Chlorophyll *a* concentrations in Otsego Lake, summer 2002

Katie Wayman[1]

INTRODUCTION

Each year, many limnological studies of biotic and abiotic factors are done on Otsego Lake (Harman *et al.*, 1997). These studies are done in primarily to order to recognize trends and anomalies of the lake regarding trophic shifts, allowing for better management decisions and to evaluate the effects of those activities. One of these contributing factors closely studied is the density of phytoplankton in the lake.

Phytoplankton are the basis of the food chain of lakes. Zooplankton's production is largely dictated by the production of phytoplankton, which in turn affects the production at higher trophic levels, including game fish. Conversely, phytoplankton also actively contributes to the lake's transparency and dissolved oxygen content. As phytoplankton die, they sink through the hypolimnion, where bacteria decompose them. Bacterial respiration consumes the oxygen upon which cold-water gamefish depend.

Some natural, interrelating factors that contribute to the growth of phytoplankton are light, temperature, inorganic nutrients, the avoidance of destruction by other organisms, staying in the photic zone of the lake, and competition for available resources (Wetzel, 1975).

A light sensitive pigment used for the process of photosynthesis which is found in all plants is chlorophyll *a*. By studying and evaluating the vertical distribution of this substance in the lake, estimates the biomass of phytoplankton in the lake can be made. Since the ratio between chlorophyll *a* and biomass is somewhat variable among taxa, these estimates may not be entirely accurate, but this information allows for relative spatial and temporal estimations of algal densities. Concurrent with this work, profiles of temperature, pH, dissolved oxygen, and conductivity were recorded by using a Hydrolab Scout II®. Surface to bottom samples were collected for the analysis of nitrate+nitrate nitrogen, alkalinity, total phosphorus, chlorides, and calcium (Albright, 2003).

METHODS AND MATERIALS

Chlorophyll *a* studies involved collecting samples in profile from the lake starting from the surface and going down every meter to 20 meters. Samples were taken for the deepest part of the lake, TR4C (Figure 1) biweekly from July 2 to August 15 between 09:00 and 11:00.

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[1] F.H.V. Mecklenburg Conservation Fellow, Summer 2002. Present Affiliation: Worcester High School.

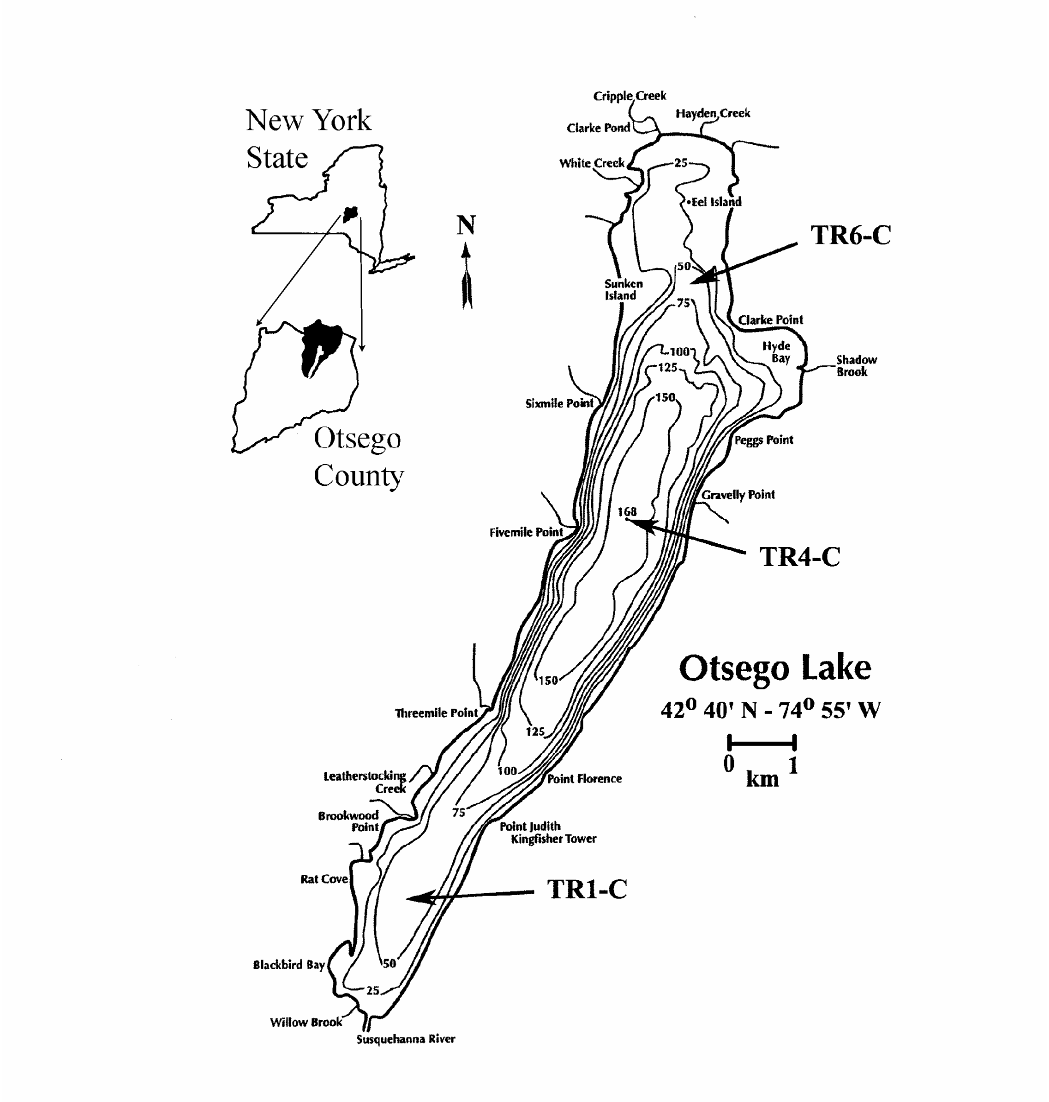

Figure 1. Map of Otsego Lake, NY, showing sampling station (TR4-C).

Water samples were collected by using a Van Dorn sampler and were transferred to 250 ml polyethelene bottles. They were stored in a cooler on ice for transport back to the Biological Field Station for further processing and analysis. All of the samples were processed in duplicate in the dark because chlorophyll *a* is affected by light and heat.

Laboratory processing involved passing 100 ml sub-samples through a Whatman GF/A glass microfibre filter using a low-pressure vacuum pump. Filters were removed from the filter funnels by forceps, folded in half, and padded dry with paper towels. All excess filter matter that did not encounter the sample or chlorophyll was removed and discarded. Filters were then stored in Petri dishes labeled with the date, location, and depth, and were wrapped in aluminum foil and kept in a freezer at -20 C^{o} until the next day when the analysis was continued.

Each filter was cut up into small pieces, in order to increase the surface area, and placed in a 10 ml glass grinding tube with about 4 ml of buffered acetone (90% acetone + 10% magnesium carbonate). Each sample was then ground to a homogenous slurry using a pestle connected by a chuck to an electric drill. The slurry substance was rinsed into a 20 ml centrifuge tube. The pestle and grinding tube were also rinsed into the centrifuge tubes and the sample was taken to 10 ml of buffered acetone, capped and shaken. The centrifuge tubes were then allowed to steep for approximately two hours at 4ºC before being centrifuged at 1000g for ten minutes. This removed particulate matter that may interfere with the sample's chlorophyll *a* reading. The substance was then transferred to a one centimeter curvet and chlorophyll *a* concentrations were determined using a Turner Designs TD-700 Fluorometer™. Methodologies followed those by Arar and Collins (1997).

The readings were then recorded, calculated, and graphed. All materials were cleaned thoroughly with buffed acetone before and after every use.

RESULTS AND DISCUSSION

Figure 2 shows the chlorophyll *a* concentrations in profile (the duplicates being averaged together) for 2002. Concentrations were lower, and more uniform, in 2002 than in recent years past. Generally, the levels were somewhat elevated between 6 and 10 m, slightly above the thermocline. Temporal variation in the profile means were similarly consistent, ranging only from 3.11 (2 July) to 3.92 *u*g/l (15 August). This homogeneity is not consistent with earlier years. In 1997, the first year for which these profiles are available, the surface-to-20 m means ranged from 3.41 (7 July) to 9.57 *u*g/l (16 June) (King, 1998). That year, concentrations were regularly highest between 8 to 10 m (the top of the thermocline) and the summer average was 6.37. In 2000, water column averages ranged from 6.38 (17 August) to 14.53 *u*g/l (8 June) (Durie, 2001). Concentrations were uniformly high (>10 *u*g/l) throughout the epilimnion and decreased below the thermocline. The summer of 2001 (Wayman, 2002) was most similar to 2002, in that temporal and vertical variation was slight, though concentrations were about 30% higher. Figure 3 plots the summer mean chlorophyll *a* concentrations for 1997, 2000, 2001 and 2002.

It is postulated that a decline in the planktivorous alewife (*Alosa psuedoharengus*) between fall 2001 and spring 2002 (Warner and Cornwell, unpubl.) has allowed for an increase in larger bodied zooplankton (Martin, 2003), and increased grazing by those animals was, at least in part, responsible for the decline in algal biomass, documented here, as well as increased Secchi transparencies and lower rates of hypolimnetic oxygen depletion reported by Albright (2003).

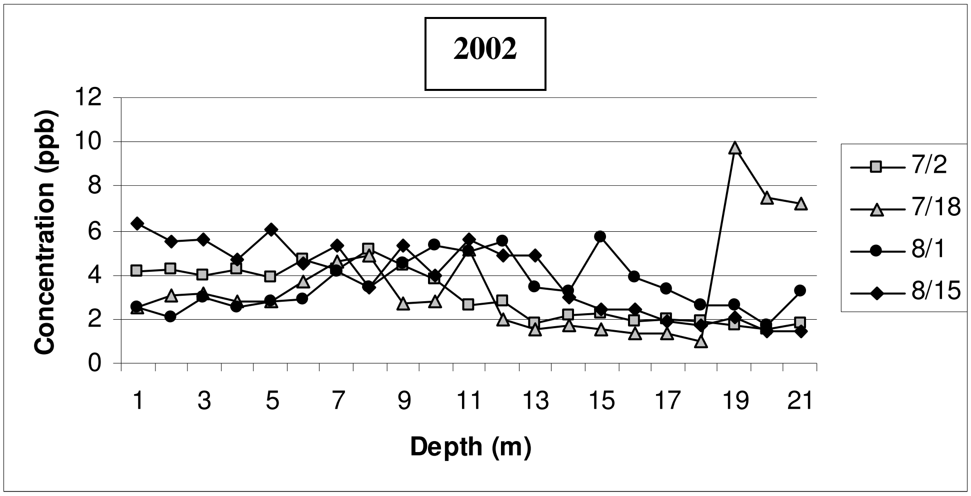

Figure 2. Summer 2002 profiles of chlorophyll *a.*

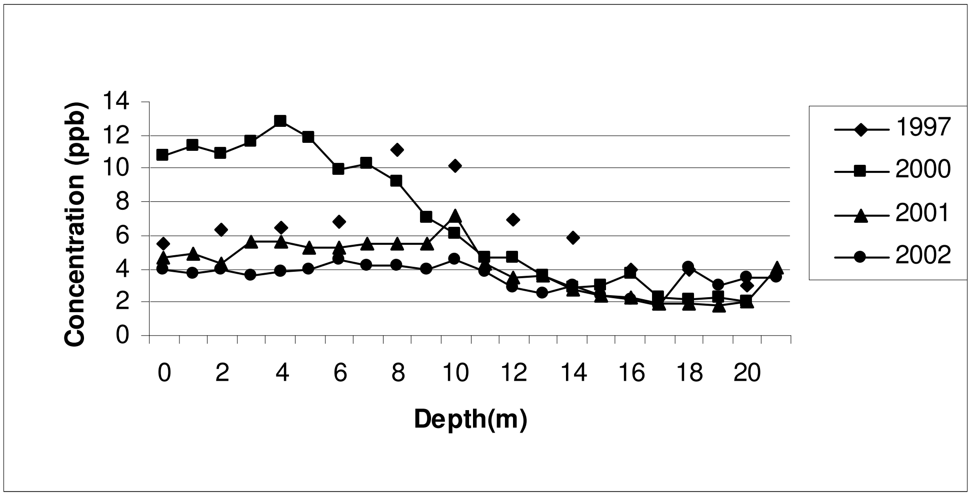

Figure 3. Summer mean chlorophyll *a* concentrations for 1997 (King, 1998), 2000 (Durie, 2001), 2001 (Wayman, 2002) and 2002. Note that 1997 profiles were at 2 m intervals.

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