

Threats to freshwater mussels and the consequences for ecosystems

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At the University of Oklahoma's Aquatic Research Facility in Norman, zoologist Caryn Vaughn shows off freshwater mussels that she's recently collected from rivers in the southeastern part of the state. One river alone may have as many as 30 species of mussels.

"They have very colorful names. This is the pistol grip, because you can hold it in your hand like a pistol," says Vaughn. There are also mussels commonly known as the rabbitsfoot, bankclimber, pigtoe, pimpleback, and fatmucket. Vaughn is in a good location to do her research. Oklahoma is home to 55 mussel species all together, out of the approximately 300 mussel species found across North America.

These invertebrates play a crucial role in river ecosystems.

"I've had colleagues call them 'fuzzy rocks' because algae grow on them, but they're really important filter feeders. They're very important ecologically and they're actually very interesting as well," she says.

With support from the National Science Foundation (NSF), Vaughn studies mussels' role in their environment. "Almost 70 percent of the species are considered threatened in some way. They're the most globally threatened freshwater organism there is," she says.

Vaughn works with the mussels in large bathtub-sized tanks where she and her team have recreated the stream environment. But, in this lab setting, they can control such factors as temperature and flow rate.

Mussels need plentiful water to thrive, and healthy fish to reproduce. Vaughn explains their unusual [reproductive strategy](#).

"Freshwater mussels can't move very far. So the way they get around is by sticking their larvae on a fish. And the fish takes it to a new habitat," she says.

Vaughn showed some underwater video shot by biologist Christopher Barnhart of Missouri State University, which shows how mussels lure their fish host.

"The flesh of the mussel looks like a little minnow. It waves in the water. When a [predator fish](#) bites down on that, the glochidium (larval mussels) will be dispersed and infect the fish gills. Just one of the many little tricks mussels use for attracting fish hosts," continues Vaughn. "There are elaborate strategies for attracting the right kind of host, and then after they attach to the fish and grow into a juvenile, then you have to fall into the right habitat and riverbed to grow up into an adult. So, it's really a complex lifecycle, which is not well adapted to things humans are doing to the landscape."

Most mussels look pretty rough on the outside. But for decades, the beautiful iridescence of their inner shells caused them to be harvested to make fancy buttons. Their shells were also used to make the small beads that were put in freshwater oysters to seed pearls. The availability of cheap plastic and other synthetic materials finally put an end to most mussel harvests for those products.

The human need for water is now the biggest danger to mussels. Habitat destruction, fragmentation from dams, and more recently an intense drought in the southern plains have all contributed to destruction of mussel beds.

"This one river that we've been working in for over 20 years, we probably lost a third of the mussels in that river because of water levels. We probably could have saved a lot of them if we had better water management practices in place at the time of the drought. So we really need to take what we know and use that to help them manage the resources, so we can keep the mussel populations, while meeting human needs. That's a difficult thing to do," says Vaughn.

In the rivers she studies, there are often dozens of different species of mussels together in beds. That diversity, she's found, makes all the animals healthier.

There are 35 species in the Little River in southeastern Oklahoma, and perhaps 20 different species may live very close together.

"When the fatmucket and the bankclimber are together, do they do something different than mussels when they are just by themselves? They're definitely in better condition when they're in more diverse beds," says Vaughn.

The almost constant water filtering done by [freshwater mussels](#) provides a benefit for humans as well.

"Most of their bodies are these big gills, and they're filtering particles out of the water column, so they're filtering water and taking impurities out of it," explains Vaughn.

"So, the direction that we're trying to go next in our research is to put monetary values on these services that mussels are providing. We know how many mussels are out there, we know the rates at which different species filter water. So we ought to be able to compare the biofiltration of mussels to how much it costs for us to treat water, like in a water treatment plant. And hopefully show that, if you leave the mussels in the

river or if you restore mussels to the densities that they used to have, then it will save you this much money in [water](#) treatment," says Vaughn.

Believe it or not, mussels can live 30 to 50 years! Because of their longevity, and the current threats to their habitat, Vaughn and her team don't keep the mussels they take from the field.

"We bring them into the lab, we tag them, we use them in our experiments and then we take them back and set them free, basically because they're so long-lived, we don't want to cause any undue mortality," she says.

Mussel shells also shelter and nurture insect larvae and other tiny creatures. Another reason, Vaughn says, to help these [mussels](#) stay strong!

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