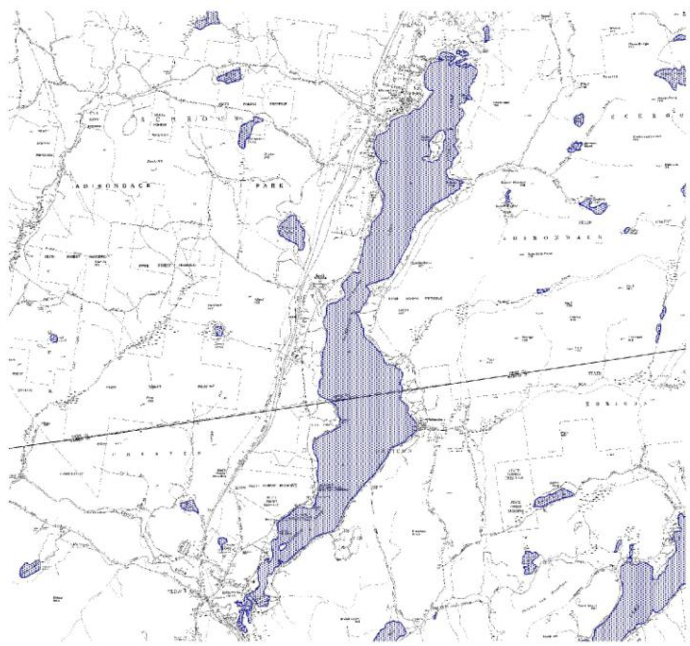
New York State Department of Environmental Conservation

Division of Water

New York
Citizens Statewide Lake Assessment Program
(CSLAP)

2008 Annual Report-Schroon Lake

October, 2009



New York State Department of Environmental Conservation

2008 INTERPRETIVE SUMMARY

NEW YORK
CITIZENS STATEWIDE
LAKE ASSESSMENT PROGRAM
(CSLAP)

SCHROON LAKE

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NYS Department of Environmental Conservation
NY Federation of Lake Associations

October, 2009

Table of Contents

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 **Schroon Lake**.

Schroon Lake is a 4125 acre, class AA lake found in the Town of Schroon in Essex County and the town of Horicon in Essex County, in southeastern Adirondack region of New York State. It was first sampled as part of CSLAP in 1987. The following volunteers have participated in CSLAP, and deserve most of the credit for the success of this program at **Schroon Lake**: **Bob Schmidt, Jacki and Donald Mackintosh, Mike, Annie, N. and Rudolf Kraus, Cookie and Carm Barker, Brian Cuza, Steve Aiken, Zac Subra, Jim Hamilton, Kevin Lavarnway, Paul Hale, Rich Barry, Georgie Mcutcheon, Taylor Gath, Ethan and Jeremy Tyrell, Sherri McCray, Lianna Karp, Amanda Forbes, Wesley Beers, Anthony Vanderwalker, Elliott Hibbard, Rebecca Armstrong, Anne Pieper, Chuck and Nancy Harste, Vince Blando, Helen Wildman, Linda Milson, Chrys Matterson, Thad and Jane Smith, Rory Baxter, Charley Jelinck, Bill and Joanne McGhie, and Steve Fahey.**

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.

SCHROON LAKE
FINDINGS AND EXECUTIVE SUMMARY

Schroon Lake 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 Schroon Lake prior to 2008.

The majority of the short- and long-term analyses of the water quality conditions in Schroon Lake are summarized in Table 2, divided into assessments of eutrophication indicators, other water quality indicators, and lake perception indicators. These data indicate that the lake continues to be best classified as *mesoligotrophic*, or moderately unproductive. Schroon Lake was about as productive in 2008 as in most previous CSLAP sampling seasons, whether evaluated in the north or south basin. Chlorophyll *a* readings in both sites were lower than normal (continuing a recent pattern), but phosphorus readings were close to normal, despite a slight increase in these readings in recent years. It is likely that the small changes in these trophic indicators represent normal variability. CSLAP data suggest that water clarity is probably closely influenced by both algae and nutrients (based on the similar trophic classification generated from each of the trophic indicators). The nitrogen to phosphorus ratios indicate that algae levels in Schroon Lake are controlled by phosphorus. Lake productivity does not change much over the course of a typical sampling season, due in part to low deepwater nutrient levels. Phosphorus levels in the lake are consistently below the state phosphorus guidance value, and clarity readings consistently exceed the minimum transparency for swimming beaches. Data from the two sampling sites were comparable, although algae levels are slightly lower in the south basin site.

The lake is weakly to moderately colored (low levels of dissolved organic matter), and the higher color in the last six years corresponded to lower water clarity. It is likely that this was due to the wetter weather and change in laboratories. Schroon Lake has soft water, circumneutral to slightly alkaline (just above neutral) pH readings, and low nitrate, ammonia and total nitrogen readings. Conductivity readings have decreased over the last six years, although it is not believed that this has resulted in water quality or ecological impacts. pH readings continue to fall within the NYS water quality standards (=6.5 to 8.5). Nitrate and ammonia levels do not appear to warrant a threat to the lake, whether in surface or bottom waters, despite slightly higher deepwater nitrate readings. Calcium levels are below the threshold to support zebra mussels throughout the lake.

The recreational suitability of Schroon Lake has been mostly favorable, moreso when weather conditions are favorable. Recreational conditions in the lake have most often been described as “excellent” for most uses, and the lake was also regularly described as “crystal clear” to “not quite crystal clear”, slightly more favorable than expected given the measured water clarity. Aquatic plant coverage was slightly greater in 2008, but surface growth continues to be uncommon in the areas evaluated, and “excessive weeds” and have not been implicated in recreational use impacts. Recreational assessments improve slightly during the summer, coincident with improving weather. These assessments are mostly comparable, though variable, at the north and south basin sampling sites.

The 2006 NYSDEC Priority Waterbody Listings (PWL) for the Upper Hudson River drainage basin indicated that *fish consumption* is *impaired* in Schroon Lake due to PCBs and mercury. The CSLAP datasets cannot evaluate fish consumption, but suggest that no additional listings appear to be warranted. The next PWL review for the Upper Hudson River drainage basin will likely occur in 2011.

General Comments and Questions:

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

Water quality conditions in Schroon Lake appear to be more than adequate to support most recreational uses of the lake during the summer, at least most years. Water clarity and nutrient and algae levels are typical of moderately unproductive lakes, with essentially no algal blooms. Recreational assessments of the lake are usually favorable when weather is favorable, although occasionally elevated weed densities and water color may affect recreational assessments of the lake in both basins.

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

The nutrient (phosphorus and nitrogen) levels near the bottom of Schroon Lake are similar to those at the lake surface at both sites, contributing to the lack of seasonal change in surface nutrient levels. This also suggests that deepwater oxygen levels are not significantly depleted; the Biological Survey data from the 1930s indicate very high oxygen levels even in the deepest portions of the lake.

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

The productivity of Schroon Lake (clarity, nutrient and algae levels) does not change in any predictable way during the summer, leading to recreational assessments that are also seasonally stable and favorable. This is coincident with deepwater phosphorus readings that are similar to those at the lake surface. The lowest clarity occurs in August, coincident with peak algae levels and water temperature.

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

Chlorophyll *a* readings have been consistently lower in the last few years at both sampling sites, but phosphorus readings have been slightly higher over this period, suggesting that both trophic indicators are exhibiting normal variability. Nitrate readings have decreased and water color has increased in recent years, although neither change is significant. The former might be due to slightly less acidic rain, and the latter may reflect wetter weather or the change in laboratories in 2002.

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

Schroon Lake continues to be less productive (re: higher clarity, lower nutrient and algae levels) than other nearby (Upper Hudson River basin) lakes, other lakes classified for potable water use (Class AA(T)), and other NYS lakes. Recreational assessments are usually more favorable than these other lakes, also due to favorable water quality and the lack of excessive weed growth in most places.

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

The introduction of exotic organisms, such as Eurasian watermilfoil and zebra mussels, should be minimized by close and aggressive surveillance of boats and launch areas (formal and informal). Nutrient loading to the lake through active management of septic systems, stormwater runoff, lawn fertilization, eroding stream banks, and other sources of nutrients, will help to keep the condition of the lake as favorable as possible. At this point, it does not appear that either basin will require significantly different management efforts, given the similarity in water quality in the two basins, and most efforts can be dedicated to reducing nutrient inputs rather than addressing existing water quality problems.

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.

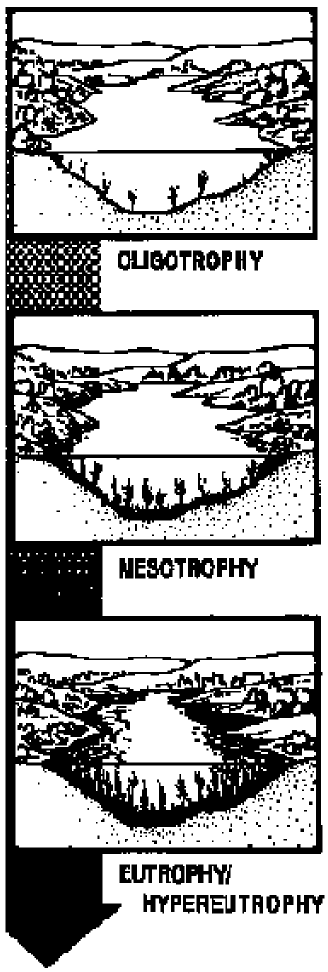


Figure 1- Eutrophication and Lake Succession

Understanding Trophic States

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 CSLAP Sampling Protocol 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 Schroon Lake

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	Schroon Lake (North/South)
Phosphorus (mg/l)	> 0.020	0.010 - 0.020	< 0.010	**0.007 / 0.008**
Chlorophyll a (µg/l)	> 8	2- 8	< 2	**3.5 / 1.8**
Secchi Disk Clarity (m)	< 2	2- 5	> 5	**4.2 / 3.9**

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 and chlorophyll *a* trophic standards listed above, the lake would be considered *mesotrophic*, or moderately productive. By the total phosphorus standards above, and based on chlorophyll *a* readings in the south basin, the lake would be considered *oligotrophic*, or unproductive. The most appropriate trophic classification for the lake is probably *mesoligotrophic*, or moderately unproductive. This has been the appropriate assessment for most of the twelve CSLAP sampling seasons at the lake. However, the total phosphorus readings in the lake in 2005 and 2006, and chlorophyll *a* readings in the south basin in 2003, 20005, and 2006 were typical of *mesotrophic* lakes. Chlorophyll *a* readings in the north basin in 2008 were typical of *oligotrophic* lakes. The trophic condition of Schroon Lake 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.

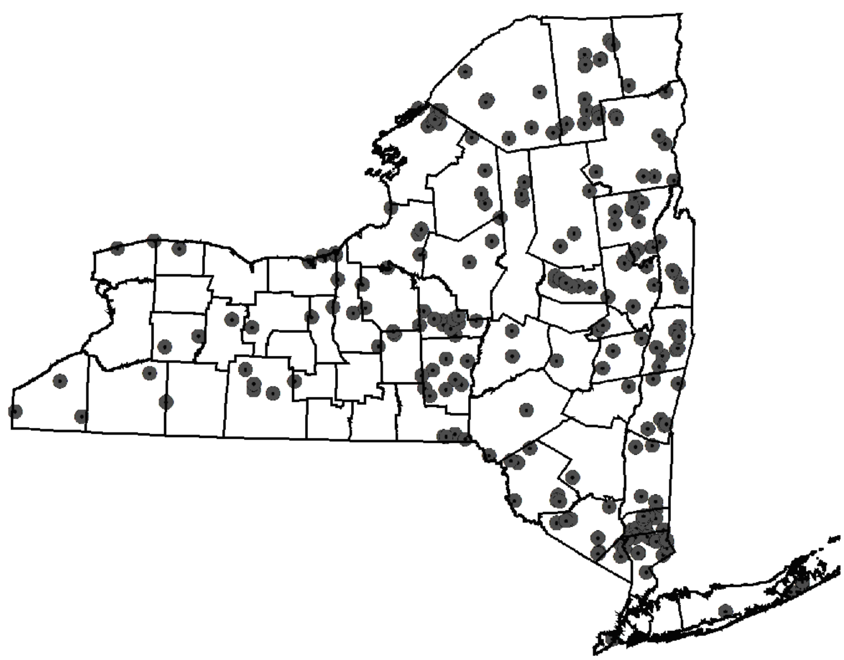
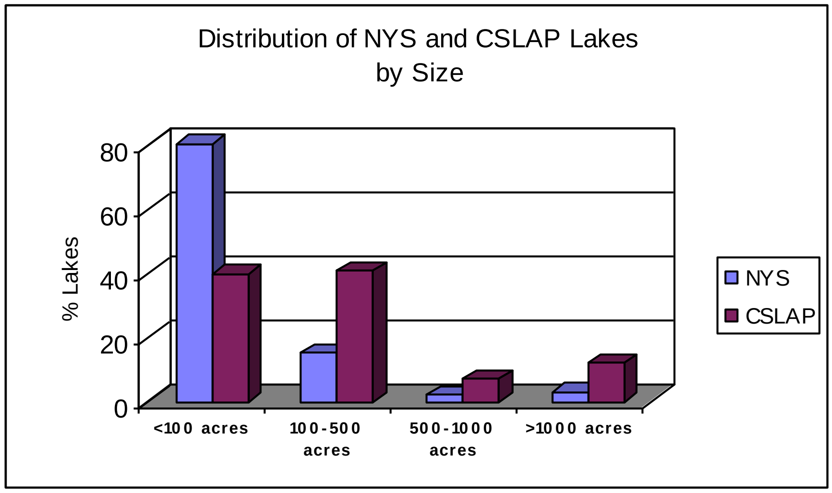


Figure 4: CSLAP Sampling Sites, 1986-2008

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.



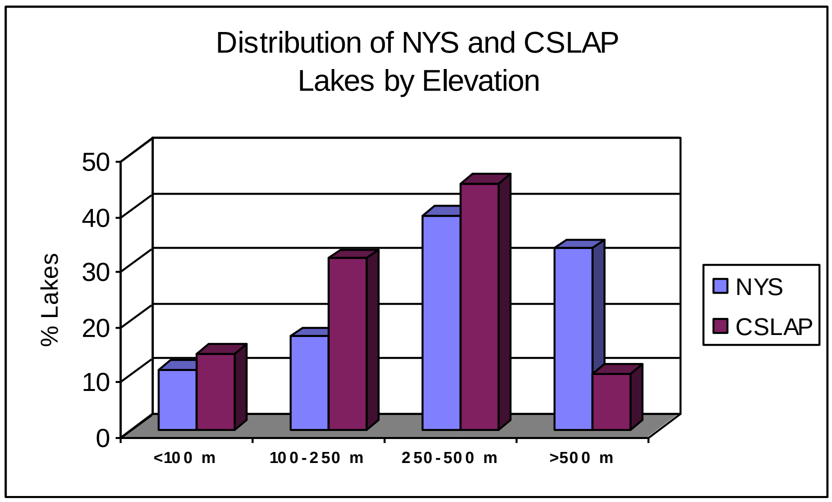
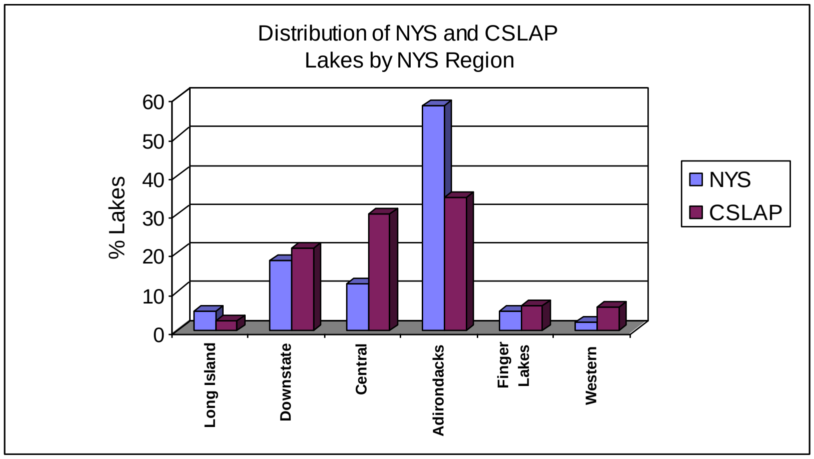


Figure 5a- Comparison of CSLAP and New York State Lakes by Size and Elevation

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.



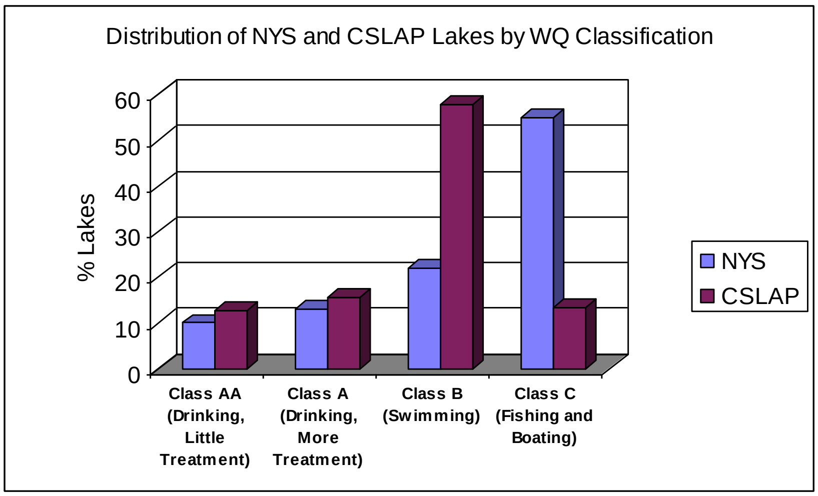


Figure 5b- Comparison of CSLAP and New York State Lakes by New York State Region and Water Quality Classification

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: SCHROON LAKE- BACKGROUND INFORMATION

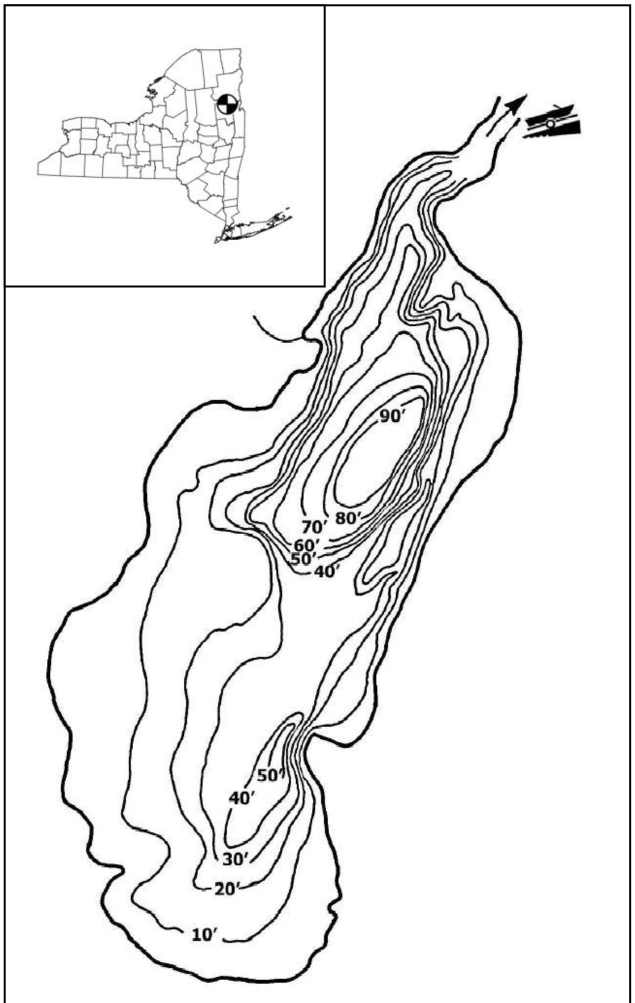


Figure 6- Location of Schroon Lake

Schroon Lake is a 4125 acre, class AA lake found in the Town of Schroon in Essex County and the town of Horicon in Essex County, in southeastern Adirondack region of New York State. It was first sampled as part of CSLAP in 1987. Figure 6 shows the location of Schroon Lake. It is one of 9 CSLAP lakes among the >270 lakes found in Essex County, one of 12 CSLAP lakes among the 120 lakes in Warren County, and one of 24 CSLAP lakes among the >470 lakes and ponds in the Upper Hudson River drainage basin. Schroon Lake is a Class AA lake; this means that the best intended use for the lake is for potable water—drinking water—and contact recreation—swimming and bathing—although the lake also supports non-contact recreation—boating and angling, aquatic life and aesthetics. These "categories" will be used to evaluate water-quality conditions later in the report.

CSLAP samples have been collected from the deepest part of the lake, corresponding to a depth of about 45 meters (145 feet). Most lakes with a maximum depth of > 20 feet are thermally stratified, and the sampling data indicate that Schroon Lake is stratified. As such, surface and deepwater samples have been collected at the lake.

Historical Water-Quality Information for Schroon Lake

Schroon Lake has been sampled through a number of major monitoring programs. It was sampled in 1992 as part of the US Environmental Protection Agency's Environmental Monitoring and Assessment Program (EMAP), a short-term nationwide monitoring program in which samples lakes are randomly chosen. The lake was also sampled in 1991 as part of the USEPA Temporal Integrated Monitoring (TIME) program used to evaluate lake acidity and other water quality issues. Schroon Lake was also sampled through several NYSDEC monitoring programs prior to CSLAP, including the Lake Classification and Inventory (LCI) survey and its predecessor ambient lake monitoring program in 1982, 1973 and 1972. The lake has also been regularly sampled by NYSDEC Fisheries staff, recently in 1983, 1984, 1989, and 1998, and originally by the Conservation Department (the predecessor to the NYSDEC) as part of the Biological Survey of the Black River basin in 1931. The lake was also sampled extensively by Adirondack Ecologists (AE) through consulting work conducted by Steve LaMere. The data from these programs is summarized in Table 2.

The data from the USEPA and NYSDEC monitoring programs from the early 1970s through the early 1990s indicated that water quality conditions were similar to that measured through CSLAP starting in the late 1980s. There was depressed pH in the 1982 LCI surface sample, but it is likely that this was not representative of the lake.

The 1932 Biological Survey was intended in part to evaluate water quality conditions as they relate to fisheries management, so much of the information collected cannot be easily compared to the CSLAP dataset. The summary information for the lake included the following:

"*Within the area bounded by its shores are a variety of depths and bottom conditions which meet the life requirements of several species of fishes. A large part of the lakes is over 50 feet deep and in most places the bottom slopes rapidly away from the shores which are made for the most part of sand, gravel, or rubble. The oxygen and temperature relationships are especially good, the oxygen value of 8.1 parts per million which obtains on the bottom in 130 feet of water surpassing all other records secured in the deep part of lakes in the watershed. In spite of these excellent conditions in the deeper portions of the lake there are few records of lake trout for this season.*

The principal weed beds are located at the head and foot of the lake and extend into the river at the foot. Few weeds grow along the greater part of the shoreline because of the hard bottom and the action of winds which have an unobstructed sweep of the length of the lake.

(Schroon Lake) has a rather irregular shoreline which provides several large bays, some of which support considerable weed areas. The most extensive weed areas were found in the narrow bay at the south end and in the mouth of the Schroon River. Another weed area was found at the north end west of the Schroon River"

The water quality data showed much higher water transparency than in any of the monitoring programs conducted 40-60 years later. Dissolved oxygen levels were very high even at the lake bottom in 130 feet of water.

None of the major tributaries to the lake (Mill Brook, Sucker Brook, Spectacle Brook, Rogers Brook, and the Schroon River) have been sampled through the state Rotating Intensive Basins (RIBS) stream monitoring program. However, Mill Brook at Adirondack and the Schroon River at Schroon Falls were sample as part of the state stream biomonitoring program in 2001. The summary of those sampling results is as follows, as appearing in the 30 Year Trends in Water Quality of Rivers and Streams in New York State (1972-2002):

"(Mill Brook) This small tributary of Schroon Lake was sampled at Adirondack in 2001, and was assessed as non-impacted. Two metrics were within the range of slight impact, and the headwater correction factor was applied to these. The stream habitat of boulders was not conducive to a diverse fauna.

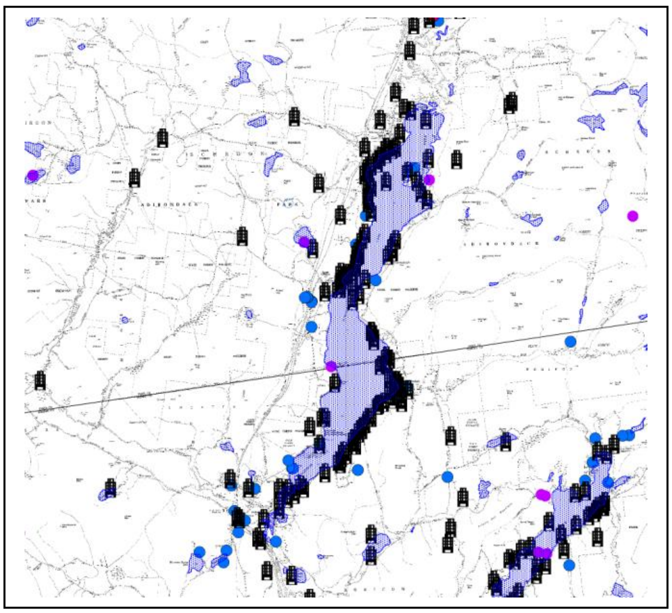
(Schroon River) The upstream site at Schroon Falls was assessed as slightly impacted in 2001. Although the fauna contained many clean-water mayflies, stoneflies, and caddisflies, species richness was low, possibly due to the substrate of boulders embedded in sand. A similarly reduced fauna was found at the downstream Warrensburg site. Previous sampling assessed the Schroon Falls site as non-impacted in 1994. The Warrensburg site was assessed as non-impacted in 1994, slightly impacted in 1993, and non-impacted in 1987 and 1988. Further sampling of these sites is recommended to determine if the decline is genuine."

Historical Fisheries Information for Schroon Lake

The state stocks about 7,300 6.5” lake trout and about 3,000 7” landlocked salmon each year at Schroon Lake. Fish species in the lake include Atlantic salmon, black crappie, brown bullhead, lake trout, largemouth bass, northern pike, pumpkinseed sunfish, rainbow smelt, rock bass, white sucker, and yellow perch.

General statewide fishing regulations are applicable in Schroon Lake. In addition, for sunfish, yellow perch, and pickerel, the open season lasts all year long, with no daily take or size limit. For landlocked salmon, open season lasts all year long, with a minimum size limit of 15” and a daily take limit of 3. There is a daily limit of 2 lake trout and a minimum size of 18”. For trout, there is a daily take limit of 5, but no size limits or limits on the length of the open season.

There are several fish advisories governing consumption of fish in Schroon Lake. For lake trout greater than 27” in length, yellow perch > 13”, or smallmouth bass of any size, the NYS Department of Health recommends no more than a single meal per month.



Permitted Facilities Associated with Schroon Lake

There are many facilities or activities on Schroon Lake that require permits or are otherwise regulated by the NYSDEC; the map above shows facilities on or near the lake (represented by “derricks”) and well locations (represented by the large circles). These correspond to more than a half dozen beaches, several marinas, several larger developments or subdivisions, large campgrounds, boat launches, wastewater treatment plants, and about 75 private property activities associated with shoreline improvement projects (dock or boathouse construction, breakwall construction and repair, shoreline stabilization, etc).

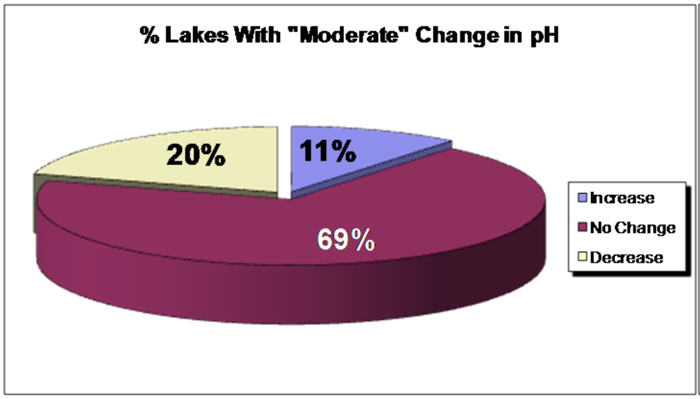
NEW YORK STATE, CSLAP AND SCHROON LAKE WATER-QUALITY DATA: 1986-2007

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).



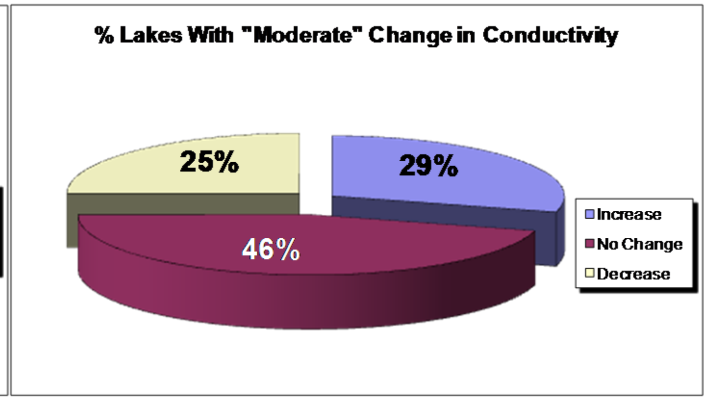
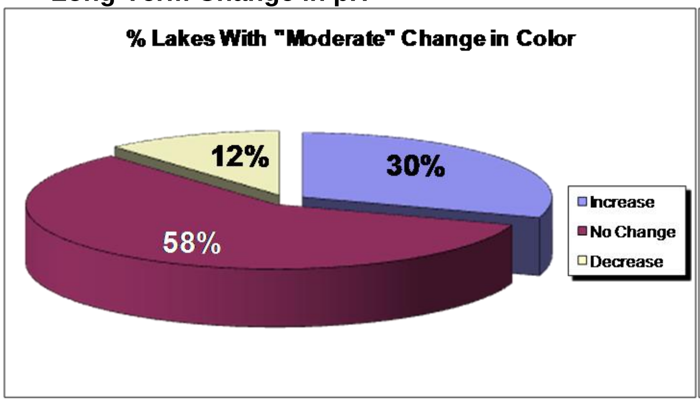


Figure 7a. %CSLAP Lakes Exhibiting Moderate Long-Term Change in pH

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



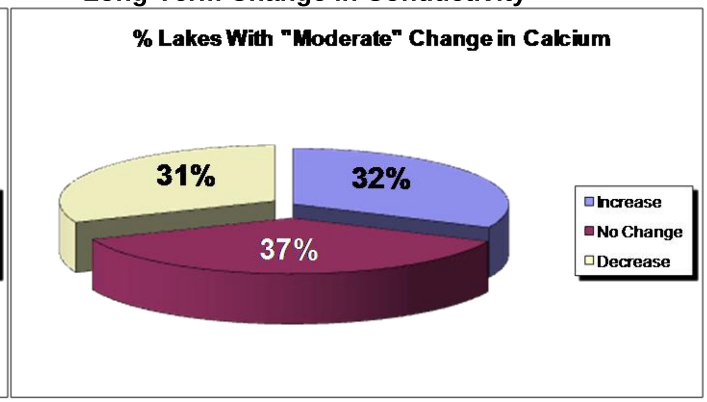
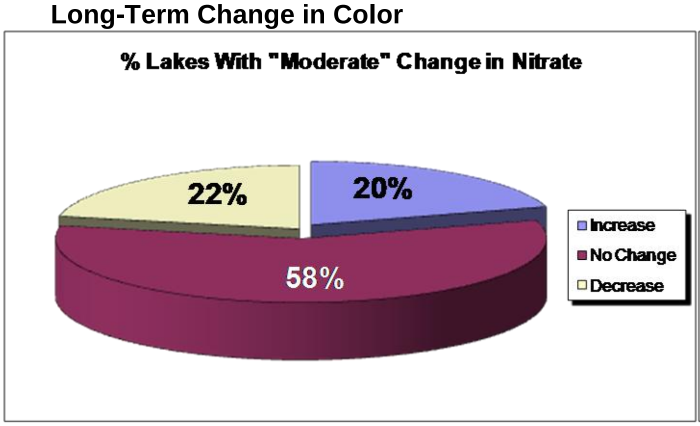


Figure 7c. %CSLAP Lakes Exhibiting Moderate Long-Term Change in Color

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



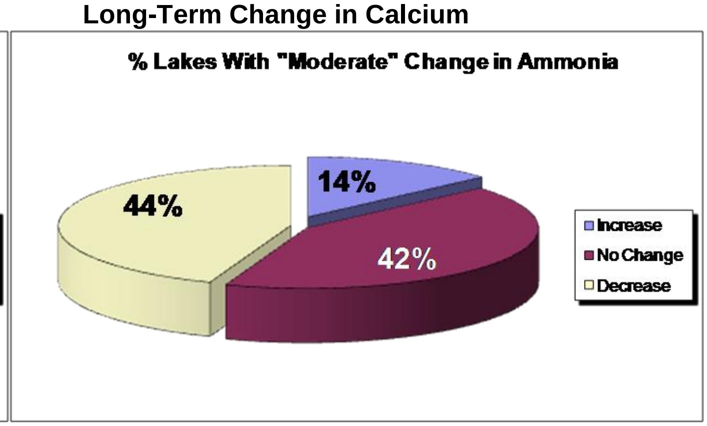
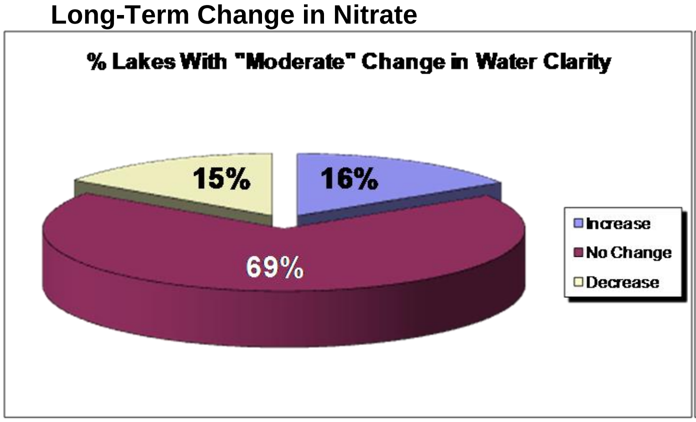


Figure 7e. %CSLAP Lakes Exhibiting Moderate Long-Term Change in Nitrate

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



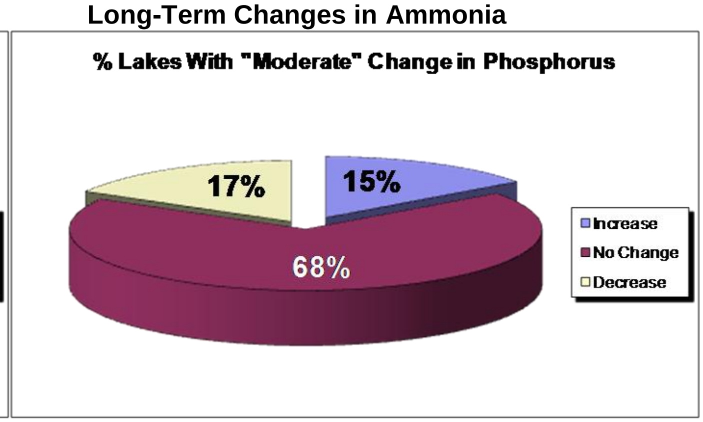


Figure 7g. %CSLAP Lakes Exhibiting Moderate Long-Term Change in Water Clarity

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

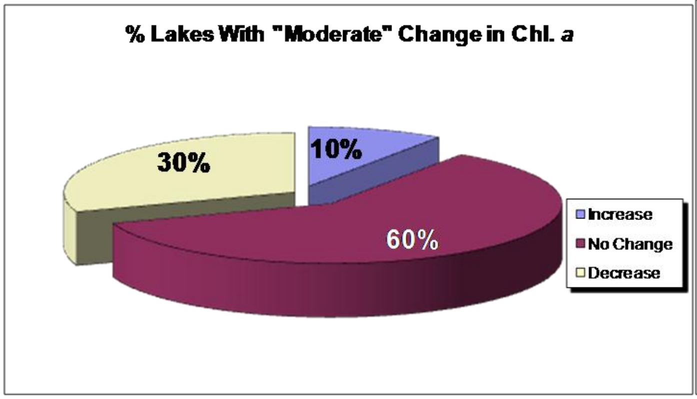


Figure 7i. %CSLAP Lakes Exhibiting Moderate Long-Term Change in Chlorophyll *a*

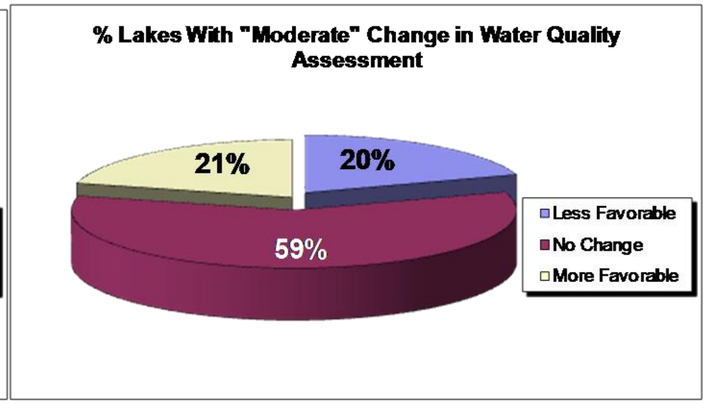


Figure 7j. %CSLAP Lakes Exhibiting Moderate Long-Term Change in Water-quality Assessment

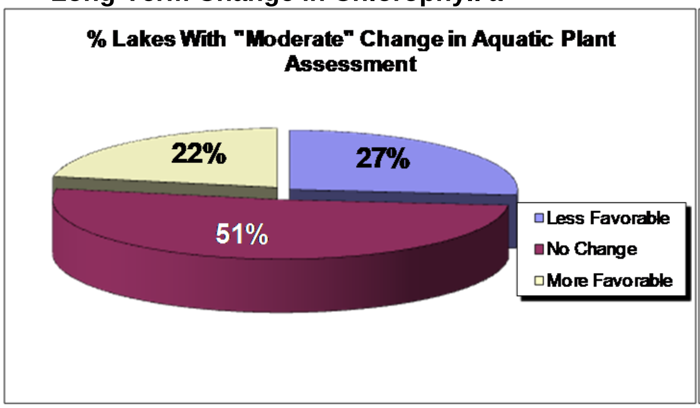


Figure 7k. %CSLAP Lakes Exhibiting Moderate Long-Term Change in Aquatic Plant Assessment

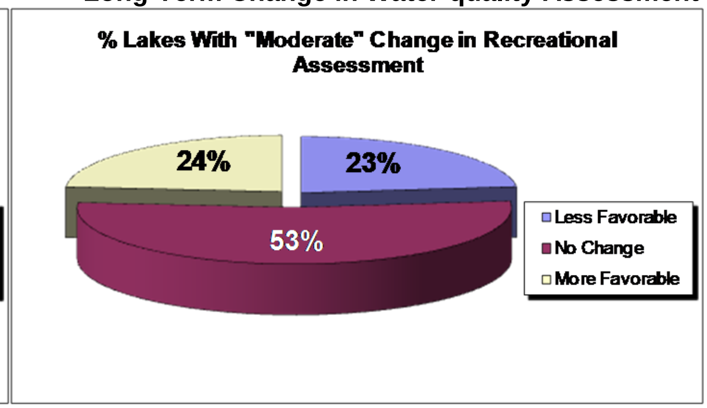


Figure 7l. %CSLAP Lakes Exhibiting Moderate Long-Term Change in Recreational Assessment

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.

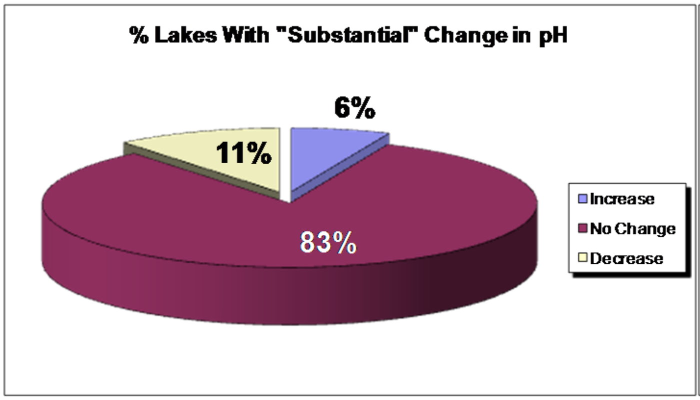


Figure 8a. %CSLAP Lakes Exhibiting Substantial Long-Term Change in pH

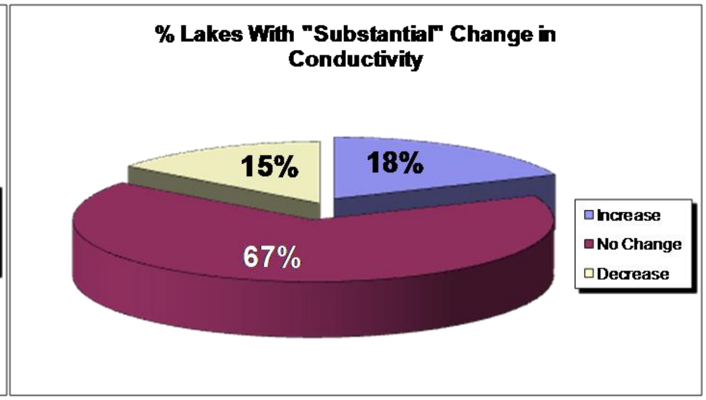


Figure 8b. %CSLAP Lakes Exhibiting Substantial Long-Term Change in Conductivity

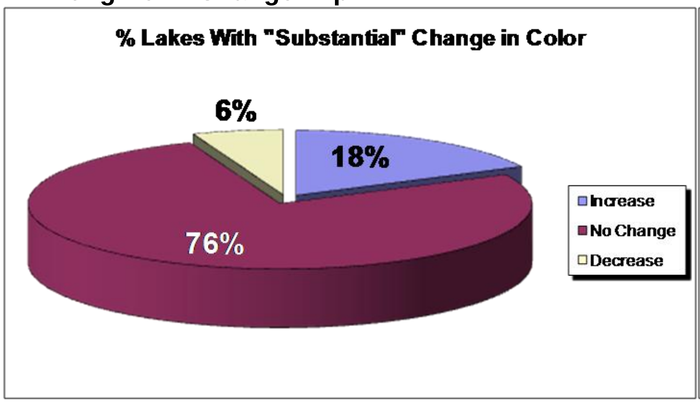


Figure 8c. %CSLAP Lakes Exhibiting Substantial Long-Term Change in Color

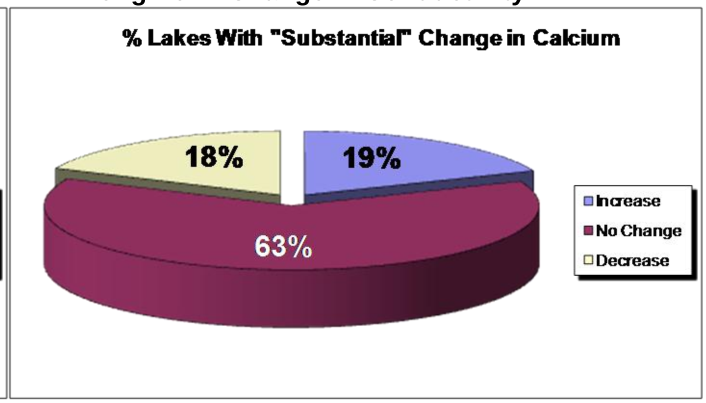


Figure 8d. %CSLAP Lakes Exhibiting Substantial Long-Term Change in Calcium

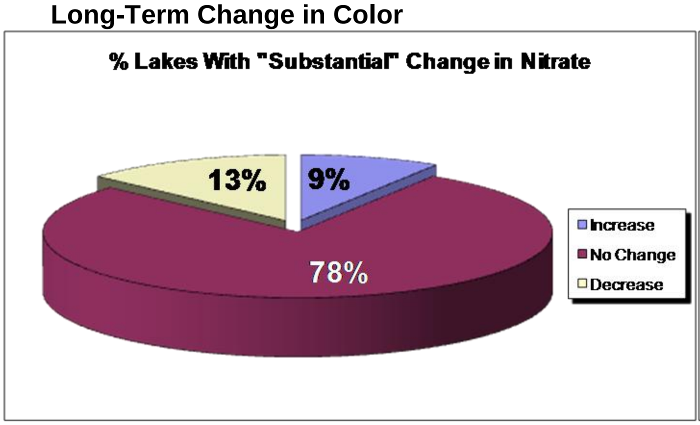


Figure 8e. %CSLAP Lakes Exhibiting Substantial Long-Term Change in Nitrate

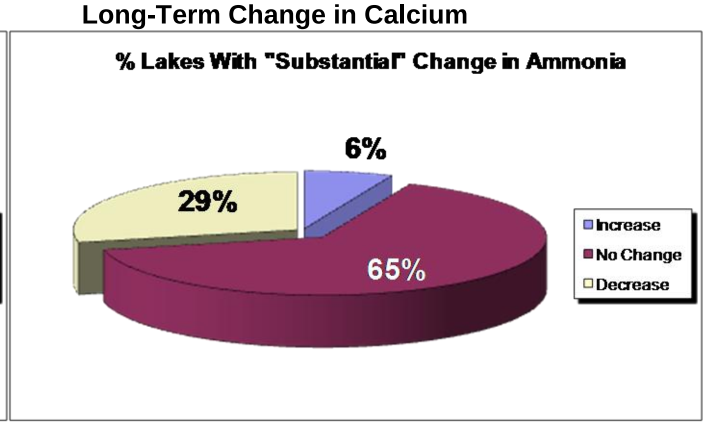


Figure 8f. %CSLAP Lakes Exhibiting Substantial Long-Term Changes in Ammonia

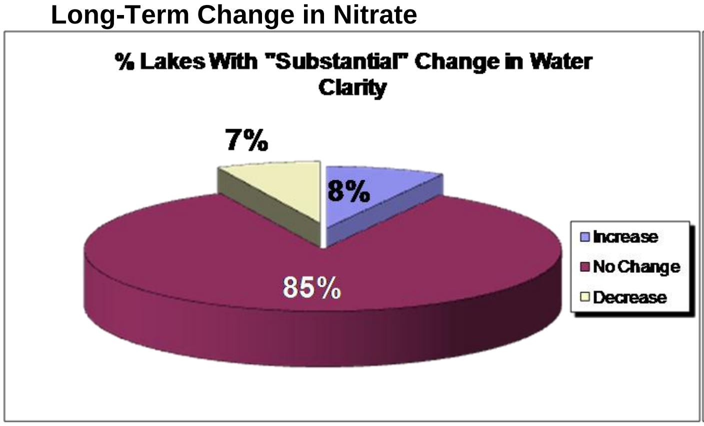


Figure 8g. %CSLAP Lakes Exhibiting Substantial Long-Term Change in Water Clarity

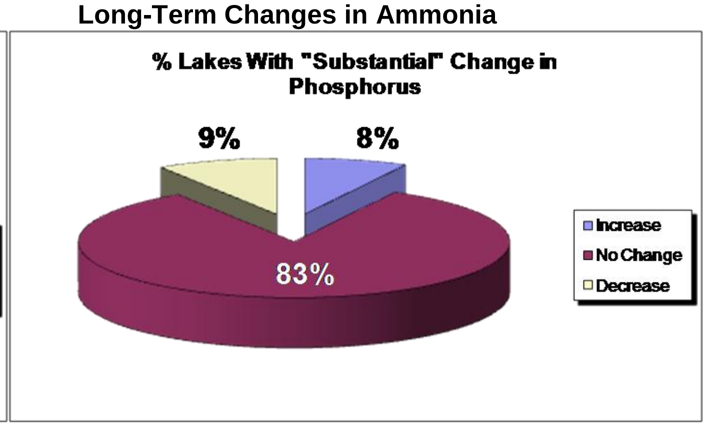


Figure 8h. %CSLAP Lakes Exhibiting Substantial Long-Term Changes in Phosphorus

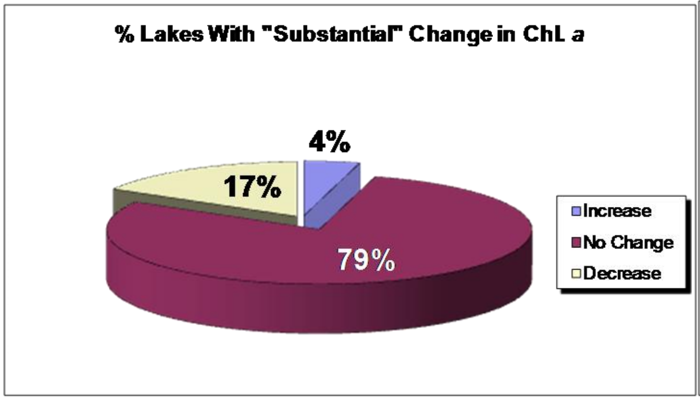


Figure 8i. %CSLAP Lakes Exhibiting Substantial Long-Term Change in Chlorophyll *a*

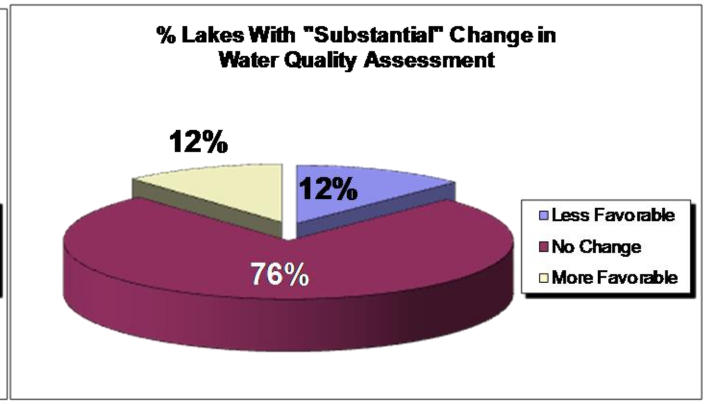


Figure 8j. %CSLAP Lakes Exhibiting Substantial Long-Term Change in Water-quality Assessment

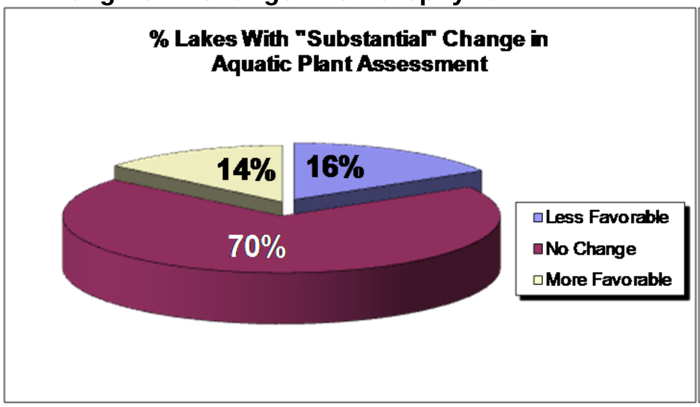


Figure 8k. %CSLAP Lakes Exhibiting Substantial Long-Term Change in Aquatic Plant Assessment

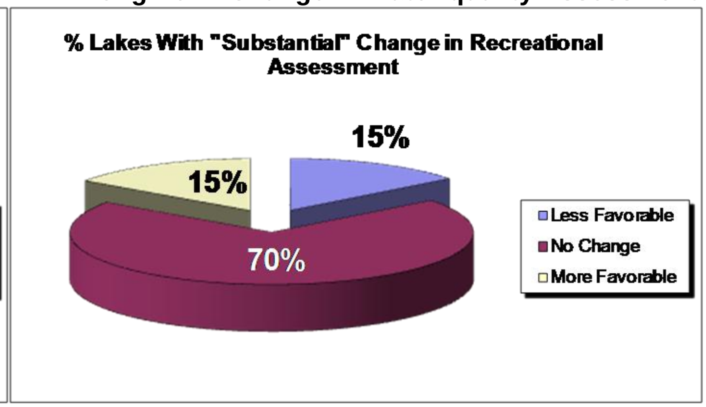


Figure 8l. %CSLAP Lakes Exhibiting Substantial Long-Term Change in Recreational Assessment

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.

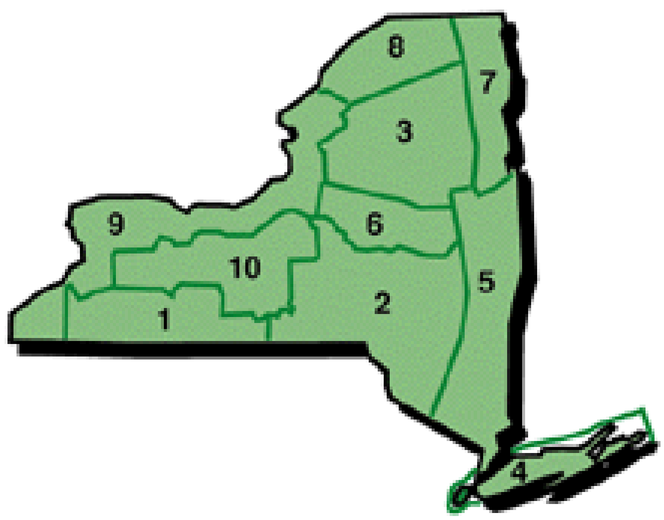


Figure 9- NOAA Weather Zones in New York State

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 Schroon Lake Water Quality Summary.**

Schroon Lake is in NOAA weather zone 7, the Champlain Valley region. The precipitation patterns for this zone are summarized below.

Statewide and Schroon Lake 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 Schroon Lake. 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 7 Avg: Winter-Spring / Summer
1986	Normal / Wet	Normal / Wet
1987	Dry / Normal	Normal / Normal
1988	Very Dry / Normal	Very Dry / Normal
1989	Wet / Normal	Normal / Wet
1990	Very Wet / Normal	Very Wet / Normal
1991	Normal / Normal	Dry / Normal
1992	Normal / Wet	Dry / Normal
1993	Wet / Normal	Wet / Normal
1994	Wet / Normal	Normal / Normal
1995	Very Dry / Normal	Very Dry / Normal
1996	Very Wet / Normal	Wet / Normal
1997	Normal / Normal	Dry / Wet
1998	Very Wet / Normal	Very Wet / Wet
1999	Normal / Normal	Normal / Wet
2000	Very Wet / Normal	Very Wet / Normal
2001	Normal / Normal	Wet / Dry
2002	Very Wet / Dry	Very Wet / Dry
2003	Normal / Wet	Normal / Wet
2004	Dry / Very Wet	Dry / Very Wet
2005	Normal / Normal	Wet / Normal
2006	Wet / Wet	Wet / Normal
2007	Normal / Normal	Wet / Normal

Table 1: Statewide and NOAA Zone 7 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 Champlain Valley region—which includes Schroon Lake—have indicated normal to wet conditions over the last six years. The wettest years have been 1998, 2000 and 1990, while the driest years were 1995 and 1988. It should be noted that only two dry summers (2001 and 2002) and one dry winter (2004) has occurred in this region in the last ten years. Among the years in which Schroon Lake was sampled, 1990, 1989, 2003, 2004, 2005 and 2006 were wet, and 1988 was dry. The CSLAP samplers' observations suggest that 2008 was probably a wet year.

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.

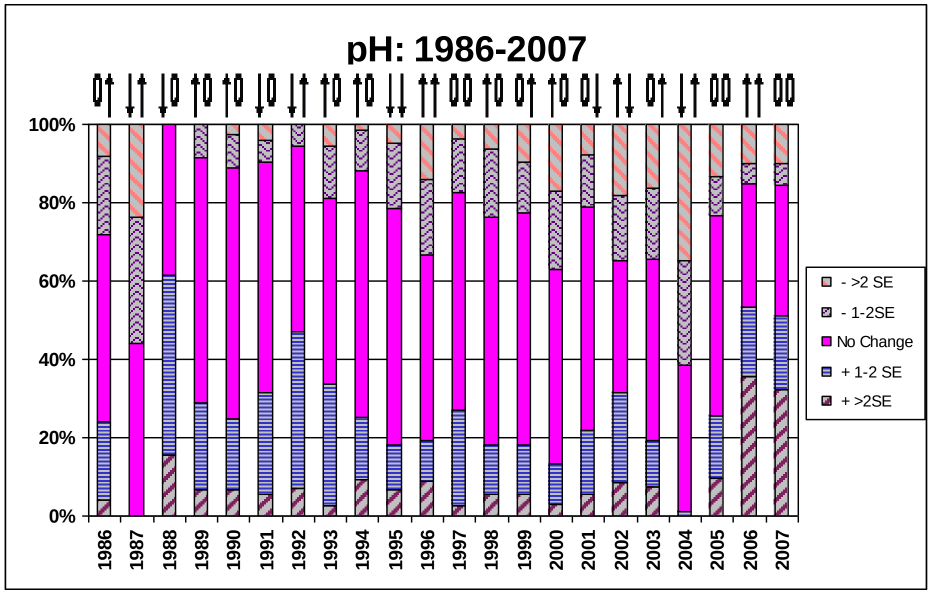


Figure 10a. *Annual Change from "Normal" pH in CSLAP Lakes (SE = Standard Error)*

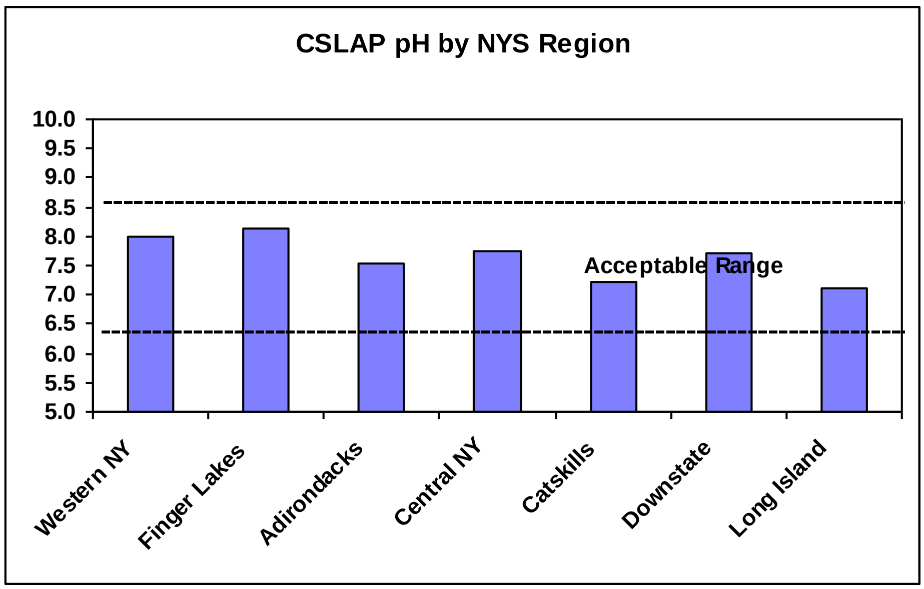


Figure 10b. *pH in CSLAP Lakes by NYS Region*

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 Schroon Lake in 2008?

pH readings were slightly higher later in the 2008 sampling season at both sampling sites, although seasonal trends have not normally been apparent. These readings have usually been typical of circumneutral to weakly alkaline lakes. pH has increased over the last few years at both sampling sites, but no long-term trends have been apparent.

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.

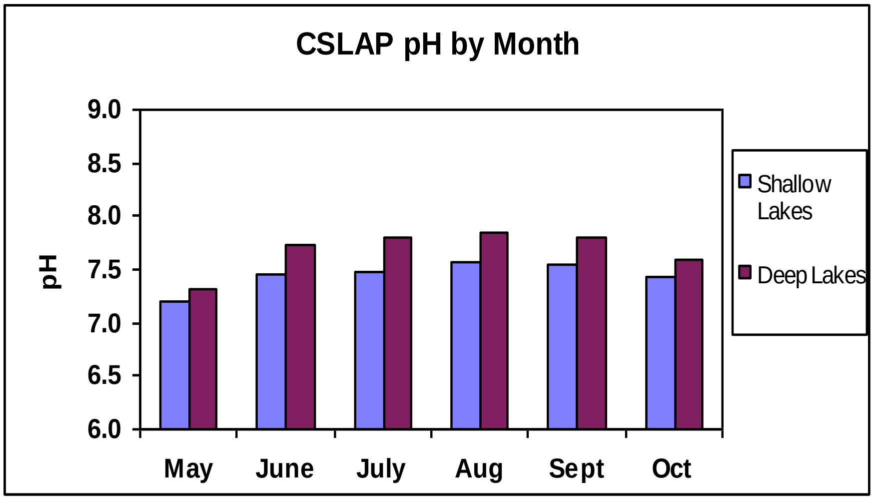


Figure 10c. *pH in Shallow (<20ft deep) and Deep CSLAP Lakes by Month*

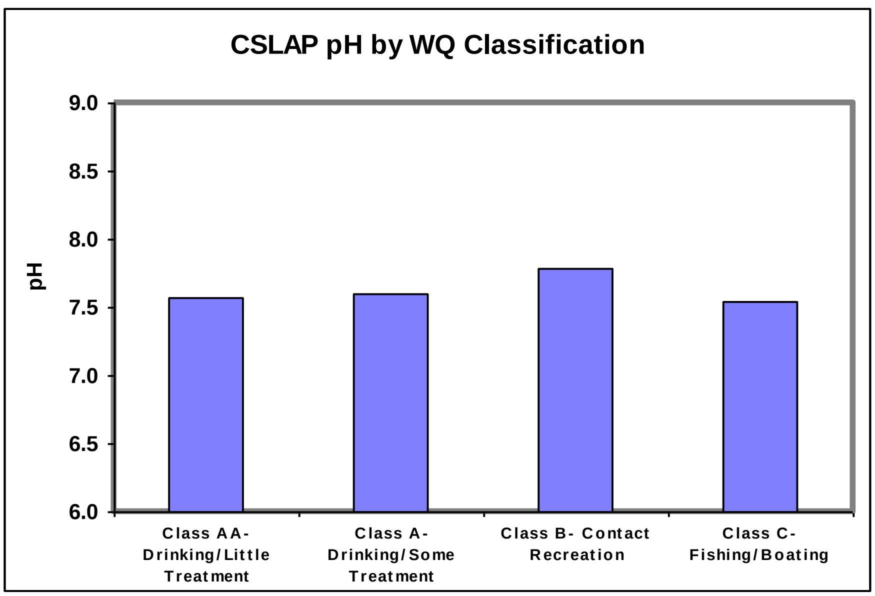


Figure 10d. *pH in CSLAP Lakes by Lake Use*

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.

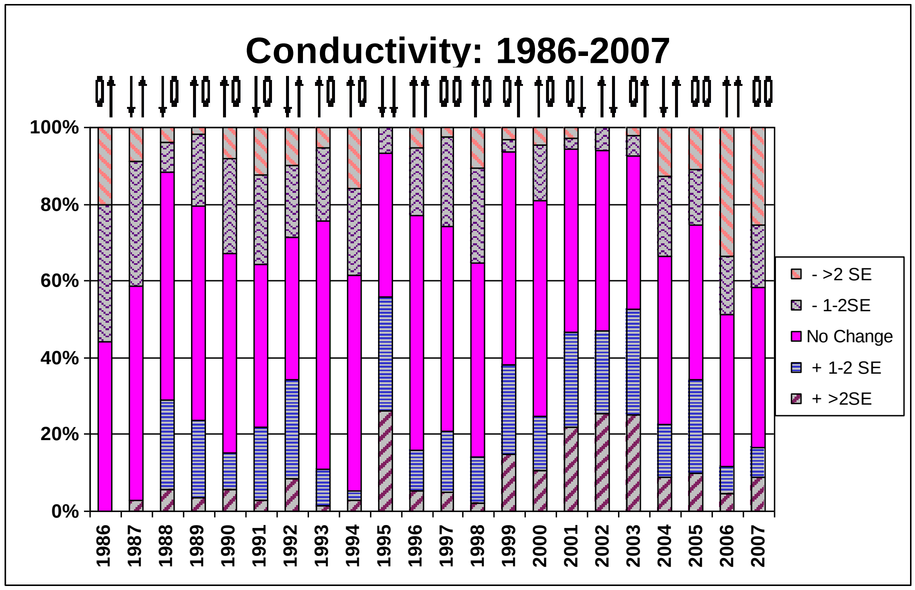


Figure 11a. *Annual Change from "Normal" Conductivity in CSLAP Lakes (SE = Standard Error)*

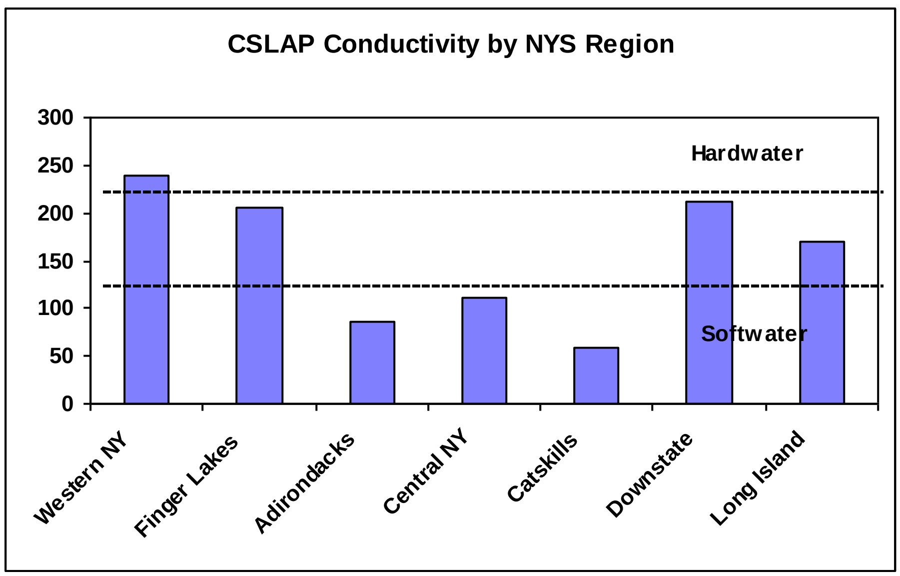


Figure 11b. *Conductivity in CSLAP Lakes by NYS Region*

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 Schroon Lake in 2008?

Conductivity readings increased slightly in the north basin during the 2008 sampling season, although these readings normally do not exhibit any clear seasonal patterns. Conductivity has decreased over the last five years at both sampling sites, apparently inconsistent with the increasing pH over the same period. This suggests that these changes are "random" and not part of a long-term pattern, an observation consistent with the change in conductivity readings in the north basin over the last twenty two years.

Statewide Variability:

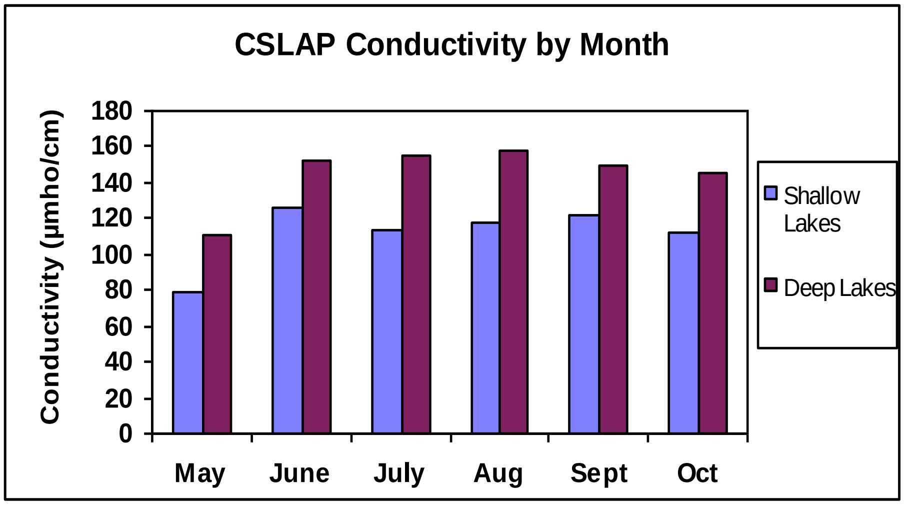


Figure 11c. *Conductivity in Shallow (<20ft deep) and Deep CSLAP Lakes by Month*

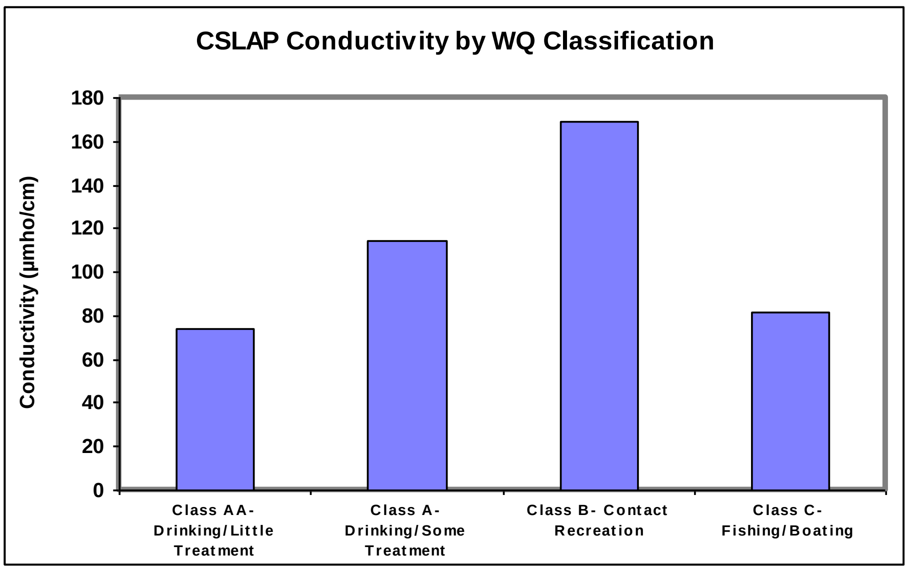


Figure 11d. *Conductivity in CSLAP Lakes by Lake Use*

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.

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).

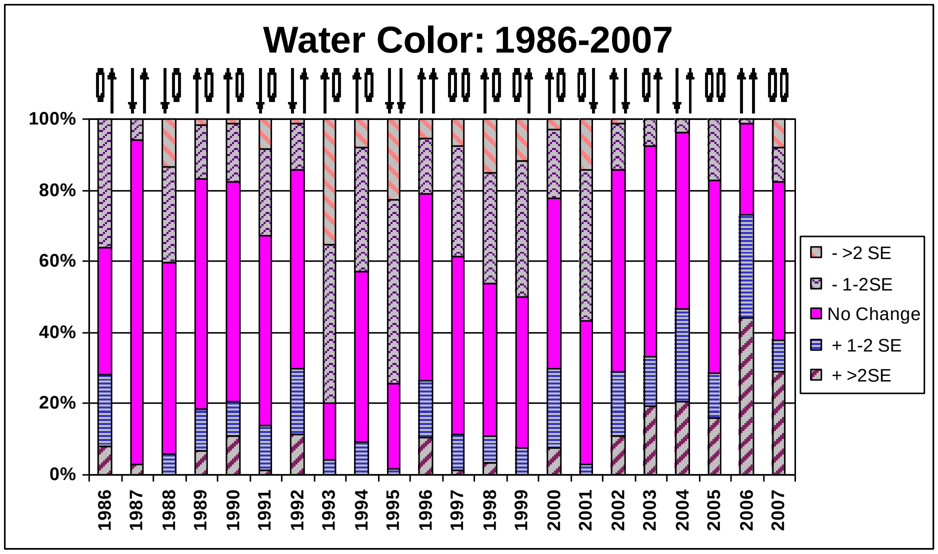


Figure 12a. *Annual Change from "Normal" Color in CSLAP Lakes (SE = Standard Error)*

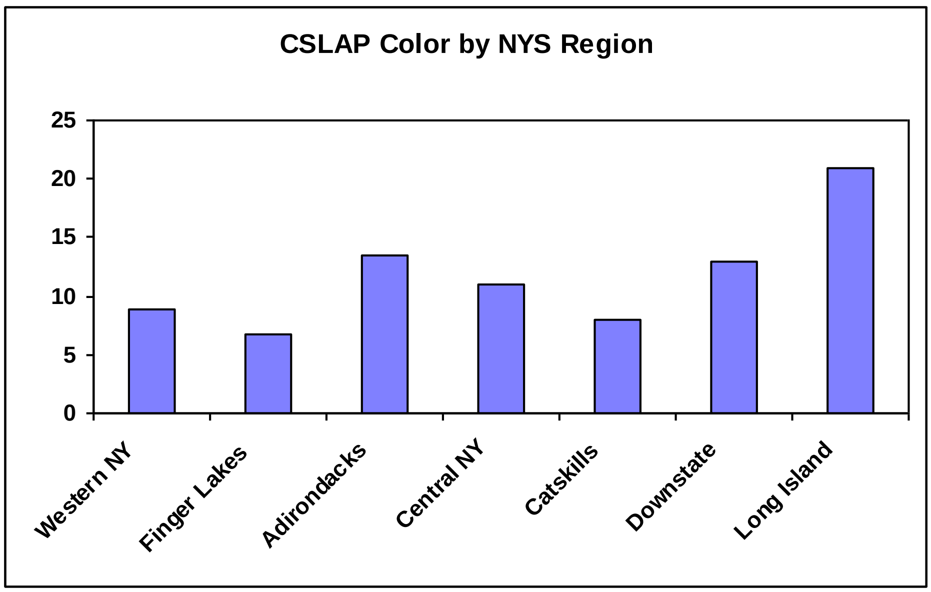


Figure 12b. *Color in CSLAP Lakes by NYS Region*

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 Schroon Lake in 2008?

Water color readings were fairly stable during most of the summer of 2008, and these readings were close to the recent average for the lake. These readings have been higher than usual in the last six years, and may influence water transparency when algae levels are very low.

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.

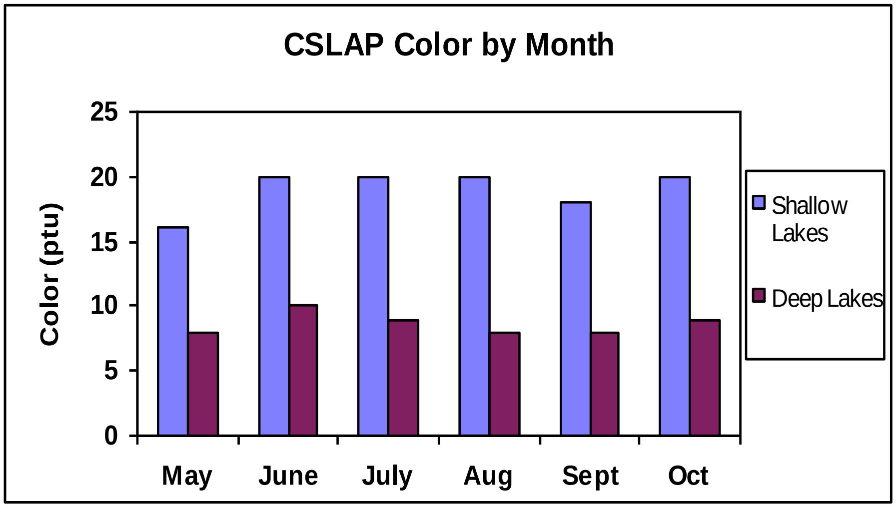


Figure 12c. *Color in Shallow (<20ft deep) and Deep CSLAP Lakes by Month*

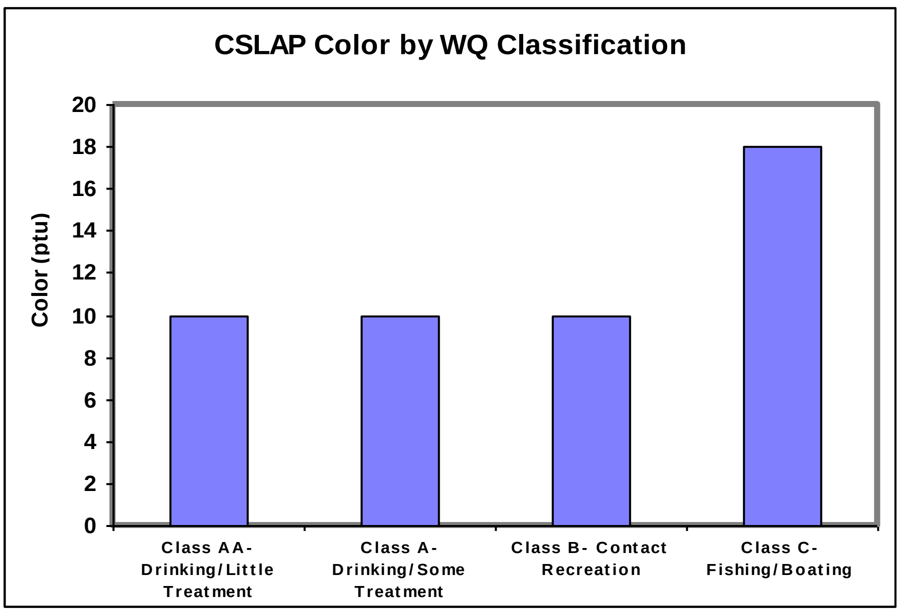


Figure 12d. *Color in CSLAP Lakes by Lake Use*

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.

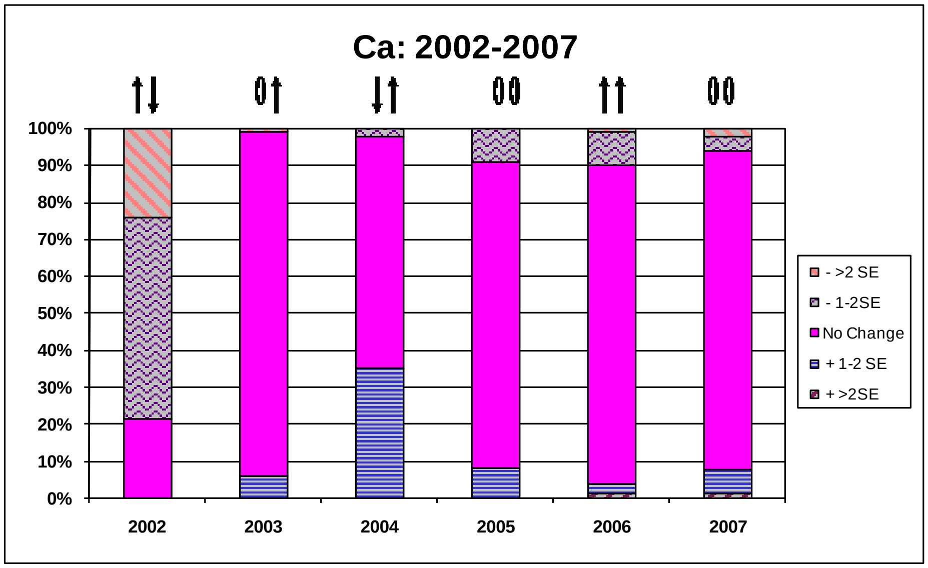


Figure 13a. *Annual Change from "Normal" Calcium in CSLAP Lakes (SE = Standard Error)*

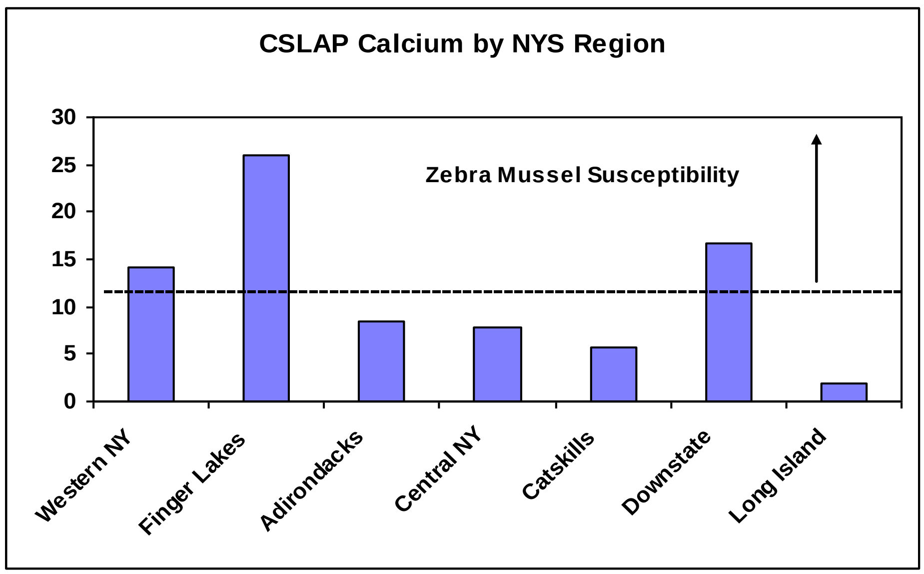


Figure 13b. *Calcium in CSLAP Lakes by NYS Region*

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 Schroon Lake in 2008?

Calcium readings in Schroon Lake have been typical of lakes with soft water, and these readings have not changed significantly over the last six years. With only 1-2 samples collected per year, seasonal trends cannot be evaluated. These readings are inadequate to support zebra mussels, and these exotic bivalves have not been found in the lake. These readings are comparable at both sampling sites.

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.

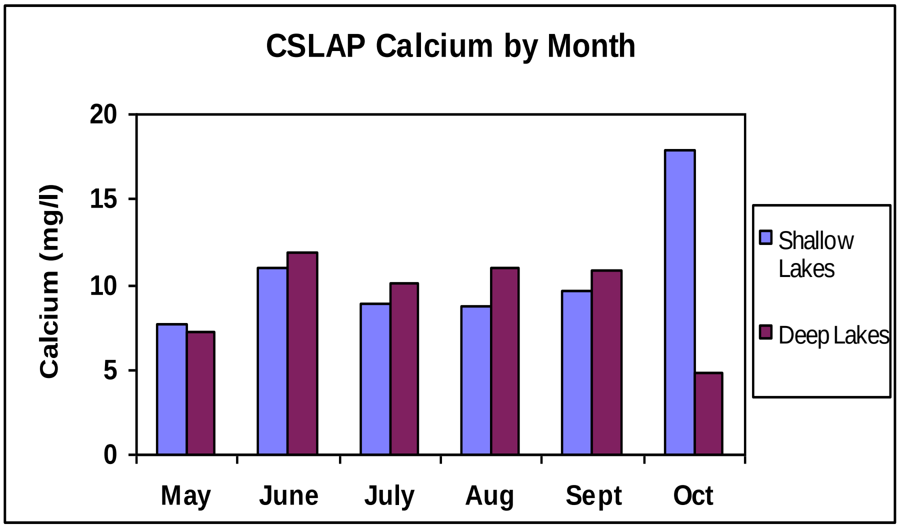


Figure 13c. *Calcium in Shallow (<20ft deep) and Deep CSLAP Lakes by Month*

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.

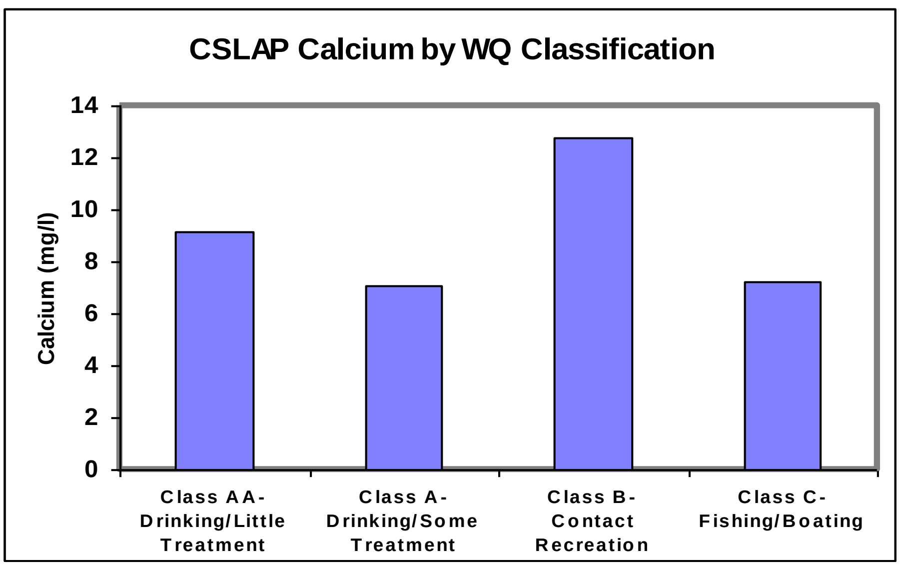


Figure 13d. *Calcium in CSLAP Lakes by Lake Use*

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.

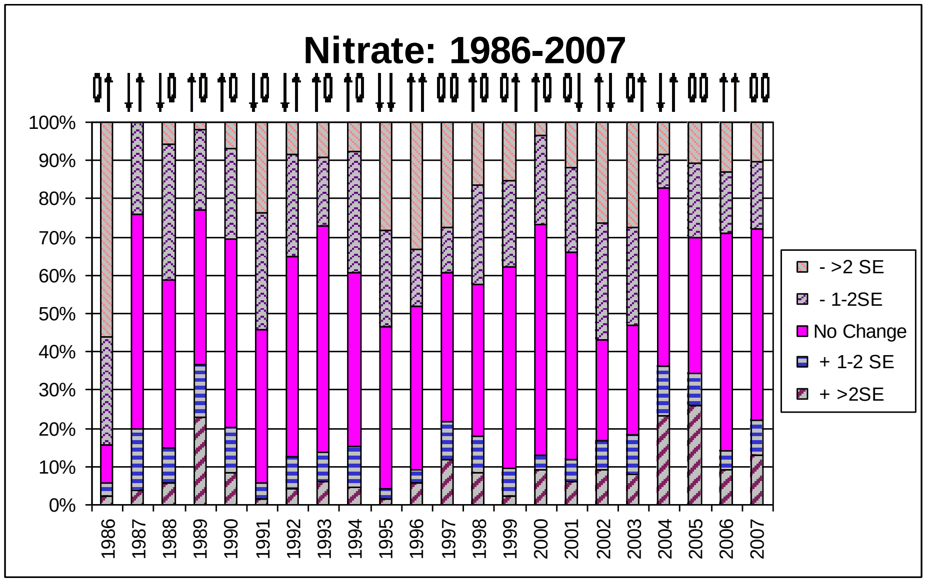


Figure 14a. *Annual Change from "Normal" Nitrate in CSLAP Lakes (SE = Standard Error)*

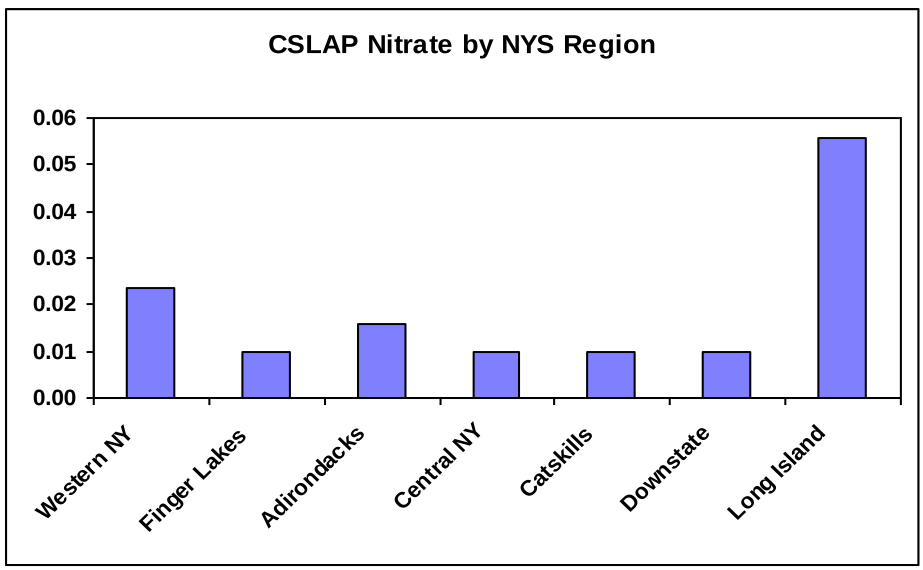


Figure 14b. *Nitrate in CSLAP Lakes by NYS Region*

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 Schroon Lake in 2008?

Nitrate readings were slightly higher than normal at the beginning of the 2008 sampling season, a seasonal pattern observed in Schroon Lake and other Adirondack lakes, probably due to dilution of snowpack meltwater. These readings have been lower than normal in the last seven years, coincident with wetter weather. Nitrate readings are comparable at both sites.

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.

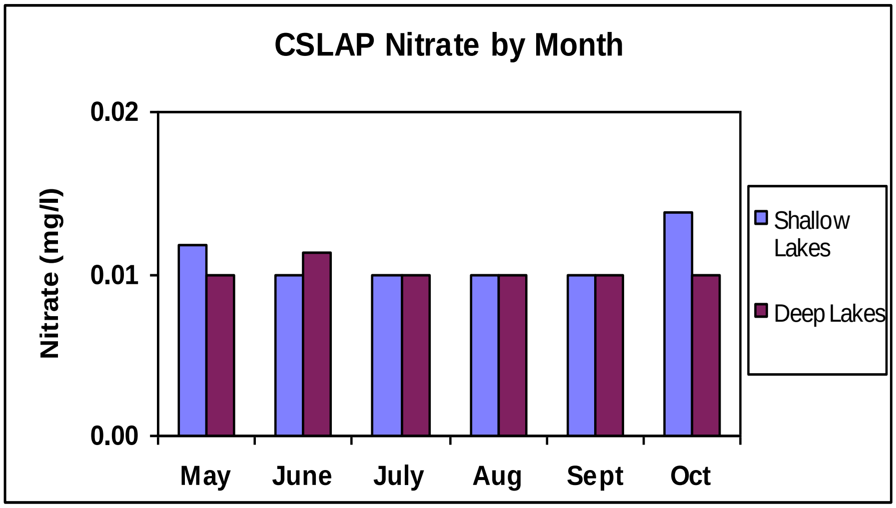


Figure 14c. *Nitrate in Shallow (<20ft deep) and Deep CSLAP Lakes by Month*

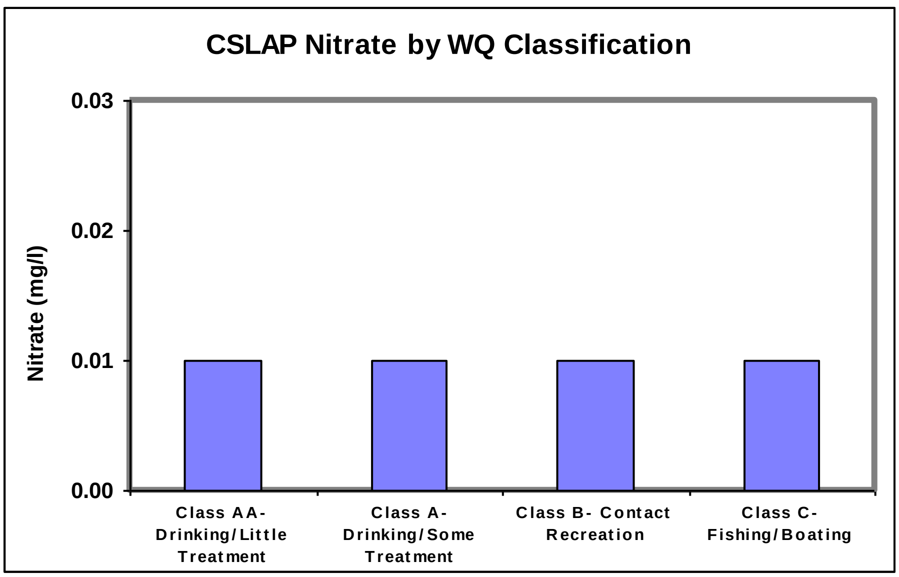


Figure 14d. *Nitrate in CSLAP Lakes by Lake Use*

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.

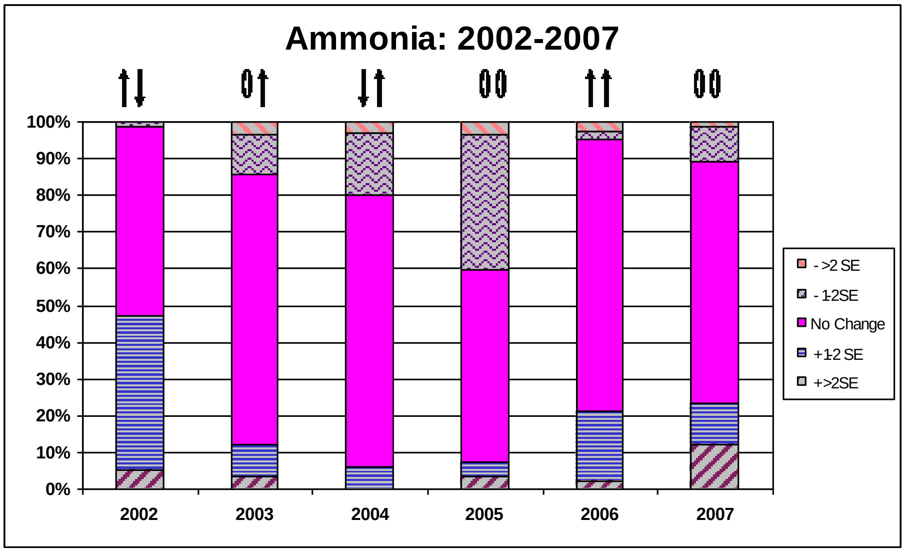


Figure 15a. *Annual Change from "Normal" Ammonia in CSLAP Lakes (SE = Standard Error)*

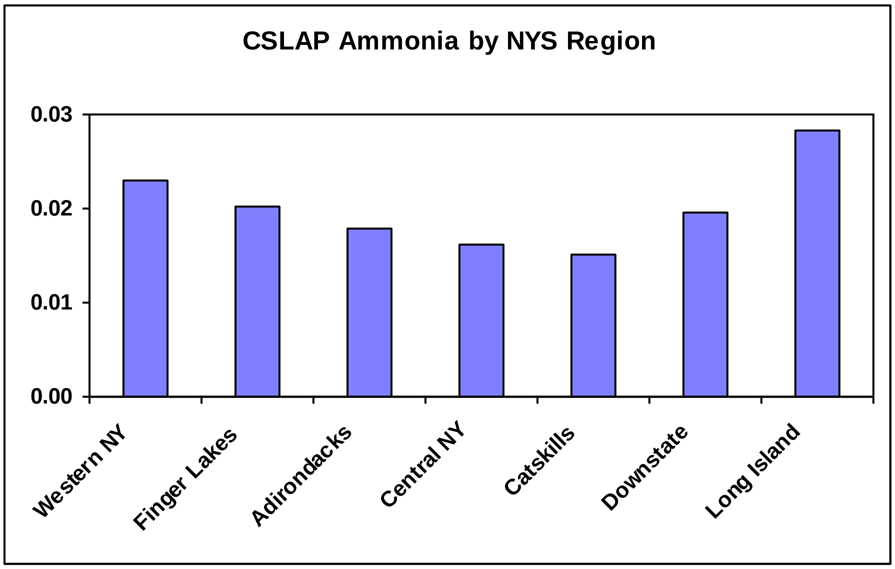


Figure 15b. *Ammonia in CSLAP Lakes by NYS Region*

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 Schroon Lake in 2008?

Ammonia readings in 2008 were slightly higher at the beginning of the summer in the north basin, but not in the south basin. However, nearly all readings have been low, and no seasonal or long-term trends have been apparent at either sampling site.

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.

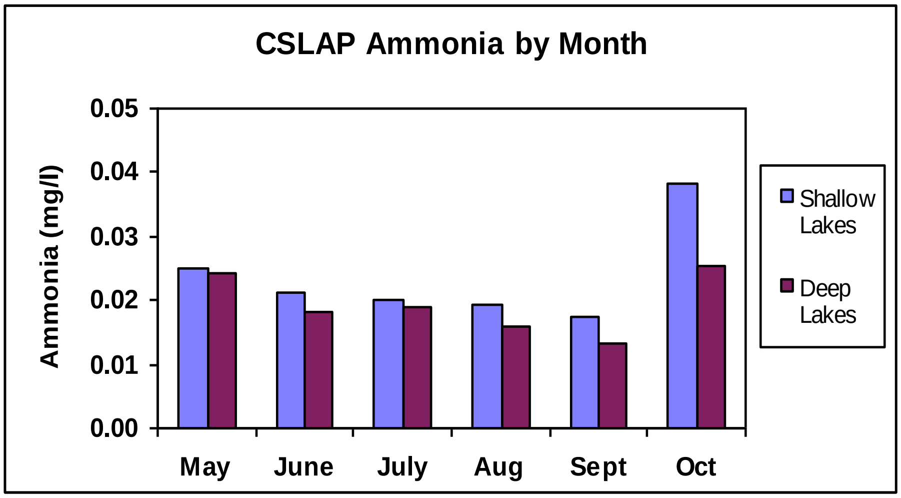


Figure 15c. *Ammonia in Shallow (<20ft deep) and Deep CSLAP Lakes by Month*

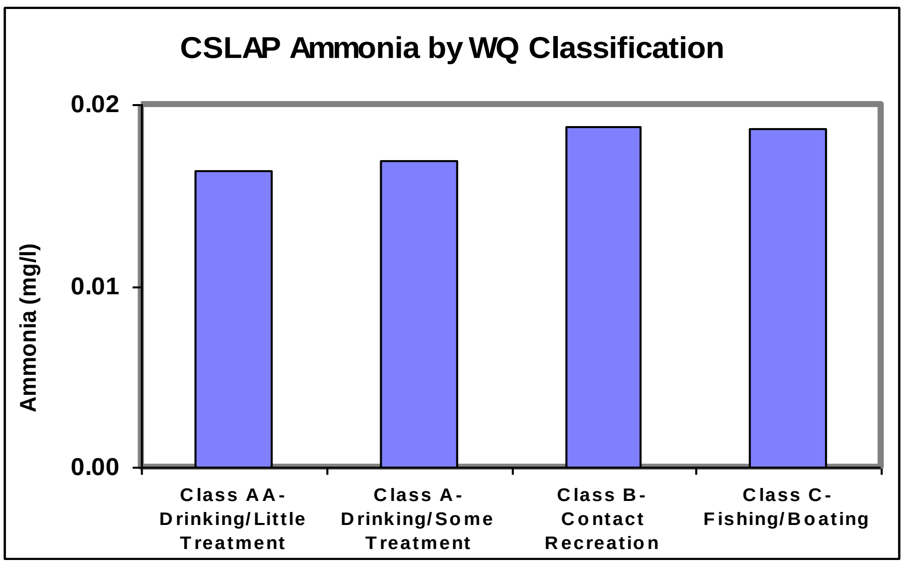


Figure 15d. *Ammonia in CSLAP Lakes by Lake Use*

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.

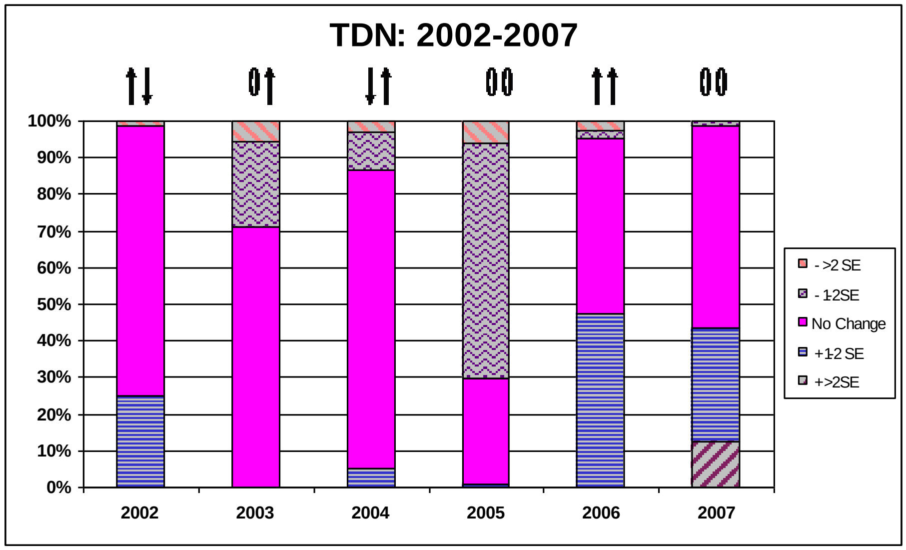


Figure 16a. *Annual Change from "Normal" TDN in CSLAP Lakes (SE = Standard Error)*

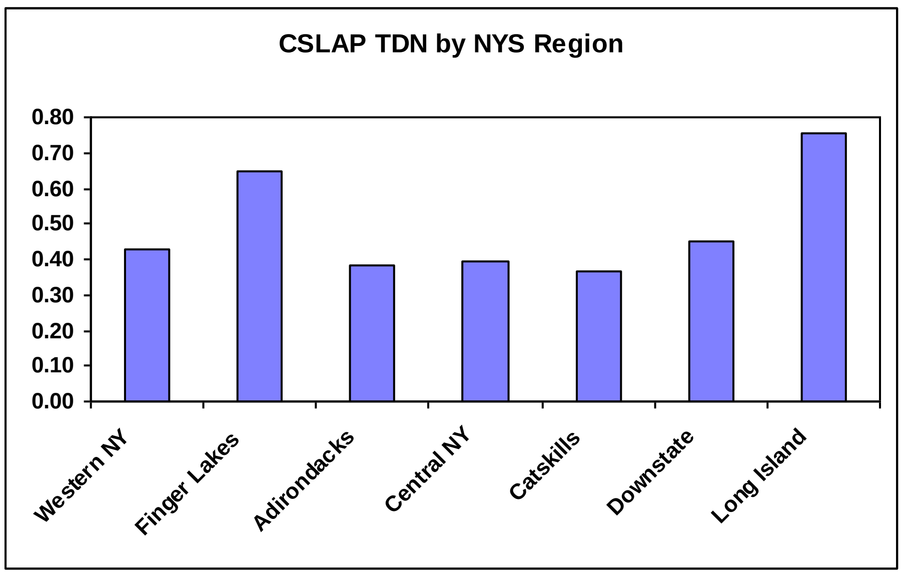


Figure 16b. *TDN in CSLAP Lakes by NYS Region*

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 Schroon Lake in 2008?

TDN readings were slightly higher in the middle of the 2008 sampling season in the north basin, but not in the south basin, and these readings have varied from year to year in a manner that does not appear to be statistically significant. No seasonal or long-term trends have been apparent, and TDN readings have been comparable at both sampling sites.

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*).

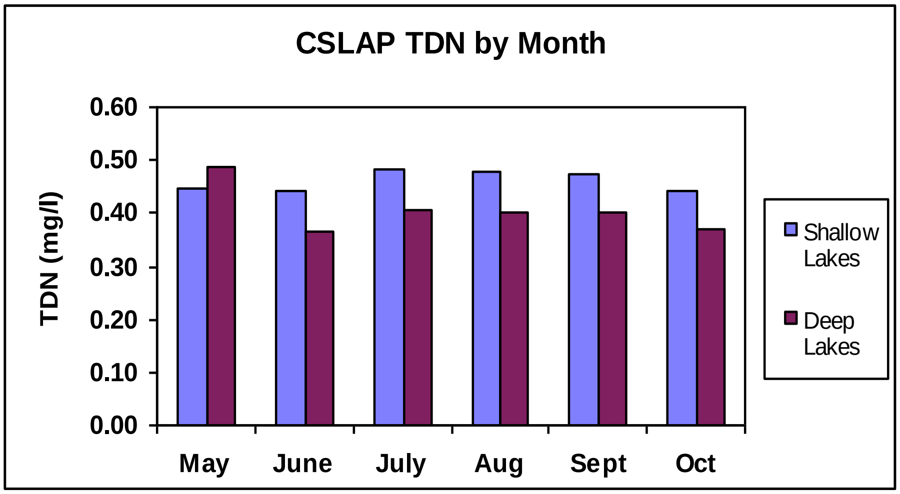


Figure 16c. *TDN in Shallow (<20ft deep) and Deep CSLAP Lakes by Month*

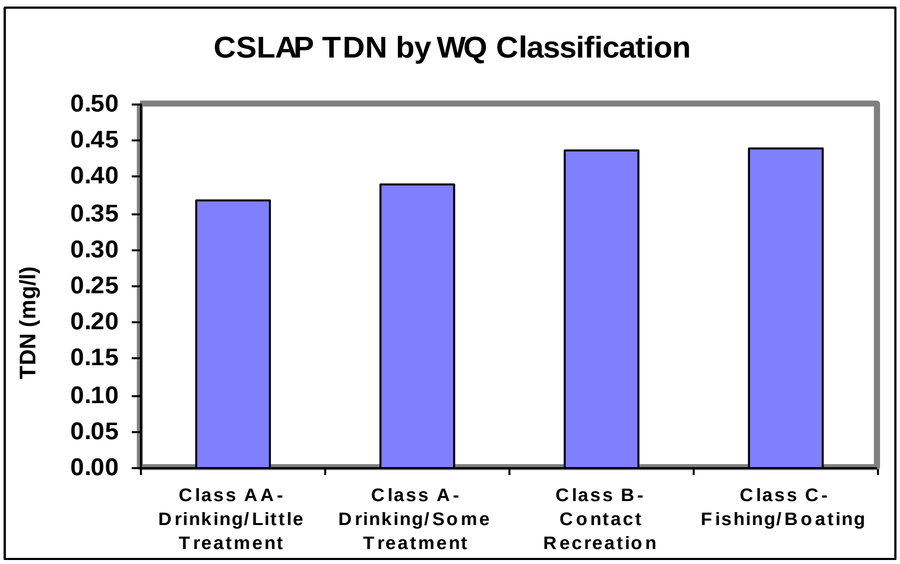


Figure 16d. *TDN in CSLAP Lakes by Lake Use*

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).

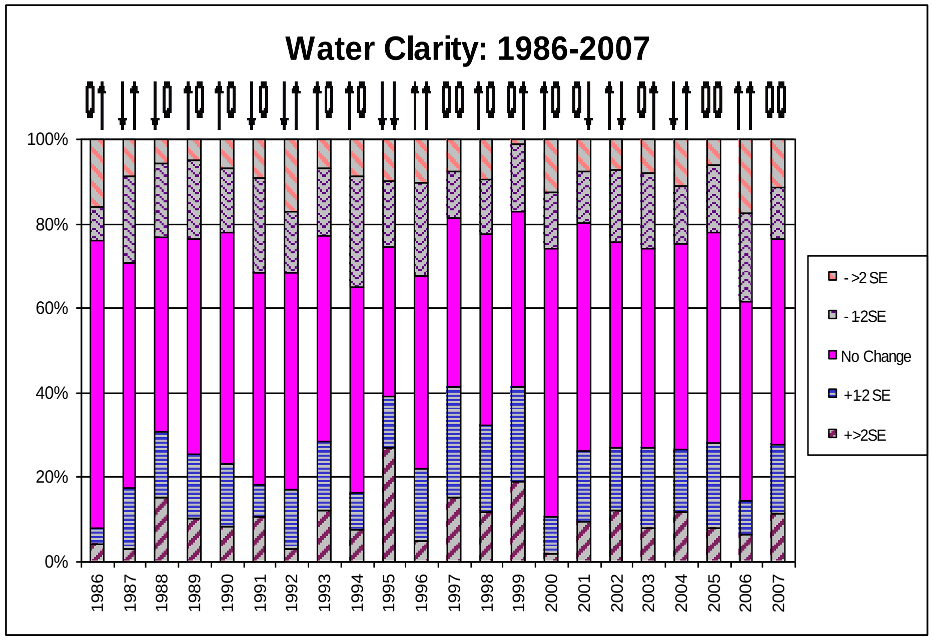


Figure 17a. *Change from "Normal" Water Clarity in CSLAP Lakes (SE = Standard Error)*

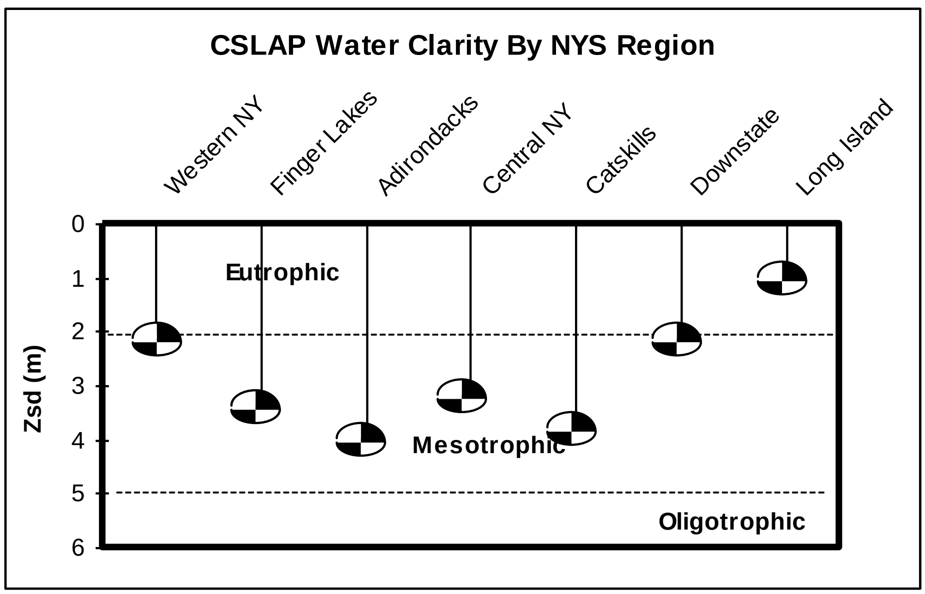


Figure 17b. *Water Clarity in CSLAP Lakes by NYS Region*

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 Schroon Lake in 2008?

Water clarity readings in 2008 were slightly higher than normal throughout the 2008 sampling season in the north basin, but lower than normal in the south basin. It is not known if this is due to a stronger influence of heavy rainfall (or wind action) on the south basin, but this was not triggered by "fundamental" differences in phosphorus or chlorophyll readings. No significant seasonal or long-term trends have been apparent at either sampling site, and water clarity is generally comparable in the north and south basin.

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.*

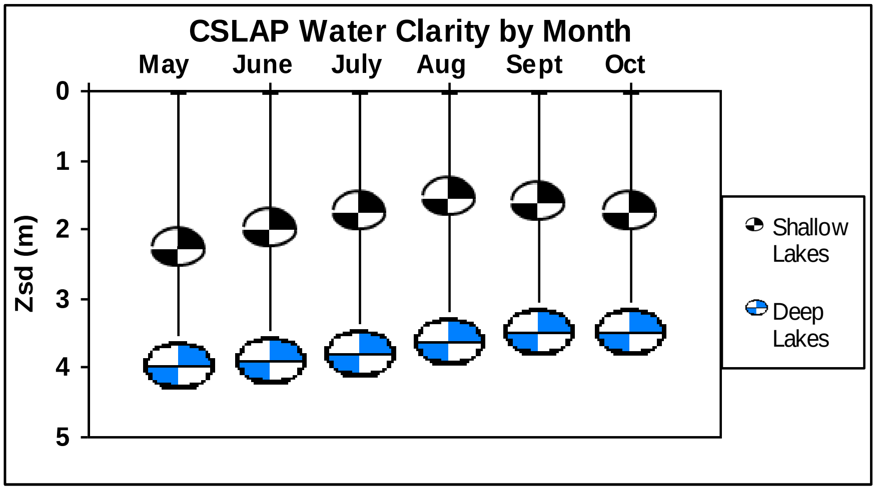


Figure 17c. *Water Clarity in Shallow (<20ft deep) and Deep CSLAP Lakes by Month*

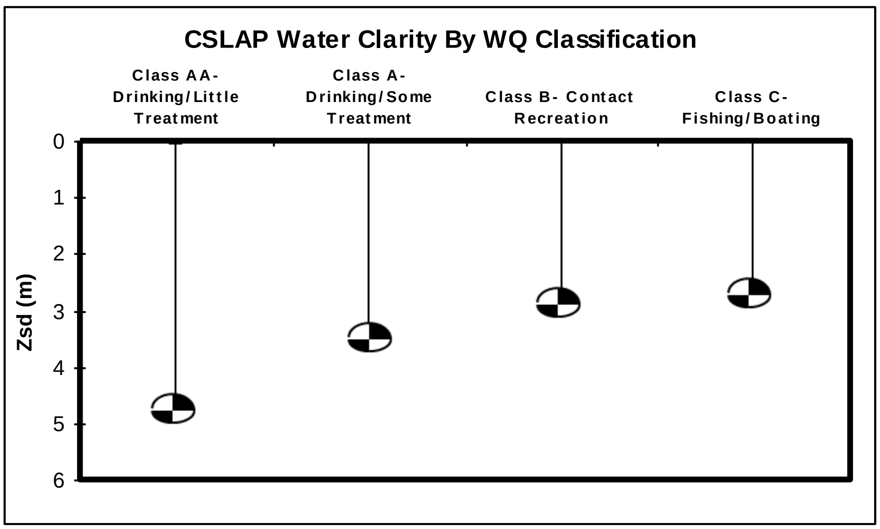


Figure 17d. *Water Clarity in CSLAP Lakes by Lake Use*

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.

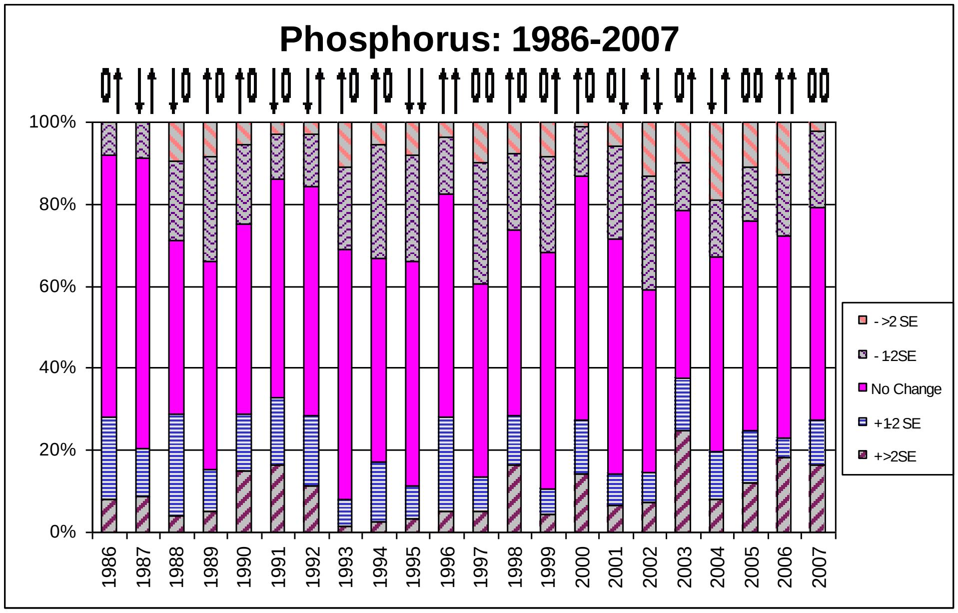


Figure 18a. *Annual Change from "Normal" TP in CSLAP Lakes (SE = Standard Error)*

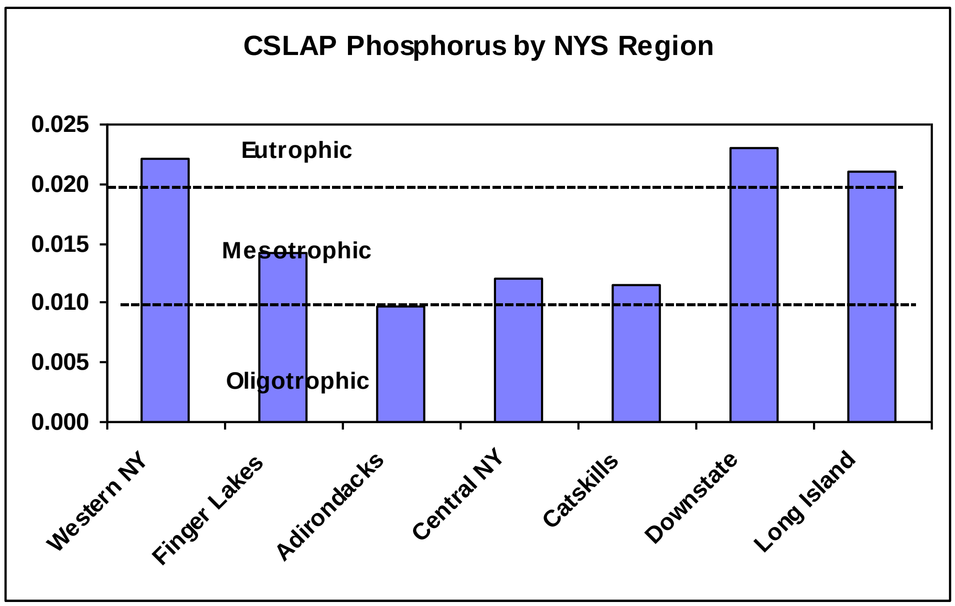


Figure 18b. *TP in CSLAP Lakes by NYS Region*

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 Schroon Lake in 2008?

Phosphorus readings in 2008 were close to normal throughout the sampling season in the north basin, and higher than normal in the south basin. These readings have been higher than normal in the last three years, but this has not triggered like changes in algae levels. The TP spike in the first south basin sample in 2008 was probably an erroneous datapoint, as are the late summer deepwater TP samples in the south basin. Deepwater phosphorus readings are mostly comparable to those measured at the lake surface, although deeper samples collected in 2009 may provide better insights as to these gradients.

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.

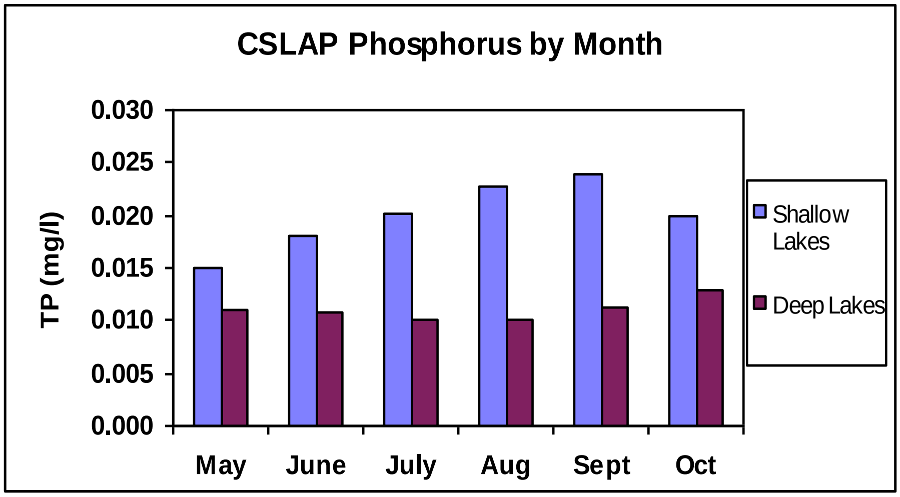


Figure 18c. *TP in Shallow (<20ft deep) and Deep CSLAP Lakes by Month*

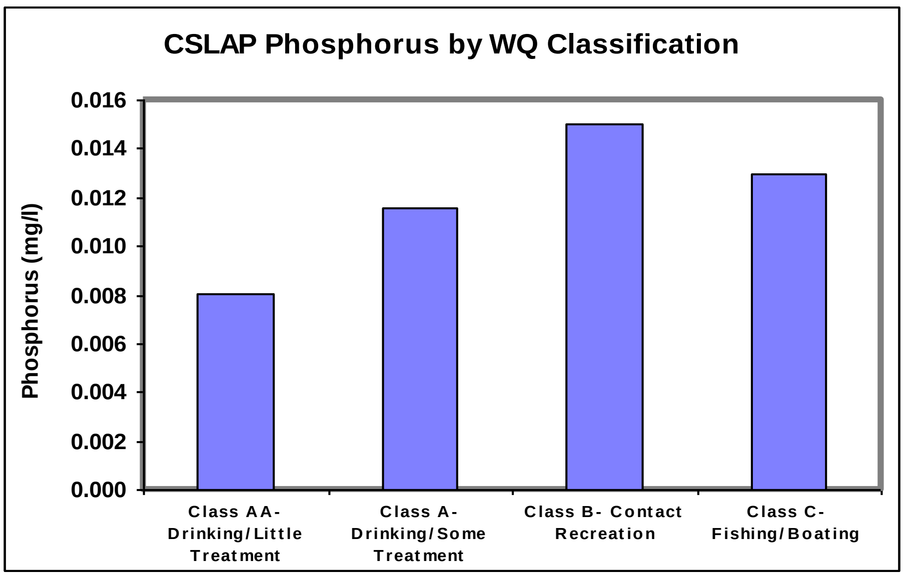


Figure 18d. *TP in CSLAP Lakes by Lake Use*

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:

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.

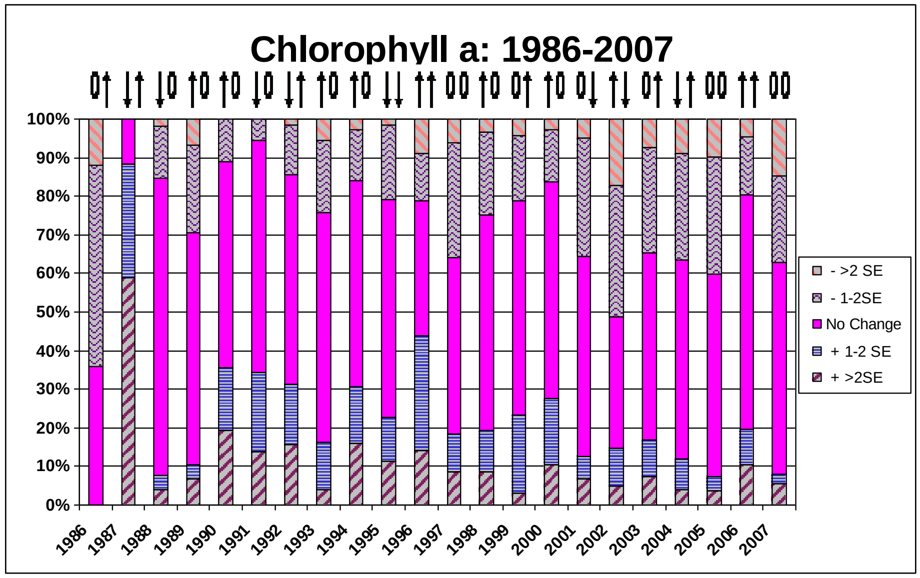


Figure 19a. *Annual Change from "Normal" Chlorophyll a in CSLAP Lakes (SE = Standard Error)*

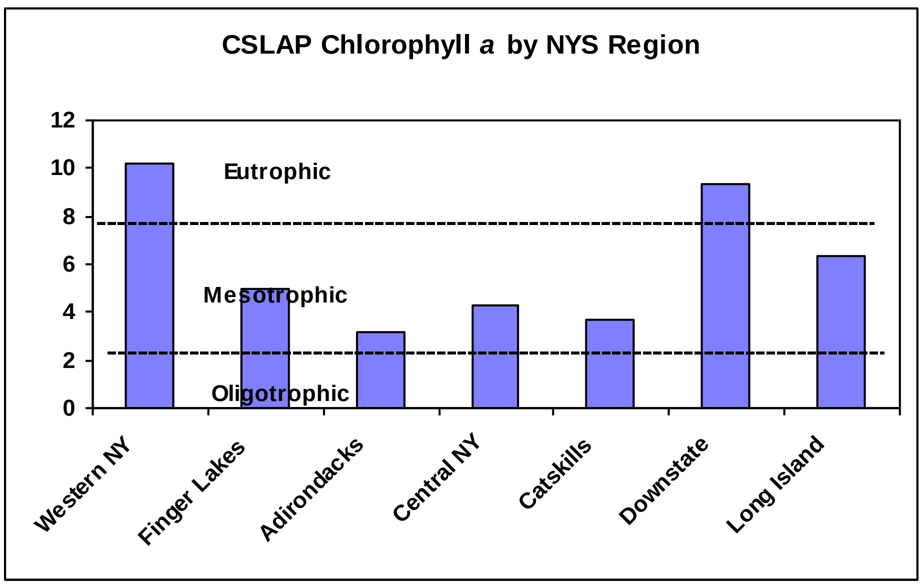


Figure 19b. *Chlorophyll a in CSLAP Lakes by NYS Region*

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 Schroon Lake in 2008?

Chlorophyll *a* readings in 2008 were consistently lower than normal at both sampling sites, with no clear seasonal patterns. These readings have been lower than normal in the last few years, despite higher than normal phosphorus readings. This suggests both indicators are exhibiting normal variability.

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.

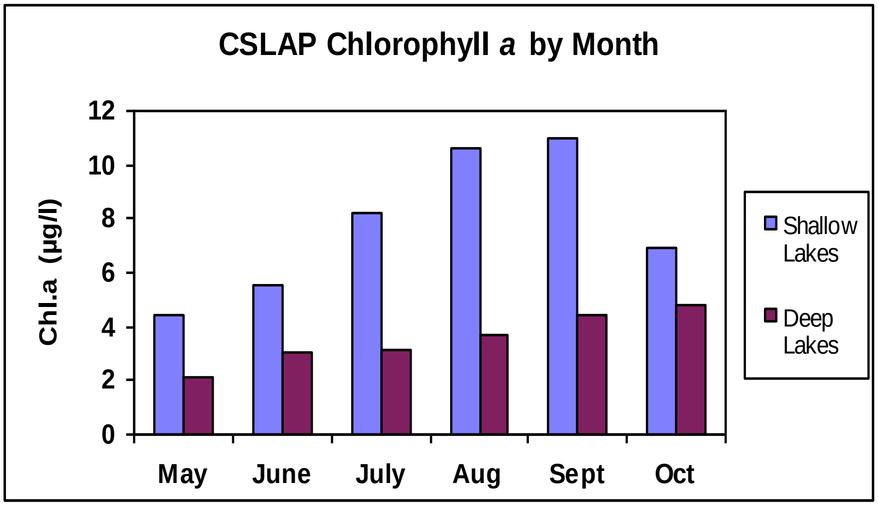


Figure 19c. *Chlorophyll a in Shallow (<20ft deep) and Deep CSLAP Lakes by Month*

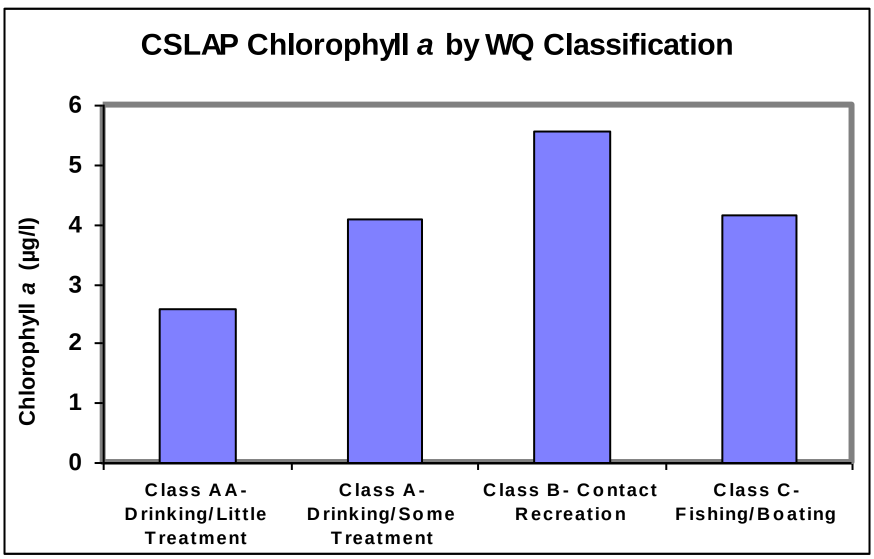


Figure 19d. *Chlorophyll a in CSLAP Lakes by Lake Use*

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).

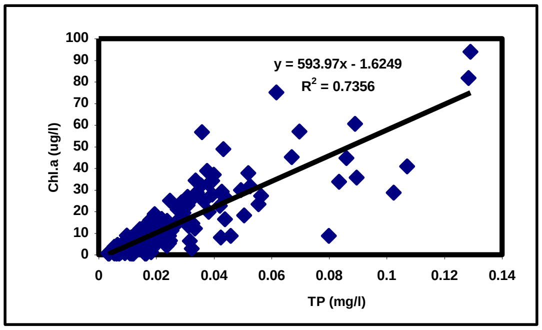
Lake-Use Variability:

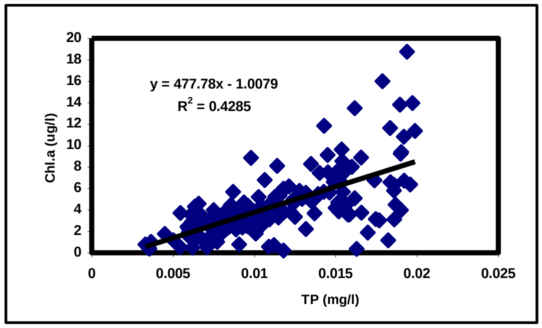
Chlorophyll readings are lower in lakes used for minimally treated potable water intakes (Class AA) and are higher for other lake uses. Although Class B waters are utilized for a "higher" lake use than Class C lakes (contact recreation versus non-contact recreation), these lakes actually have similar 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.

Detailed Discussion #8- Chlorophyll *a*

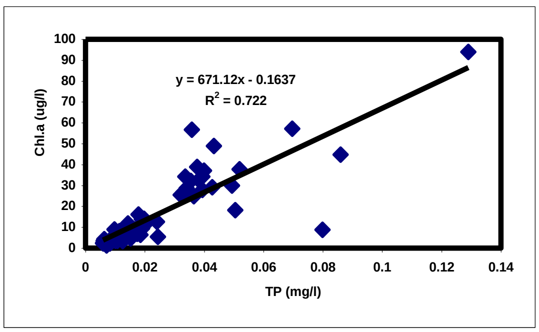
How closely connected are phosphorus and chlorophyll a?

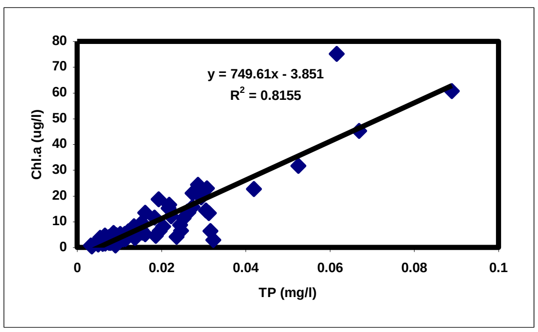
Discussion:





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.

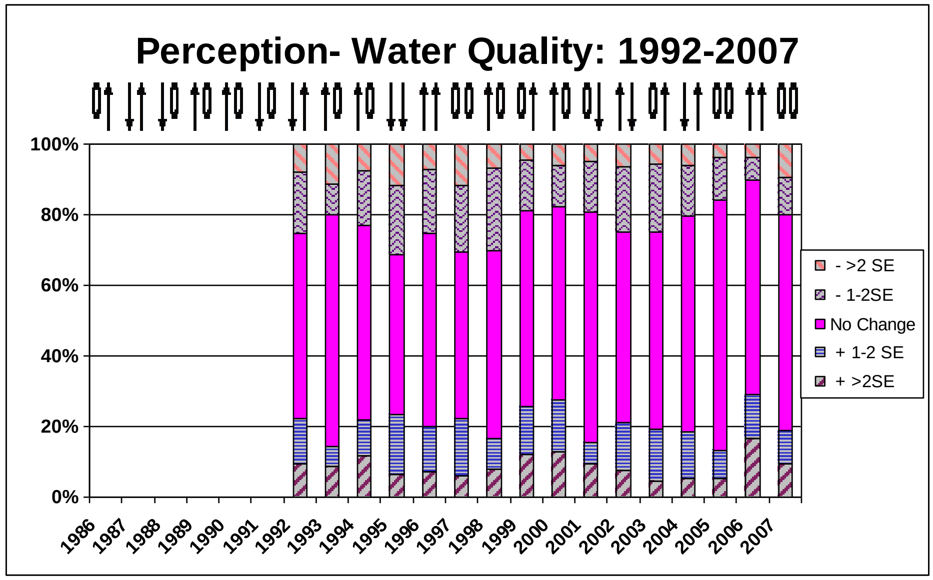


Figure 20a. *Annual Change from "Normal" Water-Quality Assessment in CSLAP Lakes (SE = Standard Error)*

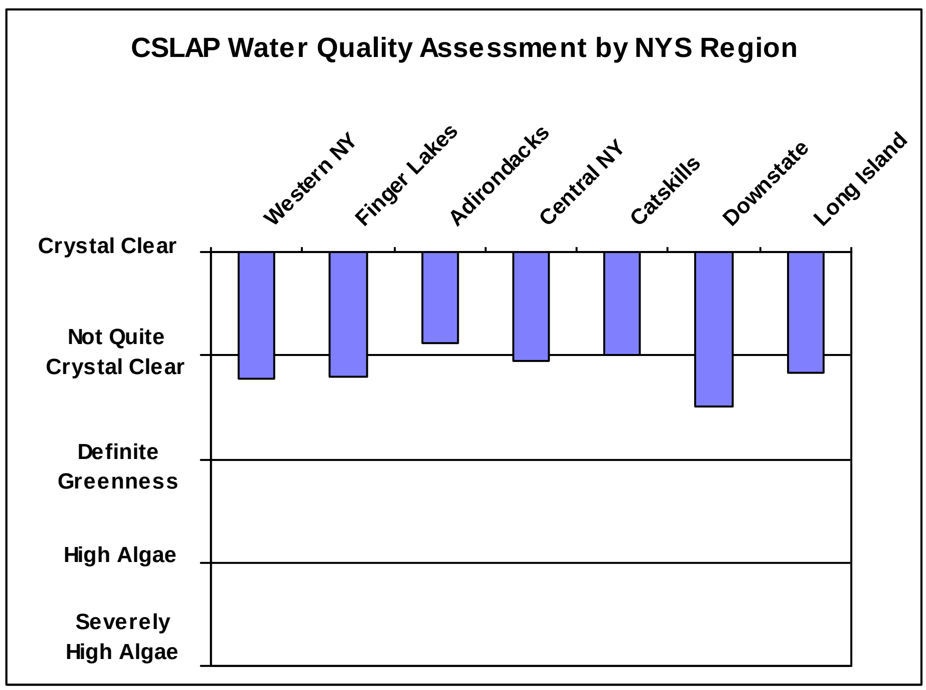


Figure 20b. *Water-Quality Assessment in CSLAP Lakes by NYS Region*

What 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.

What Happened at Schroon Lake in 2008?

Water-quality assessments were fairly stable and favorable at all times in 2008 in both sites, and were similar to those reported in previous years. No seasonal or long-term trends have been apparent. Water quality assessments are mostly comparable at both sampling sites.

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.

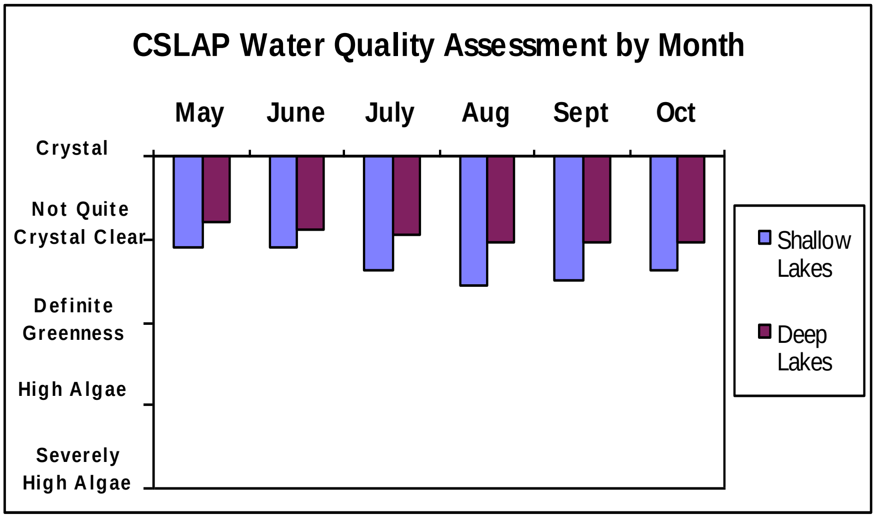


Figure 20c. *Water-Quality Assessment in Shallow (<20ft deep) and Deep CSLAP Lakes by Month*

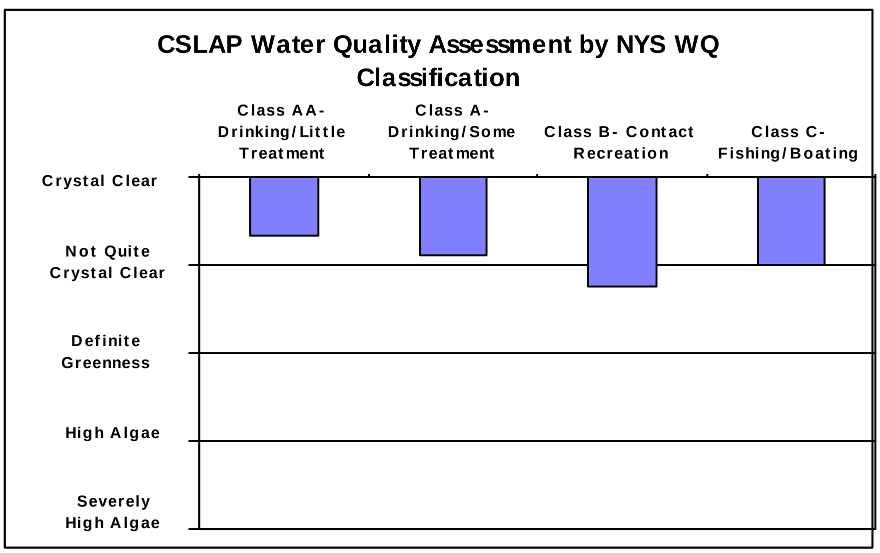


Figure 20d. *Water-Quality Assessment in CSLAP Lakes by Lake Use*

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:

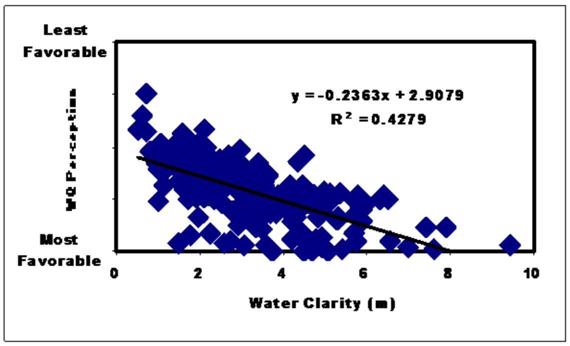
Water-quality assessments are more favorable in lakes used for potable water intakes (Class AA and Class A) and less favorable for other lake uses. Although Class B waters are utilized for a "higher" lake use than Class C lakes (contact recreation versus non-contact recreation), these lakes actually 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.

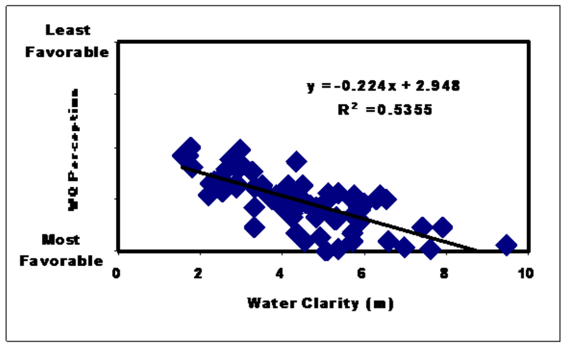
Detailed Discussion #9- Water quality assessments

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.

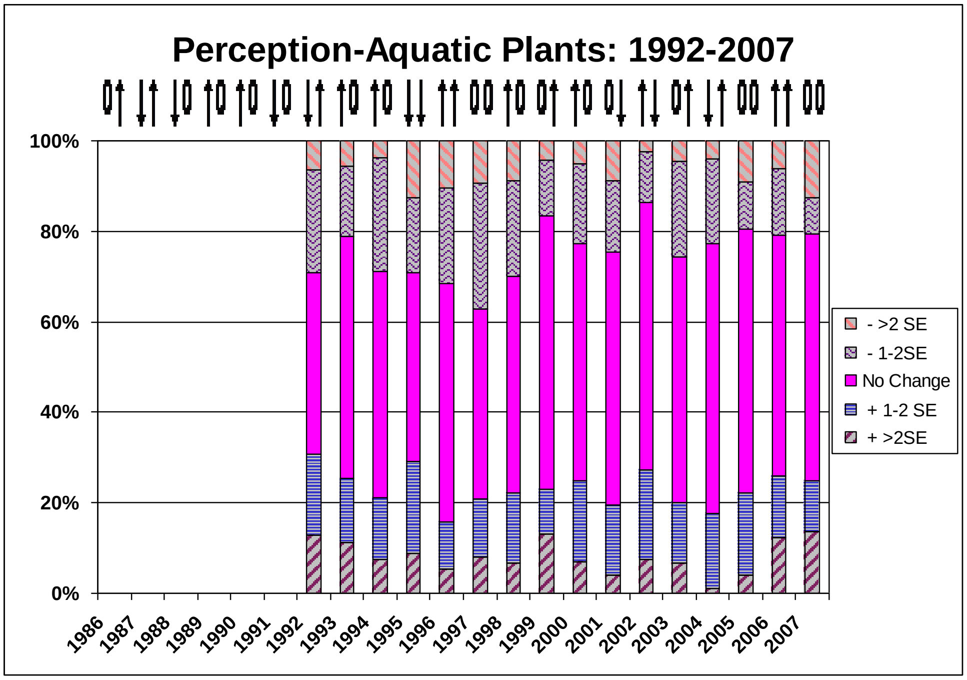


Figure 21a. *Annual Change from "Normal" Weed Assessment in CSLAP Lakes (SE = Standard Error)*

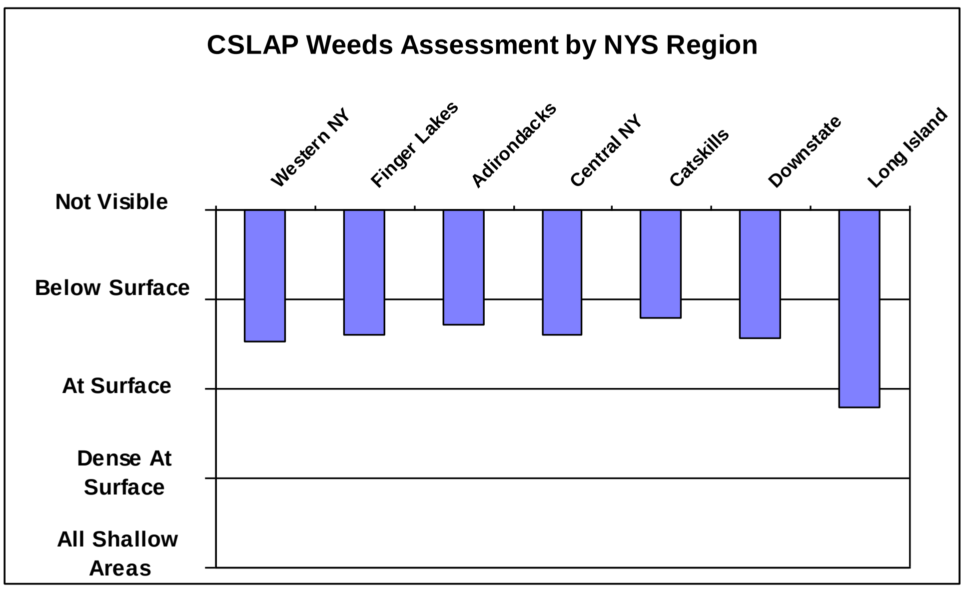


Figure 21b. *Weed Assessment in CSLAP Lakes by NYS Region*

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 Schroon Lake in 2008?

Aquatic plant coverage has been slightly greater at the south basin site than at the north basin site, although surface plant coverage in the evaluated areas is still very uncommon. No clear seasonal or long-term trends have been apparent, although plant coverage has been slightly higher at the south basin site since 2006.

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.

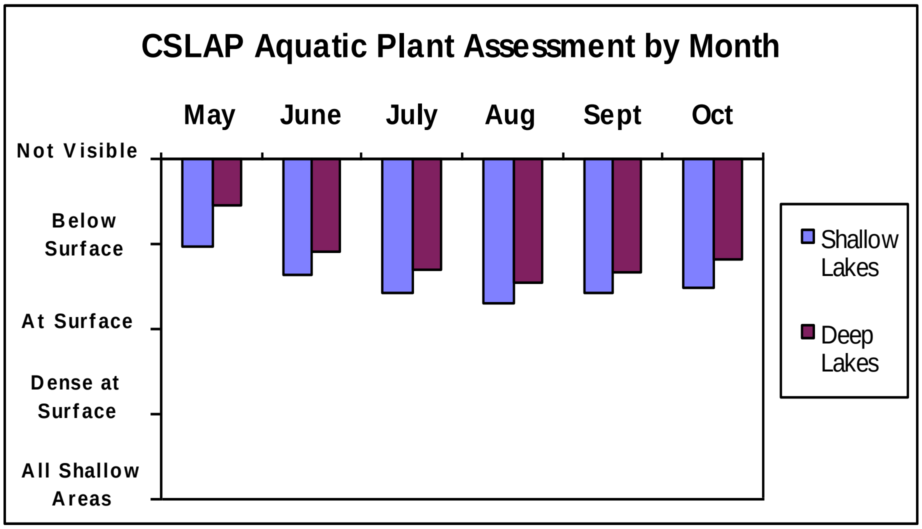


Figure 21c. *Weed Assessment in Shallow (<20ft deep) and Deep CSLAP Lakes by Month*

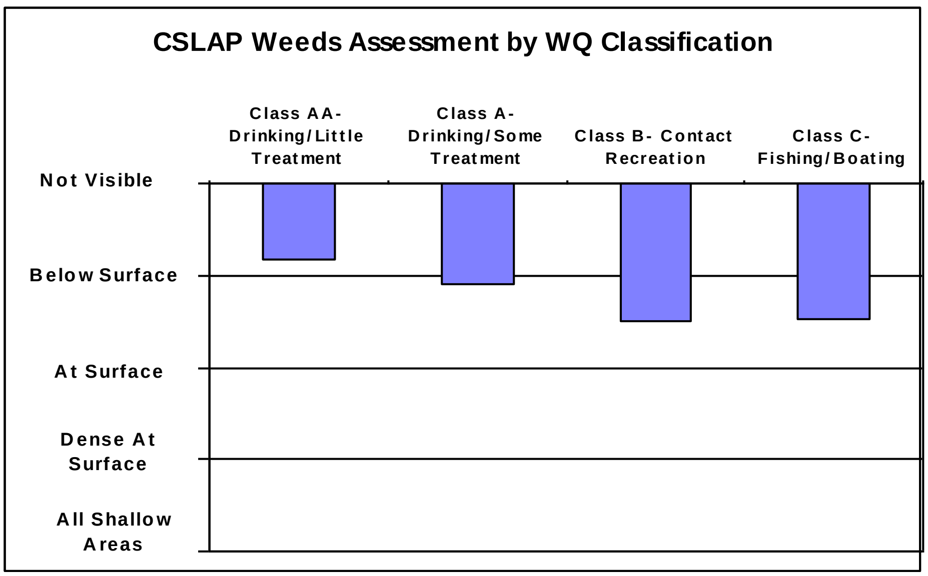


Figure 21d. *Weed Assessment in CSLAP Lakes by Lake Use*

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).

Detailed Discussion #10- Aquatic plant assessments

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

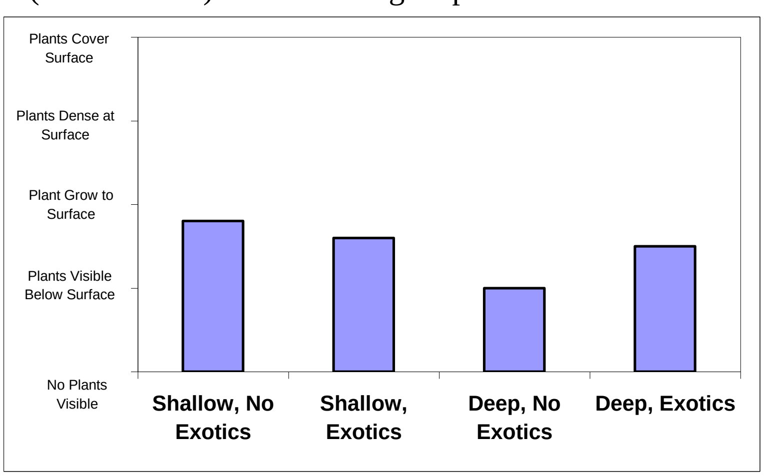
Discussion:

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.

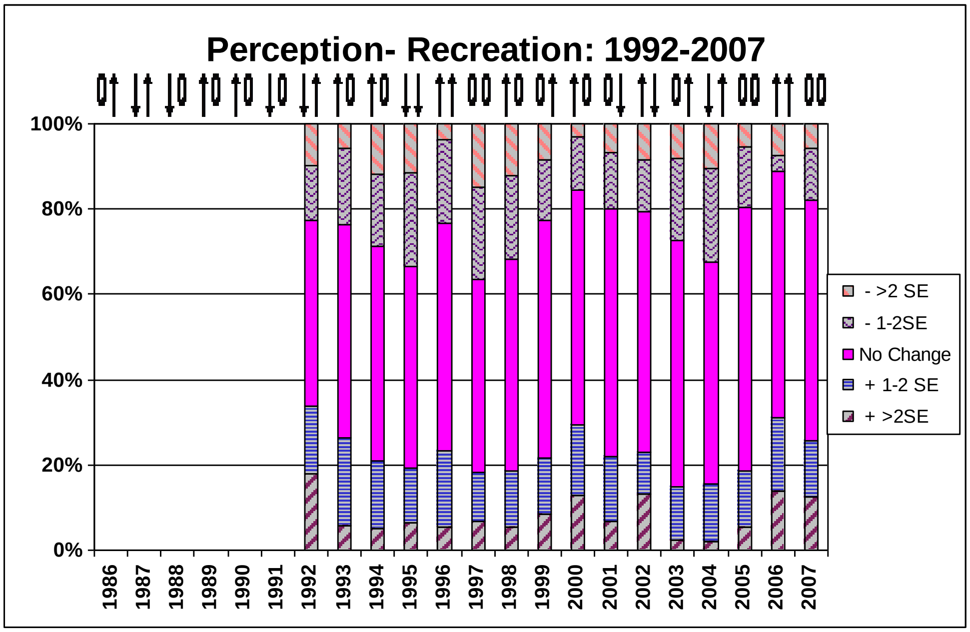


Figure 22a. *Annual Change from "Normal" Recreational Assessment in CSLAP Lakes (SE = Standard Error)*

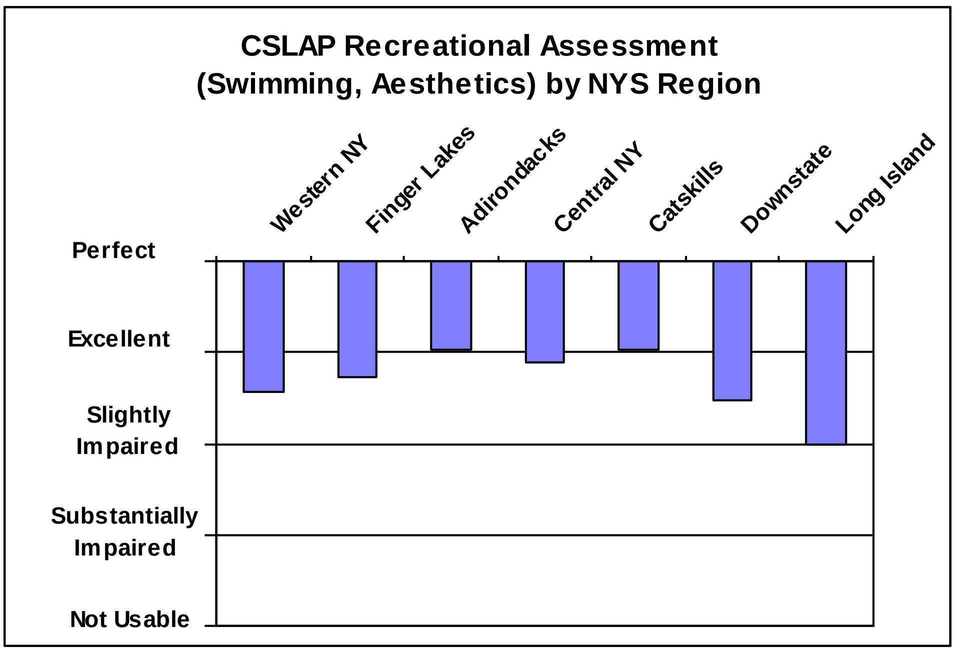


Figure 22b. *Recreational Assessment in CSLAP Lakes by NYS Region*

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 Schroon Lake in 2008?

Recreational assessments in 2008 were highly variable during the summer, in response to changes in weather conditions rather than changes in water quality assessments or changes in aquatic plant cover. These assessments are mostly comparable at the two sampling sites.

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.

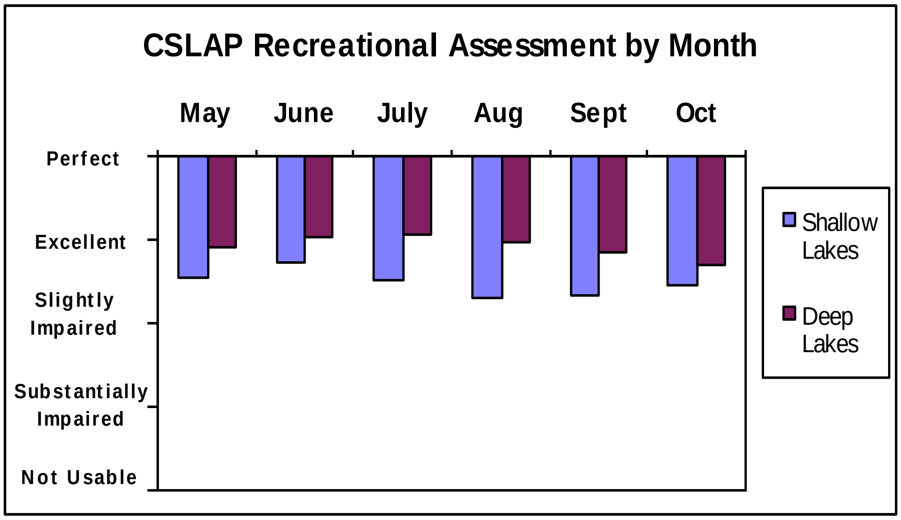


Figure 22c. *Recreational Assessment in Shallow (<20ft deep) and Deep CSLAP Lakes by Month*

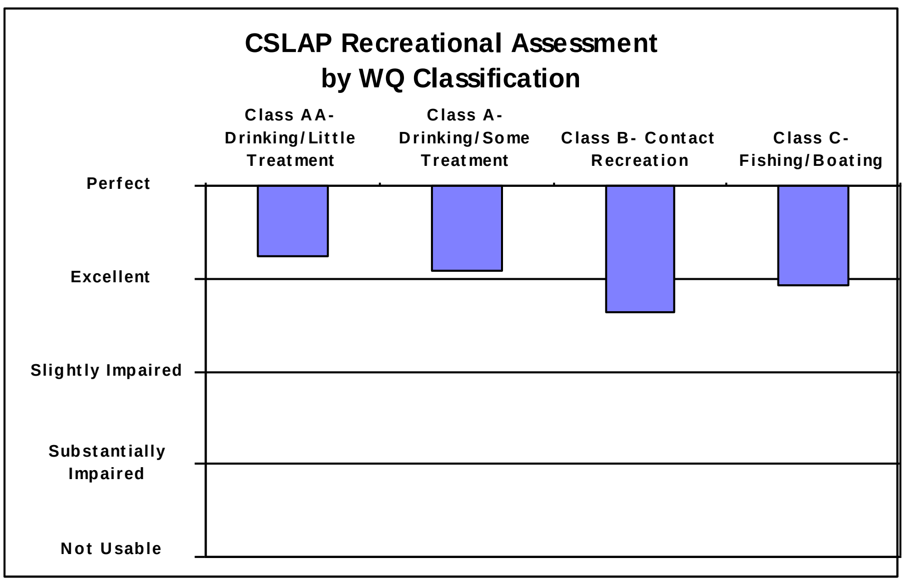


Figure 22d. *Recreational Assessment in CSLAP Lakes by Lake Use*

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).

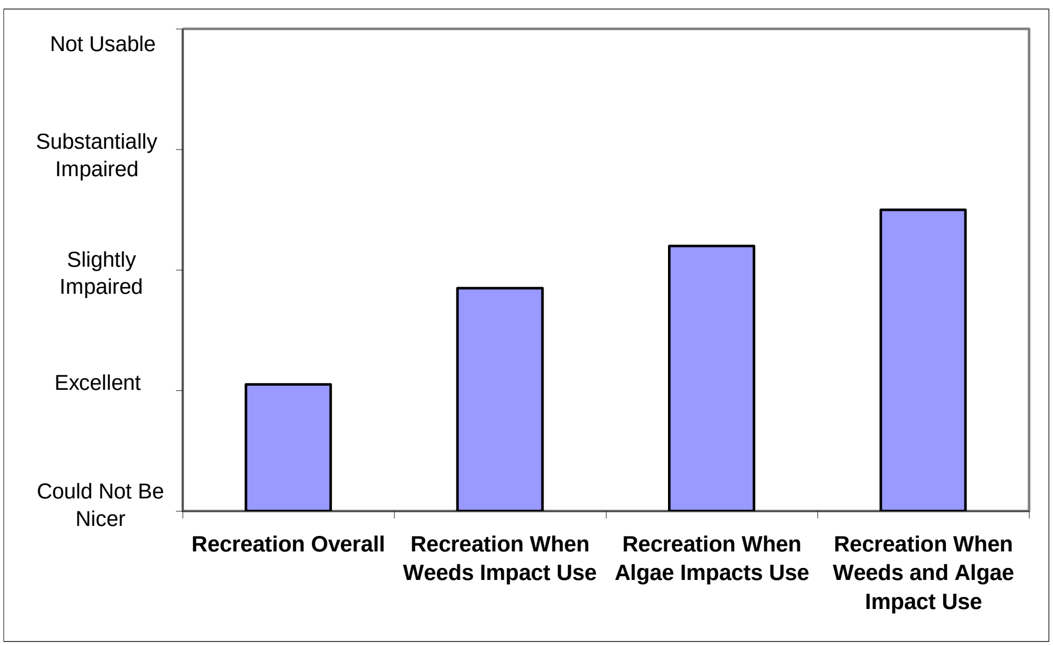
Detailed Discussion #11- Recreational assessments

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. Likewise, 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 SCHROON LAKE 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 Schroon Lake

Year	Min	Avg	Max	N	Parameter
1987-08	**2.25**	**4.22**	**10.00**	**92**	**CSLAP Zsd**
2008	4.00	5.17	7.10	8	CSLAP Zsd
2008	2.30	3.92	5.30	7	CSLAP Zsd-S
2006	2.60	2.97	3.70	7	CSLAP Zsd
2006	3.00	3.16	3.45	7	CSLAP Zsd-S
2005	2.25	3.16	4.45	8	CSLAP Zsd
2005	2.80	3.41	4.48	8	CSLAP Zsd-S
2005	4.82	4.82	4.82	1	AE Zsd
2005	4.63	4.63	4.63	1	AE Zsd-S
2004	3.40	5.07	10.00	8	CSLAP Zsd
2004	2.90	4.78	9.00	8	CSLAP Zsd-S
2004	4.57	4.57	4.57	1	AE Zsd
2004	3.96	3.96	3.96	1	AE Zsd-S
2003	2.75	3.73	5.54	8	CSLAP Zsd
2003	2.83	4.32	6.14	8	CSLAP Zsd-S
2003	5.79	5.79	5.79	1	AE Zsd
2003	4.88	4.88	4.88	1	AE Zsd-S
2002	3.06	4.19	8.50	8	CSLAP Zsd
1998	4.12	4.12	4.12	1	Fisheries Zsd
1997	2.80	3.95	5.06	3	CSLAP Zsd
1992	3.75	3.88	4.00	2	EMAP Zsd
1991	3.70	4.99	6.50	6	CSLAP Zsd
1991	5.95	5.95	5.95	1	TIME Zsd
1990	3.80	4.62	5.60	7	CSLAP Zsd
1989	3.10	4.08	4.90	8	CSLAP Zsd
1989	4.27	4.27	4.27	1	Fisheries Zsd
1988	4.30	5.07	5.75	7	CSLAP Zsd
1987	3.00	3.91	5.35	14	CSLAP Zsd
1984	3.51	3.51	3.51	1	Fisheries Zsd
1983	4.57	4.57	4.57	1	Fisheries Zsd
1982	3.00	3.00	3.00	1	LCI
1973	4.59	4.59	4.59	1	DEC
1972	3.50	3.50	3.50	1	DEC
1932	5.50	6.50	7.50	5	DEC
Year	Min	Avg	Max	N	Parameter
1987-08	**0.001**	**0.007**	**0.018**	**91**	**CSLAP Tot.P**
2008	0.005	0.007	0.008	8	CSLAP Tot.P
2008	0.002	0.011	0.059	8	CSLAP HypoTP
2008	0.004	0.008	0.026	8	CSLAP TP-S
2008	0.004	0.005	0.006	5	CSLAP HyTP-S
2006	0.009	0.012	0.016	7	CSLAP Tot.P
2006	0.004	0.008	0.013	7	CSLAP HypoTP
2006	0.005	0.009	0.011	7	CSLAP TP-S
2006	0.003	0.006	0.010	6	CSLAP HyTP-S
2005	0.008	0.011	0.018	8	CSLAP Tot.P
2005	0.010	0.027	0.038	6	CSLAP HypoTP
2005	0.006	0.014	0.021	8	CSLAP TP-S

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
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 Schroon Lake (cont)

Year	Min	Avg	Max	N	Parameter
1987-08	**0.001**	**0.007**	**0.018**	**91**	**CSLAP Tot.P**
2005	0.004	0.009	0.013	7	CSLAP HypoTP-S
2005	0.006	0.006	0.006	1	AE Tot.P
2005	0.019	0.019	0.019	1	AE HypoTP
2005	0.007	0.007	0.007	1	AE TP-S
2005	0.012	0.012	0.012	1	AE HypoTP-S
2004	0.003	0.006	0.011	8	CSLAP Tot.P
2004	0.003	0.005	0.007	8	CSLAP HypoTP
2004	0.003	0.004	0.007	8	CSLAP TP-S
2004	0.002	0.004	0.007	8	CSLAP HypoTP-S
2004	0.007	0.007	0.007	1	AE Tot.P
2004	0.004	0.004	0.004	1	AE HypoTP
2004	0.006	0.006	0.006	1	AE TP-S
2004	0.004	0.004	0.004	1	AE HypoTP-S
2003	0.004	0.006	0.007	7	CSLAP Tot.P
2003	0.002	0.004	0.007	8	CSLAP HypoTP
2003	0.004	0.004	0.006	8	CSLAP TP-S
2003	0.003	0.004	0.007	8	CSLAP HypoTP-S
2003	0.005	0.005	0.005	1	AE Tot.P
2003	0.008	0.008	0.008	1	AE HypoTP
2003	0.004	0.004	0.004	1	AE TP-S
2003	0.004	0.004	0.004	1	AE HypoTP-S
2002	0.002	0.006	0.007	7	CSLAP Tot.P
2002	0.000	0.004	0.007	8	CSLAP Hypo TP
1997	0.004	0.006	0.008	3	CSLAP Tot.P
1992	0.003	0.004	0.005	2	EMAP Tot.P
1991	0.003	0.007	0.010	6	CSLAP Tot.P
1991	0.006	0.006	0.006	1	TIME Tot.P
1990	0.003	0.005	0.009	7	CSLAP Tot.P
1989	0.003	0.005	0.008	8	CSLAP Tot.P
1988	0.001	0.004	0.006	7	CSLAP Tot.P
1987	0.001	0.006	0.009	15	CSLAP Tot.P
Year	Min	Avg	Max	N	Parameter
1987-08	**0.00**	**0.04**	**0.15**	**91**	**CSLAP NO3**
2008	0.00	0.03	0.13	8	CSLAP NO3
2008	0.01	0.02	0.04	7	CSLAP NO3-S
2006	0.03	0.05	0.10	6	CSLAP NO3
2006	0.03	0.05	0.10	7	CSLAP NO3-S
2005	0.01	0.02	0.03	7	CSLAP NO3
2005	0.01	0.02	0.04	8	CSLAP NO3-S
2005	0.01	0.01	0.01	1	AE NO3
2005	0.01	0.01	0.01	1	AE NO3-S
2004	0.01	0.04	0.13	8	CSLAP NO3
2004	0.03	0.19	0.28	8	CSLAP HypoNO3
2004	0.02	0.05	0.09	8	CSLAP NO3-S
2004	0.14	0.17	0.25	7	CSLAP HypoNO3-S
2004	0.01	0.01	0.01	1	AE NO3

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

Year	Min	Avg	Max	N	Parameter
1987-08	**0.00**	**0.04**	**0.15**	**91**	**CSLAP NO3**
2004	0.23	0.23	0.23	1	AE HypoNO3
2004	0.01	0.01	0.01	1	AE NO3-S
2004	0.17	0.17	0.17	1	AE HypoNO3-S
2003	0.00	0.03	0.08	8	CSLAP NO3
2003	0.10	0.19	0.24	8	CSLAP HypoNO3
2003	0.00	0.04	0.15	8	CSLAP NO3-S
2003	0.03	0.14	0.24	8	CSLAP HypoNO3-S
2003	0.01	0.01	0.01	1	AE NO3
2003	0.22	0.22	0.22	1	AE HypoNO3
2003	0.01	0.01	0.01	1	AE NO3-S
2003	0.13	0.13	0.13	1	AE HypoNO3-S
2002	0.00	0.04	0.10	8	CSLAP NO3
2002	0.14	0.17	0.23	8	CSLAP HypoNO3
1997	0.01	0.03	0.06	3	CSLAP NO3
1991	0.01	0.04	0.10	6	CSLAP NO3
1990	0.04	0.06	0.10	7	CSLAP NO3
1989	0.01	0.04	0.08	8	CSLAP NO3
1988	0.02	0.05	0.11	7	CSLAP NO3
1987	0.01	0.06	0.15	15	CSLAP NO3
Year	Min	Avg	Max	N	Parameter
2002-08	**0.00**	**0.03**	**0.20**	**45**	**CSLAP NH4**
2008	0.00	0.01	0.02	8	CSLAP NH4
2008	0.00	0.01	0.02	7	CSLAP NH4-S
2006	0.01	0.02	0.04	6	CSLAP NH4
2006	0.01	0.03	0.09	7	CSLAP NH4-S
2006	0.01	0.02	0.04	6	CSLAP NH4
2006	0.01	0.03	0.09	7	CSLAP NH4-S
2004	0.01	0.03	0.08	8	CSLAP NH4
2004	0.01	0.04	0.11	8	CSLAP HypoNH4
2004	0.01	0.02	0.07	8	CSLAP NH4-S
2004	0.01	0.02	0.03	7	CSLAP HypoNH4-S
2003	0.01	0.02	0.03	8	CSLAP NH4
2003	0.01	0.03	0.07	8	CSLAP HypoNH4
2003	0.01	0.01	0.03	8	CSLAP NH4-S
2003	0.00	0.01	0.02	8	CSLAP HypoNH4-S
2002	0.01	0.04	0.07	8	CSLAP NH4
2002	0.01	0.04	0.09	8	CSLAP HypoNH4
Year	Min	Avg	Max	N	Parameter
2002-08	**0.07**	**0.36**	**1.34**	**46**	**CSLAP TDN**
2008	0.15	0.19	0.32	8	CSLAP TDN
2008	0.17	0.21	0.27	7	CSLAP TDN-S
2006	0.25	0.50	0.67	6	CSLAP TDN
2006	0.27	0.49	0.66	7	CSLAP TDN-S
2005	0.13	0.25	0.35	8	CSLAP TDN
2005	0.15	0.23	0.33	8	CSLAP TDN-S

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

Year	Min	Avg	Max	N	Parameter
2002-08	**0.07**	**0.36**	**1.34**	**46**	**CSLAP TDN**
2005	0.26	0.26	0.26	1	AE TDN
2005	0.27	0.27	0.27	1	AE TDN-S
2004	0.19	0.55	1.34	8	CSLAP TDN
2004	0.09	0.41	0.98	8	CSLAP HypoTDN
2004	0.23	0.42	1.04	8	CSLAP TDN-S
2004	0.24	0.42	1.04	8	CSLAP HypoTDN-S
2004	0.17	0.17	0.17	1	AE TDN
2004	0.41	0.41	0.41	1	AE HypoTDN
2004	0.18	0.18	0.18	1	AE TDN-S
2004	0.27	0.27	0.27	1	AE HypoTDN-S
2003	0.07	0.22	0.29	8	CSLAP TDN
2003	0.03	0.33	0.63	8	CSLAP HypoTDN
2003	0.11	0.23	0.32	8	CSLAP TDN-S
2003	0.14	0.29	0.45	8	CSLAP HypoTDN-S
2003	0.23	0.23	0.23	1	AE TDN
2003	0.76	0.76	0.76	1	AE HypoTDN
2003	0.20	0.20	0.20	1	AE TDN-S
2003	0.30	0.30	0.30	1	AE HypoTDN-S
2002	0.31	0.46	1.01	8	CSLAP TDN
2002	0.41	0.51	0.66	8	CSLAP HypoTDN
Year	Min	Avg	Max	N	Parameter
2002-08	**5**	**62**	**311**	**44**	**CSLAP TN/TP**
2008	42	64	134	8	CSLAP TN/TP
2008	21	80	115	7	CSLAP TN/TP-S
2006	20	45	62	6	CSLAP TN/TP
2006	24	57	104	7	CSLAP TN/TP-S
2005	5	13	32	8	CSLAP TN/TP
2005	9	23	54	8	CSLAP TN/TP-S
2005	46	46	46	1	AE TN/TP
2005	41	41	41	1	AE TN/TP-S
2004	17	119	311	8	CSLAP TN/TP
2004	22	92	207	8	CSLAP HypoTN/TP
2004	46	111	301	8	CSLAP TN/TP-S
2004	64	113	291	8	CSLAP HypTN/TP-S
2004	24	24	24	1	AE TN/TP
2004	100	100	100	1	AE HypoTN/TP
2004	32	32	32	1	AE TN/TP-S
2004	69	69	69	1	AE HypoTN/TP-S
2003	12	40	76	7	CSLAP TN/TP
2003	5	90	195	8	CSLAP HypoTN/TP
2003	28	54	78	8	CSLAP TN/TP-S
2003	33	69	96	8	CSLAP HypTN/TP-S
2003	45	45	45	1	AE TN/TP
2003	96	96	96	1	AE HypoTN/TP
2003	49	49	49	1	AE TN/TP-S
2003	79	79	79	1	AE HypoTN/TP-S

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

Year	Min	Avg	Max	N	Parameter
1987-08	**3**	**16**	**35**	**91**	**CSLAP TColor**
2008	13	19	26	8	CSLAP TColor
2008	15	20	26	8	CSLAP Tcolor-S
2006	10	23	35	7	CSLAP TColor
2006	11	20	37	7	CSLAP Tcolor-S
2005	3	23	35	7	CSLAP TColor
2005	14	24	40	8	CSLAP Tcolor-S
2004	12	18	22	7	CSLAP TColor
2004	13	17	22	7	CSLAP Tcolor-S
2003	12	17	22	8	CSLAP TColor
2003	11	15	17	8	CSLAP Tcolor-S
2002	11	15	19	8	CSLAP TColor
1997	7	9	10	3	CSLAP TColor
1992	13	14	14	2	EMAP Tcolor
1991	9	11	15	6	CSLAP TColor
1991	8	8	8	1	TIME Tcolor
1990	14	16	19	7	CSLAP TColor
1989	9	14	17	8	CSLAP TColor
1988	5	8	15	7	CSLAP TColor
1987	6	13	17	15	CSLAP TColor
Year	Min	Avg	Max	N	Parameter
1987-08	**6.29**	**7.44**	**9.07**	**92**	**CSLAP pH**
2008	7.38	8.05	9.07	8	CSLAP pH
2008	6.98	7.76	8.30	8	CSLAP pH-S
2006	6.96	7.50	8.25	7	CSLAP pH
2006	7.27	7.75	8.40	7	CSLAP pH-S
2005	6.76	7.27	8.20	8	CSLAP pH
2005	6.83	7.33	8.00	8	CSLAP pH-S
2005	7.13	7.13	7.13	1	AE pH
2005	7.28	7.28	7.28	1	AE pH-S
2004	6.29	7.04	8.29	8	CSLAP pH
2004	6.25	6.93	7.77	8	CSLAP pH-S
2004	6.82	6.82	6.82	1	AE pH
2004	6.82	6.82	6.82	1	AE pH-S
2003	7.08	7.26	7.48	8	CSLAP pH
2003	6.97	7.22	7.44	8	CSLAP pH-S
2003	7.19	7.19	7.19	1	AE pH
2003	7.12	7.12	7.12	1	AE pH-S
2002	7.25	7.42	7.64	8	CSLAP pH
1997	6.89	7.31	7.53	3	CSLAP pH
1992	7.28	7.47	7.65	2	EMAP pH
1991	7.04	7.44	7.65	6	CSLAP pH
1991	7.68	7.68	7.68	1	TIME pH
1990	6.73	7.30	7.70	6	CSLAP pH
1989	7.41	7.56	7.77	8	CSLAP pH
1989	7.43	7.43	7.43	1	Fisheries pH
1988	7.58	7.77	7.93	7	CSLAP pH

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

Year	Min	Avg	Max	N	Parameter
1987-08	**6.29**	**7.44**	**9.07**	**92**	**CSLAP pH**
1987	6.91	7.35	7.87	15	CSLAP pH
1984	7.32	7.32	7.32	1	Fisheries pH
1982	6.40	6.40	6.40	1	LCI
1973	8.27	8.27	8.27	1	DEC
1972	7.50	7.50	7.50	1	DEC
1932	7.00	7.00	7.00	1	DEC
Year	Min	Avg	Max	N	Parameter
1987-08	**40**	**70**	**104**	**93**	**CSLAP Cond25**
2008	53	60	68	8	CSLAP Cond25
2008	58	67	79	8	CSLAP Cond25-S
2006	40	57	75	7	CSLAP Cond25
2006	37	60	74	7	CSLAP Cond25-S
2005	60	80	104	8	CSLAP Cond25
2005	64	74	90	8	CSLAP Cond25-S
2005	81	81	81	1	AE Cond25
2005	90	90	90	1	AE Cond25-S
2004	51	72	91	8	CSLAP Cond25
2004	61	71	85	8	CSLAP Cond25-S
2004	83	83	83	1	AE Cond25
2004	81	81	81	1	AE Cond25-S
2003	81	84	88	8	CSLAP Cond25
2003	72	79	86	8	CSLAP Cond25-S
2003	92	92	92	1	AE Cond25
2003	88	88	88	1	AE Cond25-S
2002	73	80	87	8	CSLAP Cond25
1997	68	70	72	3	CSLAP Cond25
1992	66	67	68	2	EMAP Cond25
1991	66	72	88	6	CSLAP Cond25
1991	63	63	63	1	TIME Cond25
1990	62	65	70	7	CSLAP Cond25
1989	64	68	71	8	CSLAP Cond25
1989	73	73	73	1	Fisheries Cond25
1988	65	72	80	7	CSLAP Cond25
1987	60	64	71	15	CSLAP Cond25
1984	62	62	62	1	Fisheries Cond25
1982	40	40	40	1	LCI
Year	Min	Avg	Max	N	Parameter
2002-08	**2.9**	**5.8**	**9.1**	**15**	**CSLAP Ca**
2008	4.0	4.9	5.9	8	CSLAP Ca
2008	4.3	5.1	6.0	8	CSLAP Ca-S
2006	5.8	5.9	6.0	2	CSLAP Ca
2006	5.0	5.4	5.7	2	CSLAP Ca-S
2005	2.9	4.0	5.1	2	CSLAP Ca
2005	5.9	6.1	6.3	2	CSLAP Ca-S
2005	5.9	5.9	5.9	1	AE Ca

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

Year	Min	Avg	Max	N	Parameter
2002-08	**2.9**	**5.8**	**9.1**	**15**	**CSLAP Ca**
2005	6.5	6.5	6.5	1	AE Ca-S
2004	9.1	9.1	9.1	1	CSLAP Ca
2004				0	CSLAP Ca-S
2004	6.2	6.2	6.2	1	AE Ca
2004	6.0	6.0	6.0	1	AE Ca-S
2003	6.2	6.6	6.9	2	CSLAP Ca
2003	6.7	7.6	8.4	2	CSLAP Ca-S
2003	4.7	4.7	4.7	1	AE Ca
2003	5.1	5.1	5.1	1	AE Ca-S
2002				0	CSLAP Ca
Year	Min	Avg	Max	N	Parameter
1987-08	**0.10**	**3.18**	**10.10**	**91**	**CSLAP Chl.a**
2008	0.10	0.32	0.80	8	CSLAP Chl.a
2008	0.10	0.24	0.71	8	CSLAP Chl.a-S
2006	0.39	2.32	3.41	7	CSLAP Chl.a
2006	0.41	2.44	3.91	7	CSLAP Chl.a-S
2005	1.49	3.05	5.51	8	CSLAP Chl.a
2005	1.17	2.40	4.85	8	CSLAP Chl.a-S
2005	3.60	3.60	3.60	1	AE Chl.a
2005	3.70	3.70	3.70	1	AE Chl.a-S
2004	0.60	2.48	3.92	8	CSLAP Chl.a
2004	0.40	1.75	3.30	8	CSLAP Chl.a-S
2004	5.30	5.30	5.30	1	AE Chl.a
2004	2.90	2.90	2.90	1	AE Chl.a-S
2003	0.46	2.14	4.61	8	CSLAP Chl.a
2003	0.49	2.01	3.15	8	CSLAP Chl.a-S
2003	5.00	5.00	5.00	1	AE Chl.a
2003	3.10	3.10	3.10	1	AE Chl.a-S
2002	0.95	2.52	3.47	7	CSLAP Chl.a
1997	2.50	3.00	3.48	3	CSLAP Chl.a
1992	2.80	3.35	3.90	2	EMAP Chl.a
1991	1.89	3.24	4.42	6	CSLAP Chl.a
1991	2.06	2.06	2.06	1	TIME Chl.a
1990	0.69	4.17	8.00	7	CSLAP Chl.a
1989	2.11	3.49	4.33	8	CSLAP Chl.a
1988	2.15	2.83	3.77	7	CSLAP Chl.a
1987	3.50	6.17	10.10	14	CSLAP Chl.a
1973	3.00	3.00	3.00	1	LCI Chl.a
Year	Min	Avg	Max	N	Parameter
1997-08	**1**	**1.6**	**3**	**50**	**QA**
2008	1	1.4	2	8	QA
2008	1	1.0	1	6	QA-S
2006	2	2.0	2	7	QA
2006	2	2.0	2	7	QA-S
2005	1	1.8	3	8	QA

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

Year	Min	Avg	Max	N	Parameter
1997-08	**1**	**1.6**	**3**	**50**	**QA**
2005	1	1.8	3	8	QA-S
2004	1	1.9	3	8	QA
2004	1	1.9	3	8	QA-S
2003	1	1.4	2	8	QA
2003	1	1.4	2	8	QA-S
2002	1	1.4	2	8	QA
1997	1	1.3	2	3	QA
Year	Min	Avg	Max	N	Parameter
1997-08	**1**	**1.3**	**2**	**49**	**QB**
2008	1	1.6	2	7	QB
2008	1	1.7	3	6	QB-S
2006	1	1.7	2	7	QB
2006	1	1.9	2	7	QB-S
2005	1	1.0	1	8	QB
2005	1	1.0	1	8	QB-S
2004	1	1.0	1	8	QB
2004	1	1.0	1	8	QB-S
2003	1	1.0	1	8	QB
2003	1	1.0	1	8	QB-S
2002	1	1.4	2	8	QB
1997	1	1.7	2	3	QB
Year	Min	Avg	Max	N	Parameter
1997-08	**1**	**2.1**	**5**	**50**	**QC**
2008	1	1.9	4	8	QC
2008	1	1.0	1	6	QC-S
2006	2	2.9	4	7	QC
2006	1	2.7	4	7	QC-S
2005	1	2.1	4	8	QC
2005	1	2.1	4	8	QC-S
2004	1	2.5	4	8	QC
2004	1	2.3	4	8	QC-S
2003	1	1.6	5	8	QC
2003	1	1.3	2	8	QC-S
2002	1	1.9	4	8	QC
1997	1	1.0	1	3	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 3a- Current and Historical Data Summaries for Schroon Lake-North
Eutrophication Indicators

Parameter	Year	Minimum	Average	Maximum
Zsd	2008	4.00	5.17	7.10
(meters)	All Years	2.25	4.22	10.00
Parameter	**Year**	**Minimum**	**Average**	**Maximum**
Phosphorus	2008	0.005	0.007	0.008
(mg/l)	All Years	0.001	0.007	0.018
Parameter	**Year**	**Minimum**	**Average**	**Maximum**
Chl.a	2008	0.10	0.32	0.80
(µg/l)	All Years	0.10	3.18	10.10

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	Higher than Normal	Oligotrophic	No	0
(meters)	All Years			Mesotrophic		0
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	Within Normal Range	Yes	Oligotrophic	No	0
(mg/l)	All Years			Oligotrophic		0
Parameter	**Year**	**Was 2008 Algae the Highest or Lowest on Record?**	**Was 2008 a Typical Year?**	**Trophic Category**	**Chl.a Changing?**	
Chl.a	2008	Lowest at Times	Yes	Oligotrophic	Decreasing?	
(µg/l)	All Years			Mesotrophic		

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

TABLE 3b- Current and Historical Data Summaries for Schroon Lake-South
Eutrophication Indicators

Parameter	Year	Minimum	Average	Maximum
Zsd	2008	2.30	3.92	5.30
(meters)	All Years	2.30	3.94	9.00
Parameter	**Year**	**Minimum**	**Average**	**Maximum**
Phosphorus	2008	0.004	0.008	0.026
(mg/l)	All Years	0.003	0.008	0.026
Parameter	**Year**	**Minimum**	**Average**	**Maximum**
Chl.a	2008	0.10	0.24	0.71
(µg/l)	All Years	0.10	1.75	4.85

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	Lowest at Times	Yes	Mesotrophic	No	0
(meters)	All Years			Mesotrophic		0
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	Highest at Times	Yes	Oligotrophic	No	13
(mg/l)	All Years			Oligotrophic		5
Parameter	**Year**	**Was 2008 Algae the Highest or Lowest on Record?**	**Was 2008 a Typical Year?**	**Trophic Category**	**Chl.a Changing?**	
Chl.a	2008	Lowest at Times	Yes	Oligotrophic	No	
(µg/l)	All Years			Oligotrophic		

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 Schroon Lake is a *mesoligotrophic*, or moderately to highly unproductive lake, based on Secchi disk transparency (*mesotrophic)*, chlorophyll *a* and total phosphorus readings (*oligotrophic*). Schroon Lake was probably about as productive in 2008 as in the typical CSLAP sampling season. Water clarity readings were higher than normal in the north basin and close to normal in the south basin, and chlorophyll *a* readings were lower than normal. However, total phosphorus readings were close to the long-term average for the lake. Algae levels have generally been lower and phosphorus readings have been higher in the last few years, and it is likely that the small variability from sample to sample and year to year has been within the normal range for the lake. There is only a weak correlation between changes in clarity and algae, and between phosphorus and algae is weaker. However, these data suggest that phosphorus is the limiting nutrient for algae growth, and suggest that any efforts to prevent algal blooms and maintain or improve water clarity need to address nutrient (phosphorus) inputs to the lake.

Lake productivity has not exhibited any clear seasonal trends during the summer at either site. This may be consistent with deepwater phosphorus levels that are similar to, and follow identical seasonal patterns of, those at the lake surface. Phosphorus readings usually fall below the state guidance value for lakes used for contact recreation (swimming), and as a result, Secchi disk transparency readings never fail to reach the minimum recommended water clarity for swimming beaches (= 1.2 meters).

The trophic conditions are comparable at both sampling sites.

TABLE 4a- Current and Historical Data Summaries for Schroon Lake-North (cont.)

Other Water-Quality Indicators

Parameter	**Year**	**Minimum**	**Average**	**Maximum**
Nitrate	2008	0.00	0.03	0.13
(mg/l)	All Years	0.00	0.04	0.15
Parameter	**Year**	**Minimum**	**Average**	**Maximum**
NH4	2008	0.00	0.01	0.02
(mg/l)	All Years	0.00	0.03	0.20
Parameter	**Year**	**Minimum**	**Average**	**Maximum**
TDN	2008	0.15	0.19	0.32
(mg/l)	All Years	0.07	0.36	1.34
Parameter	**Year**	**Minimum**	**Average**	**Maximum**
True Color	2008	13	19	26
(ptu)	All Years	3	16	35
Parameter	**Year**	**Minimum**	**Average**	**Maximum**
pH	2008	7.38	8.05	9.07
(std units)	All Years	6.29	7.44	9.07
Parameter	**Year**	**Minimum**	**Average**	**Maximum**
Conductivity	2008	53	60	68
(µmho/cm)	All Years	40	70	104
Parameter	**Year**	**Minimum**	**Average**	**Maximum**
Calcium	2008	4.0	4.9	5.9
(mg/l)	All Years	2.9	5.8	9.1

TABLE 4a- Current and Historical Data Summaries for Schroon Lake-North (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	Decreasing?	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	Lowest at Times	Lower Than Normal	No	No	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	Within Normal Range	Lower Than Normal	No	No	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	Increasing?		
(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	Highest at Times	Higher than Normal	Yes	No	13	0
(std units)	All Years			Yes		1	3
Parameter	**Year**	**Was 2008 Conductivity Highest or Lowest on Record?**	**Was 2008 a Typical Year?**	**Relative Hardness**	**Conductivity Changing?**		
Conductivity	2008	Within Normal Range	Lower Than Normal	Softwater	No		
(µmho/cm)	All Years			Softwater			
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	No	No		
(mg/l)	All Years			No			

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 4b- Current and Historical Data Summaries for Schroon Lake-South (cont.)

Other Water-Quality Indicators

Parameter	Year	Minimum	Average	Maximum
Nitrate	2008	0.01	0.02	0.04
(mg/l)	All Years	0.00	0.03	0.15
Parameter	**Year**	**Minimum**	**Average**	**Maximum**
NH4	2008	0.00	0.01	0.02
(mg/l)	All Years	0.00	0.02	0.09
Parameter	**Year**	**Minimum**	**Average**	**Maximum**
TDN	2008	0.17	0.21	0.27
(mg/l)	All Years	0.11	0.31	1.04
Parameter	**Year**	**Minimum**	**Average**	**Maximum**
True Color	2008	15	20	26
(ptu)	All Years	11	19	40
Parameter	**Year**	**Minimum**	**Average**	**Maximum**
pH	2008	6.98	7.76	8.30
(std units)	All Years	6.25	7.39	8.40
Parameter	**Year**	**Minimum**	**Average**	**Maximum**
Conductivity	2008	58	67	79
(µmho/cm)	All Years	37	70	90
Parameter	**Year**	**Minimum**	**Average**	**Maximum**
Calcium	2008	4.3	5.1	6.0
(mg/l)	All Years	4.3	6.0	8.4

These data indicate Schroon Lake is a weakly to moderately colored, circumneutral (near neutral pH) to slightly alkaline lake with low nitrate, ammonia, and total nitrogen readings, and soft water. Water transparency readings are more affected by algae than water color, and latter has increased only slightly in Schroon Lake in recent years, less so than in many other CSLAP lakes over the last seven years. Nitrogen readings are low and typical of lakes with rare to occasional algal blooms. The nitrogen-to-phosphorus ratios indicate that algae growth is controlled by phosphorus. Conductivity readings are indicative of lakes with soft water, and conductivity has decreased in the last few years after increasing prior to the mid-2000s. pH readings are typical of moderately buffered lakes, and these readings only rarely fall outside the state water quality standards. Calcium levels are well below the threshold found to support zebra mussels, which have not been found in the lake.

Most of the non-trophic indicators have not exhibited any longer-term changes. Color readings have increased slightly over the last twenty-two years, while nitrate readings have decreased. It is not known if this change has been associated with wetter weather, active management of nutrient sources, or normal variability. The rise in color was mirrored in many other CSLAP lakes and may be due to wetter weather or the 2002 change in laboratories. The drop in nitrate may reflect the reduced impact of snowpack meltwater or the (federal Clean Air Act) reductions in atmospheric nitrous oxides.

TABLE 4b- Current and Historical Data Summaries for Schroon Lake-South (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	Lowest at Times	Lower Than Normal	No	No	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	Within Normal Range	Lower Than Normal	No	No	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	Increasing?		
(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	Within Normal Range	Yes	Yes	No	0	0
(std units)	All Years			Yes		0	5
Parameter	**Year**	**Was 2008 Conductivity Highest or Lowest on Record?**	**Was 2008 a Typical Year?**		**Conductivity Changing?**		
Conductivity	2008	Within Normal Range	Yes		No		
(µmho/cm)	All Years						
Parameter	**Year**	**Was 2008 Calcium Highest or Lowest on Record?**	**Was 2008 a Typical Year?**	**Support Zebra Mussels?**	**Calcium Changing?**		
Calcium	2008	Lowest at Times	Yes	No	No		
(mg/l)	All Years			No			

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 5a- Current and Historical Data Summaries for Schroon Lake-North

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

Parameter	Year	Minimum	Average	Maximum
QA	2008	1	1.4	2
(Clarity)	All Years	1	1.6	3
Parameter	**Year**	**Minimum**	**Average**	**Maximum**
QB	2008	1	1.6	2
(Plants)	All Years	1	1.3	2
Parameter	**Year**	**Minimum**	**Average**	**Maximum**
QC	2008	1	1.9	4
(Recreation)	All Years	1	2.1	5

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	Highest on Record	Yes	No	0	0	0	0
(Clarity)	All Years				4	0	0	0
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	No	0	0	0	0
(Plants)	All Years				0	0	0	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	Degrading?	25	13		
(Recreation)	All Years				32	12		

TABLE 5b- Current and Historical Data Summaries for Schroon Lake-South

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

Parameter	Year	Minimum	Average	Maximum
QA	2008	1	1.0	1
(Clarity)	All Years	1	1.6	3
Parameter	**Year**	**Minimum**	**Average**	**Maximum**
QB	2008	1	1.7	3
(Plants)	All Years	1	1.3	3
Parameter	**Year**	**Minimum**	**Average**	**Maximum**
QC	2008	1	1.0	1
(Recreation)	All Years	1	1.9	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	Highest on Record	More favorable	No	0	0	0	0
(Clarity)	All Years				5	0	0	0
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	No	17	0	0	0
(Plants)	All Years				3	0	0	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	More favorable	No	0	0		
(Recreation)	All Years				30	8		

Recreational assessments in Schroon Lake were again mostly favorable in 2008, consistent with highly favorable water quality assessments and the lack of problems with nuisance weeds in the evaluated areas. Schroon Lake is most often described as “crystal clear” to “not quite crystal clear.” These assessments are slightly more favorable than in other lakes with similar water clarity readings. Aquatic plants rarely grow to the lake surface in the evaluated areas. Plant coverage was slightly higher than normal in 2008, probably normal variability.

The lake is usually described as “excellent” for most recreational uses, with most recreational impacts due to poor weather. These assessments are more favorable than expected given the water quality conditions and mostly subsurface plant growth, but are typical of other “crystal clear” lakes without significant problems with nuisance weeds, at least when weather conditions are favorable. Recreational assessments improve during the summer, as weather conditions improve, and these assessments are comparable at both sites.

Schroon Lake has been described by the CSLAP sampling volunteers as “slightly” impaired during 32% of the north basin and 30% of the south basin CSLAP sampling sessions, and “substantially” impaired 12% (north) and 8% (south) of the time. Neither slightly nor substantially impaired conditions have been linked to excessive algae or excessive weeds.

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

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

Figures 23 and 24 compare data for the measured eutrophication parameters for Schroon Lake in 2008 and since CSLAP sampling began at Schroon Lake. 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.

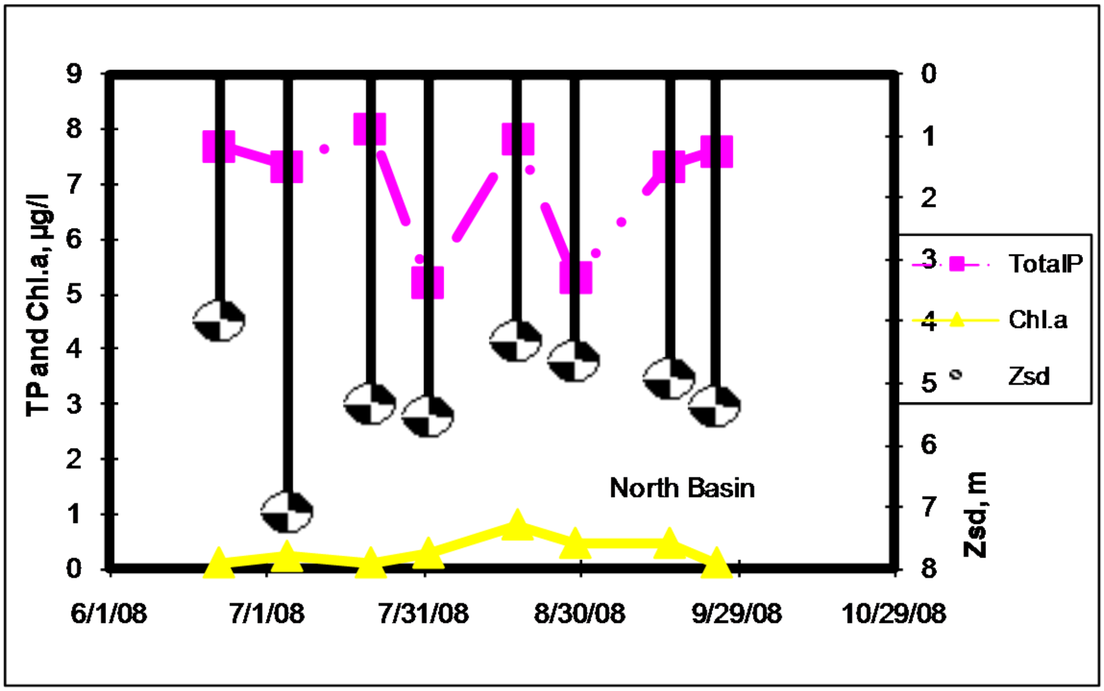


Figure 23a. 2008 Eutrophication Data for Schroon Lake-North

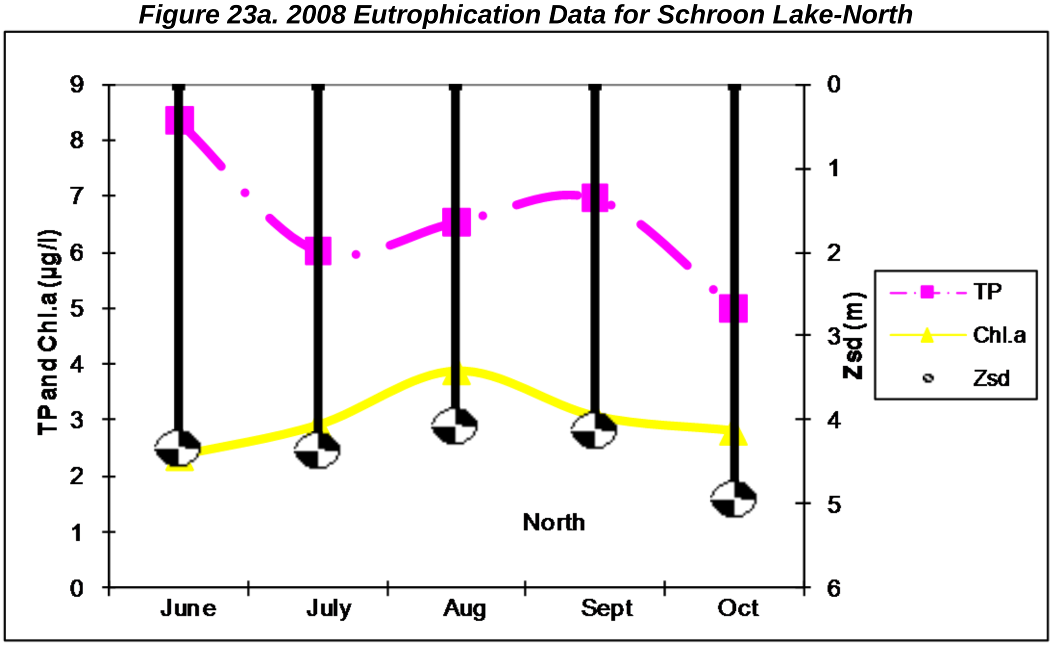


Figure 24a- Eutrophication Data in a Typical (Monthly Mean) Year for Schroon Lake-N

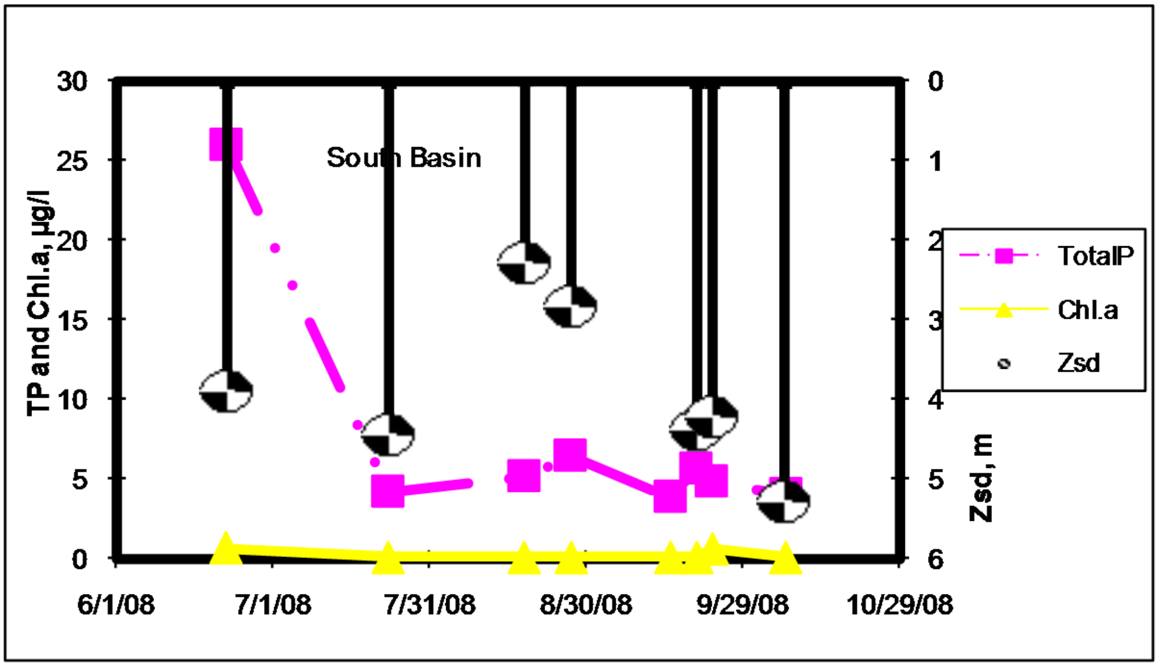


Figure 23b. 2008 Eutrophication Data for Schroon Lake-South

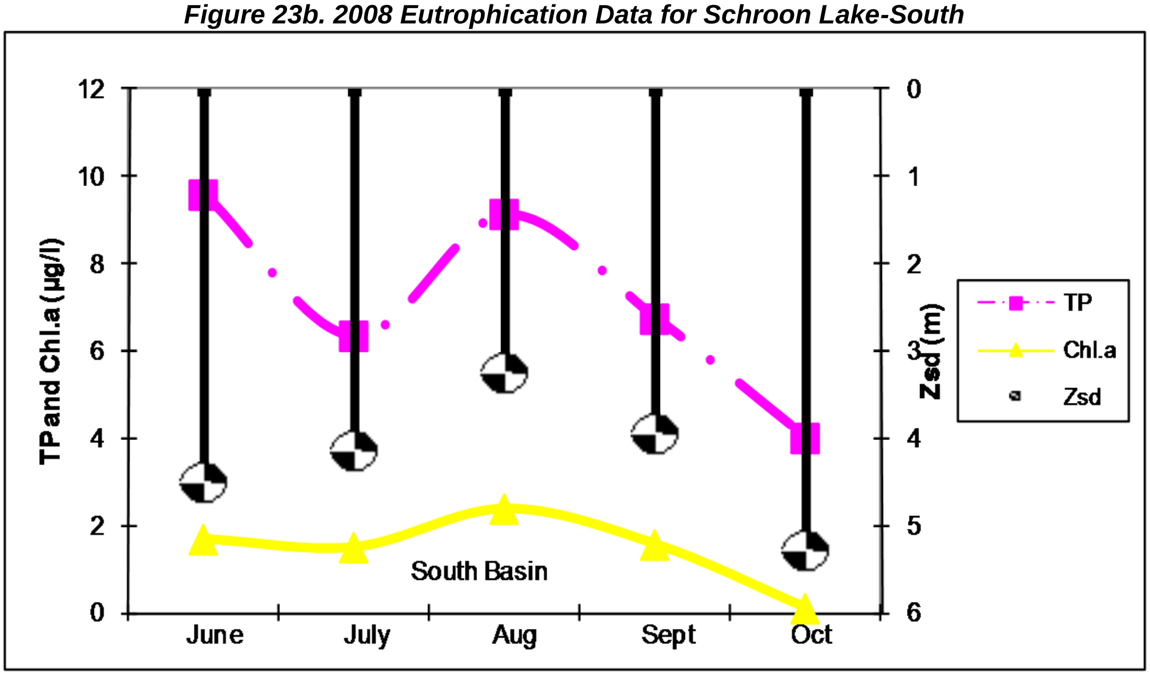


Figure 24b- Eutrophication Data in a Typical (Monthly Mean) Year for Schroon Lake-S

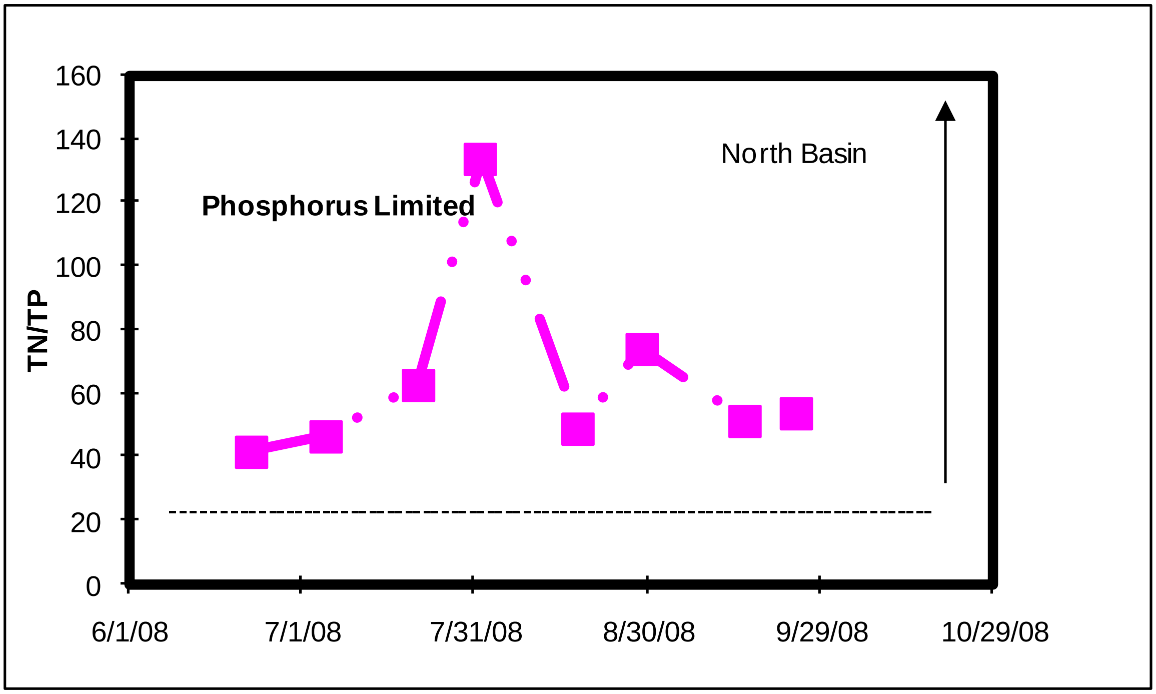


Figure 25a. 2008 Nitrogen-to-Phosphorus Ratios for Schroon Lake-North

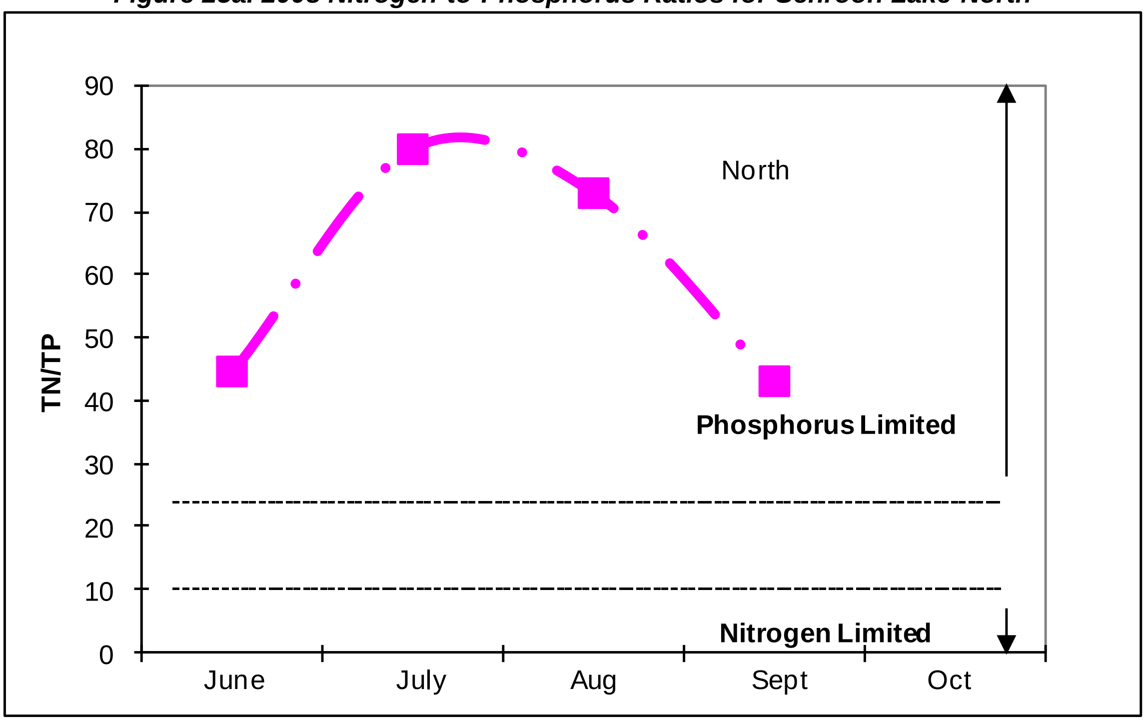


Figure 26a- Nitrogen–to-Phosphorus Ratios in a Typical (Monthly Mean) Year for Schroon Lake-North

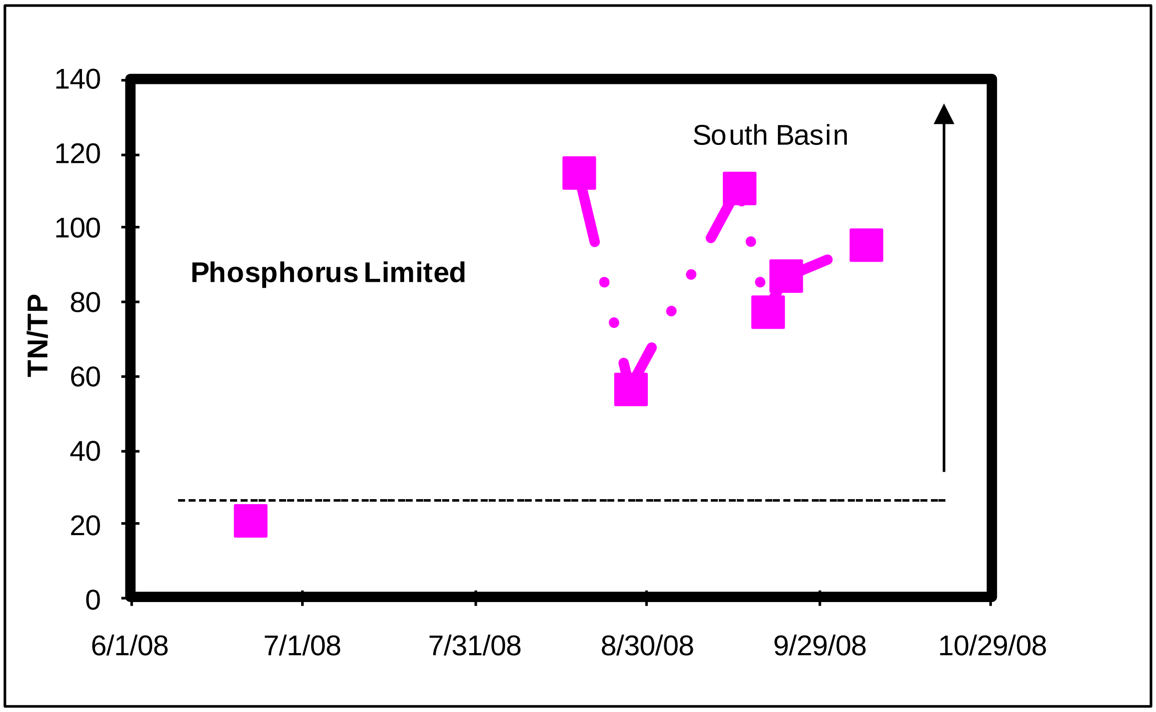


Figure 25b. 2008 Nitrogen-to-Phosphorus Ratios for Schroon Lake-South

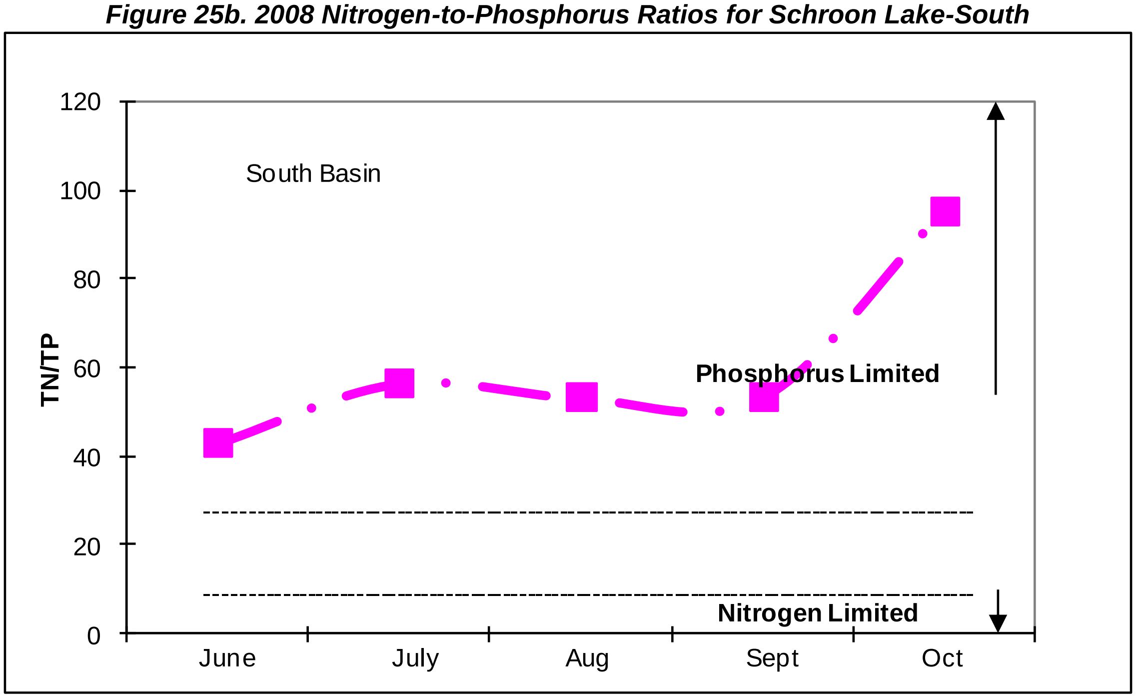


Figure 26b- Nitrogen–to-Phosphorus Ratios in a Typical (Monthly Mean) Year for Schroon Lake-South

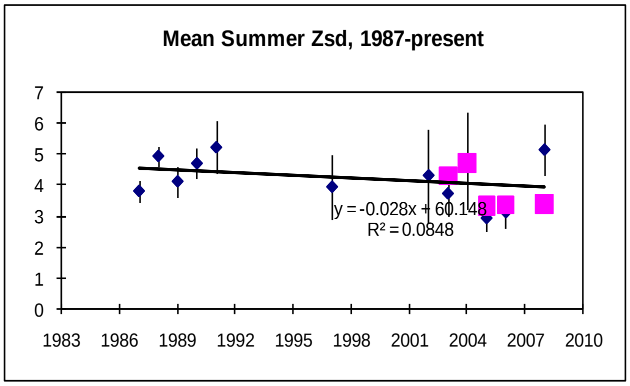


Figure 27. Annual Average Summer Water Clarity for Schroon Lake

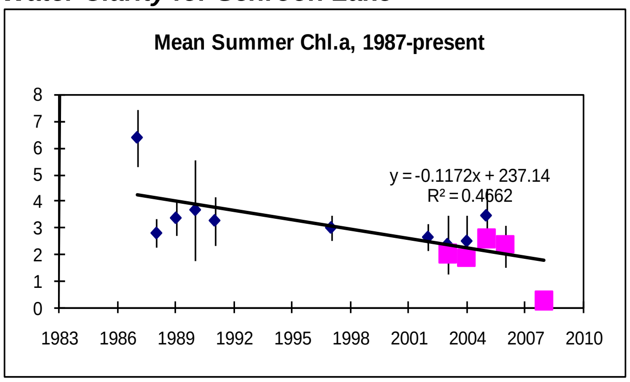


Figure 28. Annual Average Summer Chlorophyll a for Schroon Lake

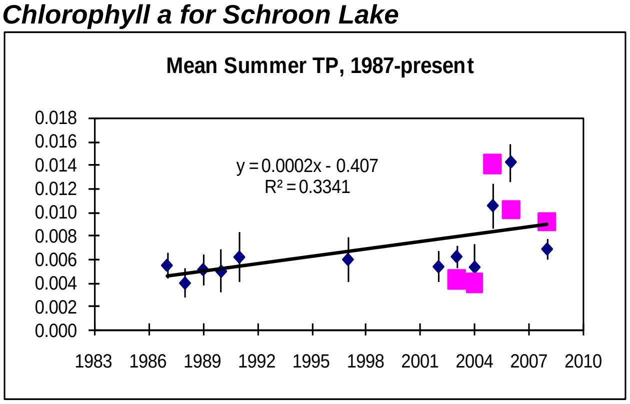


Figure 29. Annual Average Summer Total Phosphorus for Schroon Lake

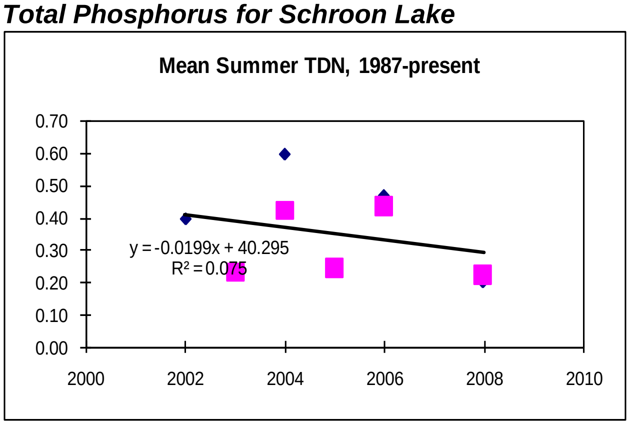


Figure 30. Annual Average Summer Total Nitrogen for Schroon Lake

Annual Averages, 1987-2008

Wettest Years: 1990,‘89,’03,‘04,’05,’06,’08
Driest Years: 1988
Highest Clarity: 2008 (N), 1991, 2004
Lowest Clarity: 2005, 2006
Long Term Trend?: None apparent
Discussion: Water transparency readings varied slightly from 1987 to 2008, with no apparent long-term trends. There does not appear to be a connection between changes in weather and water clarity, and these readings are mostly comparable in both basins.

Wettest Years: 1990,‘89,’03,‘04,’05,’06,’08
Driest Years: 1988
Highest Chl.a: 1987, 1990, 2005
Lowest Chl.a: 2008, 2003, 2004
Long Term Trend?: Decreasing?
Discussion: Chlorophyll *a* readings have been lower in the last few years, despite higher phosphorus readings over the same period. These readings have been mostly comparable but slightly lower in the south basin than in the north basin.

Wettest Years: 1990,‘89,’03,‘04,’05,’06,’08
Driest Years: 1988
Highest TP: 2006 (N), 2005 (S)
Lowest TP: 1988, 1987, 1990, 1989
Long Term Trend?: Increasing?
Discussion: Phosphorus readings have been higher in the last three years than in previous sampling seasons, although algae levels have been lower than normal over this period. It is not known if this indicates less (biologically) available phosphorus in the surface waters.

Wettest Years: 1990,‘89,’03,‘04,’05,’06,’08
Driest Years: 1988
Highest Total N: 2004, 2006
Lowest Total N: 2008, 2003, 2005
Long Term Trend?: None apparent
Discussion: Total nitrogen readings have varied slightly from year to year in a manner that does not appear to be statistically significant. There does not appear to be a connection between precipitation and total nitrogen. These readings are comparable at both sampling sites.

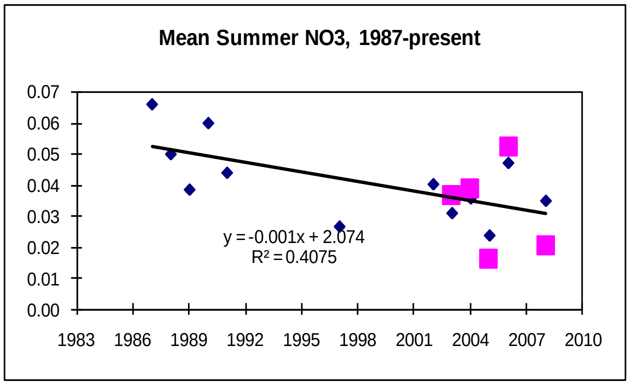


Figure 31. Annual Average Summer Nitrate for Schroon Lake

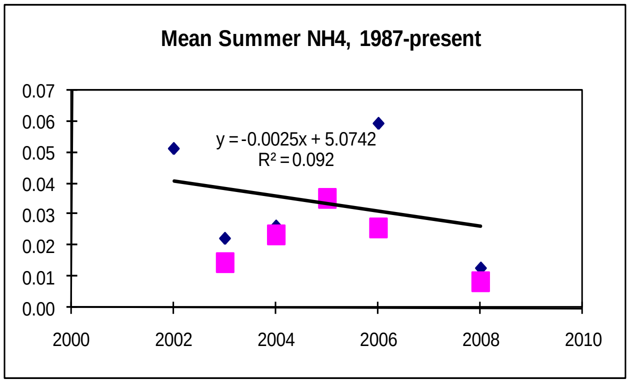


Figure 32. Annual Average Summer Ammonia for Schroon Lake

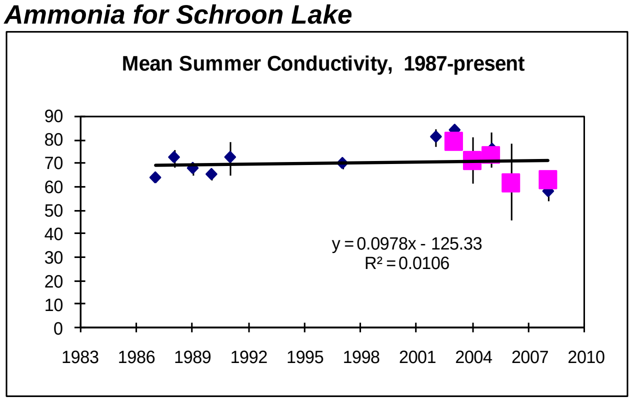


Figure 33. Annual Average Summer Conductivity for Schroon Lake

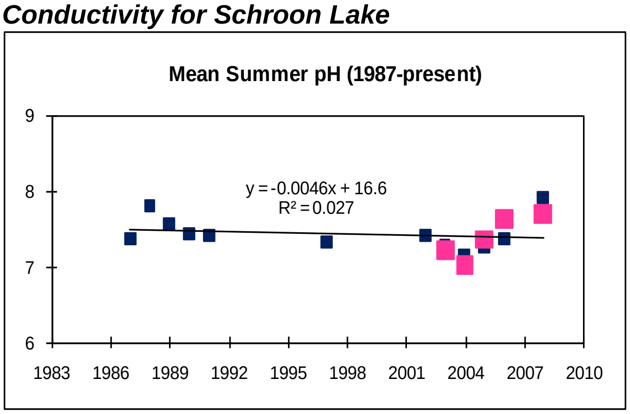


Figure 34. Annual Average Summer pH for Schroon Lake

Annual Averages, 1987-2008

Wettest Years: 1990,'89,'03,'04,'05,'06,'08
Driest Years: 1988
Highest Nitrate: 1987, 1990, 2006
Lowest Nitrate: 2005, 2008 (S)
Long Term Trend?: Decreasing?
Discussion: Nitrate readings have been lower in the last seven years than in the period from 1987 to 1991, and appear to be comparable at both sampling sites. It is not known if the lower nitrate is in response to wetter weather, reduced atmospheric nitric acid, or normal variability.

Wettest Years: 1990,'89,'03,'04,'05,'06,'08
Driest Years: 1988
Highest Ammonia: 2006, 2002
Lowest Ammonia: 2008
Long Term Trend?: None apparent
Discussion: Ammonia readings have varied slightly from year to year, in a manner that does not appear to be statistically significant. No long-term trends have been apparent. These readings are comparable in both basins.

Wettest Years: 1990,'89,'03,'04,'05,'06,'08
Driest Years: 1988
Highest Cond.: 2004, 2003
Lowest Cond.: 2008, 2007
Long Term Trend?: None apparent
Discussion: Conductivity readings have generally decreased over the last six years, although these readings are still indicative of softwater lakes. This does not appear to be closely related to changes in weather patterns.

Wettest Years: 1990,'89,'03,'04,'05,'06,'08
Driest Years: 1988
Highest pH: 2008, 1988
Lowest pH: 2004, 2005 (N), 2003 (S)
Long Term Trend?: None apparent
Discussion: pH readings have increased at both sampling sites in the last five years, but no long-term trends have been apparent in the north basin (the south basin hasn't been sampled long enough to evaluate trends). This increase may be inconsistent with the drop in conductivity.

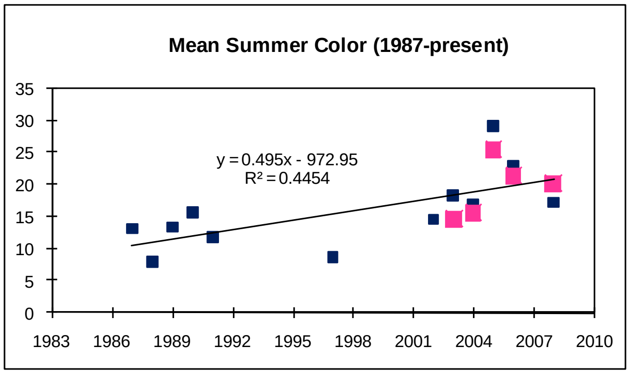


Figure 35. Annual Average Summer Color for Schroon Lake

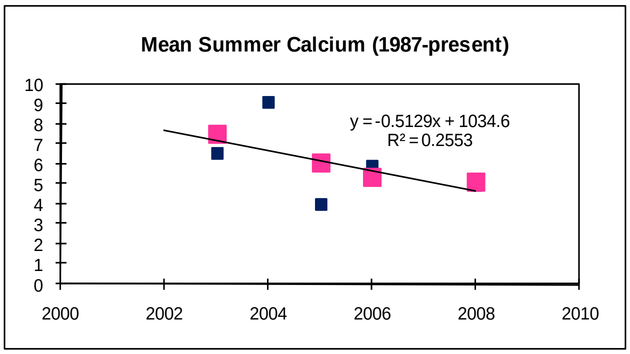
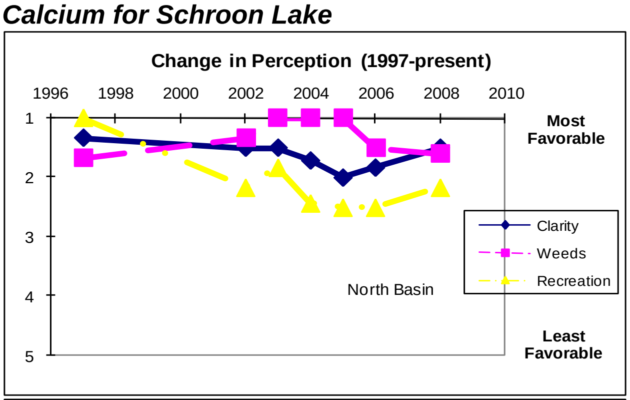


Figure 36. Annual Average Summer Calcium for Schroon Lake



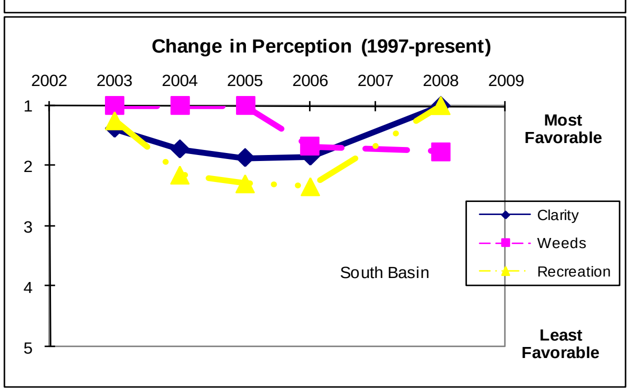


Figure 37. Annual Average Summer Lake Perception for Schroon Lake

(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, 1987-2008

Wettest Years:	1990,'89,'03,'04,'05,'06,'08
Driest Years:	1988
Highest Color:	2005, 2006
Lowest Color:	1988, 1997
Long Term Trend?:	Increasing?

Discussion: Water color readings have been higher in the last six years than in the period from 1987 to 1991. This may be due to wetter weather or the change in laboratories in 2002. Color was comparable at both sites.

Wettest Years:	1990,'89,'03,'04,'05,'06,'08
Driest Years:	1988
Highest Calcium:	2004, 2003
Lowest Calcium:	2005 (N), 2008
Long Term Trend?:	None apparent

Discussion: Calcium readings have been slightly lower in the last few years, but no long-term trends have been apparent. These readings are inadequate to support zebra mussels, and are comparable at both sampling sites.

Wettest Years:	1990,'89,'03,'04,'05,'06,'08
Driest Years:	1988
Most Favorable WQ:	1997 (N), 2003, 2008
Least Favorable WQ:	2005, 2006
Highest Weed Cov.	1997 (N), 2008, 2006
Lowest Weed Cov.	2003-2005
Most Favorable Rec.	1997 (N), 2003, 2008
Least Favorable Rec.	2006, 2005
Long Term Trend?:	None apparent

Discussion: Recreational, water quality, and aquatic plant assessments have varied from year to year in a manner that does not appear to represent a trend. Water quality assessments have varied slightly and independently of changes in water clarity and chlorophyll *a* readings. It is not known if the slight changes in aquatic plant coverage are due to changes in invasive plant communities. These assessments are mostly comparable in both sites, although these vary in different ways and at different times.

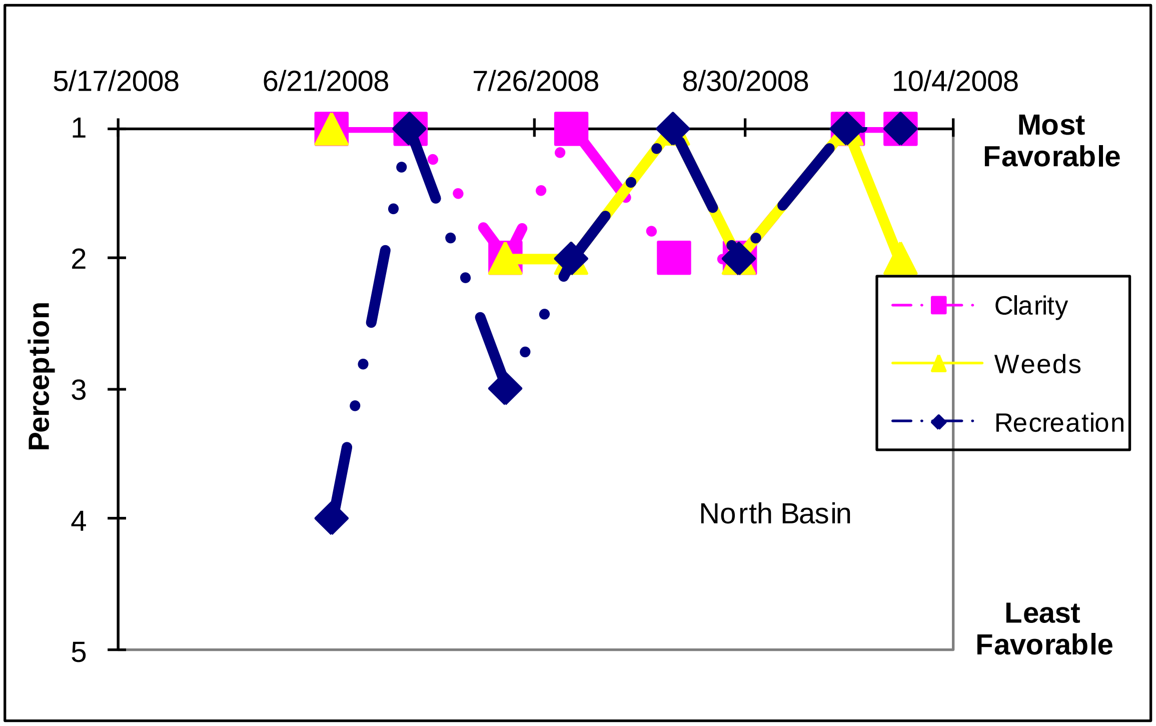


Figure 38a. 2008 Lake Perception Data for Schroon Lake-North

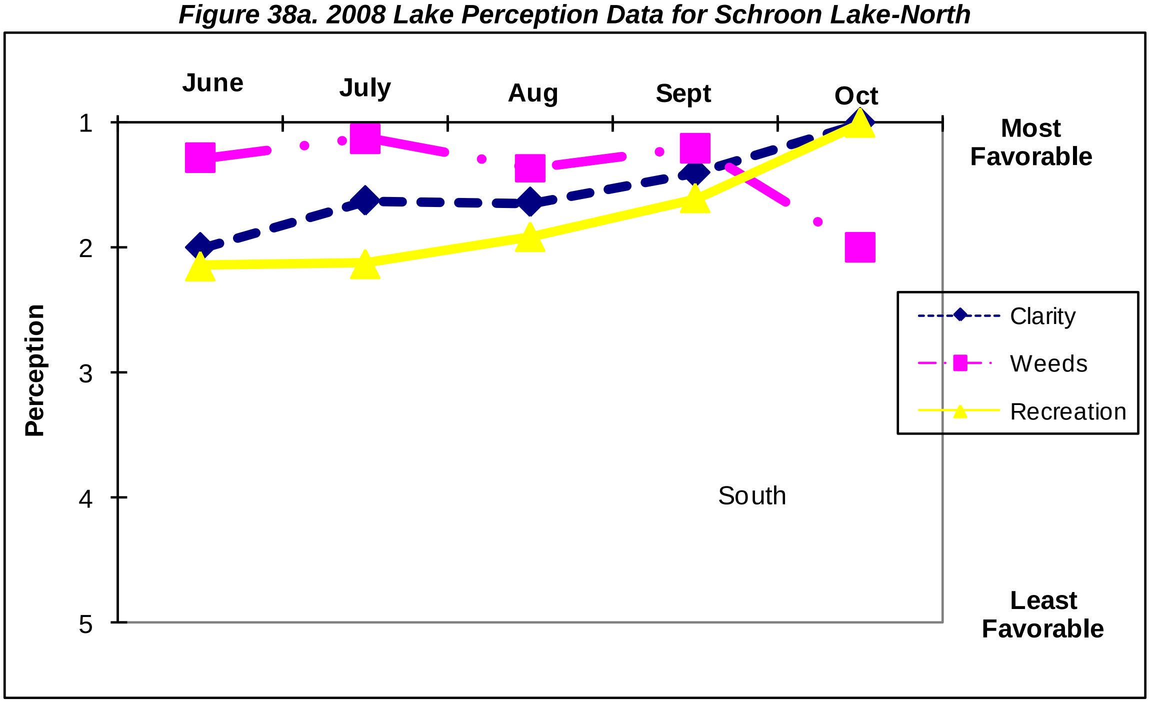


Figure 39a- Lake Perception Data in a Typical (Monthly Mean) Year for Schroon Lake-North

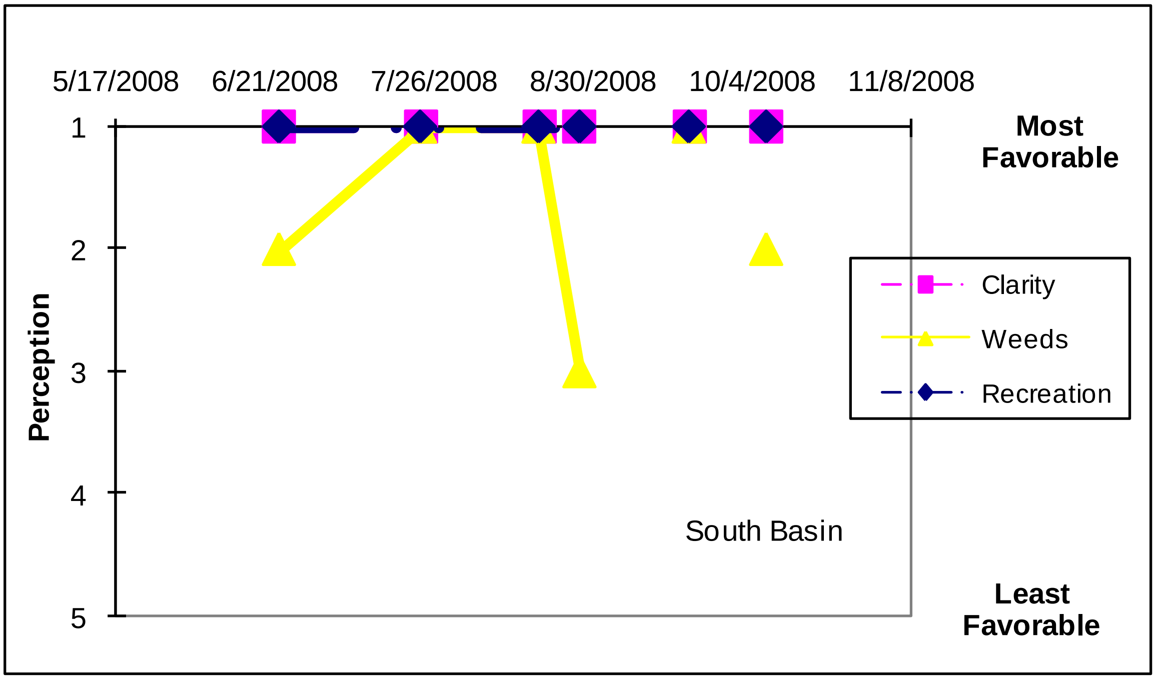


Figure 38b. 2008 Lake Perception Data for Schroon Lake-South

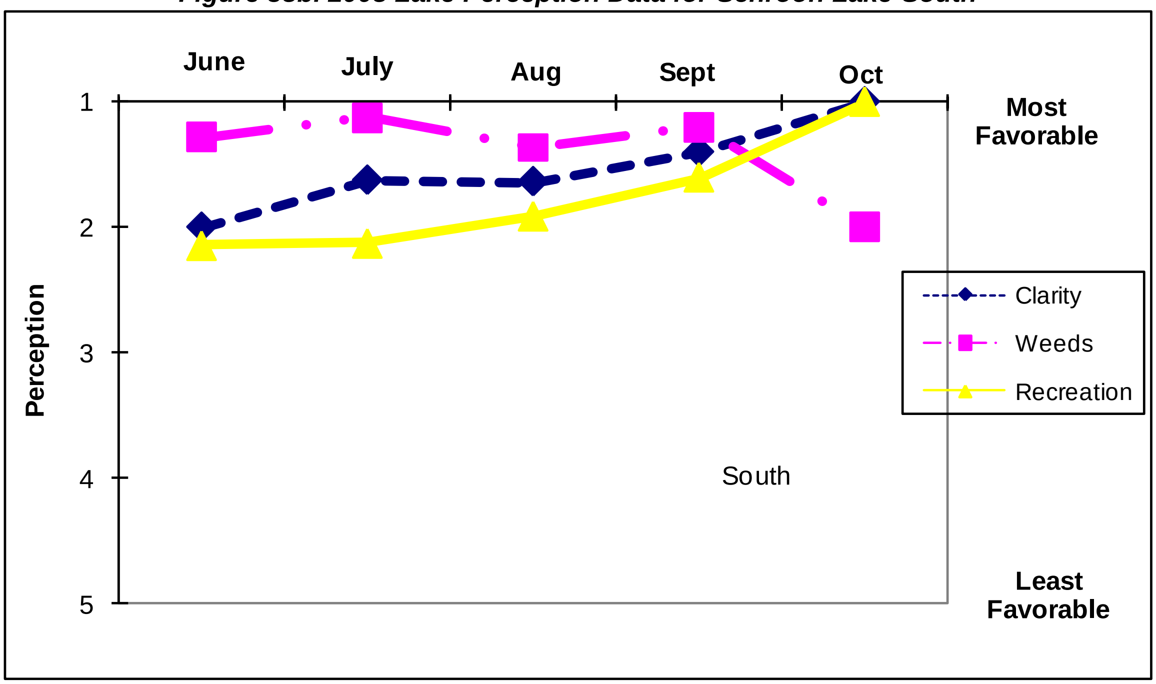


Figure 39b- Lake Perception Data in a Typical (Monthly Mean) Year for Schroon Lake-South

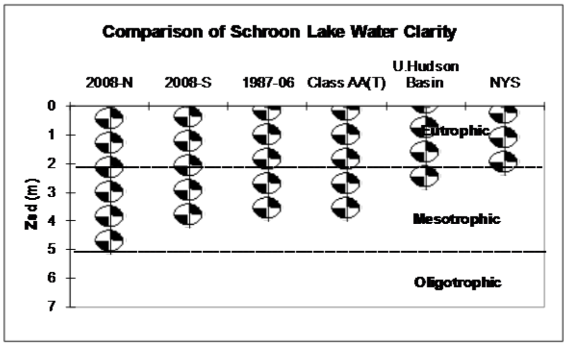


Figure 40. *Comparison of 2008 Secchi Disk Transparency to Lakes With the Same Water-Quality Classification, Neighboring Lakes, and Other CSLAP Lakes*

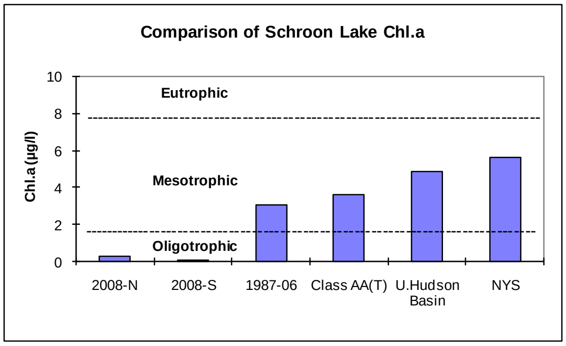


Figure 41. *Comparison of 2008 Chlorophyll a to Lakes with the Same Water-Quality Classification, Neighboring Lakes, and Other CSLAP Lakes*

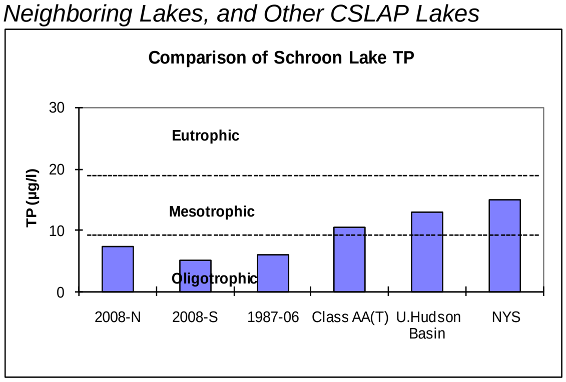


Figure 42. *Comparison of 2008 Total Phosphorus to Lakes With the Same Water-Quality Classification, Neighboring Lakes, and Other CSLAP Lakes*

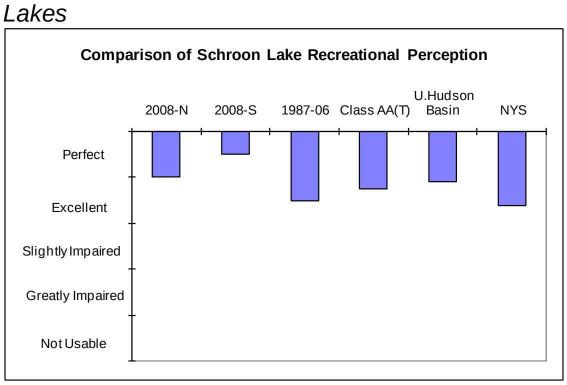


Figure 43. *Comparison of 2008 Recreational Perception to Lakes With the Same Water-Quality Classification, Neighboring Lakes, and Other CSLAP Lakes*

How does Schroon Lake compare to other lakes?

Annual Comparison of Median Readings for Eutrophication Parameters and Recreational Assessment For Schroon Lake in 2008 to Historical Data for Schroon Lake, 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 Schroon Lake—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.

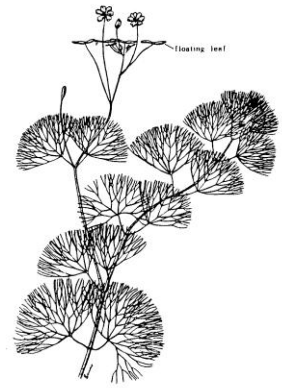
Based on these graphs, the following conclusions can be made about Schroon Lake in 2008:

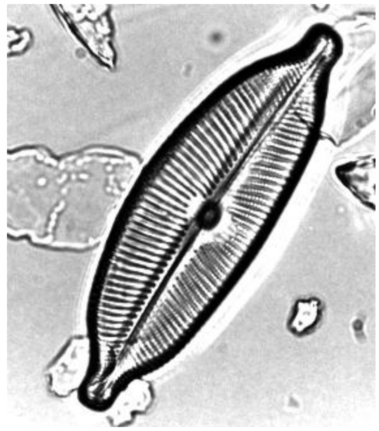
a) Using water clarity as an indicator, Schroon Lake is usually about as productive as other Class AA(T) lakes, and less productive than other Upper Hudson River basin lakes, and other NYS lakes, although in 2008 it was less productive than other Class AA(T) lakes.

b) Using chlorophyll *a* concentrations as an indicator, Schroon Lake is less productive than other Class AA(T) lakes, other Upper Hudson River basin lakes, and other NYS lakes.

c) Using total phosphorus concentrations as an indicator, Schroon Lake is less productive than other Upper Hudson River basin lakes, other Class AA(T) lakes and other NYS lakes.

d) Using QC on the field-observations form as an indicator, Schroon Lake is usually about as suitable for recreation as other Upper Hudson River basin lakes and other Class AA(T) lakes, and more suitable for recreation than other NYS lakes, although in 2008, it was more suitable for recreation than other lakes in each of these groups.





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 has identified the presence of northern pondweed (Potamogeton alpinus), a threatened plant.*

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.

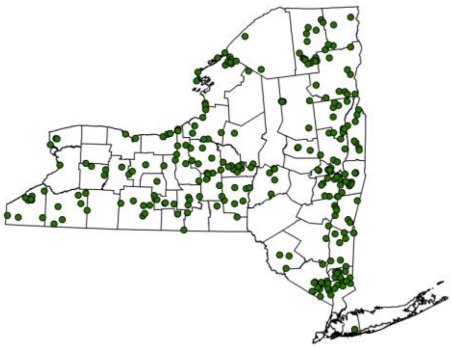


Figure 44a. Myriophyllum spicatum distribution in New York State

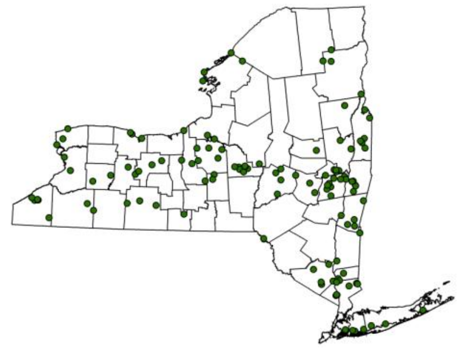


Figure 44b. Potamogeton crispus distribution in New York State

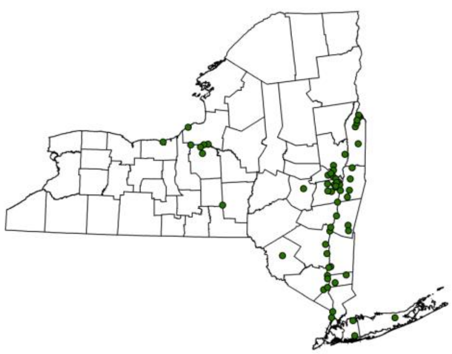


Figure 44c. Trapa natans distribution in New York State

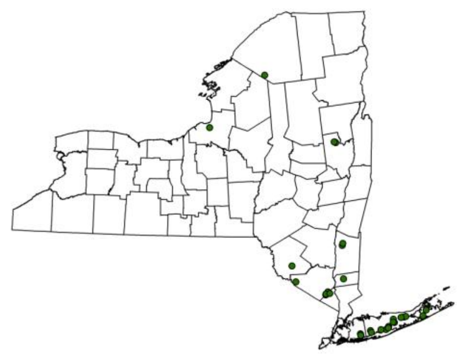


Figure 44d. Cabomba caroliniana distribution in New York State

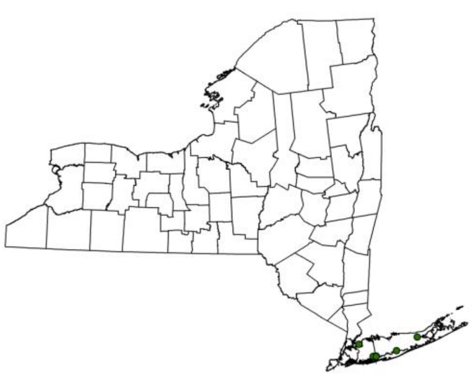


Figure 44e. Myriophyllum aquaticum distribution in New York State

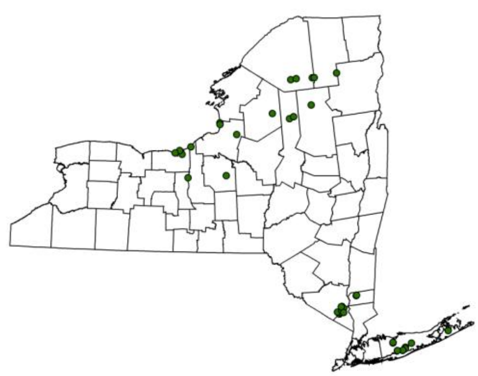


Figure 44f. Myriophyllum heterophyllum distribution in New York State

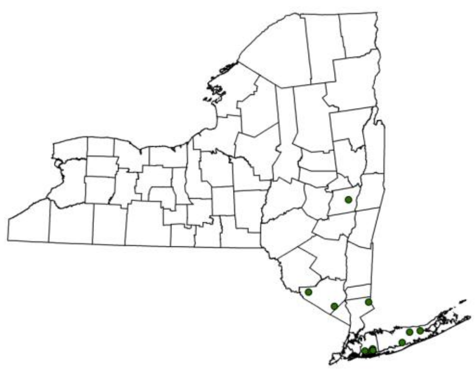


Figure 44g. Egeria densa distribution in New York State

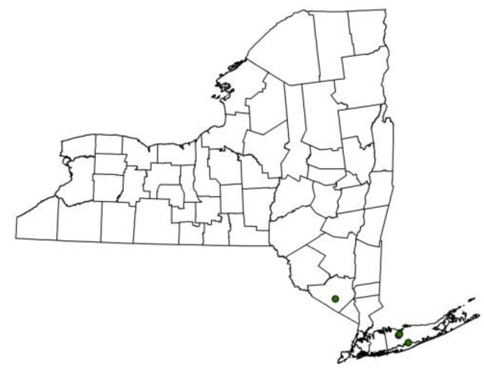


Figure 44h. Hydrilla verticillatum distribution in New York State

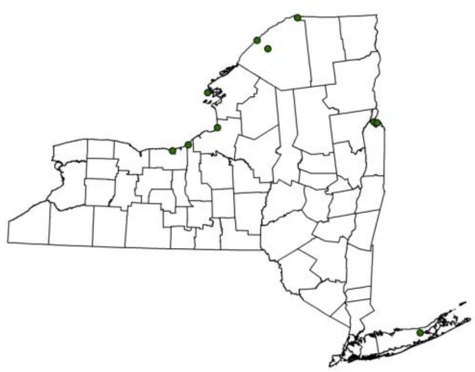


Figure 44i. Hydrocharis morsus-ranae distribution in New York State

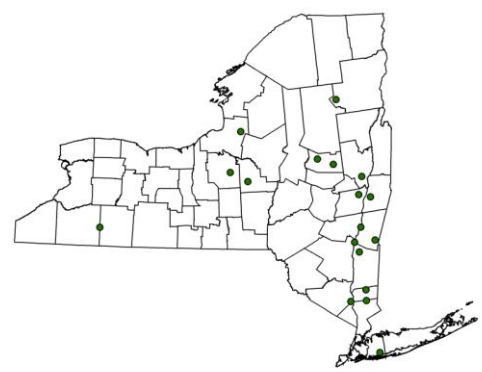


Figure 44j. Najas minor distribution in New York State

Aquatic plant surveys conducted through CSLAP have identified the following aquatic plants at Schroon Lake:

Species	CommonName	Exotic?	Sub/Emerg?	Date	Location	%Cover	Abundance
Potamogeton robbinsii	Robbins pondweed	no	submergent	8/21/1990	site 1-Nend-Word of Life Isl.-A frame house	80	scarce
Najas flexilis	Slender naiad	no	submergent	8/21/1990	site 1-Nend-Word of Life Isl.-A frame house	10	scarce
Elodea canadensis	Common waterweed	no	submergent	8/21/1990	site 1-Nend-Word of Life Isl.-A frame house	10	scarce
Elodea canadensis	Common waterweed	no	submergent	8/21/1990	site 2-Nend-Word of Life Isl.-A frame house	20	scarce

Species	CommonName	Exotic?	Sub/Emerg?	Date	Location	%Cover	Abundance
Vallisneria americanum	eel grass	no	submergent	8/21/1990	site 2-Nend-Word of Life Isl.-A frame house	20	scarce
Potamogeton praelongus	white-stemmed pondweed	no	submergent	8/21/1990	site 2-Nend-Word of Life Isl.-A frame house	20	scarce
Myriophyllum humile	low watermilfoil	no	submergent	8/21/1990	site 2-Nend-Word of Life Isl.-A frame house	20	scarce
Potamogeton zosteriformis	flatstem pondweed	no	submergent	8/21/1990	site 2-Nend-Word of Life Isl.-A frame house	20	scarce
Eriocaulon spp.	pipewort	no	submergent	8/21/1990	site 3-Nend-Word of Life Isl.-A frame house	100	scarce
none				6/24/2003	not reported		

Aquatic plant surveys were also conducted as part of the 1930s Biological Survey of the Upper Hudson River basin- a semi-quantitative assessment of plant communities is provided in the table below:

Abundant	Common	Frequent	Rare
Brasenia schreberi (water shield)	*Sparganium fluitans (floating bur reed)*	*Sparganium eurycarpum (broadfruit bur reed)*	*Bidens beckii (water marigold)*
	Potamogeton amplifolius (largeleaf pondweed)	*Potamogeton americanus (long leaf pondweed)*	
	Potamogeton epihydrus (ribbonleaf pondweed)	*Potamogeton bupleuroides (clasping leaf pondweed)*	
	Potamogeton gramineus (variable pondweed)	*Potamogeton compressus (flatstemmed pondweed)*	
	Potamogeton natans (floating leaf pondweed)	*Potamogeton dimorphus (spiral pondweed)*	
	Potamogeton praelongus (white stem pondweed)	*Potamogeton pectinatus (Sago pondweed)*	
	Potamogeton pusillus (leafy pondweed)	*Potamogeton richardsonii (Richardson's pondweed)*	
	Elodea canadensis (common waterweed)	*Potamogeton robbinsii (Robbins pondweed)*	
	Vallisneria americana (eelgrass)	*Najas flexilis (slender naiad)*	
	Scirpus subterminalis (water bulrush)	*Sagittaria latifolia (broadleaf arrowhead)*	
	Eleocharis palustris (common spikerush)	*Eleocharis acicularis (needle spikerush)*	
	Nymphaea odorata (fragrant waterlily)	*Eriocaulon septangulaire (pipewort)*	
	Nymphaea advena (white water lily)	*Pontederia cordata (pickerelweed)*	
		Ceratophyllum demersum (coontail)	
		Utricularia vulgaris (common bladderwort)	
		Isoetes echinospora (spiny-spored quillwort)	

It should be noted that the lake possessed a wide variety of native plant species in 1932, and no milfoil species were found in the lake at this time (although Eurasian watermilfoil was not found in many places in New York State prior to the 1940s)

So What Does That Mean?

The aquatic plant surveys conducted at Schroon Lake have identified a wide variety of native plants, and none of the submergent aquatic plants considered to be exotic (non-native) to New York State have been identified in the lake. Moreover, "excessive weed growth" has not usually been identified as impacting recreational use of the lake.

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 Schroon Lake.

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 3) 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.

Schroon Lake is presently among the lakes listed on the 2006 Upper Hudson River basin PWL as having fish consumption impaired due to PCBs and mercury. The narrative for this listing is as follows:

“Fish consumption in Schroon Lake is impaired due to a NYS DOH health advisory that recommends eating no more than one meal per month of larger lake trout (over 27 inches), larger yellow perch (over 13 inches) and smallmouth bass; the advisories are the result of elevated PCB and mercury levels. The most recent laboratory results from lake trout and yellow perch collected in 1989 (DFW) suggest that PCB and other organochlorine concentrations in fish have declined, but mercury concentrations in lake trout were still relatively high. The source of mercury is considered to be atmospheric deposition, as there are not other apparent sources in the lake watershed. The advisory for this lake related to PCBs was issued prior to 1998-99; the mercury advisory was added in 2000-01. (2006-07 NYS DOH Health Advisories and DEC/FWMR, Habitat, December 2006).

Water column, soil and bottom sediment samples taken by the regional staff (1990) and central office (1991, DEC/DOW BMA report June 1992) showed only very low concentrations of PCBs and mercury. Macroinvertebrate sampling (1991) found no significant levels of PCBs in invertebrates, but mercury was found above levels of concern in crayfish in Schroon River above the inlet. Based on the various data gathered it was determined jointly by DFW and BMA staff that although PCB and other organochlorine contamination of Schroon Lake lake trout is no longer as serious, monitoring of the Fisheries resource should be continued, since sensitive species of fish-eating wildlife are at risk. No additional biological sampling of the Schroon River inlet or its tributaries was recommended, as DFW data suggested mercury concentrations, though elevated, were typical of other waters affected by atmospheric deposition of mercury in this region of NYS. (DEC/DOW and FWMR, BWAM and Habitat, 2000)

Schroon Lake has been sampled as part of the NYSDEC Citizen Statewide Lake Assessment Program (CSLAP) beginning in 1987 and continuing through 2005. An Interpretive Summary report of the findings of this sampling was published in 2006. These data indicate that the lake continues to be best characterized as mesoligotrophic, or moderately unproductive. Phosphorus levels in the lake are consistently below criteria that would indicate impacted recreational uses and transparency measurements satisfy what is recommended for swimming beaches. DEC/DOW, BWAM/CSLAP, May 2006)

Public perception of the Schroon Lake and its uses are also evaluated as part of the CSLAP program. These assessments also indicate recreational suitability of the lake to be mostly favorable since the lake was first evaluated and continuing through the most recent assessment. Recreational conditions in the lake have been most often described as "could not be nicer" to "excellent" for most uses. The lake is regularly described as "not quite crystal clear." Aquatic plants are not typically visible from the lake surface. (DEC/DOW, BWAM/CSLAP, May 2006)

This waterbody is included on the NYS 2006 Section 303(d) List of Impaired Waters. The lake was included on Part 2b of the List as a Fish Consumption Water."

TABLE 3- 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 (NH3+NH4) 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 Schroon Lake:

pH readings exceeded the NYS water-quality standards (=6.5 to 8.5) during 1% of the CSLAP sampling sessions at Schroon Lake in the north basin, and none of the sampling sessions in the south basin, and failed to reach these standards 3% of the time in the north basin and 5% of the time in the south basin. Phosphorus levels at Schroon Lake have exceeded the phosphorus guidance value for NYS lakes (=0.020 mg/l) during 5% of the CSLAP sampling sessions in the south basin and never in the north basin. Water transparency readings have never failed to reach the minimum recommended water clarity for swimming beaches (= 1.2 meters) during all of the CSLAP sampling sessions at either sampling site. It is not known whether any of the narrative water-quality standards listed in Table 3 have been violated at Schroon Lake; 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.

Schroon Lake is a Class AA(T) lake, which means it is designated for support of potable water (drinking), contact recreation (swimming and bathing), aquatic life (including fishing), non-contact recreation (such as boating) and aesthetics. The (T) designation refers to the lake supporting trout survival. As such, Schroon Lake should be evaluated for its best intended uses—support of drinking water, swimming, aquatic life, non-contact recreation, and aesthetics.

a. Potable Water

Schroon Lake is classified for potable water use, although it is not known if the lake presently supports this use.

CSLAP is not intended to evaluate the suitability of lakes or ponds for potable water use. Several of the water quality indicators measured through CSLAP provide little insight into potability, even when a water quality standard exists for that indicator. For example, while there is a potable water quality standard for nitrate, the 10 mg/l standard will not be exceeded in any lake or pond not dominated by wastewater influent. The highest lake nitrate readings measured through CSLAP- those from the Finger Lakes region or Long Island- do not exceed 3-4 mg/l. Likewise, ammonia readings in the surface waters of lakes rarely approach the 2 mg/l standard, although these numbers are within the range found in the bottom of some lakes with extreme deepwater anoxia. While even limited dissolved oxygen deficits do indicate susceptibility to impacts from other oxygen-sensitive pollutants, such as arsenic, iron, and manganese, these are not presently measured through CSLAP.

Nuisance algae can create some significant impacts to potable water use. Several algal species, especially blue green algae, are often associated with taste- and odor-producing compounds. Many of the same blue green algae produce toxins. The blue-green algae most frequently implicated in either taste and odor problems or the production of algal toxins include *Anabaena*, *Aphanizomena*, *Microcystis* (also known as Annie, Fannie, and Mike), and *Oscillatoria.*

Overall Evaluation- Drinking Water

The CSLAP dataset at Schroon Lake, including water chemistry data, physical measurements, and volunteer samplers' perception data, is inadequate to evaluate the use of the lake for potable water. Surface water quality data and the lack of any reports of toxic or taste- or odor-causing algae suggest few impacts associated with surface water intakes, but these cannot be well evaluated through CSLAP (although this evaluation is occurring in 2009).

b. Swimming/Contact Recreation

It is presumed that Schroon Lake 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 5% of the Schroon Lake samples possessed total phosphorus readings in the south basin and none of the north basin samples exceed 20 parts per billion (=µg/l), which corresponds to the state phosphorus guidance value. Water transparency readings were less than 2 meters during none of the CSLAP sampling sessions at either site. 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. 3% of the north basin and none of the south basin Schroon Lake samples corresponded to chlorophyll *a* readings > 8 µg/l.

Bacteria data have not been collected through CSLAP on Schroon Lake 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 described Schroon Lake as “slightly” impaired during 32% of the north basin and 30% of the south basin CSLAP sampling sessions, and as “substantially” impaired 12% of the time in the north basin and 8% of the time in the south basin. Slightly and substantially impaired conditions were never associated with excessive weeds or poor water clarity at any time in either basin.

3. Overall Evaluation- Swimming and Contact Recreation

The CSLAP dataset at Schroon Lake, including water chemistry data, physical measurements, and volunteer samplers’ perception data, suggests that swimming and contact recreation should be fully supported, although additional information about bacteria levels is needed to determine if pathogens impact swimming.

c. Aquatic Life/Non-Contact Recreation

Schroon Lake 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 Schroon Lake 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 Schroon Lake.

These data indicate that pH readings in 3% of the north basin and 5% of the south basin Schroon Lake samples failed to reach the state water-quality standards (= 6.5 to 8.5), and exceeded these standards 1% of the time in the north basin. While laboratory pH is not as accurate as field pH for evaluating lake acidity, these data suggest that fisheries or aquatic life impacts do not occur as a result of depressed or elevated pH.

It is not known if fishing regulations result in any impact to the use of Schroon Lake for fishing. While the lake may possess several coolwater and coldwater fish species susceptible to low oxygen levels in coldwater habitats (deepwater conditions during the summer, and throughout the water column during other times of the year), there is no evidence that any oxygen deficits that may occur in the lake impact the survival of these fish.

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 never reported that Schroon Lake “looks bad” during any of the CSLAP sampling sessions in either basin. Surface weed growth was reported during 3% of the south basin and none of the north basin CSLAP sampling sessions, and dense aquatic plant growth was not reported at any time. This does not likely reflect the shoreline macrophyte growth characteristics in most of the lake.

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

The CSLAP dataset on Schroon Lake, including water chemistry data, physical measurements, and volunteer samplers’ perception data, suggest that non-contact recreation, aquatic life and aesthetics should be fully supported. Additional data are needed to evaluate the food and habitat conditions for aquatic organisms in the lake.

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 Reducing the Impacts of Stormwater Runoff 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 Controlling Agricultural Nonpoint Source Water Pollution in New York State. 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. *Land use restrictions are already in place through the Adirondack Park Agency.*

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 SCHROON LAKE

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 a favorable physical condition and water clarity of the lake, *or at least that low water clarity does not adversely affect recreational assessments.* This places the focus of water clarity management on maintaining present conditions, an enviable position for many other lake associations. 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**,** *at least in the areas of the lake monitored through CSLAP***.** 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, Common Nuisance Aquatic Plants in New York State, contains information about nuisance plants.

Hand harvesting and benthic barriers have been extensively utilized at Schroon Lake by residents and consultants to the lake association.

-*Naturally occurring biological controls* - may include native species of *aquatic weevils and moths* which eat aquatic plants. These organisms feed on Eurasian watermilfoil, and control nuisance plants in some Finger Lakes and throughout the Northeast. However, they also inhabit other lakes with varied or undocumented effectiveness for the long term. Because these organisms live in the canopy of weed beds and feed primarily on the top of the plants, harvesting may have severe negative impact on the population. Research is on-going about their natural occurrence, and as to their effectiveness both as a natural or deliberately- introduced control mechanism for Eurasian watermilfoil. *It is not known by the report authors if these organisms are indigenous (native) to Schroon 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.

-*If you have a small amount of nuisance plant growth you may want to consider the following (these activities may require a general permit from the Adirondack Park Agency):*

-*Hand harvesting* is a very labor-intensive means for controlling weed populations. If only a very small number of nuisance plant stems exist, this may be the best means of control, removing the roots and stems of the entire plant, and disposing properly before they propagate into larger, uncontrollable beds that become the obnoxious neighbors of beneficial native plants**.**

-*Benthic barriers* are small opaque mats (usually constructed from plastic, burlap, or other materials) anchored down on top of plants to prevent sunlight from reaching the plants, thus eventually killing the plants. These are limited to only small areas, and the mats must be anchored and perforated to prevent gas bubbles from dislodging the mats.

c. SPECIFIC MONITORING CONSIDERATIONS FOR SCHROON LAKE

Discussion:
Schroon Lake was first sampled through CSLAP in 1987. 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*- Schroon Lake is classified for use for contact recreation (swimming), and the lake is extensively used for swimming. 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 Schroon Lake 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 not been conducted through CSLAP at Schroon Lake for many years. 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. *More extensive aquatic plant surveys are no doubt conducted through APIPP volunteers and in concert with the lake consultant (Adirondack Ecologists)*
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, but, at present, neither of these is collected through CSLAP at Schroon Lake.

Appendix A. Raw Data for Schroon Lake

LNum	PName	Date	Zbot	Zsd	Zsamp	Tot.P	NO3	NH4	TDN	TN/TP	TColor	pH	Cond25	Ca	Chl.a
34	Schroon L	6/23/1987	2.0		1.5	0.005	0.14				16	7.33	62		4.70
34	Schroon L	7/1/1987	20.0	3.00	1.5	0.006	0.15				16	7.58	60		5.80
34	Schroon L	7/8/1987	21.0	4.00	1.5	0.006	0.12				14	7.09	60		4.40
34	Schroon L	7/13/1987	21.0	3.00	1.5	0.005	0.10				16	6.91	61		4.00
34	Schroon L	7/21/1987	20.0	4.00	1.5	0.001	0.09				16	7.23	62		7.60
34	Schroon L	7/27/1987	20.0	4.00	1.5	0.009	0.06				15	7.51	62		5.60
34	Schroon L	8/4/1987	20.0	4.00	1.5	0.005	0.06				17	7.87	64		6.20
34	Schroon L	8/7/1987	45.0	4.15	1.5	0.009	0.03				11	7.02	63		8.70
34	Schroon L	8/14/1987	23.7	3.50	1.5	0.007	0.03				17	7.26	64		6.10
34	Schroon L	8/17/1987	23.0	3.35	1.5	0.005	0.02				12	7.63	64		4.70
34	Schroon L	8/24/1987	23.0	3.15	1.5	0.005	0.02				10	7.52	66		10.10
34	Schroon L	8/30/1987	25.0	4.25	1.5	0.005	0.02				9	7.36	62		
34	Schroon L	9/9/1987	24.0	3.83	1.5	0.006	0.08				8	7.48	71		9.70
34	Schroon L	9/14/1987	23.5	5.35	1.5	0.003	0.01				6	7.17	69		5.30
34	Schroon L	9/22/1987	23.0	5.10	1.5	0.007	0.03				11	7.34	68		3.50
34	Schroon L	7/6/1988	22.5	4.30	1.5	0.004	0.11				15	7.75	80		3.63
34	Schroon L	7/20/1988	25.0	5.25	1.5	0.004	0.08				6	7.93	76		2.15
34	Schroon L	8/4/1988	25.0	5.05	1.5	0.004	0.05				5	7.92	70		2.15
34	Schroon L	8/16/1988	25.0	4.50	1.5	0.001	0.02				7	7.69	65		2.96
34	Schroon L	8/31/1988	25.0	5.20	1.5	0.006	0.02				7	7.79	70		2.15
34	Schroon L	9/12/1988	25.0	5.45	1.5	0.005	0.02				7	7.72	72		3.77
34	Schroon L	9/26/1988	18.0	5.75	1.5	0.003	0.02				7	7.58	71		3.03
34	Schroon L	6/27/1989	23.0	4.90	1.5	0.006	0.08				15	7.68	64		2.64
34	Schroon L	7/5/1989	24.0	4.60	1.5	0.003	0.07				17	7.77	64		2.55
34	Schroon L	7/17/1989	20.0	4.25	1.5	0.008	0.06				17	7.42	64		2.11
34	Schroon L	7/31/1989	18.3	4.85	1.5	0.005	0.03				12	7.58	71		4.31
34	Schroon L	8/14/1989	24.4	3.65	1.5	0.003	0.01				13	7.41	69		4.23
34	Schroon L	8/29/1989	18.3	3.10	1.5	0.004	0.01				10	7.58	70		4.03
34	Schroon L	9/11/1989	25.0	3.55	1.5	0.007	0.01				9	7.44	71		3.70
34	Schroon L	9/25/1989	25.0	3.75	1.5	0.006	0.01				16	7.62	67		4.33
34	Schroon L	7/2/1990	24.0	4.20	1.5	0.009	0.10				15	7.37	62		4.12
34	Schroon L	7/19/1990	25.0	4.70	1.5	0.004	0.06				15	7.61	65		3.69
34	Schroon L	7/30/1990	25.0	5.10	1.5	0.004	0.06				14		70		0.69
34	Schroon L	8/15/1990	25.0	4.00	1.5	0.005	0.04				16	7.70	64		7.29
34	Schroon L	9/4/1990	25.0	5.60	1.5	0.003	0.04				18	7.01	64		2.56
34	Schroon L	9/17/1990	25.0	3.80	1.5	0.005	0.04				19	7.36	67		8.00
34	Schroon L	10/1/1990	25.0	4.95	1.5	0.005	0.08				18	6.73	66		2.81
34	Schroon L	7/9/1991	25.0	6.50	1.5	0.003	0.10				15	7.60	66		2.17
34	Schroon L	7/22/1991	25.0	5.72	1.5	0.005	0.07				10	7.04	88		1.89
34	Schroon L	8/6/1991	25.0	5.80	1.5	0.009	0.03				14	7.08	69		3.67
34	Schroon L	8/19/1991	20.0	4.30	1.5	0.005	0.01				9	7.65	69		4.42
34	Schroon L	9/3/1991	25.0	3.90	1.5	0.009	0.01				11	7.64	69		4.20
34	Schroon L	9/16/1991	25.0	3.70	1.5	0.010	0.01				9	7.60	69		3.11
34	Schroon L	7/20/1997		4.00	1.5	0.008	0.05				10	7.51	68		3.48
34	Schroon L	8/3/1997	9.3	5.05	1.5	0.004	0.02				9	7.53	69		3.03
34	Schroon L	9/8/1997		2.80	1.5	0.006	0.01				7	6.89	72		2.50
34	Schroon L	6/10/2002	43.6	3.05	1.0		0.10	0.02	1.01		14	7.25	73		0.95
34	Schroon L	6/25/2002	44.2	3.25	1.0	0.007	0.07	0.04	0.47	68.14	15	7.25	73		2.68
34	Schroon L	7/9/2002	44.3	4.10	1.0	0.007	0.06	0.07	0.32	45.20	15	7.27	77		
34	Schroon L	7/23/2002	43.6	3.30	2.0	0.005	0.04	0.07	0.34	64.37	19	7.29	81		3.37
34	Schroon L	8/6/2002	42.6	8.50	1.0	0.002	0.03	0.06	0.47	235.76	11	7.56	86		1.79
34	Schroon L	8/20/2002	44.2	3.30		0.006	0.02	0.05	0.47	77.36	15	7.64	87		2.37
34	Schroon L	9/3/2002	43.9	3.50		0.005	0.02	0.01	0.31	60.94	12	7.43	82		3.03
34	Schroon L	9/17/2002	42.6	4.50	1.0	0.005	0.00	0.01	0.31	60.13	16	7.64	86		3.47
34	Schroon L-N	6/24/2003	44.2	3.45	1.0		0.08	0.02	0.19		22	7.28	82	6.2	1.45
34	Schroon L-N	7/8/2003	42.7	4.15	1.0	0.006	0.06	0.03	0.21	36.65	12	7.34	84		1.15
34	Schroon L-N	7/22/2003	44.5	5.54		0.004	0.04	0.02	0.21	47.79	21	7.48	88		2.63
34	Schroon L-N	8/5/2003	43.0	2.75	1.0	0.007	0.00	0.03	0.24	32.27	17	7.25	84		4.61
34	Schroon L-N	8/19/2003	42.7	3.10		0.007	0.01	0.02	0.29	40.99	21	7.19	81	6.9	3.58
34	Schroon L-N	9/2/2003	43.9	3.40	1.0	0.007	0.00	0.02	0.25	37.09	17	7.08	84		0.87

LNum	PName	Date	Zbot	Zsd	Zsamp	Tot.P	NO3	NH4	TDN	TN/TP	TColor	pH	Cond25	Ca	Chl.a
34	Schroon L-N	9/17/2003	44.0	3.60	1	0.005	0.01	0.02	0.07	12.15	13	7.25	88		2.36
34	Schroon L-N	9/30/2003	45.1	3.88		0.004	0.00	0.01	0.28	75.66	12	7.22	81		0.46
34	Schroon L-N	6/11/2004		6.75		0.011	0.07	0.02	0.19	17.30	22	6.32	79		2.36
34	Schroon L-N	6/23/2004	44.2	10.00	1.0	0.003	0.05	0.02	0.31	108.66	19	6.29	81		3.92
34	Schroon L-N	7/7/2004	43.9	4.00	1.0	0.006	0.13	0.08	1.11	176.65	17	6.32	59		1.00
34	Schroon L-N	7/21/2004	44.5	4.38		0.004	0.02	0.02	1.34	311.07	14	7.40	83		0.60
34	Schroon L-N	8/4/2004	44.5	4.05	1.0	0.003	0.02	0.03	0.31	102.98	17	8.29	91	9.1	3.70
34	Schroon L-N	8/18/2004	43.3	3.85	1.0	0.003	0.01	0.01	0.39	155.96	12	7.17	74		3.90
34	Schroon L-N	9/1/2004	44.8	3.40	1.0	0.009	0.01	0.01	0.34	36.74		7.02	61		2.30
34	Schroon L-N	9/14/2004	43.3	4.10	1.0	0.009	0.02	0.03	0.38	41.12	22	7.48	51		2.10
34	Schroon L-N	6/21/2005	46.0	2.80	1.0	0.008	0.01	0.08	0.13	13.21	35	7.50	60	5.1	4.17
34	Schroon L-N	7/5/2005	44.8	2.25	1.0	0.009	0.03	0.03	0.30	32.46	33	8.20	88		1.49
34	Schroon L-N	7/19/2005	44.8	3.10	1.0	0.008	0.03	0.04	0.17	12.20	18	7.10	70		4.11
34	Schroon L-N	8/2/2005	44.0	2.85	1.0	0.011	0.03	0.01	0.35	9.63		7.02	83		5.51
34	Schroon L-N	8/16/2005	44.2	2.65	1.0	0.015			0.34	12.17	35	6.76	72	2.9	2.84
34	Schroon L-N	8/30/2005	44.0	3.90	1.0	0.013	0.03	0.01	0.23	6.12	25	6.94	81		2.62
34	Schroon L-N	9/13/2005	45.0	3.30	1.0	0.010	0.01	0.01	0.18	5.30	14	7.40	83		1.99
34	Schroon L-N	9/27/2005	45.1	4.45	1.0	0.018	0.02	0.20	0.27	15.22	3	7.25	104		1.67
34	Schroon L-N	6/16/2006	44.8	2.75	1.5	0.013	0.10	0.01	0.25	19.52	22	7.53	40	5.8	0.39
34	Schroon L-N	6/29/2006	44.2	2.60	1.0	0.014					21	6.96	62		2.65
34	Schroon L-N	7/27/2006	44.8	2.90	1.0	0.012	0.04	0.02	0.57	45.85	35	7.36	55		2.76
34	Schroon L-N	8/10/2006	44.2	2.70	1.0	0.012	0.03	0.04	0.67	55.69	26	7.53	48		3.41
34	Schroon L-N	8/24/2006	43.3	3.30	1.0	0.016	0.04	0.03	0.59	36.49	31	7.55	62	6.0	2.84
34	Schroon L-N	9/7/2006	44.2	3.70	1.0	0.009	0.03	0.02	0.41	47.64	10	8.25	59		2.51
34	Schroon L-N	9/20/2006	44.2	2.85	1.0	0.009	0.04	0.02	0.53	62.26	17	7.31	75		1.68
34	Schroon L-N	6/22/2008	33.0	4.00	1.5	0.008	0.04	0.02	0.15	41.95	20	7.38	53	4.0	0.10
34	Schroon L-N	7/5/2008	30.0	7.10	1.5	0.007	0.13	0.02	0.15	46.67		7.90	66		0.22
34	Schroon L-N	7/21/2008	31.0	5.35	1.5	0.008	0.03	0.01	0.23	62.66	13	7.95	53		0.10
34	Schroon L-N	8/1/2008	32.0	5.55	1.5	0.005	0.01	0.02	0.32	134.03	15	7.78	58		0.28
34	Schroon L-N	8/18/2008		4.35	1.5	0.008	0.00	0.01	0.17	49.10	20	8.10	56	5.9	0.80
34	Schroon L-N	8/29/2008	30.5	4.65	1.5	0.005	0.00	0.00	0.18	74.39	18	8.34	60		0.46
34	Schroon L-N	9/16/2008	33.5	4.95	1.5	0.007	0.03	0.00	0.17	51.68	26	7.91	66		0.46
34	Schroon L-N	9/25/2008	32.0	5.40	1.5	0.008	0.02	0.00	0.19	53.67	21	9.07	68		0.10
34	Schroon L	6/10/2002	43.6	3.05	30.5	0.005	0.14	0.04	0.51	94.25					
34	Schroon L	6/25/2002	44.2	3.25	30.5	0.007	0.14	0.09	0.53	74.39					
34	Schroon L	7/9/2002	44.3	4.10		0.006	0.15	0.07	0.41	65.68					
34	Schroon L	7/23/2002	43.6	3.30		0.000	0.16	0.05	0.54	6806.88					
34	Schroon L	8/6/2002	42.6	8.50	30.5	0.000	0.17	0.03	0.55	1377.45					
34	Schroon L	8/20/2002	44.2	3.30	30.5	0.006	0.21	0.05	0.66	114.58					
34	Schroon L	9/3/2002	43.9	3.50		0.004	0.16	0.01	0.42	97.76					
34	Schroon L	9/17/2002	42.6	4.50	30.5	0.004	0.23	0.01	0.48	114.01					
34	Schroon L-N	6/24/2003			30.5	0.004	0.20	0.03	0.25	58.33					
34	Schroon L-N	7/8/2003			30.5	0.005	0.24	0.06	0.45	95.49					
34	Schroon L-N	7/22/2003			30.5	0.005	0.19	0.03	0.03	4.93					
34	Schroon L-N	8/5/2003			43.0	0.004	0.10	0.01	0.28	73.96					
34	Schroon L-N	8/19/2003				0.006	0.19	0.03	0.34	60.18					
34	Schroon L-N	9/2/2003			30.5	0.004	0.17	0.01	0.63	143.61					
34	Schroon L-N	9/17/2003			30.5	0.003	0.24	0.02	0.25	91.30					
34	Schroon L-N	9/30/2003			30.5	0.002	0.21	0.01	0.41	194.89					
34	Schroon L-N	6/11/2004			44.2	0.005	0.20	0.05	0.15	27.26					
34	Schroon L-N	6/23/2004	44.2		30.5	0.004	0.18	0.02	0.09	22.04					
34	Schroon L-N	7/7/2004	43.9		30.5	0.005	0.23	0.02	0.98	207.35					
34	Schroon L-N	7/21/2004	44.5		30.5	0.005	0.28	0.11	0.72	154.26					
34	Schroon L-N	8/4/2004				0.005	0.20	0.01	0.35	76.63					
34	Schroon L-N	8/18/2004				0.003	0.18	0.01	0.42	132.85					
34	Schroon L-N	9/1/2004				0.005	0.19	0.01	0.26	57.51					
34	Schroon L-N	9/14/2004	43.3		30.5	0.006	0.03	0.04	0.33	59.04					
34	Schroon L-N	6/21/2005			30.5	0.010									
34	Schroon L-N	7/5/2005													
34	Schroon L-N	7/19/2005			25.0	0.014									
34	Schroon L-N	8/2/2005			25.0	0.036									
34	Schroon L-N	8/16/2005			25.0	0.028									
34	Schroon L-N	8/30/2005			25.0	0.038									

LNum	PName	Date	Zbot	Zsd	Zsamp	Tot.P	NO3	NH4	TDN	TN/TP	TColor	pH	Cond25	Ca	Chl.a
34	Schroon L-N	9/13/2005			25.0	0.034									
34	Schroon L-N	9/27/2005			25.0										
34	Schroon L-N	6/16/2006	44.8		30.5	0.007									
34	Schroon L-N	6/29/2006	44.2		30.5	0.011									
34	Schroon L-N	7/27/2006	44.8		30.5	0.010									
34	Schroon L-N	8/10/2006	44.2		30.5	0.013									
34	Schroon L-N	8/24/2006	43.3		30.5	0.005									
34	Schroon L-N	9/7/2006	44.2		30.5	0.004									
34	Schroon L-N	9/20/2006	44.2		30.5	0.008									
34	Schroon L-N	6/22/2008	33.0		33.0	0.059									
34	Schroon L-N	7/5/2008	30.0		30.0	0.005									
34	Schroon L-N	7/21/2008	31.0		30.5	0.005									
34	Schroon L-N	8/1/2008	32.0		30.5	0.003									
34	Schroon L-N	8/18/2008			31.0	0.005									
34	Schroon L-N	8/29/2008	30.5		30.5	0.004									
34	Schroon L-N	9/16/2008	33.5		30.5	0.002									
34	Schroon L-N	9/25/2008	32.0		30.0	0.005									

LNum	PName	Date	Zbot	Zsd	Zsamp	Tot.P	NO3	NH4	TDN	TN/TP	TColor	pH	Cond25	Ca	Chl.a
34.1	Schroon L-S	6/24/2003	35.7	3.95	1.0	0.004	0.15	0.02	0.17	41.00	16	7.31	72	8.4	0.49
34.1	Schroon L-S	7/8/2003	36.6	4.85	1.0	0.004	0.07	0.01	0.32	78.09	11	7.38	74		1.16
34.1	Schroon L-S	7/22/2003	34.0	6.14		0.004	0.05	0.03	0.28	73.80	15	7.44	77		2.05
34.1	Schroon L-S	8/5/2003	34.0	3.95	1.0	0.004	0.00	0.02	0.28	64.14	17	7.15	78		3.15
34.1	Schroon L-S	8/19/2003	36.6	3.30	1.0	0.004	0.00	0.01	0.23	62.40	11	7.23	79	6.7	2.83
34.1	Schroon L-S	9/2/2003	32.6	4.60	1.0	0.004	0.00	0.01	0.16	40.20	17	7.24	81		1.96
34.1	Schroon L-S	9/17/2003	35.0	4.95	1.0	0.004	0.00	0.01	0.11	27.86	13	7.04	85		2.21
34.1	Schroon L-S	9/30/2003	35.0	2.83	1.5	0.006	0.02	0.01	0.29	47.41	17	6.97	86		2.22
34.1	Schroon L-S	6/11/2004		5.00		0.006	0.09	0.02	0.38	62.83	22	6.26	73		1.22
34.1	Schroon L-S	6/23/2004	34.7	9.00	1.0	0.004	0.05	0.01	0.29	80.38	16	6.25	72		2.09
34.1	Schroon L-S	7/7/2004	34.4	4.50	1.0	0.003	0.09	0.03	1.04	301.24	16	6.76	74		0.50
34.1	Schroon L-S	7/21/2004	34.5	4.00		0.005	0.05	0.07	0.36	77.23	13	7.54	76		0.40
34.1	Schroon L-S	8/4/2004	35.1	3.70	1.0	0.005	0.02	0.02	0.23	45.52	17	7.77	85		3.30
34.1	Schroon L-S	8/18/2004	36.0	2.90	1.0	0.003	0.02	0.01	0.35	138.23	14	7.20	63		2.70
34.1	Schroon L-S	9/1/2004	36.0	4.10	1.0	0.003	0.03	0.01	0.38	124.89		7.02	61		2.60
34.1	Schroon L-S	9/14/2004	36.0	5.00	1.0	0.006	0.03	0.03	0.34	61.04	18	6.64	64		1.20
34.1	Schroon L-S	6/21/2005	36.0	3.00	1.0	0.006	0.01	0.08	0.33	53.51	28	8.00	65	5.9	2.30
34.1	Schroon L-S	7/5/2005	25.0	2.80	1.0	0.005	0.02	0.06	0.25	45.84	23	7.80	64		1.23
34.1	Schroon L-S	7/19/2005	34.1	3.40	1.0	0.014	0.01	0.05	0.17	12.12	15	7.29	72		2.80
34.1	Schroon L-S	8/2/2005	34.0	3.15	1.0	0.014	0.04	0.02	0.31	21.91	39	7.02	76		4.85
34.1	Schroon L-S	8/16/2005	35.0	3.10	1.0	0.019	0.03	0.02	0.29	15.81	40	6.83	72	6.3	2.12
34.1	Schroon L-S	8/30/2005	34.0	4.48	1.0	0.021	0.01	0.01	0.19	8.92	20	7.31	90		2.52
34.1	Schroon L-S	9/13/2005	33.0	3.25	1.0	0.019	0.01	0.01	0.17	8.83	14	7.30	73		2.18
34.1	Schroon L-S	9/27/2005	34.1	4.10	1.0	0.010	0.02	0.03	0.15	15.33	16	7.06	82		1.17
34.1	Schroon L-S	6/16/2006	34.8	3.45	1.0	0.011	0.10	0.01	0.27	24.29	13	7.27	48	5.0	2.09
34.1	Schroon L-S	6/28/2006	36.0	3.25	1.0	0.010	0.08	0.03	0.41	41.11	18	7.75	60		2.79
34.1	Schroon L-S	7/27/2006	34.1	3.09	1.0	0.011	0.03	0.02	0.50	46.49	37	8.40	37		3.65
34.1	Schroon L-S	8/10/2006	35.1	3.00	1.0	0.011	0.04	0.02	0.62	59.20	28	7.81	66		3.91
34.1	Schroon L-S	8/24/2006	36.0	3.15	1.0	0.009	0.05	0.03	0.66	77.15	17	7.55	74	5.7	0.41
34.1	Schroon L-S	9/7/2006	36.0	3.15	1.0	0.005	0.03	0.03	0.51	103.52	11	7.60	60		2.67
34.1	Schroon L-S	9/20/2006	36.0	3.00	1.0	0.010	0.04	0.09	0.46	45.87	13	7.86	73		1.56
34.1	Schroon L-S	6/22/2008	33.0	3.90	1.5	0.026	0.04	0.01	0.25	21.11	21	6.98	58	6.0	0.71
34.1	Schroon L-S	7/23/2008	43.0	4.45	1.5	0.004					15	8.24	58		0.10
34.1	Schroon L-S	8/18/2008	33.0	2.30	1.5	0.005	0.01	0.00	0.27	114.69		7.76	61		0.10
34.1	Schroon L-S	8/27/2008	33.0	2.85		0.007	0.01	0.00	0.17	56.77	26	7.88	66		0.10
34.1	Schroon L-S	9/15/2008				0.004	0.02	0.02	0.20	110.27	19	7.65	69	4.3	0.10
34.1	Schroon L-S	9/20/2008	33.0	4.40		0.006	0.02	0.01	0.20	77.22	20	7.52	65		0.10
34.1	Schroon L-S	9/23/2008	44.0	4.23		0.005	0.03	0.01	0.19	86.66	19	7.74	77		0.64
34.1	Schroon L-S	10/7/2008		5.30	1.5	0.004	0.03	0.01	0.17	95.26	17	8.30	79		0.10
34.1	Schroon L-S	6/24/2003			30.5	0.004	0.16	0.02	0.15	36.88	6	6.96	147		
34.1	Schroon L-S	7/8/2003			30.5	0.004	0.17	0.02	0.36	96.23					1.41
34.1	Schroon L-S	7/22/2003			30.5	0.003	0.17	0.01	0.27	80.33					
34.1	Schroon L-S	8/5/2003			34.0	0.004	0.10	0.01	0.28	73.96					

LNum	PName	Date	Zbot	Zsd	Zsamp	Tot.P	NO3	NH4	TDN	TN/TP	TColor	pH	Cond25	Ca	Chl.a
34.1	Schroon L-S	8/19/2003			30.5	0.004	0.03	0.01	0.26	72.43					
34.1	Schroon L-S	9/2/2003			30.5	0.007	0.18	0.00	0.45	63.58					
34.1	Schroon L-S	9/17/2003			30.5	0.004	0.05	0.01	0.14	32.65					
34.1	Schroon L-S	9/30/2003			30.5	0.004	0.24	0.01	0.42	95.82					
34.1	Schroon L-S	6/11/2004			34.4	0.007	0.17	0.02	0.43	64.33					
34.1	Schroon L-S	6/23/2004	34.7		30.5	0.003	0.14	0.02	0.24	95.72					
34.1	Schroon L-S	7/7/2004	34.4		30.5	0.004	0.25	0.03	1.04	291.49					
34.1	Schroon L-S	7/21/2004	34.5		30.5	0.003	0.14	0.03	0.25	75.72					
34.1	Schroon L-S	8/4/2004	35.1		30.5	0.005	0.18	0.02	0.41	87.92					
34.1	Schroon L-S	8/18/2004	36.0		30.5	0.002	0.15	0.01	0.25	108.94					
34.1	Schroon L-S	9/1/2004	36.0		30.5	0.004	0.15	0.01	0.27	69.27					
34.1	Schroon L-S	9/14/2004	36.0		30.5	0.004			0.45	108.66					
34.1	Schroon L-S	6/21/2005			30.5	0.007									
34.1	Schroon L-S	7/5/2005													
34.1	Schroon L-S	7/19/2005			25.0	0.004									
34.1	Schroon L-S	8/2/2005			25.0	0.013									
34.1	Schroon L-S	8/16/2005			25.0	0.011									
34.1	Schroon L-S	8/30/2005			25.0	0.013									
34.1	Schroon L-S	9/13/2005			25.0	0.006									
34.1	Schroon L-S	9/27/2005			25.0	0.012									
34.1	Schroon L-S	6/16/2006	34.8		30.5	0.006									
34.1	Schroon L-S	6/28/2006	36.0		30.5	0.007									
34.1	Schroon L-S	7/27/2006	34.1		30.5										
34.1	Schroon L-S	8/10/2006	35.1		30.5	0.003									
34.1	Schroon L-S	8/24/2006	36.0		30.5	0.010									
34.1	Schroon L-S	9/7/2006	36.0		30.5	0.004									
34.1	Schroon L-S	9/20/2006	36.0		30.5	0.009									
34.1	Schroon L-S	6/22/2008	33.0		33.0	0.006									
34.1	Schroon L-S	7/23/2008	43.0		30.5	0.004									
34.1	Schroon L-S	8/18/2008	33.0		33.0	2.650									
34.1	Schroon L-S	8/27/2008	33.0			1.389									
34.1	Schroon L-S	9/15/2008				1.401									
34.1	Schroon L-S	9/20/2008	33.0			0.005									
34.1	Schroon L-S	9/23/2008	44.0		33.0	0.004									
34.1	Schroon L-S	10/7/2008			30.5	0.004									

LNum	PName	Date	Zbot	Zsd	Zsamp	QaQc	TAir	TH20	QA	QB	QC	QD
34	Schroon L	6/23/1987	2.0		1.5	1	25	20				
34	Schroon L	7/1/1987	20.0	3.00	1.5	1	18	20				
34	Schroon L	7/8/1987	21.0	4.00	1.5	1	20	20				
34	Schroon L	7/13/1987	21.0	3.00	1.5	1	24	25				
34	Schroon L	7/21/1987	20.0	4.00	1.5	1	20	22				
34	Schroon L	7/27/1987	20.0	4.00	1.5	1	23	23				
34	Schroon L	8/4/1987	20.0	4.00	1.5	1	25	22				
34	Schroon L	8/7/1987	45.0	4.15	1.5	1	24	22				
34	Schroon L	8/14/1987	23.7	3.50	1.5	1	25	23				
34	Schroon L	8/17/1987	23.0	3.35	1.5	1	25	23				
34	Schroon L	8/24/1987	23.0	3.15	1.5	1	19	20				
34	Schroon L	8/30/1987	25.0	4.25	1.5	1	20	19				
34	Schroon L	9/9/1987	24.0	3.83	1.5	1	20	19				
34	Schroon L	9/14/1987	23.5	5.35	1.5	1	17	18				
34	Schroon L	9/22/1987	23.0	5.10	1.5	1	18	15				
34	Schroon L	7/6/1988	22.5	4.30	1.5	1	27	26				
34	Schroon L	7/20/1988	25.0	5.25	1.5	1	24	26				
34	Schroon L	8/4/1988	25.0	5.05	1.5	1	28	27				
34	Schroon L	8/16/1988	25.0	4.50	1.5	1	21	25				
34	Schroon L	8/31/1988	25.0	5.20	1.5	1	23	20				
34	Schroon L	9/12/1988	25.0	5.45	1.5	1	16	19				
34	Schroon L	9/26/1988	18.0	5.75	1.5	1	16	16				
34	Schroon L	6/27/1989	23.0	4.90	1.5	1	22	22				
34	Schroon L	7/5/1989	24.0	4.60	1.5	1	20	20				

LNum	PName	Date	Zbot	Zsd	Zsamp	QaQc	TAir	TH20	QA	QB	QC	QD
34	Schroon L	7/17/1989	20.0	4.25	1.5	1	22	20				
34	Schroon L	7/31/1989	18.3	4.85	1.5	1	24	22				
34	Schroon L	8/14/1989	24.4	3.65	1.5	1	23	23				
34	Schroon L	8/29/1989	18.3	3.10	1.5	1	22	20				
34	Schroon L	9/11/1989	25.0	3.55	1.5	1	20	20				
34	Schroon L	9/25/1989	25.0	3.75	1.5	1	10	15				
34	Schroon L	7/2/1990	24.0	4.20	1.5	1	28	24				
34	Schroon L	7/19/1990	25.0	4.70	1.5	1	24	22				
34	Schroon L	7/30/1990	25.0	5.10	1.5	1	26	28				
34	Schroon L	8/15/1990	25.0	4.00	1.5	1	22	23				
34	Schroon L	9/4/1990	25.0	5.60	1.5	1	22	22				
34	Schroon L	9/17/1990	25.0	3.80	1.5	1	10	17				
34	Schroon L	10/1/1990	25.0	4.95	1.5	1	17	14				
34	Schroon L	7/9/1991	25.0	6.50	1.5	1	21	23				
34	Schroon L	7/22/1991	25.0	5.72	1.5	1	24	28				
34	Schroon L	8/6/1991	25.0	5.80	1.5	1	18	23				
34	Schroon L	8/19/1991	20.0	4.30	1.5	1	20	23				
34	Schroon L	9/3/1991	25.0	3.90	1.5	1	20	21				
34	Schroon L	9/16/1991	25.0	3.70	1.5	1	27	27				
34	Schroon L	7/20/1997		4.00	1.5	1	24	23	1	2	1	
34	Schroon L	8/3/1997	9.3	5.05	1.5	1	31	25	1	1	1	
34	Schroon L	9/8/1997		2.80	1.5	1		20	2	2	1	
34	Schroon L	6/10/2002	43.6	3.05	1.0	1	22	21	1	2	1	5
34	Schroon L	6/25/2002	44.2	3.25	1.0	1	28	24	2	2	2	
34	Schroon L	7/9/2002	44.3	4.10	1.0	1	25	23	1	1	2	5
34	Schroon L	7/23/2002	43.6	3.30	2.0	1	25	24	1	1	2	5
34	Schroon L	8/6/2002	42.6	8.50	1.0	1	18	24	1	1	4	5
34	Schroon L	8/20/2002	44.2	3.30		1	26	26	2	2	1	
34	Schroon L	9/3/2002	43.9	3.50		1	27	23.5	2	1	2	5
34	Schroon L	9/17/2002	42.6	4.50	1.0	1	25	21	1	1	1	
34	Schroon L-N	6/24/2003	44.2	3.45	1.0	1	35	23	2	1	1	8
34	Schroon L-N	7/8/2003	42.7	4.15	1.0	1	26	26	1	1	1	
34	Schroon L-N	7/22/2003	44.5	5.54		1	23	23	1	1	1	8
34	Schroon L-N	8/5/2003	43.0	2.75	1.0	1	25	26	2	1	2	5
34	Schroon L-N	8/19/2003	42.7	3.10		1	22	24	1	1	1	
34	Schroon L-N	9/2/2003	43.9	3.40	1.0	1	21		2	1	5	58
34	Schroon L-N	9/17/2003	44.0	3.60	1	1	23	21	1	1	1	
34	Schroon L-N	9/30/2003	45.1	3.88		1	23		1	1	1	5
34	Schroon L-N	6/11/2004		6.75		1	20	20	3	1	3	8
34	Schroon L-N	6/23/2004	44.2	10.00	1.0	1	25	21	2	1	1	0
34	Schroon L-N	7/7/2004	43.9	4.00	1.0	1	21	21	2	1	2	5
34	Schroon L-N	7/21/2004	44.5	4.38		1	27	23	1	1	2	5
34	Schroon L-N	8/4/2004	44.5	4.05	1.0	1	19	23	2	1	3	5
34	Schroon L-N	8/18/2004	43.3	3.85	1.0	1	21	20	2	1	4	5
34	Schroon L-N	9/1/2004	44.8	3.40	1.0	1	20	20	1	1	3	5
34	Schroon L-N	9/14/2004	43.3	4.10	1.0	1	18	18	2	1	2	0
34	Schroon L-N	6/21/2005	46.0	2.80	1.0	1	23	18	2	1	3	0
34	Schroon L-N	7/5/2005	44.8	2.25	1.0	1	18	23	3	1	4	5
34	Schroon L-N	7/19/2005	44.8	3.10	1.0	1	25	24	2	1	3	5
34	Schroon L-N	8/2/2005	44.0	2.85	1.0	1	22	22	2	1	1	0
34	Schroon L-N	8/16/2005	44.2	2.65	1.0	1	18	22	1	1	2	5
34	Schroon L-N	8/30/2005	44.0	3.90	1.0	1	18	20	2	1	2	5
34	Schroon L-N	9/13/2005	45.0	3.30	1.0	1	21	21	1	1	1	0
34	Schroon L-N	9/27/2005	45.1	4.45	1.0	1	14	18	1	1	1	0
34	Schroon L-N	6/16/2006	44.8	2.75	1.5	1	25	16	2	1	2	5
34	Schroon L-N	6/29/2006	44.2	2.60	1.0	1	19	17	2	1	4	58
34	Schroon L-N	7/27/2006	44.8	2.90	1.0	1	22	22	2	2	3	5
34	Schroon L-N	8/10/2006	44.2	2.70	1.0	1	17	22	2	2	2	5
34	Schroon L-N	8/24/2006	43.3	3.30	1.0	1	12	19	2	2	3	5
34	Schroon L-N	9/7/2006	44.2	3.70	1.0	1	18	18	2	2	3	5

LNum	PName	Date	Zbot	Zsd	Zsamp	QaQc	TAir	TH20	QA	QB	QC	QD
34	Schroon L-N	9/20/2006	44.2	2.85	1.0	1	14	17	2	2	3	5
34	Schroon L-N	6/22/2008	33.0	4.00	1.5	1	16		1	1	4	5
34	Schroon L-N	7/5/2008	30.0	7.10	1.5	1	21	20	1		1	0
34	Schroon L-N	7/21/2008	31.0	5.35	1.5	1	18	22	2	2	3	6
34	Schroon L-N	8/1/2008	32.0	5.55	1.5	1	19	21	1	2	2	0
34	Schroon L-N	8/18/2008		4.35	1.5	1	17	17	2	1	1	0
34	Schroon L-N	8/29/2008	30.5	4.65	1.5	1	18	20	2	2	2	0
34	Schroon L-N	9/16/2008	33.5	4.95	1.5	1	12	18	1	1	1	0
34	Schroon L-N	9/25/2008	32.0	5.40	1.5	1	15	16	1	2	1	0
34	Schroon L	6/10/2002	43.6	3.05	30.5	2	22	10				
34	Schroon L	6/25/2002	44.2	3.25	30.5	2	28	12				
34	Schroon L	7/9/2002	44.3	4.10		2	25					
34	Schroon L	7/23/2002	43.6	3.30		2	25					
34	Schroon L	8/6/2002	42.6	8.50	30.5	2	18	10				
34	Schroon L	8/20/2002	44.2	3.30	30.5	2	26	9				
34	Schroon L	9/3/2002	43.9	3.50		2	27	10.0				
34	Schroon L	9/17/2002	42.6	4.50	30.5	2	25	11				
34	Schroon L-N	6/24/2003			30.5	2		9				
34	Schroon L-N	7/8/2003			30.5	2		9				
34	Schroon L-N	7/22/2003			30.5	2		8				
34	Schroon L-N	8/5/2003			43.0	2		8				
34	Schroon L-N	8/19/2003				2		12				
34	Schroon L-N	9/2/2003			30.5	2		7				
34	Schroon L-N	9/17/2003			30.5	2		7				
34	Schroon L-N	9/30/2003			30.5	2		7				
34	Schroon L-N	6/11/2004			44.2	2		7				
34	Schroon L-N	6/23/2004	44.2		30.5	2		6				
34	Schroon L-N	7/7/2004	43.9		30.5	2		7				
34	Schroon L-N	7/21/2004	44.5		30.5	2		7				
34	Schroon L-N	8/4/2004				2						
34	Schroon L-N	8/18/2004				2						
34	Schroon L-N	9/1/2004				2						
34	Schroon L-N	9/14/2004	43.3		30.5	2		5				
34	Schroon L-N	6/21/2005			30.5	2						
34	Schroon L-N	7/5/2005				2						
34	Schroon L-N	7/19/2005			25.0	2		6				
34	Schroon L-N	8/2/2005			25.0	2		5				
34	Schroon L-N	8/16/2005			25.0	2		6				
34	Schroon L-N	8/30/2005			25.0	2		6				
34	Schroon L-N	9/13/2005			25.0	2		7				
34	Schroon L-N	9/27/2005			25.0	2		5				
34	Schroon L-N	6/16/2006	44.8		30.5	2		9				
34	Schroon L-N	6/29/2006	44.2		30.5	2		8				
34	Schroon L-N	7/27/2006	44.8		30.5	2		5				
34	Schroon L-N	8/10/2006	44.2		30.5	2		5				
34	Schroon L-N	8/24/2006	43.3		30.5	2		5				
34	Schroon L-N	9/7/2006	44.2		30.5	2		5				
34	Schroon L-N	9/20/2006	44.2		30.5	2		5				
34	Schroon L-N	6/22/2008	33.0		33.0	2		3				
34	Schroon L-N	7/5/2008	30.0		30.0	2		5				
34	Schroon L-N	7/21/2008	31.0		30.5	2		5				
34	Schroon L-N	8/1/2008	32.0		30.5	2		5				
34	Schroon L-N	8/18/2008			31.0	2		4				
34	Schroon L-N	8/29/2008	30.5		30.5	2		4				
34	Schroon L-N	9/16/2008	33.5		30.5	2		5				
34	Schroon L-N	9/25/2008	32.0		30.0	2		5				
34.1	Schroon L-S	6/24/2003	35.7	3.95	1.0	11	36	24	2	1	1	8
34.1	Schroon L-S	7/8/2003	36.6	4.85	1.0	11	27	25	1	1	1	
34.1	Schroon L-S	7/22/2003	34.0	6.14		11	23	23	1	1	1	8
34.1	Schroon L-S	8/5/2003	34.0	3.95	1.0	11	26	24	2	1	2	5

LNum	PName	Date	Zbot	Zsd	Zsamp	QaQc	TAir	TH20	QA	QB	QC	QD
34.1	Schroon L-S	8/19/2003	36.6	3.30	1.0	11	22	24	1	1	1	
34.1	Schroon L-S	9/2/2003	32.6	4.60	1.0	11	18	21	2	1	2	5
34.1	Schroon L-S	9/17/2003	35.0	4.95	1.0	11	23	21	1	1	1	
34.1	Schroon L-S	9/30/2003	35.0	2.83	1.5	11	16		1	1	1	5
34.1	Schroon L-S	6/11/2004		5.00		11	23	19	3	1	3	8
34.1	Schroon L-S	6/23/2004	34.7	9.00	1.0	11	25	21	2	1	1	0
34.1	Schroon L-S	7/7/2004	34.4	4.50	1.0	11	19	21	2	1	2	5
34.1	Schroon L-S	7/21/2004	34.5	4.00		11	27	23	1	1	2	5
34.1	Schroon L-S	8/4/2004	35.1	3.70	1.0	11	20	24	2	1	3	5
34.1	Schroon L-S	8/18/2004	36.0	2.90	1.0	11	20	20	2	1	4	5
34.1	Schroon L-S	9/1/2004	36.0	4.10	1.0	11	20	21	1	1	2	5
34.1	Schroon L-S	9/14/2004	36.0	5.00	1.0	11	17	17	2	1	1	0
34.1	Schroon L-S	6/21/2005	36.0	3.00	1.0	1	23	19	2	1	3	0
34.1	Schroon L-S	7/5/2005	25.0	2.80	1.0	1	18	22	3	1	4	5
34.1	Schroon L-S	7/19/2005	34.1	3.40	1.0	1	25	24	2	1	3	5
34.1	Schroon L-S	8/2/2005	34.0	3.15	1.0	1	23	22	2	1	1	0
34.1	Schroon L-S	8/16/2005	35.0	3.10	1.0	1	20	22	1	1	2	5
34.1	Schroon L-S	8/30/2005	34.0	4.48	1.0	1	16	20	2	1	2	5
34.1	Schroon L-S	9/13/2005	33.0	3.25	1.0	1	24	21	1	1	1	0
34.1	Schroon L-S	9/27/2005	34.1	4.10	1.0	1	17	17	1	1	1	0
34.1	Schroon L-S	6/16/2006	34.8	3.45	1.0	1	25	17	2	2	2	5
34.1	Schroon L-S	6/28/2006	36.0	3.25	1.0	1	21	18	2	1	4	5
34.1	Schroon L-S	7/27/2006	34.1	3.09	1.0	1	22	22	2	2	3	5
34.1	Schroon L-S	8/10/2006	35.1	3.00	1.0	1	18	22	2	2	1	5
34.1	Schroon L-S	8/24/2006	36.0	3.15	1.0	1	13	19	2	2	3	5
34.1	Schroon L-S	9/7/2006	36.0	3.15	1.0	1	18	18	2	2	3	5
34.1	Schroon L-S	9/20/2006	36.0	3.00	1.0	1	13	16	2	2	3	5
34.1	Schroon L-S	6/22/2008	33.0	3.90	1.5	1	16	21	1	2	1	0
34.1	Schroon L-S	7/23/2008	43.0	4.45	1.5	1	21	23	1	1	1	5
34.1	Schroon L-S	8/18/2008	33.0	2.30	1.5	1	24	24	1	1	1	15
34.1	Schroon L-S	8/27/2008	33.0	2.85		1	28	23	1	3	1	0
34.1	Schroon L-S	9/15/2008				1						
34.1	Schroon L-S	9/20/2008	33.0	4.40		1	24	21	1	1	1	0
34.1	Schroon L-S	9/23/2008	44.0	4.23		1	24	22				
34.1	Schroon L-S	10/7/2008		5.30	1.5	1	6	12	1	2	1	8
34.1	Schroon L-S	6/24/2003			30.5	22		9				
34.1	Schroon L-S	7/8/2003			30.5	22		9				
34.1	Schroon L-S	7/22/2003			30.5	22		7				
34.1	Schroon L-S	8/5/2003			34.0	22		8				
34.1	Schroon L-S	8/19/2003			30.5	22		11				
34.1	Schroon L-S	9/2/2003			30.5	22		8				
34.1	Schroon L-S	9/17/2003			30.5	22		15				
34.1	Schroon L-S	9/30/2003			30.5	22		7				
34.1	Schroon L-S	6/11/2004			34.4	22		8				
34.1	Schroon L-S	6/23/2004	34.7		30.5	22		6				
34.1	Schroon L-S	7/7/2004	34.4		30.5	22		5				
34.1	Schroon L-S	7/21/2004	34.5		30.5	22		6				
34.1	Schroon L-S	8/4/2004	35.1		30.5	22		6				
34.1	Schroon L-S	8/18/2004	36.0		30.5	22		7				
34.1	Schroon L-S	9/1/2004	36.0		30.5	22		6				
34.1	Schroon L-S	9/14/2004	36.0		30.5	22		6				
34.1	Schroon L-S	6/21/2005			30.5	2		6				
34.1	Schroon L-S	7/5/2005				2						
34.1	Schroon L-S	7/19/2005			25.0	2		8				
34.1	Schroon L-S	8/2/2005			25.0	2		6				
34.1	Schroon L-S	8/16/2005			25.0	2		7				
34.1	Schroon L-S	8/30/2005			25.0	2		7				
34.1	Schroon L-S	9/13/2005			25.0	2		8				
34.1	Schroon L-S	9/27/2005			25.0	2		7				
34.1	Schroon L-S	6/16/2006	34.8		30.5	2		6				

LNum	PName	Date	Zbot	Zsd	Zsamp	QaQc	TAir	TH20	QA	QB	QC	QD
34.1	Schroon L-S	6/28/2006	36.0		30.5	2		8				
34.1	Schroon L-S	7/27/2006	34.1		30.5	2		5				
34.1	Schroon L-S	8/10/2006	35.1		30.5	2		5				
34.1	Schroon L-S	8/24/2006	36.0		30.5	2		5				
34.1	Schroon L-S	9/7/2006	36.0		30.5	2		7				
34.1	Schroon L-S	9/20/2006	36.0		30.5	2		5				
34.1	Schroon L-S	6/22/2008	33.0		33.0	2						
34.1	Schroon L-S	7/23/2008	43.0		30.5	2		8				
34.1	Schroon L-S	8/18/2008	33.0		33.0	2		9				
34.1	Schroon L-S	8/27/2008	33.0			2		10				
34.1	Schroon L-S	9/15/2008				2						
34.1	Schroon L-S	9/20/2008	33.0			2		9				
34.1	Schroon L-S	9/23/2008	44.0		33.0	2		8				
34.1	Schroon L-S	10/7/2008			30.5	2		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 $S = \Sigma(P-Q)$. 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 SCHROON LAKE

CSLAP Number	34
Lake Name	Schroon L
First CSLAP Year	1987
Sampled in 2007?	yes
Latitude	434340
Longitude	734842
Elevation (m)	246
Area (ha)	1670.6
Volume Code	5
Volume Code Name	Upper Hudson River
Pond Number	374
Qualifier	none
Water-quality Classification	AA
County	Essex
Town	Schroon Lake
Watershed Area (ha)	1.36E+05
Retention Time (years)	0.40
Mean Depth (m)	17.0
Runoff (m/yr)	0.52
Watershed Number	11
Watershed Name	Upper Hudson River
NOAA Section	7
Closest NOAA Station	North Creek
Closest USGS Gaging Station-Number	1315500
Closest USGS Gaging Station-Name	Hudson River at North Creek
CSLAP Lakes in Watershed	Adirondack L, Babcock L, Ballston L, Brant L, Cossayuna L, Eagle L, Efner L, Friends L, Garnet L, Goodnow F, Hedges L, Hunt L, Kellum L, L Forest, L Lauderdale, L Luzerne, Loon L-W, Mayfield L, Moreau L, Paradox L, Piseco L, Sacandaga L, Saratoga L, Schroon L, Summit L-W, Taconic P, Windover L

APPENDIX E: AQUATIC PLANTS FOUND THROIUGH CSLAP IN SCHROON LAKE

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.

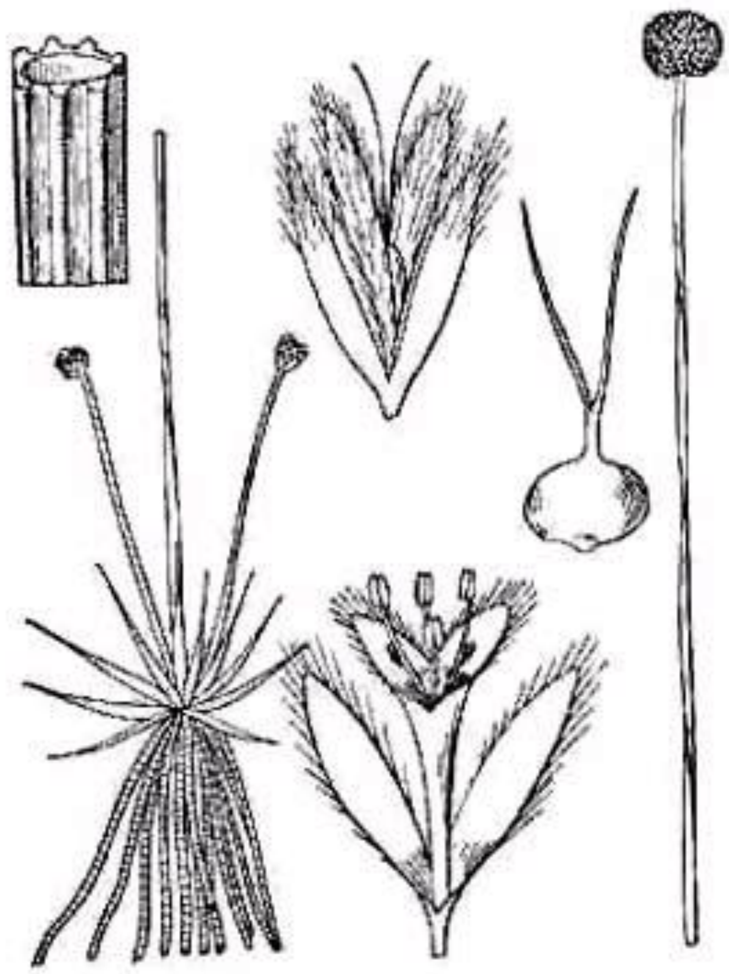
COMMENTS: *Elodea* is entirely submersed, often forming large masses near the lake bottom, typically in 3-12 feet of water. The stem pattern is similar to that of the *Potamogeton*, *Ruppia*, *Zanichellia*, *Najas*, *Callitriche*, and *Utricularia*. It is a member of the frogbit family (*Hydrocharitaceae*), 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: *Eriocaulon septangulaire*

COMMON NAME: pipewort

ECOLOGICAL VALUE: like all submergents, *Eriocaulon* harbors aquatic insects, provides hiding, nurseries and spawning areas for amphibians and fish, and provides some food for waterfowl.



DISTRIBUTION: in shallow to deep waters of sandy, gravelly, or peaty shores of rivers, lakes, slow streams, and saline estuaries from Newfoundland west to western Ontario, south to Long Island, New Jersey, Delaware, North Carolina, northern Ohio, northern Indiana, Wisconsin and Minnesota.

DISTRIBUTION IN NEW YORK: common and often abundant, particularly in Long Island, the Catskills, the Hudson River basin, and Adirondacks

DEGREE OF NUISANCE: while it may be frequent and common in some lakes, only occasionally is *Eriocaulon* present at nuisance levels

COMMENTS: This genus is characterized by long, slender, taper-pointed, translucent leaves which show many cross-veins when held to a light. The roots are white and fibrous with cross-markings. It commonly does not exceed 20 feet in depth, but can be found in about 30 feet of water. There are two species found in New York State, one of which (*Eriocaulon parkeri*) is limited primarily to shallow estuarine waters of the Hudson River. *Eriocaulon septangulaire* was also once known as *Eriocaulon articulatum*. The stems are seldom less than 10cm tall, and they often elongate so that the stalk heads reach the surface

Line drawing: http://www.nearctica.com/flowers/dtoh/Eseptan.htm

SPECIES NAME: *Myriophyllum humile*

COMMON NAME: low water milfoil

ECOLOGICAL VALUE: like most submergents, *Myriophyllum* harbors aquatic insects, provides hiding, nurseries, and spawning areas for amphibians and fish, and provides some food for waterfowl.

DISTRIBUTION: common in aquatic and terrestrial forms from Nova Scotia west (sparingly) to Minnesota, south to New England, eastern New York, eastern Pennsylvania, and eastern Maryland.

DISTRIBUTION IN NEW YORK: relatively uncommon, though locally abundant in the Long Island area, with some presence in the lower Hudson River area and the Adirondacks.

DEGREE OF NUISANCE: *M. humile* seldom becomes abundant to a nuisance level in New York, although it is a frequently observed plant in some locations.

COMMENTS: the individual species within the *Myriophyllum* genus are superficially similar, so complete plants, including flowers (often pink) and fruits, are often needed for positive identification. The leaf structures and patterns of the milfoil closely resemble those of the *Ceratophyllum* (coontail) and *Utricularia* (bladderwort), and as a result, these plants are often confused for each other, particularly when viewed from a slight distance. Peak growth for most species is in mid-summer. *Myriophyllum* spreads and reproduces vegetatively. *M. humile* closely resembles both *M. farwelli* and *M. alterniflorum*, so, as with other milfoils, fruits or turions (the overwintering buds) are often needed to distinguish these plants. Since these structures were often not available in specimen sent through CSLAP, it is quite possible that plants identified as *M. humile* may be one of the other species. *M. humile* (and *M. farwelli*) is distinguished from the other milfoils by having both whorled and scattered leaves, and flowers in the submersed leaves, not in spikes borne above the water. It is on the rare and endangered plant list in at least one New England state.

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

SPECIES NAME: *Potamogeton praelongus*

COMMON NAME: white stemmed pondweed, muskie weed

ECOLOGICAL VALUE: like most submergents, *Potamogeton* harbors aquatic insects, provides hiding, nurseries and spawning areas for amphibians and fish, and provides some food for waterfowl. The leaves are eaten by bluegills, while both the seeds and foliage are used for food by muskrats and waterfowl. *Potamogeton* is often a favorite food of wildfowl and eaten heavily by beaver, deer, and moose, sometimes eaten whole, and sometimes in parts (all species are edible). *Potamogeton* can soften water, removing lime and carbon dioxide and depositing marl. This species produces fruits, tubers and roots, all of which are eagerly sought by waterfowl. *P. praelongus* provides a feeding ground for muskellunge, is a good food producer for trout and provides good food for ducks

961. Potamogeton prælongus Wulf.
Long Pondweed.

DISTRIBUTION: locally abundant in deep, moderately alkaline waters from Labrador west to Alaska, south to New Jersey, Ohio, Indiana, Colorado, Utah, and California.

DISTRIBUTION IN NEW YORK: occasionally found in the deep water of lakes and streams throughout the state, particularly in the Upper Hudson River and St. Lawrence River basins, and in the Finger Lakes.

DEGREE OF NUISANCE: while this plant may grow successfully in some lakes, it rarely becomes abundant to a nuisance level.

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. praelongus* is on the rare and endangered plant list in at least one New England state.

Line drawing- http://caliban.mpiz-koeln.mpg.de/~stueber/fitch/icon_page_00990.html

SPECIES NAME: *Potamogeton robbinsii*

COMMON NAME: Robbins' pondweed, fern-leaf pondweed

ECOLOGICAL VALUE: like most submergents, *Potamogeton* harbors aquatic insects, provides hiding, nurseries and spawning areas for amphibians and fish, and provides some food for waterfowl. The leaves are eaten by bluegills, while both the seeds and foliage are used for food by muskrats and waterfowl. *Potamogeton* is often a favorite food of wildfowl and eaten heavily by beaver, deer, and moose, sometimes eaten whole, and sometimes in parts (all species are edible). *Potamogeton* can soften water, removing lime and carbon dioxide and depositing marl. *P. Robbinsii* provides food and shelter for fish, particularly for northern pike and food for ducks. It is tough, and probably not eaten by wildfowl

DISTRIBUTION: found in deep water and slow streams from Labrador west to British Columbia, south to New Jersey, Indiana, Alabama, Utah, and California, with the greatest abundance in the northeastern states.

DISTRIBUTION IN NEW YORK: occasional to common to locally abundant and weedy, primarily in the Hudson River and Great Lakes basins, the Finger Lakes, and the Adirondacks.

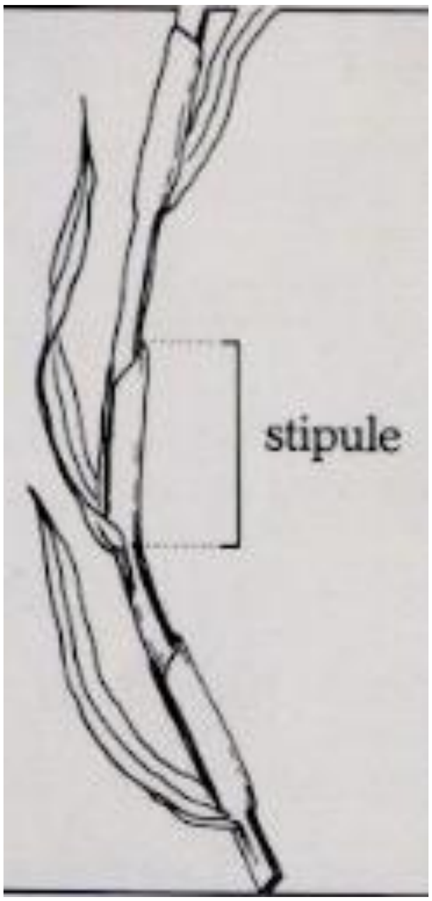
DEGREE OF NUISANCE: *P. richardsonii* can often dominate the bottom of a lake, but the plant rarely tops out or creates recreational or aesthetic impacts.

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. there is at least one subvariety of *P. robbinsii*- this is limited primarily to local occurrences. *P. robbinsii* is unique among the pondweeds in possessing rigid, flattened leaf structures, growing at deeper depths than other species, and generally sterile (plants flower, but do not fruit, near the surface).

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

SPECIES NAME: *Potamogeton zosteriformis*

COMMON NAME: flatstem pondweed, eelgrass pondweed



ECOLOGICAL VALUE: like most submergents, *Potamogeton* harbors aquatic insects, provides hiding, nurseries and spawning areas for amphibians and fish, and provides some food for waterfowl. The leaves are eaten by bluegills, while both the seeds and foliage are used for food by muskrats and waterfowl. *Potamogeton* is often a favorite food of wildfowl and eaten heavily by beaver, deer, and moose, sometimes eaten whole, and sometimes in parts (all species are edible). *Potamogeton* can soften water, removing lime and carbon dioxide and depositing marl. Sometimes *P. zosteriformis* is good duck food, but this plant does not generally support insects.

DISTRIBUTION: found in mostly alkaline lakes from Quebec west to Manitoba, south to northern Virginia, southern Ohio and Nebraska, with minor ranges and scattered occurrences throughout the country.

DISTRIBUTION IN NEW YORK: common in lakes and quiet streams throughout the state, especially along the Great Lakes and Finger Lakes regions, and the Hudson River basin.

DEGREE OF NUISANCE: it may be frequent or common, but seldom is *P. zosteriformis* present at nuisance levels.

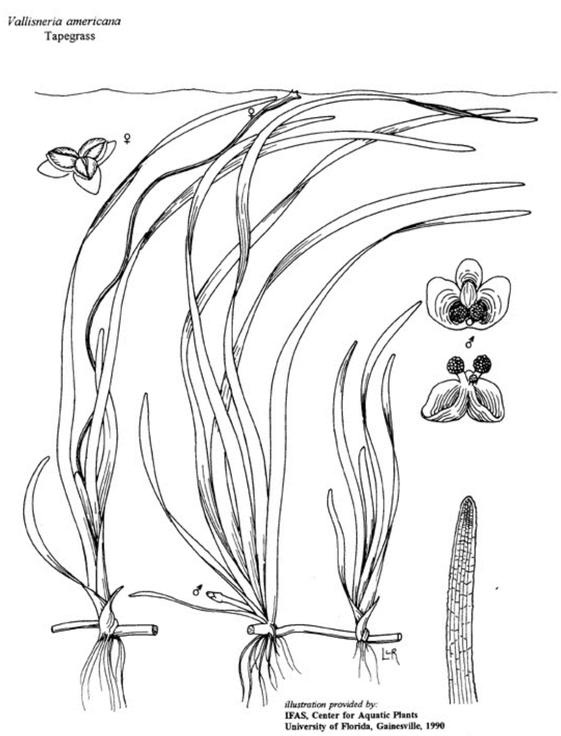
COMMENTS: *Potamogeton* is a highly variable genus within the pondweed family. Species within the genus often are characterized by two leaf types-firm floating leaves and thin emersed leaves. Many mature species have flowers borne in spikes (for wind pollination), conspicuous in early summer. Identification 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. there is at least one subvariety of *P. robbinsii*- this is limited primarily to local occurrences. *P. zosteriformis* has been known at times as *P. zosterifolius* and *P. compressus*, and it is on the rare and endangered plant 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: *Vallisneria americanum*

COMMON NAME: tapegrass/eelgrass/duck celery

ECOLOGICAL VALUE: like all submergents, *Vallisneria* harbors aquatic insects, provides hiding, nurseries, and spawning areas for amphibians and fish, and provides some food for waterfowl. It is valuable as a waterfowl food and considered an excellent plant along the margins of lakes and streams for protective fish spawning areas. It is an excellent food for wildfowl, which eat all parts, especially winter buds and rootstocks. This species attracts marsh birds, wildfowl, and shorebirds. It harbors minute animals and muskrat.



DISTRIBUTION: common in both acid and alkaline lakes, spring-fed streams, and clear or colored waters, usually in quiet waters at a depth of 2-10 feet, with a range extending from southern New Brunswick west to North Dakota and Nebraska, south to Florida, Texas, New Mexico, and Arizona.

DISTRIBUTION IN NEW YORK: very common and often abundant in lakes, the quiet waters of ponds and slow streams with muddy or sandy bottoms. It is found throughout the state, particularly along the Hudson River/Lake Champlain basins, Great Lakes basins, and Finger Lakes area

DEGREE OF NUISANCE: although *Vallisneria* is common to and often abundant in lakes, it rarely becomes a nuisance for recreational use or aesthetic enjoyment

COMMENTS: The leaves of this plant are dark green, slender and ribbon-like, and can grow up to 12 feet in length. Plants are submersed, and reproduce by rootstocks (roots and tubers) growing in soft sediments, although seed pods form after a white flower is pushed above the lake surface. *Vallisneria* is often confused with *Sagittaria*, since both possess flowing ribbon-like leaves- however, the *Vallisneria* does not produce a milky juice or scales. Proliferation of this plant is often the result of duck hunting; it reproduces sexually and by rhizome fragmentation. There is one major species of this plant in North America. *Vallisneria americanum* is protected for its beneficial properties in many areas. It is a member of the frogbit (*Hydrocharitaceae*) family with *Elodea*, although superficially these genera do not appear to be very similar. *V. americanum* is often used as an aquarium plant.

Line drawing: http://aquat1.ifas.ufl.edu/drawlist.html