

Mussels of Minnesota

Most people are unaware of the many different kinds of animals that live under the water. Mussels are one of these often overlooked animals. Freshwater mussels inhabit lakes and rivers throughout the world, with North America supporting more species than any other continent.

Mussels are members of the second largest group of animals in the world, the mollusks. Being members of the phylum *Mollusca*, mussels are closely related to other bivalves, marine mussels and clams, as well as snails and even octopuses. Freshwater mussels, also called naiads or unionids, consist of a soft body enclosed by two shell halves called valves. Inside the shell a thin tissue called the mantle surrounds the soft body. This mantle is also the part of the body that secretes the two valves of the shell. The valves, which are held together by an elastic-like hinge, have the ability to be closed by two strong muscles whenever the animal senses a threat.

Freshwater mussels filter oxygen and particles from the water, cleansing the water in the process and absorbing what they consume into their bodies and shells. It is for these reasons that mussels are sensitive to changes in their environment, and serve as indicators of the health of our lakes and streams.

Degradation of our lakes and rivers from runoff of silt and chemicals as well as physical changes from damming, channelization, and dredging, have taken their toll on native



Underwater photograph of a mussel bed.

mussels in North America. As a result, conservation groups such as the American Fisheries Society and The Nature Conservancy list mussels as one of North America's most imperiled groups of animals. Of the 297 known species and subspecies of freshwater mussels in North America, 213 are listed as either endangered, threatened, or of special concern. In Minnesota, 25 of our 48 native mussel species are listed as endangered, threatened, or of special concern, and two are believed to be extinct from Minnesota.

Why are mussels important?

Mussels are an important food source for several different kinds of animals, including muskrats and raccoons, as well as several species of fish. Because mussels firmly anchor themselves to the lake or stream bed, they actually stabilize the lake or stream bottom, thus minimizing the affects of wave action and floods. Mussel shells form an important substrate to which algae and insect larvae attach. When present in large numbers, they may become underwater gardens that attract feeding fish, including their host fish. Mussels also "clean" the water they live in by removing undesirable particles and chemicals during their feeding process.



Discarded shells or "midden pile" left behind by feeding muskrats.

Freshwater mussels were used by early Americans. Archaeological excavations have unearthed shell material in eastern North America from sites dating back to 8000 B.C. These early people not only used the mussels for food, but also used the shells to temper pottery, and to make tools, utensils, and jewelry.

By the mid 1800s European Americans in the eastern United States were searching for natural pearls formed within mussel shells. Pearl hunting spread throughout the United States and "pearlers" were collecting mussels from as far west as the Mississippi River by the end of the 1800s.

Beginning in the 1890s mussel shells were harvested and manufactured into pearl buttons.



Mussel shells used to make pearl buttons.

These early harvesters collected mussels by the ton from the Mississippi River and its major tributaries. Mussels were harvested for this multimillion dollar industry until the 1940s when pearl buttons were replaced by those made from plastic.

Freshwater mussels are presently harvested throughout much of their range for use in the cultured pearl industry. The shells are collected, ground into beads, and inserted into live oysters. The mantle of the oyster then secretes a thin layer of mother of pearl upon the beads forming a cultured pearl. These pearls are left inside the oyster from one to several years, at which time they are removed, sorted, and sold.



Mussel processing camp, Mississippi River, 1907.

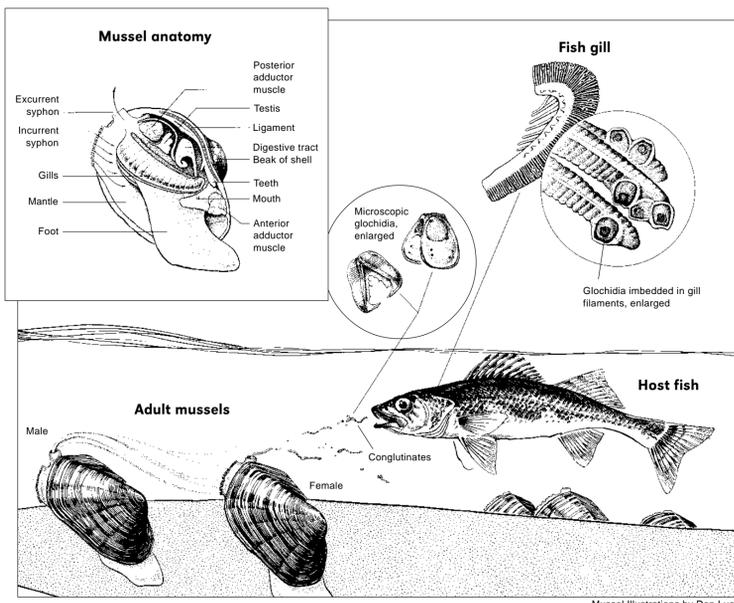
How do mussels live?

Mussels spend most of their lives in a small area of the lake or stream bed. However, they do have the ability to move with the use of their muscular foot. Mussels insert their "foot" into the sand or gravel and pull themselves forward, thus enabling them to inch along the bottom. This enables them to avoid falling water levels and to search for favorable habitats in which to live.

Mussels gather food and oxygen from the water. They do this by drawing water in through their incurrent syphon, removing the food and oxygen with their gills, and passing the water out through their excurrent syphon. The food in the water, mostly plankton and other organic matter, is carried to the mussel's mouth by tiny hairlike cilia located on their gills.

Freshwater mussels have a complicated life history that is tightly linked to fishes. During their larval or "glochidial" stage, mussels must attach to fish tissue as parasites. Some freshwater mussels require one particular species of fish as a host, whereas others use many. One mussel species, the salamander mussel, is very specialized in that it only uses the gills of an amphibian, the mudpuppy, as its host. After being released by the female, the glochidia attach to the host's skin or gills, and grows there for one to several months.

To improve the larvae's chances for survival, many mussel species have evolved elaborate methods to lure fish to gravid females. Some of these mechanisms include the modified mantle flap of the pocketbook mussel which resembles a minnow. Other mussel species package their developing glochidia into cases called "conglutinates." These conglutinates may resemble the insects on which fish normally feed. When a fish attempts to eat this "imposter insect" the fish becomes infected with the mussel's glochidia. The glochidia



develop into juvenile mussels while attached to the host fish, detach from the host, fall to the lake or stream bed, and begin their lives as free living mussels. This method of reproduction is also the primary way that mussels are distributed throughout a water body; mussel species distributions are therefore directly related to the host fish's distribution.



The pocketbook mussel (*Lampsilis* spp.) shown mimicking a minnow in an attempt to lure a host fish. Several Minnesota species use a similar mechanism.

What does the future hold for mussels in Minnesota?

As sentinels of a river's health, Minnesota's native mussels provide us with an important measure of society's impacts on the environment. Ignoring our mussel resources could aid not only in their demise, but the continued decline of riverine health. In response, the Minnesota Department of Natural Resources has initiated a statewide mussel survey project. Information gained about the distribution and abundance of mussels will be used to protect remaining areas where mussels and the water resources that sustain them are healthy, and to target areas where conditions indicate that improvements are needed. By conserving mussel habitats, we can maintain the health of the lakes and rivers that are an integral part of Minnesota's quality of life.



Harvest Regulations

No live mussels may be collected in Minnesota without a special permit. No live or dead mussels may be collected in National Park Services units, including the St. Croix River. If you pick up a live mussel, return it to the water immediately, being careful to place its foot end in the lake or stream bottom so about two-thirds of the shell is buried. Currently, with a fishing license, a person may possess up to 24 whole or 48 half shells of dead mussels. However, it is illegal to collect state listed species. Since many common species look like listed species, it is best to leave mussels where you find them.

Freshwater mussel references

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Freshwater mussel websites

- Minnesota Department of Natural Resources—
http://www.dnr.state.mn.us/ecological_services/nhrnp/mussels/nativemussels.html
- Illinois Natural History Survey—
<http://www.inhs.uiuc.edu/cbd/collections/mollusk.html>
- Mollusc information website—
<http://www.ucmp.berkeley.edu/mologis/mollia.html>
- American Malacological Union—
<http://erato.acnatsci.org/ams/>
- Chippewa National Forest—
<http://www.fs.fed.us/r9/chippewa/index.htm>
- Minnesota Historical Society—
<http://www.mnhs.org/>
- Mollusc resource page for students and teachers—
<http://www.manandmollusc.net>
- Additional mussel website links—
<http://www.fw.umn.edu/Personnel/staff/Hove/Mussel.web.sites>

Glossary

- Adductor muscle:** Large muscle that bivalve mollusks possess which are attached to both valves of the shell and when contracted tightly close the shell.
- Bivalve:** A mollusk whose body is enclosed by a pair of hard shells.
- Conglutinate:** A mass of glochidia held together by mucous. These often look very similar to aquatic insects or worms.
- Endangered:** The species is threatened with extinction throughout all or a significant portion of its range.
- Excurrent syphon:** An opening that expels the water cleaned of food and oxygen away from the mussels body.
- Exotic species:** A species of plant or animal that has been introduced to an area outside of its native habitat.
- Extirpated:** The species is no longer found in this portion of its historic range.
- Foot:** Muscular organ that a bivalve mollusk uses for locomotion.
- Glochidia:** The bivalved larva of freshwater unionid mussels which are parasitic on fish.
- Incurrent siphon:** An opening that brings the oxygen and food containing water into the mussels body.
- Larva:** Immature form of an animal that undergoes metamorphosis.
- Mantle:** A thin tissue that surrounds the soft body of a mollusk. In most mollusks the mantle secretes a hard protective shell.
- Mollusk:** Soft bodied animal that possess a muscular foot, mantle, and usually a hard exoskeleton called a shell.
- Special Concern:** The species is not endangered or threatened, although it is extremely uncommon, or has unique or highly specific habitat requirements and deserves careful monitoring of its status.
- Threatened:** The species is likely to become endangered within the foreseeable future throughout all or a significant portion of its range.

Why are mussels in trouble?

The survival of freshwater mussels is threatened by dams and their resulting silt-laden impoundments, stream channelization, stream dredging, wetland drainage and field tiling that leads to frequent and severe flooding, commercial harvesting, water pollution, and zebra mussels. Dams, channelization, frequent flooding and dredging physically alter the habitat conditions that these animals require to live. Habitat loss has been identified as the most important factor causing the decline of mussel species throughout North America.

In Minnesota, over 2500 dams have been constructed across once natural flowing streams. Many streams have been channelized and thousands of acres of crop land have been underlain by drainage tiles. It is estimated that over 2000 miles of natural rivers have been channelized in Minnesota's portion of the Red River Basin alone.

Dams not only alter the natural flow of rivers but also block the movements of fish hosts. Dams turn free flowing streams into a series of lakes or pools. This makes the survival of mussels adapted to a riverine environment

difficult or impossible. In some areas of North America, dams, channelization, and drainage of river systems, have eliminated 30 to 60 percent of the original mussel fauna residing in the impacted habitats.

Unregulated commercial harvest of mussels in the early part of the last century has also adversely affected mussel communities. It is believed that populations of mussels no longer legally collected may still be experiencing the impacts of having been harvested during the early 1900s. The State of Minnesota does not allow the harvesting of mussels from inland waters, and allows only limited commercial harvest of a single species from the Mississippi River along the border with Wisconsin. A special permit is required to legally harvest mussels from this portion of the Mississippi River.

More recently, mussels are being threatened by the introduction of an exotic mussel species. The zebra mussel (*Dreissena polymorpha*), brought from Europe into the Great Lakes in the late 1980s in the ballast water of ships, affects native mussels by attaching in large

numbers to any exposed area of the native mussel's shell. This eventually causes death due to increased vulnerability to parasitism, interference with movement, suffocation, and starvation. Zebra mussels can form colonies so dense that they may carpet the lake or river bottom in a layer several inches thick, eliminating the habitat required by native mussels and other bottom dwelling animals.

In Minnesota, zebra mussels are presently found in the Mississippi River south of Minneapolis-St. Paul, in one small tributary of the Mississippi River, the St. Croix River, and Lake Zumbro in southeast Minnesota. Because zebra mussels can rapidly colonize new habitats, it is important for people to learn to recognize this invader so they do not inadvertently spread them throughout the state.



Zebra mussels (*Dreissena polymorpha*) colonized upon a threeridge mussel (*Amblema plicata*).



A large dam on the St. Louis River, Minnesota.



A stream undergoing channelization.

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