

**RECOVERY PROGRAM
FY 2018-2019 SCOPE OF WORK for:**

Middle Yampa smallmouth bass and northern pike removal

Recovery Program Project Number: 125

Reclamation Agreement number: R14AP00001
Reclamation Agreement term: Oct. 1, 2008 – Sep. 30, 2018

Lead agency: Larval Fish Laboratory (LFL)
Submitted by: John Hawkins (Lead)
Larval Fish Laboratory
Department of Fish, Wildlife, and Conservation Biology
Colorado State University
Ft Collins, CO 80523
Voice: (970) 491-2777 FAX: (970) 491-5091
John.Hawkins@ColoState.EDU

Some of this work receives personnel and equipment assistance from USFWS- see attached budgets.

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Revision Notes: 5/17/17 revision based on McAbee budget comments.

<u>Category:</u>	<u>Expected Funding Source:</u>
<input checked="" type="checkbox"/> Ongoing project	<input checked="" type="checkbox"/> Annual funds
<input type="checkbox"/> Ongoing-revised project	Capital funds
<input type="checkbox"/> Requested new project	Other
<input type="checkbox"/> Unsolicited proposal	

Title of Proposal: **Evaluation of smallmouth bass and northern pike management in the middle Yampa River.**

Relationship to RIPRAP: (draft version 3/12/2015)
[See 2016 RIPRAP](#)

	Action Plan: General Recovery Program Support.
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.1.	Where not already generally known, identify negative impacts (e.g., predation, competition, hybridization) of problem species.
III.A.1.c.	Re-evaluate levels of hybridization with white sucker and assess effects on razorback sucker populations. (Program will monitor for evidence of hybridization as razorbacks increase in the system.)
III.A.1.c.(1)	If necessary, implement actions to minimize hybridization between white sucker and razorback sucker.
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 an integrated, viable active control program.
III.A.2.c.(1)	Project-level synthesis: synthesize data on each species/river nonnative fish control effort and concomitant native fish response (e.g., smallmouth bass in the Yampa River and native fish response in the Yampa River) (completed by PI's and identified as a task in individual scopes of work). (YS G-3) See Bestgen et al., 2007 for Yampa River native fish response report (2003-2006) and Skorupski et al 2012 for Middle Green River native fish response report (2005-2008).
III.A.2.c.(3)	Develop one or more standardized nonnative fish datasets to facilitate data analyses and information tracking (one dataset will incorporate all tagging data, others may incorporate all movement, mark-recapture, removal data, etc.) *YS G-1.) Relates to item V.A.1., Interagency Data Management.
III.A.2.c.(4)	Evaluate additional techniques to improve data analysis (e.g., advanced software, exploitation models, ecosystem response models). (YS M-1,2). See, for example, Haines and Modde, 2007.
III.A.2.c.(5)	Develop a measure of successful suppression of smallmouth bass.
III.G.	Remove smallmouth bass and / or replace them with a Compatible species (as identified in the Basinwide Strategy) everywhere they occur throughout the UCRB (exceptions = McPhee Res., Lake Powell Res., and upstream of Flaming Gorge Dam; and 'containment' may prove to be a viable management option for smallmouth bass at Starvation Res.). Specific waters will be targeted based on risk of escapement, opportunity and available resources.
	Action Plan: Yampa River.
III.B.	Implement CPW Yampa Basin aquatic wildlife management plan and the Recovery Program's Yampa River Nonnative Fish Control Strategy. Each control activity will be evaluated for effectiveness and then continued as needed. See also III.A.2.c.1.& 2. under General Recovery Program Support Action Plan.
III.B.1.d.	Target spawning areas (YS C-4)
III.B.1.d.(1)	Northern pike
III.B.1.d.(1)(a)	Identify and evaluate natural and artificial spawning/nursery habitats for northern pike in the Yampa River for exclusion devices.
III.B.1.d.(1)(b)	Implement remedial measures to reduce pike reproduction in Yampa River.
III.B.1.(d)(2)	Smallmouth bass
III.B.1.f.	Convert and extend the ongoing Stagecoach Reservoir northern pike escapement study to a removal effort (will require an addendum to existing FERC Biological Opinion).
III.B.2.	Control nonnative fishes via mechanical removal
III.B.2.a.	Estimate nonnative abundance, status, trends & distribution (YS I-3)
III.B.2.b.	Develop and refine nonnative fish removal criteria (YS K-1)
III.B.2.c.	Identify and evaluate gear types and methods to control nonnative fishes (YS I-5)
III.B.2.d.	Remove (formerly "and translocate") northern pike from Yampa River. See Hawkins et al. 2005. (YS J-1)
III.B.2.d.(1)	Remove northern pike and smallmouth bass above Craig, CO (YS C-3)
III.B.2.e.	Remove (formerly "and translocate") smallmouth bass. (YS J-1)
III.B.2.h.	Monitor native and endangered fish response (YS L-2)

Study Background/Rationale and Hypotheses:

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, 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.

Study Goals, Objectives, End Product(s): We are implementing mechanical removal of nonnative smallmouth bass and northern pike in the middle and upper Yampa River; we coordinate our sampling with Colorado Parks and Wildlife (CPW) and U.S. Fish and Wildlife Service (FWS) who are responsible for removal of those species in adjacent reaches during certain times of the year. CPW will be responsible for management and analysis of northern pike data collected from the middle Yampa River. We (CSU) will be responsible for management and analysis of smallmouth bass data collected from the middle Yampa River, and northern pike data collected from our study reach in the upper Yampa River.

Smallmouth bass

The goal is to reduce the number of smallmouth bass and decrease their spawning success in the middle Yampa River in order to benefit native fishes and assist in the recovery of endangered fishes.

Objectives:

- Obtain an estimate of the number of smallmouth bass in Little Yampa Canyon using a mark-recapture abundance estimator.
- Conduct at least one adequate marking pass in Little Yampa Canyon and additional removal passes in the other reaches of the Yampa River between South Beach and Deerlodge Park.
- Reduce the success of smallmouth bass spawning in the South Beach, Little Yampa Canyon, Lower Juniper, and Maybell reaches.
- Calculate the proportion of juvenile and adult smallmouth bass removed from Little Yampa Canyon based on initial population size.
- Remove large numbers of age-0 and age-1 smallmouth bass from a 12-mile treatment reach (RM100-112) in Little Yampa Canyon in coordination with Recovery Program Project 140 (Native fish response evaluation).

Northern pike

The goal is to reduce the number of northern pike from the middle Yampa River between South Beach and Deerlodge Park and from the upper Yampa River between Steamboat and the Hayden Power Station Intake Boat ramp (appended Project 98c) in order to benefit native fishes and assist in the recovery of endangered fishes. We will coordinate northern pike removal with CPW and FWS.

Objectives:

In the upper Yampa River between Steamboat Springs and Hayden (Project 98c):

- Obtain an estimate of the number of northern pike using a mark-recapture abundance estimator.

- Remove northern pike on two removal passes.
- Identify potential spawning locations.

In the lower Yampa River sites:

- Conduct removal passes for northern pike.
- Provide data on pike removed to CPW for analysis.

Other species

The goal is to reduce the number of other nonnative species from all treatment reaches in order to benefit native fishes and assist in the recovery of endangered fishes.

Objectives:

- Remove white sucker, white sucker hybrids, common carp, and other nonnative species such as green sunfish, black crappie, black bullhead, and brook stickleback. These species will be removed on all sample occasions if the effort for their removal does not reduce our ability to remove target species of smallmouth bass and northern pike.
- Evaluate changes in relative abundance of these species over time using catch per unit effort (CPUE).

Study Area and sample dates:

Upper Yampa River:

Steamboat – Hayden: 24 miles: Tree Haus Bridge (RM 189.2) to CPW boat ramp at Highway 40 Bridge and Hayden Power plant intake (RM 170.6).

March-April: Adult pike sampling with raft electrofishing (timing dependent upon flows, temperatures, and access).

June-October: Young-of-year (YOY) pike sampling with seine, dipnet, backpack electrofisher, light traps, or electric seine.

Middle Yampa River:

South Beach – Deerlodge Park 90 miles :

April – July: Smallmouth bass sampling with boat electrofishing using a 10-days on and 4- days off rotation including eight consecutive sampling days and two travel days. Both northern pike and smallmouth bass are susceptible to electrofishing when they occupy shallow shoreline and flooded off-channel habitats during runoff flows. Spring runoff sampling also allows for safer navigation with large electrofishing boats. As discharge declines and water clears, young smallmouth bass become more susceptible to capture.

July- August: Age-0 bass sampling during base flow from Lily Park and the lower 12-miles of the Little Yampa Canyon reach. Removing age-0 bass only in the 12-mile treatment reach in Little Yampa Canyon maintains the Control-Treatment study design originally designated in 2004 in the native fish response evaluation by Project 140.

Study Methods/Approach:

Upper Yampa River- Pike: This reach is primarily located within private property and most of the current access points (boat ramps) require landowner permission. Although much of the work can occur on the water without touching land, gaining access to launch boats, take-out boats, set nets, or process fish requires landowner permission. The short section through Steamboat Springs contains

several low bridges that are not navigable during higher flow events and this section has minimal northern pike habitat. For those reasons, it will be excluded from sampling if navigation is deemed unsafe or unproductive for catching northern pike. The PI will contact and seek landowner permission for bank access for the mentioned activities. CPW will provide electrofishing rafts for CSU use. We will focus primarily on sampling backwaters to reduce potential negative effects on sport fish (trout and whitefish). The reach will be sampled on at least three occasions, most likely in April, depending on access and flows. We will mark northern pike on the first sample pass with Floy tags and remove pike on two subsequent passes. Abundance will be estimated using a modified Lincoln-Peterson estimator. Catch per unit effort will be calculated for each pass for comparison with other reaches where pike are being removed.

We will note sex and sexual conditions of all pike captured and obtain GPS locations of confirmed or potential spawning sites. If we can obtain permission, we will return to those locations and sample with fyke, trammel, or gill nets during high flows.

Spawning location and density will be confirmed by sampling for YOY later in the year. We will sample backwaters where we captured ripe fish or where there is suitable spawning habitat. Knowledge of spawning locations will direct future removal or management efforts that target removal of spawning pike in an attempt to reduce production.

Lower Yampa River:

Sampling protocol— Each year, we will remove northern pike and smallmouth bass from the middle Yampa River on multiple occasions in an attempt to reduce their number and size structure. In three of five years (FY 18, 20, and 21), effort will also focus on monitoring of Colorado pikeminnow to support population estimation under project 128. Sampling in May and early June will be accomplished in coordination with CPW, who has committed to assist according to the specifics found in project 98a. CSU crews will maintain flexibility to react to hydrologic conditions to accomplish early season sampling in conjunction with CPW.

Fish will be captured with boat electrofishing from April through July when flow is sufficient (>1000 cfs) to navigate the river with 17-ft. aluminum, Jon-boats fitted with outboard jet motors. Both shorelines will be sampled concurrently with two electrofishing boats using ETS brand, pulsed – DC current following Standard Operating Procedures (Martinez and Kolz, 2015). Sampling will occur in a downstream direction covering about 6-10 miles per day until the entire reach is sampled.

Other sampling gear may include backpack or bank electrofisher, seine, trammel, fyke, or gill net, angling, or suction devices for young fish. A third boat will be used to process, maintain, and transport live fish as needed. We will sample each reach on multiple occasions each year with an interval of 4–10 days between occasions. In the Little Yampa Canyon reach only, smallmouth bass ≥ 100 mm TL will be marked with a numbered Floy tag and released on at least one sample occasion each year to serve as a mark for abundance estimation. On all other non- marking sample occasions, smallmouth bass will be removed from the river. For a description of the sampling protocol see Hawkins et al. (2009a).

Marked smallmouth bass that are returned to the river will be Floy tagged and released within the ½-mile section from which they were captured. Backwater and flooded tributary mouth areas will be sampled by electrofishing boat, fyke, gill, or trammel nets or block-and-shock techniques described

by Nesler (1995). To determine spawning locations and timing of smallmouth bass reproduction, we will note when we observe males moving off nests and the reproductive condition of captured fish. Spawning areas will be intensively targeted for removal of nesting, spawning or nest guarding adult fish, young bass will be removed from active nests, and nest sites will be physically destroyed when possible.

Removal effort— We will attempt to maximize the number of removal occasions each year based on time and resources.

Removal evaluation— Each year we will estimate the abundance and capture probability of smallmouth bass at Little Yampa Canyon using mark-recapture methods. We will calculate catch per unit effort (CPUE) for adult smallmouth bass for each sample occasion and obtain an average CPUE for all sample occasions each year. Removal effectiveness will be determined primarily by examining changes in annual abundance of juvenile (100-199mm TL) and adult (≥ 200 mm TL) smallmouth bass in Little Yampa Canyon.

The Surge-Intensive sampling during smallmouth bass spawning —We will use current knowledge about smallmouth bass spawning ecology to focus and increase removal of spawning smallmouth bass. Once temperatures reach 16°C , we will increase removal efforts in areas with known or potential spawning habitat by organizing and coordinating a multi-agency effort known as “The Surge”. Our goal is to disrupt all stages of the spawning period, including pre- spawn nest building, spawning, and nest guarding. This activity has been shown in our to increase the catch of adult fish, disrupt the spawning event, remove guarding males from active nests, and is expected to ultimately reduce the survival of young hatchlings. Modeling shows that disrupting early season nests via the Surge is an effective means to reduce overwinter survival of young bass, thus reducing the abundance of year classes throughout the future. Removing spawning adults from nesting areas during the earlier nest building and spawning stages will create a sink in these areas for late spawners which will then be targeted for removal. Adult bass on nests are vulnerable to electrofishing gear because they are in shallow water and they have a tendency to remain and protect the nest rather than flee.

Our plan is to remove spawning fish and create a void in desirable spawning habitat so that new bass can move in and occupy those areas and be removed on subsequent sampling occasions. In that process, we will also be disrupting and decreasing the survival of eggs or young in nests. Sampling effort will be directed at river sections with concentrations of spawning bass. We will focus on the reaches between South Beach and Lower Juniper (RM 135–90), because those reaches have abundant spawning habitat.

Smallmouth bass spawning —Spawning activity begins when temperatures reach about $16\text{--}18^{\circ}\text{C}$ ($60\text{--}65^{\circ}\text{F}$) which in the Yampa River can range from early to late June. Bestgen presented back-calculated hatching dates based on otolith increments at the 2009 Nonnative Workshop that support a start of spawning at 16°C which can vary depending on discharge volume and timing (Figure 1). Hatching date ranges from two to nine days after spawning, depending on temperatures. Optimum incubation and hatching temperatures range from $19\text{--}22^{\circ}\text{C}$ ($66\text{--}72^{\circ}\text{F}$) and shorten hatching time. After hatching, larvae drop into the gravel nest and they eventually emerge and remain in the nest for an additional 6–15 days. Males will often remain in the area and guard the slowly dispersing young for as long as 28 days.

Removing the male from a nest (typically reported in the literature by angling) often results in large losses of eggs or larvae due to predation on the young or abandonment of the nest by the male if released back to the water.

Additional resources during The Surge— Increased removal effort requires additional people and equipment; therefore, we (CSU) will work closely with CPW and FWS crews. During intensive spawning sampling, CPW will increase sampling in South Beach, upper and lower Maybell, and Lower Juniper and will contribute a total of six people and three boats. FWS Grand Junction FWCO will assist with intensive sampling for 2 weeks and provide three people, two electrofishing jet boats or rafts, and two trucks. FWS Green River Basin FWCO will assist for 2 weeks and provide two people and one truck. See attached budgets for FWS field station participation. CPW budget is included in the SOW for project 98a.

Effort required to complete one pass of the South Beach, Little Yampa Canyon, and lower Juniper reaches is about 7 days. But with one extra crew (in addition to the CSU crew), we can increase our sampling effort to complete all three reaches within 3-4 days. We will also allow each section to have about a 3-4-day reset period before returning to resample in order to allow spawning habitat to reset with either displaced fish or new spawners.

Prediction of spawning period—CSU will measure water temperature daily at the Maybell gage and report to CPW and FWS when temperatures are expected to reach 16° C. Based on past years, this typically occurs between late-May and the end of June. Spawning generally starts during the last part of the descending hydrograph and ends when young bass leave the nest about the time runoff drops to base flow. Bass nests are active for 10-20 days depending on temperatures and we plan to sample intensively so that almost all nests, no matter when started, would be disturbed on two to five occasions. Intensive sampling should start within 5 days of temperatures reaching 16° C and continue for approximately 4 weeks or until water levels decline to a point that the river is un-navigable.

Spawning habitat probably occurs in all reaches but nests are often dispersed along the river shoreline or in backwaters and can vary in density. We propose sampling through all three spawning reaches at least once to discover and document either specific locations or sections of river where spawning is concentrated. We will then target spawning concentrations or river sections with high densities of spawning habitat on future removal occasions. If time and logistics allow, we will extend some effort in other reaches where spawning could be occurring after we have confirmed that spawning is occurring in known reaches.

YOY bass removal: After spawning and during low stream discharge in July and August, we will focus on removing young (age-0 and age-1) smallmouth bass from the lower 12-mile section of the Little Yampa Canyon study site (i.e. the original treatment reach designated in 2004). This reach is part of the control-treatment design within the native fish evaluation study (Bestgen et al. 2007). Young smallmouth bass will be captured with a 10 m-long electric seine powered by a 2000-watt generator. Other gear may include boat or backpack electrofisher, angling, seine, trap net, or cages with baited or scented attractants. We will conduct at least three separate sampling occasions, in July and August, each about 10 days long and reaches will be sampled multiple times on each occasion. We will sample primarily shallow, low-velocity shorelines associated with backwaters, embayments, or among boulders deposited from talus slopes. All native and nonnative species will be handled as they are during boat electrofishing and as specified in Table 2 unless specified differently by the state collecting permit.

Fish handling — Fish captured with boat electrofishing will be placed in a live well, measured to the nearest mm TL, and weighed with a Pesola® spring scale. Fish handling time will be reduced by subsampling lengths and weights of fish, except for tagged or recaptured fish, which we will measure and weigh. Northern pike will be euthanized. Smallmouth bass > 100 mm TL captured in Little Yampa Canyon will be tagged with a numbered, Floy® t-bar anchor tag (model FD-94) and released on one sampling occasion for information about abundance, growth, and movement and on all other sample occasions they will be euthanized. At all other reaches smallmouth bass will be euthanized on all sample occasions. Fish that are euthanized will be overdosed with Tricaine methanesulfonate (MS-222). Fish that are euthanized will be provided to CPW researchers, kept as voucher specimens, cataloged into the LFL fish collection, or disposed of per state collecting permit requirements. We will evaluate if we are having a removal effect on white sucker and common carp by comparing their CPUE and relative abundance.

Endangered fishes and roundtail chub will be handled per guidelines and permits of the CPW and the FWS. All Colorado pikeminnow and roundtail chub will be captured, PIT tagged per Recovery Program protocol, their location recorded within 0.1 mile. Other native fishes will be captured, measured, and released. All trout species and channel catfish will be measured and released in the river. Other nonnative species captured that will be euthanized include northern pike, centrarchids, black bullhead *Ameiurus exile*, walleye *Stizostedion vitreum*, brook stickleback, common carp *Cyprinus carpio*, white sucker, and white sucker hybrids. Any other species captured that is on the Colorado prohibited species list will be removed and euthanized. See Colorado's prohibited species list: <http://wildlife.state.co.us/RulesRegs/Regulations/>.

Justification for marking and releasing fish:

Middle Yampa Smallmouth bass

Methods: Smallmouth bass ≥ 100 mm total length in the 24-mile Little Yampa Canyon (LYC) reach would be marked with a numbered Floy tag on one sampling occasion (pass). On all other passes, bass will be removed and euthanized. Reasons to mark bass include:

- The primary purpose is to obtain abundance (population size) data.
- We have marked smallmouth bass here since 2003 and consider it a sentinel reach because it is within the epicenter of smallmouth bass production in the Yampa River.
- It will allow us to continue monitoring the effects of changing management activities on smallmouth bass population dynamics.
- Marked fish will provide information about dispersal, movement, and growth; things that may change as the population responds to environmental or removal effects.
- Tracking abundance and immigration into LYC may help evaluate the effectiveness of the Elkhead screen. Recall that most of the bass that escaped Elkhead Reservoir moved into LYC and abundance data could help determine the effectiveness of that screen in reducing immigration and therefore abundance of smallmouth bass in LYC.
- Abundance data from mark and release studies has historically provided the best evidence of the effects of removal.

Upper Yampa northern pike

Methods: Northern pike in the upper 28-mile reach of the Yampa River from Steamboat Springs- Hayden Power Plant Intake will be marked with a numbered Floy tag and released on one sampling occasion (pass). On all other passes, pike will be removed and euthanized. Reasons to mark pike include:

- The primary purpose is to obtain abundance data.
- The last estimate of abundance of northern pike in this reach was in 2005 and no sampling or removal of that species has occurred in this reach since that time.
- Since 2005, there has been a large effort by CPW to remove northern pike from the river upstream of Steamboat Springs and from Catamount Reservoir. This effort has most likely reduced the dispersal of northern pike into the study reach and an abundance estimate will determine the population change compared to 10 years ago.
- An initial abundance estimate will provide a baseline for this and any future removal projects in this reach. In 2017, we recommended not marking pike again until 2018.

Revisions from previous SOW: CSU added additional staff and equipment to perform earlier season electrofishing in the Yampa River that was previously accomplished by CPW (Task 4a). In years that task 4a is supporting Colorado pikeminnow abundance estimates, budgets for work are included in Project 128 SOW. Assistance for sampling of northern pike in the Little Snake River (previous Task 7) was removed, as was river-wide sampling for abundance of small-bodied fish community (previous Task 9).

Task Description and Schedule:

- Task 1 Oct-Jan:** (Project 125/ 98c) Consolidate data collected during previous fiscal year, write annual report, assemble and submit data to Recovery Program and Colorado Collecting Permit (SciColl) databases. Summarize results for National Park Service Investigator's Annual Report. Attend coordinating meetings and workshops with other agencies and PIs including database workshop, nonnative PI coordinating meeting, and training workshops. Prepare and present results of the previous year's fieldwork at: Dinosaur River Symposium, nonnative workshops, and Researcher's Annual Meeting.
- Task 2 Feb-Mar:** (Project 125/ 98c) Prepare equipment, train crew, assemble maps and land ownership information, coordinate with CPW regarding access. Contact landowners and obtain permission for access on private property. Hire and train field crew; purchase, prepare, and fabricate equipment.
- Task 3 Apr:** (Project 98c) Conduct three passes for northern pike between Steamboat and Highway 40 Bridge.
- Task 4a Apr-May:** (Project 128) Early season sampling. Focus on Colorado pikeminnow sampling for abundance estimation in FY18,21, and 22. In 2019 and 2020, focus on removal of northern pike and smallmouth bass. Coordinate with CPW to accomplish sampling during May.
This task is included in SOW 128 in FY18, 21, and 22 because it will focus on providing data for Colorado pikeminnow population estimates. Strikeout text is not included in budget totals for this SOW, but included for consistency.
- Task 4b Jun-Jul:** (Project 125) Sampling in middle Yampa River to capture and remove smallmouth bass, northern pike and other invasive nonnative species. Coordinate with CPW in early June.
- Task 5 Jul-Aug:** (Project 125) Coordinate and conduct smallmouth bass removal and spawning disruption during the spawning period.
- Task 6 Jun-Aug:** (Project 98c) Sampling for YOY pike to confirm spawning locations. Otolith removal, preparation, and aging to determine spawning dates.
- Task 7 Aug:** (Project 125) Capture and remove YOY and yearling smallmouth bass from treatment sites.
- Task 8 Sept:** (Project 125/ 98c) Equipment maintenance. Data entry and analysis. Meetings, interaction, and data sharing with other biologists and researchers.

Table of Task schedule, Note unnumbered Task for Project 128 which samples in April and May and that is focused on capturing pikeminnow for abundance estimates.

Task	Project	Oct	Sep	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	125 98c	x	x	x	x	x								
2a	125 98c						x	x						
2b	125/128					x								
3	98c								x					
4a	128								x	x				
4b	125										x	x		
5	125											x	x	
6	98c										x	x	x	
7	125												x	
8	125 98c													x

Deliverables, Due Dates, and Budget by Fiscal

FY —2018-2022

Deliverables: Project annual reports to Program Directors Office by November each year. Red text indicates a 2% annual increase in salary costs per year. Strikeout text indicates costs not included in this SOW, but are rather included in project 128 budget. Budget numbers included here for ease of review.

Budget Table

	2018	2019	2020	2021	2022
Task 1- (Projects 125 & 98c)-Data Analysis, Reporting, and Meetings					
Labor-Biologist (\$8160/month x 1.5 month)	12,240	12,485	12,734	12,989	13,249
Labor-Biologist (\$4000/ month x 1.5 months)	6,000	6,120	6,242	6,367	6,495
Labor-Biologists (\$3566/month x 1.5 months)	5,349	5,456	5,565	5,676	5,790
Travel-Lodging (\$80/night-3 nights/trip x 2 people x 3 trips)	1,440	1,440	1,440	1,440	1,440
Travel-per Diem (\$51/day x 4 days/trip x 2 people x 3 trips)	1,224	1,224	1,224	1,224	1,224
Travel- Truck mileage (\$0.50/mile x 500 miles/trip x 4 trips)	1,000	1,000	1,000	1,000	1,000
Task 1 subtotal	27,253	27,725	28,206	28,697	29,197

Task 2 -Field Prep and train crew

Labor-Biologist (\$5682/month x 1 month)	5,682	5,796	5,912	6,030	6,150
abor-Biologist (\$4000/ month x 1 months)	4,000	4,080	4,162	4,245	4,330
Labor-Biologists (2 @ \$3566/month x 1 month)	7,132	7,275	7,420	7,569	7,720
Travel-Lodging (\$80/night-2 nights x 2 people)	320	320	320	320	320
Travel-per Diem (\$51/day x 4 days x 2 people)	408	408	408	408	408
Service- Annual boat engine service at dealer, \$550/ boat x 5 boats	2,750	2,750	2,750	2,750	2,750
Service- repair and maintenance- Welding, rigging and field equipment maintenance. Cost based on average of past expenses.	2,300	2,300	2,300	2,300	2,300
Travel- Truck mileage (\$0.50/mile x 1200 miles)	600	600	600	600	600
Task 2 subtotal	23,192	23,528	23,871	24,221	24,578

Task 2b –Equipment purchases

Equipment-17 ft Aluminum utility boat, motor, rigging, trailer, and delivery	29,900				
Equipment-Mercury 150 HP outboard Jet motor, controls and jet pump	11,000	11,000			
Task 2b subtotal	40,900	11,000			

Task 3 (Project 98c)-Pike removal

Labor-Biologist (\$8160/month x 1 month)	8,160	8,323	8,490	8,659	8,833
Labor-Biologist (\$4701*/ month x 1 months)	4,701	4,795	4,891	4,989	5,089
Labor-Biologists (2 @ \$4166*/month x 1 months)	8,332	8,499	8,669	8,842	9,019
Travel-per Diem (\$51/day x 5 days/trip x 4 trips x 4 people)	4,080	4,080	4,080	4,080	4,080
Travel- Truck mileage-2 trucks Ft Collins-Hayden, Colorado then daily travel to sample sites (1928 miles x \$0.50 /mile)	964	964	964	964	964

Travel- Truck Liability Insurance and motor pool administration fees (\$25/truck/month x 1 months x 2 trucks)	50	50	50	50	50
Supplies- Electrofishing Generator gas (2 gallons/day x \$3.00/gal x 5 days/trip x 4 trips)	120	120	120	120	120
Supplies-Raft and electrofishing maintenance and repair- based on average expenses for past two years.	1,150	1,150	1,150	1,150	1,150
Equipment-ETS Backpack electrofisher	6,700	6,700	6,700	6,700	6,700
Task 3 subtotal	34,257	34,681	35,113	35,554	36,004

Task 4a -(Projects 125/128) early CPM¹ & SMB/NP Removal

Labor-Biologist (\$5682 /month x 1.5 months)	8,523	8,693	8,867	9,045	9,226
Labor-Biologists (2 @ \$4166*/month – 1.5 months)	12,581	12,833	13,090	13,351	13,618
Labor-Biologist (\$8160/month x 0.5 months)	4,080	4,162	4,245	4,330	4,416
Labor-Biologist (\$4700*/month x 1.5 months)	7,050	7,191	7,335	7,482	7,631
Labor-Technicians (2 @ \$3872*/month x 1.5 months)	11,616	11,848	12,085	12,327	12,574
Labor-Technicians (2 @ \$3872*/month x 0.5 months)	3,872	3,949	4,028	4,109	4,191
Travel-Lodging rental house (\$1200/ month x 1.5 months)	2,400	2,400	2,400	2,400	2,400
Travel-per Diem (\$20/day x 10 days/trip x 4 trips x 9 people)	7,200	7,200	7,200	7,200	7,200
Travel- Truck Liability Insurance and motor pool administration fees (\$25/truck/month x 2 months x 4 trucks)	200	200	200	200	200
Travel- Truck mileage-2 trucks Ft Collins-Axial, Colorado then 4 trucks daily travel to sample sites (2420 miles/trip x \$0.50 /mile x 4 trips)	4,840	4,840	4,840	4,840	4,840

¹ This task is included in SOW 128 in FY18, 21, and 22 because it will focus on providing data for Colorado pikeminnow population estimates. Strikeout text is not included in budget totals for this SOW, but included for consistency.

Supplies- Boat Gas (4 boats x \$3.00/gal premium x 15 gal/day x 8 days/trip x 4 trips)	5,760	5,760	5,760	5,760	5,760
Supplies- Boat 2-cycle oil (\$35/gal x 4 gallons/boat/trip x 4 boats x 4 trips)	2,240	2,240	2,240	2,240	2,240
Supplies-Field supplies (sampling nets, boots and waders, electrical safety gloves, tools, and tune up parts for generators. electrical connector replacement for safe electrofishing operation)	3,800	3,800	3,800	3,800	3,800
Service- emergency Spot locators and satellite fees and wireless broadband cell modem for work related email and communication in the field	600	600	600	600	600
Task 4a subtotal	74,762	75,717	76,690	77,683	78,696

Task 4b (Project 128)-late SMB/NP Removal

Labor-Biologist (5682 /month x 2 months)	11,364	11,591	11,823	12,060	12,301
Labor-Biologists (2 @ \$4166*/month – 2 months)	16,664	16,997	17,337	17,684	18,038
Labor-Biologist (\$8160/month x 1.5months)	12,240	12,485	12,734	12,989	13,249
Labor-Biologist (\$4700*/month x 2 months)	9,400	9,588	9,780	9,975	10,175
Labor-Technicians (4 @ \$3872*/month x 2 months)	30,976	31,596	32,227	32,872	33,529
Travel-Lodging rental house (\$1200/ month x 2 months)	2,400	2,400	2,400	2,400	2,400
Travel-per Diem (\$20/day x 10 days/trip x 5 trips x 9 people)	9,000	9,000	9,000	9,000	9,000
Travel- Truck Liability Insurance and motor pool administration fees (\$25/truck/month x 2 months x 4 trucks)	200	200	200	200	200
Travel- Truck mileage-2 trucks Ft Collins-Axial, Colorado then 4 trucks daily travel to sample sites (2420 miles/trip x \$0.50 /mile x 5 trips)	6,050	6,050	6,050	6,050	6,050

Supplies- Boat Gas (4 boats x \$3.00/gal premium x 15 gal/day x 8 days/trip x 5 trips)	7,200	7,200	7,200	7,200	7,200
Supplies-Field supplies (sampling nets, boots and waders, electrical safety gloves, tools, and tune up parts for generators. electrical connector replacement for safe electrofishing operation)	4,200	4,200	4,200	4,200	4,200
Supplies- Boat 2-cycle oil (\$35/gal x 4 gallons/boat/trip x 4 boats x 5 trips)	2,800	2,800	2,800	2,800	2,800
Field Computer hardware upgrades	1,200	1,200	1,200	1,200	1,200
Field computer software	2,500	2,500	2,500	2,500	2,500
Service- wireless broadband cell modem for work related email and communication in the field	234	234	234	234	234
Task 4b subtotal	116,428	118,041	119,686	121,364	123,076

Task 5 (Project 125)-Bass spawn removal

Labor-Biologist (\$5682 /month x 1 month)	5,682	5,796	5,912	6,030	6,150
Labor-Biologists (2 @ \$4166*/month x 1 month)	8,332	8,499	8,669	8,842	9,019
Labor-Biologist (\$4700*/month x 1 month)	4,700	4,794	4,890	4,988	5,087
Labor-Technicians (4 @ \$3872*/month x 1 month)	15,488	15,798	16,114	16,436	16,765
Travel-Lodging rental house (\$1200/ month x 1 months)	1,200	1,200	1,200	1,200	1,200
Travel-per Diem (\$20/day x 10 days/trip x 2 trips x 7 people)	2,800	2,800	2,800	2,800	2,800
Travel- Truck Liability Insurance and motor pool administration fees (\$25/truck/month x 1 months x 4 trucks)	100	100	100	100	100
Travel- Truck mileage-2 trucks Ft Collins-Axial, Colorado then 4 trucks daily travel to sample sites (1888 miles/trip x \$0.50 /mile x 2 trips)	1,888	1,888	1,888	1,888	1,888
Task 5 subtotal	40,190	40,874	41,572	42,283	43,009

Task 6 (Project 98c)- YOY pike removal and aging

Labor-Biologist (\$8160/month x 0.5 month)	4,080	4,162	4,245	4,330	4,416
Labor-Technicians (2 @ \$3872*/month x 1 month)	7,744	7,899	8,057	8,218	8,382
Labor- Biologist Otolith extraction, aging, and analysis (\$3566/month x 2 months)	7,132	7,275	7,420	7,569	7,720
Travel-per Diem (\$20/day x 4 days/trip x 4 trips x 2 people)	640	640	640	640	640
Travel- Truck Liability Insurance and motor pool administration fees (\$25/truck/month x 1 months x 1 trucks)	25	25	25	25	25
Travel- Truck mileage-1 truck Craig - Steamboat Springs, Colorado to sample sites (400 miles/trip x \$0.50 /mile x 4 trips)	800	800	800	800	800
Supplies- Electrofishing gloves and Backpack electrofisher batteries, and lab supplies for otolith extractions.	360	360	360	360	360
Task 6 subtotal	20,781	21,160	21,547	21,941	22,344

Task 7 (Project 125)-YOY bass removal

Labor-Biologist (5682 /month x 1 months)	5,682	5,796	5,912	6,030	6,150
Labor-Biologists (2 @ \$4166*/month x 1 month)	8,332	8,499	8,669	8,842	9,019
Labor-Technicians (2 @ \$3872/month x 1 month)	7,744	7,899	8,057	8,218	8,382
Travel-Lodging rental house (\$1200/ month x 1 months)	1,200	1,200	1,200	1,200	1,200
Travel-per Diem (\$20/day x 10 days/trip x 2 trips x 5 people)	2,000	2,000	2,000	2,000	2,000
Travel- Truck Liability Insurance and motor pool administration fees (\$25/truck/month x 2 months x 2 trucks)	100	100	100	100	100
Travel- Truck mileage-2 trucks Ft Collins-Axial, Colorado then 4 trucks daily travel to sample sites (1288 miles/trip x \$0.50 /mile x 2 trips)	1,288	1,288	1,288	1,288	1,288

Supplies- Electric seine repair and maintenance (replacement of electrical connections to maintain safe operation)	550	550	550	550	550
Task 7 subtotal	26,896	27,331	27,775	28,228	28,690

Task 8 (Projects 125 & 98c)-Equip. maintenance, data entry, analysis

Labor-Biologist (\$8160/month x 1 month)	8,160	8,323	8,490	8,659	8,833
Labor-Biologist (\$4000/ month x 1 months)	4,000	4,080	4,162	4,245	4,330
Labor-Technicians (2 @ \$3872/month x 1 month)	7,744	7,899	8,057	8,218	8,382
Computer- hardware and software updates for data analysis	404	404	404	404	404
Task 8 subtotal	20,308	20,706	21,112	21,526	21,949

Sub Total all Tasks	350,205	400,763	395,573	323,815	328,846
CSU overhead BOR rate 17.5%	61,286	70,134	69,225	56,668	57,548
Total- CSU LFL	411,491	470,896	464,798	380,483	386,394

All salaries include CSU fringe rate

* Asterisk marked salary includes approximately 20 hours OT per month only when in the field.

Budget Summary: **FWS Budgets Attached in Appendix**

	CSU-LFL	FWS- Grand Junction	FWS-Vernal	Total
FY-2018	411,491	15,598	22,739	449,828
FY-2019	470,896	15,907	22,648	509,451
FY-2020	464,798	16,222	23,486	504,506
FY-2021	380,483	16,542	23,491	420,516
FY-2022	386,394	16,869	23,941	427,204

Reviewers: Kevin McAbee, 5/3/17

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FWS Vernal Budgets for Project 125 Surge

FY2018:

Task Activity	Rate \$/h	Hours	Cost
Task 5. Conduct smallmouth bass removal and spawning disruption during the spawning period.			
Labor			
GS-11 Biologist	\$42.37	80	\$3,390
1 GS-5 Tech/ WG-5 Boat Operator	\$23.16	80	\$1,853
Overtime for tech	\$34.74	20	\$695
Subtotal			\$5,937
Travel			
Lodging (2 people/day x \$93/person x 8 nights)			\$1,488
Meals and IE per diem (2 people/day x \$52/person x 10 days)			\$1,040
Subtotal			\$2,528
Equipment			
(2 trucks/trip x 550 mi/truck x \$0.33/mi x 2 trips) Vernal to Craig and during boat shuttles, round trip			\$726
(12 gal gas/boat x 2 boats/day x \$4.00/gal x 10 days)			\$960
GSA truck (rate/mo x # truck-months)	\$250	1	\$250
GS-8 Fisheries Tech Maintenance work	\$43.43	196	\$8,512
Boat propellers, boating equipment replacement/repair, safety equipment (PFDs, etc)			\$500
Subtotal			\$10,948
TASK 1 TOTAL			\$19,413
Task 10- Data Analysis, Project Administration			
Labor			
GS-9 Admin Assist.	\$41.57	80	\$3,326
Subtotal			\$3,326
TASK 2 TOTAL			\$3,326
USFWS Vernal SOW TOTAL			\$22,739

FY2019:

Task Activity	Rate \$/h	Hours	Cost
Task 5. Conduct smallmouth bass removal and spawning disruption during the spawning period.			
Labor			
GS-11 Biologist	\$43.73	80	\$3,498
1 GS-5 Tech/ WG-5 Boat Operator	\$23.63	80	\$1,890
Overtime for tech	\$35.45	20	\$709
Subtotal			\$6,098
Travel			
Lodging (2 people/day x \$94/person x 8 nights)			\$1,504
Meals and IE per diem (2 people/day x \$54/person x 10 days)			\$1,080
Subtotal			\$2,584
Equipment			
(2 trucks/trip x 550 mi/truck x \$0.34/mi x 2 trips) Vernal to Craig and during boat shuttles, round trip			\$748
(12 gal gas/boat x 2 boats/day x \$4.00/gal x 10 days)			\$960
GSA truck (rate/mo x # truck-months)	\$255	1	\$255
GS-8 Fisheries Tech Maintenance work	\$44.29	112	\$4,960
Boat propellers, boating equipment replacement/repair, safety equipment (PFDs, etc)			\$500
Subtotal			\$7,423
TASK 1 TOTAL			\$16,105
Task 10- Data Analysis, Project Administration			
Labor			
GS-12 Supervisory Fish Biologist	\$62.05	16	\$993
GS-9 Admin Assist.	\$42.69	130	\$5,550
TASK 2 TOTAL			\$6,543
USFWS Vernal SOW TOTAL			\$22,648

FY2020:

Task Activity	Rate \$/h	Hours	Cost
Task 5. Conduct smallmouth bass removal and spawning disruption during the spawning period.			
Labor			
GS-11 Biologist	\$46.92	80	\$3,754
1 GS-5 Tech/ WG-5 Boat Operator	\$24.10	80	\$1,928
Overtime for tech	\$36.15	20	\$723
Subtotal			\$6,405
Travel			
Lodging (2 people/day x \$96/person x 8 nights)			\$1,536
Meals and IE per diem (2 people/day x \$55/person x 10 days)			\$1,100
Subtotal			\$2,636
Equipment			
(2 trucks/trip x 550 mi/truck x \$0.34/mi x 2 trips) Vernal to Craig and during boat shuttles, round trip			\$748
(12 gal gas/boat x 2 boats/day x \$4.00/gal x 10 days)			\$960
GSA truck (rate/mo x # truck-months)	\$260	1	\$260
GS-8 Fisheries Tech Maintenance work	\$46.34	112	\$5,190
Boat propellers, boating equipment replacement/repair, safety equipment (PFDs, etc)			\$500
Subtotal			\$7,658
TASK 1 TOTAL			\$16,699
Task 10- Data Analysis, Project Administration			
Labor			
GS-12 Supervisory Fish Biologist	\$63.30	16	\$1,013
GS-9 Admin Assist.	\$44.42	130	\$5,775
TASK 2 TOTAL			\$6,787
USFWS Vernal SOW TOTAL			\$23,486

FY2021:

Task Activity	Rate \$/h	Hours	Cost
Task 5. Conduct smallmouth bass removal and spawning disruption during the spawning period.			
Labor			
GS-11 Biologist	\$47.86	80	\$3,829
1 GS-5 Tech/ WG-5 Boat Operator	\$24.58	80	\$1,966
Overtime for tech	\$36.87	20	\$737
Subtotal			\$6,533
Travel			
Lodging (2 people/day x \$97/person x 8 nights)			\$1,552
Meals and IE per diem (2 people/day x \$57/person x 10 days)			\$1,140
Subtotal			\$1,552
Equipment			
(2 trucks/trip x 550 mi/truck x \$0.35/mi x 2 trips) Vernal to Craig and during boat shuttles, round trip			\$770
(12 gal gas/boat x 2 boats/day x \$4.00/gal x 10 days)			\$960
GSA truck (rate/mo x # truck-months)	\$265	1	\$265
GS-8 Fisheries Tech Maintenance work	\$47.26	196	\$9,263
Boat propellers, boating equipment replacement/repair, safety equipment (PFDs, etc)			\$500
Subtotal			\$11,758
TASK 1 TOTAL			\$19,843
Task 10- Data Analysis, Project Administration			
Labor			
GS-9 Admin Assist.	\$45.61	80	\$3,649
Subtotal			\$3,649
TASK 2 TOTAL			\$3,649
USFWS Vernal SOW TOTAL			\$23,491

FY2022:

Task Activity	Rate \$/h	Hours	Cost
Task 5. Conduct smallmouth bass removal and spawning disruption during the spawning period.			
Labor			
GS-11 Biologist	\$48.81	80	\$3,905
1 GS-5 Tech/ WG-5 Boat Operator	\$25.07	80	\$2,006
Overtime for tech	\$37.61	20	\$752
Subtotal			\$6,663
Travel			
Lodging (2 people/day x \$99/person x 8 nights)			\$1,584
Meals and IE per diem (2 people/day x \$58/person x 10 days)			\$1,160
Subtotal			\$1,584
Equipment			
(2 trucks/trip x 550 mi/truck x \$0.36/mi x 2 trips) Vernal to Craig and during boat shuttles, round trip			\$792
(12 gal gas/boat x 2 boats/day x \$4.00/gal x 10 days)			\$960
GSA truck (rate/mo x # truck-months)	\$271	1	\$271
GS-8 Fisheries Tech Maintenance work	\$48.21	196	\$9,449
Boat propellers, boating equipment replacement/repair, safety equipment (PFDs, etc)			\$500
Subtotal			\$11,972
TASK 1 TOTAL			\$20,219
Task 10- Data Analysis, Project Administration			
Labor			
GS-9 Admin Assist.	\$46.53	80	\$3,722
Subtotal			\$3,722
TASK 2 TOTAL			\$3,722
USFWS Vernal SOW TOTAL			\$23,941