
A paleolimnological record of anthropogenic impact on water quality in First Lake, Lower Sackville, Nova Scotia

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Lakes situated in urban environments are commonly subjected to a variety of anthropogenically induced pressures including nutrient loading, erosion, metal and salt inputs, and hypolimnetic anoxia. Since the 1920s, First Lake in Lower Sackville has been the focus of watershed

development and lake water quality degradation is an ongoing concern. A paleolimnological approach was undertaken in order to better understand the relationship between watershed development and water quality. A time stratigraphic, multi-parameter, multi-proxy, geochemical investigation was conducted on a sediment core from First Lake in order to determine pre-and post-development water quality conditions. A year-long study of limnological conditions in the lake (pH, D.O., conductivity, secchi depth) and a historical survey of existing data were conducted to characterize seasonal lake physical and chemical conditions. First Lake is 82 ha in size with a maximum depth of 23m. The lake stratifies strongly during the summer and algal blooms and hypolimnic anoxia commonly occur. Elevated *Escherichia coli* (*E.Coli*) concentrations have led to beach closures. Survey results indicate that shallow secchi depths (<2 m), strong stratification (~6 m), neutral pH values, and oxygen-deprived bottom waters (<5%) commonly develop as summer progresses. A 33 cm-long sediment core from the lake basin captured approximately 600 years of sediment accumulation. Atmospheric Pb concentrations were used to approximate sedimentation rates. Predevelopment (pre-1920) data indicates a productive, likely mesotrophic lake. Higher $\delta^{15}\text{N}$ values and lower C/N ratios near the top of the core indicate increased primary productivity within the lake as a result of increased nutrient input from early agricultural development during the 1920s. Changes in concentrations of Ti, Cu, K, loss-on-ignition and magnetic susceptibility values indicate landscape instability, and an increase in sediment and toxin transfer into the lake associated with urbanization in the 1960s. These data indicate that changes in water quality in First Lake are strongly linked to specific anthropogenic activities in the watershed, an understanding of which is a fundamental factor in developing effective lake management strategies.