## Assessing the vulnerability of shallow lakes to water-level fluctuations: an example from southwestern Nova Scotia

DAVID TERRY[1], IAN SPOONER[1], AND CHRIS E. WHITE[2]
*1. Department of Earth and Environmental Science, Acadia University, Wolfville, Nova Scotia B4P 2R6, Canada <ian.spooner@acadiau.ca> ¶ 2. Nova Scotia Department of Natural Resources, P.O. Box 698, Halifax, Nova Scotia, B3J 2T9, Canada*

Lakes are of particular importance in groundwater vulnerability studies since they act as catchment basins for close to 40% of the landscape, supply drinking water, generate electricity, are used to irrigate fields, and serve as recreational areas. To develop effective lake management strategies and assess risk associated with development or changing climate it is necessary to understand contemporary processes operating and catchments. Most lakes in Atlantic Canada are small (<50 ha.) and shallow (<3 m avg. depth). This study focuses on assessing the vulnerability of a shallow organic lake to small variations in water depth. Tupper Lake is a 45 ha lake with an average depth of 1.3 m and is located on the South Mountain Uplands in Kings County, Nova Scotia. The lake has recently been the focus of water quality and environmental change studies both prompted by an awareness of the potential impacts of shoreline development. Recently, much controversy has centered on short term, anthropogenically driven water level changes that have been a consequence of development pressure at the lake. This study focuses on determining if relatively small fluctuations in water level have the potential to affect water quality.

In the summer and fall of 2010, a variety of autochthonous physical and chemical data was collected. A historical perspective was provided by long-term residents of the lake and climatological data were gathered from regional sources. Interviews indicate that metre-scale water level change occurred in the early 1900s associated with hydroelectric development. Sonar, sub-bottom, and penetrometer data indicate that strong storms have the potential to create sufficient bottom shear to




Atlantic Geology, 2011, Volume 47, Number 1

re-suspend lake- bottom sediment. Gravity core stratigraphy indicates significant anthropogenic influence during the past 100 years including the addition of substantial amounts of saw mill waste. Chemical data from lake sediment cores demonstrate that though the limiting nutrient P decreases up core, the concentrations of many metals including Cu, Zn, As, and Ni increase substantially towards the top of the core.

The results of this study indicate that Tupper Lake, and likely many other lakes in Atlantic Canada, may experience substantial water quality change in response to small, decimetre-scale reductions in lake level. Lake management strategies are required to address the risk associated with drawdown.