A 100-year paleolimnological record of environmental change from Cecil Lake, northern British Columbia, Canada: application to the assessment of the habitat viability for migratory waterfowl

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Lake sediment archives are an established tool for examining environmental change over time. Cecil Lake is a productive shallow lake located in the Peace River region of northeastern British Columbia. It supports a variety of water birds, including a significant northern breeding population of eared grebes (*Podiceps nigricollis*). The Cecil Lake watershed primarily consisted of well-forested muskeg when the surrounding area was first homesteaded in 1928. As of 2018, ~80% of the landscape has been developed by the agricultural and energy sectors; consequently, Cecil Lake represents an opportunity to examine the effects of this development on a northern lake. The bulk geochemistry of the lake sediment archive at Cecil Lake was investigated to decouple natural and anthropogenic impacts over time. Water samples were collected for limnological assessment. Three sediment cores were collected in July 2018 using a NLA gravity corer. A 30 cm core was extruded at a 0.5 cm scale to determine stratigraphic variations in bulk geochemistry (metals, $\delta^{15}N$, $\delta^{15}C$, Total C, N). X-ray fluorescence analysis was used to determine metal concentrations at different depths in the core. Total lead data suggested that the duration of the recovered record was more than 100 years. A distinct zone of change, estimated to have occurred ~1920–1940, was characterized by increasing calcium, and manganese, as well as decreased titanium, potassium, and iron. This period was also characterized by increased %C, $\delta^{13}C$, and %N, and a steadily increasing trend in the $\delta^{15}N$ ratio. Strontium, zinc, and iron data showed increased variability from ~1940 onwards. Collectively, these data indicate three distinct signatures: (i) background conditions, (ii) a strong response to initial clearing and development, and (iii) increased environmental fluctuations associated with resultant water level variability and nutrient input changes. ^{210}Pb analysis of the core will provide temporal control allowing for the accurate correlation of historic events to the sediment archive. This record will be coupled with ecological data to better understand the vulnerability of similar lakes to environmental change.

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