

INTRODUCTION

Freshwater mussels, also known as clams, are found on every continent except Antarctica. The mussel family, *Uniondae* has 1000 species worldwide, but are most diverse in North America which boasts 300 species. While the entire continent of Europe only has eight different mussel species, historically 29 species of mussels have been found in the French Creek watershed! Fifty four species reside in Pennsylvania and recent surveys confirm **26 species** in the watershed.

Freshwater mussels are descended from their salt water relatives—oysters and clams. Part of the phylum *Mollusca* (also including snails, squids and marine clams), mussels have a soft body with a digestive tract, gills and a muscular foot all housed within two hard shells which are joined at the back and strengthened by hinged teeth. The mussels are filter feeders so water continuously pumps through their bodies. One adult mussel can filter 8 -15 gallons of water per day! Water enters through the incurrent or brachial siphon and exits though the excurrent or anal siphon. Oxygen and food (plankton and organic matter) are filtered out during this process. Because of this process, mussels are considered an indicator species of good water quality.



Freshwater Mussels

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MUSSEL LIFE STYLE

Mussels spend their entire adult lives partially or wholly submerged in sand, mud or gravel in permanent bodies of water. Often, the only part visible is the tip of their shells and their two siphons as they take in detritus, phytoplankton, zooplankton, diatoms, bacteria and other microorganisms that are filtered out by the mussels. This makes the animals exceptionally vulnerable to water pollution and degradation of the aquatic ecosystem.

Although the mussels foot can be used for movement, adult mussels rarely travel more than 100 meters in a lifetime. Different species have varying maximum ages, ranging from 10-100 years. The age of mussel species can be estimated by counting the dark rings on the shell, thought to be caused by winter resting periods.



Water is drawn into the large fringed incurrent syphon, microscopic particles get filtered and clean water is expelled through the excurrent siphon.

HABITIAT

Mussel beds in the stream system typically occur in areas that experience low flood stress, have stable sediments and highly oxygenated water. The mussels exposed shell poking up from the substrate also provide habitat for various plants and aquatic insect larvae (macroinvertebrates) such as caddisfly larvae. Aquatic insects also benefit from nutrients created by mussels. Thus, habitat and food provided by mussels to macroinvertebrates in turn benefit fish species as they serve as a food source for the fish.





As of 2018, over half of the species of mussels in the Midwest are threatened or endangered. In the French Creek watershed, four species: the **Northern Riffleshell**, **Clubshell, Rayed bean**, and **Snuffbox** are endangered at the federal level, having been lost from over 95 percent of their historic range, and the **Rabbitsfoot** is listed as threatened. Federal species listings can change as habitats degrade or improve and researchers observe declines or increases in population.



Freshwater mussels, are an important food source for muskrat, minks, raccoons, otters, fishers and some birds such as herons. It is not unusual to find piles of discarded mussel shells along the bank where a muskrat or other animal has enjoyed a dinner of mussels. These piles are know as "middens."



Muskrats are just one of the many animals that utilize freshwater mussels as a food source.



Buttons made from freshwater mussel shells.

Freshwater Mussels HISTORY

Historically, Native Americans not only ate mussels but also used the shells for utensils, tools and to make jewelry. Between the late 1800s and mid 1900s, shells were harvested to supply a multimillion dollar pearl button industry. However, with the invention and widespread use of plastics during the 1940-50s, the pearl button industry collapsed.

By the 1950s the Japanese found a new use for mussel shells in cultured pearl production. The shells are cut and finished into small beads and inserted into oysters to serve as nuclei for pearls. Still today, a small quantity of mussel shells are exported from the United States to Japan and China for this purpose.



Mussel used for buttons.

As relatively stationary filter feeders, mussels are subject to the conditions of their aquatic environment. Most of the declines in native mussel populations occurred when river systems underwent dramatic changes in water and habitat quality. Major changes in land use throughout the 20th century and major waterworks projects that dammed of diverted rivers eliminated many species in the Tennessee and Ohio basins. Today, ongoing threats such as dredging, sedimentation and non-point water pollution contribute to the decline of Pennsylvania's mussel resources.

INVASIVE SPECIES THREATS

ROUND GOBY

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Round Gobies were first discovered in the French Creek Watershed in Lake LeBeouf in 2014, where researchers believe they were transported as bait, then in LeBeouf Creek in 2015 and finally in French Creek north of Cambridge Springs in 2016. These aggressive small fish from the Black and Caspian Sea grow rapidly, reproduce profusely and will eat just about anything that fits in its mouth including the young of native species. Now that they are in French Creek, researchers say we will never get rid of them. The impacts of these alien fish on our native species are still poorly understood. However, researchers feel that they represent a serious threat to the mussels and darters found in French Creek and the lakes within the watershed. Researchers determined that Gobies eat juvenile native mussels at all stages and lengths as well as aquatic insects-especially midges. Gobies may also affect fish and darter populations as they compete for food and habitat. This in turn, may affect our native mussels-including nationally endangered musselsas some of the fish and darters act as hosts for mussel reproduction.



Invasive Round Goby fish eat juvenile freshwater mussels.



Invasive Zebra Mussels attach to freshwater mussels.

ZEBRA MUSSELS

Public interest in mussels surged in the early 2000s due to the attention given the Zebra Mussel, a non-native species from Eurasia introduced into the Great Lakes in the 1980s. With "behavior" much different than our native mussels, this comparatively small mussel reproduces prolifically, causing huge problems for humans and native mussels alike.

An invasive colony species, they will attach to any hard surface and can be costly to humans by clogging water intake lines and other equipment. Zebra Mussels also colonize on native mussels, impeding water flow, competing for available food and oxygen, and eventually killing the mussel.

Researchers who have been studying the Zebra Mussel in the French Creek watershed are predicting that Zebra Mussels might only cause problems in specific sections of the creek where waters are deep and slow, resembling their preferred lake habitat. However, Zebra Mussels remain a significant threat to the ecological balance of lakes and ponds in the French Creek watershed.

Freshwater Mussels

REPRODUCTION

Fresh water mussels have a unique way of reproducing. The male releases sperm into the water which is carried by the current and enters the female through the incurrent siphon. Eggs are fertilized and develop into an intermediate larval state know as glochidia. Glochidia are stored in the female's gills in a brood pouch. In spring or summer depending on the mussel species, the glochidia are expelled into the water where they will attach themselves onto a passing fish's gills and fins. (See below)



Glochidia will attach and ride a host fish for several weeks and metamorphose into a tiny freshwater mussel, then drop off. By hitching a ride on a fish, mussels can disperse far distances. This means of reproduction is the only way mussels can move upstream. Therefore, the health of a mussel population depends upon not only clean water and ample food sources, but also on an abundance of host fish and lack of barriers to dispersal (e.g. dams.).



Many mussel species develop adaptations that produce a lure, a piece of their living tissue which might look like a minnow, aquatic insect or another potential food source to attract a "host" fish to come closer. (See above) When the fish nibbles on the lure, the female mussel will release the glochidia into the face of the fish. Some species of mussels will even snap their shell shut-holding the fish captive before expelling the glochidia, then releasing the fish. (See below)



UNIQUE LIFE CYCLE



Matthew Rowe, DNRWRD

MUSSELS OF FRENCH CREEK

- 1. Mucket
- 2. Elktoe
- 3. Three-Ridge
- 4. Cylindrical Papershell
- 5. Spike
- 6. Northern Riffleshell *
- 7. Snuffbox *
- 8. Longsolid
- 9. Plain Pocketbook
- 10. Wavyrayed Lampmussel
- 11. Pocketbook
- 12. Fatmucket
- **13. White Heelsplitter**
- **14. Creek Heelsplitter**
- 15. Flutedshell
- 16. Eastern Pondmussel
- 17. Black Sandshell
- 18. Clubshell *
- **19. Round Pigtoe**
- 20. Kidneyshell
- **21. Giant Floater**
- 22. Rabbitsfoot †
- 23. Creeper /Squawfoot
- 24. Paper Pondshell
- 25. Raved Bean *
- 26. Rainbow

† Federally Threatened

Also found in French Creek but not freshwater mussels of the Uniondae family: Asian Clams — Family: Corbiculidae Fingernailclams or Peaclams—Family: Sphaeriidae



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Actinonaias ligamentina Alasmidonta marginata Amblema plicata Anodontoides ferussacianus Elliptio dilatata Epioblasma torulosa rangiana Epioblasma triquerta Fusconaia subrotunda Lampsilis cardium Lampsilis fasciola Lampsilis ovata Lampsilis siliquoidea Lasmigona complanata Lasmigona compressa Lasmigona costata Ligumia nasuta Ligumia recta Pleurobema clava Pleurobema sintoxia **Ptychobranchus fasciolaris Pyganodon grandis** Quadrula cylindrica Strophitus undulatus Utterbackia imbecillis Villosa fabalis Villosa iris

* Federally Endangered