

# Purple Bean

*Villosa perpurpurea*

An amazing diversity of life inhabits the free-flowing rivers of the eastern United States. Colorful crayfish, dazzling fish and fascinating pearly mussels are among the many aquatic animals that inhabit our rivers. It is easy to overlook the animals living in our streams, but they are part of a healthy aquatic ecosystem and indicators of clean water. One such animal is the purple bean mussel, named for its small bean-like shape and beautiful purple nacre (inside surface of the shell). Historically, the purple bean was never widely distributed and populations were known to exist in only a few rivers and streams in the upper Tennessee River watershed in northeast Tennessee and southwest Virginia. Today, these populations are either gone or disappearing. The species was listed as a federally endangered species in 1997.

## Life on the Bottom

Purple bean mussels live in waters ranging from small headwater streams to medium-sized rivers. Just 1½ to 2 inches long, they are typically found in moderate to fast flowing riffles, snuggled on the river bottom in a mix of sand, gravel and cobbles. To survive, purple beans need a silt-free, stable streambed and well-oxygenated water free of pollutants. Like fish, mussels use gills to breathe but unlike fish, mussels are filter feeders and use their gills to collect food. Small hairs (cilia) cover their gills and beat in a rhythmic motion. This motion creates a current that flows over the surface of the gills, enabling the mussels to remove oxygen and food (bacteria and algae) from the water. Mussels have a soft muscular “foot” that enables them to slowly crawl and burrow in the river bottom. Most mussels will remain in the same area of the stream for their entire life. Though some species of mussels can

live over 150 years, the purple bean is a relatively short-lived species and may only live up to 20 years.

## Hitching a Ride

The reproduction cycle of freshwater mussels is unique and begins when the males release sperm into the water. Relying on the current, the females filter the sperm out of the water during feeding and respiration. The filtered sperm fertilize the mussel eggs, which develop into larvae called glochidia. One female may produce thousands of glochidia. The tiny glochidia are stored in brooding chambers within the gills of the female mussels to await a host fish. Purple bean females have adapted special behaviors and tissue that are used to lure the host fish to them. Gravid (pregnant) females will partially protrude their glochidia-filled gills outside their shells and wave finger-like papillae around the exposed gills. This behavior makes the gills look like potential food and attracts the attention of small riffle-dwelling fish, namely the fantail darter (*Etheostoma flabellare*), greenside darter (*Etheostoma blennioides*), black sculpin (*Cottus baileyi*), mottled sculpin (*Cottus bairdi*), and banded sculpin (*Cottus carolinae*). The host fish is lured into biting the gills of the mussel, which results in a mouthful of glochidia that attach to the fish’s gills. While there, the glochidia find the nourishment and shelter they need to transform into free-living juvenile mussels. After a few weeks, the newly developed mussels drop off the fish into the river bottom and the cycle continues; the fish generally are unharmed. This sophisticated reproductive strategy depends on healthy fish populations of specific fish species that serve as host fish and as “taxicabs” to carry the juvenile mussels throughout the river, expanding the mussel’s range.



*Purple bean*

## Humans and Mussels

Mussels have long been important to people. For some Native Americans, mussels were an important food source. Today, huge middens (old piles of mussel shells) can be found along rivers marking regular areas where Native Americans shucked mussels. Native Americans and early settlers also used mussel shells as tools for scooping and cutting. Later, Americans used mussel shells to make buttons. Until the development of plastic in the early 1900s, the button industry was enormous, and provided an important U.S. export worldwide. Today, some freshwater mussel species are used in the freshwater and cultured pearl industry, though the purple bean is too small to be harvested for this purpose.

As the canary in the coal mine is an indicator of healthy air, the presence or absence of the purple bean mussel indicates the health of an aquatic ecosystem. Mussels continually siphon water from their surroundings; since they are relatively immobile, they accumulate chemicals in their bodies and shells, including contaminants present in their environment. Not only is the presence or absence of freshwater mussels an indication of a stream’s health, mussels can also be analyzed by scientists to identify contaminants and toxins that may be in the water. If the water is too polluted for mussels, it is also bad for people.

## Trouble in Mussel Paradise

Because mussels move very little in their lifetime, they are not able to escape changes in their environment that may harm them. Habitat loss and alteration are the primary reasons for the purple bean's decline. These habitat changes result from impoundment of waterways, stream channelization, water pollution and siltation. Silt from erosion and poor land-use practices changes the stream habitat and clogs the mussels' gills, smothering them. Dam construction and other impoundments alter many aspects of a river – speed (velocity), temperature, oxygen levels, the amount and placement of silt, and changes in water levels. Additionally, dams become a barrier to host fish and mussels, preventing them from occupying habitat upstream. Pollutants from chemical spills, agricultural runoff, coal mining and development build up in the mussels' tissues and prevent them from reproducing, or kill them outright. Degraded habitat and poor water quality also impact the diversity and abundance of fish species that the purple bean relies on for its life cycle. The invasive, non-native, Asian clam (*Corbicula fluminea*) occupies valuable space in freshwater mussel habitat, though the level this threat poses to the purple bean is not fully known.

## Saving the Purple Bean

Biologists fear that the decline of freshwater mussels is a sign of serious water quality problems in freshwater ecosystems. Mussels perform many essential functions. They are a food source for otters, raccoons, muskrats, turtles and some fish. Mussels improve water quality by filtering particles and excess nutrients from the water. The U.S. Fish and Wildlife Service has written a recovery plan for the purple bean, a document that outlines what and where priority research and restoration projects must be done to recover the purple bean mussel. Conservation efforts for the purple bean include breeding the mussel in captivity and reintroducing young mussels to streams, fencing streams to keep out livestock, repairing erosion along rivers, and helping local communities learn about the natural treasures that live in their streams.



## Help! Be Part of the Solution

Remember that what we put on the land eventually enters our streams. If you reside on property that borders a stream or other waterway, please minimize use of chemicals or fertilizers. To help control erosion and reduce runoff, maintain a buffer of native vegetation along stream banks. Install fencing to prevent livestock from entering streams; livestock can trample mussels, cause soil erosion, and contaminate water with their waste. Protecting water quality is the most effective way to keep our waterways healthy for the benefit of humans, and purple bean mussels.

To find out more about the purple bean contact:

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