Qiagen Young Scientist Research Grant ($10,000 total)

-$5,000 worth of Qiagen product

-$5,000 worth of CLC Workbench Premium license

Describe the challenges your study addresses, why it matters, and how your approach stands out. Think of it as your elevator pitch – what makes your research important and impactful. (75 words max)

Recent studies have shown that biogeochemical and ecological processes that occur in lakes during the winter have rippling effects that impact the subsequent seasons and how they operate. Therefore, understanding winter processes can better inform our understanding of interseasonal and annual lake processes. We collected water samples from each of the Laurentian Great Lakes and Lake St. Clair during winter to investigate the impacts of winter on microbial communities.

Describe your proposed research. Include the background, methods, and aim(s). (300 words max)

Winter processes remain understudied in freshwater systems relative to summer and spring, which has led to a gap in knowledge concerning annual biogeochemical and ecological processes. Winter processes also have impacts on the biogeochemical and ecological processes in subsequent seasons, which makes winter an integral component of annual lake processes. This is especially true for microbial and planktonic communities, where delayed ice has been shown to change community composition and alter spring trophic interactions. This has underlying potential for trophic cascade and bottom-up controls for other species and populations. Our research seeks to develop a further understanding of winter in the Laurentian Great Lakes and how variable winter conditions will impact microbial communities by providing a succinct dataset of the Great Lakes with samples that were sampled within 2-3 weeks of each other (as a dataset of this size and breadth of analytes does not yet exist for winter). We collected surface water samples from each of the Laurentian Great Lakes and Lake St. Clair during winter, spring, and summer of 2024 and winter of 2025 to account for interannual differences in winter severity and to encapsulate the impacts winter has on its shouldering seasons. The samples are going to be analyzed for microbial community assemblage via PCR and 16s gene sequencing, as well as various chemical analytes. We believe that we will find that with variable winter severity, we will observe variable microbial community assemblages between winters. We also expect to find that microbial communities in spring and summer will be directly affected by winter conditions. We intend to compile this data in the hopes that it will better inform future research and inform management institutions to better determine best practices to ensure that our lakes remain productive and healthy environments.

Mari’s edits

First questions written:

Recent research has shown that biogeochemical and ecological processes occurring in lakes during winter have rippling effects on the dynamics of subsequent seasons. We collected water samples from the Laurentian Great Lakes and Lake St. Clair during 2024 and 2025 to assess microbial community variation across seasons and years, with an emphasis on winter composition. This work is fundamental for understanding year-round lake dyamics through the lens of microbially mediated winter changes and processes.

Second paragraph:

In comparison to summer and spring, winter remains an understudied period in freshwater systems, resulting in a gap in knowledge regarding year-round lake behavior. Recent research suggests that under-ice dynamics influence the biogeochemical and ecological processes of subsequent seasons, making winter a crucial component of annual lake processes. This is especially true for microbial and planktonic communities, where delayed ice-on has been shown to affect community composition and alter spring trophic interactions. Further, differences in winter conditions have an underlying potential to impact trophic cascade and prevalence of bottom-up controls for grazer populations and their food sources. Our research seeks to develop a further understanding of winter in the Laurentian Great Lakes and how variable winter conditions will impact microbial communities. By providing a succinct body of data collected within a narrow temporal window of 2-3 weeks, we aim to be the first to create a comprehensive winter dataset of this size and breadth across the Great Lakes. We collected surface water samples from the Laurentian Great Lakes and Lake St. Clair during the winter, spring, and summer of 2024 and the winter of 2025 to account for interannual differences in winter severity and to capture the lasting effects of winter on subsequent seasons. Microbial community assemblages will be extracted, verified via PCR, and characterized via 16S rRNA sequencing. Chemical analytes and winter condition records will supplement the microbial community dataset. We hypothesize that microbial community composition will vary between winters because of differences in winter severity. Further, we expect microbial communities in spring and summer will be directly influenced by winter conditions and communities. We intend to compile this data to inform future targeted research and best management practices in the pursuit of maintaining the Great Lakes ecosystem.

Final Version:

Understanding year-round lake processes through the lens of microbially mediated winter changes and processes is paramount because biogeochemical and ecological processes occurring in lakes during winter have rippling effects on the dynamics of subsequent seasons. However, synoptic scale studies remain absent. In response, we collected water samples from the Laurentian Great Lakes and Lake St. Clair during 2024 and 2025 to assess microbial community variation across seasons and years, with an emphasis on winter composition.

In comparison to summer and spring, winter remains an understudied period in freshwater systems, resulting in a gap in knowledge regarding year-round lake behavior. Recent research suggests that under-ice dynamics influence the biogeochemical and ecological processes of subsequent seasons, making winter a crucial component of annual lake processes. This is especially true for microbial and planktonic communities, where delayed ice-on has been shown to affect community composition and alter spring trophic interactions. Further, differences in winter conditions have an underlying potential to impact trophic cascade and prevalence of bottom-up controls for grazer populations and their food sources. Our research seeks to develop a further understanding of winter in the Laurentian Great Lakes and how variable winter conditions will impact microbial communities. By providing a succinct body of data collected within a narrow temporal window of 2-3 weeks, we aim to be the first to create a comprehensive winter dataset of this size and breadth across the Great Lakes. We collected surface water samples from the Laurentian Great Lakes and Lake St. Clair during the winter, spring, and summer of 2024 and the winter of 2025 to account for interannual differences in winter severity and to capture the lasting effects of winter on subsequent seasons. Microbial community assemblages will be extracted, verified via PCR, and characterized via 16S rRNA sequencing. Chemical analytes and winter condition records will supplement the microbial community dataset. We hypothesize that microbial community composition will vary between winters because of differences in winter severity. Further, we expect microbial communities in spring and summer will be directly influenced by winter conditions and communities. We intend to compile this data to inform future targeted research and best management practices in the pursuit of maintaining the Great Lakes ecosystem.