

**A series that explores the ways research at the School of Freshwater Sciences can inform local, regional, and national water policy.**

## Changing the Menu in Lake Michigan

**N**on-native invasive species have changed the ecology of the Great Lakes. Introduced through a variety of ways, including man-made channels, ballast water, and boat hulls, each invasive species has had a unique impact on the biological, chemical, and physical properties of the Great Lakes ecosystem. Some impacts have been localized, affecting only small parts of the Great Lakes. Other impacts have been widespread.

Few invasive species have had as dramatic an impact on the Great Lakes as zebra mussels (*Dreissena polymorpha*) and quagga mussels (*Dreissena rostriformis bugensis*). In less than two decades, these invasive mussels firmly established themselves in the Great Lakes Basin, altering their environment as they spread. Zebra and quagga mussels are very effective filter feeders, meaning they excel at “filtering” microscopic phytoplankton, a source of food for fish and invertebrate species, from the open water. This effectively moves nutrients from the open water to the lake bottom where the mussels live. Without such an important food source in the open water, the populations of many fish and invertebrate species have declined dramatically.



Round gobies swimming in a nearshore zone of Lake Michigan. Photo courtesy of Harvey Bootsma.

In their paper, “Nearshore Energy Subsidies Support Lake Michigan Fishes and Invertebrates Following Major Changes in Food Web Structure,” Ben Turshak (University of Wisconsin-Milwaukee) and his co-authors sought to discover how the removal of phytoplankton from the open waters of Lake Michigan by invasive mussels have affected the feeding habits of fish and invertebrates. Using stable isotope analysis, a molecular technique that creates a long-term picture of what an organism eats and where it gets its food, the researchers learned that in the absence of open water food sources, many fish and invertebrate species have switched to food sources that thrive on the lake bottom in nearshore areas. This means that while

overall populations of many fish and invertebrate species have been negatively affected by invasive mussels, some of those same species are finding ways to survive in this new mussel-created environment.

Identifying the winners and losers in a changing Lake Michigan food web is critical for the management of the lake’s fisheries. Decreases in the populations of fish species important to commercial and recreational fisherman can have economic costs, reflected in reduced overall catches and fewer

recreational fishing trips taken. Policymakers and managers must weigh these costs against those of expensive mitigation strategies, such as invasive species removal, when making management decisions. Furthermore, understanding the enormous economic costs of changes caused by past invasions can highlight the relatively low costs of proactive measures to prevent introductions of future invasive species.

### ARTICLE CITATION

**Turshak, B. A., Bunnell, D., Czesny, S., Höök, T. O., Janssen, J., Warner, D., & Bootsma, H. A. (2014). Nearshore energy subsidies support Lake Michigan fishes and invertebrates following major changes in food web structure. *Ecology*, 95(5), 1243-1252.**