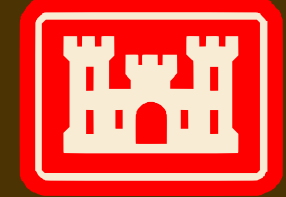


Restoring the Federally Endangered Higgins eye pearlymussel (*Lampsillis higginsii*) in the Upper Mississippi River - Propagation and Reintroduction



US Army Corps of Engineers

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 Upper Mississippi River Mussel Coordination Team (see box, top right)



Introduction

The U.S. Army Corps of Engineers, in collaboration with the Mussel Coordination Team (see box top right), has implemented a number of conservation measures for the Federally Endangered Higgins eye, starting in 2000, with the goal of producing 5 new, viable populations within the Higgins eye's historic range on the Upper Mississippi River and tributaries.

Freshwater mussels are one of the most imperiled groups of animals in North America - about 70 percent of the 300 native species are extinct, endangered, or otherwise listed for protection by a federal or state agency.¹

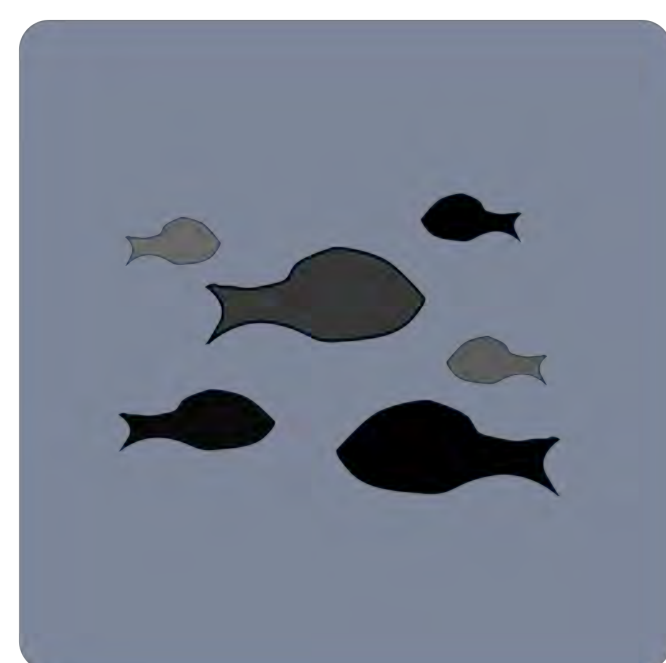
1. U.S. Geological Survey, Upper Midwest Environmental Sciences Center. Development of Landscape Models for Conservation of Freshwater Mussels in the Upper Mississippi River Basin. http://www.umesc.usgs.gov/reports_publications/fact_sheets/mussel.html

Propagation



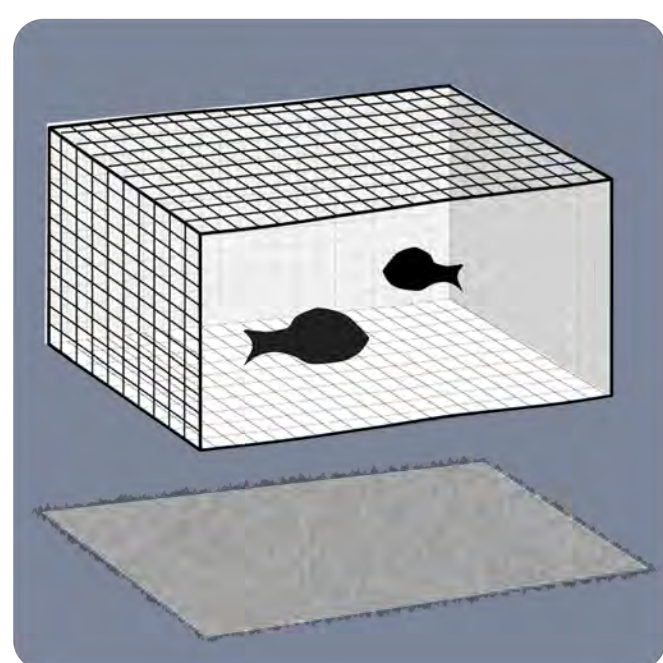
Glochidia are harvested from gravid females collected from the wild

Host fish are inoculated with harvested glochidia



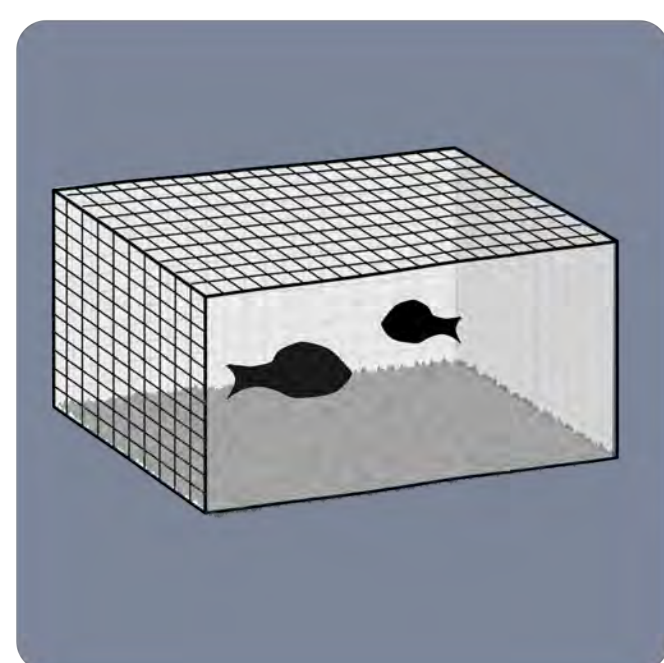
Free-Released Glochidia-Infested Fish

Inoculated fish are released directly into the wild. This method allows for the widest distribution and significantly reduces the workload of maintaining cages, but is very difficult to monitor or influence success.



Open-Bottom Cages

Inoculated fish are placed in cages with a mesh bottom. Cages are placed in the river, at a designated relocation site. Glochidia develop into juveniles and fall off onto the substrate below. The cages are removed and the juvenile mussels are left behind on the river substrate.

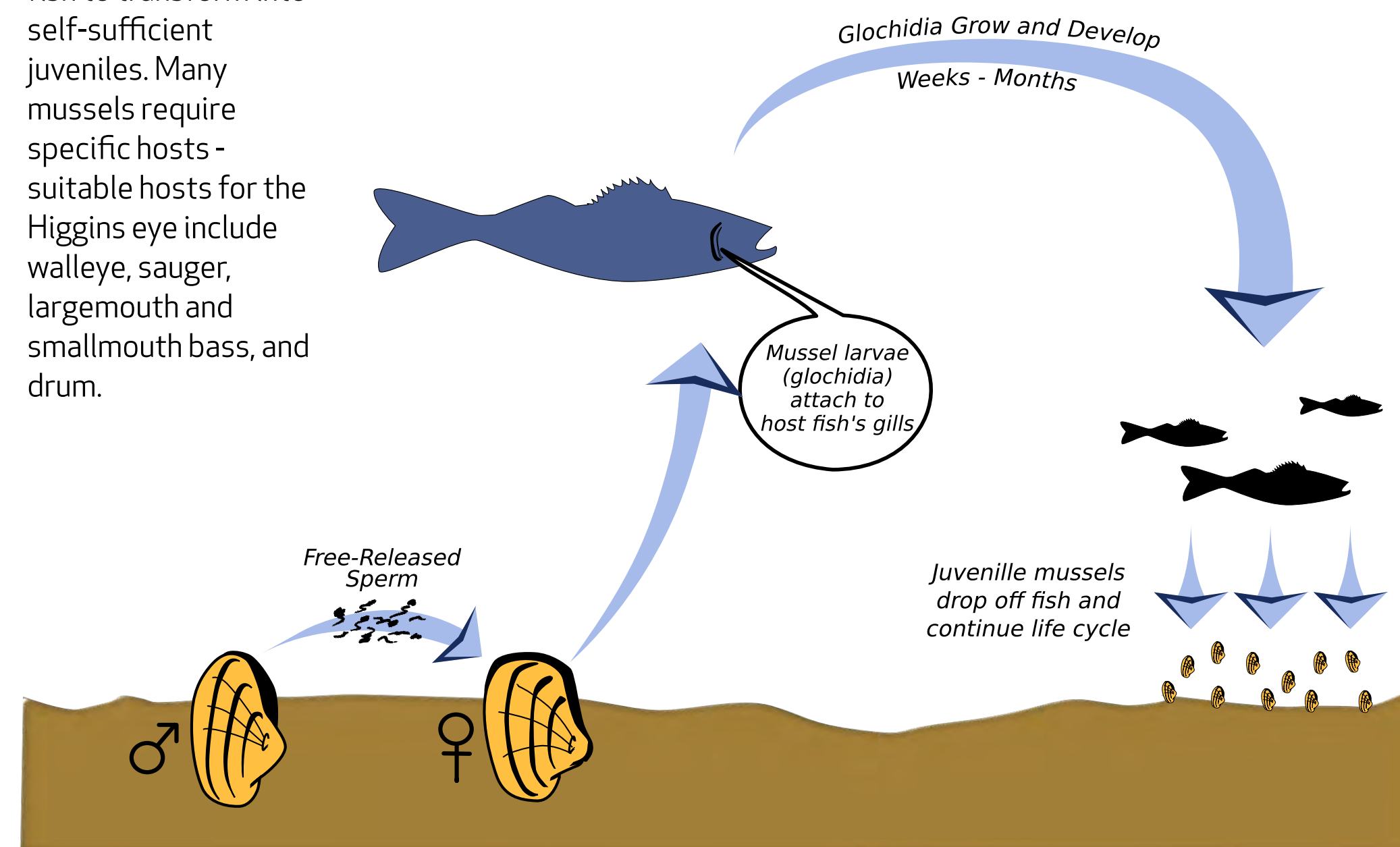


Closed-Bottom Cages

Inoculated fish are placed in cages. Juvenile mussels fall off the fish onto the bottom of the cage. The fish are released, but the mussels can be grown in cages for several years to reduce the threat of predation, then collected and transported to designated reintroduction sites.

Typical Unionid Life Cycle

Higgins eye and most other unionid larvae must attach to a host fish to transform into self-sufficient juveniles. Many mussels require specific hosts - suitable hosts for the Higgins eye include walleye, sauger, largemouth and smallmouth bass, and drum.



The Higgins eye's Struggle

The Higgins eye was added to the United States List of Endangered and Threatened Wildlife and Plants in 1976 (only 3 years after the inception of the U.S. Endangered Species Act.)

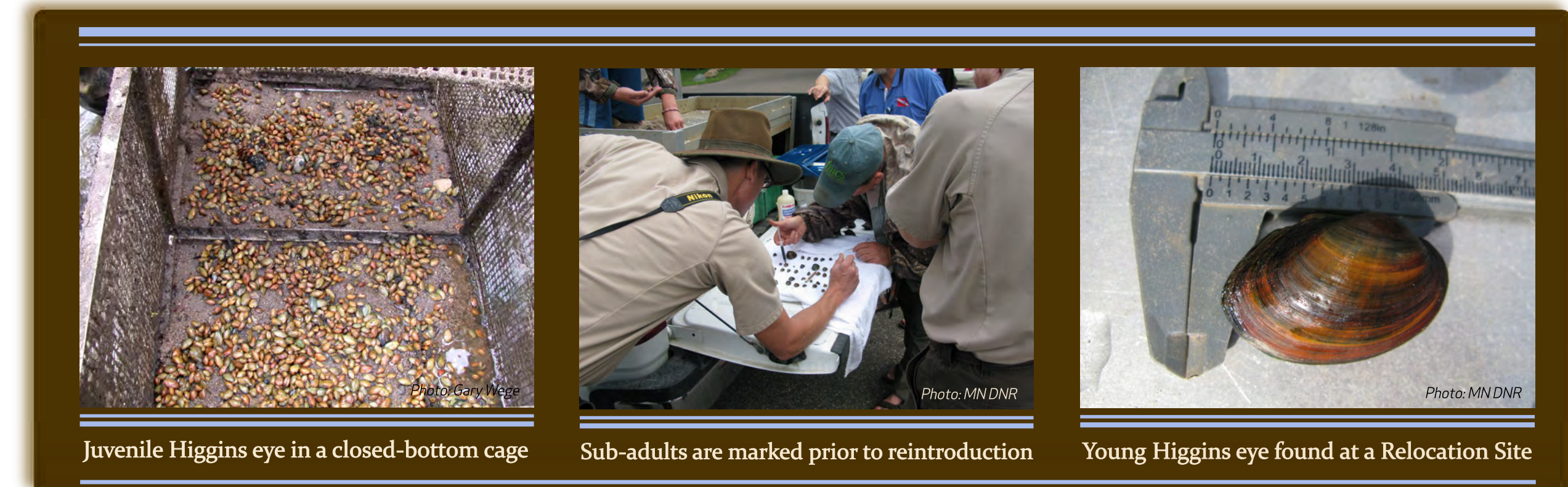
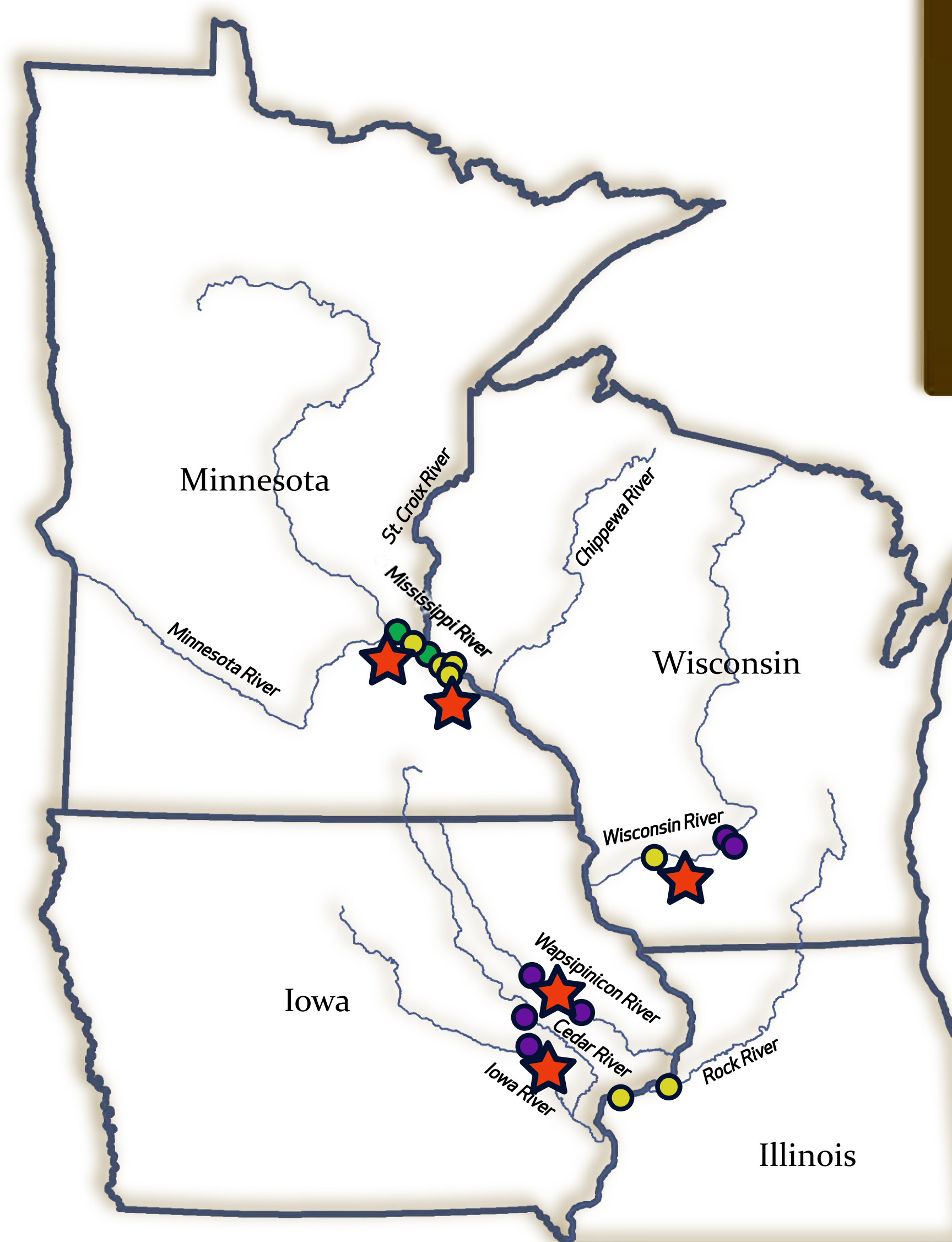
Habitat loss and degradation due to factors such as sedimentation and pollution have contributed in large part to the historic decline of freshwater mussel species on the Upper Mississippi River.

Zebra Mussels

The non-native zebra mussel was discovered in the Upper Mississippi River System in 1991 and quickly became a significant threat to freshwater mussels, including the Higgins eye. Zebra mussels attach to hard surfaces in the water, including freshwater mussel shells, which can limit native mussels' abilities to feed or reproduce. Zebra mussels also compete with native mussels for food.



Reintroduction



Accomplishments to date include (shown on map):

- ★ New Higgins eye individuals recently found following reintroduction efforts!
- 471 naturally-propagated adults relocated to areas with minimal zebra mussel infestation
- 44,671 sub-adults reintroduced from closed-bottom cages
- 30,000 glochidia-infested fish free-released or in open-bottom cages

Monitoring is planned to continue until at least 2026, but early monitoring efforts have indicated that reproduction may be occurring at several reintroduction sites.