THE 1991 LAKE GEORGE LAY MONITORING PROGRAM

by

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INTRODUCTION

October brought the twelfth year of the Lake George Lay Monitoring Program to a close. There were a few changes in the sites sampled; however, the quantity of data collected by the lay monitors was still staggering. They ascertained over 300 discrete Secchi depth and surface water temperature readings. This efficiently achieved the goal of the program which was to collect a large amount of physical lake data through the voluntary efforts of Lake George basin residents. A beneficial side-effect of the Lay Monitoring Program was 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 entire lake weekly, and by supplying information that would not otherwise be collected by the Rensselaer Fresh Water Institute.

SAMPLING SITES AND COLLECTION METHODS

There were a few changes in site locations this year, but once settled, the Lake George Lay Monitoring Program had a net loss of eight sampling sites from last year. Thirty-one seperate areas of the lake were observed, with monitored sites spread throughout the lake. The southern third was covered from Paulist Fathers (1.75 miles from Lake George Village) to the mouth of Northwest Bay and Shelving Rock including Knapps Bay (11.30 miles from Lake George village).

The northern third of the lake was covered from Bluff Head (20.00 miles from Lake George village) to Hearts Bay (29.20 miles from Lake George village). The middle third of the lake from the Narrows to Bluff Head was not monitored due to the retirement of the lay monitors in that area. Figure 1 is a map of the site locations and Table 1 is a list of lay monitors with their respective sites.

All monitors were equipped with a calibrated thermometer, Secchi disk, and data sheets. They were asked to record each week their observations and measurements of weather conditions (e.g., wind, lighting, air temperature), surface water temperature and Secchi depth 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. 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. In actuality, not all data were recorded by the various monitors under ideal conditions.

RESULTS

A total of 324 Secchi depths and corresponding surface water temperatures were reported starting June 1st and ending November 05th. Weekly samplings were not necessarily continuous between these dates.

Surface water temperatures ranged from a spring low of 20°C (68.0°F) on June 1st to a high of 25.5°C (77.9°F) on July 23rd. A late autumn low of 12°C (53.6°F) was reported on

November 05^{th}, the final sampling date. This data was plotted and shows the average temperature at each site throughout the year (Figure 2). The average surface water temperature for Lake George during the sampling season of 1991 was 21.6°C (70.9°F), scarcely different from the summer of 1990 (21.9°C).

From the secchi disc readings taken in 1991 by our volunteers, water transparency on Lake George spanned from 4.5 meters (14.7 ft at Diamond Is., 11/05/91) to 12.0 meters (39.4 ft) at numerous locations in the north throughout the summer. The whole-lake average of water clarity decreased to 8.8 meters from 9.0 meters last year, a difference of 7.9 inches. Accurate statistical analyses on the lay monitors' data is difficult due to the amount of variability in sampling conditions and differing number of volunteers and sites sampled each year. Therefore, it is doubtful whether small differences (less than 0.5 meters) in average Secchi depths between years are significant. The information from this program, however, can be used to draw trends. For example, from 1980 to 1983 there was a steady drop in average water clarity to a low of only 7.8m (25.6 ft). Since 1984, water transparency has improved but in recent years has leveled off near 9 meters (29 ft). Figure 3 shows the relationship of yearly Secchi depth averages since 1980.

Average Secchi depths per site are plotted against distance from Lake George Village in Figure 4. From the graph, a general trend is apparent; water transparency is greater in the north basin than in the south. In fact, 2m (6.6 ft) is the difference in average clarity between the two basins (southern, 8.0m, 26.3 ft; northern, 10.1m, 33.1 ft). The trend of increasing transparency along a transect running from the southern end of Lake George north has been well documented in previous Rensselaer Fresh Water Institute Lay Monitoring Program reports.

Figure 5 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 biotic life is called oligotrophic. 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.

TSI values were generated using the Lay Monitors secchi readings and RFWI chlorophyll a and total phosphorus data. The area in the south known as the Caldwell basin which runs from the steel pier in the village to Diamond Island showed the highest TSI readings in the lake basin. The higher TSI number suggest this area of the lake basin has shown the greatest decline or move toward eutrophication. RFWI offshore data confirms this conclusion: high total phosphorus, chlorophyll a and lower secchi readings have historically been found in this area. Elevated nutrient levels and reduced transparency have been attributed to urbanization and resultant stormwater runoff and its associated pollutants (Eichler, et al., 1992; Sutherland et al., 1983). This section of the lake basin has the greatest amount of urbanization. The nutrient load from natural and urban runoff combined with waste effluent in the area has led to an increased rate of eutrophication.

Leaving the Caldwell basin we see an increase in water clarity throughout the southern half of Lake George. This trend continues through the majority of the northern basin. The last three sites that are monitored on the lake shows a clear decrease in Secchi reading. This decrease in Secchi reading has been noted in the past; however, an explanation for this drop has not been confirmed.

CONCLUSIONS

The results of the 1991 Lake George Lay Monitoring Program suggest a number of trends present in the Secchi transparency of the various sites sampled. These trends include:

- Greater Secchi transparency in the North basin than the South basin.

  A leveling effect in the improvement of water clarity. The continued improvement of water clarity has leveled off over the past 5 years.

  Uniform change in Secchi depth between basins.

These trends support conclusions reached in the 1991 Lake George Chemical Monitoring Program (Eichler et al.,1992) 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 left open 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 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 Rensselaer 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 RFWI research activities whose overall goal is protection of the water quality of Lake George. You should be justifiably proud of your efforts.

Special thanks go to Mr. Robert Bryant who has collected Lay Monitoring data for years and to Beth Lawrence who has run the program for the past couple of years. Good luck to both of you! Happy retirement to you both, and thank you very much.

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

Monitor	Site No.	Site	Mile
SOUTH BASIN			
Blake	1	Paulist Fathers	1.75
	2	Plum Point midlake	2.25
	3	Woods Point	2.50
	4	Dark Bay	2.60
	5	Mouth of Dunhams Bay	3.20
Harrison	6	Diamond Is. (half mi. SW)	2.55
	7	Diamond Is. (half mi. NE)	3.70
Boehm	8	Cramer Point:Diamond Is.	3.00
	9	Dunhams Bay	3.30
	10	Diamond Is.:Canoe Is.	3.90
Wrigley	11	Assembly Pt.:Ripley Pt.	4.90
	12	Middleworth Bay midlake	5.80
Sebold	13	Kattskill Bay	5.75
	14	Long Is.:Cotton Point	6.25
Summerhayes	15	Dome Is.: Watch Pt.	9.30
	16	Crown Is.: Shelving Rock	10.70
	17	Northwest Bay mouth	11.30
Vilmar	18	Dome Is.: Huckleberry Is.	10.00
	19	Dome Is.: S. Green Is.	10.00
Whalen	20	Fourteen Mile Island	11.20
	21	Shelving Rock:Knapps Bay	11.25

Table 1 cont.

Monitor	Site No.	Site	Mile
NORTH BASIN			
Buck	22	Bluff Head:Werners marina	20.00
	23	Slim Pt.:Odell Is.	20.90
	24	Skipper Is.:Lamb Shanty	22.20
Bryant	25	Scotch Bonnet:Mallory Is.	22.70
	26	Jenkins Pt.	23.90
	27	Gull Is.:Skerry Pt.	24.00
	28	Hague Brook	24.50
Martin	29	Blairs Bay - Glenburnie	26.40
	30	Rogers Rock	28.50
	31	Hearts Bay	29.20

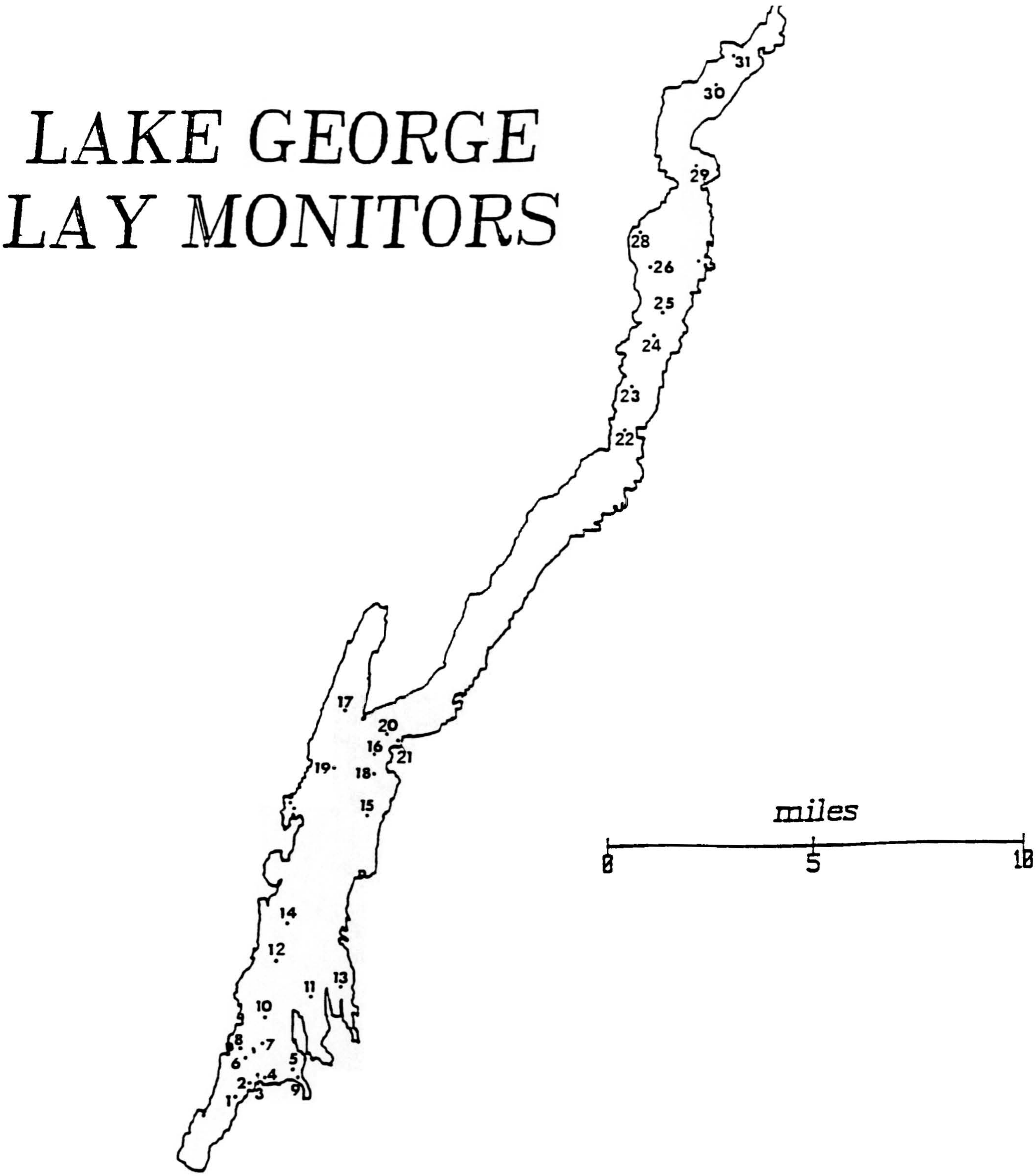

Figure 1. Location of the sampling sites on Lake George for 1991

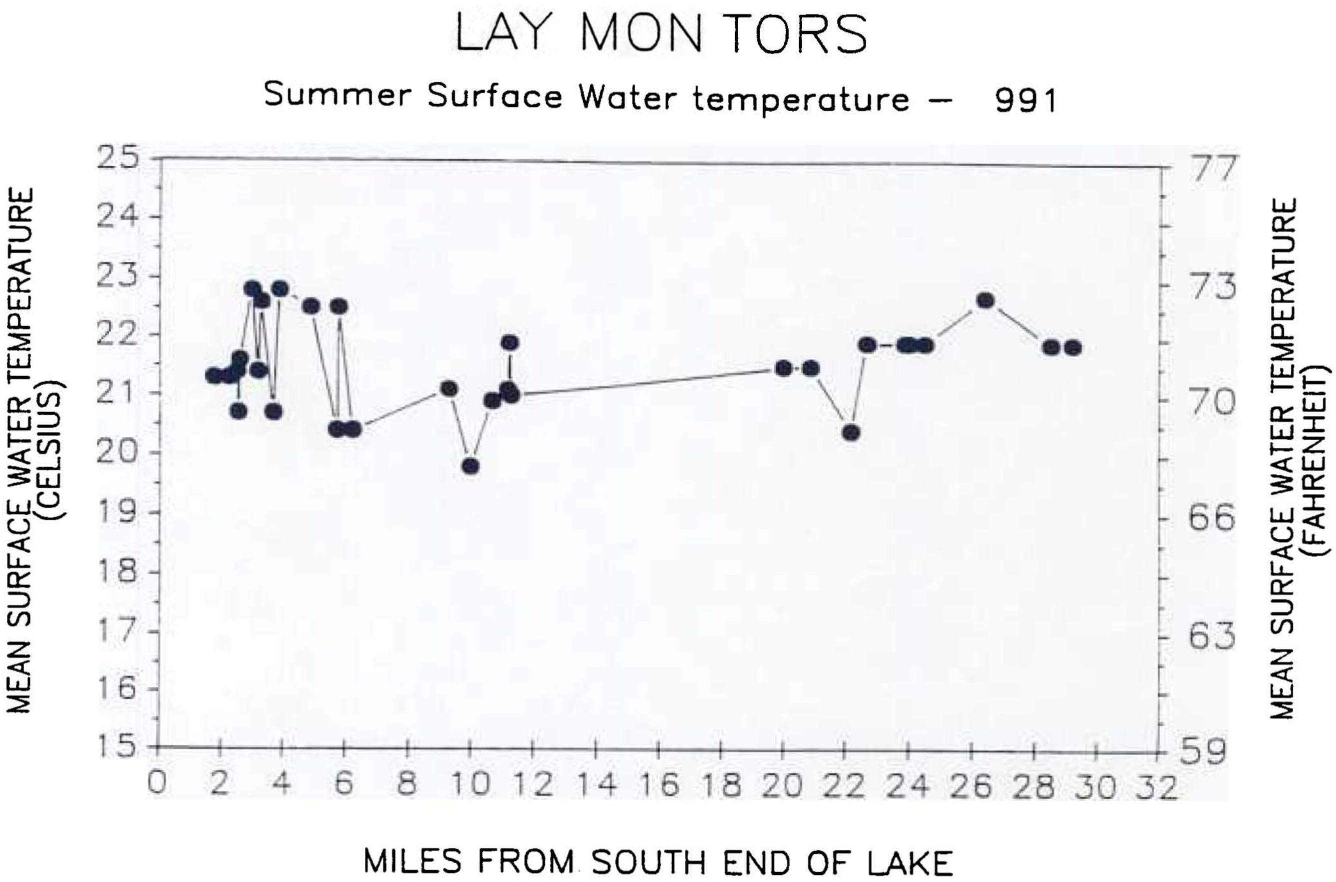

Figure 2. Mean surface water temperature of the lake for 1991.

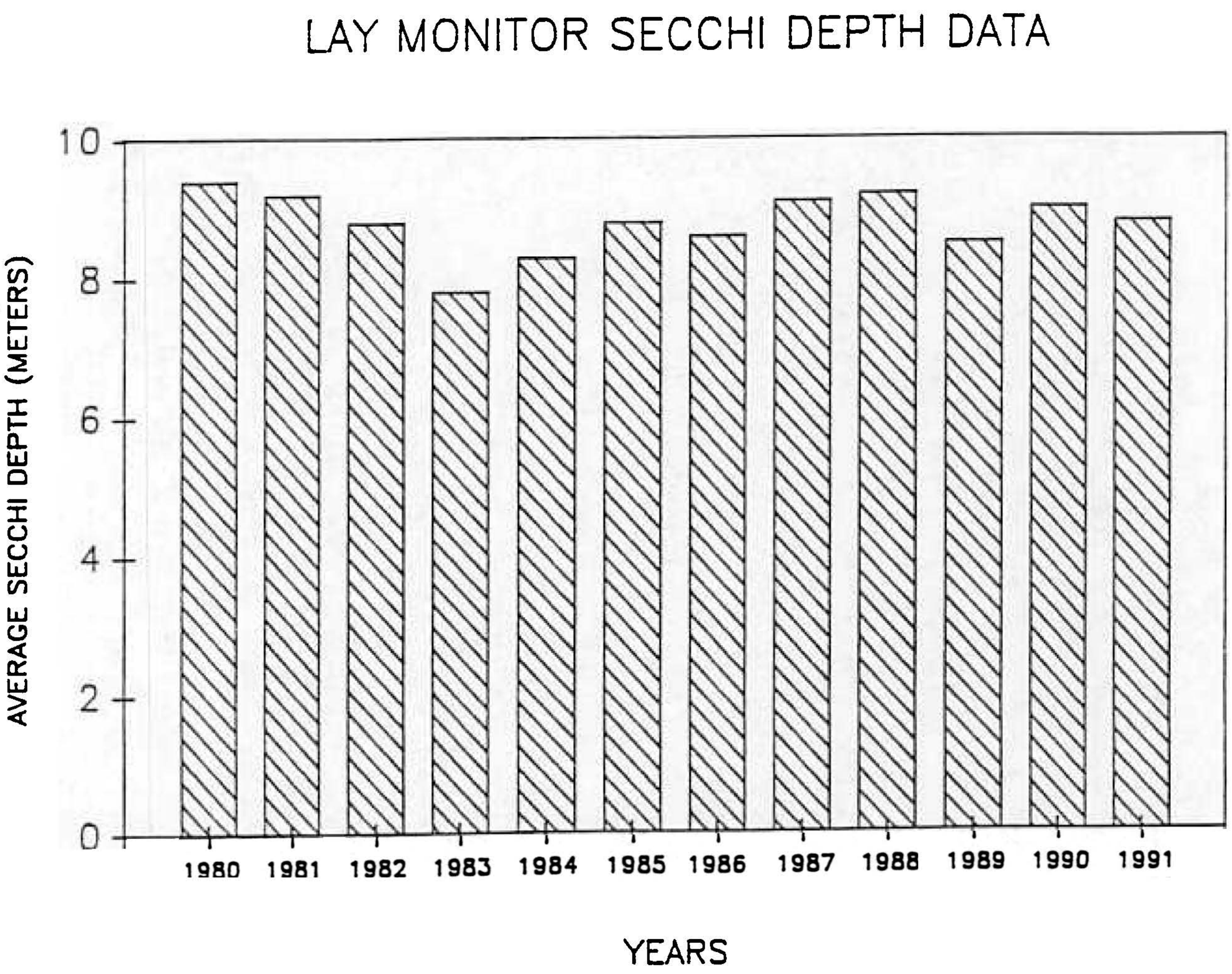

Figure 3. Average whole lake secchi depths by year, 1980 1991.

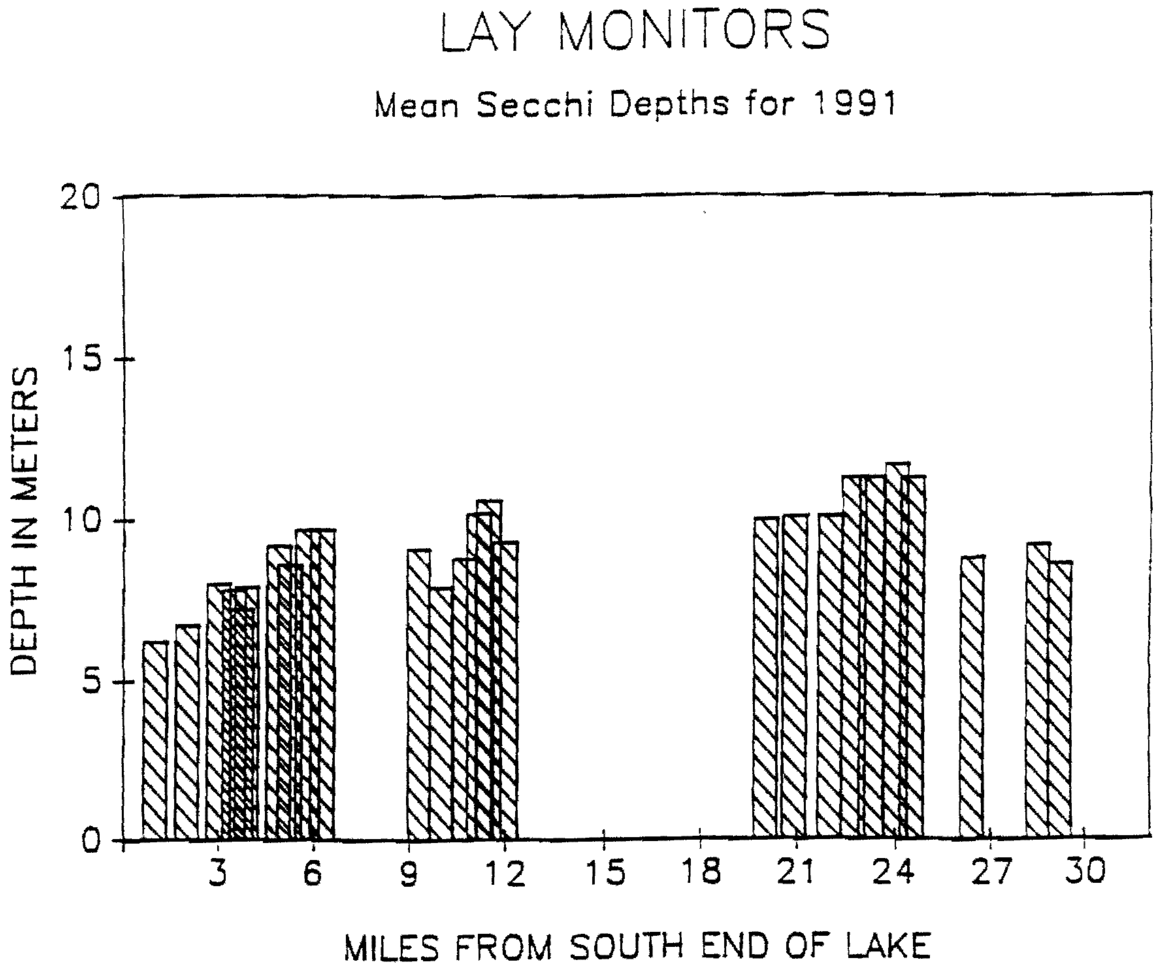

Figure 4. Average water transparencies by site for 1991 (secchi depth).

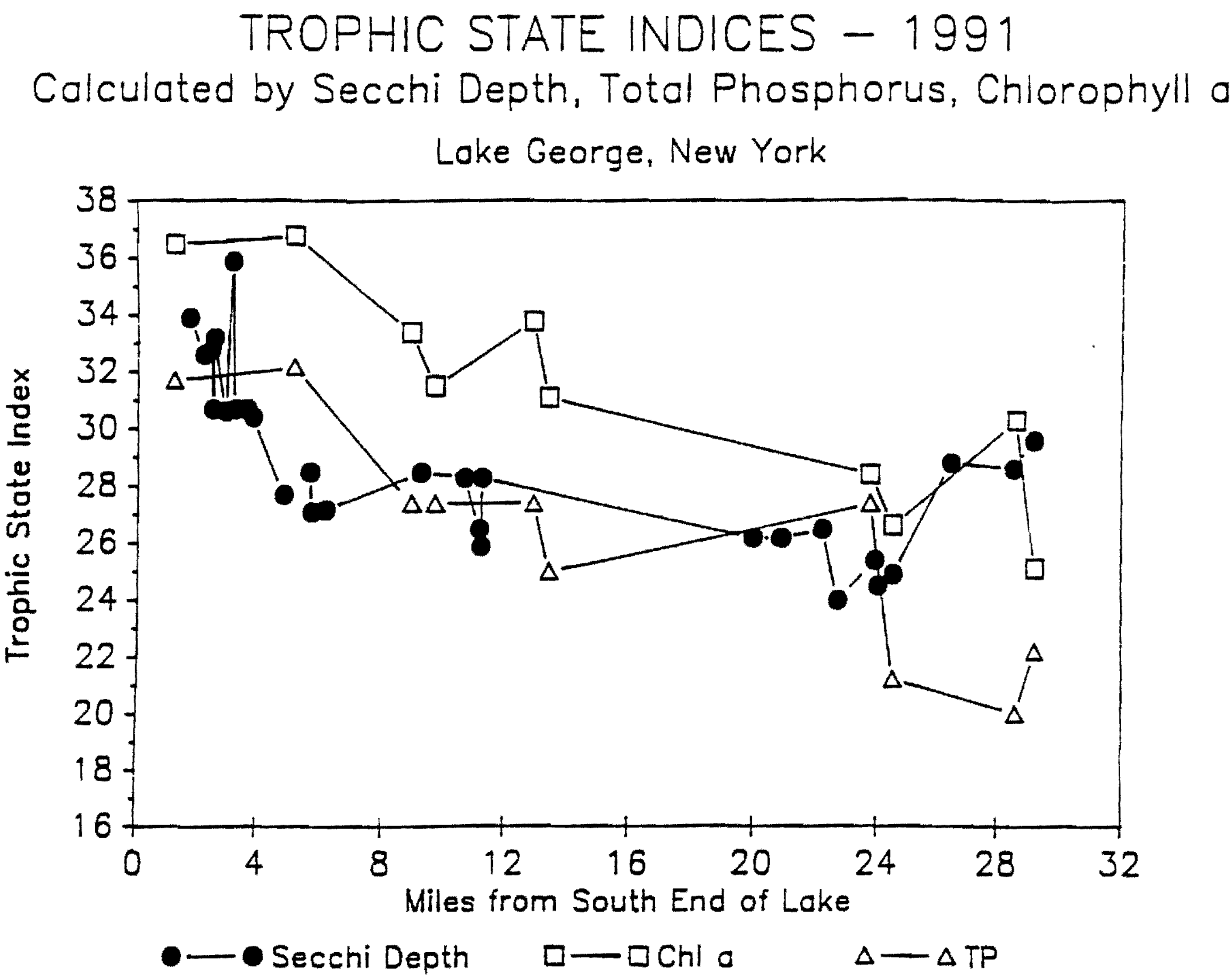

Figure 5. Trophic state index for Lake George in 1991.

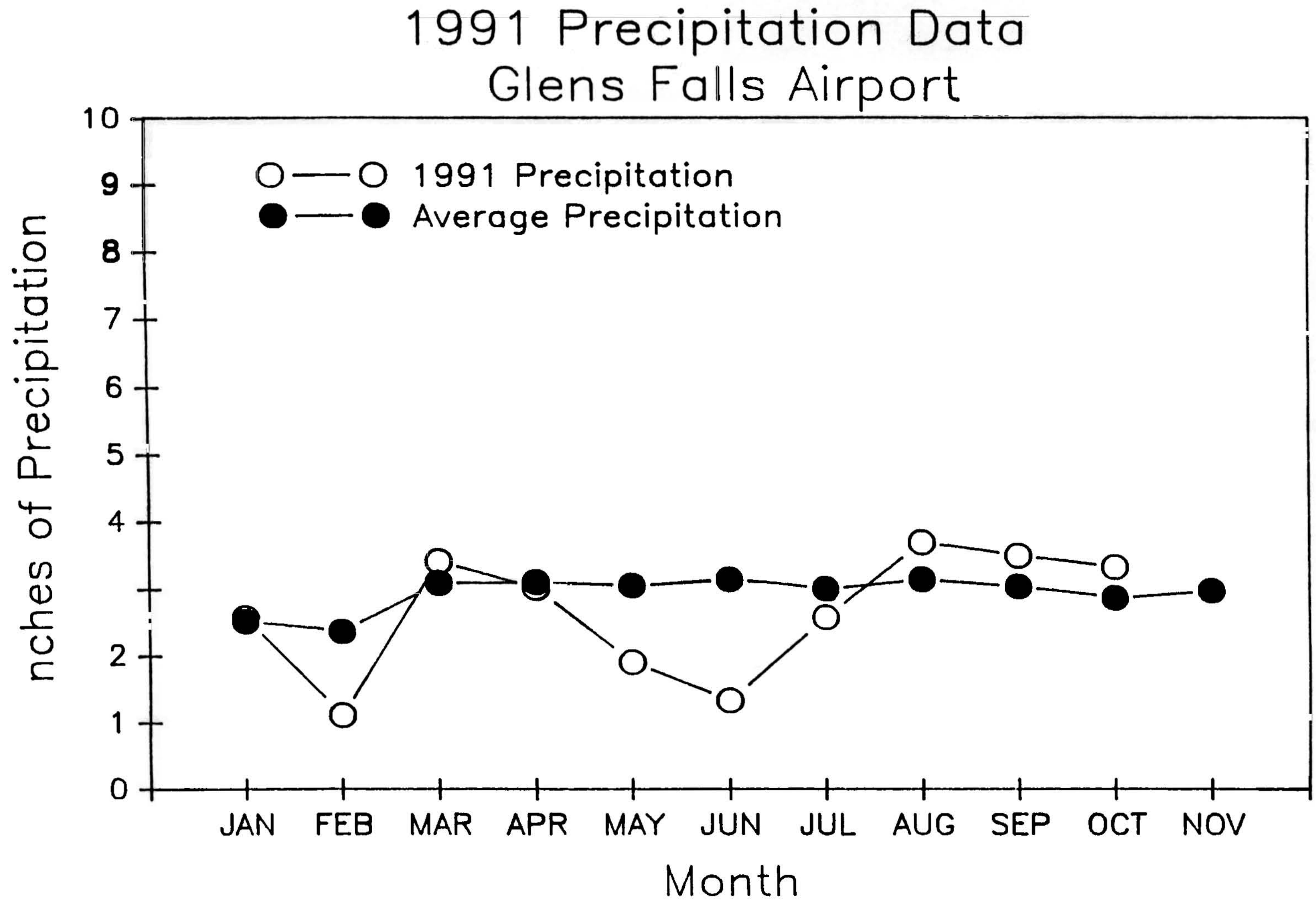

Figure 6. Average precipitation at the Glens falls Airport from January to October 1991.