

# Determining Catchment and Delta Quality of Daisy Lake, Sudbury: Assessment of Vegetation Cover, Microbial and Fish Activity, and Periphyton Growth

Kunali Gohil

## Abstract

The recovery process of the smelter-impacted Daisy Lake, Sudbury, is important to be monitored by measuring the quality of the catchment and delta areas. The quality of the catchment areas and delta productivity are combined to measure the overall quality of Daisy Lake. Delta productivity was measured by microbial activity, periphyton growth and fish abundances. All the results showed significant correlation to the terrestrial and delta physical characteristics. There is a quality gradient from the poor quality delta (closest to the Coniston smelter) to the best quality delta (furthest from the smelter). The quality of the lake is best measured by combining the terrestrial characteristics and aquatic productivity and is important for observing areas that need further restoration.

## Introduction & Objectives

Sudbury, Ontario has one of the world's largest Ni and Cu mining and smelting operations which date back to the late 1800's. The region has been heavily polluted by sulphur dioxide and trace metals. Efforts to prevent environmental degradation started with the re-greening program in 1973 and land reclamation in 1978. For this study, the goal is to measure the catchment and delta quality of Daisy Lake, Sudbury. The lake is located 3.5km south-west of the Coniston smelter and has been severely affected by smelter activities.



Daisy lake, Coniston and Falconbridge smelters

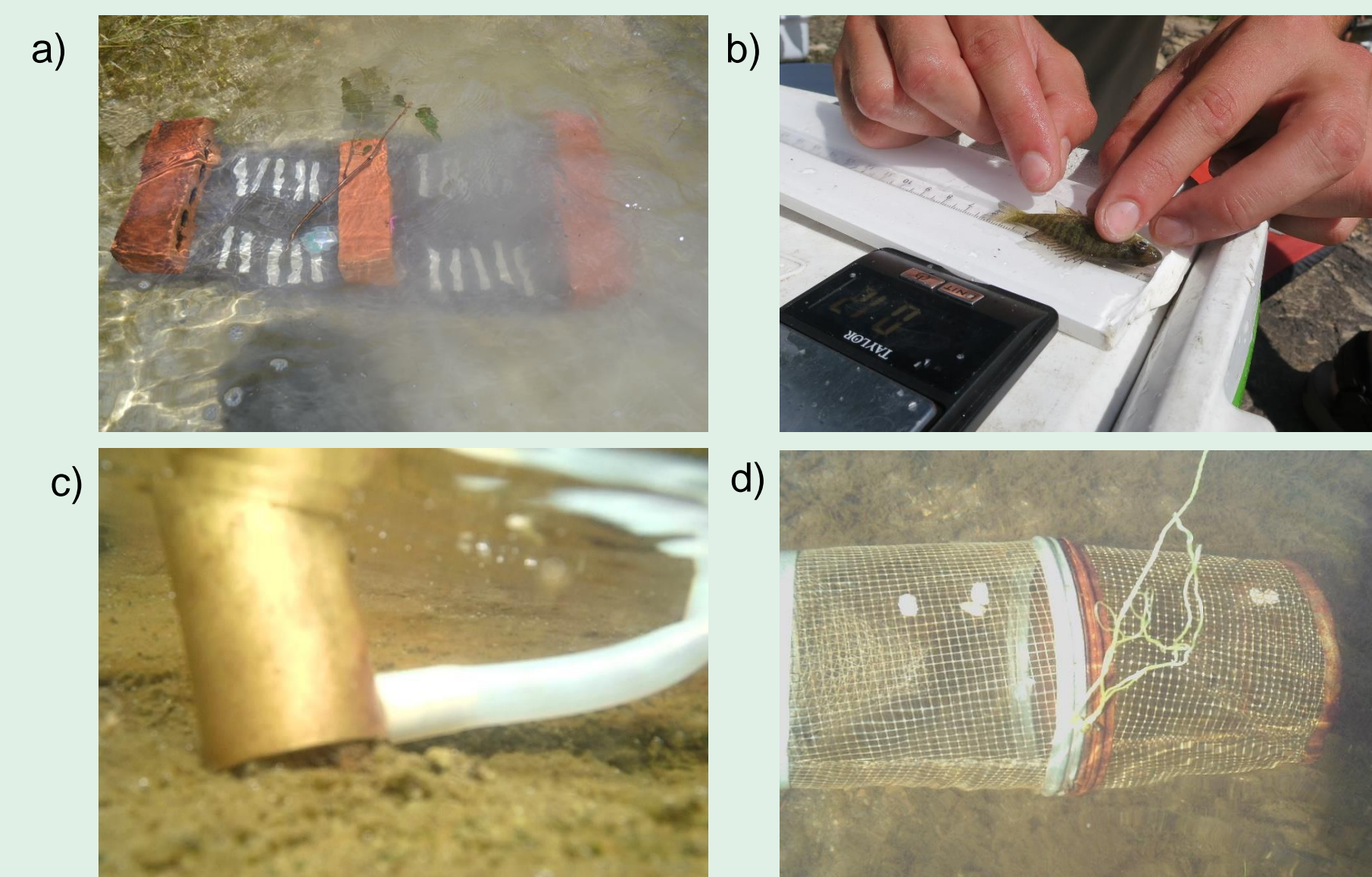
**Objective:** measure the overall catchment and delta quality of Daisy lake, Sudbury.

**Hypotheses:**

- Catchment characteristics like forest cover or barren land percentage, affect periphyton growth, and microbial and fish communities at the deltas.
- The proximity of the Coniston smelter also affects the overall catchment and delta quality of the lake. It was predicted that the proximity of the Coniston smelter should have a negative effect on closer catchments and we should see a positive quality gradient as we move away from the smelter.

## Methods

Daisy Lake is a long narrow lake located about 3.5-6.5km South-West of the Coniston smelter. Due to pollution from the smelter, the lake was acidic (<5pH) and metal contaminated. 8 catchments and their respective deltas were used for this study. The catchment characteristics used in the study were provided by Szkokan-Emilson et al. 2011. The biological variables were: vegetation cover, periphyton, minnows, and microbes.



- a) Cellulose strips to measure microbial activity b) Measuring fish size and weight c) Periphyton sampling using vacuum scrubber d) Minnow trap containing dog food and aluminum foil

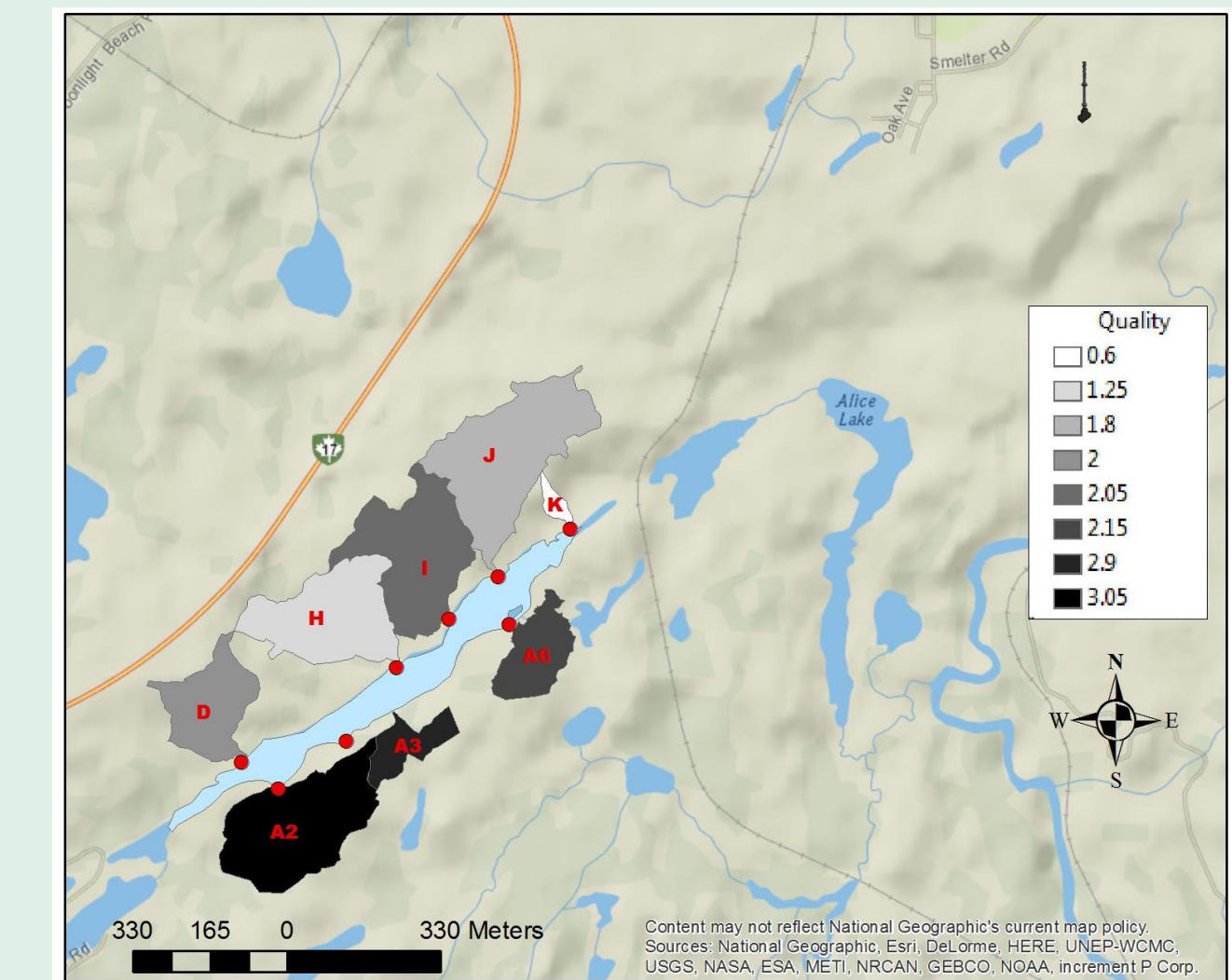
## Results

**Microbial Activity:** ANOVA and Tukey post-hoc tests, the cellulose strip data revealed 3 groupings of significant differences in microbial activity. Group 1: H, A3, D, K, Group 2: I, A6, Group 3: A2 and J

**Fish:** Statistically significant decreasing gradient from K to D

**Periphyton:** Shading effect on west side of lake caused significantly lower growth.

**Catchment analysis:** Comparing the forest cover of catchments and proximity of the smelter, a linear relationship is seen ( $r^2 = 0.5681$ ). NDVI calculation showed a vegetation gradient from K to D. A regression analysis of catchment quality revealed a linear relationship of quality and distance from the Coniston smelter ( $r^2 = 0.4727$ ).



Catchment and delta quality gradient from Daisy K to Daisy D. Quality was calculated using combined delta and catchment statistical results.

## Conclusion

Catchment and delta quality of Daisy Lake shows a positive gradient away from the smelter. Daisy J (limed) has a better quality than K and H (not limed). Sites closer to the smelter are more impacted and need more restoration work to achieve a healthier catchment and delta quality. For further restoration, chemical properties should be monitored. The quality of the lake is best measured by studying both terrestrial characteristics and aquatic productivity.