RIPPLES IN THE GRANDE RONDE

FALL EDITION 2016

RIVERS UNITING NEIGHBORS·QUARTERLY NEWS FROM THE GRANDE RONDE MODEL WATERSHED

RETURNING TO THE PROMISE LAND

Creating fish passage to prime spawning grounds

by Katie Nesbitt, Freelance Writer

LOSTINE – Just past the last man-made barrier, on Northeast Oregon's Lostine River is 20 miles of prime Chinook spawning ground. This fall newly constructed fish passage at an irrigation diversion will make it easier for late running salmon to reach natal waters.

Just 20 years ago , the Lostine River's once thriving Chinook population dwindled to a handful of returning adults prompting years of research and habitat improvement by local fisheries managers. This month the reconstruction of an old fish ladder will help adult salmon reach what Mitch Daniel, Nez Perce Tribal Fisheries project leader, called "the promised land."

"Upstream from this last barrier on the Lostine is a primo spawning reach," Daniel said. Yet reaching the Promised Land was getting tougher to reach.

Chuck Simpson, who manages the fish screens on irrigation diversions for Oregon Department of Fish and Wildlife and Ian Wilson, working on a telemetry project on the Lostine River for the Nez Perce Tribe, noticed that between mid-August and late September, when the river is at its lowest, fish were struggling to get upstream past the Sheep Ridge Diversion structure.

The Nez Perce Tribe's Fisheries Research Division verified this observation with their radio telemetry study. The upstream migration of several fish was delayed at the site, while others stopped at the barrier and dropped back and spawned downstream. Building better passage to the upper Lostine became a priority for the state, the Tribe and the Grande Ronde Model Watershed.

On a routine trip to the work site, Daniel said he was an eyewitness to the problem when he and his colleague, Montana Pagano, watched two adult fish try and fail to jump over the wooden irrigation check dam.

Daniel said, "The 18 or more inches of the exposed check dam created a jump height issue."

There is typically a second pulse of Chinook salmon heading home from the ocean late in the season when the barrier's effects were most notable. The problem was often compounded by low, late season flows. The diversion also created a substantial migration barrier for juvenile salmonids.

As the concrete fishway deteriorated in the middle section of the Lostine, the region's fish managers pooled their time and money to rebuild them, mimicking a natural stream replacing the square boxes that created artificial pools and seasonal fish barriers.

Coby Menton is with the Model Watershed's Enterprise office and worked closely with Daniel to secure funding and oversee the design and implementation of the improved fish passage along the Sheep Ridge Diversion, one of thirteen irrigation ditches on the Lostine River. He said the ditch company was concerned about the longevity of the new

Looking upstream following project completion. The old concrete fishway left intact was overtopped with an engineered roughened channel.
(Photo: Coby Menton)

Continued on page 4, **Promise Land**

Can Habitat Restoration Improve Water Temperatues for Salmon in the Upper Grande Ronde River?

by Casey Justice, Columbia River Inter-Tribal Fish Commission

Human land use—activities such as forestry, mining, crop production, livestock grazing, road construction, and urban development—often is deemed necessary to a community's economic vitality. However, if not carefully balanced with the needs of fish, wildlife, and other components of ecosystems, then land use can degrade quality of life for people, plants, and animals that depend on a healthy environment. Habitat for fish and other aquatic life in the Grande Ronde River Basin has been steadily degraded since the mid-1800s due to land use, with water temperature arguably being one of the most influential factors undermining habitat for Endangered Species Act (ESA)-listed Chinook salmon, steelhead, and bull trout in the basin. By improving our understanding of land use effects on river life, we can make more informed choices about how to manage private and public land in ways that are beneficial to both the economy and ecosystems.

Land use can influence one or more of the primary factors that regulate stream temperature, including discharge, stream morphology, groundwater interactions, and riparian vegetation. Activities such as water diversions for irrigation or urban use, tree harvest in riparian zones, poorly managed livestock grazing, and stream channelization associated with construction of roads, levees, and other impediments (e.g., mine tailings) have caused significant increases in water temperature in the Grande Ronde River Basin. In addition to land use-related impacts on watershed health, climate change is another important factor affecting stream temperature. Increases in air temperature associated with climate change have contributed to a significant warming trend in Pacific Northwest streams, with summer temperatures increasing by approximately 0.22 °C per decade between 1980 and 2009. Summer temperatures in 2015 were the warmest on record.

Water temperature has an important influence on all life stages of salmon. Cool water is required for adult salmon migration and holding in the river prior to and during spawning as well as for successful development and survival of eggs deposited in the gravel. Water temperature also directly affects the growth, disease resistance, competitive ability, and migratory behavior of juvenile salmon. The Environmental Protection Agency (EPA) established a set of temperature water quality standards for the Pacific Northwest region to protect threatened salmonids, which includes a maximum weekly maximum temperature (i.e., maximum seven-day average of the daily maximums) of 12 °C for bull trout rearing, 16 °C for juvenile salmon/trout rearing, 18 °C for salmon/trout migration plus non-core rearing, and 20 °C for salmon/trout migration. According to a 1999 water quality assessment report by the Oregon Department of Environmental Quality, approximately 92 percent of the Grande Ronde River upstream of the Wallowa River confluence exceeded the 18 °C temperature standard.

As stream temperatures increase in response to land management practices and climate change, cold-water fish such as Chinook salmon, steelhead, and bull trout may be exposed to temperatures that are outside of their optimum range, resulting in significant threats to fish communities and an increased risk of extinction. Juvenile salmonids in the Grande Ronde River Basin have been largely replaced by warm water-tolerant species such as Redside Shiner, dace, and Northern Pikeminnow across much of their historic range. Because they have the most stringent need for cold water, bull trout have been the most severely limited in their distribution. Thus, restoration of natural temperatures and preservation of existing cold-water refuges are vitally important to the recovery of imperiled salmonid populations, particularly in watersheds with excessive summer temperatures like the Grande Ronde River Basin.

Continued on page 3, **Hot Water**

Figure 1. Aerial view (above) and ground view (below) photographs of the Upper Grande Ronde River below Vey Meadows (river mile 46). Note the wide, shallow stream channel and scarcity of streamside vegetation. (Photo: Casey Justice)

Water Temperature Simulation

To better understand current water temperature conditions across the Chinook-bearing portion of the Upper Grande Ronde and Catherine Creek watersheds and to evaluate the potential for restoration activities to improve water temperatures in the future, the Columbia River Inter-Tribal Fish Commission worked with Quantum Spatial to develop a Heat Source water temperature model in 2010 (updated in 2016). In addition to providing a detailed map of water temperatures across the stream network, the model can be used to predict how future changes in air temperature, streamflow, tree and shrub cover, and channel width might influence water temperatures.

Model results for current conditions indicated that the vast majority of the Upper Grande Ronde (upstream of the Catherine Creek confluence) and Catherine Creek basins (upstream of Union) had peak summer water temperatures that exceeded stressful levels for juvenile salmon (18 °C) (Figure 2). Simulated restoration of streamside vegetation to its natural potential (i.e., prior to intense human disturbance) was predicted to substantially reduce water temperatures by an average of 5.4 °C in the Grande Ronde and 2.9 °C in Catherine Creek. In the model, the percentage of the stream network exceeding the lethal limit for Chinook salmon of 25 °C declined from 41 percent to 7 percent in the Upper Grande Ronde and from 7 percent to 0 percent in Catherine Creek as a result of riparian reforestation.

Additional model scenarios indicated that further cooling benefits could be achieved by narrowing and deepening river channels, a common goal of stream restoration projects. Most importantly, this modeling work demonstrated that the warming effects of climate change could be offset through a combination of riparian reforestation and channel narrowing projects. However, achievement of such dramatic reductions in water temperature would require aggressive basin-wide restoration of riparian vegetation and stream channel morphology as well as a significant change in some land use practices to avoid further degradation of stream channels and riparian zones. Fortunately, progress toward this goal already is underway through the collaborative restoration efforts of numerous state, federal, and tribal agencies and private landowners in the Grande Ronde River Basin.

Stream Restoration

Fish habitat restoration in the Grande Ronde River Basin has been ongoing since the early 1990s. The scope and intensity of restoration work has significantly increased during the past 5-10 years, driven largely by funding from the Bonneville Power Administration (BPA) in an effort to mitigate hydropower impacts on salmon populations in the mainstem Snake and Columbia Rivers. Restoration activities span a broad range of different treatments to improve habitat conditions for fish, including but not limited to removal of migration barriers, reconstruction of stream channels to improve floodplain connectivity and habitat complexity, fencing of riparian areas and planting of trees and shrubs to increase shading and bank stability, and placement of large woody debris and boulders in channels to scour pools, trap spawning gravel, and provide cover for fish. Many of these activities directly contribute to cooling stream temperatures.

One impressive example of recent restoration work in the basin is the Catherine Creek complex, a large-scale, multi-phase effort that includes restoration of approximately three miles of Chinook salmon habitat approximately five miles southeast of the town of Union (river mile 44). The project involves realignment of the stream channel to increase channel sinuosity, addition of large wood structures, revegetation of stream banks and floodplains, and creation of numerous new pools, alcoves, and side channels. Initiated in 2013, this ongoing restoration project is being implemented and facilitated by a collaborative partnership, which includes private landowners, the Confederated Tribes of the Umatilla Indian Reservation (CTUIR), the Union Soil and Water Conservation District (SWCD), the Grande Ronde Model Watershed, the U.S. Bureau of Reclamation, the Oregon Department of Fish and Wildlife (ODFW), and the Natural Resource Conservation Service (NRCS) with funding from BPA, the Oregon Watershed Enhancement Board, and the U.S. Fish and Wildlife Service.

Another example of current restoration work that could produce substantial cooling benefits to fish is the Meadow Creek restoration project in the U.S. Forest Service (USFS) Starkey Experimental Forest, a BPA-funded project implemented by the USFS. This ongoing restoration project began in 2012 and covers approximately seven miles of Chinook salmon and steelhead habitat on one of the Upper Grande Ronde River's largest tributaries. The project involves culvert removal, placement of numerous woody

Continued on page 8, **Hot Water**

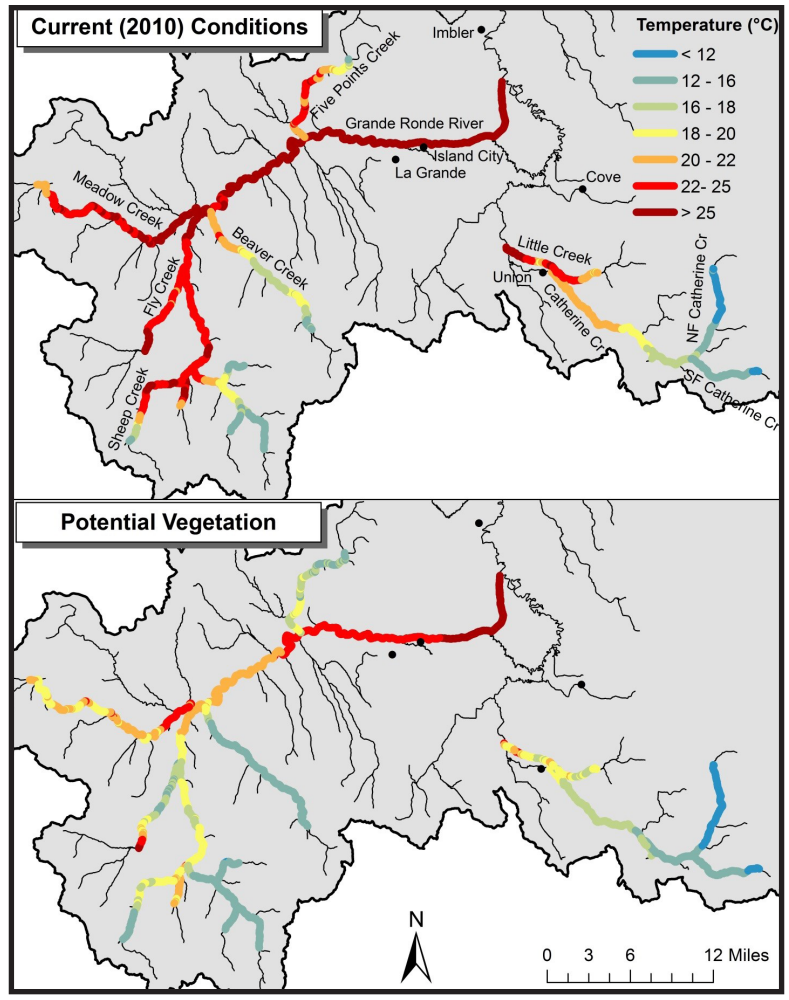


Figure 2. Map of simulated maximum water temperature (°C) for current conditions and potential vegetation conditions in the Upper Grande Ronde River and Catherine Creek basins. (Maps: Casey Justice)

Ripples in the Grande Ronde is funded by the Bonneville Power Administration and the Oregon Watershed Enhancement Board

... *continued from front page, Promise Land*

Looking upstream at the deteriorating concrete walls that no longer meet fish passage criteria, and the wooden check dam that makes fish passage difficult during low flows. This photo was captured from below the fishway and diversion for the Sheep Ridge irrigation ditch.
(Photo: Coby Menton)

passage way and asked that it be built on top of the old concrete structure.

The length of the original fish ladder was 80-feet long, Menton said. To improve passage the project was extended to 180-feet, making the incline less steep.

Using large rocks instead of concrete walls the project area better simulated the natural flow of the stream. Three to four foot boulders were keyed together in a shallow "V" shape to roughen the channel and slow the water's velocity reducing erosion and providing resting water for fish as they swim upstream. The strategically placed boulders function to slow the water, but to the untrained eye no structure is apparent – the site looks like a natural stretch of river.

The diversion's original fish passage consisted of three concrete walls and a wooden check dam owned by the ditch company who granted permission for the new fish passage construction.

With help from Aaron Maxwell of The Freshwater Trust, a group that manages "minimum flow" agreements with the Lostine water users, the complexity of keeping adequate flows during the work window was negotiated.

The water users also gave input on the new project's design and a Ditch company representative, ODFW, and the Tribe reviewed the design. GRMW and the Tribe provided implementation oversight and led fish salvage operation.

"We managed moving the river into the ditch during construction with sand bags and installed a temporary fish ladder providing fish passage during construction," Daniel said.

On the west side of the river Menton said no vegetation was disturbed. The minimal vegetation on the east side will quickly grow back. Daniel credited the Model Watershed for fostering enough projects in the Grande Ronde basin that local contractors have become experts in river restoration. Menton added that the diesel and materials the contractors buy help the local economy. And because the contractors are local, Menton said, "There is more impetus to meet or exceed job requirements so they don't compromise their ability to do restoration work here."

To check the effectiveness of the new passage Menton said tagged fish are being tracked to see if the new passage is easing their commute up stream and Fish and Wildlife staff continue to check the irrigation screens weekly. Daniel said the Tribe is using Action Effectiveness Monitoring, funded by Bonneville Power Administration that looks at habitat and fish biology data. This is a real boon to not only the project, but also the bigger picture of restoration in the sub-basin. "Action Effectiveness Monitoring is conducted two years prior to construction and two years after," Daniel said. The site will be paired with a control site to compare and contrast the before and after data; one of a few partial barriers monitored in the Columbia Basin. Daniel said, "The monitoring will assess the physical dimension of the channel, how fish use it and what life stages use it."

Nez Perce Watershed Director Emmit Taylor said, "The goal was to get it to look like and mimic what a natural river does and I think they met the goal." He said the success of the project speaks volumes of the Tribe's partnership with the Model Watershed, Fish and Wildlife and the landowners. "It takes a lot to pull off a project like that and the end product looks incredible," Taylor said.

"There's no such thing as a perfect project but it's close," Menton said. The work on the Sheep Ridge Diversion was similar to another project overseen by Model Watershed in 2012. Menton said previous fish passage improvement opened up the possibility to do the upstream work. Besides the ecological significance of the habitat improvement the Lostine was an important fishery for Chief Joseph's Wallowa Band of Nez Perce.

"The best we can tell by all studies is the Lostine was historically one of the most productive in the sub-basin for Chinook," Menton said.

With the dismal Chinook return in 1955 the

Continued on page 8, **Promise Land**

A View from the Stream

My summer as an USFS stream surveyor

by Grace Peven, US Forest Service seasonal employee

My alarm buzzes around 5:30 a.m., and I slowly make my way out of my sleeping bag. The grass outside my tent is beginning to frost on this early September morning. I throw on my waders and wading boots, still wet from the day before. I grab my wading stick, recording forms, GPS unit, radio, and other essential tools that I will use throughout the day. We open up our folder and find our assigned stream for the week, along with maps and a description of the creek.

This is a typical morning as a stream surveyor for the U.S. Forest Service (USFS). We are assigned a stream every week to survey. Does the stream have good fish habitat? What about large wood that has fallen into the stream? What is the riparian vegetation like? Is there beaver activity? Are there cows grazing in the stream? What is the stream's story?

These are the questions a stream surveyor has to ask. Stream surveying is a method to monitor and observe the effects of grazing, logging, and restoration projects on stream health and fish habitat. We methodically collect data on stream width, stream gradient, pebble size, channel length, discharge, and other basic stream characteristics. The data we collect are used to tell a story of the stream. Fish biologists, engineers, and technicians study our data and make decisions based on the nature of the stream. Is it in need of restoration? Should logging occur near the stream? How are cows affecting the stream banks?

Looking upstream on Grouse Creek, a tributary to the Imnaha River, just one of many streams surveyed last summer.
(Photo: Grace Peven)

Before we are able to answer some of these questions, we first need to access the stream. We pull out our forest maps and find a small, meandering line on the map that represents our destination. Half of the time, there are no roads or trails that lead to our streams, so access becomes an exercise in problem-solving. We look for the path of least resistance, where the contour lines are not too cozy with each other. After long hikes and bush-whacks into a remote stream, it sometimes feels like no one has been there before. Of course, we are not alone out there. Frequent signs of bear, elk, deer, wolf, and cougar are scattered throughout the forest and alongside our stream. These animals negotiate their way through the forest to the same streams over fallen trees, decaying forest floors, and steep canyons, so how do we get to the stream through some of the same obstacles? I have learned that a GPS and a good sense of humor are must-have items.

Once we reach our destination, trekking up the creek full of downed trees, slippery rocks, and thick riparian vegetation is our next venture. Some weeks, we get lucky and end up on a wide-open stream with no vegetation blocking our path. Other weeks, we find ourselves in a seemingly endless maze of alder and hawthorn bushes. At times, stream surveying can feel like doing gymnastics. When you are in a small stream surrounded by a maze of thick riparian vegetation and reach a large fallen tree over the stream, it sometimes takes creativity to conquer this obstacle blocking your path. At times, it's best to gently and carefully maneuver your way through the entangled branches that can act as a spider web, holding you back regardless of how hard you try to push through. Other times, it's best to close your eyes, duck your head, and brace yourself as you pummeled through the trees. I usually go for the latter approach.

Continued on page 6, **View**

... *continued from page 5, View*

A beaver dam ponds water on the Upper Grande Ronde River.
(Photo: Grace Peven)

My idea of a fast mile pace was completely revolutionized by stream surveying this summer. On average, we are able to cover about 1.5 miles a day walking upstream. On a really good day, we can do two miles or maybe even 2.3 miles if we are really pushing it. In only two miles, the vegetation, landscape, and character of the stream can change dramatically. Around each bend, the stream can surprise you and take on a new character, with narrow channels and steep canyon walls jutting above the water or deep, long pools scattered with beaver activity and fallen trees. One stream we surveyed this summer had about 20 beaver dams in a row.

Although some streams were hard to walk through, these streams usually were the most untouched by humans. We are able to see firsthand what a stream and forest ecosystem look like without the influence of people. Take Johnson Creek, a tributary to the North Fork Umatilla River, for example. Our only access point appeared to be a ridge that spurred off of the Umatilla Rim Trail into the North Fork Umatilla Wilderness Area. It took hours to trek into the remote stream on this ridge, but the views inside of the forest and in the stream were worth it.

Another survey of Grouse Creek, a tributary to the Imnaha River, matched the remoteness and wildness of Johnson Creek, requiring a difficult hike through miles of meandering stream channels next to steep canyon walls to reach the stream. We were met with wide-open valley floors and braided channels teeming with fish of all species and sizes. At one point, we were unknowingly following a bear along the stream, discovering increasingly fresh bear scat around every bend. We made sure to let the bear know we were coming with our whoops and hollers, and we thankfully avoided an encounter.

Throughout a summer of tough hiking and data recording/collecting, I experienced wide sweeping vistas and spectacular sunrises as well as contributed to a cause that I think makes a positive difference in our local watershed. The data collected will inform decisions to improve and conserve fish habitat, develop smart logging plans, study the effects of agriculture, and restore the health of many streams in the area.■

Grande Ronde Model Watershed
Upcoming Board Meetings

Annual Board Meeting
Tuesday, December 13th, 2016
9:00 a.m. - 3:00 p.m.
Ascension Kimsey Commons
1104 Church St.
Cove OR, 97824

The public is welcome to attend.

Meeting dates are subject to change.
Please call (541) 663 - 0570 to confirm.
Thank you!

FISH TRACKING 101:

Going Digital with PIT Tags

by Alex Borgerding, GRMW Staff

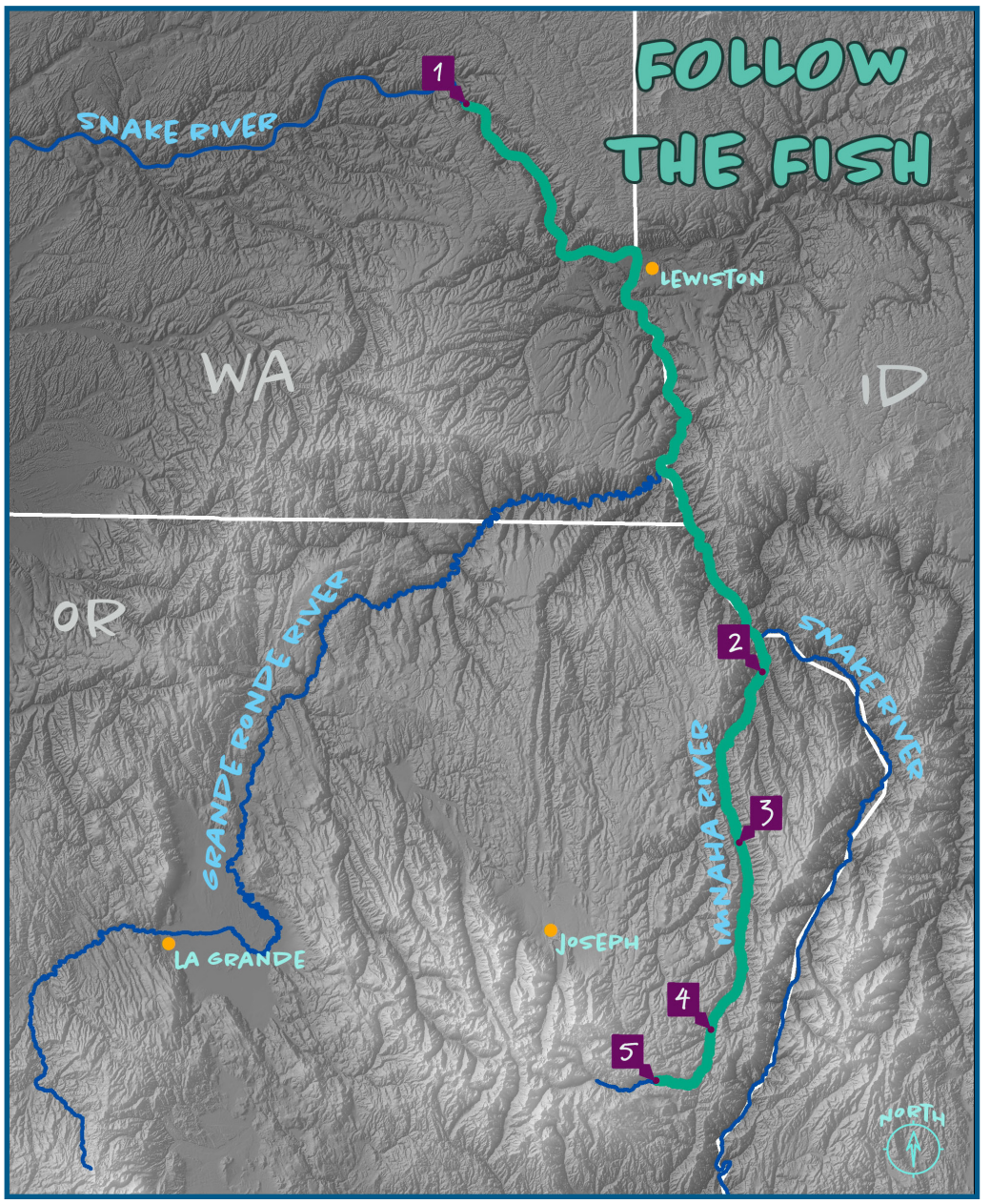
Last September, I had the chance to volunteer for an instream Chinook spawning survey on the Imnaha River. Spawning surveys involve looking for two things: redds and Chinook carcasses. We examine every carcass we find and record data about each fish. This process includes scanning fish with a Passive Integrated Transponder (PIT) reader to find out whether the fish already has been identified with a PIT tag.

What is a PIT tag? A PIT tag is a tiny device about the size of a grain of rice (12 millimeter long by 2.1 millimeter in diameter), which is used to monitor distribution and migratory habits of fish (salmon and steelhead) in the Columbia River Basin. These tags provide detailed information about how well fish migrate through dams, the speed of their travel rates, and when fish were recaptured (i.e., when the carcass was found by surveyors) as a measure of mortality. The tags are injected into the fish using a large-gauge needle. Fish are normally tagged as juveniles, but a recent project has involved capturing and tagging adult salmon at the Lower Granite Dam in Southeast Washington during their upstream migration. The tags allow for less invasive monitoring by minimizing the need to handle, restrain, and anesthetize fish for data collection.

When a fish is tagged, information about the tagging event and the fish is uploaded to The Columbia Basin PIT Tag Information System (PTAGIS) central database, which was created as part of a fisheries data project by The Pacific States Marine Fisheries Commission. This information includes PIT tag number, location of tagging, the organization that tagged the fish, species, run, weight, length, wild or hatchery type, and any comments on appearance or general health. Once tagged, the fish is released back into the river, where it can be monitored indefinitely by electronic interrogation antennas. These in-stream PIT tag arrays (ISA) are placed along the bottom of the stream at mainstem dams and various smaller tributaries within the basin. Ideally, when a fish passes over one of these arrays, the PIT tag number is scanned, and information about the date, time, and location is automatically uploaded to the database.

During the survey on which I worked, we found three fish carcasses with PIT tags. All three were part of the more recent project to tag adult salmon at the Lower Granite Dam. If one had been tagged as a juvenile, then we would have been able to see its journey to the Pacific Ocean and its return migration to spawning grounds in the Imnaha River. The map below shows the journey of one of the fish we found. By entering the unique PIT tag number into the database at PTAGIS, we can observe the journey of the fish and associated attributes.

The PIT tag retrieved from the fish tracked in this map contained information that told us this fish was an adult, mature, returning, wild spring Chinook salmon that was captured, tagged, and released on May 13, 2016. It was 780 millimeters long (that's 30.7 inches), it was captured in the adult passage ladder at Lower Granite Dam, and it had a mark on it indicating that it had been bitten by a seal.



Follow The Fish

1. May 14th: Lower Granite Dam
2. May 22nd: Lower Imnaha River ISA at kilometer 7
3. May 30th: Upper Imnaha River ISA at kilometer 41
4. June 21st: Imnaha River Weir Adult Ladder
5. September 1st: Approximate recapture location

(Map: GRMW)

Continued on page 8, PIT Tags

... *continued from page 3* **Hot Water**

debris jams and large boulders, and intensive planting of more than 40,000 native tree and shrub seedlings and cuttings. In addition, some sections of the stream have been fenced off to control grazing of cattle, deer, and elk, offering a unique opportunity to study the impacts of grazing on riparian vegetation recovery. According to Ted Sedell, an ODFW fish biologist, fish habitat monitoring data already have shown an increase in pool abundance as well as narrowing and deepening of the stream channel in response to the restoration work, and future shading potential from the tree plantings looks promising.

Numerous other restoration projects throughout the basin have contributed to improvement of fish habitat, including removal of mine tailings and floodplain reconnection in the headwaters of the Grande Ronde River (USFS and CTUIR), large woody debris placement and tree planting throughout the Upper Grande Ronde watershed (USFS), channel reconstruction, woody debris placement, and riparian restoration in lower McCoy/Meadow Creak meadow complex and Rock Creek (CTUIR), dam removal and habitat restoration on Five Points Creek (USFS), and flow restoration in lower Catherine Creek (The Freshwater Trust). Cumulatively, these restoration activities have substantially improved living conditions for fish and other plants and animals that depend on a healthy river ecosystem. In addition, the long-term benefits of much of this work have yet to be realized, as changes in river morphology and riparian habitats in response to restoration actions can be slow, and tree plantings may take decades to reach their full shading potential.

The Take-Away

Despite the significant amount of restoration that already has occurred in the basin, a lot more work needs to be done to reverse the decades-long legacy of land use activities and habitat degradation. Many parts of the basin continue to experience damaging land use impacts, including intensive grazing within riparian zones, over-allocated irrigation withdrawals, and channel confinement. With summer water temperatures expected to rise in response to climate change, there is an urgent need to continue with and enhance stream restoration actions, particularly those that will address the serious water temperature problem. Fortunately, temperature modeling work has indicated that basin-wide restoration actions can have a substantial cooling effect on streams, even in the face of climate change. Through strong collaborative partnerships among private landowners, government and tribal agencies, and other stakeholders as demonstrated by these restoration projects, we are hopeful that we can meet the challenge of restoring the streams and fish populations in the Grande Ronde River Basin that we all depend upon while also finding ways to provide for sustainable agricultural practices ■.

... *continued from page 7* *PIT Tags*

The benefits of PIT tags are easily recognized when comparing variations in data collected from each fish. Although not every fish has a PIT tag, millions of fish in the Columbia River Basin have been tagged, which provides a large sample for study, as this fish is just one of 1,716 fish returning to the Imnaha and one of 528 wild fish returning.■

... *continued from page 4* *Promise Land*

region's fisheries agencies made a concerted effort to save the run. To protect fishing treaty rights, the Nez Perce Tribe got on board to restore Chinook. In 1992 they opened a fisheries office in Wallowa County. They built a picket weir at the confluence of the Lostine and Wallowa rivers near where Chief Joseph's Wallowa band fished and lived at an annual village site. In 2011 the picket weir was replaced by a state-of-the-art facility that traps both steelhead and Chinook for research and a source of Chinook broodstock.

Prior to 2006 the Lostine River went dry at the Caudle Lane Bridge in the heart of the tiny village of Lostine. The Tribe and The Freshwater Trust brokered agreements with water users to maintain minimum late season flows. Since those agreements were made the river has not gone dry.

Oregon Watershed Enhancement Board paid for the design work and BPA, Pacific Power and the OWEB paid for the construction, Menton said.

Bonneville Power Administration contributed $147,500, Oregon Watershed Enhancement Board kicked in 90,0000, Pacific Power's Blue Sky Program granted $30,000 and the Nez Perce Tribe and Grande Ronde Model Watershed provided $10,000 of in-kind staff time.■

Grande Ronde Model Watershed

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