Darrin Fresh Water Institute

AT LAKE GEORGE

THE 1998 LAKE GEORGE LAY MONITORING PROGRAM

by

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January, 1999

FWI #1999-01

INTRODUCTION

October ended the nineteenth year of the Lake George Lay Monitoring Program. There were a few changes made in the location and number of sites measured due to the addition and loss of volunteers. Overall, lay monitors collected 132 Secchi depth and surface water temperature readings from Lake George. In this report, data taken by the Darrin Fresh Water Institute (DFWI) during the FUND for Lake George sponsored offshore chemical monitoring survey will be used to fill in 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 some changes in site locations this year. The loss of two lay monitors created a new gap in data points in each basin. One new lay monitor this year filled in an existing gap in the southern basin. With these changes in sampling monitors, the Lake George Lay Monitoring Program overall had a loss of two sites in the north basin and one in the south basin for the 1998 sampling season. Overall, eighteen separate areas of the lake were observed, with monitored sites spread throughout the lake. Nine lay monitor sites from Diamond Island to Northwest Bay and one DFWI site at Tea Island covered the southern basin of Lake George. The northern half of the lake was covered by six lay monitor sites and two 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.

Figure 1. Location of the sampling sites on Lake George for 1998.

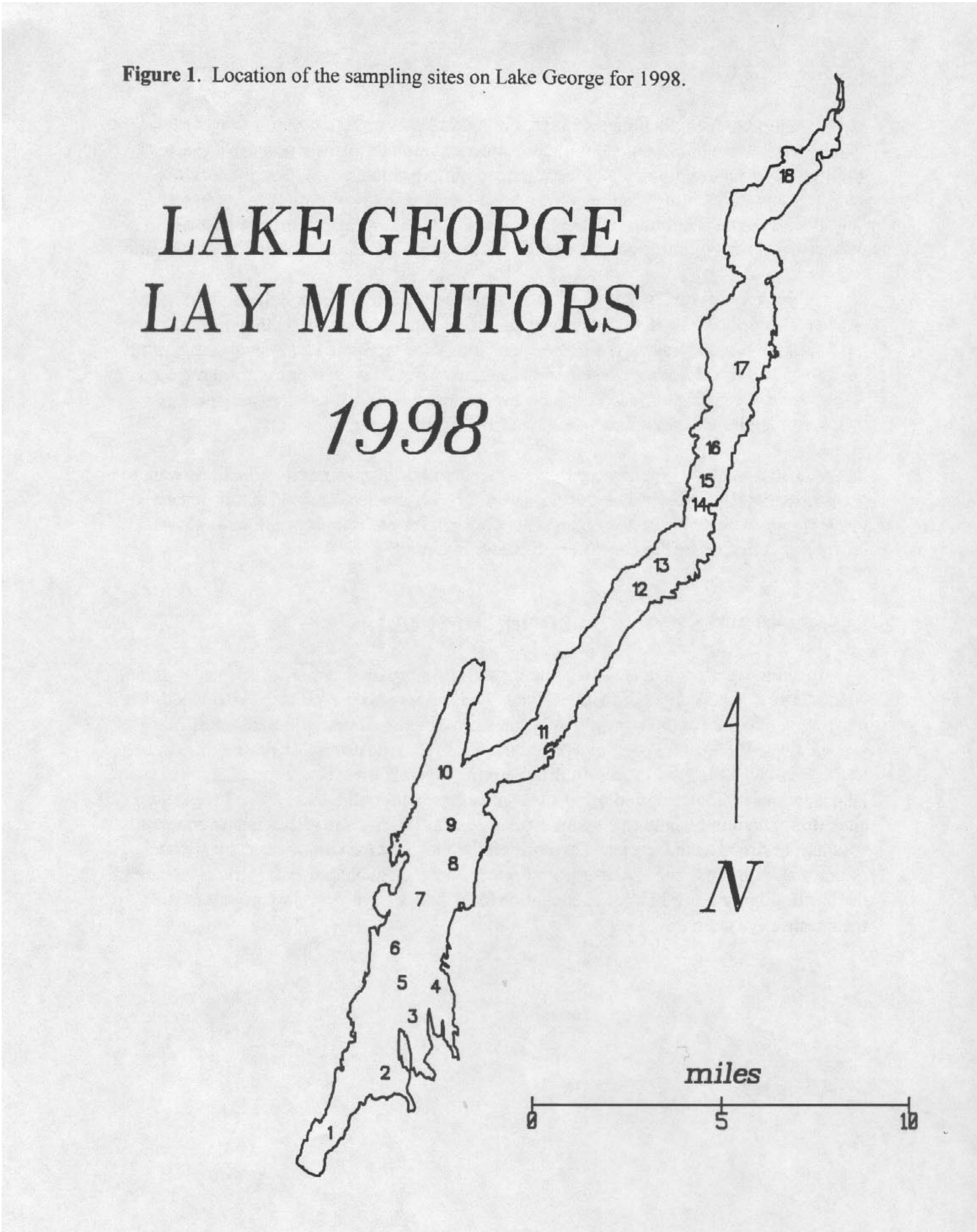


Table 1. Volunteer Lay Monitors and the sites where they obtained Secchi depth and surface temperature measurements.

Monitor	Site No.	Site Name	Miles from LG Village	Average Secchi (m)
DFWI	1	East of Tea Island	1.25	8.0
Douglas A. Wrigley	2	Dunham's Bay/Diamond Isl.	3.25	7.8
Douglas A. Wrigley	3	Assembly Pt.:Ripley Pt.	4.25	7.8
Grendon & Beverly Sebold	4	Kattskill Bay	5.75	7.4
Douglas A. Wrigley	5	Middleworth Bay, midlake	5.80	8.6
Grendon & Beverly Sebold	6	Long Island:Cotton Pt.	6.25	8.6
Carl DeSantis, Sr.	7	Fish Point:Pilot Knob	7.75	7.5
Roger R. Summerhayes	8	Dome Island:Watch Point	9.25	9.2
Roger R. Summerhayes	9	Crown Island:Shelving Rock	10.50	9.3
Roger R. Summerhayes	10	Northwest Bay mouth	11.75	9.3
DFWI	11	French Point	13.88	9.6
John Barber/Jules Holm	12	Vicars/Burgess Isl.	18.25	9.3
John Barber/Jules Holm	13	Deer Leap	19.13	9.6
Stuart Harmon	14	Odell Island	21.50	9.2
John Barber/Jules Holm	15	Slim Point	22.00	10.4
Stuart Harmon	16	Skipper Island	23.00	9.9
DFWI	17	Smith Bay	24.25	10.8
Stanley Vickers	18	Roger's Rock:Windmill Point	30.75	8.3

All lay monitors were equipped with a calibrated thermometer, Secchi disk, and data sheets. They were asked to record their observations and measurements of surface water temperature, Secchi depth and weather conditions -- wind, lighting, air temperature and precipitation – on a weekly basis 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 nearly 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

Due to the changes in volunteer lay monitors between the 1997 and 1998 seasons, slightly fewer recordings were made on Lake George in 1998 than in 1997. Although there were some changes in volunteer participation between 1996 and 1997, the same number of observations were made by lay monitors on Lake George throughout the course of the summer. Lay monitors recorded 132 Secchi depths and corresponding surface water temperatures. An additional 24 readings were provided by DFWI personnel starting May 12th and ending October 13th, 1998.

Surface water temperatures ranged from a spring low of 11.0°C (51.8.°F) on May 12th to a high of 26°C (78.8°F) on July 19th. A late autumn low of 16°C (60.8°F) was reported on September 29, and on several occasions in October. The average surface water temperature for Lake George during the sampling season of 1998 was 20.7°C (69.3°F), almost a full degree centigrade difference from the mean temperature for 1997. This could be attributed to the unusually warm winter of 1998, which did not allow the lake to freeze over completely, and consequently the average lake temperatures did not get as cold as in the past. Figures 2 and 3 demonstrate the changes in lake surface water temperature in 1998 for both basins in Lake George.

Figure 2. Water temperature records for the south basin in 1998.

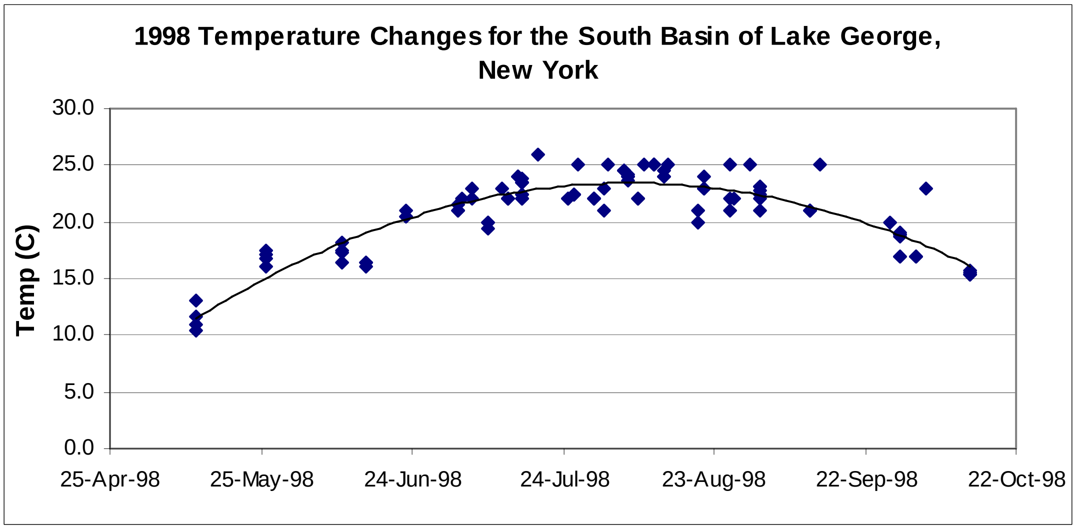
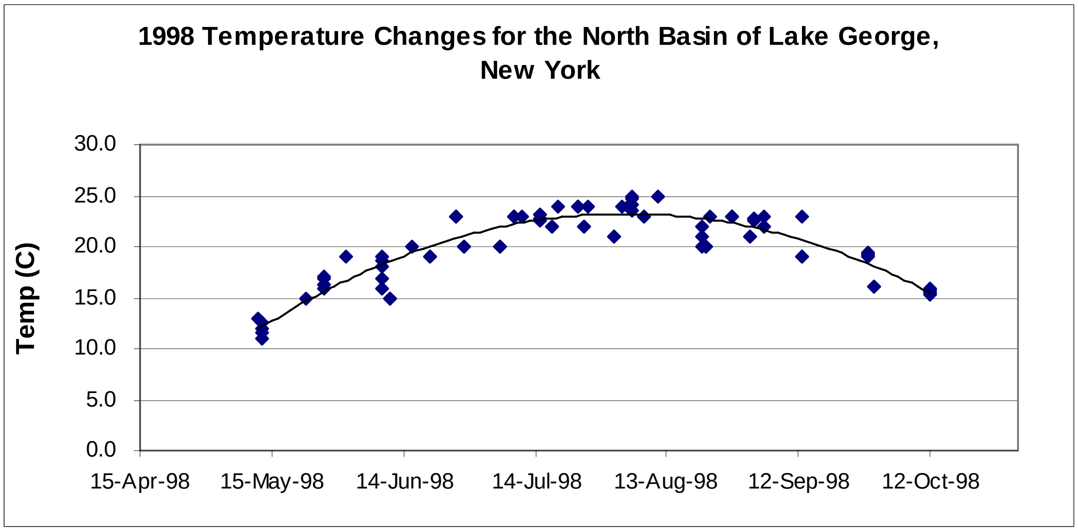
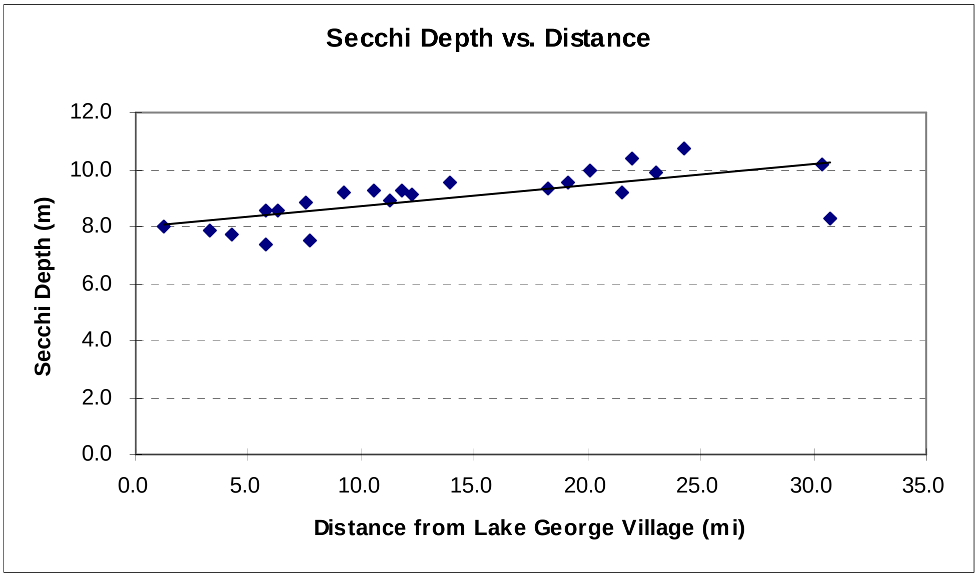


Figure 3. Water temperature records for the north basin in 1998.



The Secchi disc data collected in 1998 by the lay monitors shows water transparency ranging from 5.5 meters (16.4 feet) in Kattskill Bay on September 29 to a maximum of 13.9 meters (44.3 feet) at Smith Bay. The 1998 whole lake Secchi average decreased to 9.0 meters from 9.6 meters in 1997. This is not a significant change, and in fact the lake Secchi average for 1996 was also 9.0 meters. This demonstrates the variability of Secchi measurements that must be recognized when analyzing transparency data.

Figure 4. Average water transparency in miles from Lake George Village for 1998.



Average Secchi depths for each site are plotted against distance from Lake George Village in Figure 4. From the graph, it is apparent that the water transparency increases as the distance from Lake George Village increases, with greatest clarity found in the north basin. The average Secchi depth in the south basin was 8.5 meters and the average in the north basin was 9.6 meters for a difference between the two basins of nearly one meter. This change is demonstrated by the increasing trendline with distance from Lake George Village in Figure 4.

The trend of increasing light transparency from the southern margin of Lake George to the outlet in Ticonderoga has been well documented by lay monitors over the duration of the program. Storm water runoff deposits both nutrients and particulate matter 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 5. Comparison of historical Secchi readings at Dome Island.

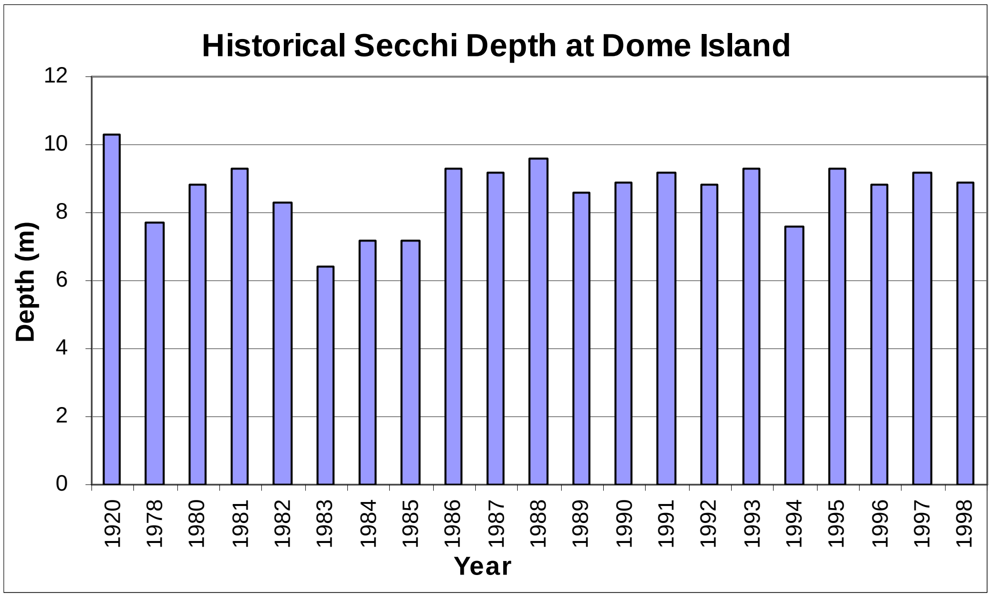


Figure 5 is a representation of the average annual Secchi readings on record for the Dome Island area. As depicted by the chart, Needham et al. (1922) took the highest value on record at Dome Island in 1920 for a biological survey (10.3 m). This however represents a single measurement. All other measurements are summer averages from data collected by lay monitors or DFWI. The data for the last 20 years indicates the variable nature of Secchi transparency. The variability is attributable to varying climatic conditions such as wind, cloud cover, and rainfall.

Figure 6 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 that 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 and total phosphorus values can also be applied to the TSI model. Figure 7 is a chart relating the Carlson trophic state index values to the classic definitions of trophic states.

Figure 6. Trophic state indices for Lake George in 1998.

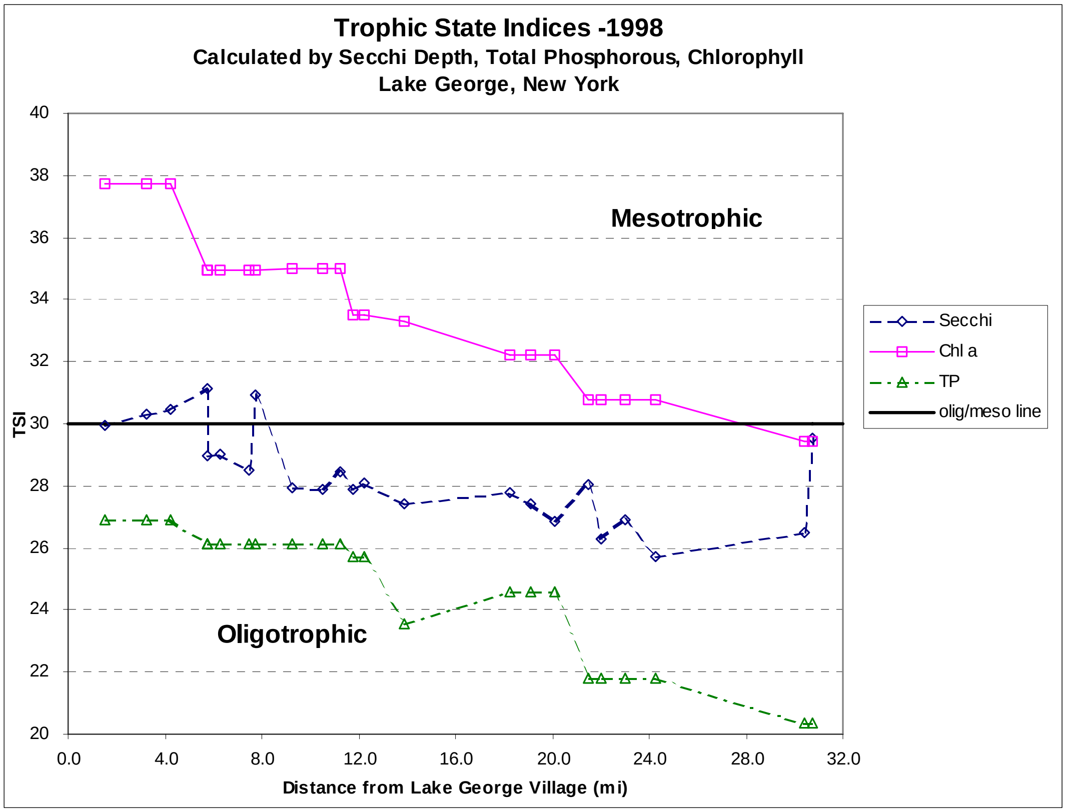
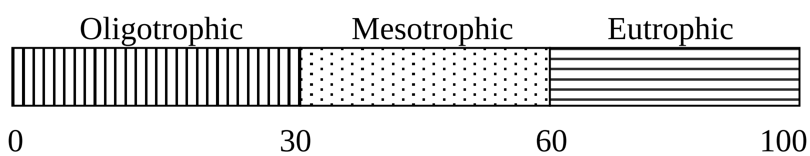


Figure 7. Carlson's trophic state definition chart.



TSI values were generated using the lay monitors Secchi readings and DFWI chlorophyll and total phosphorus data. The area in the south known as the Caldwell basin, which runs from the steel pier in the village and northward a distance of four miles to Diamond Island, showed the highest TSI readings in the lake basin. The higher TSI numbers suggest this area of the lake basin should be classified as mesotrophic or moderately enriched. DFWI offshore data confirms this conclusion: high total phosphorus, chlorophyll 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 also has the greatest amount of urbanization.

CONCLUSIONS

The results of the 1998 Lake George Lay Monitoring Program suggest a 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 minor decrease in the whole lake light transparency between 1998 and 1997
- A slight increase in overall lake surface water temperatures

An analysis of south basin sites over the past few years demonstrates a consistent increase in Secchi transparency readings at a majority of the locations compared. Increasing Secchi readings and decreasing Trophic State Indices as the distance from Lake George Village increases are trends that have been observed over many years. These trends support conclusions reached in the 1997 Lake George Chemical Monitoring Program (Eichler et al., 1998) 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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