Aliens *in Our Watersheds*

Cercopagis pengoi
Photo by Joseph Makarewicz

Another Exotic Invades Lake Ontario

As of August 1998, several independent reports, including those conducted by NYSG-funded researcher Joseph Makarewicz and the Environmental Protection Agency, confirm the existence of *Cercopagis pengoi* in Lake Ontario. Based on recent findings, Makarewicz says it is likely that this deepwater zooplankter, a native to the Caspian and Aral Seas that has invaded salt and fresh water environments in Russia, Bulgaria and Ukraine, will make its way into other Great Lakes. In early September, the "fishhook water flea" was reported in Lake Michigan. Makarewicz is conducting research to develop a fundamental understanding of this microscopic alien: what it eats, how it behaves, how it reproduces and how it will impact the Lake Ontario food web.

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Aquatic nuisance species. Just what are they and why should New Yorkers be concerned? When these non-native animals or plants enter our waterways, they often compete with native species, sometimes with devastating effects.

Of greatest concern is the effect of the zebra mussel, *Dreissena polymorpha,* and its relative, the quagga mussel, *Dreissena bugensis.* These nuisance mollusks have been shown to impact the habitat, food web and biodiversity of both Lake Erie and Lake Ontario. Because zebra mussels feed on phytoplankton and detritus, it is likely that they have helped clear the lakes of food sources normally used by tiny zooplankton. In turn, the decline of zooplankton populations could alter natural food webs and result in fewer fish of all kinds, particularly predatory sportfish such as trout, salmon and bass.

According to NYSG's **Chuck O'Neill,** combating the zebra mussel has cost New York State's public and private infrastructure at least $28 million over the last decade. The impacts have affected electric power generation, food processing, drinking water facilities and residential water supplies as well as other industries that rely on surface water for cooling or flushing. Much of this financial jolt is the result of the fouling of raw water intakes by the zebra mussel, which translates to the loss of pumping ability, clogged and corroded pipes, obstructed valves, obnoxious smells from decayed mussels and inoperable sprinkler systems.

New York is also experiencing ecological impacts on native species caused by the recent invasions of several other species like the blueback herring in the Erie Canal and Lake Ontario, the round goby in the eastern basin of Lake Erie and the New Zealand mud snail in Lake Ontario. Raising concern, too, is the introduction of the "fishhook water flea," *Cercopagis pengoi,* into Lake Ontario, which Brockport-based NYSG-funded researcher **Joseph Makarewicz** is addressing along with Edward Mills and Lars Rudstam (both Cornell University affiliates) and University of Windsor's Hugh MacIsaac (see sidebar). The recent invasion of Cayuga Lake by the Asian clam may also cause infrastructure and ecological impacts. And from the Great Lakes region to the Hudson Valley and Long Island, there is concern for changing habitat and biodiversity caused by nonindigenous plants such as purple loosestrife, *Phragmites,* waterchestnut, and the Eurasian water milfoil.

As zebra mussels are ubiquitous and abundant in many major freshwater ecosystems in New York and elsewhere, New York Sea Grant devotes a portion of its research efforts to studying the ecological effects of these aliens in our watersheds. Very little is known about their influence on the biogeochemical cycling of metals, for example. In response, NYSG-funded researcher **Nicholas Fisher** has evaluated the daily processes and functions of zebra mussels to assess the role they play in influencing metal cycling in freshwater ecosystems. Fisher's intent in the Hudson River region study, which was completed in January 1998, was also to evaluate the use of these organisms as bioindicators for the presence of toxic metals in fresh water.

Sea Grant Scholar Hudson Roditi, based at SUNY Stony Brook, with zebra mussels in a depuration chamber.

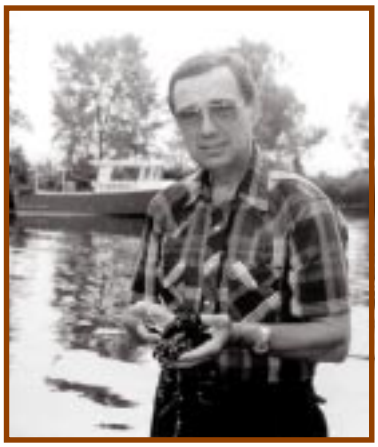
Photo by Ian Stupakoff

During the study, zebra mussels were placed in a "depuration chamber," a purification chamber that mimics their natural environment. NYSG Scholar on Fisher's project, **Hudson Roditi** (pictured illustrating the concept), explains that these mussels were initially exposed to food contaminated with radioisotopes of metals such as silver, cadmium, chromium or mercury. The mussels were then placed in the aquarium, each in its own small cup, and fed suspended algal food from filtered Hudson River water. Periodically the mussels were removed from the water and placed in a gamma

radiation counter, where their radioactivity was measured. Then the mussels were returned to the aquarium and allowed to further depurate. Says Roditi, "The measurements make it possible to calculate how long it takes for the zebra mussels to be free of the metal contaminants."

Sandra Nierzwicki-Bauer, Director of Rennselaer Polytechnic Institute's Darrin Fresh Water Institute on Lake George, is currently developing a genetic probing method whereby water samples can be quickly and simply screened for zebra mussel young without going to the laboratory for identification. An important objective and extension of the project is to cooperate with industries that are concerned with the colonization of their facilities by zebra mussels. In a 1998 *New York Times* article, Nierzwicki-Bauer was referred to as one of the few biologists who has gained "a toehold against the pesky mussel." Her NYSG-funded work also explores the possibility of developing a commercial product based on the probe technology that may be of interest to other agencies for use with numerous molluscan species.

On Lake Ontario, where Cornell affiliate **Lars C. Rudstam** completed his NYSG-funded study on "The Role of Embayments and Inshore Areas as Nursery Grounds for Young-of-Year (YOY) Alewife and Other Species" in early 1999, nonindigenous species such as alewife and rainbow smelt have had a significant impact on its ecosystem. Overall, Rudstam said, "This research will help management agencies designate appropriate locations for monitoring zooplankton in Lake Ontario and will provide basic information for the continuing efforts to model the dynamics of the lake's alewife populations."



According to NYSG-funded researcher Ed Mills, "The significance of the problem incurred by aquatic nuisance species will present a challenge to managers and stakeholders alike," emphasizing the need for prevention and control action.

Photo by Cornell University Photography

Lake George, site of Darrin Fresh Water Institute

Photo by Sharon O'Donovan

To determine how changes in nutrient levels and exotic mussels are affecting the Lake Erie food web and the future of the fish community, Cornell affiliate **Edward L. Mills** initiated a multi-agency fisheries effort in February 1998. He is studying the interactions among the number of smelt produced by eastern Lake Erie, growth rates of predatory fish such as smallmouth bass, walleye and lake trout and changes in the lake's ability to support fish. "This will help us understand how lowered nutrient levels from phosphorous reductions and zebra mussel infestations will aid in the prediction of future fish production," Mills said. As such findings unfold, plans can be made to better manage Lake Erie's fisheries resources.

More than 145 exotic species have successfully invaded the Great Lakes, with 15 fish species having found their way into Lake Ontario. Over the last two decades, it is estimated that one out of every 10 exotics has had serious impacts on Great Lakes ecosystems. As this alien invasion continues to be an issue into the 21st century, providing aquatic nuisance species research and outreach to legislators, agencies, scientists, the media and the public will continue to be a mission of New York Sea Grant.

— Paul C. Focazio

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Finding the Corridor

"Our results will help us predict the geographic and ecological impacts of this species in the Great Lakes, pointing us in the direction of potential mechanisms of control," Makarewicz says. "In addition, these findings will provide the scientific background information needed for the development of informed management policies of important Great Lakes fisheries that may be impacted."

Makarewicz, based near the shore of Lake Ontario at SUNY Brockport, places much importance on determining the "invasion corridors" of the species. "Because *Cercopagis* has a much more confined distribution in Eurasia than most other exotic species that have established in the Great Lakes, the opportunity to identify its invasion corridor is very good. By identifying the invasion route of the species, we can pinpoint the location of its introduction, thereby preventing new introductions and perhaps providing an understanding in how to reduce the spread of established populations."