

**WANTED WATER** Horses drink from the Musselshell where it bends beneath an old iron bridge west of Lavina. A lifeline for area farmers, ranchers, and towns, the river once had most of its flow diverted into upstream irrigation canals, pitting water rights holders against each other and threatening native fish.

# MUSSELHELL MAKEOVER

How the people in this central Montana watershed found a way to share water from—and restore function to—the river running through their lives.

BY BRETT FRENCH PHOTOS BY JOHN WARNER

Perched atop an irrigation pivot, a hawk scans a dense green corn crop the sprinkler has nurtured to an August height of five feet. From its aluminum roost, the raptor seems to be searching for movement, perhaps an unwary ground squirrel feeding along the field edge.

But it's the sprinkler, not the bird, that fuels 67-year-old Bob Goffena's memories

of this lower region of the Musselshell River drainage. His thoughts drift to the human changes taking place on a once-dry landscape now lush, thanks to the river's water.

"That's the other thing the water commission did, it improved the crops you could grow," Goffena says admiringly from the passenger seat of a car stopped along Harvey Road, about 30 miles east of

Roundup in central Montana. He speaks with the accumulated knowledge of a man who has served as a Musselshell County commissioner and Deadman's Basin Water Users Association board member.

The "commission" is Goffena's shorthand for the water commissioners of the Musselshell River Distribution Project. Before the project was formed and better

water appropriations were instituted, it was common for the Musselshell—which rises in the Little Belt, Crazy, and Castle Mountains and empties into Fort Peck Reservoir 342 river miles later (see map, page 30)—to dry up in its lower half. Because water allocation wasn't meeting all the needs of irrigators and municipalities, users up and down the river fought over who got water and when. Thrown into the mix were concerns about the river's fish that were stranded in shallow, tepid pools and struggled to move upstream or downstream past man-made barriers. The distribution project's system of water allocation—along with formation of a new coalition of watershed interests—is helping change how the Musselshell flows, how fish use the river, and how local communities view a waterway that affects so many lives.

**NAMED FOR THE FATMUCKET**

It's hard to conceive that an area where water is so scarce once sat beneath a vast inland sea. Relics of that ancient past are found in the region's thick coal seams, oil deposits, and the salt that still leaches from the soil. The Musselshell River, stretching along U.S. Highway 12 from Martinsdale east to Melstone and then north, is fed by young mountain ranges formed after the sea receded.

The valley has a long history of human habitation. Projectile points, pottery shards, and other archaeological evidence show that people lived in Musselshell Basin as far back as 10,000 to 12,000 years ago. The river was first named in English by Meriwether Lewis as he traveled with the Corps of Discovery up the Missouri River in 1805 and

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noted freshwater mussel shells along the banks (see sidebar below). Next came trappers and hunters pursuing the region's abundant beaver and bison.

Recognizing the productivity of the Musselshell Valley, the ranchers and farmers who followed were quick to file for water rights—the first as early as 1869 for stock water and then in 1875 for irrigation. As the valley's population slowly grew, demand for water from the river and three reservoirs—Bair, Martinsdale, and Deadman's Basin—grew. So did disagreements over water rights. The feuds became so bitter that for decades directors of the major upstream and downstream water user groups refused to talk to each other.

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During the severe drought of 1988, the river dried up just 10 miles downstream from Roundup, and Deadman's Basin Reservoir was nearly emptied. When the two water user groups met that summer, the meeting was crashed by irrigators who ended up in a shouting match over water allocation. “A lot of users were diverting water not supported by their water right without any regard for priority dates,” says Goffena. “Upstream



**Palm-sized hitchhiker**

The Musselshell River's namesake is the fatmucket mussel, a palm-sized bivalve with a thick, yellow-brown shell. Mussels can't move far but extend their range by “hitchhiking.” After mating, the female produces eggs inside herself that mature into larvae known as glochidia. She then waves soft tissue resembling an insect to attract a catfish or other fish species. When the fish tries to eat the lure, the mussel ejects her glochidia, which hook themselves to the fish's gills or skin. There they form into small mussels before breaking off and sinking to the stream bottom. Barriers to upstream fish movement on the Musselshell could prevent the fatmucket from fully occupying its historic range.



**WATER FOR CROPS BUT BLOCKAGE FOR FISH** FWP fisheries biologist Mike Ruggles examines a small rock diversion dam near Two Dot. “Behind me is where the impounded water gets diverted into an irrigation canal that ends up in pivot irrigation systems [facing page],” he says. “Trout can get over a little dam like this one, but native species like longnose dace and shorthead redhorse can't get past even something this low.”

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A big step toward resolving disputes came in the early 2000s with establishment of the Musselshell River Distribution Project. The project allowed the District Court to appoint four water commissioners, funded by water users, to monitor and enforce water rights. Now all water taken from the Musselshell is measured. That ensures no one diverts more than their legal right, while securing everyone's entitled share.

“The way they've solved this problem is a model for community-driven water distribution,” says Bruce Rich, head of the Montana Fish, Wildlife, & Parks Fisheries Division. “I could see it being emulated elsewhere to benefit both irrigators and aquatic resources.”

**WAY TOO LITTLE, WAY TOO MUCH** The Musselshell River has suffered from both a dearth and excess of water. For decades, over-diversions by upstream water rights holders left the lower half of the river dry by midsummer. That denied downstream irrigators their water and blocked migration essential to fish populations. In 2011, the Musselshell flooded with flows exceeding 30 times normal rates. Though disastrous to communities and landowners, the flood restored wetlands, created new fish habitat, and allowed upstream fish passage.



Dewatered Musselshell River, July 2010



Flooded Musselshell River, June 2011

In 2009, the Musselshell Watershed Coalition (MWC) was formed to encourage collaboration among the basin's many water management concerns—agricultural producers, water user associations, and county, state, and federal agencies stretching across five counties. Bill Milton, a dryland rancher near Roundup who serves as facilitator for MWC, says it wasn't easy at first convincing the various players to cooperate. "But then people started to see that they can accomplish more working together than they can on their own," he says. "It makes it easier for government agencies when everyone agrees." That's important because the river's aging irrigation infrastructure, much of it built in the 1930s and '40s, needs repair. Milton adds that "telling a story about a whole river basin and its community" can help attract state and federal grant money.

**STRAIGHTENING THE RIVER**

A major chapter in the Musselshell story has been the river's channelization. During the first half of the 20th century, several large building projects forever changed the waterway: construction of the now-abandoned Milwaukee Road rail line in 1907 and, later, the building of U.S. Highway 12 and more than two dozen diversion dams—barriers that divert river water into irrigation channels.

The dams blocked migratory warmwater fish from historic habitat. The railroad and highway disrupted the Musselshell's natural processes. To protect the rail and road beds from erosion and make the routes as efficient as possible, engineers straightened the river. The rail and road beds created a dike, cutting off more than 80 meanders and shortening the Musselshell by 35 miles. The transportation infrastructure also severed the river from floodplains and wetlands, which historically absorbed floodwaters like a sponge.



**CENTRAL MONTANA LIFELINE** The Musselshell River Watershed covers approximately 9,500 square miles and is home to roughly 9,325 residents. The Musselshell River flows from the confluence of the North and South Forks near Martinsdale for 342 miles to Fort Peck Reservoir, providing water for farms, ranches, and municipalities. Established in the early 2000s, the Musselshell River Distribution Project ensures that water from the river is apportioned legally. Four water commissioners, funded by water users, monitor and enforce water rights holders.

Drivers travel more slowly on twisty roads than on ruler-straight freeways, and the same is true for water in streams and rivers. In May 2011, following days of heavy rains and massive snowmelt, the Musselshell turned into an aquatic autobahn, with river flows surging up to 30 times normal rates. Charging down the constricted, straightened river channel, water blasted through railroad bridges, carved around diversion dams, and gushed across roads and farm fields. "Channelization speeds up the river, and then there are no floodways to ease the water flows," says Mike Ruggles, an FWP fisheries biologist based in Billings. By June of that year, Governor Brian Schweitzer had declared a state

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of emergency for the basin. After the flood, the MWC formed a technical advisory team to assess the devastation and find ways to lessen economic, social, and ecological damage from future flooding. The coalition's partners organized emergency repairs and rehabilitations, from fixing irrigation infrastructure for immediate use to stabilizing streambanks and other long-term conservation projects.

Though it created enormous hardship by ruining homes, roads, diversion dams,

**Mysterious species**

The Musselshell River is home to a unique fish species, a hybrid of the northern redbelly dace and the finescale dace. The hybrids are all females that reproduce by breeding with male northern redbelly dace. Yet the male's sperm does not enter the egg but rather its presence stimulates development of the egg. Because the male's genetic material is never incorporated, offspring are all females and clones (genetically identical) of the mother. (Male northern redbelly dace also breed with females of their species, which produce both males and females.) Mysteriously, though northern redbelly dace are common in eastern Montana, not a single finescale dace has been recorded here.



ILLUSTRATIONS BY JOSEPH TOMELLERI



**RIVER PEOPLE** Top: At a cafe in Roundup, FWP biologist Mike Ruggles listens as Musselshell River advocate Bob Goffena explains how gauges along the entire river—like this one (above) monitored by Leon Hammond, project manager for the Upper Musselshell Water Users Association—help allocate water fairly and legally. Left: Anglers fish for channel catfish, sauger, and other species at a diversion dam 20 miles downstream from Roundup. During drought years, the Musselshell would often dry up from this point down to where the river empties into Fort Peck Reservoir, frustrating both irrigators and anglers along the way.

and cropland, the flood was a blessing for the Musselshell Valley ecosystem. It invigorated parts of the river by seeding new areas for cottonwood trees, toppled old trees into the river to create fish habitat, blew out fish-blocking dams, and restored water-absorbing wetlands. The disaster also helped unify the valley community and increase cooperation. “Attitudes have changed about working together,” says Laura Nowlin,

who was hired by the MWC with a state grant to set up meetings, produce a quarterly newsletter, and coordinate a watershed plan. “People in the watershed are more open to helping each other out.”

The flood served as a wake-up call that convinced many landowners to re-evaluate traditional ways of using the river. For in-

“Strengthen any one of those components, and you strengthen the entire system as a whole.”

stance, many irrigators have found that portable electric pumps work as well or better than diversion dams to transport water from the river into irrigation channels. Pumps are far cheaper to replace than diversion dams—which one landowner calls “Mesopotamia technology”—if blown out by floods. They also don’t block fish movement. “Pumps are good for fish and farms,” Ruggles says. “An irrigator can turn them on and off from his house using a smartphone.”

The changes are aiding two state fish species of concern—sauger and northern redbelly dace—as well as channel catfish, burbot, shorthead redhorse, smallmouth buffalo, and more than a dozen other native nongame fish. “Through the partnerships, we’re restoring the river’s native fish species and its natural heritage,” Ruggles says.

**FOCUS ON FISH**

Ruggles enjoys rooting for and working on the underappreciated Musselshell River. “People race right by here on the way to the Bighorn River,” he says while standing at one of only two FWP Fishing Access Sites (FAS) on the entire river. The Selkirk FAS is near

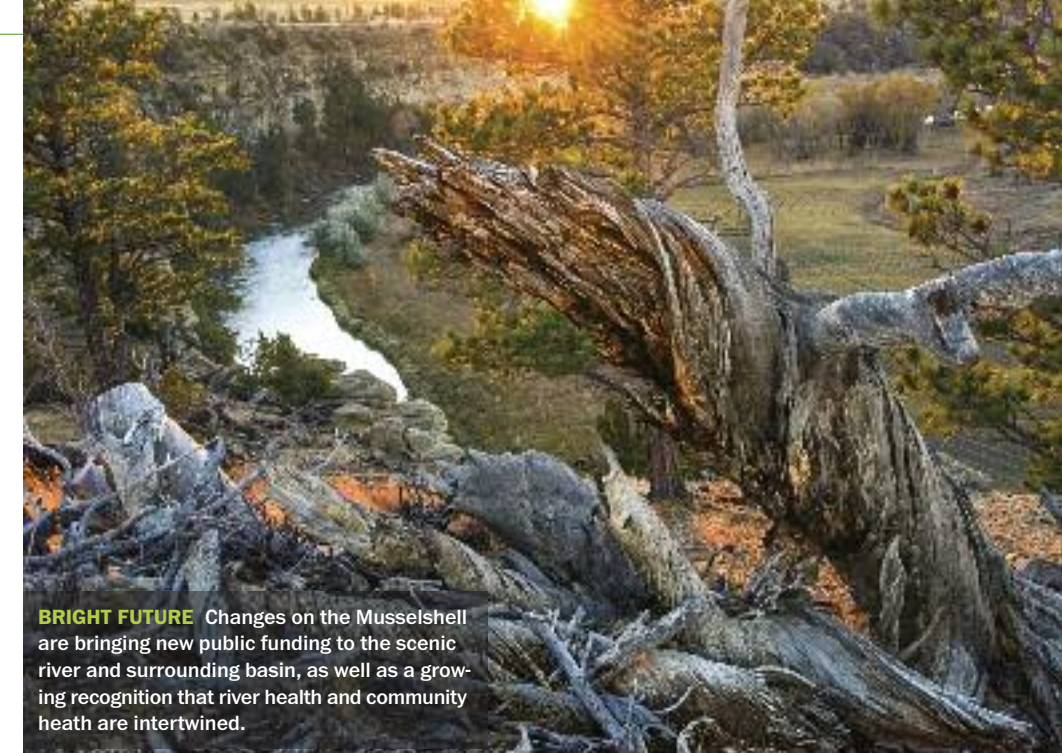
Two Dot on the river’s upper reach, which contains between 200 to 400 brown trout per mile, averaging 12 to 16 inches long.

Just downstream from the town of Harlowton, the river begins its transition to a warmwater fishery. Here—with cooperation of a landowner—Ruggles is reintroducing channel catfish. Last fall he and FWP crews trapped 20 catfish farther downstream near Fort Peck Reservoir and put them here, hoping they will reproduce. Over the next couple of years, Ruggles plans to relocate 150 to 300 more catfish. “This area has great minnow populations and suckers for forage. But because they were cut off from the Missouri by years of dewatering, catfish in this stretch never could get established,” he says.

FWP studies in eastern Montana have shown that catfish will swim long distances to find the seasonal habitats they require, sometimes several hundred miles per year. “With diversion dams and dewatered areas, like were common here for so long, channel catfish couldn’t migrate like they needed to,” Ruggles says.

**LOOKING AHEAD**

The picture isn’t all rosy on the Musselshell. The rail bed still cuts off much of the river from its historic meanders. The 2011 flood spread salt cedar, knapweed, and other invasive plants widely throughout the floodplain. With so many diversion structures



**BRIGHT FUTURE** Changes on the Musselshell are bringing new public funding to the scenic river and surrounding basin, as well as a growing recognition that river health and community health are intertwined.

damaged, many farmers and ranchers still struggle to obtain water for alfalfa and corn fields. And not everyone is sharing water. “Some people are still diverting more than is represented by their water right,” Goffena says during a drive down the valley.

Despite the setbacks, more water is making its way down the Musselshell River than in years past. That benefits downstream irrigators and fish. And if additional obsolete diversion dams are removed or the necessary ones are modified, says Ruggles, native sauger could eventually make their way upstream from the lower Musselshell to the middle part of the Musselshell, where

they haven’t been seen in decades.

The fisheries biologist is optimistic. He notes that residents of the Musselshell Basin are realizing that a healthy river and healthy communities go hand in hand. “The same water that helps keep farming families on the land is helping native fish,” he says. “Many people in this region are now looking at the big picture of the Musselshell.” That means recognizing that the entire system—the river, the fish, the local economy, the community—are interconnected. “Strengthen any one of those components,” adds Ruggles, “and you strengthen the system as a whole.”



**CAT MAN** An angler shows off a hefty channel catfish caught beneath Davis Diversion Dam between Roundup and Melstone. Upstream-migrating fish stack up below the structure, which remains the biggest obstacle to fish movement on the entire Musselshell River.

**Better for irrigators and fish**

Just upstream from the OK Bar Ranch, the Deadman’s Basin Water Users Association recently renovated the diversion dam that feeds Deadman’s Basin Reservoir. The dam, which takes 600 cubic feet per second in spring, was rebuilt at a cost of \$1 million, funded mostly by association members. FWP’s Future Fisheries Program helped pay for a rock ramp that allows migrating fish to swim up and over the dam.

Because the headgate on the old diversion did not completely close, an estimated 3,000 acre-feet of water per year leaked into the 11-mile-long canal, where it disappeared into the ground. The water never reached the reservoir, a key storage basin for irrigation and a popular recreational fishery.

Soon work will begin on removing Egge Diversion Dam, five miles east of Lavina. The 2011



Deadman’s Reservoir Diversion Dam before reconstruction.



During reconstruction, October 2015



Renovated dam with rock ramp (arrow) for fish passage, February 2016.

flood did an end-run around the dam, carving into a farmer’s field. Removing the concrete structure will reconnect 24 miles of river.

The biggest remaining obstacle to fish movement on the Musselshell is Davis Dam, about 12 miles downstream from Roundup. FWP fisheries biologist Mike Ruggles hopes that someday the dam can be removed or a bypass stream built around the structure. “We definitely don’t want to see all the diversion dams on the Musselshell gone,” says Ruggles. “Some of them, like Deadman’s Basin, are essential for irrigation. And from a fisheries standpoint, some are doing a good job of preventing non-native northern pike from moving up from Fort Peck Reservoir into the river system and preying on native fish. But we definitely would like to see Davis Dam taken out or altered to allow some fish passage.”