MONTANA **2023**
Annual Fishing Newsletter

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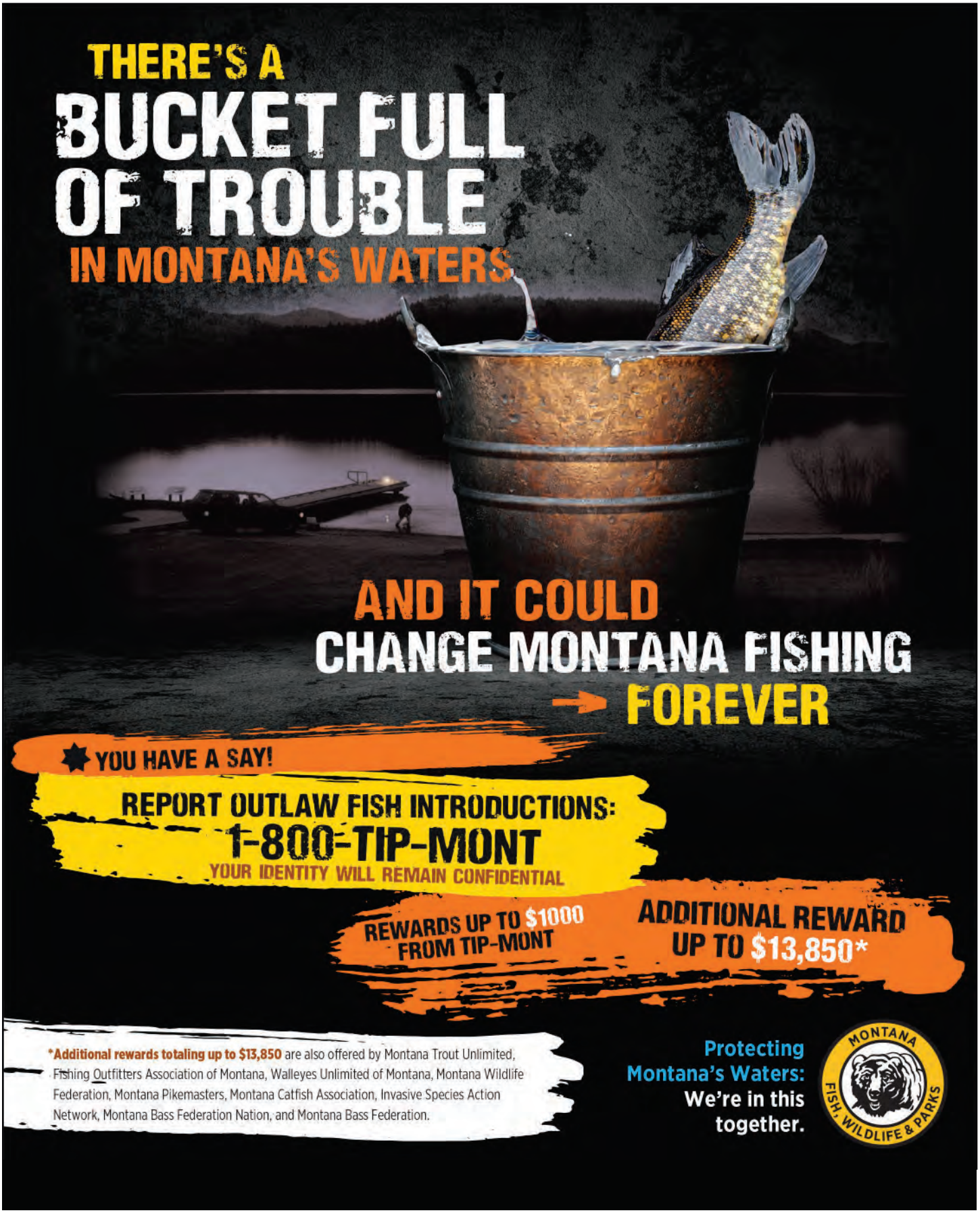
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Protecting
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We're in this
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MONTANA
FISH, WILDLIFE & PARKS

Table of Contents

FWP Administrative Regions and Hatcheries

FWP Regional Offices

Headquarters
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Helena, MT 59601
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Region 1
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Region 3
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Region 4
4600 Giant Springs Road
Great Falls, MT 59405
406-454-5840

Region 5
2300 Lake Elmo Drive
Billings, MT 59105
406-247-2940

Region 6
1 Airport Road
Glasgow, MT 59230
406-228-3700

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Miles City, MT 59301
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Butte, MT 59701
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Havre Area Office
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Havre, MT 59501
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Helena Area Office
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2051 Fish Hatchery Road
Lewistown, MT 59457
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Bluewater Springs Trout Hatchery
700 Bluewater Road
Bridger, MT 59014
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Somers, MT 59932
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Giant Springs Trout Hatchery
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Great Falls, MT 59405
(406) 452-5734

Jocko River Trout Hatchery
206 Hatchery Lane
Arlee, MT 59821
(406) 726-3344

Miles City Fish Hatchery
107 Fish Hatchery Road
Miles City, MT 59301
(406) 234-4753

Murray Springs Trout Hatchery
5475 Sophie Lake Road
Eureka, MT 59917
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Sekokini Springs Hatchery
490 North Meridian Road
Kalispell, MT 59901
(406) 857-3744

Washoe Park Trout Hatchery
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Anaconda, MT 59711
(406) 563-2531

Yellowstone River Trout Hatchery
17 Fairgrounds
Big Timber, MT 59011
(406) 932-4434

WESTERN FISHING DISTRICT

The Western Fishing District includes all waters in Montana west of the Continental Divide.

For additional information about fishing in this district, please call the following regional headquarters Monday-Friday 8:00 a.m. - 5:00 p.m.:

Kalispell 406-752-5501
Missoula 406-542-5500
TTY (Telephone Device for the Deaf).....711 or 1-800-253-4091

Region 1 Northwest Montana

Using angler tag returns to document movement of trout in the Clark Fork River basin passed above Thompson Falls Dam

The Clark Fork River is the largest river by volume in the state and flows over 300 miles from its headwaters near Butte along the Continental Divide to Lake Pend Oreille in the Idaho Panhandle. Thompson Falls Dam is the most upstream dam on the Clark Fork River and is located nearly 40 river miles downstream of its confluence with the Flathead River. NorthWestern Energy (NWE) built a fish ladder at the dam in 2011 to improve connectivity for bull trout and other migratory species. From 2011 through 2021 the fish ladder at Thompson Falls Dam on the lower Clark Fork River in Sanders County has captured nearly 39,000 fish. Most species are passed upstream of the dam where they have access to hundreds of miles of the Clark Fork River and its extensive tributary network. Species passed upstream over this 11-year period through 2021 include 2,536 rainbow trout, 1,597 brown trout, 310 westslope cutthroat trout, 387 mountain whitefish, 20 bull trout, as well as native nongame fish such as 19,578 largescale sucker, 7,861 northern pikeminnow and 124 peamouth (Figure 1).

Figure 1. FWP fisheries technician, Harvey Carlsmith, assists a largescale sucker into a holding tank at the fish ladder on the Clark Fork River at Thompson Falls Dam.

NorthWestern Energy owns and oversees the fish ladder at Thompson Falls Dam and funds two FWP fisheries technicians to conduct daily fish captures and assist with ladder maintenance and operations. The fish ladder generally operates from mid-March through the end of October each year with fish capture checks conducted each weekday and all days when the river temperature is at or above 73°F to minimize stress and mortality on fish during the warmest portions of the summer. Fish that enter the ladder ascend 48 stairstep pools into a large holding pool near the top of the ladder where biological data is collected (depends on species and time of year). Fish are not able to freely move up the ladder and access the river above.

From September 2017 through October 2021 FWP worked with NWE to deploy 921 t-bar (Floy, Seattle WA) or “Floy” tags in various trout species (rainbow trout, brown trout, westslope cutthroat trout, and westslope-rainbow hybrids) captured at the Thompson Falls fisher ladder and passed upstream of the dam. This type of tag is a small piece of plastic inserted in the fish at the base of its dorsal fin. Each tag is a specific color and contains a unique four-digit ID number and phone number that is visible to anglers (Figure 2). As anglers capture these tagged fish, fisheries data such as location caught, approximate length of the fish, and the fate of the fish (harvested or released) was collected by FWP fisheries staff in Thompson Falls and Helena. Fish also received a second tag inserted under the skin, near their dorsal fin, known as a passive integrated transponder (PIT) tag which is 12 millimeters in length and allows biologists to uniquely identify fish and collect information on their movements and growth. This also allows for the detection and identification of fish at the fish ladder that had lost their t-bar tag. Passive integrated transponder (PIT) tags are typically not detected by anglers and do not provide information on fish movement like radio tags. Tag loss was evaluated for fish recaptured at the Thompson Falls fish ladder (n=110) after initial tagging to determine whether they had retained their t-bar tag and how long it had been since initial tagging. More than two thirds of the tags

remained attached during the study with only a small amount of variation in tag loss within or between years. From October 2017 through 2021 there were 57 t-bar tagged trout reported as being caught, 20 were harvested and 36 released, with the fate of one being unknown. Angler reporting bias, or the rate at which tagged fish that are captured by anglers are reported to FWP, is unknown for this study. If we assume 50% of fish caught were reported and correct for tag loss, it is estimated that anglers captured 159 tagged fish or about 17% of the fish tagged during the study period. Using the known harvest rate of tagged fish, it is estimated that approximately 56 fish were harvested during the study period, for a harvest rate (also known as exploitation) of about 6%. These are only estimates, because the true rate at which anglers reported their catch for this study is not known.

Figure 2. A t-bar or "floy" tag inserted in a rainbow trout near the base of the dorsal fin. Anglers should record the color, unique four-digit tag number, length of the fish, location of capture and whether the fish was harvested or released. The other side of the tag that is not visible has an FWP phone number for anglers to call and report their catch.

The locations of capture by anglers for the trout that passed above Thompson Falls Dam, were widespread across the lower and middle Clark Fork River drainage as well as in the lower Flathead River drainage. Fish were caught upstream near Missoula by the mouth of Rattlesnake Creek (150 river miles upstream) and near Johnson Creek in the Blackfoot River (159 river miles upstream). Each of these rainbow trout ascended the Clark Fork River quickly, 16 days and 33 days after being passed upstream of the fish ladder. That equates to these fish on average moving upstream about nine and five miles per day. To date, a rainbow trout traveled the furthest upstream of the ladder; it was captured in the Blackfoot River above the Clearwater River confluence in June of 2021 and estimated to have moved 189 miles upstream. Fish caught in the lower Flathead River drainage including Post Creek (58 river miles upstream) and near Sloan Bridge (82 river miles upstream) by Ronan. Several fish were captured between Missoula and Paradise in the Clark Fork River, and two were caught between Paradise and St. Regis. A westslope cutthroat trout was caught in the St. Regis River (65 miles upstream).

As expected, quite a few fish were caught in the vicinity of Thompson Falls, including at the mouth of the Thompson River (6 miles upstream) and Prospect Creek (0.3 miles downstream), as well as in Thompson River with the most upstream fish captured in the Little Thompson River (24 miles upstream). The fish caught furthest downstream was in Marten Creek Bay (31.2 river miles downstream). Vermilion Bay (23 river miles downstream) in Noxon Rapids Reservoir was also a popular destination for tagged fish, the location of six recaptures. This study has documented long distance movements of both native and non-native trout passed above Thompson Falls Dam and highlights the importance of connectivity among mainstem and tributary habitats in the Clark Fork River and lower Flathead River drainages. Other native, non-gamefish species such as

Figure 3 . A big catch of adult largescale suckers, presumably on their spawning migration. Large numbers of this native species are typically caught at the fish ladder each year on the descending limb of the spring hydrograph (as high flows from spring runoff recede). Other studies in the Clark Fork basin have shown these species move long-distances on spawning migrations.

largescale sucker are also known to make long migrations across Clark Fork River basin and rely on habitat connectivity to carry out their life cycle (Figure 3). Fish need habitat connectivity between feeding/overwinter habitats and the places they spawn and rear. Feeding and overwintering areas for trout include more productive habitats such as larger rivers, lakes and reservoirs. Spawning and rearing for trout species vary but often occur in tributary streams or side-channel habitats of larger rivers systems. The fish ladder at Thompson Falls Dam provides fish with the opportunity to utilize a vast river-tributary network, connecting them to habitat that had previously not been accessible due to the dam. Passage at the dam also provides more fish, often large or trophy-sized fish (Figure 4), for anglers to catch in the Clark Fork River and its tributaries.

Figure 4. Harvey Carlsmith, FWP fisheries technician who has worked at the fish ladder since it opened in 2011, holds a 27-inch brown trout captured at the Thompson Falls fish ladder and released upstream in September 2022.

Can we have our cake and eat it too on the Kootenai River?

I live in a residential neighborhood in Libby on a modest tenth of an acre corner lot typical of most small Montana towns, and I take pride in my place. That includes my yard. Despite living in one of the wetter regions within our state, our scorching summer temperatures require almost daily watering but that never seems to be the exact ticket to really make my lawn thrive. For those reading this with even a hint of a green thumb you probably know the solution. A couple of times a year I find myself at the local Ace Hardware store wandering the garden aisles until I find the fertilizer. You're probably wondering about now, what in the heck this story is doing in FWP's annual fishing newsletter.

It turns out that my lawn isn't all that much different than any pond, lake, reservoir, river, or stream. The lowest level of any food web is made up of plants that use photosynthesis to create their own energy from sunlight. The difference between the plants (grass) in my yard and the plants in lakes and rivers is the form they take. Most plants in ponds, lakes and reservoirs are either multi-celled rooted plants called macrophytes or single celled floating plants called phytoplankton and most plants in flowing systems (rivers and streams) are typically algal species that attach to the stream bottom. Regardless of the form the plants take, they are essential to all food webs because they dictate the amount of life within the upper levels of the food chain. The energy produced by river algae gets transferred up the food chain when insects consume the algae.

Getting back to that bag of fertilizer. Most fertilizer has two primary nutrients plants require: nitrogen and phosphorus. Nitrogen is critical for all life because it is needed to produce proteins and ammino acids. Phosphorus is essential because it is used in one of the basic building blocks in the molecules that store energy required for life. Both are important and needed in relatively small quantities, but they are also needed in the correct proportion to provide a healthy, robust food base for our streams and rivers. In fact, a major concern in some Montana rivers is not the lack of either nitrogen or phosphorus, but rather an overabundance of nitrogen or phosphorus because excess amounts or an imbalance in the amounts of nitrogen or phosphorus can be harmful to lakes and rivers, causing excessive, nuisance or even harmful (toxic) algal growth. Although not as common, a scarcity of these two essential nutrients can also be an issue because it can lead to a deficiency in algal growth needed to support all higher life forms in the river. The Kootenai River downstream of Libby Dam is a good example where a scarcity of phosphorus has cascading implications for the entire food chain up to, and including, rainbow trout.

Construction of Libby Dam was completed in 1972 under provisions of the Columbia River Treaty of 1964 between the United States and Canada. The dam, which is located about 17 miles upriver of Libby, created a 90-mile-long reservoir that extends into Canada encompassing 46,500 acres at full pool. Libby Dam has undoubtedly benefitted both nations by providing reliable power generation, flood control, navigation and recreation. However, the construction and operation of Libby Dam profoundly and permanently altered several important ecological attributes of the Kootenai River, including flow and temperature patterns, and nutrient transport. Since the construction of Libby Dam, FWP has worked closely with water managers (U.S. Army Corps of Engineers and Bonneville Power Administration) to refine and improve flows and temperatures that promote the health of the Kootenai River downstream of Libby Dam while maintaining the societal benefits the dam provides. Nonetheless, the issues of nutrient transport have yet to be addressed.

A recent study estimated that during the years 2014-2017 the amount of phosphorus that entered the reservoir created by Libby Dam (Lake Koocanusa) averaged 709 tons per year (range 308-1,475 tons) but an average of only 64 tons per year (range 33-100 tons) passed Libby Dam. That means 80-93% of the total phosphorus never makes it through the dam. The reservoir also traps about 13-34% of the available nitrogen, but nitrogen levels in Lake Koocanusa and the Kootenai River remain relatively high due to elevated levels of nitrates associated with coal mining activities in the Canadian portion of the watershed (that's a story for another day). The reservoir functions as an efficient phosphorus trap because incoming phosphorus readily binds to sediment particles in the water and sinks to the bottom of this deep reservoir where it is unavailable to the food web. The fact that Lake Koocanusa traps most of the phosphorus that enters the reservoir does not in itself mean that phosphorus scarcity limits the food web. The devil is in the details, as it so often is. The amount of phosphorus that does pass Libby Dam during the critical summer growing season averages about 5 parts per million, which is many times lower than levels Montana Department of Environmental Quality (DEQ) regulates on similar sized rivers in northwest Montana and well below levels expected to result in excessive, nuisance or even harmful algal growth.

The scarcity of phosphorus downstream of Libby Dam has resulted in a decrease in productivity and an overall impairment of multiple levels of the Kootenai River food web. Low phosphorus and stable river flow downstream of Libby Dam during the winter months contribute to the proliferation of the algal diatom *Didymosphenia geminata* (didymo). Didymo is an enigma among algae. Excessive growth of most species of algae occurs when phosphorus concentrations are elevated. However, under low phosphorus conditions didymo produces excessive stalk material that blankets the river bottom and excludes other beneficial algal species. These stalk formations have very low nutritional value to the insect community residing in the riverbed.

Figure 1. Photograph of didymo that forms dense mats covering the Kootenai riverbed that excludes mayflies and caddisflies which are preferred food items for trout.

Thick carpets of didymo on the riverbed favor midges which replace most of the insects that are preferred by trout, including mayflies and caddisflies. This shift in the insect community limits the availability of mayflies and caddisflies to trout resulting in lower trout growth rates. For example, length of age-one rainbow trout from the Kootenai River were 2.5, 2.5 and 1.6 inches smaller than the Missouri, Bighorn, and Big Hole rivers, respectively. Age-3 Kootenai River trout were 4.0, 4.9, and 1.3 inches smaller than the other rivers, indicating slowed growth rates continue through the fish's life (see Figure 2). The results of a recent FWP 7-year study that tracked the annual growth of over 1,200 tagged rainbow trout on the Kootenai River from 2011 to 2018 also confirms the connection between low phosphorus, excessive didymo stalk growth, preferred insect production and low trout growth. This study found that the low Kootenai River trout growth rates were best explained by high didymo and low phospho-

rus concentration. Likewise, FWP estimated densities of mayflies and caddisflies downstream of Libby Dam over the same timeframe as the tagged trout study and found low densities were related to high didymo and low phosphorus.

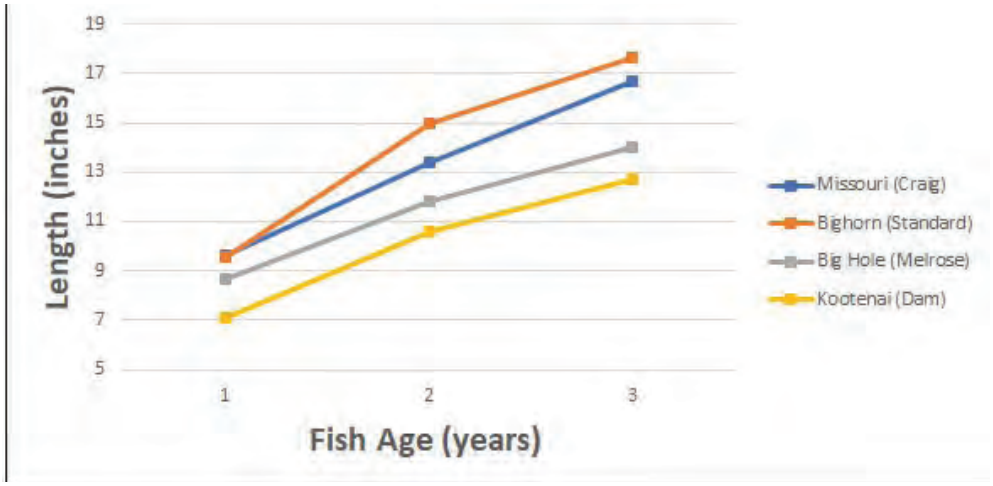


Figure 2. Comparison of Kootenai River growth rates for age 1-3 rainbow trout to the Missouri, Bighorn, and Big Hole rivers.

Unfortunately, there are no easy self-sustaining solutions to solve the phosphorus deficit in the Kootenai River downstream of Libby Dam. The societal benefits the dam provides are so tremendously high that dam removal is not a realistic option. FWP receives funding from the Bonneville Power Administration to mitigate impacts to the Kootenai River fishery that resulted from the construction and operation of Libby Dam. The mitigation program is science-based, and the science solidly supports the concept that phosphorus scarcity is limiting productivity in the Kootenai River. This concept could be experimentally confirmed by conducting a well-thought-out phosphorus addition experiment that could partially compensate for nutrients bound to the sediments in Lake Koocanusa. The amount of phosphorus needed to meaningfully boost the productivity would be many times lower than levels Montana DEQ regulates on similar sized rivers in northwest Montana and well below levels expected to result in excessive, nuisance or even harmful algal growth. Such an experiment would, of course, be accompanied by a robust monitoring program to confirm the food web connections I've explained here and have built in thresholds to ensure that unintended consequences don't occur. Accomplishing this would represent meaningful mitigation that restores the aquatic health of the Kootenai River and improves fishing opportunity. Simply put, maybe we can have our cake and eat it too on the Kootenai River. Stay tuned as we move forward with this one-of-a-kind in Montana experiment.

Region 2
West Central Montana

The Role and Importance of Stocked, Harvest-Oriented Trout Fisheries in Western Montana Lakes

Management Case Study: Browns Lake

West-central Montana rivers support numerous renowned wild trout fisheries, including Rock Creek and the Bitterroot, Blackfoot, and middle Clark Fork Rivers. The quality and sustainability of these heavily used fisheries largely depends on carefully managed harvest regulations and habitat protection. In contrast, lakes, reservoirs, and ponds in the region are often managed to provide fishery diversity and greater harvest opportunity.

Browns Lake and Georgetown Lake are the two primary waters managed as high quality, harvest-oriented rainbow trout (RB) fisheries in FWP's Region 2. Although numerous "mountain" lakes and a limited number of valley lakes and reservoirs are available to trout anglers, they are often too sterile (unproductive) or contain too many competing, introduced fish species to support sustainable opportunity for larger trout, higher levels of fishing pressure and liberal creel limits.

The Browns Lake fishery stands out among other regional trout waters due to high RB growth rates, excellent fish condition (i.e., 'plumpness'), and the *quality* of meat harvested. All of these features reflect high underlying lake productivity, and in particular, the abundance of freshwater shrimp or 'scuds' (*Gammarus* spp.) that are the primary food source along with aquatic insects. Scuds are particularly high in energy and carotenoids, leading to fat, feisty, fast growing trout with bright orange, tasty meat that is prized by harvest-oriented anglers.

Figure 2. Gammarus spp. shrimp (scuds) are a large component of trout diets in Browns Lake and contribute to excellent growth and flesh quality.

Browns Lake Setting

Browns Lake is a large (550 acre), relatively shallow (max depth 27 ft), natural 'kettle' lake, surrounded by numerous wetlands in the center of the Blackfoot River valley (approximately at 4,300 feet elevation) near the town of Ovando. The lake is inherently productive (meso-eutrophic), with abundant submerged aquatic vegetation and emergent shoreline vegetation. Water surface elevation is enhanced at the lake outlet, which has been raised somewhat to increase water storage. Although many springs are evident in the main lake basin and north arm, surface water input and exchange rate are largely dependent on one small inlet/outlet stream (Ward Creek).

Figure 1. Browns Lake is a popular year-round trout fishery, including a strong contingent of ice fishing enthusiasts.

Browns Lake Trout Fishery & Stocking Program

Other than during transitional periods (ice formation and break up), Browns Lake provides a popular year-round fishery that now supports 8,000-16,000 angler-days annually (accord-

ing to FWP Statewide Angler Pressure estimates). Overall, fishing pressure has roughly tripled over the past 30 years (Figure 3). A third to one half of total angling pressure on Browns Lake occurs during winter months (ice fishing). During open water periods, anglers troll, fly fish, sink bait, and employ a creative range of tactics to catch RB that can be surprisingly picky and elusive… or overly aggressive… depending on the day. Standard, year-round angling regulations allow a creel of five rainbow trout daily, including one fish that may be greater than 22 inches total length.

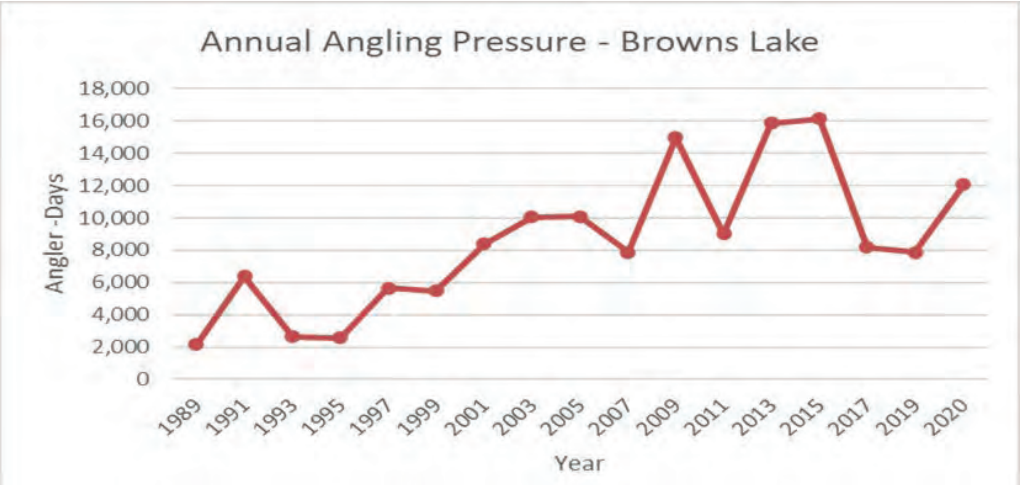


Figure 3. Estimated annual angling pressure for Browns Lake over the past 3 decades from FWP Angler Use Surveys.

Like many stocked lakes and ponds across the state, Browns Lake is fundamentally a 'put-grow-and-take' fishery. In this scenario, fingerling trout from the hatchery (4-6 inches) are stocked, then grow rapidly until they are available to anglers (6-12 months later), and continue building length and weight until maturity (1.5-2 years after stocking). At this point, trout growth rate slows as more energy is converted to development of gonads. In angling terms, the 'meat' of the trout fishery is supported by sub-adult, 1 - 2.5 pound fish that have been in the lake for 6-24 months, while a smaller component of older, slower growing mature fish provides a trophy fishery.

Browns Lake is currently stocked with *Arlee* and *Eagle Lake* strain RB produced at the Jocko River and Giant Springs State Fish Hatcheries, respectively. Although other RB varieties are available through the FWP hatchery system and have been tested, these two strains have consistently performed well in Browns Lake and contribute to fishery diversity (i.e., both harvest and trophy components). Arlee RB grow fast, mature early and maintain high body condition, while the Eagle Lake strain is typically less susceptible to angling and provide most of the trophy fish opportunity. With the exception of occasional wild brook trout that originate in the inlet stream, stocked rainbow trout are the only sport fish present.

Adult RB are frequently observed spawning in the inlet and outlet of Browns Lake (Ward Creek), as well as along the shorelines where pockets of gravel are available (Figure 4). Based on recent lake surveys, hatchery trout marking schemes, and electrofishing in Ward Creek, it appears that natural reproduction of RB is absent or extremely limited. Spawning success is likely limited by lack of suitable habitat for egg incubation in the lake and rapid dewatering of Ward Creek after spring runoff.

Figure 4. Although Browns Lake provides a popular harvest fishery, many anglers target the trophy component that congregates along shorelines in spring (photo by Phil Backofner).

Browns Lake Monitoring and Management Recommendations

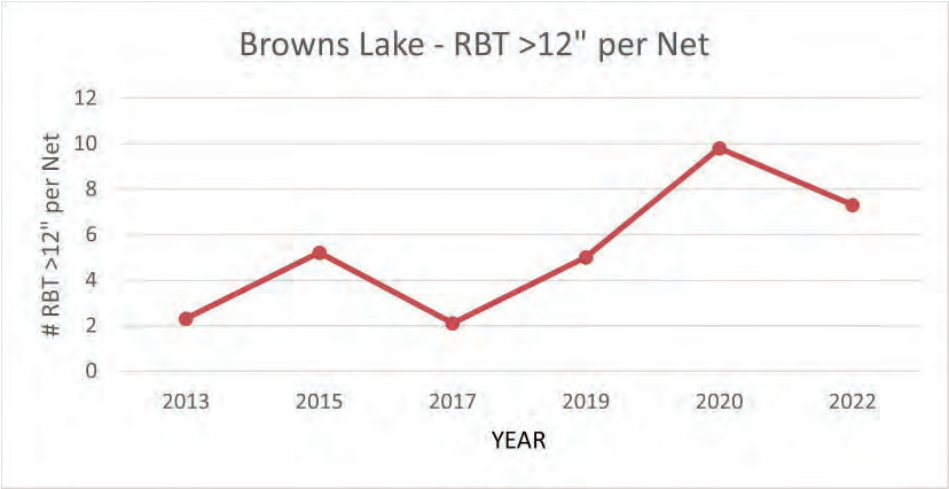


Figure 5. Relative abundance of catchable (greater than12") rainbow trout in Browns Lake gillnet surveys over time.

For fishery managers, the challenge with Browns Lake has always been maintaining *consistency* of the fishery. The same high productivity and features that lead to excellent trout growth also make it highly susceptable to low oxygen in winter and high stress during summer heat. These environmental stressors can also facilitate bacterial infections and other water quality issues (e.g., algal blooms) that further impact aquatic health. Fishery impacts associated with environmental extremes often manifest as reduced growth and condition, poor success of specific hatchery plants, and, occasionally, significant fish kills.

Despite annual stocking with two strains of fingerling rainbow trout, catchable trout density and the quality of the fishery have been variable. Inherent instability of the trout fishery and high angler interest led FWP to increase monitoring efforts and implement a more intensive evaluation of the stocking program and fishery over the past decade. Specifically, we developed management recommendations intended to improve RB size structure (quality and harvest opportunity) and fishery consistency (year-to-year angler success). The evaluation primarily involved incremental changes in stocking practices (e.g., methods, timing, location, number of fish, type, and size of fish), coupled with standardized monitoring techniques (e.g., gillnet surveys - Figure 5).

Stocking Program Adjustments

Given the instability in lake conditions, we began employing a more diversified stocking strategy to improve consistency of the fishery. This strategy included changes in stocking methods, locations, and timing, as well as incremental increases in number and size of stocked fish. The quality of hatchery trout was enhanced (larger fish with higher condition) and we began marking individual plants to track relative growth and survival. The objective for all plants is to maximize size and condition of fish at the time of stocking, but the relative benefits of spring and fall stocking varies annually with lake conditions and food availability. Concurrent marking of individual plants with adipose fin clips, oxytetracycline (OTC) chemical marks on bone structure, etc. helped us to track and evaluate the implemented stocking changes.

Monitoring indicated that stocking success has significantly improved as the quality of hatchery fish (size and condition) has increased and when stocking methods (e.g., lake-wide boat plants for distribution and preferred timing) were modified (Figure 6). These measures directly enhanced survival and growth of hatchery plants, likely reduced susceptibility to avian predation, and facilitated immediate use of food resources throughout the lake. Stocking rates (40,000-60,000 annually) were also fine-tuned based on fish growth rates and condition.

Although stocking triploid (sterile) RB has been an effective tool for some lakes, it is not recommended for Browns Lake based on poor survival during initial trials. These results are consistent with findings on similar waters in Idaho, where sterile RB performed poorly when facing stressful physical conditions such as high summer water temperatures and low winter oxygen levels. Experimental stocking of longer-lived, later maturing RB strains (e.g., Gerrard) is recommended when these strains are more available in the hatchery system.

Monitoring Adjustments

Standardized gillnet locations and methods were established for the fishery, and annual or semi-annual

Figure 6. FWP staff transfer fingerling rainbow trout from the hatchery truck to boat tanks for distribution throughout the lake.

fall monitoring allows us to track the fishery and survival of specific plants. Relative abundance data, along with information on fish growth and condition, now allow immediate adjustments to the stocking program.

Informal angler feedback and statewide angler pressure surveys provide information regarding the effectiveness of fishing regulations, trends in angling pressure and angler satisfaction over time. Formalized onsite creel surveys are another tool that may be implemented in coming years.

Lake Level Management

Browns Lake surface elevation is significantly influenced by the magnitude of spring runoff but is ultimately controlled by storage capacity and elevation of the lake outlet. Enhancements to maximize lake pool elevation and storage (through management of the outlet structure) may be possible with cooperation from affected landowners and irrigators.

Fishing Regulations & Illegal Introductions

Current angling regulations on Browns Lake allow liberal, year-round harvest and provide moderate protection of potential trophy fish (5 rainbow trout daily, 1 over 22 inches), as per standard creel limits for the Western Fishing District. The lake has produced some rainbow trout greater than 28 inches within the last decade, but intensive angling pressure and harvest, reduce survival rates for larger fish. In other words, most larger trout are harvested before they reach trophy size. If a higher quality trophy fishery is desired by constituents, more protective length restrictions are likely warranted.

Unauthorized introduction of new plant and animal species is a growing threat for western Montana lakes, but particularly for waters such as Browns Lake with heavy use and high boat traffic. Public outreach and education should be an emphasis, as well as increased enforcement and penalties for violators.

Georgetown Lake Diet Study - What is Going on with Kokanee and Rainbow Trout in Georgetown?

A "satisfactory" kokanee measuring 14-inches. Photo credit: Katie Furey.

Kokanee in Georgetown Lake have always been abundant. So abundant that local anglers say, "If you didn't catch 100 through the ice, it wasn't a good day." Although this might be just another fishing tale, their words do hold some truth about the kokanee population in Georgetown Lake. Unfortunately, when fish are this dense, it makes growth difficult which results in lots of smaller, stunted, fish. Historically, the average size of kokanee in Georgetown ranged from 8 to 10 inches, which has been considered unsatisfactory by a large contingency of fisherman and by fisheries managers. Given this, managers at Georgetown started brainstorming ideas of how to manage the kokanee population to improve their average length. FWP settled on a trying a common method for reducing fish density and increasing length – predation.

The Gerrard strain of rainbow trout, native to Kootenay Lake in British Columbia, are thought to eat more fish than the Arlee and Eagle Lake strains of rainbows that FWP historically stocked in Georgetown Lake. Given their diet of fish in their native range, Gerrard rainbows are also known to reach sizes upwards of 30 pounds in larger bodies of water. In 2015, FWP started stocking Gerrard rainbows along with the normal strains to see if the Gerrards would increase predation on kokanee in Georgetown Lake.

Fast-forward to 2018, and FWP recorded larger than average kokanee. Two-years after that in 2020, kokanee hit an average of 13 and a half inches. On top of that, average rainbow trout size also increased. Easy, right? Not so fast.

The average length of kokanee in 2021 were back to 10 inches, and by 2022 it was down to 8 and a half inches. Not surprisingly, our perfect picture in 2020 just got a lot more muddied, so FWP went back to the "ecology" drawing board. All sorts of variables can simultaneously affect populations: angling pressure, predation, recruitment, nutrients, temperatures, and all of these change with time and interact with each other. FWP just needed to figure out what variable or combination of variables were responsible for the increase in kokanee and rainbow length.

In 2022, FWP partnered with Montana State University to better understand what was going on. Katie Furey, a master's student at MSU, and her advisor Dr. Chris Guy started a 2-year study investigating the feeding ecology of the kokanee, rainbow trout and brook trout in Georgetown Lake. This study aims to identify if rainbow or brook trout are consuming kokanee, if Gerrards are out consuming the other strains of rainbows, and if there is a relationship between consumption and the fluctuation of kokanee size. FWP is simultaneously conducting nutrient sampling and a creel survey throughout the study period to assess nutrient dynamics and fish harvest by humans. Additionally, FWP will be tracking population dynamics of the three species to determine if this could all be a natural boom and bust cycle of a kokanee fishery.

After year-one of the study, results indicate that nutrient levels and density dependent effects both correlate with larger kokanee. Nutrients were higher in years when kokanee were larger and decreased concurrent with a decrease in kokanee size. This suggests that nutrients may be the driving factor and that overfilling Georgetown Lake for four years may have led to bigger kokanee. However, why are rainbow trout maintaining their larger average size even though nutrients are returning to normal levels in Georgetown Lake? Multiple years of low recruitment also correlate with larger kokanee, suggesting that lower densities could have reduced competition. This data is preliminary, and the story will likely evolve as more information is gathered. Regardless of the outcome, we hope to use the knowledge gained in this study to more effectively manage Georgetown Lake for "satisfactory" kokanee.

Aquatic Education in the Bitterroot: Engaging the Next Generation

"I've never touched a fish." "What a weird-looking fish." "Oh wow—that is really cool!" "I didn't know that." These are just a few of the comments that I've heard over the years when presenting an aquatic education lesson.

In the Bitterroot, we work with a variety of groups, partnering on educating students and adults about the natural world. Our lessons focus on the aquatic world and fascinating fish of Montana. We've presented lessons for many years at Bitterroot Trout Unlimited's youth and adult classes and Bitterroot Conservation District's Annual Conservation Days (for 6th graders across the valley). We've done programs for the library, community groups, day cares and schools. These programs are often short lessons, indoors or outdoors with a fishy focus but there are two other programs where we engage students at a deeper level.

One program is the Earth Stewardship Program (ESP). The ESP program is for Bitterroot Valley 7th graders. It started as Healthy Kids Healthy Forests, a project of the Bitter Root Resource Conservation & Development in partnership with the Bitterroot National Forest but is now organized by the Bitter Root Water Forum. It is great to partner with these other groups and FWP Fisheries staff started participating in 2012 with a native fish lesson. There is a classroom portion and a field trip. During a class visit, students learn about fish: how many fish are on planet earth and in Montana, what distinguishes fish from other species, life needs and habitats, native and non-native species, and scientific classification. The students then become the instructor and teach each other about the 10 native Bitterroot fish using pictures of each species, a dichotomous key, and the Montana Field Guide. Yes, it is true, there are MANY species of fish in the Bitterroot but only 10 are native. After this lesson, the 7th graders can tell you that being a native fish means that the fish swam through the many waterways and got to Montana on their own. They may not have been here since the beginning of time, but they've probably been here a long time. Non-native species were brought to Montana, often by people, from somewhere else, maybe a nearby state, maybe from the east coast or maybe from another continent. For example, non-native brown trout are from Europe and non-native rainbow trout are from the Pacific Coast, up around the Pacific Rim into Russia. Rainbow trout are one of the most widely distributed fish species, occurring on every continent except Antarctica. While rainbow trout populations in Montana are non-native fish, we do have one native population called the redband rainbow trout, found in the Kootenai River system of northwest Montana.

In the field trip portion of the ESP program, the students choose a fish that lives in Montana (a fish photo on a string that they wear around their neck) then they move through an activity called, *A Fish's Life*. They encounter a variety of real-life scenarios that teach them about what can happen to a fish. A few examples:

Watch out! Electrofishing crew ahead.
Don't get caught!
Swim out around the electric field about 5 feet then move ahead to station 3.

5th grade students learning about fish identification. Photo Credit Amanda Bestor.

WHEW!
You made a narrow escape from an Osprey.
Go back 2 stations while you recover.

The shrubs on the streambank provide a lot of shade and food.
Rub your stomach 15 times and move ahead 5 stations.

A river otter catches you and eats you.
The game is over for you. SORRY!
Die dramatically…then go back to the beginning and mark the chart.

It is very rewarding to work with the 7th graders and fun to see them learn about our cool native fish. Combining a classroom lesson and a field trip is an ideal way to expose students to Montana's natural world.

What do the 7th graders think about this program, what did they learn?

"I learned all the different fish and how to identify them. I found it very interesting, and I loved looking at them."

"I learned how different fish, depending on where they live, they have different fins."

"I learned a lot about the native fish."

"I learned about all these cool facts about fish that I never knew."
"I loved learning about fish, and it was cool to learn about their habitat."

"What I found interesting was the game we played that simulated basically the life of a native or any fish we have."

"I think this was fun and gave me a new perspective on how it is like for the fish population. I also think it was interesting at the amount of different things that can happen to a fish so commonly."

A second program that engages students on a deeper level involves Corvallis and Hamilton High School's Classroom Without Walls classes. This program is a senior level field ecology class. We are fortunate to work with high school students in the field and demonstrate how fisheries work is conducted. The students join us for a day of electrofishing on Skalkaho Creek. Donning waders, rubber gloves and polarized sunglasses, they learn about electrofishing, net the fish, learn about fish identification and mark-recapture population estimates and the many facets of how that science works. Corvallis joins us on one day and Hamilton on another day. There is always friendly competition on which school catches the most fish. We talk about our jobs, the necessary education for working in fisheries, the work that we do year-round, various types of fish sampling gear and we answer any questions that the students may have. There have been times when we're out there on a very cold, fall day so they learn that field work is not always as glamorous as some may think. It is great for the students to see first-hand what fisheries work is all about.

The field trip activity starts with a review of the 10 native fish in the Bitterroot, the same photos that they used in class. Photo Credit Katie Vennie.

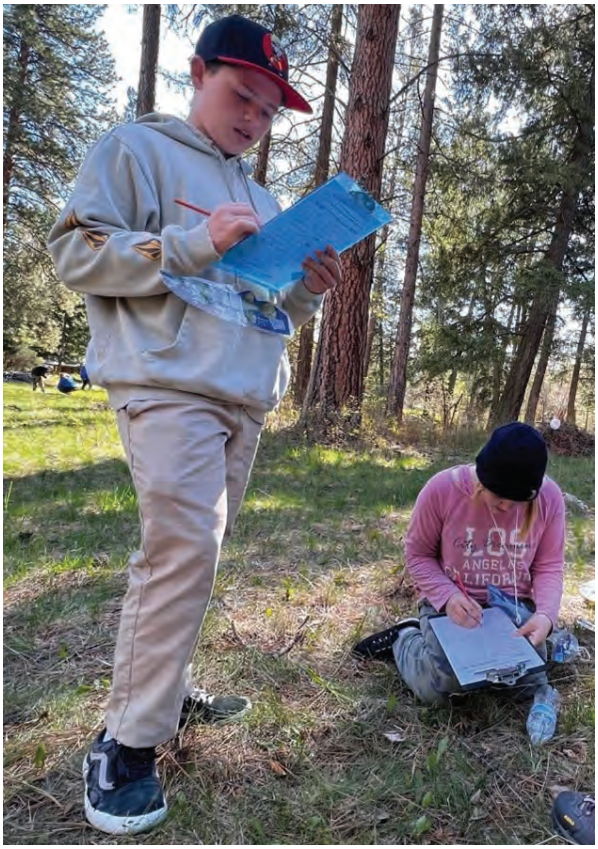
Fish photos the 7th graders wear as part of the field trip activity. Photo Credit Alex Ocañas (left) and Leslie Nyce (right).

What do the high school students really think of this field day?

"Electrofishing opened my eyes to the importance of population research on our local wildlife. Not only was the experience educational, but it inspired a new sense of respect and appreciation for the Bitterroot's wild fish. I was lucky enough to participate in catching the fish and collecting the data. I am now considering doing fish ecology as a career." ~Sofia Lewanski

"This field trip gave us a glimpse at the type of field work a fisheries biologist does on a daily basis. It was a cool experience." ~ Cole Kimzey

Protecting, preserving, and managing Montana's aquatic resources supports the vision and mission of the Fisheries Division of Montana Fish, Wildlife & Parks. Aquatic education programs are an integral component of our overall efforts to fulfill this mission, teaching others about all the cool, aquatic resources that we have in our backyard. If kids, be that grade school, high school, or more mature kids of the adult variety, don't have a basic understanding of what our natural resources are, how will they want to protect and preserve them for future generations? Baba Dioum said it well: "In the end, we will conserve only what we love; we will love only what we understand, and we will understand only what we are taught." It is a passion of mine to help others learn about Montana's amazing natural world and presenting aquatic education programs in the Bitterroot, fulfills that passion.



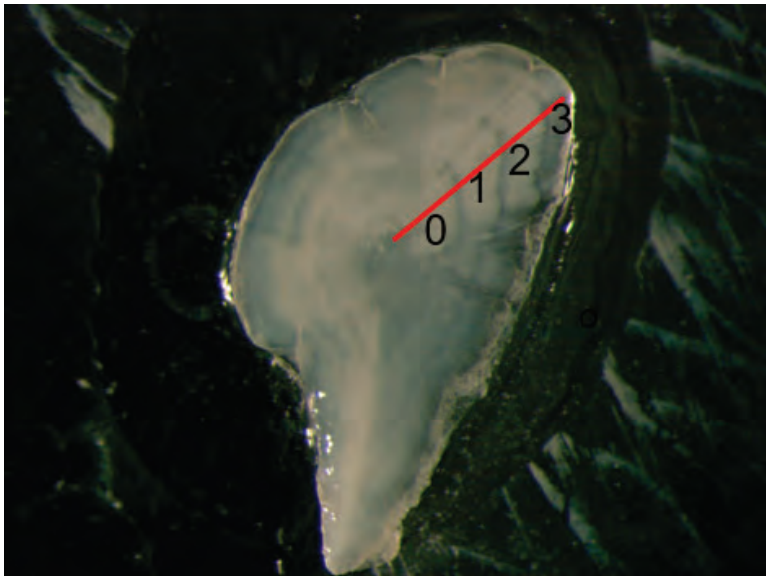
7th grade students choosing fish and recording if they survived or died during, A Fish's Life activity. Photo Credit Alex Ocañas (left) and Leslie Nyce (top).

Hamilton High School students work with fisheries biologists, Jason Lindstrom and Leslie Nyce, to net trout on Skalkaho Creek using electrofishing methods. Photo Credit Vanessa Haflich.

Fisheries biologist, Jason Lindstrom, performs length and weight measurements on a brown trout during the Hamilton High School field day. All trout caught were tagged and released as part of a population count study. Authentic mark-recapture data was then shared with students to calculate a population count on Skalkaho Creek. Photo Credit Vanessa Haflich.

Where Have the Brown Trout Gone? A Question We Have Asked in the Upper Clark Fork

Brown trout populations on the upper Clark Fork River, specifically upstream of Deer Lodge, MT, have declined significantly recently. This section of the Clark Fork River averaged about 900 brown trout per mile from the mid-1990s through 2014, and numbers were as high as 1,900 per mile in some years (Figure 1). Starting in 2015 densities declined and currently average around 200 fish per mile. Montana Fish, Wildlife & Parks (FWP) data suggests a lack of recruitment of juvenile fish to the population is responsible for the decline. Younger age-class trout generally make up most of a population in a healthy fishery, with fewer trout in older age-classes. Recently in the upper Clark Fork we have documented the opposite, where we have very few younger fish and nearly an even split across age-classes.



A brown trout otolith from the Clark Fork River with numbers marking annuli rings. This fish was 3.5 years old when its otolith was taken.

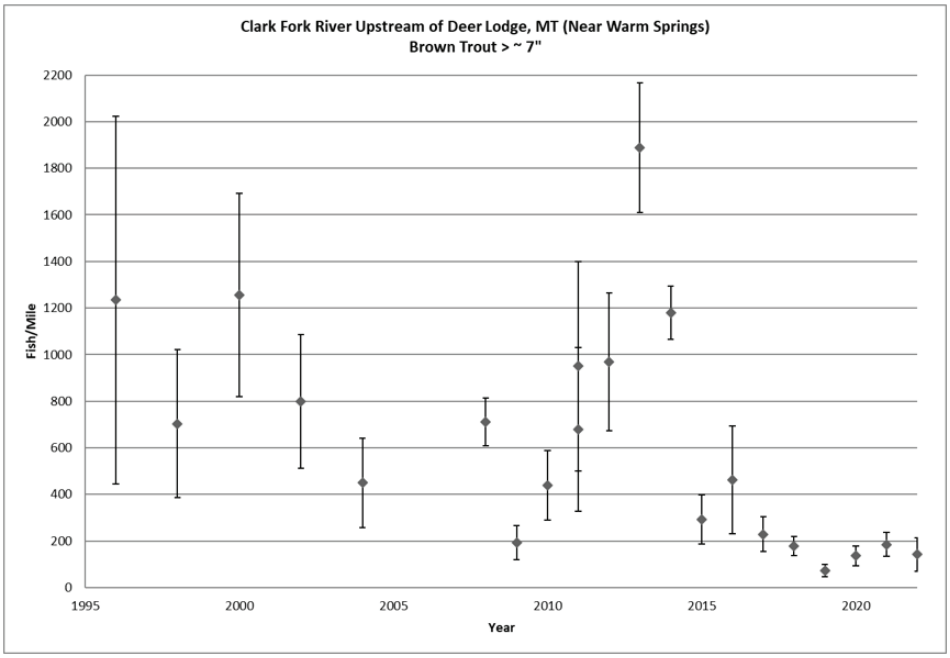


Figure 1. Brown trout population estimates on the Upper Clark Fork upstream of Deer Lodge, MT going back to 1995.

Juvenile trout in larger river systems are notoriously hard for biologists to study and get accurate population estimates. In the case of the Upper Clark Fork, we know that we have lost recruitment of juvenile trout, but we don't know what tributary or source of juvenile trout was lost. We'd also like more information about at what age these younger fish are dying.

A study was done before the decline, in 2015-2016, that identified where trout that are in the mainstem above Deer Lodge were born. The project was completed to understand which tributaries were a high priority for restoration activity. We found that they came from a variety of locations; however, the majority were spawned in Mill-Willow Bypass (32%), the upper reaches of the mainstem Clark Fork River (29%), and Warm Springs Creek (22%). We have replicated this study in 2022 to see if any of these sources of fish was lost or if all were equally reduced. This will help us pinpoint where the problem is.

These studies use a unique method known as otolith microchemistry for identifying where a fish has spent its life from birth to the time it was sampled. Otolith microchemistry is a relatively new tool in the fish biologist toolbox that can give a glimpse at where a fish lived during different periods of its life. Otoliths are a bone that grows in the head of a fish that is used for hearing and balance. Otoliths grow larger as a fish ages and a ring can be seen on the otolith representing the period of slow growth each winter, similar

to rings in a tree trunk. Counting rings on an otolith is generally the most accurate way to age a fish. Simplified, the microchemistry part is a process of running a laser across the otolith to remove a small amount of material along the laser and create a profile of isotopes (barium, strontium, calcium, and magnesium) present in the bone throughout the life of the fish. The isotope ratios from the first few months (the center) of bone growth on the otolith can then be compared to isotope ratios in the water of various tributaries and spawning areas to see where a fish was born and reared. If the isotopes in the otolith of the fish match to those found in a particular stream, then that's where that fish spent time. If that time is towards the center of the otolith's growth, then that's where it was born. Fish otoliths for the replicated study were collected in spring and summer of 2022 and will be analyzed in early 2023. The results of this study will be pertinent in answering management questions related to brown trout on the Clark Fork River.

Management Strategies in the Blackfoot: Informing Direction in the 2023 Statewide Fisheries Management Plan

Wild trout management is a cornerstone of fisheries management in Montana. Here in the Blackfoot River, a primary focus of our management program is native, wild trout. The Blackfoot has a long history of habitat restoration (more than three decades), with native bull trout and westslope cutthroat trout as the target species. The actions that benefit these species also improve habitat conditions for native, non-game species as well as non-native trout that represent an extremely popular and important component of sport fishing opportunity. Several key elements of our management portfolio in these popular wild fisheries include population monitoring, habitat protection, and habitat restoration.

Most of the angling use on many popular rivers in western Montana has shifted to catch and release fly fishing, so our contemporary approach to fisheries management is a little different than when angling participation was dominated by trout anglers that harvested their catch. Even as recently as the late-1980s, creel surveys indicated that anglers preferred to harvest fish they caught that were longer than 12 inches. Periodic creel surveys in the mid-1990s, early 2000s, and 2010s, showed a consistent trend away from harvest-oriented bait fishing towards a recreational fishery predominately comprised of fly anglers participating in catch and release angling even if regulations allowed harvest. Because we no longer need to frequently adjust bag limits and size restrictions in response to harvest rates and corresponding fish population status, management tools are somewhat limited compared to tra-

Figure 1. Electrofishing the Blackfoot River in May 2021.

ditional fisheries management techniques where regulation changes elicited strong responses from fish populations.

Often in catch and release, wild fisheries, our only management tools are related to habitat. Therefore, under the wild trout management paradigm, a significant portion of our management effort is habitat protection and restoration. Where high quality habitat is contributing to healthy fisheries, we focus on keeping those components intact. Where habitat is degraded, we use fish surveys and research to understand what factors are broken. Then we use habitat restoration to improve those conditions and, ultimately, the fishery.

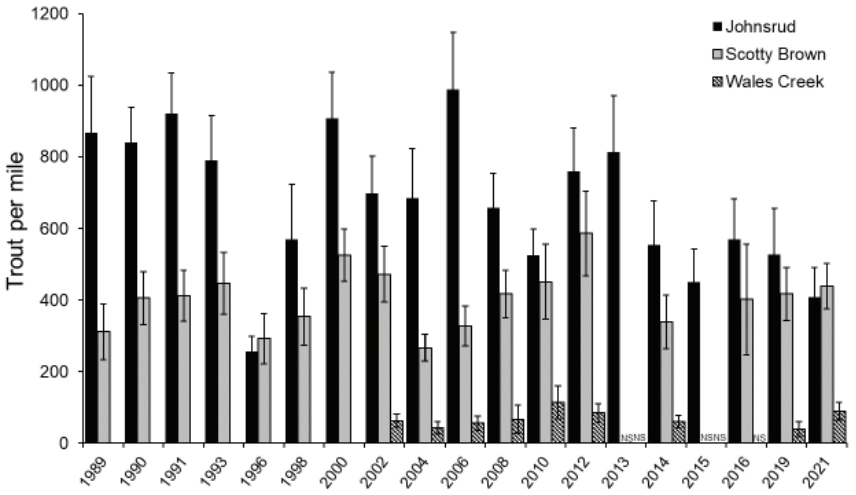


Figure 2. Abundance estimates (95% confidence intervals) of trout with lengths 6-inches and greater, 1989-2021. Surveys in the Wales Creek section began in 2002. NS denotes years in which surveys did not occur.

Fisheries Monitoring

In waterbodies that we stock to supplement or maintain fisheries (i.e., lakes and reservoirs), our monitoring is used in an adaptive management framework to provide information to hatcheries about stocking rates, strains, and species, to ensure we achieve our intended management goals for a particular waterbody. With the emphasis of wild fish management in rivers and streams, our monitoring is focused on long-term status and trend monitoring, as well as targeted research to identify problems that can be addressed through active restoration actions. We can also focus sampling efforts on project-specific effectiveness monitoring to understand the benefits of restoration projects.

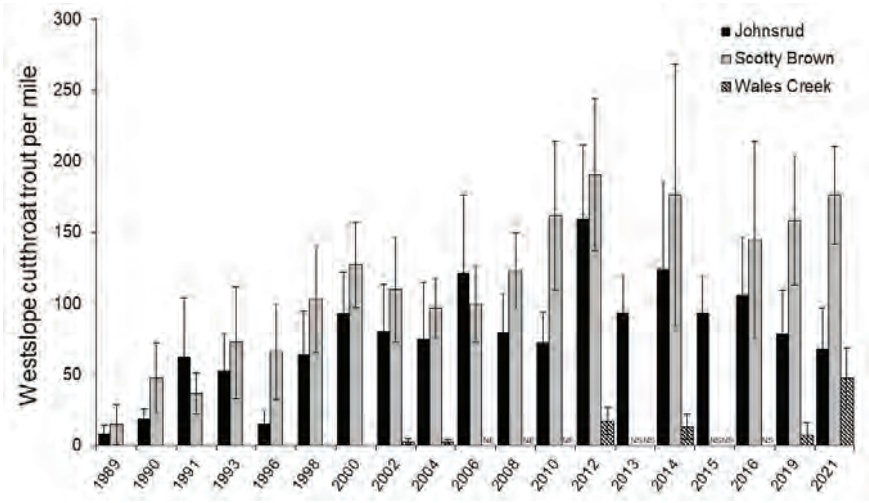


Figure 3. Estimates of westslope cutthroat trout abundance (≥ 6 inches) in three mainstem Blackfoot River monitoring sites. Estimates are shown with 95% confidence intervals. NE = no estimate, NS = no survey conducted.

Montana has some of the longest and most robust data sets of river electrofishing surveys. In the Blackfoot, some of our mainstem monitoring sections have surveys dating back to 1989. Every two or three years, we use drift boat electrofishing units to survey the mainstem Blackfoot River (Figure 1). We have three long-term monitoring sections – Johnsrud (river mile 14), Scotty Brown (river mile 44), and Wales Creek (river mile 63). The Johnsrud and Scotty Brown sections have been surveyed since 1989 and the Wales Creek section has been surveyed since 2002. We use two electrofishing drifts boats, so each vessel can survey along one streambank. The survey sections are 3-6 miles long. We conduct mark recapture sampling, which entails taking a tiny fin clip from all fish greater than 6-inches to mark them, and then resampling the same section a week later. We can estimate population size using statistical models that incorporate the proportion of marked to unmarked fish in the recapture sampling event. This provides us with abundance estimates, so we can assess changes in species composition and population status over time. In 2021, we conducted these electrofishing surveys from May 17 through May 26 based on target river discharge levels of 3,000-6,000 cfs. As flows increase, many fish move into the slow-water margins, which enables us to capture a larger sample size to develop more precise abundance estimates.

Overall, estimates of total trout abundance (i.e., combined across all species) have been relatively stable in these sections over the last few decades (Figure 2). From a native species perspective, we have documented a long-term increase in the abundance of westslope cutthroat trout following harvest restrictions in 1990 and comprehensive restoration actions over the last three decades (Figure 3). There has been a pronounced and persistent long-term shift in species composition in the Blackfoot River. From 1989 through the early 2000s, a relatively rapid decrease in rainbow trout composition and concurrent increase in westslope cutthroat trout composition was documented (Figure 4). This marked shift has been attributed to the systematic restoration of priority native trout tributaries, which has increased the production of cutthroat trout. High prevalence of whirling disease during the 1990s and early 2000s in many spawning and rearing tributaries used by rainbow trout, may have contributed to this species composition shift. With the decrease in rainbow trout occurring in tandem with the increase in westslope cutthroat trout, the overall trout population within the Blackfoot River has remained relatively stable over the last three decades.

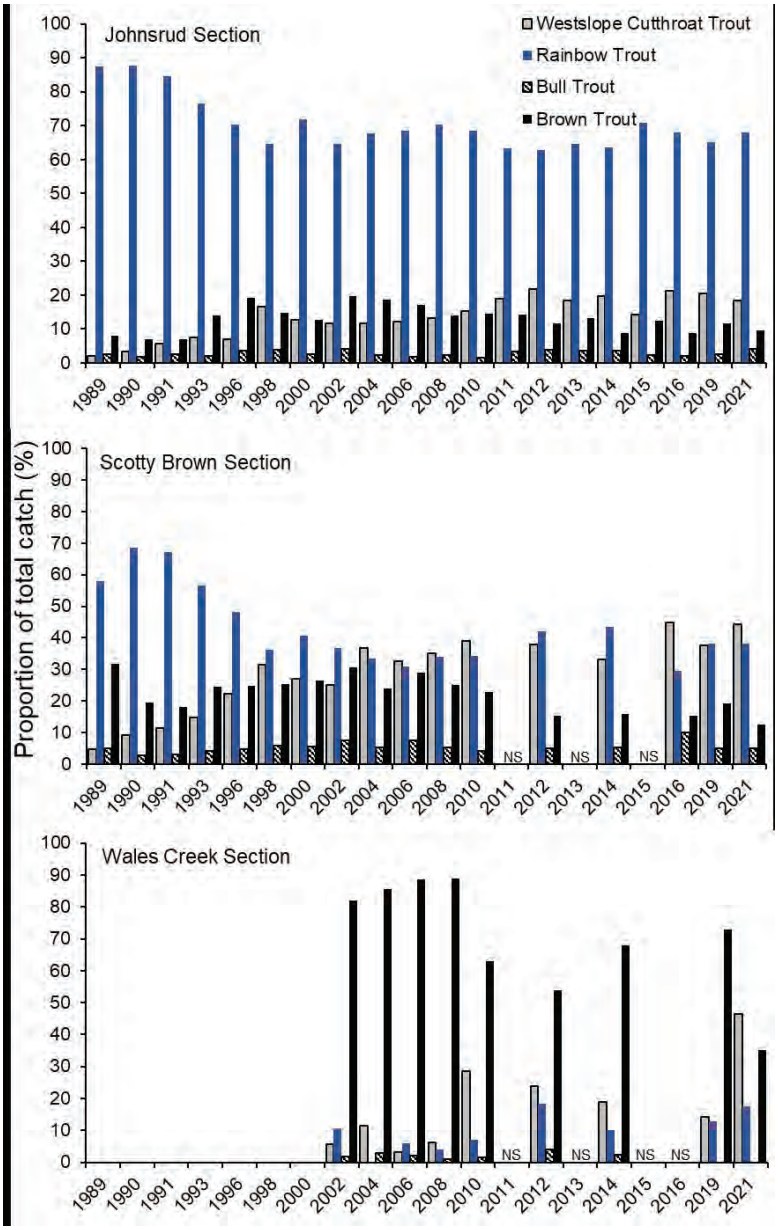


Figure 4. Species composition of trout (≥ 6 inches) in three mainstem Blackfoot River electrofishing survey sections, 1989-2021. Surveys in the Wales Creek section began in 2002. NS denotes years in which surveys did not occur.

The tributaries are production areas within river networks, providing the spawning and rearing habitats that ultimately recruit fish to the mainstem river sections. You can think of tributaries in the context of wild fish management as "nature's hatcheries". Adult migratory fish move into these streams and lay their eggs in the gravel. These eggs hatch and the juvenile fish reside in their natal streams for 1-3 years before emigrating to the mainstem Blackfoot River where they become available to anglers. Angler pressure in the Blackfoot River has doubled from around 30,000 angler days per year in the 1990s to over 90,000 angler days per year in recent years. Despite this pronounced increase in angling activity, catch rates and angler satisfaction remain high. This is a testament to the ability of wild trout production to sustain high quality, recreational fisheries.

Long-term fisheries research and monitoring efforts have identified important spawning and rearing areas, as well as habitat issues and limiting factors in those locations. We continue working with restoration partners in the drainage to facilitate improvement of these streams and increase production in natal areas to provide more fish to anglers in the mainstem river. For example, monitoring in important spawning and rearing areas has indicated increased production following restoration actions, such as this recently restored section of an upper Blackfoot River tributary (Figure 5).

Habitat Restoration

We typically highlight at least one restoration project for these annual newsletters, and with the theme of this year's letter, the fishery response to reclamation of the Upper Blackfoot Mining Com-

plex (UBMC) is a prime example of the wild fish management paradigm in action. Specifically, this project demonstrates the success of relying on natural fish production to seed the newly constructed fish habitat. A dam failure in 1975 released 100,000 tons of toxic mine tailings that were deposited in the river channel and floodplain. The fish population was severely impacted throughout the upper Blackfoot River, and the most heavily impacted tributaries and upper river sections were completely devoid of aquatic life. Fortunately, two isolated tributary populations of westslope cutthroat trout persisted. The fisheries portion of the reclamation and remediation plan decided to allow for natural recolonization from these nearby source populations rather than stocking with hatchery-produced fish.

Figure 5. Electrofishing a restoration project section to evaluate fishery response in an important westslope cutthroat trout spawning tributary in the upper Blackfoot watershed. This project restored a previously channelized section of stream impacted from placer mining. Note the wide floodplain and meandering channel pattern representative of reference conditions for this type of stream and valley.

Annual monitoring has indicated that recolonization has been rapid, and the seeding of vacant habitat has resulted in the early stages of exponential growth as the population approaches habitat carrying capacity (Figure 6). Recolonization by brook trout was documented in the first year of water being present in the new channel. Abundance and biomass have continued to increase since then. Moreover, native westslope cutthroat trout are now present in all three survey sections in the upper Blackfoot River. Anaconda Creek and Shaue Gulch Creek had westslope cutthroat trout prior to reclamation and are the likely sources for this recolonization. The variety of size classes documented in the 2022 surveys provide optimism that a migratory life history form of westslope cutthroat trout will once again reside in the recently reclaimed upper Blackfoot drainage. This demonstrates the resiliency of fish populations when river connectivity and suitable habitat are present. If quality habitat in the form of water quality, quantity, cover, and food resources are present, then fish have the resiliency to recolonize, expand, and sustain their populations.

Habitat Protection

To accomplish our habitat projection goals, we work with a suite of partners including non-governmental organizations (NGOs) such as, Trout Unlimited (TU) (Big Blackfoot Chapter of TU), Blackfoot Challenge, The Nature Conservancy, and government agencies such as U.S. Forest Service, Bureau of Land Management, U.S. Fish & Wildlife Service, and Montana Department of Natural Resources and Conservation (DNRC). For example, this consortium of watershed groups and agencies have implemented landscape-scale conservation efforts in the Blackfoot that have protected entire watersheds with high aquatic values. Moving previous industrial timberlands into public ownership has facilitated restoration and recovery opportunities. Moreover, conservation easements on private ranchlands have protected existing high quality fish habitat, as well as facilitated restoration opportunities through large stream sections of single ownership that allow for restoration to occur on a large enough scale to make appreciable, positive impacts on fish populations.

In addition to collaborating with groups to enact land preservation and protection efforts, we also work with local conservation districts to provide technical expertise for fisheries and aquatic resources related to administration of the Natural Streambed and Land Preservation Act (also known as the "310 Law"). This law requires non-government entities (e.g., private landowners) to apply for a permit when conducting any work that alters the bed or banks of perennial streams. While local conservation districts administer the 310 Law, FWP has regulatory authority over the Stream Protection Act (also known as "SPA 124"). This law is similar to the 310 Law but requires government entities to apply for SPA 124 permits when conducting any work that will affect the natural shape and function of a stream and its banks. Collectively, these habitat protection regulations allow us to influence actions

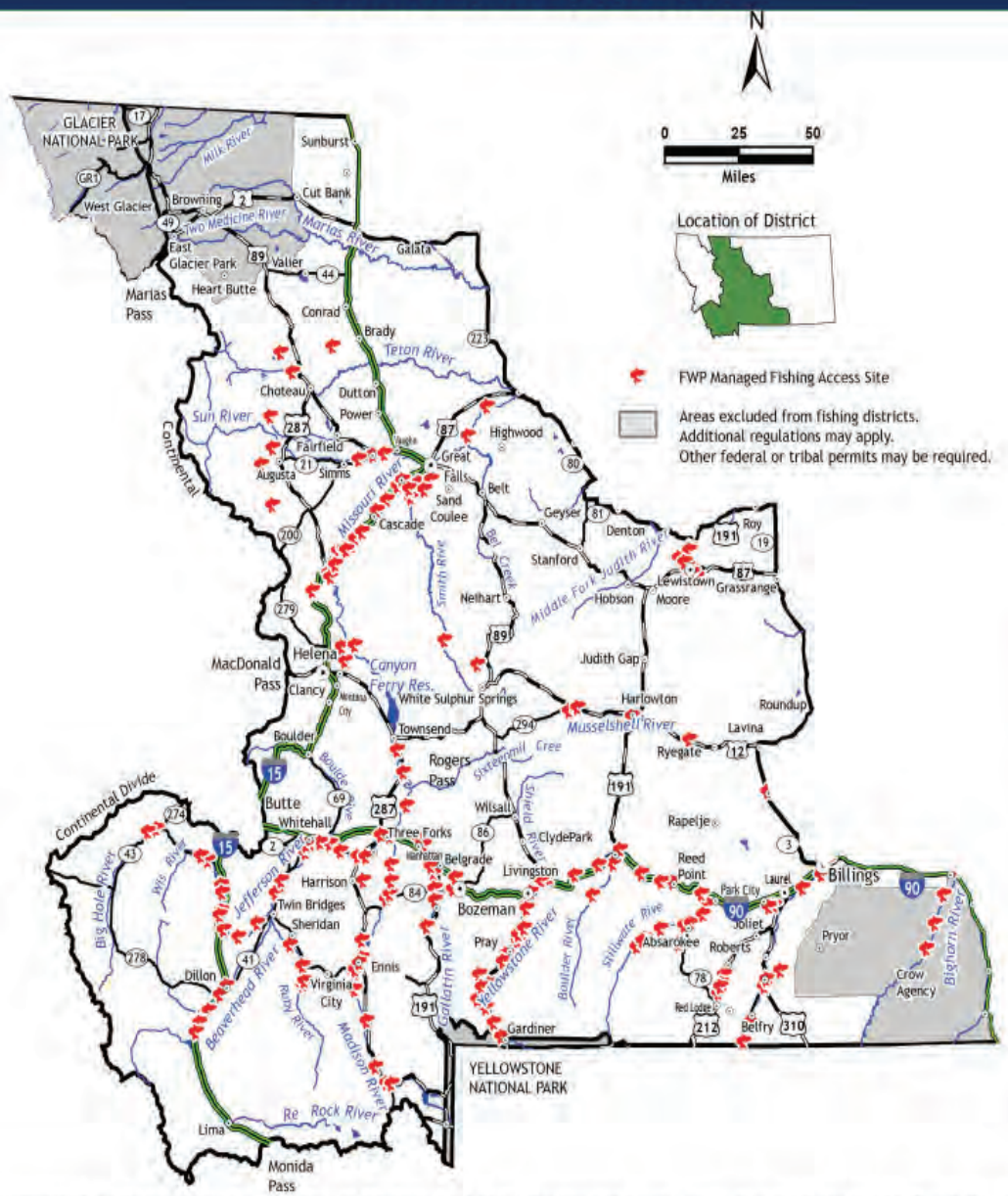
Figure 6. The upper Blackfoot River near the water treatment plant in the UBMC reclamation area. This section was devoid of aquatic life prior to reclamation and restoration. The fishery response has been rapid as evidenced by an abundance of trout captured during an electrofishing survey in September 2021. Brook trout and native westslope cutthroat trout have recolonized this area.

that could negatively impact streams, and work with applicants to implement actions in a way that minimize negative effects to streams while protecting fishery values. Moreover, conducting site inspections with private landowners during the application review process provides valuable opportunities for face-to-face education about the importance of habitat protection and can lead to exciting opportunities to develop restoration projects.

In addition to physical habitat, we also deal with issues related to water quality and water quantity. Wild fisheries are affected by environmental conditions, and populations fluctuate in response to environmental changes and disturbances. Acute disturbances are often short lived and trout populations rebound rapidly, but chronic issues can become limiting factors that control long-term population potential. Fortunately, with the proper habitat, trout populations are generally stable over the long-term because they have relatively high natural mortality rates along with high reproductive output and early age at maturity. Given that populations are resilient and have long-term stability, wild fish management presents a tradeoff that we as anglers need to recognize. Sometimes our favorite fishery may experience short-term decreases in abundance, but with the proper habitat conditions, the population will rebound to the long-term average population size.

The past couple summers are a stark reminder of the extreme conditions these systems face (e.g., drought) and the potential impacts to coldwater fisheries. The Blackfoot Drought Response Plan was developed to minimize fishery-related drought impacts. The plan is administered by the Blackfoot Drought Committee, which is comprised of representatives from FWP, Blackfoot Challenge, DNRC, Montana Department of Environmental Quality (DEQ), TU, Confederated Salish and Kootenai Tribes (CSKT), and water users in the drainage. The drought plan is managed within the context of the State of Montana's instream flow (Murphy) right that FWP administers on behalf of Montana's citizens for fisheries benefits. The Blackfoot Challenge assists FWP with implementation of this instream flow right by coordinating the drought response plan, which is a community oriented, shared-sacrifice model that proactively engages affected stakeholders and water users. The Challenge is instrumental in recruiting and maintaining water user participation in the plan. Collectively, the focus on long-term watershed health, water conservation, and community support provides benefits to the river even in non-drought years. The Drought Committee voted to activate the drought response plan in August 2022 when the Blackfoot River dropped below the minimum flow threshold in early-August. Although we were very fortunate to have better river conditions and less drought impacts than elsewhere in the state, it was a timely reminder of the relevance and value of the Blackfoot Drought Response Plan. Even though minimum flow triggers were not met until later in the season, it was important to stick with the terms of the plan to keep participants engaged and ensure the long-term viability of the drought response plan. As the competition for a dwindling supply of water increases in the future, the enduring benefits and community buy-in from this 20-year program will be invaluable to ensuring the long-term health of the watershed, river, and fisheries.

CENTRAL FISHING DISTRICT



The Central Fishing District includes all waters in Montana east of the Continental Divide, (including the Belly and St. Mary's River drainages) and west of the following described boundary: Interstate 15 from the Montana-Canada border south to its junction with Hwy 2 at Shelby, then east on Hwy 2 to Chester, then south on Hwy 223 to State Hwy 80 at Fort Benton, then southeasterly along State Hwy 80 to its junction with State Hwy 81, then easterly on State Hwy 81 to its junction with U.S. Hwy 191, then northeasterly along U.S. Hwy 191 to its junction with State Hwy 19, then south on State Hwy 19 to its junction with U.S. Hwy 87 at Grassrange, then south on U.S. Hwy 87 to its junction with U.S. Hwy 12 at Roundup, then west on U.S. Hwy 12 to its junction with State Hwy 3 at Lavina, then south on State Hwy 3 to its junction with Interstate 90 at Billings, then easterly and southerly on Interstate 90 to the first crossing of the Little Bighorn River, then southerly along the west bank of the Little Bighorn River to the Montana-Wyoming border.

Note: Roadways that are used as boundaries between the Central and Eastern Fishing Districts are interpreted to be in the Central Fishing District.

For additional information regarding the boundaries in this fishing district, please call the following regional headquarters Monday-Friday 8:00 a.m. - 5:00 p.m.:

Billings.....406-247-2940
Bozeman.....406-577-7900
Butte Area Office.....406-494-1953
Great Falls.....406-454-5840
Helena Area Office.....406-495-3260
Lewistown Area Office.....406-538-4658
TTY (Telephone device for the deaf).....711 or 1-800-253-4091

Region 3 Southwest Montana

Creating an Arctic Grayling Genetic Reserve

Indigenous populations of Arctic grayling currently exist in the Big Hole River and Centennial valleys of southwest Montana in the headwaters of the Missouri River. These populations are considered glacial relicts, meaning they were left behind after the retreat of the glaciers over 10,000 years ago. Since the 1980s, FWP and its partners have been working together to protect the populations of Arctic grayling in the Upper Missouri River (UMR). Most notably, the Candidate Conservation Agreement with Assurances (CCAA) was established in 2006 in the Big Hole River and has 32 enlisted landowners who voluntarily work with FWP to improve grayling habitat and flow conditions on the upper Big Hole River. The Big Hole River population has increased and remains stable since the inception of that program. Since then, a CCAA program was also developed in the Centennial Valley and numerous restoration projects have been conducted to help grayling in both valleys.

After observed declines in Big Hole River Arctic grayling in the 1980s, a genetic reserve (brood) for the population was established in Upper Twin Lake (Axolotl) in the Gravelly Range in 1991. This population was founded using the offspring of wild Big Hole River fish and is periodically maintained with genetic infusions from wild Big Hole River grayling to ensure that genetic diversity of the captive brood remains similar to the wild population. A second Big Hole River brood reserve was also established in 1998 in the Gallatin River watershed. The purpose of these broods were to preserve the genetic diversity of the Big Hole River population and to serve as a source for introductions to the Big Hole River and elsewhere in the Upper Missouri River (UMR). The Axolotl brood reserve was the source of the successful re-establishment of grayling to the Ruby River 20 years ago and both broods currently serve as primary sources for ongoing reintroduction efforts in the Madison River.

In the Centennial Valley, Montana's other indigenous grayling population remained abundant until 2016 when a lack of suitable over-winter habitat in Upper Red Rock Lake caused the population to decline dramatically. The population of spawning adults has remained below 100 fish for the past seven years.

FWP employees collect eggs from Arctic grayling at Bobcat Lake to supplement the Centennial Valley brood population in Handkerchief Lake.

Currently, FWP and the U.S. Fish & Wildlife Service are developing a project to improve over-winter habitat in the lake. However, unlike the Big Hole River, a genetic reserve for the Centennial Valley grayling population was never created.

Handkerchief Lake, in northwest Montana, is outside the native range of grayling but contained a viable population of introduced grayling for over 50 years until it was treated with rotenone in 2013 to remove hybridized cutthroat trout. As part of the public scoping process, FWP and its partners agreed that grayling would be reintroduced to Handkerchief Lake if the population had high conservation value for state recovery efforts. Following the fish removal project, attempts to replicate the Centennial Valley population were made in Handkerchief Lake using progeny from wild Red Rock Creek fish. However, those efforts ultimately resulted in only 12,000 grayling fry stocked over five years. Conversely, the original Handkerchief Lake grayling fishery was established with more than 700,000 fish stocked on 14 occasions during the 1950s and 1960s. Based on recent sampling and angler reports from Handkerchief

FWP employees collect eggs from Arctic grayling at Odell Lake to supplement the Centennial Valley brood population in Handkerchief Lake.

Fertilized grayling eggs from Odell Lake getting delivered to the Washoe hatchery in Anaconda.

Lake, grayling are present but rare, and the surviving fish have low genetic diversity. The population is not abundant enough for managers to utilize those fish for conservation projects. In early 2022, FWP biologists from Regions 1 and 3, hatchery staff, and geneticists determined that Handkerchief Lake needed more grayling. But with the population in Upper Red Rock Lake at an all-time low, where could we get fish to supplement the population?

Between the 1890s and the 1960s, grayling from the Centennial Valley and Madison River were heavily propagated and stocked into lakes and rivers throughout the state. This resulted in many self-sustaining populations of Arctic grayling in mountain lakes which were founded entirely with UMR grayling. In 2020, we initiated a study to look at the genetic ancestry of 20 self-sustaining mountain lake grayling populations in Montana and Wyoming. The results revealed that all populations were a mix of Centennial Valley and Madison River fish. However, some populations were predominantly one or the other. In this case, we identified five populations which were suitable donors for a Centennial Valley brood population due to a predominant Centennial ancestry.

The goal was to establish a population in Handkerchief Lake that most accurately represented the historic genetic diversity of Centennial Valley grayling at abundances sufficient to serve as a brood source for conservation projects. To do this, FWP sought to use grayling from four of the appropriate mountain lakes in 2022 to supplement the Handkerchief Lake population. To avoid a genetic bottleneck (when too few parents are used to create a population inbreeding can occur), we planned to spawn at least 50 pairs of adults from each of the four lakes. The cold, wet spring in 2022 delayed our efforts as many lakes above 8,000 feet did not begin to thaw until late-June. Arctic grayling spawn when the water temperature reaches 50°F and this typically happens 1-2 weeks after ice-off at high elevations. Some of the fish were not in spawning condition until early-July. Ultimately, we spawned 277 males with 241 females from the four lakes. Eggs were flown to the Washoe and Sekokini hatcheries and raised until they were 1.5-2.0 inches long. Over 20,000 grayling fry were eventually stocked into Handkerchief this year with a plan to repeat this project in 2023. FWP staff in Region 1 will continue to monitor Handkerchief Lake to determine the success of these introductions. Once established, Handkerchief Lake will serve as the primary donor source for introductions into suitable habitat in the Centennial Valley and Red Rock River drainage.

The Choice to Keep Westslope Cutthroat Trout at Dutchman and Sixteenmile

A once robust westslope cutthroat trout (WCT) population was fading in Dutchman Creek (Elkhorn Mountains) due to a brook trout invasion. Simultaneously in 2022, 7 miles of barren stream in the headwaters of the South Fork of Sixteenmile Creek (Bridger Mountains) needed a source of cutthroat trout with good genetics. It seemed like a win-win solution to move the last remaining 47 cutthroat in Dutchman to the clean, secure tributary located on the north slope of the Bridger Mountains. It only took a few days to gather the fish at Dutchman Creek, but it took years to create a suitable place for them to recover, expand, and eventually be ready to return to the Elkhorn Mountains.

At Sixteenmile, the U.S. Forest Service (USFS) and Montana Fish, Wildlife & Parks (FWP) proposed a westslope cutthroat trout restoration project in the southern headwaters in 2013. After many public meetings and assessments, the first step to implement the project involved construction of an upstream fish passage barrier, which was completed in 2015. After the barrier was in place, it took years of coordination with neighboring landowners, followed by fish removals interrupted by floods and forest fires to finally certify that the stream no longer supported hybridized trout in August 2022—nearly 10 years later.

South Fork Sixteenmile Creek Barrier Installation in 2015

Timeline of Fish Removals at South Fork Sixteenmile Creek (SF16) Project:

September 2018: A complete rotenone treatment was completed for the entire project area.

September 2019: The west branch of SF16 was treated but a major rainstorm caused high flow and resulted in the east branch not being treated.

September 2020: A forest fire south of the project resulted in cancelation of the treatment. Extensive sampling was conducted to determine presence of trout in the project area and no trout were observed. However, eDNA sampling indicated potential fish presence in the east branch.

September 2021: Despite the unlikely presence of fish in the project area, the entire area was re-treated over a two-day period. No trout were observed during the process.

Summer/Fall 2022: eDNA sampling during summer 2022 confirmed the absence of rainbow trout hybrids, and Dutchman Creek cutthroat trout were "replicated" by introducing 47 fish in SF16 during October 2022.

Dutchman Creek Project:

Westslope cutthroat trout (WCT) monitoring began in 1999, when WCT outnumbered brook trout by over 2:1. After nearly 20 years of monitoring the gradual takeover of upper Dutchman Creek by invading brook trout (in 2022 brook trout outnumbered WCT by over 20:1), biologists prepared to make a major shift in fish management. They proposed removing WCT from the 2-mile reach of upper Dutchman Creek and transporting the fishery to a more secure stream. Eventually, upper Dutchman Creek will need removal of brook trout and construction of a barrier to provide a secure location for the return of the Dutchman Creek progeny. This work at Dutchman Creek is expected to be completed by 2025.

Why Replace hybridized trout in South Fork Sixteenmile and why not allow brook trout to colonize the headwaters of Dutchman Creek?

Photo of WCT from Dutchman Creek residing in a clear pool at Sixteenmile Creek.

Every fishery worker will tell you that the most dreaded task of cutthroat trout recovery is killing fish to provide a secure place for Montana's state fish to recover. They will also tell you that the current plight of this rare species makes it necessary to create fishless habitat above secure fish passage barriers. They hold their noses and do it.

The Dutchman/Sixteenmile project will eventually provide about 9 miles of stream that will contain a few thousand fish where few anglers will go fishing. These fish will have genetics very similar to the fish that historically dominated many streams and rivers in Montana in the 19th century. Fish managers of tomorrow might not choose to go to such efforts to methodically hang on to cutthroat in Montana one stream at a time, but current management of WCT in Montana attempts keeps options open for future generations.

An Evaluation of Upper Missouri River Brown Trout Genetic Structure and Movement Related to Habitat Fragmentation by Toston Dam

Radio receiver site below Toston Dam on the upper Missouri River.

Brown trout play an important role in the sport fisheries of southwest Montana. As a top game species, preservation of abundant brown trout populations is a high priority for fishery managers. A decline in brown trout numbers across many rivers in southwest Montana has prompted an evaluation of habitat fragmentation effects on this important sport fish.

A 43-mile reach of the upper Missouri River between its headwaters and Canyon Ferry Reservoir, is home to the Toston Dam. The dam was originally built for diversion of irrigation water in 1940 and was retrofit with a turbine for hydroelectric generation in 1989. This concrete gravity overflow dam allows for no upstream fish passage and minimal downstream passage. While the dam plays a vital role in halting upstream expansion of other non-native species, brown trout are vulnerable to the resulting turbine and habitat fragmentation effects. This altered mainstem river habitat makes access to the associated tributaries important, and it is thought that Sixteenmile Creek (upstream of Toston Dam) is a historically significant juvenile recruitment source for brown trout in the river.

Montana Department of Natural Resources and Conservation (DNRC) and Montana Fish, Wildlife & Parks (FWP) have worked together to mitigate fishery effects from the structure for three decades under the original Federal Energy Regulation Commission (FERC) license. A new license with new fishery mitigation will begin in 2024. The results of this brown trout evaluation may help guide future management action.

The objectives of this study are to (1) define the amount of genetic variation in brown trout above and below Toston Dam, (2) identify where brown trout in the river originate from in relation to the dam, and (3) find out if migrating adults will use Sixteenmile Creek to spawn when given the opportunity. Each objective has a specific method involved with completion.

A look at the variety of sport fish (brown trout, rainbow trout, and walleye) captured in the Missouri River between Toston Dam and Canyon Ferry Reservoir.

Large male brown trout from the upper Missouri River.

1) **Genetics:** Evaluation of brown trout genetics in the upper Missouri River sub-basin and associated tributaries will provide an understanding of variation and reproductive crossover among the local populations.

2) **Otolith Microchemistry:** The chemical makeup of inner ear bones (otoliths) can be matched to water chemistry from the area. Therefore, examining chemistry of fish otoliths from the Missouri River can help determine hatching origin (natal origin) of individual fish to identify sources of brown trout.

3) **Radio Telemetry:** Finally, tracking the movement of radio-tagged spawning capable adults moved upstream from below Toston Dam, will lead to information about the extent of use and the importance of Sixteenmile Creek and other locations as potential spawning areas.

At a local scale, this research will lead to a greater understanding of the effects of fragmentation by Toston Dam on this brown trout population and help decide what action can be taken to improve the abundance of brown trout in this important fishery. At a broader scale, this work could prompt a region wide effort to characterize the genetic structure of brown trout populations in southwest Montana, and how they connect in these important blue-ribbon trout streams.

Region 4
North Central Montana

An adult Arctic grayling sampled within Tunnel Lake originally from the Sunnyslope Canal population.

Lending a Hand to a Unique Arctic Grayling Population

The prairie landscape below the Rocky Mountain Front remains green through the summer by a series of reservoirs and irrigation canals. Pishkun Reservoir is filled by Sun River water which is stored and then transported out of the reservoir to the Fairfield Bench via the Sunnyslope Canal system.

Madison River origin Arctic grayling were stocked into Pishkun Reservoir in 1937, 1939, and 1943 by the FWP Giant Springs Trout Hatchery. Reports of grayling within the canal system began by 1940 and persisted, suggesting that escaped grayling were not only surviving, but also reproducing within the canals. In 1971, the Sunnyslope Canal Arctic grayling population was documented by FWP fisheries biologist Bill Hill. Further examination into the population was completed by Scott Barndt as part of his 1996 master's thesis at Montana State University. A unique population in all regards, these special "ditch fish" are currently undergoing an improvement project for long term sustainability.

A circumpolar species, Arctic grayling are a Fish of Special Concern within Montana. The populations within Montana, specifically those in the upper Big Hole River, are the only remaining native fluvial Arctic grayling in the lower 48 states. Many non-native Arctic grayling populations, such as the Sunnyslope Canal population, exist throughout Montana and are closely managed by biologists.

FWP employees and volunteers salvaging Arctic grayling from the Sunnyslope Canal after irrigation season ended.

The Sunnyslope Canal grayling reside within deep pools below drop structures throughout the canal system. These pools hold water even after the canal system is shut off for winter allowing fish to persist. In the spring, the water is turned on and the grayling spawn. As water moves through the system, many juvenile fish and some adults swim downstream of drop structures (the drop structures prevent fish from swimming back upstream) thereby permanently leaving the population.

Each year, after the canal is turned off, juvenile and adult grayling are stuck downstream in shallow water below the drop structures. These fish will die once the water freezes, so FWP employees rescue the stranded fish and take them to Tunnel Lake for future recreational angling opportunities. Over time, as more adults have been lost from the canal population, the genetic integrity has declined. In 2020, genetic analysis showed a 15% and 26% decrease of genetic heterozygosity and allelic richness from 2006 and a very low effective population size. Decreased genetic integrity can lead to failure of a population. To avoid loss of this unique population, FWP staff implemented a genetic rescue project in 2022.

As an isolated population, translocating new fish into the canal system is the only way to bring in new genetics. In October, after the canal had been shut off, stranded juvenile grayling were collected through

backpack shocking and seining and moved to Tunnel Lake. Adult grayling were collected, measured, tagged, and moved back into the deep pools in the canal. The following week, 15 adult grayling were captured from Park Lake, tagged, measured, and transported to the Sunnyslope Canal drop structures.

Measuring and tagging adult Arctic grayling at Park Lake, for translocation to the Sunnyslope Canal outside Fairfield, Montana.

For the next three years, FWP staff will monitor the population response through collecting genetic samples from juvenile fish during salvage events. This data will provide additional insight into genetic rescue projects that introduce small numbers of fish into isolated populations. The Sunnyslope Canal Artic grayling population is a testament to the survival and persistence of fish in varied environments and hopefully, they will continue to persist for another 85 years. Anglers who fish within the Sun River drainage are encouraged to report any adult grayling that are caught to the Choteau Area fisheries office at 406-466-5621.

Big Casino Creek Reservoir

Drought and aging infrastructure have been tough for Lewistown area ponds the last few years. As ponds winterkill and dams breach, it is hard not to reflect on the good fishing that was lost. Losing these fisheries really makes you appreciate and work harder with what you still have. We have taken a solid look at the management of our remaining ponds, and one place we have put a lot of effort into is Big Casino Creek Reservoir.

Big Casino Creek Reservoir is a 16-acre reservoir just outside of Lewistown. A need to improve the fishery was recognized in 2014 as the fishery was dominated by white suckers. Rainbow trout and yellow perch were in poor condition. The first action was taken in 2015 when 5,000 largemouth bass and 100 black crappie were stocked.

Sampling efforts in 2018 revealed that white sucker catch rates were still through the roof and neither bass nor crappie populations had established despite the stocking efforts. In 2019, 75 tiger muskie were stocked, and an additional 50 were stocked in 2020 to control the overly abundant sucker population.

Crews used electrofishing in 2020 to monitor the stocked tiger muskie. No tiger muskie were sampled, but we found the first evidence of success from the crappie and bass stocking efforts. Angler reports in 2020 indicated the tiger muskie were surviving and we noted that yellow perch were bigger and healthier, and some adult bass were being caught. Despite the fishery trending towards improvement, most angling use was directed at catching suckers for cut bait.

A boat load of porcupine ball habitat structures ready to be taken to Big Casino Creek Reservoir.

To get a better understanding of angler catch rates and input from the public, a voluntary creel box survey was initiated in 2021. Initial results suggested low catch rates and angler frustration was apparent. Comments included: "Needs more fish!!! Please - we caught zero", "Please stock with this thing called fish", "I only got nibbles - I think the lake needs MORE fish!" and "There was nothing." Electrofishing was repeated in 2022. There were more crappie and bass than in 2021, and an increasing number of quality yellow perch. This was promising but creel cards through the summer 2021 showed low angler success. Reported angler harvest for all of 2021 was a total of 20 game fish: 18 yellow perch, 1 black crappie, and 1 largemouth bass. We were seeing better numbers of fish during sampling efforts, but those fish were not being caught by anglers.

After talking to anglers and amongst ourselves we recognized a few patterns and problems. 1) The reservoir was consistently murky. The main access point near the pavilion had severe erosion, sending a fine red silt into the reservoir every time there was a mild wind, causing low visibility conditions for several days after. 2) Access. An access pier provides some access to deep water habitat, but the platform is elevated well above the surface of the reservoir, making it difficult to fish from. The most popular area to fish had a cut bank and took an extremely long cast to reach deeper water. 3) In general, the anglers fishing from the most accessible locations weren't catching fish.

Beginning in the fall of 2021, FWP began implementing a variety of solutions to address these problems. We started with the low hanging fruit. Since the majority of anglers couldn't get to the fish, we brought the fish to them. Big Casino Reservoir is a relatively small reservoir with a shallow silt bottom and limited deep-water habitat which made it a prime choice for fish-attracting habitat structures. Partnering with local interest groups and utilizing FWP's Community Pond Grant, we blanketed the area around the popular fishing points with Georgia Cubes (4' PVC cubes with 4" irrigation tubing) and Bill Dance Porcupine Balls (spheres with 24 PVC arms that made 3-6' structures). These structures are proven to attract bass and crappie, giving them quality ambush sites.

The next problem to fix was the shoreline erosion issue that was contributing to the low visibility conditions in the reservoir. The treatment used was called a Saw-Toothed Deflector. This treatment was chosen both for its fish attracting properties and the quality shoreline fishing access it provides while eliminating erosion.
The shoreline treatment and the habitat structures helped improve angler access to fish, but crews thought more could be done. In July 2022, FWP installed a floating dock between the rebuilt shoreline and the access pier. The dock was placed such that it provides easy access to the deep-water habitat and it was surrounded by the Georgia Cubes, porcupine balls, and strategically placed Christmas trees.

That's all great but… is it working?

YES!!! There was an increase in use after the dock was installed and the shoreline rebuilt. It became a

Before and after photos of shoreline improvements at Big Casino Creek Reservoir near Lewistown.

What it's all about! A local youth angler shows off his catch and other youth anglers utiliting the improved access provided by the floating dock at Big Casino Creek Reservoir.

more popular area for families using the newly created shoreline area to swim and fish. Anglers excitedly targeting crappie and bass and reports of young kids catching crappie are common. Creel survey cards in 2022 reported catch rates of 2 fish/hour compared to only 1 fish/hour in 2021. In 2022, 43% of comments were positive compared to only 9% in 2021. Angler satisfaction has improved, and angler harvest has tripled. The water clarity was noticeably better throughout the summer and fall after the shoreline treatment. The predator stocking appears to be paying off as well. We have noted an upward shift in the size structure of white suckers in the reservoir, suggesting that the tiger muskie and other predators have begun to reduce the sucker population. In 2021, 36% of angler catch was comprised of white suckers. In 2022 that number was reduced to only 10%. The most dramatic increase in angler catch rates was seen in black crappie, which comprised 3% of angler catch in 2021 compared to 34% in 2022.

In a tough time for ponds in Central Montana, fishing at Big Casino Creek Reservoir is on the upswing, providing a unique fishery and a great place to take the family in Lewistown. All the hard work that went into improving this fishery is rewarded tenfold by watching young kids pull in crappie after crappie from the dock.

Nerka Nostalgia: A Kokanee Comeback?

Hauser, Holter and Helena Valley Regulating Reservoirs

A recent uptick in kokanee salmon (Oncorhynchus nerka) populations in two Missouri River reservoirs has anglers excited about the future of kokanee fishing in Central Montana. As recent as the early 2000's, "chromers" were king and annually drew tens of thousands of anglers to Hauser and Holter Reservoirs, both near Helena, to chase giant salmon. In fact, the standing state record kokanee, a beastly 26-inches and 7.85- pounds, was caught in Hauser in 2003. Since then, kokanee numbers fell to historically low numbers in Hauser and Holter, due to a variety of factors, and subsequently anglers moved on to other fish species or waterbodies.

Fisheries technician Ashton Clinger with a Hauser kokanee from a fall 2022 FWP survey.

A stable kokanee population in Helena Valley Regulating Reservoir (HVRR) has kept "burgundy bruiser" fanatics busy during the Hauser and Holter kokanee lull. Currently, 50,000 salmon are stocked annually in the small, 600-acre waterbody. HVRR kokanee typically range from 12 to 16-inches (some larger) and are caught on the hardwater, trolling, and during the fall snagging season. Despite smokers full of "bluebacks" from HVRR and other waterbodies in recent decades, "redfish" wranglers remain nostalgic for the once epic kokanee fisheries in Hauser and Holter Reservoirs.

A Helena angler holding a fish caught in HVRR in the Summer of 2022.

Surplus = Opportunity

Annual kokanee stocking in Hauser Reservoir ended in 2004 because the fish were simply not surviving. In June 2020 FWP had surplus kokanee and decided to stock 113,000, 3-inch kokanee in Hauser Reservoir to jumpstart the fishery. Post-stock population monitoring indicated the surplus plant was a success as kokanee were observed in various surveys and spawning numbers appear to have increased in major reservoir tributaries (Prickly Pear Creek, Trout Creek, etc.). Positive monitoring results led FWP to commit 100 thousand kokanee plants annually in Hauser beginning in 2022, with the hope of reestablishing the storied fishery. A few anglers began targeting and catching kokanee in Hauser in 2022 and FWP anticipates more anglers will rekindle their passion for "kokes" as future annual plants begin to reestablish the population.

Surprise, Surprise

Holter Reservoir kokanee have taken matters into their own fins the past few years and as a result, anglers are beginning to catch kokanee once again! An incred-

ible number of fish were observed spawning in the Missouri River below Hauser Dam in 2021. Kokanee haven't been stocked in Holter since 2009; therefore, fish migrating from Holter to spawn upstream in the river indicates that natural reproduction in recent years is responsible for the latest surge in "crimson cruisers." FWP survey results in 2022 revealed the highest number of "KOK's" in Holter since 2004, with fish averaging 19-inches, and anglers are again catching fish throughout the reservoir most of the year and upstream in the river in the fall.

Call them what you want, but kokanee salmon energize an enthusiastic angling base with dreams of hooking, fighting, and landing feisty salmonids known for testing reel limits and aerial acrobatics. So, take the kokanee tactics you've fine-tuned at HVRR, and other waterbodies in Montana, and rekindle your search for "silvers" in Hauser and Holter Reservoirs! Like always, be sure to check the current fishing and watercraft regulations before your next trip.

A volunteer with a Holter kokanee from a Fall 2021 FWP survey.

Canyon Ferry Reservoir – Rainbow Trout Factory or Underachiever?

Rainbow trout have been stocked annually into Canyon Ferry Reservoir (CFR) since 1953. Different strains, seasons, and size of stocked fish have been adjusted and analyzed over time to determine the best chance of success. The current stocking regime of planting two strains of rainbow trout, the Arlee and Eagle Lake strains, was initialized in 2005. Arlee rainbow trout are characterized by fast growth and are relatively easy to catch. Eagle Lake rainbow trout grow slower, live longer, and attempt to spawn along shorelines and in streams. The phenomenon of masses of large Eagle Lake rainbow trout cruising the shorelines of local reservoirs in the spring has created a unique angling opportunity.

Population trend monitoring of Canyon Ferry rainbow trout has been ongoing since 1986 and is completed annually every October using eighteen floating style horizontal gillnets. These nets (125 feet long and 6 feet deep) are on the surface of the water and fish the top six feet of the water column. The Upper Missouri River Reservoir Management Plan (UMRRMP) provides management direction for Canyon Ferry Reservoir and lists as a goal that it is to be stocked with 300,000 rainbow trout annually. In addition to stocking goals, an abundance goal range of 4-6 rainbow trout per net is also listed in the UMRRMP. The abundance goal has only been reached three times during the past ten years. This would indicate that Canyon Ferry Reservoir is indeed underachieving.

To better understand what is going on a closer look is needed. In comparing annual rainbow trout plants in two local reservoirs, Canyon Ferry is planted with 300,000 while Holter Reservoir is planted with 250,000. That equates to a stocking density of 9 rainbows per acre for Canyon Ferry and 68 rainbows per acre for the much smaller Holter Reservoir. The UMRRMP lists a goal range for both reservoirs of 4-6 rainbows per net, which Holter has met eight of the past ten years.

When looking at catch rates in the summer creel for anglers specifically targeting rainbow trout, Holter Reservoir catch rates are 0.54 rainbow trout per hour, while Canyon Ferry Reservoir catch rates are 0.46 rainbow trout per hour over the past 10-years. This equates to approximately one rainbow being caught for every two hours of fishing, which is quite remarkable. The literature states that 0.25-0.30 fish per hour is considered really good fishing and a benchmark for a sport fishery.

Even though Canyon Ferry is stocked at a much lower density than Holter, rainbow trout catch rates are nearly equal for both reservoirs. Canyon Ferry's rainbow trout thrive in the reservoir and are readily available to anglers. So, you decide - is Canyon Ferry Reservoir a rainbow trout factory or underachiever?

FWP hatchery staff plant rainbow trout into Canyon Ferry Reservoir.

Before They Slip Through Our Fingers: Rescuing Westslope Cutthroat Trout from Genomic Extinction

A westslope cutthroat trout collected from a hybridizing stream in the Judith River basin.

East of the Continental Divide in North Central Montana the native westslope cutthroat trout (WCT) has declined significantly throughout the Upper Missouri River basin. Reasons for this decline include loss of habitat, competition and predation from nonnative fish species, and hybridization. Even with current proactive conservation efforts to restore the species, we continue to lose WCT populations across their range. Why is this happening?

The answer lies in the fact that the vast majority of our WCT populations are not protected from nonnative species. The streams that WCT occupy are typically connected to downstream sources of brook, brown, and rainbow trout. While these are valued game fish, they are largely responsible for displacing the native cutthroat trout in the Upper Missouri River basin. Rainbow trout are particularly detrimental to WCT populations because of their ability to interbreed and produce fertile hybrid offspring. As this process continues over time, the entire population ultimately becomes composed of hybrid individuals leading to what is termed the genomic extinction of the original WCT population.

Unfortunately, this is the fate that many of our WCT populations have been met with. However, the hybridization process does not play out the same in each stream and creek. Sometimes the path to genomic extinction can take decades. In these situations, it is possible to intervene in the actively hybridizing population before the native WCT disappear forever. That is the goal of several ongoing projects currently underway in North Central Montana.

In hybridizing streams where nonhybridized WCT still persist, we are seeking to salvage the remaining WCT before it is too late. These populations often contain unique genetic characteristics found nowhere else and are of high conservation value. We backpack electrofish these streams to tag and collect genetic tissue samples from every individual encountered. Genetic tissue samples are then sent to the University of Montana Fish Conservation Genetics Lab for analysis. The lab then provides us with a list of tagged individuals that appear to be nonhybridized WCT. We then return to the stream and recollect the tagged fish and transfer those that are nonhybridized to another waterbody where they are safe from the threat of continued hybridization.

Through this work we hope to rescue our most at-risk WCT populations and secure their lineages into the future. In many cases it is a race against the clock, several populations are only one or two generations away from genomic extinction. However, with thoughtful planning and collaboration we can ensure these rare resources are preserved to further the conservation of the species in Montana.

Middle Fork Judith River

I've been banging this drum for a few years in newsletter articles now, but the Middle Fork Judith River (MFJ) is magnificent to behold. At the same time, the fishery is disappointingly bad. Excessive siltation that originates from 27 jeep trail crossings, with more than 80 ingress/egress points, has resulted in chronic degradation of the aquatic habitat. The effective collaboration between engaged stakeholders, Montana Trout Unlimited, and the Helena – Lewis and Clark National Forest continues to make impressive progress on restoring this Central Montana treasure. Their vision, creative problem solving, and diligence have made this pipedream a reality.

Recent surveys have documented the relative paucity of fish in the mainstem MFJ. In Montana, - we know that quality fisheries rely on quality habitat. That hasn't been present in the Middle Fork for many decades, but we fully anticipate that once the source of chronic degradation is removed and the jeep trail reroute project is completed, the habitat of the MFJ should be set to recover quickly. Once the habitat is in place, - get your fishing gear ready - because we'll be anticipating a quality fishery to soon follow.

What that fishery looks like is still uncertain. It could very well mimic the current fishery as a mix of brookies, rainbows, cutbows, and the occasional brown trout. On the other hand, - the MFJ, and the broader Judith River drainage, is at the easternmost extent of

Numerous jeep trail crossings (left) in the Middle Fork Judith River have led to chronic siltation of the river (right).

Work continues on rerouting these trails with a finalized bypass route down Arch Coulee completed in late 2021. In September, crews worked to decommission and rehabilitate numerous duplicative entrances to 9 crossings upstream of the Arch Coulee reroute. Work was also done to improve the remaining entrances above Arch Coulee to a more sustainable design and roughly three quarters of a mile of new trail was constructed outside the active riparian area. This will reduce erosion and sedimentation to the stream. Restoration work downstream of Arch Coulee on the remaining 18 crossings is expected to occur in late summer/fall 2023 and is fully funded thanks to the Future Fisheries grant program, Montana Department of Environmental Quality, and Montana Trout Unlimited, among others.

aboriginal westslope cutthroat trout range. This makes the area especially important to the genetic diversity of the species as well as particularly at risk to extirpation. Fringe ranges have limited opportunities for recolonization should a species blink out. The MFJ provides a potential opportunity to pursue a largescale native fish restoration project. There are roughly 80 miles of salmonid habitat in the MFJ. Currently, westslope cutthroat are limited to a few small reaches in headwater streams. If it proves feasible and deemed appropriate, native fish restoration in the Middle Fork would result in a 10-fold increase of westslope occupied stream miles in the Judith drainage. We are evaluating the genetic status of MFJ headwater cutthroat populations to provide a benchmark for introgression and also provide information for potential native fish

Before and after photos of typical decommissioning work performed on duplicative entrances to the Middle Fork Judith River along the existing jeep trail (photo courtesy of Montana Trout Unlimited).

restoration projects in the MFJ and/or other waters. We've collected genetic samples from Yogo, Weatherwax, Cleveland, and Harrison creeks, as well as evaluated fisheries present in Hell Creek and the upper Lost Fork. These evaluations play a part in determining what the future of the westslope cutthroat populations look like in the MFJ.

FWP crews have been working throughout the Middle Fork Judith headwaters to collect westslope cutthroat genetic samples.

Whatever the future species assemblage consists of one thing is certain, quality wild fisheries don't exist without quality habitat. The Middle Fork Judith has been an unfortunate example of how true this is. This aesthetically beautiful, yet chronically degraded river has produced terrible fishing for far too long. We are so excited to see the river system restored and look forward to seeing how the fishery responds. Just don't tell too many folks, because I have a feeling it's going to be good!

Region 5
South Central Montana

A Golden Year

2023 is a Golden Year. This means that FWP crews will again hike to Sylvan Lake to collect eggs from the wild golden trout that reside there. Eggs will then be transported to the Yellowstone River Trout Hatchery in Big Timber. Golden trout will be reared in the hatchery until late summer when they are approximately an inch and a half long. They then will be loaded into a helicopter and stocked out into several high mountain lakes across Montana. Golden trout eggs are collected from the wild brood stock at Sylvan Lake once every six years. There is no captive brood stock for golden trout in Montana therefore lakes that are stocked with golden trout only receive fish once every six years.

A spawned out golden trout from Sylvan Lake with a bowl of eggs.

Sylvan Lake lies high in the Absaroka-Beartooth Wilderness near the town of Roscoe, Montana. It can be most easily accessed by a roughly five-mile hike with over 3,000 feet of elevation gain from the trailhead near East Rosebud Lake. Historically, nearly all the lakes in the Absaroka-Beartooth Wilderness were fishless, including Sylvan Lake. Golden trout have been thriving in Sylvan Lake waters since the late 1930s when they were brought to the area by train from their native range in California's Kern River drainage.

FWP's mountain lakes crew, fish health, and hatchery personnel will hike into Sylvan Lake within days of ice out, usually late June or early July, to collect and spawn golden trout. Golden trout are outlet spawners, so during the spawn they congregate near the outlet of the lake. When moving towards the outlet, they can be relatively easy to capture in gillnets that are checked every hour to avoid mortality to fish. After capture, fish are sorted and placed in separate net pens based on sex. Spawning begins once a sufficient number of fish have been collected. First, eggs from 2-3 females are stripped into a bowl. Then milt from 2-3 males is added to the bowl. After several minutes to allow for fertilization, the eggs are rinsed and gently placed into a small water cooler that will be their vessel for transport to the hatchery. This process continues until all captured fish have been spawned. After spawning is complete, 60 of the spawned out golden trout are sacrificed to be necropsied by FWP fish health staff to ensure they are not carrying any diseases that could be inadvertently transferred to the hatchery or other waters.

In 2017, the last Golden Year, a total of 28,520 golden trout were stocked into 18 separate mountain lakes in Montana. Mountain lakes are typically stocked with 100-200 fish per surface acre. The majority of stocked golden trout lakes lie within the Absaroka-Beartooth Wilderness, with a few lakes in the Mission Mountains and in the Beaverhead National Forest. The 2023 stocking plan calls for stocking 20,520 golden trout into 17 lakes in Montana. A typical female Sylvan Lake golden trout has 500-1000 eggs to give, so we will be looking to spawn at least 30 pairs in this Golden Year.

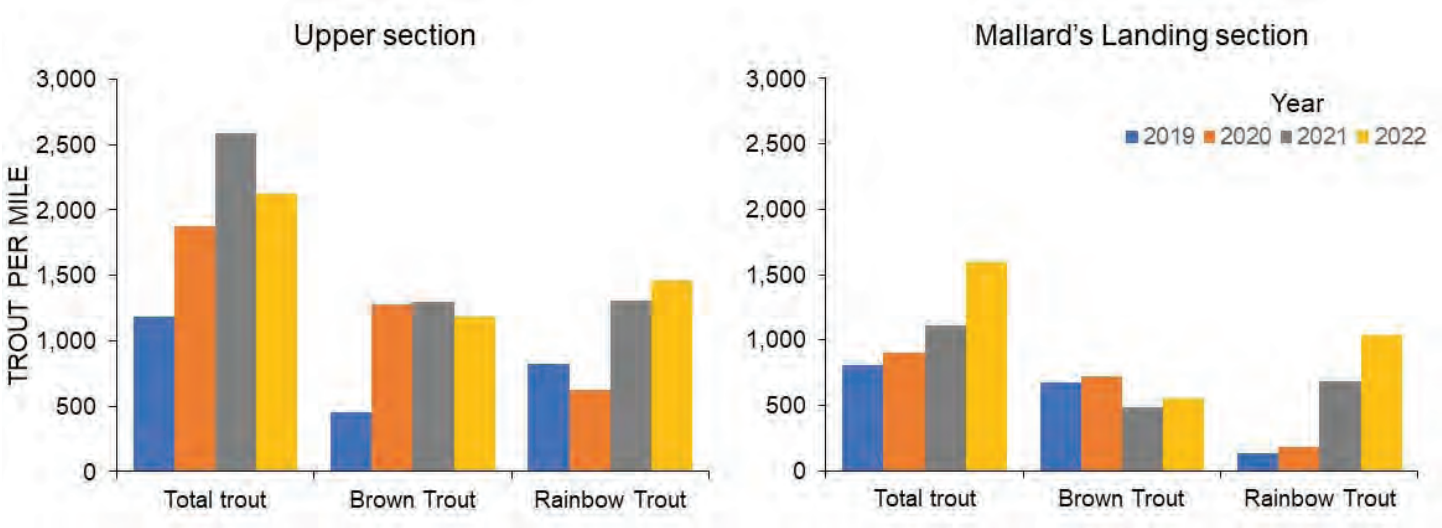
A golden trout from the 2017 Sylvan Lake progeny captured in Rock Tree Lake.

Bighorn Wild Trout Fishery Update

Fisheries technician Chrissy Webb measuring and weighing an adult brown trout.

Trout in the Bighorn River are wild, meaning they have never been in a hatchery. Wild trout are incredibly resilient as they live in dynamic river systems and move about in constantly changing environments to eat, rest, and spawn. Like other wild fish populations, Bighorn River trout experience fluctuations in population and size in response to river conditions. And river conditions have varied dramatically over the last five years. Sustained, high flushing flows in the spring and summers of 2017–2019, and drought conditions in 2020 and 2021 created challenging conditions for fish and anglers. However, 2022 flows were generally favorable for trout survival and recruitment, even with a short period of high flows (i.e., 7,000 cfs) in June. As a result, the number of trout in the Bighorn River is trending up from record lows in 2019, but still below the 30-year average.

The fisheries objectives for the trout section of the Bighorn River are to maintain high numbers of multiple year-classes of wild trout. Surveys are performed biannually using mark-recapture techniques at two sites that represent the upper and lower sections of the coldwater fishery on the Bighorn River. Fish captured during sampling are quickly weighed and measured, then released. We use this data to evaluate the population trends, recruitment, and body condition of trout. In 2022, the combined abundances of brown and rainbow trout were nearly double the 2019 estimates – 2,121 trout per mile (upper section) and 1,599 trout per mile (Mallard's Landing Fishing Access Site). There was also evi-



Population trends on the upper and lower sections of the trout portion of the Bighorn River from 2019–2022.

Fisheries crew lead Earl Radonski (retired) with a rare catch of a Yellowstone cutthroat trout on the Bighorn River.

dence of good recruitment as we observed many trout of both species under 6 inches. Like in 1997 and 2011, trout are still rebounding from low numbers with more juvenile fish surviving and growing rapidly! This creates an abundance of 8 to 12-inch fish and good numbers of larger individuals available for spawning and anglers. Body condition of trout continues to be high which makes for beautiful, healthy fish. Average total length of trout was 14.2 inches with a weight of 1.8 pounds.

There were a couple noteworthy occurrences in 2022. Fisheries crews caught a Yellowstone cutthroat trout in April which is exciting and rare. Rainbow trout were observed in much higher numbers than in recent years past, which could be reflective of the species ability to do well in drought conditions. Additionally, short-lived high flow events, like the one in June, can be beneficial to the fishery by clearing out fine sediments that smother spawning and food-producing gravels. The mouths of several side channels appear to have been hydraulically improved.

The Bighorn River remains a world-class wild trout fishery. For 2023, FWP anticipates the number of wild trout in the Bighorn River will continue to increase given favorable environmental conditions over the winter and into the spring. Moving forward, FWP will continue monitoring trout populations, implement a roving creel survey, and continue to work cooperatively with partners (e.g., Bureau of Reclamation, Bighorn River Alliance) on issues aimed at improving river and wild trout resiliency.

Wild Fish Resiliency After Historic Flood

On June 13, 2022, the drainages in the Absaroka-Beartooth Mountains were transformed. The mountains received an equivalent of five inches of snow melt when a spring storm rained on an abnormally large June snowpack. The rain on snow resulted in an unprecedented flooding event in recorded history for the area. While this was a rare historic event, events like these have become more common recently and can happen any year.

Flooding certainly affects humans, but how does it affect the fish and the rivers they call home? Overall, floods can act as a reset button for a system. Floods recruit woody debris, create pools, carve out new side channels, and deposits new gravel. Woody debris and pools are important habitat for fish, and the extra depth can provide thermal refugia for fish during the summer months when there are low flows and high-water temperatures. Side channels provide habitat for juvenile fish and, along with new gravel, spawning habitat to increase recruitment.

Wild fish are resilient. Following large flooding events, we have found that fish populations respond positively in the long-term. In some instances, fish populations may decrease slightly immediately after the event, but they rebound to higher levels, likely due to increased recruitment, growth, and survival. Recently, FWP completed an annual spawning survey on a long-term monitoring section on West Rosebud Creek and documented redds in side channels that were formed by these floods in June. Along with fish, macroinvertebrates tend to follow the same trends with a short-term population decrease followed by a rebound, as they respond well to the redistribution of sediment. Some invertebrates, like salmonflies, can have big hatches the year following a flood.

Since the June flood, we sampled two electrofishing sections on the Stillwater River this fall and plan to sample sections on the Yellowstone River, Stillwater River, Boulder River, and Rock Creek in the spring of 2023 as part of our long-term population monitoring. Most of these sections are completed every two years; however, we are prioritizing them over the next few years to assess any flooding effects on the population.

It's becoming increasingly important to manage our rivers as wild fisheries and allow streams to function

Yellowstone River near Billings, Montana on June 14, 2022. 75,000 CFS.

as naturally as possible. We know that the river will not be the same the river you stepped into before the flood, your favorite fishing hole might not be there anymore, but there might be an upgraded version a little way upstream or downstream. Explore and find a new favorite spot! Remember, wild fish are resilient. They exhibit a variety of qualities over hatchery fish including genetic and phenotypic diversity, variable life-history strategies, the ability to colonize and use new habitats, and higher levels of fitness and fecundity. These qualities are why wild fish can endure events like June 2022, they're adaptive. And that resiliency and adaptability are why we manage for wild fish in our Montana rivers.

Fisheries Update at Lake Elmo State Park

After a winter and spring of busy construction at Lake Elmo State Park in Billings, Montana, the lake is returning to the productive fishery it was before invasive corbiculid clams were discovered in 2019. Over the winter of 2021–2022 Montana Fish, Wildlife & Parks (FWP), drained Lake Elmo to remove the population of invasive clams. Spring and summer surveys found many juvenile and adult corbiculid mortalities throughout the lake and no live individuals.

A catfish condo.

While the lake was drained, improvements were made to the state park's trails, headgate, angler access, and fish habitat. Two earthen fishing jetties were constructed on the south and west ends of Lake Elmo to spread out shoreline anglers and increase access to greater depths. With the help of a Boy Scout troop, catfish condos were constructed and placed strategically throughout the lake. Catfish condos provide cover for

Fisheries technician Brad Olszewski puts the final touches on Georgia Cubes.

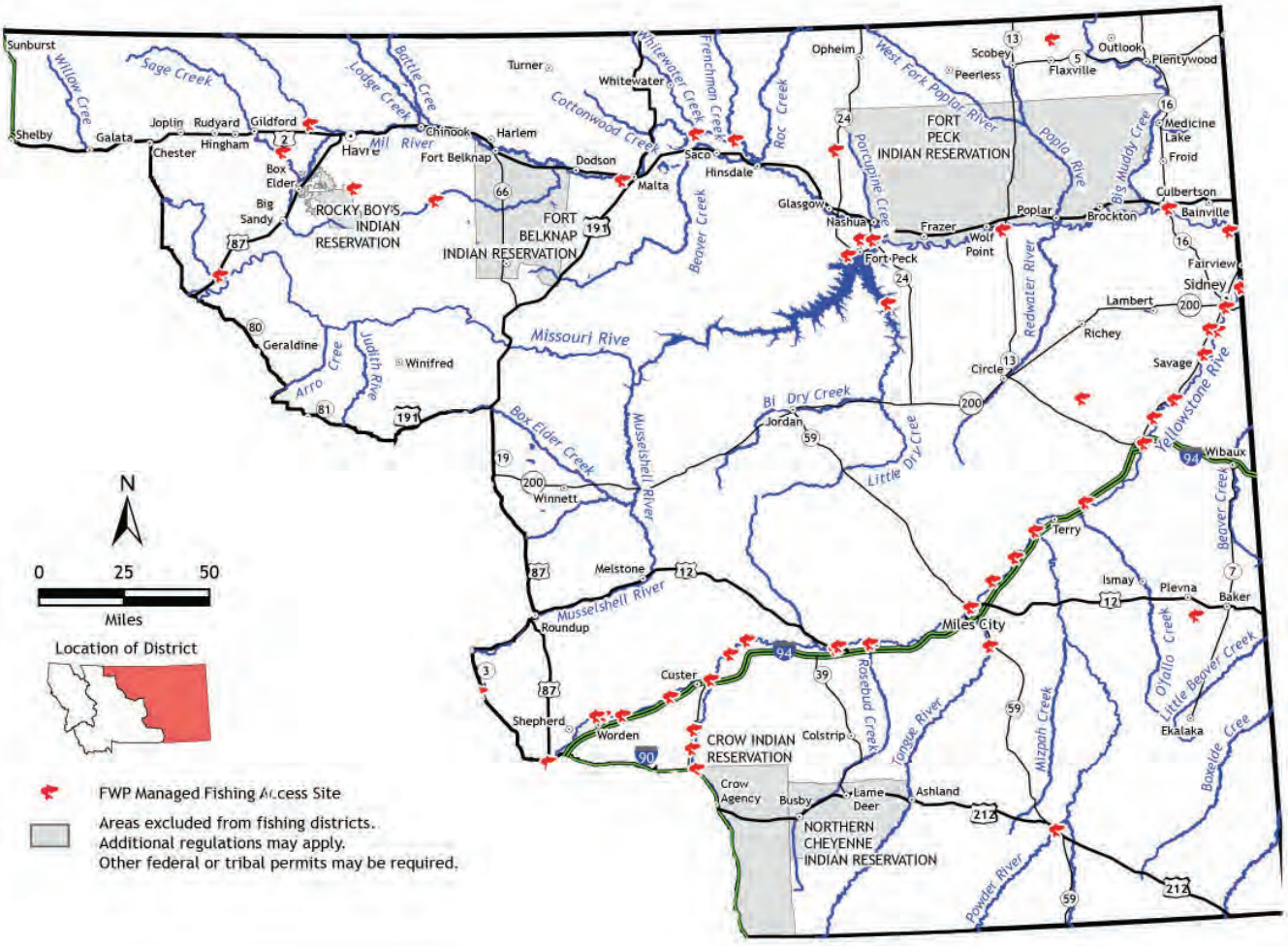
all fish and encourage cavity-nesting catfish to spawn. We also built and placed over 20 Georgia Cubes, which are structures that provide habitat and cover for both sport and baitfish. Georgia Cubes attract fish and, subsequently, anglers. To add habitat and provide more spawning substrate for minnows and panfish, brushy piles (made of felled Russian olive trees) were scattered throughout the lake and three gravel beds were added. Additionally, several trenches were excavated along the east side of the lake to increase depth and lakebed complexity. The trail on the east side of the lake, paralleling Lake Elmo Drive, was moved away from the road, widened, and paved to increase park user safety.

Restocking fish began in spring 2022 as the lake was refilling. Rainbow trout, brown trout, Yellowstone cutthroat trout, channel catfish (juveniles and adults), fathead minnows, bluegill, and yellow perch were stocked earlier this year. We hope to stock largemouth bass and crappie in 2023. In late October, FWP planted 75 juvenile tiger muskies from the Miles City Fish Hatchery varying in length from 6-12 inches into Lake Elmo.

Tiger muskies are a hybrid between northern pike and muskellunge that rarely occur in the wild. Most are produced in hatcheries. Because they are sterile, the population of tiger muskies in Lake Elmo will not increase naturally. Tiger muskies in Lake Elmo serve two purposes. One is to diversify angling opportunities for this popular urban fishery and the other is to help control the population of nongame fish that enter the lake from the Yellowstone River from an irrigation ditch. As aggressive piscivores (meaning they eat other fish), tiger muskies are often used as a biological control to manage unwanted species, such as suckers and carp. Although ditch headgates are screened to prevent some fish passage, small individuals can get through and enter Lake Elmo. Originally, FWP was planning on stocking tiger muskies in late 2024 to let the sportfish populations establish. However, netting efforts in Lake Elmo earlier this autumn showed much higher numbers of juvenile white suckers, longnose suckers, and common carp than anticipated. Because of these results, FWP moved forward on stocking tiger muskies to reduce the population of these species. Tiger muskies grow quickly in their first couple years and should be a fun challenge to target.

Regional fisheries manager Shannon Blackburn stocking an adult channel catfish into Lake Elmo.

EASTERN FISHING DISTRICT



The Eastern Fishing District includes all waters lying east of the Central Fishing District. For the boundary description, see Central Fishing District, page 25.

Note: Roadways that are used as boundaries between the Central and Eastern Fishing Districts are interpreted to be in the Central Fishing District.

For additional information regarding the boundaries of this district, please call the following regional headquarters Monday-Friday 8:00 am. - 5:00 pm.:

Billings..... 406-247-2940
Glasgow..... 406-228-3700
Great Falls..... 406-454-5840
Havre Area Resource Office..... 406-265-6177
Lewistown Area Office..... 406-538-4658
Miles City..... 406-234-0900
TTY (Telephone device for the deaf) ..... 711 or 1-800-253-4091

Region 6 Northeast Montana

New Fort Peck Fisheries Management Plan to Guide Management for the Next 10 Years

FWP needs your Fort Peck fishing pics for the cover of the new plan!

Montana Fish, Wildlife & Parks is developing updates to the new 10-year fisheries management plan for Fort Peck Reservoir. This plan will guide management of this incredible fishery through 2032 .

Plans require a lot of staff time and resources and are rarely read by anglers. So why does Fort Peck need a plan? Here are a couple points to consider when evaluating the merits of a plan.

- **Public involvement.** It's critical that the public is involved in the planning process to ensure buy-in and ownership in the management of the fishery. The Fort Peck planning process started in the spring of 2022 with a survey mailed out to 3,000 resident anglers. Most were mailed to Eastern Montana anglers as use data shows that roughly 75% of anglers fishing Fort Peck come from counties east of Billings and Great Falls (including those cities). Respondents indicated general satisfaction with the fisheries management direction resulting in minor changes made to the plan. These changes were incorporated into a draft plan which will go out for public comment this spring. Open houses will be held during this comment period in Glasgow, Lewistown, Miles City and Billings.

- **Clear direction.** The Fort Peck plan goal states: *The goal of the plan is to emphasize the walleye fishery utilizing walleye production from Montana warm water hatcheries while maintaining and enhancing the multi-species fishery that includes northern pike, smallmouth bass, chinook salmon and lake trout. Success of the sport fishery relies on a sustainable forage base including pelagic and shoreline forage species.*

    - Walleye have been king on Fort Peck since the 1970s when FWP made a commitment to stock walleyes on a consistent basis.

    - The multi-species fishery including lake trout, chinook salmon, northern pike and smallmouth bass are gaining in popularity. As anglers increasingly target these species, more management resources could be directed to them.

- **Long term vision.** This plan and the plans that preceded it were for a 10-year period. This is important as fish populations, especially for long-lived species, do not respond quickly to changes.

As an example, the 2011-year class of walleyes is one of the larger year classes produced in recent history on Fort Peck.

- This year class is still going strong 11 years later, but numbers will start to decline in the next 5 years as these fish reach the upper end of longevity. There are several good year classes of walleye coming up, but anglers need to be aware as the 2011 year class starts to age out of the population.

- Fort Peck is a huge waterbody that experiences (sometimes prolonged) wet and dry cycles. The biological changes that occur during these cycles are profound andlong-lasting to the fishery. The fishery is still "riding the wave" of productivity that occurred during 2008-2011 wet cycle. Conversely, water levels have been declining since 2021 and are currently 30 feet below full pool. Reservoir fisheries suffer during drought periods as productivity decreases due to lack of nutrient inputs. This ultimately translates into decreased fish growth and survival with some species being impacted more than others.

- This long view also forces managers to look into the crystal ball and ask questions to determine if there are emerging threats to the fishery. For example, couldnew real time electronics have any impacts on angling related mortality of certain species?

- **Accountability.** This plan lists goals and strategies for key sportfish and forage species. These targets are reviewed annually with the public to determine the effectiveness of management actions. This is the feedback loop with the public to ensure the fishery is being managed as per the guidance established in the management plan.

Lastly, FWP will be using angler submitted pictures on the cover of the new plan. Please send Fort Peck angling pictures (all species) on to: fwprg62@mt.gov with the subject **Fort Peck pics**.

FWP Partners with Eagle Scout Project to Turn Christmas Trees into Fish Habitat

The Fort Peck Trout Pond, connected to the Fort Peck Dredge Cuts, is a popular location for anglers looking for a change of scenery from the expanse of Fort Peck Reservoir and boat traffic of the Fort Peck Dredge Cuts. This popular Fishing Access Site (FAS) has great shoreline access including several fishing piers as well as handicapped access in several locations. Anglers at the Fort Peck Trout Pond target bluegill, yellow perch, largemouth bass, northern pike, and as the name would imply, rainbow trout.

Lane Thompson, pictured during the period Christmas trees were sold to the public.

Near-shore habitat is limited in the Trout Pond, primarily due to the dredging activities utilized during its construction. While the shoreline of the Trout Pond is surrounded by narrow and broadleaf cattails, steeply sloping contours just off the banks limit the amount of vegetation and complex habitat available to fish, especially prey species like bluegill and yellow perch. Due to relatively high abundance of piscivorous (fish eating) fishes in the Trout Pond, a lack of habitat for small-bodied and juvenile fish was determined to be limiting the fishery.

In winter 2021, FWP fisheries staff in collaboration with Glasgow Area Boy Scout Troop 861 began placing bundles of Christmas trees in the Trout Pond as an effort to increase habitat availability. Approximately 25 leftover trees from Troop 861's Christmas sales were placed in the northwest portion of the pond, with hopes that these bundles would be used as spawning and rearing habitat by yellow perch and bluegill.

In winter 2022, Lane Thompson, a member of Troop 861, led the Scout's effort during these activities as he completed his Eagle Scout project. Thompson and FWP fisheries staff expanded this project in 2022 using not just leftover trees, but also coordinating the return of trees after Christmas from members of the public. As a result of this partnership, Thompson, Troop 861, and FWP staff received approximately 125 trees following the holidays that were turned into artificial habitat and placed in the Trout Pond. Increased habitat availability for juvenile and small-bodied fishes as a result of this effort is expected to benefit a number of species, ultimately improving the fishery.

Troop 861 pictured with tree bundles constructed on the ice of the Fort Peck Trout Pond.

Lower Missouri River Pallid Sturgeon

FWP native species coordinator, Zach Shattuck, releasing a wild pallid sturgeon.

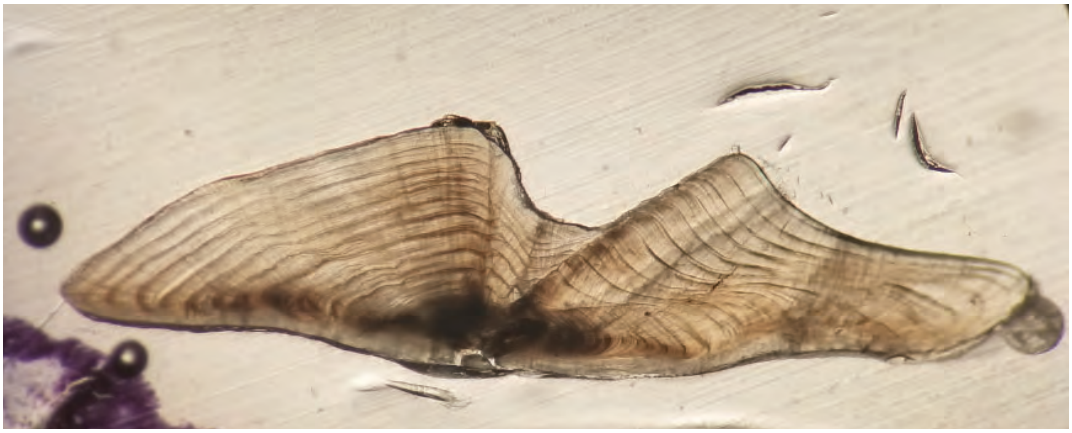
Montana Fish, Wildlife & Parks collaborates with the U.S. Army Corps of Engineers (ACOE), the U.S. Geological Survey (USGS), the U.S. Fish & Wildlife Service (USFWS), as well as other federal and state agencies to conduct monitoring and research on all aspects of pallid sturgeon life history. Due to a shortage in federal funding for the 2022 field season, FWP's scope of activities was significantly reduced from the previous 16 years. Nevertheless, FWP was still able to monitor movement, production, and potential recruitment of pallid sturgeon in the Missouri River downstream of Fort Peck Dam.

The 2022 field season can be summed up in one word, "drought." The drought that is currently plaguing the upper Missouri River basin made for relatively low flows in the Missouri River and its tributaries. There was virtually no spring freshet during the late spring and early summer. These low water flows lead to minimal use by adult pallid sturgeon of the Missouri River downstream of Fort Peck Dam. Similarly, low flows in the Missouri River and its tributary the Milk River seem to have limited shovelnose sturgeon production.

Probably the most interesting finding of the 2022 field season, was the movement of one hatchery reared adult female pallid sturgeon. This individual, which we call code 302 did move up the Missouri River in the early spring before flows on the Yellowstone River had increased. FWP was able to catch her and evaluate her reproductive status. The black eggs she was carrying indicated that this fish would likely spawn in 2022. Subsequently, flows dropped in the Missouri River during late spring, and she made a downstream migration of over 150 miles and headed into the Yellowstone River where crews from the USGS believed she spawned.

The drought has affected the biology of the pallid sturgeon and shovelnose sturgeon population in the lower Missouri River and has also limited the ability of the ACOE to perform a large-scale flow test for pallid sturgeon. During 2021, the ACOE issued a Record of Decision (ROD) that test flows from Fort Peck Dam would occur to test the hypothesis that flow releases from Fort Peck Dam could attract, retain, and aggregate reproductive ready pallid sturgeon, leading to successful spawning, drift, larval development and recruitment of pallid sturgeon. Test flows could occur 3 to 5 in the future when specific hydrological criteria are met (Fort Peck Reservoir cannot be lower than 2,227 feet, minimum and maximum flow constraints at Wolf Point and Culbertson). When implemented, flow in the river will be a combination of water coming from the Fort Peck powerhouse, Fort Peck Spillway and major tributaries like the Milk River. Data indicates that the limiting factor in pallid sturgeon recruitment occurs in their early life history when free-embryos drift for several days after being hatched. Due to the mainstem dams on the Missouri River, the amount of free-flowing river has been decreased and the distance that pallid sturgeon free embryos have available to drift before being able to swim and feed is limited. Therefore, the basis of the Fort Peck test flows is to mimic a spring freshet downstream of Fort Peck Dam which may trigger sexually mature pallid sturgeon to migrate up the Missouri River and spawn near the Fort Peck Dam project.

Small Otoliths Provide Big Insight on an Even Bigger Body of Water



Annular marks from a sectioned walleye otolith determined to be 11 years old.

Walleye stocking efforts are an important component of fisheries management across much of North America. This holds especially true in water bodies where limited natural reproduction occurs. However, assessing the success of large-scale walleye stocking efforts on a massive waterbody such as Fort Peck can be a daunting task. Oxytetracycline (OTC) has been used to mark hatchery-reared walleye in the past but has its limitations. OTC marking requires a six-hour immersion to form a visible mark on the otolith which prevents its use with large batches of hatchery fish. Since Fort Peck Reservoir receives an average of 2.5 million fingerlings and 20.3 million fry annually, makes the use of OTC logistically unfeasible.

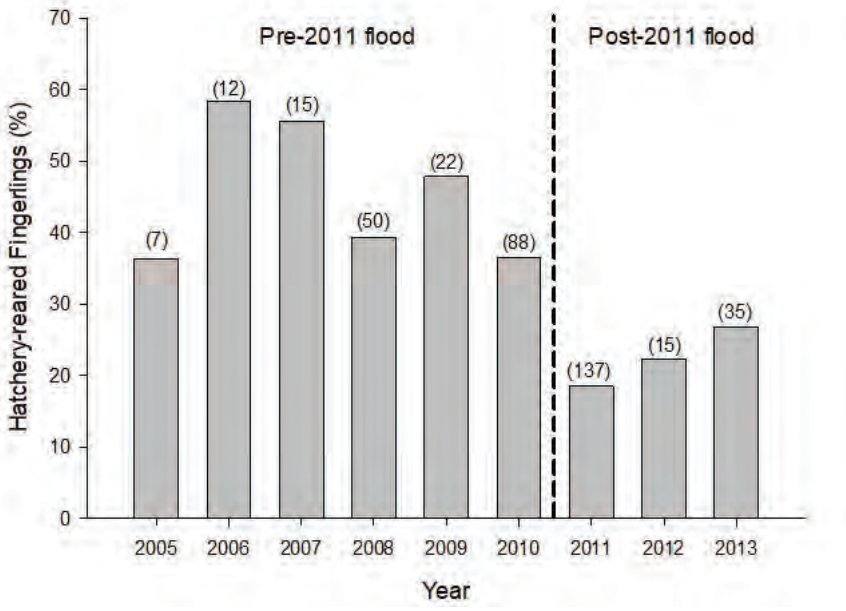
This is where otolith microchemistry comes into play. Otolith microchemistry examines unique combinations of elements and isotopes in the otoliths or ear bones of fish to ultimately determine the origin of that fish. Otoliths deposit annual rings much like trees, but they also absorb the unique combination of isotopes and chemical elements contained within the water such as strontium, barium, calcium, and magnesium. Streams, rivers, lakes, reservoirs, and even hatcheries will typically have their own different composition of elements creating a unique signature. This means a natural "marker" is already present and there is no need to mark the fish! We used this technique to determine natal (or birthplace) origin to differentiate between hatchery-reared fingerlings and wild walleye. Ultimately, we are attempting to determine the contribution of these two groups of fish to the Fort Peck walleye fishery. By measuring otolith elemental concentrations at the core or nucleus of the otolith, we can identify if the walleye originated from the hatchery or from a particular location in Fort Peck Reservoir or tributary.

So, what information did this cutting-edge technology yield? Because this study examined different cohorts of walleye that originated from the 2005-2013 period, we were able to examine what affect reservoir elevation changes had on walleye survival. Hatchery-reared walleye fingerlings comprised 31% of the fishery during the study period. During the low water years of 2006 and 2007 hatchery-reared walleye fingerling contributed over 50%. Conversely, when reservoir elevations were increasing and providing additional spawning and rearing habitat, contribution of stocked walleye fingerling decreased to 18% in 2011. This suggests that natural reproduction likely contributed heavily to the large 2011-year class of walleye and that these fish originated from the Big Dry Creek arm of the reservoir. Standardized gillnetting surveys confirmed this as large numbers of small walleye were captured following the historic flood year of 2011. In fact, this record year class of walleye is still swimming in the system today. Results also indicated successful natural reproduction was occurring in the Missouri River above Fort Peck Reservoir and was more consistent during periods of lower reservoir elevations.

The results of this study indicate stocking of walleye fingerlings is an important management tool for supplementing the walleye fishery in Fort Peck Reservoir. This especially holds true during drought years when reservoir elevations and inflows are low enough to limit migration and successful spawning in the Big Dry Creek. However, natural reproduction can contribute large numbers of walleye when water conditions are more favorable by providing access to quality spawning and rearing habitat. This research also recognizes the important role tributaries such as the Big Dry Arm and Missouri River play in the spawning and rearing of walleye. By identifying these spawning areas, it also assists with stocking strategies. It would be counterproductive to stock hatchery walleye in areas that see more

consistent natural reproduction. Stocking additional walleye in these areas would create competition for limited resources such as food and habitat with naturally reproduced fish. Ultimately, this could lead to slow growth rates and decreased survival which would defeat the purpose of stocking efforts to supplement the fishery.

Lastly, this study was not able to determine contribution of hatchery walleye fry to the fishery. This is due to the short residence time that fry spend in the hatchery before being stocked. This short window does not allow the unique elements to lay down a "signature" on the fry. Additional studies are planned to try to overcome this through the development of a unique mark that could be applied and taken up by the fry in a short period of time.



Contribution of hatchery-reared walleye fingerling to Fort Peck Reservoir by cohort. Number of walleye sampled per year are represented in parenthesis above the bars.

Prolonging Pond Productivity - Habitat Enhancement at Reser Reservoir

Artificial habitat structures FWP has recently used in Region 6 ponds.

Many small impoundments in Region 6 were constructed shortly after the Dust Bowl and are now getting a bit long in the tooth. Like most things that age, pond ecosystems lose a fair amount of biological production ability they had when they were young. Decades of erosion and sedimentation decreases pond depth and enhances aquatic vegetation growth as the pond gets shallower. The gradual decrease in depth and accumulation of sediment affects water quality leading to higher rates of winter and summer fish kills. Other impacts of pond aging (called eutrophication) include loss of zooplankton and invertebrate production as well as loss of spawning substrates. The cumulative impacts of these factors lead to a general decrease in the ponds value as a fishery. Fisheries managers work to offset these losses and at times will prescribe a habitat enhancement plan to maintain or improve a ponds fishery value. Biologist first need to identify that habitat is a limiting factor before investing time a resources in the project. Also, these projects can be costly but if successful can add productive years back to the aging pond.

In June 2022, one of these habitat enhancement projects was completed at Reser Reservoir, a Bureau of Land Management (BLM) reservoir located in Blaine County near the cities of Havre and Chinook. The project started in 2019, when the reservoir was drawn down to upgrade infrastructure. The BLM partnered with FWP to develop a plan to increase aquatic habitats and angling access at Reser while water levels were reduced. The primary goal was to increase the amount of available spawning and rearing habitats for warmwater species like fathead minnow, bluegill, black crappie, and largemouth bass. A secondary goal was to increase invertebrate production and water quality using diversified aquatic habitats at variable depths. A small boat ramp and two shoreline access paths were also constructed by the BLM to increase safe access for small boats and shore anglers.

Spawning structure.

Seven spawning structures were constructed using almost 500 cubic yards (the equivalent to 55,000 basketballs) of one-fourth inches - three-fourths inches gravel and sand mix. The structures were placed near shore with low gradient slopes, in areas not exposed to prevailing winds. Largemouth bass, bluegill, and black crappie are all bed spawners, where males actively seek out preferred substrates to fan out small depressions for a female to lay eggs. The beds are then guarded until the small fry disperse from the bed. The material for

Rock vein and pile.

Aerial view of Reser post enhancement and waiting to refill.

the spawning habitat was strategically used to attract these species to the structures. The smaller sized gravel and sand allows the fish to easily move and clean the substrates during bed building.

Four rock piles and three rock veins were also constructed using nearly 400 tons (60 times heavier than an elephant) of large rock. The piles and veins varied in size and were placed in deeper depths and in locations with no naturally occurring bottom complexity. These structures will be used by smaller fish as rearing habitats and will also attract larger predatory fish yearround. Additional habitat enhancement that will occur includes the use of bundled trees and artificial dome structures.

The habitat enhancement costs totaled $70,000 with funding provided through the Future Fisheries Improvement Program and BLM. The improvements made at Reser will optimize spawning and rearing habitats, diversify aquatic habitats, and prolong the productivity and fisheries value of this pond well into the future.

Reser is currently drawn down and it will take some time before water levels return to full pool elevations, especially given the recent drought conditions along the Hi-Line. FWP will continue to identify and pursue additional habitat enhancement projects at Region 6 public fishing ponds in need of a production boost. These pond fisheries have provided anglers with diverse fishing opportunities and FWP will strive to maintain that opportunity for decades to come.

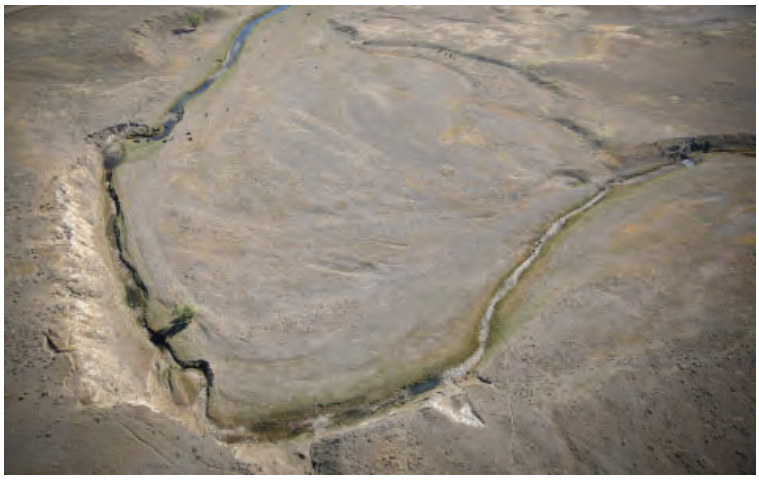
Planes, Pike, and Passage: Using Flights to Guide Management of Northeast Montana Streams

The prairie streams of northeast Montana are home to a variety of game and nongame fish species. These small, warmwater streams generally lose flow during the summer and winter months, and the resulting intermittent pools are the only remaining habitat for fish species that inhabit them. Spring runoff is critical for restoring flow to reconnect these intermittent pools, as it allows fish species to recolonize reaches that were isolated during low water periods. Beginning in the 1950s the construction of stock dams, primarily for livestock grazing, began interrupting this reconnection of prairie streams. Now, hundreds of earthen dams, cattle crossings, and road crossings create barriers that prevent fish passage throughout streams across northeast Montana. Recolonization within these prairie streams is important not only for fish, but for the ecosystem as a whole.

Barriers preventing fish passage within prairie streams are not the only management concern for fishes residing in them. The expansion of nonnative species, primarily northern pike, has negatively impacted many native fish species within these streams. Even at small sizes, northern pike are incredibly efficient predators that thrive in intermittent pools formed as a result of barriers within prairie streams. Diversity of fishes often decreases when northern pike are present. This presents a challenge for managers wishing to restore fish passage within prairie streams by removing barriers, as it may lead to further expansion of northern pike.

To identify barriers, guide fish sampling efforts, and determine opportunities for restoration activities Region 6 fisheries staff have taken an aerial approach. Contracted flight surveys of two streams in Valley County and two streams in Blaine County produced high-definition photographs of barriers inhibiting fish passage and associated habitats. These photo series allow biologists to quantify barriers as well as aid in developing strategies for restoring fish passage via barrier removal. Biologists then sample individual pools identified from aerial photography to determine fish populations, including the presence or absence of northern pike. This fish sampling allows biologists to evaluate potential fish passage and stream restoration between pools lacking northern pike. Further, more naturalized flows in prairie streams ultimately increase habitat availability, allowing for greater fish diversity and improvement of ecosystem health.

Example of an in-channel dam - Larb Creek, Valley County.



Overview of a section of Snake Creek, Blaine County.

Example of a hardened crossing – Larb Creek, Valley County.

Region 7 Southeast Montana

Pallid Sturgeon Migrations and Intake Project Update

Yellowstone & Missouri River Pallid Sturgeon Population:

- This population utilizes the Missouri River between Fort Peck Dam and Lake Sakakawea, Yellowstone River between Missouri River and Forsyth area, and Tongue and Powder rivers.

- Pallid sturgeon are river species and generally avoid lake habitats. Heritage adults generally reside year-round in the lower 20 miles of the Yellowstone River and lower 40 miles of the Missouri River. Venturing upstream only during the April-July spawning period.

- Most recent pallid sturgeon population estimate: 90 heritage adults and approximately 20,000 hatchery released juveniles.

- Population bottleneck – larval pallid sturgeon perish when they drift into the headwaters of Lake Sakakawea. As river water transitions to the lake, the suspended silt and organic material settles to the lakebed where larval pallid sturgeon drift. This rich layer of organic material and silt includes extremely low to no oxygen levels that suffocate or bury larval pallid sturgeon. Thus, natural recruitment of a year-class to age-one has not occurred since at least the mid-1960s when Lake Sakakawea filled with water. Demonstrates the age of remaining heritage fish is a minimum of 60 years old.

- After hatching from the egg, larval pallid sturgeon require 9-14 days of growth before attaining capacity to physically hold in the river and stop downstream drift.

- Recovery needs and actions include allowing adult pallid sturgeon to maximize upstream spawning migrations, including upstream of Intake Diversion Dam (located 71 river miles upstream from the Yellowstone-Missouri confluence).

- Heritage adults demonstrate spawning migrations in both the Yellowstone and Missouri rivers, stimulated by increased river flows in April-June that generally include high turbidity.

- Pallid sturgeon in Montana are visually and genetically distinct from pallid sturgeon in downstream states. Montana has few pallid-shovelnose sturgeon hybrids compared to downstream populations which have a high composition of hybrids.

Pallid Sturgeon Monitoring:

- Internal transmitters were implanted in 60 heritage adults and 150 hatchery juvenile pallid sturgeon.

Large heritage female pallid sturgeon near Fairview; photo by FWP.

- Fish tracked by 30 receiver base stations (see map for locations), some with remote satellite communication, and manual boat & airplane tracking.

- Focus on induvial fish migrations, spawning aggregations, and habitat usage.

- A 4-year pre-bypass channel migration study (2015-2018) and post-bypass channel study was conducted (2022-2025) at Intake. Five fish species (pallid sturgeon, shovelnose sturgeon, paddlefish, blue sucker and sauger) were included in these studies.

- Larval fish sampling June-July upstream of the Missouri-Yellowstone confluence and three locations each at the Yellowstone-Tongue and Yellowstone-Powder confluences.

- Survival, growth rates, and distribution monitoring of juvenile pallid sturgeon occurs in Aug.-Sept.

- Pallid sturgeon with transmitters that reached Intake Diversion Dam in 2017-2020 were translocated upstream of Intake. Provided an investigation/understanding if fish would continue to migrate upstream of Intake.

Intake Bypass Channel:

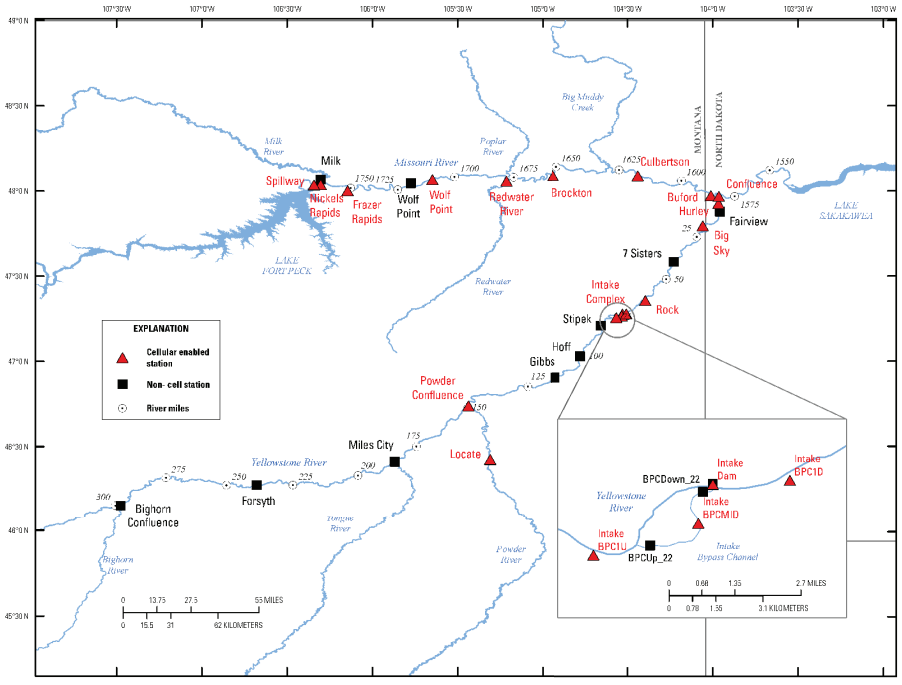
- New 1.9-mile-long excavated channel opened April 19, 2022.

- Twenty pallid sturgeon (adults and juveniles) with transmitters successfully used the bypass channel and continued migrations upstream. Apex migrations of these fish included Yellowstone River to Hathaway area (225 river miles upstream of Intake), Tongue River to T&Y Dam (134 river miles upstream of Intake), and Powder River near Powderville Bridge (176 river miles upstream of Intake).

- Apex migrations for fish residing upstream of Intake Diversion Dam included: Powder River upstream of Broadus (230 river miles upstream of Intake) and Cartersville Diversion Dam at Forsyth (166 river miles upstream of Intake).

- Adult pallid sturgeon presence during spawning migrations (April-July) likely annual event upstream of Intake.

- Juvenile hatchery origin pallid sturgeon released between (1997-2022) present in the Yellowstone River year-round downstream of Forsyth.



Telemetry base station map, provided by U.S. Geological Services.

- Exponential increase in spawning adults as hatchery juveniles reach sexually maturity over the next 10-20 years.

- Awareness of pallid sturgeon presence in the Yellowstone River drainage relative to 310 projects.

- Awareness to include or improve screening on pumps and headgates to minimize entrainment of adult, juvenile and larval pallid sturgeon into irrigation infrastructure.

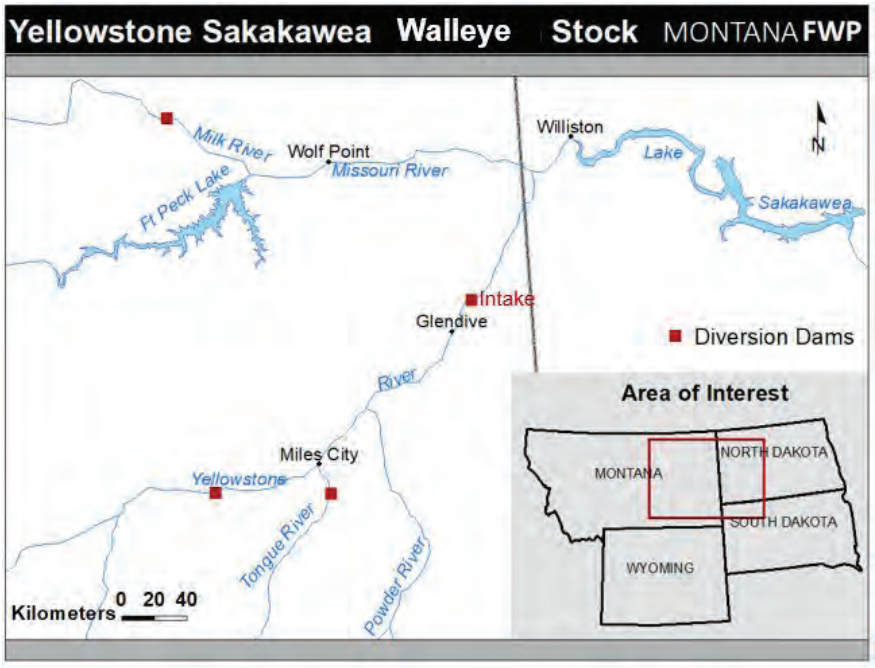
- Explore improving sturgeon passage at T&Y Dam in the Tongue River.

- Explore NGO and government programs/funds to assist local stakeholders with voluntary proactive pallid sturgeon efforts.

Intake Diversion Dam and Bypass Channel, provided by U.S. Bureau of Reclamation.

Apex pallid sturgeon migrations (adults & juveniles) in the Yellowstone, Tongue & Powder rivers, 2014-2022.

Wild Fish Transfers, A Walleye Management Tool for Community Ponds



In Region 7 we have recently been using wild fish transfers of adult walleye to improve angler opportunity in community ponds. Each April, there is a run of migratory walleye that move upstream from Lake Sakakawea in North Dakota into the Yellowstone River in Montana to seek shallow gravel substrate for spawning. This run of walleye adds to resident walleye downstream of Intake Diversion Dam.

Some years, if water clarity and weather patterns cooperate, this run of walleye in the river can offer some of the best, local walleye angling. However, poor water clarity tends to minimize angler opportunity most years. This run of walleye is not a new discovery. FWP biologists, Mike Haddix and Christopher Estes described spawning locations and the migratory nature of this walleye population in the 1976 report titled Lower Yellowstone River Fishery Study. Furthermore, this spring run of walleye motivated biologists to collect eggs for propagating walleye in the hatchery system from 1984 to 1991. This Yellowstone River egg take was not very successful for a variety of reasons including a decline in walleye abundance in Lake Sakakawea, poor eye-up of eggs, and at times a sex ratio skewed towards males, a trend that continues today. In 2022, crews handled 1,542 sexually mature walleye, 96% of which were male. Most years we handle those fish with few or no angler boats on the water because high turbidity or abrupt weather changes shuts down the bite. A feeling of lost opportunity would often pass through my mind as we conducted tagging surveys knowing most of the tag returns would come from anglers fishing Lake Sakakawea in the months to follow, not from the Yellowstone River. Then one day while discussing plans for wild fish transfers, fisheries biologist Mat Rugg from Glendive suggested moving the migratory adult walleye into community ponds to improve fishing for these heavily used local fisheries.

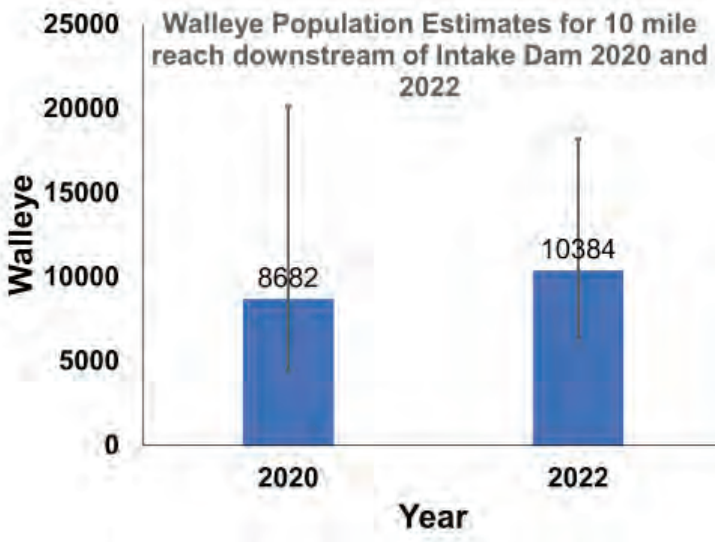
Walleye Wild Fish Transfer Summary for FWP Region 7

Date	Receiving Water	County	Number Transferred	Mean Length (inches)	Mean Weight (lbs)
5/6/2019	Baker Lake	Fallon	19	18.8	2.1
4/8/2020 & 4/10/2020	Baker Lake	Fallon	220	17.9	1.9
4/17/2020 & 4/20/2020	Spotted Eagle	Custer	200	18.3	2.0
4/14/2021 & 4/15/2021	Spotted Eagle	Custer	215	17.1	1.8
4/29/2021	Hollecker	Dawson	198	16.0	1.4
4/26/2022 & 5/4/2022	Baker Lake	Fallon	245	18.4	1.9
4/27/2022 & 4/29/2022	Spotted Eagle	Custer	262	17.8	2.0
4/22/2022 & 4/29/2022	Hollecker	Dawson	253	17.4	1.8

After approval by the Aquatic Fish Health Advisory Committee and clean test results for fish pathogens and aquatic invasive species of the donor water, a walleye transfer occurred on May 6, 2019 to the newly renovated Baker Lake. It was a modest transfer (19 fish) as most fish by that date had already moved downstream out of Montana and back into Lake Sakakawea. In spite of the small number of fish transferred, we received a few tag returns from Baker Lake anglers.

Since then, additional walleye transfers have resulted in expanding angler opportunity to catch these walleye in community ponds year round. We have also been estimating the size of the walleye run in the Intake reach of the Lower Yellowstone River (about a 10 mile stretch of river immediately downstream of Intake Dam) using tagging data. This has allowed us to determine whether the number of fish we are transferring out of the population will affect the viability of the run or angler opportunity remaining in the river. The data demonstrates we can provide additional walleye angling opportunity for community ponds in southeast Montana without diminishing the walleye run or cutting into river fishing opportunity. In 2022, we transferred a total of 760 adult walleye out of the Intake Reach, while our estimate of the size of the run was 10,384 walleye (95% lower confidence interval of 6394, 95% upper confidence interval of 18167), or about 7.3% transferred.

Based on tag returns and visual observation these transfers of adult walleye are leading to instant angling opportunity and have been well received in the communities of Miles City, Baker, and Glendive. One of our original questions was whether the effort of transferring these fish would be justified by realized angler opportunity. Angler feedback and tag returns has demonstrated that in this unique situation for a relatively small effort we can significantly augment the fishing opportunity in these community fisheries.



Region 8 Headquarters

Record Angler Pressure Estimates Set in 2020

The year 2020 presented a unique opportunity for FWP to conduct its biennial statewide angling pressure mail survey during an off year, a year in which a global pandemic may have influenced fishing pressure in the lakes and streams of Montana as people seemed driven to get outside. And indeed, they were . Montana's lakes and streams experienced an estimated 4,014,803 angler days during the 2020 license year, representing a record 28% increase in pressure from 2019. Not surprisingly, most of the angling pressure (67%) came from Montana residents as people were staying closer to home.

Percent change of statewide annual angling pressure between the years 2011-2020.

The drive to get outside was also felt by Montana state parks who experienced record visitation with an estimated 3.4 million individuals visiting a state park in 2020 (a 29.5% increase over 2019), while FWP's Aquatic Invasive Species Prevention Program and partners performed a record 174,423 watercraft inspections in 2020, a 54% increase from 2019.

All FWP regions saw an increase in angling pressure compared to the 2019 license year. Region 3 alone had over 1 million anglers in 2020, of which just 51% were residents. Most of this pressure came from all four sections of the Madison River totaling 303,205 estimated angler days. Region 6 had the largest percentage of lake fishing (76%) mainly due to Fort Peck. Region 4 had the largest percent of resident anglers (80%) primarily due to fishing on Canyon Ferry (94% of its 123,823 angler days were from residents).

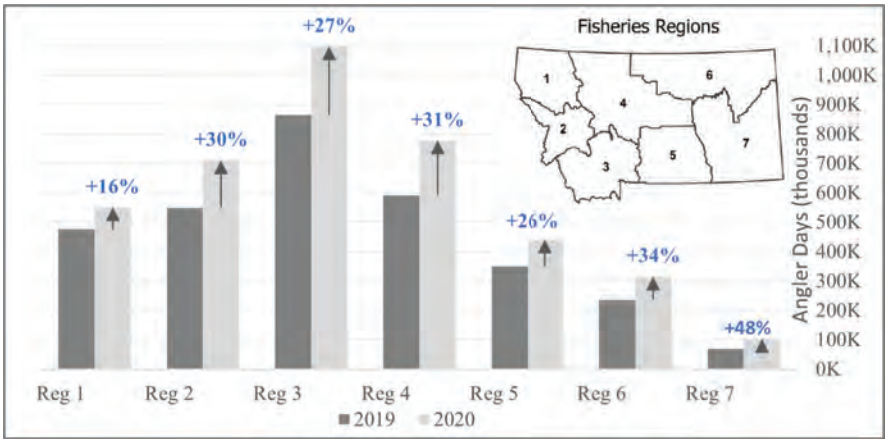
Other highlights from the Angling Pressure Survey:

- July was the most popular month for fishing in Montana with an estimated 817,487 angler days. March was the least popular 121,247 angler days.
- Looking to escape the crowds? The top three drainages in Montana with the least pressure were the Lower Milk River, Little Missouri River, and the Powder River drainages.

•Trout (43%) or rainbow trout (11%) were the species primarily targeted in most Montana drainages. Though walleye were primarily targeted in the Fort Peck, Marias, Tongue, and Upper and Middle Milk River drainages, and channel catfish were primarily targeted in the Powder, Lower Milk, and Lower and Middle Yellowstone River drainages.

•50% of anglers fished from shore, 36% boat, 9% shore and boat, and 4% ice.

•The highest angler satisfaction scores came from the St. Mary and Belly, South Fork of the Flathead, Beaverhead, Sun, and Powder River drainages.



Percent change of annual angling pressure by FWP region between 2019-2020.

Rank	Waterbody	Total pressure	Resident pressure	Nonresident pressure
1	Fort Peck Reservoir	191,495	109,408	82,087
2	Missouri River Sec 9	163,239	98,055	65,184
3	Madison River Sec 2A	135,037	48,768	86,268
4	Canyon Ferry Res	123,823	115,897	7,926
5	Georgetown Lake	93,530	71,084	22,446
6	Bitterroot River Sec 2	86,813	51,993	34,820
7	Madison River Sec 2B	77,013	16,809	60,204
8	Missouri River Sec 10a	74,319	61,300	13,019
9	Madison River Sec 1	68,474	36,023	32,451
10	Gallatin River Sec 3	68,379	22,859	45,520
11	Clark Fork River Sec 2	67,128	40,224	26,904
12	Gallatin River Sec 2	61,602	40,620	20,982

Top 12 pressure estimates for individual waterbodies (in angler days)

FWP has conducted its statewide angling mail surveys for over 60 years; (biennially since 1989). Pressure estimates are a useful resource for the Fisheries Division to make informed management decisions, as well as provide important data for estimating the statewide economic value of expenditures from fishing activity. The survey is sent out to a random sample of 67,600 resident and nonresident license holders, asking anglers which lakes and streams they fished, satisfaction, access, and species targeted. Estimated angling pressure is calculated monthly, based on the number of respondents, days fished on a particular waterbody, and the number of eligible anglers that month.

The 2021 angler pressure survey was recently conducted during the license year beginning March 1, 2021 to February 29, 2022. Results from the 2021 survey will be available in 2023. Results from all recent angler pressure surveys can be found online at https://fwp.mt.gov/fish/pressure-surveys.

The Great Montana Crayfish Project (2021-2022)

In 2021, an elite biologist unit was sent to HR for an infraction they didn't commit. These women (and men) promptly escaped from a maximum- security desk job and went to the Montana underground. Today, still wanted by the government, they survive as scientists of fortune. If you have a problem, no one else can help, and you can find them, maybe you can hire, THE CRAY TEAM [insert "The A-Team" theme music here]. You may have seen the videos or heard some whispers about the Cray Team.

Some time ago (exact years unspecified, they're not old), David Schmetterling and Susie Adams collaborated on some sculpin research in Montana. This collaboration morphed into something that would appear to an outsider as a love/hate relationship between two scientists with similar interests and a lasting friendship. This relationship (as well as their positions within FWP and the USDA Forest Service [USFS], respectively) brought about another collaborative project—to document the crayfish species in Montana—and THE CRAY TEAM was hatched! Like the little crayling it was!

Me, their ~~cheap labor hired help~~ consulting scientist, have always been interested in crayfish (aka crawdads), starting out as a kid with my head in the water trying to catch them so I could look at them more closely, and later in life as an aquatic invasive species scientist with FWP. I was aware of the threat of invasive crayfish species such as the rusty crayfish and red swamp crayfish. Crayfish are fascinating creatures as any kid will tell you.

As fisheries managers know, crayfish are an important food for fish and have been moved extensively (often illegally or irresponsibly legally – we know much more now than we did back in the day about invasive species) to bolster fisheries. Also, crayfish themselves provide a popular sport fishery—people love to catch them to eat. But globally, crayfish are some of the most invasive species in the world, and they have altered food webs, changed habitats, and displaced many native fauna, including other crayfish species.

I was excited to work on this project to collaborate more closely with David Schmetterling (FWP's fisheries research coordinator) and Dr. Susie Adams (a world-renowned crayfish expert with the USFS in Oxford, Mississippi). Sampling the entire state of Montana, collecting specimens for identification, genetic analysis, disease testing, and contaminant testing was a daunting task. We were able to accomplish it through a variety of partnerships within and outside of FWP (like the University of Idaho) and through Susie's contacts around the globe, including scientists in Alabama, Louisiana, Illinois, and even Spain.

Montana lacked historical information on crayfish species and their distributions in the state. In the 1980s, FWP contracted with a University of Montana scientist to document the species in western Montana and make recommendations for the burgeoning commercial crayfishery in Montana.

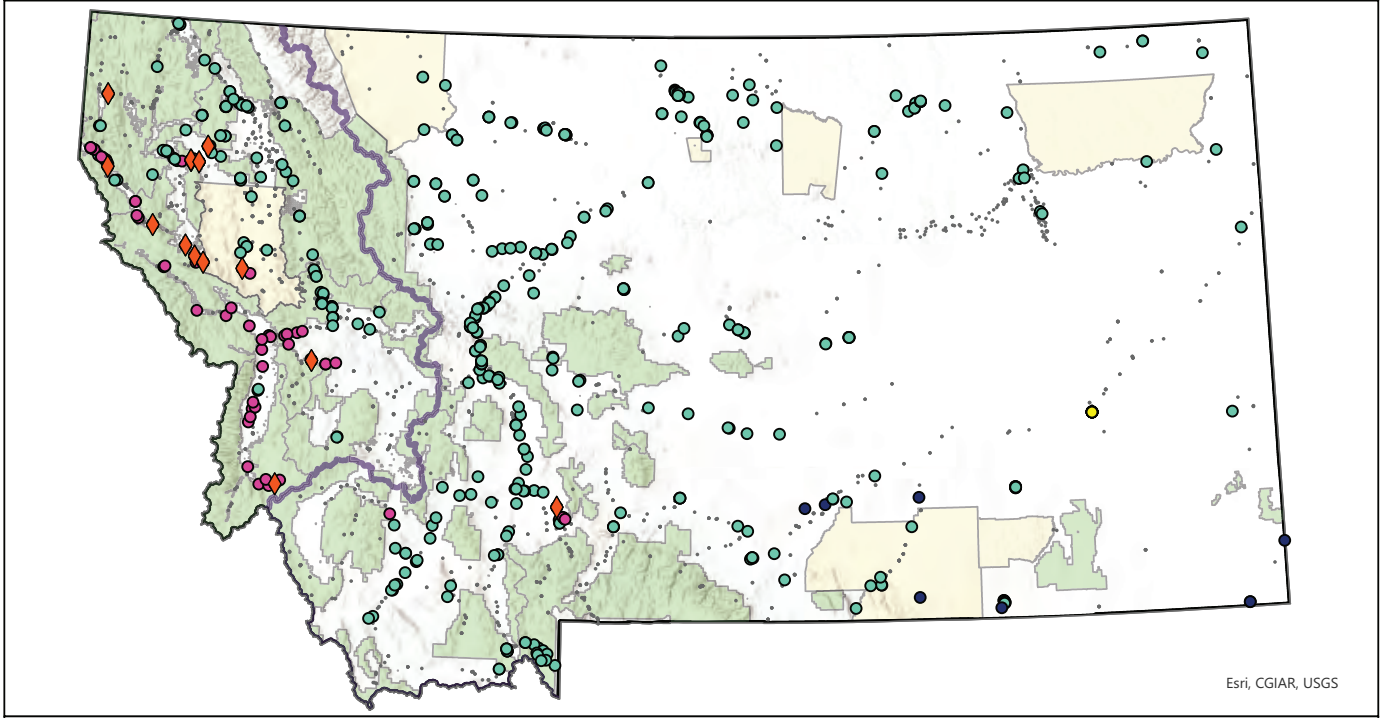
More of the Cray Team members left to right: Elizabeth Herrmann, Lindsey Gilstrap, David Schmetterling, Trevor Selch (photo credit Susie Adams).

Some of the Cray Team members left to right: Zach Shattuck, David Schmetterling, Stacy Schmidt, Susie Adams (photo credit Lindsey Gilstrap).

2021-2022 Montana Crayfish Project Findings

MONTANA FWP

Sample sites with crayfish during the 2021 and 2022 sampling seasons. Preliminary data as of 11-23-2022.



Crayfish Species

- Virile & Signal (14)
- Virile (442)
- Signal (77)
- Calico (8)
- Southern Plains (6)
- No Crayfish

Continental Divide

U.S. National Forest

Indian Reservation

N

Map Produced by: AIS Bureau
File: 2021_2022CrayfishSampling

Credits: Administrative boundaries and data from Montana Fish, Wildlife & Parks, Helena, MT. Background Imagery from ESRI.

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Miles

A lot has changed in Montana since the 80s, but many of the same questions and concerns remain. Within the Aquatic Invasive Species Bureau, we always have concerns over people moving crayfish, leading to introductions (such as, escape from ponds, aquarium dumps, intentional releases, etc.).

In addition to documenting what species are currently in Montana and where they came from, we also wanted to train our staff, developing expertise in Montana, to determine the best ways to conduct sampling and track crayfish population changes in the future.

The Crayfish Project was a massive undertaking with so many people helping—too many to name in this short article! It was so much fun to work with so many different people ranging from private homeowners and students to representatives of indigenous tribes, universities, and government agencies across the nation and globe.

Susie Adams (left) working with Jeremiah North Piegan (right), fisheries biologist for the Blackfeet Nation Fish and Wildlife (photo credit Stacy Schmidt).

The field work for this two-year project is now complete and has led to many more questions.

1. We completed two years of crayfish sampling (preliminary data shows close to 2,800 sites and finding crayfish at over 550 of them!) and now have a much better idea of species distributions in the state and distributional changes in western Montana since the 1980s.

Virile or northern crayfish, Faxonius virilis (photo credit Susie Adams).

   a. Northern or virile crayfish are widely distributed across Montana. These are thought to be historically native to a small portion of eastern Montana but now are widespread.

Signal crayfish, Pacifastacus leniusculus (photo credit Guenter Schuster).

   b. Signal crayfish (*Pacifastacus leniusculus*), the largest species in the state (one of the largest in the country), are native to the Columbia drainage, and probably to the Clark Fork River drainage in Montana. But like so many other crayfish species, they have been moved around, and so we are using genetic techniques to unravel where they originated.

Calico crayfish, Faxonius immunis (photo credit Susie Adams).

c. We found calico crayfish (*Faxonius immunis*) throughout southeast Montana.

Procambarus simulans, the southern plains crayfish (Photo credit Guenter Schuster).

d. We discovered the southern plains crayfish (*Procambarus simulans*), a non-native crayfish species never previously documented in Montana, near Miles City. It is well outside its native range, and we just published an article about this noteworthy find. We are working with our hatchery staff and partners in Mississippi, Michigan and Alabama on methods to control this crayfish. We hope to publish those results soon.

2. We collected samples to test for mercury and other contaminants that inform our recommendations for human consumption. These are all published now in the Montana Sport Fish Consumption Guidelines which can be found on the FWP website (https://fwp.mt.gov/binaries/content/assets/fwp/fish/fish-consumption-guide_2021_fnl_selchedited_2022.pdf).

3. Though not one of the original goals of this project, perhaps one of the most important findings, is that we discovered the first-ever clinical signs of the crayfish plague in North America by working with scientists in Spain and Louisiana. Crayfish plague is endemic to North American crayfish, but they have never been visibly affected by it. In Europe and Scandinavia, this North. American disease has devastated native crayfish and collapsed socially and economically important crayfisheries. While we accomplished so much over the last two years and have learned a lot, we still have more questions. So, stay tuned for more to come out of … THE GREAT MONTANA CRAYFISH PROJECT.

Crayfish plague lesion on virile crayfish (photo credit Susie Adams).

Partnership Aims to Answer Questions About Out-of-State Boat Traffic Missing Aquatic Invasive Species Inspection Stations

Montana Fish, Wildlife & Parks' Aquatic Invasive Species (AIS) Prevention staff, Region 6 FWP staff and Garfield Conservation District (CD) partnered in 2022 to help address a persistent question from Fort Peck: "How many out-of-state boats are not receiving an AIS inspection before they launch?"

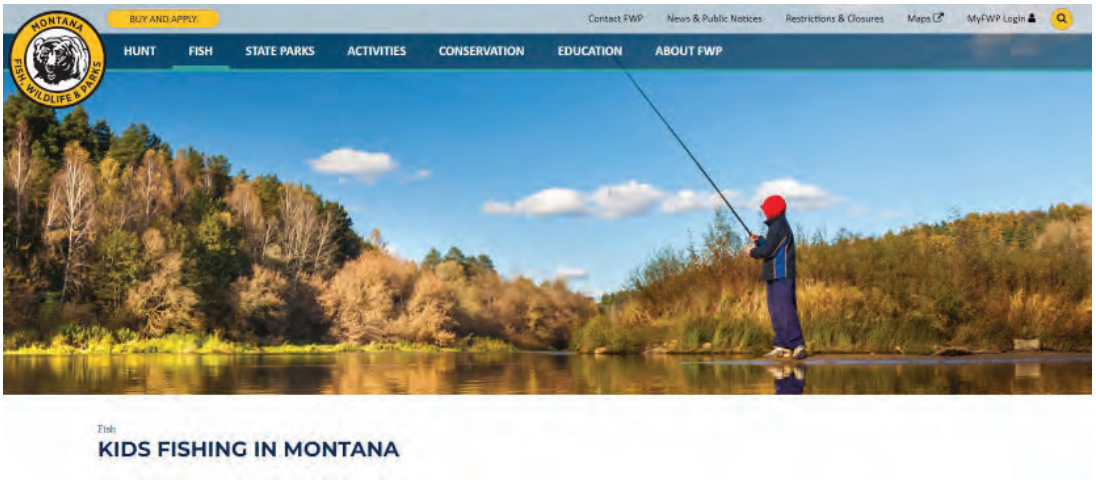
Boat launch at Fort Peck.

Building on existing partnerships (Garfield CD currently partners with FWP to operate inspection stations at Flowing Wells and Wibaux), Garfield CD inspectors were strategically placed at boat ramps around Fort Peck. The mission: To keep an eye out for out-of-state boats, verify they met Montana's inspection-before-launch requirements and ensure they were not transporting AIS.

Throughout the boating season inspectors surveyed boats at Hell Creek, Duck Creek, Fort Peck Marina, Rock Creek and Devils Creek. They interacted with 115 out-of-state boaters and observed over 340 Montana resident boats. The survey found only seven boats that did not receive an inspection prior to arriving at Fort Peck, easing some of the concerns that substantial traffic was slipping through. Uninspected boats received an AIS inspection and information was collected on where and when the boat came into the state to help identify gaps in the Watercraft Inspection Program. These boats originated from our neighboring states and none were found transporting invasive species. The information gathered from these boats also did not identify any specific gaps in watercraft inspection stations in the state.

The valuable data gathered as part of this program during the 2022 boating season shows that watercraft inspection stations are doing an effective job intercepting out-of-state boats before they can reach the world class-fishery at Fort Peck. This project will continue during the 2023 boating season to further investigate the effectiveness of Montana's Watercraft Inspection Program.

KidsFishMT



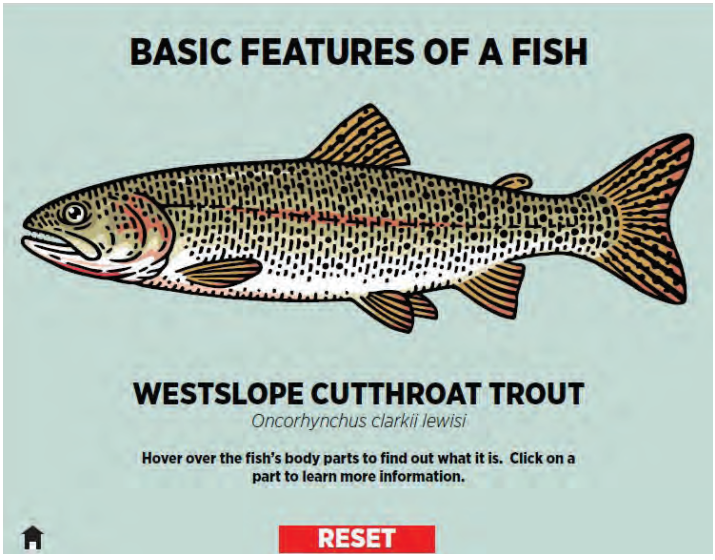
We are pleased to announce the Kids Fishing in Montana webpage fwp.mt.gov/fish/kids. It's a new addition to the FishMT website. In July 2022, we launched this new webpage to to provide a tool for youth anglers, parents, grandparents, guardians, and teachers who want to learn about everything fish. We are excited to bring fisheries into the home or classroom by making fish education more available to everyone. The Hooked-On-Fishing Program has been part of FWP since 1996 and we are very proud that Hooked-On-Fishing has brought fish science and fishing ethics to our youth. The new fish education webpage expands upon the Hooked-On-Fishing Program and continues to make fish education available to everyone across the state. If teachers are interested in bringing Hooked-On Fishing into their classrooms, they can find more information by going to the Hooked-On-Fishing link - https://fwp.mt.gov/fish/kids/hooked-on-fishing.

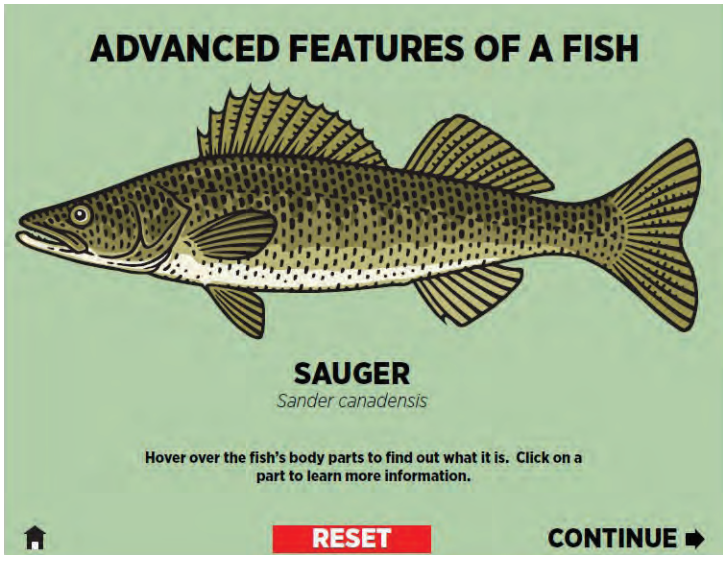
The Kids Fishing website has many tools that will assist planning a fishing trip. There is a checklist that provides parents with license information, tackle and last, but not least, a place to take kids fishing!

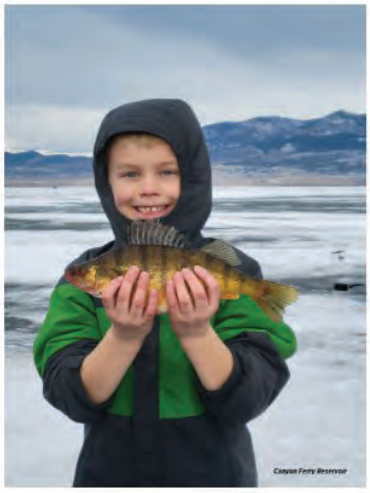
We have also included activity pages to take on your adventures if the family needs a little more engagement while exploring the outdoors. These can be found in the Activities section where one can also find coloring pages, outdoor bingo games, and at home craft projects. We plan to keep adding new content to the printable activities, so please continue to check back for new materials.

The education link has an interactive Fish Anatomy Guide. This guide was created to make learning fish anatomy both fun and educational.

In addition to educational resources, we included a fishing photo reel where parents or guardians can submit photos of their kids fishing from anywhere in Montana. Every month those photos will be added to the photo reel so feel free to submit as many photos as you want all year round! If you post pictures on social media of your kids' fishing adventures, we encourage you to use #KidsFishMT.







We plan to add more educational components to the webpage including additional printable materials such as new BINGO cards and more coloring pages, a fish dissection guide and new series where kids can send in a video question to our fisheries gurus and they will respond in a fun video on the webpage. Our team is also working to add hatchery education, aquatic invasive species and zooplankton education, crayfish identification, fish species identification and so much more!

We want to hear from you!

If there is something you would like to learn about, please reach out to our team at the Fisheries office at FWP Headquarters in Helena. You can call (406) 444-2449 or email FWPFishAdmin@mt.gov.

We hope you see you out there!

#KidsFishMT

Hatcheries

Revamping Protocols

In 2020, the department re-evaluated biosecurity in our 12 state hatcheries. A biosecurity evaluation is intended to look for invasive species and other potential areas of concern, such as quagga mussels, zebra mussels or New Zealand mudsnails (NZMS). Through these investigations, New Zealand mudsnails were discovered at Bluewater Springs State Trout Hatchery in Bridger. After a smaller population was discovered in early 2022, the department determined that a biosecurity plan needed to be developed for each hatchery to ensure hatchery personnel are doing everything possible to prevent an invasion and future spread of unwanted species. Improving hatchery biosecurity will also reduce the likelihood of introduction and potential spread of AIS and other fish pathogens, improve overall fish health by reducing stress on fish and reduce economic losses from mortalities and mandatory depopulation and facility closures.

The issue of AIS and the FWP hatchery system is not dissimilar to the discovery of whirling disease in the Madison River in 1994. After whirling disease was discovered and began to spread throughout Montana, FWP hatcheries examined infrastructure needs and altered general operations to prevent invasion and the spread of the Myxobolus parasite. At that time, many hatcheries received infrastructure improvements on incoming water supplies. In addition, adjustments were made to general hatchery operations to prevent whirling disease from invading .

For the current issue of AIS, biosecurity plans will be based on the Clean. Drain. Dry. motto. Simply put, each rearing area of an individual hatchery will receive a routine dry period. During that time, personnel will clean, pressure spray the area and inspect for places that could harbor AIS. Additional dry times will ensure that we have eliminated habitat for any AIS that may be onsite. We are also altering our aquaculture practices in and around the hatchery by cleaning vehicles and transport units more often, increasing education of staff and visitors so everyone knows how to look for AIS and replacing routine cleaning equipment more often.

We have also discovered that we can improve infrastructure within the hatchery to protect from AIS. Some examples of infrastructure improvements that we are currently planning include covering outside raceways, adding perimeter fencing and creating 'drop points' so that water leaving the hatchery spills at least 12 inches into receiving water – preventing an upstream invasion. We have also discovered that a thin sheet of copper on the inside of effluent pipelines prevents mussels and mudsnails from moving up the pipelines. You will hear more about that in a few of the hatchery update articles.

Although Montana's fish hatcheries are facing increasing threats from aquatic invasive species, FWP is committed to doing all we can to stop any invasion from occurring. Montana FWP is ahead of the curve when it comes to hatchery biosecurity and our efforts will likely inform other state manager's decisions on their facilities as well as set the bar high for biosecurity in the future. Long range plans will be in place before the end of 2022, and we are looking forward to a successful 2023 full of big fish and lots of 'em.

The Yellowstone River Flood of 2022 and its Effects on the Yellowstone River Trout Hatchery

Early morning of the flood inundating only two raceways.

Intuitively, anyone visiting would think that "Yellowstone River Trout Hatchery" means we raise Yellowstone cutthroat trout to outplant into the Yellowstone River and having fish escaping due to flooding wouldn't be anything to worry about, but this is not the case. To give some background and clarity regarding the hatchery's purpose, none of the Yellowstone cutthroat raised at the hatchery are released into the Yellowstone River as it has a sustained wild population of native Yellowstone cutthroat. The Yellowstone River Trout Hatchery primarily raises Yellowstone River cutthroat trout which are a 100% pure LaHardy River, a Yellowstone Lake tributary, strain of Yellowstone cutthroat. The Yellowstone cutthroat trout raised for production are either out planted via helicopter into an assortment of high mountain lakes or out planted with a stocking truck into a variety of public lakes and ponds in the southwestern part of the state for recreational fishing purposes.

During the initial stage of the event, the flood waters had not yet infiltrated the middle raceways which held 2019 and 2020 Yellowstone cutthroat trout broodstock. As the morning quickly progressed so did the level of water from the flood. Eventually as the flood water rose it infiltrated all outside raceways.

Policy and protocol dictate that in the event of a flood where the Yellowstone River water infiltrates the raceways, all remaining fish are compromised due to the risk of invasive species (i.e. New Zealand mud snail) and disease (i.e. whirling disease). We did see some fish swimming around in the flood waters outside the raceways but surprisingly, some of the fish stayed in the raceways near the bottom of the water column. We think this happened because the hatchery is supplied by a constant 52-degree, pathogen free, spring water source and the fish probably felt more comfortable remaining in the calmer warmer spring water below than in the colder dirtier flood waters near the top of the water column.

The hatchery front lawn and driveway underwater.

To ensure that our raceways are indeed free of invasive species and disease, policy dictates we drain and pressure wash each raceway and expose them to dry for 30 days. The next step is to hot pressure wash each raceway and have an invasive species technician do a follow up inspection to give the "all clear" to fill the raceways back up and add fish.

Outside raceways completely underwater.

The peak of the flood before receding.

Due to the flood 586 3 year old, 1,160 2 year old, and 1,900 1 year old Yellowstone cutthroat broodstock were euthanized along with 2,000 1 year old production Yellowstone cutthroat. Since we lost 3 age classes of Yellowstone cutthroat broodstock, the hatchery will not be spawning for the next three years. To remedy our spawning loss, over the next three years we will be receiving both brood and production eggs from Wyoming Game and Fish – Ten Sleep Fish Hatchery.

History and Phase-out of the "M012 " Westslope Cutthroat Broodstock

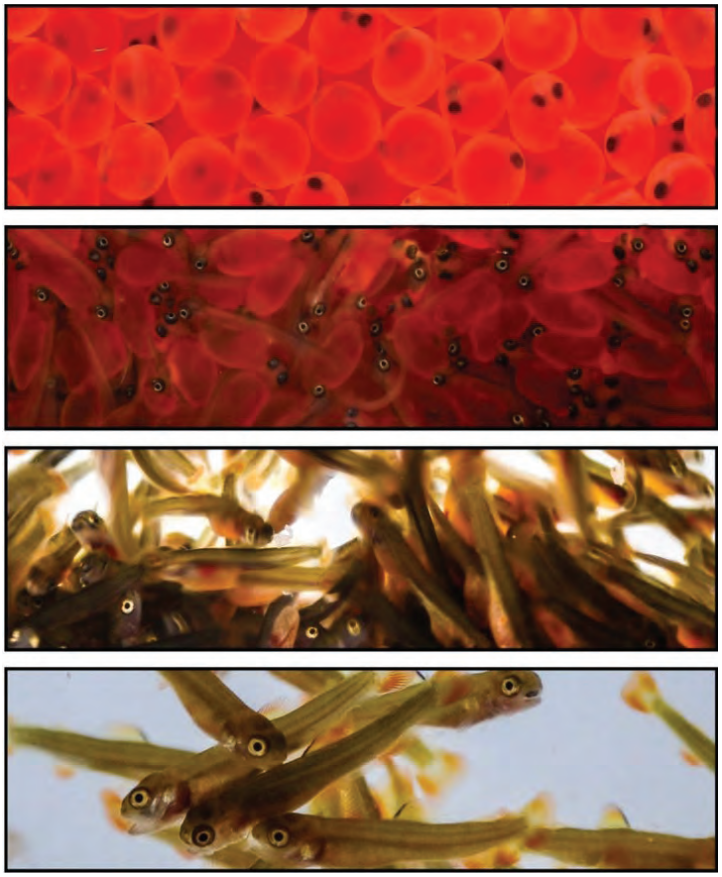
Original source streams of the M012 broodstock.

The objective of founding the brood stock was to establish a genetically diverse population of westslope cutthroat trout that would be capable of surviving and reproducing in a variety of natural situations. Prior to collection, electrophoretic analysis indicated that all these streams contained pure westslope cutthroat trout populations. Disease analysis also indicated a lack of detectable pathogens. To incorporate genetic diversity into the brood stock, fish were collected from many of streams. Both fluvial and adfluvial fish were collected. It was felt that by collecting fish from many populations, a number of variant alleles would be introduced into the brood stock thereby increasing genetic diversity. The present broodstock was founded in 1983 and 1984 from fish collected from South Fork Flathead River tributaries above Hungry Horse Dam and Clark Fork tributaries in the Noxon area.

The offspring of those wild fish spawned for the first time in 1990, and for the next eleven years the westslope broodstock was maintained using large numbers of individuals spawned randomly. The priorities of management of the M012 were to protect the genetic variability of the broodstock by ensuring survival of males to age three and females to age four (for 4 x 3 crosses), producing quality eggs which adequately represent the broodstock, and obtaining genetic data from every year class produced to monitor the genetic characteristics of the broodstock

From 1986-2009, horizontal starch gel electrophoresis was used to determine each fish's genotype. Later, a 'chip' was developed specifically for analysis of westslope cutthroat trout populations. This chip allowed simultaneously genotyping at a significantly higher level of certainty. In 2016, these improved methods revealed "oddities" in the brood, and it was determined that the M012 had a very small amount of Yellowstone cutthroat trout and rainbow trout genetics and were 99.8% pure.

Fast forward to 2022 and its now year thee of building a new, 100% pure westslope cutthroat broodstock. Using cutting edge genetic testing on each donor population helps to ensure that the new broodstock is healthy. The Sekokini Springs Hatchery houses drainage specific broodstocks, from the South Fork of the Flathead, with relatively large numbers and extensive health and genetic testing. The new brood is being built year by year by taking eggs from the various Sekokini stocks and combining them into one brood with a high level of genetic diversity.



Westslope cutthroat at various stages of development eyed egg, hatch, sac fry, swim-up fry.

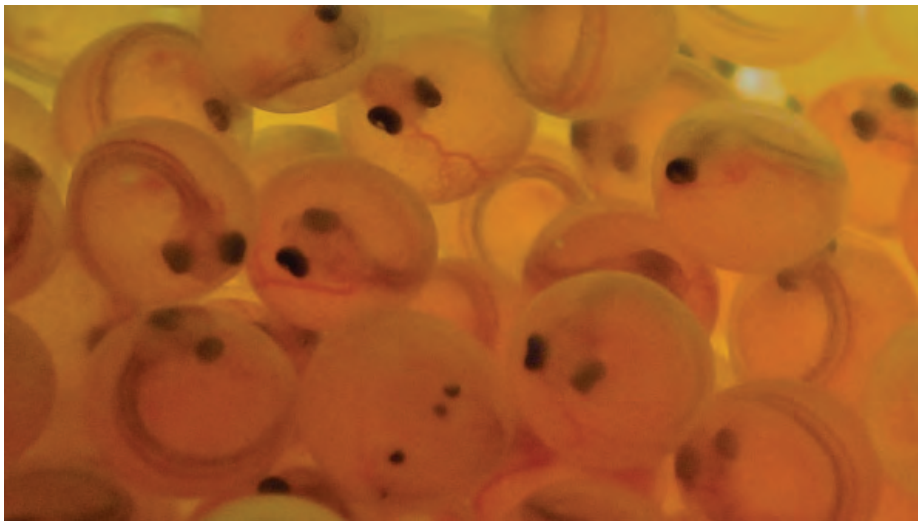
The Washoe Park Trout Hatchery stocks cutthroat for a variety of purposes, including sport fishing and conservation. It is because of this conservation aspect of the stocking program that it is paramount that the broodstock at the hatchery is maintained at the highest level of integrity. After working with the M012 for nearly two decades, I will be sad to see them go, but I look forward to a new broodstock that will provide pure westslope cutthroat both for angler enjoyment AND conservation efforts in cutthroat historical range.

Adult M012 westslope cutthroat caught by an angler in a high mountain lake.

Lake Mary Ronan Kokanee Salmon

A male kokanee shows his teeth.

Flathead Lake Salmon Hatchery in Somers, Montana has begun the process of finding an answer to the threat kokanee salmon are experiencing in Lake Mary Ronan (LMR). Northern pike were illegally introduced into this popular Northwest Montana "destination fishery" recently and have been found to be reproducing. Northern pike are ferocious predators and kokanee in LMR unsurprisingly make up the bulk of stomach contents in pike collected in this lake. Illegal introductions have many negative implications, and in this case, it affects all Montana's stocked kokanee waters. Lake Mary Ronan kokanee provides 3 Montana fish hatcheries a source of fertilized kokanee eggs for ultimate fish stocking in 31 lakes across 5 regions with 1.7 million fish. In response to the pike threat, hatchery and regional fisheries staff began collecting health samples and behavioral data from two alternative donor lakes.



Eyed kokanee eggs are ready to ship once they reach this stage in development.

Ashley Lake and Little Bitterroot Lake, both in Region 1, fit the bill as kokanee egg sources as they both have robust salmon populations and are compatible to a spawning operation by hatchery staff. In fall 2022, 120 kokanee from each of these lakes have undergone thorough and comprehensive health screenings to detect presence of known disease organisms. Rigorous testing is standard procedure on any population where eggs and fish are destined into any Montana waters. Pathogen results informs fisheries decisions and with favorable disease profiles in hand, kokanee egg needs will be supplemented with Ashley Lake or Little Bitterroot Lake as needed.

Meanwhile, the extent the growing menace northern pike pose to kokanee fishing and annual egg-collecting at Lake Mary Ronan is unpredictable. Kokanee spawning operations in October 2022 met egg needs with ample adults collected, but there are many examples of significant fishery impacts at the hands of pike across the landscape. In most cases of illegal introductions such as this, it is not a matter of if, but when the needle moves south. That trend toward empty is often precipitous. An agile response to the possibility of kokanee declines in LMR is paramount to maintaining salmon fishing as part of a diverse Montana angling opportunity.

Making Haploids

Hatchery redband rainbow trout.

Nearly all animals have two sets of chromosomes in their cells. One set originates from each parent. This "normal" condition is called diploid. Fish hatcheries often create fish with three sets of chromosomes called triploids. These fish are nearly indistinguishable from their diploid cousins but are sterile and can be used to stock lakes without the chance of reproduction. The eggs are treated with pressure or heat at a specific time after fertilization to create this condition.

Another genetic manipulation is used to produce haploid embryos. These are not viable, but they are very useful in genetic research. The DNA from the male is destroyed prior to fertilization so the embryo only has the one set of chromosomes from the female. The embryo will grow for a few weeks producing cells with identical sets of chromosomes. These are used to map the locations of the genes on each chromosome. Since there aren't any genes from the male, the process of mapping is greatly simplified. The reason for needing to do this is fascinating, so we've asked Seth Smith (one of the geneticists we work with) to explain:

The idea of using phenotypic or genetic data from diploid siblings to map genomes has been around for more than 100 years (Sturtevant, 1913) and the underlying logic is quite simple. If a pair of genes are on separate chromosomes, then alleles (versions of genes) at the two loci will be passed from parents to offspring independently. On the other hand, if a pair of genes are close together on the same chromosome, then alleles located on the same chromosome copy in parents will tend to be passed down together. This causes the proportion of offspring with certain genotype combination to deviate from expectations under independence, with the size of the deviation providing a measure of the distance between the two genes. If we measure this deviation (using genotypes from offspring) for hundreds, thousands, or millions of gene pairs, then we can use this information to determine which genes are located on the same chromosome, as well as the relative order of genes along each chromosome. Genetic maps constructed in this manner have been used to assemble complete genomes for most model organisms, as well as numerous salmon and trout species.

However, there are some added complications associated with constructing genetic maps for salmon and trout. The common ancestor of all salmonids underwent a whole genome duplication event approximately 80-100 million years ago (Macqueen & Johnston, 2014). As a result, each salmonid chromosome has a duplicate that is similar, but often not identical, somewhere else in the genome. We commonly refer to duplicated chromosomes resulting from whole genome duplication events as ohnologs. In normal diploid individuals, it can be difficult, and in many cases impossible, to determine if observed alleles originate from one or both ohnologs. However, if offspring are haploid, we can often infer the underlying genotypes for both duplicates (Waples,et al., 2016) and determine the location of these loci using the logic described above. We can then use these maps to determine how the genomes of species are different from one another, and potentially gain insights about sources of reproductive isolation among species.

This past spring, Seth asked Sekokini Springs Hatchery to create haploid embryos from wild redband rainbow trout. Here in Montana, this subspecies of rainbow trout is native to the Kootenai Drainage, but historical stocking of non-native coastal rainbow trout has reduced the range of redband significantly. While genetic mapping has proven to be beneficial in conserving similar species such as westslope cutthroat trout , a complete genetic linkage map for redband has yet to be constructed, and creating one would greatly assist fisheries scientists in identifying the remaining

Wild redband rainbow trout.

populations of pure redbands left in the region. So, we packed up our gear and traveled to the Libby Field Station in May when the fish were ripe and ready to spawn.

Creating haploids requires multiple steps to ensure the eggs are activated by the milt but not fertilized. We used ultraviolet radiation to destroy the DNA in the milt, but we had to be cautious not to kill the sperm in the process. First, we tested our chemical solutions to make sure they worked as they should. We used a buffered salt solution that is mostly potassium chloride (KCl) to dilute the milt so the UV radiation could reach all the sperm cells. The KCl prevents the sperm from activating. When it was time to fertilize the eggs, we activated the milt with a buffered sodium chloride (NaCl) solution. The sperm can remain active for several minutes in this solution allowing ample time for fertilization. We placed drops of milt on a microscope slide and added the KCl solution first and observed the results before adding the NaCl solution. When we were satisfied that both solutions were performing to specifications, we began irradiating the milt in a UV chamber.

We diluted six 1 ml samples of milt each with 10 ml of the KCl solution and put them on ice. Samples were irradiated at increasing 30 second durations starting at one minute and ending at three and a half minutes. The NaCl solution was added to each sample after treatment and sperm activity observed under the microscope. We found two and a half minutes was the optimal time of irradiation. At this point, 10% of the sperm was still active, which is an ample amount for fertilization, and we can safely assume all the DNA was destroyed.

We returned to Libby the next week when the females were ready to spawn. We stripped eggs from a female and milt from a male. Once the milt was diluted and irradiated, it was added to the eggs with an ample amount of the NaCl solution to activate the sperm. The mixture was agitated for at least 30 seconds to give the sperm time to reach the eggs. The eggs were then rinsed and allowed to water harden before being placed in a labeled Ziploc bag for transport to Sekokini Springs Hatchery. Once at the hatchery, each bag of eggs was incubated in a labeled cup for three weeks. The embryos were preserved in ethanol and delivered to the genetics lab for DNA extraction.

The project was a success. All six of the females used produced haploid embryos, ranging from 13 to 400 per cross. The linkage map resulting from this work will allow fish biologist not only in Montana, but throughout the Northwest, to determine the purity of isolated redband rainbow trout populations, future threats they might face, and potential for restoration to their historic range.

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A Season of Construction

Pond liners being installed.

The Miles City Fish Hatchery was built in the 1950s and is one of the states two warm-water hatcheries. The hatchery pumps its water 2.5 miles from the Yellowstone River to feed not only the hatchery building, but 49 production ponds as well. In total, 54.5 surface acres of aquatic rearing space. Not all 49 production ponds are uniform in size and liner style. There are 18 fully earthen ponds either 1.5 or 3 acres in size, 18 1-acre earth bottom ponds with lined sides, and 13 fully lined 0.5-acre ponds. Every pond bottom is sloped to one end where drain lines, water supply valves and cement kettle structures are located for collecting fish from the pond, draining, or filling. The hatchery primarily raises walleye and largemouth bass, though occasionally rears pallid sturgeon, channel catfish, tiger muskie, yellow perch, bluegill, crappie, fathead minnows, and trout.

Built in the 1950s, the original liners were predicted to have a 20-year life span before needing replaced. Over time, being expose to the elements throughout Eastern Montana's changing seasons, caused liners to become more brittle and damaged. For example, ripping from the weight of the water at full capacity, sloughing of dikes due to wind and wave action. Damage to the liners created large areas of seepage and ballooning behavior affecting the water demand and the rearing capacity of each pond.

The collaboration and hard work of FWP hatchery staff and multiple independent contractors, resulted in all new geomembrane liners to our outdoor ponds during the field season of 2022. New liners will be extremely beneficial to the hatchery allowing more efficient water retention and less seepage into the ground. Without pond water consistently seeping into the soil, the supply pumps will run less often requiring less maintenance and extending their life span, as well as fewer electrical expenses.

Along with new liners being installed, we also had the opportunity to upgrade designs on 11 kettles. A kettle is a cement catch basin located in the center of the deepest end of the pond used for harvesting fish during the draining process.

Cement catch basins constructed in different years were built similarly to match in their deep-walled, "U" shaped design. Having a deeper catch basin provides a larger water column for fish to hide from predators and reside in lower densities. The "U" shaped design of the kettle allows for sediment and aquatic plants to flow towards the drain screen and fish to escape to the freshwater flow on the opposite side during the draining process. This self-cleaning function improves water circulation, reducing overall fish stress and increases survival. Newer style kettles are designed to use inset screens and water leveling dam boards to hold fish inside the structure overnight to load for transport the next day.

Fish Hatcheries, A Place for Experiential Learning

Student assisting with milt collection.

At the Jocko River Trout Hatchery in Arlee, Montana, we spend hundreds of hours giving educational tours to visitors and school groups. Each and every interaction with the public is an opportunity to show people what we do and why we do it in a very engaging way. I like to begin my tours with asking kids the simple question of, "Who here likes to fish!?" I usually get about half the hands raised and if it is a younger tour group, kids will begin telling me their tall fish stories. I then ask about specific waterbodies where they fish. For example, if the school is from Hamilton, I'll ask if anyone has caught a rainbow from Lake Como, or if from Missoula, has anyone caught a rainbow from McCormick Park Kids Pond. Then I get the pleasure of telling them that specific rainbow trout started its life right here at this hatchery. I then spend an hour or two showing them exactly how the process of spawning, egg incubating, fry rearing, fingerling and catchable production, and fish stocking works to make those trout available for them to fish for. And of course, they get to feed the fish.

Hatcheries are a combination of a farm and a laboratory, and every single hatchery is unique. Each hatchery differs in its water source, the structure of its buildings, tanks and raceways, the strain(s) of fish (or other aquatic life) it raises, and the goals and purposes of its facility. Here at Jocko, we raise non-native Arlee rainbow trout to supplement sports fishing, provide fishing opportunities where they wouldn't otherwise exist (think stocking man-made reservoirs), and to stock urban kids ponds to provide kids with successful fishing opportunities to inspire the next generation of anglers. We are both a production hatchery (raising fish for stocking) and a brood hatchery, which means we hold and care for the captive domestic brood stock of Arlee rainbow trout for the state of Montana, which we have successfully been managing for the past 70 years. Brood hatcheries are extremely important because they provide the eggs to deliver to other production hatcheries across the state for raising and stocking in the respective bodies of water in their region. Of our 5.5 million eggs we produce each year, we send most of them to the big production hatcheries in Great Falls (Giant Springs Trout Hatchery), Lewistown (Big Springs Trout Hatchery) and Bridger (Bluewater Springs Trout Hatchery). While these production hatcheries are here to supplement sport fishing and provide a huge economic benefit for the state, other hatcheries exist for the purpose of conservation and propagation of Montana's native fish species. For example, Washoe Park Trout Hatchery (Anaconda) raises and maintains the brood stock of native westslope cutthroat trout and the Yellowstone River Trout Hatchery (Big Timber) is responsible for the native Yellowstone cutthroat trout. All the hatcheries discussed so far are cold water fish hatcheries, which means they raise fish (mainly trout and salmon) acclimated to the cold water temperatures of the mountainous western part of the state, on the eastern, prairie dominated part of the state we have the warm water hatcheries of Miles City and Fort Peck fish hatcheries that supply regional waters with largemouth and smallmouth bass, walleye, sauger, black and white crappie, channel catfish, yellow perch, northern pike, pallid sturgeon, paddlefish and tiger muskie. The point is, no matter what type of hatchery, cold water or warm water, native species conservation or sport fishing supplementation, hatcheries play an

Young visitor feeding the fish.

integral role in ensuring fishing opportunities are available for Montana citizens and visitors, and also assist in maintaining the ecological health of our fisheries and native fish populations.

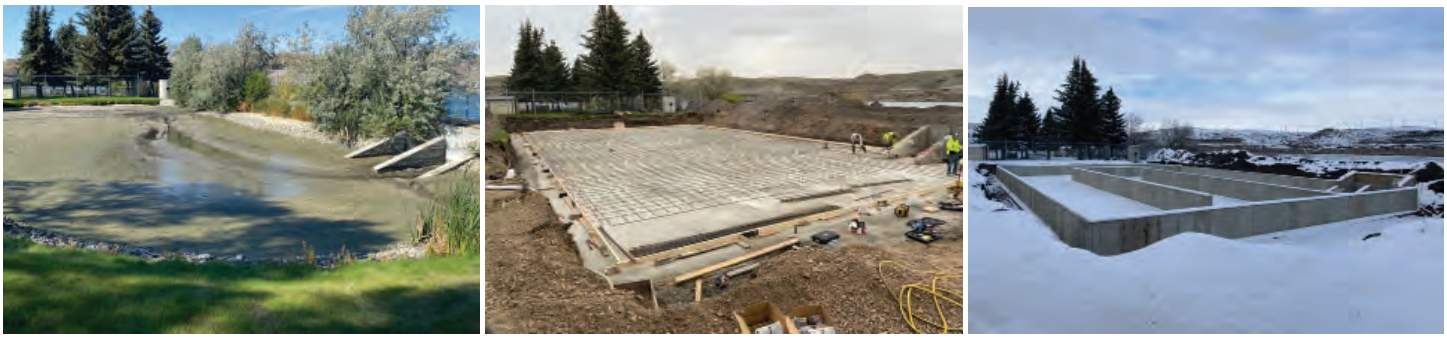
When fish culture specialists engage and educate visitors and students it provides real benefits, mostly intangible, such as an increased awareness and understanding of a hatchery's importance in fisheries management. But the most rewarding thing about tours is getting young people excited and supportive about aquaculture after being exposed to it. My favorite tours are during spawning season when we have local high school science students get "gloved up" and assist with the collection of milt from our males. It is a raucous time full of excitement, fish pics, and a maybe few inappropriate jokes. Showing the students firsthand how we air needle spawn is also an eye-opening experience for them. By getting kids interested in fish culture or providing kids with fishing opportunities to get them hooked on fishing, we are hopefully inspiring the next generation of stewards of the land and future wildlife professionals.

Giant Springs State Fish Hatchery

In 2022 Giant Springs State Fish Hatchery (SFH) staff drove more than 15,000 miles of Montana's highways and gravel roads to stock over 722,000 fish (rainbow trout and kokanee salmon), which weighed over 60,000 pounds. This year, our fall stocking season was shortened by several weeks to dewater the raceways and allow time for two projects. We continued our aquatic invasive species (AIS) project preventing New Zealand mud snails and completely replacing our waste pond.

Newly installed copper lining in an outflow pipe.

In 2021 copper lining was installed into the outflow pipe of four raceways to prevent snails from entering, which New Zealand mud snails as well as other snails and slugs, don't like to cross and will actively avoid when possible. After one year, no snails, either native or nonnative, were observed within the outflow pipes or tail boxes where copper was installed, and the decision was made to install copper in all the remaining pipes that enter the river. While installing the copper we pressure washed and heat treated the tail boxes of the facility to eliminate any snails in those areas before they could enter Giant Springs SFH. Hatchery staff also replaced all the raceway dam boards to reduce leaking.



Settling pond before, during and after construction.

This will allow dry raceways to freeze during the winter, which is also effective at eliminating snails.

In late September, work began to completely replace and update the waste pond at Giant Springs SFH. The existing waste pond had a loose stone bottom and was extremely difficult to clean. The updated cement structure will have a flat bottom and a baffle system that will leave waste in the pond to be removed while allowing clean water to return to the Missouri River.

Aluminum tank.

The crew at Giant Springs SFH is always glad to help with spawning fish at other facilities, and this year were able to assist spawning wild rainbow trout with Big Springs Trout Hatchery, Arlee rainbow trout with Jocko River Trout Hatchery and kokanee salmon with the Flathead Lake Salmon Hatchery. A portion of the eggs collected at each of these are raised at the Giant Springs SFH. Staff also assisted the Fort Peck Fish Hatchery with the walleye spawn.

One challenge we face at Giant Springs SFH is the density of fish inside the hatchery during certain times of the year. To reduce densities, two aluminum tanks were designed and built for the hatchery, which more than double the rearing capacity of the tanks they replaced. Over the next few years, Giant Springs SFH hopes to replace around 20 of its smaller troughs with these larger aluminum ones.

Hatchery tours returned in earnest this year, and the Giant Springs SFH staff were happy to bring nearly 800 children and adults through the facility. The Junior Ranger Program at Giant Springs State Park also added some color to the hatchery by painting water and rainbow trout along the path between the visitor center and show pond.

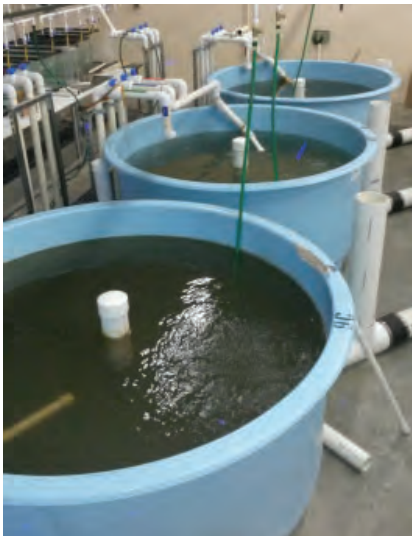
We at Giant Springs SFH hope that 2023 brings with it good health and tight lines for all our anglers and wish you a happy fishing season.

Junior Rangers paint waves and fish stencils near the show pond at Giant Springs State Fish Hatchery.

Trials, Tribulations, and What the Future Holds for the Fort Peck Fish Hatchery

The Beginning

Staff at the Fort Peck Fish Hatchery begin noticing less water to use for fish culture practices. It was discovered that the current water intake structures were collapsing and plugging water lines that supply water and allowing more sediment into the hatchery building. For continued fish culture use, the water intake structures are blown out with air every month, or when extremely busy twice or more a day. We began looking into securing a new water source for the Fort Peck Fish Hatchery in 2012. An environmental assessment in 2013 looked at options, location possibilities, and possible costs for a new water source. Funding for this new water source was secured in 2017, and in 2018, an engineering firm was hired with the task of designing a new water source for future hatchery survival.



Circular tanks with muddy water. Picture by Ryan Lott, Fish Culturist.

Where We Are Now

The existing intake structures continue to be blown out as needed. We are noticing more and more sediment being brought into to the hatchery causing issues with having clean water for fish production has begun. This new waterline will be attached to the drain lines in the Fort Peck powerhouse tunnels operated by the U.S. Army Corps of Engineers (ACOE). This water comes from just off the bottom of Fort Peck Reservoir and supplies the turbines in the powerhouse for energy production. The waterline will then follow the toe of the Fort Peck Dam and attach to the current intake piping system at the hatchery. The capability of this waterline is to supply the hatchery with up to 3200 gpm water for fish culture use. In comparison, the hatchery now uses approximately 1000 gpm from the current intake structure. This current system only allows the hatchery to utilize 20% of the water the hatchery was designed for. We are also in the process of obtaining all permits for this project, with the biggest already in initial reviews with the COE. We are in the waiting stages for the initial review to be completed by the COE, so we can discuss/add recommendations as assigned.

What the Future Holds

This new water system will be needed for the hatchery to survive. First, this system will give us the ability to use more water to continue and possibly increase hatchery production. Space utilization will be more efficient to raise fish species with more water to survive. Second, the sediment will be less, allowing for healthier fish species to be grown. Sediment is detrimental to the development of eggs, fry, and small fingerlings by not allowing oxygen transfer needed for survival. Third, water temperatures needed for fish growth and survival, will be better at the hatchery. The hatchery will have the capabilities to raise fish for a longer period, with the possibilities of raising certain fish species all year long. Currently, we are only able to raise eggs and fish from mid-September to mid-June of each year, due to increasing water temperatures at the present intakes over the summer months. So, yes, the future does look bright for the Fort Peck Fish Hatchery with this new waterline going online.

Blowing out intakes at Fort Peck Fish Hatchery. Ryan Lott, Fish Culturist and BJ Erickson, retired Fish Culturist keeping an eye on the intake structure and blowing out intakes.

Bluewater State Fish Hatchery

Matthew M. Wipf, Hatchery Manager

In 2020 FWP staff detected New Zealand mudsnails at Bluewater State Fish Hatchery and were detected again in a settling pond in 2022 during AIS monitoring. This prompted a more in-depth mitigation approach which included full decontamination of the hatchery, changes to the outflow, and destruction and rebuild of old settling ponds. All the plumbing and hatchery water infrastructure was hot water jetted in late June. The hatchery remained dry until fall to ensure any potentially remaining mudsnails were eliminated.

To minimize future infection at Bluewater many infrastructure changes are occurring. We have dramatically influenced the effluent outflow to prevent potential AIS invasion from nearby Bridger Creek. The old settling ponds which were constructed in the late 1940s were destroyed and are currently being rebuilt, allowing periods of time to allow each pond to dry out following use to prevent AIS colonization. We recently acquired a pump to clean settled waste monthly to reduce any habitat that may harbor AIS. Future plans include a full metal cover for the lower unit of raceways, and bird netting for the upper unit of raceways to reduce transfer of AIS from terrestrial and avian visitors.

Despite discovery of snails in 2022, FWP staff are confident that the hatchery can remain AIS free and continue to stock Montana waterbodies with minimal risk of spreading AIS. The hatchery is now back at full production and expects to stock a full allotment of fish for 2023.

Outflow changes from 2020.

Original outflow point of all of Bluewater effluent.

Copper covered strut channel and new copper lined and extended effluent plumbing 2022.

#KidsFishMT

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FISH	MONTANA NATIVE	LENGTH (inches)	WEIGHT	GIRTH (inches)	SITE	ANGLER	BAIT TACKLE	DATE
Arctic Grayling	■	20	3.63 lbs.	11.7	Washtub Lake	Glenn Owens	Wet Fly	6/28/03
Bigmouth Buffalo	■	40.7	57.75 lbs.	32.5	Nelson Reservoir	Craig D. Grassel	Bow & Arrow	6/4/94
Black Bullhead		14.37	2.60 lbs.	11.5	Smiley Slough	Birrell White	Bait	6/20/09
Black Crappie		16.7	3.13 lbs.		Tongue River Reservoir	Al Elser		1973
Bluegill		11	2.64 lbs.	17	Peterson's Stock Dam	Brent Fladmo	Worm	6/3/83
Blue Sucker	■	34.5625	13.29 lbs.	18.1875	Marias River	Jason Karls	Worm	4/19/19
Brook Trout			9.06 lbs.		Lower Two Medicine Lake	John R. Cook		1940
Brown Trout		37	32.4 lbs.	28	Marias River	Robbie Dockter		3/3/21
Bull Trout (Dolly Varden)	■	37	25.63 lbs.	25		James Hyer	Trolling Line	1916
Burbot	■	39	17.08 lbs.	16.25	Missouri River Wolf Point	Jeff Eugene Iwen	Minnow	4/18/89
Channel Catfish	■	38.25	35.18 lbs.	27	Colstrip Surge Pond	John D. Smith	Beetle Spin w/ Mr. Twister	7/7/19
Chinook Salmon		38.125	32.05 lbs.	26.50	Fort Peck Reservoir Face of Dam	Greg Haug	Squid & Flasher	8/16/20
Cisco		18.2	2.08 lbs.		Missouri River	Troy Holstein	Jig & Minnow	6/2/14
Creek Chub	■	11.0	0.52 lbs.		Harbaugh Bass Pond	William Bibeau	Worm	5/12/13
Coho Salmon		25.5	4.88 lbs.		Fort Peck Reservoir Face of Dam	Irven F. Stohl	Daredevil	5/29/73
Common Carp		38	40.2 lbs.	30.5	Nelson Reservoir	Jared S. Albus	Bow & Arrow	5/24/98
Cutthroat Trout	■		16 lbs.		Red Eagle Lake	Wm. D. Sands		1955
Emerald Shiner		3.43	0.01 lbs.		Park Grove Bridge	Ike Braaten	Rapala	6/9/06
Flathead Chub	■	11.2	0.59 lbs.		Thornton Pond	Douglas Jordan	Worm	4/29/01
Freshwater Drum	■	29.5	21.59 lbs.	26.5	Fort Peck – Ghost Coulee	Matt Washut	Smelt	5/3/03
Golden Shiner		7.375	0.18 lbs.	4.75	Gardner Reservoir	Kelson Hickman	Lure	7/29/22
Golden Trout		23.5	5.43 lbs.	13	Cave Lake	Mike Malixi	Lure	7/16/00
Goldeye	■		3.18 lbs.		Nelson Reservoir	Don Nevrivy	Jig/Power Crawler	7/4/00
Green Sunfish		9.0	0.84 lbs.	9.87	Hickson's Pond	Bette Schmieding	Worm	5/25/09
Kokanee Salmon		26. 8	7.85 lbs.		Hauser Lake	John Bomar	Jig	9/23/03
Lake Chub	■	5.9	0.075 lbs.	3.4	Corner Lake	James Cashell	Artificial Fly	7/23/17
Lake Trout		42.5	42.69 lbs.	31.5	Flathead Lake	Ruth Barber	Flatfish	6/23/04
Lake Whitefish		27	10.46 lbs.		Flathead Lake	Swan McDonald V	Jig	8/26/06
Largemouth Bass		22.5	9.58 lbs.	18.9	Lake Elmo	Brandon Wright	Worm	4/24/21
Largescale Sucker	■	23.1	6.16 lbs.	14.8	Woodland Pond	Kevin Fraley	Worm	6/27/08
Longnose Sucker	■	19.5	4.21 lbs.	12.4	Holter Lake	Austin Wargo	Jig	5/14/21
Mottled Sculpin	■	4.96	0.063 lbs.	3.75	Yellowstone County Canal	Bridger Burrows	Plastic Worm	3/15/22
Mountain Sucker	■	6.2	1.60 oz.		Beaver Creek Reservoir	Robert Garwood	Worm	4/23/01

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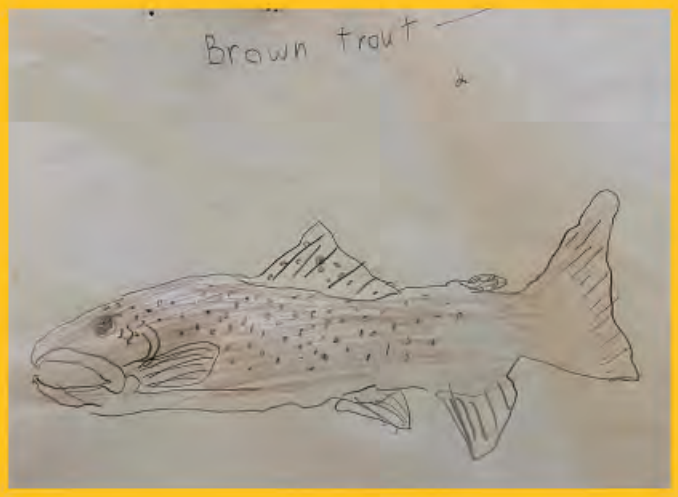
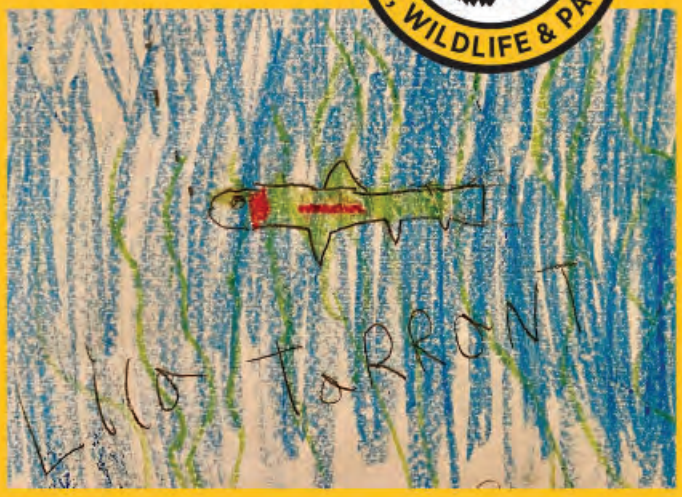
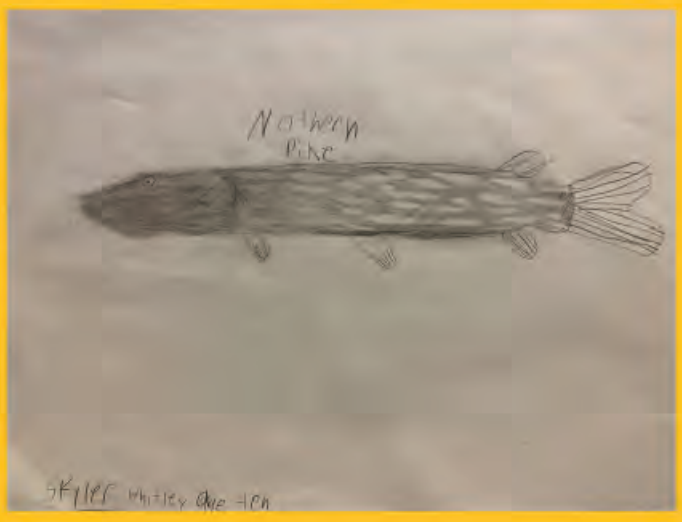
Mountain Whitefish	■	23	5.11 lbs.	12.5	Hauser Reservoir	Walt Goodman	Rapala	10/10/07
Northern Pikeminnow	■	27.125	7.88 lbs.		Noxon Rapids Reservoir	Darrel Torgrimson	Lure	5/28/91
Northern Pike			37.5 lbs.		Tongue River Reservoir	Lance Moyer		1972
Paddlefish	■	77	142.5 lbs.	41.75	Missouri River Near Kipp Park	Larry Branstetter	Snagged	5/20/73
Pallid Sturgeon	■		60 lbs.	27.5	Yellowstone River Near Sidney	Gene Sattler		5/13/79
Peamouth	■	16.125	1.52 lbs.		Clark Fork River	Mike Jensen	Artificial Fly	7/29/07
Pumpkinseed		10	0.995 lbs.	11	Fennon Slough	Pete Jellar	Pete's Tackle	4/26/22
Pygmy Whitefish	■	9.84	0.36 lbs.	6.3	Little Bitterroot Lake	Richard Geldrich	Maggot	2/13/10
Rainbow Smelt		7.1	0.08 lbs.		Fort Peck Dredge Cuts	Nathan Cooper	Jigging Spoon	2/18/20
Rainbow Trout		38.62	33.1 lbs.	27	Kootenai River David Thompson Bdg	Jack G. Housel, Jr.	Lure	8/11/97
Rainbow-Cutthroat Hybrid Trout		35.75	30.25 lbs.	27.5	Ashley Lake	Pat Kelley	Bait	5/16/82
Redside Shiner	■	6.5	0.10 lbs.	3.75	Lost Lake	Josh Ahles	Worm	8/21/01
River Carpsucker	■	26.1875	7.915 lbs.	17.125	Yellowstone River	Jaxson Franklin	Jig	8/15/08
Rock Bass		10.8	1.31 lbs.		Lower Crazy Head Springs Pond	Karson Campbell	Nightcrawler	4/26/14
Sauger	■	28.2	8.805 lbs.	15.1	Fort Peck Reservoir	Gene Moore	Whistler/ Minnow	12/12/94
Saugeye			15.66 lbs.		Fort Peck Reservoir Squaw Creek	Myron Kibler	Minnow	1/11/95
Shorthead Redhorse	■	20.25	4.68 lbs.		Marias River Near Loma	Ray Quigley	Worm	4/14/85
Shortnose Gar	■	35	7.41 lbs.		Fort Peck Dredge Cuts	Brandon Hansard	Bow and Arrow	5/16/13
Shovelnose Sturgeon	■	39.75	14.125 lbs.		Missouri River	Chad Buck	Nightcrawler	5/21/10
Smallmouth Bass		22	7.84 lbs.	17.75	Fort Peck Reservoir	Theron Thompson	Jig & Minnow	10/3/20
Smallmouth Buffalo	■	38	38 lbs.	29.25	Nelson Reservoir	Brady Miller	Bow & Arrow	4/28/07
Spottail Shiner		3.0	0.02 lbs.		Tiber Reservoir	Joe Hagengruber	Worm	8/14/10
Stonecat	■	10	0.54 lbs.		Milk River	Dale Bjerga	Worm	6/16/96
Tiger Muskellunge		50	38.75 lbs.		Deadmans Basin Reservoir	Leo Cantin	Bait	9/2/12
Tiger Trout		20.6	4.04 lbs.	12	Bear Lake	Joe Sobczak	Wooley Bugger	2/9/97
Utah Chub		15.9	2.39 lbs.	10.4	Canyon Ferry Res. – Duck Creek	Steve Hagen	Jig/Maggots	3/7/22
Walleye		32.25	18.02 lbs.	22	Holter Lake	Trevor Johnson	Kit's Tackle	5/10/21
White Bass		17	2.80 lbs.	12	Missouri River South of Bainville	Vernon Pacovsky	Minnow	10/13/07
White Crappie		18.5	3.68 lbs.		Tongue River	Gene Bassett	Worm	5/10/96
White Sturgeon	■	75	96 lbs.		Kootenai River	Herb Stout		1968
White Sucker	■	21.625	5.33 lbs.	12.75	Nelson Reservoir	Fred Perry	Spear	2/10/83
Yellow Bullhead	■	15.5	1.91 lbs.	10	Tongue River Reservoir	Roberta Legge	Minnow	12/17/20
Yellow Perch		14.375	2.39 lbs.	12.1875	Lower Stillwater Lake	Josh Emmert	Jig	2/19/06

MONTANA 2023
Annual Fishing Newsletter







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