

# swimming upstream

San Juan River Basin Recovery Implementation Program  
Upper Colorado River Endangered Fish Recovery Program

Field Report 2020

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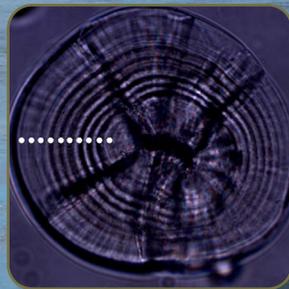


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# swimming upstream

*Swimming Upstream* is a publication of the Upper Colorado River Endangered Fish Recovery Program and the San Juan River Basin Recovery Implementation Program. These programs are national models of cost-effective public and private partnerships. The programs are working to recover endangered fishes while water development continues in accordance with federal and state laws and interstate compacts, including fulfillment of federal trust responsibilities to American Indian tribes.

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The Nature Conservancy  
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The Nature Conservancy  
Ute Mountain Ute Tribe  
U.S. Fish and Wildlife Service  
Water Development Interests

## Program Director's Message

By **Tom Chart**, Program Director, Upper Colorado Program



It's mid-April, 2020. I am drafting this note while sitting at my telework station in our spare bedroom in our home in Evergreen, Colorado. We are entering our second month of staying at home as dictated or advised by our community leaders in response to the pandemic. COVID-19 rages on in various parts of our country and around the world with some early indications we may be "flattening the curve" here in Colorado—maybe? From conversations with many of you, it seems we all are generally rolling with the cards this virus has dealt us. We are adjusting to the new norm of maintaining physical distance from each other, conducting even more conference calls (didn't seem possible) and video meetups, and younger parents are balancing their work load against homeschooling their children. I wish the best to you and your loved ones—it seems we will be dealing with this for quite some time.

As we look toward our Post-2023 future, we, as stakeholders in the Upper Colorado and San Juan river recovery programs, are dealing with our own particular flavor of uncertainty. Can we secure funding to keep these collaborative partnerships moving toward species recovery at a reasonable pace? The current proposals to downlist humpback chub and razorback sucker are tangible signs of progress, but they also provide important perspective to us in our role as big river conservationists. The proposals to change the listing status of these two species clearly recognize the importance of sustained management (e.g. of flows, habitat, fish ladders and screens, captive populations of endangered fish, and control of invasive species) in a highly regulated river system like the Colorado River. To date, Congress has demonstrated bi-partisan support of our chosen brand of Endangered Species Act implementation; one in which we have spread the costs of mitigating the effects of water depletions as broadly and painlessly as possible. The result has been a collective and synergistic approach to ecosystem conservation that far outweighs what we could have accomplished with project by project depletion impact mitigation. We will come up with a Post-2023 solution, and along the way will hopefully get closer to describing what Colorado River conservation will look like in the very long term.

More immediately, project leaders busy themselves with packing bearings on boat trailers, tuning up boat motors, repairing nets, and applying new data analyses to old data sets. Of course, they would rather be netting northern pike in Yampa River backwaters before they spawn or looking for juvenile razorback sucker on the San Juan River. But they are scientists who respect the value of the best available information.

A handwritten signature in black ink that reads "Tom Chart". The signature is written in a cursive, flowing style.

# The Green River Canal Fish Screen: From Entrainment to Freedom for Endangered Fish

By **Dave Speas**, U.S. Bureau of Reclamation (USBR)

People across the basin use water from natural rivers to irrigate crops, create electricity and to provide water to homes and businesses. When canals are not screened, fish can enter canals along with water that is being diverted. Entrainment of fish in irrigation canals is problematic for populations of endangered species. For many years, the Green River Canal near Green River, UT was no exception, as nothing stood between endangered fish entering the canal and ending up on a farmer's field.

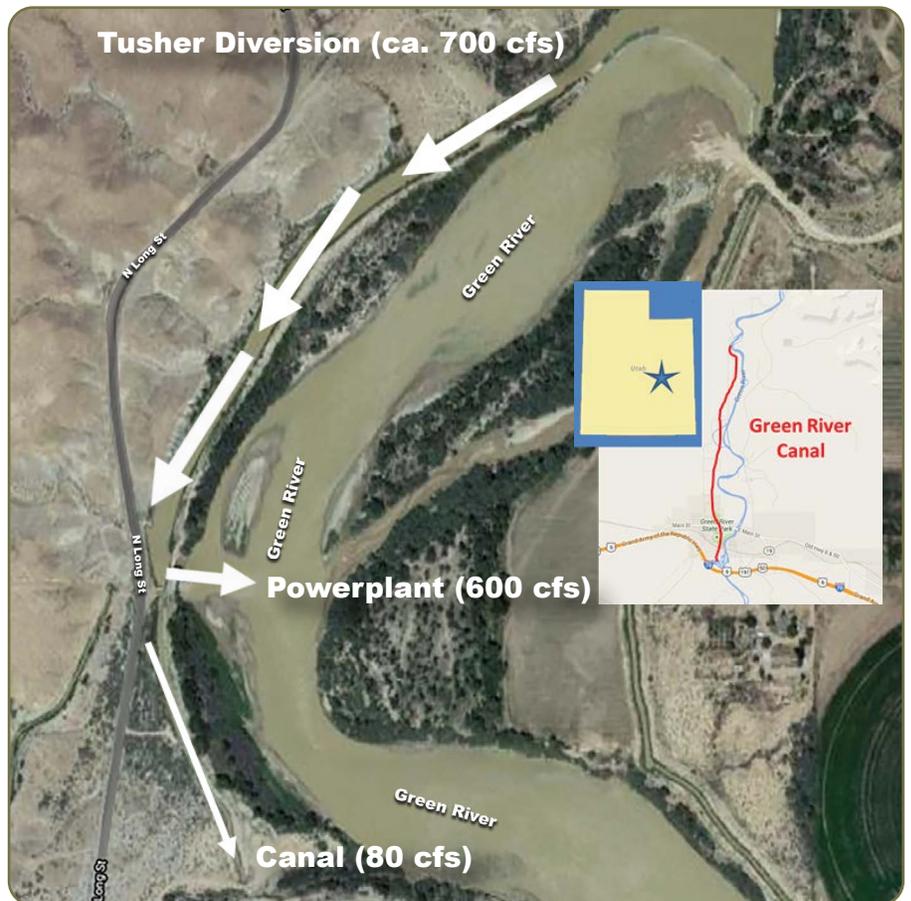
The Green River Canal originates about a half-mile below the historic Tusher Wash diversion dam, which diverts about 700 cubic feet per second (cfs) from the Green River year-round (Figure 1). Most of this water (600 cfs) passes through a small, partially screened power plant and back to the river. About 80 cfs enters the Green River Canal, mostly for agricultural purposes. The canal flows about eight miles toward the town of Green River and feeds many lateral canals along the way, irrigating the community's renowned melon crops.

In 2012, the Upper Colorado Program installed a passive-integrated-transponder (PIT) array near the top of the canal to figure out how many fish were being entrained. The results were striking. In 2013, almost 700 endangered fish, representing all four species, were detected entering the canal. In fact, 301 razorback sucker became entrained in a single day. In subsequent years, entrainment rates reduced as flow rates increased, but remained at alarming levels through 2018.

As the search for a solution to the entrainment problem became more and more urgent, engineers became focused on a solution installed in New Mexico in 2014. The Hogback Diversion weir wall on the San Juan River near Shiprock is a 550'-long concrete wall which runs at a shallow angle from one bank of the Hogback Canal to the other. Operation is simple: a few inches of water flows over the crest of the weir wall and into the canal. Because these endangered fish swim close to the bottom, most follow the bottom of the wall until they end up back in the river. Fish could also swim back upstream and out the way they came in.

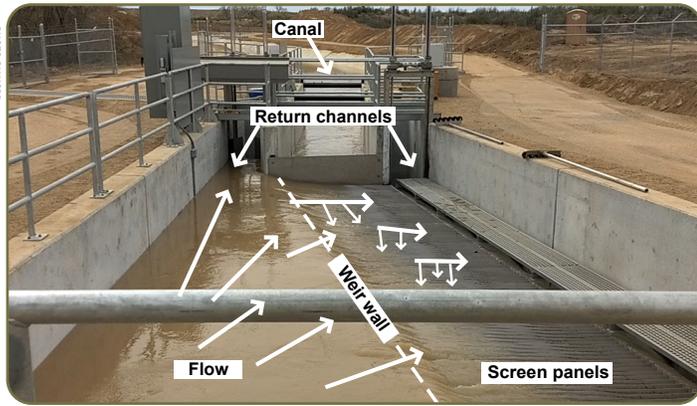
The Hogback weir kept 89% of fish out of the canal; only a few fish passed over the wall. Engineers thought they could improve the screen by adding something to the crest of the wall. The final design included horizontal screen panels attached to the downstream edge the weir wall (Figure 2). About 90% of the water flowing over the wall falls through thousands of tiny holes punched in the panels, and flows into the canal. The other 10% of the water--and anything in it, like fish--continues to flow over the panel and falls off the edge into a return channel. Like the Hogback Diversion, fish who don't try to jump over the weir wall would have the option of moving downstream and back to the river through the return channel, or swim back out the top of the canal; importantly, though, any fish jumping over the wall would return to the river rather than entering the canal.

The Green River Canal screen was completed prior to the 2019 irrigation season. The new canal screen included several antennas to detect PIT-tagged fish entrained in the canal. During the irrigation season, 1,007 PIT-tagged fish visited the canal above the screen, comprised mostly of razorback sucker and bonytail. Of these fish, 545 exited the canal via the fish return channel, and the remainder presumably exited the area through the canal head gates a few hundred feet upstream. Most



**Figure 1.** Location and layout of the Green River Canal near Green River, UT, prior to construction of the Green River Canal in 2019. River and canal flow direction is from top to bottom.

## The Green River Canal Fish Screen: From Entrainment to Freedom for Endangered Fish, *continued from page 3*



**Figure 2.** Green River Canal fish screen in operation, looking downstream. Water flows across the screen panels from left to right; about 90% falls through the screen to the canal but 10% (and fish) flows into one of two return channels back to the Green River. Photo courtesy Ryan Christianson, USBR.

## A Library of Fish in the Desert

By **Emily S. DeArmon and Steven P. Platania**, Division of Fishes, Museum of Southwestern Biology (MSB), University of New Mexico

June 1959 was memorable for 67 year old Milton Seibel of Arboles, Colorado. As that year's meager San Juan mountain snowmelt waned and daylight hours advanced towards their maximum, Seibel escaped his farm to partake in his favorite pastime. A few hours after settling along the bank of the San Juan River in pursuit of that which is elusive, Milton was rewarded with a 415 millimeter (mm) SL (16½ inches) male Colorado pikeminnow (MSB 3235) which he pulled from an expansive pool abutting the rocky bluff. The super-sized minnow, called "salmon" by local residents, was caught at a popular fishing hole off old NM 362 (Rosa Road) about three miles downstream of the New Mexican pioneer village of Rosa. The unusual fish was proudly carried home by Mr. Seibel and carefully placed in his freezer to await the arrival of an honorable guest from Albuquerque.

About three months later, on Saturday August 29, 1959, Dr. William J. Koster, Ichthyologist and Curator of Vertebrates in the Department of Biology at the University of New Mexico, anxiously accompanied Mr. Seibel back to the Rosa fishing hole with hopes of catching lightning in a bottle. Defying seemingly overwhelming odds, Mr. Seibel proceeded to reel in another, even larger, Colorado pikeminnow (590 mm, 24¼ inches, female; MSB 3234; Figures 1 and 2) from the now in-



**Figure 2.** The second Colorado pikeminnow, 590 mm SL, MSB 3234, caught on August 29 1959 in the San Juan River downstream of Rosa by Milton Seibel.

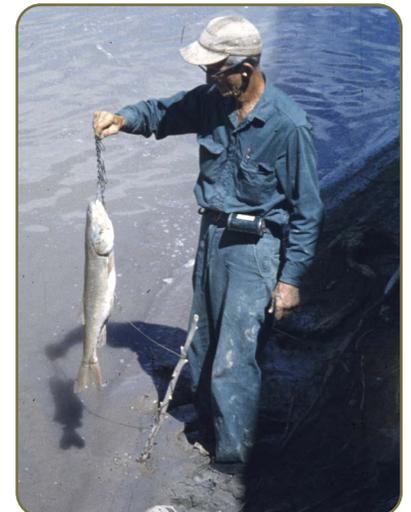
importantly, no fish were detected on the PIT antennas below the canal screen, suggesting a 100% success rate of the new screen design.

At present, endangered fish are no longer in danger of entering the Green River Canal and the canal company continues to receive water that is now free of large woody debris, which the Upper Colorado Program participants and partners can be proud of. This success story is the product of persistent efforts on the part of coordinators and committees, vital cooperation of the Green River Canal Company, some truly innovative and thoughtful hydraulic and structural engineers, and personnel, machinery, and materials supported by the Upper Colorado Program's capital construction fund. From an endangered fish- es' perspective, these efforts proved to be worth every penny.

famous fishing hole. Less than 24 hours later, Dr. Koster was carefully ferrying both trophies back to Albuquerque, knowing he had acquired the first two Colorado pikeminnow from the San Juan River Basin.

Fast forward about forty years to the beginning of the new millennium. The Division of Fishes at the University of New Mexico that was created in 1939 by the late Dr. Koster is a well-established repository for fish from New Mexico and the American Southwest. Navajo Reservoir is nearing its fourth decade in operation and the San Juan River Basin Recovery Implementation Program is approaching its 10 year anniversary. Endangered Colorado pikeminnow and razorback sucker are routinely stocked in the San Juan River and the first wild spawning of razorback sucker has been documented (Figure 3). Larval and juvenile fish are now archived in the museum.

As the collection of fish tissue at the repository grows, so does the ability to address a suite of questions on the recovery of the endangered species. The first discovery occurred after a spate of developmental deformities were detected in the annual catch of larval San Juan River suckers (Figure 4). Biologists examined over 55,000 larval and early juvenile suckers from throughout the San Juan River to



**Figure 1.** August, 29 1959, Milton Seibel holds his prize catch of a Colorado pikeminnow (MSB 3234) from the San Juan River downstream of Rosa.



**Figure 3.** Larval fish collected from the San Juan River.



**Figure 4.** Early juvenile San Juan River flannelmouth sucker displaying opercular deformities ranging from mild (bottom image) to severe (top image).

determine the frequency of the potentially lethal deformity. They discovered that the presence of the opercular deformity was significantly greater in razorback sucker than in the other two native suckers and forwarded museum material on to toxicologists and histologists for further investigation.

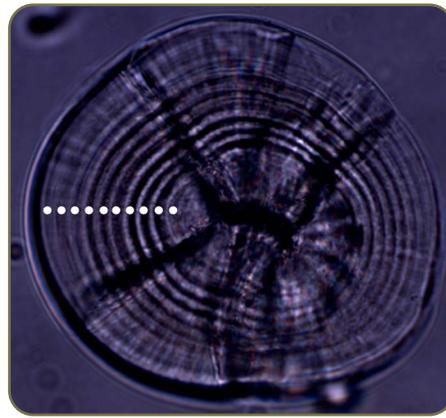
By 2017, the number of endangered fish present in the San Juan River resulted in a concurrent increase in the number of larval specimens collected annually. In 2018, a project was undertaken to determine the spawning periodicity of these two endangered fishes, their larval growth rates, and environmental factors correlated with spawning of these two species. Like the opercular deformity investigation, this study relied exclusively on material already available and permanently housed in the MSB Division of Fishes.

Researchers selected larval specimens from hundreds of samples containing the two endangered species taken



**Figure 5.** Larval San Juan River sucker, 12 mm in length, with otoliths back-illuminated (two otoliths are located inside the white oblong sphere).

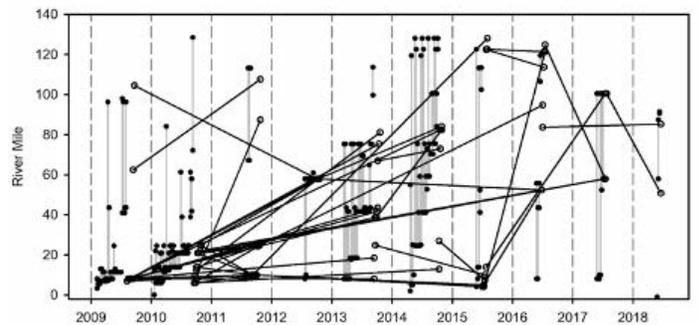
from 2009 to 2017. One can determine the age of a fish by counting the number of rings present on the bones of the fish, just as in tree rings. The fish bones that provide the most reliable readings are those in its inner ear (=otoliths; Figure 5). In larval fish, researchers can see and count daily growth rings thereby determining a fish's age in days (Figure 6), when it spawned, and its larval rate of growth.



**Figure 6.** Image of one of the above otoliths showing daily growth rings. The white spots indicate the daily growth rings (n=10) deposited by this fish. Photo by ASIR

The larval fish showed correlations between spawning and discharge, slower growth rates for Colorado pikeminnow and razorback sucker than in the Green River, and that their spawning period is shorter than previously predicted; all important information related to the recovery of these two species.

Most recently, Tracy Diver, former U.S. Fish and Wildlife Service biologist, initiated a cutting-edge genetic study to determine the number of breeding Colorado pikeminnow and razorback sucker in the San Juan River. Using genetic information extracted from tissue samples of MSB larval Colorado pikeminnow and razorback sucker (2009–2018), Ms. Diver and her team documented annual variation in the number of spawning Colorado pikeminnow (3–50) and razorback sucker (65–109) as well as showed sibling relationships between individual specimens. They plan to expand this work to include larval endangered fish collected downstream of the Paiute Waterfalls and from the 2019 larval fish samples. These represent only a few of the museum based San Juan River



**Figure 7.** Predicted full-sibling relationships between pairs of larval razorback sucker collected between 2009 and 2018. Full-siblings over space and time are connected by grey lines (within year) and black lines (between years). Year of collection are separated by vertical dashed grey lines.

projects that have occurred over the past decade. (Figure 7)

Sixty-some years after capture of the first Colorado pikeminnow in the San Juan River, the village of Rosa is submerged several fathoms under Navajo Reservoir and Mr. Seibel lay at rest on his 1919 homestead. While both the community where the fish were caught and the man who collected the fishes have been gone since 1963, MSB 3234 and 3235 persist, in nearly the same condition as 60 years earlier

## A Library of Fish in the Desert, *continued from page 5*

when catalogued into the burgeoning fish collection at the University of New Mexico (Figure 8). And since then, thousands of additional San Juan River fish samples, the products of a variety of recovery efforts, are neatly organized on the shelves in the Division of Fishes (Figure 9). Arranged like books in a library, they shelter irreplaceable information awaiting to be revealed by the next curious researcher who uncaps a jar. In the meantime, like library books, MSB 3234, 3235, and all subsequent San Juan River acquisitions will continue to be cared for, in perpetuity, at the University of New Mexico.



**Figure 8.** The two Colorado pikeminnow (A: MSB 3235 and B: MSB 3234) collected by Milton Seibel in 1959 as they appear in 2020.



**Figure 9.** The wet collection of the Division of Fishes at the MSB in 2020.

## Record Number of Juvenile Razorback Sucker Captured in San Juan River

By **Ben Schleicher**, USFWS

In 2018, the San Juan River saw some of the lowest runoff in recent history, leading to low, warm and very clear summer base flow conditions. This proved to be ideal conditions for larval razorback sucker spawned in the wild to successfully survive and recruit to an older age class. A record number ( $n=164$ ) early juvenile life stage razorback sucker were captured during summer sampling performed by American Southwest Ichthyological Researchers (ASIR). Six young-of-year razorback sucker were then collected in the fall by New Mexico Department of Game and Fish (NMDGF). Interest created by these findings led to a sampling trip in spring 2019 to document over-winter survival of this 2018 cohort of wild razorback sucker.

Between 25 March and 4 April 2019, the San Juan River was sampled from Shiprock Bridge in NM River Mile (RM) 147.9 downstream to Clay Hills in UT (RM 2.9) using electrofishing rafts. The objective was to capture and identify wild-spawned razorback sucker early in the season, before these age-1 fish had grown significantly. It was thought that sampling efforts that occur later in the calendar year may have been unable to effectively distinguish these wild-produced, age-1 recruits from the smallest hatchery-reared razorback sucker stocked into the river early that fall [minimum stocking length = 300 mm total length (TL)] and that might have lost their passive integrated transponder (PIT) tag.

A total of 45 fish identified as wild age-1 razorback sucker were collected along with one identified as razorback sucker X flannelmouth sucker hybrid. These age-1 fish were collected from RM 119.0 downstream to RM 17.0 and varied from 100-197 mm TL. Of the 45 age-1 razorback sucker collected, 43 were PIT-tagged, the other two were too small to tag at time of capture. Two fish were recaptured during fall 2019 sampling efforts. One was a razorback sucker that grew 90 mm in seven months, the other was a fish originally identified as a razorback sucker in spring 2019, but after growing 115 mm in the seven months between captures, this fish was subsequently identified as a razorback sucker x flannelmouth sucker hybrid. We are hopeful that being able to collect and PIT-tag these young razorback sucker will allow us to examine over-winter survival rates, identify habitats utilized by this life stage of fish, and help us hone our identification skills to be able to more accurately find and correctly identify this rare life stage of endangered fish in the field.



PHOTO BY USFWS

# Matheson Wetland Valuable Nursery Habitat

By Zach Ahrens, Utah Division of Wildlife Resources (UDWR)

All creatures need habitats in which to feed, grow, seek refuge and reproduce. Stream fishes like those of the Colorado River Basin require access to a variety of habitat types throughout their lives to achieve these life history events. Loss of such habitat is one of many threats facing native fishes of the Colorado River basin.

Studies have shown that floodplain wetland habitats—when kept free of exotic predator fishes—can be valuable nurseries for young razorback sucker to grow and survive their first year. Management of wetlands on the Green River, such as Utah’s Stewart Lake, has demonstrated the potential for these habitats to help recover the razorback sucker and other endangered fishes. Delivery of water from Flaming Gorge Reservoir to the Green River, timed to mimic natural spring runoff, supports this management by carrying drifting larval suckers into off-channel refuge habitats. Similar facilities have not been developed on the Colorado, until now.

Matheson Preserve co-owners, UDWR and The Nature Conservancy, teamed up with the U.S. Bureau of Reclamation to help razorback sucker access this critical wetland area. During the 2018-2019 winter, the Preserve’s largest wetland pond was deepened and reconnected to the Colorado River, providing access for razorback sucker. In 2019, screens—wide enough for tiny fish, but too tight for large predators to pass—were installed to provide a larval safe-haven. A flood gate was also installed to keep the wetland wet while baby suckers grow and to release the fish when their growing season ends each year.

Although the gate and screens were not installed until after runoff, biologists at UDWR were able to entrain larval razorback sucker into the wetland. The renovated river-floodplain connection helped bring water into the Preserve’s often dry Central Pond again. The flooding created both open water and vegetated aquatic habitats critical to feeding and refuge for young suckers. Razorback sucker larvae were captured in the Preserve in the highest numbers observed since project planning began. In spring 2020, larval razorback sucker were entrained using the new infrastructure and are safely growing: a first for the Colorado River.

These preliminary successes highlight the exciting potential for razorback sucker recovery. With a little help from Mother Nature and a dedicated recovery team, wetlands of the Colorado may pitch in with those of the Green to help razorback sucker complete their life cycle in the wild once again.



PHOTOS BY ZACH AHRENS, UDWR

# Update: Palisade High School Fish Hatchery Project

By Michael Gross, USFWS

The Palisade High School Fish Hatchery, in partnership with Ouray National Fish Hatchery-Grand Valley Unit (Ouray NFH-GVU), filled the newly constructed on-campus recirculating aquaculture system in June 2020 with plans to bring in 250 razorback sucker mid-July. These endangered fish will be raised by students and released into the upper Colorado River in late spring 2021, immediately boosting populations of the highly depleted species, all while giving young science-minded high school students the opportunity to practice hands-on fish culture.

Beginning in 2018, Palisade High School students raised an impressive \$40,000 through various fundraisers and a slew of community donations to upgrade an old storage building at the edge of campus, equipping it with all the essentials needed to facilitate the indoor aquaculture operation. The aquaculture system itself was purchased by the Upper Colorado River Endangered Fish Recovery Program and Bureau of Reclamation, and consists of three 235 gallon circular tanks, dual bag filters, ultraviolet filter, auxiliary biofilter and a 150 gallon sump tank.

Palisade High School students will operate the facility with guidance from Ouray NFH-GVU personnel. This project will give students the opportunity to learn a wide array of topics including: raising endangered fish, recirculating aquaculture, ichthyology, fish biology and much more, helping to foster the next generation of fisheries scientists and aquaculturists. Congratulations to the Palisade High School students, School District 51 and the Grand Valley community for all of the incredible support to make this happen.



PHOTOS BY MICHAEL GROSS, USFWS

# A Gauntlet of Mouths

By **Tildon Jones**, Upper Colorado Program

**N**onnative fish introductions into river habitats are a major program concern, but many wonder why Program partners are so concerned about the addition of new species to our western rivers? The Colorado pikeminnow is the largest minnow species native to North America, and was historically the top predator in the Colorado River basin. How could such a large predator be impacted by new species of nonnative fish?

It starts when Colorado pikeminnow hatch from eggs. Newly hatched pikeminnow larvae are very small (about 1/2 inch long) and have not fully developed all their fins. As they drift down river to nursery habitats with slower currents, they are vulnerable to even small minnows that can eat the tiny larvae. Studies have confirmed that introduced bait fish like red shiner can consume pikeminnow larvae when they arrive in nursery backwaters.



As the larval pikeminnow grows and develops its full complement of fins, its swimming ability improves, but new predator species emerge as potential threats. Nonnative smallmouth bass spawn and hatch during a similar time in summer as Colorado pikeminnow, but their fry grow much more quickly. A smallmouth bass hatched on the same day as a Colorado pikeminnow can grow large enough to eat the pikeminnow in as little as two weeks. To make matters worse, the two species inhabit similar habitats in their first summer, so encounters are frequent.

After their first summer, pikeminnow are considered to be “juveniles” for the next several years, at a size of 4-15 inches. At this stage, they start to outgrow the size that smallmouth bass can fit into their mouth, and pikeminnow typically move downstream into lower river reaches. Unfortunately, the lower rivers have higher concentrations of a new predator—the walleye. Researchers have consistently documented pikeminnow in the stomachs of walleye in both the Green and Colorado rivers, and walleye are capable of consuming pikeminnow half their size.

Finally, upon reaching adult size (>18 inches) after seven or more years, the Colorado River’s largest native fish is still vulnerable to a new nonnative predator often illegally introduced. Northern pike can reach lengths of more than 39 inches and at that size, they are capable of consuming small adult pikeminnow. With their large mouth and sharp teeth, northern pike are ambush predators that dash out from vegetated cover to grab other fish that swim by. Native fish in areas with high concentrations of northern pike have been captured with bite marks indicating an unsuccessful attack.

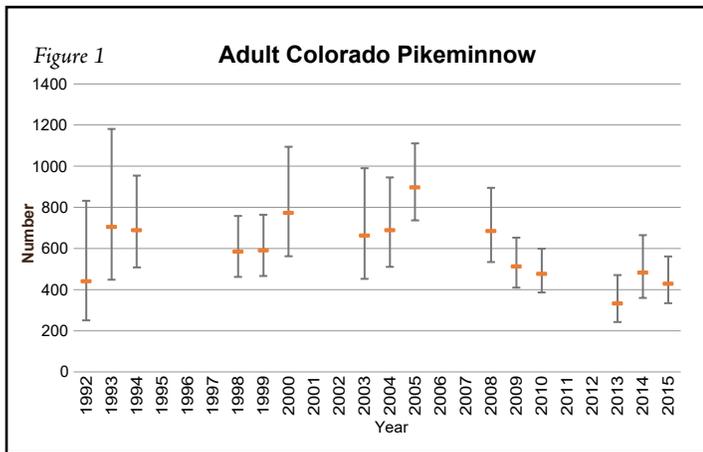
Because the Colorado pikeminnow were the primary predator species native to the basin, many native fishes, including pikeminnow, evolved to grow slowly and take advantage of different habitats than the adults. And because pikeminnow do not have teeth in their mouth, none of the native fishes have sharp fins or scales for defense. As a result, even the largest predator in the Colorado River basin is vulnerable to the new species of fish that have been introduced throughout the basin, and they must outgrow or avoid predation at every stage of life. Because Colorado pikeminnow take such a long time to mature (7+ years) they are threatened with predation every year until they reach spawning age. This is why the Upper Colorado Program is so concerned with nonnative fish introductions and spends more than a quarter of the annual budget controlling their numbers.

# Status of Colorado Pikeminnow in the Colorado River

By **Darek Elverud**, USFWS Grand Junction Fish and Wildlife Conservation Office

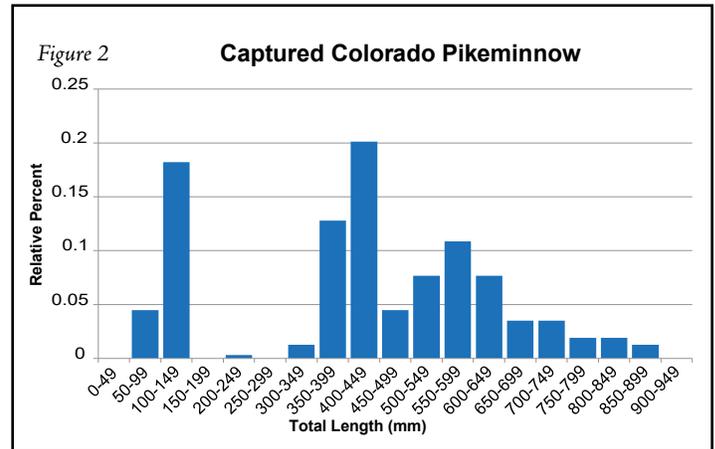
The Colorado River upstream of Lake Powell contains one of the two naturally reproducing and recruiting populations of endangered Colorado pikeminnow in the world. Monitoring of Colorado pikeminnow in the Colorado River began in 1992. It typically takes approximately 6 years for a Colorado pikeminnow to reach the adult size of 450 mm TL. Researchers complete four to five sampling trips each year from Government Highline Dam, near Cameo, Colorado, downstream to the confluence of the Green and Colorado rivers in Canyonlands National Park, Utah. This stretch of river is a total of 194 miles. Researchers primarily utilize electrofishing boats to sample for Colorado pikeminnow in the Colorado River, but also employ trammel nets to sample backwater habitats where electrofishing equipment is less effective. Sampling for Colorado pikeminnow occurs for three consecutive years, followed by a two or three-year break when no sampling occurs. A recovery goal of 700 adult Colorado pikeminnow for the Colorado River was established in 2002. A Colorado pikeminnow is considered an adult if the fish is greater than or equal to 450 mm TL.

From 1992 until 2015, the Colorado pikeminnow population has ranged from a high of 897 in 2005 to a low of 332 in 2013 (Figure 1).



The most recent estimate was 429 adult Colorado pikeminnow in 2015. Confidence limits for the estimates overlap in many of the years, indicating that while the estimates change, the difference is not always statistically significant between years.

In 2019, a total of 314 individual Colorado pikeminnow were captured during sampling. Twenty-three were captured a second time in 2019, and one Colorado pikeminnow was captured a third time. Captured Colorado pikeminnow range from 76 to 898 mm (TL). Seventy-three Colorado pikeminnow were captured in 2019 from the year class produced in 2018 (Figure 2).



These 73 age-1 Colorado pikeminnow were too small, less than 150 mm TL, to receive a PIT-tag when captured in 2019. Figure 2 also indicates that the record number of young-of-year Colorado pikeminnow produced in 2015 has resulted in a large number of juvenile Colorado pikeminnow (350-449 mm TL) that are approaching the size at which they become adults.

The Colorado pikeminnow population in the Colorado River is currently below the goal of 700 adults. The population peaked in 2005 and then declined until 2014. Annual survival estimates calculated during this period indicate that adult Colorado pikeminnow survival in the Colorado River remained constant. The constant adult survival estimates indicate that the decrease in the population between 2005 and 2013 was due to an insufficient number of juvenile Colorado pikeminnow surviving until adulthood to offset adult mortality. Data collected in 2019 indicating several large year classes (2015 and 2018) of juvenile Colorado pikeminnow being present is encouraging and these fish will hopefully contribute to the rebound of the Colorado pikeminnow population in the Colorado River.



Travis Francis, USFWS, holds an adult Colorado pikeminnow captured on the Colorado River.

PHOTO BY DAREK ELVERUD, USFWS

# The Competitive Drive of Anglers Benefits Endangered Fish

By **Randy Hampton**, Colorado Parks and Wildlife

One costly effort that Upper Colorado Program partners face is nonnative fish control in popular fishing reservoirs. Controlling nonnative fish not only involves expensive and maintenance-intensive screens and diversions, it involves thousands of hours of employee time to manually perform sometimes unpopular electrofishing removals. Efforts take many years to make an impact and can be altered by weather, runoff, water level, and angler apathy or even hostility. For the managers at Colorado Parks and Wildlife (CPW), the question was: Is there a better way to make the public an enthusiastic partner in recovery efforts?

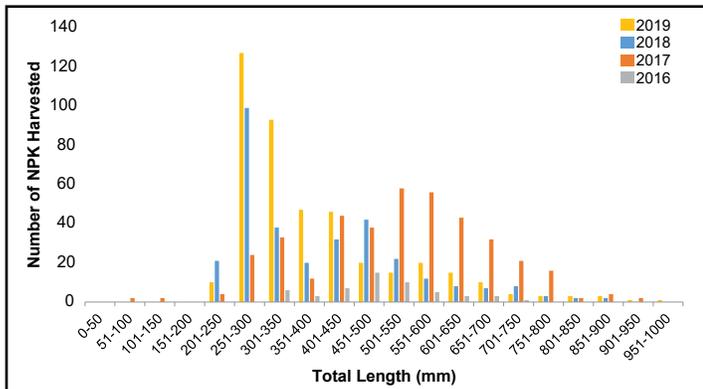
Beginning in 2015, CPW biologists began offering competitive ways for anglers to get involved in nonnative fish control. Approaches include weekend fishing tournaments, season-long ‘catch-and-keep’ competitions, and specially tagged nonnative fish that reward anglers with valuable prizes. While anglers see competition for cash and prizes, biologists see valuable reductions in nonnative species. Funding for the awards and prizes is provided by the Colorado Water Conservation Board through the Species Conservation Trust Fund.

At Ridgway Reservoir in Southwest Colorado, the results have been impressive. “Since 2015, we’ve seen a 79 percent reduction in smallmouth bass at Ridgway,” explains John Alves, Senior Aquatic Biologist for the Southwest Region. “We have also integrated the angler submitted harvest into our population estimates, allowing us to spend less staff time in recapture efforts.”

At Elkhead Reservoir near Craig, biologists report an estimated 52 percent decrease in adult smallmouth bass. “We’re also able to impact the northern pike population at Elkhead,” says Lori Martin, Senior Aquatic Biologist for the Northwest Region. “In 2019, tournament anglers turned in more than 400 northern pike, the most since the tournament began in 2016.”

The 2019 competition at Ridgway State Park ran during the month of July. Anglers received one raffle ticket for each smallmouth bass they turned in at a CPW checkstation. The raffle grand prize winner claimed a \$2,500 award. Prizes were also given to the anglers with the most smallmouth bass turned in as well as prizes for smallest and largest smallmouth submitted. A total of \$12,000 was available in prizes.

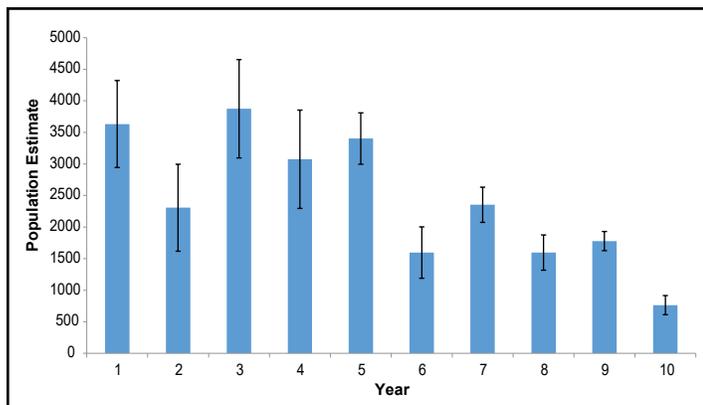
At Elkhead Reservoir, the 2019 competition included \$1,500 cash prizes for specially tagged smallmouth bass and northern pike. A prize of \$750 was also given to the angler who turned in the most smallmouth and the angler with the most northern pike. Daily prizes were also given during the tournament.



Graph showing northern pike harvest length during tournaments at Elkhead Reservoir 2016-2019



Annual participant Levi Archuleta won \$750 by catching 35% of the smallmouth bass in the 2019 Elkhead tourney.



Graph showing smallmouth bass populations at Ridgway Reservoir both pre- and post-tournament 2015-2019

Chase Nicholson of Ridgway claimed \$5,750 in 2019 by harvesting the most, largest (tie), and smallest smallmouth bass during the tournament. These competitive anglers are key to making the competition work.



AMY JAE SULLOHN

# Northern Pike Management: Successes and Setbacks

By **Kevin McAbee**, Upper Colorado Program

Ever since northern pike began increasing in number and range in the Yampa River in the 1980s, the Upper Colorado Program has known they are a threat to recovery of endangered fish. Northern pike removal began in earnest in the Yampa River in the early 2000s to reduce the number of large predators in the river.

In a 2015 report, researchers from Colorado State University analyzed the effectiveness of the Upper Colorado Program's northern pike removal efforts in the Yampa River. They concluded the amount of effort being used for in-river removal would not achieve the Upper Colorado Program's goals of controlling northern pike. They determined the large number of new pike produced each year from reproduction, and the number of pike swimming downstream from lakes, reservoirs, and ponds, was offsetting the work the Upper Colorado Program was undertaking in the river.

Importantly, the report recommended three steps the Upper Colorado Program could take to improve the effectiveness of removal efforts: 1) disrupt northern pike spawning in the river; 2) increase removal effort in the Yampa and Green rivers; and 3) prevent or reduce escapement of from off-channel sources and reservoirs. As described in these examples, the Upper Colorado Program heeded the advice of sound science and adjusted the way it managed northern pike. As a result, the Upper Colorado Program has seen a measurable reduction in northern pike numbers across the upper basin in the last five years (story on page 12).

Unfortunately, simultaneously to the successes, there have been setbacks. Specifically, northern pike have been introduced into new locations, likely through illegal introductions (see story below). Each time a northern pike is introduced to a new location, it lengthens the time and increases the money required to meet Upper Colorado Program goals.

## Mamm Creek: Successfully preventing escapement from off-channel sources

Along the mainstem Colorado River between Glenwood Springs, Colorado and Cisco, Utah, there are many gravel pit ponds which connect to the river at it rises during spring runoff. Each year when the ponds connect, fish can enter or leave the pond. Fish that remain after the river has receded are given a vegetated, calm location to lay eggs and a small area to easily eat other fish; this is the perfect area for a large ambush predator like a northern pike. Each summer, large adult pike spawn, create many offspring, and eat the copious prey in the pond. Each subsequent spring, the pond contains many one year old pike that have grown in this protected environment and which are large enough to live in the river.

One such set of ponds are the Mamm Creek Pits, between Rifle and Silt, Colorado. This complex of three pits was discovered to have northern pike after the large runoff in 2011; Pit 1 had hundreds of northern pike, while Pits 2 and 3 had just a few.

In 2015, Colorado Parks and Wildlife (CPW) used a new tool to remove northern pike in Pit 1, called a 'Merwin Trap', which is an oversized trap net. During runoff, this net captured any fish that tried to leave the pond when the river was connected and prevented new fish from entering the pond. Later in the summer, it removed northern pike that resided in the pond.

The Merwin trap was an overwhelming success. Over 500 northern pike were removed from pit #1 in its first two years of use, including some as big as 40 inches! By 2019, CPW no longer captured any northern pike in Pit 1. Using standard boat electrofishing, CPW also removed the last northern pike from Pits 2 and 3 in 2017. Therefore, the Upper Colorado Program believes it has removed all northern pike from this off-channel source. Removing this off-channel source has improved conditions in the river as well. Upper Colorado Program crews have only caught one northern pike in the river in 2018 and 2019.



Aerial photo of Merwin Trap at outlet breach in Mamm Creek Pit #1 from Google Earth imagery. Photo taken in June 2016.

## Two New Locations of Northern Pike Recently Discovered

Northern pike have been illegally introduced into a new upper Colorado River basin reservoir, lake, or pond at least five times since 2000. Each time northern pike is introduced into a new location where it could escape downstream and impact endangered fish, additional recovery actions are required. Two recent introductions demonstrate how one action by a member of the public can offset years of work by the Upper Colorado Program.

In 2018, CPW determined northern pike had been introduced in Kenney Reservoir near Rangely, Colorado, likely illegally by a member of the public. Kenney Reservoir is an on-river reservoir on the White River. The concern for the Upper Colorado Program is that this introduction could cause the White River to have a reproducing population of northern pike,

continued on page 12

## Two New Locations of Northern Pike Recently Discovered, *continued from page 11*

like in the Yampa River. The Upper Colorado Program has worked hard to try and eliminate this population before it spreads downstream, but a few northern pike have already been captured in the river downstream of the Reservoir.

Similarly, in 2018, CPW discovered northern pike and yellow perch in the East Rifle Municipal Pond. The source of these two fish is unknown. However, it is possible that the northern pike and yellow perch were illicitly stocked directly into the pond. CPW hopes to shift their efforts from the newly northern pike free Mamm Creek Pits to East Rifle Municipal Pond.

The Upper Colorado Program is committed to reducing the impact of northern pike on endangered fish. However, we need the public's help to do so.

### Follow Your State's Fishing Regulations

## DO NOT MOVE FISH!

If you know anyone who has moved fish illegally, please report them to your state wildlife agency.

## Spring Netting Reduces Northern Pike Abundance in the Yampa River

By **Kevin Bestgen**, Colorado State University (CSU), **Kevin McAbee**, Upper Colorado Program and **Koreen Zelasko**<sup>1</sup>, CSU

As the Yampa River thaws each April, biologists from Colorado Parks and Wildlife (CPW), the U.S. Fish and Wildlife Service (USFWS), and Colorado State University (CSU) brave the frigid temperatures to set nets in the slow, weedy edges of the river (called backwaters). The goal is to remove predaceous, invasive northern pike and reduce negative effects on native and endangered fishes. Setting nets is a newer, experimental technique designed to capture northern pike before they deposit eggs in shoreline vegetation. Early spring netting offers the dual benefit of removing large, adult predators and reducing the number of small pike born each year.

Based on the steady and substantial decline in the number of northern pike removed from the river, the work seems successful (orange line on Figure 1). However, simply counting the number of pike removed is not a reliable method for understanding how many are actually in the river.

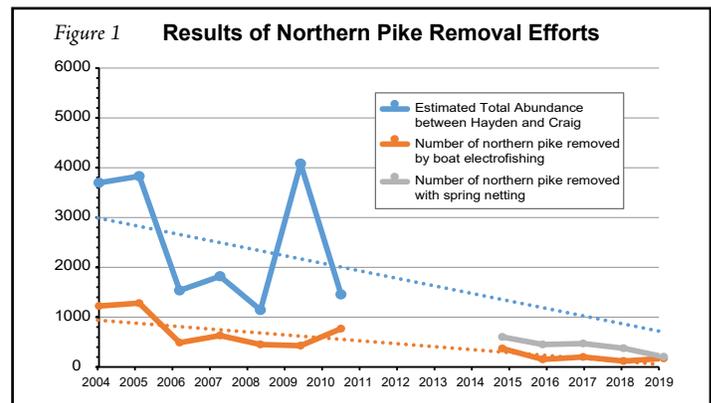
To accurately determine northern pike abundance in one reach of the river, crews undertook a mark-recapture study. First, USFWS crews used boat electrofishing to capture 84 northern pike in the river before netting began. Each fish received a tag to uniquely identify it in the "mark" portion of the study. Next, crews performed normal removal work (netting and boat electrofishing), documenting the proportion of fish that had a tag. This was the "recapture" portion of the study. In total, USFWS and CPW removed 251 northern pike, of which 23 had tags.

Using statistical analyses, researchers at CSU compared the proportion of fish recaptured (23 of 84) to the total number of fish removed (251) to estimate that just over 900 northern pike inhabited the Yampa River between Hayden and Craig in 2019.

Previous mark-recapture estimates performed between 2004 and 2010 determined that as many as 4,000 northern pike inhabited this reach (Figure 1). Comparing the 2019 estimate to earlier estimates, researchers concluded that the downward trend in northern pike was substantial

and legitimate (dotted blue line on Figure 1). These results support continued use of boat electrofishing and backwater netting as effective northern pike removal techniques.

Biologists will continue to set nets in the frigid Yampa River conditions in early spring and perhaps expand this approach to other reaches, to provide additional control of nonnative northern pike, and move the endangered fishes forward on the path to recovery!



Northern pike captured by gill net in the backwaters of the Yampa River.



The backwaters of the Yampa River are ideal habitat for spawning northern pike.

PHOTOS BY TONY EYRE, CPW

# Jerrod Bowman of Navajo Nation named 2020 Researcher of the Year

By **Melissa Mata**, San Juan Program

Jerrod Bowman, Fish Biologist with the Navajo Nation Department of Fish and Wildlife was selected as the 2020 Outstanding Researcher of the Year. Jerrod is responsible for daily management of the Navajo Agricultural Products Industry (NAPI) grow-out ponds for razorback sucker. His role includes maintenance and up-keep activities of the ponds and informing partners when problems arise. He helped set-up the flow-training system for razorback sucker. In addition, Jerrod is responsible for harvesting and stocking razorback sucker greater than 300mm at various locations, with support from the Nation and assistance from the U.S. Fish and Wildlife Service. In the last year, with Jerrod's assistance, Navajo Nation acquired funds from the Bureau of Indian Affairs to help improve NAPI ponds by installing harvest kettles in both Hidden Pond and East Avecot. In addition, Jerrod has been instrumental in solving and alleviating problems at the Public Service Company of New Mexico (PNM) fish passage. Between 2011-2017, the PNM Fish Passage was operated selectively. During that time, only 183 razorback sucker moved upstream. In 2018 and 2019, the PNM Fish Passage structure changed operation to allow more than 600 suckers to move upstream. Coincidentally in 2019, the San Juan Recovery Program detected larval razorback sucker 20 miles further upstream than previously found. This would not be possible without support from Jerrod and the Nation to maintain PIT-tag technology and keep the passage structure clear from obstructions. Much of the conservation and research advancement produced in the last few years would not have been possible without Jerrod's hard work and dedication to the San Juan Program.



PHOTO BY TOM CHART, USFWS

Melissa Mata, Program Coordinator for the San Juan Program, presents Jerrod Bowman, Navajo Nation, with the 2020 Researcher of the Year Award.

## You are What You Eat: A Dietary Approach to Survival of Bonytail

By **Cheyenne Owen**, Upper Colorado Program, **Zane Olsen**, UDWR, **Matthew Fry**, USFWS, **Dale Ryden**, USFWS, **Travis Francis**, USFWS, **Brian Sheer**, USFWS, **Michael Gross**, USFWS, **Haden Vanwinkle**, USFWS, **Ted Smith**, CPW, **Gibson Gaylord**, USFWS

Program hatcheries stock over 35,000 adult bonytail per year, however survival appears to be extremely low. Program partners have begun working together to address issues that could influence post-stocking survival, including nutrition. High levels of mesentery fat and fat deposition in livers have been observed, which could negatively impact liver function and metabolism.

Several efforts to determine an optimal bonytail diet are underway. In summer 2019, Wahweap State Fish Hatchery (Big Water, UT) tested a low energy, commercial pond diet (32% protein and 6% fat) supported by bug lights which attract prey, on young-of-year (YOY) bonytail in grow-out ponds, and observed increased growth and lower percent body fat than previously recorded. Health Condition Profile (HCP) findings also showed that only 5% of bonytail sampled from this study had fatty livers and only 5% had excessive mesentery fat; compared to 65% and 55% in bonytail sampled during last year's HCP. Recent HCP results show that 95% of bonytail sampled from this study had normal livers and only 5% had excessive mesentery fat; compared to 35% with normal livers and 55% with excessive mesentery fat in last year's HCP. J.W. Mumma Native Aquatic Species Restoration Facility (Alamosa, CO) tested the same diet on adult bonytail in late summer 2019. Growth was similar between the control commercial trout diet and the experimental commercial pond diet over 106 days; although higher growth per feed fed was observed with the control diet. This study is ongoing and further analyses are forthcoming.

Starting fall 2019, Ouray National Fish Hatcheries- Randlett (Vernal, UT) and Grand Valley Unit (Grand Junction, CO) both participated in studies testing either YOY or adult bonytail growth performances in recirculating systems on six diets produced at the USFWS Bozeman Fish Technology Center. YOY and adult bonytail gained more weight on a lower protein and fat diet (40% and 12%, respectively) than the control diet (45% protein and 15% fat) over a 56 day period.

Results of all diet studies will be used to choose an optimal bonytail diet. Encounters of bonytail will be monitored into the future to determine impacts on post-stocking survival.



Commercial feed ground and sifted to a smaller size to feed YOY bonytail at Wahweap State Fish Hatchery during feed study.



PHOTOS BY ZANE OLSEN, UDWR

Bug lights overhang pond at Wahweap State Fish Hatchery.

# Endangered Fish Benefit from Expanding River Partnerships

By **Don Anderson**, Upper Colorado Program

A broad spectrum of people and organizations in the upper Colorado River basin have a vested interest in keeping more water in local rivers – not only to recover endangered fish, but also to improve sport fishing, protect water quality, support rafting and kayaking, maintain attractive riverways, generate hydropower, and help the upper basin states meet delivery obligations to the lower basin.

The Upper Colorado Recovery Program has seen various groups emerge in recent years as kindred spirits in these efforts to keep more water in the Colorado River and its tributaries. While many are not specifically affiliated with our Program, their efforts nevertheless align with Upper Colorado Program flow objectives. In 2019, for example, organizations as diverse as the Colorado Water Trust, the Yampa River Fund, the Roaring Fork Conservancy, and the Colorado River District took bold actions to secure more water for instream flows, providing benefits for multiple interests including (but certainly not limited to) the Upper Colorado Program.

The Colorado Water Trust (CWT) describes itself as “a small non-profit that works with people using win-win solutions across the state of Colorado to keep rivers flowing and communities healthy”. It has a long history of working to enhance flows in various Colorado River tributaries. In 2019, for the first time, CWT launched an initiative that acquired 327 acre-feet of water to generate clean hydroelectric power from the Colorado River in Colorado’s Grand Valley, while also enhancing flows for endangered fish through the crucial ‘15-Mile Reach’ above the Gunnison River confluence. “We were thrilled to establish this innovative and groundbreaking partnership with Orchard Mesa Irrigation District, Grand Valley Water Users Association, and the Walton Family Foundation to help support a historic hydroelectric facility and benefit endangered fish,” says Executive Director Andy Schultheiss, “This is exactly the kind of win-win partnership we love to facilitate.”

The Yampa River Fund (YRF) describes itself as “a collaborative community-based organization dedicated to

identifying and funding activities that protect the water supply, wildlife habitat, and recreational opportunities provided by the Yampa River”. YRF launched in 2019 with extraordinary assistance from The Nature Conservancy, the Yampa Community Foundation, and more than 20 community partners in the Yampa Valley region. YRF already has amassed a multi-million-dollar endowment, and it expects to use its resources in various ways in coming years, including enhancing critical low flows in the Yampa River through leases of reservoir water. YRF Manager Andy Baur says, “Our Fund will invest in conservation activities that support valley livelihoods and ensure a healthy, flowing Yampa River for generations to come. To the extent our efforts also benefit native species like the Colorado pikeminnow and razorback sucker, we think that’s a wonderful additional outcome of these extraordinary local efforts.”

Finally, the Upper Colorado Program also benefited from a 2018 water contract that the Roaring Fork Conservancy (RFC) entered into with the Colorado River Water Conservancy District as an experimental arrangement. The contract for water from Ruedi Reservoir was used primarily to move winter water down the Fryingpan River (a Colorado River tributary) and prevent ‘anchor icing’ that impairs coldwater fisheries. In 2019, 299 acre-feet of this leased water remained ‘left over’ and available to the Upper Colorado Program to augment low flows in the 15-Mile Reach. Thus, both cold-water fish in the Fryingpan River and warm-water endangered fish farther down in the Colorado River benefited from the RFC’s innovative experiment.

It takes a village to keep a hard-working river like the Colorado alive, healthy, and continuing to deliver benefits to roughly 40 million Americans who rely on its flow. Many organizations make their own modest contributions to that gargantuan effort, and that list of organizations continues to grow. Happily, a broad array of river enthusiasts get to enjoy the fruits of their collective labors, including the Upper Colorado Program.



# Endangered species updates



PHOTO BY USFWS

Ben Schleicher holds an adult Colorado pikeminnow caught in the Colorado River.

## Colorado pikeminnow

Colorado pikeminnow are showing different trends in the three basins where they occur. In the Green River basin, recent analyses of data through 2018 indicate that the population continues a declining trend since 2000. For the Colorado River upstream of Lake Powell, Colorado pikeminnow numbers are low, but the population appears to be more stable and fluctuating. Some signs point to a new group of young fish spawned in 2015 that may be entering adulthood. Stocking of Colorado pikeminnow into the San Juan River has led to increasing numbers of the fish there, with wild-spawned larvae and now juveniles observed.



PHOTO BY UDWR

Humpback chub encountered in Westwater on the Colorado River.

## Humpback chub

Humpback chub inhabit rocky-canyon, whitewater habitats. Large populations of humpback chub are found in the Little Colorado River and are increasingly common in western Grand Canyon. In the upper basin, the Black Rocks and Westwater Canyon populations are stable with recent increases over the past 4 years. The Desolation/Gray Canyons and Cataract Canyon populations also appear stable, but with fewer fish. Conservation partners are investigating ways to re-introduce humpback into Dinosaur National Monument, which is now considered extirpated. The USFWS proposed to reclassify humpback chub as a threatened species in January of 2020.



PHOTO BY UDWR

A bonytail raised at UDWR's Wahwep Fish Hatchery in Big Water, Utah

## Bonytail

Over 452,000 bonytail have been stocked in the upper Colorado River basin since 1996, of which over 17,500 have been encountered. The majority of encounters (85%) are detections, with most detections (83%) occurring via stationary PIT-tag arrays. Nearly half of bonytail encountered have been at-large for less than 30 days, though several individuals have been at-large greater than 2,000 days. In 2019, all four Program hatcheries conducted bonytail Health Condition profiles, a system to assess fish health and condition. Across facilities, 33-100% of the bonytail tested possessed fatty livers and 55-100% contained excessive mesentery fat. Based on these results, the Program is implementing new diets to improve bonytail fitness.



PHOTO BY NPS

Close up of a razorback sucker held by Kevin Thompson of CPW.

## Razorback sucker

Good news continued for razorback sucker in 2019 and 2020. In the spring of 2019, 45 age-1 razorback sucker were found on the San Juan River, a record for the species in that basin. A few of them were then detected on antennas in McElmo Creek, documenting survival through their second summer. A record number of seven floodplain wetlands connected along the Green and Colorado rivers, providing safe, food-rich habitat for larval razorback sucker to survive their first summer of life. In the lower basin, sampling in Lake Mohave found high numbers of razorback sucker at multiple sampling locations. The USFWS is preparing documents to propose downlisting the species to threatened.

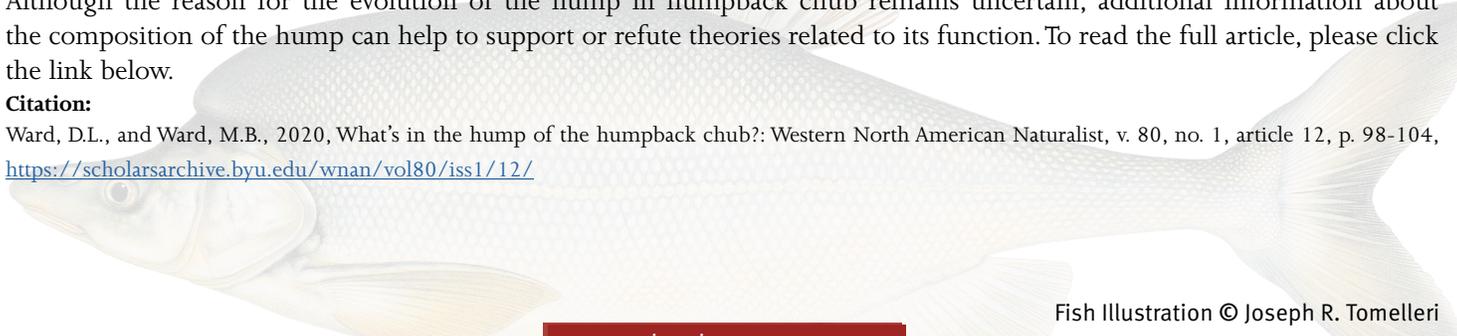
## What's in the Hump of a Humpback Chub?

By **D.L. Ward**, U. S. Geological Survey and **M.B. Ward**, University of Utah

The function of the hump on adult humpback chub has been the subject of longtime conjecture. Hypotheses about the purpose of the hump range from it being a feature that makes it easier to swim in swift water to speculation about how the hump may have reduced predation vulnerability to Colorado pikeminnow. We used comparative histology of the head region of captive-reared and wild specimens of humpback chub to evaluate whether histological examination could give insight into the function of the hump. Tissues were sectioned, stained, and photographed under a microscope at 2×, 4×, and 40× magnification. The hump is composed almost entirely of skeletal muscle, with little nervous system innervation or fatty tissue. Hump muscle and dorsal muscle appear very similar in terms of muscle cell size, fat content, and connective tissue content. No apparent differences exist between the hump tissues of wild-caught and captive-reared individuals. Histological analysis and study of the anatomical structure of the head through dissection, along with evidence from other species, suggest that the hump evolved to reduce predation vulnerability. Although the reason for the evolution of the hump in humpback chub remains uncertain, additional information about the composition of the hump can help to support or refute theories related to its function. To read the full article, please click the link below.

### Citation:

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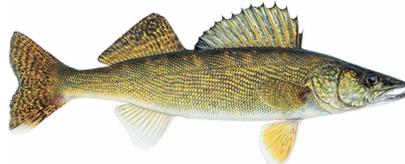
## HELP PREVENT THE SPREAD OF NONNATIVE SPECIES



### KNOW THE LAW



**SMALLMOUTH BASS**



**WALLEYE**



**NORTHERN PIKE**

UTAH AND WYOMING HAVE  
**CATCH & KEEP**  
REGULATIONS IN CERTAIN RIVER  
REACHES. IT IS ILLEGAL TO  
RETURN THESE FISH TO THE RIVER.

One hundred years ago only 13 native species swam in the upper Colorado River and its tributaries—today they have been joined by more than 50 nonnative species. Introduction and establishment of problematic nonnative predators affect native fishes, the UDREFRP and SJRBRP programs, anglers, and local communities with high environmental

and economic costs. Removing illegally introduced species is expensive and time-consuming. We must all join forces to prevent the spread of these problematic nonnative predators to preserve native fish in the river and desirable sportfisheries in reservoirs.

Review your state fishing regulations. State regulations may vary based on river mile and are the **LAW**. Regulations on the river may be **very different** than in reservoirs. **KNOW THE LAW.**

<http://cpw.state.co.us/Documents/RulesRegs/Brochure/fishing.pdf>

<https://wildlife.utah.gov/fishing/fishing-regulations.html>

<https://wgfd.wyo.gov/Fishing-and-Boating/Fishing-Regulations>

<http://www.wildlife.state.nm.us/fishing/game-fish/>