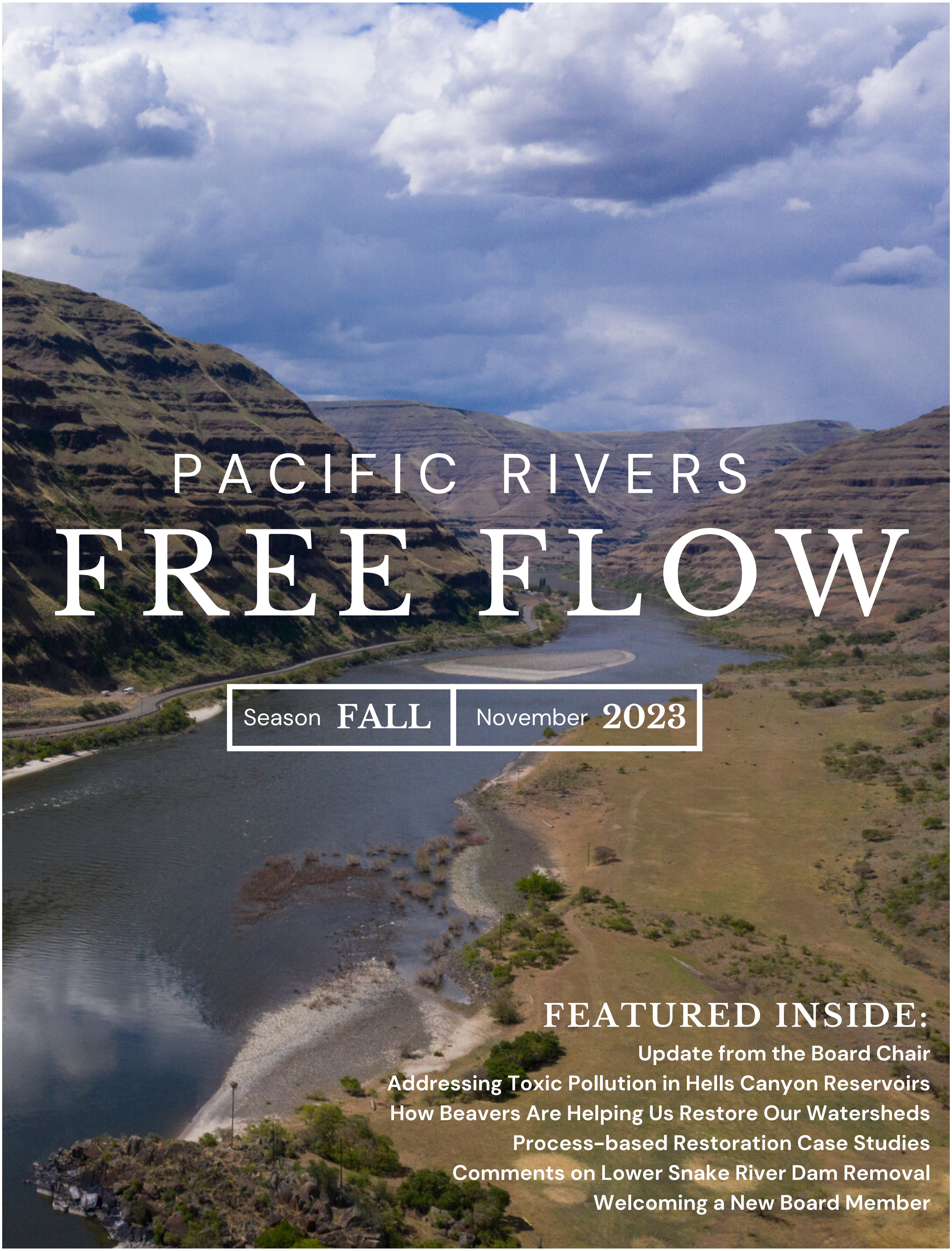


PACIFIC RIVERS

FREE FLOW

Season **FALL** | November **2023**

FEATURED INSIDE:

BOARD CHAIR UPDATE

Mike Morrison - Board Chair

As I reflect on a summer that sent us daily reminders of the toll of climate change, I welcome you to the Fall 2023 issue of Free Flow where we at Pacific Rivers keep you apprised of what we are doing to protect and restore river ecosystems of the West. That starts with our thanks to all of you for the heartwarming support you continue to give — that is what keeps us going and working to fulfill our mission.

A goal of ours is to educate and stimulate thought in our readers. In this issue we are particularly proud to showcase our nod to justice, law, science and policy as our guiding principles with two important articles by consultant Don Elder and Board Treasurer Liz Gilliam.

Liz's second article on river restoration – part one was published in Spring 2023 Free Flow — focuses on the role that beavers can contribute to improving river ecosystems and fight climate change. Don's article on methylmercury and how it impacts fish and those that consume fish is a trove of information about a topic that has received too little attention. The article highlights the importance of the issue, where we are in recognizing its impact, and an explanation of efforts underway to address it.

Pacific Rivers and Center for Biological Diversity submitted a revised petition to list Washington coast spring Chinook salmon under the Endangered Species Act on July 17, 2023 and we were notified that the Petition was accepted for a 90-day review. The 90-day finding is due October 17, but typically the agency takes longer. A 90-day review is when the National Oceanic and Atmospheric Administration (NOAA) evaluates whether a petition presents substantial information for an Endangered Species listing to be warranted. Our 121-page petition is very well-researched and available on our website.

We can also report completion of another year in the important data collection at the Canton and Steamboat Creeks by conducting snorkel surveys of juvenile salmonids. We can look forward to the report on the findings from team leader Charley Dewberry, PhD, in an upcoming issue of Free Flow. Importantly, we believe that we have now obtained enough data via these surveys that we can move to the next phase — to develop, with the US Forest Service, and local partners The North Umpqua Foundation and Steamboaters — a form of management plan for the Frank and Jeanne Moore Special Management Unit (SMU) — which we refer to as the Moore Steelhead Sanctuary. While the legislation that created the SMU set forth the designation of the SMU, it did not set forth a manner to accomplish and balance what could become competing uses. We are proud to spearhead an effort to take that next step and are encouraged by the early signs of cooperation we have received from an overburdened and overworked Forest Service. We are also pleased to know that Dr. Dewberry — with his many years of work in the North Umpqua basin — has agreed to serve as our consultant on this endeavor.

Unfortunately, not all is well on the North Umpqua. Dam repairs on the private Winchester Dam were nothing short of a disaster — of which the agencies were warned about by advocates in advance. The “repair” process blocked Pacific lamprey migration, killing hundreds of thousands of the fish. Additionally, tire mats have been used which probably released toxins into the river, which is a drinking water source. Of course, the Umpqua is an important steelhead and salmon spawning habitat, only increasing our alarm. Pacific Rivers has written to many elected officials requesting an investigation, mindful that the few private landowners of the dam were responsible to not only assure that the work was done with adherence to the permits, but also to mitigate the effects of the disaster. Instead it was governmental agencies (at taxpayer expense) and volunteers that did what could be done to save lamprey and otherwise try to lessen the damage. We will work as an organization and as a member of the North Umpqua Coalition to force decision makers to confront and remediate this completely avoidable tragedy.

Pacific Rivers has been asked to participate in many other coalitions working on environmental issues within our geographic area and have thus signed and/or written letters supporting the Legacy Roads and Trails program, Lower Snake River dam removal, preserving Mature Old Growth on BLM and FS lands, a Calawah Watershed Restoration project in the Olympic National Forest, angling regulations instituting a yearly bubble closure in the Umpqua watershed, designation of Outstanding Resource Waters in Washington, and a petition to prevent mining in the Green River Valley at Mount St. Helens. Our work toward removing the lower Snake River dams continues. We attended the virtual meeting called by the Biden Administration for public comment on the subject, and also submitted written comment. We then submitted a position letter directly to Senator Jeff Merkley. A summary of those comments, spearheaded by board member Nicky Scott, is included in this issue.

Finally, we are pleased and proud to welcome our newest board member, Gabriel Garcia M.D. Gabe is a devoted fly angler and river protector. He has extensive experience both on nonprofit boards and human rights commissions, and in the ever-important world of making progress on issues with many differing stakeholders. Please take the time to read about Gabe in this issue.

We hope you enjoy and find this issue valuable — especially since it is yours, as your confidence in us and support is what allows us to be able to report all of this.

All the Best,

Mike

Don Elder - Strategic Advisor

MERCURY CONTAMINATION OF SNAKE RIVER FISH

Understanding and addressing toxic pollution in and downstream of three Hells Canyon reservoirs

Since the 1960s, it has been known that fish in and downstream of three Hells Canyon reservoirs are laden with mercury. The questions have been why mercury pollution is a particular problem there, how serious a problem it is, and what to do about it.

This is the story of the path of mercury to the Snake River; of its transformation in Hells Canyon into its most toxic form; of important recent scientific work to understand that transformation process; and of the work of the Nez Perce Tribe, Pacific Rivers, and Idaho Rivers United to ensure that meaningful action to address the problem begins soon.

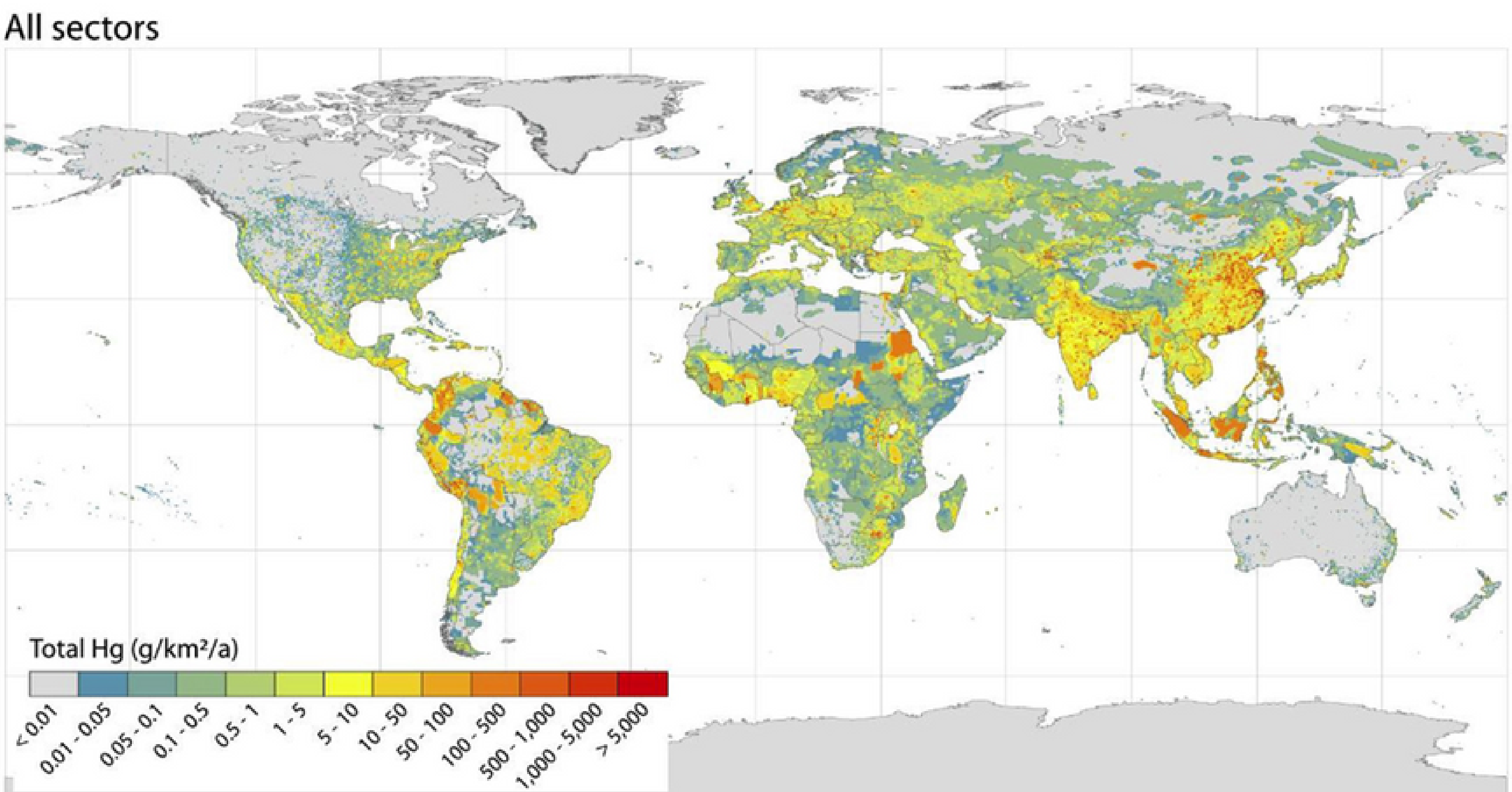
IN THIS ARTICLE:

- Mercury pollution sources
- Transformation of mercury into methylmercury in lakes and reservoirs
- Health effects of methylmercury
- Fish consumption considerations
- The Snake River and its water quality upstream of Hells Canyon
- Hells Canyon and its three Snake River reservoirs
- Methylmercury production in Hells Canyon reservoirs
- Rights, interests, and concerns of the Nez Perce Tribe
- Clean Water Act action
- Agreement
- Next steps

Mercury pollution sources

Mercury pollution is a serious widespread problem today. It has many sources. They are natural and human; historic and current; and local, regional, and global. Today, thanks to atmospheric transport of mercury from sources around the world, it's virtually everywhere in some amount and form. It's in the food chain. It's in all of us at some level.

Natural sources of mercury include volcanic eruptions and runoff from watersheds with mercury in their soil and water. Major human sources today include mining, coal burning, non-ferrous metals production, and cement production. Together these four major sources contribute about 85% of the new "unnatural" mercury being emitted around the world today. The remaining 15% comes from a long list of other human activities. All new sources contribute both to local mercury pollution in the short term and the pool of mercury circulating in the global environment over the long term.

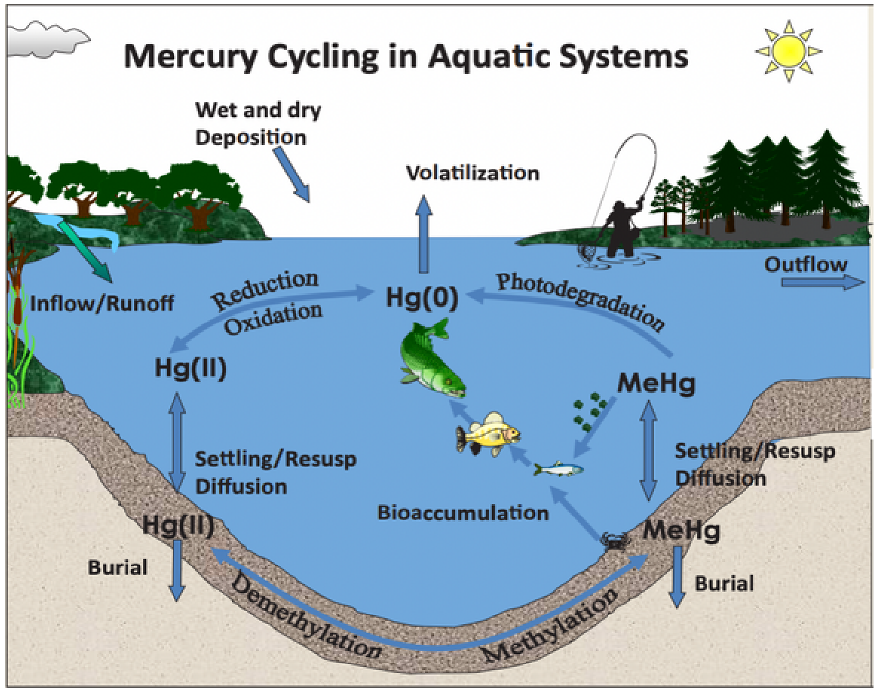


Geospatially distributed (total) mercury emissions to air from anthropogenic sources in 2015 (g/km2/a) from all sectors. Environmental Protection Agency.

We have fewer major new human-caused sources of mercury in our region than in many other parts of the world. Nevertheless, we still have mercury in our waters. We have natural sources, including volcanoes and hot springs; significant past and present human sources, including mining; and airborne mercury from countless sources around the world today (see EPA map above).

Most airborne mercury that doesn't settle on water eventually makes its way into it. As long as water flows downhill that will be the case.

Transformation of mercury to methylmercury in lakes and reservoirs

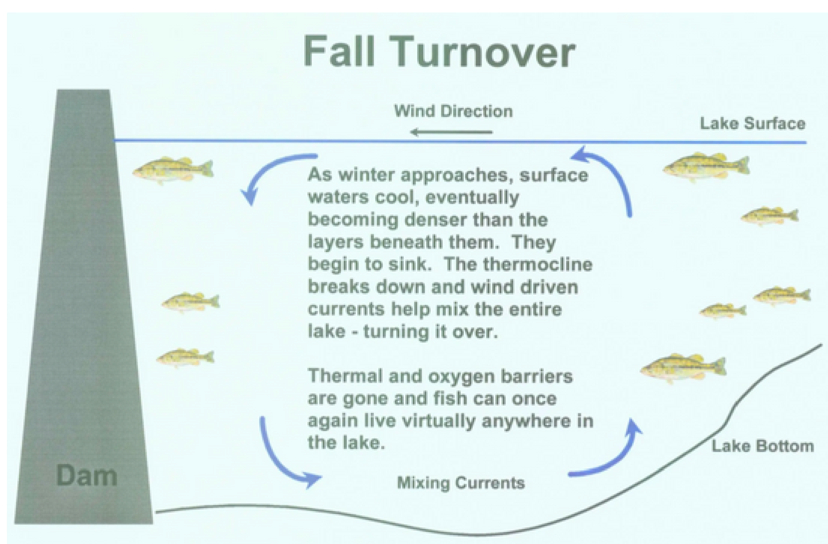


Mercury cycling pathways in aquatic environments are very complex. The various forms of mercury can be converted from one to the next; most important is the conversion of inorganic mercury to methylmercury (MeHg), the most toxic form. Ultimately, mercury ends up in the sediments, fish, and wildlife, or returns back to the atmosphere by volatilization. Diagram from USGS Mercury Cycling in the Hells Canyon Complex of the Snake River, Idaho and Oregon report.

Mercury ultimately makes its way into every aquatic ecosystem on Earth through the hydrologic cycle. It can be transformed into organic methylmercury in low-oxygen conditions. These conditions develop seasonally in many lakes and reservoirs due to decomposing organic matter. They become extreme in lakes and reservoirs that stratify in summer, creating very warm waters on top and very cold waters below. In those waterbodies, the cold bottom layer – the "hypoxic" zone – has almost no dissolved oxygen or life.

Stratification is most pronounced in deep lakes and reservoirs during long, hot summers. While there is very little life in the bottom layer, some bacteria that actually thrive in such conditions convert inorganic mercury in sediments into organic methylmercury. This most toxic form of mercury remains largely trapped in the deep, cold hypoxic zone as long as the waterbody remains stratified.

Stratification breaks down in late summer or early fall in what is commonly called the "fall turnover". Cooler weather, wind, shorter days, lower sun angles, and longer nights eventually combine to cause warm surface waters to cool and become dense enough to begin to sink. Rapid mixing can then take place – and with it, rapid release of the formerly trapped methylmercury into the food chain. It is then taken up in turn by plankton, zooplankton, and succeeding levels up the chain to fish, increasing in concentration with each step. It can bioaccumulate one million-fold or more as it works all its way up the food chain to large fish, birds, and other wildlife.



Changing seasons – stratification and the turnover. Image from Bassmaster.

The nature and degree of this phenomenon vary tremendously from one waterbody to the next. Many generate very little methylmercury. Some produce prodigious amounts.

Health effects of methylmercury

There are several reasons organic methylmercury is even more harmful to ecosystems and people than elemental mercury. They include:

1. Toxicity: It is a powerful neurotoxin and endocrine disruptor with known neurological, cardiovascular, and reproductive health effects.
2. Bioaccumulation: It accumulates rapidly in organisms and ecosystems.
3. Bioavailability: Unlike elemental mercury, it is easily absorbed into the human body through ingestion, inhalation, and skin contact.
4. Persistence: It does not break down easily in the environment or the human body, so it can have serious long-term effects on ecosystems and people.
5. Exposure: Fish - especially long-lived predatory fish - from contaminated waterbodies accumulate high levels of methylmercury. Many are eaten by people around the world.

Children, infants and especially the unborn are extremely vulnerable to methylmercury. Because their brains and nervous systems are still developing, their exposure to small amounts can have serious long-term effects on vision, cognition, memory, attention, fine motor skills, and language.

In adults, moderate levels of mercury can lead to irritability, tremors, and problems with vision, hearing and memory. High levels can lead to dementia, cerebral palsy, deafness, blindness, sensory and motor impairment, and even death.

Fish consumption considerations

Fish contain essential nutrients and omega-3 fatty acids, and are low in saturated fat. They are the foundation of many of the world's healthiest diets.

Many fish from many freshwaters are safe to eat regularly. Methylmercury accounts for a very large percentage of those that are not.

There is no "good" level of methylmercury in our bodies. Less is always better than more. However, for most people, concerns about consumption of fish with minute amounts of methylmercury are outweighed by their interest in the considerable health benefits of a well-balanced diet that includes fish.

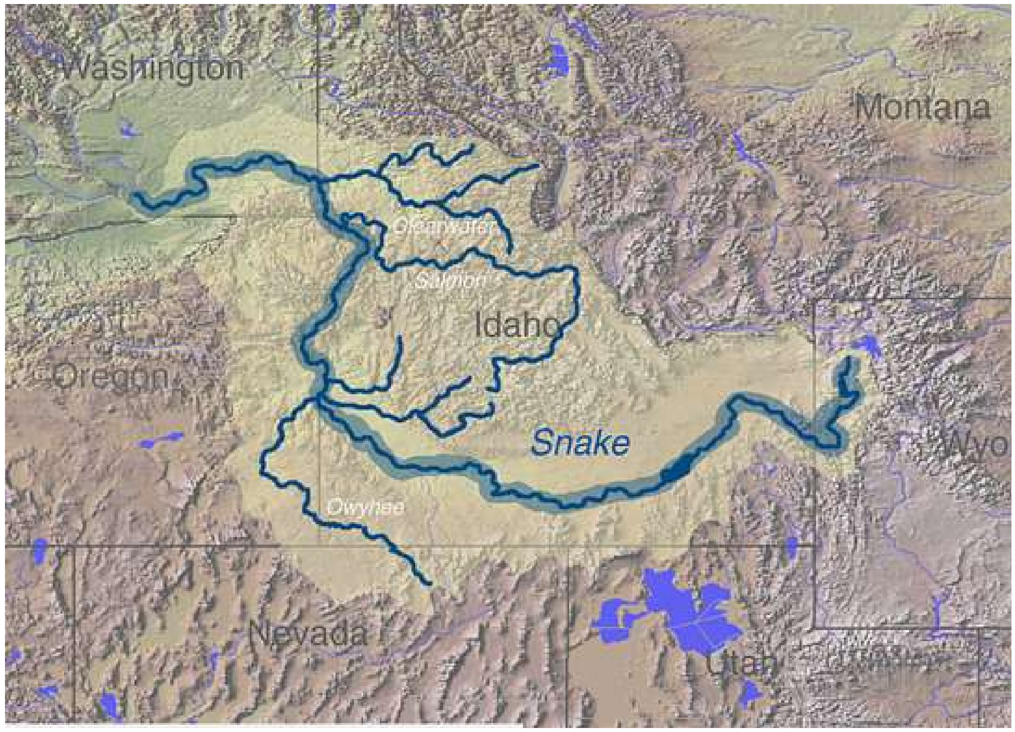
Human health risks increase in proportion to the concentrations of methylmercury in fish eaten and the amounts of those fish consumed over time. Some populations are more at risk than others. Risks are more pronounced for individuals and groups whose diets and cultures are more dependent on fish.

Where methylmercury contamination cannot be reduced enough for people to eat fish safely, the public must be warned. Warnings from public health agencies take different forms. Some are general warnings for the general public. Others are specific warnings for particular populations, for consumption of particular species or sizes of fish, or for the frequency and amounts of fish consumed.

Warnings, however, are not enough. They should be calls to action. Every effort should be made to understand and then to reduce or eliminate methylmercury problems wherever possible, as quickly as possible.

The Snake River and its water quality upstream of Hells Canyon

The Snake River rises in Yellowstone National Park in eastern Idaho and northwestern Wyoming. Its headwaters support a healthy ecosystem and world-class trout fishing. However, the Snake's character and condition change dramatically in its 1,078-mile journey west across southern Idaho, then north along the Idaho/Oregon border to its confluence with the Columbia River in southeast Washington.



Map of the path of the Snake River. USGS photo.

The Snake is dammed, diverted, and dewatered at multiple points in southern Idaho for agricultural, industrial, and municipal use. It is partially replenished between dams by municipal and industrial discharges, urban runoff, irrigation return flows, and springs. These sources are hardly pristine.

Agricultural runoff and irrigation return flows are particular concerns because they are high in volume and generally high in nitrogen and phosphorus. Today, even some *springs* in the basin have high levels of nitrogen and phosphorus, because their groundwater sources have been polluted by surface activities over decades.

As the Snake turns north and approaches Hells Canyon it is joined by eastern Oregon tributaries that contribute similar pollution loads from runoff, irrigation return flows and other sources.

One result of the Snake's cumulative pollution loads is that it is now unsafe to swim in or eat fish from many sections of the river; in fact, Idaho now warns people not even to expose their pets to some sections. Our allies at the Idaho Conservation League have recently launched a long-term campaign to solve the Snake River's serious pollution problems upstream of Hells Canyon.

Another result is that the Snake is primed for the creation of serious methylmercury problems as it enters the Hells Canyon reservoirs – problems that the Nez Perce Tribe, Pacific Rivers, and our allies at Idaho Rivers United are working to resolve.

The Snake River running through Hells Canyon. Photo by Sam Beebe, Ecotrust.

Hells Canyon and its three Snake River reservoirs

Hells Canyon is a world wonder. Two thousand feet deeper than the Grand Canyon and spanning over 1,000 square miles, it is home to an astonishing variety of microclimates, habitats, and species.

There are three dams on the Snake River in Hells Canyon. Licensed by the United States in the mid-1950s and built between 1958 and 1967, the reservoirs created by the Brownlee, Oxbow and Hells Canyon Dams span about 90 river miles. Together they comprise the Hells Canyon Complex, a hydroelectric project operated by the Idaho Power Company.

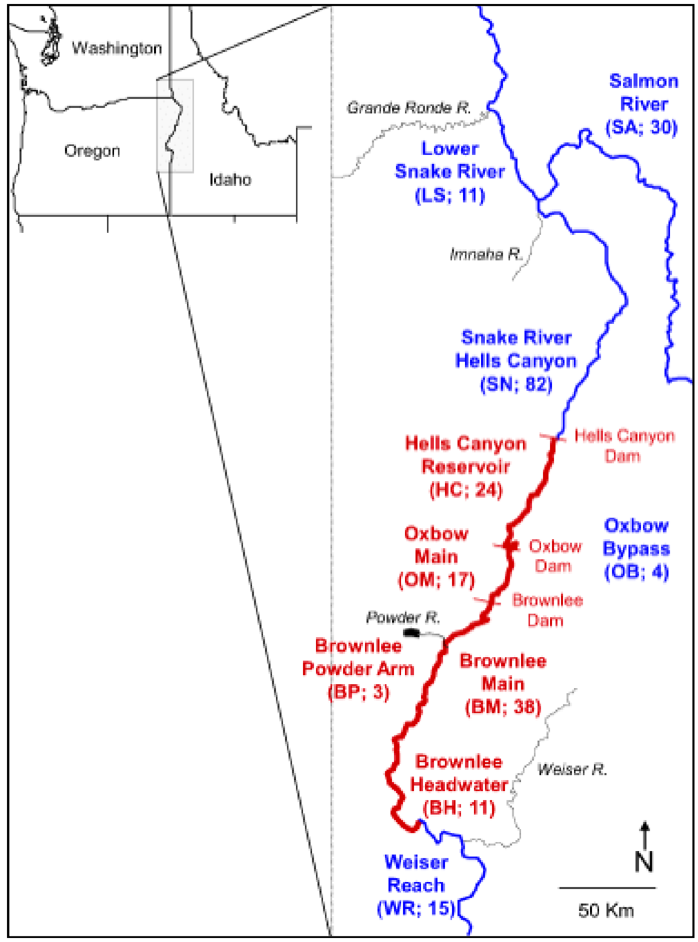
The bottom sediments of these reservoirs contain mercury from natural sources in the Snake River Basin, from human sources in Idaho and Oregon that include numerous legacy mining sites, and from watershed deposition of airborne mercury from sources around the globe. From the mercury sequestered in their bottom sediments, the three Hells Canyon reservoirs generate a great deal of mercury's most toxic form.

Methylmercury production in Hells Canyon reservoirs

How much? As early as 2004, the Idaho and Oregon Departments of Environmental Quality (IDEQ and ODEQ) stated that fish tissue samples for methylmercury already exceeded Idaho and Oregon levels of concern by 52% and 80%, respectively.

Fourteen years later, a 2018 report by the ODEQ found that the amount of methylmercury found in fish tissue in and downstream of the Hells Canyon reservoirs far exceeded standards for protection of

Algae bloom in the Brownlee Reservoir. Courtesy of Lorraine Backer / Centers for Disease Control and Prevention public health image library.



Map of the Snake River Dams from ResearchGate.

human health. It stated that the average level of mercury found in fish tissue samples in Brownlee Reservoir was eight times Oregon's standard, and that downstream of Hells Canyon dam it was more than ten times the standard.

Why? When the Snake's high loads of phosphorus and other pollutants enter the still, shallow waters of the upper portion of Brownlee Reservoir, massive algae blooms develop and deplete dissolved oxygen levels. That jumpstarts the transformation of mercury into methylmercury.

In the blazing summer sun in the depths of Hells Canyon, surface temperatures of all three reservoirs rise sharply. The reservoirs then stratify distinctly – and methylmercury production explodes in the deep hypoxic zone.

Mercury levels that are too low to detect in water even with today's state-of-the-art methods can still be high enough to cause very serious problems in the food chain. That is why Oregon and Idaho have both set additional water quality standards for concentrations of methylmercury in fish tissues. For contaminants such as mercury that are difficult or impossible to measure directly, fish tissue sampling is a proven and cost-effective method.

Idaho's current fish-tissue standard is 0.3 milligrams per kilogram (mg/kg). Oregon's standard of 0.04 mg/kg is more stringent. This is because Oregon's policy is to take into consideration the many individuals and groups who eat more fish and shellfish than the average person. Oregon's standard is intended to protect people who consume up to 175 grams of fish per day on average (about 23 typical moderate fish meals a month), which is common for many anglers and especially for Tribal populations whose diets and cultures revolve around fish.

Methylmercury concentrations in fish tissue samples in and downstream of the Hells Canyon reservoirs regularly exceed the standards of both Oregon and Idaho.

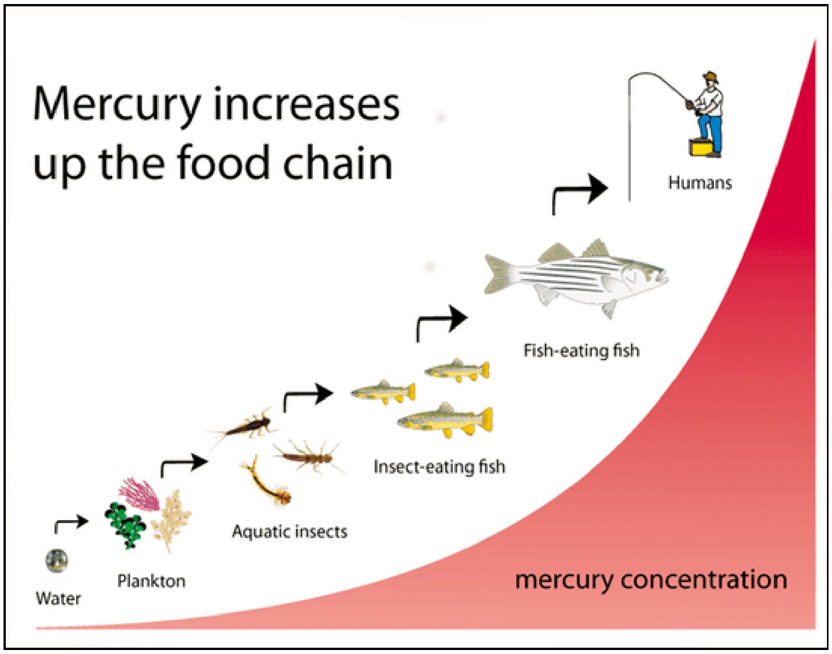


Diagram from Inhabitat depicts bioaccumulation up the food chain.

When the fall turnover occurs in the reservoirs, rapid mixing of warm surface and cold, hypoxic deep waters allows methylmercury to enter the food chain. As it moves up the chain it reaches extremely dangerous levels in the predatory and long-lived fish of the canyon, including bass, catfish, and sturgeon.

Methylmercury in the water column is discharged through the dams and flows far downstream. Fish tissue samples have shown high concentrations at least as far downstream as the Snake's confluence with the Salmon River, about 60 miles below Hells Canyon Dam. Samples taken between 2006 and 2019 showed that smallmouth bass 12 inches or longer had levels ranging from 7 to 19 times the Oregon standard. Large white sturgeon had levels as much as 75 times the standard.

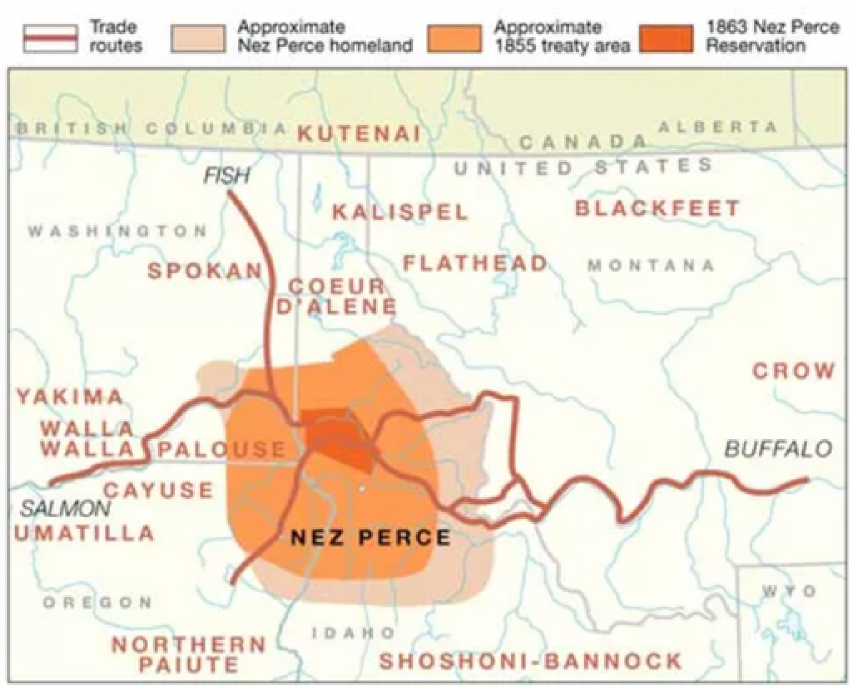
Such levels are cause for serious concern for all anglers in the region. For the Nez Perce Tribe, they are much more than that: they are an existential threat to their Treaty rights and way of life.

Rights, interests and concerns of the Nez Perce Tribe

The historic territory of the Nez Perce stretched from the Bitterroot Mountains on the east to the Blue Mountains on the west. It included large parts of what is today northeastern Oregon, eastern Washington, the panhandle of Idaho, and northwestern Montana. The Snake River in Hells Canyon is at its heart.

The 1855 Treaty between the United States and the Nez Perce recognized and promised to protect certain rights necessary to maintain the Tribe's culture and way of life, including the right to take and eat fish at all of the Tribe's "usual and accustomed places."

Historically, over one million Pacific salmon and steelhead spawned and reared upstream of Hells Canyon.



Today, the Nez Perce reservation is a small fraction of the historic homelands of the Nimiipuu people. Map from National Parks Service.

Nevertheless, the original federal license for the Hells Canyon dams required no fish passage. Over the last six decades, these dams have eliminated anadromous salmon and steelhead runs above them. They have also fragmented the habitats of Snake River migratory fish including sturgeon, rainbow trout, and endangered bull trout.

The dams have also modified the temperature regime of the Snake River downstream. Summer river temperatures there are lower than before. Fall temperatures are higher, regularly reaching levels harmful or even lethal to returning salmon and steelhead.

A third insult to the rights of the Nez Perce is that methylmercury produced behind the dams has poisoned the resident fish of Hells Canyon. It has harmed their people, birds and other wildlife that depend on eating fish from the river.

Over more than six decades, these effects of the Hells Canyon dams have shattered the promises of the United States to the Nez Perce Tribe. *It's time to renew those promises*.

Clean Water Act action

It's also time to renew our commitment to the Clean Water Act's overall goal to "restore and maintain the chemical, physical and biological integrity of the Nation's waters" for the benefit of all people.

The Clean Water Act was passed by Congress in 1972. By that time the mercury contamination problem in and downstream of the Hells Canyon reservoirs was already known.

The enormous Hells Canyon dam completely blocks fish passage.

Pacific Rivers, Idaho Rivers United and our allies have long urged state and federal agencies to take a much harder look at the methylmercury problem and other problems that are either caused or exacerbated by the Hells Canyon Dams. In 2019, we took an additional step – to court.

Idaho Power Company's federal operating license for the Hells Canyon Dams expired in 2005. Since then, while seeking a new 50-year license, the company has been operating under a series of annual licenses issued by the Federal Energy Regulatory Commission (FERC).

Section 401 of the Clean Water Act (CWA) requires states to certify that proposed FERC licenses will not violate their water quality standards. Oregon and Idaho standards for temperature and methylmercury are violated persistently and significantly in and downstream of the Hells Canyon reservoirs.

The CWA requires that a Total Maximum Daily Load (TMDL) of pollutants be established for waterbodies where state water quality standards cannot be met through typical regulatory control of one or a few direct pollution sources. The TMDL sets an upper limit for the pollutants in question – a sort of "pollution budget" – that then drives decisions about management changes necessary to bring problems under enough control for water quality standards to be met and maintained.

Under the CWA, a state certification of a proposed FERC license is to provide reasonable assurance that state water quality standards will be met. In 2019, the Oregon Department of Environmental Quality (ODEQ) issued a CWA Section 401 certification for the three Hells Canyon Dams. It was inadequate. It failed to specify how much methylmercury would have to be reduced or a clear timeframe for reductions. It also failed to provide reasonable assurance that violations of the temperature standard would end.

Pacific Rivers and Idaho Rivers United petitioned for judicial review of the ODEQ certification. Our petition was later consolidated by the court with a similar one brought by the Nez Perce Tribe. Negotiations with ODEQ, the Oregon Department of Natural Resources (ODNR), and Idaho Power ensued.

Agreement

In 2021, Pacific Rivers, Idaho Rivers United, and the Nez Perce Tribe entered into a joint Settlement Agreement with Oregon. The Agreement calls for changes in dam operations to provide water temperatures safe for salmonids downstream; for reintroduction of spring Chinook salmon and summer steelhead in Pine Creek above Hells Canyon Dam; and for the establishment of a methylmercury TMDL for the Snake River and its reservoirs.

As part of the Agreement, the State of Oregon and Idaho Power Company contributed a combined $1.5 million toward further scientific studies of the Hells Canyon methylmercury problem. Those studies, which commenced in 2014, are now being completed by a large interagency technical team led by the U.S. Geological Survey (USGS). The technical team formally includes representatives of the Nez Perce Tribe. Important papers already published by the technical team are listed below with other sources for this article.

Pacific Rivers and Idaho Rivers United representatives serve on the advisory team. Our representative is longtime Board member and attorney Bryan Lessley.

The science team's specific findings and analysis of potential management scenarios will inform regulatory and management decisions for the Snake River upstream of, in, and downstream of Hells Canyon. Their more general insights will have implications for many waterbodies with methylmercury problems across the country and around the world.

Next steps

We expect that within the next few months USGS will complete its predictive model for methylmercury management scenarios in and downstream of Hells Canyon. Our Settlement Agreement calls for ODEQ to:

1. ***Release a draft Snake River Methylmercury TMDL*** for public comment within three months after receiving the USGS model, and
2. ***Finalize the TMDL*** within eight months after receiving the model.

After the TMDL is finalized, regulatory and management actions by ODEQ, ODFW and Idaho Power Company will begin. After that, monitoring, evaluation, and adaptive management activities are to be conducted regularly in the decades ahead to ensure that steady progress is made toward the Nez Perce Tribe's long-term goal. That goal is spelled out in our joint Settlement Agreement:

> ***"…Treaty-reserved aquatic resources continue to inhabit the Snake River within and downstream of the [three-dam] Complex and are safe to support Treaty-reserved rights to harvest and consume fish within and below the Complex no later than the year 2045 and at levels at least as protective as Oregon's human-health criteria reflecting a per-capita fish consumption rate of 175 grams per day at a risk level of 10-6."***

Finally, after more than 50 years, meaningful action toward this clearly defined goal is to begin soon. We will stay engaged in the Snake River process until all the agreed-upon actions are taken and all agreed-upon goals for the Snake River and the Nez Perce Tribe are met.

As always, Pacific Rivers is working today at the intersection of justice, science, policy, and law to protect and improve Northwest rivers for the benefit of fish, wildlife, and all people.

* * * * * * *

FOR MORE ON THE TOPICS OF THIS ARTICLE:

Mercury Pollution: The Global Context (US EPA) https://www.epa.gov/international-cooperation/mercury-emissions-global-context

US EPA Fish and Shellfish Advisories and Safe Eating Guidelines https://www.epa.gov/choose-fish-and-shellfish-wisely/fish-and-shellfish-advisories-and-safe-eating-guidelines

World Health Organization Fact Sheet: Mercury and Health https://www.who.int/news-room/fact-sheets/detail/mercury-and-health

Snake River Water Quality in the Spotlight (Idaho Conservation League) https://www.idahoconservation.org/blog/snake-river-water-quality/

Mercury Cycling in the Hells Canyon Complex of the Snake River, Idaho and Oregon (USGS) https://pubs.usgs.gov/fs/2016/3051/fs20163051.pdf

Seasonal Dynamics and Interannual Variability in Mercury Concentrations and Loads through a Three-Reservoir Complex (Environmental Science and Technology) https://pubs.acs.org/doi/epdf/10.1021/acs.est.9b07103

In-Reservoir Physical Processes Modulate Aqueous and Biological Methylmercury Export from a Seasonally Anoxic Reservoir (Environmental Science and Technology) https://pubs.acs.org/doi/pdf/10.1021/acs.est.2c03958

Image from Field Guide to the Anthropocene, Substack.

Liz Gilliam - Board Treasurer

THE TALE OF THE BEAVER

How the Species Went from Nearly Extirpated to Today's Unsung Hero

In our series of articles about watershed restoration, the Spring 2023 edition of Free Flow discussed the scientific underpinnings of ecological restoration, and the evolution of the practice over time. We highlighted the importance of reinstating natural processes to restore biodiversity, providing benefits to both people and wildlife and looking beyond just the stream channel and onto the valley, floodplain and uplands, to deliver a more resilient mosaic of habitats. And this is a wonderful segue into the articles in this newsletter, as we continue to feature important projects that are being completed, some with assistance from our North American Beaver friends.

Beavers (Castor canadensis), the hardworking (and often under-appreciated) ecosystem engineers are helping restoration practitioners to make the most of limited resources to restore stream function. Through their persistence, beavers create - and better yet, maintain - disturbance-resistant landscapes that enhance biodiversity, improve water quality, reduce damage from wildfire, droughts, flooding, and more. These ecosystem services provide on the order of $69,000 per square kilometer, per year of benefits (Jordan and Fairfax 2022).

In this issue, we are showcasing the work of beavers, as well as beaver-inspired watershed restoration efforts, to combat the evolving challenge of incorporating climate change considerations and methods that will be resilient to or mitigate climate change. These include a multi-phased project on Whychus Creek in the Deschutes River Basin of Central Oregon, the return and enhancement of wet meadows for vulnerable birds in Wyoming, and a pasture irrigation project in Utah.

We will cap the Beaver Series by telling the story of Geronimo. It's a gem. If you've heard it before, it's just as entertaining another time around. Enjoy!

Beavers and Beaver Restoration Techniques

From our 21st century vantage, it's hard to conceive how profoundly beavers shaped the landscape. Surveying the Missouri River Basin in 1805, the explorers Meriwether Lewis and William Clark encountered beaver dams "extending as far up those streams as [we] could discover them." Their networks of dams and ponds once puddled the continent — impounding enough water to submerge Washington, Oregon, and California. Beavers were historically present from northern Mexico up to the southern fringe of the tundra on the Arctic coastal plain in Alaska and northern Canada. The sheer extent of their habitat and size of their population had a huge effect on landscapes across the US, and elsewhere, maintaining the wide, beaver stream-wetland valleys that shaped waterways throughout their range. In a healthy, beaver-rich creek, dams slow water flows, capture sediment, recharge shallow groundwater, cool stream flows, provide flows longer into dry seasons, support wet, healthy riparian corridors, and the list goes on.

Once numbering upwards of 250 million in North America (Wohl 2021, Atwater 1996), beavers could not withstand the fur trappers who arrived in New England in the 17th century, then quickly spread west. By 1843, naturalist John James Audubon found the Missouri Basin "quite destitute." At the outset of the 20th century, researchers estimate just 100,000 beavers survived — less than one tenth of 1% of historic numbers (Wohl 2021). Until recently, beavers who found themselves on private land were even considered predators in Oregon and elsewhere, and could be killed with little or no regulation.

In a relatively short span of time, the mosaic of habitats that beaver had created and maintained were unraveling. With the loss of beaver, old dams collapsed and washed away, streams eroded into their beds, cutting deep gullies (in a process called incision) and impacting the hydrology of the entire once-wetted floodplain valley. These steep-sided, incised streams lost the ability to spill onto their floodplains and recharge aquifers. As a result, groundwater levels and surface water flows greatly decreased. Wetlands dried up. Some groundwater-fed streams dried up altogether. This had a huge and lasting effect on not only the salmon and trout that reared in their pools, but many, many flora and fauna that benefited from the beavers' hard work.

Fast forward to current times, and beavers' numbers are rebounding. Their ecological engineering prowess is much more appreciated, and a notable effort is underway to create the conditions that beavers need to sustain in an area. In effect, we are working on **re-beavering streams.**

Incised stream in Browns Canyon pre-BDA restoration. Image from Utah Department of Natural Resources.

One solution is a rodent-human collaboration. This encompasses techniques that either mimic the beaver dams and their influence on channels, such as building small dams with posts and woven willow lattices; or projects that create conditions that can support a beaver recolonization to lure our friends back into their habitat, such as planting the tastiest plants, providing security and the appropriate amount of space. These approaches go by many names, for example, **Beaver Dam Analogs** (BDAs) and **Post-Assisted Log Structures** (PALS), and BeaverHoods (Jacobs 2021). They mostly refer to projects whose goals include slowing down creek flows, spreading water onto floodplains, creating hydrologic, sediment and plant variability, and rewetting habitats in hopes that beaver nearby return to the valley and take over, gnawing down nearby trees and reinforcing the dam with branches and mud. Perhaps for now we can call them **beaver-motivated projects.**

The benefits of beaver on the landscape are many! The dams store water during wet periods, spreading the water onto the floodplain and into shallow groundwater storage (Dittbrenner et al. 2022). These dynamics increase streamflow during summer (Puttock et al. 2021), reduce flooding during wet months (Muhawenimana et al. 2023), reduce wildfire impact (Fairfax) and improve the riparian and floodplain corridors (Larsen et al. 2021). All these, in turn, support the recovery of our native fishes.

Post-Assisted Log Structures (PALS) and **Beaver Dam Analogs (BDAs)** are nature-based beaver mimicry techniques that can restore badly eroded streams. They are hand-built structures.

PALS mimic and promote the processes of wood accumulation; whereas **BDAs** mimic and promote beaver dam activity. PALS and BDAs are permeable, temporary structures, built using natural materials.

This restoration approach is being used to heal the incised streams, disconnected wetlands and floodplains across the landscape. The technique has quickly gained fanfare from many practitioners. Federal agencies, nonprofits, and even private ranchers have installed the structures to return life to deeply eroded streams and, in some cases, to help re-establish beavers in long-abandoned territories. In Wyoming, BDAs are creating wet meadows for a vulnerable bird species. In Oregon, they're rebuilding salmon streams. In Utah, they're helping irrigate pastures for cattle. The projects are many, successful and encouraging.

Part of the allure is also that these methods are cheap compared with other restoration techniques. The costs typically amount to materials for the posts, since many projects rely on volunteer sweat equity. Once these types of projects are installed, the beavers themselves become reliable, hard-working volunteers we can count on to carry the project forward.

Despite the fanfare, the movement to restore nature's best river restoration engineers has sometimes experienced growing pains. Some landowners and government agencies are loath to aid a rodent infamous for felling valuable trees, flooding property, and clogging road culverts. Last year alone, the U.S. Department of Agriculture (USDA) killed more than 23,000 beavers deemed to be nuisances (USDA 2017).

As successful projects improve year after year, and the skeptics turn to proponents, beaver-motivated projects are gaining traction. There are obvious areas where this approach will not work, where the messiness and flooding associated with a growing beaver dam will cause conflict. Other solutions are needed there. But where there is room and conditions to support beaver, these techniques can have beautiful benefits for a fraction of the cost. We highlight some specific projects next.

Process-Based Restoration

On the light-handed and relatively economic end of the restoration spectrum, **process-based restoration** focuses on creating conditions that allow nature to heal itself, rather than relying heavily on human intervention. The concept recognizes that to restore ecologically functional habitats, we need to restore the physical and ecological processes responsible for creating and maintaining those conditions, often just by removing human-caused constraints. In short, giving the habitats and wildlife within them the space they need to function as they should and **"letting the system do the work."**

Stream and riverine landscapes are made up of a series of interconnected floodplain, groundwater, and channel habitats, and their associated biotic communities. Keeping the connections among them is vital for healthy aquatic systems. Dam removal is an excellent method for restoring many river systems, but it does not always take something as hefty as removing a dam to restore natural processes.

The restored, post-dam removal Elwha river flowing freely in the Olympic Peninsula. Photo by Richard Probst.

Other project examples of restoring processes include improving undersized road crossings, where dams and pipes can impact miles of precious habitat with a relatively small effort. So can removing constraints along the edges of a channel - levees, dikes and impinging infrastructure. These actions restore the natural hydrology, while in the process allow for a variety of habitat types, including the restoration of wetlands (aka nature's sponge), to the restoration of estuaries (a much underappreciated habitat type), to protection of the uppermost parts of the watershed: the headwaters, and a focus on conservation efforts such as the proposed new Oregon Wild and Scenic Rivers legislation. In essence, just removing hard barriers to let the river's processes do their thing.

It's worth noting the diversity of landscapes on which similar approaches can be applied. We will touch back on this through our case studies, but the approach to restoring a high desert system compared with a coastal system, or estuarine versus headwater, may not be as different as one might initially think. Many groups are making methods and materials accessible, driving the science and implementation of these relatively inexpensive projects, and working with an array of landowners to create tools and shared knowledge to get more done.

As mentioned in the Spring Issue of Free Flow, how we approach river restoration has evolved over time. When the restoration practice began, projects involved engineering-heavy, precise and stable approaches. As we learned more, the approaches evolved to focus on the restoration of processes by removing the constraints impinging the channel, and as much as necessary, letting the channel dictate its own recovery. Hard engineering is necessary in some settings, and in many cases there is not enough space to work with, but when there is, it can be magical to just free the river and watch it evolve and heal itself. You know the phrase *"Free the heels (or the reel) and the soul will follow"*? Well, something just like that.

Restoration of critical processes also allows the system to respond to future perturbations (including and especially climate change impacts), enabling riverine ecosystems to evolve and continue to function in response to shifting system drivers (e.g., changes in sediment load, hydrology, or riparian vegetation, etc). It relies on the understanding that natural systems have **inherent resilience** and the ability to **self-regulate** if given the opportunity.

One of the main characters in these restoration stories is the beaver. In the case studies outlined next, we will see examples of techniques that focus on creating ideal conditions for beavers to thrive and let the beavers do the hard work, and finally stories of process-based restoration Implementation. All in the hopes of a little affirmative action for our ecosystem engineers in support of the recovery of our native fishes.

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CASE STORIES

Wychus Creek passing through Willow Springs Preserve in early 2022. Source: Deschutes Land Trust StoryMap

Process-Based Riverscape Restoration in Whychus Creek, Upper Deschutes Basin, Oregon

Written by Liz Gilliam

The project information has been provided by the Project Partners: Upper Deschutes Watershed Council, Deschutes Land Trust and Anabranch Solutions.

Resources for more information:

1. *Deschutes Land Trust StoryMap: https://storymaps.arcgis.com/stories/465d3341852347969081bb4c20eeac3a*
2. *UDWC: https://www.upperdeschuteswatershedcouncil.org/restoration/whychus-creek/willow-springs-preserve-habitat-restoration/*

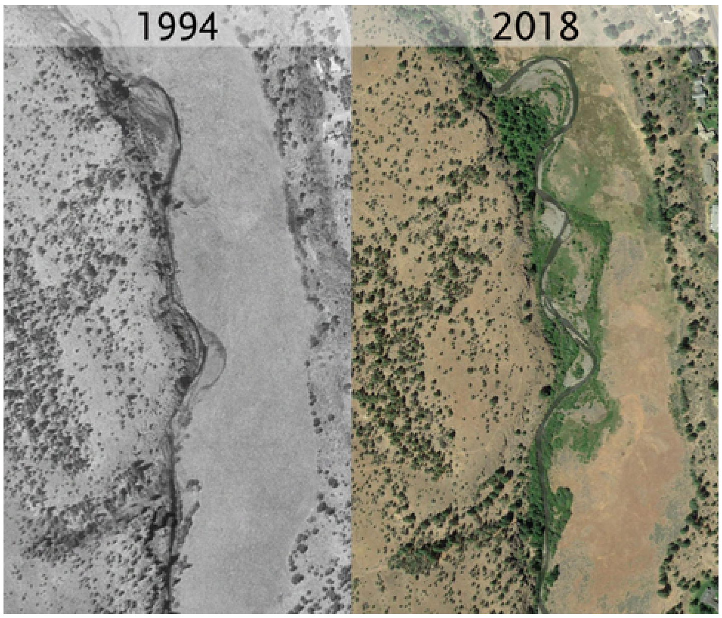
This project employs process-based principles for a 0.7-mile section of a perennial tributary to the upper Deschutes River. The Willow Springs Preserve is owned by the Deschutes Land Trust and The Upper Deschutes Watershed Council (UDWC) began restoration work at Willow Springs Preserve in June of 2022.

The design approach utilizes simple, cost-effective, hand-built structures that mimic beaver dams (i.e., Beaver Dam Analogs and Post-Assisted Log Structures). These structural elements are designed to accelerate the recovery trajectory of the degraded stream.

Why restore Whychus Creek?

Historically, Whychus Creek was a mixture of narrow canyon stretches and stretches with broad, well-vegetated meadows where the creek could spill over its banks. The biological importance of these large meadows was significant, especially considering all of the arid land surrounding them. The meadows provided diverse stream and side channel habitats for fish to spawn, rear, and hide. Streamside vegetation provided cover for wildlife and helped maintain cool stream waters. Nearby wetlands and bends in the creeks, called oxbows, were home to amphibians and songbirds. Only a small portion of the total length of Whychus Creek can provide this critical meadow habitat. Willow Springs Preserve is one of these special sections.

Today, this portion of Whychus Creek is disconnected from its surrounding meadow. Habitat within and along the creek is very basic, lacking the diversity that fish and wildlife need to thrive. Fortunately, the creek has not cut down so deep into its channel that it cannot move from its current position. In fact, the creek is already starting to elbow its way out of its main channel in several parts of the Preserve, creating new meanders.



Wychus Creek in 1994 and 2018, showing increased quantity of elbows and meandering. Source: Deschutes Land Trust StoryMap

Ultimately, **the goal is to help return the creek to a healthy, biologically diverse condition** and resilient condition capable of maintaining a diverse and self-sustaining set of fluvial and riparian processes that benefit an abundance of aquatic and terrestrial fish and wildlife species.

How is Whychus Creek being restored?

Instead of implementing restoration using large equipment to reshape the channel and surrounding floodplain, a much less invasive method is being employed. A small crew of young adults worked to install hand-built wood PAL and BDA structures. These structures were installed in the stream channel and in the adjacent floodplain.

A highlight of this and similar projects is that they reduce design and implementation costs and allow natural stream processes to do much of the restoration "work." This minimizes economic and ecological risks associated with stream restoration implementation. A win-win-win.

The information provided by the UDWC beautifully explains the project elements, goals and objectives.

Bridge Creek, Eastern Oregon

Central Oregon's Bridge Creek, a 45-kilometer-long tributary to the John Day River, is an extensive BDA test project that started implementation in 2009, over 14 years ago. There is a long and storied history of beaver removal at the site: in the 1820s, English trappers deliberately exterminated the region's beavers to dissuade U.S. trappers from invading the Oregon Territory, which was claimed at the time by both the United Kingdom and the United States. The gambit failed, but the beavers' destruction, combined with unchecked cattle grazing, have left an enduring legacy. Without the beaver dams to slow the flow and encourage sediment deposition, Bridge Creek devolved into a narrow trench bordered by dried out pastures.

Bridge creek in the Painted Hills. Source: Wikipedia.

Despite its grim appearance, Bridge Creek continued to support a small population of endangered steelhead—rainbow trout that, like salmon, migrate to the ocean and back. A skeleton crew of beavers had also survived, although any dams they built across the sluice-like channel tended to wash out during bigger storms.

In the mid-2000's, scientists had been documenting the amounts of sediment trapped behind beaver dams and thought that creating those conditions in Bridge Creek could have a profound benefit on the degraded channel, reconnect it with the floodplain, and inundate side channels and backwaters in which juvenile steelhead could thrive.

In 2009, a hydraulic post-pounder was used to build 76 BDAs, built to mimic the function of natural beaver dams with on-site building materials (such as wood, turf, mud, and cobble), and can be reinforced with wooden posts. Beavers soon returned to the site and went to work. By 2013, monitoring showed that beavers had fortified nearly 60 of the BDAs and built 115 new dams (Silverman et al. 2019). This combination of constructed and natural beaver dams can create widespread benefits at relative low-cost per area restored (Bouwes et al. 2016; Weber et al. 2017). The overarching goal was to convert a drastically simplified stream into a complex one. With the brilliant, natural ecological engineers at work, their dams slowed the water, and the stream bed began climbing out of its trench, spilling water onto floodplains. The creek's submerged area tripled, and side channels grew by more than 1,200% in just a matter of a few years.

Steelhead soon took advantage of the renewed habitat. Bridge Creek produced nearly three times more fish than a nearby control stream, and its young steelhead were 52% more likely to survive, the researchers reported in 2016 in Scientific Reports (Bowes et al.). Other studies found the dams and ponds actually helped moderate water temperature spikes, by allowing water to percolate through the gravel and streambed sediment.

Projects like this, with nearly 10 years of monitoring, are incredibly valuable. Lessons learned along the way will inform efforts and decisions on subsequent projects and provide optimism that inexpensive efforts can have big impacts, and reverse declines that lasted decades.

Birch Creek, Southeast Idaho

Some ranchers have also embraced beaver-based restoration. A rancher named Jay Wilde from Mink Creek, Idaho spent years trying to restore perennial flow to Birch Creek, a seasonal stream on his land.

He grew up swimming and fishing in Birch Creek all summer long. But when Wilde took over the family farm from his parents in 1995, the stream was dry by mid-June. He realized this was partly because his family and neighbors, like generations of American settlers before them, had trapped and removed most of the dam-building beavers. The settlers also built roads, cut trees, mined streams, overgrazed livestock and created flood-control and irrigation structures, all of which changed the plumbing of watersheds like Birch Creek's.

Wilde then tried numerous ways to improve stream conditions, but it wasn't until he incorporated beavers that he saw results. In 2015, he invited scientists to build 19 BDAs on the creek and release five beavers nearby. The following summer, the stream stayed wet for two months longer than usual, helping to irrigate his grazing meadows.

Birch Creek is a 6.1-mile-long northeastward-flowing stream originating on the western slope of the Bear River Range in Franklin County, Idaho. Idaho Bureau of Land Management photo by James Neeley.

In just three years, those beavers built 149 dams, transforming the once-narrow strip of green along the stream into a wide, vibrant floodplain. Birch Creek flowed for 42 days longer, through the hottest part of the summer. Fish rebounded quickly too: **Native Bonneville cutthroat trout populations were up to 50 times as abundant** in the ponded sections in 2019 as they were when surveyed by the U.S. Forest Service in 2000, before beavers went to work.

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BEAVER & WILDFIRE

Written by Liz Gilliam

Beavers' infrastructure slows and stores water in their ponds, canals, and the surrounding soil during wet periods. Because their dams raise water levels, the ground stores water like a sponge. Then, during dry periods the stored water is accessible to riparian vegetation, effectively irrigating the riparian zone and often providing water to flow downstream in the drier months. This greater amount of cool water directly benefits rearing steelhead and trout. Beavers can create and maintain wetlands that are resistant to both seasonal and multiyear droughts by spreading water across the floodplain, essentially creating gaps in combustible vegetation, or firebreaks. **These can help slow and limit the destruction of wildfires.**

Beaver-dammed riparian zones have been shown to burn on average three times less than those without beaver (Fairfax and Whittle 2020). For example, the Sharps Fire that scorched over 57,000 acres in south-central Idaho in July 2018 burned a wide swath of a watershed where Idaho Fish and Game had relocated beavers to restore a floodplain. A strip of wet, green vegetation stood untouched along the beavers' ponds, in the midst of a vast swath of burned forest.

The green strip of vegetation along beaver-made ponds in Baugh Creek near Hailey, Idaho, resisted flames when a wildfire scorched the region in 2018, as shown in this drone image (courtesy of J. Wheaton).

Similarly, on the Susie and Maggie Creeks in northeastern Nevada, streamsides near beaver dams were up to 88 percent greener than undammed stream sections when measured from 2013 to 2016 (Fairfax and Small 2018). Even better, beaver ponds helped maintain lush vegetation during the hottest summer months, even during a multiyear drought.

Studies have been conducted to see if creeks with beaver activity stayed greener than creeks without beavers during wildfires. Across the board, beaver-dammed areas didn't burn (Fairfax and Small). Areas without beavers averaged three times more damage than those with beavers, and where beavers or rain are absent, plants dry out and become dry fuel for fires.

In 2021, Oregon endured the third-largest wildfire in its recorded history. The Bootleg Fire tore through the Upper Klamath Basin, an ecologically sensitive area that is home to multiple threatened and endangered species including the northern spotted owl, and two fish — the koptu and c'waam (shortnose sucker and Lost River sucker) — that are culturally vital to the Klamath Tribes. The fire left behind a charred landscape more than twice the size of New York City.

Ash from the fire, which burned for more than a month, had clogged formerly pristine tributaries and turned them into black slurries. Thriving trout populations had disappeared, presumably choked to death by waterborne debris particles that deprived the fish of oxygen.

A huge column of smoke from the Bootleg Fire. National Interagency Fire Center, Fremont-Winema National Forest.

However, amid an otherwise burned-out area along Dixon Creek, a tributary in the Sprague River, roughly five acres of pristine greenery persisted. At the center were roughly eight active beaver dams. Even though the upstream reaches were burned and fish were absent, the water downstream of the beaver ponds was running clear—and trout were thriving. The dams and ponds appeared to have altered the hydrology of the landscape around them, and the beavers had effectively built something that staved off fire-related contamination (Wathen 2021).

Similar dam-driven refuges have been documented from Colorado (Fairfax and Whittle 2020) to California (Schwartz 2021), Idaho (Whitcomb 2022), and Wyoming. Through many studies, it has been shown that, along with deterring the flames themselves, beaver dams and ponds also function as filters for ash and other fire-produced pollutants that enter waterways—thus maintaining water quality for fish, other aquatic animals, and humans—emerging evidence suggests.

Perhaps instead of relying solely on human engineering and management to create and maintain fire-resistant landscape patches, we could benefit from beaver's ecosystem engineering to achieve the same goals at a lower cost. Reconnecting waterways to their floodplains, as beavers do, improves water quality and quantity, supports biodiversity and sensitive species conservation, increases flood, drought and fire resiliency, and bolsters carbon sequestration. Climate-driven disturbances are actively pushing streams into increasingly degraded states, and while the importance of river restoration is clear, beaver-based restoration—for example, strategic coexistence and mimicry—remains an underutilized strategy despite ample data demonstrating its efficacy.

The contrast is striking between the beaver wetland in Little Last Chance Creek in California and the surrounding area a year after a forest fire in 2021. Photo Courtesy of Emily Fairfax.

In California, a new policy went into effect in June 2023 that encourages landowners and agencies dealing with beaver damage to seek solutions such as putting flow devices in streams or protective wrap on trees before seeking permission from the state to kill the animals. The state is also running pilot projects to relocate beavers to places where they can be more beneficial. Federal and State land managers are acknowledging the utility of having beavers on the landscape, and are working to lower hurdles in permitting that would allow more community-driven projects to preserve more beavers, along with their nature-friendly behaviors.

Beavers and Wildfire: a stop-motion story by Emily Fairfax

Emily Fairfax produced a stop-motion video to show how beavers and their dams and channels keep water in an area, supporting the surrounding vegetation and helping the area resist wildfires. Beavers and Wildfire: A stop-motion animation by Emily Fairfax. https://youtu.be/IAM94B73bzE

Hopefully the continued good press and catalog of successful projects will encourage more beaver-inspired restoration to support building climate resilience across the landscape. Not every stream will be a good candidate for beaver-based restoration, but we have the tools to know which ones are–and so many are. We need more project proponents to spread the good word! For more information and resources, see the list below.

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Idaho Fish and Game officers load a beaver into a wooden box before he's loaded on a plane and dropped into the Idaho backcountry. Image courtesy of Idaho Fish and Game.

The Story You Needed to Read Today - The (Inexhaustible) Story of Geronimo

Written by Liz Gilliam

More than 60 years ago, Idaho Fish and Game parachuted beavers into the state's backcountry. This little-known piece of Idaho history stars a Fish and Game officer, and a now famous beaver named Geronimo.

It was just after World War II, and more people had discovered what a beautiful place McCall and Payette Lake were. Idaho Fish and Game's Steve Liebenthal says many people around that time started building homes "and in the process, kind of moved into where these beavers had been doing their things for decades, centuries, and beavers became a 'problem'," Liebenthal says.

Enter Elmo Heter. Heter worked for Idaho Fish and Game in the McCall area. He had experience with beavers, and it was his job to find a solution.

Heter knew that the Chamberlain Basin was the perfect place for the beavers. The animals would be away from people, and their natural activity would be beneficial to the habitat there. "The trouble is the Chamberlain Basin is in what is now the Frank Church River of No Return Wilderness Area, and there really aren't and weren't any roads," Liebenthal explains.

Heter thought about packing the beavers into the wilderness, but it turns out that beavers and mules don't mix.

"Horses and mules become spooky and quarrelsome when loaded with a struggling, odorous pair of live beavers. These problems involve further handling and too frequently result in a loss of beavers."

- Elmo W. Heter

Heter knew there was a surplus of parachutes from World War II, and he came up with a unique idea. What if he dropped the beavers from a plane, into the backcountry?

Heter knew it would solve the problem in McCall, help the habitat at Chamberlain, make good use of the parachutes and save money. The estimated cost for dropping four beavers from a plane was around $30 in 1948; that's about $294 in today's dollars.

Beavers in wooden boxes drop from a plane into the Frank Church Wilderness to start a new life. (Credit Idaho Fish and Game/ Idaho Fish and Game)

Now that he had a plan, Heter had to figure out how to drop the beavers safely. His first idea: a woven willow box. Once it hit the ground with the beaver inside, the animal could chew its way to freedom. But that didn't work.

"The beavers went to work immediately upon being put into one of these boxes, and it was feared they might chew their way out while dropping from the sky, or might even chew their way out while they were in the airplane which would cause a problem for the pilot."

- Elmo W. Heter

So Heter came up with a specially designed wooden box that would open upon impact. He tested it first with some dummy weights. Then he found an older male beaver who became his test pilot. Heter named him Geronimo. "And Geronimo went through a series of tests to see how this plan would work," says Liebenthal.

Heter dropped Geronimo on a landing field, over and over and over again. Each time, Geronimo popped out of the box, was caught by handlers, and put back inside for another ride.

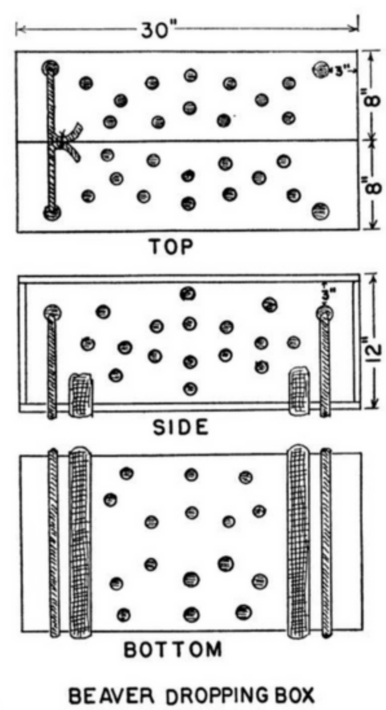

Fig. 1. Diagram of box in which beaver are dropped by parachute.

This diagram shows the special box Heter used to drop the beavers into the backcountry. (Credit Journal of Wildlife Management)

"Poor fellow! He finally became resigned, and as soon as we approached him, would crawl back into his box ready to go aloft again."

- Elmo W. Heter

Once Heter was satisfied the mechanics were sound, it was time to put his plan into action. And Geronimo's reward for all his hard work was to be the first male beaver with a first-class seat on a plane to the Chamberlain Basin. "He was sent to his own little piece of paradise, with three lovely young beavers," says Liebenthal. Three lovely *female* beavers.

Geronimo making his final exit in the Chamberlain Basin. Image courtesy of Idaho Fish and Game.

Once they hit the ground, it took Geronimo a little while to figure out his parachuting days were over, but he soon created a colony with his lady friends.

More beavers followed Geronimo; 76 in all were dropped into the basin. All but one survived the drop and went to work. "[They] created some amazing habitat that is part of what is now the largest protected roadless forest in the lower 48 states," says Liebenthal.

Liebenthal says he's not sure why the project didn't continue past 1948. "My assumption is that they accomplished what they wanted to accomplish in the area, and there was no need to continue.

And how did Heter feel about his project?

"The savings in man hours, and in the mortality of animals, is quite evident. Sex ratios are maintained. The beavers are healthier, and in better condition to establish a colony."

- Elmo W. Heter

Today, homeowners are encouraged to get along with beavers instead of transplanting them.

Archive video footage of parachuting beavers: https://www.youtube.com/watch?v=rrOE-m7sX9E

Liebenthal says it's "highly unlikely" something like the great beaver drop of 1984 would happen today. But he says the offspring of those pioneering beavers are likely still living and helping the habitat in the Frank Church Wilderness.

Much of this story appeared in the Idaho Falls Post Register on Dec. 11, 2014, but it never gets old.

All quotes from Elmo Heter are from his report called "Transplanting Beavers" which appeared in the Journal of Wildlife Management.

Nicky Scott - Board Member

URGENT NEED FOR REMOVAL OF FOUR LOWER SNAKE RIVER DAMS

Pacific Rivers supports the removal of the Lower Snake River (LSR) dams. We believe they should be removed as soon as possible to prevent the extinction of Snake River runs of Columbia River Basin (CRB) salmon and steelhead and to reduce the loss of Pacific Coast orcas that rely on these fish as a food source. The removal of the dams is the best available option to prevent the eventual extinction of these fish populations.

The Snake River has anadromous fish listed under the Endangered Species Act (ESA): sockeye; steelhead; and spring, summer and fall Chinook. The Federal Government is legally obligated to protect these fish stocks. Multiple litigations since the 1990s have reaffirmed this duty.

The construction of four dams on the mainstem Columbia River in the 1920s and 1930s significantly reduced salmon populations in the Snake River. The construction of the Lower Snake River dams in the 1960s and 1970s pushed them to the brink.

There are numerous dams on the Snake upstream of the LSRD that completely block anadromous fish from reaching their historic habitats in southern Idaho and northwestern Wyoming. That makes it all the more important to remove those on the Lower Snake, which impede migrations to what is by far the Snake River Basin's best and most extensive remaining habitat: central Idaho's Salmon River and its tributaries.

Multiple scientific studies have called for the removal of some or all of the dams on the LSR. In 2022, NOAA, the Nez Perce tribe and the U.S. Fish and Wildlife Service released a report stating that one or more of the LSR dams must be breached to save fish populations from extinction. U.S Representative Mike Simpson, R-ID, recommended in the Columbia Basin Initiative the breaching of the 4 LSR dams while upgrading the irrigation, transportation and energy production of Eastern Washington and Western Idaho.

Newer, more efficient wind turbines and solar arrays and possibly small modular nuclear reactors could replace the electricity produced by the LSR dams. Train tracks and roads already exist and could be upgraded to transport more wheat from the Palouse to compensate for the loss of barges, which currently export 60% of the wheat from the area.

All dams have impacts. Some have far more than others. The negative impacts of Lower Snake River dams greatly exceed their benefits. The time for their removal has come. There is not a moment to waste.

NEW BOARD MEMBER: GABE GARCIA

Gabriel Garcia, MD is the Bass University Fellow in Undergraduate Education and Professor of Medicine, Emeritus, at Stanford University. Gabe was born in Cuba and grew up in Puerto Rico. He is a graduate of Cornell University, studied medicine at New York University and did his residency in internal medicine and a specialty in gastroenterology and hepatology at Stanford. He served as a physician in the liver transplant program and as a clinician and researcher on liver disease. During his more than four decades at the University, he held positions as the Mimi and Peter Haas Faculty Director of the University's Haas Center for Public Service, a member at large of the School of Medicine Faculty Senate, and the Associate Dean of Admissions at the School of Medicine, during which time he also served as national chair of the Association of American Medical Colleges Committee on Admissions. He taught 5 undergraduate courses at Stanford on community health fundamentals in the communities near the university, in the central valley of California, at the Rosebud reservation in South Dakota, and in Oaxaca, Mexico. Lastly, he served as a faculty advisor to the LGBT Medical Education Research Group. After retirement, he continues to work with his Stanford Colleagues as a consultant for an NIH funded study on access to mental health services in East San Jose. In his local community, he has served on the San Mateo County LGBTQ+ Commission and on the Advisory Board of Girl Scouts of Northern California. He currently sits on the San Mateo County Health Care for the Homeless & Farm Worker Health (HCH/FH) Program Co-Applicant Board and is the chair of the advisory board for Puente de la Costa Sur, a community resource center in rural, coastal San Mateo County. He enjoys stream fishing, gardening and jazz in his spare time.

THANK YOU FOR YOUR SUPPORT!

We want to thank our many, many supporters for giving us the motivation, ammunition, and yes, funding, to tackle these challenging issues. We could not do it without our contractors, scientists, policymakers, friends and family to be eyes-wide-open and motivating change.

OUR MISSION

The mission of Pacific Rivers is to protect and restore the watershed ecosystems of the West to ensure river health, biodiversity and clean water for present and future generations.

OUR VISION

A future where healthy communities have access to clean, cool drinking water free from chemicals, and people can play in rivers and streams. A future where watersheds that store carbon are resilient to warming temperatures and other effects of climate change and are home to abundant populations of fish and aquatic wildlife.

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