

A comparative study of anthropogenic impact on dimictic lakes in Halifax Regional Municipality, Nova Scotia: Implications for restoration and management*

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Lakes occurring in watersheds that have undergone urban development are known to be subjected to an array of anthropogenically-induced impacts. Since 1920, First Lake in Lower Sackville, Nova Scotia has been the focus of significant watershed development and lake water quality degradation is an ongoing concern. Second lake is located nearby, is of similar size, and is located in an undeveloped watershed. Stable isotope ($\delta^{13}\text{C}$, $\delta^{15}\text{N}$) and x-ray fluorescence spectroscopy data from lake sediment gravity cores were used to construct a ca.600-year record of environmental change for each lake in order to de-couple natural water quality variability from anthropogenically- induced variation. Spikes in specific elements (Nb, Y, Sr, and Cu) associated with local gold mining were used to cross correlate and date the lake sediment records. Increases in Pb concentrations above background were also used for temporal control. Modern water quality data indicated that though both lakes stratify strongly over the summer, First Lake alone experiences hypolimnetic anoxia. Though both lake proxy records indicated significant natural water quality variability, stable isotope ($\delta^{13}\text{C}$, $\delta^{15}\text{N}$) and XRF (Fe, Mn, S, and Ti) data indicated that First Lake alone was subject to substantial and persistent increases in natural autochthonous productivity during the past 70 years that can be attributed directly to local watershed development. Data indicated that though logging and/or mining as well as commercial development has impacted both lakes, residential development has had the strongest negative impact on water quality. This study has shown that the paleolimnological method can be used to quantify the relative impact of different types of development on lake water quality, a fundamental step in developing effective watershed management strategies.

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