



Zebra mussel

Dreissena polymorpha (Pallas, 1771)



Quagga mussel

Dreissena bugensis (Andrusov, 1897) syn. *Dreissena rostriformis bugensis*



Government of Alberta



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Overview:

Zebra and quagga mussels are bivalve molluscs. Zebra are native to the Black, Caspian and Aral seas, and quagga to the estuarine regions of rivers in the Ukraine. These mussels expanded their range westward with the construction of interbasin canals along large European rivers during the mid-1900s.⁴ Both species were introduced to the Great Lakes likely via ballast water discharge in the late 1980's. Since then, invasive mussels have radically transformed the Great Lakes, negatively impacting many native aquatic species and imposing drastic maintenance costs on water-dependent infrastructure.

Female mussels release eggs into the water, which are then fertilized by sperm released by the males, usually in the spring or summer. The microscopic larvae, called veligers, emerge within 3-5 days and are free swimming for up to a month, being dispersed by water flow.² After this time the veligers search for an attachment site, and metamorphosis and secretion of the adult shell begins.⁴ They reach maturity in the 1-2 years.¹ A fully mature female mussel is capable of producing up to one million eggs per season.³ Reproduction is prolific

and once introduced to a new water body populations can reach a total biomass at least 10 times that of all other invertebrates.²

As with all mussel species, zebra and quagga mussels are filter feeders and each mature adult is capable of filtering at least one litre of water per day, filtering out plankton, algae, and even their own veligers. Any undesirable matter is ejected as pseudofeces.¹ Filtering by these mussels increases water transparency and light penetration, decreases organic matter, and can greatly alter the concentrations of nutrients such as ammonia, nitrates, and phosphates depending on the trophic state of the water. Only certain algal species are consumed, cyanobacteria are not, leading to toxic algal blooms⁴ which deplete the oxygen in the water, killing fish and plants.

Dreissenids attach themselves to hard substrates using byssal threads, which are secreted from a byssal gland. Zebra mussels mostly attach to hard surfaces, but quagga mussels can establish in sand and silt in non-flowing water. They will attach to rocks, wood, some plants, and man-made materials

such as concrete, metal, nylon, and fiberglass. All native mussels are free living and do not attach to anything.

Zebra and quagga mussels cause major economic and ecological problems. By significantly depleting the water column of phytoplankton through filter-feeding, invasive mussels disrupt aquatic food chains, negatively impacting food availability for other aquatic organisms. Accumulation of decomposing pseudofeces consumes oxygen and toxic by-products are produced. Increased water clarity and light penetration alter entire ecosystems. Dreissenids accumulate high levels of organic pollutants which end up in their pseudofeces.

Mussel colonies can block water intake structures of water treatment plants and hydroelectric stations, aquaculture facilities, foul docks, breakwalls, buoys, boats and beaches, costing hundreds of millions of dollars in infrastructure maintenance costs in North America each year.⁶ A zebra or quagga mussel infestation in Alberta is estimated to cost over \$75 million annually. The sharp, broken shells of dead mussels on beaches can also cause injuries, infections, and are unesthetic.⁴

Zebra mussels | Quagga mussels (Continued)

Habitat:

Zebra and quagga mussels will colonize hard surfaces in still or running fresh waters, estuaries, and brackish water.¹ Most lakes in Alberta satisfy the temperature, pH, and calcium requirements for the establishment of invasive mussels. Water velocities exceeding two metres per second inhibit veliger attachment onto, and colonization of, surfaces.¹

Identification:

Zebra mussel shells are triangular or triagonal with a sharply pointed shell hinge end. Adult shells are generally the size of fingernails and rarely exceed 4cm in length. Juvenile mussels can be incredibly small and veligers are microscopic. There is a prominent light and dark banding pattern on the shell, which may be either smooth or zigzag in shape.¹

Quagga mussel shells are shaped like the letter “D” and usually under 5 cm in length. The outer shell commonly has alternating light and dark brown stripes, but can also be solid light brown or dark brown.³

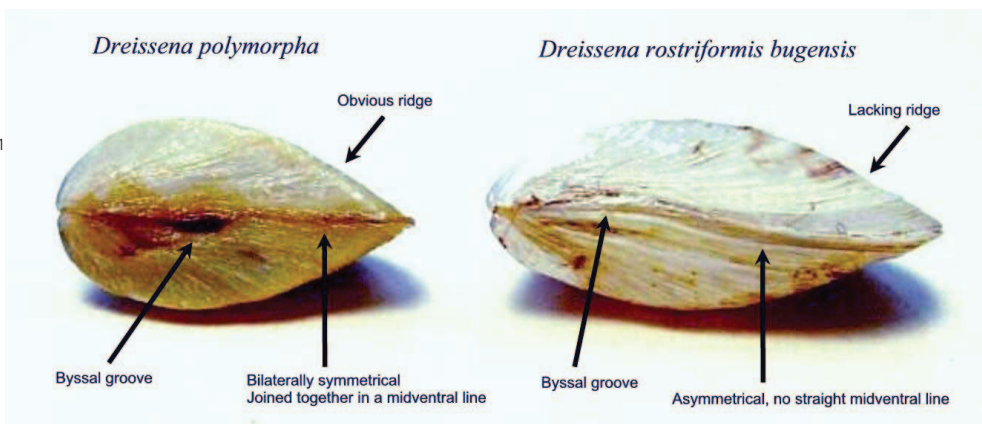
All native mussels are free living and do not attach to anything – an attached mussel is an invasive mussel.

Prevention:

Prevention is crucial for zebra and quagga mussels because once they establish in a natural body of water there is very little chance of eradicating them. Learn to recognize the physical characteristics of zebra/quagga mussels and know whether a body of water you enter is infested. The larval veligers can survive several days out of water in a moist environment like ropes, flotation vests, bilges, wet clothing, etc.

Always be sure to Clean, Drain, Dry ALL items that come in contact with water:

- Rinse, scrub or pressure wash your boat, kayak, canoe or gear away from storm drains, ditches or waterways. Use hot water if possible (maximum 60°C).



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- Before leaving the dock, drain all the water from your boat and ballasts, equipment, trailer, coolers, livewells, bilge, or buckets.
- Leave equipment to dry for at least 48 hours before entering another body of water.
- Never release plants, fish or animals into a body of water.
- Dispose unused bait by returning to its original container and put it in a garbage container.
- Wear non-felt soled waders.

Control:

Physical: Decreasing water levels to cause desiccation of *Dreissena* spp. is effective and an environmentally neutral method in structures designed to be periodically dewatered for maintenance. Other physical methods include manual scraping, high pressure jetting, antifouling coatings, and mechanical filtration.³ Heated water treatments are a common method of decontaminating boats - a spray temperature of 60°C for 5 seconds is recommended.⁴

Chemical: Several molluscicides are registered for use on invasive mussels, such as potassium chloride (potash), but pesticide use in or near water is tightly

regulated, requires appropriate approvals in place to purchases and use the product, and is usually unfeasible for eradicating extensive invasive mussel infestations from major waterways. Always check product labels to ensure the pesticide is registered for use on the target species in Canada by the Pest Management Regulatory Agency.

Biological: Research has been done to test the effectiveness of bacteria which produces a toxin that destroys the digestive system of *Dreissena* species.³ Large bodied molluscivores, such as carp, can limit *Dreissena* populations,² but can result in negative consequences from carp predation on native fishes.

REFERENCES

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- 2 *Dreissena polymorpha*. Invasive Species Compendium. CABI. <http://cabi.org> Accessed March 9, 2014.
- 3 *Dreissena bugensis* (mollusc). Global Invasive Species Database. <http://www.issg.org>. Accessed March 9, 2014.
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- 5 Help Prevent the Spread of Invasive Alien Species. <http://esrd.alberta.ca/recreation-public-use/invasive-species/invasive-species-prevention.aspx>. Accessed March 9, 2014.
- 6 *Dreissena* Species FAQs. USGS Southeast Ecological Science Center. <http://fl.biology.usgs.gov>. Accessed March 9, 2014.