

## Musseling Up

Mazzacano says Oregon's freshwater mussels face a lot of challenges, and some of them — like climate change and habitat loss — they share with many other animal species.

In the case of climate change, rivers are heating up, making it more difficult for the mussels' host fish. In terms of habitat loss, dams make it not only harder for the host fish, which often can't get past dams despite fish ladders and even trucking, but also harder for mussels to have the right river flows, substrate (the gravel, rock or sand they dig into) and temperatures. Rivers below dams can be starved for sediment, she says.

And then there are those host fish. Freshwater mussels like the Western pearlshell have an "absolute dependence on host fish," Mazzacano says. They are "salmon specialists" that need native salmonids to survive.

A mussel's life cycle goes something like this: The male mussels release sperm into the water, and the females inhale it. Thus the name "bivalve" because mussels have one valve that takes things in and another that sends it out. Embryo mussels develop into larvae called "glochidia" and are released by the female mussels. (Interesting side note: It's rare, but Western pearlshells can be hermaphrodites.)

Once released, the glochidia need the host fish. Blevins says some glochidia have hooks. Some don't, but they find a way to grab onto a fish's fins or gills, take a bite, hold on and encyst. The fish swims away and "the glochidia hang on for the ride," she says.

While Western pearlshells need native fish like cutthroat trout, Chinook, Coho and sockeye salmon, floaters tend to be generalists when it comes to their fishy hosts. But all of Oregon's freshwater mussel species need to be parasites on fish as part of their life cycles. Without the fish, the mussels cannot reproduce.

## Musseling In

Oregon is home to invasive Asian clams — possibly brought here because people saw them as tastier than Oregon's native mussels, Mazzacano says.

Or possibly, according to Alexa Main, they came to the Northwest via the Great Lakes, "as all the bad things seem to," she says, only half in jest. Main is a mussel and Pacific lamprey biologist with the Confederated Tribes of the Umatilla Indian Reservation.

Asian clams not only can compete with native mussels for food, they may also consume larval or juvenile mussels.

Main points out that not only do dams limit the mussels' access to native fish, but mussels are also up against nonnative fish. Nonnatives will eat the host fish, and native mussels are not interested in latching on to most nonnative fish — similar, Mazzacano, says to caterpillars that only like to munch on one type of plant.

And that's not all that Oregon's unobtrusive mussels are up against. There are also invasive mussels — zebra and quagga mussels, malignant little bivalves that have been invading lakes and rivers across the country. They have not made it to Oregon. Yet.

One economic assessment showed that a mussel invasion would damage hydropower, irrigation, fish hatcheries and municipal water facilities at a cost of \$500 million annually to the Pacific Northwest.

"They don't need a host fish; they shoot out the baby mussels," Mazzacano says of the invasives' reproductive technique.

And while Oregon's native freshwater mussels take years to grow up and reproduce, zebra and quagga mussels mature quickly and could compete for mussel habitat.

But if Oregon's mussels are in decline, you might think the invaders could fill in the niche that mussels have in filtering water. Unfortunately, zebra and quagga mussels reproduce so quickly the filter feeding they do "almost sterilizes the water," Mazzacano says. Rather than benefit, they damage the ecosystems they invade.

## Mussels and First Foods

Thanks to the Confederated Tribes of Umatilla Indian Reservation in northeast Oregon, mussels west of the Continental Divide are the subject of the region's only effort to re-propagate freshwater mussels.

The Umatilla, however, came to the mussel quandary and restoration differently. According to tribal member Wenix Red Elk, the CTUIR mussel effort came about as a result of the tribe's First Foods policy.

Red Elk explains, "When you lose a food source, you lose the food source but you are also losing the entire culture of that river area, that fish, that land" and the culture, the language and family stories that went with it. "It's so much bigger than losing a species."

First Foods, she says, are "natural, from that land, and have always been there, at least for us. For us, First Foods are the foods we were given by Creation."

Tribal belief says the Creator asked the foods which of them would take care of the people, and salmon was the first to promise, then other fish and mussels lined up behind salmon. The First Food serving ritual in the longhouse follows that order. First Foods are water, salmon, roots, berries, deer and elk.

While a Eurocentric viewpoint might try to save the salmon, the First Foods-informed perspective means mussels, lamprey and other key elements in the ecosystem must be saved as well in order to save salmon.

The tribes have a reciprocal response to those foods, Red Elk says. "The foods give life to us, and in turn, we protect them."

She says the tribes "have been doing this type of work from time immemorial," and they gather what they need, whether it is salmon, willows or wood for teepee poles, in such a way they come back more plentiful.

Elders tell stories of where mussels were and where they were eaten, and that information — the knowledge of the people — is brought to the scientists. "That's what's so unique about us," Red Elk says. "We put that oral history first."

This approach brings attention to species and ecological processes that those outside the Umatilla reservation may not recognize or value. Traditional ecological and cultural knowledge is brought together with science.

"Our keystone river is the Umatilla River," says Main of the CTUIR mussel project. "First Foods takes the entire river as whole, takes the pieces of what we want to see, and breaks it down into individual components. Not just a salmon run in 10 years, but everything that goes into a healthy ecosystem."

Back in the 1960s and '70s, Main says, Western pearlshells were made locally extinct in the Umatilla River. The Umatilla, Cayuse and Walla Walla Indians used pearlshells exclusively as a food source, and for jewelry and tools.

"It's really telling to see we've completely extirpated that from an entire system," she says.

Elizabeth Glidewell is the Freshwater Mussel Project lead for the CTUIR. She says the project started in 2003 and, while it has gathered vast amounts of historical data, she echoes the cry that there is still much to discover about mussels, from where they are and how many are left to their reproductive timing.

But, she says, the project is "close to being able to address the long-term goal of restoration."

Working with mussels, Glidewell tells me, is a way of "cheering for the underdog."

Knowing that the pearlshell uses salmonids, Glidewell says that scientists can take the mussel larvae and attach them to the fish, and give them time to metamorphose in a lab setting. They can then be collected and released into the river as juveniles or later on.

Aware of the argument that salmon raised on fish farms are genetically inferior, and even stupider, and thus less able to survive than wild salmon, I ask Glidewell if that is a concern for something as small and seemingly brainless as a mussel.

"We don't think so," she tells me. They are selecting for traits that will let the mussels survive in the river and with good genetics.

Main adds that the plan is to out-plant mussels into the Umatilla River in 2018 or, at the latest, 2019.

Back in Eugene, on the banks of the Willamette, Williams tells me that one thing those working on mussels do know is that overall, Western pearlshells are declining.

Maybe, just maybe, he says, if enough information about mussel distribution and abundance is collected, they could be petitioned for listing under the federal Endangered Species Act. "But right now," he says, "I don't know of anyone working on that." ■

*To find out more about Willamette Riverkeeper's efforts to document mussels in the Willamette, go to [willamette-riverkeeper.org](http://willamette-riverkeeper.org). To see Xerces Society's mussel research, check out [xerces.org](http://xerces.org). Find the CTUIR mussel project via [ctuir.org](http://ctuir.org).*

### UNEXPLAINED DIE-OFFS LIKE THESE ARE ANOTHER REASON FOR CONCERN ABOUT FRESHWATER MUSSELS

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