RECOVERY PROGRAM Recovery Program Project Number: 98a
FFY 2020-2021 SCOPE OF WORK for:

Middle Yampa River Nonnative Fish Management

Reclamation Agreement number: R17AP00301
Reclamation Agreement term: September 22, 2017 – September 30, 2022

Lead agency: Colorado Parks and Wildlife

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Category:
_X_ Ongoing project
__ Ongoing-revised project
__ Requested new project
__ Unsolicited proposal

Expected Funding Source:
_X Annual funds
__ Capital funds
__ Other *[explain]*

I. Title of Proposal:

Middle Yampa River northern pike removal and evaluation; Middle Yampa River smallmouth bass removal and evaluation; Middle Yampa River backwater northern pike removal

II. Relationship to RIPRAP:

This study will remove nonnative fish, primarily smallmouth bass and northern pike, from the middle Yampa River near Craig, Colorado (RM 134.2). CPW will evaluate the efficiency of that northern pike removal, while Colorado State University will evaluate the smallmouth bass removal effort. Colorado Parks and Wildlife (CPW) will remove northern pike from selected backwater areas in the middle Yampa River prior to conducting main channel removal passes.

General Recovery Program 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.

Green River Action Plan: Yampa and Little Snake rivers:

III.B. Implement CPW Yampa Basin aquatic wildlife management plan (CDOW 1998) and the Recovery Program's Yampa River Nonnative Fish Control Strategy. Each control activity will be evaluated for effectiveness and then continued as needed.

III.B.2. Control nonnative fishes via mechanical removal.

III.B.2.d. Remove (formerly "and translocate") northern pike from Yampa River designated critical habitat.

III.B.2.d. (1) Remove northern pike and smallmouth bass above Craig, Colorado

III.B.2.e. Remove (formerly "and translocate") smallmouth bass in Yampa River designated critical habitat.

III. Study Background/Rationale and Hypotheses:

Susceptibility of the Colorado River Basin to nonnative fish establishment has been attributed to the low diversity of the native fish fauna, a high degree of endemism of this fauna, and the highly altered physical habitat of the basin (Hawkins and Nesler 1991). Bezzerides and Bestgen (2002) report that the native fish fauna of the Colorado River Basin consists of at least 35 species, while at least 100 nonnative fishes have been introduced into the basin (Tyus and Saunders 2000). Twenty-eight of these nonnative fish species were identified as threats to native fishes through a survey of regional fisheries biologists (Hawkins and Nesler 1991). Of these 28 species, the northern pike (*Esox lucius*) was considered by biologists as the third greatest hazard to native fishes (Hawkins and Nesler 1991).

In Colorado, the northern pike is one of 40 known, introduced fish species currently existing within the Colorado River Basin (Nesler 2003). This species has been extensively introduced outside of the species' native range for use as a large sportfish, and as a predator to control other fishes (Scott and Crossman 1973). Northern pike were first introduced to the Yampa River Basin of Colorado in 1977. Less than 1,000 fingerling northern pike were released into Elkhead Reservoir to prey upon a large number of nonnative suckers present (Roehm 2004). Elkhead Creek is located approximately four miles upstream of Craig, and is the receiving stream of Elkhead Reservoir. This creek is tributary to the Yampa River. Movement of northern pike downstream was evidenced by collection of this species in the Yampa River, as early as 1979 (Tyus and Beard 1990). Northern pike numbers within the river had increased by the early 1980s (Wick et al. 1985; Tyus and Beard 1990). Subsequent downstream movement of northern pike into the Green River was first documented less than five years after initial release in Elkhead Reservoir (Tyus and Beard 1990). This species has since established itself as a self-sustaining population within the Yampa River.

Influences of such introductions on native fish fauna are cause for great concern, especially in areas occupied by endangered species. The Yampa River downstream of Craig is designated by the U.S. Fish and Wildlife Service (USFWS) as critical habitat for the federal- and state-listed Colorado pikeminnow (*Ptychocheilus lucius*), humpback chub (*Gila cypha*), bonytail (*Gila elegans*), and razorback sucker (*Xyrauchen texanus*). Primary threats to these native species include competition with and predation by nonnative fish species (USFWS 2002). The northern pike has been identified as one of two principal, nonnative hazards to juvenile and adult Colorado pikeminnow (USFWS 2002). Northern pike and Colorado pikeminnow share similar habitat in the spring and early summer during the spawning season. Both species also rely on

native sympatric species, such as roundtail chub (*Gila robusta*), flannelmouth sucker (*Catostomus latipinnis*), bluehead sucker (*Catostomus discobolus*), and speckled dace (*Rhinichthys osculus yarrowi*) as prey (Tyus and Beard 1990; Nesler 1995). Further, Nesler (1995) found that the nonnative redside shiner may also be a common prey item of northern pike and Colorado pikeminnow. Overall resource sharing between the two species may also increase the likelihood of northern pike predation on young and adult endangered fishes (Tyus and Beard 1990; Nesler 1995). Thus, the potential impacts of northern pike competition with, and predation of native, sympatric species (especially the Colorado pikeminnow) are severe.

This proposed study is one of several designed for removal of northern pike and smallmouth bass, and evaluation of such efforts within the upper Colorado River Basin. Colorado Parks and Wildlife and Colorado State University (CSU) have cooperatively developed the logistics within this proposal. These collaborative efforts will increase the efficiency and effectiveness of removing northern pike and smallmouth bass within the middle Yampa River. Evaluation of the removal efforts will assist the Upper Colorado Recovery Program (Recovery Program) in attaining nonnative fish management goals.

Study Considerations

Colorado Parks and Wildlife will remove northern pike and smallmouth bass from Yampa River backwater areas in the vicinity of Hayden and Craig, Colorado for up to six weeks (5-day weeks, of which at least 3 days will be on the river) from mid-March through the end of April depending on hydrologic conditions (Task 3). Upon completion of backwater gill-netting, CPW will perform main channel boat electrofishing for up to four weeks (5-day weeks, of which at least 3 days will be on the river) in May to monitor the Colorado pikeminnow population (work described in project 128 SOW) and remove northern pike and smallmouth bass (Task 4). Subsequently, two weeks will be devoted to main channel boat electrofishing in early June, and an additional week in early July devoted to disruption of the smallmouth bass spawning period, known as the Surge (Task 5). Temporaries will be hired for a total of 17 weeks to accomplish these three tasks. Four of the seventeen weeks (two, 5-day weeks pre-sampling and two, 5-day weeks post-sampling) will be devoted to crew training, preparation and maintenance of equipment, and data entry (Tasks 2 and 6).

Typically six weeks, but a minimum of 30 days, will be expended from mid-March through April during the backwater gill netting effort, pending appropriate hydrological conditions. Nets will be deployed seven days a week as long as conditions warrant, with staff typically working five day shifts. A crew of four people will be required to complete this portion of the project; USFWS will contribute two people for three weeks to assist in the backwater gill netting. Colorado Parks and Wildlife may request additional assistance from the USFWS and/or CSU to help complete several days of backwater work while CPW focuses on other nonnative fish control efforts (Elkhead Reservoir spillway net evaluation).

Colorado Parks and Wildlife will perform main channel boat electrofishing during the month of May for up to four weeks and for up to two weeks in early June (5-day weeks, of which at least 3 days will be on the river). These efforts will begin once the backwater netting is complete, and within the time frame that hydrological conditions allow. Colorado Parks and Wildlife will focus on completing two passes in five reaches including South Beach, Juniper, upper and lower

Maybell, and Sunbeam during the month of May, and will then contribute more effort as time allows. June sampling will be coordinated with CSU, and may include additional passes through the five reaches, or focusing on smallmouth bass/northern pike concentration areas within certain reaches.

Colorado Parks and Wildlife crews will also contribute one week in early July (5-day weeks, of which at least 3 days will be on the river) of electrofishing removal during the smallmouth bass spawning period. CPW will coordinate with CSU regarding the river reaches to focus on during this time, but CPW will likely be working in the South Beach, Juniper and Maybell reaches.

While not funded as part of this SOW, CPW will be working from the middle to end of June preparing for and managing for the Elkhead Reservoir Fishing Classic, an angler harvest incentive tournament targeting northern pike and smallmouth bass.

Temporary employees may be paid overtime wages pursuant to Colorado State law, and application of federal health care mandates may result in increased costs for temporary employees. Overtime wages have been included within the budget tables as a separate line item, while health care costs have not.

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

Study Goals

1) To reduce the number of northern pike in middle Yampa River backwaters in the vicinity of Craig, Colorado (RM 134.2) prior to and during the spawn by setting gill nets in selected backwater areas that have been identified as problematic locations.
2) To reduce the number of northern pike occupying 47.3 river miles of critical habitat within the Yampa River downstream of Craig, Colorado (RM 134.2-RM 60.6), thereby benefiting native fishes of the Yampa River Basin, as well as native fish communities downstream within the Green River Basin.
3) To reduce the number of smallmouth bass occupying 47.3 river miles of critical habitat within the Yampa River downstream of Craig, Colorado (RM 134.2-RM 60.6), thereby benefiting native fishes of the Yampa River Basin, as well as native fish communities downstream within the Green River Basin.

Study Objectives

1) To remove as many northern pike as possible within the middle Yampa River study area utilizing backwater gill netting, main channel electrofishing, and backwater block-and-shock techniques.
2) To calculate the number of northern pike removed.
3) To remove as many smallmouth bass as possible within the middle Yampa River study area utilizing main channel electrofishing and backwater and backwater block-and-shock techniques.
4) To implement disruption of nests and targeted removal of smallmouth bass during the spawn within the middle Yampa River study area, as part of The Surge and Extended Surge, in a coordinated effort with CSU, and with CSU as the lead.
5) To provide CSU with smallmouth bass data collected to estimate the number of smallmouth

bass occupying the middle Yampa River study area.

End Product

In compiling and organizing the data collected, CPW will follow quality assurance and quality control protocols provided annually by the Recovery Program Director's Office and/or CSU. Validated smallmouth bass data will be provided to CSU. An annual report, including northern pike data collected by CSU from the same general area that CPW has sampled, will be prepared and distributed to interested parties following the field season. Presentations will also be provided during the Annual Nonnative Fish Control Workshop, and at the Annual Recovery Program Researchers' Meeting.

Revisions Beginning in 2018

In 2018, CPW expanded Task 3 (remove northern pike in backwaters) to six full weeks under the approval of the Recovery Program. Task 4 (in channel electrofishing prior to runoff) is reduced in effort as a result, and now focuses on two passes in five, 10.0-mile reaches in May. Some previous Task 4 responsibilities, such as April electrofishing, were redistributed to CSU (under project 125 and 128) beginning in 2018. Tasks 5 and 5.5 were reduced by half to represent reality of needed effort for the Surge. Colorado pikeminnow monitoring previously funded under NNF SOWs (98a and 125) was moved to SOW 128 in 2018. CPW reduced its equipment budget (Task 2) to help with increased CSU costs. CPW included overtime costs because agency guidance requires the payment of overtime in lieu of compensatory time.

V. Study Area:

Backwater areas within and upstream of the study area (into the Project #98b study area as far upstream as Hayden, Colorado) will be netted as the ice recedes and hydrological conditions allow, from the middle of March through the end of April. Focusing on this time frame will allow CPW to remove as many northern pike as possible pre-spawn.

The study area for this project will focus on 47.3 river miles of the middle Yampa River just downstream of Craig, Colorado (RM 134.2) to just upstream of Cross Mountain Canyon (RM 60.6). The main channel, including backwater areas, will be boat and raft electrofished utilizing block-and-shock techniques within backwaters. Specific river segments that may be sampled include: Reach 1: RM 134.2 (South Beach launch) to RM 124.0 (Round Bottom), Reach 2: RM 100.0 (upstream Government Bridge) to RM 91.0 (mouth of Little Juniper Canyon), Reach 3: RM 88.7 (downstream of Juniper Canyon) to RM 79.2 (Maybell bridge launch), Reach 4: RM 79.2 to RM 71.0 (Sunbeam launch), and Reach 5: RM 71.0 to RM 60.6 (just upstream of Cross Mountain launch). Northern pike will not be removed by CPW in 24 miles of river, RM 124.0 (Round Bottom) to RM 100.0 (near Government Bridge). Colorado State University has established this reach as a smallmouth bass study area. These 24 miles have also been included in previous studies for northern pike removal. Therefore, CSU will remove northern pike within these stretches in conjunction with their smallmouth bass study. Colorado State University will also remove smallmouth bass and northern pike from downstream of Cross Mountain Canyon (RM 55.5) to just downstream of the Little Snake River confluence (RM 50.5). Colorado State University's northern pike data will be collated with CPW data and reported by CPW. Colorado

Parks and Wildlife will also remove smallmouth bass across the entire CPW study area. Colorado Parks and Wildlife's smallmouth bass data will be collated with CSU data and reported by CSU. Approximately two miles of river within Juniper Canyon will not be sampled, due to non-navigable riverine conditions.

VI. Study Methods/Approach:

Field Methods

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; 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; 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, Recovery Program partners will work on other means to reduce in-river reproduction and reservoir escapement, in order to make mechanical removal more effective and to attempt to reach complete eradication of riverine populations.

<u>Mid-March through April-Early Spring Backwater Netting</u>

Backwater areas in the vicinity of Craig, Colorado that have been identified as known or likely northern pike concentration areas will be netted as the ice recedes and hydrological conditions allow, from the middle of March through the end of April (a minimum of 30 days of effort). The goal of this effort is to remove northern pike from the backwater areas before they have a chance to spawn and thus reduce the annual cohort contributed to the Yampa River northern pike population by riverine spawning. Backwater areas in Project #98a and #98b sections of the Yampa River where CPW has obtained landowner permission will be included in the netting effort. A jon boat and float tubes will be used to set gill nets in the backwater areas, which will be allowed to soak overnight and retrieved the following day.

All northern pike and other nonnative fish (excluding salmonids and channel catfish) taken by this method will be identified by species, measured for total length to the nearest millimeter, weighed to the nearest gram, and lethally removed and disposed of in a landfill. Northern pike and smallmouth bass collected will be examined for the presence of FLOY tags, PIT tags, and fin clips. Any tag number and color, and any fin clips will be recorded. Nonnative species of unusual occurrence, i.e. walleye, burbot, grass carp, etc. will have their otoliths extracted prior to disposal.

Bluehead sucker, flannelmouth sucker, roundtail chub, and Colorado pikeminnow captured will be identified, measured in total length to the nearest millimeter, and weighed to the nearest gram. These species will be scanned to determine the presence of passive integrated transponder (PIT) tags. PIT tag number will be recorded and stored in the PIT tag reader for those fish encountered

with PIT tags. Individuals without PIT tags will be implanted with a new PIT tag following the appropriate protocol. Capture locations for these species will be recorded to the nearest tenth of a river mile. UTMs associated with capture locations will also be recorded, when possible. All native species captured will be released alive, immediately. Any native fish captured that is visibly stressed will not be processed, but rather returned to the location of capture within the river, immediately.

May-Mainstem Electrofishing and Backwater Block-and-Shock

Main channel electrofishing to monitor Colorado pikeminnow and block-and-shock techniques in backwaters to target northern pike and smallmouth bass will be the focus of this sampling effort. Colorado Parks and Wildlife will perform main channel boat electrofishing for up to four weeks, during the month of May. These efforts will begin once the backwater netting is complete, and within the time frame that hydrological conditions allow. Colorado Parks and Wildlife will focus on completing two passes in five reaches including South Beach, Juniper, upper and lower Maybell, and Sunbeam, and will then contribute more effort as time allows. During Colorado pikeminnow population estimate efforts (FFY 2021, 2022, and 2023), sampling will follow the study design described in project 128. Specifically, "a sufficient amount of time (e.g., 5- 10 days) should elapse between the start of consecutive sampling occasions to allow for sufficient mixing of marked and unmarked fish".

Two, three-person electrofishing crews will utilize jon boats with outboard jet units to perform sampling in the main channel. Each crew will simultaneously sample the left and right shorelines in a downstream direction using ETS electrofishing equipment. Island perimeters will also be electrofished. No river segment will be electrofished on consecutive days to allow for fish recovery and redistribution. A third chase boat will be operated by two or three additional crew members to process fish captured. Fish will be handled and processed per those protocols previously mentioned within the spring backwater netting section.

Backwaters where CPW has obtained landowner permission to sample will also be included within this sampling effort, when feasible. Crews will sample backwater areas along both sides of the river. A gill net will be used with a block-and-shock technique. Backwater habitats will be sampled until the river recedes and habitats are no longer accessible. Electrofishing output power within backwaters will be adjusted based upon changes in river conductivity. Additionally, output power will be reduced during the boat approach to the blocked mouth. Both processes will minimize the potential for electrofishing injuries to fish.

Early June and Early July (the Surge)-Mainstem Electrofishing and Backwater Block-and-Shock

Early June

Main channel electrofishing and block-and-shock techniques in backwaters to target northern pike and smallmouth bass will be the focus of this sampling effort. Colorado Parks and Wildlife will perform main channel boat electrofishing for up to two weeks in early June, and within the time frame that hydrological conditions allow. These efforts will be coordinated with CSU, and may include additional passes through the five reaches sampled in May, or focusing on

smallmouth bass/northern pike concentration areas within certain reaches. Fish sampling methodologies will follow those previously described within the May electrofishing section. Fish will be handled and processed per those protocols previously mentioned within the spring backwater netting section.

Early July (the Surge)

Colorado Parks and Wildlife will assist CSU with a targeted intensive smallmouth bass removal effort in early July, and within the time frame that hydrological conditions allow. Intensive removal of smallmouth bass during their spawning period is referred to as the "Surge," an activity that concentrates the efforts of several agencies in reaches with smallmouth bass spawning habitat. Previous work since 2010 has shown that adult smallmouth bass are most vulnerable to our sampling gear during this period, and increased rates of removal can be achieved. Further, this effort aims to exploit our ability to interfere with the spawning process by increasing the frequency of electrofishing during the spawning period, in identified reaches used for spawning by smallmouth bass. For more information regarding the Surge effort, please see the Scope of Work for Project #125.

Recent studies by Bestgen and Hill (2016) demonstrate that smallmouth bass spawning in the Yampa River occurs for approximately four weeks, often including two to three weeks when the hydrograph declines to 1,000 cfs or less. A river flow of 1,000 cfs or less is unsafe for navigation using jon boats with outboard jet units. In order to maximize the disruption of smallmouth bass spawning, this portion of the project extends the Surge below the 1,000 cfs threshold by switching to electrofishing rafts. Other gear types may also be utilized, including smaller jon boats, trammel nets, and angling over smallmouth bass nests.

Colorado Parks and Wildlife will contribute to this effort by providing four or more employees across a minimum of one week (5-day weeks, of which at least 3 days will be on the river) in early July, as well as two electrofishing rafts. Crews will utilize the rafts to electrofish and use other gear types previously mentioned. When feasible, fish sampling methodologies will follow those previously described within the May electrofishing section. Fish will be handled and processed per those protocols previously mentioned within the spring backwater netting section.

Data Collection and Analysis

All data collected will follow the same guidelines that CSU will be utilizing. In addition to fisheries information, water temperature, water conductivity, ETS settings, and gear effort will also be recorded. Quality assurance and quality control protocols provided annually by the Recovery Program Director's Office and/or the USFWS will be followed during data compilation and organization. Data collected will be analyzed to determine northern pike densities, length frequency distributions, catch per unit effort, and movement. Length frequencies and catch per unit effort will also be determined for native fishes, including Colorado pikeminnow and roundtail chub. Data collected regarding Colorado pikeminnow will be provided to the USFWS. Validated smallmouth bass data will be provided to CSU. An Annual Report will be prepared and will include the data analyses mentioned above for all years of study in which comparable methodology and data exists.

VII. Task Description and Schedule:

Task 1. Establish landowner contacts, obtain permission to access property and backwaters for sampling.
Schedule: February-Mid March

Task 2. Plan logistics, hire and train personnel, order and maintain equipment, and prepare for sampling.
Schedule: February-April

Task 3. Complete early spring backwater removals utilizing gill nets to target northern pike during the spawning period in the area covering Project #98a and #98b sections of river.
Schedule: Mid March -April

Task 4. Complete main channel and backwater electrofishing within the study area to remove northern pike and smallmouth bass. *This task is included in SOW 128 in FFY 2021, 2022, and 2023 because it will focus on providing data for Colorado pikeminnow population estimates.*
Schedule: May

Task 5. Complete main channel and backwater electrofishing within the study area to remove northern pike and smallmouth bass. Assist CSU with the Surge to target smallmouth bass utilizing raft electrofishing and other methods during the spawning period and low hydrograph conditions.
Schedule: Early to Mid June; Early July

Task 6. Maintenance of equipment, data entry, data analysis, and preparation of final report. Present findings during the Annual Nonnative Fish Control Workshop, and at the Annual Recovery Program Researchers Meeting.
Schedule: August- January

Overall Schedule FFY 2020:

Task	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1		X	X									
2		X	X	X								
3			X	X								
4					X							
5						X	X					
6	X							X	X	X	X	X

Overall Schedule FFY 2021:

Task	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1		X	X									
2		X	X	X								
3			X	X								
4					X							
5						X	X					
6	X							X	X	X	X	X

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

Annual report submission by November each year and data submissions to STReaMS by the following January. See attached USBR cost estimating worksheets for budget details.

IX. Budget Summary:

FFY 2020: $163,335
FFY 2021: $128,586 ($43,637 extracted from total in Task 4 and included in SOW 128)
FFY 2022: $123,943 ($44,217 extracted from total in Task 4 and included in SOW 128)
FFY 2023: $132,598 ($44,809 extracted from total in Task 4 and included in SOW 128)
FFY 2024: $173,179

X. Reviewers:

Harry Crockett and Brianna Franco, CPW

XI. References:

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