

Chlorophyll *a* analysis of Otsego Lake, summer 2005

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INTRODUCTION

Year round limnological studies of several biotic and abiotic factors conducted on Otsego Lake (Harman et al. 1997) include the monitoring of the vertical distribution of chlorophyll *a* in the lake. Data from these ongoing studies allow the diagnosis of trends and changes in the status of the lake before they become problems that could render standard lake management techniques ineffective (Harman et al. 1997).

Chlorophyll *a* is a photosensitive pigment present in algae (Wetzel 1975). Concentrations of chlorophyll *a* may be used to estimate the biomass of phytoplankton present. Precision of this method, however, may not be assured; different types and sizes of algae exhibit different rates of chlorophyll *a* production, and therefore the ratio of phytoplankton to biomass is somewhat variable (Wetzel 1975). Vertical distribution of chlorophyll *a* is also an indicator of a lake's water quality and trophic status (Cooke et al. 1993).

Monitoring of chlorophyll *a* concentrations in recent years has indicated a shift towards eutrophy in Otsego Lake (Harman et al. 1997). Continuing eutrication would cause large algal blooms that would threaten the municipal, aesthetic, and recreational quality of Otsego Lake. Potability of lake water and the success of cold water game fish, such as lake trout (*Salvelinus namaycush*), are also dependant upon phytoplankton populations (Cooke et al. 1993). Since phytoplankton are the basis of the food chain in Otsego Lake, success of algal populations directly affects the success of organisms at higher trophic levels. Decomposition of large dead algal blooms sinking through the hypolimnion lowers the amount of dissolved oxygen available to the cold water fishery.

Determination of chlorophyll *a* levels in Otsego Lake is done to record the vertical distribution of chlorophyll *a* over the summer months. Monitoring of chlorophyll *a* concentrations during summer 2005 was concurrent with investigations of chemical and physical parameters (Albright 2006).

METHODS AND MATERIALS

Chlorophyll *a* samples were collected weekly from 11 July to 23 August at TR4-C, the deepest part of Otsego Lake (Figure 1). Samples were taken in profile, from the surface to 20 meters at one meter intervals through the use of a Van Dorn Sampler. Samples were transferred to 125mL Nalgene[®] bottles, and stored in a cooler on ice for

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transport back to the Biological Field Station. All transport and processing of samples was executed in subdued light to prevent degradation of the chlorophyll *a*.

Laboratory processing commenced immediately upon return to the Field Station. 100mL of each sub-sample was passed through a GF/A Whatman[®] 47mm glass microfibre filter through the use of a low pressure vacuum pump. Filter papers were then removed from the filter funnels and folded with forceps. Samples were then blotted dry on a paper towel and trimmed to get rid of any filter areas that had not contacted the sample. Filters were placed in Millipore[®] dishes labeled with sample depth.

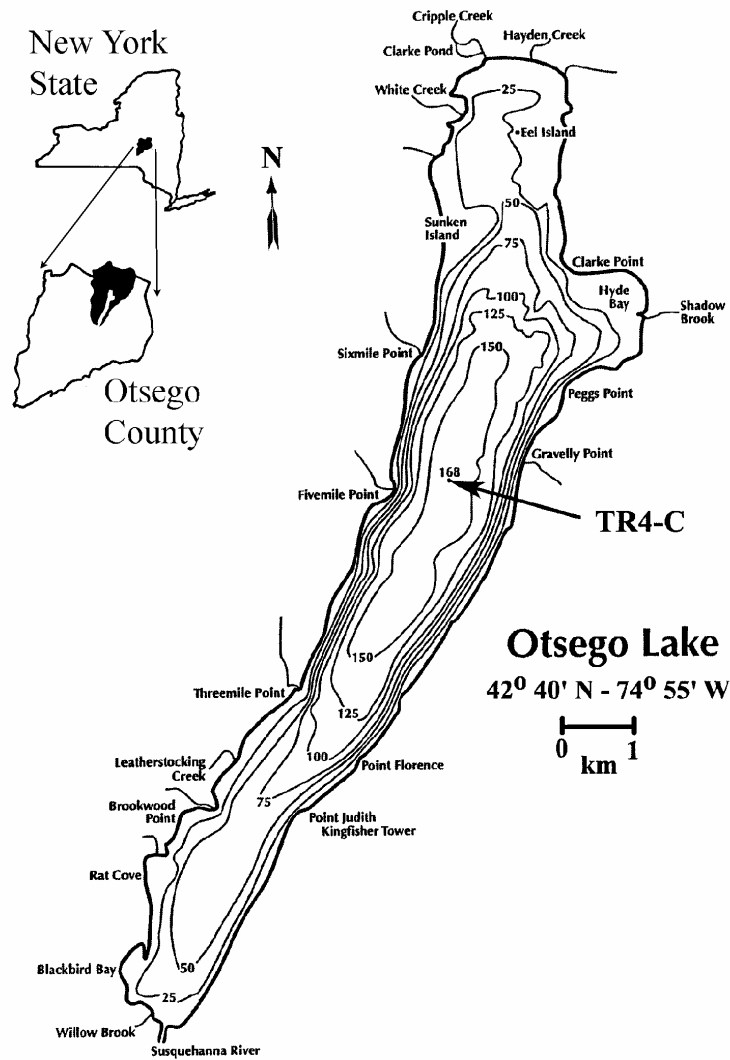


Figure 1. Bathymetric map of Otsego Lake, sampling site TR4-C. Depth in Feet.

All Millipore dishes were then placed in a large foil covered beaker labeled with site, date, and stored overnight in a freezer at -20°C.

Processing resumed immediately the next morning, as each filter was cut into small pieces into a 10mL glass grinding tube along with approximately 4mL of buffered acetone (90% acetone, 10% saturated magnesium carbonate (MgCO₃)). This was then ground to a homogeneous slurry through the use of a power drill connected to a teflon pestle via chuck. The glass grinding tube and teflon pestle were both rinsed into a 15mL centrifuge tube, and filled to the 10mL mark with additional buffered acetone solution. Centrifuge tubes were capped, shaken, and stored under foil in a refrigerator at about 4°C to steep for a minimum of two hours.

After steeping in the dark, samples were centrifuged for ten minutes at 1000g to remove particulate matter from suspension. A portion of the supernatant was then poured into a 1cm cuvette, and the concentration of chlorophyll *a* was determined through the use of a Turner Designs TD-700 fluorometer as discussed in the methodologies of Arar and Collins (1997).

RESULTS AND DISCUSSION

Figure 2 shows the concentrations of chlorophyll *a* at TR4-C at each depth and on each date sampled during the summer, 2005. Vertical profiles were quite variable over the summer, but concentrations tended to be higher at depths of less than 10 m. Figure 3 illustrates the mean surface – 20 m chlorophyll *a* concentrations on each date sampled. Photic zone averages tended to increase somewhat over the course of the study period. The entire algal growing season (May to October) ideally should be evaluated for a more accurate and complete study of phytoplankton populations.

Profiles of mean chlorophyll *a* concentrations for the summers of 2000 (Durie 2001), 2001 (Wayman 2002), 2002 (Wayman 2003), 2003 (Schmitt 2004), 2004 (Murray 2005), and 2005 are illustrated in Figure 4. Although individual samplings are highly variable average chlorophyll *a* production has exhibited a decreasing trend over the past few years (Figure 5). This decrease has been concurrent with a general increase in larger bodied crustacean zooplankton (Albright et al. 2005), which efficiently graze algae (Cornwell 2005). Investigations into trophic cascading relationships related to efforts to reduce the zooplanktivorous alewife (*Alosa pseudoharengus*) are ongoing (i.e., Brooking and Cornwell 2005).

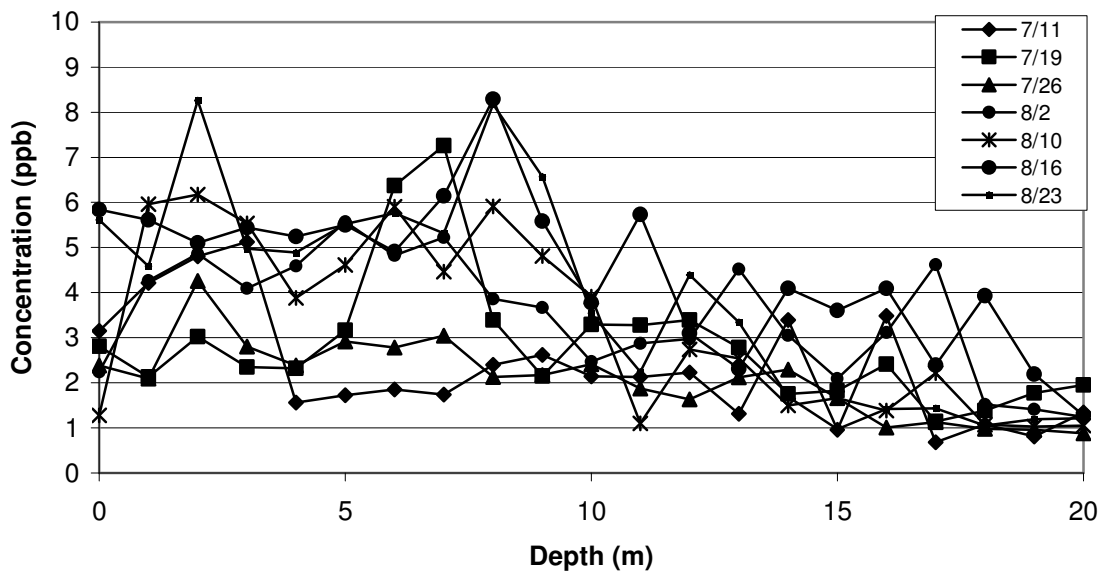


Figure 2. Summer 2005 chlorophyll *a* profiles by date.

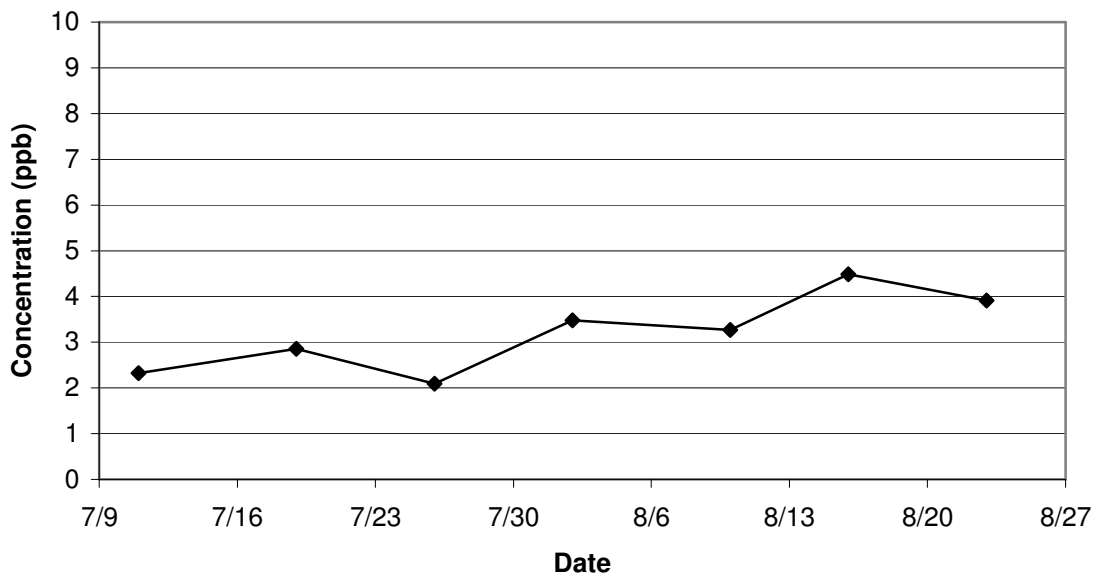


Figure 3. Mean surface - 20 m chlorophyll *a* concentrations by date, summer 2005.

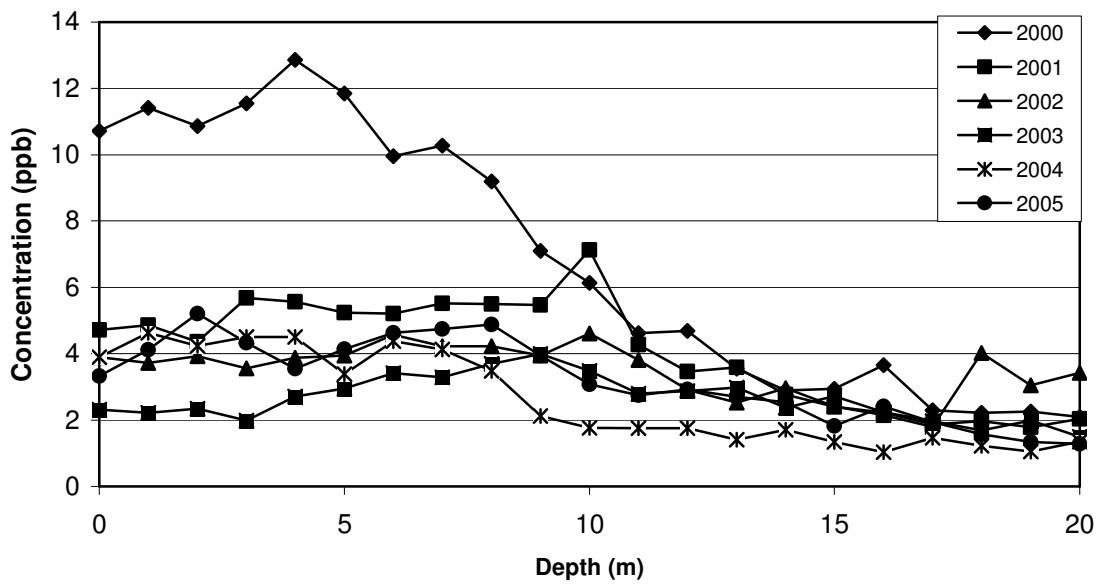


Figure 4. Summer mean chlorophyll *a* concentrations for 2000 (Durie 2001), 2001 (Wayman 2002), 2002 (Wayman 2003), 2003 (Schmitt 2004), 2004 (Murray 2004), and 2005.

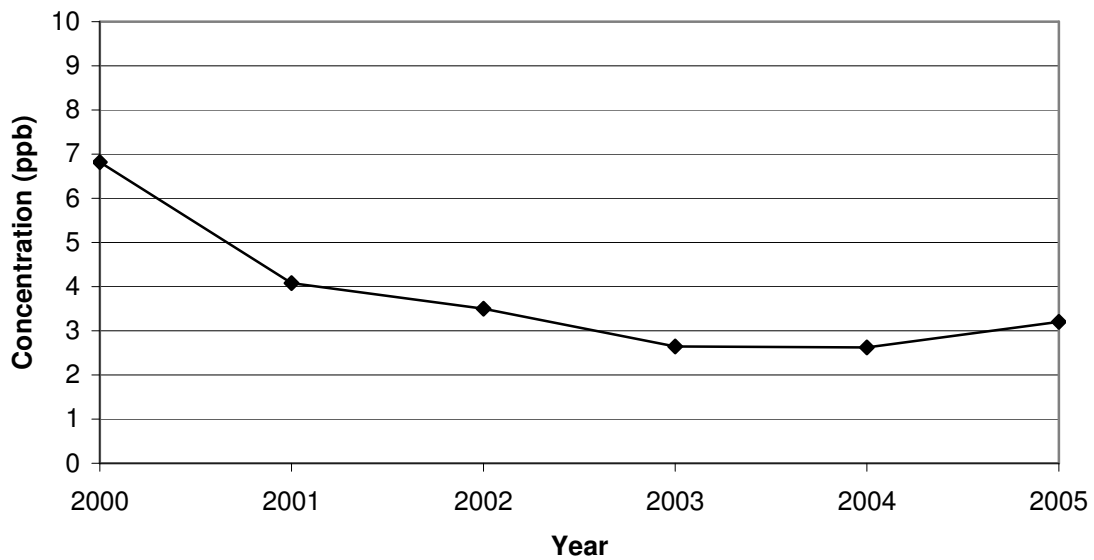


Figure 5. Mean composite (0-20 meters) chlorophyll *a* concentrations for the summers of 2000 (Durie 2001), 2001 (Wayman 2002), 2002 (Wayman 2003), 2003 (Schmitt 2004), and 2005.

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