

Suitable spawning habitat awaits salmon

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Credit: Ludvig Hedenborg from Pexels

In a multi-stage effort to return migratory salmon to the Upper Columbia River so the fish may rekindle self-sustaining populations, scientists recently concluded that acres of suitable habitat await the salmon, should they be able to reach it. Much work remains, however, before that goal can be realized.

By modeling the gravel and water that fall and summer Chinook [salmon](#) use when nesting, researchers assessed underwater habitat to better understand how spawning [fish](#) would fare in the river's blocked stretch.

"Our study was part of phase one, which assessed the overall feasibility of salmon reintroduction" said fisheries scientist Brian Bellgraph, a coauthor of the study. "And our findings showed there's a decent amount of habitat up there."

The assessment explored more than 47 miles of river running between Kettle Falls, Wash., up to the Canadian border. The region could provide nesting space for a range of 5,786 to 32,728 spawning adults, depending on how the fish space themselves.

"The phase one work showed that the habitat is in really good condition," said policy analyst Laura Robinson of the Upper Columbia United Tribes, "and there's a lot of it up here." Findings from the plan's [initial phase](#) contend that "hundreds of miles of streams" are available to support both adult and juvenile salmon.

The phased plan is orchestrated through the Upper Columbia United Tribes, a tribal nonprofit representing the Coeur d'Alene Tribe, the Confederated Tribes of the Colville Reservation, the Kalispel Tribe of Indians, the Kootenai Tribe of Idaho, and the Spokane Tribe of Indians, and adopted into the Northwest Power and Conservation Council's Fish and Wildlife Program.

Alongside researchers at the Confederated Tribes of the Colville Reservation, scientists from the U.S. Department of Energy's Pacific Northwest National Laboratory detailed their findings in a study published in the journal *Northwest Science*. The study is one of many that inform a larger project led by Native American tribes to understand what challenges the fish face and how best to set them on a successful path.

What's in a nest?

To understand the habitat's condition, the study's authors combined existing data on riverbed conditions with new, similar data provided by the Confederated Tribes of the Colville Reservation to build a two-dimensional river model. The data capture the size of the gravel lining the river, flow levels, water velocity, and slopes at different points along the riverbed.

"The lab's computational power allows us to run these intensive models," said Bellgraph. "To build the model we did, we had to have a lot of information about what exactly the bottom of the river looks like and what kinds of substrates are there."

Chinook salmon spend years at sea before returning to spawn in the rivers where they first hatched. If you're a female Chinook salmon with eggs to lay, said Bellgraph, "you're looking for the right size gravel, the right substrate, and the right temperature." A river that continually washes cool, clean, oxygen-rich water over eggs is ideal, while stagnant water or silty sediment can "choke" eggs, he added.

Looking back

When construction of Grand Coulee Dam was finalized in 1942, it brought productive farmland to the Inland Northwest, fueled industrial

development, and supplied electricity to many homes and businesses. It also permanently blocked fish migration and prevented tribes from accessing long-held salmon fishing grounds, cutting off both a cherished food supply and a central figure to important cultural traditions.

"The salmon was at the very root of our existence," said Tribal Councilmember Hemene James of the Coeur d'Alene Tribe. "We looked at salmon fishing not only as a gathering of the people, but also as the salmon giving its body to sustain the people, a deal that was made at the beginning of time between us and the salmon." James works closely with fisheries managers and tribal members in reintroduction efforts, adding that such work stands to "fully connect our peoples' spirits, minds, and hearts back to the land."

Today, Native American groups pass down some of their traditions through cultural and educational salmon releases. Fish from downstream hatcheries are carried into the river, often accompanied by singing, praying, storytelling, and sometimes fishing.

"They're beautiful, exciting cultural events to be a part of," said Robinson. "People from the tribes are able to come together by the river, welcome the fish back, and pray that, one day, the salmon will fully return to these waters."

The releases bring both cultural and scientific value; in 2017, the Spokane Tribe released roughly 750 locally hatched, yearling Chinook salmon into Tshimakain Creek, a tributary of the Spokane River. Of those, about 90 yearlings pinged fish-detecting devices downstream of Chief Joseph Dam; they had successfully passed over three dams without fish passage and survived.

"We were really pleased by those numbers," said Conor Giorgi, anadromous program manager of the Spokane Tribe of Indians. "Before

that, we didn't really have much information about juvenile behavior or survival through Lake Roosevelt or sections of the Spokane River. It was evidence that, yes, this is possible, and it also gave us a lot of hope."

Another source of hope emerged in 2019 when an adult salmon from the 2017 release returned to the Columbia River Basin and migrated upstream, passing all hydroelectric facilities up to Chief Joseph Dam. Equipped with a tag akin to the microchips dog and cat owners use to identify their pets, the female salmon pinged sensors as she swam upstream.

"Once I knew she had passed Bonneville Dam," said Giorgi, "I started checking the database a couple of times per day, watching her slowly march upstream." Later named Nucucšnetkw, which translates to "she who retraces her steps," three of the fish's siblings were later detected in 2020. All three passed through a number of dams along the Columbia River, while one eventually reached a tribal fish processor in Oregon.

Challenges upstream

Among the challenges ahead is the fact that Grand Coulee Dam blocks upstream passage. When traveling downstream, the only options for fish are swimming over the spillway to endure a steep drop or diving deep to swim through turbines. Neither Grand Coulee Dam nor the downstream Chief Joseph Dam offer juvenile fish bypass facilities.

Discussion of fish passage is underway, as researchers consider transporting the fish upstream via truck, or installing a [Whooshh system](#), where fish pass over barriers by moving through a flexible, pressurized tube.

Though no anadromous salmon can swim upstream past the dams, redband trout are able to pass the dam when swimming downstream.

"We know some fish are getting through there alive," said Bellgraph.

A changing climate, too, adds difficulty. Models project the main stem of the Columbia River could grow too warm for spawning salmon, said Bellgraph, while unlocking upper stretches of the river could provide cooler habitat. Warmer temperatures could diminish water levels, also, putting salmon closer together and adding stress to an already perilous journey.

"As other areas of the Columbia River Basin are warming due to climate change," said Robinson, "and as industry grows alongside human populations, we're not looking at the water temperature decreasing any time soon." When salmon reach warm waters, they often stop swimming, unable to pass through or access the cooler waters they need to successfully spawn.

The Bonneville Power Administration funds and organizes habitat restoration projects downstream of Grand Coulee and Chief Joseph Dams. The work reconnects wetlands to the main channel, said Robinson, and curbs sedimentation that could otherwise compromise nesting sites.

"It's really about bringing them back into the habitat that was theirs to begin with," she said.

The next phase

In phase two, researchers are exploring reintroduction of several species, including sockeye and Chinook salmon. Preliminary studies could begin as early as 2022, said Bellgraph. That research would seek to track how juvenile fish cope when introduced to Lake Roosevelt, just above Grand Coulee Dam.

"Those studies will help us fill in assumptions about their survival rate when they pass through these dams," said Bellgraph. "We have to answer a lot of questions before we can create a self-sustaining population that doesn't have to be manipulated by humans every year. And that's one of the long-term goals: self-sustainment."

The phased plan also entails assessing spawning habitat for stream-spawning salmon, who mate in the once sinuous, now channelized streams that connect to the river's main stem. Habitat Restoration Biologist Thomas Biladeau of the Coeur d'Alene Tribe leads those efforts within the Hangman Creek watershed, a main tributary of the Spokane River.

"Because there is a lack of spawning habitat now in many of the streams and tributaries that feed the rivers," said Biladeau, "it makes the habitat in the main stem that much more important for reestablishing salmon runs in the blocked area."

Biladeau adds that land changes make habitat restoration on the Coeur d'Alene Reservation more challenging than similar projects along the river's main stem, though he draws hope from witnessing the land's resilience firsthand.

"When we first started doing this work," he said, "I always thought it was amazing how quickly someone could unravel a system, how quickly you can turn a stream into a ditch. I figured it would take decades to get this landscape to rebound to where it was. But in a lot of cases I've been pleasantly surprised to be wrong."

With seedbanks persisting within the soil of restoration project areas, said Biladeau, native plants have reemerged, and native waterfowl, from tundra swans to wood ducks, soon flocked to nest among the habitat's vegetation.

"According to this study and our habitat investigations," said Biladeau, who emphasized that thoroughly testing assumptions and adaptively managing fish populations are crucial elements of the plan, "everything is pointing toward a successful reintroduction project."

Provided by Pacific Northwest National Laboratory

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