

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

II. Bureau of Reclamation Agreement Number(s): R14AP00059

Project/Grant Period: Start date (Mo/Day/Yr): 10/01/2018
End date: (Mo/Day/Yr): 09/30/2023
Reporting period end date: 09/30/2019
Is this the final report? Yes _____ No X

III. Principal Investigator(s):

Michael S. Partlow, Keena R. Elbin, and Matthew J. Breen
Utah Division of Wildlife Resources
Northeast Region
318 North Vernal Ave.
Vernal, Utah 84078
Phone: 435-781-9453; Fax: 435-789-8343
E-mail: mpartlow@utah.gov

IV. Abstract

The purpose of this project is to remove nonnative species that pose the greatest threat to recovery of the four endangered fish in the upper Colorado River basin through predation, competition, and hybridization. Nonnative target species include smallmouth bass, walleye, northern pike, and white sucker. Spring components of this project included electrofishing and fyke netting of tributaries and backwaters to target northern pike and white sucker, and main channel electrofishing to target walleye. Targeted smallmouth bass electrofishing took place during summer months. In 2019, UDWR Vernal removed 83 Northern pike, 24 walleye, 1,021 white sucker, and 2,476 smallmouth bass from the middle Green River. Total smallmouth bass catch rates declined from 2018. Smallmouth bass in the 100-199 mm length class continued to make up the largest component of the catch, but bass recruiting to the 200 mm and above length class led to an increase in the proportion of adults captured.

V. Study Schedule: Ongoing.

VI. 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.
- VII. Accomplishment of FY 2019 Tasks and Deliverables, Discussion of Initial Findings and Shortcomings:

Task 1. Northern pike, white sucker, and walleye removal

We employed several strategies to reduce impacts of nonnative fish during the spring of 2019. From 19 March-30 May, a total of 105.3 hrs of electrofishing were expended to target walleye *Sander vitreus* in the middle Green River, and 13.9 hrs of electrofishing were reallocated to Recovery Program Project #123d on the Green River below Tusher Diversion. Tributary electrofishing to target northern pike *Esox lucius* and white sucker *Catostomus commersonii* took place from 08 April-30 May targeting Ashley Creek (river mile [RM] 299.0), Stewart Lake drain (RM 299.2), Brush Creek (RM 304.6), Cliff Creek (RM 302.8) and backwaters at RM 299.8 and RM 301.8, comprising 16.4 hrs effort. Fyke netting in backwaters and tributaries to target northern pike and white sucker took place from 08 April-30 May with a total of 60 overnight sets. Fyke netting targeted the same sites as tributary electrofishing (listed above) as well as a backwater at RM 299.1. Persistent cold temperatures and snow cover delayed the start of spring efforts in 2019 compared to previous years and no sampling was conducted on the lower Duchesne River.

Northern pike—A total of 83 northern pike were captured in 2019 in the middle Green River (RM 319.3-206.8): 41 during fyke netting, eight during smallmouth bass *Micropterus dolomieu* removal (see below), 13 during tributary electrofishing, and 21 during targeted walleye removal (Table 1). Size distribution was skewed towards larger individuals with 81 adults (≥ 300 mm total length [TL]; 98% of catch), 76 piscivores (≥ 375 mm TL; 92% of catch), and two juveniles (< 300 mm TL; 2% of catch). Similar to previous years, fyke netting and electrofishing in tributaries and backwaters provided the highest catch rates for northern pike in 2019 (Table 1), but northern pike catch-per-unit-effort (CPUE) during spring main channel electrofishing (walleye removal) increased from 2017 (0.046 fish/hr, Staffeldt et al. 2017), and 2018 (0.101 fish/hr, Partlow et al.

2018) to 0.199 fish/hr in 2019 (Table 1).

Walleye—In the middle Green River, 24 walleye were captured in 2019. Targeted walleye removal in 2019 produced 16 walleye, while smallmouth bass removal accounted for eight walleye (Table 2). Low walleye catch rates in the middle Green River in 2019 (Table 2) coincided with high catch rates encountered on the Green River below Tusher Diversion by crews from UDWR Moab under Recovery Program Project #123d. From 22 April-24 April, UDWR Vernal reallocated effort to the lower Green River from RM 127.5-115, where 45 walleye were captured in 13.9 hrs of electrofishing. To maintain consistency, effort and catch during this reallocation of effort will be included on Recovery Program Project #123d annual report. Although no clear walleye spawning aggregations were observed in 2019, we removed six ripe males, two of which were captured in Dinosaur National Monument between RM 319-315.8. In 2015, spawning walleye were discovered on a cobble bar in this area (Schelly et al. 2015) and relatively high numbers of ripe walleye have been noted in this area in subsequent years (Staffeldt et al. 2017).

The size distribution of walleye removed in 2019 was skewed towards larger individuals with all 24 fish in the piscivore size class (≥ 375 mm TL; Table 2). No juvenile walleye (< 300 mm TL) were removed from the middle Green River in 2019. Captures of juvenile walleye have been rare; however, collection of juvenile and/or age-0 fish did occur in 2009 (Monroe and Hedrick 2009), 2012 (Skorupski and Breen 2012), 2013 (Harding et al. 2013), and 2017 (Staffeldt et al. 2017).

White sucker—In 2019, white sucker captures were lower than in 2018 and 2017, 1,027 vs 2,169 and 1,738, respectively (Partlow et al. 2018; Staffeldt et al. 2017). Historically, targeting tributaries and backwaters for white sucker has produced high catch rates (Skorupski et al. 2013). Electrofishing in tributaries and backwaters in 2019 produced a CPUE of 19.8 fish/hr, compared to 0.9 and 2.9 fish/hr for walleye removal and smallmouth bass removal, respectively (Table 3). Combining all sampling methods, an additional 10 white x flannelmouth sucker hybrids were captured along with two white x bluehead sucker hybrids (Table 4).

White sucker size distribution was skewed towards smaller individuals in 2019 (mean TL = 151 mm; range = 53-412 mm). 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 reduce the proportion of the white sucker population greater than or equal to 275 mm TL. In 2019, just 6.3% of the white suckers removed (n=65) were ≥ 275 mm TL.

Task 2. Smallmouth bass removal

Targeted smallmouth bass removal occurred from 03 July-2 October 2019. The onset of smallmouth bass removal in 2019 was delayed by high spring flows, which receded below 10,000 cfs on 06 July. Two full electrofishing passes were implemented in the middle Green River from Split Mountain boat ramp (RM 319.3) to Tabyago Riffle (RM 206.8). The first full pass was performed on 15-30 July 2019, and the second on 26

August-11 September 2019. Data from these passes were used to identify areas with the highest catch rates, and guide subsequent electrofishing efforts. Additionally, multi-agency crews (UDWR Vernal, UDWR Moab, and the Green River Basin Fish and Wildlife Conservation Office [GRBFWCO]) implemented the spring “surge” effort to disturb smallmouth bass spawning during the period of optimal water temperatures in Island Park (RM 333.9 to 327.6); UDWR-Vernal contributed 8.83 hrs of effort. A summary of collaborative efforts in Island Park is described in the Recovery Program Project #123a annual report.

Population size structure – Between Split Mountain boat ramp and Tabyago Riffle, 2,476 smallmouth bass were removed during targeted removal. Figure 1 displays the size distribution of smallmouth bass captured in the middle Green River in 2019. Sub-adult smallmouth bass (100-199 mm TL) constituted the most abundant size class, comprising 45% of the catch (n=1,661). Adult bass (≥ 200 mm TL) made up 39% (n=1,055) of smallmouth bass removed, while juvenile smallmouth bass (< 100 mm TL) accounted for 16% (n=401) of all bass removed. Of the total 2019 smallmouth bass catch, 2.5% (n=61) were in the piscivore size class (≥ 325 mm TL). The average TL of smallmouth bass in 2019 was 180.2 mm; a noticeable mode exists around 180-190 mm (Figure 1), indicating that the abundant sub-adult size class encountered in 2017 and 2018 are recruiting to adults and comprise a large portion of the 2019 catch. Including smallmouth bass removed during walleye removal (n=161) and tributary electrofishing (n=15) a total of 2,652 bass were removed in 2019.

Catch rate – A combined CPUE of 10.47 fish/hr during targeted smallmouth bass removal represents a decrease from higher catch rates in 2018 (17.19 fish/hr). In 2019, CPUE for juvenile smallmouth bass (< 100 mm TL) was 1.70 fish/hr, while CPUE for sub-adult (100-199 mm TL) and adult (≥ 200 mm TL) smallmouth bass was 4.73 fish/hr and 4.04 fish/hr, respectively (Figure 2). Furthermore, CPUE for smallmouth bass in the piscivore size class (≥ 325 mm TL) was 0.25 fish/hr (Figure 3). Catch rates for all size classes of smallmouth bass have decreased from elevated levels encountered in 2018 (Figure 2, Figure 3). The spatial distribution of catch rates (Figure 4) was somewhat variable in 2019, with notably low rates between Razorback Bar (RM 310.8) and Baeser Wash (RM 280.8). Catch rates for all size classes rose beginning at Baeser Wash (section H, RM 280.8) and culminated in the highest catch rates in sections K-L (RM 270.8-260.8). Adult and sub-adult catch rates remained somewhat elevated for the remainder of the middle Green River, while juvenile catch rates subsided near the White River (section O, RM 245.8). The pattern of catch rates in the middle Green River in 2019 differed from 2017 and 2018 in that high adult and sub-adult catch rates began further upstream of the confluence of the White and Duchesne rivers (RM 247.9 and RM 246.0). Considering recent increases in catch rates of presumptive 2016 and 2017 cohorts of smallmouth bass in the White River (Smith et al. 2018) and high concentrations of similar sized fish in the middle Green River in 2017 and 2018, we have suggested the White and Duchesne rivers as possible source populations (Staffeldt et al. 2017; Partlow et al. 2018). While no clear relationship between catch rates in 2019 and the confluence of those tributaries is evident, it is expected that some upstream dispersal would occur as these fish reach adulthood.

Catch rates by month generally increased throughout the season (Figure 5). Sub-adult catch rates were stable from July through September and October catch rates could be biased by a small sample size (two days). Catch rates for juveniles abruptly increased beginning in September (Figure 5). The increase in CPUE later in the season could be an artifact of targeting concentration areas determined by previous full pass sampling and an increased susceptibility by our gear as juveniles reached larger sizes later in the year.

Movement – Currently there are no mark-recapture studies conducted by UDWR-Vernal. Two floy-tagged smallmouth bass were captured in 2019. A 230 mm TL bass was captured at RM 315.8 on 15 July with a green USFWS floy tag #21428 and a 164 mm TL smallmouth bass was captured at RM 315.8 on 15 July with a green USFWS floy tag #21743. Both of these fish were tagged in 2018, between Echo Park and Split Mountain, under Recovery Program Project 123a (J. Caldwell, UDWR-Moab, personal communication).

VIII. Additional noteworthy observations:

- Direct predation on endangered fishes by nonnative piscivores was observed by scanning larger adults for a PIT tag during removal efforts and examining the stomach contents of fish with bulging stomachs. One bonytail was consumed by a 440 mm TL smallmouth bass and one bonytail was found in a 639 mm TL Northern pike in 2019. Furthermore, a 1,150 mm TL Northern pike was captured with a large adult flannelmouth sucker in its stomach, which highlights the ability of large Northern pike to devour adult native and endangered fishes.
- Ancillary captures—Table 4 lists additional nonnative fishes removed and native fishes released alive during all sampling efforts in the middle Green River in 2019. All native fish data will be submitted to the STReaMs database.
- A 545 mm burbot was captured below Split Mountain boat ramp at RM 318.0 on 19 March 2019.

IX. Recommendations:

With promising results suggesting local smallmouth bass population suppression after multiple years of using two full passes to direct intensive fishing efforts at hotspots, we recommend a continuation of this approach in 2020.

- Continue targeting riffles where walleye have been observed spawning (e.g., Dinosaur National Monument) whenever personnel and equipment are available. More specifically, this effort will be more substantial in 2020 when we are not conducting population estimates for Colorado pikeminnow under Recovery Program Project #128. In 2016, a concentration of walleye was discovered between the White River confluence and Sand Wash, thus we still recommend monitoring this area during spring sampling in 2020.

- In 2019, UDWR Vernal reallocated three days of effort to assist with project 123d below Tusher Diversion where UDWR Moab reported high walleye catch rates (C. Michaud, UDWR, personal communication). In just 13.9 hrs of electrofishing UDWR Vernal removed more walleye than in the entirety of the middle Green River in 2019 (45 vs. 24 respectively). We recommend that some flexibility be maintained to allow us to repeat such reallocations in the future if similar situations arise.
- A single burbot was captured in the middle Green River in 2019. Although burbot captures remain rare below Flaming Gorge Dam, a low susceptibility to boat electrofishing by this species could leave a newly emerging population under detected. If time and resources allow, agencies operating on the Green River below Flaming Gorge Dam should consider exploratory sampling with other gear types such as baited hoop nets or angling.
- Although smallmouth bass were encountered during the Island Park surge, just four ripe fish were captured and no obvious nesting activity was observed. Considering that Island Park is safely accessible by propeller driven jon boats only at flows above approximately 8,000 CFS, it may be unlikely that the current approach will ever be effective at disturbing nesting bass as the majority of side channels are actively flowing at those levels. We recommend exploring other gear options such as a barge electrofisher once flows have receded to the point that low velocity habitat suitable for spawning is present or accessing the area via rafts launched at Echo Park. Ultimately, if no efficient means to disturb this spawning area is determined, we recommend returning this effort to the middle Green River where propeller driven jon boats are more appropriate.

X. Project Status: On track and ongoing.

XI. FY 2019 Budget Status

- A. Funds Provided: \$280,050
- B. Funds Expended: \$280,050
- C. Difference: \$0
- D. Percent of the FY 2019 work completed, and projected costs to complete: 100%
- E. Recovery Program funds spent for publication charges: \$0

XII. Status of Data Submission (Where applicable):

We will submit our data to the Recovery Program database manager by January 2020.

XIII. Signed:

<u>Michael S. Partlow</u>	11/10/19
Principal Investigator	Date

XIV. References:

Harding, I., M.J. Breen, J.A. Skorupski, C.M. Michaud, and K.L. Creighton. 2013.

- Annual fall monitoring of young of year Colorado pikeminnow and small-bodied native fishes. Annual Report of Utah Division of Wildlife Resources to the Upper Colorado River Endangered Fish Recovery Program. Denver, CO.
- Monroe, L. and T. Hedrick. 2009. Nonnative fish control in the middle Green River. Annual Report of Utah Division of Wildlife Resources to the Upper Colorado River Endangered Fish Recovery Program. Denver, CO.
- Partlow, M.S., Staffeldt, R.R., and M.J. Breen. 2018. Nonnative fish control in the middle Green River. Annual Report of Utah Division of Wildlife Resources to the Upper Colorado River Endangered Fish recovery Program. Denver, CO.
- Schelly, R.C., Staffeldt, R.R., and M.J. Breen. 2015. Nonnative fish control in the middle Green River. Annual Report of Utah Division of Wildlife Resources to the Upper Colorado River Endangered Fish Recovery Program. Denver, CO.
- Skorupski, J.A. and M.J. Breen. 2012. Nonnative fish control in the middle Green River. Annual Report of Utah Division of Wildlife Resources to the Upper Colorado River Endangered Fish Recovery Program. Denver, CO.
- Skorupski, J.A., B.P. Kiefer, and M.J. Breen. 2013. Nonnative fish control in the middle Green River. Annual Report of Utah Division of Wildlife Resources to the Upper Colorado River Endangered Fish Recovery Program. Denver, CO.
- Smith, C.T., M.T. Jones, M.J. Breen, and J. Logan. 2018. Smallmouth bass control in the White River. Annual Report to the Upper Colorado River Endangered Fish Recovery Program. Denver, CO.
- Staffeldt, R.R., M.S. Partlow, B. R. Anderson, and M.J. Breen. 2017. Nonnative fish control in the middle Green River. Annual Report of Utah Division of Wildlife Resources to the Upper Colorado River Endangered Fish Recovery Program. Denver, CO.
- Wakefield, C.K and D.W. Beckman. 2005. Life history attributes of white sucker (*Catostomus commersonii*) in Lake Taneycomo and associated tributaries in southwestern Missouri. *The Southwestern Naturalist* 50:423-434.

Table 1. Total captures, catch-per-unit-effort (CPUE; electrofishing [fish/hr] and fyke-netting [fish/overnight set]), and total length (TL; mm) means and ranges of northern pike for four sampling phases in the middle Green River during 2019.

Project	Captures	Electrofishing CPUE	Fyke CPUE	Mean TL	Range TL
Tributary electrofishing	13	0.795	-	626.3	439-1076
Tributary fyke netting	41	-	0.683	552.7	364-662
Walleye removal	21	0.199	-	587.1	424-1150
Smallmouth bass removal	8	0.034	-	502.9	173-771

Table 2. Total captures, catch-per-unit-effort (CPUE; electrofishing [fish/hr] and fyke-netting [fish/overnight set]), and total length (TL; mm) means and ranges of walleye for four sampling phases in the middle Green River during 2019.

Project	Abundance	Electrofishing CPUE	Fyke CPUE	Mean TL	Range TL
Tributary electrofishing	0	0.000	-	-	-
Tributary fyke netting	0	-	0.000	-	-
Walleye removal	16	0.152	-	546.3	455-692
Smallmouth bass removal	8	0.034	-	596.8	486-663

Table 3. Total captures, catch-per-unit-effort (CPUE; electrofishing [fish/hr] and fyke-netting [fish/overnight set]), and total length (TL; mm) means and ranges of white sucker for four projects conducted in the middle Green River during 2019

Project	Abundance	Electrofishing CPUE	Fyke CPUE	Mean TL	Range TL
Tributary electrofishing	226	13.818	-	163.9	53-412
Tributary fyke netting	15	-	0.250	177.5	123-250
Walleye removal	98	0.930	-	199.9	67-383
Smallmouth bass removal	688	2.910	-	149.6	64-374

Table 4. Additional nonnative species removed and native species released alive during all sampling efforts in the middle Green River in 2019.

Species	Captures
Black bullhead	1
Black crappie	46
Brown trout	30
Burbot	1
Creek chub	5
Green sunfish	173
Rainbow trout	4
Redside shiner	2
White X bluehead sucker hybrid	2
White X flannelmouth sucker hybrid	10
Bluehead X razorback sucker hybrid	1
Bonytail	49
Colorado pikeminnow	38
Flannelmouth X razorback sucker hybrid	1
Roundtail chub	6
Razorback sucker	276

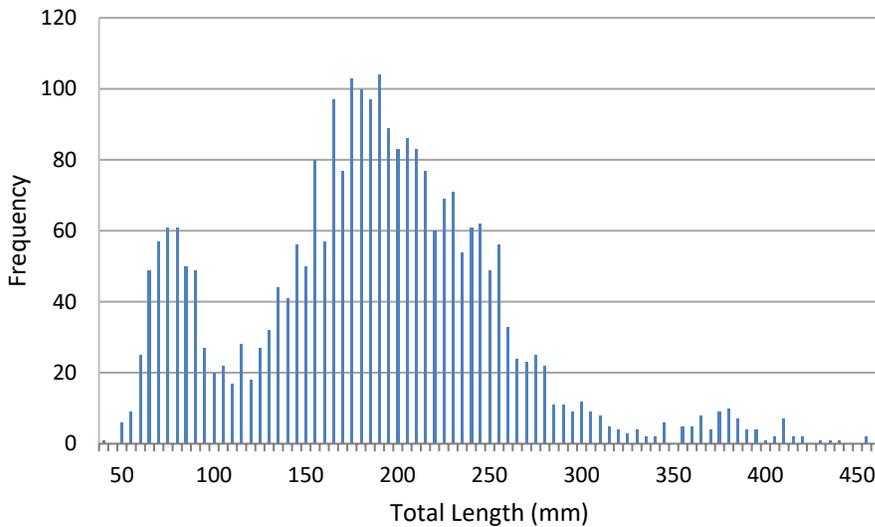


Figure 1. Size distribution of smallmouth bass electrofishing captures in the middle Green River during 2019; includes captures during tributary electrofishing, targeted walleye, and smallmouth bass removal efforts.

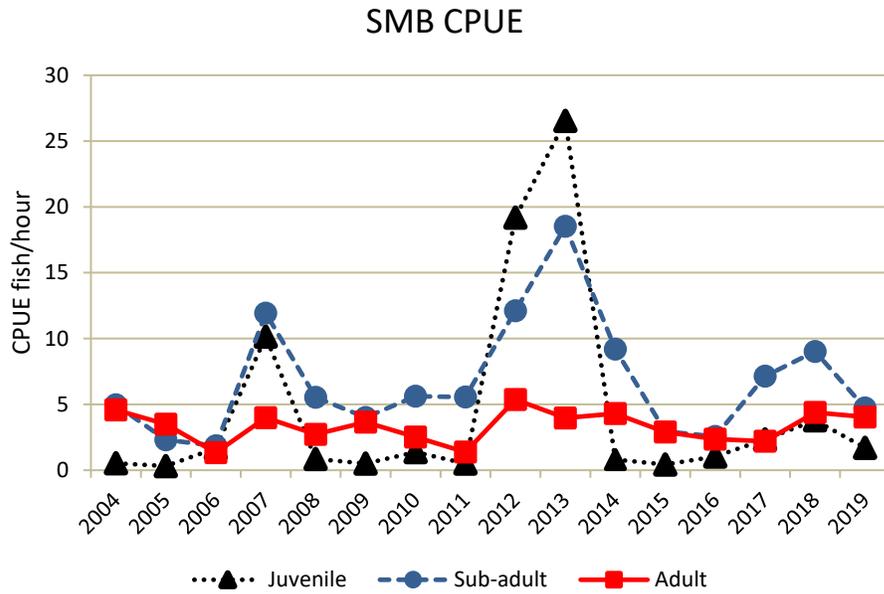


Figure 2. Catch-per-unit-effort (CPUE; fish/hr) of juvenile (< 100 mm total length [TL]), sub-adult (100-199 mm TL), and adult (≥ 200 mm TL) smallmouth bass (SMB) in the middle Green River during targeted smallmouth bass removal, 2004-2019.

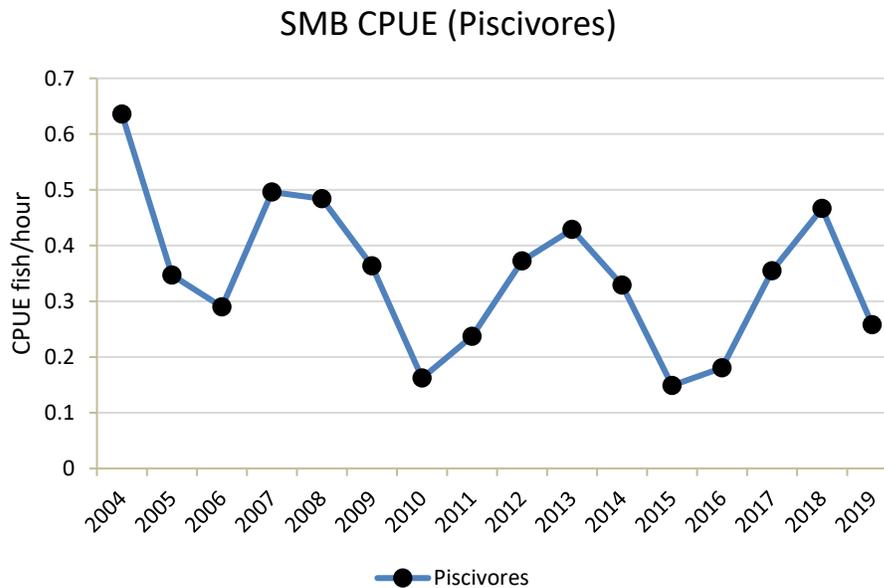


Figure 3. Catch-per-unit-effort (CPUE; fish/hr) of piscivore (≥ 375 mm total length) smallmouth bass (SMB) removed from the middle Green River during targeted smallmouth bass removal, 2004-2019.

SMB Electrofishing CPUE by 5-mile Section

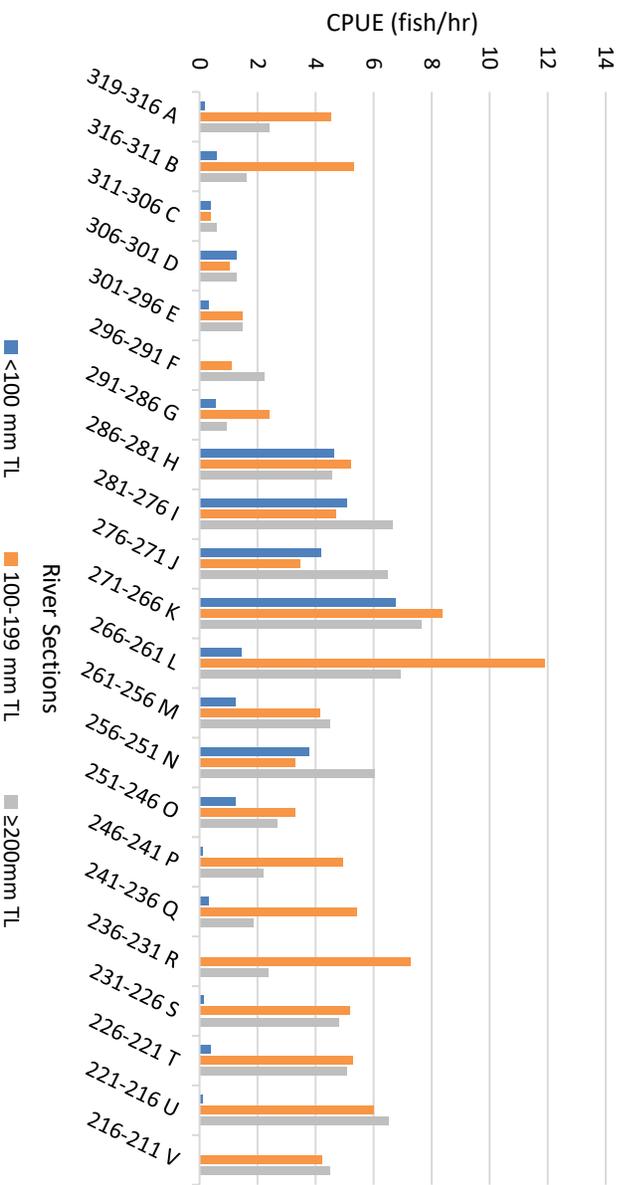


Figure 4. Smallmouth bass (SMB) juvenile (< 100 mm total length [TL]), sub-adult (100-200 mm TL), and adult (> 200 mm TL) catch rates from Split Mountain boat ramp (A) to Tabayago Riffle (V) in the middle Green River, 3 July – 2 October 2019.

SMB Electrofishing CPUE by Month

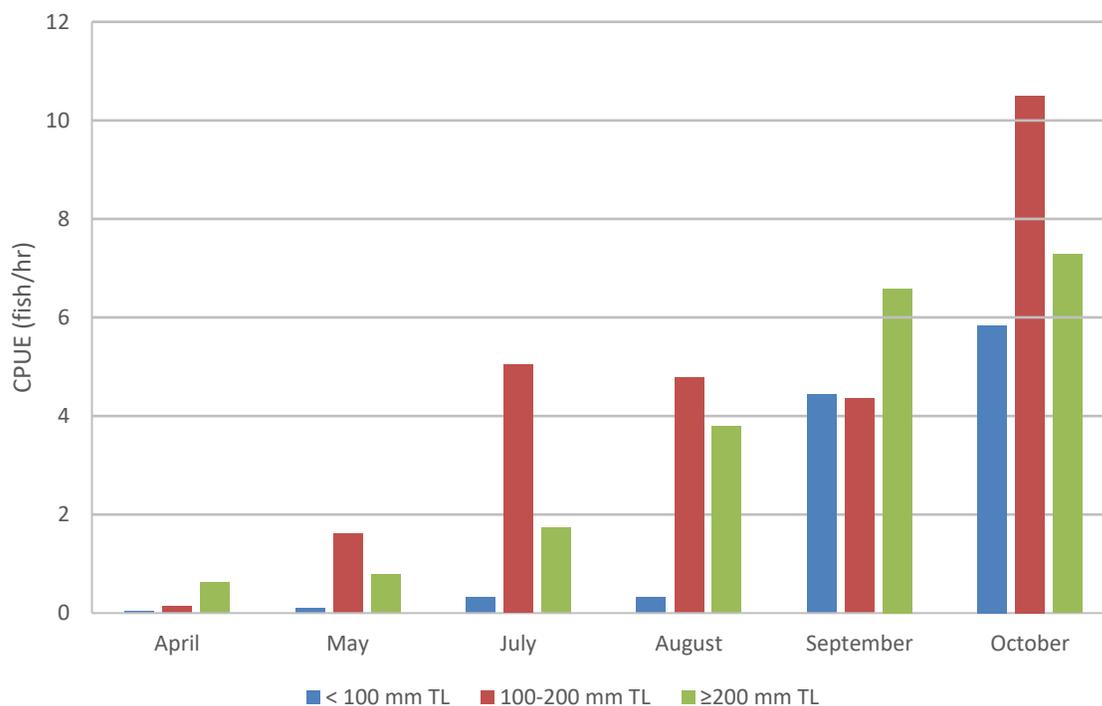


Figure 5. Smallmouth bass juvenile (< 100 mm total length [TL]), sub-adult (100-200 mm TL), and adult (> 200 mm TL) catch rates by month in the middle Green River in 2019. Catch-per-unit-effort (CPUE) in April and May correspond to walleye removal (spring fyke netting and tributary electrofishing excluded for data consistency); CPUE from 3 July–2 October 2019 correspond to sampling that targeted smallmouth bass. No sampling occurred in June.