FROM Banning TNT TO Scanning DNA

What 100-plus years of fisheries management says about Montana and its people.

By Amber Steed and Tom Dickson

You can learn a lot about Montana's changing values and priorities over the past century by studying the state's literature, art, and politics—and fisheries management.

It's true. How Montanans regard their streams, rivers, lakes, and fish populations—and how the state has responded—underscores a growing appreciation of and desire to protect these and other natural resources.

People have always wanted to catch fish in Montana—from trout in remote mountain lakes and scenic valley rivers to, in later years, walleye and other species in vast reservoirs. Historically, Salish and Kootenai Indians captured spawning bull trout using willow traps and rock weirs. In the late 19th century, commercial fishermen netted truckloads of trout for local markets. Families in the early 1900s used hook and line to fill baskets of fish to stock their larders.

Recreational angling also has a long history here. "I amused myself in fishing," Captain Meriwether Lewis wrote in 1805 after catching westslope cutthroat trout below the Great Falls of the Missouri River. Today flotillas of drift boats moving down the Madison, Bighorn, Yellowstone, and Bitterroot Rivers in midsummer embody that passion. For some anglers, fishing for native species—cutthroat trout and sauger especially—has become a pleasure in itself.

No matter why Montanans fish, they have always insisted that the state maintain abundant populations. How the Montana Fish, Wildlife & Parks Fisheries Division has responded to that challenge over the past century is a story of evolving public values, scientific breakthroughs, and political leadership.

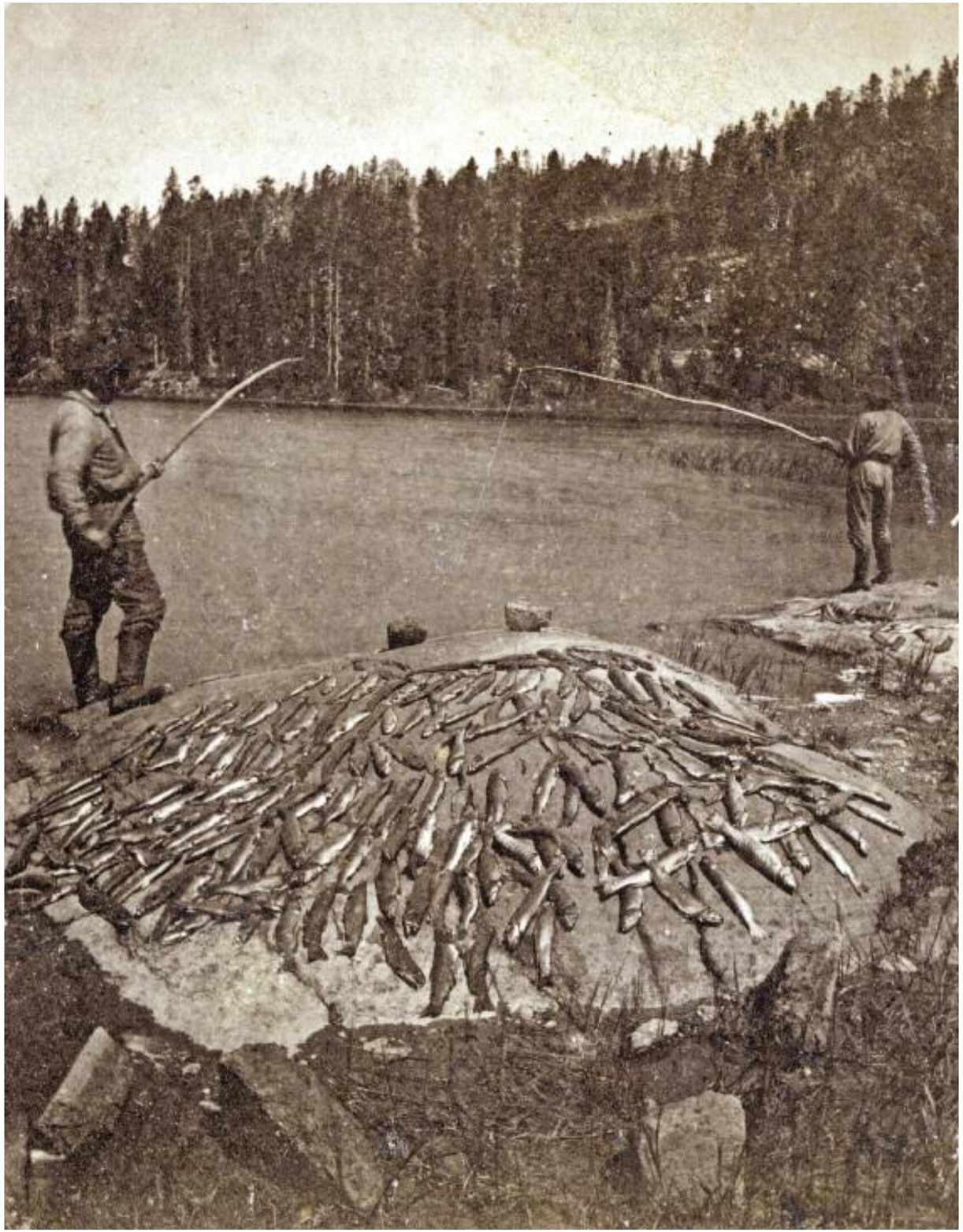
Extract at all costs

Trout conservation was the last thing anyone considered in the spring of 1886, when, on the first log drive down the Blackfoot River, 20 million board feet of timber was sent downstream to the Montana Improvement Company's Bonner mill. At the time, and for decades thereafter, Montanans sawed, mined, and plowed as much timber, minerals, and prairie as possible to feed the state's increasing population and fuel its burgeoning economy. That resource extraction could damage water, soil, native vegetation, and fish and wildlife was of little concern—at first.

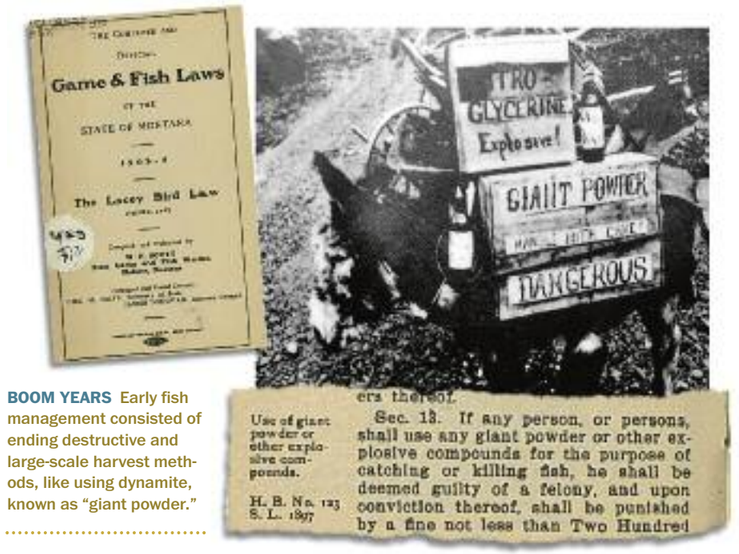
Montana's window of seemingly inexhaustible natural resources was brief. Bison, elk, beaver, and other land animals were nearly gone from most of the state by the late 1800s. Fisheries suffered, too. Explosives, seines, poisons, and other destructive or large-scale harvest methods rapidly depleted trout populations. New dams stopped fish from reaching spawning waters. Irrigators drained creeks to water crops in late summer. Communities used streams as sewage canals. As early as 1891, the U.S. Fish Commission reported that it "did not find any fish" when netting the Clark Fork near Deer Lodge because of toxic runoff from copper smelting upstream in the Butte-Anaconda area.

Intent as they were on building towns, railroads, dams, mines, and more, it took a while for Montanans to notice that fish stocks, previously so abundant, were dwindling. One of Montana's first fishing regulations, passed in 1899, made it illegal to use dynamite (known as "giant powder") for "catching, stunning, or killing fish." Other early regulations required a license to fish, registration of all fish ponds with the Board of Fish and Game Commissioners (established in 1895), fish screens on irrigation intakes to prevent stranding fish in hay fields, and that mills stop dumping

EARLY PERSEPCTIVES The journals of Lewis and Clark (above) were the first documentation of the northern Rockies' abundant fisheries. Early settlers and then recreationists, like these at Yellowstone National Park (right) exploited the resource, assuming it was limitless.



LEFT TO RIGHT: MISSOURI HISTORICAL SOCIETY ARCHIVES; MONTANA HISTORICAL SOCIETY



BOOM YEARS Early fish management consisted of ending destructive and large-scale harvest methods, like using dynamite, known as "giant powder."

sawdust into streams and rivers.

Now Montana had fish and game regulations—but no one to enforce compliance. "The vastness of Montana Territory increased the difficulty in enforcing wildlife laws, and the Legislature was particularly lax regarding enforcement," historian Joan Louise Brownell wrote in *The Genesis of Wildlife Conservation in Montana*. Finally, in 1901, the state hired its first game warden, W. F. Scott, who appointed eight deputy wardens across the state. Though only rudimentary, fisheries management was under way.

Stock, then stock more

By the early 20th century, regulations and enforcement had addressed environmental degradation—such as by outlawing mining waste in public waters. But industrial and municipal development continued ever faster. Silt from eroding clear-cut hillsides suffocated trout eggs. Factories dumped industrial waste in rivers and streams. Native fish like cutthroat trout and bull trout that evolved in clean, clear water couldn't survive the contamination and relentless overharvest. Yet Montanans still wanted to catch fish.

Capitalizing on recent breakthroughs in salmonid cultivation elsewhere in the United States, Montana began to use hatcheries to grow fish—primarily nonnative rainbow, brown, lake, and brook trout—and release them for public recreation. Stocking fish quickly became the state's top fisheries-management priority. It not only replaced fish stocks depleted by pollution but also allowed crews to put trout in fishless mountain lakes and stock newly created reservoirs. "Practically every accessible water in the state received fish of some kind at the discretion of the planter and without regard to actual need or desirability," former state fisheries chief William Alvord wrote in his history of Montana fisheries management.

The U.S. Fish Commission built the Bozeman National Fish Hatchery in 1896 to produce rainbow and brook trout. The first state-owned hatchery opened in Anaconda in 1908, followed by 13 more by 1925. Private hatcheries, operated by local sportsmen's groups, popped up just as quickly. Montana established fish stations on various streams in the 1920s to take eggs and milt from wild populations for the hatcheries. In 1933 alone, fisheries workers harvested 22 million brown trout eggs in the Madison River drainage and 12 million rainbow trout eggs at Hebgen Lake. "Fishermen were accustomed to seeing hatchery trucks plant the Madison [River] and naturally associated catching trout with the hatchery," a 1985 *Montana Outdoors* article on trout management noted.

The state reared fish for eastern Montana, too. Fisheries crews raised walleye, northern pike, largemouth bass, and other coolwater species for stocking in farm ponds, reservoirs, and rivers.

Science informing decisions

Stocking seemed like a foolproof way to keep Montana's waters filled with catchable fish. The sporting press certainly thought so. From the 1940s through '60s, Joe Brooks, Ted Trueblood, and other outdoors writers sang the praises of western trout rivers in *Field & Stream*, *Outdoor Life*, *Sports Afield*, and other national publications. Montana trout advocates like Dan Bailey and Bud Lilly built world-renowned fly shops and guiding services based on fishing for stocked rainbows and browns in the Yellowstone, Madison, and other storied rivers.

NATIONAL EXPOSURE Starting in the 1940s, outdoors magazines publicized Montana's great fishing, drawing people from across the United States to its waters, much to the ire of local anglers.

To improve the effectiveness of its stocking program, the Fisheries Division in 1947 created a fisheries biology section. The state's first fisheries biologist, Charles Phenicie, soon conducted groundbreaking scientific surveys of Montana's fish populations, streams, and rivers to better understand how stocked trout survived. As the 1950 federal Dingell-Johnson Act (which taxed angling gear to fund state fish conservation) and a new fisheries-management course at Montana State University added biologists and student volunteers to its ranks, the Fisheries Division began gathering vast amounts of data. Crews measured stream flows and conducted creel surveys to ask anglers about their catch. They used new electrofishing technology to capture fish, and applied biological science to age those fish.

By the mid-20th century, stocking still dominated Montana fisheries management, but biologists now used data from studies when making management decisions. Based on research, the Fisheries Division varied the

ALL PHOTOS FWP ARCHIVES, EXCEPT DONKEY, CONTRA COSTA COUNTY HISTORICAL SOCIETY COLLECTION

REPLENISHING STOCKS Montana's first fish distribution vehicle (above) and train, "Thymallus," (above right) were used to stock fish statewide. Trout were also carted in milk cans by mule and trucked in crates (right) to backcountry lakes devoid of game fish.

INNOVATING Early fisheries crews used primitive electroshocking equipment (above left and below left) to monitor stream populations. After World War II, they used airplanes (above) and later helicopters to deliver fish and equipment to remote areas inaccessible by vehicles.

Timeline

Montana Fisheries Management

1889 Montana achieves statehood.

1895 The legislature establishes a Board of Game and Fish Commissioners.

1896 U.S. Fish Commission builds Montana's first fish hatchery north of Bozeman.

1901 The governor appoints the first state game warden, who then appoints eight deputies statewide.

Early 1900s Rainbow trout from California's McCloud River drainage, brown trout, brook trout, and largemouth bass are introduced to Montana.

1905 Fishing licenses are required of Montana resident anglers.

1908 The first state fish hatchery is built in Anaconda.

1912 A federal hatchery is built in Somers.

1913 Daily bull trout limit set at 50 pounds.

1940 Completion of Fort Peck Dam creates Fort Peck Reservoir.

1947 FWP hires its first fisheries biologist and establishes a fisheries biology section.

1950 Congress enacts the Federal Aid in Sport Fish Restoration (Dingell-Johnson) Act.

1954 Canyon Ferry Dam is built on the Missouri River, creating Canyon Ferry Reservoir.

1955 Montana passes a comprehensive water pollution control law.

1963 Montana passes the nation's first stream protection act.

1964 Fish and Game Commission drafts policy opposing mass aerial spraying of DDT.

1973 Congress passes the Endangered Species Act (ESA).

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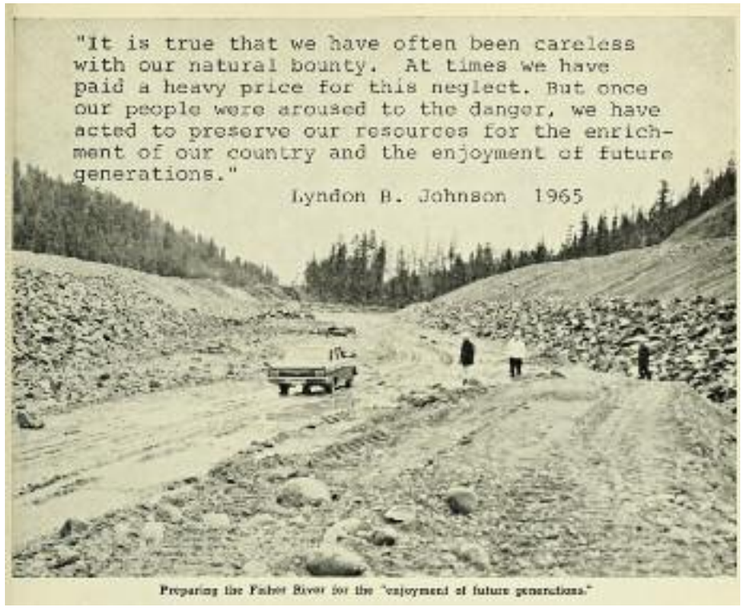


ROAD RAGE During the mid-20th century, Montanans became increasingly concerned about river destruction in the name of highway construction. This image of the Fisher River in northwestern Montana is from "Ravage the River," *Montana Wildlife* magazine, February 1967.

REVOLUTIONARY RESEARCH Dick Vincent during his groundbreaking stocking study in the early 1970s.

NATIVE RIGHTS By the 1980s, biologists were looking more closely at indigenous fish, including coldwater species such as bull trout (above left) and coolwater species like burbot (above right)

size of stocked fish, depending on species and water type. Starting in 1953, it was department policy to stock only cutthroat trout, rainbow trout, and Arctic grayling in streams, and all fish had to be at least six inches long. Concerned about the introduction of harmful species, fisheries managers employed scientific data in convincing Montana lawmakers to ban unauthorized stocking.

As they studied streams to better understand stocking success, fisheries crews also learned how human development damaged trout habitat. Montanans had become increasingly concerned about the rapid construction of two-lane highways being built or expanded across the state. "Montana's best waters are gradually disappearing [as] whole channels are being changed by the road builders," the Montana Fish and Game Department opined in a 1955 issue of *Montana Wildlife*. In response, the department launched a study of fish habitat in 13 western and central Montana streams before and after highway construction. The startling results—in some cases trout populations declined by as much as 75 percent—led to the Montana Stream Protection Act of 1963, the first bill of its kind in the United States.

New perspectives

By the 1950s, some fisheries biologists had begun to quietly question the effectiveness of stocking. "The idea then was that stocked fish were an addition to the wild populations, that two plus two equaled four," retired FWP biologist Dick Vincent said in a 2004 *Montana Outdoors* interview. "But a few of us wondered if maybe two plus two equaled three or even less." It was not until the early 1970s that a three-year study on the Madison River and nearby O'Dell Creek proved that stocking hatchery-reared fish in streams and rivers damaged existing wild trout populations and reduced the number of large trout for anglers. As biologists quit stocking rivers and restricted harvest regulations on popular trout waters to maintain populations, Montana entered the era of wild trout management.

Meanwhile, both Montana and the nation had begun enacting laws to protect the environment and imperiled species. To address DDT pesticide runoff, pulp mill pollution, and mining waste, Montana passed a comprehensive water pollution control law in 1955. In 1972, Montana enacted a new state constitution that guaranteed a clean and healthful environment. Several years later, Montana conservationists, assisted by fisheries biologists armed with reams of scientific data, successfully fought efforts to dam the Yellowstone River and turn the Paradise Valley into a series of reservoirs (see page 34).

Concerned about the disappearance of bald eagles and other popular wildlife, Congress passed the Endangered Species Act in 1973. In Montana, the law raised public awareness of the intrinsic value of native species, including fish, and compelled the state to begin efforts to recover bull trout, white and pallid sturgeon, westslope and Yellowstone cutthroat trout, and Arctic grayling.

In the 1980s, eastern Montana fisheries biologists began the first-ever surveys of prairie streams. Over time, crews seined 18,000 miles of streams and found 46 different fish species, 26 of them native, including the northern redbelly dace, emerald shiner, and Iowa darter. The surveys shed light on the rich diversity of aquatic life in eastern Montana.

One of the largest eastern Montana species was the pallid sturgeon, which was fast disappearing. Completion of Fort Peck Dam in 1940 had been a mixed blessing. By impounding the river, it eventually created a major walleye fishing destination. But it also blocked sturgeon from spawning waters upstream. On the Yellowstone River, Intake Diversion Dam similarly stymied the prehistoric fish. Despite years of Fisheries Division research on and advocacy for the federally protected species, adult pallid sturgeon numbers dropped to fewer than 100, making it one of the rarest fish in North America.

Like Fort Peck, dams elsewhere in Montana represented a fisheries paradox. Some created world-class trout waters, such as the Missouri River below Holter and the Bighorn River below Yellowtail. Others, such as a series of hydropower facilities on the lower Clark Fork River, blocked bull trout migration, hastening the decline of what became a federally threatened species.

By the late 1980s, it seemed biologists could catch their breath. With the exception of dams, major threats to Montana's fisheries and fish habitats—municipal pollution, silt washing in from clear-cut mountainsides, stream channelization, and mining waste—were being reduced thanks to improved industrial practices and stricter laws. The Montana Legislature had also determined that fish survival was one "beneficial use" of river water, giving the Fisheries Division legal

LEFT TO RIGHT: *MONTANA OUTDOORS* ARCHIVES; DICK VINCENT; TODD PERSONS/ENGBRETSON UNDERWATER PHOTOGRAPHY; MONTANA FWP ARCHIVES; SHUTTERSTOCK

The conundrum of catch-and-release

As Montana trout anglers became more environmentally conscious in the 1970s and '80s, a growing number began to reconsider the long-held practice of harvesting every fish they caught. Because family incomes were rising, fishing for food became less necessary. What's more, bass and Atlantic salmon anglers elsewhere in North America were proving that released game fish could be caught repeatedly.

For Montana fisheries managers, the growth of catch-and-release was a double-edged sword. It meant reduced concern about anglers overharvesting fish stocks. Yet fisheries biologists were less able to use harvest to manage fish populations. For instance, biologists say they could likely increase the average size of trout on some rivers if anglers would keep more fish, giving remaining trout more room and food. In other rivers, increased harvest of non-natives such as brown trout might increase dwindling native westslope cutthroat populations.

But even where legal and biologically justifiable, killing any trout on some Montana rivers has become a form of sacrilege. ■

Mid-1970s Montana discontinues stocking trout in rivers and streams.

1975 Montana passes the Natural Streambed and Land Preservation Act ("310 Law").

1985 Montana passes the Stream Access Law.

1990 U.S. Fish & Wildlife Service lists the pallid sturgeon as endangered.

1992 *A River Runs Through It* is released, fueling interest in Montana fly-fishing.

1994 U.S. Fish & Wildlife Service lists the white sturgeon as endangered.

1996 FWP establishes its Hooked on Fishing education program.

1999 FWP Commission creates new use rules for the Beaverhead and Big Hole Rivers.

2004 Biologists conduct comprehensive surveys of eastern Montana streams and find 46 species, 26 of them native.

2007 FWP reaches milestone of 300 fishing access sites statewide.

2014 U.S. Fish & Wildlife Service decides not to list the Arctic grayling trout under the ESA.

1978 The Yellowstone River is saved from impoundment.

1987 FWP releases its first warmfish management plan.

1994 Whirling disease is found in the Madison River.

1998 U.S. Fish & Wildlife Service lists the bull trout as threatened.

2006 Fort Peck Multi-Species Hatchery opens.

2009 Montana passes the Aquatic Invasive Species Act.

2017 Montana mobilizes a massive containment operation after invasive mussels are found in two reservoirs.

means to maintain flows to benefit trout and other species. In 1984, the Montana Supreme Court ruled in favor of public access to streams and rivers, accelerating the eventual development of more than 300 fishing access sites and boosting fishing recreation that funded fisheries management.

But even with these achievements, fisheries biologists could not relax. Montana was becoming a victim of its own success.

Dealing with newcomers

For years, movies, tourism campaigns, and rhapsodic reports from outdoors writers depicted Montana as a western paradise. People flocked to the scenic state to put down roots or just wave a fly rod for a week. The influx led to increased streamside housing development, growing threats of fish disease and harmful invasive species, and mounting pressure on the state's finite fish populations.

The Fisheries Division responded with vigorous scientific study using sophisticated tools. Biologists surgically implanted tiny radio transmitters into fish to track where species spawned so those waters could be protected. They retooled fish hatcheries to raise native species like Arctic grayling for restoration projects. Biologists found ways to make recreational fish like rainbow trout better able to survive in the wild, began analyzing DNA residue in streams to determine which fish species lived there, and created computerized maps showing the disappearance of genetically pure cutthroat from 90 percent of the species' historic range.

In response to growing public demand for walleye on Fort Peck Reservoir, biologists teamed with local anglers to strip eggs and milt of spawning fish for hatchery propagation. Using science-based guidelines, FWP now stocks millions of newly hatched fish in Fort Peck each year to produce one of the nation's most acclaimed walleye fisheries.

The dangers of fish pathogens made state and national headlines in 1994 when biologists discovered that whirling disease was devastating the Madison River's rainbow trout population. Disease had long been on biologists' radar. As early as 1969, they convinced Montana legislators to ban the import of infected fish and create the state's first fish-health program. Working with state and federal fish labs, biologists detected diseases in wild and reared fish, inspected hatcheries, and responded to outbreaks.

Though the Madison's rainbow population rebounded—perhaps because surviving trout passed disease-resistant genes to new generations—whirling disease remains in many Montana trout streams. Biologists also monitor for proliferative kidney disease (PKD) and

DNA AND AIS By the 2000s, the Fisheries Division had begun using advanced science, such as environmental DNA (above), to monitor fish populations. It also began watercraft inspections to keep aquatic invasive species like Eurasian watermilfoil (right and far right) from entering and degrading Montana waters.

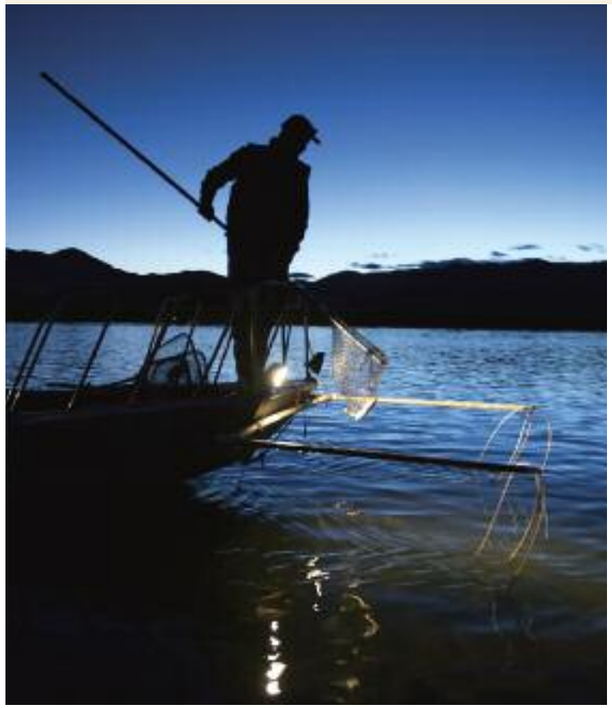
Two key habitat protection laws

Concerned about alterations to rivers and streams, Montanans pushed for laws limiting riparian development.

One of Montana's most important legal tools for conserving stream habitat is the 1975 Natural Streambed and Land Preservation Act (known as the "310 Law" because it originated as HB 310). Under this law, private landowners must obtain a permit from the local conservation district for any project that might modify a streambed or stream bank. The local FWP biologist is part of a team that reviews the permit application. That ensures scientific and technical review of how a housing or other streamside development might add silt to spawning beds, reduce pool depth, remove streamside vegetation, or otherwise harm fish habitat.

This landmark legislation came 10 years after Montana lawmakers permanently reauthorized a similar groundbreaking law, the Stream Protection Act (initially passed in 1963). That legislation required public agencies to consider the harm that highway construction and other development could cause to stream channels. As a result, the Montana Department of Transportation now routinely widens road culverts so fish can pass, increases bridge spans to allow rivers more room to naturally meander, and builds bridges over streams rather than straightening waterways to run parallel to new roads ("channelization"), as was the previous practice. ■

BROADENING THE SCOPE By the 1990s, the Fisheries Division was running large-scale management programs in central and eastern Montana. At Fort Peck Reservoir, fisheries crews and volunteers harvested walleye eggs and milt to propagate fry and fingerlings stocked in the massive impoundment. As they were raising fish, biologists were also raising concerns about ill-timed water releases from Fort Peck Dam that disrupted pallid sturgeon reproductive habitat (above left). On rivers, FWP intensified fisheries management for coolwater, warmwater (weighing channel catfish on the lower Yellowstone River, above right), and coldwater species (electrofishing trout on the Missouri River near Craig, below left). Sophisticated technology—like the sliver-sized tag in the snouts of these hatchery-reared pallid sturgeon planted in the lower Yellowstone River (below right)—allows biologists to follow even small fish to see what habitats they use throughout the year.



CLOCKWISE FROM UPPER LEFT: SHUTTERSTOCK; WINSTON GREELY/MONTANA FWP; USDA; OZAUKEE COUNTY PLANNING & PARKS

CLOCKWISE FROM TOP LEFT: BRETT FRENCH; JOHN WARNER; ANDREW MCKEAN; CHRIS MCGOWAN

infectious *hematopoietic necrosis* (IHN) virus, both of which can wipe out hatchery stocks and threaten wild populations.

Also concerning Montanans—and FWP fisheries biologists—are aquatic invasive plants and animals. Already some Montana waters are beset by New Zealand mud snails, Eurasian watermilfoil, and curly-leaf pondweed. The Fisheries Division's Aquatic Invasive Species (AIS) staff work with legislators, businesses, fishing groups, and communities to check the spread of these unwanted species and prevent new infestations. Crews inspect and clean thousands of boats each summer at check stations. Billboards and radio and TV announcements urge boaters to "Clean, Drain, Dry" their craft. In early 2017, after detection of the first invasive mussel larvae in Montana waters, FWP and other agencies and partners mobilized a massive containment operation.

What's in store?

Montanans' values and priorities regarding their fisheries, streams, and rivers continue to evolve. Jobs and economic growth remain essential, but now clean water and abundant outdoor recreation do, too. Though anglers still want to catch non-native rainbow and brown trout, perch, and walleye, they increasingly value bull trout, sauger, and other indigenous fish. Aquatic invasive species, for years not even on most peoples' radar, are now seen as major threats to Montana ecosystems, industry, and agriculture.

For fisheries biologists, responding to public demands will become harder and more complex. Housing and commercial development near streams and rivers continues to intensify. Growing angling pressure and recreational use such as personal watercraft riding, whitewater rafting, and kayaking create overcrowding and conflict. These days, managing fisheries can be as much about sociology as it is about science.

Then there's climate change. Hotter-than-average summers are straining many fisheries. Trout and grayling especially struggle to survive in waters that become too low, too warm, or both.

Despite the challenges, fisheries biologists remain hopeful. Montana remains America's premier trout-fishing destination. Walleye size and catch rates far exceed national averages. Biologists know more about native fish—from sauger and blue suckers to northern pikeminnows and bull trout—than ever and are using that knowledge to conserve those populations. Biologists also stay abreast of fast-changing technology and science to better understand, protect, and manage Montana's fisheries. Financially, the Fisheries Division continues to find new ways to bolster traditional funding sources to keep up with growing public demands. And even though invasive mussels have arrived, FWP and other agencies have the knowledge, resources, and, hopefully, public cooperation necessary to limit the species' spread within the state.

Perhaps most encouraging for Montana's future fisheries are the anglers and others who care so much about the state's waters. Biologists can't manage fish populations on their own. Collaborating with landowners, lawmakers, fishing groups, and other agencies, the FWP Fisheries Division secures conservation easements, maintains water flows, increases public fishing access, and promotes effective legislation. Using smart, community-based conservation work, Montana has kept the grayling and cutthroat trout from unnecessarily being listed as endangered.

Fisheries management in Montana has changed dramatically since the days of simply banning dynamite and poisons. And it will continue to evolve in years to come. What won't change is biologists' commitment to, and public demand for, conserving Montana's vast and valuable aquatic resources.

TEAMWORK Partnerships have become essential for effective fisheries management. On the upper Big Hole River, FWP biologists and landowners (above) established conservation measures that kept the Arctic grayling (left) from being listed as a federally endangered species.

SAME CONCEPT, NEW SPECIES A century ago, Montana fish hatcheries were used solely to produce non-native fish. Today, some fish hatcheries, like at Sekoknoni Springs near West Glacier (above), propagate westslope cutthroat trout and other native species used for conservation projects. As has been the case since statehood, fisheries management continues to reflect the values and concerns of anglers and others. Residents and nonresident visitors still want to catch fish, just as they did in the late 19th century. But equally important to a growing number of Montanans and tourists are the native species, clean water, and scenic landscapes that go hand in hand in healthy, well-managed fisheries.

CLOCKWISE FROM TOP LEFT: THOMAS LEE; PAUL N. QUINZAU; BEN PIERCE; PATRICK CLAYTON/ENGBRETSON UNDERWATER PHOTOGRAPHY