Freshwater Mussels of Michigan


Mucket


Elktoe


Slippershell


Threeridge


Cylindrical Papershell


Purple Wartyback


Pimpleback


Eastern Elliptio


White Catspaw


Female


Male

Northern Riffleshell


Female


Male

Snuffbox


Spike


Wabash Pigtoe


Plain pocketbook


Female


Male

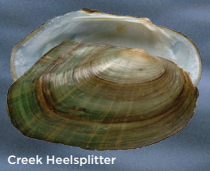
Wavy-rayed Lampmussel


Female


Male

Fatmucket


White Heelsplitter


Creek Heelsplitter


Fluted-shell


Fragile Papershell


Eastern Pondmussel


Black Sandshell


Three-horned Wartyback


Hickorynut


Round Hickorynut


Clubshell


Round Pigtoe


Pink Heelsplitter


Pink Papershell


Kidney-shell


Giant Floater


Lake Floater


Mapleleaf


Salamander Mussel


Strange Floater


Purple Lilliput

Lilliput

Fawnsfoot

Deertoe

Paper Pondshell

Ellipse

Rayed Bean

Rainbow

U.S. FISH & WILDLIFE SERVICE

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EGLE
MICHIGAN DEPARTMENT OF ENVIRONMENT, GREAT LAKES, AND ENERGY

Michigan Natural Features Inventory

DEPARTMENT OF NATURAL RESOURCES DNR MICHIGAN

While the tropics are known for their diverse insect and plant communities, eastern North America is home to some of the richest freshwater animal communities in the world. The United States in particular has more species of mussels, crayfish, snails, stoneflies, mayflies, and caddisflies than any other country. There are nearly 300 species of freshwater mussels (Unionidae) in eastern North America, with 43 species occurring in Michigan.

This brochure focuses on unionid mussels, however there are a total of four families of bivalves that live in the streams and lakes of Michigan: freshwater mussels (Unionidae), fingernail or pea clams (Sphaeriidae), Asian clams (Corbiculidae), and zebra and quagga mussels (Dreissenidae).

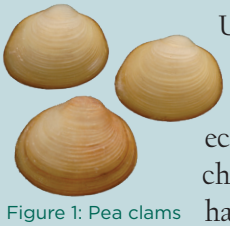

Figure 1: Pea clams

Unionid mussels are of particular interest because of their unique life history, importance to aquatic ecosystems, and use as indicators of change in water and habitat quality. They have also undergone significant declines in range and status over the past century. The pea clams, or fingernail clams, are fairly widespread in Michigan but relatively little is known about the range and status of individual species (Figure 1).

Figure 2: Asian clam

Unionid mussels and pea clams are native to North America, while Asian clams and zebra and quagga mussels are exotic to this continent. The Asian clam (*Corbicula fluminea*) was introduced to North America in the 1920s as a food species and has since spread throughout the United States (Figure 2). The dreissenid mussel family is represented by two species, the zebra mussel (*Dreissena polymorpha*) (Figure 3) and the quagga mussel (*Dreissena bugensis*) (Figure 4).

Figure 3: Zebra mussels

Zebra and quagga mussels were accidentally introduced to North America in the 1980s by being transported in the ballast water of shipping vessels. Zebra mussels are having a dramatic ecological impact on Michigan's lakes and rivers due to their consumption of plankton and ability to colonize other aquatic animals, such as native freshwater mussels.

Figure 4: Quagga mussels

LIFE HISTORY

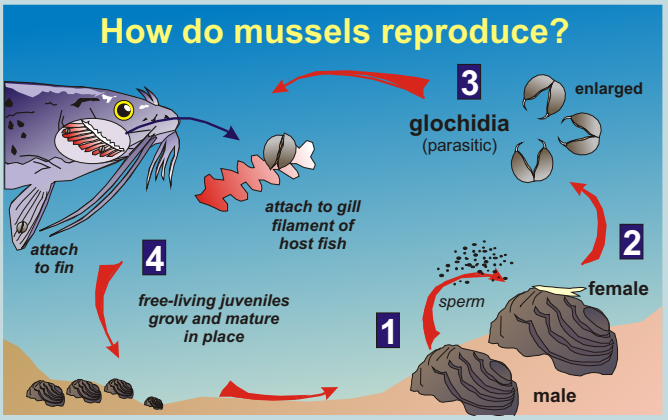

Figure 5

One of the most important differences between unionid mussels and other freshwater bivalves is their unique life cycle (Figure 5). Unionid mussels require a fish host to complete their life cycle, whereas other bivalve families produce free-swimming larvae that develop into the adult form without a host. Eggs are fertilized and develop into larvae within the marsupial gills of the female unionid mussel. These larvae, called glochidia, are released into the water and must attach to a suitable fish host to survive and transform into the adult form.

Glochidia attach to the gills or fins of fish. They are very small (approximately 0.1mm in length) and do not significantly harm their host. Some unionids are known to have only a few suitable host species, while others are generalists and utilize several host species. One Michigan species, the salamander mussel (*Simpsonaias ambigua*), uses an aquatic salamander (mudpuppy, *Necturus maculosus*) as its host.

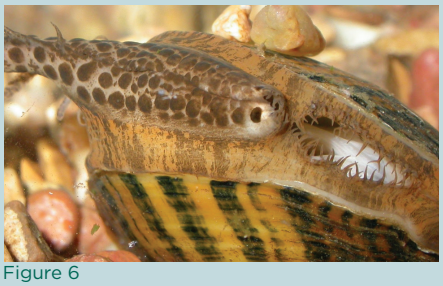

Figure 6

Unionid mussels have developed amazing ways of completing their life cycle. The females of some species have structures resembling small fish, crayfish, or other prey that are displayed when the glochidia are ready to be released.

These structures act as lures that attract host fish. There are two types of lures: mantle flap lures that resemble small fish (Figure 6), crayfish (Figure 7), worms, or insects; and conglutinate lures that are masses of glochidia clumped together and resemble small fish or worms.


Figure 7

When fish bite the lure, glochidia are released, which gives the glochidia a much better chance of attaching to a host than if they were released into the water without a fish present. Lures are often displayed in mid to late summer. Glochidia complete metamorphosis and drop off their host in the adult form after a period of time ranging from a week to several months, depending on the mussel species. Adults range from one to eight inches in length. Since adult mussels move relatively little throughout their lifetime, the ride that glochidia get while attached to their fish host allows unionid mussels to migrate to new habitat and exchange individuals among populations.

Individuals of many unionid species live to be 20 to 30 years of age, with some reaching 50 years or more. Annular rings on the outside of the shell can be counted to estimate a mussel's age. The life cycle of unionid mussels illustrates the interconnected nature of species in an ecosystem. Without the presence of healthy fish host populations, unionid mussels are unable to reproduce.

ECOLOGICAL ROLE AND VALUE

Unionids are an important component of Michigan's aquatic ecosystems. They play a significant ecological role in both rivers and lakes. Live individuals and empty shells provide habitat for aquatic insects. Empty shells also provide habitat for fish and crayfish.

Unionid mussels often constitute the highest percentage of biomass relative to other benthic stream animals. They are, therefore, a key link in the food chain between aquatic microorganisms they feed on, such as algae and bacteria, and large animals like mink, otter, raccoons, turtles, and birds that eat unionids.

Unionid mussels are useful habitat and water quality indicators for several reasons. Most species are long-lived, and they are generally sessile, spending most of their lives within a small section of a stream. Because they are filter feeders, mussels are sensitive to – and tend to accumulate – contaminants. Also, empty shells can reveal which species were present at a site in the past since they remain intact for many years after the mussels' death.

Mussel species richness and fish species richness are related. Rivers with lots of fish species tend to have lots of mussel species and rivers with few fish species tend to have few mussel species. Because unionids are sensitive to changes in habitat quality, the status of unionids can be indicative of the biological integrity of river ecosystems as a whole.

Unionid communities in southern Michigan once had economic value. In the early 1900s, live unionids were harvested from large rivers to support the pearl button industry (Figure 8). A rapid decline of unionid mussels due to harvest pressure was documented in the 1930s. In response, the Michigan Department of Natural Resources, then known as the Michigan Conservation Commission, closed the harvest for a period of five years beginning in 1944 to allow the resource to recover. By the end of the 1940s, much of the demand for unionid shell had subsided due to increased use of plastics to manufacture buttons. Michigan's unionid communities are not considered stable enough to allow harvest for commercial uses, and it is illegal to possess or collect them without a permit.


Figure 8

Unionids were once an important source of food for Native Americans. However due to PCBs, heavy metals, and other contaminants, they are generally no longer edible.

CONSERVATION

Freshwater mussels are one of the most endangered groups of animals in North America. A review of the status of U.S. and Canadian unionids by the American Fisheries Society in 1993 found that 97 of the 292 species that occur in the United States are considered endangered. Similar declines are occurring in other parts of the world as well. Thirty-five species are thought to have gone extinct in recent times.

Michigan supports globally significant populations for several unionid species that are federally listed as endangered or are candidates for federal listing. Currently 31 of Michigan's 43 unionids are listed by the state as threatened or endangered, or are considered species of special concern. Two of these have likely been extirpated from the state.

The decline of this group over the last hundred years has been attributed to direct and indirect impacts to aquatic ecosystems. Habitat and water quality degradation, including changes in water temperature and flow, the introduction of heavy metals, organic pollution, dredging, and increased sedimentation due to excessive erosion,

have caused declines in native unionid mussels. These factors have also impacted the fish species unionid mussels rely on as hosts. Without the appropriate host species present in sufficient densities, the unionid life cycle cannot be completed.

Barriers to fish migration, such as dams and degraded habitat, also act as barriers to the dispersal of unionid glochidia that have hitched a ride on the fish host. These barriers can inhibit the re-colonization of native mussels into suitable habitat, threaten genetic diversity through lack of gene flow, and prevent their recovery.

Forested riparian zones help maintain a balanced energy input to the aquatic system, provide habitat for fish hosts in the form of large woody debris, reduce the input of fine particles by stabilizing the stream banks with roots, and provide shade that regulates water temperature. Management techniques such as conservation tillage, maintaining or planting grass filter strips along streams and waterways, and maintaining forests in the floodplain can help reduce the input of silt and pollutants into the river. Several federal and state incentive programs are available to make these conservation methods economically feasible for farmers and other landowners.

Zebra mussels are having severe negative impacts on native mussels. Zebra mussels are an invasive species that require stable, hard substrates for attachment and often use unionid mussels for that purpose. Native mussels can get covered with enough zebra mussels that they cannot reproduce or feed and eventually die (Figure 9). Unionid populations have declined or, in some cases, been completely extirpated in certain lakes and rivers of the Lower Peninsula because of zebra mussels.

Figure 9

The continued range expansion zebra mussels into Michigan's streams and lakes remains a serious threat. We can reduce the spread of zebra mussels by making sure we do not transport water or aquatic plants – which can contain zebra mussel larvae – from one body of water to another while boating, fishing, and hunting. Washing boats and trailers and letting both dry overnight reduces the potential for spreading zebra mussels.

Goals for conserving native mussel diversity in Michigan parallel those identified in the National Strategy for the Conservation of Freshwater Mollusks, updated by the Freshwater Mollusk Conservation Society in 2016. These include:

- Increase knowledge of their distribution and taxonomy
- Address past, ongoing, and emerging impacts
- Conserve the quantity and quality of suitable habitat
- Understand their ecology
- Restore abundant and diverse populations
- Identify the ecosystem services provided by mollusks and their habitats
- Strengthen advocacy for mollusks and their habitats
- Educate and train the conservation community and future generations of resource managers and researchers

The status of mussel populations tends to reflect the health of the aquatic ecosystem as a whole. A more complete understanding of the status, distribution, and ecology of the Unionidae in Michigan is needed to effectively manage this endangered group and to assist in the management of Michigan's aquatic ecosystems as a whole.

HOW TO FIND FRESHWATER MUSSELS

Unionid mussels are present in nearly all of Michigan's rivers and many lakes. However, the highest abundance and species diversity is usually found in large rivers. Rivers with a mixture of pebble, gravel, and sand substrates and good current as evidenced by riffles and runs tend to support higher abundance and more species.

The best way to find freshwater mussels is to wade in a shallow (less than 2 feet deep) section of a river. Empty shells are easier to find than live individuals and are actually much easier to identify to species since the inside of the shell is visible. Empty shells can also be found by walking along a riverbank or lake shoreline.

A permit is required to collect shells or live individuals. If you do not have a permit, do not disturb live mussels and put shells you look at back where you found them. If you do pick up a live mussel, "plant" it back into the substrate anterior end down (Figure 10). Unionid mussels get oxygen and food from water that is drawn in through their siphons and across their gills. Placing them upside down can kill them since their siphons need to be pointed up into the water column.

A glass bottom bucket can enable you to see into the water more easily, especially if there are ripples on the surface or the water is turbid. You can make one by cutting the bottom out of a 5-gallon bucket and installing a circle of plexiglass.

The best time to survey for unionids is in the summer when streams and rivers tend to be at their lowest, the water tends to be clearest, and there is a chance of seeing lures being displayed. When choosing a site, be sure to use public access or get permission from private landowners. Also, be aware of potentially dangerous currents and deep pools.

IDENTIFICATION

Freshwater mussels can be identified to species by the characteristics of their shells. It is easier to identify empty shells since characters on the inside are visible. Figures 10–13 illustrate some common characters used to identify unionid species.

Identification of freshwater mussels takes lots of practice. Although there are some distinct characters that can be used for identification, many of the characters have a high amount of variation within species. The best way to improve your identification skills is to spend time looking at many individuals of each species. This will enable you to learn how each character varies within the species and help you to develop a memory for the overall three-dimensional shape of the shell. Shells of the same species are like pieces of art created by the same artist. Each one is different, yet there is a consistent theme of shape, color, and texture that holds true.

For assistance in identifying mussels, contact Pete Badra, Michigan Natural Features Inventory, badrap@msu.edu, 517-284-6200.

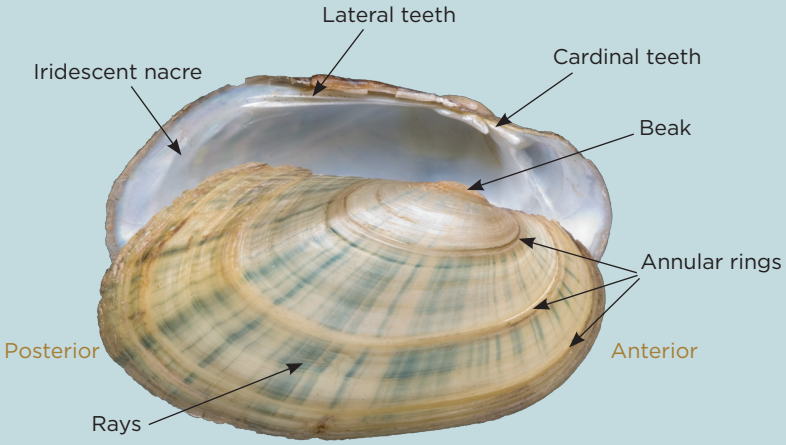

Figure 10: Fatmucket (*Lampsilis siliquoidea*)

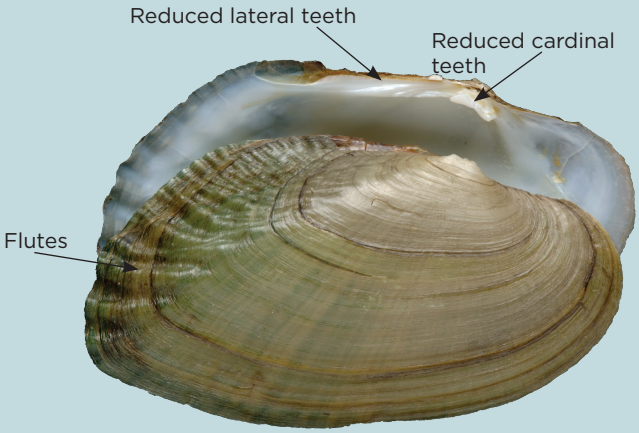

Figure 11: Fluted-shell (*Lasmigona costata*)

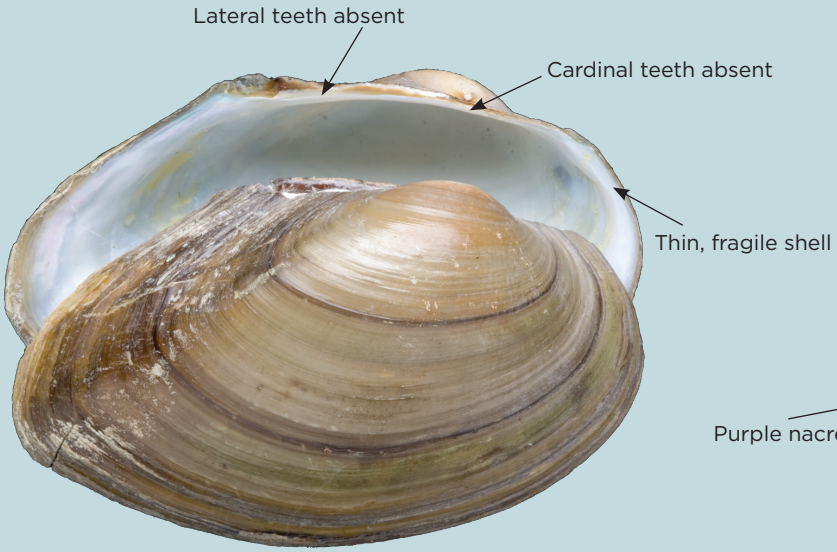

Figure 12: Giant floater (*Pyganodon grandis*)

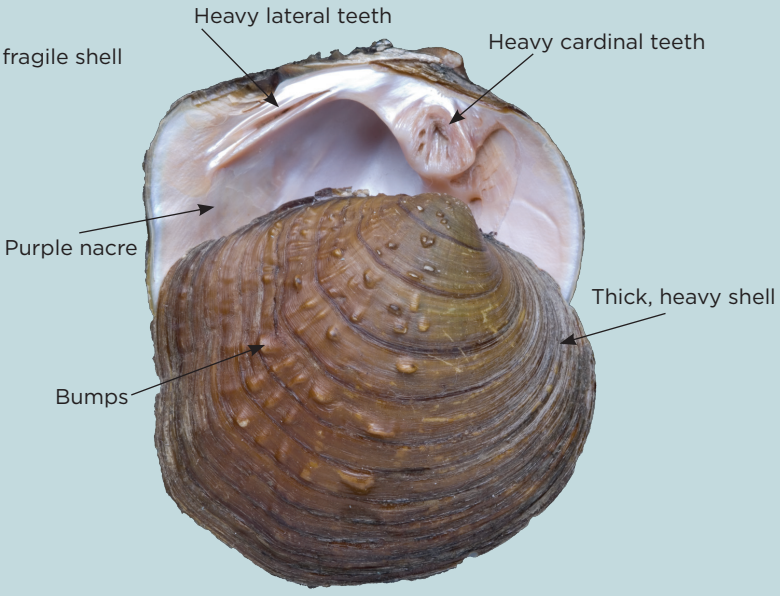

Figure 13: Purple wartyback (*Cyclonaias tuberculata*)

FOR MORE INFORMATION ON UNIONID MUSSELS

WEBSITES:

Michigan Natural Features Inventory, (including links to the Michigan Freshwater Mussel Survey Protocols and Relocation Procedures, and Map of Mussel Protocol Stream Groups)
https://mnfi.anr.msu.edu/resources/michigan-mussels

Freshwater Mollusk Conservation Society
https://molluskconservation.org/

Missouri State University, Unio Gallery
http://unionid.missouristate.edu/

University of Michigan Museum of Zoology, Mollusk Division
https://lsa.umich.edu/ummz/mollusks.html

LITERATURE:

Mulcrone, R.S. and J.E. Rathbun. 2018. Field Guide to the Freshwater Mussels of Michigan. Michigan Department of Natural Resources, 59pp.

Freshwater Mollusk Conservation Society. 2016. A national strategy for the conservation of native freshwater mollusks. Freshwater Mollusk Biology and Conservation 19: 1-21.

Haag, W.R. 2012. North American Freshwater Mussels: Natural History, Ecology, and Conservation. Cambridge University Press, New York, 505pp.

Watters, G.T., M.A. Hoggarth, D.H. Stansbery. 2009. The Freshwater Mussels of Ohio. The Ohio State University Press, Columbus, 421pp.

Burch, J.B. 1975. Freshwater Unionacean Clams (Mollusca: Pelecypoda) of North America. Malacological Publications, Hamburg, Michigan. 204pp.

This brochure was produced by the Michigan Natural Features Inventory, Michigan State University Extension. Funding was provided by the Michigan Department of Environment, Great Lakes, and Energy; the Michigan Department of Natural Resources; and the U.S. Fish and Wildlife Service.

Additional copies of this brochure and its companion poster, "Freshwater Mussels of Michigan," can be obtained from:

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Design and production: brendajsanborn.com
Shells pictured on the cover and in figures 10-15 provided by the University of Michigan Museum of Zoology, Mollusk Division, except for lake floater, which was provided by Dr. David Zanatta, Central Michigan University.
Figure 5 provided by Karl J. Scheidegger
Figures 6 and 7 provided by M. Christopher Barnhart