

The Effects of Raquette River Damming on Macroinvertebrate Biodiversity



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Abstract

Macroinvertebrates provide an excellent source of food for fish, birds, and amphibians. They provide cleaning services to aquatic ecosystems by consuming the organic waste. Rivers are home to a wide range of macroinvertebrates and are also a major site for dams. Dams heavily effect the environment not only through damaging the environment surrounding the dams, but also interfering with the aquatic ecosystems above and below them. In this study, we collected macroinvertebrate samples from 3 dams along the Raquette River in the Potsdam area, having 4 collection sites at each dam. We recorded data above and below each of the dams to observe the impact that the dams have on macroinvertebrate populations. We hypothesized that we would find a large impact on the abundance and richness of the macroinvertebrates due to the flow of the dam disrupting sediments and altering habitats. Upon finishing our research, our study showed that the damming of the Raquette River has little effect on the macroinvertebrate population's abundance and richness.



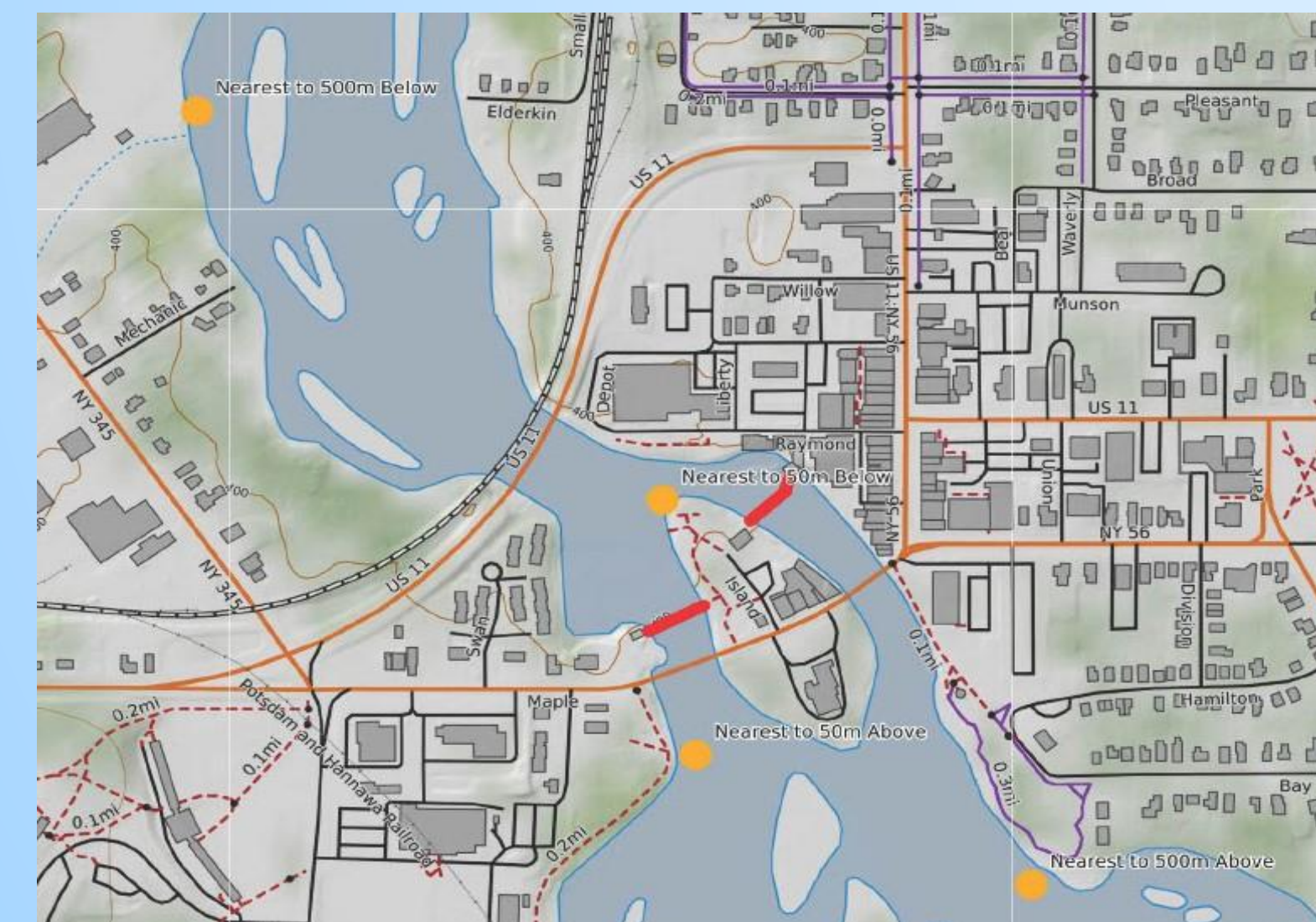
Our sorting included morpho-typing for species richness, and counting individual species for abundance

Methodology

We sampled 3 dams, 4 sites at each dam. We sampled two sites above the dams at 50 and 500 meters and two sites below the dam 50 and 500 meters. At each site we set up five collection trays and filled with water. We had 3 people dip-net simultaneously for 10 minutes at each site. Dip-netting occurred no further than 15ft from the shore and no more than 20 feet up or down the river from the designated site. Dip-net samples were distributed randomly to the five trays. Morphotype-based sorting of species was used to determine unique species within our samples. Macroinvertebrate keys were also used to identify species where possible to ensure accurate counting of species richness.

Materials .

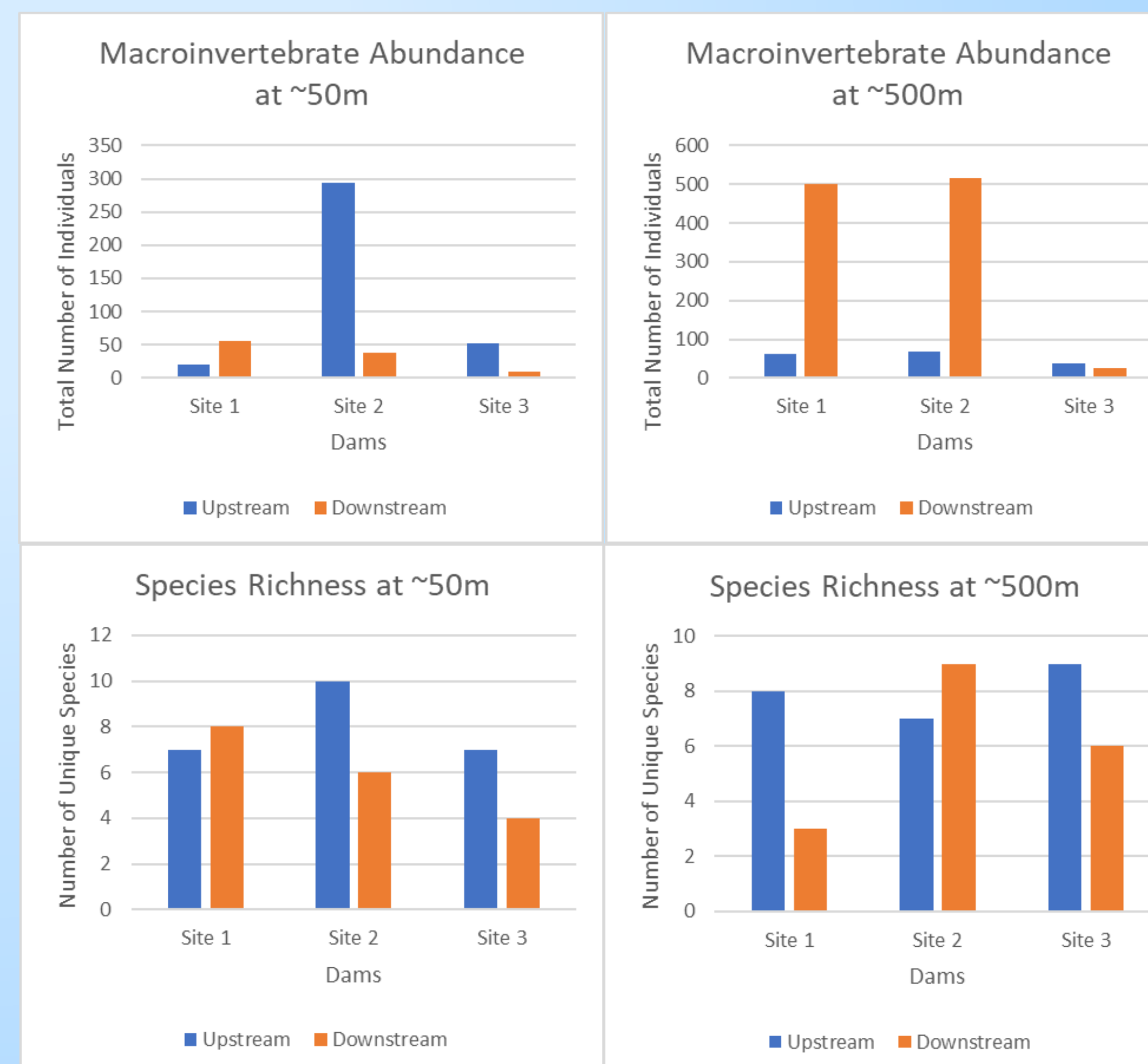
- Waders
- Metal collection trays
- Observation cups
- Dip nets
- Timer/Phone
- Notebook
- Taxonomic key



Map of the Potsdam sampling site location. The red line represents the dam, and the orange markers represent the sites.

Results

Discussion: While measures were employed to mitigate sampling irregularities and inconsistencies, our team was unable to control for multiple variables. Due to the inaccessibility of certain sampling sites, some samples were taken between 50 and 300 meters outside of our expected area. Additionally, this resulted in some samples being taken in areas more isolated from the main current or flow of the river. More stagnant water may have the potential to impact data if macroinvertebrates are more or less present in those less disturbed areas. Overall, random sampling was not used to select sampling sites or dam location due to time constraints and the nature of the project. Moreover, the data is limited twofold. It is restricted to the local area and concentrated to a smaller section of the Raquette River. It is also a smaller sample of the dams since only 3 locations were a part of the project. Consequentially, a reduction in sample sizes and the number of samples reduces the validity of the conclusions and findings to a degree. As for conditions, the temperature of the water and surrounding air was not ideal for obtaining a full analysis of macroinvertebrate biodiversity.



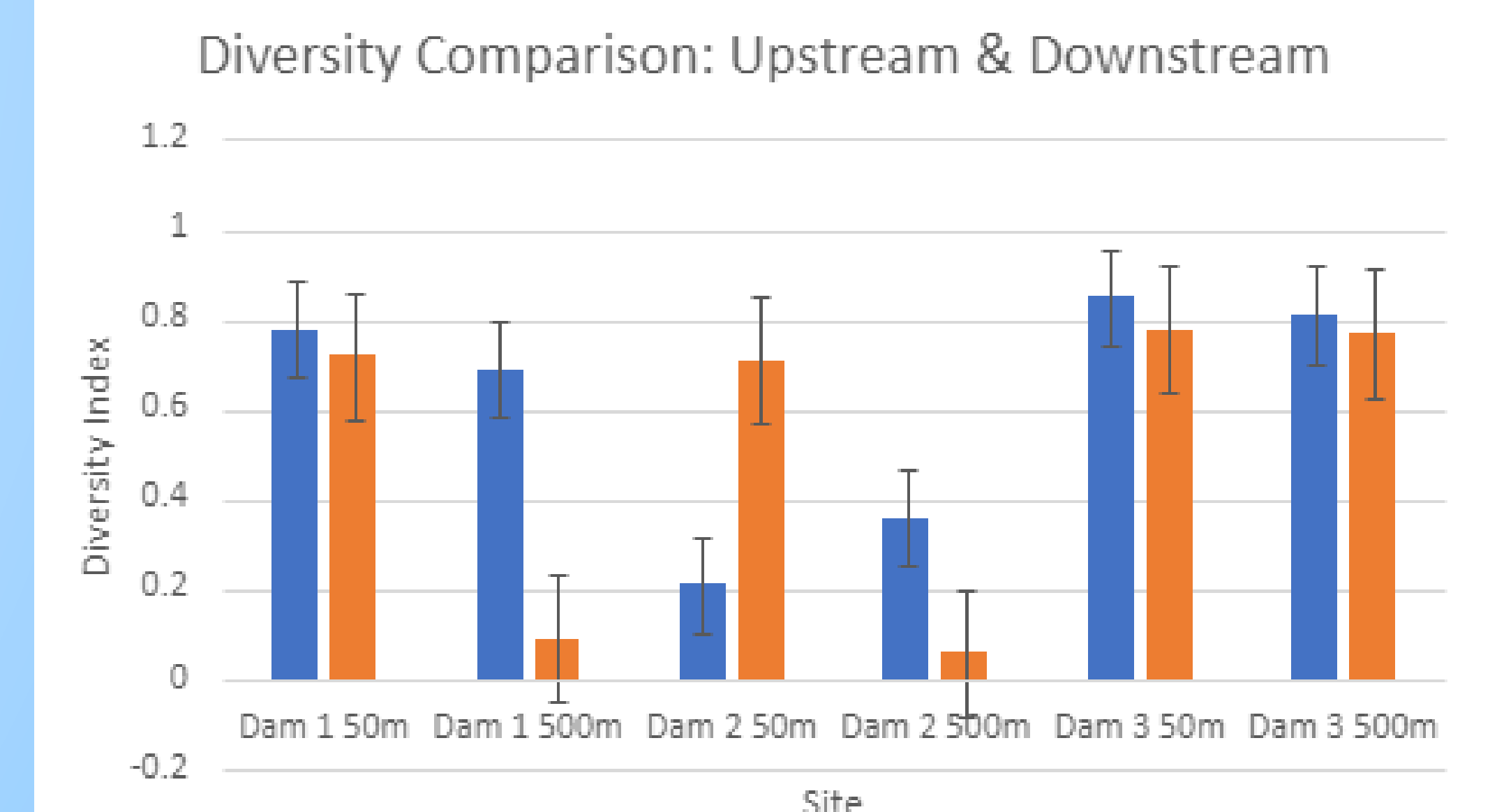
Conclusion

Within our findings it would be apparent that the null hypothesis is the case within our study. The data we have collected seems to suggest that relation either upstream or downstream of dams on the Raquette have very little effect on macro-invertebrate population dwelling in these areas. We have come to this conclusion as our data under statistical analysis showed very little connection between relation to the dams on the Raquette river and macro-invertebrate species richness, total population, and biodiversity. Each of these criteria produced a P-value far above the sub 0.05 needed to show relation.

Additional Note:

While it was not fully measured or analyzed quantitatively, disturbance-sensitive macroinvertebrates may not have appeared in some locations or may vary. Samples taken closer to the dam and species that are more sensitive to consistent agitation of a water body through human activity may have been less present in different areas.

The table below depicts the similar results gathered either side of the dams we sampled when it came to overall biodiversity.



Introduction

.With 27 established hydroelectric dam sites on the Raquette (Latremore et al. 2019), our team gained interest in the environmental impact local damming has. More specifically, the macroinvertebrate populations present and how they are impacted by a change in sediment deposition from hydroelectric plants. The effects of smaller dams, more notably ecological disruption and impacts on river life are documented in various research studies (Mbaka and Mwaniki 2015). The importance of macroinvertebrates in decomposition processes and other ecosystem functions is additionally well noted, but fewer studies have been conducted on smaller dams (Mbaka and Mwaniki 2015). With less favorable conditions found upstream and more favorable conditions for "primary productivity" downstream leading to "phytoplankton abundance" (Qiuwen et al. 2020), we questioned the downstream biota dynamics and composition. Thus, our hypothesis regarding differences between upstream and downstream macroinvertebrate populations.

Research Question:

How does altered sediment flow from Raquette River damming affect the macro-invertebrate population above and below the dams?

Hypothesis:

If the Raquette river dams reduce sediment flow, it would cause an increase of macro-invertebrates downstream and a decrease upstream.



In order: Cameron, Kali, and Charles stand in the Raquette River, downstream of one of the dams, wearing waders and carrying their dip nets

Acknowledgements & Citations

Chen, Qiuwen, et al. "Hydropower Reservoirs on the Upper Mekong River Modify Nutrient Bioavailability Downstream." Naitonal Science Review, Oxford Academic, Sept. 2020, <https://doi.org/10.1093/nsr/nwaa026>.

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Latremore, Erik, et al. "Low-Impact Hydropower Power Institute Certification Application - Lower Raquette River Hydroelectric Project." LOW-IMPACT HYDROPOWER POWER INSTITUTE, Williams Sale Partnership, Aug. 2019, https://lowimpacthydro.org/wp-content/uploads/2020/07/Lower_Raquette_Recert_Application_August_2019-Redacted.pdf.

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