



## Little Critters, Big Impacts

It came to America on cargo ships, in ballast tanks below. Made its way through the Great Lakes in bait buckets and the bilge water of boats. It is being carried in fishermen's gear from ports along Lake Ontario and the Finger Lakes.

While not all exotics are successful in their introduction to a new environment, the nearly microscopic fishhook water flea (pictured above) has successfully colonized Lakes Ontario, Erie and Michigan, as well as the Finger Lakes.

Before SUNY Brockport **Joe Makarewicz's** late '90s study of this native of the Caspian and Aral Seas, little was known about *Cercopagis* – what it eats, how it behaves,

how it reproduces and its impacts on Lake Ontario's food web. "This research provides the first available basic information on the biology and ecology of *Cercopagis* in North America," says Makarewicz.

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# Little Critters,



**Alewives are the catch of the day for Sea Grant scholar Betsy Damaske and Corey Laxson. Diets of alewife and rainbow smelt were examined before and after *Cercopagis* was discovered in Lake Ontario. The invader was absent in both fish stomachs and zooplankton samples in 1997, but by August 1998 its distribution was lake-wide and spines of the Eurasian water flea were present in stomachs of both fish species.**

**All photos courtesy of Joe Makarewicz**

Makarewicz and his research team used genetic analysis techniques to track the invasion route of *Cercopagis*. "Identifying the travel course and entrance location of *Cercopagis* will help to prevent new introductions and perhaps provide some understanding on how to reduce the spread of established populations," says Makarewicz.

In other studies, differences were identified between the invader's populations in Lake Ontario and the Caspian, Baltic and Black Seas. *Cercopagis* in the Caspian

Sea are genetically distinct from all other populations, deeming the basin an unlikely source of either Baltic Sea or Great Lakes populations. While populations are genetically related, *Cercopagis* from the Baltic Sea may have originated from the Black Sea. And, finally, fishhook water fleas found in Lake Ontario are genetically identical to those in the Baltic Sea, thus making it the likely source of the North American invasion.

While the team's findings confirmed that only a single species of the Eurasian water flea (*Cercopagis pengoi*) exists, sampling has shown

a second form exists. Named *Cercopagis* (*Apagis*) *ossiani*, this form is found only during the early spring and most likely represents hatchlings of *C. pengoi*'s resting egg generation. These eggs, which can withstand extreme environmental conditions, are how the species has been able to successfully spread itself in the Great Lakes and other regions. "Our results will lead to changes in how *Cercopagis* is classified in a taxonomical sense," says Makarewicz.

"Based on our work, we also now know that we're dealing with an epilimnetic species, meaning that it does not migrate out of the lake's upper layer. What's more, we've collected a baseline of information on *Cercopagis*' productivity, birth rates, and seasonal abundance and biomass relative to the other zooplankton species."

Since its invasion nearly seven years ago, *Cercopagis* has become a primary contributor to declines in the abundance of several dominant zooplankton in Lake Ontario's offshore waters – *Daphnia retrocurva*, *Bosmina longirostris* – and *Diacyclops thomasi*. This makes it a viable competitor with fish relying on these species as a food source, such as alewife and rainbow smelt. "If *Cercopagis* adds an extra step in the lake's food web, energy loss through a longer food chain could be substantial," says Makarewicz. "This could result in a significant bottleneck to productivity of the fish community

## How to get unhooked

While it may be too late to prevent the spread of *Cercopagis* in the Great Lakes, NYSG's fisheries specialist **Dave Mac Neill** recommends certain procedures to help reduce its reach.

"It is important for anglers and boaters to realize there are a number of measures they can take to reduce the risk of transporting *Cercopagis* from one water body to the next."



The most environmental friendly control measures are air drying the boat and equipment for at least 24 hours (but up to 5 days for other species such as zebra and quagga mussels). Rinsing with boiling water or steam cleaning is also suggested.

Other effective but more environmentally damaging treatments, such as boat cleanser, vinegar and salt water can be used in combination, but away from the water.

Despite it being highly effective in destroying *Cercopagis* resting eggs, chlorine bleach

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and, ultimately lead to a reduction in stocking.”

So far, the high abundance of *Cercopagis* and lower numbers of other zooplankton have not done much to drive down populations of alewife, rainbow smelt, and other planktivorous (plankton-eating) fish. Makarewicz has several non-exclusive explanations as to how *Cercopagis* has been able to maintain high densities despite predation pressure.

First, the establishment of *Cercopagis* in 1998 coincided with the lowest overall abundance of planktivorous alewife in Lake Ontario in 20 years. Makarewicz adds, “The high productivity rates of *Cercopagis* may allow its population growth to outpace consumption by predatory fish.” Also, with studies showing the invader to be most abundant in the late summer, it may not be around in full force earlier in the season when alewife and smelt are in peak predation mode. The flea’s characteristic s-shaped hook, which can be as large as five times its approximately 2 mm body length, make it low on the menu preference for alewife, smelt, and other prey species. “Our studies show that while both alewife and smelt are known to prey on the invader, *Cercopagis* consumption by young-of-year and adult alewife is rather low,” says Makarewicz.

“The extent to which alewife and rainbow smelt prey on *Cercopagis* has important ecological implications for Lake Ontario and, as our



NYSG-funded researcher Joe Makarewicz (pictured here with Sea Grant Scholar Betsy Damaske) says his team’s results are a benchmark in studies on the invader *Cercopagis*. “Basically, we now have a better understanding of the impact, though potentially minimal, and role of this exotic in Lake Ontario and other water bodies.”

studies have shown, may vary between age, size classes and species,” says Makarewicz. Because of its consistent presence and, at times, high abundance, *Cercopagis* may decrease food available for the plankton-eating fish. This shift is possible if the invader’s consumption of zooplankton substantially lowers the density of this food source for the fish and if it does not serve as a suitable alternate prey.

“We know that in the Baltic Sea, the entire planktivore food web was impacted by the invasion of *Cercopagis*,” says Makarewicz. “But, aside from the potential for this organism to spread quickly and far, much less is still known about the invader’s impact on Lake Ontario or other invaded ecosystems.”

— Paul C. Focazio

should not be used for disinfection near any lake either. It has toxic effects on aquatic life and can also damage boat equipment and gear.

Bait and bait water should be dumped on dry land (not back into the water) before transporting a boat and gear to another aquatic location.

Examine the boat, anchor lines, fishing lines, trailer, and gear. Remove all mud and plant fragments from the boat and equipment.

Drain and clean the boat motor. Disinfect bilge, transom and live wells, bait buckets and fishing apparatus and gear.



“*Cercopagis* is one in a number of ballast water-borne species that have invaded the Great Lakes in the past century,” says Hugh MacIsaac, a co-principal investigator on a NYSG-funded study headed by SUNY Brockport’s Joe Makarewicz. “Its introduction into Lake Ontario is attributed to the release of water taken on by ships in foreign waters for stability.”