



Rayed Bean (freshwater mussel) *Villosa fabalis*

The rayed bean is a freshwater mussel that the U.S. Fish and Wildlife Service listed as an *endangered species*. Endangered species are animals and plants that are in danger of becoming extinct. *Threatened species* are animals and plants that are likely to become endangered in the foreseeable future. Identifying, protecting, and restoring endangered and threatened species are primary objectives of the U.S. Fish and Wildlife Service's endangered species program.

What is the Rayed Bean?

Appearance: The rayed bean is a small freshwater mussel, usually less than 1.5 inches long. Its shell is smooth-textured and green, yellowish-green, or brown with numerous dark-green wavy lines. The male's shell shape is generally elongated, whereas the female's is smaller and elliptical.

Range: The rayed bean historically was found across a wide expanse that included parts of the Midwest and eastern United States, north to Ontario, Canada. Once found in at least 115 streams, canals, and lakes, the rayed bean now occurs in only 31 streams and 1 lake; a 73 percent reduction in the number of occupied streams and lakes. The species has been extirpated from Illinois, Kentucky, and Virginia but is still found in Indiana, Michigan, New York, Ohio, Pennsylvania, and Ontario, Canada. After extirpation from Tennessee and West Virginia, reintroductions have restored the rayed bean to these states.



Photo by USFWS; Angela Boyer

The rayed bean, a small freshwater mussel of the upper Midwest and Eastern United States, is endangered due to population declines and continuing threats to the rivers where it can still be found..

Habitat: The rayed bean generally lives in smaller, headwater creeks, but it is sometimes found in large rivers and wave-washed areas of glacial lakes. It prefers gravel or sand substrates, and is often found in and around roots of aquatic vegetation. Adults spend their entire lives partially or completely buried in substrate, filtering water through their gills to remove algae, bacteria, detritus, microscopic animals, and dissolved organic material for food.

Reproduction: The life cycle of the rayed bean, like most freshwater mussels, is unusual and complex. Males release sperm into the water column that is then siphoned by females to fertilize their eggs. Fertilized eggs develop into microscopic larvae, called glochidia,

within special gill chambers. Females expel mature glochidia, which then must attach to the gills or fins of specific host fish species to complete development into juvenile mussels. After attaching to host fish, glochidia mature within a few weeks. Juvenile mussels then drop off and continue to grow, if they fall onto appropriate substrate. Using fish as a host species allows the rayed bean to move upstream and populate habitats it could not otherwise reach.

What threatens the rayed bean mussel?

Dams: Dams affect both upstream and downstream mussel populations by disrupting natural river flow patterns, scouring river bottoms, changing water temperatures, and eliminating habitat. Adapted to living in flowing water, the rayed bean

cannot survive in the still water impounded behind dams.

The rayed bean also depends on host fish as a means to move upstream. Because dams block fish passage, mussels are also prevented from moving upstream, which isolates upstream mussel populations from downstream populations, leading to small unstable populations more likely to die out.

Pollution: Adult mussels are easily harmed by toxins and degraded water quality from pollution because they are sedentary (they tend to stay in one place). Pollution may come from specific, identifiable sources such as accidental spills, factory discharges, sewage treatment plants and solid waste disposal sites or from diffuse sources like runoff from cultivated fields, pastures, cattle feedlots, poultry farms, mines, construction sites, private wastewater discharges, and roads. Contaminants may directly kill mussels, but they may also reduce water quality, affect the ability of surviving mussels to have young, or result in lower numbers or disappearance of host fish.

Sedimentation: Although sedimentation is a natural process, poor land use practices, dredging, impoundments, and other activities accelerate erosion and increase sedimentation. Sediment that blankets a river bottom can suffocate mussels. Accelerated sedimentation may also reduce feeding and respiratory ability for rayed bean mussels, leading to decreased growth, reproduction, and survival.

Nonnative Species: The invasion of the nonnative zebra mussel into the U.S. poses a serious threat. Zebra mussels proliferate in such high numbers that they use up food

resources and attach to native mussel shells in such large numbers that the native mussel cannot eat or breath. Another invasive species, the round goby, is a nonnative fish species that may displace native host fish species, thus reducing the ability of the rayed bean to reproduce.

What is being done to conserve and restore rayed bean mussels?

Listing: In February 2012, the U.S. Fish and Wildlife Service added the rayed bean to the list of endangered species, giving the species full protection under the Endangered Species Act (ESA). The ESA provides protection against practices that kill or harm the species and requires planning for recovery and conservation actions.

Watershed Protection

Partnerships: The rayed bean cannot survive without help from watershed partnerships to restore habitat and improve surface lands. Causes of habitat degradation are numerous in streams throughout its range. Often, threats are not from actions in or adjacent to rivers, but from widespread problems on uplands at the highest elevations of watersheds. Habitat restoration will require improvements across the entire watershed. The voluntary assistance of federal and state agencies, conservation groups, local governments, private landowners, industries, businesses, and farming communities will be necessary to meet recovery goals.

Reintroductions: The rayed bean was extirpated from Tennessee and West Virginia, but reintroductions into suitable habitat have reestablished the species in these states. Reintroductions were in

rivers where water quality and habitat have improved since the rayed bean was extirpated.

What can you do?

Learn more about how the destruction of habitat leads to loss of endangered and threatened species and our nation's plant and animal diversity. Discuss with others what you have learned.

Help improve water quality locally in streams by minimizing use of lawn-care chemicals and properly disposing of or recycling hazardous materials found in your home, like batteries, paint, car oil, and pesticides.

When boating, please follow any rules established to prevent the spread of exotic pests like the zebra mussel.

Join a conservation group or volunteer at a local nature center, zoo, or wildlife refuge.

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