The dynamics of a large northern lake
(Lhù’àan Mân - Kluane Lake, Yukon) in the face of climate change

E. McKnight¹, D. S. Hik¹, Kluane First Nation (KFN)² & Dân Keyi Renewable Resources Council (DKRRC)²
¹Department of Biological Sciences, University of Alberta
²Burwash Landing & Destruction Bay, Yukon Territory

INTRODUCTION

Large northern lakes hold vast quantities of freshwater, provide habitat and travel corridors for species, regulate local hydrological processes and climate, and have significant value to local communities. However, as climate change continues to amplify in northern regions, the integrity of and ecosystem services provided by these lakes are increasingly threatened. A growing number of studies show that large northern lakes are sensitive to small physical, chemical, and biological changes, which can lead to state shifts with consequences for surrounding ecosystems and communities (Adrian et al. 2009; Schnidler et al. 2009). Despite this, basic knowledge of the water properties and dynamics of these large northern lakes is very limited, and a need for increased research and long-term monitoring has been identified. Lhù’àan Mân (Kluane Lake) is the Yukon’s largest lake (400 km²) with a maximum depth of 80 m, is located within Kluane First Nation and White River First Nation traditional territories and borders Champagne and Ashihvik traditional territory, and is an excellent model system to study the impacts of climate change on large northern lakes.

2015 BASELINE STUDY

• Designed and conducted in 2015 in conjunction with KFN
• 28 sampling sites to provide spatial coverage and incorporate sites of community interest (Figure 1)
• Data collected at each site minimum once per season using CTWs, sondes, and water samples: temperature (°C), conductivity (μS/cm), dissolved oxygen (%), turbidity, total dissolved solids (TDS), total photosynthetic pigments, total nitrogen (TN) and total phosphorous (TP)

2016 À’AY CHU “PIRACY”

The Kaskawulsh Glacier meltwater fed both the À’Ay Chu and the Kaskawulsh River until recession and terminus changes reached a critical point in 2016, causing the glacier’s meltwater to be redirected entirely into the Kaskawulsh River (Shugar et al. 2017). The À’Ay Chu now comprises only tributary waters. The reduced inflow to Lhù’àan Mân has significantly lowered lake levels (Figure 2). The impacts of inflow changes on the lake water properties are unknown.

LONG-TERM MONITORING & COMPARING STATE CHANGES

Spring 2016: funding secured from DKRRC to build and deploy 4 long-term moorings (equipped with temperature and conductivity loggers) in Lhù’àan Mân with the help of the Department of Fisheries and Oceans (Figure 3).

March 2017: moorings deployed in areas representative of the various ecozones at Lhù’àan Mân (Figure 1). Early data (first 6 months) from these mooring is shown in Figure 4; different thermal dynamics are observed in different parts of Lhù’àan Mân, highlighting the significant variability within the lake and importance of spatial and temporal coverage when monitoring large lake systems.

Next steps: comparing thermal and conductivity dynamics between 2015 (baseline data) and 2017 (mooring data) to determine if and how the À’Ay Chu may be affecting the thermal and conductivity dynamics of Lhù’àan Mân.

SIGNIFICANCE

1. Expands our limited understanding of large northern lake dynamics and establishes a model for large lake monitoring in the Yukon and elsewhere in the North.
2. Demonstrates the value of high spatial & temporal resolution monitoring of large northern lakes in order to detect and understand consequences of change in these systems.
3. Examines the consequences of the loss of glacial input to a large northern watershed (via natural experiment), a likely more frequent event with future climate change: the À’Ay Chu piracy event presents a unique opportunity to explore watershed resilience and test theories about how large lakes may shift from one state to another.
4. Realizes the meaningful collaboration between researchers & local communities as a model for future research and environmental monitoring at Lhù’àan Mân and beyond.

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