

Zebra Mussels: Invasive, Damaging and Costly

A few facts about these exotic pests can help you keep them out of New Hampshire's waters.



Since they were first found in North America in 1988, zebra mussels have been spreading rapidly on the waterways, wreaking havoc with utilities, water suppliers and boaters. Though they've reached Lake Champlain, the mussels haven't yet made it to New Hampshire.

THE ZEBRA MUSSEL is a freshwater mollusk native to the Black and Caspian Sea region of Eurasia. After their accidental introduction to North America, they've subsequently caused tremendous impacts ecologically, socially, and economically. It has been said that zebra mussels can potentially become the most serious pest of any exotic species ever introduced to North American surface waters.

Zebra mussels were first discovered in North America in 1988 in Lake St. Clair (between lakes Erie and Huron). This introduction was probably the result of transoceanic vessels releasing infested ballast water into Lake St. Clair. Just two years later, zebra mussels had spread throughout all of the Great Lakes. Since the initial introduction in the Great Lakes, zebra mussels have spread throughout many rivers and inland lakes in the states and provinces surrounding the Great Lakes and elsewhere.

In the summer of 1993, zebra mussels were found in Lake Champlain in northern Vermont. In

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1999 the expansion of their range in Vermont was confirmed in samples collected from lakes Bomoseen, Hortonia, and Dunmore in Vermont, and Lake George in New York. Zebra mussels have also been found in East Twin Lake in Connecticut.

This organism is easily, and often unknowingly, transported by humans and dispersed into new areas. Once established, it's impossible to completely eradicate them.

Their Life Cycle

These little mussels reproduce very rapidly. One adult female zebra mussel can produce up to one million eggs during a single breeding season! Fertilization of the zebra mussel's eggs occurs in the water. Three to five days after the eggs are fertilized, they enter a free-swimming juvenile life

stage called a veliger. The veligers typically remain in the water column for up to three weeks, during which time they can be transported great distances within a water body, or between naturally connected water bodies in the water that flows between them.

The veliger life stage is largely responsible for the rapid expansion of the zebra mussel's range. For example, zebra mussels have been carried from Lake Michigan as far south as New Orleans in the Illinois and Mississippi rivers. As veligers mature, they form a shell and begin to settle onto hard surfaces where they can firmly adhere with their byssal threads. Once they settle and begin to feed, their main goal is growth and reproduction.

Zebra mussels grow up to 2 inches long, and can live four to five years.

Adult mussels have a hard D-shaped shell, with alternating dark and light bands marking the exterior of the shell, hence the name "zebra" mussel. The hinged side of the shell is very flat, which lets the mussel pull itself tightly against a solid surface. Extending from the flat-hinged surface are hundreds of byssal threads that terminate at a sticky pad, letting the animal firmly attach to a solid surface. Once attached, zebra mussels can withstand water velocities up to 2 meters per second.

The Great Infesters

Zebra mussels will inhabit any solid surface, including rocks, logs, pipelines, intake structures, and shells of other mussels, to mention a few. They'll even grow on top of one another, forming tight barnacle-like colonies. In parts of the Great Lakes these colonies have been as dense as 700,000 mussels per square meter.

Zebra mussels are found in water with temperatures ranging from 32° F to 81° F. However, for successful reproduction to occur, the water temperature must remain between 54° and 74° F for at least one month. They need a certain amount of calcium in the water to form their protective shell. The optimal range is 25 to 125 parts per million (ppm). However, in Lake Champlain, where zebra mussels are thriving, the calcium levels range from 12 to 20 ppm.

The mussels prefer water depths of 7 to 13 feet, and a solid surface to attach to, preferably within that depth range. However, zebra mussels have been found in water as deep as 90 feet and they have begun to colonize muddy substrates as well.

Many New England water bodies have suitable water chemistry to

support a growing zebra mussel population. Calcium levels in New England water bodies are often lower than optimum for the formation of the protective shell, but not too low to prevent some amount of infestation.

Their Environmental Impacts

Environmental effects from the spread of zebra mussels are alarming. For instance, the mussels are extremely efficient filter-feeders, consuming large portions of microscopic plants (phytoplankton) and



Zebra mussels often live together in high densities and attach themselves to rocks, pipes and other shells by adhesive byssal threads. The mussels are open most of the day, siphoning water through the large (incurrent siphon) opening, and passing it out the excurrent siphon.

animals (zooplankton) that form the base of the food chain. A single zebra mussel can filter up to 1 liter of water per day. Over time, this feeding behavior can affect a lake's entire ecological balance, causing significant shifts in native species populations.

A second effect of their rapid filtering rate is a dramatic increase in water clarity.

Although this may seem like a good thing, increased water clarity lets more sunlight into the water column, causing a proliferation of

plant growth. The increased plant growth can choke waterways.

Zebra mussels are having a tremendous impact on North America's native mussels. Zebra mussels attach themselves to the shells of native mussels, impeding movement, feeding, and respiration. As the native mussels become heavily encrusted they suffer increasing stress, losing body weight until they eventually succumb from starvation, disease, or other problems.

Their Economic Impacts

The introduction of zebra mussels into North America has caused huge economic impacts. They've infested water intake pipes of municipal water supplies, irrigation systems, and intake valves at electrical generating stations. The insides of pipes are an excellent habitat for newly settling juvenile zebra mussels.

In the Great Lakes, water treatment facilities and electrical generators have been shut down due to infestations. At two generating facilities on Lake Erie, 50 tons of zebra mussels were removed from both facilities in 1990 and again in 1991, just three years after the initial infestation in Lake Erie. The weight of attached zebra mussels has caused navigational buoys to sink. They can attach to boat hulls, eventually causing drag, and to the water intake pipes of boat motors. Once inside the engine, clusters of zebra mussels can stop the flow of cooling water, causing serious damage. They have even infested swimming areas. Their shells have washed up by the thousands onto favorite beaches, making it impossible to go barefoot.

The financial cost of the zebra mussel infestation is astounding.

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Industries all over the country spent more than \$69 million dollars to monitor and remove zebra mussels between 1989 and 1995.

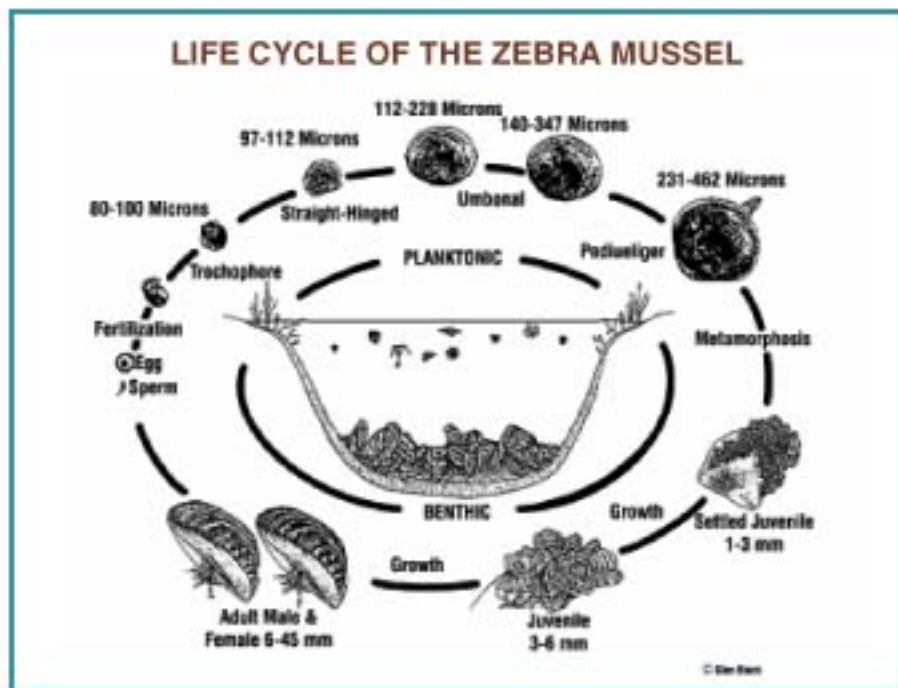
The Threat of Spreading

Given the zebra mussels' high reproductive rate and their ability to disperse and attach, new introductions threaten North American waters.

There are several ongoing programs to monitor zebra mussels in New England. The state of Vermont monitors Lake Champlain and other inland lakes in Vermont. And there is active monitoring on the Connecticut River in Vermont, which now sponsored by the Vermont Yankee Nuclear Power Plant in Vernon.

Vermont Yankee's consultant, Normandeau Associates, samples for the egg and early veliger life stages of zebra mussels by collecting water samples and analyzing them under a microscope. Additionally, settling plates are deployed to monitor for the presence of veligers and juvenile zebra mussels.

To date, no life stages have been located in the Connecticut River. Through continued monitoring and



increased public awareness of the impacts that zebra mussels pose to everyone who lives, works, or recreates on New England's water bodies, we can help keep zebra mussels from further spreading in New England and elsewhere.

Take Steps To Keep 'Em Out

People can take a few steps to slow the spread of these invasive species. They include:

Learning more about the zebra mussel. Find out what they look like, where they live, and how they are spread. Pass this information on to people who spend time on the water.

- Inspect your recreational equipment for zebra mussels, especially if you've been in waters that are known to support zebra mussel populations. Zebra mussels have been spread from diving gear, boats, jet skis, and trailers used in infested waters and not cleaned properly before being used in a non-infested water body.
- When you take your boat and other equipment out of the water, make sure to drain all of the water out of it

and remove any aquatic vegetation that may be attached.

- If you have had equipment in infested water, let it sit out in the sun and dry for several days before you use it in a non-infested water body. Zebra mussels can stay alive for several days without water. If you must use your boat or equipment before allowing sufficient time to dry in hot, sunny weather then rinse it with hot water (140°F or hotter). Run water through the cooling system of your boat's motor. Even if you can't use hot water for these rinses, any rinsing will be better than doing nothing.
- Finally, a reminder about your leftover bait fish: In New Hampshire, it's unlawful to release any fish into water other than where it came from. Zebra mussel veligers may be in the bait water, and you won't even know.

If you think you have found any zebra mussels, note the exact location and take a specimen with you. Store the specimen in rubbing alcohol, and report it to the N.H. Fish and Game Department (603-271-2501), the N.H. Department of Environmental Services (603-271-2963) or Normandeau Associates. Finally, if you'd like more information or a free zebra mussel awareness program for a group, please contact Normandeau Associates, (802) 257-5500. ■



Barely bigger than a coin, the little zebra mussel can cause big problems. If you boat in waters infested with zebra mussels, take a few steps to keep them out of New Hampshire's waters.