

LAKE CHAMPLAIN BASIN PROGRAM

Fact Sheet Series

Number 1



ZEBRA MUSSEL & QUAGGA MUSSEL

*Zebra mussels (*Dreissena polymorpha*) and quagga mussels (*Dreissena bugensis*) are closely related species native to fresh waters of southeast Europe. Zebra mussels are thumbnail-sized mollusks with D-shaped shells that are often striped with alternating light and dark bands like a zebra. The name "quagga" refers to an extinct African relative of zebras. "Zebras" were first identified in North America in 1988 in Lake St. Clair, Michigan, and "quaggas" were first found in Lake Ontario in 1989. Since that time, both species have spread quickly through many waterways of North America.*

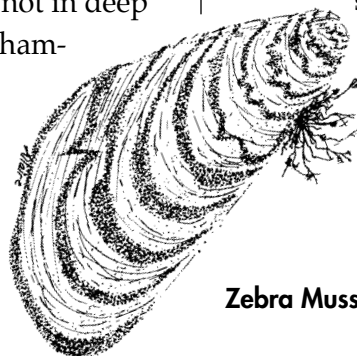
A young angler discovered zebra mussels in southern Lake Champlain in July, 1993. Since then, the mussels have infested virtually all suitable habitat in the Lake. This infestation poses both ecological and economic threats to the region. The Lake Champlain Basin community faces the challenge of preventing the spread of this invasive species to other nearby lakes.

Quagga mussels look very similar to zebra mussels but may have a far greater impact on the Lake's ecosystem. Fortunately, there have been no sightings in Lake Champlain to date, but they continue to spread and are now found in California and Nevada. It is essential to prevent their introduction to the Lake and other waterbodies in the Basin.

NONNATIVE MUSSEL IMPACTS

Scientists believe that zebra mussels were unknowingly transported to the Great Lakes in the ballast waters of transatlantic freighters around 1986. Despite millions of dollars spent, zebra mussels create many serious problems in the Great Lakes and in Lake Champlain. They clog residential, municipal and industrial water intake pipes, foul boat hulls and engines, cut the feet of swimmers, and obscure underwater archeological artifacts that are not in deep water. The mussels also displace Lake Champlain's native mussel populations, causing rapid population decline. Zebra mussels in Lake Champlain have already begun to significantly alter the Lake's ecosystem.

While quagga mussels cause the same types of negative impacts as zebra mussels, they can do so on a far greater scale. Quagga mussels colonize a wider variety of lake bottom surfaces than zebra mussels and tolerate a greater range of temperatures, depths and other environmental conditions. In the Great Lakes, quagga mussels are already out-competing and replacing zebra mussel populations, but in greater numbers. Quagga mussels have the potential to significantly change Lake Champlain and must be monitored regionally to prevent spread and infestation.



Carol Allaire

Zebra Mussel

ECONOMIC IMPACTS

When nonnative mussels attach to submerged surfaces and rapidly form dense colonies they:

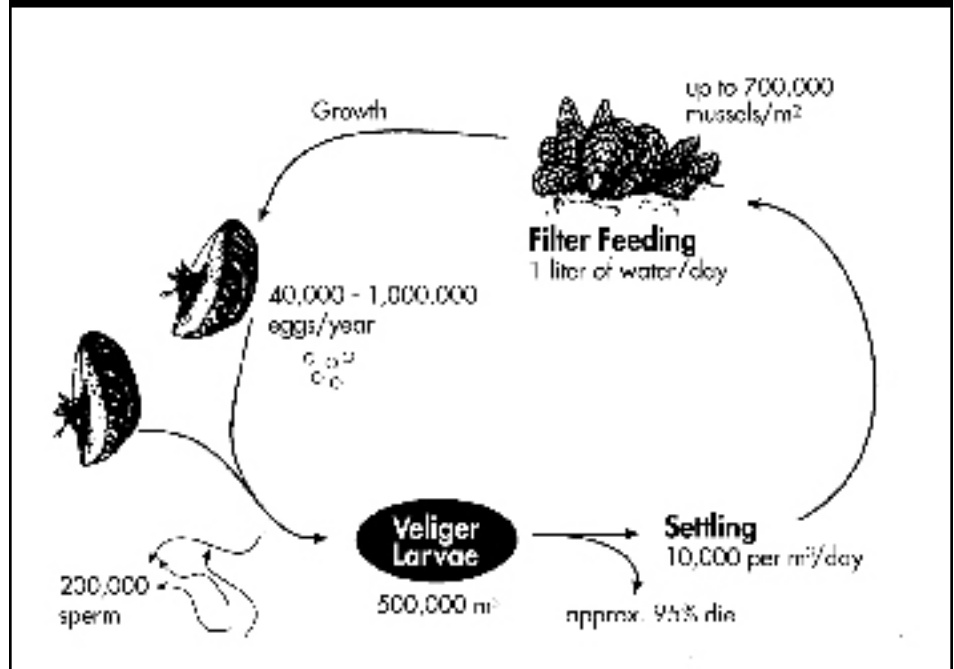
- Clog water intake or out flow pipes
- Disrupt sensitive water-dependent systems including:
 - boat motors,
 - municipal water facilities, and
 - industrial facilities
- Harm tourism by covering:
 - beaches, leaving behind sharp shells and decay odor
 - historical artifacts and ship-wrecks

ECOLOGICAL IMPACTS

Zebra and quagga mussels filter-feed on phytoplankton and detritus (the main elements of the aquatic food chain). When the mussels are present in large numbers, they:

- Alter established food chains and threaten other species.
- Harm or kill fish and wildlife that consume zebra mussels (since they are filter feeders, some mussels may contain high concentrations of toxic materials).
- Starve or suffocate native mussels.
- Contribute to "dead zones", like those experienced in the Great Lakes following quagga infestation, where almost all aquatic life disappears due to a lack of oxygen and bottom level food sources.

GENERAL ZEBRA MUSSEL LIFE CYCLE



MUSSEL LIFE CYCLE

On average, zebra and quagga mussels live 2-5 years and reproduce by their second year. Each year, females release up to one million eggs while males release more than two hundred million sperm into the water where fertilization takes place. In about two days, the fertilized eggs develop into free-swimming larvae, called veligers, which are transported by water currents. Within 2-3 weeks, the veligers "settle out" under the weight of their forming shells and attach to firm, submerged surfaces with thread-like strands, called byssal fibers. Seven hundred thousand mussels can occupy one square meter. Mussels are also transported by hitch-hiking on boats, boat trailers, barges, sea planes, and other aquatic equipment. Adult mussels feed by filtering large amounts of plankton and detritus from the water. Each mature mussel can filter over one liter of water a day.

MUSSEL HABITAT

Zebra and quagga mussels thrive in water with healthy populations of plankton. Substantial levels of calcium are required for shell production. Zebra mussels attach to firm surfaces, whereas quagga mussels can live on many surfaces including sand and silt. Both prefer slightly alkaline water, but vary in their temperature tolerances. Quagga mussels can thrive in significantly colder water, although both species can survive in Lake Champlain's winter water. Quaggas tolerate deeper water than zebra mussels. Zebra mussels are rarely found at depths below 50 feet, whereas quaggas are routinely found 100 feet deep with a maximum depth of over 400 feet (deeper than Lake Champlain). Water intake pipes are an ideal habitat because they afford protection from predators and severe weather. Water flowing through the pipes provides a constant food supply and removes their waste.

THE DIFFERENCE BETWEEN ZEBRA AND QUAGGA MUSSELS

Zebra and quagga mussels appear very similar to the untrained eye, but there are differences that distinguish the two. Learn the difference between them and help prevent quagga mussels from infesting Lake Champlain.





WHAT YOU CAN DO

- Learn to identify zebra and quagga mussels and monitor them.
- Report any quagga mussel sightings in Lake Champlain IMMEDIATELY to the Lake Champlain Basin Program at 1-800-468- LCBP, or the Vermont DEC at 802-241-3777. Contact the same numbers if you see zebra and/or quagga mussels in other inland lakes. Please note the date and location of the sighting.
- Marina, camp and other lake-shore business owners can distribute and maintain nonnative mussel literature at public facilities.
- Lake associations can work with state agencies to post "Attention Boater and Angler" signs at all public water accesses.

WATER USERS BEWARE

Anglers, boaters, SCUBA divers, and other water users may accidentally transport nonnative mussels! Juvenile and adult mussels can attach to boat hulls, engines, anchors, and other equipment, as well as to plant material caught on boats and trailers. Veligers can be carried in boat bilge water, live wells, bait buckets, engine cooling systems, and SCUBA gear, including wetsuits. It is illegal to transport nonnative mussels and other nonnative species in many states including Vermont and New York. People who draw water directly from a zebra mussel infested waterbody will also need to protect their system from infestation.

A Comparison of Zebra and Quagga Mussels

	ZEBRA MUSSEL <i>Dreissena polymorpha</i>	QUAGGA MUSSEL <i>Dreissena bugensis</i>
BOTTOM VIEW	 <p>more prominent byssal groove</p> <p>the two halves of the shell are symmetrical, creating a straight ventral (bottom) line</p>	 <p>less prominent byssal groove</p> <p>the two halves of the shell are not symmetrical, no straight ventral (bottom) line</p>
SIDE VIEW	 <ul style="list-style-type: none"> - sits flat on its bottom side - triangular in shape - color patterns vary - size tends to be smaller than quagga mussel 	 <ul style="list-style-type: none"> - does not sit flat on its bottom side (topples over) - rounder in shape - usually has dark rings on shell - paler in color near the hinge

TIPS FOR BOATERS AND ANGLERS

- Inspect boats and trailers for mussels and weeds. Remove mussels or vegetation and discard in the trash.
- Drain all water, including the bilge, live well, and engine cooling system.
- Dry the boat and trailer in the sun for at least 5 days. If you use your boat sooner, rinse off the boat, trailer, anchor, anchor line, bumpers, engine, etc. with hot water or at a car wash.
- Leave live bait behind — either give it to someone using the same waterbody, or discard it in the trash.

CAN THESE MUSSELS BE CONTROLLED?

Currently, controls exist only for protecting water supply systems. There are no known, environmentally-sound methods for eliminating nonnative mussels from a waterbody once they have become established. Research has found that some native species of fish in Lake Champlain are feeding on zebra mussels, but not enough to impede population growth.

Control methods for water supply systems include exclusion and removal with proper disposal. Exclusion methods typically use filters to prevent mussels from entering. Removal methods include scraping, pigging (pushing a full-bore ramrod through a pipe), back flushing, and depriving them of oxygen. Nonnative mussels that are physically removed should be disposed of away from waterbodies to prevent reattachment and/or spread. Although chemical exclusion and removal methods exist, they are not widely used because of harmful impacts to native species.



Eva McCauley

GLOSSARY

byssal fibers: thread-like strands on an adult mussels that attach to firm objects.

detritus: bits of vegetation, animal remains or waste, and other organic material that form the base of food chains.

drainage basin: a region including land and water which drains to a waterbody; also called a watershed.

ecosystem: a system of interrelated organisms together with their physical and chemical environment.

food chain: the sequential transfer of food energy from one species to another. Higher species in the

chain consume lower species in the chain.

mollusk: a soft-bodied aquatic animal, typically protected by a hard shell, such as a snail, clam, or mussel.

nonindigenous: not naturally originating in a particular area; nonnative.

plankton: small, usually microscopic, plants and animals that float in the water.

predator: an animal species that captures and eats other animals, its prey.

veliger: microscopic juvenile stage of the zebra mussel.

RESOURCES

- Zebra mussel identification cards and boater information (Contact LCBP to order for free)
- Information on protecting residential water supplies: www.sgnis.org/publicat/oneill.htm
- Lake Champlain Zebra Mussel Monitoring: www.anr.state.vt.us/dec/waterq/lakes/hm/lp_lcebbbramon.htm
- Quagga Information and Controls (Cornell University): www.utilities.cornell.edu/utl_lsceis_mussels.html
- Quagga Facts & Distribution Map (USGS) nas.er.usgs.gov/queries/FactSheet.asp?speciesID=95

CONTACTS

Lake Champlain Basin Program (LCBP)
54 West Shore Road
Grand Isle, VT 05458
1-800-468-5227 or 802-372-3213
www.lcbp.org

Vermont DEC
Water Quality Division
103 South Main Street, 10 North
Waterbury, VT 05671-0408
802-241-3777
www.anr.state.vt.us/dec/

Lake Champlain Sea Grant
George D. Aiken Center
81 Carrigan Drive
Burlington, VT 05401
802-656-0682
www.uvm.edu/~seagrant/

LCBP Goals

The Lake Champlain Basin Program has developed a plan to insure that the Lake and its drainage basin will be restored, protected and maintained so that current and future generations will enjoy its full benefits.
1-800-468-LCBP

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