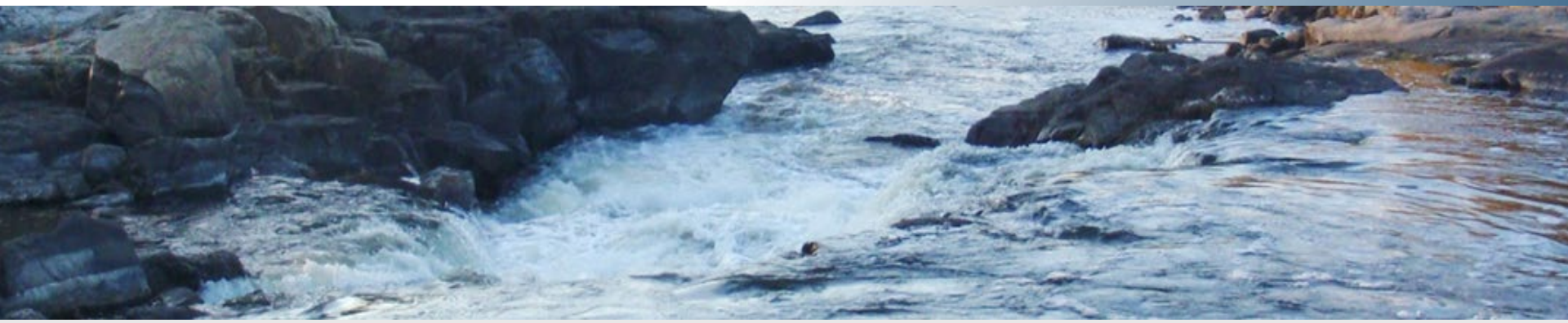
Stories of River Recovery in Minnesota

RIBBONS OF LIFE | BENEFITS OF RIVER RECONNECTION



DEPARTMENT OF NATURAL RESOURCES

Division of Ecological and Water Resources
River Ecology Unit

CHAPTER 1

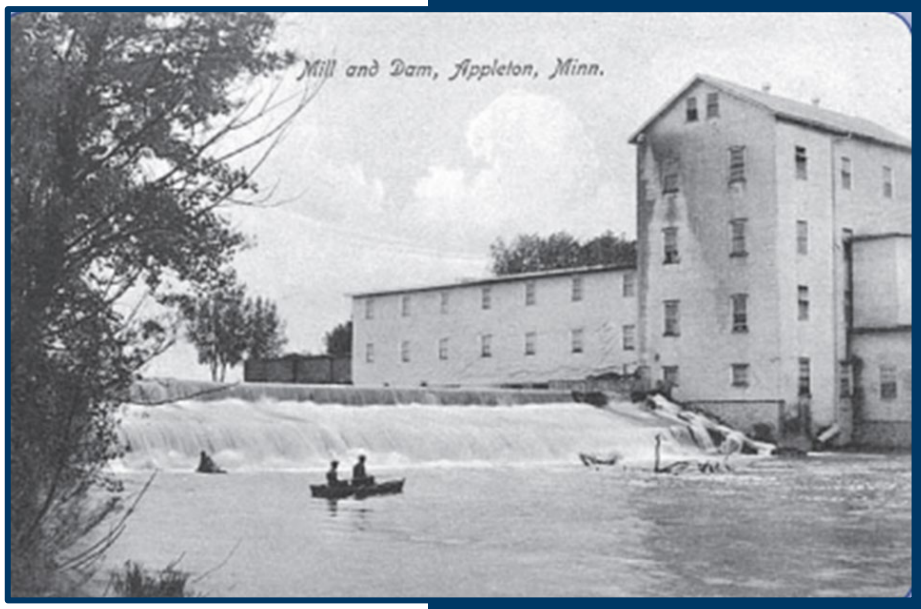
Reconnecting the lower Pomme de Terre River

DEPARTMENT OF NATURAL RESOURCES

Renewed Connections

Reconnecting the Pomme de Terre

Like most stories about dams, this one starts with good intentions. In 1872, a 16-foot-high milldam was built on the Pomme de Terre River in Appleton, Minnesota. The mill provided the industrial roots for the small town of 2,871 people.



The Appleton Milldam in 1910. Photo courtesy of the Minnesota Historical Society.

Fast forward 120 years; by the mid 1990's the benefits of the dam were wearing thin. The reservoir in Appleton had accumulated up to 15 feet of sediment and the dam no longer powered a mill. The dam was a complete barrier to fish migration, with carp and bullheads now the dominant fish species upstream of the dam. The reservoir had also submerged and buried the gravel riffles needed as fish spawning habitat, further impacting the fishery.

By 1997 the reservoir created by the dam had filled with sand.

The Impetus for Reconnection

Flood Brings New Perspective

The city was discussing the cost and benefits of either rebuilding or removing the dam when the spillway was undermined by a record flood in April 1997. That flood brought the momentum needed to move toward restoring the Pomme de Terre as a free-flowing river.

Dam Removal and Channel Restoration

In 1998 and 1999 the damaged dam was removed, and a series of low-profile riffles were built to replace the dam. These step-like riffles were designed to retain the 120+ years of accumulated reservoir sediment in place while still allowing fish and other aquatic life to navigate up and down the river. Later in 1999, the river channel and floodplain were restored to properly accommodate the range of river flows and sediment now being transported by the free-flowing river. The newly excavated meandering river channel was stabilized with wood, plantings, and boulder riffles. Trees were planted in the newly exposed floodplain.

The reconnected Pomme de Terre River was now able to allow fish and other aquatic life to travel unimpeded for 45 miles upstream, all the way to Morris, MN.

The Appleton Milldam spillway breach following flooding in April 1997.

The dam was removed and replaced with a series of low-profile riffles by the MN DNR.

Species Respond to Reconnected River

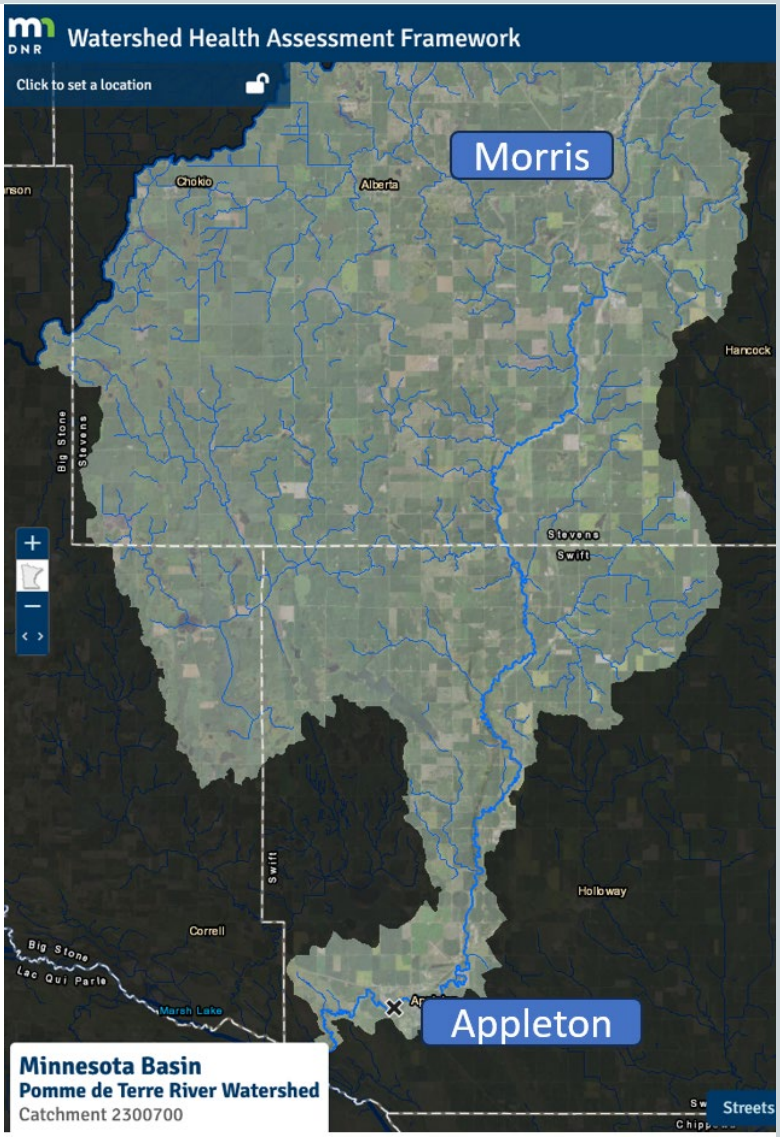
And the native species returned…

The return of native fish and mussel species to those newly opened river miles was well documented, and monitoring of their recovery has continued.

It was reported that people began catching walleyes in the restored river and fish surveys documented the return of 17 native fish species. Important mussel hosts like channel catfish and freshwater drum helped mussel species re-establish mussel beds 45 miles upstream to near Morris Dam, the next barrier.

In 1997 in the former millpond impoundment, there were only three mussel species documented alive. In 2007, 8 years after reconnection, that number increased to seven species. Three of those seven species had never been found alive upstream of the former dam.

A freshwater drum, walleye, and two boys with a walleye caught in Appleton.



Explore this map in your browser

Looking Downstream to the Minnesota River

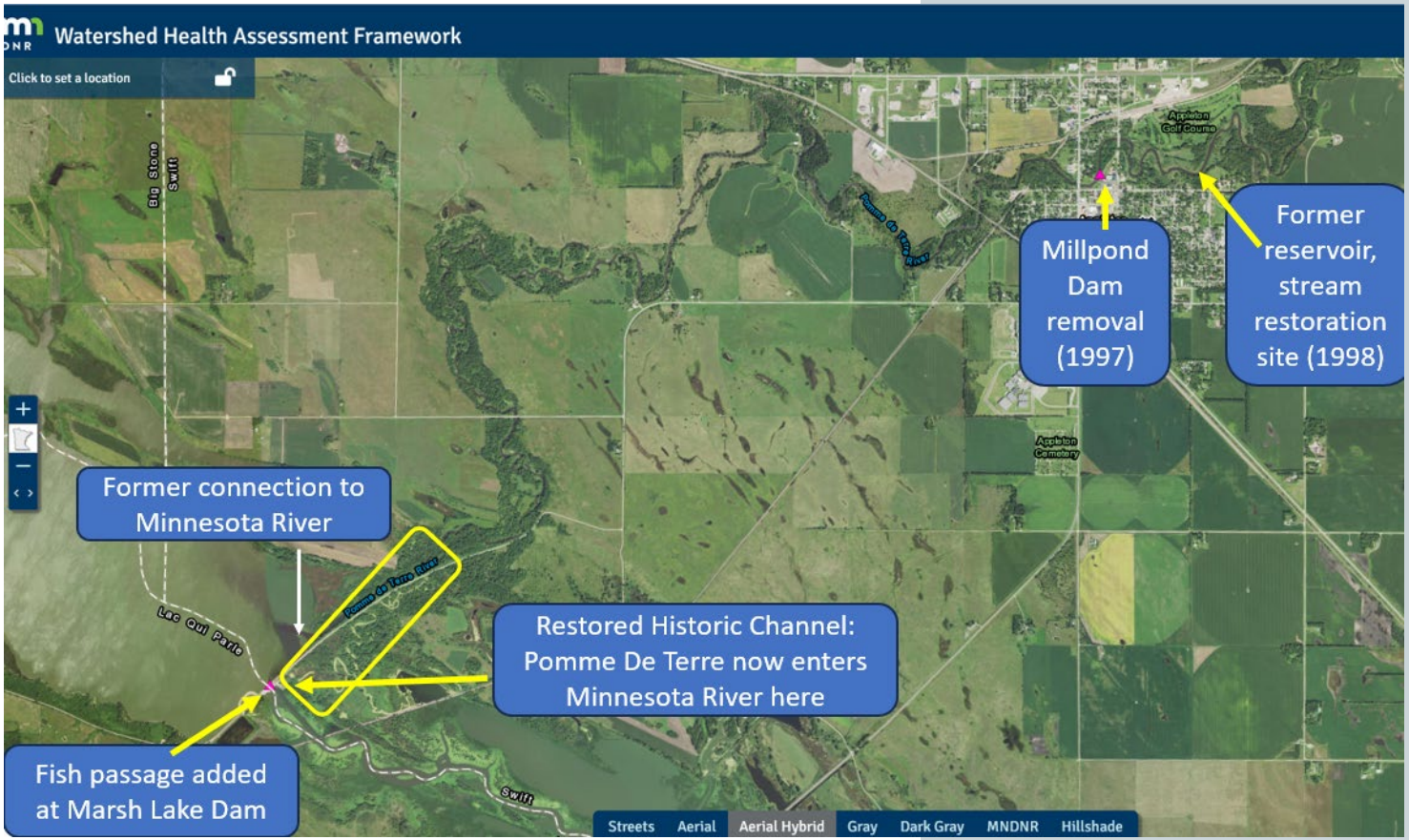
Connecting the Pomme de Terre to the Minnesota River

With the Pomme de Terre River now reconnected to 45 miles upstream, attention shifted nine river miles downstream to the Marsh Lake Dam on the Minnesota River. The Pomme de Terre River flowed into the Minnesota River at Marsh Lake above the dam, again disrupting upstream and downstream migration. To reopen fish and mussel migration on the Minnesota River, two additional projects were completed in 2018.

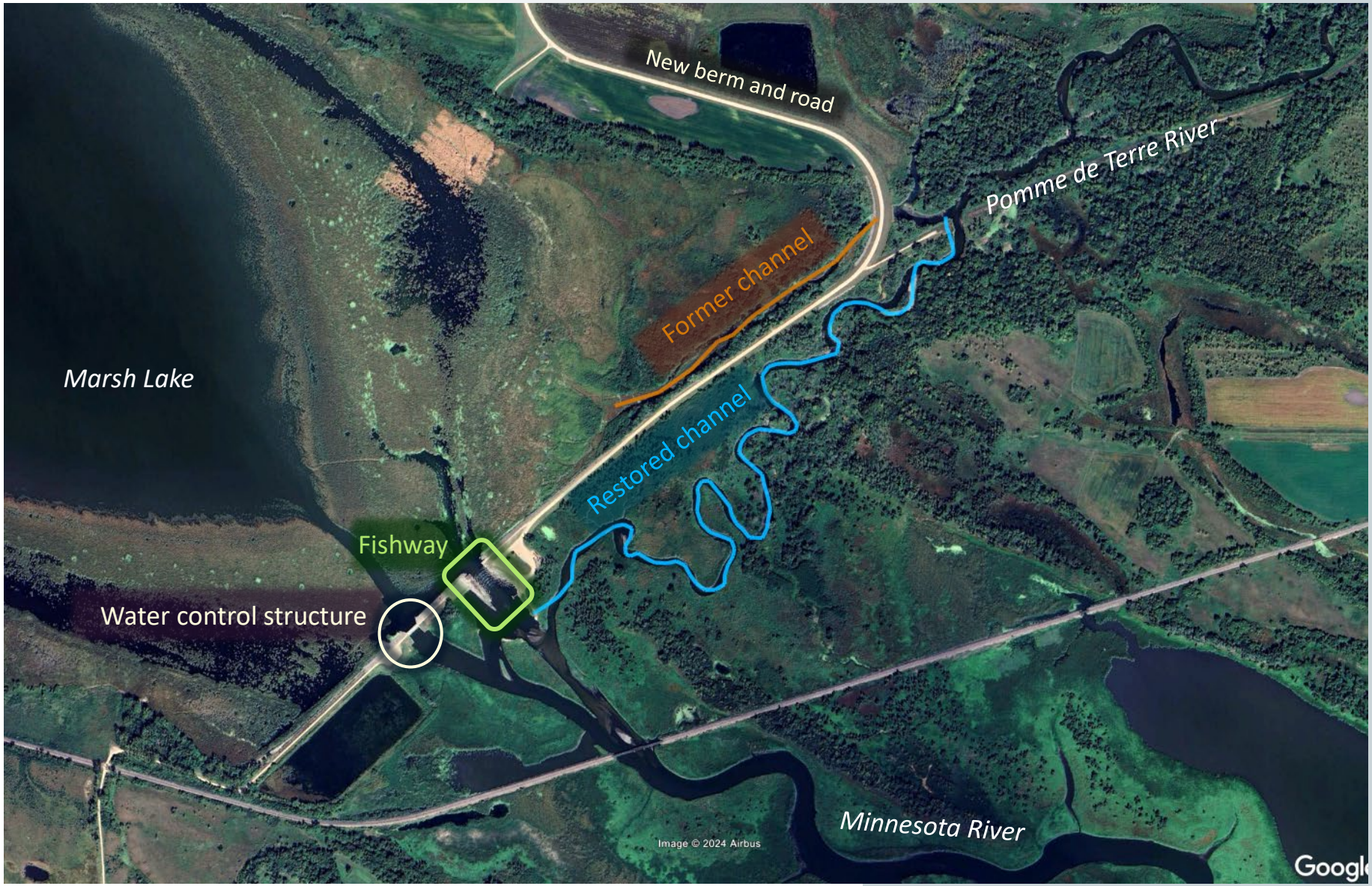
Explore this map in your browser

The **first project** rerouted the main stem of the Pomme de Terre River into the abandoned historic channel that enters the Minnesota River below the Marsh Lake Dam.

The **second project** redesigned the Marsh Lake Dam to allow fish to pass and a water control structure was built to maintain Marsh Lake water levels.



A Closer Look at Downstream Projects



Changes made to the Pomme de Terre River and Marsh Lake.

The Reconnected River Benefits Native Species

Fish recovery on the Pomme de Terre

Fish surveys since the 1940s have documented 67 species of native fish species is this entire watershed, from the small darters and shiners to the bigger channel catfish and lake sturgeon. Of those 67 species, 17 were found nowhere upstream of the Appleton dam. **Since the barriers were removed, 12 of those 17 missing species have returned to the upstream watershed**. The larger species that returned include channel catfish, freshwater drum, silver redhorse, greater redhorse, white bass and quillback. The smaller fish include banded darter, least darter, central mudminnow, northern redbelly dace, and rainbow darter.

Mussel recovery on the Pomme de Terre

The work of returning mussels to places where they have been lost or diminished is the mission of the MN DNR CAMP (Center for Aquatic Mollusk Programs). The DNR CAMP staff and volunteers relocated mussels from areas where construction and channel dewatering would impact existing mussel beds. They moved 3,382 mussels including 13 different species, from the mainstem of the Pomme de Terre River to a site with suitable habitat in the Minnesota River. They also monitored mussel recolonization into the reconnected historical channel. Within four years most of these species had naturally recolonized and established mussel beds in the restored channel, further stabilizing the streambed and reestablishing the biodiversity of this dynamic river ecosystem.

Mussels were collected, identified, and moved from the channel before it was dewatered to suitable locations in the Minnesota River.

Mussel Recovery on the Pomme de Terre

More on Mussels…

The Pomme de Terre continues to be a showcase of mussel recovery after the removal of the Appleton Dam and reconnecting the lower river with its historical channel directly connected to the Minnesota River in 2018. The detailed monitoring data from the CAMP staff has been key to understanding the mussels of the Pomme de Terre.

Mussel Density Data Reveals Natural Recruitment

In addition to finding species in river reaches where they had long been absent, the CAMP experts have documented increases in mussel density. For example, the state threatened Elktoe mussel was not observed during sampling from 2012 to 2014, but juveniles less than 3 years old were found in 2023. What's more, the *density of all mussels increased over sixfold from 2012 to 2023, due entirely to an increase of young mussels.*

Strong successful production and survival of juveniles, termed recruitment, was found at multiple sites downstream of the historical Appleton Dam in 2022-2023. With most mussel species in the Pomme de Terre River having a life span of 10 to 30 or more years, this dominance of young mussels shows that the mussel populations, including Elktoe, increased recently. It appears that dam removal and historical channel restoration were both needed to create the healthy, connected river system that reinvigorated the mussel community with the natural reproduction that is now occurring. (Learn about the Elktoe mussel)

CAMP staff diving for answers.

Young Deertoe mussels collected from reconnected reach.

Why is Connection the Key to Healthy Rivers?

Fish and Mussels Thrive Together

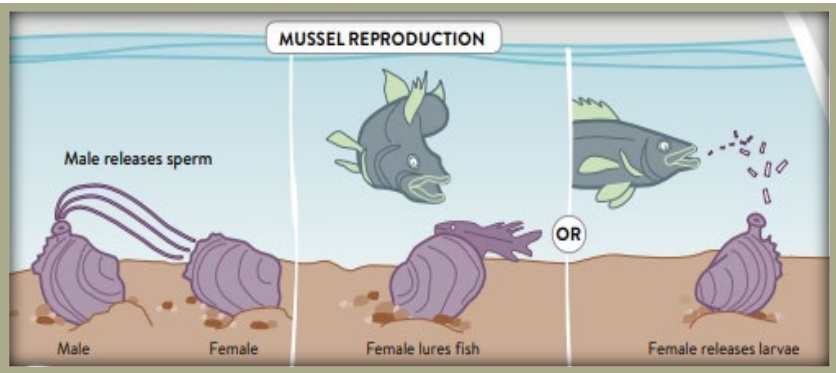
There is an interesting twist to this story that helps illustrate the unseen consequences of barriers in our rivers and streams. It is easy to picture how a dam stops fish from migrating upstream and downstream, and limits access to important spawning habitat or places of refuge during winter extremes, floods and droughts. The less well-known story matches the fate of our endangered freshwater mussels to that fish migration story.

For mussels to complete their life cycle, the mussel 'babies' (glochidia) must attach themselves to the gills of fish. What's more, fish are the only way mussels can travel upstream in a river. The glochidia hitch a ride until they develop enough to drop off and establish themselves on the riverbed, often in a new location. If fish cannot travel, neither can mussels.

Connecting with the 'Right' Host Fish

While that story is interesting, the relationship between mussels and fish is even more intricate. Most mussel glochidia can only attach to specific fish species known as their 'host fish'. Some can transform on a variety of host fish; others can only use one species. They even develop 'lures' that draw the fish species they need to come close enough for the babies to attach. But if the fish species they need is blocked from the mussel bed, the mussels cannot complete their life cycle, and their population will die out over time.

Being blocked is precisely the predicament Elktoe mussels in the Pomme de Terre were in. Their host fish are generally from the sucker family, such as Big Mouth Buffalo, White Sucker and Redhorse. With connection to nearly half of their migratory host fish species long severed, populations of this mussel species eventually disappeared as they were unable to reproduce. Other mussels in decline included the Deertoe, Pink Heelsplitter, and Fragile Papershell mussels that all use Freshwater Drum as a host.



Native mussel's intricate reproductive cycle.

Female Pocketbook mussel lure mimics a minnow to draw in its host fish.

Mussels Help Create Healthier Rivers

Recovery Underway

To recap, the increase in mussel diversity and abundance are mostly attributed to an increase in the abundance and diversity of their host fish species. Since reconnecting the historical channel, channel catfish, freshwater drum, silver redhorse, greater redhorse, and quillback that were previously rare or absent have returned in strong numbers.

These species are important host fishes for several species of mussels in the Pomme de Terre. The CAMP crew has plans to survey the Pomme de Terre in 2024-2025 to further assess the ongoing changes in the mussel community associated with these restoration projects.

Colorful assortment of tagged mussels.

Mussels and Healthy Rivers

These entwined life cycles provide benefits far beyond the fate of a single mussel or fish species. As the 'coral reefs' of our river systems, mussels are filter feeders that remove contaminants from the water, improving water quality and water clarity that benefits the entire aquatic community. (Check out this cool mussel filtration video.) Mussel beds are a living substrate, a complex matrix that provides habitat for an immense range of fish and aquatic bugs. Historically, mussels dominated many streams in Minnesota as the base for complex food chains and life cycles that benefitted water quality and biodiversity. Rebuilding mussel populations brings back a critical missing piece needed to reclaim our healthy river heritage.

Mussels of Minnesota (pdf poster)

Mussels interspersed across the stream bed.

Flowing Ribbons of Life

What's Next for the Pomme de Terre?

Stories of success on the lower Pomme de Terre River have brought more attention to fish passage and mussel recolonization for the Upper Pomme de Terre. Steps are underway to create passage through the Crissy Dam in Morris, as well as Perkins Lake and Pomme de Terre Lake further upstream. As more of the Pomme de Terre flows free, the river will meander its way toward healthier connections that benefit aquatic and human communities.

Why Do We Care about Free-Flowing Rivers in Minnesota?

The Pomme de Terre story of recovery can be replicated other places in Minnesota. Over time, interrupted life cycles are completed, and ecological relationships are re-established. Restoring free-flowing rivers reestablishes travel corridors for aquatic life that allows healthier, more resilient system to emerge.

Building Climate Resilience

Within Minnesota, providing access to more river miles is of increasing importance as our changing climate introduces the need to adjust more quickly to unpredictable temperature and rainfall patterns. Greater biodiversity and connections to a wider range of habitats improves the resilience of our aquatic systems, allowing species to adapt and to seek a range of habitat types for refuge.

Spreading River Health

Looking beyond Minnesota, we have some responsibility for the three major river systems that originate here. The Minnesota, the Red and the Mississippi Rivers all start from humble beginnings within our state. What we send downstream matters. While we often think of this as a water quality responsibility, our rivers carry much more than water. These three 'big rivers' are flowing ribbons of life that are needed to reinvigorate downstream aquatic and human communities. We have a stewardship responsibility to keep that abundant biodiversity flowing to our downstream neighbors.