Great Lakes Fishery Commission

ESTABLISHED BY CONVENTION BETWEEN CANADA AND THE UNITED STATES TO IMPROVE AND PERPETUATE FISHERY RESOURCES

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ZEBRA MUSSELS RECONFIGURE "SOCIAL" INTERACTIONS TO THEIR BENEFIT

ANN ARBOR, MI—Zebra mussels, an invasive mollusk from Eurasia, have had dramatic effects on food web relationships in the Bay of Quinte, Ontario, and Oneida Lake, New York, according to research supported by the Great Lakes Fishery Commission. Using a novel research approach that combined social science research methods with ecological food web analysis, researchers from Michigan State University have quantified how zebra mussels have redirected the flow of vital energy in the two systems. This redirection of energy increased the production of plants and animals associated with the lake bottom at the expense of the algae and animals found higher in the water column.

The Bay of Quinte and Oneida Lake are similar ecosystems that were colonized by zebra mussels in the early 1990s. Zebra mussels have contributed to the transfer of energy from high in the water column to the lower levels of both systems, a process called benthification. By filtering algae from the water column, zebra mussels reduce the primary food source for many species, while increasing the amount of light that reaches plants used as fish habitat on the lake bottom. In other cases, zebra mussels actually benefit some species. "Overall, zebra mussels are having a negative impact on ecosystems and on species like walleye, bass, and pike" said Andrea Miehls, the study's lead investigator. "However the effects of zebra mussels on fish are not wholly negative. Our models suggest that other fishery species, such as sturgeon, bluegill, and pumpkinseeds, actually benefit in some ways from zebra mussels."

To better understand the role of zebra mussels in complex food webs, researchers from Michigan State University adapted social network analysis, typically used to study relationships among social cliques, to predator-prey relationships in the Bay of Quinte and Oneida Lake. Social network analysis examines the behavior of groups of people who interact frequently. The study identified cliques in the food web as groups of organisms that interact frequently through predator prey relationships. "Although social network and ecological food web analyses may not initially appear to have much in common—one involves people communicating with one another and the other involves organisms eating each other—they actually can be analyzed using similar methods." Miehls continued. "The success of merging methods from ecological and social network analyses in our research suggests there is much to be gained by collaborating across disciplines."

"Our research found that complex food webs with numerous cliques offer a buffering effect against the disruptive impact of invasive species," Miehls added. "The most pronounced effects of zebra mussels in Oneida Lake occurred in the algae-dependent clique that the mussels invaded. In the Bay of Quinte, zebra mussels eliminated the algae-dependent clique. By reducing the presence of cliques, zebra mussels reconfigured the entire food web into a simpler set of interactions, redirecting vital energy used to support aquatic life to the lake bottom. In simplifying the foodweb, zebra mussels made both systems more vulnerable to invasive species in the future."

The Great Lakes Fishery Commission is an international organization established by the United States and Canada through the 1954 Convention on Great Lakes Fisheries. The commission has the responsibility to support fisheries research, control the invasive sea lamprey in the Great Lakes, and facilitate implementation of A Joint Strategic Plan for Management of Great Lakes Fisheries, a provincial, state, and tribal fisheries management agreement. Visit online at www.glfc.org

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