

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

II. Bureau of Reclamation Agreement Number: R14AP00007

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Is this the final report? Yes \_\_\_\_\_ No  X

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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. Total smallmouth bass catch rates increased for the second consecutive year with smallmouth bass in the 100-199 mm length class making up the largest component of the catch. Removal of nonnative fishes that occurred during spring Colorado pikeminnow sampling is also summarized in this report.

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.
- VII. Accomplishment of FY 2018 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 2018. From 15 March-26 April, a total of 40.2 hrs of electrofishing, including six sampling events on the lower Duchesne River (RM 3.4-0.0), were expended to target walleye. Tributary electrofishing for northern pike took place from 13 March-7 May targeting Ashley Creek (river mile [RM] 299.0), Stewart Lake drain (RM 299.2), Brush Creek (RM 304.6), and backwaters at RM 299.8 and RM 301.8, comprising 13.7 hrs effort. Fyke netting, to target northern pike, in backwaters and tributaries took place from March 13-May 9 with a total of 86 overnight sets. Fyke netting targeted the same sites as tributary electrofishing (listed above) as well as a backwater at RM 299.1. Overall, low water levels in the Green River limited the amount of habitat available for fyke netting and tributary electrofishing in 2018.

*Northern pike*—A total of 60 northern pike were captured in 2018 in the middle Green River (RM 319.3-210.8) and lower Duchesne River (RM 3.4-0): 24 during Colorado pikeminnow population estimates, 16 during fyke netting, 10 during smallmouth bass removal, eight during tributary electrofishing, and two during targeted walleye removal (Table 1). Size distribution was skewed towards larger individuals with 51 adults ( $\geq 300$  mm total length [TL]; 85% of catch), 47 piscivores ( $\geq 375$  mm TL; 78% of catch), and nine juveniles ( $< 300$  mm TL; 15% of catch). Similar to previous years, fyke netting and electrofishing in tributaries and backwaters provided the highest catch rates for northern pike in 2018 (Table 1), but northern pike catch-per-unit-effort (CPUE) during spring main channel electrofishing (Colorado pikeminnow estimate and walleye removal) increased from 0.046 fish/hr in 2017 (Staffeldt et al. 2017) to 0.101 fish/hr in 2018 (Table 1).

*Walleye*—Of the 54 walleye removed in 2018, the majority (n=47) were caught during Colorado pikeminnow population estimate passes. Targeted walleye removal produced four walleye, and smallmouth bass removal accounted for three walleye (Table 2). An additional five walleye were removed by Green River Basin Fish and Wildlife

Conservation Office (GRBFWCO) between Snider Bottom (RM 231.0) and Tabyago Riffle (RM 206.8). Although no clear walleye spawning aggregations were observed in 2018, we removed 11 ripe males, five 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 2018 was skewed towards larger individuals with all but two fish in the piscivore size class ( $\geq 375$  mm TL; Table 2). One juvenile walleye (286 mm TL) was removed from the lower Duchesne River during targeted walleye removal. Captures of juvenile walleye in the middle Green River 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 2018, white sucker captures ( $n=2,169$ ) were higher than in 2017 and 2016 (1,738 and 649, respectively; Staffeldt et al. 2016, 2017). Historically, targeting tributaries and backwaters for white sucker has produced high catch rates (Skorupski et al. 2013). Electrofishing in tributaries and backwaters in 2018 produced a CPUE of 23.0 fish/hr, compared to 3.3 and 4.2 fish/hr for spring main channel electrofishing and smallmouth bass removal, respectively (Table 3). Combining all sampling methods, an additional 35 white x flannelmouth sucker hybrids were captured along with one white x bluehead sucker hybrid (Table 4). Ten additional white sucker were removed by GRBFWCO between Snider Bottom and Tabyago Riffle during Colorado pikeminnow population estimates.

White sucker size distribution was skewed towards smaller individuals in 2018 (mean TL = 151 mm; range = 50-421 mm). In southwestern Missouri, white sucker become mature around 275 mm (Wakefield and Beckman 2005). Because of this, our goal for removing white sucker is to keep the average total length of the white sucker population less than 275 mm TL. In 2018, just 3% of the white sucker removed ( $n=74$ ) were  $\geq 275$  mm TL.

## **Task 2. Smallmouth bass removal**

Targeted smallmouth bass removal occurred from 18 June-5 September 2018. Utah Division of Wildlife Resources (UDWR)-Vernal ended smallmouth bass removal several weeks earlier than anticipated in 2018 due to funding uncertainties. Two full electrofishing passes were implemented in the middle Green River from Split Mountain boat ramp (RM 319.3) to Duches Hole (RM 210.8). The last four miles to Tabyago Riffle (RM 206.8) were not sampled in 2018 due to low water levels and safety concerns regarding upstream travel back to the Sand Wash boat ramp (RM 215.6). The first full pass was performed on 18 June-5 July 2018, and the second on 13-23 August 2018. Data from these passes were used to identify areas with the highest catch rates and to guide subsequent electrofishing efforts. In 2018, low water levels in the Green River prohibited safe upstream navigation of Island Park (RM 333.9 to 327.6) by propeller driven aluminum jon boats during the period of optimal water temperatures to disrupt spawning smallmouth bass, when a spring “surge” effort is typically undertaken by multi-agency crews (UDWR-Vernal, UDWR-Moab, and GRBFWCO). Nonnative fish removed by

UDWR-Vernal during project #128 (Colorado pikeminnow estimates) in Island Park are included in the Project #123a annual report.

*Population size structure* – Between Split Mountain boat ramp and Duches Hole, 4,054 smallmouth bass were removed during targeted removal. Figure 1 displays the size distribution of smallmouth bass captured in the middle Green River in 2018. Sub-adult smallmouth bass (100-199 mm TL) constituted the most abundant size class, comprising 52% of the catch (n=1,774). Adult bass ( $\geq 200$  mm TL) made up 28% (n=1,322) of all smallmouth bass removed, while juvenile smallmouth bass ( $< 100$  mm TL) accounted for 20% (n=958) of all bass removed. Of the total 2018 smallmouth bass catch, 5.3% (n=251) were in the piscivore size class ( $\geq 325$  mm TL), an increase over the previous years of 2017, 2016 and 2015 (3.5%, 3.9%, and 2.4%, respectively; Staffeldt et al. 2016, 2017; Schelly et al. 2015). Including smallmouth bass removed during Colorado pikeminnow population estimate sampling (n=590), walleye removal (n=125), tributary electrofishing (n=10), and fyke netting (n=1), a total of 4,780 bass were removed in 2018. Additionally, GRBFWCO removed 40 smallmouth bass between Snider Bottom and Tabyago Riffle during Colorado pikeminnow sampling (T. Jones, personal communication).

*Catch rate* – A combined CPUE of 17.19 fish/hr during targeted smallmouth bass removal represents the highest catch rate since 2013 (Table 5). In 2018, CPUE for juvenile smallmouth bass ( $< 100$  mm TL) was 3.79 fish/hr, while CPUE for sub-adult (100-199 mm TL) and adult ( $\geq 200$  mm TL) smallmouth bass was 9.02 fish/hr and 4.38 fish/hr, respectively (Figure 2). Furthermore, CPUE for smallmouth bass in the piscivore size class ( $\geq 325$  mm TL) was 0.47 fish/hr (Figure 3). Catch rates for all size classes of smallmouth bass have been trending upwards since 2016 (Figure 2), but only piscivore sized fish have reached the elevated levels encountered in 2012 and 2013 (Figure 3). Although captures of juvenile smallmouth bass likely represent a successful spawn in 2018, we did not observe extremely high catch rates previously encountered during similar drought years in the Green River (Skorupski and Breen; 2012, 2013). Catch rates generally increased moving downstream through the middle Green River with notable concentrations of juvenile bass occurring in sections D and E (Jensen area, RM 305.8-295.8) and in sections J-N (Stirrup to Ouray, RM 275.8-250.8; Figure 4). Sub-adult catch rates rose beginning in section O (Ouray to White River, RM 250.8-245.8), increasing in the downstream direction, and culminating with the highest CPUE in sections Q-S (Pariette Draw to Fourmile Wash, RM 240.8-225.8; Figure 4). Catch rates of adult bass generally rose moving downstream with the highest CPUE in section S (Snider Bottom to Fourmile Wash, RM 230.8-225.8; Figure 4). The spatial pattern of catch rates in the middle Green River in 2018 was similar to that of 2017 with the exception of juvenile catch rates occurring further upstream in 2018 (Staffeldt et al. 2017; Figure 4). Considering recent increases in catch rates of presumptive 2016 and 2017 cohorts of smallmouth bass in the White River (Smith et al. 2018), it is possible that smallmouth bass populations in the White and Duchesne rivers are factors contributing to increased catch rates observed in 2017 (Staffeldt et al. 2017) and 2018 below the confluence of those tributaries with the Green River (RM 247.9 and RM 246.0, respectively). Although 15.9 hrs of electrofishing performed on the lower Duchesne River (RM 3.4-0.0) from 22 March-10 April 2018 was intended to target walleye, 90 smallmouth bass were removed, 53 of which were in the piscivore size class. The capture of 11 presumptive 2017 age

class (< 100 mm TL) smallmouth bass from the lower Duchesne River in 2018 suggests a successful spawn in 2017, although upstream migration from the Green River is also possible.

Catch rates by month were low and stable from March to May, with an increase in sub-adults and adults beginning in June and culminating in high catch rates during July August and September (Figure 5). Catch rates for juveniles abruptly increased beginning in August (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 2018. A 319 mm TL bass was captured at RM 270.8 on 16 August with a green USFWS floy tag #21138, and a 267 mm TL smallmouth bass was captured at RM 327.5 on 10 May with a green USFWS floy tag #21780. Both fish were tagged upstream in the Echo Park to Split Mountain reach. These data will be submitted to the STReaMs database for use by interested parties.

### **Task 3. Data entry, analysis, and reporting**

Recovery Program annual progress report submitted in November 2018.

#### VIII. Additional noteworthy observations:

- Crews observed suspected spawning Colorado pikeminnow while electrofishing during targeted smallmouth bass removal at RM 316 on 9 July 2018. A remote submersible PIT antenna was subsequently deployed at this location. Data from this antenna is summarized in the project #172 annual report.
- Direct predation on endangered fishes by nonnative piscivores was observed by scanning larger adults for a PIT tag during removal efforts. Three PIT tags were found in the stomachs of walleye in 2018. Two of those tags correspond to bonytail stocked in 2018. A third tag (3DD003D3ADD04) detected in a walleye could not be located in the digestive track of the predatory fish and has no record in STReaMS.
- Ancillary captures—Table 4 lists additional nonnative fishes removed and native fishes released alive during all sampling efforts in the middle Green River and lower Duchesne River in 2018. All native fish data will be submitted to the STReaMs database.
- An 821 mm TL grass carp was captured in the lower Duchesne River on 29 March 2018. Eyeball samples were submitted the U.S. Fish and Wildlife Service La Crosse Fish Health Center. Results indicated that the fish was triploid with a DNA mass of 2.81 (Jennifer Bailey, personal communication).

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 2019.
- 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 2019-2020 when we are not conducting population estimates for Colorado pikeminnow under 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 2019.

X. Project Status: On track and ongoing.

XI. FY 2018 Budget Status

- A. Funds Provided: \$285,220
- B. Funds Expended: \$285,220
- C. Difference: \$0
- D. Percent of the FY 2018 work completed, and projected costs to complete: 100%
- E. Recovery Program funds spent for publication charges: \$0

XII. Status of Data Submission:

We will submit our data to the Recovery Program database manager by January 2019.

XIII. Signed: Michael S. Partlow                      11/30/18  
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.

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.

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- 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., R.C. Schelly, and M.J. Breen. 2016. 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.
- 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 abundance, 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 projects during 2018. Spring main channel sampling included captures during dedicated walleye removal and Colorado pikeminnow population estimates.

Project	Abundance	Electrofishing CPUE	Fyke CPUE	Mean TL	Range TL
Spring tributary sampling	24	0.584	0.186	478.2	251-738
Spring main channel sampling	26	0.101	-	437.7	228-679
Smallmouth bass removal	10	0.042	-	461.2	298-554

**Table 2.** Total abundance, 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 projects during 2018. Spring main channel sampling included captures during dedicated walleye removal and Colorado pikeminnow population estimates.

Project	Abundance	Electrofishing CPUE	Fyke CPUE	Mean TL	Range TL
Spring tributary sampling	0	0.000	0.000	-	-
Spring main channel sampling	51	0.198	-	541.7	286-692
Smallmouth bass removal	3	0.013	-	669.3	660-681

**Table 3.** Total abundance, 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 during 2018. Spring main channel sampling included captures during dedicated walleye removal and Colorado pikeminnow population estimates.

Project	Abundance	Electrofishing CPUE	Fyke CPUE	Mean TL	Range TL
Spring tributary sampling	323	22.993	0.093	145.1	51-421
Spring main channel sampling	846	3.288	-	153.9	52-413
Smallmouth bass removal	1000	4.241	-	150.8	50-413

**Table 4.** Additional nonnative species removed and native species released alive during all sampling efforts in the middle Green River and lower Duchesne River in 2018.

Species	Abundance
Black bullhead	8
Black crappie	29
Brown trout	87
Creek chub	3
Grass carp	1
Green sunfish	552
Gizzard shad	45
Kokanee	1
Rainbow trout	22
White x bluehead sucker hybrid	1
White x flannelmouth sucker hybrid	35
Yellow perch	3
Bonytail	49
Colorado pikeminnow	52
Flannelmouth sucker	26
Flannelmouth X razorback sucker hybrid	6
Humpback chub	1
Roundtail chub	28
Razorback sucker	615

**Table 5.** Smallmouth bass catch-per-unit-effort (CPUE; fish/hr) from 2004–2018.

Year	CPUE (fish/hr)
2004	9.33
2005	4.02
2005	4.71
2007	26.04
2008	8.56
2009	7.96
2010	9.6
2011	7.4
2012	34.1
2013	48.6
2014	16.97
2015	6.55
2016	6.45
2017	11.68
2018	17.19

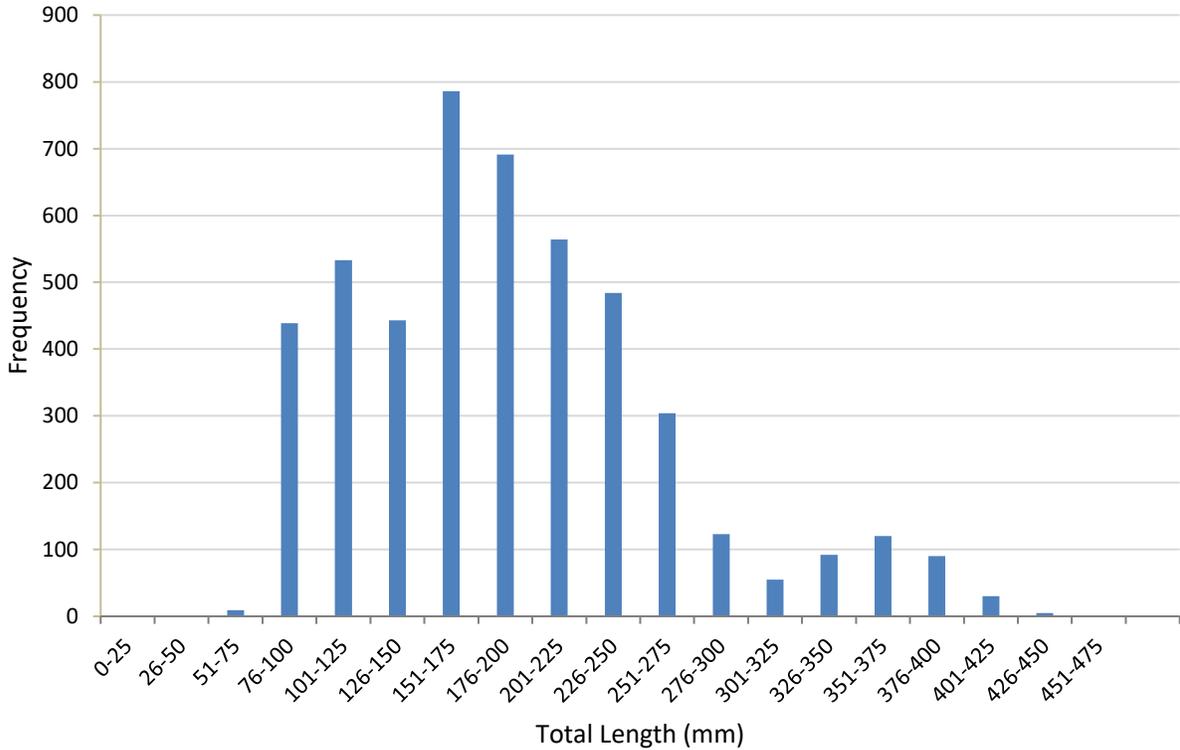


Figure 1. Size distribution of smallmouth bass electrofishing captures in the middle Green River; includes captures during Colorado pikeminnow population estimates, as well as targeted walleye and smallmouth bass removal efforts.

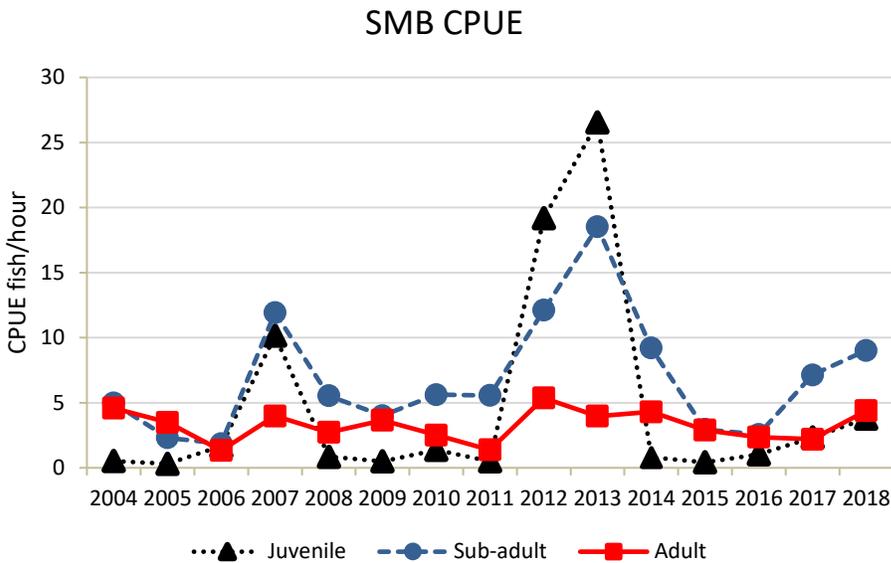


Figure 2. Catch-per-unit-effort (CPUE; fish/hr) of juvenile (< 100 mm total length [TL]), sub-adult (100-199 mm TL), and adult (≥ 200 mm TL) smallmouth bass in the middle Green River 2004-2018, during targeted smallmouth bass removal.

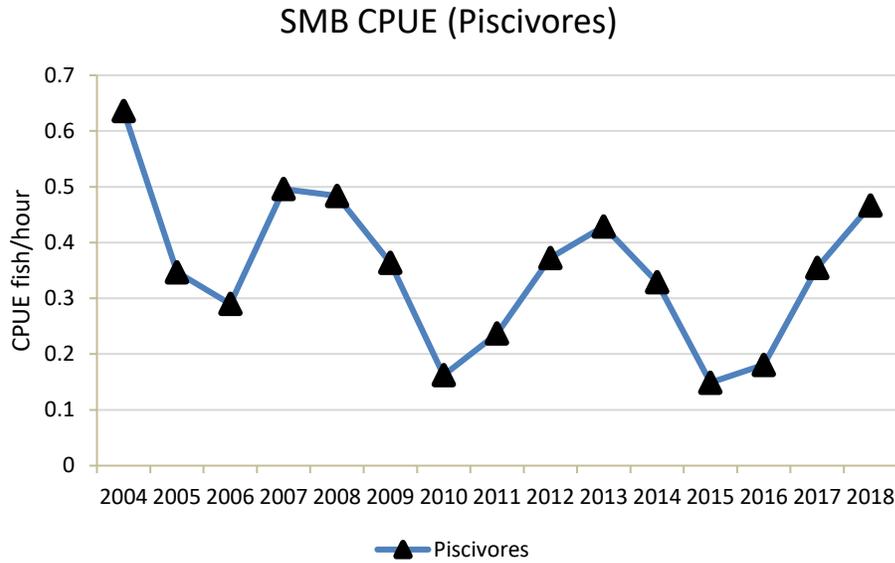


Figure 3. Catch-per-unit-effort (CPUE; fish/hr) of piscivore ( $\geq 375$  mm total length) smallmouth bass removed from the middle Green River 2004-2018, during targeted smallmouth bass removal.

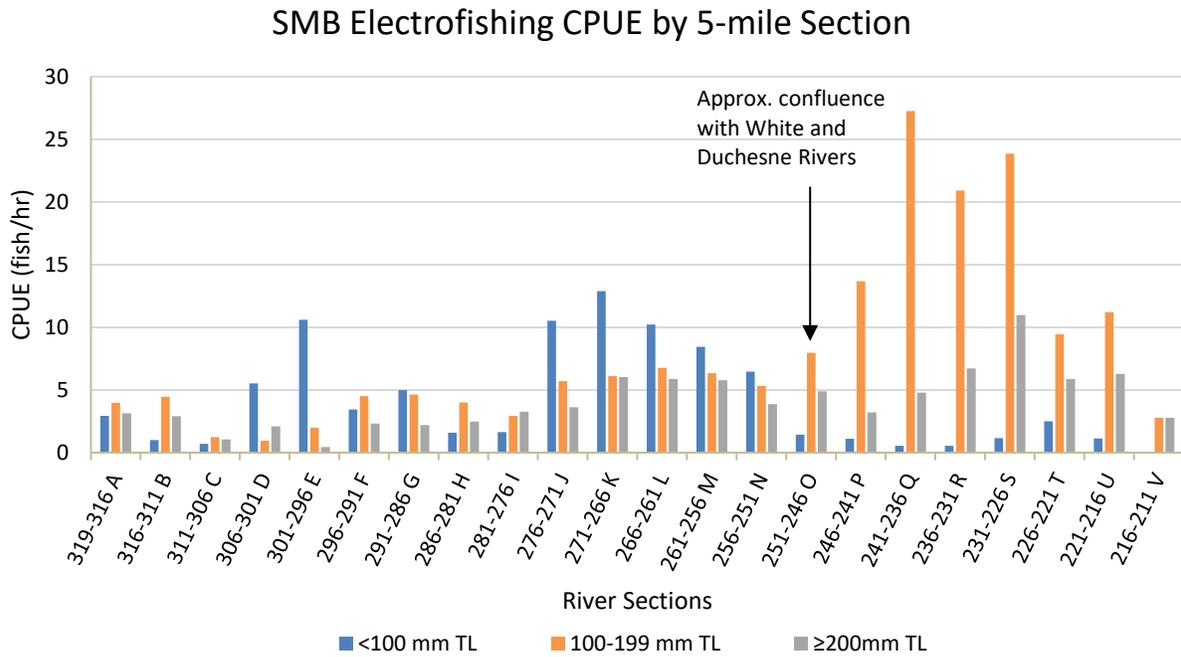


Figure 4. Smallmouth bass juvenile ( $< 100$  mm total length [TL]), sub-adult (100-200 mm TL), and adult ( $> 200$  mm TL) catch rates from Split Mountain boat ramp (A) to Duches Hole (V) in the middle Green River, 18 June – 5 September 2018.

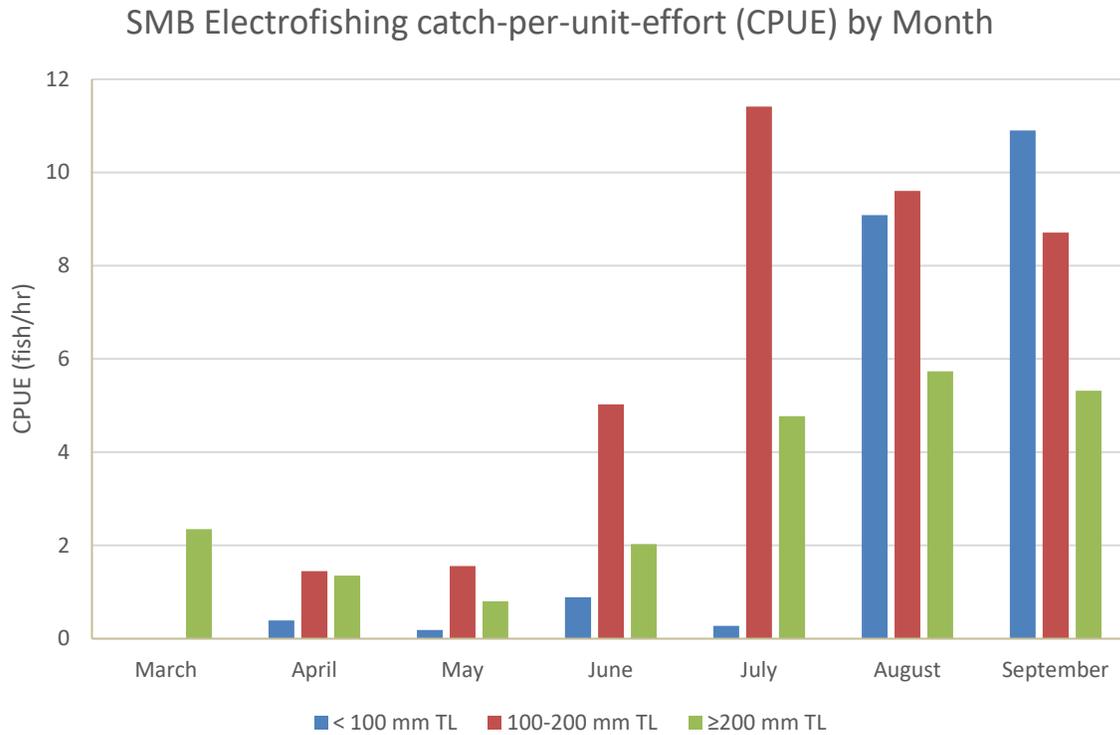


Figure 5. Smallmouth bass juvenile (< 100 mm total length [TL]), sub-adult (100-200 mm TL), and adult (> 200 mm TL) catch rates by month in the middle Green River in 2018. Catch-per-unit-effort (CPUE) in March, April, May and early June correspond to sampling that specifically targeted Colorado pikeminnow and walleye (spring fyke netting and tributary electrofishing excluded for data consistency); CPUE from 18 June–5 September 2018 correspond to sampling that targeted smallmouth bass.