A preliminary investigation of the seston of Otsego Lake, summer 1997

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INTRODUCTION

Extensive work has been done on various trophic indicators of Otsego lake (i.e. Harman et al., 1997). Investigations into their temporal trends provide insight into the changing nature of the Lake. An ultimate consequence of increasing eutrophy is the loss of oxygen in a lake's deeper strata which, if severe, results in the loss of deep water fauna, including coldwater fish, and promotes the liberation of phosphorus from lake sediments, compounding the problem and making remediation difficult.

During 1997, several investigations related to oxygen loss in Otsego Lake were conducted. These included biweekly monitoring of oxygen and nutrient profiles at TR4-C (Albright, 1998), algal productivity (King, 1998) and taxa (Irving, 1998) studies. Related studies evaluated nutrient sources to the Lake (Miller, 1998; Ives and Albright, 1998), and the role of the changing fish community in the eutrophication process (Haresign and Warner, 1998; Warner et al., 1997). Briefly, oxygen loss is the consequence of the decomposition of organic matter, primarily that originating from algal primary production, as it settles through the hypolimnion (Wetzel, 1975).

In order to further characterize the process of oxygen loss in Otsego Lake, and to compare the current situation with those of the past, this study evaluates methodologies for quantifying seston, or the particulate matter suspended in free water (Hutchinson, 1967), and determining its organic content. These methods were employed on samples collected from Otsego Lake on 7 and 11 August, 1997.

METHODS

Samples were collected from TR4-C at 4 meter intervals from the surface to 20 m on 7 and 11 August, 1997 using a 4 liter Van Dorn sampler. Upon return to the lab, containers were shaken and approximately 50 ml was drawn off for turbidimetric determinations using a Monitek model 21PE nephelometer.

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Prior to seston analysis, GF/A glass microfibre filters were prepared by passing three successive 20 ml aliquots of distilled water, under vacuum, through them. Each filter was then transferred to a stainless steel planchet, dried in an oven at 105 °C for one hour, and stored in a desiccator. Filter weight, to the nearest 0.1 mg, was recorded immediately before sample processing.

Samples collected 7 August were filtered at a rate of 2 l per filter and were processed in duplicate. Because final seston levels were found to be quite low, analysis for samples collected 11 August involved filtering 4 l (an exception being the surface sample, where severe filter clogging limited filtration to 3 l). Because of this increased volume, duplication of processing was not conducted. In order to provide some measure of quality control, a blank, involving the filtration of distilled water and processing as normal, was evaluated concurrent with sample processing.

Analysis involved shaking each sample, filtering the appropriate volume, and drying the filter in a stainless steel planchet at 105 °C for one hour. While processing the first series of samples, problems were encountered with the filters sticking to the planchets; residue lost while trying to remove the filter undoubtedly caused inaccuracies. This was remedied during the processing of the second series of samples by placing a disk of clean paper in the planchet under the filter. After drying, filters were allowed to cool in a desiccator then reweighed. The difference between this weight and that of the filter before sample processing provided the seston dry weight.

To ascertain the ash content of seston, filters were next combusted at 550 °C for one hour, allowed to cool in a desiccator, and reweighed. The difference between this weight and that of the filter before sample processing provided the ash weight of the seston. Organic content was taken as the difference between dry weight and ash weight.

RESULTS AND DISCUSSION

Due to problems encountered during the processing of the first series of samples (see above), these data were discarded. Information on turbidity, dry weight, organic seston weight (and as percent of seston dry weight) and ash weight for samples collected on 11 August, 1997 are given in Table 1. Figure 1 compares these data with organic seston studies conducted on 7/23/35 (Tressler and Bere, 1935), 7/23/71 (Sohacki, 1972), and 8/15/75 (Doremus, 1975). The inclusion of a blank was intended to ensure that a filter not exposed to particulate matter would retain a constant weight throughout the analytical procedure.

Generally, the changes in trophic indices that have been documented over the past several decades in Otsego Lake imply increasing eutrophy of this waterbody. In particular, ever increasing rates of hypolimnetic oxygen depletion noted over the past 25 years (Albright, 1998) would suggest an increase in the amount of oxidizable organic seston settling from the trophogenic zone. However, results from this study reveal concentrations of seston comparable to
Figure 1. Organic seston concentrations at TR4-C, Otsego Lake, on 7/23/35 (Tressler and Bere, 1936), 7/23/71 (Sohacki, 1972), 8/15/75 (Doremus, 1976), and 8/11/97.
Table 1. Profiles of turbidity (NTU), dry weight (mg/l), organic seston weight (mg/l and as % of dry weight) and ash weight (mg/l), TR4-C, 11 August, 1997.

those of 1935 and considerably lower than concentrations recorded since 1971. Several factors may account, in part, for these apparent inconsistencies.

The 1935 seston work involved continuos flow centrifugation to concentrate particulate matter. The studies of the 1970s followed suit, despite the fact that this method is prone to error (Sohacki, 1998), to retain consistency of the data. The current work employed different methodologies which may make comparisons with past work difficult. Secondly, and perhaps of greater importance, is the fact that each study examined conditions prevailing at only one point in time. Investigations into algal biomass indicate considerable seasonal variation with little apparent consistencies from year to year (Harman et al., 1997). Work on seasonal distributions of chlorophyll a throughout the summer of 1997 (King, 1998) indicate significantly higher algal standing crops prior to seston analysis.

The methodologies employed here, while not evaluated formally, seem to hold promise. Future work should include replicate samples; processing blank filters also lends credence to the analysis. In order to understand the links between algal production and hypolimnetic oxygen depletion, it is imperative that future investigations address seston on a regular basis throughout summer stratification.

REFERENCES


Doremus, C. 1976. Ecological factors affecting phytoplankton growth during summer


