

MUSSEL LOSS

What can we do about the western pearlshell's steady decline?

BY PAUL J. DRISCOLL

While surveying fish populations on an upper reach of Browns Gulch Creek, a tributary of Silver Bow Creek northwest of Butte, Fish, Wildlife & Parks fisheries biologist Jason Lindstrom and his crew began noticing iridescent blue shells on several sand bars. Lindstrom thought that seemed odd, because it wasn't a stream known to contain native freshwater mussels. Then he looked down into the stream substrate and was surprised to see living specimens of the rare western pearlshell mussel.

"What was so strange was that we'd always thought of the western pearlshell as living mainly in clear, cold streams," Lindstrom says of his 2007 discovery.

That's certainly not Browns Gulch Creek. The Montana Department of Environmental Quality (DEQ) ranks the stream as one of the basin's most degraded tributaries due to sedimentation (which suffocates trout eggs and underwater insects) caused by erosion, land cultivation, and roadwork in the surrounding watershed. What's more, non-native brook trout have replaced native westslope cutthroat, a species that pearlshells historically used as part of their reproduction process.

Yet for some reason, Browns Gulch contains western pearlshell mussels. The Montana Natural Heritage Program (MNHP) found large numbers of both adult and juvenile mussels, indicating a healthy popula-



MUSSEL MAN Ecologist Dave Stagliano transfers adult pearlshell mussels into Monture Creek in the Blackfoot Valley. Reintroductions could help offset the chronic loss of these native species throughout their range.

tion, in 2009 and 2014.

The Browns Gulch Creek discovery is the only good news for the western pearlshell in recent years. Elsewhere populations have tanked, causing biologists to worry about the species' long-term prospects. (Meanwhile, biologists have sounded alarms about infestations of non-native invasive zebra and quagga mussels, which threaten to damage Montana aquatic ecosystems as well as irrigation pipes, hydropower facilities, and boating equipment.)

In 2014, while working for MNHP, aquatic ecologist Dave Stagliano found no living western pearlshells during his 2014 survey of central Montana's Smith River and its tributaries. "Things look pretty grim for pearl-

shells there and in other parts of the eastern Missouri drainage," he says. Montana retains only about 20 quality western pearlshell mussel populations out of roughly 200 known historical locations.

The loss of western pearlshells means more than a native species gone forever, as tragic as that would be. The mussels filter stream water, making it cleaner. "Think of them as a stream's kidneys," says Stagliano. "Losing them is like losing your kidneys." Pearlshells also serve as indicator species. "If they are disappearing, that means you've got

STREAM "KIDNEYS" A single western pearlshell mussel can filter one gallon of water per hour. Healthy mussel populations can keep streams clean while converting bacteria and bits of detritus into protein-rich "pseudo-feces" that feeds aquatic insects.



water quality problems, and it's only a matter of time before you also start losing aquatic insects and native trout," he says.

IRIDESCENT SHELL LINING

Freshwater mussels are among Montana's strangest creatures. Three to four inches long, the underwater animals are bivalves, possessing two opposing shells hinged by tough, fibrous ligaments. Though lacking big eyes, they possess sense organs that allow them to negotiate their underwater environment. Using its inhalant siphon, a mus-

sel draws in water over its gills. The gills absorb oxygen and filter out the protozoa, bacteria, and bits of detritus that the mussel consumes. The filtered water is then pumped out via the exhalant siphon.

The western pearlshell is the most common mussel in the Pacific Northwest, ranging from Alaska and British Columbia south to California and east to Wyoming and Montana. In Montana, the western pearlshell is the only native mussel west of the Continental Divide. Historically, it also lived east of the Divide in water that contained westslope

“If these mussels are disappearing, that means water quality problems, and it's only a matter of time before you start losing native trout.”



“Pearlshell” refers to the iridescent blend of minerals secreted by this species and some other mussels on the inside of the shell, called *nacre* and commonly known as mother-of-pearl.

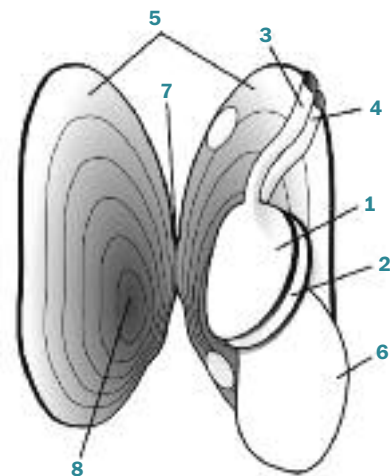
rents, structure, and depth provide ideal conditions for long-term survival. The best habitats are in deep pools or runs where the mussels can remain under several feet of water even during low summer flows. Gravel beds sheltered from heavy spring flows by upstream boulders also provide prime habitat.

Adults and young mussels slowly move a few inches at a time via a single “foot” (actually an organ), allowing them to adjust position to reach better underwater feeding lanes. For the most part, mussels are sedentary, rarely traveling more than a few feet within a gravel bed where they spend their entire lives. In winter, the mussels work their way down into the gravel and become semidormant until water temperatures rise in spring.

Mussels purify water. A single mussel filters up to a gallon per hour during the summer. “When multiplied by thousands or tens of thousands of mussels in a stream, all that filtration helps keep water clean,” Stagliano says. Also, the protein-packed “pseudo-feces” the mussel emits enriches the surrounding streambed and feeds salmonflies, stoneflies, caddis flies, and other aquatic insects.

Freshwater mussels require fish hosts for reproduction and distribution. In Montana’s

Western pearlshell mussel anatomy (interior)



1. Frontal gill
2. Back gill
3. Exhalant siphon
4. Inhalant siphon
5. Shell halves
6. “Foot”
7. Hingeline and ligament
8. The shell’s thickest part, the umbo

cutthroat trout. (Central and eastern Montana are also home to the native fatmucket and giant floater mussels.)

“Pearlshell” refers to the iridescent blend of minerals secreted on the inside of the shell, called nacre and commonly known as mother-of-pearl. The calcium carbonate material is the same substance that makes a pearl, created when an oyster or mussel secretes minerals to cover a grain of sand or other irritant that gets between its shells. Occasionally a western pearlshell mussel produces a small, misshapen pearl, but for the most part it’s the shell lining that has ornamental value.

Aboriginal peoples probably used the shells of western pearlshell mussels for decorative purposes and as tools like hide scrapers.

Natural history writer Paul J. Driscoll is an information officer with the Montana Department of Environmental Quality. He has previously written articles for Montana Outdoors on axolotls and locusts.

In 1900, University of Montana biologist Morton Elrod reported finding spent pearlshells in large piles—known as middens—along the Clark Fork and Bitterroot Rivers. A 3,000- to 5,000-year-old archaeological site near today’s Three Forks of the Missouri also indicates the historical presence of pearlshell mussels. Biologists use these archaeological finds to map where the native species historically occurred.

Though saltwater mussels are widely eaten worldwide, the flesh of the pearlshell and other freshwater mussels is tough, rubbery, and muddy tasting. Wildlife is not so picky. River otters, raccoons, and muskrats sometimes find a bed of mussels and carry the aquatic animals to the banks, where they force open the shells and eat the fleshy interiors. The remains of such a feast is likely what Lindstrom found along the sand bars of Browns Gulch Creek.

WATER PURIFIERS

Western pearlshells congregate where cur-

“A fully mature pearlshell mussel alive today conceivably could have dropped off a cutthroat trout’s gills during Theodore Roosevelt’s presidency.”



part of the northern Rockies, the western pearlshell evolved alongside native west-slope cutthroat trout. Elsewhere in the Northwest, steelhead, rainbow, and salmon help distribute the species. Each spring, when water temperature and flow reach just the right level, male mussels release sperm through their exhalant siphon. The sperm washes over nearby females, which take it up through their inhalant siphon to fertilize eggs held in their gills. Later, the females release millions of the fertilized eggs, called glochidia. Newborn trout fry gobble up the eggs as they float past. Once inside the fry, glochidia attach to the gills and become enclosed in cysts. For the next one to three months, they harmlessly live off the fry. The tiny mussels then fall from the fish and settle to the stream bottom, usually in a new stretch of stream. If the habitat is healthy, young mussels can burrow into the gravel and survive—often for decades.

In fact, the western pearlshell is one of Montana’s longest-lived species, on average surviving 50 to 70 years. Some scientists think specimens can live for more than 100 years. That means a fully mature pearlshell mussel alive today conceivably could have dropped off a cutthroat trout’s gills during Theodore Roosevelt’s presidency.

POLLUTED TO DEATH

That western pearlshells live a long time does not mean the species is resilient. Just the opposite. Like other long-lived species, such as Montana’s white and pallid sturgeons, mussels grow and develop slowly. It may take them a decade or more to reach sexual maturity. As with sturgeons, a mussel that dies during its first several years of life never has a chance to reproduce and replace itself in the population. Compare that to fast-maturing species like cottontails, which rarely live more than one year but can produce four litters of young during that time.

What causes western pearlshell populations to decline? Stagliano says it’s the combination of sediment (from streambed alterations and cattle trampling the banks) and excess nutrients (from overfertilized crops or leaky septic systems). Even more harmful is low water. “When stream stretches dry up, the mussels are exposed and die,” he says.

Stagliano has seen population declines firsthand. While working for the Montana Natural Heritage Program in 2003 and 2004, he conducted benchmark surveys of western pearlshells on streams and rivers throughout Montana. In follow-up surveys for FWP on the same waters a decade later, he found that

western pearlshells were fast disappearing.

Some biologists suspect the loss of west-slope cutthroat trout in those streams—caused by the same factors harming mussels—may be contributing to the pearlshell’s decline. Stagliano concurs, but notes that non-native brook trout and rainbows, which have replaced cutthroats in many streams, may sometimes serve as adequate substitutes.

That may be one reason pearlshell mussels have survived in Browns Gulch Creek. “Brook trout may not be the ideal species, but apparently they are working out for the mussels,” Stagliano says. Another reason could be that parts of the stream are not as degraded as previously thought. “Maybe the section where they are persisting is in better shape than downstream, which really is in rough shape,” he says.

One way of helping stem the pearlshell’s decline is to reintroduce mussel colonies into streams where the species historically lived. Several efforts in Washington State have appeared to work. FWP and the U.S. Fish & Wildlife Service hired Stagliano to try similar reintroductions in Montana. Unfortunately, only one Montana reintroduction, into Monture Creek near Ovando, has shown even modest results.

Conservation agencies now hope to boost success by introducing cutthroat fry carrying mussel glochidia instead of planting adult pearlshells. Stagliano says plans are under way for scientists to closely observe adult mussels in a laboratory setting to learn more about the timing and water temperatures needed for successful reproduction. Once female pearlshells in aquariums are ready to release their glochidia, genetically pure cutthroat fry will be added to feed on the fertilized eggs. Then the tiny fish will be released into suitable streams.

Though reintroductions could help offset some loss of western pearlshells throughout the species’ range, they cannot reverse the mussels’ widespread decline. Streams and rivers throughout western Montana where pearlshells were once abundant now hold none of the mussels. That signifies more than a little-known animal’s demise. It also means that Montana’s cold, clean, abundant water that supported the species for hundreds of thousands of years is likely disappearing, too. 🐼