

Powering Progress: The Innovative Solution Taking Mussel Research and Restoration Further for Tribal Communities

Xylem's Flojet Technology Supports Advanced Solution to Replenish First Foods in the Western U.S.

Overview

The Confederated Tribes of the Umatilla Indian Reservation (CTUIR) is a sovereign governmental nation made up of three Native American tribes - Cayuse, Umatilla, and Walla Walla. In the 1855 Treaty of Walla Walla, CTUIR ceded 6.4 million acres of homeland in what is now known as northeastern Oregon and southeastern Washington. They retained reserved rights to hunt, fish and gather 'First Foods', an indigenous term for traditional foods that are native to the community such as freshwater mussels, salmon, elk and deer.

Today, the Umatilla Indian Reservation spans 172,000 acres, including a significant portion of the Umatilla River Watershed. While the three-tribe confederation boasts a population of 2,900 people, the tribes have been impacted by severe habitat degradation due to overfishing and hunting, and land use changes. Now, many of the First Foods relied upon for sustenance are at serious risk of becoming endangered. To return these foods to self-sustaining and harvestable levels, CTUIR have commenced a number of research and restoration projects.

Challenge

One such project is the Freshwater Mussel Research and Restoration Project - the first of its kind in the western U.S. Freshwater mussels are extremely understudied worldwide, and even more so in the western U.S where very few species remain. In 2002, having applied for funding from Bonneville Power Administration, CTUIR began an ambitious restoration project using historical data to



The Umatilla Indian Reservation spans a significant portion of the Umatilla river Watershed. In a bid to replenish freshwater mussels, a first food for the tribes, CTUIR began an ambitious restoration project in 2002.

determine what mussels were in existence in its home river, the Umatilla River, before expanding to other rivers in the area.

More than two decades later, CTUIR has the longest running freshwater mussel restoration project in the western U.S., and the only dedicated freshwater mussel propagation laboratory for western mussels, including the Western Ridged Mussel - a rare species specific to the western region. This year, CTUIR's laboratory propagated around 4,000 western ridged mussels, and more than 8,000 mussels have been propagated under the restoration program in total. Today, there are currently more than 2,000 juvenile mussels across three different species in CTUIR's laboratory.

Raising thousands of juvenile mussels in a laboratory requires meticulous control. The equipment and cultivation environment has to be just right. To aid successful and sustainable propagation, CTUIR deployed an innovative system that's capable of culturing juvenile mussels while taking the complexity out of culture processes. A central challenge of captive culture is maintaining adequate food levels while ensuring appropriate water quality - particularly for newly metamorphosed and juvenile freshwater mussels that are small and delicate.

The system deployed by CTUIR addresses those challenges by optimizing the flow of water and nutrients, aiding the slow but steady growth of the freshwater mussels.

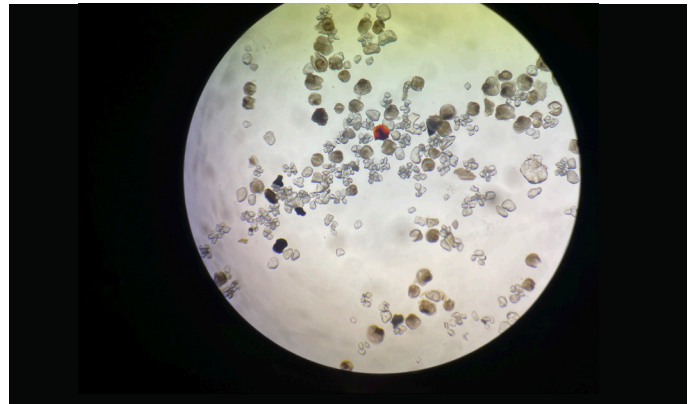
Solution

To support the system, CTUIR required a pumping solution that was capable of handling the right rate of flow while moving the fresh water up 10 feet from the reservoir to the dosing subsystem. Designers of the original system recommended Xylem's innovative Flojet 02840 Series light duty water boost system due to its renowned reliability and flexibility. Comprised of both a pump and tank, the system is fully automatic and is designed to provide a constant water pressure of between 0 to 40 psi, with a maximum flow rate of 4.5 gallons per minute at 10 psi.



Comprised of both pump and tank, Xylem's Flojet 02840 Series water boost system provides the reliability and flexibility needed to sustain steady growth of the freshwater mussels.

"Xylem's Flojet solution has solved a lot of problems for us", said Alexa Maine, Aquatic Propagation Lab Supervisor at CTUIR. "When deploying the rearing system in our lab initially, it was incredibly difficult for us to identify the correct flow rate while ensuring the pumps could get above the required head length. Trying to plumb it any other way would have been way more expensive than the system itself."



This year, CTUIR's Laboratory has propagated around 4,000 western ridged Mussels, and more than 8,000 mussels have been propagated under the Program in total. Photo: Alexa Maine, Confederated Tribes of the Umatilla Indian, Reservation Freshwater Mussel Project.

Prior to installing the pumping solution in 2022, laboratory staff at CTUIR had to raise the freshwater mussels by hand, feeding them up to 18 times a day as juvenile freshwater mussels need constant food and fresh water to survive. Now that CTUIR have a reliable pumping system that automatically triggers a pulse flow once an hour, every hour, the mussels have a finite way of receiving the correct dosage of nutrients and water without risking their growth progress. Since implementing the technology, survival rates of the freshwater mussels has increased from just 30% at six weeks, to 95% at six weeks.

"I've been doing this close to 10 years now, and for 8 of those years I experienced significant mortality rates, with only 30% of the freshwater mussels surviving until six weeks. To go from that to a 95% survival rate is absolutely unheard of - other labs that are involved in mussel restoration might only get a survival rate of 60% at best. The Flojet pumps have been transformative for us, and I can assure you that this rearing system is setting the gold standard for mussel propagation efforts going forward" , Maine continued.

Result

CTUIR are now looking ahead to the next phase of the restoration project which will involve the 'out-planting' of the lab-reared mussels into their natural habitat in the wild. Most of the mussel species currently being propagated in the CTUIR laboratory will continue to grow there over the next year, though some slower growing species may remain in the cultivation system for up to three years. When they reach a taggable size - around 20-30 millimeters - they will move into a pond system where the mussels can access more natural food and a temperature regime that's more in line with their natural environment.

The first out-planting is expected to take place during an initial pilot phase from June to October of 2024. They will be tagged and tracked so that they can be pulled back into the laboratory and analyzed for growth, and their shells and guts will be examined to determine what they are eating in the wild. Should the initial pilot phase be successful, a full out-planting of the mussels will take place. From there, they will continue to be tracked until they become fully reproductive, which for some species could take up to seven to ten years. If they persist in the wild, this will create a new population to effectively restore harvestable levels of freshwater mussels.

"We are in year 10 of our mussel restoration project and we've learned quite a bit about mussel propagation. However, since installing our cultivation technology, we've been able to move much further, at a faster rate," Maine continued. "We've achieved more over the last two years than we did in the first eight. And so theoretically, within my career lifetime, we may see the full restoration of some freshwater mussel populations, and we may see our first full harvest for tribal members in several generations."

Moving forward, CTUIR are looking at similar aquatic applications to help restore other First Foods in the region. The laboratory already runs an artificial propagation for Pacific Lamprey, and there is potential to use a similar flow-pulse system to help replenish harvestable levels for the Cayuse, Umatilla, and Walla Walla tribes.

"We're honored to have supplied CTUIR with our renowned Flojet system in support of this impactful work. It's amazing to think that this solution has advanced progress in juvenile mussel survival rates far beyond what was ever achieved before. Projects like this are critical to the health and prosperity of tribal communities in the western U.S. and we're happy to support CTUIR in any way we can," said Alaina Celeste, Business Development Manager, Sustainable Solutions at Xylem.

"Our fully automatic Flojet solution supports the specific pulse-flow levels required, ensuring that the freshwater mussels receive just the right amount of nutrients and fresh water needed to sustain growth. As a standalone solution that does not require external plumbing, the system is flexible enough to scale as the project advances. This is an incredibly important capability for CTUIR as they continue to expand mussel restoration efforts."



Previously, CTUIR raised freshwater mussels by hand, feeding them up to 18 times daily. Since implementing the solution, survival rates have increased from just 30% at six weeks, to 95% at six weeks: Photo: USFWS/C. Newlon