KOOTENAI UNDER SCRUTINY

Fisheries biologists are searching for ways to mitigate the effects of Libby Dam on the river's remarkably diverse fishery.

BY TOM DICKSON

WATER WALL Built from 7.6 million tons of concrete and more than 400 feet tall and 3,000 feet wide, Libby Dam creates the 90-mile-long Lake Koocanusa stretching north into Canada. PHOTO BY TRAVIS D. HEITMAN

On a sunny morning in early July, I stand atop 422-foot Libby Dam with Jim Dunnigan looking north toward British Columbia over the waters of Lake Koocanusa, a 90-mile-long impoundment of the Kootenai River.

A fisheries biologist for Montana Fish, Wildlife & Parks, Dunnigan has been the Libby Dam mitigation coordinator on the Kootenai for 24 years. He tells me that 300 feet below the reservoir's sparkling blue waters are deep layers of silt accumulated over the past half-century. Bound to the silt is phosphorus, a naturally occurring element in rock that is ground to fine powder by glaciers in the mountains of British Columbia.

When present in the right amount, phosphorus helps fuel the food chain of aquatic systems. But too much phosphorus can overstimulate excess algae and aquatic plant growth harmful to fish.

Dunnigan turns and leads me over to look at the Kootenai River coming out of the pumphouse at the dam's base, 200 feet below. "That's where the nutrient hose will come out," he says, referring to a proposed nutrient drip aimed at adding phosphorus to the river.

You read that right: *phosphorus*. Pumped directly into what may be Montana's clearest trout river of its size.

Before you break out the pitchforks and torches, bear in mind that Dunnigan and Brian Stephens, FWP Libby-area fisheries biologist, face a problem unlike that of most every fisheries professional in the United States. Since Libby Dam was built in 1972, this massive concrete structure has created a "nutrient sink" beneath the reservoir, Dunnigan says. "Downstream, it's so phosphorus-deficient that it's borderline unhealthy."

The Kootenai is actually *too* clean and clear. The nutrient deficiency means it can't produce enough beneficial algae needed to feed aquatic insects like mayflies and caddis flies that feed trout and other fish.

This gin-clear, postcard-perfect river is basically starving.

The result, says Dunnigan, is a river where most anglers catch trout that average just 9 to 11 inches long—compared to 12- to 15-inchers in many other Montana rivers where the water is far more fertile. "For an angler, the difference between catching a 10-inch rainbow and a 14-incher is huge," he says.

That's not the only problem facing fisheries biologists on the Kootenai, the third largest tributary of the Columbia River, which it joins at Castlegar, British Columbia. It is also home to one of the most imperiled fish in North America—the Kootenai River white sturgeon—as well as the federally threatened bull trout. Over the past two decades, the Kootenai has also seen an explosion in Didymo—a native algae that most underwater insects don't eat and whose growth now blankets the river bottom in thick, spongy mats of what anglers call "rock snot."

These problems stem in large part from how the Libby Dam backs up water upstream and alters historical water flows downstream. Understanding them, much less finding solutions, has been a long process of scientific study and experimentation.

TRAGIC ORIGINS

Libby Dam was born of a tragedy that occurred nearly 80 years ago and 400 miles away. On May 30, 1948, floodwaters surging down the Columbia River from British Columbia, Idaho, and Montana burst through levees protecting Vanport, a housing project outside Portland, Oregon, destroying the city, leaving 18,000 residents homeless and killing at least 15 people. Along its multistate path of destruction, the flood caused more than $100 million in damages.

To prevent future tragedies in the Columbia River basin while meeting both nations' growing need for electricity, the United States and Canada signed the Columbia River Treaty in 1961. Three hydropower dams were built in Canada, and construction began in 1966 on a fourth, Libby Dam, completed in 1972.

The effects of the massive concrete structure on the Kootenai River were immediate. Water began backing up behind the dam to form Lake Koocanusa, which gets its name from a word mash-up of "Kootenai," "Canada," and "USA." Eventually the reservoir backed up water across the United States–Canada border and now reaches well into British Columbia. With regulated water flows, the dam changed the river. Floodwaters that historically gushed down each spring were held back in the reservoir, then meted out to generate electricity sold by the Bonneville Power Administration.

The moderation of flows below Libby Dam, operated by the U.S. Army Corps of Engineers, has benefited West Coast power customers and downstream communities previously prone to spring flooding. But it has harmed several fish populations, chiefly the Kootenai River white sturgeon.

TRAPPED BY THE FALLS

Before the most recent ice age, white sturgeon could swim 700-plus miles from the Pacific Ocean up the Columbia River and then the Kootenai River as far as Kootenai Falls (29 miles below today's Libby Dam). That migration ended roughly 11,000 years ago when retreating glaciers

Tom Dickson was the Montana Outdoors *editor from 2001 to 2024. He lives in Helena.*

PROBLEM SOLVERS Libby-area fisheries biologists Jim Dunnigan (left) and Brian Stephens (right) face a unique set of challenges with the Kootenai River.

PHOTO BY JEREMIE HOLLMAN

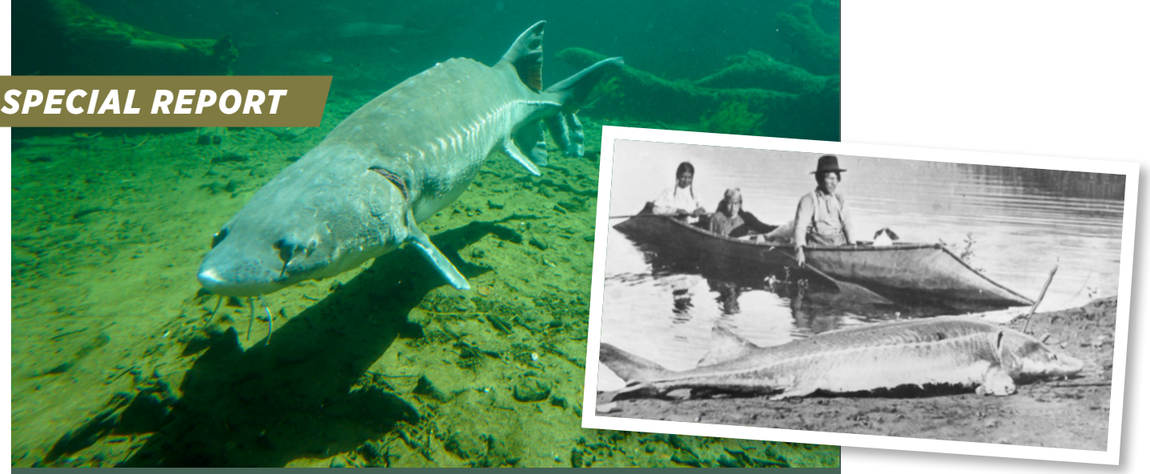
DEADLY DELUGE On May 30, 1948, floodwaters on the Columbia River burst through a dike and inundated Vanport, then Oregon's second largest city, leaving 18,000 residents homeless and killing at least 15 people. Hundreds of miles upstream, this multistate flood also ravaged Libby, Montana, on the Kootenai River. The damages from this disaster combined with the region's growing need for electricity led to the construction of Libby Dam. PHOTO COURTESY OF THE OREGON HISTORICAL SOCIETY

FROM TOP: WIKIMEDIA; JOHN RUTH

THE KOOTENAI RIVER

The Kootenai River begins in southeastern British Columbia just across the Continental Divide from Banff National Park. Known there as the Kootenay, the river flows south and is joined by the Elk River before entering Lake Koocanusa. The river continues south through Libby Dam, then flows west over Kootenai Falls, a historic natural barrier that blocks most fish moving upstream, then flows into Idaho, where, at Bonners Ferry, the river changes from a cobble and gravel bottom to a wide, flat meandering silt-bottom river. Next the river flows into British Columbia and Kootenay Lake, then out the lake's west arm into the Columbia River at Castlegar. From there the Columbia goes through a dozen dams before emptying into the Pacific Ocean at Astoria, Oregon.

CLEARLY CANADIAN The Kootenai River is gin clear due in part to its lack of phosphorus, which binds to silt behind Libby Dam carried downstream from Canadian glaciers.



STIFLED STURGEON White sturgeon were long a staple food for Native people in the Kootenai region, shown in this historical photo at right with a sturgeon-nosed canoe. White sturgeon can live to be 100 years old but haven't successfully reproduced in the Kootenai River since Libby Dam was built. They were listed as a federal endangered species in 1994, and by 2004, fewer than a dozen remained in Montana's portion of the river. Hatchery-reared fish have helped boost the population to 300.

created Bonnington Falls, on the west arm of Kootenay Lake before the Kootenai reaches the Columbia River near present-day Nelson, British Columbia. With the falls cutting off access to the Pacific, the trapped white sturgeon became a genetically distinct landlocked population.

Deprived of abundant ocean food, the Kootenai River white sturgeon never attained the size of its seagoing ancestors. Historically, white sturgeon in the lower Columbia grew as long as 15 feet and weighed nearly a ton. The largest recorded Kootenai River specimen was roughly 350 pounds, but most adult Kootenai sturgeon are 5 to 6 feet long and weigh upward of 80 pounds. The population of this prehistoric fish survived in the Kootenai River over the next several thousand years.

But the arrival of European-American settlement brought mining and forest clear-cutting that polluted rivers with silt, heavy metals, and toxins that killed the aquatic insects that sturgeon eat. Dikes that drained river bottomlands for farming and housing eliminated many wetlands that provided nutrients and food for juvenile sturgeon and hiding cover from predators. Then came Libby Dam.

The structure seems to have hampered the white sturgeon's reproductive success downstream, though biologists are not sure why. "All we know for certain is that after the adults spawn, either the eggs or larvae aren't surviving," says Mike Hensler, FWP regional fisheries manager in Kalispell.

> Trapped by glaciers 11,000 years ago, Kootenai River white sturgeon became a genetically distinct, landlocked population—cut off forever from the Pacific.

Most Kootenai River white sturgeon live in the British Columbia and Idaho portions of the river. The best spawning habitat—clean cobblestones where fresh water can oxygenate eggs—is far upstream between Bonners Ferry, Idaho, and Kootenai Falls. But instead of moving up into Montana during spawning season, the adult white sturgeon swim only a short distance to a stretch below Bonners Ferry, where they lay their eggs on a substrate of clay and silt.

"There's not a clear reason for why they do this," says Dunnigan. "But what is clear is that there is almost no survival."

The main theory is that the warmer and reduced springtime flows from Libby Dam are preventing the fish from moving farther upstream to better spawning habitat. "Bear in mind that no one knows exactly where these fish spawned successfully pre-dam," says Dunnigan. Maybe it was where they spawn now and somehow the eggs and juvenile fish survived, he adds. "But it seems more likely that they spawned upstream of their current spawning locations, where the habitat is more suitable."

With little to no natural reproduction, the sturgeon population steadily declined, causing the subspecies to be listed under the Endangered Species Act (ESA) in 1994. By 2004, FWP fisheries biologists estimated that fewer than a dozen sturgeon remained in Montana's portion of the river.

Since 1992, more than 320,000 juvenile white sturgeon raised at hatcheries in Idaho and British Columbia have been released into the Kootenai in British Columbia, Idaho, and Montana. Sturgeon can live up to 100 years, and don't spawn until about age 25 to 40. A few males from those early 1990s releases have reached sexual maturity, but so far biologists have not documented a sexually mature female from the hatchery.

Even if a female and male can pull off a successful spawn, the eggs won't survive without suitable habitat. Since the 1990s, under pressure from the white sturgeon ESA listing, the Corps of Engineers has cooperated with FWP and other agencies to periodically open up some of the dam's turbines for a few weeks in spring to provide 25,000 cfs (cubic feet per second) of flows to encourage fish to migrate farther upstream to better spawning habitat.

Yet due to lowland housing near Bonners Ferry and in British Columbia around Kootenay Lake, the Corps can't risk replicating the 65,000 cfs average springtime flows before Libby Dam was built. "Those are the flows the white sturgeon evolved and thrived with," Dunnigan says.

Over the past two decades, the Kootenai Tribe of Idaho and other partners have created habitats for various life stages of white sturgeon in Idaho, including placing cobble in the silty areas where sturgeon now spawn, enhancing backwater channels where baby sturgeon can escape predators, and creating pools to deepen the river and encourage fish to migrate upstream to better spawning habitat. In Montana, FWP fisheries biologists monitor the state's white sturgeon population, which is estimated at roughly 300, almost all juveniles from hatcheries.

OODLES OF SMALL TROUT

Though white sturgeon have been a casualty, Libby Dam's altered water regimes have benefited the rainbow trout population downstream. Before the dam was built, the Kootenai flowed at about 4,600 cfs in August. Now it averages around 9,000 cfs. With strategic water releases, the dam keeps river temperatures cooler in summer and warmer in winter. As is the case on many dam "tailwater" fisheries, the moderated temperatures and flows have helped boost rainbow trout numbers by making the river more hospitable throughout the year. "We've also got great natural reproduction on several tributaries of the Kootenai in this area that produce oodles of trout," says Dunnigan.

The problem is that the water doesn't support enough aquatic life to feed all those fish. "There's plenty of smaller organisms to grow trout their first year, up to 8 inches or so," says Brian Stephens, FWP Libby-area fisheries biologist. "But then they don't have the stoneflies, mayflies, and caddis flies that beef up trout into that 14- to 16-inch range."

Many Montana waters have too many nutrients, mainly from fertilizer and livestock manure washing in from surrounding farm fields, leaky septic tanks, wastewater treatment plants, and urban and subdivision stormwater runoff. This fuels excessive algae blooms and degrades drinking water supplies. Mats of floating vegetation can clog waterways, like the infamous islands of vegetation that drift down the Missouri River below Holter Dam in late summer.

The Kootenai River has the opposite problem: It's not fertile enough.

Previous studies showed that from 2014 to 2017, Lake Koocanusa was capturing 80 to 93 percent of the total phosphorus entering from upstream. "The geology of this region of Montana makes the river far less productive than, say, the Bighorn or the Missouri," whose headwaters are in nutrient-rich limestone bedrock, says Dunnigan. "So that nutrient loss downstream is significant."

Making matters worse is the proliferation of an unwanted native algae that anglers call "rock snot."

Kokanee and Giant Rainbows

Yet another twist in the Kootenai's complex fishery is that the stretch 3 miles below Libby Dam contains the largest rainbow trout in Montana. The steelhead-sized fish, which average about 12 pounds and occasionally top 30, do just fine without mayflies and caddis. They feed on foot-long kokanee salmon killed or disoriented as they are entrained through the turbines. The massive trout, a strain known as Gerrard rainbows, originate in British Columbia's Kootenay Lake and were historically stocked in Lake Koocanusa and tributaries in Canada. Some manage to survive after tumbling through the Libby Dam turbines.

Kokanee, meanwhile, are a landlocked sockeye salmon native to Kootenay Lake, a natural waterbody (similar to Montana's Flathead Lake) downstream on the Kootenay River in British Columbia after it leaves Idaho. Like the white sturgeon, sockeye were cut off from the ocean with the formation of Bonnington Falls after the last ice age. And like the sturgeon, their growth stunted. As with the white sturgeon, kokanee historically never made it any farther upstream on the Kootenai River than Kootenai Falls. But sometime during the 1970s, the small salmon were inadvertently released from a British Columbia hatchery into Lake Koocanusa. The kokanee, which eat plankton they strain from the water with fine comblike filters in their gills, thrived in the nutrient-rich environment of the newly created reservoir. Though the average size of kokanee in the reservoir has declined since the early introduction, Lake Koocanusa anglers still troll for the abundant 10- to 13-inch salmon, which are considered excellent eating, especially when grilled, canned, or smoked.

Those kokanee also fed the massive 33.1-pound Montana state record rainbow trout caught in 1997 below Libby Dam. Jim Dunnigan, FWP Libby Dam mitigation coordinator, says that each year in the 3-mile stretch below the dam, dozens of rainbows over 28 inches are caught, though none big enough to challenge the 1997 record. To protect this unique trophy fishery, FWP allows harvest of only one rainbow in the stretch, and it must be over 28 inches. That allows the "smaller" 20- to 28-inchers to survive and give other anglers a thrill of a lifetime.

NORTHERN ANGLERS TAXIDERMY

FROM LEFT: ERIC ENGBRETSON UNDERWATER PHOTOGRAPHY; MONTANA PBS

The Kootenai's Diverse Fishery

In addition to rainbow trout and white sturgeon, FWP monitors several other important fish species on the Kootenai.

Burbot

JEREMIE HOLLMAN

For thousands of years, burbot, known for its flaky white flesh, helped sustain the Kootenai people (known as Ktunaxa in British Columbia). Beginning in the mid-20th century, the long, eel-shaped also became popular with sport anglers.

But after construction of Libby Dam, the burbot fishery collapsed, for reasons still not well understood. By 2004, it was estimated that only 50 adult burbot remained in the entire Kootenai River downstream of the dam.

Idaho and Montana ended angling harvest of burbot, a freshwater member of the cod family also known as ling cod, to protect the remaining fish. In 2015, the Kootenai Tribe of Idaho built the Twin Rivers hatchery facility at the confluence of the Kootenai and Moyie rivers to produce both burbot and white sturgeon. The tribe partnered with the British Columbia Ministry of Environment, Idaho Department of Fish and Game, and the University of Idaho to develop the complex procedures required to rear burbot from eggs.

Since 2018, hundreds of thousands of young hatchery-reared burbot have been released.

For unknown reasons, very few burbot reproduce naturally, yet the hatchery fish are thriving. Idaho Fish and Game estimates that the Kootenai River in that state now holds about 50,000 burbot, and thousands more have moved up into Montana waters. "We've definitely benefited from the Idaho program," says Mike Hensler, FWP regional fisheries manager in Kalispell.

Confident that this fishery is healthy enough to sustain harvest, both Idaho and Montana now allow anglers to keep some burbot (see Montana fishing regulations for specific rules and limits).

Bull Trout

PATRICK CLAYTON/ENGBRETSON UNDERWATER PHOTOGRAPHY

The Kootenai River basin remains a critical area for this native char, listed as federally threatened in 1998. The biggest risk to bull trout is logging in surrounding mountains that can send silt downstream, burying spawning gravel, smothering aquatic insects, and warming the water. Another threat is Libby Dam, which cuts off access to many of the historical spawning streams used by bull trout, limiting natural reproduction. The Kootenai River between the dam and Kootenai Falls still contains over-wintering and other critical habitat for juvenile, subadult, and adult bull trout.

Torrent Sculpin

STANLEY GREGORY

Sculpins are small fish that live along the bottom of swift-running mountain streams. They have a large, flat head with big, bulging eyes and a wide mouth with large lips.

Northwestern Montana is home to several sculpin species. The torrent sculpin lives only in the fast headwater streams of the Kootenai River drainage. The fish is threatened by unregulated livestock grazing, poor logging practices, and mining waste, which add silt and pollution to their stream habitats. FWP has designated the torrent sculpin as one of 21 Montana fish species of greatest conservation need.

Inland Redband Trout

Rainbow trout are common throughout much of Montana, but almost all are introduced, descendants of coastal rainbow trout originally brought in from California hatcheries starting in the 1880s. Montana does have one native rainbow, though: the Columbia River interior redband trout. Commonly called redband trout, this rainbow trout subspecies is found here only in the Kootenai River and some tributaries.

No one is sure how redband trout originally got to Montana. One theory is that they came from British Columbia's Kootenay Lake. Each spring a large, lake-dwelling strain of the redband trout known as the Gerrard rainbow swims upstream (north) from Kootenay Lake to the Lardeau River to spawn. Hensler suspects that thousands of years ago, some Gerrards migrated south (also upstream) through the Idaho Panhandle into Montana to spawn in the Kootenai River and its tributaries. Over time, some of those fish remained and formed the resident redband trout populations here.

Inland redband trout historically occupied portions of major river basins in Nevada, California, Oregon, Washington, Idaho, and Montana. The fish now occupies just 42 percent of its historic range. The steelhead that move from the Pacific Ocean up the Columbia River into the Snake River basin in Idaho and British Columbia's Fraser River are a variation of the inland redband trout.

For years California coastal rainbows were stocked in Montana streams containing native redbands. As a result, the two rainbow subspecies hybridized, making genetically pure redbands increasingly rare. Genetically intact redbands today occupy just 15 percent of their historic range in Montana, Hensler says, relegated mostly to the upper reaches of streams where drainage culverts, small waterfalls, or other barriers prevent hatchery coastal rainbows from moving upstream and intermingling. FWP and the U.S. Fish & Wildlife Service now consider redbands a species of special concern.

MONTANA FWP

To keep the subspecies from declining further, FWP raises redband trout at its Murray Springs Hatchery near Eureka on the east shore of Lake Koocanusa. The hatchery uses brood stock taken from three streams containing genetically intact inland redbands. Fingerling redbands from the hatchery are stocked in suitable local lakes.

Hensler says the program expands the range of this unique species while providing anglers with additional fishing opportunities. "You can go anywhere in Montana and catch an ordinary rainbow trout," he says, "but only in a few waters in this region can you catch a native Montana rainbow."

Westslope Cutthroat Trout

ENGBRETSON UNDERWATER PHOTOGRAPHY

Historically, westslope cutthroat trout were the most widely distributed fish species throughout the Montana portion of the Kootenai River watershed. Though westslope numbers have declined here and throughout their range, the Kootenai watershed remains a stronghold. The region still retains some of the best cutthroat habitat in Montana.

But even here, westslope cutthroats face threats, mainly from hybridization with non-native rainbow trout and with Yellowstone cutthroat trout stocked by the state in the early 1900s.

Mountain Whitefish

STANLEY GREGORY

Whitefish populations below Libby Dam have declined considerably in recent years. Biologists found that populations of this salmonid species, which previously averaged 700 fish per 1,000 feet of the Kootenai River, were down 53 percent in 2018 and 55 percent in 2023. Selenium, which has been found in high levels in whitefish eggs and ovaries (see sidebar, page 30), is suspected to be a cause of the decline.

"NASTY CONTAMINANT" FROM THE NORTH

One of the most serious threats to Kootenai River fish populations is selenium contamination from coal mines in southeastern British Columbia. For more than a century, coal has been mined in the Elk River valley just north of Montana, but mining has accelerated in recent decades, increasing selenium runoff into Lake Koocanusa and the Kootenai River.

At low concentrations, selenium can be metabolized by fish. But at high levels—like those documented in Koocanusa and the Kootenai—it can cause deformities or kill fish during egg and larval stages.

"It's a really nasty contaminant in how it causes deformities during reproduction," says Erin Sexton, senior scientist at the University of Montana Flathead Lake Biological Station. "They call it an invisible killer because it's hard to account for fish that never hatch."

U.S. and tribal officials maintain that the pollution violates the 1909 International Boundary Waters Treaty. The international mining company Glencore owns most Elk Valley mines and plans expansions. Coal from the mines is exported to Asia for steel manufacturing. Though runoff is treated at some facilities, British Columbia allows companies to self-monitor with limited provincial oversight, and Canada lacks federal clean water laws comparable to those in the U.S.

"Mitigations need to address past pollution and protect fish and water quality in the Kootenai River now and into the future, particularly with the new mines and mine expansions being proposed," says Sexton.

Biologists have found that the federally endangered Kootenai River white sturgeon is particularly sensitive to selenium poisoning, and trout, burbot, and largescale suckers are also highly vulnerable.

Montana adopted stringent selenium standards for Lake Koocanusa in 2020. A 2023 U.S. Geological Survey study linked expanded Elk Valley mining with rising selenium and nitrate concentrations over decades, and found that Koocanusa selenium levels had exceeded Montana's standards since 2020. Teck Resources (later purchased by Glencore) challenged the standards, but in April 2026, a Montana district court ruled the state's 2020 selenium limits should not be weakened. ■

STREAM OF SNOT Below Libby Dam, the Kootenai is low in phosphorus but high in nitrogen, creating an ideal petri dish to grow Didymo, a native algae nicknamed rock snot. This spongy vegetation now shrouds the river bottom for long stretches, crowding out beneficial algae.

> "This is one of the few algaes that grows like crazy when phosphorus is low. Unfortunately, it's not a species used by mayflies, stoneflies, and caddis flies."

In addition to low phosphorus levels below Libby Dam, the Kootenai has unnaturally high levels of nitrogen released from coal mining in British Columbia. Though nitrogen is another important building block in food webs, too much of it can cause problems. Unlike phosphorus, the more soluble nitrogen doesn't bind as readily to the Lake Koocanusa bottom and continues downstream.

In the measured flows below the dam, the combo of low phosphorus and high nitrogen creates a perfect petri dish for a native algae known as Didymo (*Didymosphenia geminata*) to flourish. This spongy vegetation now shrouds the Kootenai River bottom for long stretches, crowding out beneficial algae.

"Didymo is one of the few algaes that grows like crazy when phosphorus is low," says Dunnigan. "Unfortunately, it's not a species used by mayflies, stoneflies, and caddis."

Instead of the Kootenai having these and other trout-fattening invertebrates that historically populated the river bottom, today it is dominated by tiny chironomids, or midges, which thrive in the carpet of Didymo.

Rainbow trout growth rates have suffered. Most three-year-old rainbows in the Kootenai River below Libby Dam are around 13 inches long, while a three-year-old on the Bighorn runs 15 inches and a trout of the same age on the Missouri below Holter Dam tops 17. "The anglers here are asking why they can't have fish like that," says Stephens.

Other species also suffer from the lack of aquatic insects. Adult redband trout, Montana's only native rainbow trout species, feed on aquatic invertebrates, as do cutthroat trout, mountain whitefish, largescale suckers, burbot, northern pikeminnows, torrent sculpins, and other species, including juvenile bull trout.

FERTILIZING THE RIVER

Like fertilizing a languishing garden with Miracle-Gro, one way to solve the Kootenai's nutrient deficiency is to add nutrients. Since 2005, Idaho state and tribal biologists have pumped liquid phosphorus into the Kootenai at the Montana border. Almost immediately, scientists reported more beneficial algae growth and greater densities and diversity of mayflies, caddis flies, and other insects. Within three years, numbers of mountain whitefish, largescale suckers, and rainbow trout increased. "Fishing guides tell us that the Kootenai in Idaho is producing way more 13- to 15-inch rainbows and that they almost never hook the 8- to 10-inchers that dominate in Montana," Stephens says.

Montana fishery managers want to follow Idaho's lead and try fertilizing the Kootenai below Libby Dam, hoping for similar results. "This would be nothing new," says Dunnigan. "The Kootenai Tribe of Idaho and Idaho Fish and Game invented the wheel. We're just copying their blueprint."

Montana's proposal is to drip liquid phosphorus into the river for five years as it passes through Libby Dam. "It's really not a lot," says Stephens of the fertilizer. "The amount we're proposing is many times lower than naturally occurring levels DEQ [the Montana Department of Environmental Quality] allows in similar size rivers in this region."

The experiment aims to increase the number of beneficial insects that fish eat; reduce Didymo; and—"the ultimate goal," says Dunnigan—improve rainbow trout growth. Benefits to bull trout, cutthroat trout, redband trout, and other species would be considered a bonus but aren't identified in the study.

Dunnigan and his crew will monitor changes in the algal and aquatic insect communities. To learn if trout growth accelerates from the nutrient boost, they will regularly survey the trout populations downstream of the dam. Each trout they capture will be measured, weighed, and fitted with a rice-grain–size tracking tag.

To ensure the treatments don't exceed water quality standards in the 3.5-mile study area, FWP has contracted with the University of Montana Freshwater Research Laboratory at the Flathead Lake Biological Station in Polson for periodic water quality analysis.

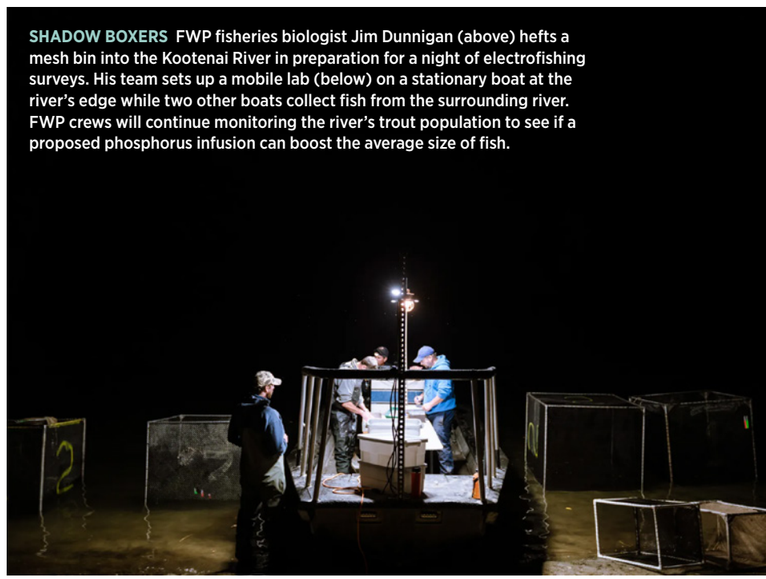
The experiment has been reviewed and approved several times by an independent panel of scientists and given the green light by the U.S. Fish & Wildlife Service. Later this year, the proposal will go through the DEQ's permitting process.

Back at Libby Dam, Dunnigan gestures downstream at the river's crystalline waters glittering in the sunlight.

"What this experiment comes down to is our desire to improve conditions on the Kootenai—for fish populations and for people who value those fish," he says.

It's been a long process. FWP conducted studies for 15 years before formally proposing the phosphorus drip experiment in 2020. Almost every entity whose approval is needed has signed off. Dunnigan looks at the Libby Dam powerhouse below us, where tanks will hold the liquid fertilizer and a hose will feed it into the Kootenai. "This is basic science," he adds. "We have a hypothesis that adding phosphorus will achieve these goals. Now we want to test it to see if it works." 🐻

Editor's note: For more on Lake Koocanusa, see "Straddling the Border," July-August 2015: issuu.com/montanaoutdoors/docs/lakekoocanusa/.



SHADOW BOXERS FWP fisheries biologist Jim Dunnigan (above) hefts a mesh bin into the Kootenai River in preparation for a night of electrofishing surveys. His team sets up a mobile lab (below) on a stationary boat at the river's edge while two other boats collect fish from the surrounding river. FWP crews will continue monitoring the river's trout population to see if a proposed phosphorus infusion can boost the average size of fish.

MONTANA FWP

SARAH MOSQUERA