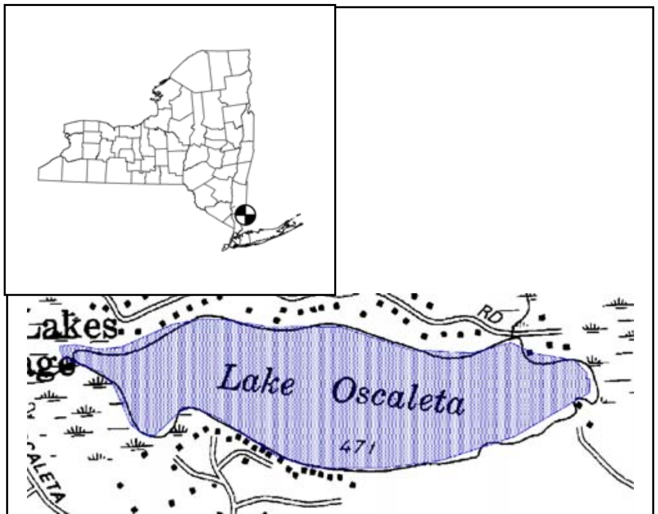


Figure 6- Location of Lake Oscaleta

Lake Oscaleta is a 65 acre lake found in the town of Lewisboro in Westchester County, just north of the New York City region of New York State. Figure 6 shows the location of Lake Oscaleta. It is one of 15 CSLAP lakes among the >120 lakes found in Westchester County, and one of 41 CSLAP lakes among the >350 lakes and ponds in the Lower Hudson River drainage basin. Lake Oscaleta is a Class B lake- this means that the best intended use for the lake is for contact recreation—bathing and swimming, non-contact recreation—boating and fishing, aquatic life, and aesthetics. These “categories” will be used to evaluate water quality conditions later in the report.

CSLAP samples were collected from the deepest part of the lake, at least as determined by the CSLAP sampling volunteers. This was determined by the samplers to be equal to a depth of about 10.7 meters (about 35 feet). Since the lake is thermally stratified, deepwater samples have been collected through CSLAP.

Historical Water-Quality Information for Lake Oscaleta

Lake Oscaleta was sampled in 1987 as part of the Adirondack Lake Survey Corporation (ALSC) study of >1500 lakes in the Adirondacks and southern New York. These data are presented in Table 2, and showed that Lake Oscaleta was less productive in 1987, based on slightly higher water transparency and lower nutrient levels. Dissolved oxygen readings were depressed near the lake bottom, although these readings did not bottom out. The lake was dominated by submergent plants- although milfoil and pondweeds were identified, it was not reported if these corresponded to exotic species. Phragmities were found at the lake. The lake was also sampled by Cedar Eden Environmental LLC in 2003 in anticipation of developing a Lake and Watershed Management Plan for the lake. These data are also provided in Table 2.

It is not known if local monitoring has been conducted as a fisheries management tool, or to evaluate swimming conditions in the lake.

None of the ephemeral inlets has been monitored through the NYSDEC Rotating Intensive Basins (RIBS) program or the state stream macroinvertebrate monitoring program. The lake was not been sampled by DEC fisheries staff in support of fish stocking activities.

Historical Fisheries Information for Lake Oscaleta

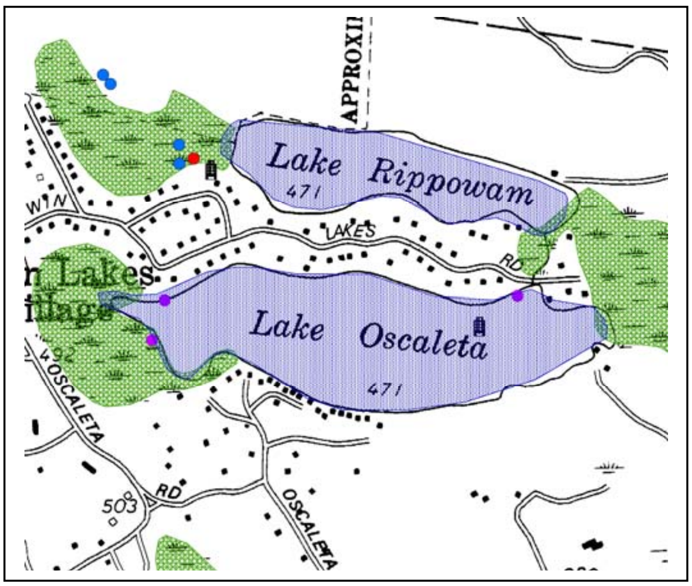
It is not known if Lake Oscaleta has been stocked through any state fisheries stocking programs. The following local stocking record is reported by the Three Lakes Council for Lake Oscaleta, Lake Rippowam, and Lake Oscaleta:

1996 -no stocking
1997- ?

1998- 500 small mouth bass, 250 each in Rippowam and Oscaleta
1999- 1000 11" brown trout, 800 in Waccabuc, 200 in Oscaleta
2000- 500 11" brown trout
2001- 420 11" brown trout, 300 in Waccabuc, 120 in Oscaleta
2002- no stocking
2003- 500 10" brown trout, 350 in Waccabuc, 150 in Oscaleta
2004- 650 11" brown trout, 400 in Waccabuc, 250 in Oscaleta
2005- ?
2006- 650 11" brown trout, 425 in Waccabuc and 225 in Oscaleta
2007- no stocking
2008- 350 brown trout in Oscaleta

The state record hybrid striped bass was caught in Lake Oscaleta in 2000, as cited in the Cedar Eden report. Fish species in the lake, as of 1987 (as noted in the ALSC survey of the lake), included alewife, bluegill, brown bullhead, brown trout, chain pickerel, largemouth bass, pumpkinseed, white catfish, white sucker, and yellow perch.

General statewide fishing regulations are applicable in Lake Oscaleta.



Permitted Facilities Associated with Lake Oscaleta

There appear to be only a small number of facilities on or near Lake Oscaleta that require permits or are otherwise regulated by the NYSDEC. These correspond to private residences (or wells just to the west of Lake Rippowam), and are shown as “milkcan” symbols on the map on the left. The green crosshatched areas correspond to regulated wetlands.

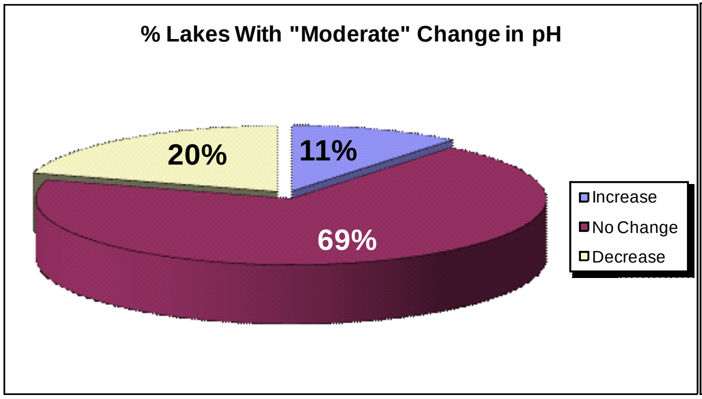
V. NEW YORK STATE, CSLAP AND LAKE OSCALETA WATER-QUALITY DATA: 1986-2007

Overall Summary:

Although water-quality conditions at each CSLAP lake have varied each year since 1986, and although detailed statistical analyses of the entire CSLAP dataset has not yet been conducted, general water-quality trends can be evaluated after 5-22 years' worth of CSLAP data from these lakes. Overall (regional and statewide) water-quality conditions and trends can be evaluated by a variety of different means. Each of the tested parameters ("analytes") can be evaluated by looking at how the analyte varies from year to year from the long-term average ("normal") condition for each lake, and by comparing these parameters across a variety of categories, such as across regions of the state, across seasons (or months within a few seasons), and across designated best uses for these lakes. Such evaluations are provided in the second part of this summary, via figures 7 through 17. The annual variability is expressed as the difference in the annual average (mean) from both the long-term average and the normal variability expected from this long-term average. The latter can be presented as the "standard error" (SE, calculated here within the 95% confidence interval)—one standard error away from the long-term average can be considered a "moderate" change from "normal," with a deviation of two or more standard errors considered to be a "significant" change. For each of these parameters, the percentage of lakes with annual data falling within one standard error from the long-term average are considered to exhibit "no change," with the percentage of lakes demonstrating moderate to significant changes also displayed on these graphs (figures 7a through 17a). Annual changes in these lakes can also be evaluated by standard linear regressions- annual means over time, with moderate correlation defined as $R^2 > 0.33$, and significant correlation defined as $R^2 > 0.5$. These methods are described in greater detail in Appendix D. Assessments of weather patterns—whether a given year was wetter or drier than usual—accounts for broad statewide patterns, not weather conditions at any particular CSLAP lake. As such, weather may have very different impacts at some (but not most) CSLAP lakes in some of these years.

Long-term trends can also be evaluated by looking at the summary findings of individual lakes and attempting to extrapolate consistent findings to the rest of the lakes. Given the (non-Gaussian) distribution of many of the water-quality parameters evaluated in this report, non-parametric tools may be the most effective means for assessing the presence of a water-quality trend. However, these tools do not indicate the magnitude of the trend. As such, a combination of parametric and non-parametric tools is employed here to evaluate trends. The Kendall tau ranking coefficient has been utilized by several researchers and state water-quality agencies to evaluate water-quality trends via non-parametric analyses and is utilized here. For parametric analyses, best-fit analysis of summer (June 15 through September 15) averages for each of the eutrophication indicators can be evaluated, with trends attributable to instances in which deviations in annual means exceed the deviations found in the calculation of any single annual mean. "Moderate" change is defined as $\tau > 0.33$, and "significant" change is defined as $\tau > 0.5$. It has been demonstrated in many of these programs that long-term trend analyses cannot be utilized to evaluate lake datasets until at least five years' worth of data have been collected.

As of 2008, there were 159 CSLAP lakes that have been sampled for at least five years; of these, 115 were sampled within the last five years. The change in these lakes is demonstrated in figures 7 and 8; figures 7a through 7l indicate "moderate" long-term change, while figures 8a through 8l indicate "significant" long-term change**.** When these lakes are analyzed by this combination of parametric and non-parametric analyses, these data suggest that while most NYS lakes have not demonstrated a significant change (either τ or R^2 >0.5) or even a moderate changes (τ or R^2 >0.33).



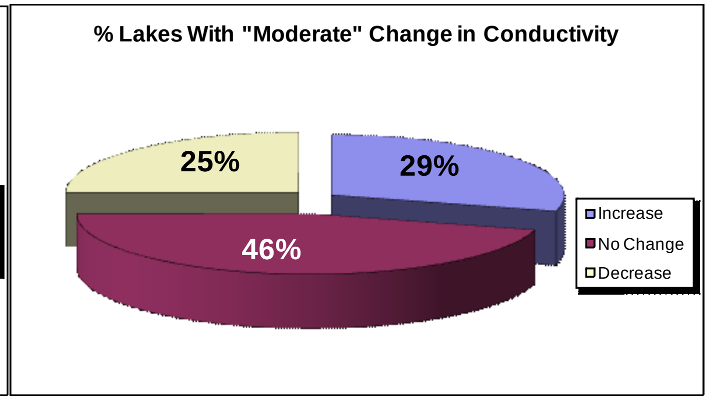
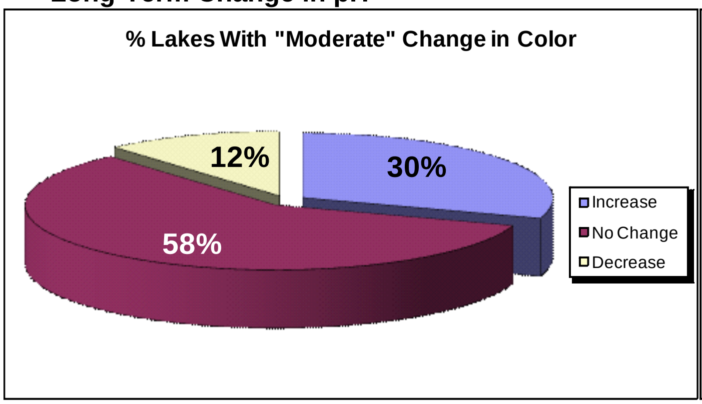


Figure 7a. %CSLAP Lakes Exhibiting Moderate Long-Term Change in pH

Figure 7b. %CSLAP Lakes Exhibiting Moderate Long-Term Change in Conductivity



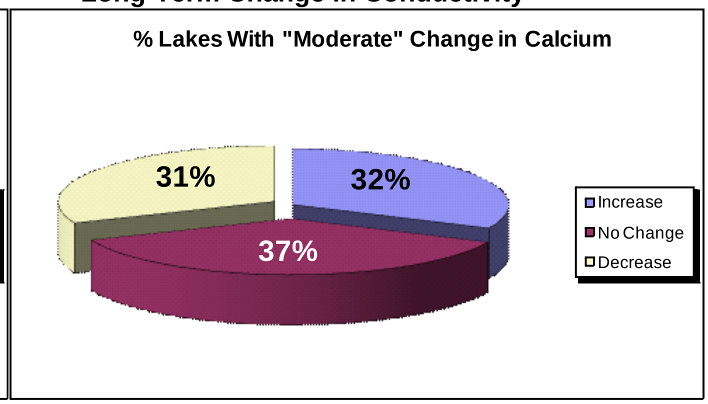
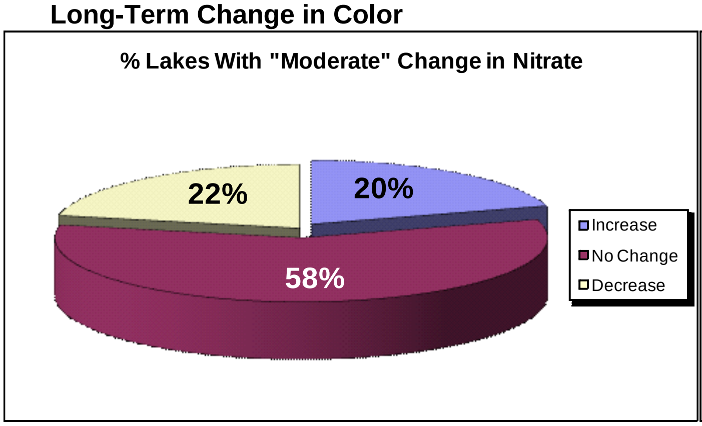


Figure 7c. %CSLAP Lakes Exhibiting Moderate Long-Term Change in Color

Figure 7d. %CSLAP Lakes Exhibiting Moderate Long-Term Change in Calcium



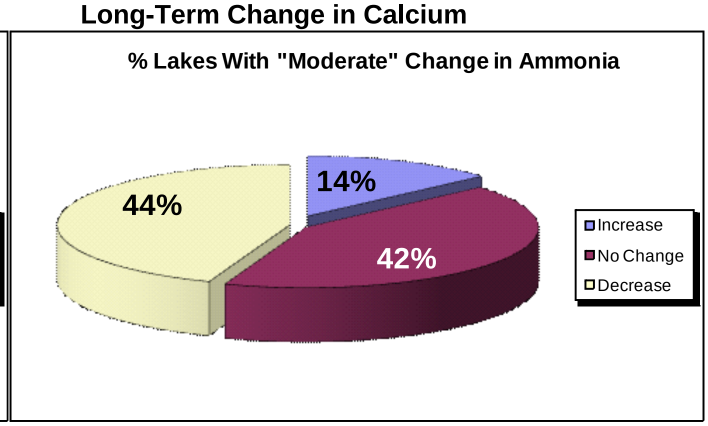
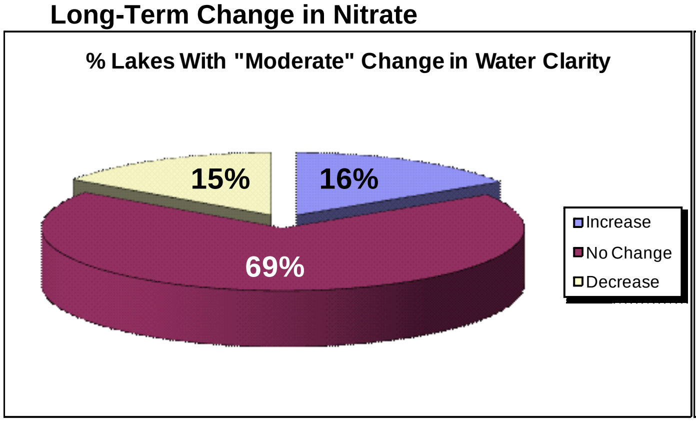


Figure 7e. %CSLAP Lakes Exhibiting Moderate Long-Term Change in Nitrate

Figure 7f. %CSLAP Lakes Exhibiting Moderate Long-Term Changes in Ammonia



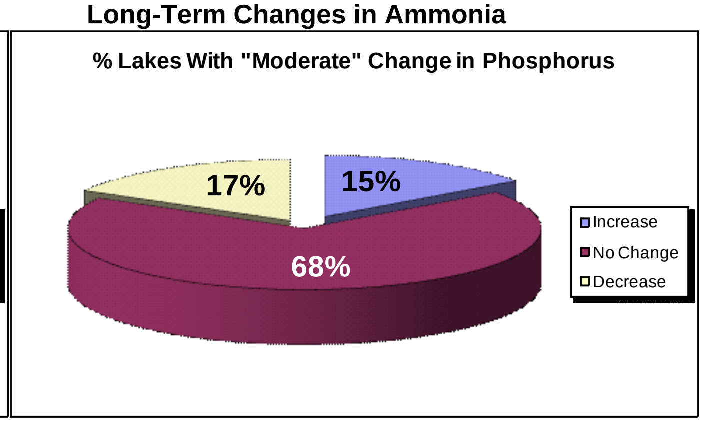


Figure 7g. %CSLAP Lakes Exhibiting Moderate Long-Term Change in Water Clarity

Figure 7h. %CSLAP Lakes Exhibiting Moderate Long-Term Changes in Phosphorus

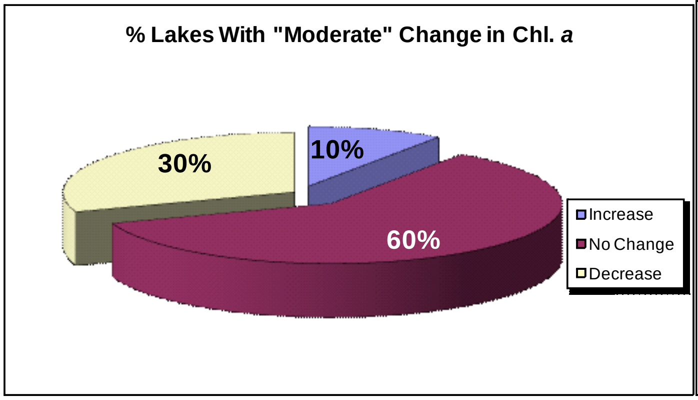


Figure 7i. %CSLAP Lakes Exhibiting Moderate Long-Term Change in Chlorophyll *a*

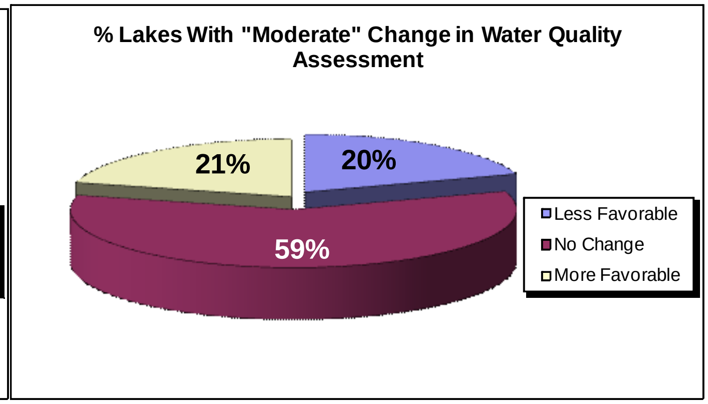


Figure 7j. %CSLAP Lakes Exhibiting Moderate Long-Term Change in Water-quality Assessment

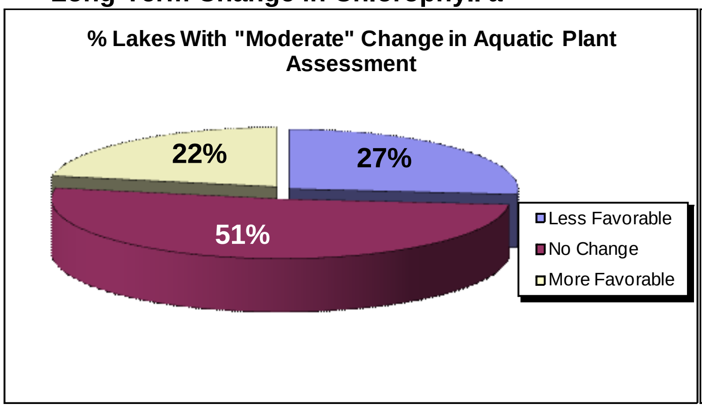


Figure 7k. %CSLAP Lakes Exhibiting Moderate Long-Term Change in Aquatic Plant Assessment

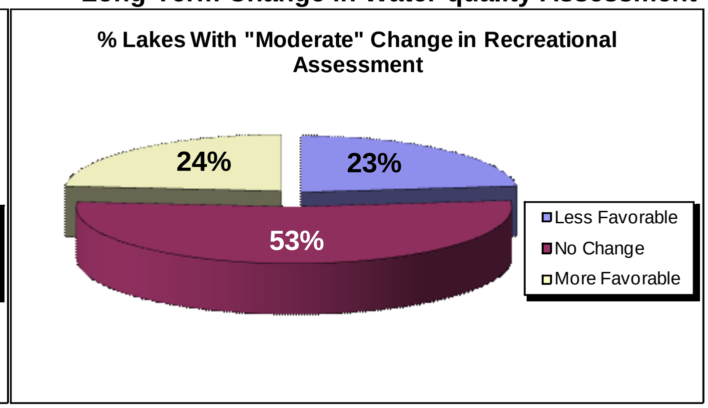


Figure 7l. %CSLAP Lakes Exhibiting Moderate Long-Term Change in Recreational Assessment

Some of the lakes sampling through CSLAP have demonstrated a moderate change since CSLAP sampling began in 1986, at least for some of the sampling parameters measured through CSLAP. In general, between 50% and 65% of the CSLAP lakes have not exhibited even moderate changes. Some of the parameters that have exhibited moderate changes may not reflect actual water-quality change. For example, it appears that the increase in color (Figure 7c) could be due to the shift in laboratories, even though the analytical methods are comparable. However, in most parts of the state, more precipitation fell in the last 10-12 years than in the previous 10-12 years. For some CSLAP lakes, this may have triggered an increase in runoff in organic soils. The decrease in pH (Figure 7a) is probably a real phenomenon—this decrease was evident to some degree prior to the shift in laboratories, and both are largely predictable. The differences in the other indicators do not appear to be important and probably indicates random variability.

Figures 8a through 8l indicate that, not surprisingly, "substantial" change is less common. Substantial change follows the same patterns as discussed above with the evaluation of "moderate" change in CSLAP lakes, except that the percentage of CSLAP lakes not exhibiting significant change is much higher, rising to about 65-85% of these lakes. For those CSLAP lakes exhibiting substantial change, it is most apparent in the same parameters described above. About 20% of the CSLAP lakes have exhibited a substantial increase in water color, consistent with a broad (and expected) successional pattern, in which lakes generally concentrate materials washed in from the surrounding watershed (and as the runoff itself concentrates organic materials as these watersheds move from forested to more urbanized, whether via residential development or other uses. The comparison between figures 8b and 8e through 8h indicate that this has not (yet) translated into higher nutrient loading into lakes.

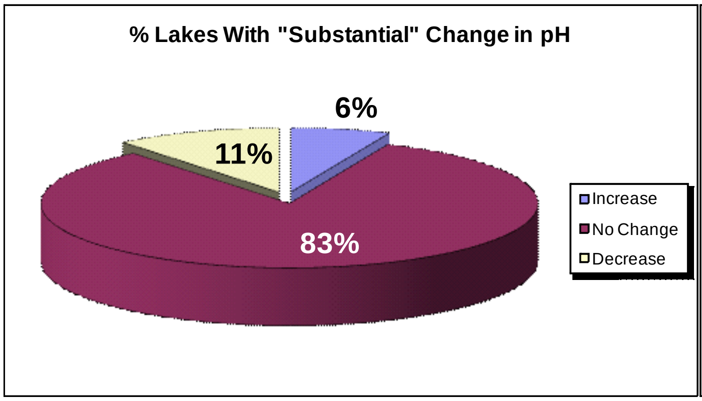


Figure 8a. %CSLAP Lakes Exhibiting Substantial Long-Term Change in pH

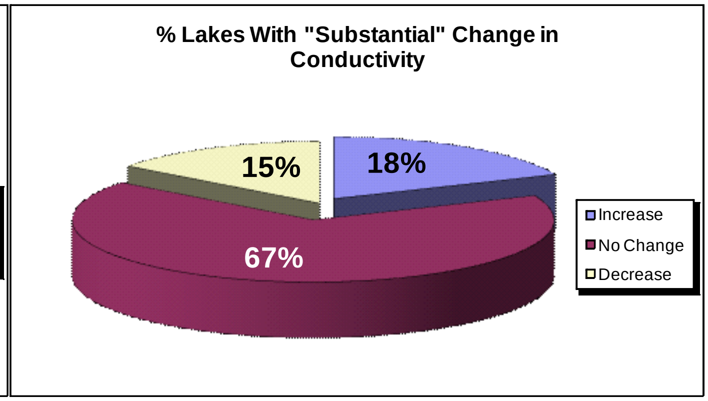


Figure 8b. %CSLAP Lakes Exhibiting Substantial Long-Term Change in Conductivity

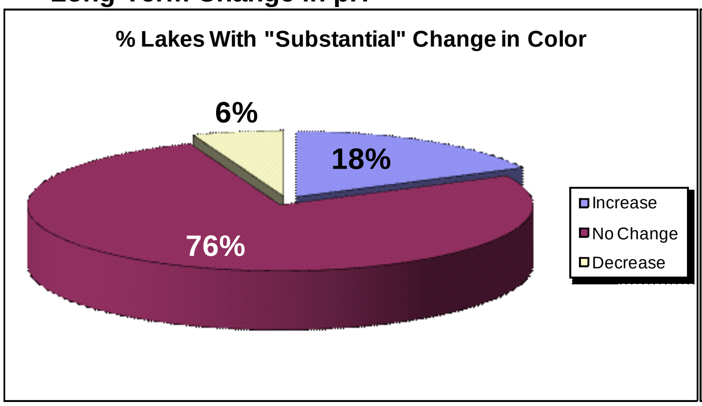


Figure 8c. %CSLAP Lakes Exhibiting Substantial Long-Term Change in Color

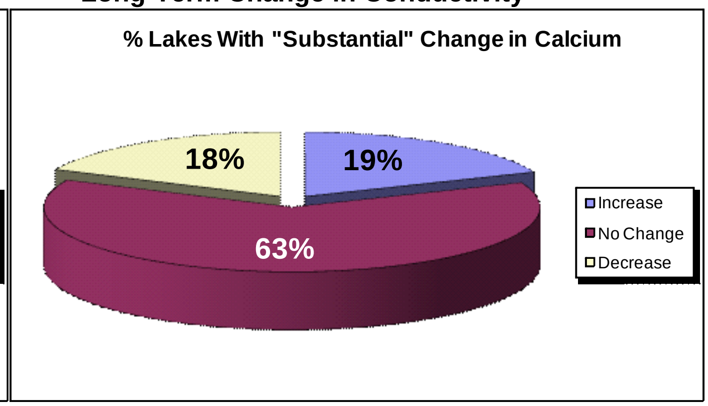


Figure 8d. %CSLAP Lakes Exhibiting Substantial Long-Term Change in Calcium

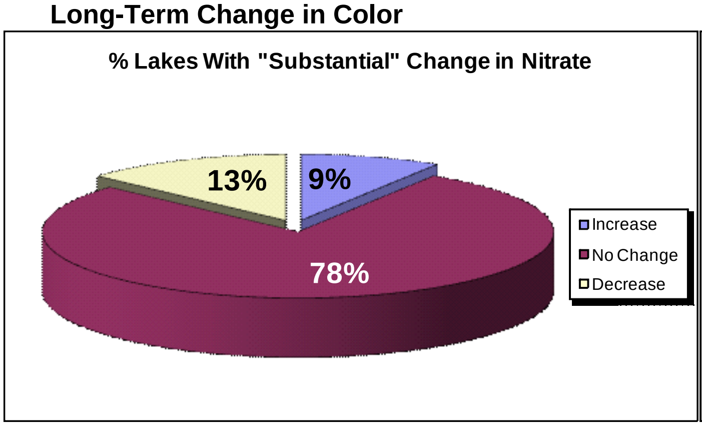


Figure 8e. %CSLAP Lakes Exhibiting Substantial Long-Term Change in Nitrate

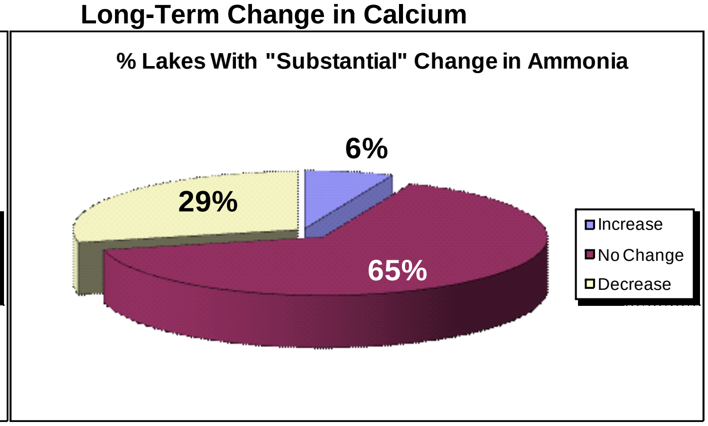


Figure 8f. %CSLAP Lakes Exhibiting Substantial Long-Term Changes in Ammonia

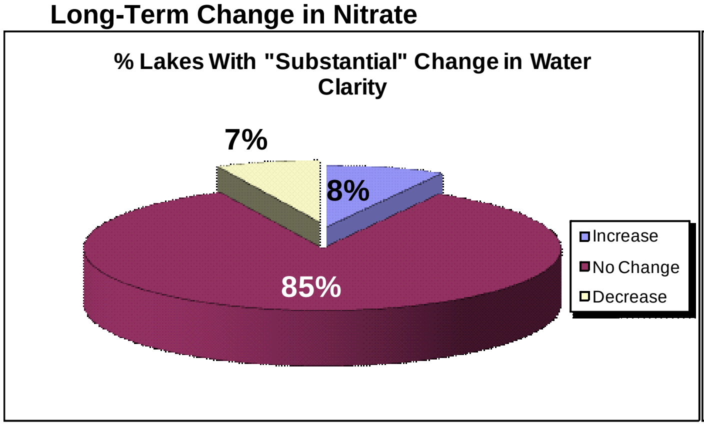


Figure 8g. %CSLAP Lakes Exhibiting Substantial Long-Term Change in Water Clarity

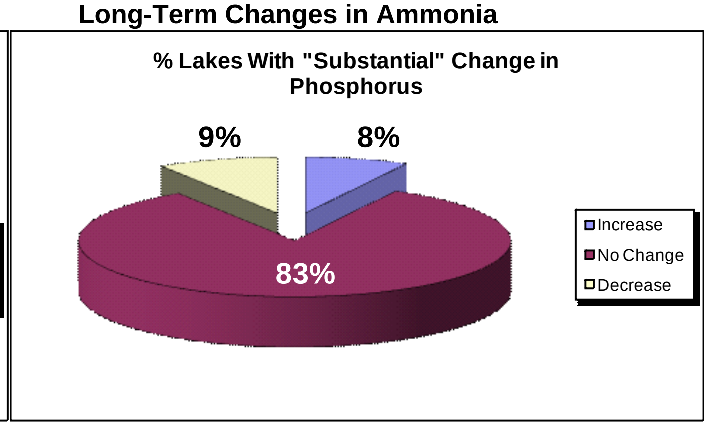


Figure 8h. %CSLAP Lakes Exhibiting Substantial Long-Term Changes in Phosphorus

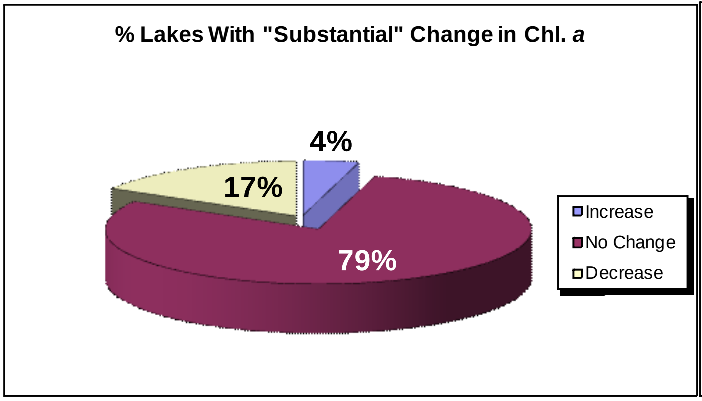


Figure 8i. %CSLAP Lakes Exhibiting Substantial Long-Term Change in Chlorophyll *a*

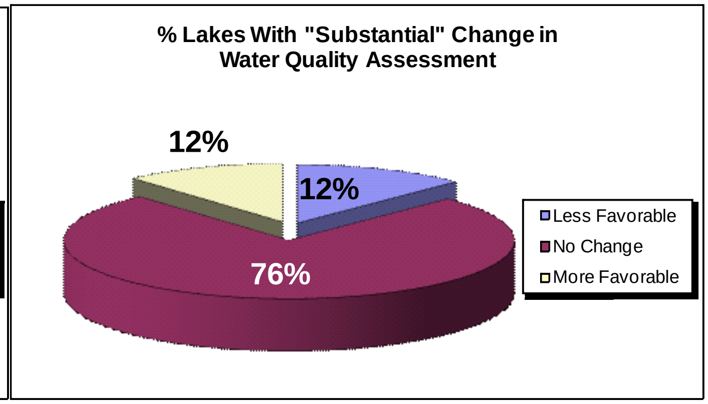


Figure 8j. %CSLAP Lakes Exhibiting Substantial Long-Term Change in Water-quality Assessment

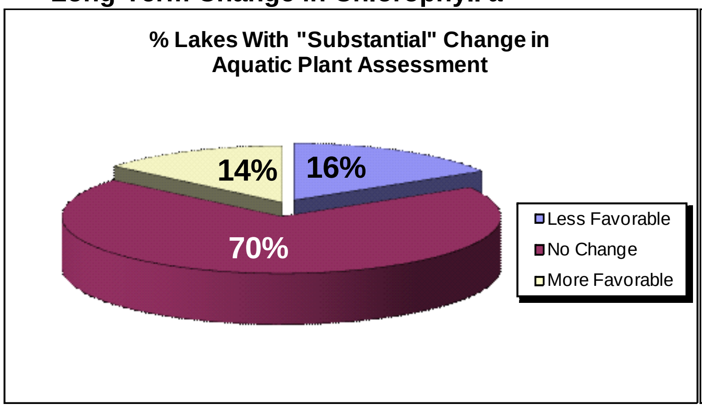


Figure 8k. %CSLAP Lakes Exhibiting Substantial Long-Term Change in Aquatic Plant Assessment

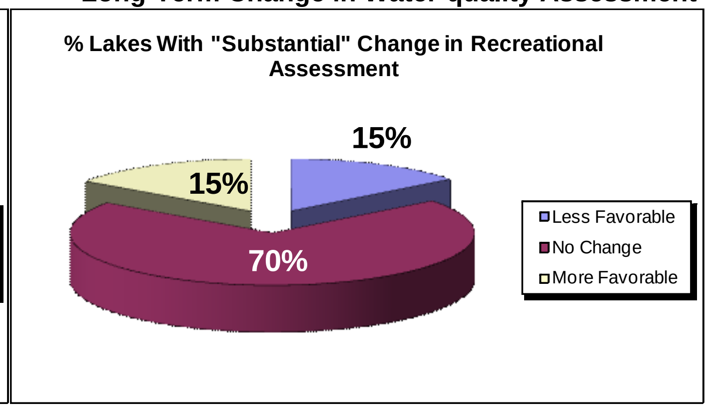


Figure 8l. %CSLAP Lakes Exhibiting Substantial Long-Term Change in Recreational Assessment

As noted above, there does not appear to be any clear pattern between weather and water-quality changes, although some connection between changes in precipitation and changes in some water-quality indicators is at least alluded to in some cases. However, all of these lakes may be the long-term beneficiaries of the ban on phosphorus in detergents in the early 1970s, which, with other local circumstances (perhaps locally more "favorable" weather, local stormwater or septic management, etc.), has resulted in less productive conditions. Without these circumstances, water-quality conditions in many of these lakes might otherwise be more productive in the creeping march toward aging, eutrophication, and succession (as suggested from the steady rise in conductivity). In other words, the higher materials loading into these lakes may be largely balanced by a reduction in nutrients within the corresponding runoff.

The drop in pH in NYS lakes has been studied at length within the Adirondacks and may continue to be attributable on a statewide basis to acid rain, which continues to fall throughout the state. The CSLAP dataset is not adequate to evaluate any ecological changes associated with higher lake acidity, and it is certainly worth noting that the slight drop in pH in most CSLAP lakes does not bring these lakes into an acidic status (these lakes have, at worse, become slightly less basic). In addition, for lakes most susceptible to acidification, laboratory pH is only an approximation of actual pH. Fully accurate pH readings require field measurements using very specialized equipment, although for most lakes with even modest buffering capacity, laboratory pH is a good estimate of *in situ* pH readings. So while the decrease in pH in some CSLAP lakes should continue to be watched, it does not appear to be a cause for concern, at least relative to the low pH in small, undeveloped, high-elevation lakes within the Adirondack Park.

Lake perception has changed more significantly than water-quality (except conductivity). None of the lake perception indicators—water-quality, weeds, or recreation—have varied in a consistent manner, although variability is more common in each of these indicators. The largest change is in recreational assessments, with about one third of all lakes exhibiting substantial change and nearly half demonstrating moderate change. A more detailed analysis of these assessments (not presented here) indicates that the Adirondacks have demonstrated more "positive" change than other regions of the state, due to the perception that aquatic weed densities have not increased as significantly (and water-quality conditions have improved in some cases). However, the rapid spread of *Myriophyllum spicatum* into the interior Adirondacks will likely reverse this "trend" in coming years, and it is not clear if these "findings" can be extrapolated to other lakes within the Adirondack Park.

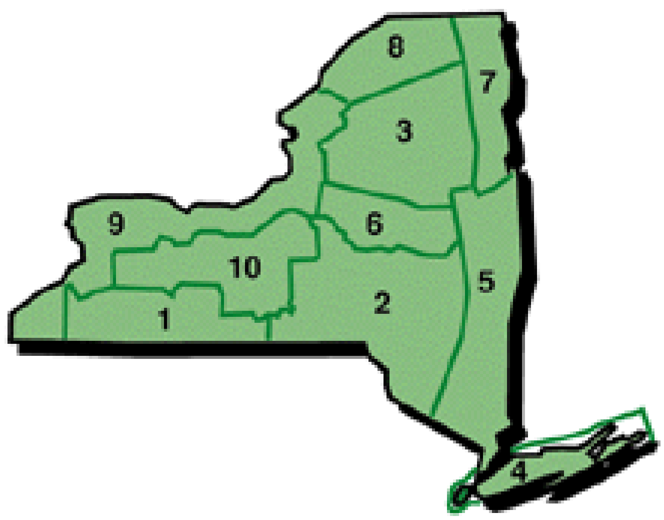


Figure 9- NOAA Weather Zones in New York State

Larger trends and observations about each of the CSLAP sampling parameters are presented below in figures 10 through 21. Information about general precipitation and runoff patterns—whether a particular year was wet or dry—is reported to provide a basis for understanding the connection between weather and water quality for lakes in New York state. It is clear that weather patterns are highly variable within the state. While this is also apparent down at the individual lake scale—storms can fall at a lake but not a neighboring lake—the National Oceanographic and Atmospheric Administration (NOAA) has established ten weather zones in New York state corresponding to regions exhibiting similar weather patterns. Weather data for the state can be summarized by each of these zones, in an attempt to fine-tune individual lake analyses to local weather data. This would be even more accurate with individual NOAA station weather data, but these are not consistently available in much of the state.

The individual parameter summaries provided in figures 10-20 correspond to the predominant weather patterns found from 1986 to 2007 in the state. A code can be located above the columns for each year; a "↑" corresponds to wetter (>50%) than normal weather, while "↓" corresponds to drier (<50%) than normal weather, and "0" corresponds to normal weather. In this code, the first symbol corresponds to the winter and spring precipitation, and the second symbol corresponds to summer precipitation. So, for example, a code of "↑↓" corresponds to a wet spring and dry summer, while "00" corresponds to normal spring and summer precipitation. While ideally the individual parameter summaries and weather summaries could be delineated by weather zone, the CSLAP lake dataset is not sufficient large for most of these weather zones to generate statistically meaningful data summaries. However, these weather zone data are used in the individual lake data summaries in **Section IV: Detailed Lake Oscaleta Water Quality Summary.**

Lake Oscaleta is in NOAA weather zone 5, the Hudson Valley region. The precipitation patterns for this zone are summarized below.

Statewide and Lake Oscaleta Regional Weather Patterns

Weather patterns in New York state have varied significantly from year to year since at least 1986. This may be a response to global climatic change, since greater weather variance has been observed by both climatologists and casual observers.

Using the criteria above (wetter = >50% more precipitation than the long-term average, drier = >50% less precipitation than normal) and equally weighing each of the 10 NOAA weather zones in New York state, Table 1 shows the winter (January through March) and spring (April through June) precipitation and "summer" (June through September) precipitation patterns for New York state and the NOAA zone corresponding to Lake Oscaleta. Summer was defined here to overlap with spring to include the entirety of the sampling season for most CSLAP lakes.

Year	Statewide Avg: Winter-Spring / Summer	NOAA Zone 5 Avg: Winter-Spring / Summer
1986	Normal / Wet	Normal / Normal
1987	Dry / Normal	Normal / Wet
1988	Very Dry / Normal	Very Dry / Normal
1989	Wet / Normal	Wet / Normal
1990	Very Wet / Normal	Very Wet / Normal
1991	Normal / Normal	Dry / Normal
1992	Normal / Wet	Dry / Normal
1993	Wet / Normal	Normal / Normal
1994	Wet / Normal	Very Wet / Wet
1995	Very Dry / Normal	Very Dry / Normal
1996	Very Wet / Normal	Very Wet / Very Wet
1997	Normal / Normal	Dry / Normal
1998	Very Wet / Normal	Very Wet / Dry
1999	Normal / Normal	Wet / Wet
2000	Very Wet / Normal	Very Wet / Normal
2001	Normal / Normal	Normal / Normal
2002	Very Wet / Dry	Normal / Normal
2003	Normal / Wet	Normal / Very Wet
2004	Dry / Very Wet	Very Dry / Very Wet
2005	Normal / Normal	Wet / Normal
2006	Wet / Wet	Very Wet / Normal
2007	Normal / Normal	Wet / Normal

Table 1: Statewide and NOAA Zone 5 Weather Patterns

The weather data in Table 1 shows that wetter than normal summers have occurred in three of the last four years, although more variable weather patterns have occurred in the winter and spring. The wettest years have been 1990, 1996, 1998, 2004 and 2006, while the driest years were 1988 and 1995. The only dry seasons since 1995 were the winter of 2004 and the summer of 2002.

Data from the Hudson Valley Region—which includes Lake Oscaleta— have indicated wet conditions over the last five years. The wettest years have been 1994, 1996, 1999, 2000, 2003, and 2006, while the driest years were 1988, 1995, 1991 and 1992. It should be noted that only one dry summer (1998) and one dry winter (2004) has occurred in this region in the last ten years. Within the CSLAP sampling timetable for Lake Oscaleta, 2006 and 2007 were wet, and the CSLAP volunteers reports indicate that 2008 was probably wet.

pH

Annual Variability:

The pH of most CSLAP lakes has consistently been well within acceptable ranges for most aquatic organisms during each sampling season. The average pH has not varied significantly from one sampling season to the next, although pH was highest in 1988 (one of the driest years), 1992, 2006 and 2007 and lowest in 1987 and 2004. pH readings were slightly lower than normal in 1996 but higher than normal in 2006, the two wettest years, and were not significantly different than normal in 1995, perhaps the driest year. There do not appear to be any significant annual pH trends in the CSLAP dataset, at least as evaluated in Figure 10a. 90% of all samples had pH between 6.5 and 8.5 (the state water-quality standards); 6% of samples have pH > 8.5, and 4% have pH < 6.5.

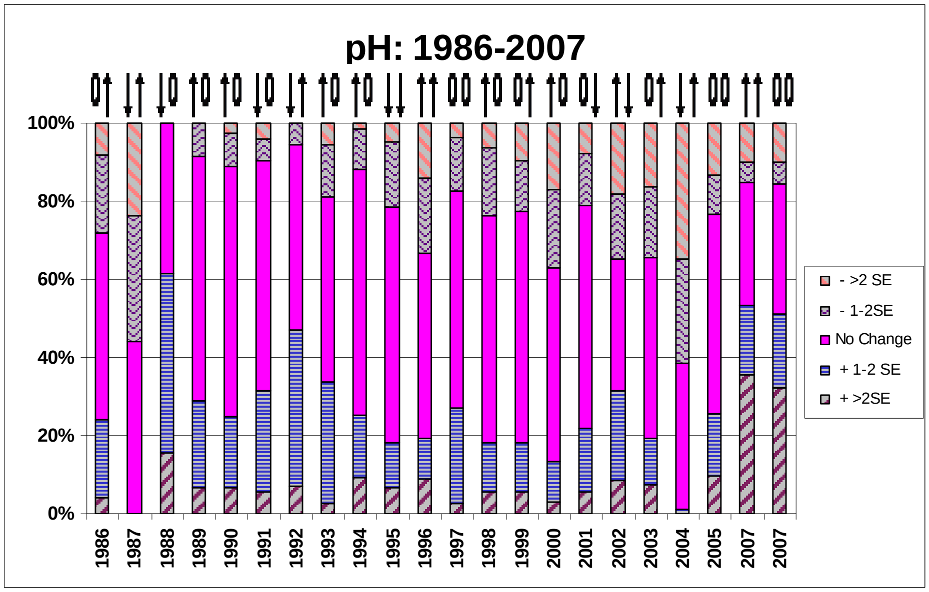


Figure 10a. *Annual Change from "Normal" pH in CSLAP Lakes (SE = Standard Error)*

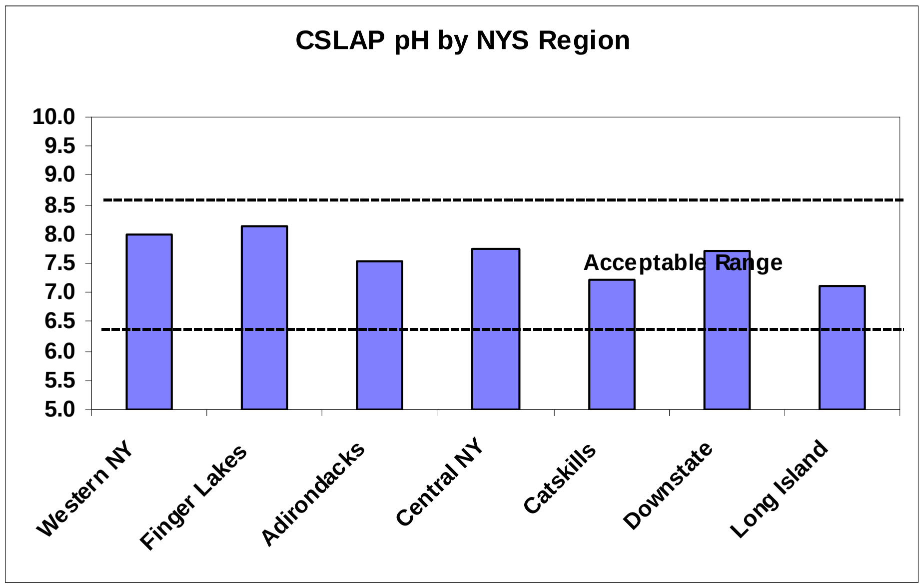


Figure 10b. *pH in CSLAP Lakes by NYS Region*

What Was Expected in 2008?

2008 was a relatively wet year, at least in most of the state during the spring to early summer. There is not a strong correlation between weather and pH during most of the CSLAP sampling seasons. However, pH readings have slightly higher in the last few years, perhaps due to phenomena unrelated to weather. This suggests that pH readings may be slightly higher than normal in 2008, though probably lower than in 2006 and 2007.

What Happened at Lake Oscaleta in 2008?

pH readings in 2008 were lower at the end of the sampling season, and a few readings in the beginning of the sampling season were above the state water quality standards. It is not known if this has resulted in any ecological impacts.

Statewide Variability:

As expected, pH readings are lowest in the high-elevation regions (Adirondacks and Catskills) or Long Island, which has primarily shallow and slightly colored lakes, and the highest in regions with relatively high conductivity (western NY and the Finger Lakes region). All of these readings are consistently within the acceptable range for most aquatic organisms. However, the CSLAP dataset does not reflect the low pH found in many high elevation NYS lakes overlying granite and poorly buffered soils, because the typical CSLAP lake resides in geological settings (primarily limestone) that allow for residential development. In other words, pH is one of the few CSLAP sampling parameters that do not yield comparable results when comparing CSLAP results to overall NYS results, because CSLAP lakes are not really representative of the typical NYS lake as related to pH.

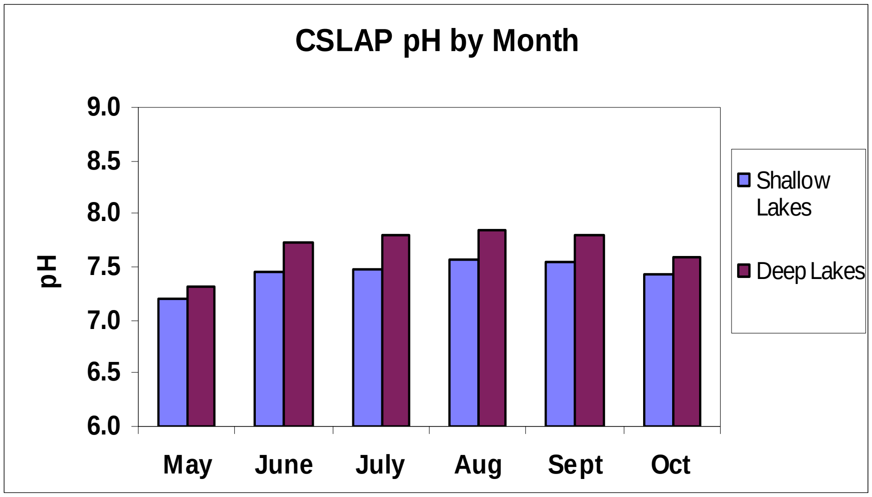


Figure 10c. *pH in Shallow (<20ft deep) and Deep CSLAP Lakes by Month*

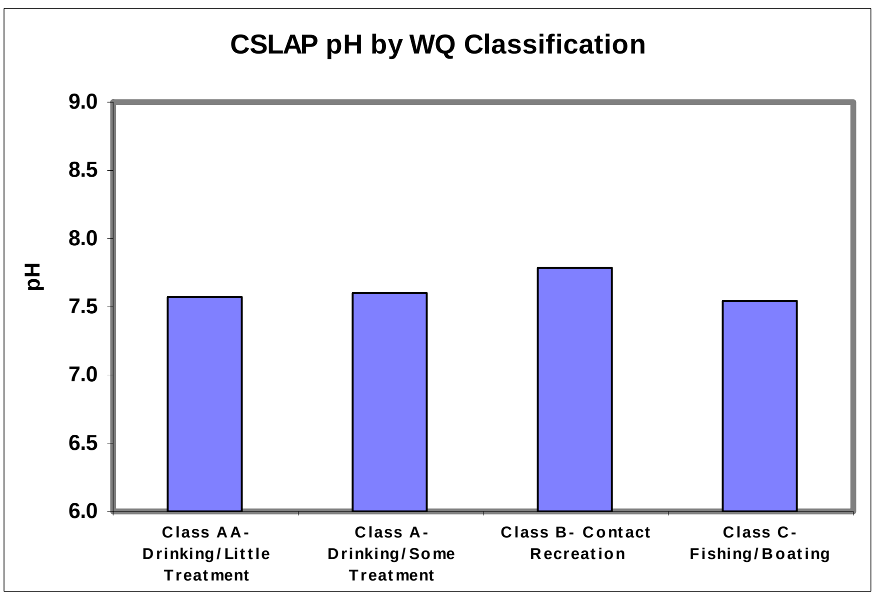


Figure 10d. *pH in CSLAP Lakes by Lake Use*

Seasonal Variability:

pH readings tend to increase slightly during the course of the summer, due largely to increasing algal photosynthesis (which consumes CO_2 and drives pH upward), although these seasonal changes are probably not significant. Low pH depressions are most common early in the sampling season (due to lingering effects from snowpack runoff), and high pH spikes occur mostly in mid- to late summer.

Lake-Use Variability:

pH does not vary significantly from one lake use to another, although in general, pH readings are slightly higher for lakes used primarily for contact recreation (Class B). However, this is probably more reflective of geographical differences (there are relatively more Class B CSLAP lakes in higher pH regions, and more Class A lakes in lower pH regions) than any inherent link between pH and lake usage.

Detailed Discussion #1- pH

Why was pH higher than normal in the last two years (2006 and 2007)?

Discussion:

Figure 10a shows that pH readings in more than 30% of the CSLAP lakes were much higher than normal in either 2006 or 2007. The lakes with the higher increase in pH were not confined to a particular geographic area, size range, or trophic status. These lakes do not share any other common water quality or morphometric characteristics—the higher pH lakes ranged from softwater to hardwater, high elevation to near sea level, Adirondack to downstate, and deep to shallow. It is also worth noting that nearly all of these lakes had pH readings well within the state water quality standards.

Given the connection between pH and conductivity, and between pH and chlorophyll *a* (both usually fall and rise together), it might be reasonable to expect that the lakes with the most significant rise in pH in 2007 would see a rise in either of these related indicators. However, looking at the 20 lakes for which pH rose most significantly (>250% more than expected given the normal variability from year to year) in 2007, fewer than 10% of these lakes also saw a comparable rise in either conductivity or chlorophyll *a* in 2007. In fact, a slightly larger percentage of these lakes saw a small decrease in either conductivity or chlorophyll *a* in 2007, suggesting that the increase in pH was not triggered by heavier runoff (of inorganic sediment) or higher algae growth. For some of these lakes, an isolated rise in pH was associated with higher than normal chlorophyll *a* readings, but for most of the lakes with consistently higher pH in 2007, neither conductivity nor chlorophyll *a* exhibited similar increases over the same sampling period. None of the other water quality indicators measured through CSLAP exhibited similar changes in 2007.

The lack of correlation between pH and the other CSLAP water quality indicators in 2007 suggests that the increase in pH in 2006 and 2007 represents normal variability, notwithstanding the magnitude of the increase in some of these lakes. However, more than 50% of the lakes with substantially higher than normal pH in 2006 also had substantially higher pH in 2007, a higher percentage than expected if this phenomena represented normal variability. This phenomenon was probably not related to precipitation or water level—while most of these lakes had higher pH readings coincident with wetter weather, others exhibited their highest pH during significant drought (with water level reported the lowest in more than 40 years at one lake). No other common factors are apparent in each of the lakes with consistently higher pH readings in both 2006 and 2007.

So for now, the underlying cause for the pH change in some of these CSLAP lakes is not yet apparent, but will continue to be evaluated.

Conductivity

Annual Variability:

There appeared to be a clear trend toward increasing lake conductivity from 1986 through 2004. While conductivity often increased after storm events, the highest conductivity occurred in drier years, since as 1995, with lower readings occurring in wetter years, such as 1996 and 1998. This suggests that other factors may have influenced the rise in conductivity over this period. However, conductivity was much lower than usual in 2006, a wet year, and in 2007, a year with normal precipitation, with nearly half of the CSLAP lakes exhibiting conductivity readings at least one standard error lower than usual in both years.

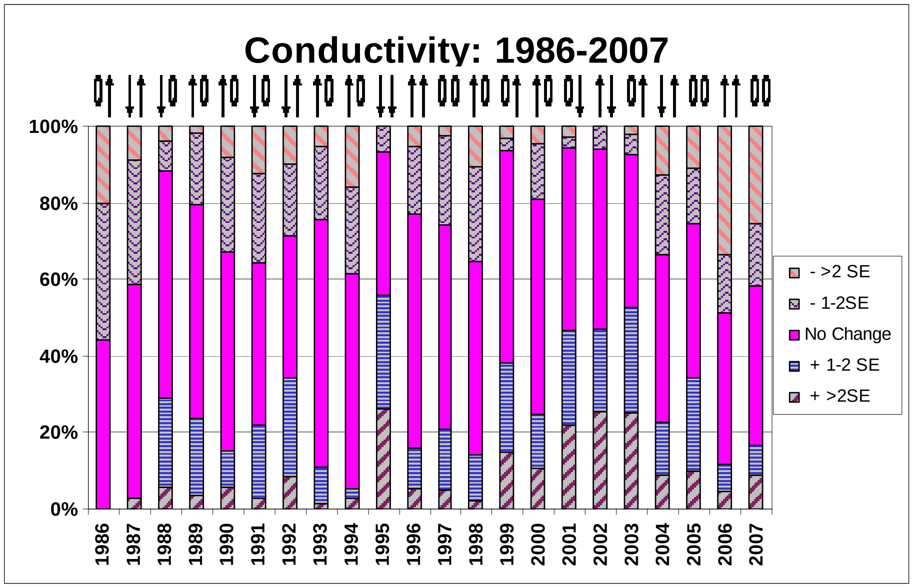


Figure 11a. *Annual Change from "Normal" Conductivity in CSLAP Lakes (SE = Standard Error)*

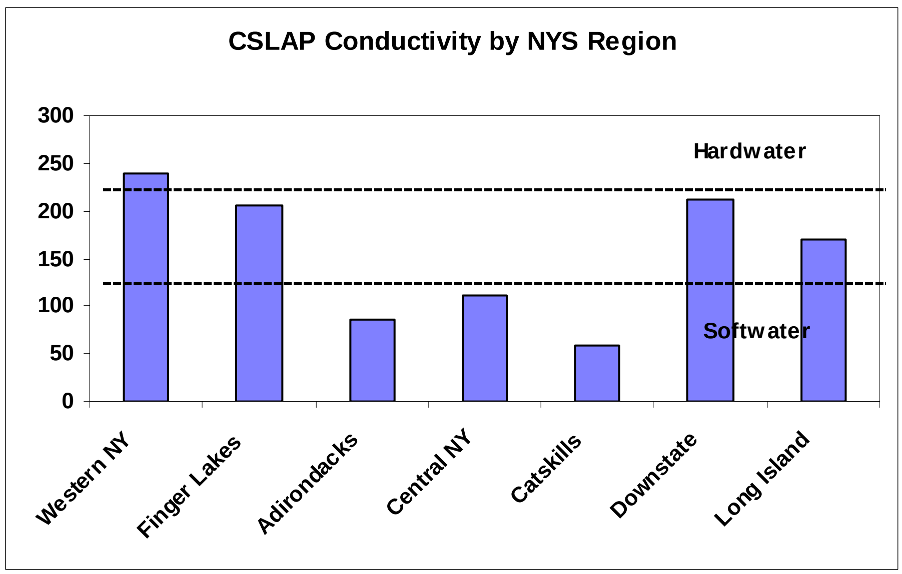


Figure 11b. *Conductivity in CSLAP Lakes by NYS Region*

What Was Expected in 2008?

2008 was a relatively wet year, at least in most of the state during much of the spring to early summer sampling season. The relationship between conductivity and precipitation is not consistent, although as noted below, wet winters appear to have triggered a decrease in summer conductivity. Therefore, it is anticipated that conductivity readings may again be lower than normal, since the winter of 2008 was wetter than normal in much of the state.

What Happened at Lake Oscaleta in 2008?

Conductivity readings were variable in the beginning of the 2008 CSLAP sampling season, then stabilized and increased slightly through the end of the summer, a pattern also observed at Lake Waccabuc. These readings were close to normal during most of the summer.

Statewide Variability:

Although “hardwater” and “softwater” are not consistently defined by conductivity, in general lakes in the Adirondacks and Catskills have lower conductivity (softer water), and lakes downstate, in western NY, and in the Finger Lakes region have higher conductivity (harder water). These regional differences are due primarily to surficial geology and “natural” conditions in these areas. However, within each of these broad geographical areas, there are usually some lakes with higher conductivity and some lakes with lower conductivity readings.

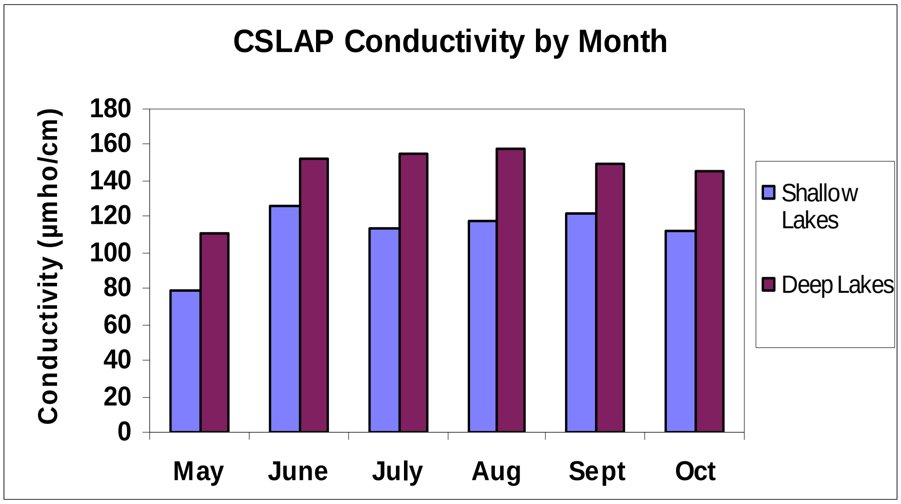


Figure 11c. *Conductivity in Shallow (<20ft deep) and Deep CSLAP Lakes by Month*

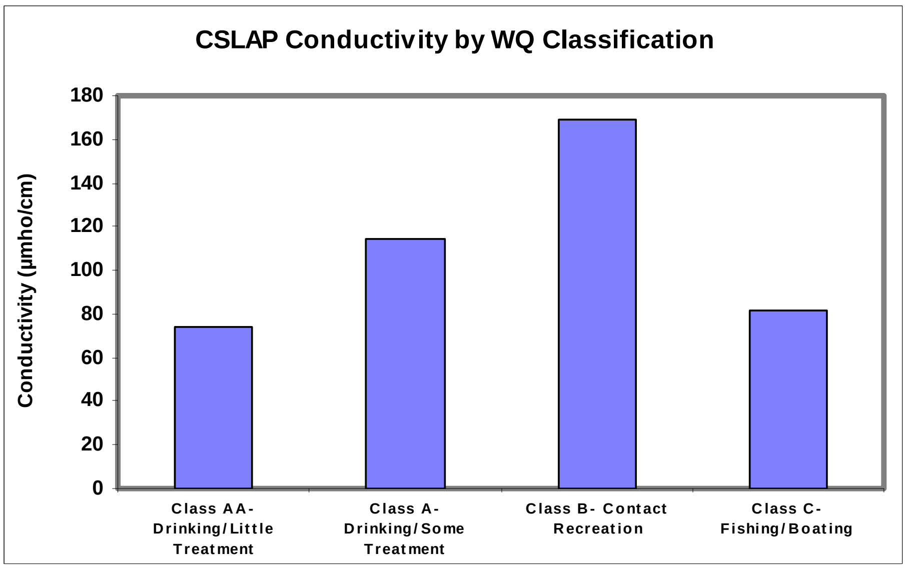


Figure 11d. *Conductivity in CSLAP Lakes by Lake Use*

Seasonal Variability:

Conductivity readings are higher in the summer than in the late spring in many CSLAP lakes. These readings decreased in deep lakes in the late summer and fall but remained fairly steady in shallow lakes during this period (actual readings within specific lakes, however, may often vary significantly from week to week). Although lake destratification (turnover) brings bottom waters with higher conductivity to the lake surface in deeper lakes, conductivity readings dropped in the fall. It is possible that fully mixed conditions may be missed in some NYS lakes by discontinuing sampling after the end of October. Conductivity readings overall were higher in deep lakes, although this may be an artifact of the sampling set (there are more CSLAP deep lakes in areas that “naturally” have harder water).

Lake-Use Variability:

Conductivity readings are substantially higher for lakes used primarily for contact recreation (Class B) and are somewhat higher for lakes used for drinking water with some treatment (Class A). However, this is probably more reflective of geographical differences (there are relatively more softwater CSLAP lakes in the Adirondacks, which tend to have more Class A or Class AA lakes, at least in CSLAP, and more Class B lakes are found in hardwater regions) than any *de facto* connection between conductivity and lake usage.

Detailed Discussion #2- Specific conductance

Why was conductivity lower than normal in the last two years (2006 and 2007)?

Discussion:

Figure 11a shows that conductivity readings in more than 30% of the CSLAP lakes were much lower than normal in either 2006 or 2007, and less than 10% of the CSLAP lakes had much higher than normal readings in these two years. This can be explained in part by pH—although the rise in pH did not appear to be triggered by a rise in conductivity, the reverse phenomenon occurs more commonly. About 40% of the lakes with much lower conductivity readings in 2007 also exhibited much lower pH. An even stronger correlation exists with color; about half of the lakes with significantly lower conductivity in 2007 also had much higher than normal color readings. This makes up an inordinately high percentage of the lakes with higher color readings, and suggests that an increasing load (migration) of organic matter to these lakes may have triggered both a rise in color (which is usually associated with dissolved organic matter) and a drop in conductivity (since these organic compounds may contain "neutral" ions and thus do not contribute to conductivity measurements).

The majority of the lakes with relatively lower conductivity were in the "central" region of the state, particularly concentrated in a band between east of the Finger Lakes region (generally starting with Madison County) and the Capital District region, with few lakes north of the Mohawk River and south of the Catskills. The majority of this band corresponds to NOAA Division 2 (the "Eastern Plateau" region shown in Figure 9), which had the wettest spring runoff conditions of any region of the state in 2007. This pattern was also apparent in other recent years with wet winters. More than 50% of the lakes in the Eastern Plateau region exhibited much lower than normal conductivity readings in each of 2005, 2006 and 2007, when winter to spring precipitation and runoff were much higher than normal. The inverse trend was apparent in 1995, corresponding to a very dry winter and spring, in which nearly 90% of the lakes in this region exhibited significant increases in conductivity. This trend was not apparent in every year—for example, wet winters and springs in 2002 and 2003 corresponded to higher summer conductivity readings in about half of the lake—but it has been consistent in the last three years. This trend was also apparent in other regions of the state. In the "Hudson Valley" region (see Figure 9), for example, wetter than normal winters and springs led to lower than normal conductivity in 2006, 2000, and 1996, and higher than normal conductivity in 1995, corresponding to a drier year.

In summary, at least part of the decrease in conductivity in many CSLAP lakes in the last two years appears to be in response to wetter winter and spring conditions, and presumably more runoff, in both of these years.

Color

Annual Variability:

Color readings in many CSLAP lakes have increased in recent years. One of the years with the lowest color readings, 1995, was the driest of the CSLAP sampling seasons, while the highest color occurred in two of the wettest years (2004 and 2006). Most lake samples (88%) correspond to water-color readings too low (< 30 ptu) to significantly influence water clarity, although nearly 30% of the samples in 2006 and 20% of the samples in 2007 corresponded to color readings exceeding this threshold. Color readings were much higher in 2006 than in any other CSLAP sampling season. Given that color readings were also highest in four of the last five years, the increase in color may be attributable in part to the shift in laboratories, which occurred prior to the 2003 sampling season. The higher color has also been coincident with wet summers and/or wet winters during most of these years (the lower color in 2005 may have been due to more normal weather patterns).

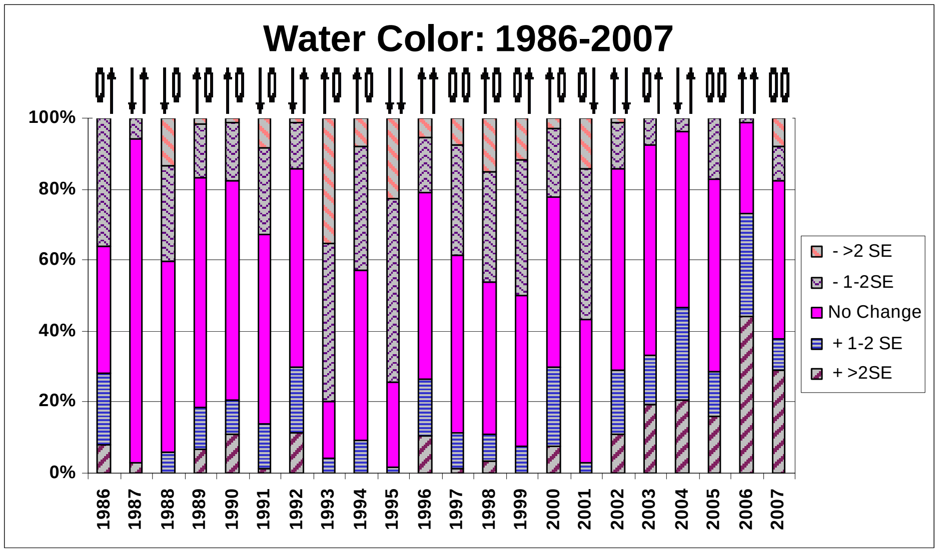


Figure 12a. *Annual Change from "Normal" Color in CSLAP Lakes (SE = Standard Error)*

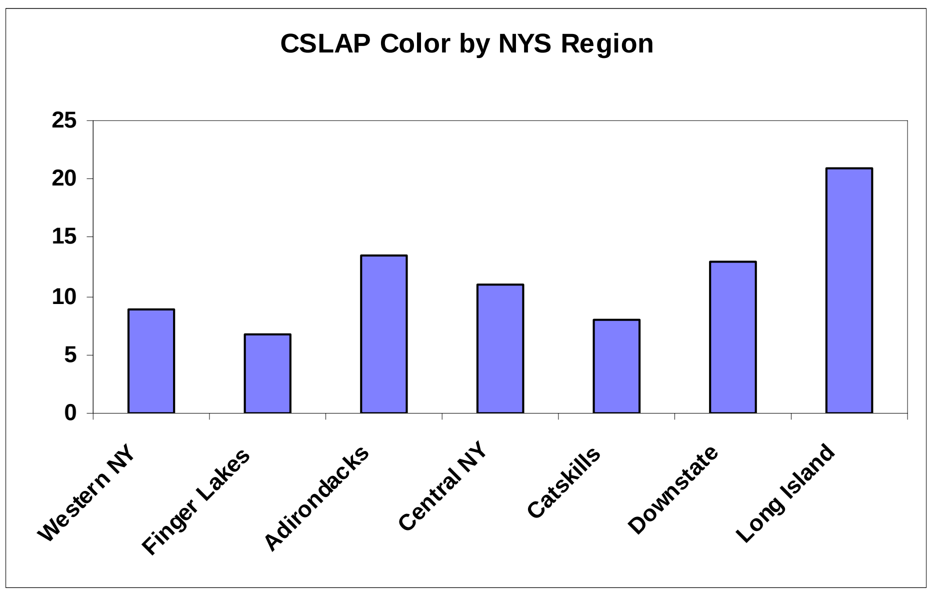


Figure 12b. *Color in CSLAP Lakes by NYS Region*

What Was Expected in 2008?

As noted above, color readings have generally been higher during wet years, and readings have been higher in most of the last six years, perhaps due in part to slightly different analytical methodology. Since 2008 generally corresponded to a wet year, it was expected that color readings in 2008 would at least be higher than the long-term average.

What Happened at Lake Oscaleta in 2008?

Water color readings in the last two years were slightly lower than in 2006. No seasonal trends have been apparent.

Statewide Variability:

Water color is highest in Long Island and the Adirondacks, and lowest in the Finger Lakes, Catskill and western NY regions. This is mostly coincident with the statewide conductivity distribution (with softwater lakes more likely to be colored). The CSLAP dataset may be a representative cross-section of NYS lakes as related to color.

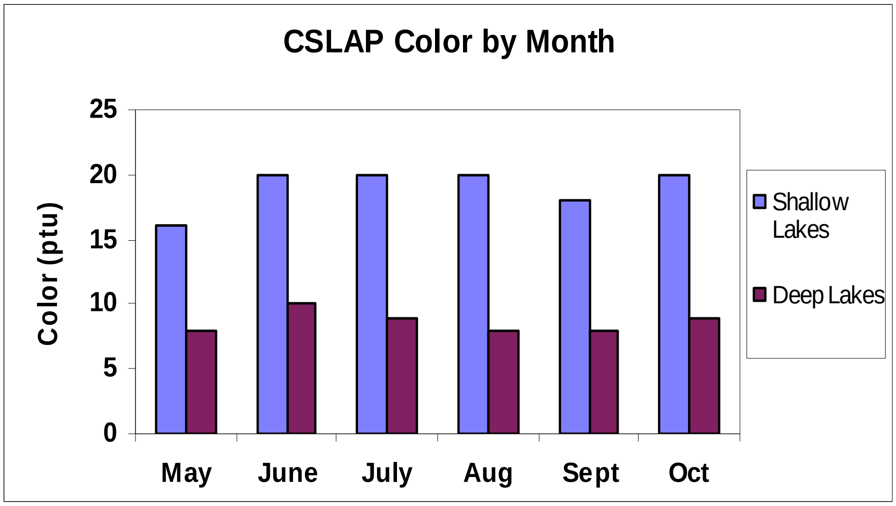


Figure 12c. *Color in Shallow (<20ft deep) and Deep CSLAP Lakes by Month*

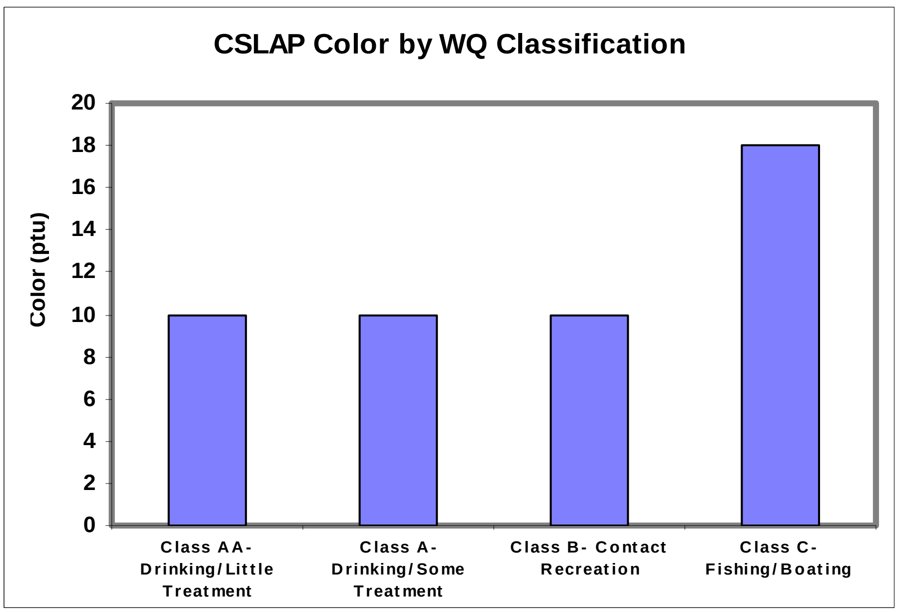


Figure 12d. *Color in CSLAP Lakes by Lake Use*

Seasonal Variability:

Color readings are significantly higher in shallow lakes than in deepwater lakes; these readings increase from spring to summer in these shallower lakes (perhaps due to dissolution of organic material, including algae, and wind-induced mixing during the summer) and then drop off again in late summer into the fall. Color generally follows the opposite trend in deeper lakes, with slightly decreasing color readings perhaps due to more particle setting in the summer and remixing in the fall, although the seasonal trend in the deeper lakes is not as pronounced as in shallow lakes.

Lake-Use Variability:

Color readings are substantially higher for lakes used primarily for non-contact recreation (Class C), but this is probably more reflective of morphometric differences, for Class C lakes tend to be shallow lakes (mean depth = 4 meters), while the other classes tend to be deeper lakes (mean depth = 9 meters). However, the elevated color readings correspond to elevated levels of dissolved organic matter and may also reflect impediments (via economically viable water treatment, aesthetics, and potential formation of hazardous compounds during chlorination) to the use of these waters for drinking.

Detailed Discussion #3- Water color

Why have color readings increased since 2002?

Discussion:

Figure 12a shows that color readings have been higher than normal in the last six years, with 30-70% of the CSLAP lakes exhibited higher color readings in each of these years. This pattern was most pronounced in 2006, when nearly half of the sampled lakes exhibited color readings that were substantially higher than normal.

This shift occurred starting in 2002 and especially in 2003, which corresponded to a shift in laboratories from the NYSDOH to Upstate Freshwater Institute. More so than any of the other sampling parameters, color measurements are not automated; they involve a visual comparison of a filtered water sample against a scaled order of known (brown) color solutions created from platinum-cobalt standards.

An analysis of the color and water clarity data indicates that the rise in color is, at least in part, a real phenomenon. Of the 30 lakes in 2006 in which color rose most significantly, more than half exhibited a significant decrease in water clarity, although nearly 30% of these lakes also showed a slight rise in algae levels (as measured by chlorophyll *a*). The same pattern was observed in 2007, when the more colored lakes were 4x more likely to exhibit a decrease in water clarity than an increase in transparency (despite no significant changes in chlorophyll *a* readings), and in 2003, when water clarity remained fairly stable despite a substantial decrease in algae levels in these more colored lakes. This pattern also occurred in other years when samples were analyzed at the NYSDOH.

The basis for this increase in color also seems to be related to precipitation. The most significant increase in water color occurred in 2006. In the Eastern Plateau and Hudson Valley regions of New York state, water color readings increased significantly in 70-85% of the lakes, due to much wetter than normal weather throughout the spring runoff and summer sampling season. In 2005 and 2007, corresponding to precipitation and runoff patterns in these regions much closer to normal, the percentage of lakes in which water color increased was only slightly higher than the percentage of lakes in which color decreased, suggesting normal variability. In the “Northern Plateau” (Adirondacks), water color readings were higher than normal in nearly 70% of the lakes in 2006, corresponding to the only wet year since 2002. In other recent years, when either winters or summers were normal to dry, water color readings increased in fewer than 25% of the lakes, about the same percentage in which color readings decreased over the same period.

Calcium

Annual Variability:

Calcium was analyzed for the first time in 2002, so long-term analyses are limited by the relative lack of data. Readings were highest in 2004 and lowest in 2002; the latter corresponded to a year in which calcium was analyzed by a different laboratory. While 2004 was the only year since 2001 with a relatively dry winter, it is not known if there is a connection between winter and spring weather and summer calcium readings. Likewise, it is also not known if the drier summer in 2002 triggered the lower calcium readings. Additional data will help to determine if calcium levels are changing, but these data suggest that a significant long-term trend is not apparent.

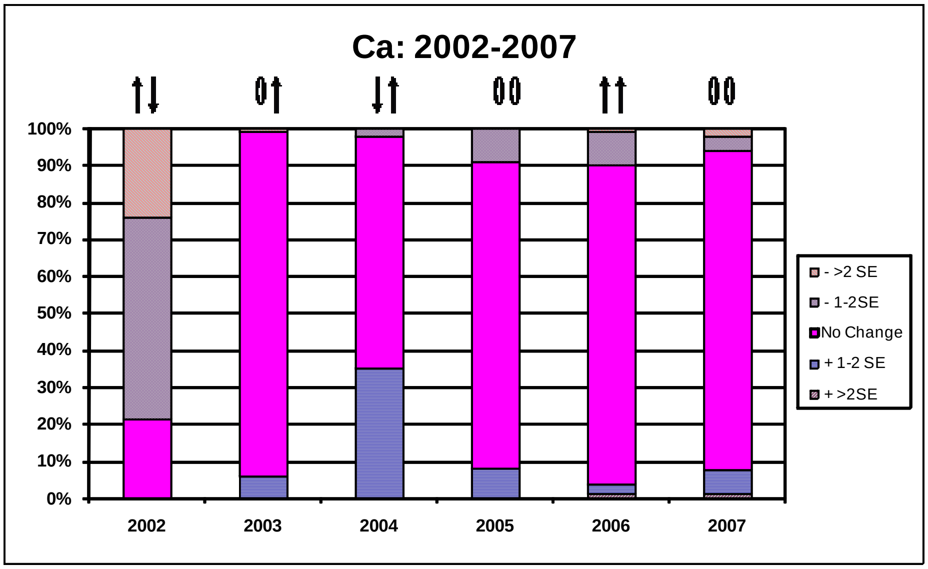


Figure 13a. *Annual Change from "Normal" Calcium in CSLAP Lakes (SE = Standard Error)*

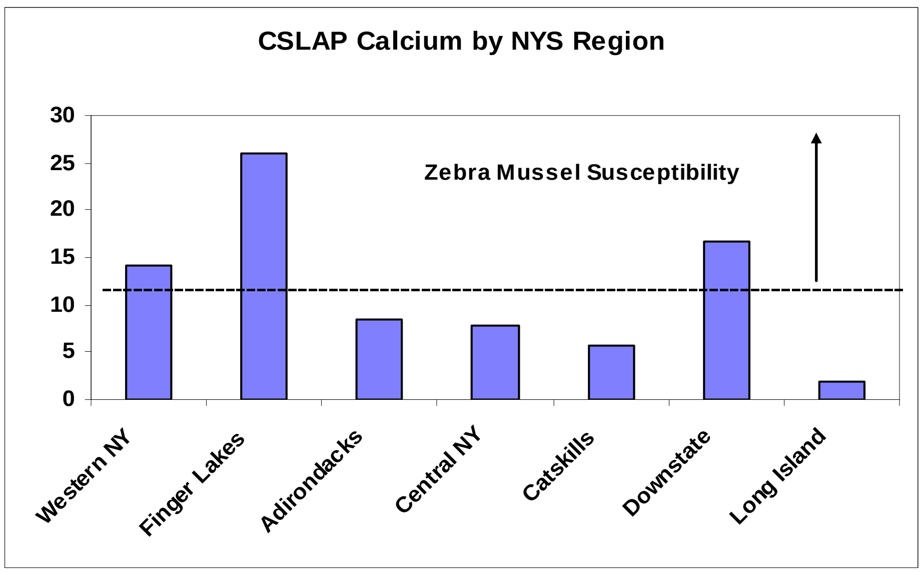


Figure 13b. *Calcium in CSLAP Lakes by NYS Region*

What Was Expected in 2008?

There did not appear to be a strong predictive connection between weather and calcium levels in the lake, notwithstanding the observations about spring and summer precipitation levels in 2002 and 2004. So the calcium readings in 2008 were expected to be "unexpected".

What Happened at Lake Oscaleta in 2008?

Calcium readings in Lake Oscaleta have been typical of lakes with intermediate hardness, and were probably comparable in the three years with calcium sampling. With only 1-2 samples collected per year, seasonal trends cannot be evaluated. These readings are probably inadequate to support zebra mussel colonization in some lakes.

Statewide Variability:

Calcium readings are highest in the Finger Lakes, western, and downstate New York regions. This is mostly coincident with the statewide conductivity distribution (since the ions that contribute to conductivity are often found in the same proportions as calcium). While the former two regions are already populated by zebra mussel-infested lakes, the downstate region at present does not possess many lakes with these exotic organisms. The data in Figure 13b suggest many of the downstate lakes may be susceptible to zebra mussels, while some lakes in many of the other regions may have already crossed the susceptibility threshold. The CSLAP dataset is most likely a reasonably representative cross-section of NYS lakes as related to calcium.

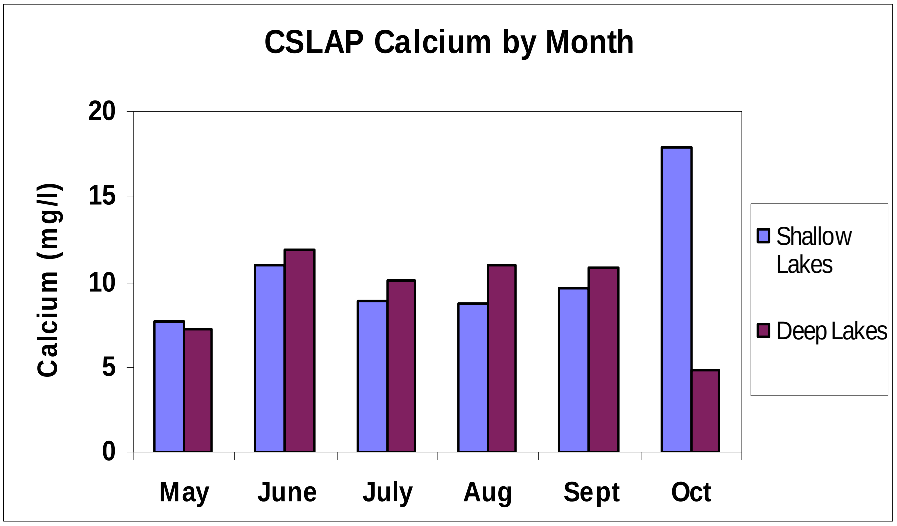


Figure 13c. *Calcium in Shallow (<20ft deep) and Deep CSLAP Lakes by Month*

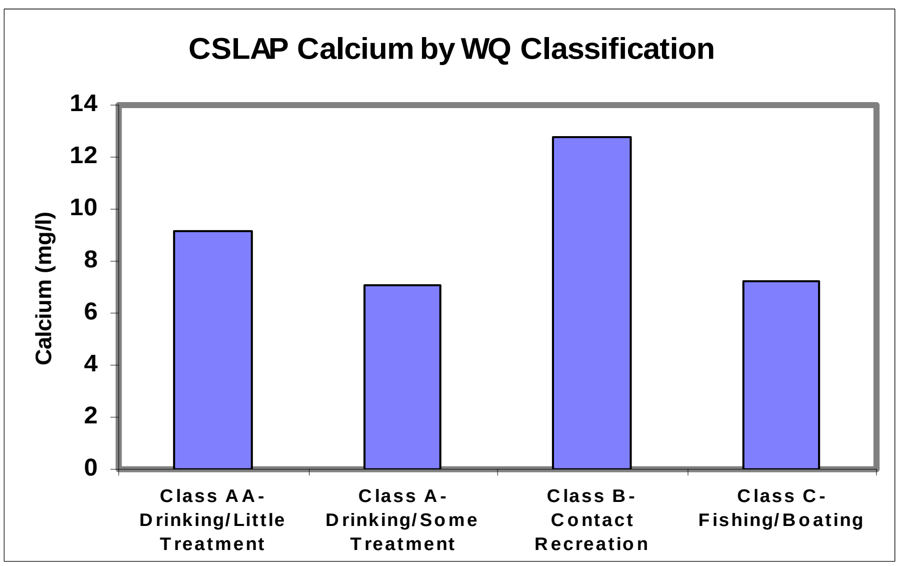


Figure 13d. *Calcium in CSLAP Lakes by Lake Use*

Seasonal Variability:

Calcium readings appear to increase during the sampling season at many shallow CSLAP lakes, with the highest readings occurring in the fall. The opposite appears to occur with deeper lakes, but it is more likely that the seasonal distribution noted in Figure 13c reflects a relatively larger number of low calcium lakes sampled in the fall rather than an actual fall decrease in calcium levels in these lakes.

Lake-Use Variability:

Calcium readings are substantially higher for lakes used primarily for contact recreation (Class B), but this is probably more reflective of regional differences, for Class B lakes are more likely to be found in the regions with higher conductivity and calcium readings, such as the Finger Lakes region, downstate, and western New York. As noted earlier, many of the Class C lakes in CSLAP are found in the Adirondacks, where calcium readings are lower.

Detailed Discussion #4- Calcium

What is the calcium threshold for zebra mussel colonization?

Discussion:

This continues to be a topic of discussion and debate among scientists. Most of the recent data in the scientific literature indicates that zebra mussel (and presumably quagga mussel) shell formation requires at least 20-25 mg/l of calcium, based on research conducted by the San Francisco Estuary Institute and others. However, there are a number of lakes in New York State supporting zebra mussel populations in which open water calcium levels are well below this threshold. In some cases, baseline calcium levels are closer to 8-10 mg/l in these lakes.

For each of these lakes, it is likely that a shoreline or localized source of calcium is sufficiently increasing the "microclimate" calcium levels to allow zebra mussel colonization, albeit at low and perhaps stunted population levels. The CSLAP dataset can be used to identify the range of open water calcium levels corresponding to at least susceptibility to zebra mussel infestations, assuming that (1) the low calcium CSLAP lakes supporting zebra mussels are probably representative of other NYS lakes and (2) lakes with sub-threshold calcium levels either do not possess natural calcium sources in the watershed or are sufficiently well mixed to support some calcium inputs (from concrete barriers) without reaching this threshold.

The CSLAP dataset includes about 1/3 of the known zebra mussel sites have been monitored. Within this dataset, there is a single lake in which calcium levels in close to 15 sites monitored throughout the (open water portion of the) lake average 8-12 mg/l. 29 other CSLAP lakes possess calcium levels between 8 and 15 mg/l. There are two other zebra mussel lakes monitored through CSLAP in which average calcium levels are between 15 and 20 mg/l; 11 other CSLAP lakes with no evidence of zebra mussel populations exhibit calcium levels in this range. One other zebra mussel-infested CSLAP lake and 14 uninfected CSLAP lakes had calcium levels between 20 and 25 mg/l. The typical calcium levels for all of the other "infected" CSLAP lakes exceeded 25 mg/l. There are also 19 other CSLAP lakes with high calcium levels that at present have not been identified as colonized by zebra mussels.

These data indicate that, although calcium levels in the waters immediately surrounding zebra mussel veligers (the larval form of this exotic mussel) may need to exceed 20-25 mg/l to produce an adult shell, there are a number of NYS lakes and at least 70 CSLAP lakes that may be susceptible to zebra mussel infestations with open water calcium levels below this threshold.

Nitrate

Annual Variability:

Evaluating nitrate in CSLAP lakes is confounded by the relative lack of nitrate data for many sampling seasons (it was analyzed in water samples at a lower frequency, or not at all, for many years), the high number of undetectable nitrate readings, and some changes in detection levels. The limited data indicated that nitrate was highest in 1986 and 1989, two early CSLAP years in which nitrate was analyzed more frequently (including a relatively large number of early season samples), and in 2004 and 2005, which corresponded to the use of a new analytical tool. Readings were lowest in 1995, 2002 and 2003. Although nitrate levels are probably closely related to winter and spring precipitation levels (due to the higher nitrate readings in snowpacks), this is not apparent from Figure 14a. There was not a predictable relationship between either winter runoff or summer rains and nitrate levels. No readings have approached the state water-quality standard (= 10 mg/l) in any CSLAP sample.

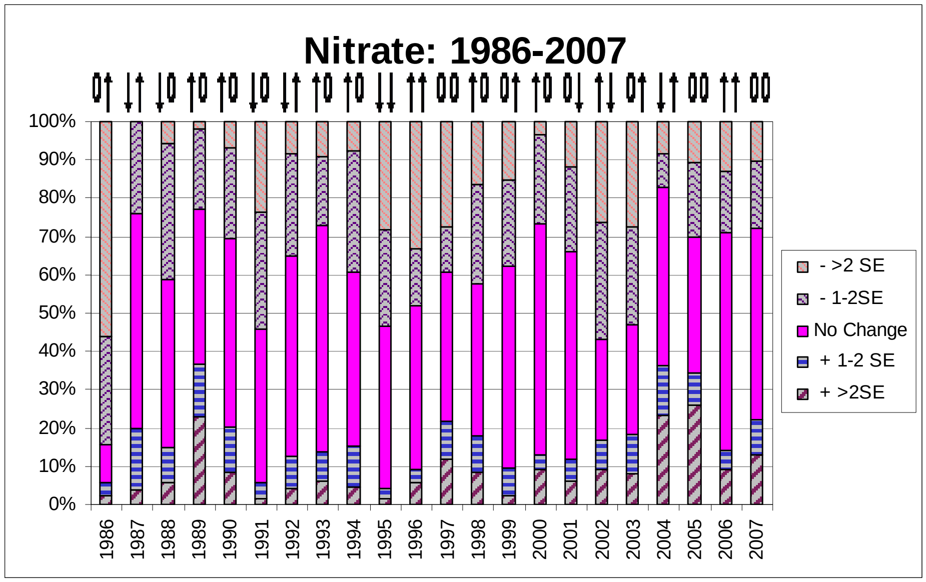


Figure 14a. *Annual Change from "Normal" Nitrate in CSLAP Lakes (SE = Standard Error)*

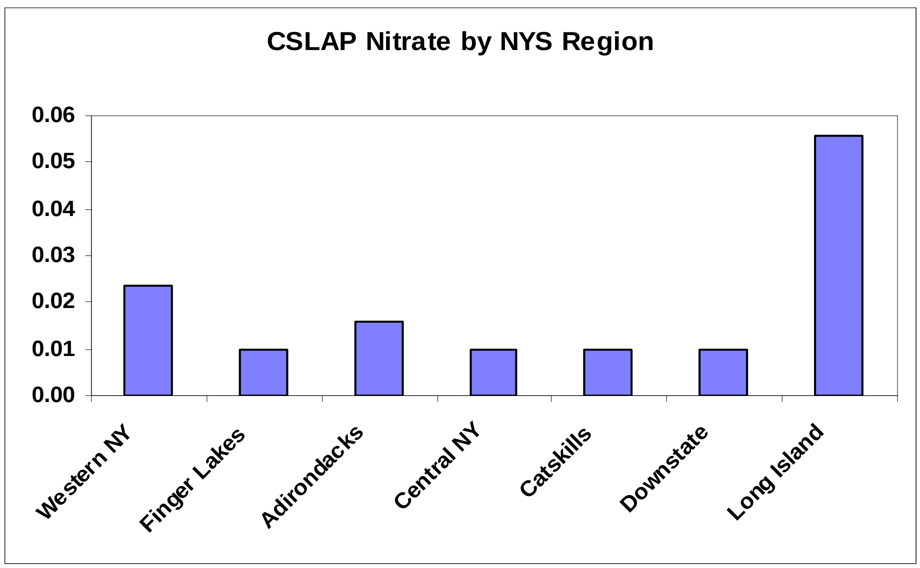


Figure 14b. *Nitrate in CSLAP Lakes by NYS Region*

What Was Expected in 2008?

Nitrate readings have been very unpredictable, although at nearly all times, nitrate readings have been low. Given the higher readings found in 2004 and lower readings found in 2006, nitrate levels cannot be easily predicted in 2008.

What Happened at Lake Oscaleta in 2008?

Nitrate readings in 2008 were close to the analytical detection limit, with no apparent seasonal trends (although the highest readings occurred in the final sample). Most nitrate readings have been low in the last three years.

Statewide Variability:

Nitrate levels are highest in Long Island, western NY, and the Adirondacks, and lowest in the other NYS regions. However, none of these regions demonstrate readings that are particularly high. Readings from individual lakes in Long Island, Madison County, and the Adirondacks (spring only) are often elevated, although still well below water-quality standards.

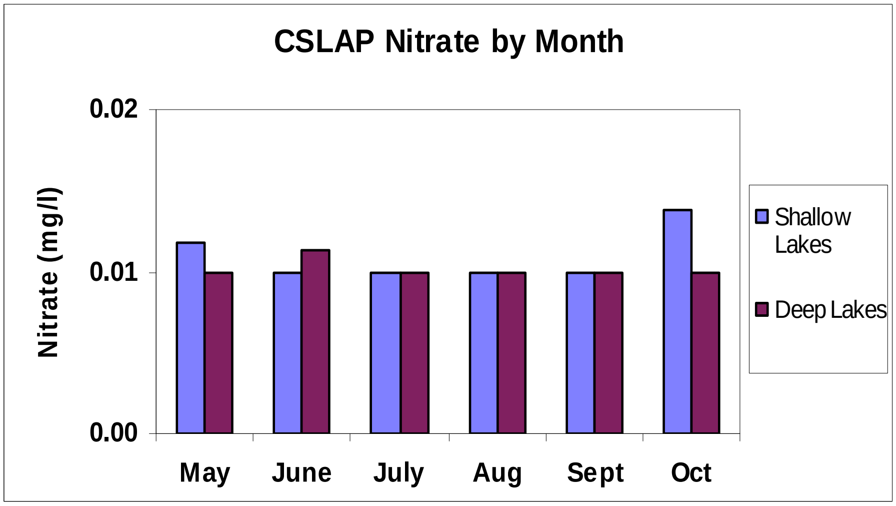


Figure 14c. *Nitrate in Shallow (<20ft deep) and Deep CSLAP Lakes by Month*

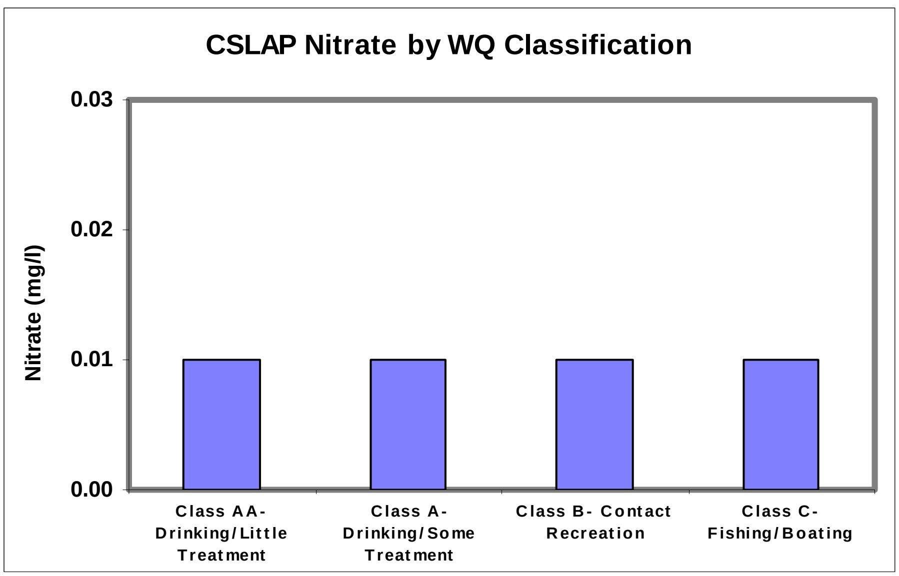


Figure 14d. *Nitrate in CSLAP Lakes by Lake Use*

Seasonal Variability:

Nitrate readings are not seasonally variable on a program-wide basis, as indicated in Figure 14c. However, in some individual lakes, in the regions listed above, nitrate is often detectable until early summer and then undetectable through the rest of the sampling season (the large number of lakes with undetectable nitrate levels throughout the year overwhelms the statistics in Figure 14c). Nitrate levels in shallow lakes were slightly higher in October, but the difference between September and October nitrate readings is probably within the rounding error for these analyses.

Lake-Use Variability:

Nitrate readings appeared to be identical for all classes of lake uses, as indicated in Figure 14d. Higher early-season nitrate readings are found in some lakes influenced by the melting of large winter snowpacks, such as some Class AA and A lakes in the Adirondacks, but these statistics cannot be easily teased from datasets strongly influenced by the large number of lakes with undetectable nitrate readings.

Detailed Discussion #5- Nitrate

Why are nitrate levels higher in the fall and on Long Island?

Discussion:

Figure 14c shows that nitrate readings are fairly stable most of the summer in shallow lakes, but increase in the fall. This does not appear to be a phenomenon related to lake turnover, since the fall nitrate increase does not seem to occur in deeper lakes. It is probably unrelated to the higher nitrate readings in shallow lakes in May; this is likely the result of nitrate-enriched snowpack meltwater entering the lake. Nitrate levels are no doubt even higher in March and April, when the bulk of this meltwater enters these lakes, but CSLAP sampling is not conducted at that time. This phenomenon is also not mirrored by late season changes in most of the other water quality indicators. Calcium levels are also higher in the fall, but this is probably due to the influence of a few measurements on a very small dataset (since calcium is usually measured on in the first and fifth samples, corresponding to early and mid year, and since it has only been analyzed since 2002).

However, in most parts of the state, nitrate readings in the fall are very similar to those measured earlier in the sampling season. The higher fall readings occur in the region referred to as nutrient ecoregion 83, or the “mostly glaciated dairy region” that encompasses most of northern NY outside the Adirondacks, Tug Hill and the Catskills. This is the region, outside of Long Island, with the highest ambient nitrate levels in the state, and the higher fall nitrate readings may reflect the residual from applied nitrogen fertilizers during the summer on the agricultural fields that dominate the landscape in this part of the state. The same trend is apparent with ammonia in both shallow and deep lakes, as noted in Figure 15c, though not with total nitrogen (Figure 16c)

As noted in Figure 14b, nitrate levels are substantially higher in Long Island than in other regions of the state. It is not known if this is an artifact of small sample size—there are only a few Long Island lakes in CSLAP, and the very high nitrate levels in one of these lakes may dominate the “typical lake” records measured in Figure 14b. In fact, the larger NYS datasets do not show a significant discrepancy between nitrate readings in Long Island and in other regions of the state. As with pH, this is another area in which the CSLAP dataset for a region is not representative of the typical lake. In the case of pH, it is due to the CSLAP site selection process, in which sampling is limited to lakes with lake associations, and thus lakes that support development, septic systems, and access to major roads. The typical Adirondack lake is smaller and more isolated than the typical CSLAP lake, resulting in lower pH readings.

Ammonia

Annual Variability:

Ammonia was analyzed for the first time in 2002, so long-term analyses are limited by the relative lack of data. The limited data indicated that ammonia was highest in 2002, 2006 and 2007, and lowest in 2005. 2006 was a wet year, and 2005 was dry, and while 2002 was not a wet year, these data suggest that ammonia increases with precipitation and decreases in dry conditions. It is more likely that the higher ammonia readings were associated with wet winter and spring conditions, as were apparent in both 2002 and 2006. No surface readings have approached the state water-quality standard (= 2 mg/l) in any CSLAP sample, although this threshold has been reached in some anoxic (oxygen-depleted) deepwater samples.

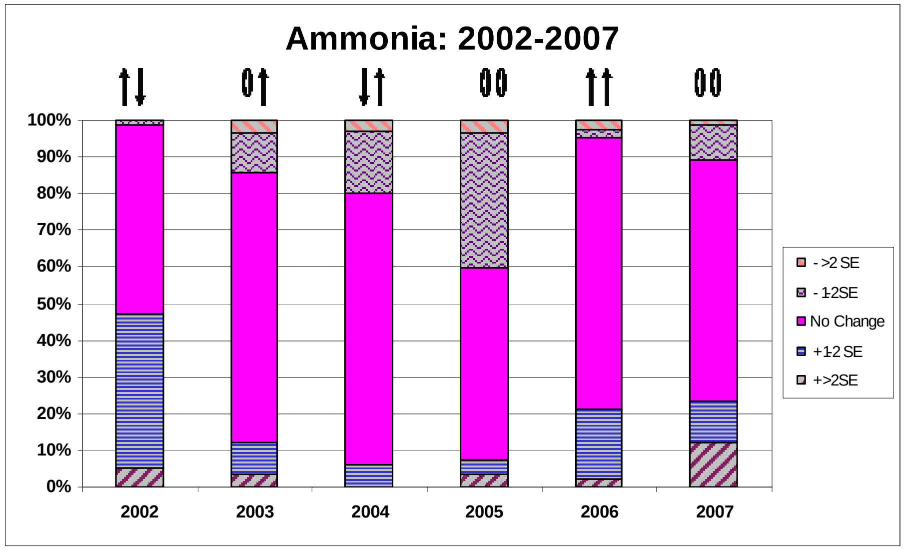


Figure 15a. *Annual Change from "Normal" Ammonia in CSLAP Lakes (SE = Standard Error)*

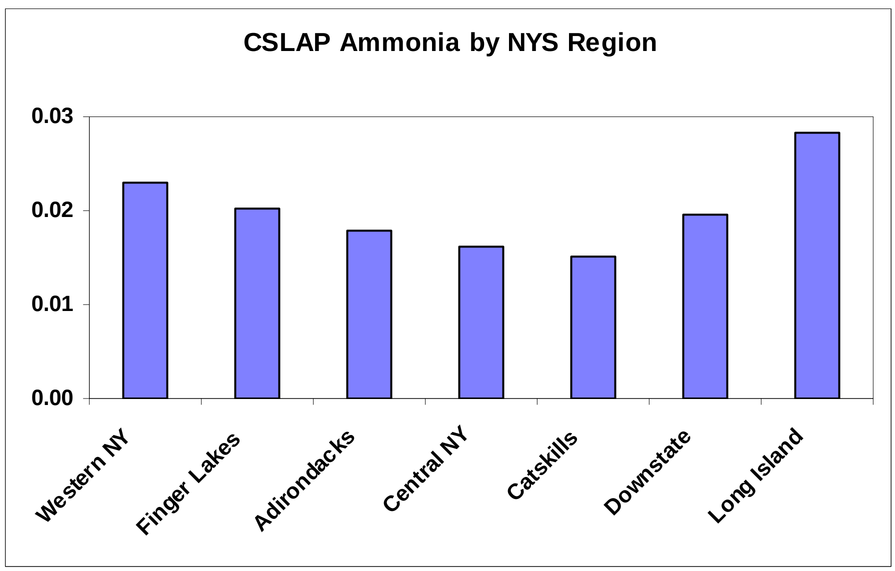


Figure 15b. *Ammonia in CSLAP Lakes by NYS Region*

What Was Expected in 2008?

As noted above, ammonia readings were higher when winter and spring runoff was heaviest, and lowest when spring and summer precipitation was lower. Given the higher than normal winter and spring precipitation levels in 2008, ammonia readings were expected to increase in 2008.

What Happened at Lake Oscaleta in 2008?

Ammonia readings were highest in the beginning and especially the end of the summer, but close to the analytical detection limit during most sampling sessions. These readings have decreased since 2006.

Statewide Variability:

Ammonia levels are highest in Long Island, western NY, and the Finger Lakes, and lowest in Central New York and the Catskills. However, none of these regions demonstrate readings that are particularly high.

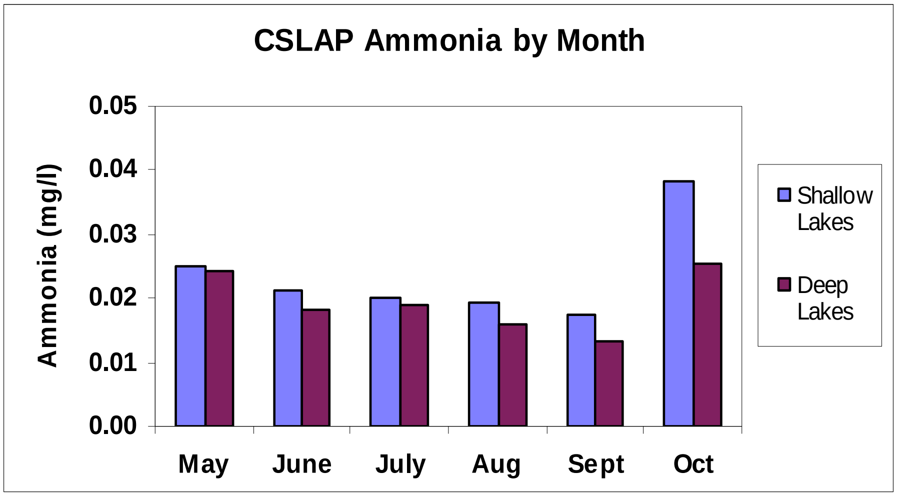


Figure 15c. *Ammonia in Shallow (<20ft deep) and Deep CSLAP Lakes by Month*

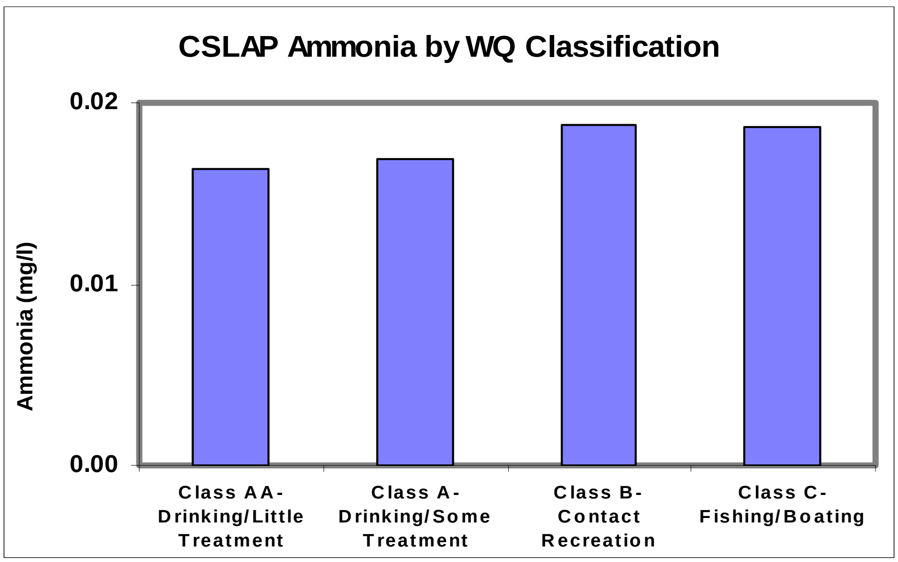


Figure 15d. *Ammonia in CSLAP Lakes by Lake Use*

Seasonal Variability:

Ammonia readings appear to decrease during the summer, and then increase in the fall, as indicated in Figure 15c. For the deeper lakes, this may be due to the migration of deepwater ammonia levels (which may have risen in response to deepwater anoxia) to the surface after the lake has been destratified. However, the rise in ammonia levels was greater for shallow lakes, suggesting other factors may also be in play.

Lake-Use Variability:

Ammonia readings appeared to be identical for all classes of lake uses, as indicated in Figure 15d. In nearly all classes of lakes, ammonia levels are close to the analytical detection limit, and far below the state water quality standard (= 2.0 mg/l).

Total (Dissolved) Nitrogen

Annual Variability:

Total dissolved nitrogen (TDN) was analyzed for the first time in 2002, so long-term analyses are limited by the relative lack of data. The limited data indicated that TDN was highest in 2006, when the winter/spring and summer precipitation levels were higher than normal, and in 2007. TDN data were lowest in 2005, which was perhaps drier than any other CSLAP sampling season since 2002, at least on a statewide basis. These patterns generally follow the trends observed with the ammonia data, but were inconsistent with the nitrate data.

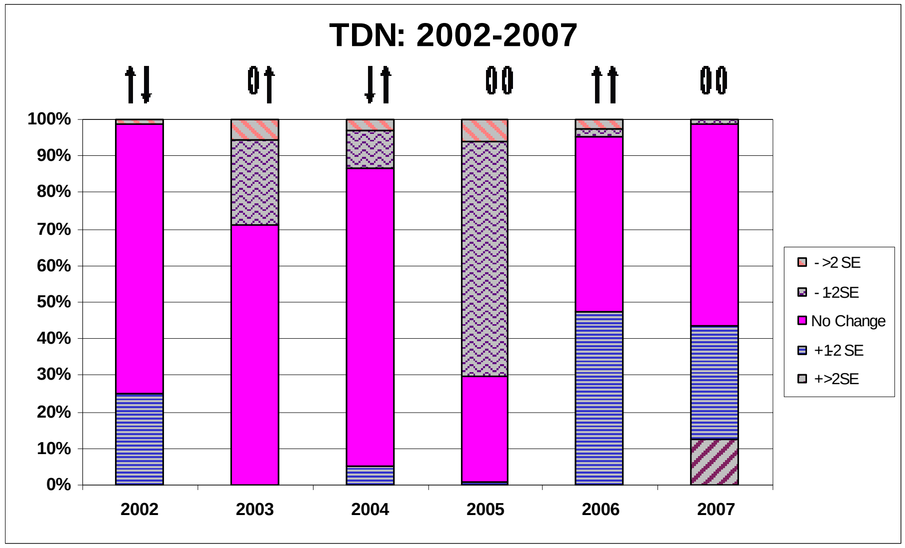


Figure 16a. *Annual Change from "Normal" TDN in CSLAP Lakes (SE = Standard Error)*

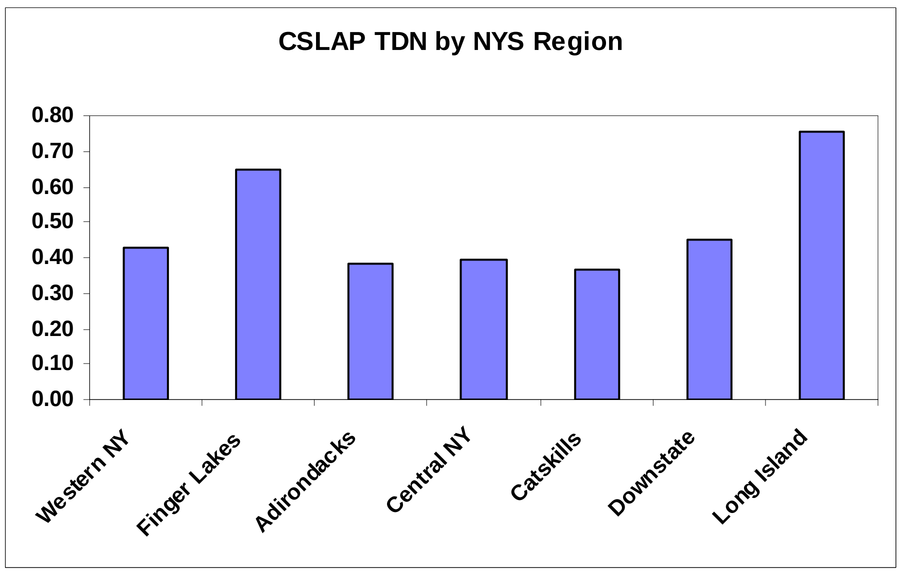


Figure 16b. *TDN in CSLAP Lakes by NYS Region*

What Was Expected in 2008?

Given the apparent connection between total nitrogen and precipitation noted in Figure 16a (readings highest in wet weather and lowest in dry weather), total nitrogen readings could be expected to be higher than normal in 2008, since precipitation levels were higher in most parts of the state.

What Happened at Lake Oscaleta in 2008?

TDN readings were fairly stable during the summer of 2008, and did not exhibit any clear seasonal patterns. These readings have decreased over the last several years.

Statewide Variability:

Total dissolved nitrogen levels are highest in Long Island and the Finger Lakes, and consistently lower everywhere else. The higher readings from both regions are probably associated with dissolved organic nitrogen, since nitrate and ammonia readings are much lower than total nitrogen. This does not appear to have translated into higher algae levels in these regions (see the discussion below re: chlorophyll *a*).

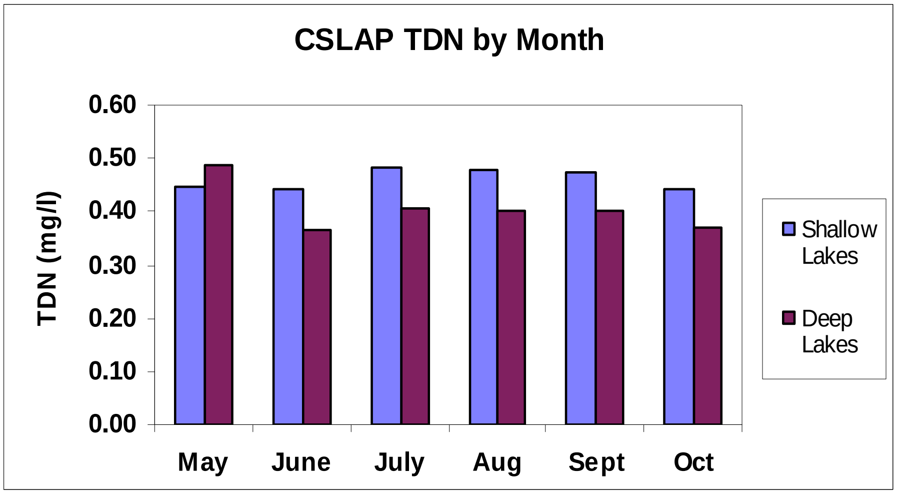


Figure 16c. *TDN in Shallow (<20ft deep) and Deep CSLAP Lakes by Month*

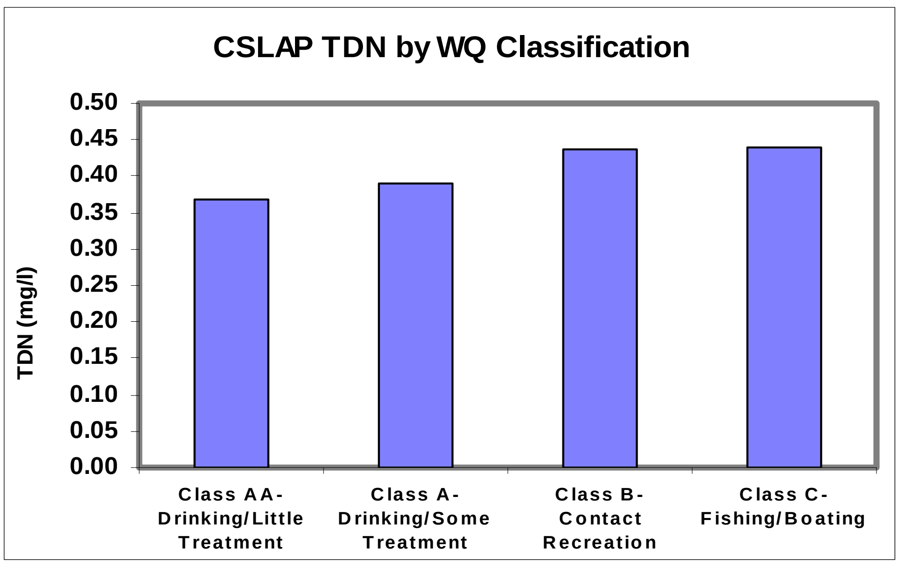


Figure 16d. *TDN in CSLAP Lakes by Lake Use*

Seasonal Variability:

Total dissolved nitrogen readings are not seasonally variable, particularly in shallow lakes, as indicated in Figure 16c. TDN readings in deeper lakes were higher in May than in any subsequent sampling month, although this is probably due to more May sampling of deep lakes with “normally” high dissolved nitrogen readings rather than higher early season readings in all deep lakes. Shallow lake TDN readings were fairly stable throughout the summer, and at nearly all times were higher than deep lake TDN levels.

Lake-Use Variability:

Total dissolved nitrogen readings were higher in Class B and Class C lakes than in Class AA or Class A lakes, as can be seen in Figure 16d. This “finding” cannot be easily explained, but additional data in the coming years may help to determine if the pattern shown in Figure 16d represents a real phenomenon or one influenced by relatively small datasets.

Trophic Indicators: Water Clarity

Annual Variability:

Water clarity (transparency) has varied annually in most CSLAP lakes. There does not appears to be much of a correlation between clarity and precipitation—the highest clarity occurred in 1995, 1997, and 1999, which corresponded to normal precipitation (statewide), although the lowest clarity occurred during three wet years (1996, 2000, and 2006). There are no significant broad statewide water clarity trends, although (as described in other portions of this report), clear trends do exist on some lakes. The majority of water clarity readings in CSLAP lakes (59%) correspond to *mesotrophic* conditions (clarity between 2 and 5 meters), with 26% corresponding to *eutrophic* conditions (Zsd < 2) and 15% corresponding to *oligotrophic* conditions (Zsd > 5).

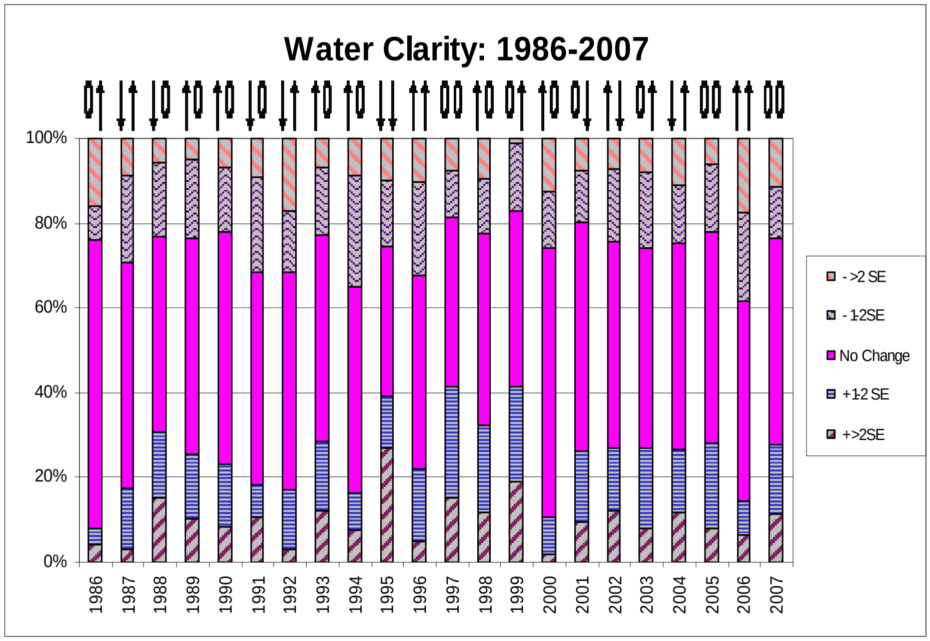


Figure 17a. *Change from "Normal" Water Clarity in CSLAP Lakes (SE = Standard Error)*

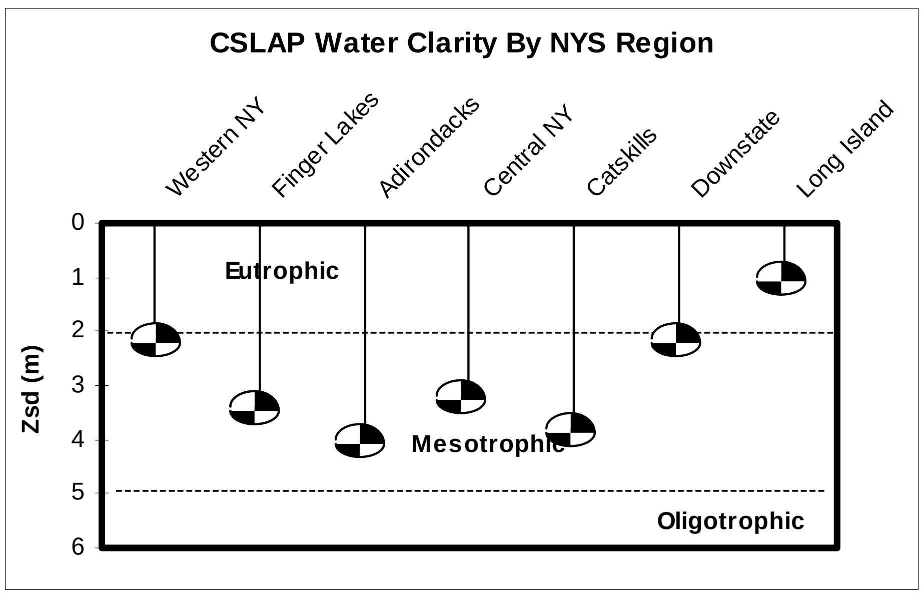


Figure 17b. *Water Clarity in CSLAP Lakes by NYS Region*

What Was Expected in 2008?

While water transparency readings do not appear to be strongly affected by dry weather, water clarity seems to be lowest during wet years. Since 2008 was a wet year in much of the state, it is likely that more lakes would exhibit slightly lower water transparency readings in 2008.

What Happened at Lake Oscaleta in 2008?

Water clarity readings in 2008 increased through late summer, then decreased through the fall, a seasonal pattern also observed at Lake Waccabuc. Overall readings have varied slightly from year to year, without any clear long-term trends.

Statewide Variability:

As expected, water clarity is highest in the Adirondacks, Catskills, and Finger Lakes regions, and lowest in Long Island, downstate, and western NY. The differences are more pronounced (at least for the Adirondacks) when "naturally" colored lakes are not considered. However, except for Long Island (for which water clarity is at least partially limited by the shallow water depth), the "typical" lake in each of these regions would be classified as *mesotrophic*.

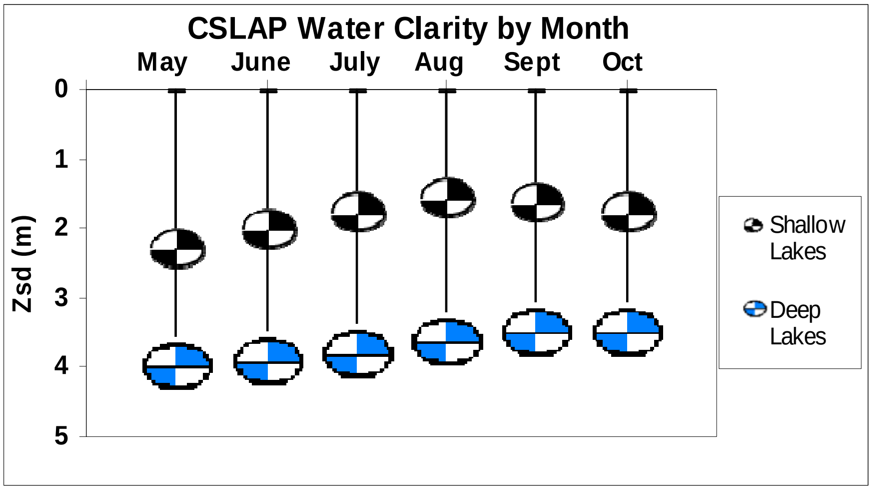


Figure 17c. *Water Clarity in Shallow (<20ft deep) and Deep CSLAP Lakes by Month*

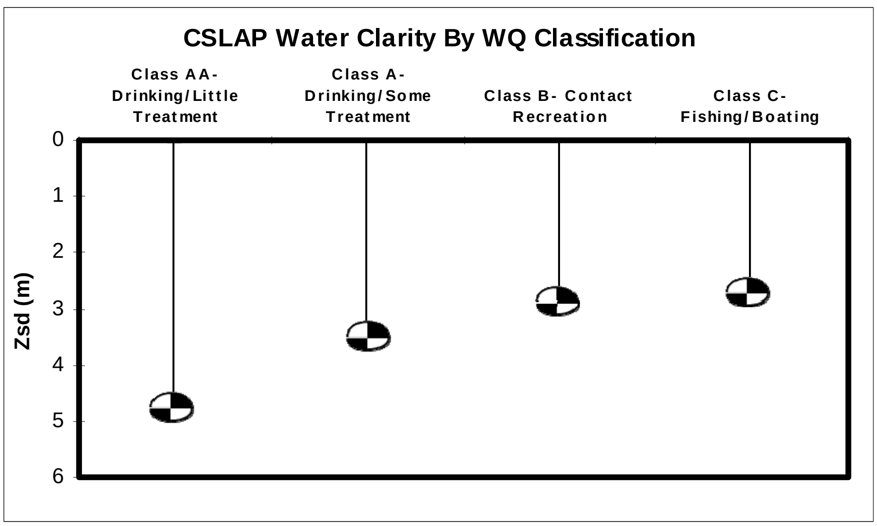


Figure 17d. *Water Clarity in CSLAP Lakes by Lake Use*

Seasonal Variability:

Water clarity readings are lower, as expected, in shallow lakes, even when water depth does not physically limit a water clarity measurement. Transparency decreases in both shallow and deep lakes during the course of the sampling season (the drop in clarity in shallower lakes is somewhat more significant), although clarity readings increase from spring to early summer in deeper CSLAP lakes. Water transparency rebounds slightly in shallower lakes in the fall, probably due to a drop in nutrient levels. The lack of "rebound" in deeper lakes may be due to occasional fall algal blooms in response to surface nutrient enrichment after lake turnover (see below).

Lake-Use Variability:

Water transparency decreases as the "sensitivity" of the lake use decreases, with higher clarity found in lakes used for potable water (Class AA), and lower clarity found in lakes used primarily for contact and non-contact (fishing and boating) recreation. As with many of the other water-quality indicators, this is due to both geographical and morphometric (depth) differences, although the original designation of these uses may also reflect these measurable and visually apparent water-quality differences.

Detailed Discussion #6- Water clarity

What is the connection between precipitation and water clarity?

Discussion:

Figures 7g, 8a, and 17a do not show any clear long-term trends in water transparency readings in the lakes sampled through CSLAP, and presumably throughout the rest of the state. However, a close inspection of Figure 17a shows a strong correlation, even on a statewide basis, between precipitation and water clarity. Specifically, heavy rain triggers increased runoff into lakes, resulting in higher turbidity (from algae and suspended sediment) and higher water color, and ultimately a decrease in water clarity.

There seems to be a distinction between lakes with long retention times (generally deeper lakes with relatively small watersheds) and short retention times (shallower lakes with relatively large watersheds). In 2006, 50% of the lakes with short retention time had significantly lower water clarity than normal, particularly those in regions with heavy rainfall. However, lakes with longer retention time were more likely to exhibit higher than normal water clarity when rainfall was heavier than normal.

In years with drier conditions, such as 1995, short retention time lakes were more likely to have higher than normal water clarity readings, although long retention time lakes were also clearer than normal. These data suggest that short retention time lakes are more susceptible to changes in water clarity in response to changes in precipitation, a finding consistent with expectations (since these lakes tend to respond more quickly to changes in nutrient and materials loading). The retention time for each lake, if known, is provided in Appendix A. The cutoff between short- and long-retention time lakes, for the purposes of this evaluation, is on the order of one year.

The connection between precipitation and water clarity was apparent in all regions of the state except the Delaware River basin in 2006 (where heavy rains did not trigger consistent decreases in clarity), and in the Allegheny River/Chemung River basin in 2000. It is likely in these regions that the same correlation exists, but that the local weather conditions in these basins were significantly different (drier) than represented in the NOAA basin.

Trophic Indicators: Phosphorus (TP)

Annual Variability:

Total phosphorus (TP) has varied annually in most CSLAP lakes. The highest phosphorus readings occurred during 1991, 1996, 1998, 2000, and 2003, the latter four of which corresponded to wet years. However, of the years with the lowest readings, only 1995 (and not 1989, 1997, and 2002) corresponded to dry years, and 2004 was a fairly wet year. The majority of phosphorus readings in CSLAP lakes (40%) correspond to *mesotrophic* conditions (clarity of 2 to 5m), with 30% corresponding to *eutrophic* conditions (< 2m clarity) and 30% corresponding to *oligotrophic* conditions (> 5m clarity); the latter is a much higher percentage than the trophic designation for water clarity.

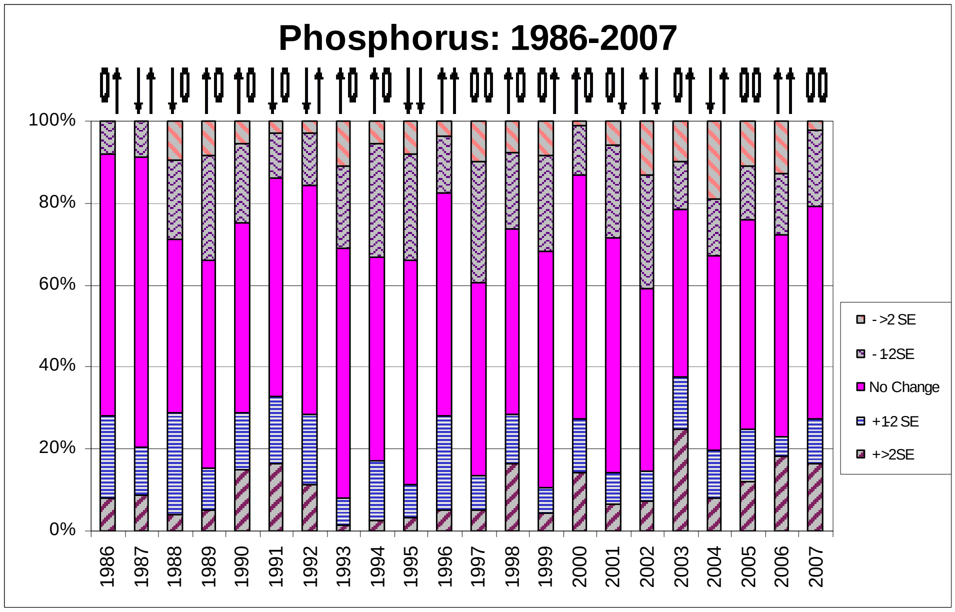


Figure 18a. *Annual Change from "Normal" TP in CSLAP Lakes (SE = Standard Error)*

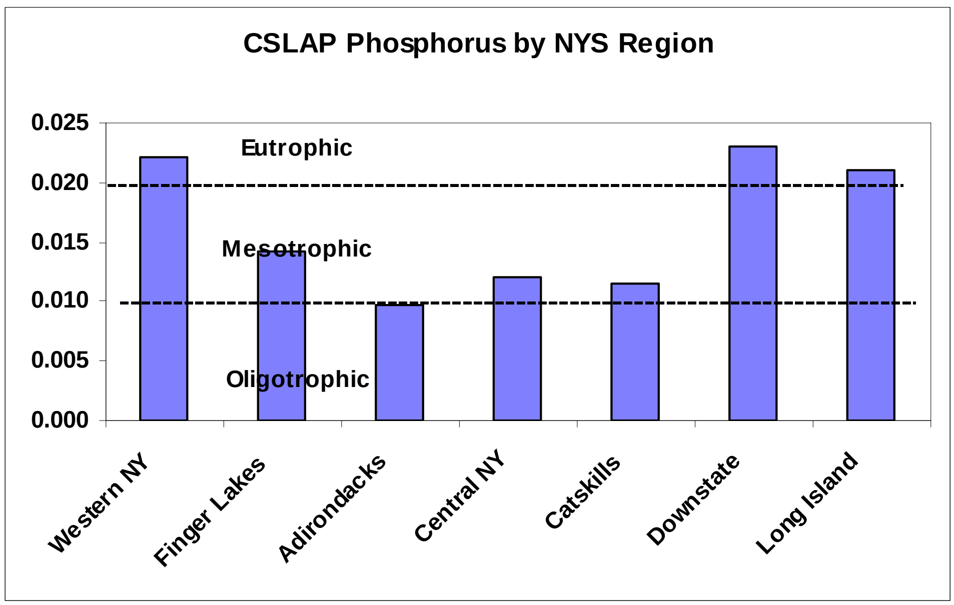


Figure 18b. *TP in CSLAP Lakes by NYS Region*

What Was Expected in 2008?

As noted above, there is not a strong correlation between weather and total phosphorus, and there does not appear to be a consistent long-term pattern in the total phosphorus data. The data also does not appear to be significantly laboratory-dependent, at least as apparent in Figure 18a. As such, it is difficult to predict whether phosphorus levels might be expected to be higher or lower in most CSLAP lakes in 2008.

What Happened at Lake Oscaleta in 2008?

Phosphorus readings decreased through late summer, then increased through the end of the CSLAP sampling season. This pattern was also apparent at Lake Waccabuc. Deepwater phosphorus levels are slightly higher than those measured at the lake surface.

Statewide Variability:

As expected, nutrient levels are lowest in the Adirondacks, Catskills, and Central New York (where clarity is highest). Nutrient concentrations were highest in Long Island, downstate, and western NY, where water transparency is lowest. In the latter three regions, the "typical" lake in each of these regions would be classified as *eutrophic,* while only in the Adirondacks could most lakes be described as *oligotrophic*, based on nutrients.

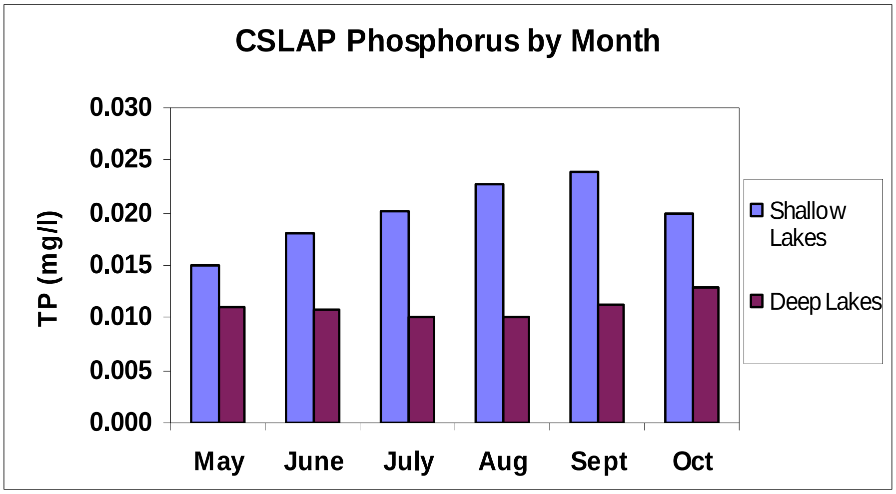


Figure 18c. *TP in Shallow (<20ft deep) and Deep CSLAP Lakes by Month*

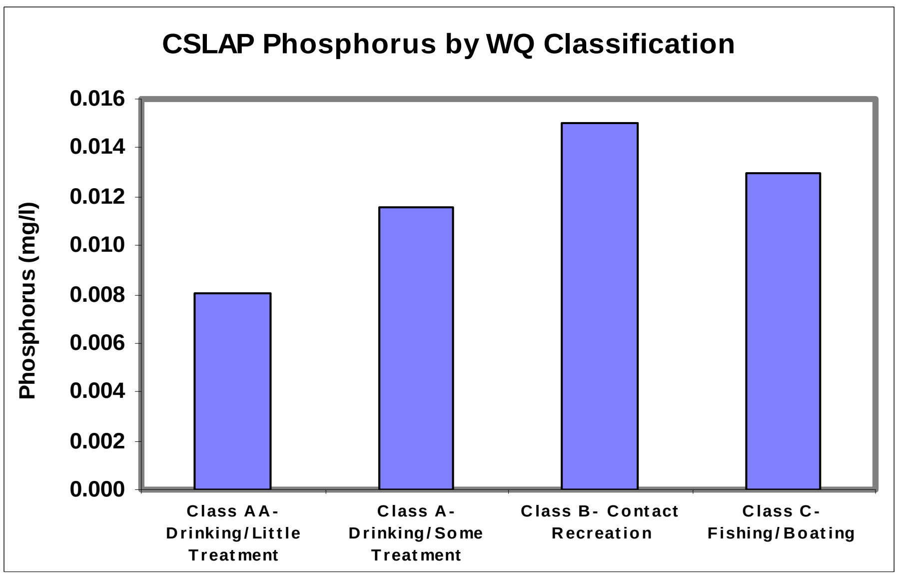


Figure 18d. *TP in CSLAP Lakes by Lake Use*

Seasonal Variability:

Nutrient levels are higher, as expected, in shallow lakes, and phosphorus levels increase in shallow lakes during the course of the sampling season, until dropping in the fall. However, phosphorus levels in deeper lakes are lower and decrease slightly through July, then increase into the fall. The latter phenomenon is due to surface nutrient enrichment after lake turnover (high nutrient water from the lake bottom, due to release of nutrients from poorly oxygenated lake sediments in the summer, migrates to the lake surface when the lake destratifies).

Lake-Use Variability

Phosphorus readings are lower in lakes used for minimally treated potable water intakes (Class AA) and are higher for other lake uses. Although Class B waters are utilized for a "higher" lake use than Class C lakes (contact recreation versus non-contact recreation), these lakes actually have higher nutrient levels, perhaps reflecting the influence of deepwater nutrient enrichments (these lakes are typically deeper) and the "unofficial" use of Class C waters for bathing and contact recreation.

Detailed Discussion #7- Phosphorus

What drives the seasonal increase in phosphorus in shallow lakes?

Discussion:

Figure 18c shows a steady seasonal increase in phosphorus concentrations in shallow lakes. Phosphorus readings decrease slightly through mid summer, then increase in the fall in deeper lakes. The latter observation is probably due to two different phenomena. The higher spring phosphorus readings in deeper lakes are influenced by the movement of erodible materials into lakes during the snowpack melt in late spring. This may be less significant in shallower lakes due to the shorter retention time found in many shallow lakes—these nutrients may be washed into and out of the lake more quickly in these lakes. The increased fall phosphorus readings in deeper lakes are probably associated with the migration of nutrients from bottom waters to the surface waters during and after lake destratification. These nutrients build up in the hypolimnetic waters of lakes under anoxic (no oxygen) conditions and are brought to the lake surface as the thermocline drops during late summer and as the lake mixes after destratification later in the fall. But since the latter phenomenon does not occur in shallower lakes, why do phosphorus readings increase during the summer and into the fall?

There are several factors at play. Increased use of the lake occurs during the summer, taxing the septic systems and creating a more significant hydraulic and nutrient load to the leach field and ultimately the lake. This is consistent with a seasonal increase in conductivity (see Figure 11c), a pattern generally not observed in deeper lakes. Both shallow and deep lakes exhibit aerobic sediment release, a lesser phenomenon than nutrient release under anoxic conditions, but more substantial in shallow lakes with few if any zones of poorly oxygenated water. Nutrients and nearly all other materials in lakes are concentrated by evaporation, which increases substantially during the summer. For many lakes, the senescence of macrophytes occurs in early to mid summer, particularly when plant communities are dominated by *Potamogeton crispus* (curly-leafed pondweed). This early season macrophyte will usually die out by early July, resulting in a release of nutrients into the water. It should be noted that most of the nutrients encompassed in the plant stems and leaves comes from the sediments, not the water column, and these nutrients usually go back into the sediments later in the year.

This seasonal increase in phosphorus in shallow lakes appears to be the primary cause of the seasonal increase in algae levels in these shallow lakes (as is apparent in Figure 19c), and as discussed below.

Trophic Indicators: Chlorophyll *a* (Chl.a)

Annual Variability:

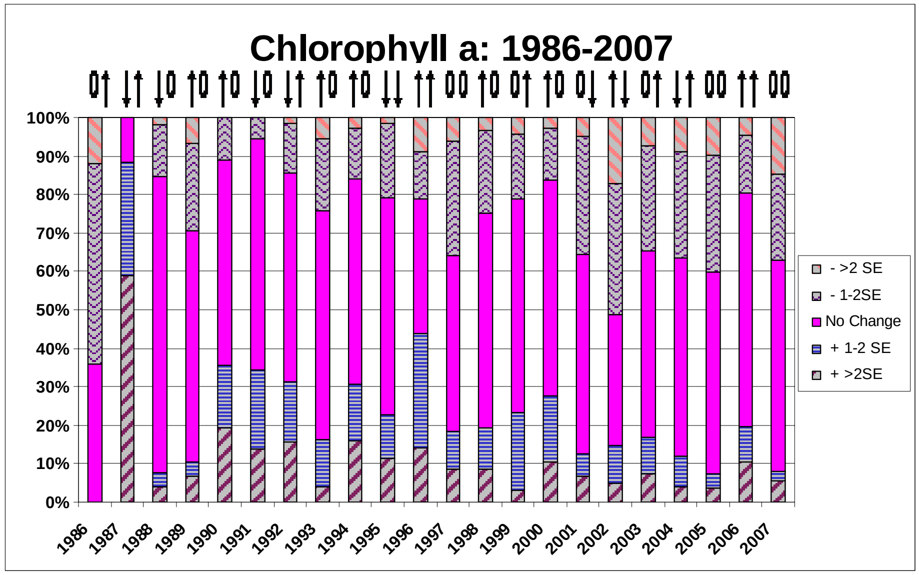


Figure 19a. *Annual Change from "Normal" Chlorophyll a in CSLAP Lakes (SE = Standard Error)*

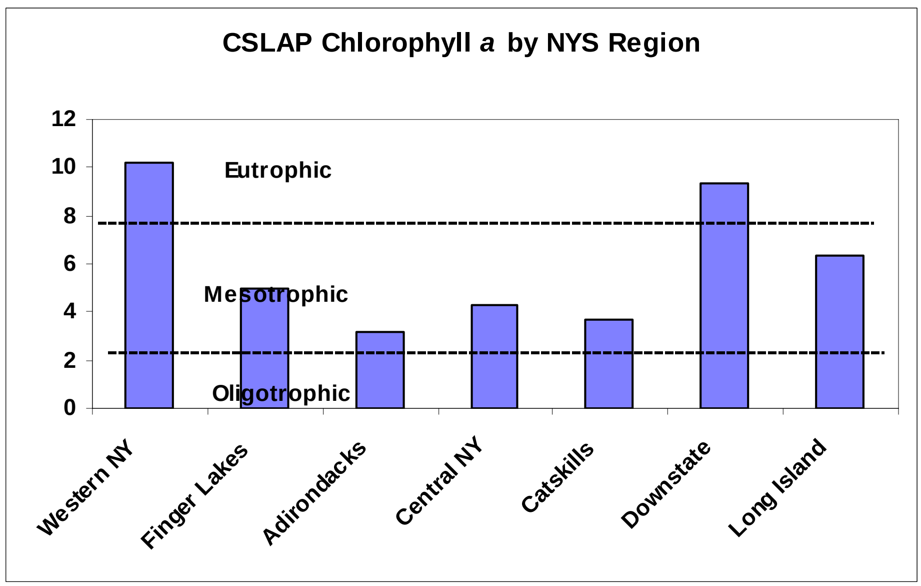


Figure 19b. *Chlorophyll a in CSLAP Lakes by NYS Region*

Chlorophyll *a* (chl.*a*) has varied in most CSLAP lakes more significantly than the other trophic indicators, as is typical of biological indicators, which tend to grow "patchy". With the exception of the very high readings in 1987 (probably due to a lab problem), the highest chlorophyll *a* levels occurred during 1990, 1991, 1994, and 1996, with all but 1991 corresponding to higher spring rainfall. However, the lowest readings were in 1986, 2002, 2005, and 2007; none of these years corresponded to a particularly dry year. The consistently lower chlorophyll readings in the last six years may also correspond to the shift in laboratories, although both labs use the same analytical methodology and chlorophyll readings were also low in the last few years before changing laboratories. The near majority of chlorophyll readings in CSLAP lakes (53%) correspond to *mesotrophic* conditions (chlorophyll *a* readings between 2 and 8 µg/l), with 37% corresponding to *eutrophic* conditions (chl.*a* > 8 µg/l) and 10% corresponding to *oligotrophic* conditions (chl.*a* < 2 µg/l); these percentages are more like those for water clarity rather than those for phosphorus.

What Was Expected in 2008?

Chlorophyll *a* levels cannot be well predicted in dry years, as observed in Figure 19a. However, chlorophyll *a* readings are occasionally higher than normal during wet years. Since at least the winter and spring of 2008 was wet in most of the state, algae levels in New York state could be expected to be higher than normal.

What Happened at Lake Oscaleta in 2008?

Chlorophyll *a* readings were slightly lower than normal during much of 2008, and increased later in the summer. The latter is generally consistent with an increase in phosphorus over the same period, and consistent with the decrease in water clarity.

Statewide Variability:

As with phosphorus, chlorophyll levels are lowest in the Adirondacks, Central New York, and the Catskills (where clarity is highest) and highest in Long Island, downstate, and western NY, where water transparency is lowest. In the latter two regions, the "typical" lake in each of these regions would be classified as *eutrophic,* while lakes in the other regions would be described as *mesotrophic*, based on assessments from chlorophyll *a* readings.

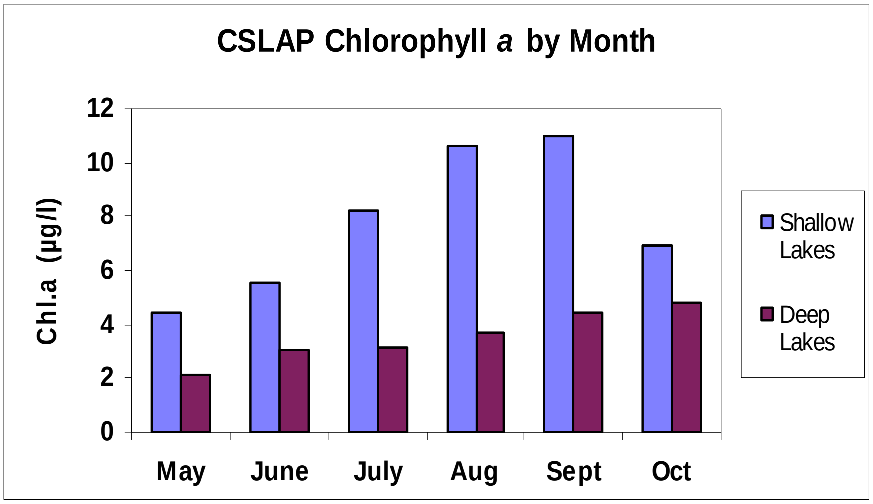


Figure 19c. *Chlorophyll a in Shallow (<20ft deep) and Deep CSLAP Lakes by Month*

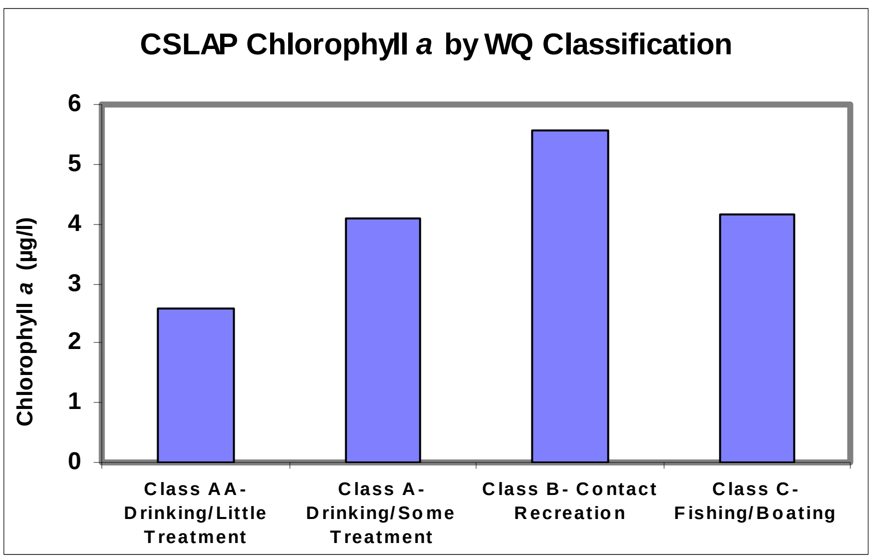


Figure 19d. *Chlorophyll a in CSLAP Lakes by Lake Use*

Seasonal Variability:

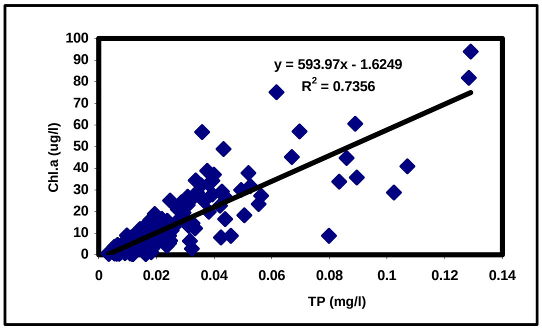
Chlorophyll levels are higher, as expected, in shallow lakes, and increase in both shallow and deep lakes during the course of the sampling season, with chlorophyll readings dropping in shallow lakes in the fall. The steady increase in chlorophyll in both shallow and (to a lesser extent) deep lakes is consistent with the change in phosphorus over the same period, due to steady migration of nutrients released from poorly oxygenated lake sediments during the summer and especially in the fall (as well as drier weather, increased lake use, and other factors).

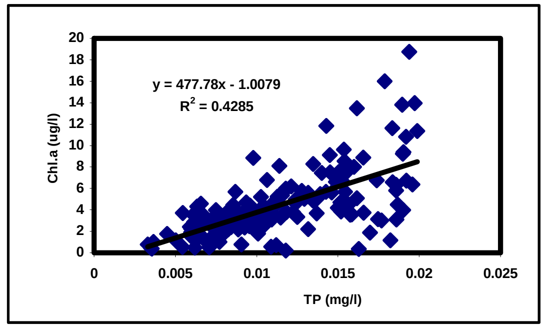
Lake-Use Variability:

Chlorophyll readings are lower in lakes used for minimally treated potable water intakes (Class AA) and are higher for other lake uses. Although Class B waters are utilized for a "higher" lake use than Class C lakes (contact recreation versus non-contact recreation), these lakes actually have similar levels, perhaps reflecting the influence of deepwater nutrient enrichments (these lakes are typically deeper) and the "unofficial" use of Class C waters for bathing and contact recreation. This is similar to the use pattern for phosphorus.

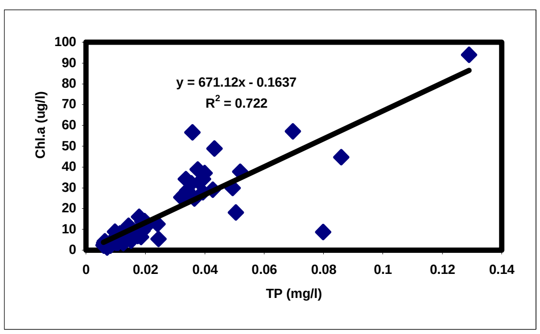
How closely connected are phosphorus and chlorophyll a?

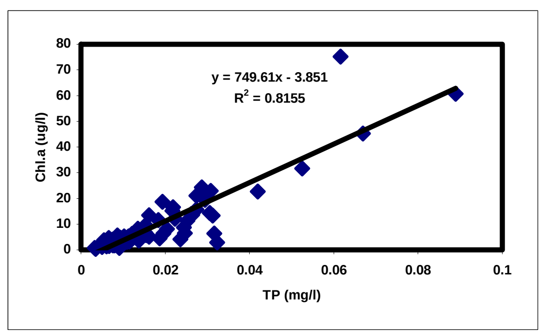
Discussion:





As is apparent from the plot on the upper left, which shows the average chlorophyll *a* (Chl.a) reading for each CSLAP lake plotted against the average total phosphorus (TP) levels for the lake, there is a strong correlation between phosphorus and chlorophyll *a*. This plot shows that nearly 75% of the variability in chlorophyll *a* readings is explained by changes in phosphorus concentrations. This relationship is less clear when considering only lakes with slightly lower phosphorus concentrations, as seen in the plot to the upper right. This plot shows that phosphorus levels below about 2 ppb (=0.002 mg/l) are insufficient to produce measureable algae levels. This corresponds to the lower analytical detection limit for phosphorus.





The relationship between algae and phosphorus improves when lakes are distinguished by residence time, or the amount of time any drop of water stays in the lake. The plot on the left includes only lakes with low residence time, defined here as less than 0.5 years (equivalent to the lake water being completely replaced twice per year). The plot on the right corresponds to lakes with residence time greater than 0.5 years. The slopes of these plots are also similar, suggesting that the "buildout" of algae in response to additions of nutrients does not depend on the amount of time (residence time) the algae are exposed to the nutrients. The same relationship and similar scope occurs even when considering only lakes with residence time less than 0.2 years (2-3 months), although the slope does flatten when considering only lakes with a residence time less than 0.1 year (about 5 weeks), probably corresponding to a minimum period of time needed for algae to be exposed to nutrients (even though algal uptake of nutrients is usually rapid).

Water-quality Assessment (QA on the Perception Form)
Annual Variability

Water-quality assessments (the perceived physical condition of the lake or QA on the use-impairment surveys) were least favorable in wet (2000 and 2006) years, but were highly variable in very dry (1995) years, suggesting the lack of correlation between weather and perceived water-quality. These assessments were most favorable in 1992, 1997, and 1999. There is a strong connection between measured and perceived water clarity in most CSLAP lakes, and a comparison of Figures 17a and 20a shows that the most favorable water quality assessments usually occurred in the years with the highest measured water transparency. This occurs despite the lack of a strong connection between water quality assessments and precipitation patterns.

What Was Expected in 2008?

There was not a strong connection between precipitation and perceived water-quality. It is difficult to predict expected conditions in 2008, although water clarity readings were expected to be slightly lower than normal in response to wetter weather in much of the state in 2008.

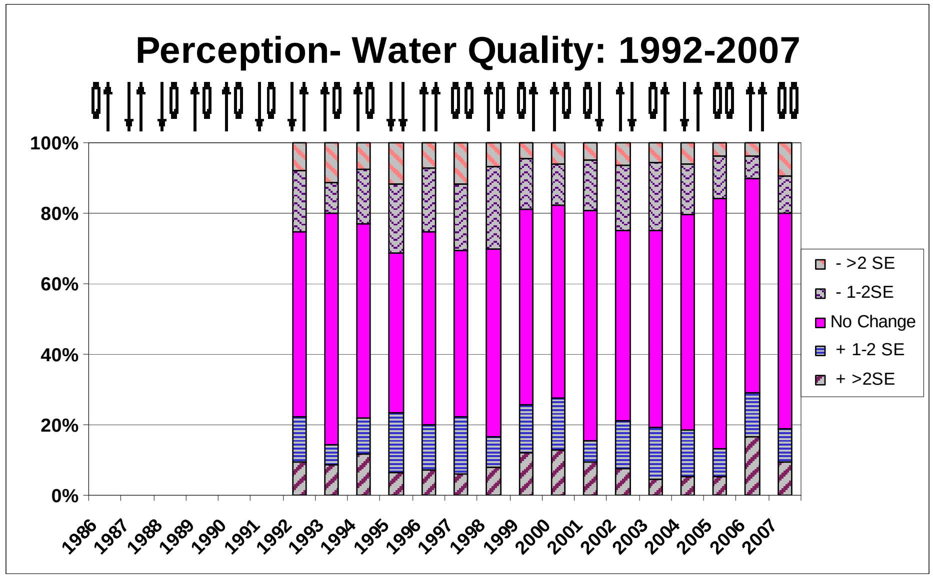


Figure 20a. *Annual Change from "Normal" Water-Quality Assessment in CSLAP Lakes (SE = Standard Error)*

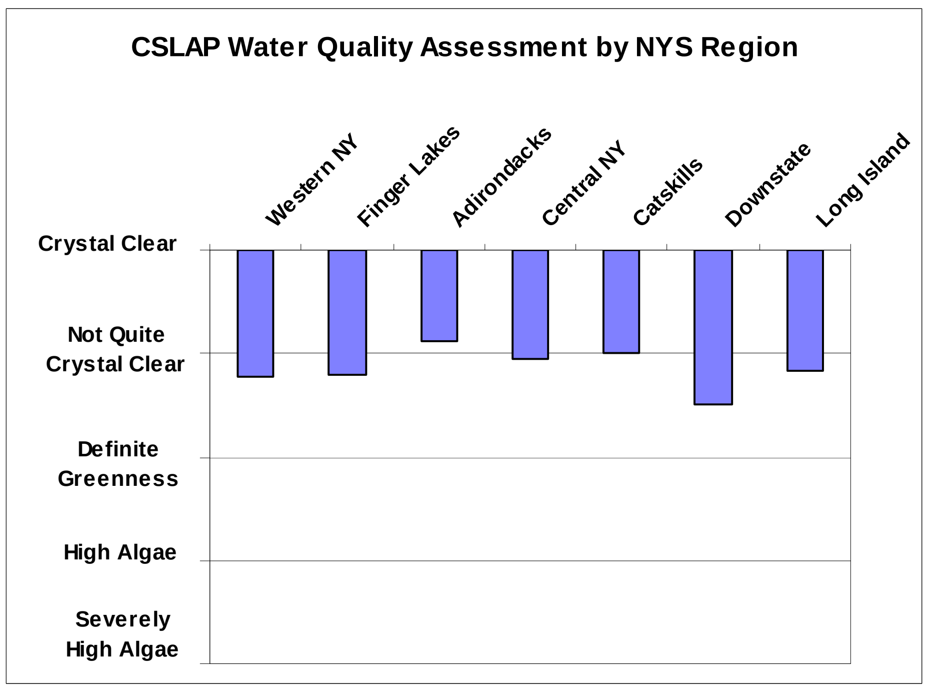


Figure 20b. *Water-Quality Assessment in CSLAP Lakes by NYS Region*

What Happened at Lake Oscaleta in 2008?

Water-quality assessments in 2008 varied slightly during the summer, and generally in response to changes in water clarity readings over this period. Additional data will help to determine if the water quality conditions in the last three years represent normal conditions in the lake.

Statewide Variability:

The most favorable water-quality assessments (at least in support of contact recreation) occurred in the Adirondacks, Catskills, and central New York, as expected, and water-quality assessments were slightly less favorable downstate, in western NY, and on Long Island. This is mostly consistent with the water clarity readings in these regions. However, since the difference between the most favorable (Adirondacks) and least favorable (downstate) assessments is smaller than the measured water transparency differences, this suggests that the relatively low water clarity in the latter regions may often be considered "normal" by lake residents.

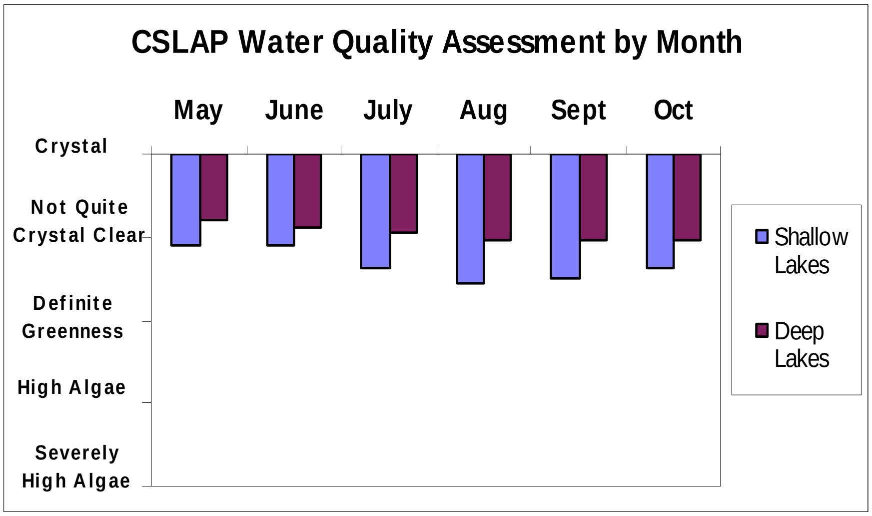


Figure 20c. *Water-Quality Assessment in Shallow (<20ft deep) and Deep CSLAP Lakes by Month*

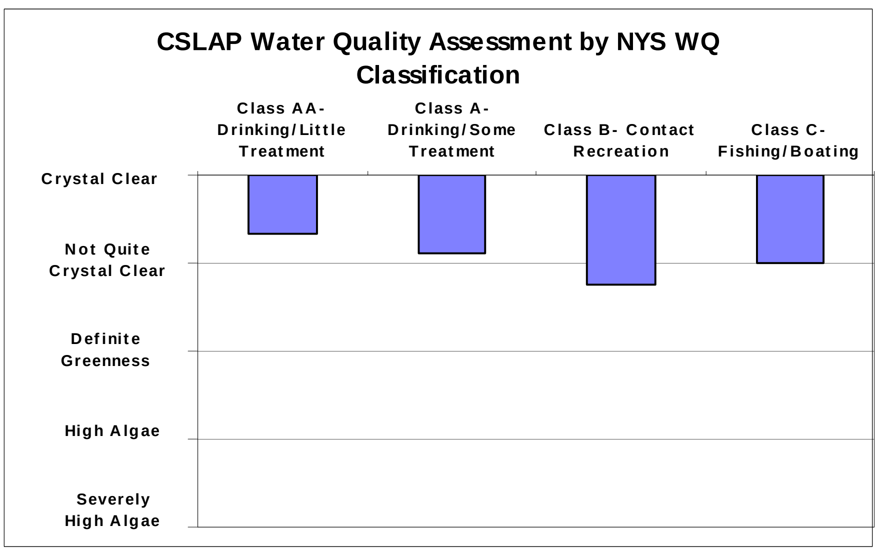


Figure 20d. *Water-Quality Assessment in CSLAP Lakes by Lake Use*

Seasonal Variability:

Water-quality assessments become less favorable as the summer progresses in both deep and (especially) shallow lakes, coincident with similar patterns for the trophic indicators. However, the seasonal changes in these assessments are not very large. These assessments become slightly more favorable in shallow lakes in the fall, consistent with the improved (measured) water clarity, although overall water-quality assessments are less favorable all year in shallow lakes.

Lake Use Variability:

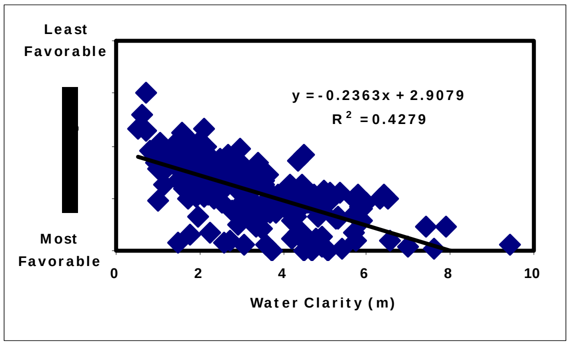
Water-quality assessments are more favorable in lakes used for potable water intakes (Class AA and Class A) and less favorable for other lake uses. Although Class B waters are utilized for a "higher" lake use than Class C lakes (contact recreation versus non-contact recreation), these lakes actually have similar water-quality assessments, perhaps reflecting the influence of deepwater nutrient enrichments (these lakes are typically deeper) and the "unofficial" use of Class C waters for bathing and contact recreation. This is similar to the pattern seen for the trophic indicators.

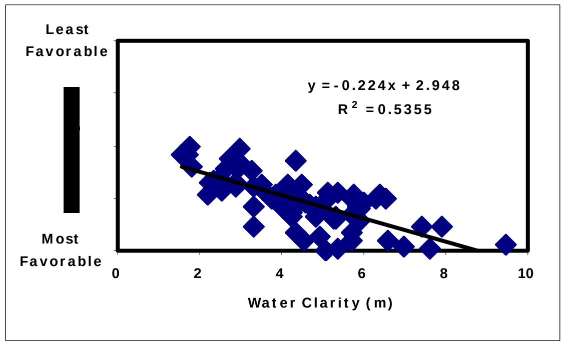
Detailed Discussion #9- Water quality assessments

How closely connected are water quality assessments and water clarity readings?

Discussion:

Water quality perceptions (QA on the field perception form) evaluates the "physical condition" of the lake on a five point scale, with "1" corresponding to "crystal clear" and "5" corresponding to "severely high algae levels". These qualitative assessments may be akin to a narrative interpretation of a water clarity measurement, although these assessments are evaluated before any water quality measurements occur. How closely related are measured water transparency and these qualitative assessments?





The figure on the left shows the relationship between the typical (average) water quality assessment for each CSLAP lake, and the corresponding typical water clarity measurement. The correlation coefficient (R^2) in the figure shows that nearly half of the change in water quality perception can be explained by changes in measured water clarity. This relationship improves when the two most prominent "interferences" are removed from the plot. The figure on the right shows only those "clearwater" CSLAP lakes that are deep enough to remove the impact of water depth on water clarity measurements. "Clearwater" refers to lakes with average water color measurements less than 15 ptu, which generally eliminates from consideration those samples in which water transparency is limited by the brownness of the water. The water quality conditions in many CSLAP lakes are perceived favorably even if water clarity is limited by "natural" color, presumably because these water clarity limits are not associated with excessive algae and do not impede recreational uses of the lake.

The plot on the left, however, does show that very poor water quality assessments are probably associated with shallow lakes, even if water clarity readings are as influenced by water depth as by excessive algae. The plot on the right shows that the most favorable water quality assessments in relatively deep, uncolored lakes require water clarity measurements of about 5 meters. Perhaps not coincidentally, this corresponds to the boundary between *mesotrophic*, or moderately productive lakes, and *oligotrophic*, or biologically unproductive lakes, as shown in Figure 2.

Aquatic Plant (Weed) Assessment (QB)

Annual Variability:

Aquatic-plant assessments (the perceived extent of weed growth in the lake or QB on the use impairment surveys) indicated that weed coverage was greatest in 1992, 1998, 2000, 2002, and 2005 with only 1998 associated with wet weather. Weed growth was less extensive in 1997 and 2003, neither of which exhibited significant changes in precipitation, suggesting the lack of correlation between weather and weed densities. The highest weed growth occurred when the perceived physical condition (clarity) of the lake was also least favorable, such as in 1995 and 2000. These conditions may offer a selective advantage to invasive or exotic weeds (such as *Myriophyllum spicatum*) which can create surface canopies. Despite continuing concerns about increased invasion from exotic weeds, Figure 21a suggests that no long-term trend toward greater aquatic plant coverage is apparent.

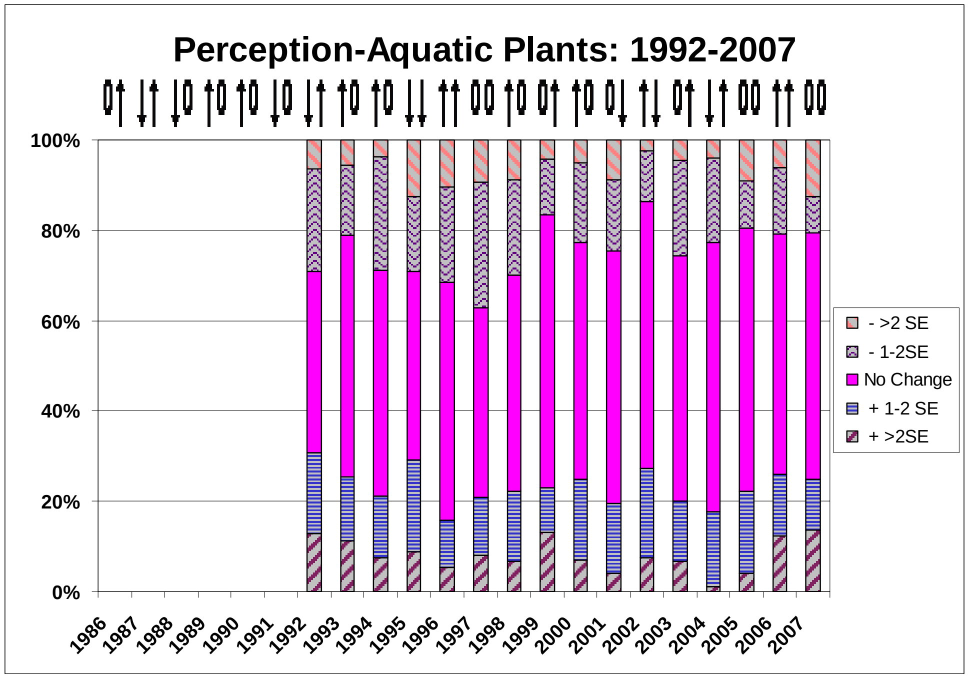


Figure 21a. *Annual Change from "Normal" Weed Assessment in CSLAP Lakes (SE = Standard Error)*

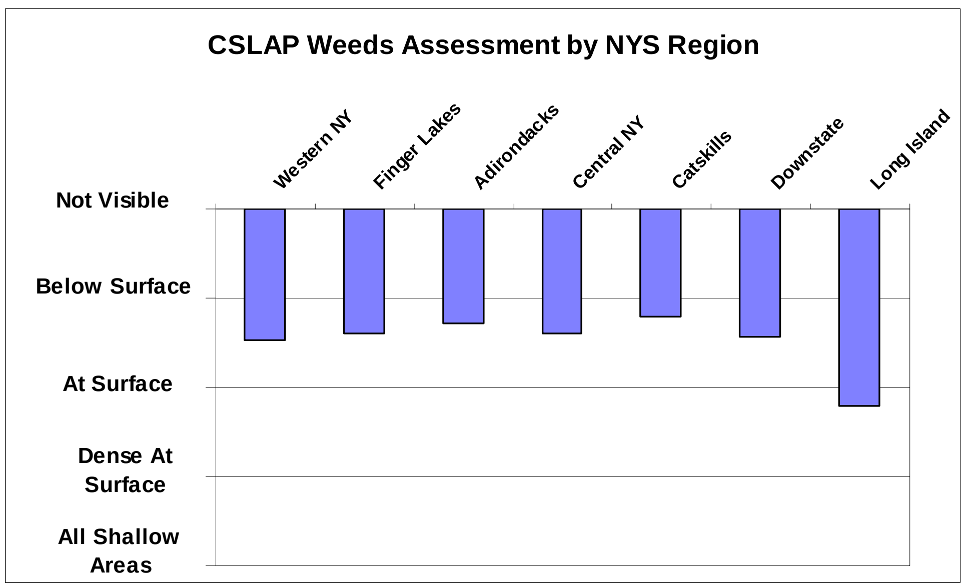


Figure 21b. *Weed Assessment in CSLAP Lakes by NYS Region*

What Was Expected in 2008?

There was not a strong connection between precipitation and extent of weed growth, at least as measurable through CSLAP. This makes it difficult to identify expected conditions in 2008. However, aquatic plant densities are often greater when water clarity is lowest (particularly in lakes with exotic weeds), so lower water transparency in 2008 may trigger an increase in weed densities.

And What Happened at Lake Oscaleta in 2008?

Aquatic plant coverage in 2008 was mostly stable during the summer, and "excessive weeds" were regularly implicated in recreational use restrictions. It is not yet known if plant coverage in the last three years represent normal conditions.

Statewide Variability:

Aquatic plant growth was most significant in Long Island (and to a lesser extent downstate and in western NY) and least significant in the Catskills and Adirondacks. The former may have a larger concentration of shallow lakes (Long Island) or preponderance of exotic weeds (downstate and western NY), while the latter may correspond to deeper lakes or fewer instances of these invasive weeds, although it is also likely that invasive-weed growth may be increasing in many lakes within these "less impacted" areas.

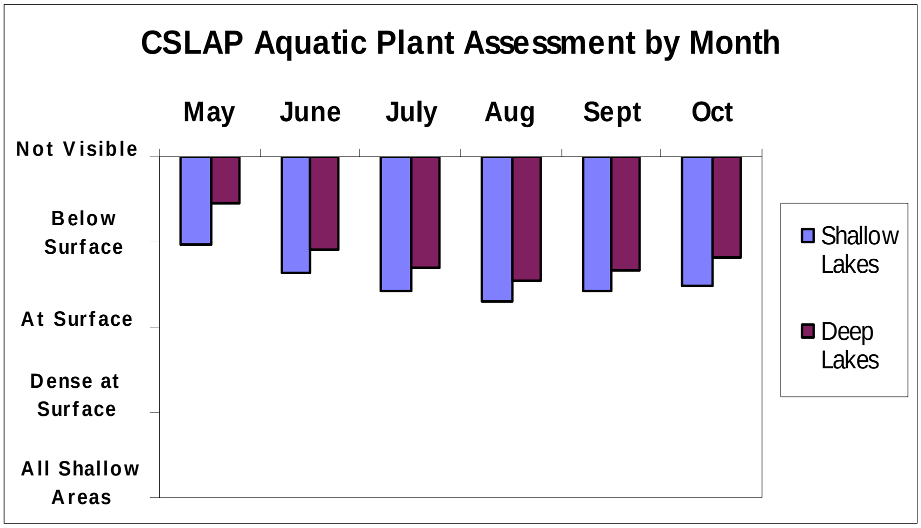


Figure 21c. *Weed Assessment in Shallow (<20ft deep) and Deep CSLAP Lakes by Month*

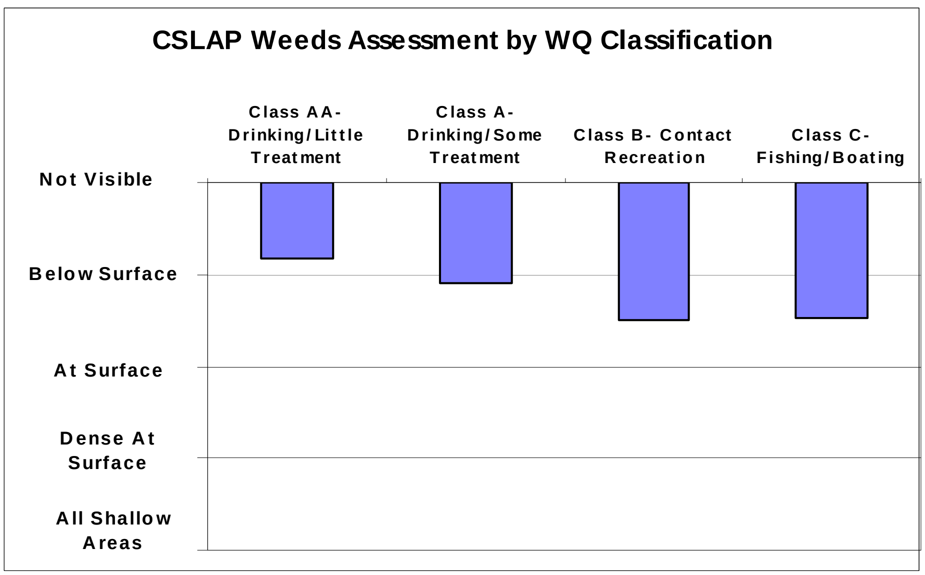


Figure 21d. *Weed Assessment in CSLAP Lakes by Lake Use*

Seasonal Variability:

As expected, aquatic-plant densities and coverage increase seasonally (through late summer) in both shallow and deep lakes, with greater aquatic-plant coverage and densities found in shallow lakes. Peak aquatic-plant densities tend to occur in late summer in both deep and shallow lakes. The variability from one lake to another (from very little growth to dense growth at the lake surface) is more pronounced later in the summer. Despite higher clarity in shallow lakes in the fall, aquatic-plant coverage decreases, while the drop in fall plant coverage in deeper lakes is less pronounced.

Lake Use Variability:

Aquatic-plant coverage was more significant in Class B and Class C lakes than in other lakes, but this (again) is probably a greater reflection of geography or lake size and depth (Class B lakes tend to be found outside the high elevation areas in the Catskills and Adirondacks, and Class C lakes tend to be shallower than Class AA or Class A lakes).

Does the introduction of exotic plants usually lead to an increase in weed coverage?

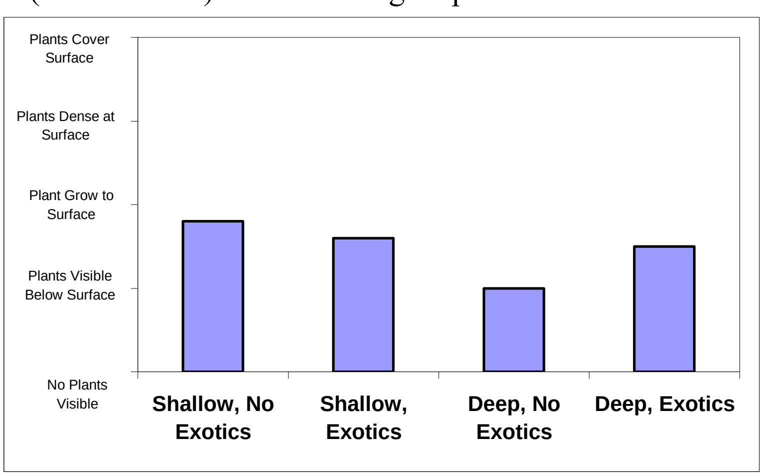
Discussion:

Aquatic plant densities and coverage are evaluated through the CSLAP perception survey. Question B evaluates aquatic plant communities on a five point scale, ranging from “no plants visible” (=#1) to “dense plant growth covering the lake surface…” (=#5). Although a single assessment for any given lake cannot be used to evaluate plant communities throughout a lake, this tool can provide some insights into aquatic plant coverage in these lakes.

Evaluating the effect of exotic plant introductions on changes in plant coverage is greatly compromised by the lack of data on the year of introduction. In addition, for most CSLAP lakes (and nearly all NYS lakes), there are no plant abundance data before and after the introduction of exotic plants, even though exotic plants have been confirmed in at least 55% of the CSLAP lakes. This further impacts an evaluation of these data.

The CSLAP dataset shows that the perception survey results were comparable for lakes with exotic plants and lakes with only native plants—both sets of lakes typically are described as having plants varying between visible below the lake surface and growing to the lake surface (the average “response” for both sets of lakes was about 2.4). But this appraisal is confounded by the large number of shallow lakes for which all aquatic plants are likely to grow to the lake surface.

In deep lakes without exotic plants, aquatic plants are most frequency described as “visible below the lake surface” (average response = 2.0), but plants in deep lakes in which exotic plants are located are described as between “visible below the lake surface” and “growing to the lake surface” (average response = 2.5). Native plant coverage in shallow lakes is much more extensive than in deep lakes (average response = 2.7), but the presence of exotic plants actually reduces the extent of plant coverage (average response = 2.5). These distributions are plotted below. It is not likely that this represents a real phenomenon, although the native plant coverage in shallow lakes may be associated with floating leaf plants (such as lilies) or even emergent plants.



Recreational Assessment (QC)

Annual Variability:

Recreational assessments (the perceived recreational suitability of the lake or QC on the use-impairment surveys) have varied from year to year, with no clear long-term pattern. The most favorable assessments were in 1995, 1997, and 1998. 1997 corresponded to a year with low aquatic-plant (weed) coverage and favorable water quality. This suggests that recreational assessments are influenced by both water-quality conditions and aquatic plant densities. Less favorable assessments occurred in 1992, 2000, and 2006. Extensive weed growth was reported in 1992 and 2000, and poor water quality was more common in 2000 and 2006. The extent of "normal" conditions (the middle bar in Figure 22a) has generally not changed significantly since perception surveys were first conducted in 1992.

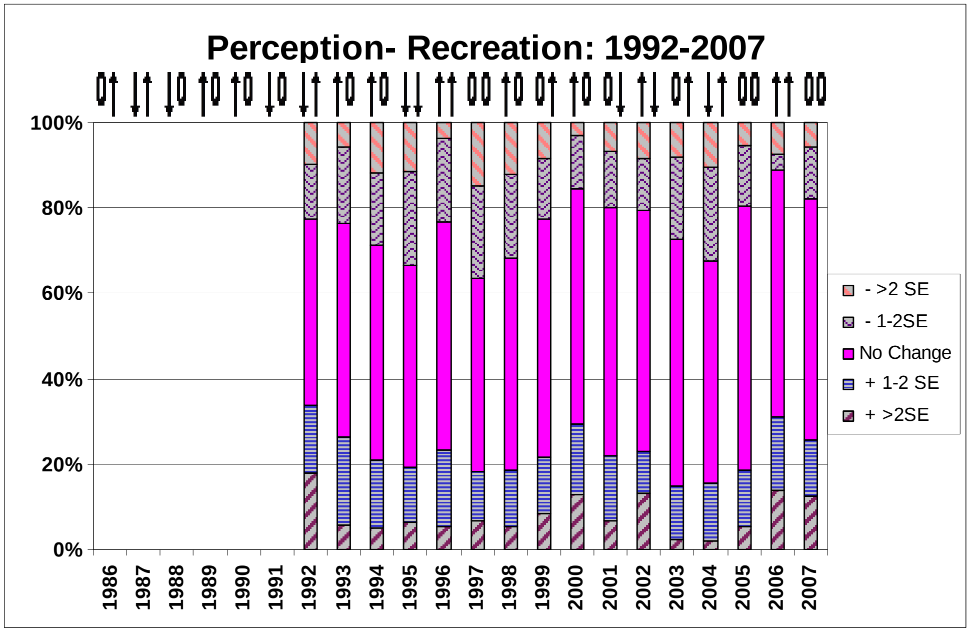


Figure 22a. *Annual Change from "Normal" Recreational Assessment in CSLAP Lakes (SE = Standard Error)*

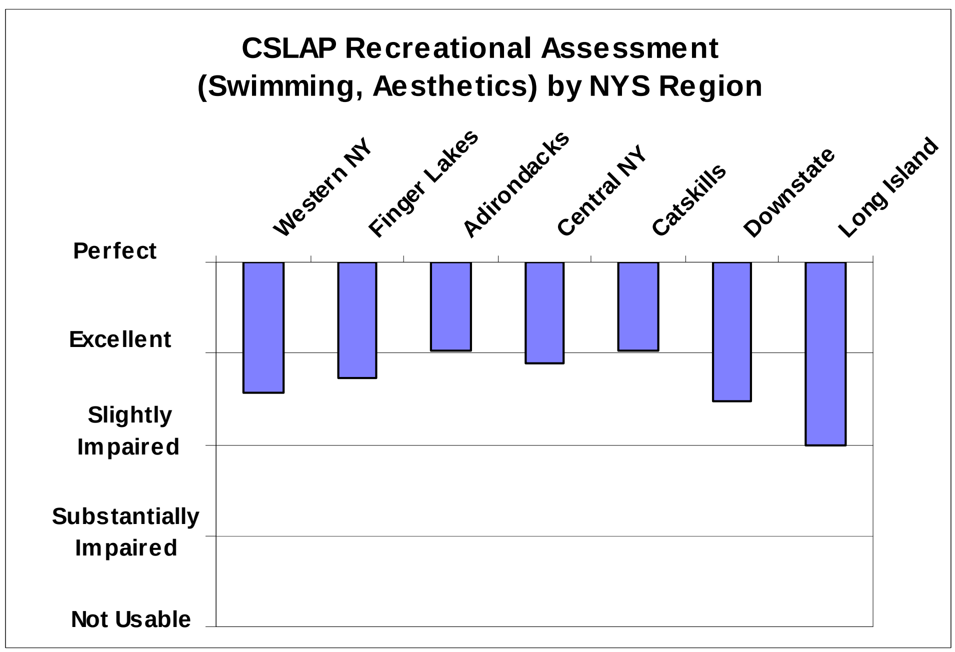


Figure 22b. *Recreational Assessment in CSLAP Lakes by NYS Region*

What Was Expected in 2008?

There is not a strong connection between precipitation and perceived recreational conditions. While it is reasonable to assume that recreational assessments will be less favorable if either water quality perceptions are unfavorable or aquatic plant coverage increases, changes in water quality or plant coverage is difficult to predict. As noted above, given the 2008 weather patterns and their expected impact on water transparency and weeds, it is more likely that recreational assessments will be less favorable than more favorable.

What Happened at Lake Oscaleta in 2008?

Recreational assessments were most favorable toward the end of the 2008 sampling season, coincident with the most favorable water quality assessments and the lowest aquatic plant coverage. These recreational assessments were more closely tied to excessive weeds than to poor water clarity.

Statewide Variability:

Recreational assessments are most favorable in the Adirondacks and Catskills, and less favorable in Long Island and (to a lesser extent) downstate and in western New York. This appears to be in response to less favorable assessments of water-quality and aquatic plant growth, respectively. Except for (the assessments in the small number of CSLAP lakes in) Long Island, overall recreational assessments in all regions are, in general, highly favorable.

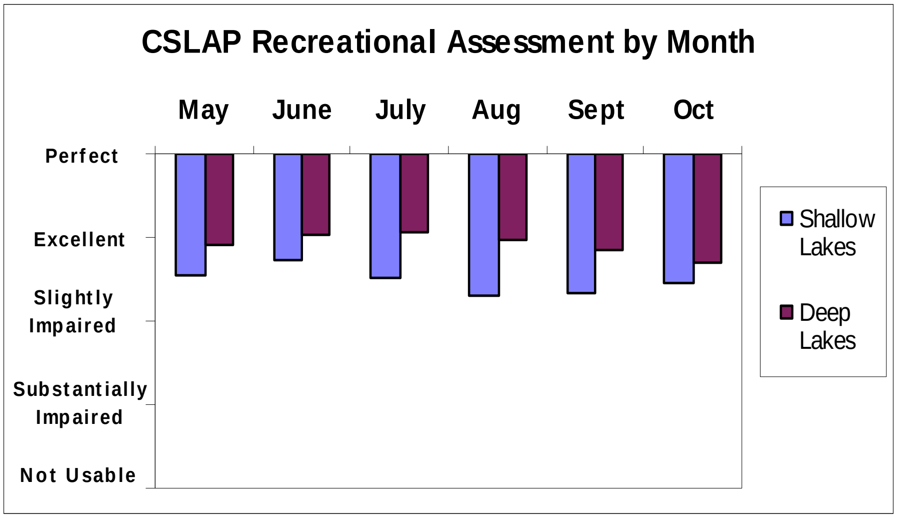


Figure 22c. *Recreational Assessment in Shallow (<20ft deep) and Deep CSLAP Lakes by Month*

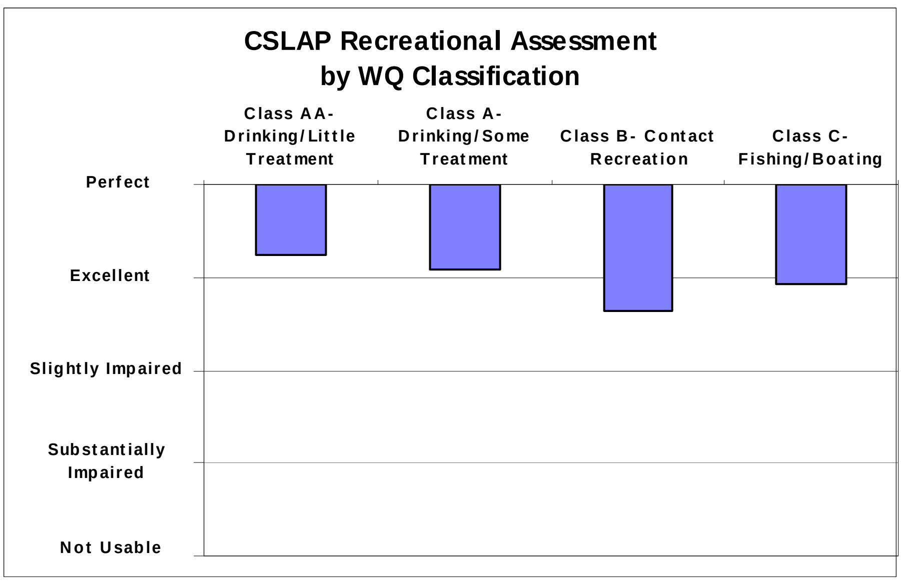


Figure 22d. *Recreational Assessment in CSLAP Lakes by Lake Use*

Seasonal Variability:

Recreational assessment in both shallow and deep lakes tends to improve from spring to early summer and then degrade through the summer, improving in shallow lakes in the fall. As expected, this generally corresponds to seasonal increases in aquatic plant coverage in deep lakes and also to seasonally degrading water-quality in shallow lakes. Overall recreational assessments are more favorable in deep lakes every month of the sampling season, although the differences are less pronounced in late spring and early fall (and winter, when every lake looks nice!).

Lake Use Variability:

Recreational assessment becomes less favorable as the designated lake use becomes less sensitive (drinking water to contact recreation), although recreational assessments of Class B and C lakes are only slightly less favorable than in Class AA and A lakes. This may be considered a validation of these classifications (recognizing, again, that many Class C lakes continue to fully support contact recreation and perhaps even potable-water use).

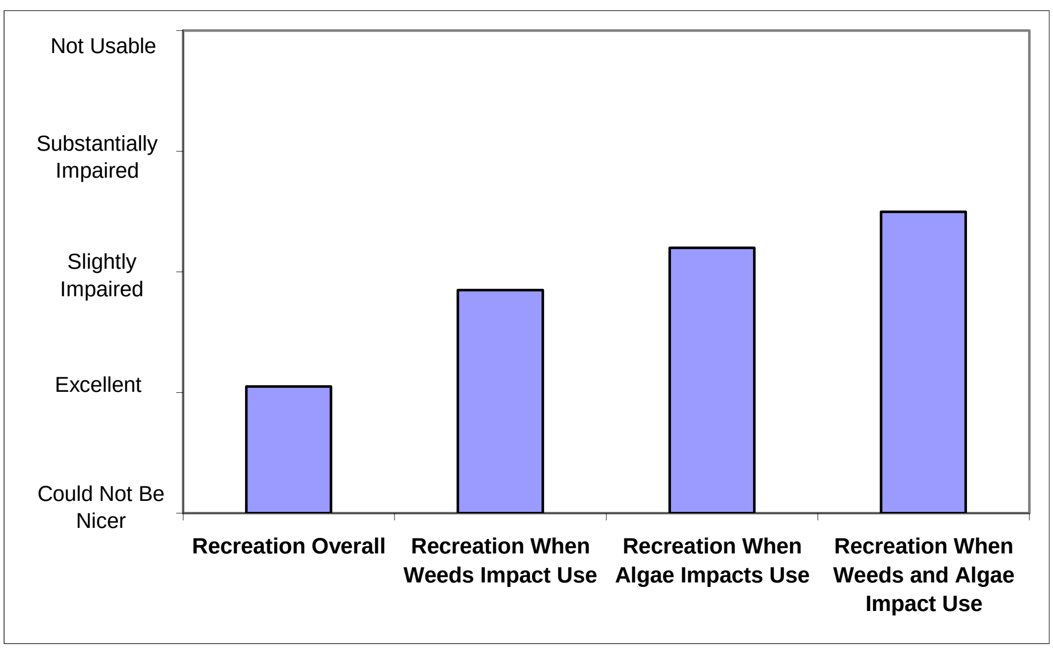
Detailed Discussion #11- Recreational assessments

Are lakes with both invasive plants and excessive algae usually viewed less favorably than lakes with problems with either weeds or algae (but not both)?

Discussion:

The CSLAP perception survey provides a five point scale for evaluating recreational suitability, ranging from “could not be nicer” (= #1) to “lake not usable” (= #5). As is apparent from the plot below, the typical response for CSLAP lakes is “excellent” for most recreational uses, corresponding to #2 on this scale. The relative impact of aquatic plants and water quality conditions can be evaluated for each recreational use response. The typical response to this question is less favorable when “excessive weed growth” is reported as impacting recreational use, and is even less favorable when “poor water clarity” or “excessive algae growth” are implicated in recreational use impacts. These lakes are most frequently described as being “slightly impaired”. The greater impacts from excessive algae may reflect the nature of this recreational use survey, which directs respondents to evaluate impacts to “swimming and aesthetic enjoyment”. Surveys geared toward evaluating non-contact recreation, such as boating, would no doubt yield different results.

It is clear from the plot below that the combination of excessive algae and excessive weeds create more problems than either factor alone, even though each factor may ultimately limit the other. For example, very dense weed growth may outcompete algae for available nutrients, even though most rooted aquatic plants in NYS uptake nutrients primarily from the water. Likewide, dense algal blooms may limit sunlight transmission to the bottom of the lake, thus limiting weed growth to only the very shallow shoreline areas. These findings may better reflect the influence of Eurasian watermilfoil, which can grow very densely in highly turbid water.



So What Have We Learned Through CSLAP?

After more than twenty years and more than 15,000 samples collected from more than 220 lakes throughout New York State, we have learned a lot about the lakes of New York State as a direct result of the work of nearly 1,500 volunteers through CSLAP. Some of these findings have been summarized in other places in this report, but these and other findings can be distilled here:

- Water quality conditions in most CSLAP lakes have not changed significantly in the last twenty years. While there have been some water quality trends, as discussed below, the majority of the changes observed in these lakes appear to be within the normal range of variability expected in most lakes. This is not to discount the important work done by many NYSFOLA lake associations—improvements in septic management, reductions in lawn fertilization, erosion and stormwater management, and invasive species prevention may have minimized or at least slowed down the steady progression toward lake succession and the continued onslaught of overdevelopment and global climate change. Unfortunately, it is not yet known if these findings can be extrapolated to the entirety of New York State lakes, even though the typical CSLAP lake is similar to the typical New York State lake (in the “developed” portions of the state).
- For those lakes that exhibited significant change, there was no clear pattern of change for most water quality indicators measured through CSLAP. However, there were some exceptions:
  - Conductivity changed more than any of the other CSLAP water quality indicators measured over the last 23 years, although about an equal number of lakes exhibited increasing conductivity as exhibited decreasing conductivity. It was reported in 2007 that more lakes had shown an increase in conductivity, but this “trend” may have disappeared due to wetter weather in recent years.
  - Water color increased in 15-20% of these lakes, with the majority of the increase occurring in the last six years. As discussed in detail above, this may have reflected both an increase in association with wetter weather and the change in laboratories in 2002. However, the increase in water color and corresponding decrease in water transparency did not appear to affect recreational assessments of the lake or any of the other measured water quality indicators.
  - pH has decreased in twice as many lakes than it has increased, although this decrease occurred in only about 10% of the CSLAP lakes. This indicates that acid rain continues to fall, although it is important to note that pH has increased in 30-50% of these lakes in last two years. This suggests that the increase in pH apparent in many Adirondack lakes as a consequence of federal Clean Air Act emission reductions and cap and trade programs may have been realized in other NYS lakes as well. It should be noted that the drop in pH over the last twenty years, and increase in the last two years, has not resulted in any significant change in the frequency of water quality standards violations in these lakes. It should also be noted that there are few CSLAP lakes in the most acid-sensitive class of lakes (high elevation, small, undeveloped lakes), and thus the very significant change in lake ecology found in some of these sensitive lakes would not be apparent in these affected CSLAP lakes.
  - Water temperature readings have increased in 10-15% of the CSLAP lakes that have been sampled for more than 5 years. More precisely, water temperature readings have increased in about 20-30% of the lakes in a statistically significant manner, and have decreased in 10-15% of the lakes. While a similar change was not apparent with the air temperature data, the latter reflects an instantaneous measurement that might not reflect larger scale changes. The overall change in any of these lakes is probably less than 2ºC, and given the lack of sensitivity in the

pocket thermometers used in CSLAP, it is not clear if this change is outside the normal variability for the lake. But if this increase has occurred, the implications may be significant. The increase in water temperature will effectively increase the growing season in these lakes. This may trigger an increase in the growth and duration of algae and rooted aquatic vegetation. The increasing suitability of New York lakes for more traditionally southern exotic plants, such as *Hydrilla verticillatum* (hydrilla) and *Egeria densa* (Brazilian elodea), will make these lakes more susceptible to invasive growth of these exotics. There is at least some antidotal evidence from several CSLAP lakes that the end of the growing season for *Potamogeton crispus* (curly-leafed pondweed) has shifted from late June until at least mid July, with an increasing number of lakes reported persistent curly-leafed pondweed populations lasting well into late summer. In addition, several New York State lakes have reported as much as a 20 day decrease in the ice cover season over the last 100 years. The implications for plant growing seasons, spring runoff patterns, winter recreation, and ice damage to docks could be significant, but at present are not known.

- The frequency of phosphorus readings exceeding 20 parts per billion (or µg/l) is very similar to the frequency of water clarity readings below 2 meters. Since the former corresponds to the state guidance value for Class B (swimming) lakes, this suggests that water clarity readings may be a useful surrogate for evaluating potential impacts of excessive algae to swimming and contact recreation.
- For many CSLAP lakes, there appears to be a strong correlation between water transparency and precipitation—lower water clarity readings occur in response to heavy rainfall and/or runoff. While phosphorus readings and algae levels also increase as a result of higher precipitation, the correlation is not as strong, probably due to increasing turbidity and lower transmission of light into the water, less sunlight, and the impact of water color on water transparency. A more detailed analysis will require truly local precipitation data—rather than aggregate data from large regions of the state as presented in this report—and its impact on runoff, lake water level, and even water temperature readings.
- There is a strong correlation between water quality perception and standard eutrophication indicators—water clarity, chlorophyll *a*, and total phosphorus. This has significant implications for developing water quality standards or criteria for these water quality indicators, since poor water quality perception is closely connected to recreational and aesthetic impacts and provides an impetus for managing these resources. These data will continue to be used by the state of New York to develop recreation-based water quality criteria to protect lakes and ponds from over-enrichment from excessive phosphorus and algae levels. Since perception data are also closely related to justification (or providing an impetus) for lake management actions, these perception data can only be collected by lake residents or others intimately familiar with the ebb and flow of “normal” conditions in lakes.

VI. DETAILED LAKE OSCALETA WATER-QUALITY SUMMARY

CSLAP is intended to provide a database to help lake associations understand lake conditions and foster sound lake protection and pollution prevention decisions. This individual lake summary for 2008 contains two forms of information. The raw data and graphs present a snapshot or glimpse of water-quality conditions at each lake. They are based on (at most) eight or nine sampling events during the summer. As lakes are sampled through CSLAP for a number of years, the database for each lake will expand, and assessments of lake conditions and water-quality data become more accurate. For this reason, lakes new to CSLAP for only one year will not have information about annual trends.

Raw Data

Two **“**data sets**”** are provided below. The data presented in Table 2 include an annual summary of the minimum, maximum, and average for each of the CSLAP sampling parameters, including data from other sources for which sufficient quality-assurance/quality-control documentation is available for assessing the validity of the results. This data may be useful for comparing a particular data point for the current sampling year with historical data or information. Tables 3 through 5 includes more detailed summaries of the 2008 and historical data sets, including some evaluation of water-quality trends, comparison against existing water-quality standards, and whether 2008 represented a typical year.

Graphs

The second form of data analysis for your lake is presented in the form of graphs. These graphs are based on the raw data sets to represent a snapshot of water-quality conditions at your lake. The more sampling that has been done on a particular lake, the more information that can be presented on the graph, and the more information you have to identify annual trends for your lake. For example, a lake that has been doing CSLAP monitoring consistently for five years will have a graph depicting five years’ worth of data, whereas a lake that has been doing CSLAP sampling for only one year will only have one. Therefore, it is important to consider the number of sampling years of information in addition to where the data points fall on a graph when trying to draw conclusions about annual trends. There are certain factors not accounted for in this report that lake managers should consider:

- **Local weather conditions** (high or low temperatures, rainfall, droughts or hurricanes). Due to delays in receiving meteorological data from NOAA stations within NYS, weather data from individual weather stations or the present sampling season are not included in these reports. Some of the variability reported below can be attributed more to weather patterns than to a “real” water trend or change. However, it is presumed that much of the sampling “noise” associated with weather is dampened over multiple years of data collection and thus should not significantly influence the limited trend analyses provided for CSLAP lakes with longer and larger databases.

- **Sampling season and parameter limitations**. Because sampling is generally confined to June-September, this report does not look at CSLAP parameters during the winter and other seasons. Winter conditions can impact the usability and water-quality of a lake. In addition, there are other sampling parameters (fecal coliform, dissolved oxygen, etc.) that may be responsible for chemical and biological processes and changes in physical measurements (such as water clarity) and the perceived conditions in the lake. *The 2008 CSLAP report attempts to standardize some comparisons by limiting the evaluation to the summer recreational season and the most common sampling periods (mid-June through mid-September), in the event that samples are collected at other times of the year (such as May or October) during only some sampling seasons.*

TABLE 2: CSLAP Data Summary for Lake Oscaleta

Year	Min	Avg	Max	N	Parameter
2006-08	**0.50**	**2.79**	**4.05**	**31**	**CSLAP Zsd**
2008	1.85	2.79	3.75	15	CSLAP Zsd
2007	2.93	3.44	4.05	8	CSLAP Zsd
2006	0.50	2.13	3.10	8	CSLAP Zsd
2003	2.90	3.39	4.30	5	CedEd Zsd
1987	2.30	3.20	4.10	2	ALSC Zsd
Year	Min	Avg	Max	N	Parameter
2006-08	**0.011**	**0.022**	**0.055**	**31**	**CSLAP Tot.P**
2008	0.011	0.019	0.032	15	CSLAP Tot.P
2008	0.017	0.059	0.096	16	CSLAP HypoTP
2007	0.012	0.019	0.030	8	CSLAP Tot.P
2007	0.013	0.056	0.089	7	CSLAP HypoTP
2006	0.016	0.031	0.055	8	CSLAP Tot.P
2006	0.038	0.057	0.082	7	CSLAP HypoTP
2003	0.020	0.026	0.037	5	CedEd Tot.P
2003	0.050	0.071	0.085	5	CedEd HypoTP
1987	0.011	0.018	0.025	2	ALSC Tot.P
1987	0.027	0.027	0.027	1	ALSC HypoTP
Year	Min	Avg	Max	N	Parameter
2006-08	**0.00**	**0.01**	**0.04**	**30**	**CSLAP NO3**
2008	0.00	0.01	0.04	14	CSLAP NO3
2007	0.00	0.01	0.04	8	CSLAP NO3
2006	0.01	0.02	0.03	8	CSLAP NO3
2003		0.01			CedEd NO3
1987	0.01	0.01	0.01	2	ALSC NO3
Year	Min	Avg	Max	N	Parameter
2006-08	**0.01**	**0.03**	**0.12**	**31**	**CSLAP NH4**
2008	0.01	0.03	0.09	15	CSLAP NH4
2007	0.01	0.01	0.03	8	CSLAP NH4
2006	0.01	0.04	0.12	8	CSLAP NH4
1987	0.01	0.01	0.01	2	ALSC NH4
Year	Min	Avg	Max	N	Parameter
2006-08	**0.22**	**0.47**	**0.80**	**26**	**CSLAP TDN**
2008	0.22	0.37	0.50	13	CSLAP TDN
2007	0.37	0.57	0.76	8	CSLAP TDN
2006	0.48	0.57	0.80	5	CSLAP TDN
Year	Min	Avg	Max	N	Parameter
2006-08	**10**	**49**	**103**	**26**	**CSLAP TN/TP**
2008	21	47	97	13	CSLAP TN/TP
2007	45	69	103	8	CSLAP TN/TP
2006	10	20	30	5	CSLAP TN/TP

DATA SOURCE KEY

CSLAP	New York Citizens Statewide Lake Assessment Program
LCI	the NYSDEC Lake Classification and Inventory Survey conducted during the 1980s and again beginning in 1996 on select sets of lakes, typically 1 to 4x per year
DEC	other water-quality data collected by the NYSDEC Divisions of Water and Fish and Wildlife, typically 1 to 2x in any given year
ALSC	the NYSDEC (and other partners) Adirondack Lake Survey Corporation study of more than 1500 Adirondack and Catskill lakes during the mid 1980s, typically 1 to 2x
ELS	USEPA's Eastern Lakes Survey, conducted in the fall of 1982, 1x
CedEd	Cedar Eden Environmental study in 2003
EMAP	USEPA and US Dept. of Interior's Environmental Monitoring and Assessment Program conducted from 1990 to present, 1 to 2x in four year cycles

Additional data source codes are provided in the individual lake reports

CSLAP DATA KEY:

The following key defines column headings and parameter results for each sampling season:

Min	Minimum reading for the parameter
Avg	Geometric average (mean) reading for the parameter
Max	Maximum reading for the parameter
N	Number of samples collected
Zsd	Secchi disk transparency, meters
Tot.P	Total Phosphorus as P, in mg/l (Hypo or Hy = bottom sample)
NO3	Nitrate + Nitrite nitrogen as N, in mg/l
NH_4	Ammonia as N, in mg/l
TDN	Total Dissolved Nitrogen as N, in mg/l
TN	Total Nitrogen as N, in mg/l
TN/TP	Nitrogen/Phosphorus ratios, unitless (calculated from TDN)
Ca	Calcium, in mg/l
Tcolor	True color, as platinum color units
pH	(negative logarithm of hydrogen ion concentration), standard pH
Cond25	Specific conductance corrected to 25°C, in µmho/cm
Chl.a	Chlorophyll *a*, in µg/l
QA	Survey question re: physical condition of lake: (1) crystal clear; (2) not quite crystal clear; (3) definite algae greenness; (4) high algae levels; and (5) severely high algae levels
QB	Survey question re: aquatic plant populations of lake: (1) none visible; (2) visible underwater; (3) visible at lake surface; (4) dense growth at lake surface; (5) dense growth completely covering the nearshore lake surface
QC	Survey question re: recreational suitability of lake: (1) couldn't be nicer; (2) very minor aesthetic problems but excellent for overall use; (3) slightly impaired; (4) substantially impaired, although lake can be used; (5) recreation impossible
QD	Survey question re: factors affecting answer QC: (1) poor water clarity; (2) excessive weeds; (3) too much algae/odor; (4) lake looks bad; (5) poor weather; (6) litter, surface debris, beached/floating material; (7) too many lake users (boats, PWCs, etc); (8) other

TABLE 2: CSLAP Data Summary for Lake Oscaleta (cont)

Year	Min	Avg	Max	N	Parameter
2006-08	**8**	**16**	**35**	**30**	**CSLAP TColor**
2008	9	15	23	14	CSLAP TColor
2007	8	14	17	8	CSLAP TColor
2006	12	20	35	8	CSLAP TColor
1987	15	18	20	2	ALSC TColor
Year	Min	Avg	Max	N	Parameter
2006-08	**7.10**	**7.95**	**9.36**	**31**	**CSLAP pH**
2008	7.10	7.83	8.91	15	CSLAP pH
2007	7.14	7.81	8.56	8	CSLAP pH
2006	7.39	8.32	9.36	8	CSLAP pH
2003	7.40	7.66	8.00	5	CedEd pH
1987	7.59	7.78	7.97	2	ALSC pH
Year	Min	Avg	Max	N	Parameter
2006-08	**95**	**134**	**172**	**30**	**CSLAP Cond25**
2008	95	138	172	14	CSLAP Cond25
2007	108	127	150	8	CSLAP Cond25
2006	121	133	151	8	CSLAP Cond25
1987	112	115	118	2	ALSC Cond25
Year	Min	Avg	Max	N	Parameter
2006-08	**11.7**	**12.7**	**15.6**	**15**	**CSLAP Ca**
2008	12.5	12.6	12.7	11	CSLAP Ca
2007	11.9	11.9	11.9	2	CSLAP Ca
2006	11.7	13.7	15.6	2	CSLAP Ca
1987	10.0	10.3	10.6	2	ALSC Ca
Year	Min	Avg	Max	N	Parameter
2006-08	**0.16**	**11.21**	**53.64**	**31**	**CSLAP Chl.a**
2008	3.46	11.27	48.04	15	CSLAP Chl.a
2007	2.90	7.66	13.35	8	CSLAP Chl.a
2006	0.16	14.65	53.64	8	CSLAP Chl.a
2003	5.00	5.50	7.00	5	CedEd Chl.a
Year	Min	Avg	Max	N	Parameter
2006-08	**1**	**2.3**	**4**	**29**	**QA**
2008	2	2.3	3	13	QA
2007	1	2.0	3	8	QA
2006	2	2.6	4	8	QA
Year	Min	Avg	Max	N	Parameter
2006-08	**2**	**2.6**	**4**	**29**	**QB**
2008	2	2.7	4	13	QB
2007	2	2.8	4	8	QB
2006	2	2.3	3	8	QB

TABLE 2: CSLAP Data Summary for Lake Oscaleta (cont)

Year	Min	Avg	Max	N	Parameter
2006-08	**2**	**2.5**	**4**	**29**	**QC**
2008	2	2.5	3	13	QC
2007	2	2.4	3	8	QC
2006	2	2.5	4	8	QC

- **Statistical analyses**. True assessments of water-quality trends and comparison to other lakes involve rigid statistical analyses. Such analyses are generally beyond the scope of this program, in part due to limitations on the time available to summarize data from more than 100 lakes in the five months from data receipt to the next sampling season. This may be due in part to the inevitable inter-lake inconsistencies in sampling dates from year to year and in part to the limited scope of monitoring. Where appropriate, some statistical summaries, utilizing both parametric and non-parametric statistics, have been provided within the report (primarily in Table 2).

- **Mean versus Median.** Much of the water-quality summary data presented in this report is reported as the mean, or the average of all of the readings in the period in question (summer, annual, year to year). However, while mean remains one of the most useful, and often most powerful, ways to estimate the most typical reading for many of the measured water-quality indicators, it is a less useful and perhaps misleading estimate when the data are not "normally" distributed (most common readings in the middle of the range of all readings, with readings less common toward the end of the range).

  In particular, comparisons of one lake to another, such as comparisons within a particular basin, can be greatly affected by the spread of the data across the range of all readings. For example, the average phosphorus level of nine lakes with very low readings (say 10 µg/l) and one lake with very high readings (say 110 µg/l) could be much higher (in this case, 20 µg/l) than in the "typical lake" in this set of lakes (much closer to 10 µg/l). In this case, median, or the middle reading in the range, is probably the most accurate representation of "typical".

  This report will include the use of both mean and median to evaluate "central tendency," or the most typical reading, for the indicator in question. In most cases, "mean" is used most often to estimate central tendency. However, where noted, "median" may also be used.

TABLE 3- Current and Historical Data Summaries for Lake Oscaleta
Eutrophication Indicators

Parameter	Year	Minimum	Average	Maximum
Zsd	2008	1.85	2.79	3.75
(meters)	All Years	0.50	2.79	4.05
Parameter	**Year**	**Minimum**	**Average**	**Maximum**
Phosphorus	2008	0.011	0.019	0.032
(mg/l)	All Years	0.011	0.022	0.055
Parameter	**Year**	**Minimum**	**Average**	**Maximum**
Chl.a	2008	3.46	11.27	48.04
(µg/l)	All Years	0.16	11.21	53.64

Parameter	Year	Was 2008 Clarity the Highest or Lowest on Record?	Was 2008 a Typical Year?	Trophic Category	Zsd Changing?	% Samples Violating DOH Beach Std?+
Zsd	2008	Within Normal Range	Yes	Mesotrophic	No	0
(meters)	All Years			Mesotrophic		3
Parameter	**Year**	**Was 2008 TP the Highest or Lowest on Record?**	**Was 2008 a Typical Year?**	**Trophic Category**	**TP Changing?**	**% Samples Exceeding TP Guidance Value**
Phosphorus	2008	Lowest at Times	Yes	Mesotrophic	No	40
(mg/l)	All Years			Eutrophic		48
Parameter	**Year**	**Was 2008 Algae the Highest or Lowest on Record?**	**Was 2008 a Typical Year?**	**Trophic Category**	**Chl.a Changing?**	
Chl.a	2008	Within Normal Range	Yes	Eutrophic	No	
(µg/l)	All Years			Eutrophic		

Minimum allowable water clarity for siting a new NYS swimming beach = 1.2 meters
NYS Total Phosphorus Guidance Value for Class B and Higher Lakes = 0.020 mg/l

The CSLAP dataset indicates that Lake Oscaleta is a *mesoeutrophic*, or moderately to highly productive lake, based on total phosphorus, chlorophyll *a* (both typical of *eutrophic* lakes) and Secchi disk transparency readings (typical of *mesotrophic* lakes). Lake Oscaleta was probably slightly less productive than normal in 2008. Phosphorus readings were lower than normal, continuing a pattern observed over the last three years. Algae levels reported in Table 3 (annual average) were also slightly lower than normal. Water clarity was more variable, but generally was close to normal during most of the summer. There is only a weak correlation between changes in clarity and algae, and between changes in phosphorus and algae. However, phosphorus is the limiting nutrient for algae growth, and these data suggest that any efforts to prevent algal blooms and increase water clarity need to address nutrient loading to the lake.

Lake productivity does not vary in any measurable way during the summer, but nutrient and algae levels increase substantially in the fall, indicating that deepwater nutrients are migrating to the lake surface during and after turnover. This is consistent with the generally increasing deepwater phosphorus levels in the fall, although the seasonal increase (and overall deepwater nutrient levels) are not as significant as in Lake Waccabuc. Phosphorus readings are regularly above the state guidance value for lakes used for contact recreation (swimming), with most of the higher readings occurring after the swimming season. However, Secchi disk transparency readings exceed the recommended water clarity for swimming beaches (= 1.2 meters) during nearly all of the CSLAP sampling sessions.

TABLE 4- Current and Historical Data Summaries for Lake Oscaleta (cont.)
Other Water-Quality Indicators

Parameter	Year	Minimum	Average	Maximum
Nitrate	2008	0.00	0.01	0.04
(mg/l)	All Years	0.00	0.01	0.04
Parameter	**Year**	**Minimum**	**Average**	**Maximum**
NH4	2008	0.01	0.03	0.09
(mg/l)	All Years	0.01	0.03	0.12
Parameter	**Year**	**Minimum**	**Average**	**Maximum**
TDN	2008	0.22	0.37	0.50
(mg/l)	All Years	0.22	0.47	0.80
Parameter	**Year**	**Minimum**	**Average**	**Maximum**
True Color	2008	9	15	23
(ptu)	All Years	8	16	35
Parameter	**Year**	**Minimum**	**Average**	**Maximum**
pH	2008	7.10	7.83	8.91
(std units)	All Years	7.10	7.95	9.36
Parameter	**Year**	**Minimum**	**Average**	**Maximum**
Conductivity	2008	95	138	172
(µmho/cm)	All Years	95	134	172
Parameter	**Year**	**Minimum**	**Average**	**Maximum**
Calcium	2008	12.5	12.6	12.7
(mg/l)	All Years	11.7	12.7	15.6

These data indicate Lake Oscaleta is a weakly colored, alkaline (above neutral pH) lake with low nitrate, ammonia and total nitrogen levels, and water of intermediate hardness. Water transparency readings are more influenced by algae than by water color. Nitrate levels are low and ammonia readings are fairly low, and none of these nitrogen indicators represents a threat to surface water-quality. Total nitrogen is comprised primarily of organic nitrogen, and these readings have been slightly lower than in other CSLAP lakes with periodic algal blooms. The higher TDN readings in 2006 were consistent with higher lake productivity in that year, but it is assumed that the readings in the last two years are closer to normal for the lake. The nitrogen-to-phosphorus ratios indicate that algae growth is controlled by phosphorus. Conductivity readings are indicative of lakes with intermediate hardness, and have not exhibited any clear seasonal patterns. pH readings occasionally exceed the state water quality standards, and although no ecological impacts have been apparent, pH should continue to be watched. Calcium levels are slightly lower than the threshold found to support zebra mussels, and these exotic animals have not been found in Lake Oscaleta. It is not suspected that nearshore calcium levels are sufficiently elevated to support the colonization of the lake by zebra mussels.

TABLE 4- Current and Historical Data Summaries for Lake Oscaleta (cont.)
Other Water-Quality Indicators (cont)

Parameter	Year	Was 2008 Nitrate the Highest or Lowest on Record?	Was 2008 a Typical Year?	Nitrate High?	Nitrate Changing?	% Samples Exceeding NO3 Standard	
Nitrate	2008	Within Normal Range	Yes	No	No	0	
(mg/l)	All Years			No		0	
Parameter	**Year**	**Was 2008 NH4 the Highest or Lowest on Record?**	**Was 2008 a Typical Year?**	**NH4 High?**	**NH4 Changing?**	**% Samples Exceeding NH4 Standard**	
NH4	2008	Within Normal Range	Yes	No	Yes	0	
(mg/l)	All Years			No		0	
Parameter	**Year**	**Was 2008 TDN the Highest or Lowest on Record?**	**Was 2008 a Typical Year?**	**TDN High?**	**TDN Changing?**	**Ratios of TN/TP Indicate P or N Limitation?**	
TDN	2008	Lowest at Times	Yes	No	Yes	P Limitation	
(mg/l)	All Years			No		P Limitation	
Parameter	**Year**	**Was 2008 Color the Highest or Lowest on Record?**	**Was 2008 a Typical Year?**	**Colored Lake?**	**Color Changing?**		
True Color	2008	Within Normal Range	Yes	No	No		
(ptu)	All Years			No			
Parameter	**Year**	**Was 2008 pH the Highest or Lowest on Record?**	**Was 2008 a Typical Year?**	**Acceptable Range?**	**pH Changing?**	**% Samples > Upper pH Standard**	**% Samples < Lower pH Standard**
pH	2008	Lowest at Times	Yes	Yes	No	13	0
(std units)	All Years			Yes		23	0
Parameter	**Year**	**Was 2008 Conductivity Highest or Lowest on Record?**	**Was 2008 a Typical Year?**	**Relative Hardness**	**Conductivity Changing?**		
Conductivity	2008	Both Highest and Lowest at Times	Yes	Intermediate	No		
(µmho/cm)	All Years			Intermediate			
Parameter	**Year**	**Was 2008 Calcium Highest or Lowest on Record?**	**Was 2008 a Typical Year?**	**Support Zebra Mussels?**	**Calcium Changing?**		
Calcium	2008	Within Normal Range	Yes	Yes	No		
(mg/l)	All Years			Yes			

NYS Nitrate standard = 10 mg/l
NYS Ammonia standard = 2 mg/l (as NH_3-NH_4)
NYS pH standard- 6.5 < acceptable pH < 8.5

TABLE 5- Current and Historical Data Summaries for Lake Oscaleta

Lake Perception Indicators (1= most favorable, 5= least favorable)

Parameter	**Year**	**Minimum**	**Average**	**Maximum**
QA	2008	2	2.3	3
(Clarity)	All Years	1	2.3	4
Parameter	**Year**	**Minimum**	**Average**	**Maximum**
QB	2008	2	2.7	4
(Plants)	All Years	2	2.6	4
Parameter	**Year**	**Minimum**	**Average**	**Maximum**
QC	2008	2	2.5	3
(Recreation)	All Years	2	2.5	4

Parameter	**Year**	**Was 2008 Clarity the Highest or Lowest on Record?**	**Was 2008 a Typical Year?**	**Clarity Changed?**	**%Frequency 'Definite Algae Greenness'**	**%Frequency 'Severe Algae Levels'**	**%Frequency 'Slightly Impaired' Due to Algae**	**%Frequency 'Substantially Impaired' Due to Algae**
QA	2008	Within Normal Range	Yes	No	31	0	7	0
(Clarity)	All Years				28	7	10	3
Parameter	**Year**	**Was 2008 Weed Growth the Heaviest on Record?**	**Was 2008 a Typical Year?**	**Weeds Changed?**	**%Frequency Surface Weeds**	**%Frequency Dense Weeds**	**%Frequency 'Slightly Impaired' Due to Weeds**	**%Frequency 'Substantially Impaired' Due to Weeds**
QB	2008	Heaviest and Lightest	Yes	Yes	62	8	47	0
(Plants)	All Years				52	7	39	0
Parameter	**Year**	**Was 2008 Recreation the Best or Worst on Record?**	**Was 2008 a Typical Year?**	**Recreation Changed?**	**%Frequency Slightly Impaired**	**%Frequency Substantially Impaired**		
QC	2008	Best at Times	Yes	No	54	0		
(Recreation)	All Years				45	3		

Recreational and water quality assessments in Lake Oscaleta have varied only slightly from year to year. Lake Oscaleta was most often described as “not quite crystal clear” to having “definite algal greenness” in 2008, assessments that vary with changes in water clarity. These assessments are slightly more favorable than in other lakes with similar water clarity readings. Aquatic plant coverage was higher than normal in 2008, with surface plant growth common. It is not known if surface plant growth is associated with exotic (curly leafed pondweed) or native plants. The lake is most often described as “excellent” to “slightly impaired” for most recreational uses, with the occasional use impacts due to “excessive weeds”. It is not yet known if any of these assessments have exhibited any long-term changes, but this may be apparent with additional data. Recreational assessments generally degrade through early fall, then improve into late fall, consistent with seasonal changes in aquatic plant coverage.

Lake Oscaleta has been described by the CSLAP sampling volunteers as “slightly” impaired during 45% of the CSLAP sampling sessions, and “substantially” impaired 3% of the time. Slightly impaired conditions have been associated with excessive algae during 10% of the CSLAP sampling sessions, and with excessive weeds 39% of the time. Excessive algae has been implicated in “substantially impaired” conditions 3% of the time.

How Do the 2008 Data Compare to Historical Data from Lake Oscaleta?

Seasonal Comparison of Eutrophication, Other Water-quality, and Lake-Perception Indicators–2008 Sampling Season and in the Typical or Previous Sampling Seasons at Lake Oscaleta

Figures 23 and 24 compare data for the measured eutrophication parameters for Lake Oscaleta in 2008 and since CSLAP sampling began at Lake Oscaleta. Figures 25 and 26 compare nitrogen to phosphorus ratios, figures 27 through 34 compare other sampling indicators, and figures 35 and 36 compare volunteer perception responses during the same periods.

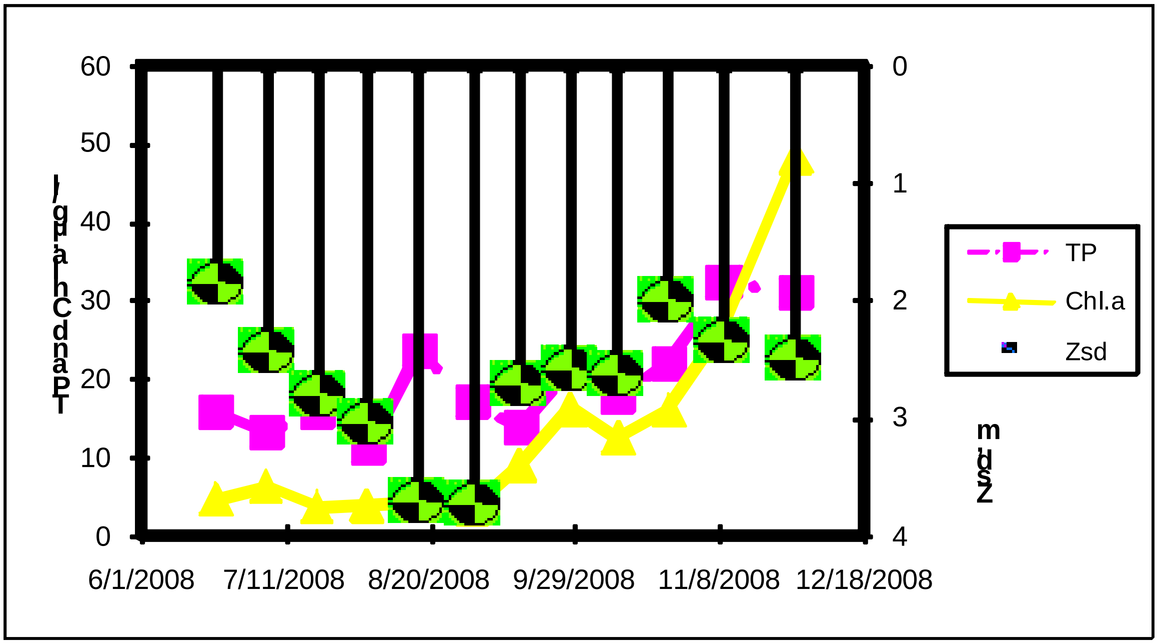


Figure 23. 2008 Eutrophication Data for Lake Oscaleta

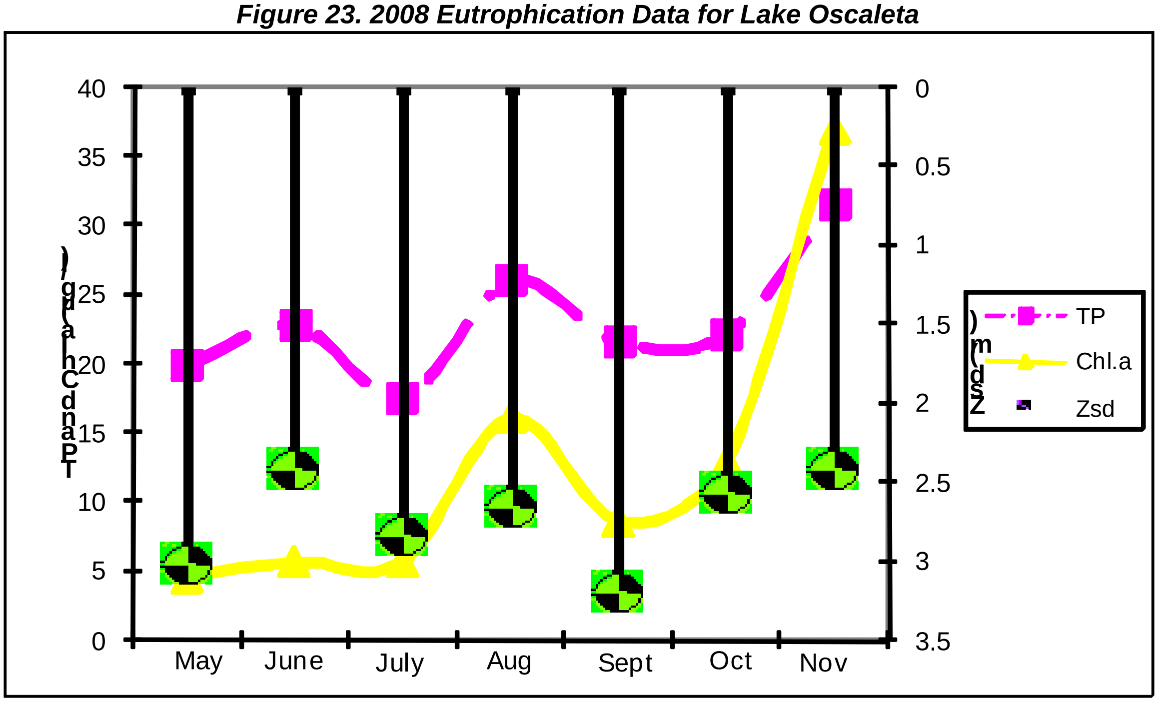


Figure 24- Eutrophication Data in a Typical (Monthly Mean) Year for Lake Oscaleta

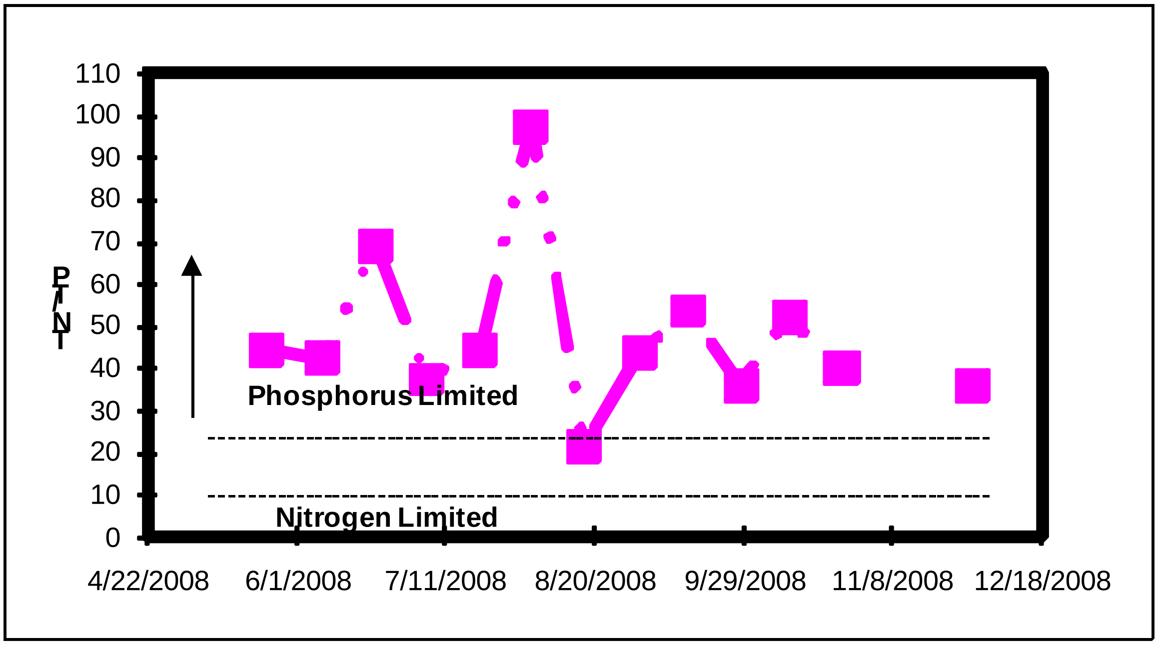


Figure 25. 2008 Nitrogen-to-Phosphorus Ratios for Lake Oscaleta

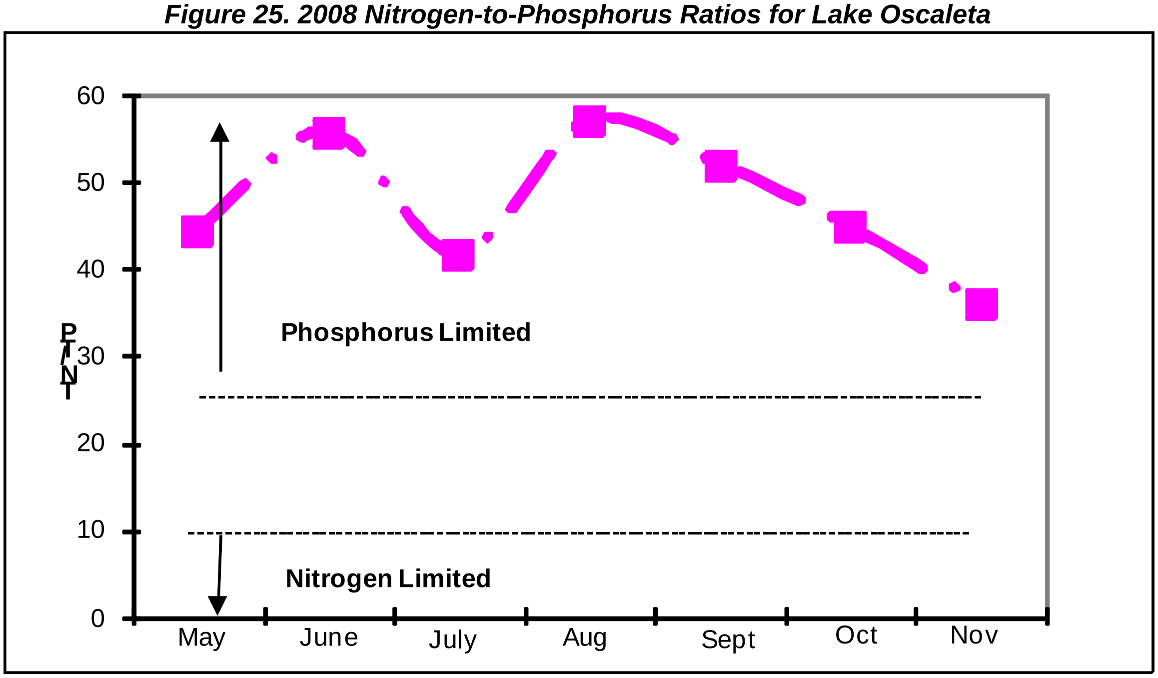


Figure 26- Nitrogen–to-Phosphorus Ratios in a Typical (Monthly Mean) Year for Lake Oscaleta

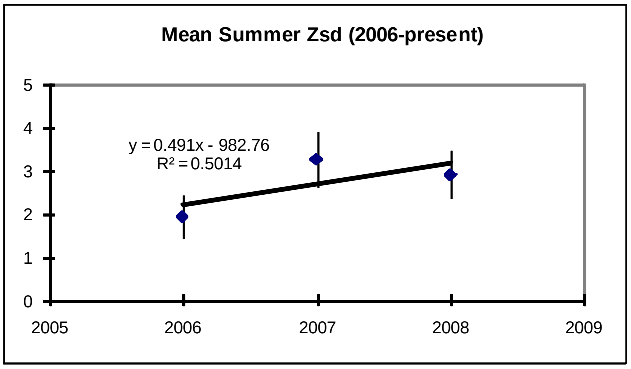


Figure 27. Annual Average Summer Water Clarity for Lake Oscaleta

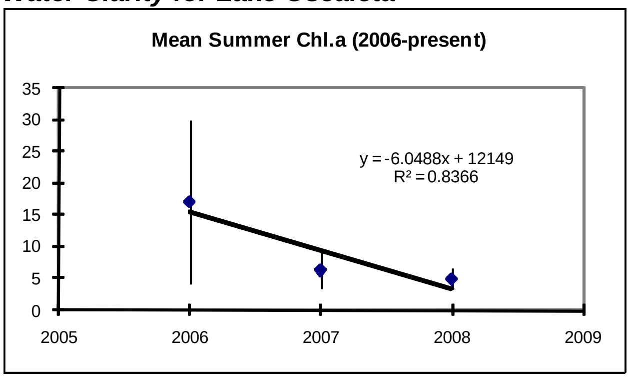


Figure 28. Annual Average Summer Chlorophyll a for Lake Oscaleta

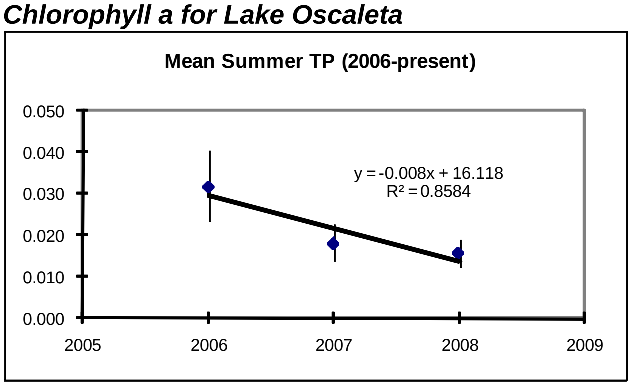


Figure 29. Annual Average Summer Total Phosphorus for Lake Oscaleta

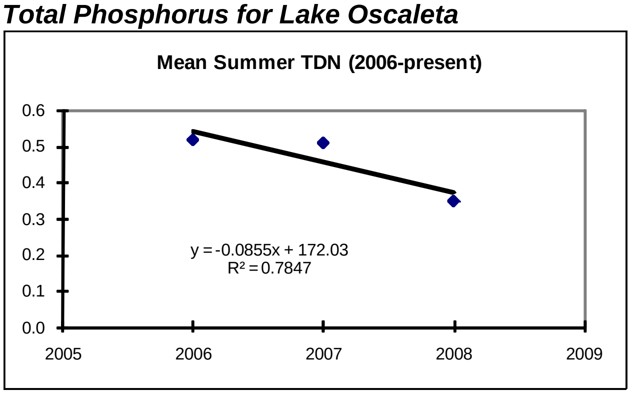


Figure 30. Annual Average Summer Total Nitrogen for Lake Oscaleta

Annual Averages, 2006-2008

Wettest Years: 2006-2008?
Driest Years: none
Highest Clarity: 2007, 2008
Lowest Clarity: 2006
Long Term Trend?: None apparent
Discussion: Water transparency readings have varied slightly from year to year, in a manner that does not appear to be statistically significant. It is not known if there is any correlation between clarity and precipitation levels.

Wettest Years: 2006-2008?
Driest Years: none
Highest Chl.a: 2006
Lowest Chl.a: 2008, 2007
Long Term Trend?: None apparent
Discussion: Chlorophyll *a* readings have varied, at times significantly, and these changes are mostly consistent with changes in water clarity readings over the same period.

Wettest Years: 2006-2008?
Driest Years: none
Highest TP: 2006
Lowest TP: 2008, 2007
Long Term Trend?: Too early to tell
Discussion: Phosphorus readings have been similar in the last two years. It is not yet known if the readings in the last two years or those from 2006 were more representative of normal conditions in the lake.

Wettest Years: 2006-2008?
Driest Years: none
Highest Total N: 2006, 2007
Lowest Total N: 2008
Long Term Trend?: Too early to tell
Discussion: Total nitrogen readings have generally decreased, consistent with the long-term ammonia "trend". However, nearly all of these readings have been low.

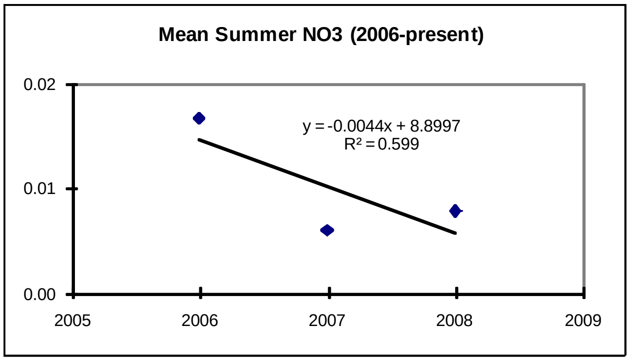


Figure 31. Annual Average Summer Nitrate for Lake Oscaleta

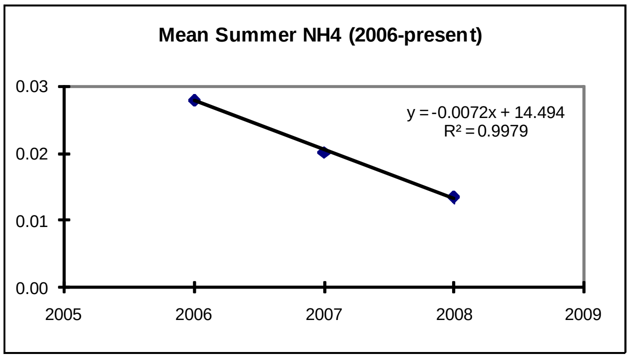


Figure 32. Annual Average Summer Ammonia for Lake Oscaleta

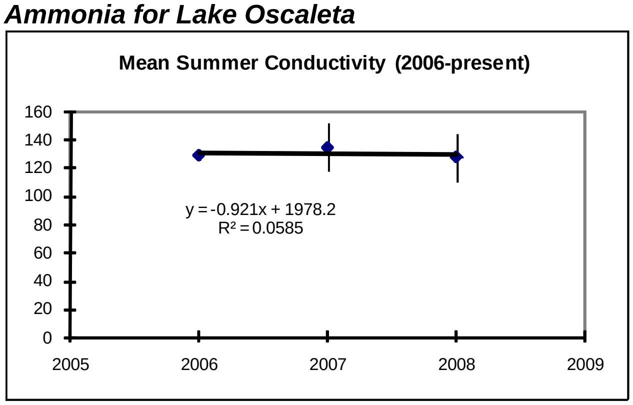


Figure 33. Annual Average Summer Conductivity for Lake Oscaleta

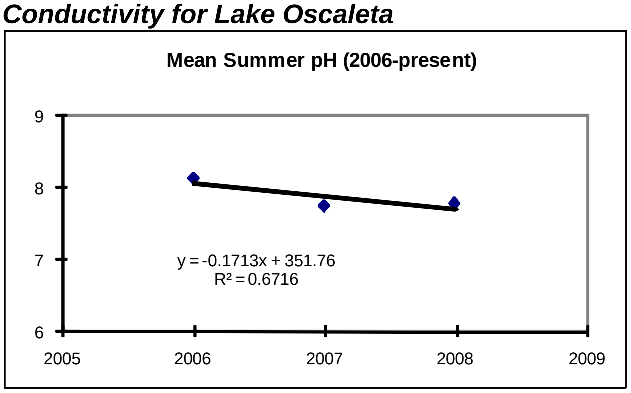


Figure 34. Annual Average Summer pH for Lake Oscaleta

Annual Averages, 1986-2008

Wettest Years: 2006-2008?
Driest Years: none
Highest Nitrate: 2006
Lowest Nitrate: 2007, 2008
Long Term Trend?: None apparent
Discussion: Nitrate readings have been consistently low, with no seasonal or long-term trends.

Wettest Years: 2006-2008?
Driest Years: none
Highest Ammonia: 2006
Lowest Ammonia: 2008
Long Term Trend?: Too early to tell
Discussion: Ammonia readings have decreased in each of the last three years, but there are insufficient data to evaluate long-term trends. Nearly all readings have been low.

Wettest Years: 2006-2008?
Driest Years: none
Highest Cond.: 2007
Lowest Cond.: 2006, 2008
Long Term Trend?: None apparent
Discussion: Conductivity readings have varied from sample to sample, particularly in the last two years, and no long-term trends have been apparent.

Wettest Years: 2006-2008?
Driest Years: none
Highest pH: 2006
Lowest pH: 2007, 2008
Long Term Trend?: Decreasing?
Discussion: pH readings have been lower in the last two years than in 2006, but it is likely that readings in all three years represent normal conditions in the lake.

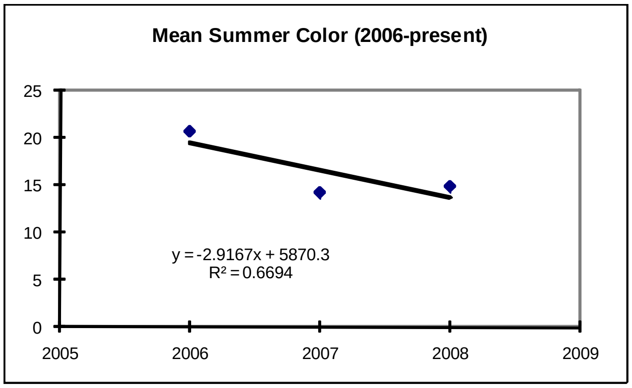


Figure 35. Annual Average Summer Color for Lake Oscaleta

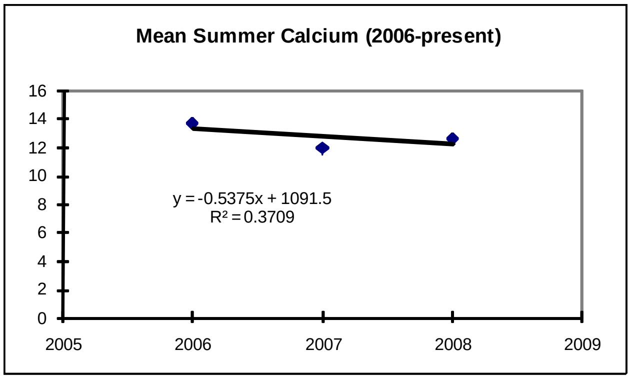


Figure 36. Annual Average Summer Calcium for Lake Oscaleta

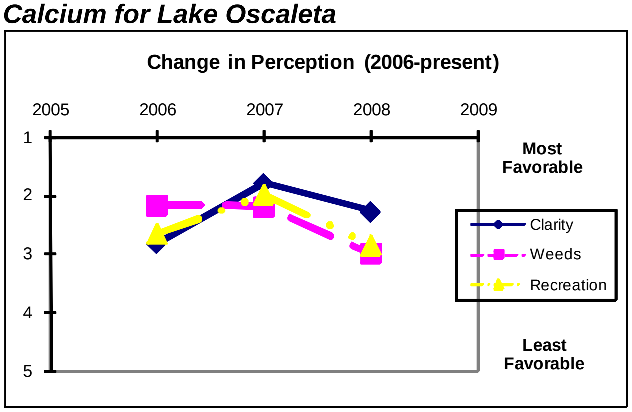


Figure 37. Annual Average Summer Lake Perception for Lake Oscaleta

(QA = clarity, ranging from (1) crystal clear to (3) definite algae greenness to (5) severely high algae levels;
QB = weeds, ranging from (1) not visible to (3) growing to the surface to (5) dense growth covers lake;
QC = recreation, ranging from (1) could not be nicer to (3) slightly impaired to (5) lake not usable)

Annual Averages, 2006-2008

Wettest Years: 2006-2008?
Driest Years: none
Highest Color: 2006
Lowest Color: 2007, 2008
Long Term Trend?: Not yet known
Discussion: Water color readings were comparable in the last two years, and lower than in 2006. It is not yet known if any of these years represent normal conditions, or if any longer-term trends have occurred.

Wettest Years: 2006-2008?
Driest Years: none
Highest Calcium: 2006
Lowest Calcium: 2007
Long Term Trend?: Too early to tell
Discussion: Calcium readings have only been measured in the last three years, so long-term trends are not apparent. Readings in both years are probably too low to support zebra mussels.

Wettest Years: 2006-2008?
Driest Years: none
Most Favorable WQ: 2007, 2008
Least Favorable WQ: 2006
Highest Weed Cov. 2008
Lowest Weed Cov. 2006, 2007
Most Favorable Rec. 2007
Least Favorable Rec. 2008, 2006
Long Term Trend?: Too early to tell
Discussion: Water quality assessments have generally varied in response to changes in water clarity readings. Recreational assessments have varied more in response to changes in plant coverage than to changes in water quality assessments. It is premature to determine if any patterns have occurred with water quality, aquatic plant, or recreational assessments

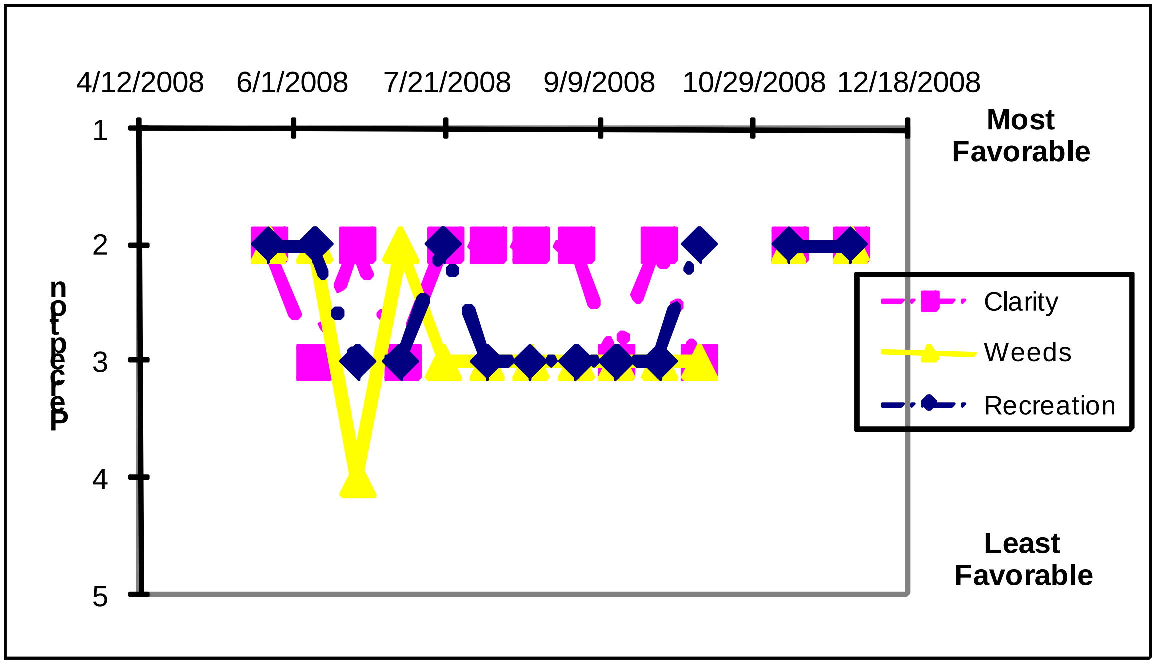


Figure 38. 2008 Lake Perception Data for Lake Oscaleta

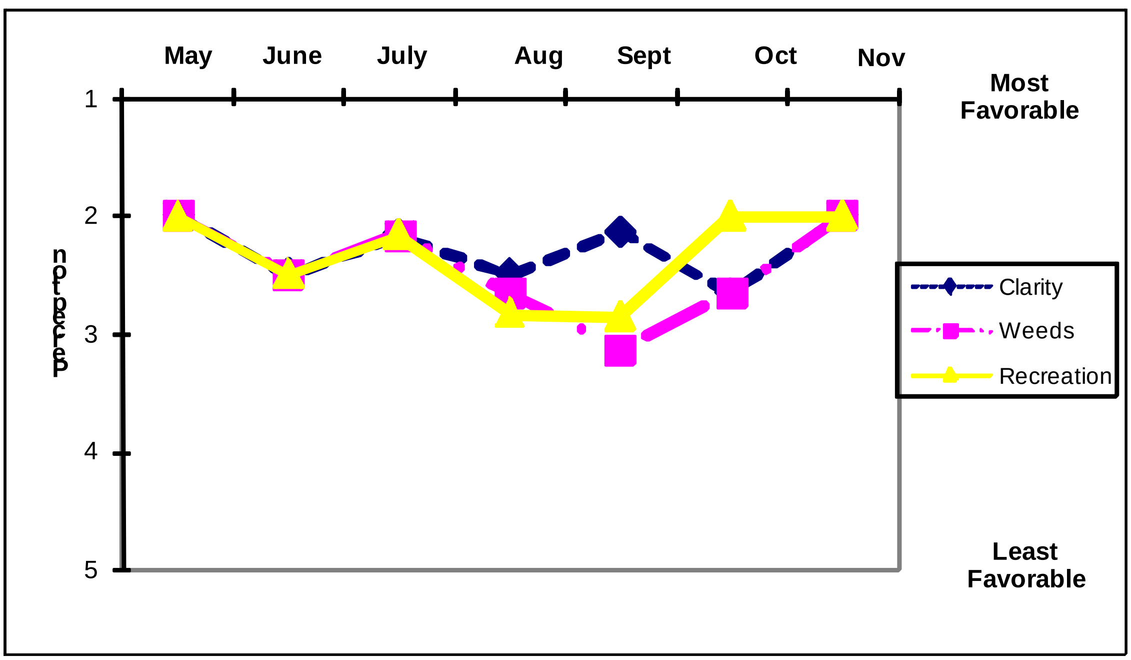


Figure 39- Lake Perception Data in a Typical (Monthly Mean) Year for Lake Oscaleta

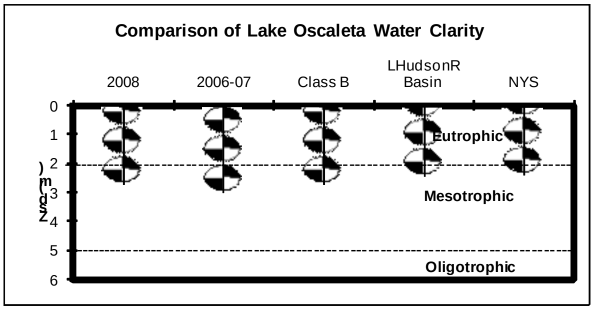


Figure 40. *Comparison of 2008 Secchi Disk Transparency to Lakes With the Same Water-Quality Classification, Neighboring Lakes, and Other CSLAP Lakes*

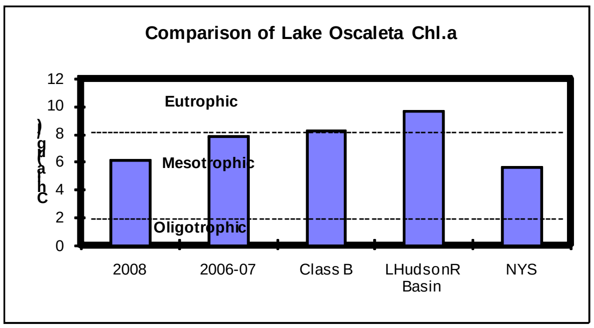


Figure 41. *Comparison of 2008 Chlorophyll a to Lakes with the Same Water-Quality Classification, Neighboring Lakes, and Other CSLAP Lakes*

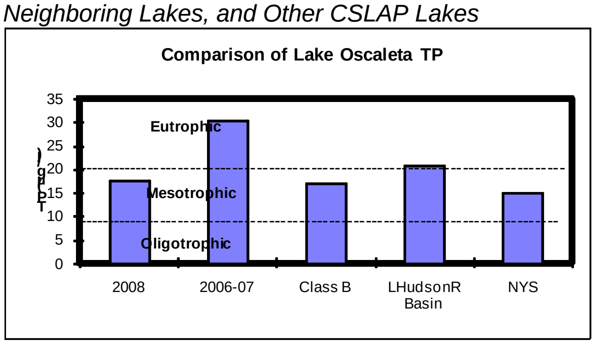


Figure 42. *Comparison of 2008 Total Phosphorus to Lakes With the Same Water-Quality Classification, Neighboring Lakes, and Other CSLAP Lakes*

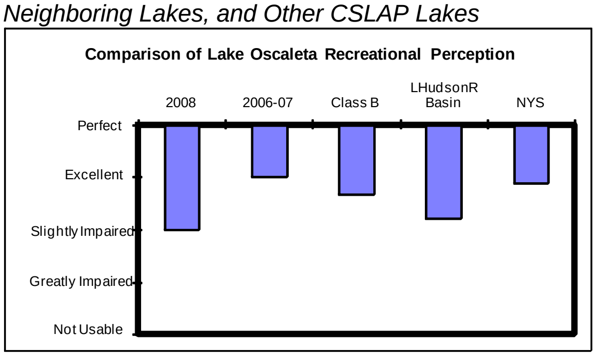


Figure 43. *Comparison of 2008 Recreational Perception to Lakes With the Same Water-Quality Classification, Neighboring Lakes, and Other CSLAP Lakes*

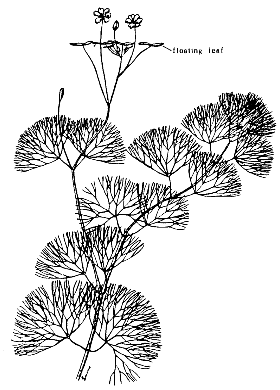
How does Lake Oscaleta compare to other lakes?

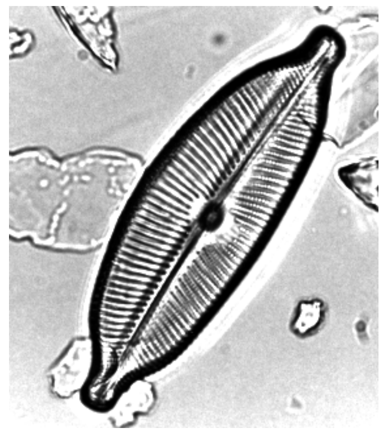
Annual Comparison of Median Readings for Eutrophication Parameters and Recreational Assessment For Lake Oscaleta in 2008 to Historical Data for Lake Oscaleta, Neighboring Lakes, Lakes with the Same Lake Classification, and Other CSLAP Lakes

The graphs to the left illustrate comparisons of each eutrophication parameter and recreational perception at Lake Oscaleta—in 2008, other lakes in the same drainage basin, lakes with the same water-quality classification (each classification is summarized in Appendix B), and all of CSLAP. Readers should note that differences in watershed types, activities, lake history and other factors may result in differing water-quality conditions at your lake relative to other nearby lakes. In addition, the limited database for some regions of the state precludes a comprehensive comparison to neighboring lakes.

Based on these graphs, the following conclusions can be made about Lake Oscaleta in 2008:

a) Using water clarity as an indicator, Lake Oscaleta is about as productive as other Class B lakes, other Lower Hudson River basin and other NYS lakes.
b) Using chlorophyll *a* concentrations as an indicator, Lake Oscaleta is usually more productive than other NYS lakes, about as productive as other Class B lakes, and less productive than other Lower Hudson River basin lakes, although in 2008 it was less productive than other Class B lakes.
c) Using total phosphorus concentrations as an indicator, Lake Oscaleta is usually more productive than other Class B, Lower Hudson River basin, and other NYS lakes, although in 2008 it was about as productive as other Class B and NYS lakes.
d) Using QC on the field-observations form as an indicator, Lake Oscaleta is usually as suitable for recreation as other NYS lakes and more suitable than other Class B and Lower Hudson River basin lakes. However, in 2008 it was about as suitable for recreation as other Lower Hudson River basin lakes.





VII. AQUATIC PLANTS

a. Macrophytes:

Aquatic plants should be recognized for their contributions to lake beauty as well as for providing food and shelter for other life in the lake. Emergent and floating plants such as water lilies floating on the lake surface may provide aesthetic appeal with their colorful flowers; sedges and cattails help to prevent shoreline erosion and may provide food and cover for birds. Submergent plants like pondweeds and leafy waterweed harbor insects, provide nurseries for amphibians and fish, and provide food for birds and other animals. Those who enjoy fishing at the lake appreciate a diverse plant population. Aquatic plants can be found throughout the *littoral zone*, the near-shore areas in which sufficient light reaches the lake bottom to promote photosynthesis. Plant growth in any particular part of the lake is a function of available light, nutrition and space, bottom substrate, wave action, and other factors, and extensive plant growth can occur in both “clean” and “polluted” lakes. A large portion of aquatic vegetation consists of the microscopic algae referred to as phytoplankton; the other portion consists of the larger rooted plants called macrophytes**.**

As invasive plants colonize and spread into a lake, native plant species can be threatened or even eliminated from aquatic plant communities. The most susceptible of these are those that reside in marginal regions, limited by water depth, sediment type, or inability to compete for space. As a result, many plants identified as *rare, threatened* or *endangered (RTE) species* are protected under New York State law. *The New York State Natural Heritage Program reports that angled spikerush (Eleocharis quadrangulata) is an RTE (endangered) species found in Lake Oscaleta in 1999. The plant was also reported by Cedar Eden in 2003.*

Of particular concern to many lakefront residents and recreational users are the *non-indigenous macrophytes* that can frequently dominate native aquatic plants and crowd out more beneficial plant species. The invasive plant species may be introduced to a lake by waterfowl, but in most cases they are introduced by fragments or seedlings that remain on watercraft from already-infested lakes. Once introduced, these species have tenacious survival skills, crowding out, dominating and eventually aggressively overtaking the indigenous (native) plant communities in a variety of water-quality conditions. When this occurs, they interfere with recreational activities such as fishing, swimming or water skiing. These species need to be properly identified to be effectively managed.

Non-native Invasive Macrophyte Species

For many years, four common non-native invasive species were considered the most important exotic aquatic plant species in New York lakes and ponds:

- **Eurasian watermilfoil** *(Myriophyllum spicatum)*
- **Curly-leaf pondweed** *(Potamogeton crispus)*
- **Eurasian water chestnut** *(Trapa natans)*
- **Fanwort** *(Cabomba caroliniana)*

If these plants are not present, efforts should be made to continue protecting the lake from the introduction of these species.

In addition, there are a number of other submergent or floating non-native invasive species that are becoming increasingly problematic in New York, particularly in Long Island and in lakes in other moderate climates:

- **Parrotfeather** (*Myriophyllum aquaticum*)
- **Variable watermilfoil** (*Myriophyllum heterophyllum*)
- **Brazilian elodea** *(Egeria densa)*
- **Hydrilla** (*Hydrilla verticillatum*)
- **European frogbit** *(Hydrocharis morsus-ranae*)
- **Brittle naiad** (*Najas minor*)

Hydrilla was found in New York State for the first time in at least five locations in 2008. This exotic plant has been identified as the most invasive aquatic plant in North America.

Whether the role of the lake manager is to better understand the lake ecosystem or better manage the aquatic plant community, knowledge of plant distribution is paramount to the management process. There are many procedures available for assessing and monitoring aquatic vegetation. The CSLAP Sampling Protocol contains procedures for a “semi-quantitative” plant-monitoring program. Volunteers collect plant specimens and provide field information and qualitative abundance estimates for an assessment of the macrophyte communities within critical areas of the lake. While these techniques are no substitute for professional plant surveys, they can help provide better information for lake managers. Lake associations planning to devote significant time and expenditures toward a plant-management program are advised to pursue more extensive plant surveying activities.

Formal and informal survey work has been effective in developing statewide distribution maps of each of the major submergent exotic species, and CSLAP data has figured prominently in this process. As of 2008, the statewide distribution maps of confirmed identifications are shown on Figures 44a to 44j.

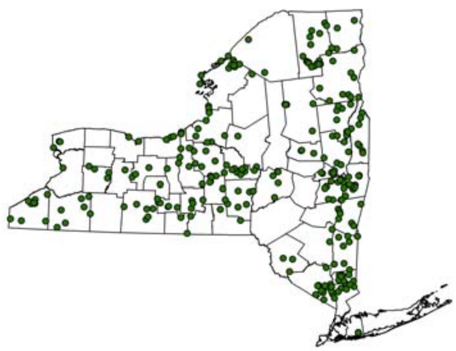


Figure 44a. Myriophyllum spicatum distribution in New York State

Figure 44b. Potamogeton crispus distribution in New York State

Figure 44c. Trapa natans distribution in New York State

Figure 44d. Cabomba caroliniana distribution in New York State

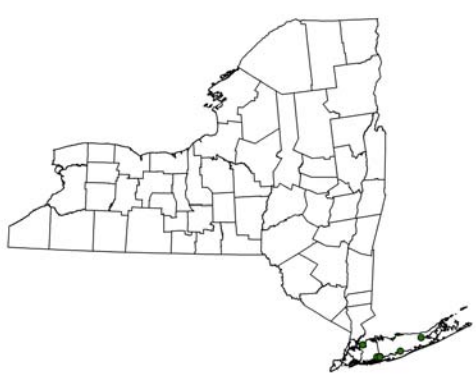


Figure 44e. Myriophyllum aquaticum distribution in New York State

Figure 44f. Myriophyllum heterophyllum distribution in New York State

Figure 44g. Egeria densa distribution in New York State

Figure 44h. Hydrilla verticillatum distribution in New York State

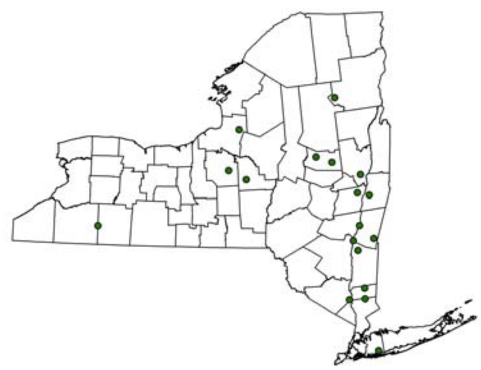


Figure 44i. Hydrocharis morsus-ranae distribution in New York State

Figure 44j. Najas minor distribution in New York State

Aquatic plant surveys conducted through CSLAP at Lake Oscaleta have identified the following plants"

Species	CommonName	Subm/Emer?	Exotic?	Date	Location	Abundance
Elodea canadensis	**common waterweed**	**submergent**	**no**	**6/25/2007**	**west end**	**Some dense beds near launch area**
Potamogeton crispus	**curly-leafed pondweed**	**submergent**	**yes**	**8/5/2007**	**west end**	

The 1987 ALSC study found the following aquatic plants:

SPECIES	COMMON NAME	SUBM/EMER?	EXOTIC?	DATE	LOCATION
Typha sp	cattail	emergent	no	1987	not reported
Potamogeton sp	pondweed	submergent	?	1987	not reported
Sagittaria sp	arrowhead	emergent	no	1987	not reported
Phragmites sp	reed	emergent	?	1987	not reported
Juncus sp	rush	emergent	no	1987	not reported
Iris sp	iris	emergent	no	1987	not reported
Nuphar sp	yellow waterlily	floating	no	1987	not reported
Nymphaea sp	white waterlily	floating	no	1987	not reported
Brasenia sp	watershield	floating	no	1987	not reported
Hypericum sp	St. Johns wort	submergent?	no	1987	not reported
Myriophyllum sp	milfoil	submergent	?	1987	not reported
Scirpus sp	bulrush	emergent	no	1987	not reported

These plants were not identified down to species level. The 2004 Diagnostic-Feasibility Study of the Lake (conducted by Cedar Eden Environmental, LLC of Saranac Lake, NY) reported that the plant community was dominated by bassweed (Potamogeton amplifolius) and Eurasian watermilfoil (Myriophyllum spicatum). The latter is considered an exotic plant, and may correspond to the milfoil reported in 1987.

b. Algae

Microscopic algae referred to as phytoplankton make up much of aquatic vegetation found in lakes. For this reason, and because phytoplankton are the primary producers of food (through photosynthesis) in lakes, they are the most important component of the complex food web that governs ecological interactions in lakes.

In a lake, phytoplankton communities are usually very diverse and are comprised of hundreds of species having different requirements for nutrients, temperature and light. In many lakes, including those of New York, diatom populations are greatest in the spring, due to a competitive advantage in cooler water and relatively high levels of silica. In most lakes, however, diatom densities rarely reach nuisance portions in the spring. By the summer, green algae take advantage of warmer temperatures and greater amounts of nutrients (particularly nitrogen) in the warm water and often increase in density. These alga often grow in higher densities than do diatoms or most other species, although they are often not the types of algae most frequently implicated in noxious algae blooms. Later in the summer and in the early fall, blue-green algae, which possess the ability to utilize atmospheric nitrogen to provide this required nutrient, increase in response to higher phosphorus concentrations. This often happens right before turnover or destratification in the fall. These alga are most often associated with taste and odor problems, bloom conditions, and the “spilled paint” slick that prompts the most complaints about algae. Each lake possesses a unique blend of algal communities, often varying in population size from year to year and with differing species proportional in the entire population. The most common types range from the mentioned diatoms, green, and blue-green algae, to golden-brown algae to dinoflagellates and many others, dominating each lake community.

So how can this be evaluated through CSLAP? CSLAP does assess algal biomass through the chlorophyll *a* measurement. While algal differentiation is important, many CSLAP lake associations are primarily interested in "how much?," not "what kind?," and this is assessed through the chlorophyll *a* measurement. Phytoplankton communities have not been regularly identified and monitored through CSLAP, in part due to the cost and difficulty in analyzing samples and in part due to the difficulty in using a one-time sample to assess long-term variability in lake conditions. A phytoplankton analysis may reflect a temporary, highly unstable and dynamic water-quality condition.

Prior to 1998, nearly all CSLAP lakes were sampled once for phytoplankton identification, but since then, phytoplankton sampling has not been a regular part of CSLAP. For these sampled lakes, a summary of the most abundant phytoplankton species is included below. Algal species frequently associated with taste and odor problems are specifically noted in this table, although it should be mentioned that these samples, like all other water samples collected through CSLAP, come from near the center of the lake, a location not usually near water intakes or swimming beaches. Since algal communities can also be spatially quite variable, even a preponderance of taste- and odor-causing species in the water samples might not necessarily translate to potable-water-intake or aesthetic impairments, although the threat of such an impairment might be duly noted in the "Considerations" section below.

Phytoplankton surveys have not been conducted through CSLAP at Lake Oscaleta. The Cedar Eden phytoplankton survey determined that the lake was dominated by blue- green algae in early to mid summer, by green algae in late summer, and golden brown algae in the fall, although the early season blue-green algal densities were highest. The corresponding zooplankton surveys found rotifers dominating the early and late summer surveys, with cladoceran dominated the lake in mid summer.

VIII: PRIORITY WATERBODY LISTS AND IMPACTS TO LAKE USE

The Priority Waterbody List (PWL) is presently an inventory of all waters in New York State (lakes, ponds, reservoirs, rivers, streams, and estuaries) known to have designated water uses with some degree of impairment, or those threatened by potential impairment. However, the PWL is slowly evolving into an inventory of all waterbodies for which sufficient information is available to assess the condition and/or usability of the waterbody. PWL waterbodies are identified through a broad network of county and state agencies, with significant public outreach and input, and the list is maintained and compiled by the NYSDEC Division of Water. Monitoring data from a variety of sources, including CSLAP, have been utilized by state agencies to evaluate lakes for inclusion on the PWL, and the process for incorporating lakes data has become more standardized.

Specific numeric criteria have recently been developed to characterize sampled lakes in the available use-based PWL categories (*precluded*, *impaired*, *stressed*, or *threatened*). Evaluations utilize the NYS phosphorus guidance value, water-quality standards, criteria utilized by other states, and the trophic ranges described earlier to supplement the other more antidotal inputs to the listing. The procedures by which waterbodies are evaluated are known as the Consolidated Assessment and Listing Methodology (CALM) process. This process is undertaken on an annual rotating basin, with waterbodies in several drainage basins evaluated each year. Each of the 17 drainage basins in the state is assessed within every 5 years. In general, waterbodies that violate pertinent water-quality standards (such as those listed in Table 6) at a frequency of greater than 25% are identified as *impaired*, at a frequency of 10-25% are identified as *stressed*, and at a frequency of 0-10% are identified as *threatened*, although some evidence of use impairment (including through CSLAP lake-perception surveys) might also be required. Mean (average) phosphorus levels are evaluated against the state guidance value. Evidence of use prohibitions (via beach closures, etc.) is often required to identify a waterbody as *precluded*, while evidence of actual use restrictions or necessary management must accompany an *impaired* listing, at least for lakes evaluated in recent years.

Lakes that have been identified as *precluded* or *impaired* on the PWL are likely candidates for the federal 303(d) list, an "Impaired Waters" designation mandated by the federal Clean Water Act. Lakes on this list must be closely evaluated for the causes and sources of these problems. Remedial measures must be undertaken, under a defined schedule, to solve these water-quality problems. This entire evaluation and remediation process is known as the "TMDL" process, which refers to the Total Maximum Daily Load calculations necessary to determine how much (pollution that causes the water-quality problems) is too much.

Lake Oscaleta is presently among the lakes cited on the final draft 2008 Lower Hudson River Basin PWL, with recreation listed as stressed due to excessive algae and weed growth due to excessive nutrients (phosphorus). The actual PWL listing for both Lake Oscaleta and Lake Rippowam was as follows:

"Water Quality Sampling
Lake Oscaleta and Lake Rippowam have been sampled as part of the NYSDEC Citizen Statewide Lake Assessment Program (CSLAP) beginning in 2006. An Interpretive Summary report of the findings of this sampling was published in 2007. These data indicate that the lake continues to be best characterized as eutrophic, or highly productive. Phosphorus levels in the lake regularly exceed the state guidance values indicating impacted/stressed recreational uses. However, corresponding transparency measurements rarely fail to meet what is the recommended minimum for swimming beaches. Measurements of pH typically fall within the state water quality range of 6.5 to 8.5; occasional high pH does not appear to result in ecological impacts. The lake water is moderately colored, likely reflecting natural conditions, but color does not limit water transparency. (DEC/DOW, BWAM/CSLAP, September 2007)

Recreational Assessment
Public perception of the lake and its uses is also evaluated as part of the CSLAP program. This assessment indicates recreational suitability of the lake to be generally favorable. The recreational suitability of Lake Rippowam is described most frequently as "excellent." The lake itself is most often described as "not quite crystal clear." Recreational suitability in Lake Oscaleta was described most frequently as "slightly" impacted with the lake typically described as having "definite algal greenness." Assessments have noted that aquatic plants and algal growth have occasional impact on uses. (DEC/DOW, BWAM/CSLAP, September 2007)

Lake Uses

This lake waterbody is designated class B, suitable for use as a public bathing beach, general recreation and aquatic life support, but not as a water supply. Water quality monitoring by NYSDEC focuses primarily on support of general recreation and aquatic life. Samples to evaluate the bacteriological condition and bathing use of the lake or to evaluate contamination from organic compounds, metals or other inorganic pollutants have not been collected as part of the CSLAP monitoring program. Monitoring to assess public bathing use is generally the responsibility of state and/or local health departments.

New York City Watershed

Lake Oscaleta and Lake Rippowam are tributary to the Croton System of New York City water supply reservoirs (see New Croton Reservoir, Segment 1302-0010). A Watershed Agreement is in place between NYCDEP and the Croton Watershed communities which sets forth programs and funding for watershed protection. In addition, NYCDEP has developed a phosphorus TMDL for the entire Croton System Watershed to aid in the management of nutrients. An Implementation Plan for this TMDL is being developed. (NYCDEP, July 2006)"

TABLE 6- Water-Quality Standards Associated With Class B and Higher Lakes

Parameter	Acceptable Level	To Protect…..
Secchi Disk Transparency	> 1.2 meters*	Swimming
Total Phosphorus	< 0.020 mg/L and Narrative*	Swimming
Chlorophyll a	none	NA
Nitrate Nitrogen	< 10 mg/L and Narrative*	Drinking Water
Ammonia Nitrogen	2 mg/L*	Drinking Water
True Color	Narrative*	Swimming
pH	< 8.5 and > 6.5*	Aquatic Life
Conductivity	None	NA

Narrative Standards and Notes:

Secchi Disk Transparency: The 1.2 meter (4 feet) guidance is applied for safety reasons (to see submerged swimmers or bottom debris) and strictly applies only to citing new swimming beaches, but may be appropriate for all waterbodies used for contact recreation (swimming).

Phosphorus and Nitrogen: "None in amounts that will result in the growths of algae, weeds and slimes that will impair the waters for their best usages" (Class B= swimming)

-The 0.020 mg/l threshold for TP corresponds to a guidance value, not a standard; it strictly applies to Class B and higher waters but may be appropriate for other waterbodies used for contact recreation (swimming). NYS (and other states) is in the process of identifying numerical nutrient (phosphorus and perhaps Secchi disk transparency, chlorophyll *a*, and nitrogen) standards, but this is unlikely to be finalized within the next several years.

-The 10 mg/L Nitrate standard strictly applies to only Class A or higher waters, but is included here because some Class B lakes are informally used for potable-water intake.

-For the form of ammonia (NH_3+NH_4) analyzed, a 2 mg/l human health standard applies to Class A or higher waters. Lower un-ionized ammonia standards apply to all classes of NYS lakes; this form is not analyzed through CSLAP.

Color: "None in amounts that will adversely affect the color or impair the waters for their best usages" (for Class B waters, this is swimming).

pH: The standard applies to all classes of waterbodies

1. Water-quality Standards Evaluation on Lake Oscaleta:

pH readings exceeded the NYS water-quality standards (=6.5 to 8.5) during 23% of the CSLAP sampling sessions, and never failed to reach these standards at any time. Phosphorus levels at Lake Oscaleta have exceeded the phosphorus guidance value for NYS lakes (=0.020 mg/l) during 48% of the CSLAP sampling sessions, and water transparency readings have failed to reach the minimum recommended water clarity for swimming beaches (= 1.2 meters) during 3% of the CSLAP sampling sessions. It is not known whether any of the narrative water-quality standards listed in Table 3 have been violated at Lake Oscaleta; none of the other numeric standards summarized in Table 3 have been violated.

2. Lake Uses:

Water-quality monitoring programs are devised to evaluate lake conditions as they relate to a variety of lake indicators, from water-quality standards to trophic conditions to invasive species to other measures of the physical, chemical, and biological integrity of these ecological systems. One of these indicators is intended to be lake uses—whether these lakes and ponds can be used for potable water, swimming and bathing, fishing and use of the water by aquatic life, and aesthetics. This is consistent with the broad goals of the 1972 federal Clean Water Act, the governing legislation for federal and state management of lakes and ponds, which states that a fundamental goal of environmental management was to make all waterbodies "fishable and swimmable" by 1983.

The "fishability" of a lake or pond is a function of water-quality (are there pollutants that will kill the fish or render them inedible?); substrate and habitat (is there enough cold water and high oxygen for coldwater fish?; is there enough food for the fish? is there enough cover from predators or structure for fishermen?); space (is there enough flowing water for survival or reproduction?; is there enough room to support all of the various fish species in the lake?), and even access (can anglers get to the areas where the fish can be found?).

Likewise, the "swimmability" of a lake or pond also depends on water-quality (will I get sick due to bacterial contamination from sewage, stormwater or waterfowl?); safety (can swimmers or bottom debris be seen in deeper water?); aesthetics (is the water too green, too weedy, or too cold?; is the bottom too mucky?); user conflicts (can I swim where people use PWCs?); the physical characteristics of the lake and shoreline (how quickly does the lake get too deep? is the shoreline flat enough for a beach?); legal considerations (will the threat of litigation prevent a lake community from establishing public beaches?), and also access (can swimmers from less hospitable parts of the lake or from the outside swim at a beach?).

Although other designated lake uses are not identified as primary goals of the Clean Water Act, they should be evaluated as part of the lake-assessment process. These include potable water, non-contact recreational uses such as boating, aquatic life support unrelated to fishing, and aesthetics. Similar questions could be posed about the suitability of a particular lake or pond for this use, although many of the concerns addressed in evaluating the fishability or swimmability of a waterbody are pertinent to evaluating drinking-water quality, the ability of a lake to support power boating or sailing, or the adequacy of the lake bottom for salamanders, frogs, and other valued biota.

CSLAP is not really designated to answer many of these questions, at least directly. Some of these issues relate to the physical characteristics of the entire shoreline and bottom of the lake or pond and cannot be easily evaluated in simple water-quality surveys. Other important water-quality indicators, such as bacteria, cannot be sampled at the frequency needed to compare lake conditions to existing water-quality standards or are limited by logistic considerations. Other indicators, such as sediment toxins, are too expensive to be included in standard water-quality monitoring programs. It is anticipated that future generations of CSLAP will look to better address some of these questions through expanded monitoring and partnerships with other monitoring agencies, academic institutions, lake residents, and other parties invested in the lake-assessment and management process. It is also anticipated that data from other sources will be more completely included in the lake- and pond-assessment process in the future. Until that time, however, it should again be stated that these assessments are both preliminary and incomplete, based on data presently collectable through the monitoring programs summarized in this report.

Lake Oscaleta is a Class B lake, which means it is designated for support of contact recreation (swimming and bathing), aquatic life (including fishing), non-contact recreation (such as boating) and aesthetics. It is not designated for potable water intake (drinking), although some residents may use the lake for that purpose. As such, Lake Oscaleta should be evaluated for its best intended uses—support of swimming, aquatic life, non-contact recreation, and aesthetics.

a. Potable Water

Lake Oscaleta is not classified for potable water use, and it is not likely that the lake is used for that purpose.

b. Swimming/Contact Recreation

It is presumed that Lake Oscaleta is used for swimming, bathing, or other forms of contact recreation, although the frequency of and opportunities for swimming are not evaluated through CSLAP. As noted above, it is classified for bathing and swimming.

A number of water-quality indicators are measured in CSLAP that relate to the suitability of lake for swimming and contact recreation. Water clarity measurements can be used to evaluate the lake against the NYS Department of Health guidelines for siting new swimming beaches (= 4 feet). Public-perception data collected through CSLAP assess swimming conditions, and regional or statewide criteria connecting water transparency readings (or nutrient and algae levels) to recreational-use impacts will likely be developed in the near future. However, there remains a relatively strong correlation between contact recreational conditions and phosphorus readings, with recreational-use impacts generally corresponding to the state guidance value for phosphorus (= 20 parts per billion total phosphorus). Algae levels are measured as chlorophyll *a*, while rooted aquatic-plant populations are broadly quantified through CSLAP, and are linked to potential impacts on swimming and aesthetics. These water-quality-based and perception-based evaluations of swimming conditions are outlined below.

1. Water-quality Evaluation of Swimming/Contact Recreation

These data showed that 48% of the Lake Oscaleta samples possessed total phosphorus readings exceeding 20 parts per billion (=µg/l), which corresponds to the state phosphorus guidance value. Water transparency readings were less than 2 meters during 10% of the CSLAP sampling sessions. This roughly corresponds to the distinction between *eutrophic* and *mesotrophic* lakes and a water clarity reading that would roughly be equivalent to the state phosphorus guidance value. Perhaps more importantly, this may correspond to the saddle point between high-quality and reduced-quality swimming, based on lake perception data (see below).

Although there is no state water-quality standard for chlorophyll *a*, readings exceeding 8 µg/l generally correspond to water clarity readings lower than 2 meters and total phosphorus readings in excess of 20 µg/l- each of these indicator thresholds marks the distinction between *mesotrophic* and *eutrophic* lake. 48% of the Lake Oscaleta samples corresponded to chlorophyll *a* readings > 8 µg/l.

Bacteria data have not been collected through CSLAP on Lake Oscaleta or (if collected by the lake association or local community) have not been forwarded to the NYSDEC for evaluation.

2. Lake Perception Evaluation

Lake perception data from CSLAP provide insights into recreational (swimming) conditions, perceptions of water clarity, and the density and coverage of aquatic plants. Recreational assessments indicating “beautiful, could not be nicer” and “..excellent for swimming, boating, and overall enjoyment” conditions suggest no limits to recreational use. The frequency of “slightly” to “substantially” impaired conditions may be closely related to the need to implement lake-management actions. These surveys also assess the extent to which these impacts are influenced by excessive weed growth, nuisance algae or poor water clarity.

The evaluation of these survey results, and the extrapolation of these results to a lake-wide assessment, are restricted by the small sample size and the potential for responses that are not representative of the responses from the typical lake resident, whether due to the impact of local conditions or different goals for different lake users. However, these assessments may serve as an instructive starting point for evaluating impacts on lake uses.

The CSLAP volunteers reported that Lake Oscaleta was described as “slightly impaired” during 45% of the CSLAP sampling sessions, and “substantially impaired” 3% of the time. Slightly impaired conditions were associated with “poor water clarity” during 10% of the CSLAP sampling sessions, and with “excessive algae growth” 39% of the time. Excessive algae growth was implicated in “substantially impaired” conditions during 3% of the CSLAP sampling sessions; excessive weed growth was never associated with substantial use impairments.

3. Overall Evaluation- Swimming and Contact Recreation

The CSLAP dataset at Lake Oscaleta, including water chemistry data, physical measurements, and volunteer samplers' perception data, suggests that swimming and contact recreation may be stressed by excessive weeds, excessive algae and poor water clarity.

c. Aquatic Life/Non-Contact Recreation

Lake Oscaleta supports fishing and other forms of non-contact recreation. Other forms of non-contact recreation, such as boating, may be a function of access points, whether the lake shoreline is inhabited, and water depth, but it is also presumed that Lake Oscaleta may be used for boating.

While water-quality plays a role in evaluating non-contact recreation, particularly cold-water fisheries, the information needed to properly evaluate fishing quality, angler success, and boating enjoyment and viability are not collected in most routine monitoring programs. It is anticipated that future generations of the CSLAP report will include more comprehensive evaluations of non-contact recreational conditions in lakes and ponds, as databases containing this information become more readily available, but until that time, only ancillary measures can be evaluated.

The primary indicators from these monitoring programs used to evaluate fisheries, aquatic life, and non-contact recreation (boating, etc.) include lake perception surveys, aquatic plant densities (and the presence of invasive exotic plants), and water-quality indicators related to fish habitat and survival, such as pH and ammonia. While other water-quality indicators, such as other forms of nitrogen, can also be used to evaluate water-quality impacts to aquatic life, these indicators are generally found at low enough levels to minimize their utility in evaluating lake conditions. Dissolved oxygen can be very useful in evaluating habitat, but temperature and oxygen profiles are not collected through CSLAP. These datasets can provide at least some insights into the ability of lakes and ponds to support these uses.

1. Fisheries and Aquatic Life Evaluation

pH data are collected through CSLAP. Fish consumption advisories are issued by the NYS Department of Health, and fishing regulations are instituted by the NYSDEC. Lake recreational perception data related to non-contact recreation (fishing and boating) and aesthetics are also collected through CSLAP, and these can be used to evaluate fisheries and aquatic life impacts to Lake Oscaleta.

These data indicate that no pH readings in the Lake Oscaleta samples failed to reach the state water-quality standards (= 6.5 to 8.5), and 23% of the samples exceeded these standards. While laboratory pH is not as accurate as field pH for evaluating lake acidity, these data suggest that fisheries or aquatic life impacts may occur as a result of elevated pH, although any ecological impacts are not likely to be observable (or measurable) through CSLAP.

It is not known if fishing regulations result in any impact to the use of Lake Oscaleta for fishing. Some of the fish species in the lake may be susceptible to low dissolved oxygen/low temperature conditions, *and the thermal profile data collected by the lake association show that anoxic (no oxygen conditions) occur during the summer*.

2. Boating (Recreation) and Aesthetics Evaluation

Impacts to non-contact recreation, such as boating and aesthetics, can only be peripherally evaluated through CSLAP. Sampling volunteers can report that the lake "looks bad," as a direct measure of impacts to lake aesthetics, while "poor water clarity," "excessive algae growth," and "excessive weed growth" may be indirect measures of these impacts.

The CSLAP volunteers reported that Lake Oscaleta "looks bad" during 7% of the sampling sessions. Surface weed growth was reported during 52% of the CSLAP sessions, while "dense" weed growth was reported 7% of the time.

3. Overall Evaluation- Aquatic Life and Non-Contact Recreation

The CSLAP dataset on Lake Oscaleta, including water chemistry data, physical measurements, and volunteer samplers' perception data, suggest that recreation may be threatened by excessive weeds. Aquatic life may be threatened by anoxic conditions and elevated pH. Aesthetics may be fully supported.

IX: CONSIDERATIONS FOR LAKE MANAGEMENT

CSLAP is intended for a variety of uses, such as collecting needed information for comprehensive lake management, although it is not capable of collecting all the needed information. To this end, this section includes a broad summary of the major lake problems and "considerations" for lake management. These include only those lake problems that may have been defined by CSLAP sampling, such as physical condition (algae and water clarity), aquatic plant coverage (type and extent of weed populations), and recreational suitability of the lake, as related to contact recreation. These broad categories may not encompass the most pressing issue at a particular time at any given CSLAP lake, for example, local concerns about filamentous algae or concerns about other parameters not analyzed in the CSLAP sampling. While there is some opportunity for CLSAP-trained volunteers to report and assess some site-specific conditions or concerns on the CSLAP Field Observations Form, such as algae blooms or shoreline vegetation, this section is limited to the confines of this program. The categories represent the most common, broadest issues within the lake management as reported through CSLAP.

Each summarized management strategy is more extensively outlined in *Diet for a Small Lake*, and this joint NYSDEC-NYSFLA publication should be consulted for more details and for a broader context of in-lake- or watershed- management techniques. These "considerations" should not be construed as "recommendations," because there is insufficient information available through CSLAP to assess whether or how a lake should be managed. Issues associated with local environmental sensitivity, permits, and broad community-management objectives also cannot be addressed here. Rather, the following section should be considered as “tips” or a compilation of suggestions for a lake association to manage problems defined by CSLAP water-quality data or articulated by perception data. When appropriate, lake-specific management information, and other lake-specific or local “data” (such as the presence of a controllable outlet structure) is reported in ***bold*** in this “considerations” section.

The primary focus of CSLAP monitoring is to evaluate lake condition and impacts associated with lake eutrophication. Because lake eutrophication is often manifested in excessive plant growth, whether algae or aquatic macrophytes (weeds), it is likely that lake-management activities, whether promulgated to reduce algae or weed growth or to maintain water clarity and the existing makeup and density of aquatic plants in the lake, will need to address watershed inputs of nutrients and sediment to the lake, because both can contribute to either algal blooms or excessive weed growth. A core group of nutrient and sediment control activities will likely serve as the foundation for most comprehensive lake-management plans and activities and can be summarized below.

a. GENERAL CONSIDERATIONS FOR ALL CSLAP LAKES

Nutrient controls can take several forms, depending on the original source of the nutrients:

- Septic systems can be regularly pumped or upgraded to reduce the stress on the leach fields which can be replaced with new soil or moving the discharge from the septic tank to a new field). Pumpout programs are usually quite inexpensive, particularly when lakefront residents negotiate a bulk rate discount with local pumping companies. Upgrading systems can be expensive, but may be necessary to handle the increased loading from camp expansion or conversion to year-round residency. Replacing leach fields alone can be expensive and limited by local soil or slope conditions, but may be the only way to reduce actual nutrient loading from septic systems to the lake. It should be noted that upgrading or replacing the leach field may do little to change any bacterial loading to the lake, since bacteria are controlled primarily within the septic tank, not the leach field.
- Stormwater runoff control plans include street cleaning, artificial marshes, sedimentation basins, runoff conveyance systems, and other strategies aimed at minimizing or intercepting pollutant discharge from impervious surfaces. The NYSDEC has developed a guide called <u>Reducing the Impacts of Stormwater Runoff</u> to provide more detailed information about developing a stormwater management plan. This is a strategy that cannot generally be tackled by an individual homeowner, but rather requires the effort and cooperation of lake residents and municipal officials.
- There are numerous agriculture management practices such as fertilizer controls, soil erosion practices, and control of animal wastes, which either reduce nutrient export or retain particles lost from agricultural fields. These practices are frequently employed in cooperation with county Soil and Water Conservation District offices, and are described in greater detail in the NYSDEC’s <u>Controlling Agricultural Nonpoint Source Water Pollution in New York State.</u> Like stormwater controls, these require the cooperation of many watershed partners, including farmers.

- Streambank erosion can be caused by increased flow due to poorly managed urban areas, agricultural fields, construction sites, and deforested areas, or it may simply come from repetitive flow over disturbed streambanks. Control strategies may involve streambank stabilization, detention basins, revegetation, and water diversion.

Land use restrictions development and zoning tools such as floodplain management, master planning to allow for development clusters in more tolerant areas in the watershed and protection of more sensitive areas, deed or contracts which limit access to the lake, and cutting restrictions can be used to reduce pollutant loading to lakes. This approach varies greatly from one community to the next and frequently involves balancing lake-use protection with land-use restrictions. State law gives great latitude to local government in developing land-use plans.

Lawn fertilizers frequently contain phosphorus, even though nitrogen is more likely to be the limiting nutrient for grasses and other terrestrial plants. By using lawn fertilizers with little or no phosphorus, eliminating lawn fertilizers or using lake water as a “fertilizer” on shoreline properties, fewer nutrients may enter the lake. Retaining the original flora as much as possible, or planting a buffer strip (trees, bushes, shrubs) along the shoreline, can reduce the nutrient load leaving a residential lawn.

Waterfowl introduce nutrients, plant fragments, and bacteria to the lake water through their feces. Feeding the waterfowl encourages congregation which in turn concentrates and increases this nutrient source and will increase the likelihood that plant fragments, particularly from Eurasian watermilfoil and other plants that easily fragment and reproduce through small fragments, can be introduced to a previously uncolonized lake.

Although not really a “watershed control strategy”, establishing **no-wake zones** can reduce shoreline erosion and local turbidity. Wave action, which can disturb flocculent bottom sediments and unconsolidated shoreline terrain is ultimately reduced, minimizing the spread of fertile soils to susceptible portions of the lake.

Do not discard or introduce plants from one water source to another or deliberately introduce a "new" species from a catalogue or vendor. For example, do not empty bilge or bait bucket water from another lake upon arrival at another lake, for this may contain traces of exotic plants or animals. Do not empty aquaria wastewater or plants in the lake.

Boat propellers are a major mode of transport to uncolonized lakes. Propellers, hitches, and trailers frequently get entangled by weeds and weed fragments. Boats not cleaned of fragments after leaving a colonized lake may introduce plant fragments to another location. New introductions of plants are often found near public access sites.

b. SPECIFIC CONSIDERATIONS FOR LAKE OSCALETA

Management Focus: **Water Clarity/Algae/Physical Condition/Recreational Condition**

Issue	Through	By?
Maintain water clarity	Maintaining or reducing algae levels	Maintaining or reducing nutrient Inputs to the lake

Discussion:
User perception and water quality data indicate that water clarity readings are sufficient to support most uses of the lake. This places the focus of water clarity management on maintaining present conditions. Although some increase in nutrient loading is inevitable, the lake association should devote efforts to minimize the input of nutrients to the lake, or change activities that otherwise influence water clarity.

Management Focus: **The Impact of Weeds on Recreational Condition**

Issue	Effect on Lake Use
Low weed growth	**No use impairments associated with weed growth**

Discussion:
Weed growth in this lake is not dense enough to have a significant impact on recreational or aesthetic quality of the lake**.** For many lake associations this is the ideal situation, even though an ideal condition for swimmers, boaters and lakefront residents may not be ideal for a significant sports fishery. For lakes in this condition, lake management is largely a task of maintaining course, of keeping siltation from the watershed at a very low level, and of keeping nuisance plants under control or out of the lake. The DEC publication, <u>Common Nuisance Aquatic Plants in New York State,</u> contains information about nuisance plants

Preventative measures should address:

- *Boat propellers* frequently get entangled by weeds and weed fragments. Propellers not cleaned after leaving an “infected” lake or before entering an “uncontaminated” lake may introduce plant fragments to the lake. This is a particular problem for many nuisance plants that propagate through fragmentation.
- *Waterfowl* may introduce to plant fragments to lakes, particularly nuisance weeds like *Eurasian watermilfoil* that easily fragment. Encouraging the congregation of waterfowl by feeding will increase the likelihood that these fragments can be introduced to a previously uncolonized lake.
- *Weed watcher* (“...look out for this plant..”) signs have been successful in reducing the spread of nuisance aquatic plants. They are usually placed near high traffic areas, such as boat launch sites, marinas, and inlets and outlets.

c. SPECIFIC MONITORING CONSIDERATIONS FOR LAKE OSCALETA

Discussion:
Lake Oscaleta was first sampled through CSLAP in 2006. More extensive data will help to continue evaluating “normal” conditions on the lake, and to identify water quality or use

problems at the lake. However, some additional parameters may be appropriate for evaluation at the lake:

1. *Bacteria*- Lake Oscaleta is classified for use for contact recreation (swimming), and it is likely that at least some swimming occurs. The use of the lake for swimming and bathing can best be evaluated with bacteriological data. A comparison of sampling results to the state water quality standards requires at least five samples per month. These data cannot be collected through CSLAP.
2. *Algal toxins*- Algal toxins, usually associated with blue-green algae, may affect swimmers and others who ingest small amounts of water (as well as any lake residents who utilize Lake Oscaleta as a potable water supply). These may be analyzed in standard water samples as part of CSLAP in coming years.
3. *Aquatic plants*- Aquatic plant surveys have been conducted through CSLAP at Lake Oscaleta. CSLAP samplers can collect and submit for identification any plant samples thought to be exotic or otherwise invasive, as well as any rare or unusual plants. Sampling protocols are also available to conduct systematic monitoring of aquatic plants for the purpose of evaluating aquatic plant management actions utilized at the lake.
4. *Temperature and oxygen profiles*- the suitability of the lake for supporting sensitive fish, the susceptibility of the lake to nutrient release from bottom sediments and fall algal blooms, and the environment for aquatic plant growth can be evaluated through temperature and oxygen profiles. These can be created through the use of electronic meters or through chemical titrations conducted on site. *Depth profiles have been collected by the lake association in recent years.*

Appendix A. Raw Data for Lake Oscaleta

LNum	LName	Date	Zbot	Zsd	Zsamp	Tot.P	NO3	NH4	TDN	TN/TP	TColor	pH	Cond25	Ca	Chl.a
205	L Oscaleta	6/12/2006	10.6	2.26	1.5	0.024	0.03	0.04			17	7.78	135	15.6	10.46
205	L Oscaleta	6/25/2006	10.7	2.25	1.5	0.034	0.02	0.02			12	7.62	128		0.16
205	L Oscaleta	7/9/2006	10.5	2.35	1.5	0.016	0.01	0.06	0.48	29.63	15	8.89	121		4.97
205	L Oscaleta	7/22/2006	11.0	2.50	1.5	0.030	0.01	0.01	0.50	16.68	21	8.70	133		8.11
205	L Oscaleta	8/5/2006	10.8	1.70	1.5	0.055	0.02	0.03	0.57	10.32	35	9.11	131	11.7	24.62
205	L Oscaleta	8/19/2006	10.6	0.50	1.5	0.031	0.01	0.01			24	9.36	124		53.64
205	L Oscaleta	9/9/2006	10.7	3.10	1.5	0.036	0.02	0.12	0.80	22.02	18	7.68	138		5.17
205	L Oscaleta	10/7/2006	10.8	2.35	1.5	0.024	0.01	0.05	0.48	19.99	15	7.39	151		10.07
205	L Oscaleta	7/7/2007	10.8	4.05	1.5	0.012	0.01	0.03	0.37	70.8	17	7.54	150	11.9	3.68
205	L Oscaleta	7/22/2007	10.8	2.93	1.5	0.018	0.01	0.01	0.42	51.1	15	8.56	108		7.55
205	L Oscaleta	8/5/2007	10.8	3.60	1.5	0.019	0.01	0.01	0.60	70.3	16	8.15	131		2.90
205	L Oscaleta	8/19/2007	10.8	3.40	1.5	0.017	0.00	0.01	0.66	85.9	8	7.98	131		7.37
205	L Oscaleta	9/2/2007	10.8	3.88	1.5	0.030	0.00	0.01	0.61	44.6	17	7.14	112	11.9	4.48
205	L Oscaleta	9/16/2007	10.7	3.05	1.5	0.017	0.01	0.01	0.48	60.8	12	7.65	137		11.11
205	L Oscaleta	9/30/2007	10.9	3.30	1.5	0.015	0.04	0.02	0.68	103.4	14	8.00	121		10.85
205	L Oscaleta	10/21/2007	10.7	3.30	1.5	0.025	0.01	0.02	0.76	67.7	12	7.45	124		13.35
205	L Oscaleta	5/10/2008	10.9	2.85	1.5	0.021	0.01	0.02			9	8.30	129		5.25
205	L Oscaleta	5/24/2008	10.8	3.20	1.5	0.019	0.02	0.04	0.38	44.39	15	8.91	156		3.76
205	L Oscaleta	6/8/2008	10.7	3.35	1.5	0.017		0.02	0.34	42.38	18	8.17	172		7.53
205	L Oscaleta	6/22/2008	11.5	1.85	1.5	0.016	0.00	0.01	0.49	69.15		8.75	95	12.7	4.47
205	L Oscaleta	7/6/2008	10.7	2.45	1.5	0.013	0.03	0.03	0.22	37.31	16	8.22	142		6.15
205	L Oscaleta	7/20/2008	10.3	2.80	1.5	0.016	0.01	0.01	0.32	44.46	12	7.72	104		3.51
205	L Oscaleta	8/3/2008	10.4	3.05	1.5	0.011	0.00	0.01	0.49	97.30	13	7.51	132		3.76
205	L Oscaleta	8/17/2008	10.7	3.73	1.5	0.024	0.00	0.01	0.23	21.33	9	7.81	122	12.5	4.17
205	L Oscaleta	9/1/2008	10.6	3.75	1.5	0.017	0.00	0.01	0.33	43.60	23	8.27	150		3.46
205	L Oscaleta	9/14/2008	10.9	2.73	1.5	0.014	0.01	0.01	0.34	53.59	16	7.43	142		8.75
205	L Oscaleta	9/28/2008	10.8	2.60	1.5	0.022	0.01	0.03	0.35	36.03	15	7.79	134		16.05
205	L Oscaleta	10/11/2008	10.8	2.63	1.5	0.018	0.01	0.01	0.41	51.92		7.20	152		12.28
205	L Oscaleta	10/25/2008	10.8	2.00	1.5	0.022	0.01	0.06	0.39	39.86		7.10	149		15.80
205	L Oscaleta	11/9/2008	10.8	2.35	1.5	0.032	0.02	0.09				7.10	157		26.14
205	L Oscaleta	11/29/2008	10.6	2.50	1.5	0.031	0.04	0.09	0.50	35.98		7.10			48.04
205	L Oscaleta	6/12/2006	10.6												
205	L Oscaleta	6/25/2006	10.7		9.2	0.038									
205	L Oscaleta	7/9/2006	10.5		9.0	0.044									
205	L Oscaleta	7/22/2006	11.0		9.5	0.046									
205	L Oscaleta	8/5/2006	10.8		9.0	0.051									
205	L Oscaleta	8/19/2006	10.6		9.0	0.082									
205	L Oscaleta	9/9/2006	10.7		9.0	0.077									
205	L Oscaleta	10/7/2006	10.8		9.5	0.061									
205	L Oscaleta	7/7/2007	10.8		9.0	0.057									
205	L Oscaleta	7/22/2007	10.8		9.0	0.017									
205	L Oscaleta	8/5/2007	10.8		9.0	0.067									
205	L Oscaleta	8/19/2007	10.8		9.0	0.013									
205	L Oscaleta	9/2/2007	10.8		9.0	0.089									
205	L Oscaleta	9/16/2007	10.7		9.0	0.073									
205	L Oscaleta	9/30/2007	10.9		9.0	0.075									
205	L Oscaleta	10/21/2007	10.7		9.0	0.090									
205	L Oscaleta	5/10/2008			9.0	0.028									
205	L Oscaleta	5/24/2008			9.0	0.033									
205	L Oscaleta	6/8/2008			9.0	0.017									
205	L Oscaleta	6/22/2008			11.0	0.058									
205	L Oscaleta	7/6/2008			9.2	0.063									
205	L Oscaleta	7/20/2008			9.3	0.079									
205	L Oscaleta	8/3/2008			9.0	0.088									
205	L Oscaleta	8/17/2008			9.0	0.096									
205	L Oscaleta	9/1/2008			9.0	0.081									
205	L Oscaleta	9/14/2008			9.0	0.066									
205	L Oscaleta	9/28/2008			9.0	0.049									
205	L Oscaleta	10/11/2008				0.062									
205	L Oscaleta	10/25/2008				0.062									
205	L Oscaleta	11/9/2008				0.039									
205	L Oscaleta	11/29/2008			9.0	0.027									

LNum	LName	Date	TAir	TH2O	QA	QB	QC	QD
205	L Oscaleta	6/12/2006	23	20	3	2	2	0
205	L Oscaleta	6/25/2006	23	24	2	2	3	2
205	L Oscaleta	7/9/2006	27	25	2	2	2	12
205	L Oscaleta	7/22/2006	25	27	2	2	2	125
205	L Oscaleta	8/5/2006	31	31	4	2	3	1234
205	L Oscaleta	8/19/2006	32	27	4	3	4	134
205	L Oscaleta	9/9/2006	29	23	2	3	2	12
205	L Oscaleta	10/7/2006	15	17	2	2	2	25
205	L Oscaleta	7/7/2007	28	25	2	2	2	2
205	L Oscaleta	7/22/2007	26	25	2	2	2	2
205	L Oscaleta	8/5/2007	25	28	2	2	2	2
205	L Oscaleta	8/19/2007	24	25	1	3	2	2
205	L Oscaleta	9/2/2007	25	24	2	4	3	2
205	L Oscaleta	9/16/2007	20	22	2	3	3	2
205	L Oscaleta	9/30/2007	20	21	2	3	3	2
205	L Oscaleta	10/21/2007	21	18	3	3	2	2
205	L Oscaleta	5/10/2008	19	16				
205	L Oscaleta	5/24/2008	20	16	2	2	2	5
205	L Oscaleta	6/8/2008	32	23	3	2	2	8
205	L Oscaleta	6/22/2008	28	25	2	4	3	2
205	L Oscaleta	7/6/2008	29	26	3	2	3	2
205	L Oscaleta	7/20/2008	30	29	2	3	2	2
205	L Oscaleta	8/3/2008	26	27	2	3	3	2
205	L Oscaleta	8/17/2008	26	25	2	3	3	2
205	L Oscaleta	9/1/2008	24	24	2	3	3	2
205	L Oscaleta	9/14/2008	27	23	3	3	3	23
205	L Oscaleta	9/28/2008	25	20	2	3	3	2
205	L Oscaleta	10/11/2008	20	17	3	3	2	2
205	L Oscaleta	10/25/2008	17	13				
205	L Oscaleta	11/9/2008	15	12	2	2	2	1
205	L Oscaleta	11/29/2008	8	6	2	2	2	8
205	L Oscaleta	6/12/2006						
205	L Oscaleta	6/25/2006						
205	L Oscaleta	7/9/2006						
205	L Oscaleta	7/22/2006		8				
205	L Oscaleta	8/5/2006		8				
205	L Oscaleta	8/19/2006		8				
205	L Oscaleta	9/9/2006		8				
205	L Oscaleta	10/7/2006		9				
205	L Oscaleta	7/7/2007		8				
205	L Oscaleta	7/22/2007		8				
205	L Oscaleta	8/5/2007		8				
205	L Oscaleta	8/19/2007		9				
205	L Oscaleta	9/2/2007		8				
205	L Oscaleta	9/16/2007		9				
205	L Oscaleta	9/30/2007		9				
205	L Oscaleta	10/21/2007		9				
205	L Oscaleta	5/10/2008		7				
205	L Oscaleta	5/24/2008		7				
205	L Oscaleta	6/8/2008		7				
205	L Oscaleta	6/22/2008		7				
205	L Oscaleta	7/6/2008		8				
205	L Oscaleta	7/20/2008		8				
205	L Oscaleta	8/3/2008		8				
205	L Oscaleta	8/17/2008		8				
205	L Oscaleta	9/1/2008		8				
205	L Oscaleta	9/14/2008		9				
205	L Oscaleta	9/28/2008		9				
205	L Oscaleta	10/11/2008		9				
205	L Oscaleta	10/25/2008		10				
205	L Oscaleta	11/9/2008		10				
205	L Oscaleta	11/29/2008		6				

Appendix B. New York State Water-Quality Classifications

Class N: Enjoyment of water in its natural condition and where compatible, as a source of water for drinking or culinary purposes, bathing, fishing and fish propagation, recreation and any other usages except for the discharge of sewage, industrial wastes or other wastes or any sewage or waste effluent not having filtration resulting from at least 200 feet of lateral travel through unconsolidated earth. These waters should contain no deleterious substances, hydrocarbons or substances that would contribute to eutrophication, nor shall they receive surface runoff containing any such substance.

Class $AA_{special}$: Source of water supply for drinking, culinary or food-processing purposes; primary and secondary contact recreation, and fishing. These waters shall be suitable for fish propagation and survival and shall contain no floating solids, settleable solids, oils, sludge deposits, toxic wastes, deleterious substances, colored or other wastes or heated liquids attributable to sewage, industrial wastes or other wastes. There shall be no discharge or disposal of sewage, industrial wastes or other wastes into these waters. These waters shall contain no phosphorus and nitrogen in amounts that will result in growths of algae, weeds and slimes that will impair the waters for their best usages.

Class $A_{special}$: Source of water supply for drinking, culinary or food-processing purposes; primary and secondary contact recreation; and fishing. These waters shall be suitable for fish propagation and survival. These international boundary waters, if subjected to approved treatment equal to coagulation, sedimentation, filtration and disinfection, with additional treatment if necessary to remove naturally present impurities, will meet New York State Department of Health drinking water standards and will be considered safe and satisfactory for drinking water purposes.

Class AA: Source of water supply for drinking, culinary or food processing purposes; primary and secondary contact recreation, and fishing. These waters shall be suitable for fish propagation and survival. These waters, if subjected to approved disinfection treatment, with additional treatment if necessary to remove naturally present impurities, will meet New York State Department of Health drinking-water standards and will be considered safe and satisfactory for drinking-water purposes.

Class A: Source of water supply for drinking, culinary or food-processing purposes; primary and secondary contact recreation, and fishing. These waters shall be suitable for fish propagation and survival. These waters, if subjected to approved treatment equal to coagulation, sedimentation, filtration and disinfection, with additional treatment if necessary to remove naturally present impurities, will meet New York State Department of Health drinking-water standards and will be considered safe and satisfactory for drinking-water purposes

Class B — Suitable for primary and secondary contact recreation and fishing. These waters shall be suitable for fish propagation and survival.

Class C: — Suitable for fishing and fish propagation and survival. The water quality shall be suitable for primary and secondary contact recreation, although other factors may limit the use for these purposes.

Class D: — Suitable for fishing. Due to such natural conditions as intermittency of flow, water conditions not conducive to propagation of game fishery, or stream bed conditions, the waters will not support fish propagation. These waters shall be suitable for fish survival. The water-quality shall be suitable for primary and secondary contact recreation, although other factors may limit the use for these purposes.

Class (T): — Designated for trout survival, defined by the Environmental Conservation Law Article 11 (NYS, 1984b) as brook trout, brown trout, red throat trout, rainbow trout, and splake.

APPENDIX C:
SUMMARY OF STATISTICAL METHODS USED TO EVALUATE TRENDS

1. Non-Parametric Analyses

Kendall tau ranking orders paired observations by one of the variables (arranging water clarity readings by date). Starting with the left-hand (earliest date) pair, the number of times that the variable not ordered (clarity readings) is exceeded by the same variable in subsequent pairs is computed as P, and the number of times in which the unordered variable is not exceeded is computed as Q. This computation is completed for each ordered pair, with N= total number of pairs (samples), and the sum of the differences S = Σ(P-Q). The Kendall tau rank correlation coefficient **t** is computed as:

$$t = 2S/(N*(N-1))$$

Values for t range from –1 (complete negative correlation) to +1 (complete positive correlation). As above, strong correlations (or simply "significance") may be associated with values for t greater than 0.5 (or less than –0.5), and moderate correlations may be associated with values for t between 0.3 and 0.5 (or between –0.3 and –0.5), but the "significance" of this correlation must be further computed. Standard charts for computing the probabilities for testing the significance of S are provided in most statistics text books, and for values of N greater than 10, a standard normal deviate D can be computed by calculating the quotient:

$$D= S\sqrt{18} /\sqrt{[(N(N-1)(2N+5)]}$$

and attributing the following significance:

$D > 3.29$ = 0.05% significance
$2.58 < D < 3.29$ = 0.5% significance
$1.96 < D < 2.58$ = 2.5% significance
$D < 1.96$ = > 2.5% significance

For the purpose of this exercise, 2.5% significance or less is necessary to assign validity (or, using the vernacular above, "significance") to the trend determined by the Kendall tau correlation. It should be noted again that this evaluation does not determine the magnitude of the trend but only whether a trend is likely to occur.

Parametric trends can be defined by standard best-fit linear regression lines, with the significance of these data customarily defined by the magnitude of the best-fit regression coefficient ® or R^2. This can be conducted using raw or individual data points, or seasonal summaries (using some indicator of central tendency, such as mean or median). Because the former can be adversely influenced by seasonal variability and/or imprecision in the length and breadth of the sampling season during any given year, seasonal summaries may provide more realistic measures for long-term trend analyses. However, because the summaries may not adequately reflect variability within any given sampling season, it may be appropriate to compare deviations from seasonal means or medians with the "modeled" change in the mean/median resulting from the regression analyses.

When similar parametric and non-parametric tools are utilized to evaluate long-term trends in NYS lakes, a few assumptions must be adopted:

- Using the non-parametric tools, trend "significance" (defined as no more than approx. 3% "likelihood" that a trend is calculated when none exists) can only be achieved with at least four years of averaged water-quality data. When looking at all summer data points (as opposed to data averaging), a minimum of 40 data points is required to achieve some confidence in data significance. This corresponds to at least five years of CSLAP data. The "lesson" in these assumptions is that data trends assigned to data sets collected over fewer than five years assume only marginal significance.

As noted above, summer data only are utilized (as in the previous analyses) to minimize seasonal effects and different sampling schedules around the fringes (primarily May and September) of the sampling season. This reduces the number of data points used to compile averages or whole data sets but is considered necessary to best evaluate the CSLAP datasets.

2. Parametric Analyses

Parametric analyses are conducted by comparing annual changes in summer mean values for each of the analyzed sampling parameters. Summer is defined as the period from June 15 thru September 15, and roughly corresponds to the window between the end of spring runoff (after ice out) and start of thermal stratification, and the onset of thermal destratification. This period also corresponds to the peak summer recreational season and (for most lakes) the most critical period for water-quality impacts. It also bounds the most frequent range of sampling dates for the majority of both the primarily seasonal volunteers and full-time residents of CSLAP lakes.

Trends in the parametric analyses are determined by the least squares method, in which "significance" requires both a high correlation coefficient ($R^2>0.5$) and intra-seasonal variance to be lower than the predicted change (trend) during the period of sampling (roughly corresponding to Δy). Changes in water-quality indicators are also evaluated by the two-sided t-test, in which the change (z statistic) in the mean summer value for each of the indicators by decade of sampling (1980s, 1990s, 2000s) is compared to the t statistic distribution within the 95% confidence interval, with the null hypothesis corresponding to no significant change.

APPENDIX D: BACKGROUND INFO FOR LAKE OSCALETA

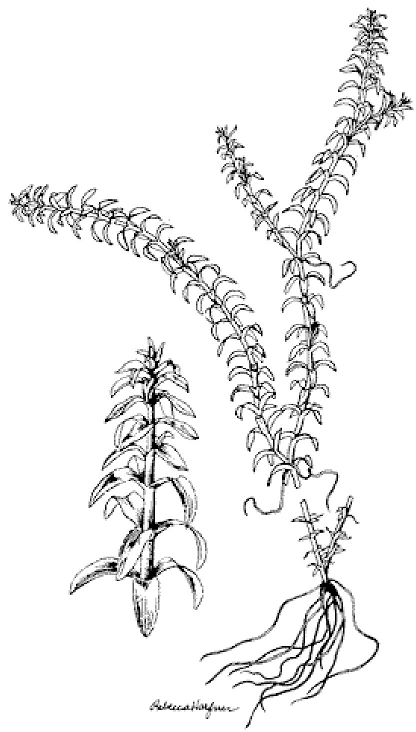
CSLAP Number	205
Lake Name	L Oscaleta
First CSLAP Year	2006
Sampled in 2007?	yes
Latitude	411750
Longitude	733410
Elevation (m)	144
Area (ha)	23.3
Volume Code	13
Volume Code Name	Lower Hudson River
Pond Number	118
Qualifier	none
Water Quality Classification	B
County	Westchester
Town	South Salem
Watershed Area (ha)	4486000
Retention Time (years)	0.71
Mean Depth (m)	6.8
Runoff (m/yr)	0.56
Watershed Number	13
Watershed Name	Lower Hudson River
NOAA Section	5
Closest NOAA Station	Yorktown Heights
Closest USGS Gaging Station-Number	1374821
Closest USGS Gaging Station-Name	Titicus River at Purdys Station
CSLAP Lakes in Watershed	Beaver Dam L, Blue Heron L, Burden L, Copake L, Cranberry L, Duane L, Forest L-R, Gossamans P, Highland L, Hillside L, Indian L-P, Katonah L, Kinderhook L, L Carmel, L Celeste, L Kitchawan, L Lincolndale, L Lucille, L Mahopac, L Meahagh, L Mohegan, L Myosotis, L Nimham, L Oscaleta, L Oscawana, L Ossi, L Peekskill, L Rippowam, L Taghanic, L Tibet, L Truesdale, L Waccabuc, Long P, Monhagen L, Nassau L, Orange L, Peach L, Plum Brook L, Queechy L, Robinson P, Round P, Sagamore L, Sepasco L, Shadow L, Shaver P, Shawangunk L, Shenorock L, Snyders L, Spring L, Stissing L, Teatown L, Thompsons L, Timber L, Tomkins L, Ulster Heights L, Wallace P, Whaley L

APPENDIX E: AQUATIC PLANTS FOUND THROUGH CSLAP IN LAKE OSCALETA

SPECIES NAME: *Elodea canadensis*

COMMON NAME: common waterweed

ECOLOGICAL VALUE: Like all submergents, *Elodea* harbors aquatic insects, provides hiding, nurseries and spawning areas for amphibians and fish, and provides some food for waterfowl, including ducks and beaver. *E. canadensis* provides wildfowl food of variable importance. This plant may suppress other plants under certain circumstances



DISTRIBUTION: common in hardwater, alkaline lakes from Quebec west to Saskatchewan and Washington, south to North Carolina, Alabama, Iowa, Texas, New Mexico, Arizona, and California.

DISTRIBUTION IN NEW YORK: very common and often abundant in alkaline water throughout the State except perhaps Long Island; especially along the Hudson River and Adirondacks with some occurrences in the Finger Lakes and Great Lakes regions.

DEGREE OF NUISANCE: it may be frequent and common, but only occasionally is *Elodea* present at nuisance levels. Not surprisingly, the most abundant growth is found in shallow lakes, and the plant can form a dense canopy along the lake bottom only, since it does not often grow to the lake surface.

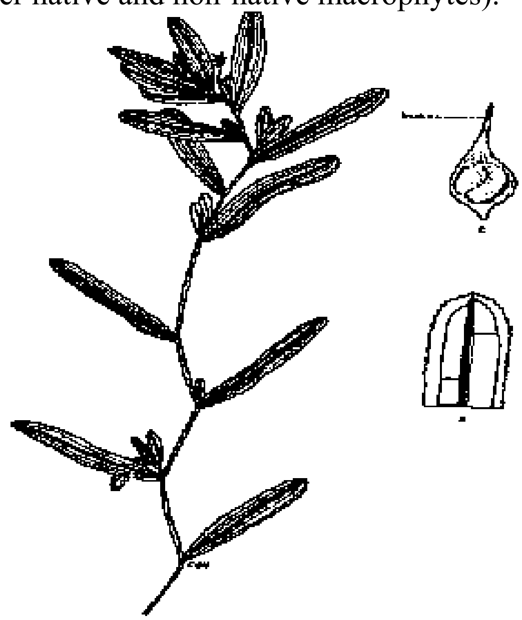
COMMENTS: *Elodea* is entirely submersed, often forming large masses near the lake bottom, typically in 3-12 feet of water. The stem pattern is similar to that of the *Potamogeton*, *Ruppia*, *Zanichellia*, *Najas*, *Callitriche*, and *Utricularia*. It is a member of the frogbit family (*Hydrocharitaceae*), along with *Vallisneria* and other genera. There are three species of this genus found in New York, one of which (*Elodea* or *Egeria densa*) is a common aquarium or laboratory plant that has been introduced and still persists in parts of Long Island. The genus was once known as *Anacharis* and *Philotria*. It produces tiny white flowers above the surface, but generally reproduces vegetatively. This species is distinguished from the slightly less common *Elodea nuttallii* by its wider leaves and long, thread-like tube that reaches the surface. Although it is quite common in New York, this plant is on the rare and endangered species list in at least one New England state.

Line drawing- Crowe, G.E. and C.B. Hellquist. Aquatic and wetlands plants of northeastern North America. 2000

SPECIES NAME: *Potamogeton crispus*

COMMON NAME: curlyleaf pondweed

ECOLOGICAL VALUE: While this is not a native plant to New York state, it has become well established in many lakes and does not disrupt the aquatic ecosystem as do other (recently-introduced) exotics, although it still can out-compete native species and dominate a macrophyte community, particularly in late spring and early summer (before the peak growing season for other native and non-native macrophytes).



DISTRIBUTION IN UNITED STATES: In hard or brackish, often polluted waters, naturalized from Europe and common in New England, western Massachusetts, with a range extending from Quebec west to Minnesota, south to Alabama and Texas, and scattered throughout the western states

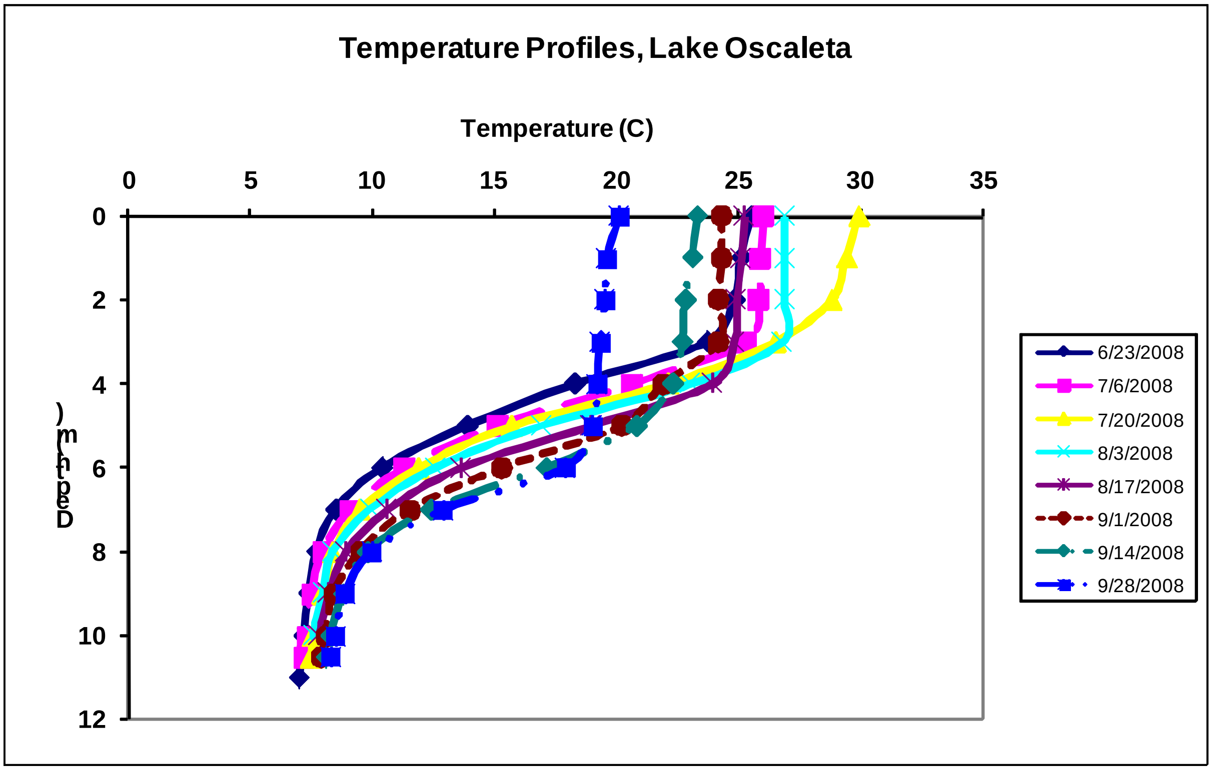
DISTRIBUTION IN NEW YORK: widespread and often abundant along the Hudson River and Finger Lakes basins, with some occurrences in far western New York

DEGREE OF NUISANCE: *Potamogeton crispus* may establish easily and grow abundantly, reaching nuisance levels, although the extent of coverage and nuisance conditions is limited by the growing season (winter through early-mid summer)

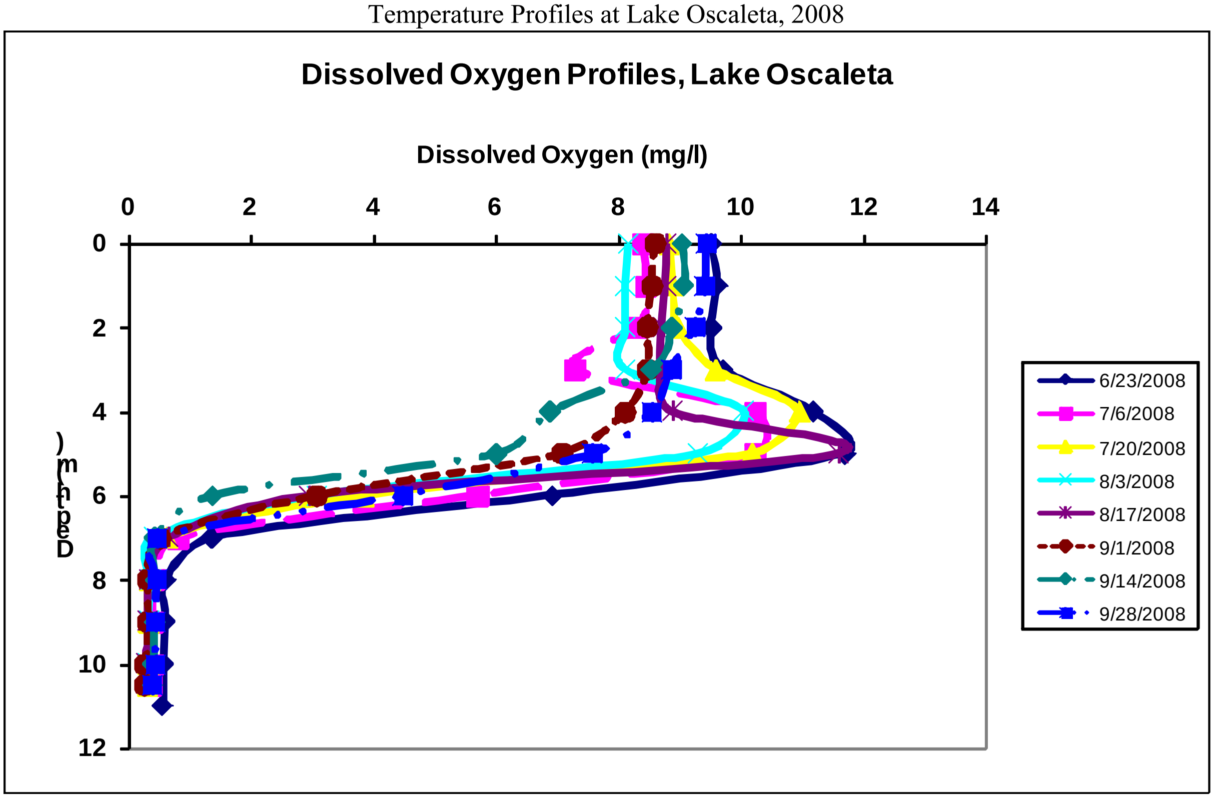
COMMENTS: *Potamogeton* is a highly variable genus within the pondweed family. Species within the genus often are characterized by two leaf types-firm floating leaves and thin emersed leaves. Many mature species have flowers borne in spikes (for wind pollination), conspicuous in early summer. Identification of the individual species can be extremely difficult, particularly among the narrow-leaved pondweeds. The *Potamogeton* are distinguished from the other genus within the pondweed family by having alternate leaves (unlike the *Zanichellia* and *Najas*), and by their presence in fresh or estuarine waters (unlike the *Zostera*). There are nearly 30 species found within New York State, some quite rare and others extremely common. *P. crispus* is one of the four major non-native exotic plant species in New York state, and has served as the impetus for several lake restoration and plant management programs. However, it naturally dies out in many lakes by early to mid summer, often to be replaced by other monocultures. It is characterized by finely-toothed leaf margins and a ‘lasagna’-like leaf appearance.

Line drawing- Crowe, G.E. and C.B. Hellquist. Aquatic and wetlands plants of northeastern North America. 2000

APPENDIX F: TEMPERATURE / DISSOLVED OXYGEN PROFILES



Temperature Profiles at Lake Oscaleta, 2008



Dissolved Oxygen Profiles at Lake Oscaleta, 2008