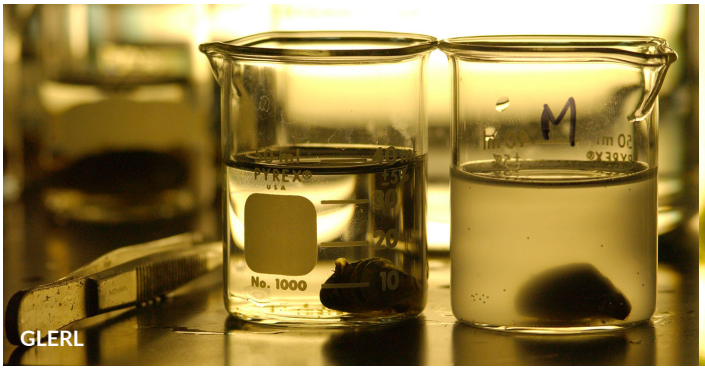
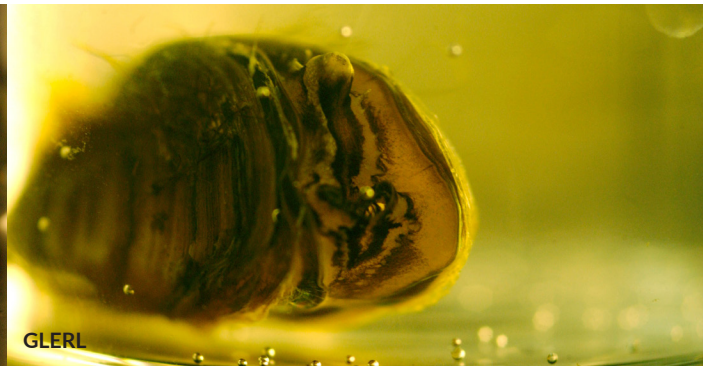
Sensitivity of invasive dreissenid mussels to freshwater acidification in the Great Lakes





Core Question: How are environmental stressors affecting algae and the feeding habits of quagga mussels?

The Laurentian Great Lakes are experiencing rapid ecological changes driven by land use, invasive species, and shifting climate patterns. Although ocean acidification is a well-known global issue, scientists have only recently begun to investigate how increasing atmospheric carbon dioxide is lowering the pH levels in these massive freshwater systems. Understanding how local biology responds to this acidification is essential for protecting the ecosystem services that these lakes provide to the region.

A major factor in this changing environment is the presence of invasive quagga and zebra mussels. These organisms have fundamentally altered the cycling of carbon, nitrogen, and phosphorus throughout the Great Lakes. Specifically, the massive colonization of quagga mussels has been linked to increased carbon dioxide saturation in the water. This increase may be caused by the mussels' high respiration rates and the way they increase water clarity, which can actually decrease the overall productivity of the lake's microscopic plant life.

These mussels also dictate the movement of vital nutrients like phosphorus and nitrogen. Through a process known as the nearshore shunt, mussel feeding activity traps phosphorus in shallow coastal waters rather than allowing it to circulate into the open lake. The amount of phosphorus cycling through mussel biomass is estimated to be eight times higher than the input from the surrounding watershed, meaning even small changes in mussel populations can significantly impact water chemistry. Furthermore, the presence of mussels encourages specific bacteria that convert ammonia into nitrate. Because different forms of nitrogen promote the growth of different types of algae, these invasive mussels effectively steer the base of the food web, making their study vital for future lake management.

This study will investigate how these environmental stressors are affecting the fatty acid content of algae and the feeding habits of quagga mussels. By understanding these shifts at the base of the food web, researchers can better predict and protect the future of Great Lakes fisheries and water quality.

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