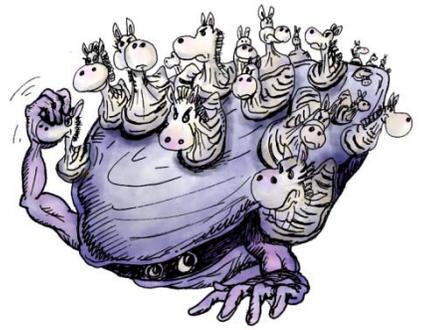


# Zebra Mussel (*Dreissena polymorpha*)

# Quagga Mussel (*Dreissena bugensis*)



## What are they & where are they found?

The Zebra mussel and its clammy cousin the quagga mussel are small freshwater bivalve mollusks named after their distinct zebra-like stripes. They can be found in freshwater rivers, lakes, reservoirs and brackish water habitats.

**FACT:** Quagga mussels were named after the “Quagga”, an extinct relative of the zebra.

(<http://en.wikipedia.org/wiki/Quagga>)

## What do they look like?

These revolting relatives are frequently mistaken for one another due to their similar appearance and habitat preferences. Like their namesakes, both zebra and quagga mussels have alternating dark (brown, black, or green) and light (yellow, white, or cream) banding on their shells. However, color patterns vary widely between individuals of both species. Shell stripes may be bold, faint, horizontal, vertical or absent from the mussel all together – talk about phenotypic plasticity! Both mussels are relatively small (< 1.5 inches) and generally D-shaped. Quagga mussels have a rounded appearance, with a convex ventral (hinge) surface, and two asymmetrical shell halves that meet to form a curved line. Zebra mussels have a more triangular shaped appearance, with a flat ventral surface, and two symmetrical shell halves that meet to form a straight line.

Zebra and quagga mussels are relatively short-lived species (2-5 years), but they more than make up for this attribute by being extremely prolific breeders. Adult females of both species can produce 30,000 to 1 million eggs per year. Microscopic planktonic larvae, called veligers, float freely in the water column for 2-5 weeks before settling onto a suitable substrate to feed and mature. Unlike our native freshwater mussel species, zebra and quagga mussels secrete strong glue-like fibers called byssal threads that enable the mussel to attach to just about any underwater surface imaginable. Zebra and quagga mussels typically colonize hard stable surfaces such as rock, concrete, metal, or wood, but will also colonize mud and sandy substrates as well. Both species tolerate a fairly broad range of environmental conditions including water temperature (33-86°F), water velocity (< 6 feet/sec), dissolved oxygen (> 25% saturation), water depth (200+ feet), and salinity (< 5ppt).



Zebra Mussels. Photo Credit: ANS Task Force



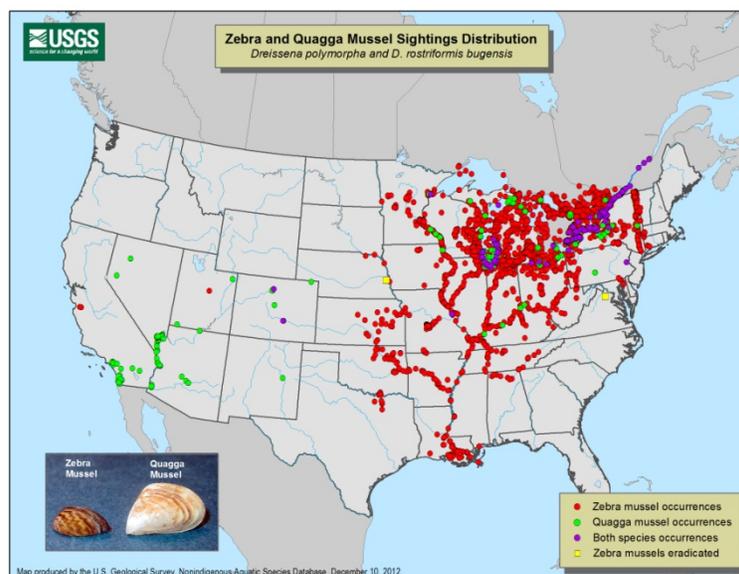
Quagga Mussels. Photo Credit: ANS Task Force

**FACT:** Zebra and quagga mussel were not recognized as distinct species until 1991.

## Where are they from & Where are they now?

Zebra and quagga mussels are native to the Aral, Azov, Black and Caspian seas of eastern Europe and western Asia.

This dastardly duo was first introduced to several European freshwater ports in the late 1700's. Within 150 years it was present throughout many inland European water bodies. Zebra mussels were first discovered in the United States in Lake St. Clair (near MI) in 1988. Quagga mussels were first detected near lake Erie in 1989. Since their initial discovery, zebra and quagga mussels have spread rapidly throughout the Great Lakes, Mississippi River basin states, and numerous watersheds throughout the eastern and central United States. In 2007, quagga mussels were detected for the first time in a water body west of the Rocky Mountains (Lake Mead, NV). As of 2011, zebra and quagga mussels have collectively spread to 29 states and two Canadian Provinces (Ontario and Quebec)



**FACT:** There have been multiple discoveries of zebra and quagga mussels on trailered boats traveling through Oregon, Washington, California and Montana – EEK!

## How did they get here?

Zebra and quagga mussels were first introduced to North America through ballast water discharged from commercial cargo ships carrying veligers or adults. Their rapid spread throughout the Great Lakes and other navigable water bodies has been attributed to the natural downstream dispersal of floating veligers, and the transport of adults on private boats or commercial barges. Inland and overland dispersal is attributed to the unintentional transport of adult mussels affixed to recreational boats, trailers, anchors and other recreational equipment, as well as the transport of veligers in boat live wells, bilges, bait buckets, engine cooling systems or any other water bearing compartment.

**FACT:** In a cool damp environment, adult zebra and quagga mussels can survive for weeks out of water by tightly sealing their shells.

## What are their impacts?

This bothersome bivalve's affinity for permanently attaching to any stable surface has caused a number of environmental and economic problems. Zebra and quagga mussels foul private and commercial boats, inundate navigation buoys, deteriorate docks and piers, impact the structural integrity of steel and concrete structures, litter public beaches, and clog pipes and intake screens at power and water treatment plants, fish passage, and aquaculture facilities. In the Great lakes region, water treatment and power plants spend millions of dollars annually to keep intake pipes clear of zebra mussels. In addition to hard substrates, zebra and quagga mussels will also colonize on aquatic vegetation, native mussels, crayfish, aquatic insects, and even slow moving turtles. Dense colonies of invasive mussels may crowd out or smother native plants and other benthic organisms, inhibiting their ability to feed, move or breathe. Zebra mussel infestations have led to the near extinction of native freshwater mussel populations in Lake St. Clair.

Zebra and quagga mussels are insatiable filter feeders. Each mussel can filter about one quart of water every day, removing small zooplankton, bacteria, silt and algae that form the food base for many native aquatic insects, mollusks and juvenile fish species. In addition to disrupting the food web, the filtering action of zebra and quagga mussels greatly improves water clarity in a water body. I know what you are thinking – this is a good thing right? It is up to a point. Unfortunately much of the material removed from the water is food for fish and other invertebrates. As this food source changes or declines, so do native populations. As light penetrates deeper into the water column, water temperatures may rise, and aquatic plant growth increases (including those nasty nuisance plant species), which can lead to problems for

recreational boaters, swimmers, and water dependent industries. As aquatic plants die, decomposing plant matter depletes oxygen levels in the water body. The filtering action of zebra and quagga mussels may also lead to the accumulation of toxins (e.g., metals, PCBs, pesticides) in the fatty tissue and feces of the mussels. When the mussels are eaten by birds, fish, or other wildlife the concentration of toxins can increase as they pass up the food chain. Zebra and quagga mussels have been associated with avian botulism outbreaks in the Great Lakes which have caused the death of thousands of birds.

**FACT:** If zebra and quagga mussels were to invade the Columbia River, they could cost hydroelectric facilities up to \$250-300 million annually.

<http://www.nwcouncil.org/library/report.asp?d=14>



Photo Credit: Jason Goeckler, KS Department of Wildlife & Parks



Photo Credit: Chris Barnhart

## Menace Management?

Once these foul filter feeders become established in a water body, there are no species specific control methods that can be used to eradicate the population without causing harm to the natural environment. A wide variety of chemical and mechanical control methods have been employed to combat zebra and quagga mussels (such as chlorine, ozone, water drawdowns, electric currents, UV radiation, heat, screens and filters, mechanical scraping, pressure washing and pipeline pigging), but most only provide temporary relief from problematic infestations.

Public education and outreach remains critical in the fight against the introduction and spread of zebra and quagga mussels. Common educational materials include informational brochures, videos, public service announcements, billboards, websites, and awareness campaign's such as "Don't Move a Mussel" and "Zap a Zebra", which teach boat owners and water recreationists how to identify aquatic nuisance species, specific actions people can take prevent their introduction or spread, and how to inspect and disinfect boats and recreational equipment for aquatic hitchhikers. Many states (including Oregon) also have mandatory boat inspection stations at state lines, boat ramps, and rest areas, where boats and other watercrafts are

thoroughly inspected for the presence of zebra and quagga mussels or other aquatic nuisance species. If any are found, the boat is decontaminated on site at no cost to the owner.

**FACT:** An early detection technique that uses polymerase chain reaction (PCR) to amplify zebra and quagga mussel DNA may enable scientists to detect mussels at the planktonic stage, before populations reach uncontrollable levels.



## How can YOU prevent the spread of zebra and quagga mussel?

To minimize the potential spread of these mischievous mussels, follow these simple steps.

- **CHECK and REMOVE** sand, mud, and plant fragments from all recreational gear and clothing that has come in contact with water before leaving a water body. Dispose of all material in the trash.
- **FEEL** your boat's exterior for any rough or gritty spots. Microscopic zebra and quagga mussels will feel like sandpaper.
- **DRAIN:** all of the water from your boat (including the bilge, live well, motor), trailer, tackle, and gear, away from waterways and stormdrains.
- **CLEAN** boat and recreational equipment with high pressure hot tap water (>104°F) for at least 20 minutes and allow to air dry COMPLETELY.
- **DISINFECT** your gear (especially waders and boots) before traveling to a different water body. Freeze your gear for a minimum of 24 hours (< 32°F), soak gear in a hot water bath for 3 minutes (≥ 140°F) (not recommended for Gortex), soak gear in undiluted vinegar for at least 20 minutes, or a 1% salt bath for 24 hours.
- **DRY** your gear completely after each use (3-5 days in a dry location).

## What if I find zebra or quagga mussels?

If you find zebra or quagga mussels, contact the Aquatic Nuisance Species Task Force at 1-877-STOP-ANS. If you spot a potential aquatic invader in Oregon, contact the Oregon Invasive Species Hotline at 1-866-UNVADER. In Washington State you can report a potential sighting at 1-877-9-INFEST