# 2003 Morris Katz Memorial Lecture in Environmental Research


Professor Hugh MacIsaac

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## Predicting biological invasions in the Great Lakes and inland lakes in Ontario

Friday, May 30, 2003

2:00 p.m.

York University

Senate Chamber, N940 Ross Bldg.

4700 Keele Street, Toronto

Centre for Atmospheric Chemistry

## Abstract

Invasions by nonindigenous species (NIS) are the second leading threat to global biodiversity and the leading threat to lakes. Work in our lab addresses invasion vectors that bring NIS to the Great Lakes, and from the Great Lakes to inland lakes; we utilize a number of approaches including modeling, genetic analyses, tracking of shipping traffic and ballast water discharge patterns. One area of particular interest to us is how dispersal of invertebrate species can be effected by 'resting' eggs, propagules which evolved to tolerate adverse environmental conditions but which now serve to allow human-mediated transfer of species to new lakes. Many NIS are native to the Black Sea region of eastern Europe, invade major port areas in the North and Baltic Seas, and arrive to the Great Lakes in a wave of secondary invasions from these locations. The invertebrate waterfleas *Bythotrephes* and *Cercopagis*, for example, invaded the Great Lakes from the Baltic Sea. These species alter food webs and impart economic damage. Ballast water discharge patterns indicate that Lake Superior should be most the most vulnerable Great Lake to invasions, yet the most invaded 'hotspot' is the southern Lake Huron – western Lake Erie corridor.

Invasion of the Great Lakes often portends invasion of inland lakes. For example, the invertebrate waterflea *Bythotrephes* has spread to ~ 55 inland lakes throughout Ontario, particularly in the Muskoka region. We developed a vector-based model to assess spread of this species via human dispersal mechanisms (e.g. contaminated fishing line) that transport it from invaded source to noninvaded destination lakes. This model successfully hindcasts and forecasts invasions based simply on vector flows. The network of 'outflow' connections from invaded lakes to other invaded lakes as well as to noninvaded lakes has increased exponentially over the past decade as more systems became invaded.

Curtailing spread of NIS globally will require a comprehensive, collaborative effort to identify and eliminate invasion pathways that bring nonindigenous species to our forests and agricultural and aquatic ecosystems. Managerial efforts on the Great Lakes must focus on primary (e.g. shipping) and secondary (e.g. bait fish, aquaculture, live fish sales) dispersal vectors, while those on inland lakes will require concerted public education campaigns. Efforts to prevent invasion of lakes that could function as 'hubs' for future invasions is an imperative.

## Biological Sketch

Hugh MacIsaac's interests lie in theoretical and practical aspects of invasion success of ecosystems. Most of his work pertains to invasion vectors that bring species to the Great Lakes (mainly from Eurasia), and from the Great Lakes to inland lakes. Lakes serve as excellent model ecosystems with which to study biological invasions because the habitats have clearly differentiated borders and readily studied invasion vectors.

Hugh MacIsaac's lab conducted a report for the Auditor General's Office in 2002 on economic aspects of invasive species in Canada. While poorly studied, this aspect of invasion may ultimately prod governments to action owing to massive economic losses to many different industries associated with invasive species.

He maintains an interest in and teaches courses in conservation biology and Great Lakes ecology.

## The Lectureship Fund

The Morris Katz Lectureship was made possible by the establishment of an Endowment Fund created through contributions from his family, his friends, his colleagues, private companies, universities and government. It is intended that this lectureship become self sustaining. Major contributions in support of this year's lecture have been made by:

The Centre for Atmospheric Chemistry
and
The Ontario Ministry of the Environment

If you share in Morris Katz' enthusiasm and commitment to having a cleaner environment, please make a contribution to support this ongoing educational activity. Send your contribution in care of: The Morris Katz Memorial Lectureship, Centre for Atmospheric Chemistry, York University, 4700 Keele Street, Toronto, Ontario, M3J 1P3 Canada.

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