An Ecosystem-Scale Approach to Understanding Changing Winters in the Great Lakes

CORE QUESTION:
How is the limnology, ecology, and health of Great Lakes ecosystems responding to changing winters?

The Laurentian Great Lakes are the world's largest reservoir of freshwater; unfortunately, this valuable resource is being affected by multiple interacting stressors, many of which are related to climate change. Winter limnology represents a major gap in our understanding of the lakes' responses to a changing climate, hampering our ability to manage these systems for resiliency.

UNDERSTANDING WINTER LIMNOLOGY

Winter on the Laurentian Great Lakes extends for more than one-third of the year, yet there is a scarcity of data collected during this period. Climate change increasingly is altering winter conditions, including affecting precipitation, air temperatures, ice cover extent, and lake thermal structure. These changes can affect limnological processes, potentially impacting water quality and biodiversity.

Traditionally, winter was considered a period of low biological activity in aquatic systems due to low light and temperature levels. However, research in polar regions and smaller temperate lakes suggests significant productivity can occur during winter. Ice cover variations can influence light transmission and nutrient availability, impacting phytoplankton communities.

In addition, bacterial communities play a crucial role in nutrient cycling, with winter rates influenced by temperature, ice cover, and other factors.

The proposed research will generate an understanding of the productivity across trophic levels in the Great Lakes during winter, filling a current knowledge gap. Ultimately, the goal of this research is to enhance preparedness and resilience for communities dependent on the lakes for various purposes.

This research will produce high-quality data to support a holistic understanding by managers of year-round water quality issues on the Great Lakes and will generate new understanding of linkages between seasonal aspects of Great Lakes limnology and ecology and the health of Great Lakes ecosystems and their responses to climate change.

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