THE 1988 LAKE GEORGE LAY MONITORING PROGRAM

by

Rensselaer Fresh Water Institute
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INTRODUCTION

In 1988, the Lake George Lay Monitoring Program completed its ninth year of data collection. The goal of this program continues to be the collection of a large body of data on the lake using as a resource the residents of the Lake George basin. An important aspect of this data collection is the ability to encourage lake residents to take an active role in maintenance of Lake George water quality and to familiarize people with methods used in freshwater ecology.

The basic water quality parameters measured by the lay monitors included water temperature and transparency (Secchi depth). Chlorophyll samples were collected by four monitors on August 20, 1988. The data collected by the lay monitors continues to closely parallel information collected by FWI staff, while providing data on a more contiguous (weekly) basis than would be possible otherwise.

SAMPLING SITES AND COLLECTION METHODS

The 19 sites sampled by the lay monitors in 1988 stretched the length of Lake George. Figure 1 shows a map of these locations and Table 1 is a list of lay monitors with their respective sites.

The number of lay monitored sites has varied since the program was initiated in 1980; a low of 14 sites were reported in 1985 while a high of 28 were sampled the following year. Each of the eight monitors this year were equipped with a calibrated thermometer, Secchi disk, water column sampler, and data sheets. All were asked to record, weekly, 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.

Data were to be collected between 10 A.M. and 2 P.M. when the sun was as nearly directly overhead as possible. If possible, measurements were to be limited to days when the weather was calm and clear in order to reduce the influence of waves and wind on the Secchi disk determinations.

RESULTS

A total of 172 Secchi depths and corresponding surface water temperatures were reported starting June 11th and continuing to October 19th.

Surface water temperatures varied from an early summer low of 14°C (57.2°F) on July 7th to a high of 27°C (80.6°F) on August 11th and 14th. An autumn low of 12°C (53.6°F) was reported on October 15th, four days prior to the final sampling date. Figure 2 is a plot of mean surface water temperatures at each site related to distance from the south end of the lake. Due to the highly variable nature of surface water temperatures, any discussion of a trend for this parameter is speculative. The average surface water temperature for Lake George during the summer of 1988 was 21.7°C (71.1°F).

The range of Secchi depths fell between 5.0 meters (16.4 ft) (Plum Point, 07/29/88; Dunhams Bay, 07/22/88, 08/05/88) and 13.0 m (42.7 ft) (Jenkins Point, 09/16/88; Gull Bay, 07/15/88, 09/16/88). The average water transparency, secchi depth, in 1988 was 9.2m (30.2 ft), a depth last seen in 1981 (Figure 3). Since 1983, there has been a general increase in transparency in the waters of Lake George.

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, 5.6 feet (1.7m) is the difference in average clarity between the two basins (southern, 27.9 ft, 8.5m; northern, 33.5 ft, 10.2m). The trend of increasing transparency (Secchi depth) along a transect running from the southern end of Lake George north has been well documented in previous Fresh Water Institute Lay Monitoring Program reports. There does not appear to be a measurable seasonal trend in transparency, possibly due to the variability in Secchi measurements. This variability may be the result of physical conditions at the time of sampling (i.e. wind and wave action and relative cloud cover).

In order to follow Lake George's progression of nutrient enrichment (eutrophication), this year's lay monitoring data and comparable 1988 FWI Offshore Monitoring data (Fresh Water Institute, 1989) have been applied to Carlson's (1977) formulae for a Trophic State Index (TSI). The trophic state of a lake relates to the amount of nutrients available for consumption by various organisms in that lake. A lake with a high level of nutrients (and, therefore, primary producers such as algae, phytoplankters, and plants) is generally known as eutrophic. Conversely, a lake with low levels of nutrients and biotic life is called oligotrophic. Mesotrophic is used to describe lakes which fall between the extremes. In order to describe all lakes on a similar scale unbound by the three basic trophic classes, Carlson developed the Trophic State Index which describes all shades of the trophic process on a scale ranging from 0 to 100 (0 being highly oligotrophic). A decrease of 10 points of the TSI (e.g., from 30 to 20) represents a doubling of Secchi depth in meters (e.g., from 8 to 16 meters). Chlorophyll _a_ and total phosphorus values can also be applied to the TSI model.

In 1979, Wood and Fuhs used Carlson's TSI method to determine the trophic state of Lake George for 1978. They discovered a chlorophyll _a_ based TSI value of 38 for the southern basin and 34 for the northern basin. Due to the fact that only four chlorophyll _a_ samples were collected by lay monitors in 1988, the average values of chlorophyll _a_ samples from the FWI Offshore Monitoring sites (FWI,1989) nearest, respectively, to the Lay Monitoring sites were used to calculate the TSI values. These data produced indices of 35 in the South and 33 in the North, representing a reprieve in Lake George's trophic progression since 1979.

Using Secchi disk data from 1970 by Ferris and Clesceri (1977), Wood and Fuhs calculated a TSI of 32 for the south end of the lake. Wood and Fuhs' 1978 data for Secchi transparency produced TSI values between 33 and 35 for the same region while 1988 transparency data showed the south end having a TSI of 29.

Total phosphorus (1988 summer data averaged from the same sites as chlorophyll _a_) calculations of the TSI produced values of 30 and 26 for the southern and northern basins, respectively. Figure 5 is a representation of the computed TSI values for each of the three parameters graphed by site against the distance of Lake George.

In all, the 1988 data transformed into the Trophic State Index nearly equated the values determined for phosphorus and Secchi depth while the chlorophyll _a_ index predicted a higher degree of "nutrification" in Lake George.

CONCLUSIONS

The results of the 1987 Lake George Lay Monitoring Program indicate 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.
- Transparency results for 1988 were higher than results reported between 1982 and 1987, equal to those reported in 1981, but lower than results for 1980.
- Trophic State Indices for Lake George calculated with Secchi depth and total phosphorus approached the same trophic level while the TSI calculated from chlorophyll _a_ indicated a more advanced trophic state.

These trends support conclusions reached in the 1987 Lake George Chemical Monitoring Program (FWI, 1988) which were 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.

Wood and Fuhs (1979) noted the elevated TSI for chlorophyll _a_ in relation to Secchi depth and total phosphorus and suggested the nutrient inputs during the summer peak of July-August affect turbidity (and, therefore, transparency) less than they affect chlorophyll _a_.

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 vary on the precise amounts of nutrient loading from a variety of sources, all investigators agree that atmospheric deposition (rain, snow, and dryfall) and surface runoff are the major sources of nitrogen and phosphorus to the lake. Inputs from atmospheric sources are very difficult if not impossible to control on a local or regional basis. Surface runoff of nutrients, however, 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, 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 Fresh Water Institute would like to thank all of this years Lay Monitors for a job well done. The Lay Monitoring Program continues to provide a large amount of valuable data in a very cost effective manner. Results of this program support conclusions generated through this and other 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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Table 1. Volunteer Lay Monitors and the sites where they obtained Secchi depth and surface temperature measurements.

Monitor	Site No.	Site	Mile
Blake	1	Midlake at Plum Point	1.75
	2	Woods Point	2.50
	3	The Mouth of Dunhams Bay	2.75
Harrison	4	Midbay between Plum Point and East Shore	1.90
Sebold	5	Kattskill Bay	4.50
	6	Midlake between Long Is. and Cotton Point	5.50
Kennedy	7	Warner Bay	4.40
	8	Basin Bay	7.50
Summerhayes	9	Midlake between Crown Is. and Shelving Rock	10.50
	10	Midlake between Montcalm Pt. and West Shore	10.80
	11	Juanita Island	11.50
Whalen	12	Knapps Bay	10.00
	13	Fourteen Mile Island	10.60
Bryant	14	Jenkins Point	20.00
	15	Gull Bay	21.00
	16	Hague	21.50
Martin	17	Blairs Bay	24.00
	18	Rogers Rock	27.50
	19	Hearts Bay	28.00

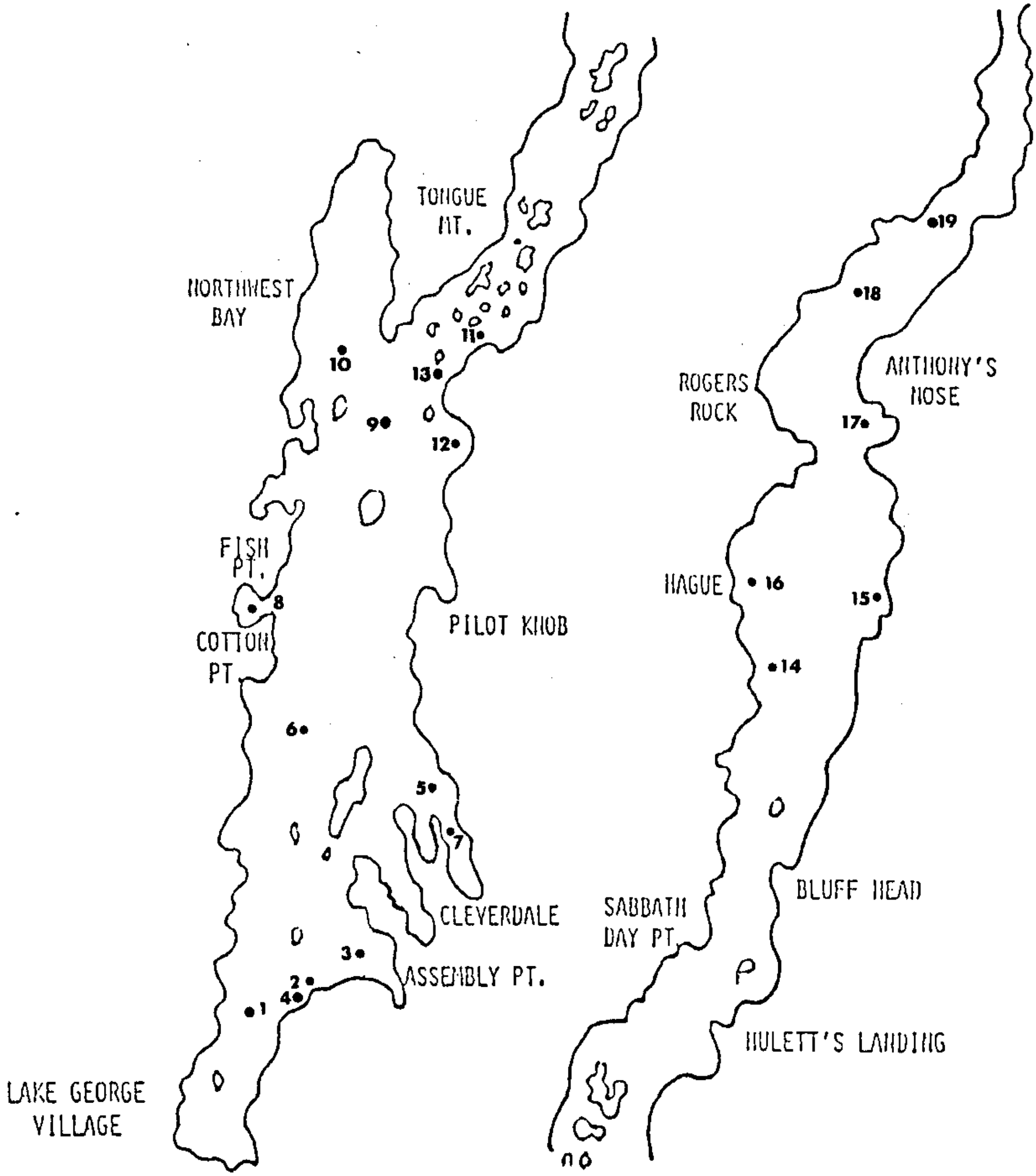

Figure 1. Locations of sampling sites in the north basin (right) and south basin (left) of Lake George.

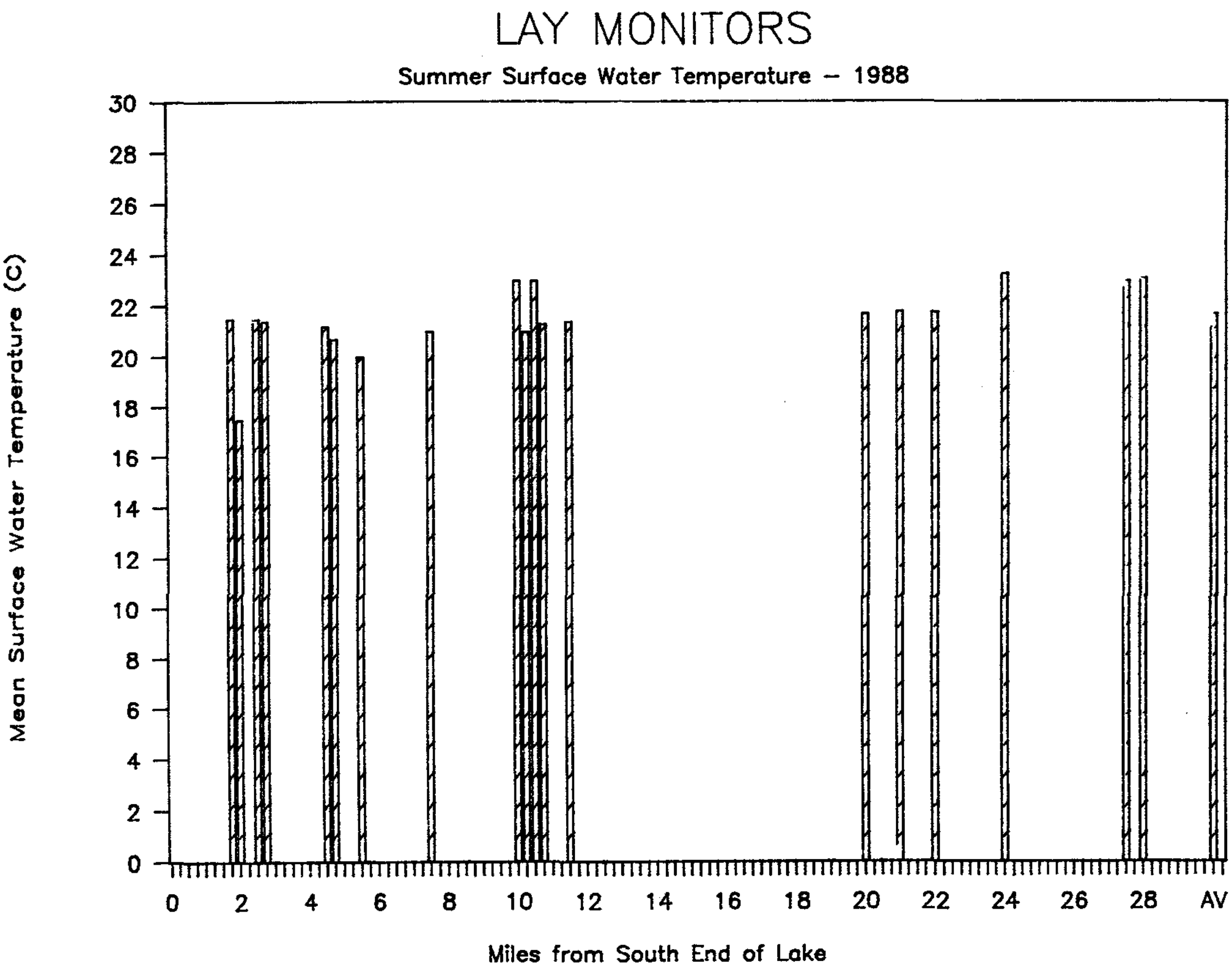

Figure 2. Mean surface water temperatures by site vs. distance from south end of Lake George.

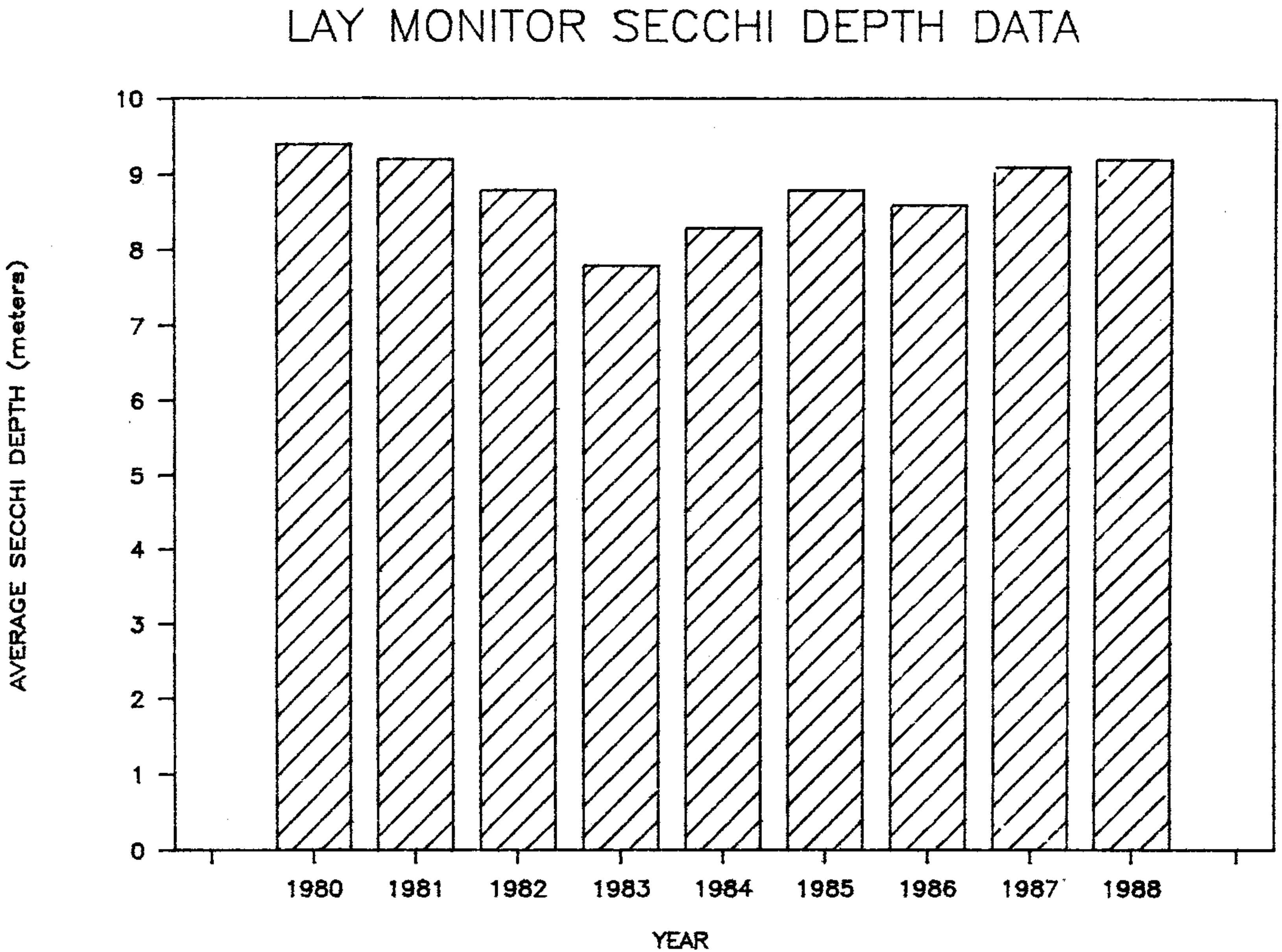

Figure 3. Average whole lake Secchi depths by year.

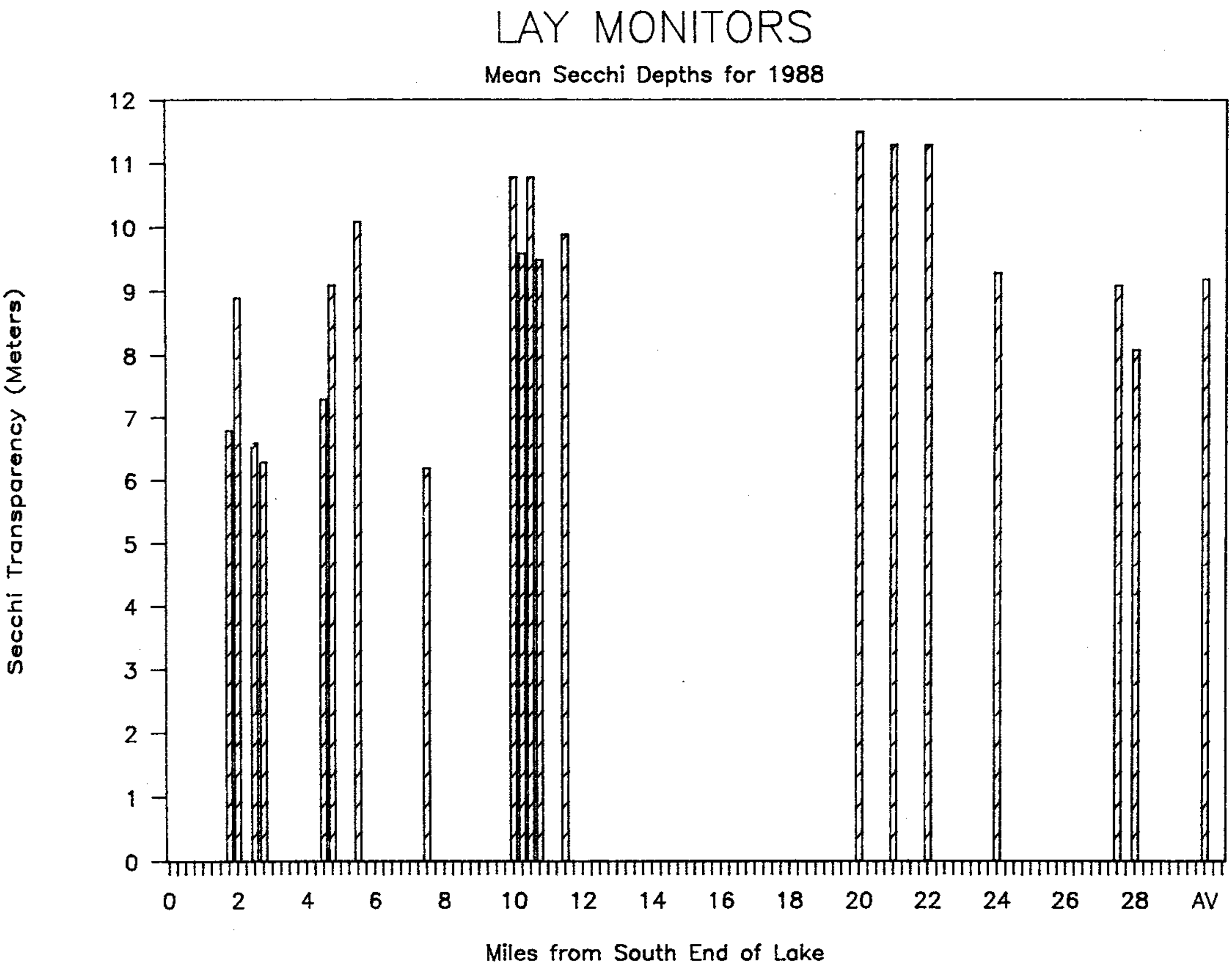

Figure 4. Average water tranparencies by site vs. distance from south end of Lake George.

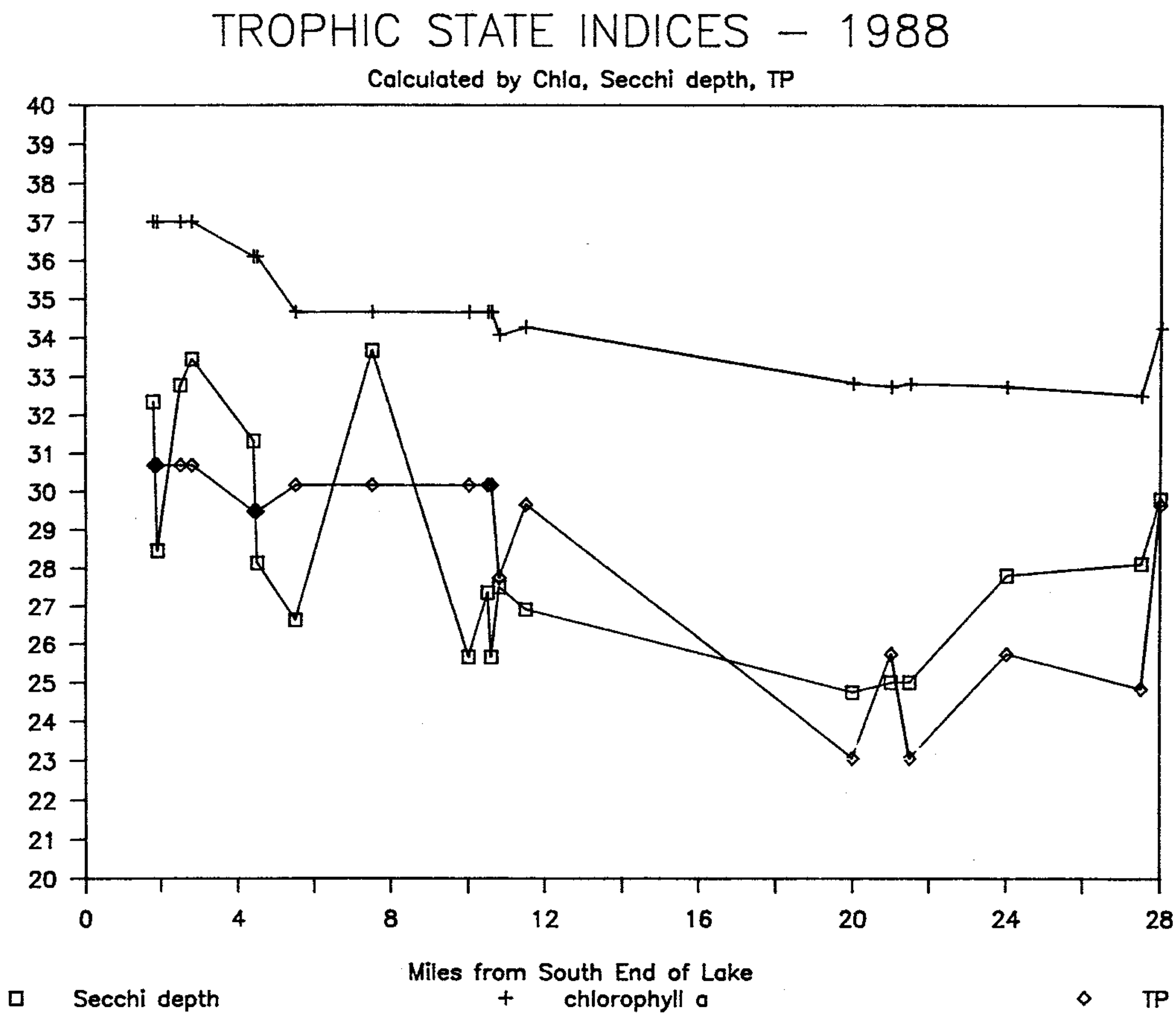

Figure 5. Relationship of Chlorophyll a-, Secchi depth-, and Total phosphorus-based TSI values by site.