

Chlorophyll *a* analysis of Otsego Lake, Summer 2001

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INTRODUCTION

Because of long-term limnological studies of biotic and abiotic factors of Otsego Lake (Harman *et al.*, 1997) trends and anomalies regarding water quality can be recognized. One closely studied factor is the amount of phytoplankton (algae) in the lake. Algal growth is the most direct indicator of trophic status; it is a function of nutrient concentrations and zooplankton grazing and it dictates water clarity and deep-water oxygen losses.

Phytoplankton is the basis of the food chain in the lake. Its abundance dictates that of zooplankton, which translates to production at higher trophic levels, including gamefish. However, phytoplankton affects the lake actively, influencing dissolved oxygen, and transparency. Senescent phytoplankton sinks through the hypolimnion. Oxygen is consumed during its respiration and decomposition. Hypolimnetic oxygen concentrations in recent years (Albright, 1999; 2000; 2001) have been approaching those necessary for maintaining a healthy cold-water fishery (Nichols, 1995).

Chlorophyll *a* is a light sensitive pigment found in all plants which is used in the process of photosynthesis. Studying the vertical distribution of chlorophyll *a* in a lake enables scientists to estimate the biomass of phytoplankton in the lake. This procedure is not precise because the ratio between biomass and chlorophyll *a* is somewhat variable. However, the information obtained from measuring the amount of chlorophyll *a* does provide information relative to the trophic status of the lake.

METHODS AND MATERIALS

Samples were taken from TR4C (the deepest part of Otsego Lake, Figure 1) on 12 and 26 July and 9 and 22 August 01 between 09:00 and 11:00. Water was collected in profile from the surface to 20 m at 1 m intervals using a Van Dorn bottle. The samples were placed in 250 ml polyethelene bottles and stored in a cooler with ice for transport back to the Biological Field Station for laboratory analysis. Concurrent with this work, profiles of temperature, pH, dissolved oxygen and conductivity was recorded using a Hydrolab Scout II and surface-to-bottom samples were collected for the analyses of total phosphorus, nitrite+nitrate nitrogen, alkalinity, calcium and chlorides (Albright, 2002).

Chlorophyll *a* samples were processed in duplicate. One hundred ml were passed through Whatman GF/A glass microfibre filters using a low-pressure vacuum pump. The filters were folded, blotted dry and the outer edge trimmed to remove excess filter which did not contact the

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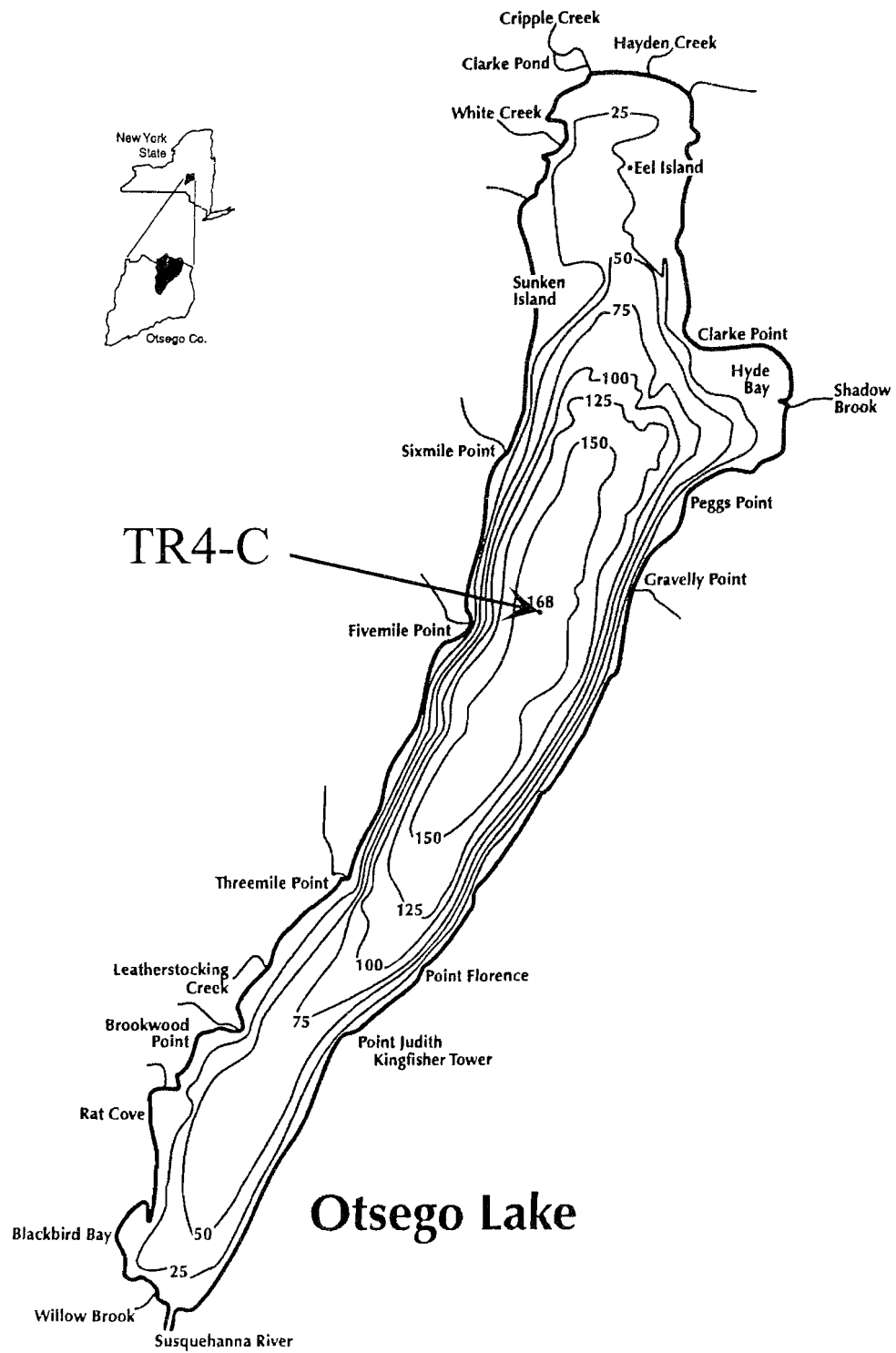


Figure 1. Otsego Lake, Otsego County, NY showing sampling site.

sample. Filters were then placed in 50 mm plastic Petri dishes which were wrapped in aluminum foil, because light will degrade chlorophyll, and were held at -20°C until processing continued (usually the next day).

Each filter containing chlorophyll *a* was cut up into small pieces to increase the surface area and placed in a 20 mL glass grinding tube with about 4 ml of buffered acetone (90% acetone + 10% saturated magnesium carbonate). The filters were then ground to a slurry with a pestle connected with a chuck to an electric drill. The slurry was then poured into a 20 ml centrifuge tube. The pestle and grinding tube were both rinsed with buffered acetone into the curvet and the slurry was taken to 10 ml with more acetone and capped. The centrifuge tubes were allowed to steep for about two hours at 4°C and then were centrifuged at 1000g for ten minutes. This removed particulate material from suspension. The supernatant was then transferred to a one-centimeter curvet and the chlorophyll *a* readings were determined by fluorescence using a Turner Designs TD-700 fluorometer following the methodologies outlined by Arar and Collins (1997).

RESULTS

Figure 2 shows the chlorophyll *a* concentrations in profile (the duplicates being averaged together). The chlorophyll *a* concentrations were generally fairly homogeneous through the epilimnion, peaking slightly near the thermocline (at about ten meters, with the exception of 12 July when the peak was approximately seven meters). The concentrations were at their highest at 11 m on 22 August, having an average of about $9.5 \mu\text{g/l}$, the second highest of $7.4 \mu\text{g/l}$ at 10 m on 26 July. This differs from 1999 (Rudd and Albright, 2000) and 2000 (Durie, 2001) when the concentrations usually peak earlier and drop off in August. In 2000, early-June algal blooms were responsible for concentrations in excess of $30 \mu\text{g/l}$ through the epilimnion (Durie, 2001). The current study did not start until July; therefore, any spring bloom would have gone undetected.

In recent years, chlorophyll *a* concentrations have been quite variable. In 1993, it was found by Ramsey (Harman et al., 1997.) that the concentrations peaked at over $30 \mu\text{g/l}$ at a depth of 15m; that year concentrations in the thermocline were above $15 \mu\text{g/l}$ throughout most of the summer. Conversely, during the summer of 1994 concentrations through the epilimnion averaged only $3.7 \mu\text{g/l}$ (Harman et al., 1997.). In 1997 the summer time average concentration was $7.7 \mu\text{g/l}$ (King, 1998). In 1999, the chlorophyll *a* concentrations averaged $5.2 \mu\text{g/l}$. That year, a metalimnetic maxima was particularly evident (Rudd and Albright, 2000).

DISCUSSION

Chlorophyll *a* concentrations in Otsego Lake have been quite variable over the past 20 years, both temporally (year-to-year and seasonally) and spatially (i.e. vertical distribution). This

is probably a function of dominant taxa, as algae have different temperature, light and nutrient requirements and have differing chlorophyll *a* to biomass ratios. A shortcoming of many of the studies conducted on Otsego Lake is that only part of the growing season is evaluated. Ideally, monitoring should be conducted from May to October, and biomass estimates should be complimented with a taxonomic description of the community.

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