

**RECOVERY PROGRAM
FY 2020-2021 SCOPE OF WORK for:**

Recovery Program Project Number: 123b

Nonnative fish control in the middle Green River

Reclamation Agreement number: R19AP00059
Reclamation Agreement term: Oct. 1, 2019 – Sept. 30, 2024

Note: Recovery Program FY20-21 scopes of work are drafted in May 2019. They often are revised before final Program approval and may subsequently be revised again in response to changing Program needs. Program participants also recognize the need and allow for some flexibility in scopes of work to accommodate new information (especially in nonnative fish management projects) and changing hydrological conditions.

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Category:

- Ongoing project
 Ongoing-revised project
 Requested new project
 Unsolicited proposal

Expected Funding Source:

- Annual funds
 Capital funds
 Other [*explain*]

I. Title of Proposal: Nonnative fish control in the middle Green River

II. Relationship to RIPRAP:

GENERAL RECOVERY PROGRAM SUPPORT ACTION PLAN

- III. Reduce negative impacts of nonnative fishes and sportfish management activities (nonnative and sportfish management).
III.A. Reduce negative interactions between nonnative and endangered fishes.
III.A.2. Identify and implement viable active control measures.
III.A.2.c. Evaluate the effectiveness (e.g., nonnative and native fish response) and develop and implement and integrated, viable active control program.

GREEN RIVER ACTION PLAN: MAINSTEM

- III. Reduce impacts of nonnative fishes and sportfish management activities (nonnative and sportfish management).

- III.A. Reduce negative impacts to endangered fishes from sportfish management activities.
- III.A.4. Develop and implement control programs for nonnative fishes in river reaches occupied by the endangered fishes to identify required levels of control. Each control activity will be evaluated for effectiveness, and then continued as needed.
 - III.A.4.a. Northern pike in the middle Green River.
 - III.A.4.b. (3) Smallmouth bass in the middle and lower Green River.
 - III.A.4.d. Walleye in the middle and lower Green River

III. Study Background/Rationale and Hypotheses:

The Upper Colorado River Endangered Fish Recovery Program has determined that control of nonnative fish in the upper Colorado River basin is essential to the recovery of the four endangered fish species: Colorado pikeminnow (*Ptychocheilus lucius*), razorback sucker (*Xyrauchen texanus*), humpback chub (*Gila cypha*), and bonytail (*Gila elegans*). This determination has been documented specifically for Colorado pikeminnow, razorback sucker, and bonytail in nursery habitats and in the main stem middle Green River in Section 4.3.2 of each species' Recovery Goals document (USFWS 2002).

Smallmouth bass (*Micropterus dolomieu*) abundance has dramatically increased in the Green River since 2000. This increase resulted in a recommendation from the December 2003 Nonnative Fish Control Workshop (Grand Junction, CO) to attempt control of this species in the Green River. Annual removal efforts since 2004, as well as Nonnative Fish Control Workshops have added to the knowledge base of the effort required to remove smallmouth bass from the Green River. During the December 2006 workshop, participants discussed the importance of increasing this removal effort and discussed the need for a significant increase to adequately suppress the middle Green River smallmouth bass population. Additionally, Brenton et al. (2015) identified a need to reduce reproduction and emigration by disrupting nests and targeting spawning bass during "surge" efforts when water temperatures reach 15-16° C. Increased removal effort began in 2007, and several adjustments were made in 2012 to increase our effectiveness and efficiency (Skorupski and Breen 2012). During the second full pass, it was apparent that multiple smallmouth bass concentration areas were present, due to a high spawning success under low flow conditions and a warmer temperature regime. Thus, we used an adaptive fisheries management strategy to target "hot spots" maximizing our catch with funds and time available; "hot spots" vary season to season. We have continued to implement this adaptive management strategy each year since 2012 where we complete two full passes, one occurring at the onset of smallmouth bass removal and one occurring approximately halfway through the smallmouth bass removal phase. Data from each full pass is analyzed to identify smallmouth bass concentration areas and to guide subsequent removal efforts. Specifically, full pass removal efforts are divided into 5-mile sub-reaches and a metric of cumulative length-per-effort is calculated. This metric gives greater weight to adult and piscivorous fish but does not ignore juveniles and sub-adults entirely.

Northern pike (*Esox lucius*) are a significant predatory and competitive threat to the endangered fishes and were rated as a nonnative species of greatest concern by experts on the Colorado River native fish assemblage (Hawkins and Nesler 1991; Johnson et al. 2008).

Northern pike became established in the Yampa River in the early 1980's. Originally introduced as game fish in Elkhead Reservoir in 1977, the species escaped and invaded the upper Yampa River and have expanded their number and range within the Yampa and Green rivers (Tyus and Beard 1990). In previous years, there has been evidence of successful spawning in Stewart Lake and Escalante Ranch wetland near Jensen, Utah and in Old Charley Wash wetland on the Ouray National Wildlife Refuge (Webber and Jones 2013; K. Christopherson, Division of Wildlife Northeastern Regional Supervisor, pers. comm.; T. Modde, U.S. Fish and Wildlife Service, Project Leader, pers. comm.). A control program for northern pike in the Yampa River was initiated in 1999 and removal of northern pike in the middle Green River was initiated in 2001. Based on trends in catch rates over subsequent years, removal efforts have been successful at reducing the number of northern pike and maintaining this reduced level in the middle Green River. However, in 2012 more than three times as many northern pike were captured than in 2011 (Skorupski and Breen 2011) and most were in a smaller size class, likely representing age-1 fish. This large age class likely represents a high level of spawning success in 2011. High flows created additional habitat during the spring in the middle Green River, which allowed for a more successful spawning year for northern pike. Future effort will be adaptive to target northern pike in concentration areas during the spring to maximize efficiency, including exploratory removal efforts in areas where northern pike are being reported.

White sucker (*Catostomus commersonii*) are present in the middle Green River and are problematic due to their ability to hybridize with native suckers (McDonald et al. 2008) and compete with native suckers for limited resources. In southwestern Missouri, white suckers become mature around 275 mm (Wakefield and Beckman 2005). Because of this, our goal for removing white suckers is to keep the average total length of the white sucker population less than 275 mm. This may not address their ability to compete with native suckers; however, it should limit their ability to hybridize with native catostomids. A pond complex at the Parson's Unit in Brown's Park was identified in 2014 as a potential source population for white sucker (Schelly et al. 2014), and follow up sampling took place in the fall of 2015 to better understand the scope of the problem (Schelly et al. 2015). Based on 2015 sampling, additional surveys were not necessary in 2016. However, we have moved forward with engineer consultation for wetland renovations to eliminate fish escapement in the future, and we have moved forward with funding requests (Watershed Restoration Initiative). Treatment of these ponds will be required prior to renovation (hopeful for 2020).

At the 2013 Nonnative Fish Workshop, walleye (*Sander vitreus*) were identified as a substantial threat to the recovery of endangered fishes in the upper Colorado River basin, due to increasing densities and the predatory and competitive pressure this species imposes. However, there was not a removal program in place that focused on walleye when they are most vulnerable to capture. Recent observations of increasing densities have mainly come from ancillary captures during Colorado pikeminnow population estimates (UCRRP Project #128), which typically occur earlier in the spring than smallmouth bass removal and in only three out of every five years. Therefore, our future efforts will apply adaptive strategies to target walleye when other projects are not in place for adequate removal efforts. For example, future walleye removal efforts will focus on key spawning temperatures and fluctuations in flow that may allow for maximum effectiveness, as well as targeting concentration areas for walleye (i.e., spawning bars in Dinosaur National Monument, and below the White River

confluence to Sand Wash).

IV. Study Goals, Objectives, End Product(s):

Goal:

Sufficiently reduce the abundance of adult smallmouth bass, northern pike, white sucker, and walleye in the middle Green River such that their potential to spawn and their predatory and competitive impacts on the growth, recruitment, and survival of endangered and other native fishes is minimized.

Objectives:

1. Conduct two smallmouth bass removal passes in the middle Green River from Split Mountain boat ramp to Tabyago Riffle. Full passes will identify concentration areas to focus more effort on. Smallmouth bass will be specifically targeted through boat electrofishing (approximately 14 total weeks of effort; incidental captures occurring during other projects will also be recorded).
2. Conduct northern pike removal in the middle Green River in concentration areas to maximize efficiency. Northern pike will be targeted specifically in tributary habitats via fyke netting and boat electrofishing during fluctuating spring flows (~8-10 weeks of effort; incidental captures occurring during other projects will also be recorded).
3. Conduct white sucker removal in the middle Green River to minimize the threat of hybridization with native fishes. White sucker will be targeted specifically in tributary habitats via fyke netting and boat electrofishing during fluctuating spring flows (~8-10 weeks of effort; incidental captures occurring during other projects will also be recorded).
4. Conduct walleye removal in the mainstem middle Green River using adaptive strategies to target this species when other projects are not in place for adequate removal efforts. Walleye will be targeted in main channel habitats during early spring (~6-8 weeks of effort during off years for UCRRP Project #128, ~2 weeks during on years; incidental captures occurring during other projects will also be recorded).

End product:

Annual results from removal efforts of each species in the middle Green River will be analyzed for further interpretation among nonnative removal primary investigators across the upper Colorado River basin (conference calls or a nonnative fish workshop each December) to determine focal strategies for future implementation.

V. Study Area:

The study area encompasses the middle Green River from Island Park to Rainbow Park (RM 333.9 to 327.6) in Dinosaur National Monument and from Split Mountain boat ramp (RM

319.3) to Tabyago Riffle (RM 206.8). Effort will focus on concentration areas identified during subsequent removal passes for smallmouth bass and walleye. We will also sample key off channel habitats previously identified for northern pike and white sucker (see Study Methods below for specifics) shortly after ice-off to document spawning and remove ripe adults.

VI. Study Methods/Approach:

Temporarily reducing riverine smallmouth bass and northern pike populations appears viable under certain environmental conditions but both species can easily reverse these reductions in population abundance and return to pre-removal abundances under favorable environmental conditions (Breton et al. 2014, 2015; Zelasko et al. 2015). Therefore, mechanical removal efforts will attempt to reach eradication of nonnative fish populations in the river. However, recent synthesis reports investigating effectiveness of in-river removal efforts for northern pike and smallmouth bass determined that reducing in-river populations of these two species would not be successful unless in-river reproduction and reservoir escapement were controlled (Breton et al. 2014, 2015; Zelasko et al. 2015). Therefore, mechanical removal efforts will continue to temporarily suppress riverine populations, and will focus on reducing in-river reproduction when feasible. Simultaneously, Program partners will work on other means to reduce in-river reproduction and reservoir escapement (i.e., barriers at Red Fleet and Starvation reservoirs), in order to make mechanical removal more effective and to attempt to reach complete eradication of riverine populations.

Smallmouth bass will be removed primarily by boat electrofishing. Sampling crews will conduct removal activities in a manner that minimizes potential negative impacts to endangered fish. This includes discontinuing electrofishing when elevated numbers of endangered fish are known to be present. Situations when this is likely to occur will be when Colorado pikeminnow are staging in tributary mouths or backwater habitats prior to spawning, when razorback sucker are on or near spawning bars, and following recent stocking of endangered bonytail or razorback sucker. Two electrofishing boats will simultaneously electrofish each shoreline of the river. Electrofishing passes will be conducted when spring peak flows recede below 10,000 cfs. Effort will be focused on shoreline habitat that is likely to contain smallmouth bass. Two full passes, each comprising approximately two weeks of effort, will extend from Split Mountain boat ramp to Tabyago Riffle. Effort for the remaining 10 weeks will be allocated to concentration areas identified during complete passes (such as Split Mountain, Ouray National Wildlife Refuge, and below the Duchesne and White rivers; Staffeldt et al. 2017; Partlow et al. 2018). Fish lengths and weights will be recorded on each pass. All smallmouth bass, northern pike, white sucker, and walleye collected during smallmouth bass removal will be removed and disposed of.

Initial bass removal efforts (i.e., June electrofishing) may serve to identify concentrations of spawning fish. These areas will receive additional electrofishing effort in subsequent passes. If ripe fish or nesting males are encountered, additional effort will be spent at that time to capture other potential spawning or nesting fish in that area. Two methods will be used in an attempt to identify bass spawning periods and locations. First, crews will examine shoreline areas for nests and destroy any found; crews will also examine all bass captured in the first few passes for spawning condition (i.e., dissection of any bass > 200 mm TL that are not

expressing gametes at time of collection). Further effort may also give an indication as to the presence of young-of-year (YOY) bass. Locations of congregations of YOY bass will be noted and these areas will receive additional electrofishing effort as well in an effort to displace YOY bass.

In addition, smallmouth bass will be removed from Island Park to Rainbow Park (RM 333.9 to 327.6) in Dinosaur National Monument. In collaboration with USFWS–GRBFWCO and UDWR–Moab, we will conduct a “surge” effort in this reach to maximize nest disturbance during the active spawning period (e.g., Schelly et al. 2014, 2015). More specifically, three passes per week were conducted in this reach over a three week period in 2014 (Schelly et al. 2014), which proved to be effective in removing concentrations of spawning adult smallmouth bass and will be continued.

More recently, smallmouth bass populations have reached concerning levels in the White River, where successful reproduction and recruitment has occurred each year since removal efforts were initiated in 2012 (UCRRP Project #167), regardless of annual hydrology (Smith et al. 2018). As such, primary investigator discussions in December 2018 led to the development of recommendations to increase removal efforts in the White River. In order to increase removal effort in the Utah portion of the White River without increasing costs of that scope of work, it was determined that we would shift smallmouth bass removal effort from this project to UCRRP Project #167 as needed. Specifically, we requested to shift four days of spring and four days of fall removal effort from this project to the White River; recommendation approved at the March 4-5, 2019 UCRRP Biology Committee meeting. This reallocation of effort will reduce our total smallmouth bass effort from 16 weeks to 14 weeks of total effort.

Known concentration areas for northern pike and white sucker in the middle Green River during spring include: the mouth of Brush Creek (RM 304.5), Cliff Creek (RM 302.9), Stewart Lake Drain (RM 300.0) and Ashley Creek (RM 299.0). These areas and additional backwater/low-velocity habitats will be targeted as needed for removal of northern pike and white sucker. Removal will primarily be completed using fyke nets and boat electrofishing. Sampling methods will be adjusted depending on whether difficulties arise (i.e., otters in fyke nets, fluctuations in flows, etc.). We will also evaluate spawning periods for both species to best target removal of reproductively mature adults; dissection of adult northern pike and white sucker will occur for individuals that are not expressing gametes.

Walleye removal efforts will be an adaptive process using past capture locations to identify concentration areas. Given what we know from past captures, removal efforts will focus on the time period from March until May, with consideration for specific temperatures and flow conditions, as well as for locations where potential spawning bars are located (i.e., Split Mountain reach; Schelly et al. 2015). Additional effort will occur in years that do not have Colorado pikeminnow population estimates (UCRRP Project #128). As with smallmouth bass, northern pike, and white sucker, adult walleye that are not expressing gametes at time of capture will be dissected to determine whether our efforts are appropriately targeting the spawning period for this species.

Nonnative removal and evaluation efforts, which includes tagging and marking of endangered and target nonnative fishes, are also being conducted by other researchers and agencies in other

reaches of the Green and Yampa rivers. Therefore, sampling crews will examine all captured endangered and target nonnative fish for tags or marks and record pertinent information. This information will then be reported to pertinent principal investigators and included in annual reporting. All data will be provided to the Recovery Program for submission to the STReAMS database. Additionally, all larger (i.e., piscivore size class) smallmouth bass, northern pike, and walleye will be scanned for a PIT tag to determine if native fish predation has recently occurred; dissection of individuals for visual confirmation will be used in cases where fish exhibit obvious bulging abdominal regions.

Besides targeted smallmouth bass, northern pike, white sucker, and walleye, all nonnative fish encountered during sampling will be removed except for common carp (*Cyprinus carpio*), channel catfish (*Ictalurus punctatus*), and small-bodied cyprinids. Nonnative fishes that will be removed include, but are not limited to green sunfish (*Lepomis cyanellus*), black crappie (*Pomoxis nigromaculatus*), bluegill (*Lepomis macrochirus*), gizzard shad (*Dorosoma cepedianum*), and potentially burbot (*Lota lota*). Otolith structures will be collected from specific nonnative species (e.g., burbot) upon Upper Colorado River Recovery Program request.

All endangered fishes captured during nonnative removal projects will be scanned for a PIT tag, tagged if needed, weighed (g), measured TL (mm), and released alive.

VII. Task Description and Schedule:

Task 1. Northern pike, white sucker, and walleye removal: conduct 8-10 weeks of fyke netting and electrofishing in backwaters and flooded tributary mouths. One week of effort is equal to approximately three overnight fyke sets and four days of electrofishing in available habitat from the Escalante wetland outlet to Ashley Creek. Conduct 6-8 weeks of main channel electrofishing to target walleye during UCRRP project #128 off years and two weeks during UCRRP project #128 on years. One week of effort is equal to approximately four 10 hour days for a two-boat crew, including travel time and preparation time for camping trips.

Task 2. Smallmouth bass removal: conduct 14 weeks of electrofishing to remove smallmouth bass (2 weeks of effort previously allocated to this project have been reallocated to White River smallmouth bass control). Two full passes (4 weeks of effort) from Split Mountain to Tabyago Riffle (one at the onset of removal and one approximately half way through the season) will guide subsequent removal targeting identified concentrations. Up to two weeks of total effort will be expended in Island Park during optimum spawning conditions to disadvantage reproduction in that area. One week of effort is equal to approximately four ten hour days for a two-boat crew, including travel time and preparation time for camping trips.

Task 3. Data entry, analysis, and reporting: quality control and analyze data to determine trends in nonnative catch rates. Report findings via recovery program annual report and submit data to STReAMS.

Task	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1			X	X	X							
2						X	X	X	X	X		
3										X	X	X

VIII. Deliverables, Due Dates, and Budget by Fiscal Year:

FY 2020-2024

Program annual reports due each November.

Project data will be submitted to the Recovery Program Database Manager by January.

In addition to annual reports, the PIs will submit a short article and photos for inclusion in the 2021 *Swimming Upstream* field report.

IX. Budget Summary:

	UDWR-Vernal
FY 2020	266,716.82
FY 2021	260,669.69
FY 2022	273,974.24
FY 2023	274,789.00
FY 2024	288,702.86
TOTAL	1,364,852.62

Note: In response to poor quality of seasonal hires resulting from lack of affordable housing, this scope of work has funded seasonal housing from 2013-2018. This precedent was established and approved by the Recovery Program prior to the 2013 field season because Vernal, UT is a remote location compared to other UDWR offices (e.g., Wasatch Front) and short-term rental options are rare. Moreover, the foundation of the local economy in Vernal is focused on natural resource development (i.e., natural gas and oil extraction), which increases housing demand and therefore drives area housing costs high. More specifically, the Vernal area is characterized by a cyclical boom-bust economy that is associated with large fluctuations in cost of living. Furthermore, in order for us to find enough qualified applications, we have to post seasonal technician positions nationwide and our more qualified hires are typically from outside of the area. However, during a recent budget audit conducted by UDWR's Director's Office it was determined that our Native Aquatics Program in Vernal would no longer be allowed this convenience given recent economic stability in the area. Therefore, we are obligated to relinquish annual funds for this purpose (**\$11,016/yr at FY 2019 levels**). With that said, our Director's Office will support seasonal housing expenses in the future if large economic swings observed in the past resurface. If such circumstances occur in the future, we will be requesting reinstatement of funds for this purpose.

X. Reviewers:

XI. References:

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