

Little Dams, BIG BARRIERS

Diversion dams on the Yellowstone River system cause the loss of countless fish each year, including one species' near-extinction. One irrigator has found a way to keep fields watered while helping fish survive. Will others follow? **BY TOM DICKSON**

ROGER MUGGLI HAD seen enough. In June of 1988, as he had every spring for years, the manager of the Tongue and Yellowstone (T-Y) Irrigation District in southwestern Montana watched as hundreds of downstream-swimming fish were sucked into the irrigation canals where the 12-Mile Diversion Dam diverts the Tongue River. The 100-plus miles of canals in the T-Y irrigation system send water to crops such as alfalfa, corn, and barley, as well as to vegetable gardens and orchard trees, on 9,400 acres owned by roughly 300 families. But the channels also capture sauger, catfish, perch, sunfish, smallmouth bass, and a dozen other fish species.

"It just killed me to see those fish get trapped in the canals," Muggli says.

Each spring, several dozen species spawn in the upper Tongue and other tributaries of the Yellowstone River. After the eggs hatch, the young fish float downstream with the current. Before the region was settled, they eventually would end up in the Yellowstone.

But that was before construction of diversion dams—3- to 8-foot-tall concrete or rock structures on the Yellowstone and major tributaries. The dams divert water from the main current into canals to irrigate crops in thirsty fields nearby. Unfortunately, fish move into the canals along with river water. They are then inadver-

tently pumped out onto crop fields as part of flood irrigation. Or they stay in the canals, easy prey for herons and raccoons when the canals are drained in late summer.

"Either way, the vast majority of those fish don't make their way back to the Yellowstone," says Brad Schmitz, Montana Fish, Wildlife & Parks regional fisheries manager in Miles City.

Schmitz and other biologists estimate that hundreds of thousands of fish are lost each year on the Yellowstone system to what they call "entrainment."

The 12-Mile Diversion Dam, 12 miles up the Tongue River from Miles City, was built in 1885. Muggli's father managed the water there for nearly 30 years, and his grandfather before that. As a boy, Muggli had seen fish entrained in the canals. In 1988, when he became manager, he decided to do something about it.

"I vowed then that if I lived long enough, I'd get the Tongue River fixed," says Muggli, who also runs a feed processing plant near Miles City with his family.

Over the next 11 years, Muggli "fought like hell to get support for this project," he says. To document fish entrainment, he convinced FWP to set survey nets. Biologists found that at least 37,000 fish go down the irrigation canal each year. Then Muggli galvanized financial support from public agencies and national conservation groups to replace the aging inlet into the canal. The renovation included adding a downstream bypass to screen fish from the canal and allow them to move around the dam (page 15). Completed in 1999, the project cost \$900,000; just \$60,000 was required from the irrigation district.

"That was a big selling point for our guys," says Muggli.



TOM DICKSON

FISH FRIENDLY Roger Muggli, shown here on the Tongue River's 12-Mile Diversion Dam, says he felt a personal obligation to find some way for fish to move past the irrigation structure.



GARY LEPPART

Now fish are moving down the Tongue in numbers not seen for more than a century. On the Yellowstone itself, however, diversion dams continue to damage fish populations, threatening both angling recreation and the very existence of some species.

Biologists, anglers, and others concerned about river fisheries now hope the 12-Mile Dam improvements will inspire owners of diversion dams on the Yellowstone River to consider similar modifications to help fish. For that to happen, however, public interest in the Yellowstone's warmwater fish—and public funding for conserving those species—may have to increase.

“LAST BEST RIVER”

Running 670 miles from Yellowstone National Park to where it joins the Missouri River near the Montana–North Dakota border, the Yellowstone is one of the wildest rivers in the lower 48 states. That's due in large part to Montana FWP and state leaders. In the late 1970s, they thwarted efforts by the U.S. Corps of Engineers to build a 660-foot-tall dam a few miles upstream from Livingston that would have drowned the entire Paradise Valley.

Today, abundant antelope, mule and white-tailed deer, and an occasional elk

HOOVER DAMS TO SOME FISH Though essential for crop irrigation, Waco-Custer (above) and five other diversion dams on the Yellowstone River block the upstream migration of burbot, suckers, and other fish species. Farther downstream, Intake Diversion Dam stops federally endangered pallid sturgeon (right) from reaching upstream spawning waters.

continue to graze in the Yellowstone's lushly wooded bottomlands. Thirty-three native fish species swim in the river, from colorful Yellowstone cutthroat trout in the upper reaches to prehistoric paddlefish in the lower, warmer waters.

Much of what *National Geographic* magazine called the nation's “last best river” still contains braided channels, sandbars, and islands that provide important fish habitat. Along much of its length, the Yellowstone—named by Plains Indians for the sandstone bluffs that overlook the river near present-day Billings—looks remarkably similar to when Captain William Clark canoed downstream in 1806.

Though free of large impoundments such as those on the Missouri, the Yellowstone is not the longest “undammed river” in the United States, as it is often described. Diversion dams block the river at six sites



USEFWS

between Billings and Sidney. Like 12-Mile Dam on the Tongue, the Yellowstone's Huntley, Waco-Custer, Rancher's Ditch, Yellowstone, Cartersville, and Intake diversion dams were built decades ago to provide water for crop irrigation.

From an agricultural perspective, “these dams have been a huge economic success,” says Jerry Nypen, manager of the Lower Yellowstone Irrigation Project, a nonprofit organization that owns the water rights at Intake. “They have contributed immensely to the ag economy along the Yellowstone, without creating huge reservoirs like you see on many other major rivers.”

From a fisheries health perspective, however, the Yellowstone River's diversion dams cause major problems for sturgeon and other fish populations.

“Let’s say 50,000 of those sauger would have otherwise grown up to be 12 inches and larger. That adds up to 10,000 five-fish angler limits lost just at Intake every year. That’s a huge amount of recreation disappearing down a ditch.” —BRAD SCHMITZ, FWP REGIONAL FISHERIES MANAGER, MILES CITY

ONE-WAY STREET

Each year tens of thousands of sauger take an ill-fated detour into canals siphoning water from the Yellowstone. These smaller cousins to walleyes are then either pumped out into fields along with irrigation water or left stranded in the ditches.

After a 2003 Montana State University study found that none of 27 radio-tagged sauger that entered Intake Canal returned to the Yellowstone River, biologists concluded the canal is a one-way street. When he analyzed results of a Bureau of Reclamation (BOR) study on entrainment at Intake conducted in the late 1990s, Schmitz estimated that at least 70,000 sauger over 8 inches long disappear into that one canal each year.

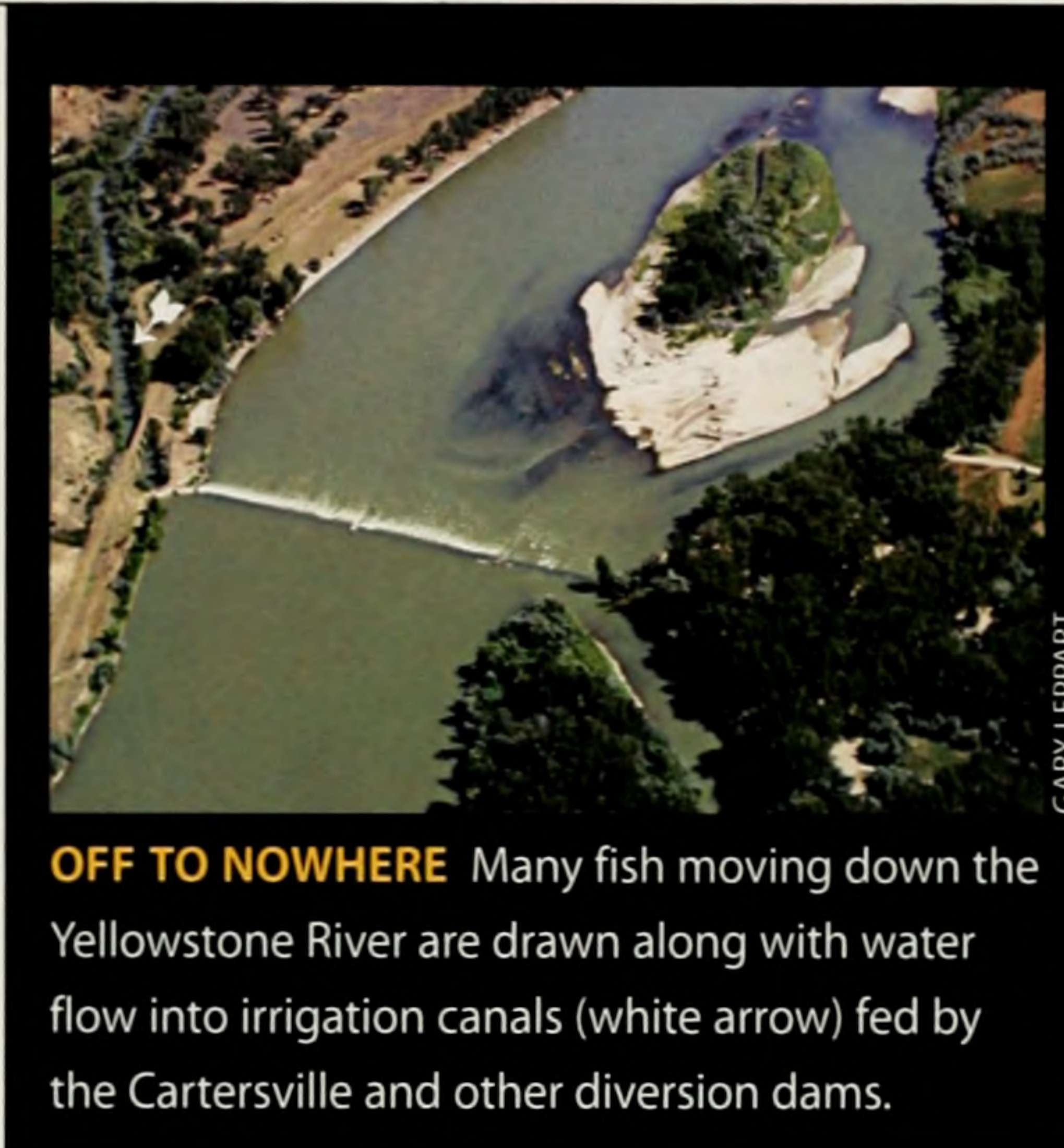
“Let’s say 50,000 of those sauger would have otherwise grown up to be 12 inches and larger,” he says. “That adds up to 10,000 five-fish angler limits lost just at Intake every year. That’s a huge amount of recreation disappearing down a ditch.”

The ditches attract other species, too. Two years ago, Schmitz caught a 35-pound paddlefish in Intake Canal. And Steve Hiebert, who headed the BOR study, says that the survey nets he and his crew set inside the Intake headworks captured catfish up to 3 pounds, walleyes up to 4 pounds, and 30 other species, including sturgeon chubs, goldeye, and blue suckers. He estimates at least 500,000 fish are sucked into Intake Canal each year.

“And that’s just based on the fish that we caught in our half-inch mesh nets,” Hiebert says. “There’s no telling how many smaller, juvenile fish go into the canal.”

Add entrainment from the five other diversion dams—as well as from hundreds of pumps drawing water directly from the river—and losses on the Yellowstone likely total millions of fish each year.

Tom Dickson is editor of Montana Outdoors.



OFF TO NOWHERE Many fish moving down the Yellowstone River are drawn along with water flow into irrigation canals (white arrow) fed by the Cartersville and other diversion dams.

END OF THE ROAD

While the diversion dams are drawing off downstream-swimming fish, they’re also blocking those trying to move up the Yellowstone to spawn. Walleye, sauger, and several other species can swim over the dams during high water. But bottom-hugging species find the structures insurmountable.

To a pallid sturgeon, for example, a diversion dam might as well be Hoover Dam. “They don’t have the physical form to swim up rapids, much less over an actual barrier,” says Schmitz. The pallid’s wedge-shaped head has evolved to keep the fish close to the river bottom, where it finds fish, aquatic insects, and other food.

Currently only 4,000 or so pallid sturgeon exist in the United States, making the species one of the nation’s rarest and causing it, since 1990, to be listed as federally endangered. In the Yellowstone, which has some of the nation’s best remaining pallid sturgeon habitat, numbers are down to fewer than 200.

“There are now so few,” explains Schmitz, “that it’s hard for a mature male and mature female to even find each other, much less spawn successfully.” As a result, there has been no documented “recruitment” (new fish being born into the fishery) in the river for more than 30 years.

Diversion dams aren’t the only reason the Yellowstone’s pallid sturgeon may become extinct within the next few decades. Another big factor is Yellowtail Dam, built on the Bighorn River in 1966 to create energy and control flooding in the valley below. Behind the dam is 500-foot-deep Bighorn Reservoir, which releases cool, clear water from its depths. The dam has created one of the nation’s top trout fisheries downstream in the Bighorn River, a Yellowstone tributary. However, it has also deprived the Yellowstone’s warmwater species of yearly floods, which for millennia sent sand, woody debris, and sediment downstream, producing sturgeon food and creating spawning and rearing sites.

LIKE THREE RIVERS COMBINED

The greatest barrier on the Yellowstone is also the biggest straw sucking water from the river. Intake Diversion Dam, located 18 miles downstream from Glendive, draws up to 1,400 cubic feet of water per second. That’s more than the average flow of the Big Hole, Beaverhead, and Gallatin rivers combined.

Intake Dam was built in 1911 to divert water from the Yellowstone River to 50,000 acres in eastern Montana and western North Dakota. Made of rocks in timber cribs, the 5-foot-tall structure stretches 700 feet across the river. Depending on the time of year, it pushes up to half the Yellowstone River into Intake Canal and a 225-mile network of lateral canals that move and distribute water to roughly 500 farms.

According to George Jordan, Yellowstone River coordinator for the U.S. Fish and Wildlife Service, Intake Dam is “a known barrier for the upstream migration of pallid sturgeon, paddlefish, and other species in years when water is low.”

Intake is owned by the Bureau of Reclamation. Because the Endangered Species Act requires that federal projects



Sauger

JOSEPH TOMELLERI

not harm listed species, Jordan says “the USFWS is helping the BOR evaluate various options that would allow for upstream fish passage and reduce entrainment.”

Nypen, the irrigation project manager for the lower Yellowstone, says his organization recognizes that fish are entrained in the canal. “We’ve known that for years, and we think a fish screen of some sort would be helpful,” he says. The group is skeptical, however, about building an upstream passageway, at least for now. “There probably should be more research on the need for that,” Nypen says.

Jordan says he has no doubt the dam will be modified, but it may take several years. The delay, he says, is due in part to the lack of a warmwater fish group to advocate on behalf of sturgeon and other Yellowstone River species. “It’s too bad there isn’t something like a Sturgeon Unlimited that could turn up the heat in Washington, D.C.,” he says, only halfway kidding.

WORKING WITH IRRIGATORS

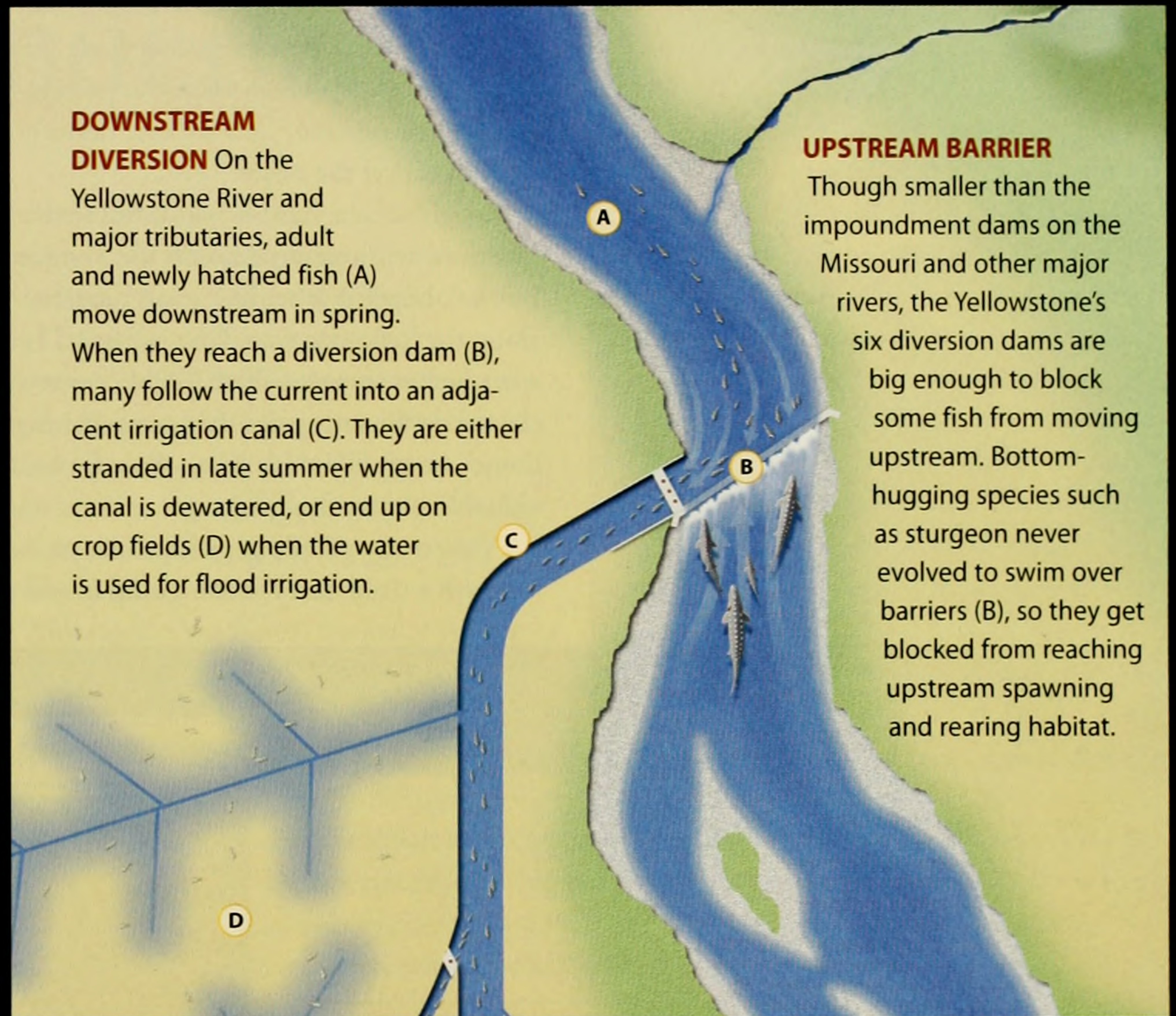
Though biologists are adamant about wanting to keep fish in the rivers and off crop fields, they don’t want to impede irrigation.

“No one is trying to prevent irrigators with water rights on these ditches from getting their water,” says Matt Jaeger, FWP’s lower Yellowstone River fisheries biologist. “We just want to minimize the number of fish entrained and killed in ditches and limit the restriction of passage around diversions as much as possible.”

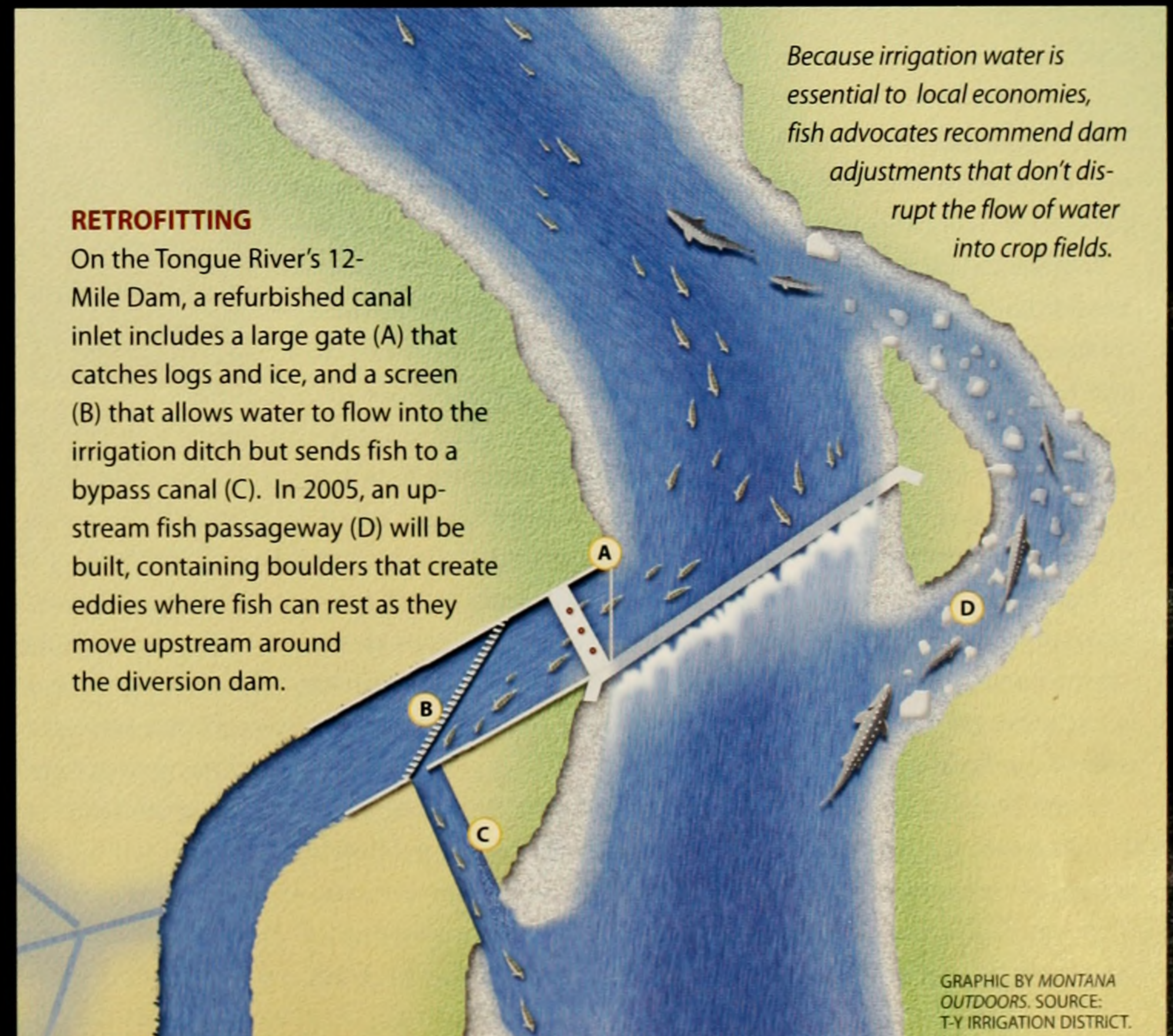
That’s why river advocates are applauding what Muggli and others are accomplishing on the Tongue. “The T-Y project has been the perfect cooperative venture among agencies and the irrigation district,” says Jordan. “It’s a model for what could happen on the Yellowstone and other tributaries.”

In addition to getting the downstream fish bypass structure built in 1999, Muggli, state and federal agencies, and The

How diversion dams affect fish movement



Solutions that don’t hamper irrigation



GRAPHIC BY MONTANA OUTDOORS. SOURCE: T-Y IRRIGATION DISTRICT.

Nature Conservancy funded an upstream fish passageway around the west side of the dam. As part of that effort, Muggli persuaded his irrigation district to donate 3 acres of land and digging equipment. The \$300,000 project, which will begin later this year, includes a 660-foot canal filled with large boulders that block current flow and create eddies where fish can rest as they move upstream around the dam. The fish bypass will allow roughly 30 species to reach an additional 50 miles of spawning water in the lower Tongue (before running into another diversion dam) for the first time since the late 19th century.

“We joke with Roger that we want him

to go on tour and talk to other irrigators to lessen their distrust of state and federal agencies,” says Jordan. “We’re hoping they will look at the T-Y structures and see for themselves that you can have fish passage and water irrigation, that the one doesn’t need to cancel the other.”

Muggli says he has his hands full with just the one diversion dam on the Tongue. But he’s hopeful other irrigation districts along the Yellowstone will be intrigued by what he has accomplished. “Public agencies aren’t the only ones that can get things done,” he says. “It also takes effort by individuals to move things along.

“Not many people get the chance to improve a river, and I’m not going to rest

until the fish that have been blocked all these years are finally able to make their way upstream as well as downstream, so that the circle is complete,” he adds. “Only then can I feel that I did my part to repair something in eastern Montana that has been broken for far too long.”

Meanwhile, Jordan and other fish advocates say they will continue working with irrigators to find ways to adjust the Yellowstone’s diversion dams to benefit fish.

“We know that the dams are causing problems, and we’re learning how the structures can be modified to allow for fish passage without compromising irrigation needs,” says Jordan. “What we really need now are more Roger Mugglis.” 🐘

The Armored Canal

Diversion dams and the Bighorn River’s changing water composition aren’t the only things disrupting the Yellowstone River ecosystem. For decades homeowners, farmers, and communities on the upper Yellowstone between Livingston and Billings have built shoreline dikes (“levees”) to prevent flooding and lined banks with boulders (“riprap”) to lessen bank erosion. These shoreline reinforcements, say biologists, rob the Yellowstone of its natural hydrological functions, thus harming fish, wildlife, and native vegetation such as cottonwoods.

Record floods in 1996 and 1997 tore away portions of Yellowstone riverbank and inundated thousands of acres. Afterwards, communities and landowners began riprapping the river like never before. By 2000, roughly 40 percent of the shoreline between Laurel and Billings was riprapped, and tons of boulders were installed along the river’s banks near Livingston and Big Timber.

Anglers and other conservationists became alarmed at the rapid transformation of the river. “Parts of the Yellowstone have now become less a meandering natural river and more of an armored ditch,” says Joe Gutkoski, president of Montana River Action, a coalition of conservation groups formed in 2000 to stop dike construction and riprapping. Though flooding and bank erosion in the immediate area have declined, the narrowing of the river has increased water speed and energy, likely leading to greater flooding and erosion downstream.

“Riprap in one or two places is no big deal,” says Bruce Rich, FWP regional fisheries manager in Bozeman. “But if everyone keeps armor-ing the banks, then the water and its energy are diverted downstream, where it becomes more powerful and eventually spills out, creating even worse flooding.”

In addition, the inability of the Yellowstone to occasionally overflow its banks has robbed floodplains of the valuable silt needed to rejuvenate cottonwoods and other plants that depend on periodic high water. Also, braided channels, sandbars, and islands that provide fish and wildlife habitat have been reduced. A 1998 FWP study



BETWEEN A ROCK AND A HARD PLACE Floodwaters must eventually spill out somewhere. By building dikes and armor-ing banks with riprap, communities and landowners squeeze the river and move flood energy downstream, where it creates even worse flooding for people there.

found that trout populations in the Livingston stretch, heavily fortified by riprap and levees, dropped by 50 percent after the record floods. “The area just got hosed down and blew fish out of the area,” says Joel Tohlz, FWP fisheries biologist in Bozeman. “There was no place for fish to escape.”

Rich points out that no single riprapping or levee project is to blame. “It’s the cumulative effects of tens and then hundreds of projects that add up,” he explains.

As more people build on riverfront property, the demand for bank “improvements” continues to grow. “The irony,” notes Rich, “is that the wildness of the Yellowstone is what draws people to the river. And what they are doing to the river is actually lessening the wildness that attracted them in the first place.”

—Tom Dickson