Darrin Fresh Water Institute

AT LAKE GEORGE

THE 1996 LAKE GEORGE LAY MONITORING PROGRAM

by

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INTRODUCTION

October brought the seventeenth year of the Lake George Lay Monitoring Program to a close. This year there were several changes made in the location and number of sites which were measured due to the addition of several new volunteers. Overall, they collected 200 Secchi depth and surface water temperature readings from the north and south basins of Lake George. However, for 1996 there were no readings taken from Lake George Village north to Diamond Island and from Tea Island to Assembly Point in the south. In the north basin no readings were taken from French Point to Deer Leap or from Smith Bay to Anthony's Nose. In this report data taken by the Darrin Fresh Water Institute (DFWI) during the offshore chemical monitoring survey at Tea Island, Basin Bay, Dome Island and Northwest Bay in the south and French Point, Sabbath Day and Smith Bay in the north will be used to fill in some of the gaps between monitoring sites.

The goal of the Lay Monitoring Program continues to be the collection of a large amount of physical lake data over a long period of time through the voluntary efforts of Lake George basin residents. This allows for long-term monitoring of changes in physical characteristics of the lake. A beneficial side-effect of the Lay Monitoring Program has always been the opportunity to educate basin residents with hands-on experience about lake water quality and techniques used to study freshwater ecology.

The basic water quality parameters measured by all lay monitors included water temperature and transparency (Secchi depth). The lay monitors provided a great service by sampling the lake basin weekly, and supplying information that would not otherwise have been collected by the Darrin Fresh Water Institute.

SAMPLING SITES AND COLLECTION METHODS

There were a number of changes in site locations this year, with the loss of two monitors in the south and the addition of five in the north. The Lake George Lay Monitoring Program had a loss of four sites from the south basin and an addition of six in the north for 1996. Twenty-one separate areas of the lake were observed, with monitored sites spread throughout the lake. The southern half was covered by 5 lay monitor sites and DFWI at 4 sites from Tea Island to Northwest Bay. The northern half of the lake was covered by 9 lay monitor sites and by three DFWI sites from French Point in the Narrows to Windmill Point in the north. Figure 1 is a map of site locations and Table 1 is a list of lay monitors with their respective sites.

All lay monitors were equipped with a calibrated thermometer, Secchi disk, and data sheets. They were asked to record each week their observations and measurements of surface water temperature, Secchi depth and weather conditions -- wind, lighting, air temperature and precipitation -- during the months of June through September. Secchi depth is a measurement of water clarity determined by lowering an eight inch diameter, black and white Secchi disk into the water until the viewer can no longer see it and recording the depth. Data were to be collected between 10 A.M. and 2 P.M. when the sun was as directly overhead as possible. When convenient, measurements were to be limited to days with calm, clear weather in order to reduce the influence of waves and wind on the Secchi depth readings. Realistically, ideal conditions rarely occur, thereby affecting the results of the measurements.

RESULTS

A total of 200 Secchi depths and corresponding surface water temperatures were recorded by Lay monitors starting May 27th and ending October 15th, 1996. With the addition of several new volunteers this was almost a doubling of the number of results taken in 1995.

Surface water temperatures ranged from a spring low of 11^{o}C (51.8^{o}F) on May 27th to a high of 29^{o}C (84.2^{o}F) on August 12th. A late autumn low of 13^{o}C (55.4^{o}F) was reported on October 15th, the final sampling date (Figure 4). The average surface water temperature for Lake George during the sampling season of 1996 was 19.5^{o}C (67.1^{o}F), a difference of slightly more than one degree from the summer of 1995.

The Secchi disc data collected by the 1996 lay monitors shows water transparency ranging from 5.5 meters (17.9 feet) at Windmill Point on June 24th, to a maximum of 13.0 meters (42.3 feet) on two different occasions at two sites in the north basin. The 1996 whole lake Secchi average decreased marginally by 0.02m (1”) from 1995.

Average Secchi depths for each site are plotted against distance from Lake George Village in Figure 2. From the graph, there is a slight, but noticeable trend that the water transparency increases as the distance from Lake George Village increases with the greatest clarity found in the north basin. The average Secchi depth in the south basin was 8.98 meters and the average in the north basin was 9.04 meters. The difference between the Secchi average from the north basin when compared to the south basin was negligible, only 0.06 meters (2.5”).

The trend of increasing transparency along a transect running from the southern end of Lake George north has been well documented in previous Darrin Fresh Water Institute Lay Monitoring Program reports. The weather during the summer of 1996 exhibited substantially more rainfall than in most years. Storm water runoff deposits both nutrients and particulates into the lake, which increase the productivity of the algae and phytoplankton thereby reducing the water clarity. Accurate statistical analyses on the lay monitors' data are difficult due to the amount of variability in sampling conditions and differing number of volunteers and sites sampled each year.

Figure 3 is a plot of trophic state indices comparing the two basins. The Carlson trophic state index (TSI) relates to the amount of nutrients available for consumption by various organisms in the lake. A lake with a high level of nutrients is generally known as eutrophic; conversely, a lake with low levels of nutrients and aquatic biota is called oligotrophic. The term mesotrophic is used to describe all lakes which fall between the two extremes. The index describes all shades of the trophic process on a scale ranging from 0 to 100 (0 being highly oligotrophic). A decrease of 10 points on the TSI scale (e.g., from 30 to 20) represents a doubling of Secchi depth in meters (e.g., from 9 to 18 meters). Chlorophyll *a* and total phosphorus values can also be applied to the TSI model. Figure 5 is a chart relating the Carlson trophic state index values to the classic definitions of trophic states.

TSI values were generated using the Lay Monitors Secchi readings and DFWI chlorophyll *a* and total phosphorus data. The area in the south known as the Caldwell basin that runs from the steel pier in the village to Diamond Island showed the highest TSI readings in the lake basin. The higher TSI numbers suggest this area of the lake basin is the most productive portion of the lake. DFWI offshore data confirms this conclusion: higher total phosphorus, chlorophyll *a* and lower Secchi readings have historically been found in this area. Elevated nutrient levels and reduced transparency in Lake George have been attributed to urbanization and resultant storm water runoff and its associated pollutants (Eichler et al., 1993; Sutherland et al., 1983). This section of the lake basin has the greatest amount of urbanization. The nutrient load from natural and urban runoff in the area has led to an increased rate of eutrophication.

Leaving the Caldwell basin we see an increase in water clarity throughout most of the southern half of Lake George. This trend continues through the majority of the northern basin.

CONCLUSIONS

The results of the 1996 Lake George Lay Monitoring Program do not suggest a strong continuation of the trends presented in Secchi transparency findings of the past. These trends include:

- Greater Secchi transparency in the North basin than the South basin.
- Consistent differences in Secchi depths between basins.
- A large increase in the whole lake Secchi depth averages between 1994 and 1995

The cause for this lack of correlation of the 1996 data to past years may be due to the dramatic change in the number of Lay Monitors for the 1996 season. With the loss of two volunteers in the south basin, the number of sites monitored was reduced by half. Also, with the addition of six lay monitoring sites in the north basin, the program had a threefold increase in the number of sites in the north basin. These dramatic changes in the sampling may be the most influential cause for the lack of continuity between the results in previous years.

That the Trophic State Indices decreased as the distance from Lake George Village increased is a trend that has been observed over many years. This trend supports conclusions reached in the 1994 Lake George Chemical Monitoring Program (Eichler et al.,1994) in that greater concentrations of nutrients (nitrogen and phosphorus) and greater overall productivity were found in the south basin when compared to the north basin. Higher concentrations of nutrients generally result in more phytoplankton and thus reduced transparency.

The source of the elevated levels of nutrients in the south basin has been the subject of a number of studies (Gibble, 1974; Ferris and Clesceri, 1975; Aulenbach, 1979; Wood and Fuhs, 1979; Sutherland et al., 1983; and Dillon, 1983). Although estimates differ on the precise amounts of nutrient loading from various sources, all investigators agree that atmospheric deposition (rain, snow, and dryfall), erosion, and urban runoff are the major sources of nitrogen and phosphorus to the lake. In addition to these plant nutrients, erosion and urban runoff are the leading causes of sedimentation in Lake George. Urban runoff includes rainwater that washes tons of road sand and salt into the lake. This is particularly evident at the deltas of English, Finkle, East, West and Hague Brooks. Erosion, both natural and instigated, occurs all around the basin where bare soil is exposed to the elements. Wind, rain and snowmelt all contribute to increased suspended solids, and therefore, decreased water transparency in Lake George.

Erosion and urban runoff may be mediated in a variety of ways including sediment traps, management of vegetation in shoreline and riparian zones, replacement of impermeable with permeable surfaces, reduction in the amount of road sanding, and a host of other methods dependent on the type and quantity of surface runoff. It should be the responsibility of all persons interested in the water quality of Lake George to press for more effective runoff controls.

ACKNOWLEDGMENTS

The staff of the Darrin Fresh Water Institute would like to thank all of this year's Lay Monitors for a job well done. The Lake George Lay Monitoring Program continues to provide an enormous amount of valuable data in a very cost effective manner. Results of this program support conclusions generated through this and other DFWI research activities whose overall goal is protection of the water quality of Lake George. You should be justifiably proud of your efforts.

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Figure 1. Location of the sampling sites on Lake George for 1996.
Volunteer Lay Monitors and the sites where they obtained Secchi depth and
Surface temperature measurements.

Monitor	Site No.	Site Name	Miles from L.G. Village
DFWI	1	East of Tea Island	1.25
Wrigley	2	Assembly Pt.:Ripley Pt.	4.25
Wrigley	3	Middleworth Bay, midlake	5.75
DFWI	4	Basin Bay	8.00
Summerhayes	5	Dome Island:Watch Point	9.25
Summerhayes	6	Crown Island:Shelving Rock	10.50
DFWI	7	East of Dome Island	11.25
Summerhayes	8	Northwest Bay Mouth	11.75
DFWI	9	Northwest Bay, mid-bay	12.25
DFWI	10	French Point	13.88
Barber/Barton	11	Deer Leap	19.13
Neal	12	Agnes Island	19.75
DFWI	13	Sabbath Day Point	20.13
Neal	14	Bluff Head	20.75
Harmon	15	Odell Island	21.50
Barbar/Holm	16	Slim Point	22.00
Harmon	17	Skipper Island	23.00
DFWI	18	Smith Bay	24.25
Pote	19	Anthony's Nose	27.00
Pote	20	Juniper Island/Rogers Rock	29.80
Vickers	21	Roger's Rock:Windmill Point	30.75

Figure 2. Average Dome Island Secchi depths by year, 1920 - 1996.

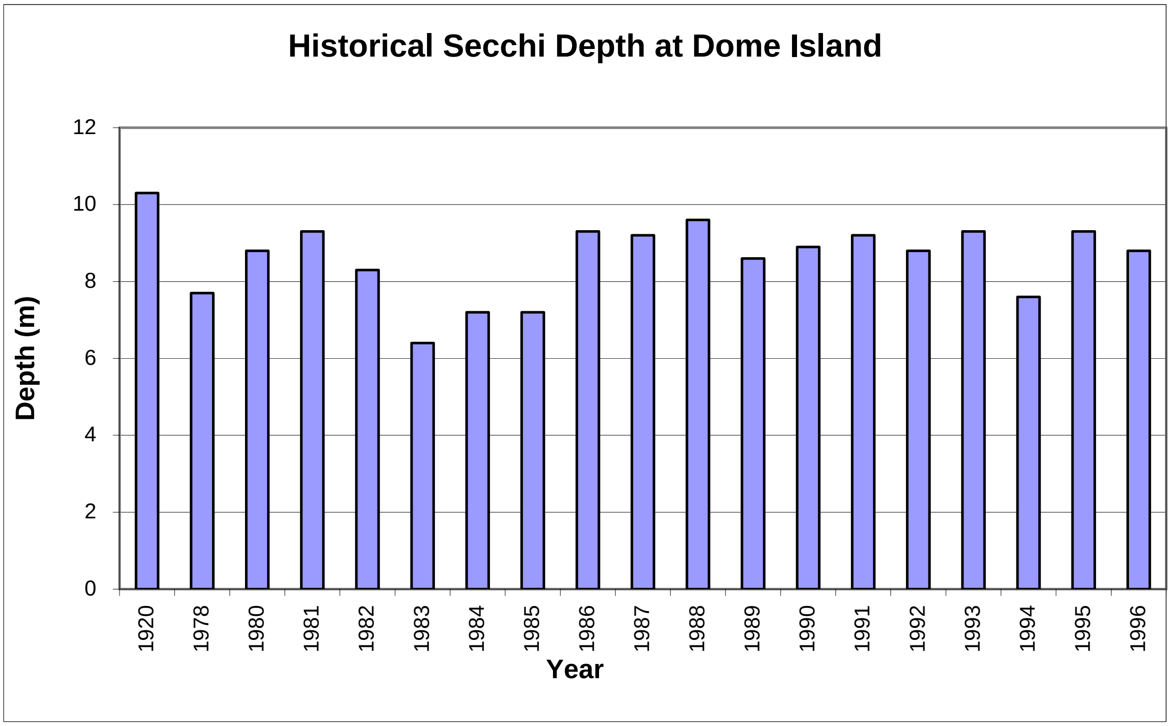

Figure 3. Average water transparencies by site for 1996.

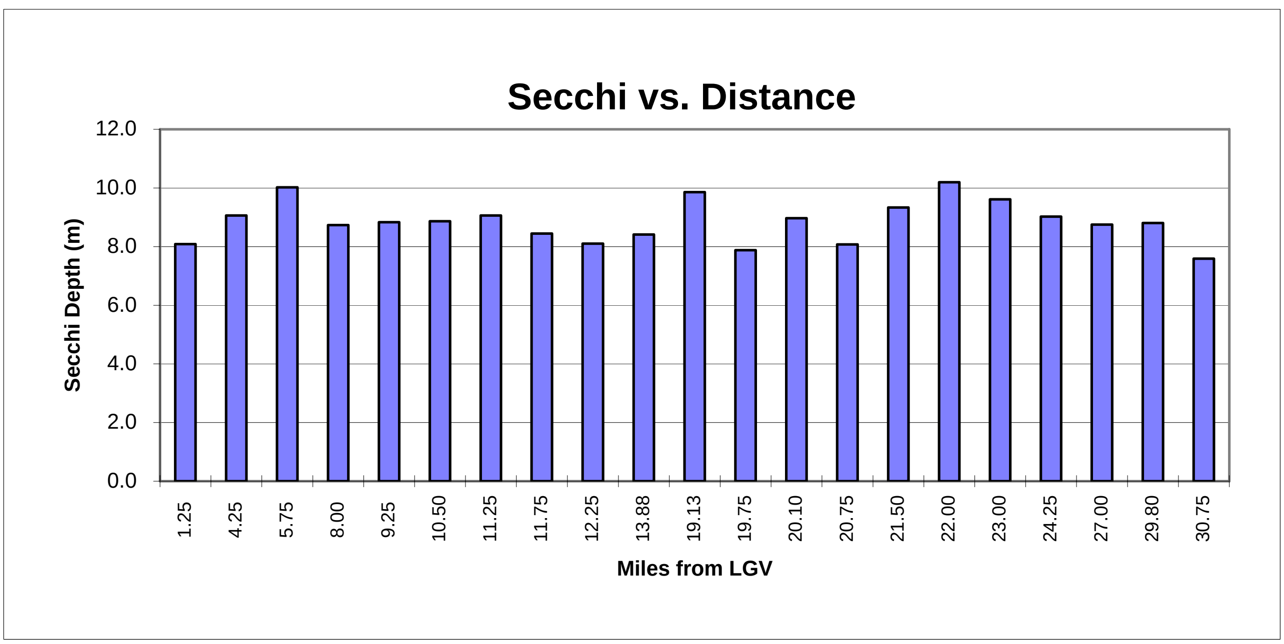

Figure 4. Trophic state index for Lake George in 1996.

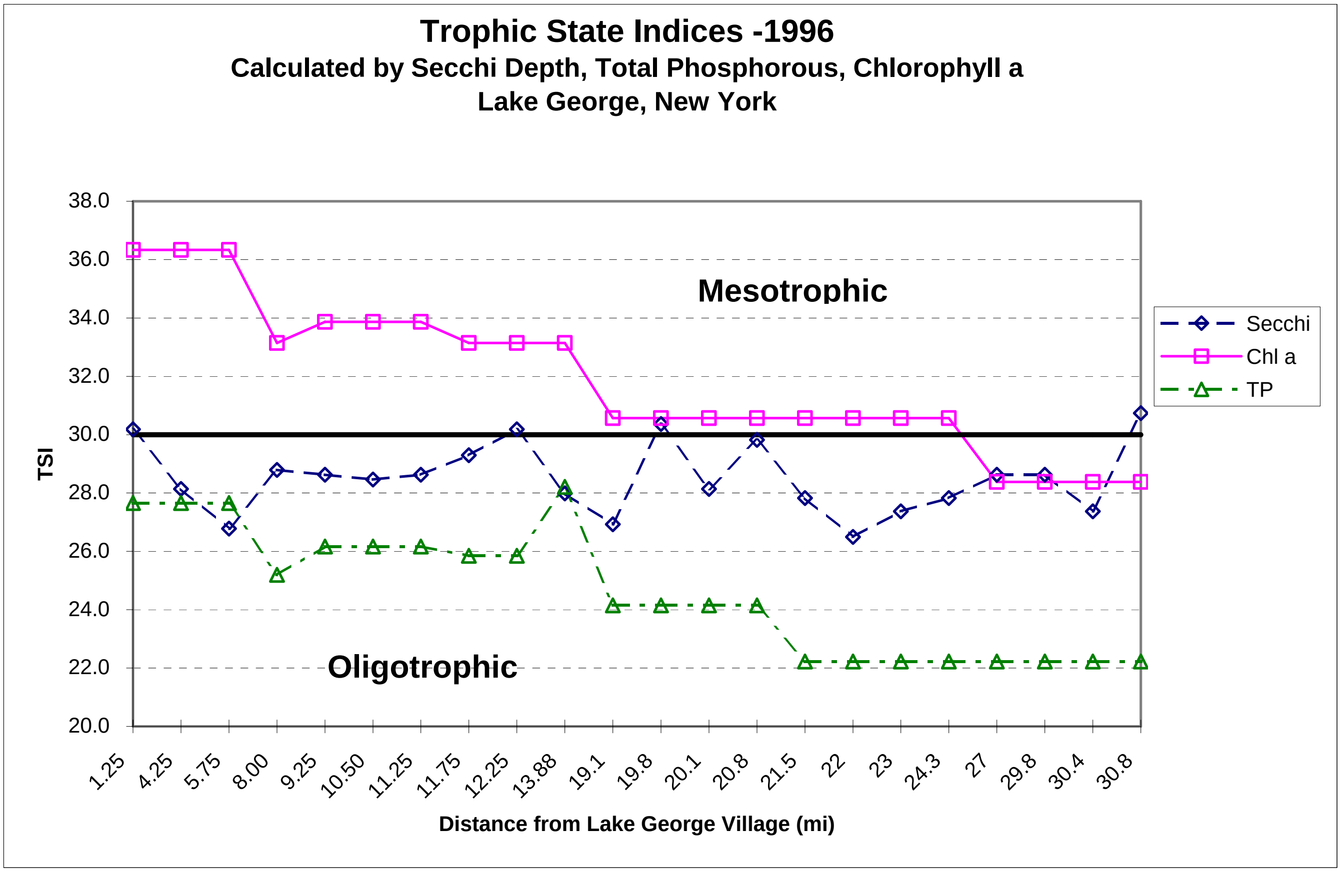

Figure 5. Carlson's Trophic State Index Definition Chart

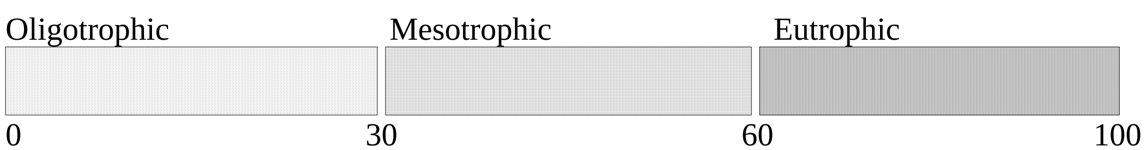

Figure 6. 1996 Surface Temperature Data by Date