

Daphnia lumholtzi: The Next Great Lakes Exotic?

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Daphnia lumholtzi, an exotic zooplankton species, has been well established in the Illinois River since 1995, and now appears poised to invade Lake Michigan. This invasion will likely be facilitated by the system of locks, dams, and artificial canals connecting Lake Michigan and the Illinois River. Construction of this connection between two major drainage basins, the Great Lakes-St. Lawrence and the Mississippi, was initiated in the late 1800s and now, unintentionally, provides a conduit for exotic species established in one basin to invade the other. For example, zebra mussels invaded the Great Lakes in the 1980s and are now well established in the Mississippi River and several of its tributaries. *Daphnia lumholtzi*, already common in the Illinois River, is now found in the canal system near Lake Michigan, and may soon be another unwelcome addition to the long list of non-native species that have become established in the Great Lakes.

Characteristics

Cladocerans, also known as water fleas, are a type of zooplankton nearly invisible to the naked eye. Despite their small size, they are an important food source for larval and early juvenile stages of nearly every species of North American fish. One of the most important and well studied cladoceran groups is *Daphnia*. *Daphnia* spend most of their time drifting in the water column where they feed on algal cells and other small particles.

Daphnia lumholtzi is a species of *Daphnia* that has recently invaded North America. Easily identified, *Daphnia lumholtzi* produces much larger and more numerous spines than do North American *Daphnia* (Fig. 1). The head and tail spines may be

as long as the body, which is partially covered with smaller spines. Large individuals can reach total lengths of 5.6 mm (nearly 0.25 in), making them visible to the naked eye.

Potential Impacts

Scientists are concerned that *Daphnia lumholtzi* may have negative effects on North American ecosystems. The large spines make it difficult for young fish (larval and juvenile stages) to consume this exotic. Native *Daphnia* have fewer, smaller spines (Fig. 1) and, therefore, are more susceptible to fish predation. The protection from predation afforded by its spines may allow *Daphnia lumholtzi* to replace native *Daphnia* species. If this replacement occurs, the amount of food available to larval and juvenile fishes may be reduced. This could result in reduced survivorship of young sport and food fishes in lakes, rivers, and fish hatcheries where *Daphnia lumholtzi* becomes abundant.

Fishes that most likely would be affected are late-spawning species such as bass and other sunfish. In the Midwest, populations of *Daphnia lumholtzi* tend to peak during mid-summer when juveniles of these fishes may still be dependent on zooplankton as a primary food source. Reduced survivorship of these young fishes is a worst-case scenario and may not occur everywhere *Daphnia lumholtzi* becomes established.

Initial studies indicate *Daphnia lumholtzi* is having varying effects on the zooplankton of North American lakes and reservoirs. In Norris Reservoir (TN), larval and juvenile threadfin shad avoided *Daphnia lumholtzi*, but fed heavily on other *Daphnia* species. Despite the disparity in predation pressure, *Daphnia lumholtzi* did not appear to be replacing native *Daphnia* populations. Studies of reservoirs in Kentucky and Illinois, however, indicate that *Daphnia lumholtzi* may be replacing native *Daphnia* and other zooplankton species. Ultimate effects of this invasive species will become more apparent in subsequent years as long-term trends in zooplankton abundance and fish survival and growth within ecosystems invaded by *Daphnia lumholtzi* are documented.

Introduction and Spread

Daphnia lumholtzi is native to Africa, Asia, and Australia. It most likely was brought to North America with African fish imported for the aquarium trade or to stock reservoirs. The earliest published record of *Daphnia lumholtzi* in North America is from a Missouri reservoir in 1990. This date of first detection will likely change, however, as samples collected prior to 1990 are re-examined. In Illinois, *Daphnia lumholtzi* has been established in several reservoirs since 1992. It was first documented in the Illinois River in 1995, but was probably present sporadically in the river since 1991. In 1995, *Daphnia*

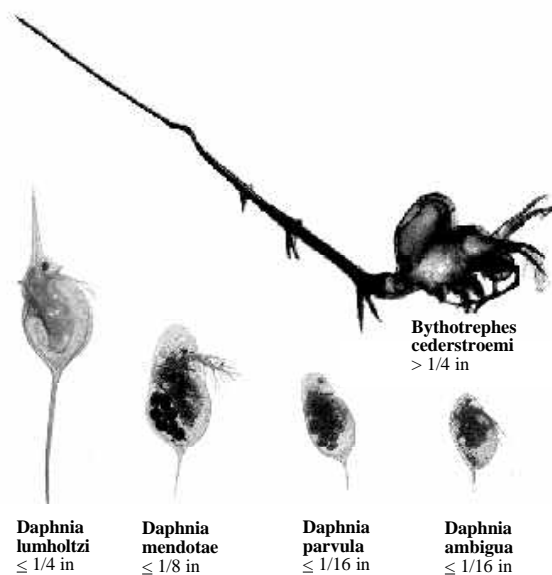


Figure 1. Common *Daphnia* species of the Illinois River drainage basin as compared to the new invader, *Daphnia lumholtzi*, and a Great Lakes invader, *Bythotrephes cederstroemi* (the spiny water flea). Adding to the mix, *Daphnia mendotae* shown here may actually be a hybrid between *Daphnia medotae* and a European species, *Daphnia galeata*.

lumholtzi was collected as far north as Illinois River Mile (IRM) 195.9, approximately 135 river miles from Lake Michigan (Fig. 2). In 1996, it was found in the Cal-Sag Channel

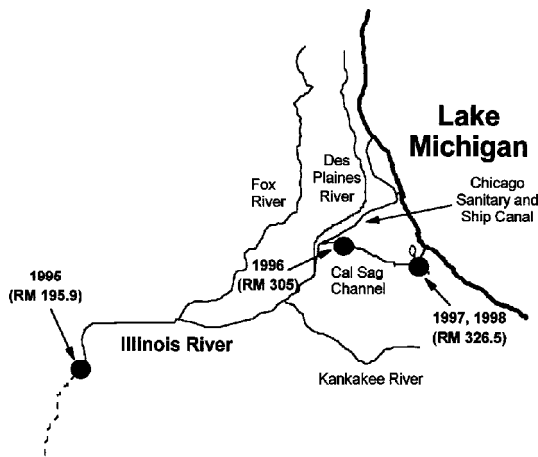


Figure 2. Known proximity of *Daphnia lumholtzi* to Lake Michigan in the Illinois River and the Cal-Sag Channel, 1995-1998 (RM = river mile).

approximately 30 river miles from Lake Michigan. In 1997 and 1998, *Daphnia lumholtzi* was collected just upriver of the T.J. O'Brien Lock and Dam, less than 10 river miles from Lake Michigan. This species is likely to invade Lake Michigan in the near future if it has not done so already.

Daphnia lumholtzi may have spread upriver toward Lake Michigan in a number of ways. Although it likely does not swim against river currents, *Daphnia lumholtzi* may have traveled upriver in baitbuckets or in bilge-water of recreational and commercial watercraft. It may also have spread upriver in its dormant egg stage. Occasionally, *Daphnia lumholtzi* produces a pair of resting eggs coated in a protective coating called an ephippium (ĭ fĭp' ee um). This ephippium protects the resting eggs against drying and freezing. These ephippial eggs may be transported far distances overland by migrating birds, high winds, and human activities.

Potential for Success in Lake Michigan

The likelihood of *Daphnia lumholtzi* establishing large populations in Lake Michigan is uncertain. In the Illinois River, *Daphnia lumholtzi* exhibits peak abundances and highest reproduction rates during mid-summer when water temperatures are 20-30°C (70-86°F). Individuals with eggs, however, have been collected from the Illinois River in water temperatures of 3-10°C (37-50°F). If most individuals are intolerant of cool temperatures, *Daphnia lumholtzi* may be restricted to warm surface and nearshore waters of Lake Michigan. Cold-tolerant individuals, however, may be able to establish viable populations throughout the lake.

Another introduced cladoceran, the spiny waterflea *Bythotrephes cederstroemi*, is already established in Lake Michigan. In some areas, it has caused a reduction in the abundance of small cladoceran species. Unlike *Daphnia lumholtzi*, *Bythotrephes* is a predator and feeds mainly on other zooplankton; it is unknown whether *Bythotrephes* will feed on *Daphnia lumholtzi*. If *Bythotrephes* does not eat it, *Daphnia lumholtzi* may have even more of a competitive advantage over native cladocerans.

What Can Be Done?

Eliminating a species once it has become established can be extremely difficult. Therefore, it is important that we work to prevent the initial introduction of exotic species such as *Daphnia lumholtzi*. Various research projects, educational activities, and state and federal regulations are established to prevent initial introductions. Once a species becomes established, we can work to slow its spread. Recreational water users can avoid accidentally spreading established exotic nuisance species (and in some cases prevent new introductions) with a few simple steps (see below). Aquarium enthusiasts can help, too, by never dumping aquaria water or aquarium organisms into local lakes or streams. Some tropical plants and fish can survive northern winters, and undetected hitchhikers such as zooplankton may thrive.

What Can You Do?

- 1) Learn how to identify exotic species such as *Daphnia lumholtzi* (see Fig. 1). Biologists rely on sightings reported by the public to track the spread of these species. Your help is extremely important. *Daphnia lumholtzi* may be visible to the naked eye in standing water of baitbuckets, livewells, etc.
- 2) If you find *Daphnia lumholtzi* (or any other exotic species), preserve it in rubbing alcohol or freeze it. Preservation of the specimen allows for expert confirmation of the identification. Then, contact Sea Grant (Illinois-Indiana Sea Grant: 847 872-8677), or your state natural resources agency.

Steps for Recreational Water Users

BEFORE leaving boat launch:

Inspect boat, trailer, and equipment; then remove any observed plants and animals.

Drain, on land, all water from the motor, livewell, bilge, and transom well.

Empty water from bait buckets on land, and dispose of unwanted bait in trash.

AFTER leaving boat launch:

Wash all equipment with 104°F water or a high pressure sprayer.

OR

Dry equipment for at least five days.

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