Modelling the thermal sensitivity of shallow organic lakes in Nova Scotia

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Most freshwater lakes in Canada are small (< 4 ha) and shallow (< 6 m average depth). To interpret lake sediment records in terms of fluctuating climate, it is necessary to understand contemporary processes operating in these lakes and within their catchments. As well, although these lakes comprise significant habitat for a wide variety of species, very little is understood about how climate change will affect the physical state of these lakes. Canoran Lake, Lunenburg Co., and Sandy Lake, Annapolis Co., have similar volumes, areas, and elevations but have unique basin morphometries. Datalogged thermistor strings were placed in the littoral and profundal zones of both lakes and data was collected hourly from May – August, 2003. Thermistors were also placed in the canopy surrounding the lake to monitor air temperature change. The physical (morphometric) character of each lake was determined using 50 kHz sonar and the water quality characteristics (in particular lake trophic state) were determined using a wide variety of standard analyses.

Sonar results indicate that these lakes have very different morphometries, though surface areas and volumes are almost the same. Canoran Lake is a complex basin with two profundal zones and a discontinuous, vegetated littoral zone; Sandy Lake, has one profundal basin and a continuous, largely unvegetated littoral zone. Preliminary thermal results indicated that these two lakes reacted uniquely to thermal variation. For instance, during a rapid 10°C temperature decline (a low-pressure system influx) Sandy Lake mixed to a 5 m depth within a 24 hour period whereas only the top 3 m of Canoran Lake mixed over a period of 50 hours. During the subsequent temperature increase (high-pressure influx) Sandy Lake stratified more rapidly than Canoran Lake. Littoral temperatures in both lakes warmed from about 15 to 25°C during the study period. Profundal lake temperatures remained nearly constant in Canoran Lake but increased consistently in Sandy Lake; at

both sites profundal temperatures were unaffected by short-term thermal variation. These results indicate that Sandy Lake is more sensitive to summer air mass circulations changes, possibly as a result of its larger and largely unvegetated littoral zone. Though these changes are subtle, they are anticipated to have a significant affect on productivity; a relationship between wind dynamics and thermal response is still being investigated. Thermal sensitivity models based on this data will allow ecologists to better understand how the lake (as habitat) will evolve and are essential to the implementation of species monitoring and conservation programs.