FY 2021 ANNUAL REPORT PROJECT: 123b

Project Title
Nonnative fish control in the middle Green River

Bureau of Reclamation Agreement Number:
R14AP00059

Project/Grant Period:
Start date: 08/19/2019
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Is this the final report? Yes _____ No __X

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Abstract:
The purpose of this project is to remove nonnative species that pose the greatest threat to recovery of the four federally listed fishes in the upper Colorado River basin through predation, competition, and hybridization. Spring components of this project included electrofishing and fyke netting of tributaries and backwaters to target northern pike (*Esox lucius*) and white sucker (*Catostomus commersonii*), and main channel electrofishing to target walleye (*Sander vitreus*). Targeted smallmouth bass (*Micropterus dolomieu*) electrofishing took place during summer months. In 2021, we removed 24 northern pike, 21 walleye, 976 white sucker, and 5,755 smallmouth bass from the middle Green River. Total smallmouth bass catch rates for all size classes were similar to 2020, with the 100-199 mm length class comprising the largest component of the catch. Northern pike and walleye catch rates declined from 2020, with walleye catch rates remaining low compared to historical trends.

Study Schedule:
Ongoing

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.

Accomplishment of FY 2021 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 2021. From 15 April to 28 May 2021, 81.4 hrs of electrofishing were expended to target walleye (*Sander vitreus*) in mainstem habitats of the middle Green River. Tributary electrofishing to target northern pike (*Esox lucius*) and white sucker (*Catostomus commersonii*) took place from 12 April to 27 May 2021 targeting Ashley Creek (river mile [RM] 299.0), Stewart Lake drain (RM 299.2), and Brush Creek (RM 304.6), comprising 6.4 hrs of effort. Fyke netting in backwaters and tributaries to target northern pike and white sucker took place from 12 April to 27 May 2021 with a total of 29 overnight sets. Fyke netting targeted the same sites as tributary electrofishing (listed above).

Northern pike

A total of 24 northern pike were captured in 2021 in the middle Green River (RM 319.3-206.8): 13 during fyke netting, six during walleye removal, two during smallmouth bass (*Micropterus dolomieu*) removal (see below), and three during tributary electrofishing (Table 1). Size distribution was skewed towards larger individuals; all 24 northern pike were adults (≥ 300 mm total length [TL]), of which 21 were considered piscivores (≥ 375 mm TL; 88% of the total catch). Similar to previous years, fyke netting and electrofishing in tributaries and backwaters provided the highest catch rates for northern pike in 2021 (Table 1). A decrease in northern pike captures from 2020 (n = 52) may be partially attributed to drought hydrology and subsequent decrease in flooded tributary mouths and backwaters in spring 2021 where effective sampling could take place.

Walleye

In the middle Green River, 21 walleye were captured in 2021. Targeted walleye removal in 2021 produced 16 walleye, while smallmouth bass removal accounted for four walleye and fyke netting captured one walleye (Table 2). Although no clear walleye spawning aggregations were observed in 2021, we removed 10 ripe males. In 2015, walleye in spawning condition were discovered on a cobble bar in Dinosaur National Monument between RM 319-315.8 (Schelly et al. 2015) and relatively high numbers of ripe walleye have been noted in this area in subsequent years (Staffeldt et al. 2017). Targeted walleye removal in 2021 took place from Split Mountain boat ramp (RM 319.3) to Sand Wash (RM 215.6).

The size distribution of walleye removed in 2021 was skewed towards larger individuals with all 21 fish in the adult size class (≥ 300 mm TL; Table 2), of which 20 were classified as piscivores (≥ 350 mm TL; 95% of catch). No juvenile walleye (< 300 mm TL) were removed from the middle Green River in 2021. 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 2021, total white sucker captures were similar to 2020 and 2019 (976, 1,037, and 1,027, respectively) but were lower than in 2018 and 2017, 2,169 and 1,738, respectively (Partlow et al. 2018, 2019, and 2020; 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 2021 produced a catch-per-unit-effort (CPUE) of 17.6 fish/hr, compared to 2.6 and 2.3 fish/hr for walleye and smallmouth bass removal, respectively (Table 3). Combining all sampling methods, an additional 10 white x flannelmouth sucker hybrids were captured along with four white x bluehead sucker hybrids (Table 4). White sucker size distribution was skewed towards smaller individuals in 2021 (mean TL = 184 mm; range = 69-395 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 ≥ 275 mm TL. In 2021, just 6.4% of the white suckers removed (n = 61) were ≥ 275 mm TL.

Task 2. Smallmouth bass removal

Targeted smallmouth bass removal occurred from 3 June to 7 October 2021. The onset of smallmouth bass removal is typically determined by timing of flows, with a transition of the target species from walleye to smallmouth bass when flows recede below 10,000 cubic feet/second (cfs). Due to drought conditions, flows at Jensen, Utah never reached a daily average of 10,000 cfs in 2021 (United States Geological Survey provisional data, gauge #09261000). Two full boat 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 03-23 June 2021, and the second on 27 July to 11 August 2021. Data from these passes were analyzed to identify areas with the highest catch rates, and guide subsequent electrofishing efforts. However, several rain events drastically changed turbidity during the second pass, making meaningful comparisons difficult. Additionally, multi-agency crews (Utah Division of Wildlife Resources [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). However, low water conditions prohibited the use of propeller driven jon boats in Island Park this year. Therefore, on 15 July 2021, UDWR Vernal personnel provided focused removal efforts by utilizing a three-electrode barge electrofishing unit in several pools associated with a large side channel at the upstream end of Island Park. This method was successful in removing adult bass in 2020 (Partlow et al. 2020), but in 2021, only juvenile smallmouth bass were removed (n = 19) from two pools that were isolated from the main channel due to low water levels.

Population size structure

Between Split Mountain boat ramp and Tabyago Riffle, 5,495 smallmouth bass were removed during targeted removal. Figure 1 displays the size distribution of smallmouth bass captured in the middle Green River in 2021. Sub-adult smallmouth bass (100-199 mm TL) constituted the most abundant size

class, comprising 60% of the catch (n = 3,306). Adult bass (≥ 200 mm TL) made up 27% (n = 1,470) of smallmouth bass removed, while juvenile smallmouth bass (< 100 mm TL) accounted for 13% (n = 719) of all bass removed. Of the total 2021 smallmouth bass catch, 2.1% (n = 118) were in the piscivore size class (≥ 325 mm TL). The average TL of smallmouth bass in 2021 was 172.3 mm. Including smallmouth bass removed during walleye removal (n = 236), tributary electrofishing (n = 23), and fyke netting (n = 1), a total of 5,755 bass were removed in 2021.

Catch rate

A combined CPUE of 20.73 fish/hr during targeted smallmouth bass removal is notably similar to 2020 (20.88 fish/hr), but represents an increase from 2019 and 2018 (10.47 and 17.19 fish/hr, respectively). In 2021, CPUE for juvenile smallmouth bass was 2.71 fish/hr, while CPUE for sub-adult and adult smallmouth bass was 12.47 fish/hr and 5.55 fish/hr, respectively (Figure 2). Furthermore, CPUE for smallmouth bass classified as piscivores was 0.45 fish/hr (Figure 3). Catch rates for all size classes of smallmouth bass are similar to levels encountered in 2020 except for a slight increase with piscivores (Figures 2 and 3). The spatial distribution of catch rates in 2021 (Figure 4) was characterized by a general increase in the downstream direction for sub-adult and adult bass, while juvenile bass were more prevalent in upstream reaches. Particularly high sub-adult catch rates were encountered near Nine Mile Creek in section V (RM 210.8-215.8).

Monthly catch rates were punctuated by high sub-adult and adult catch rates in July, which decreased in August and September and then increased again in October (Figure 5). This contrasts with a general trend of increasing catch rates in later months that we have observed in preceding years (Partlow et al. 2018, 2019, and 2020; Staffeldt et al. 2017). Multiple turbidity events following monsoonal rainstorms during August and September 2021 likely affected these catch rates as turbid water can make it difficult to see and net fish.

Movement

Currently there are no mark-recapture studies conducted by UDWR Vernal. Two floy-tagged smallmouth bass were captured in 2021. A 255 mm TL bass was captured at RM 310.8 on 27 July 2021 with a green GRBFWCO floy tag #10396 and a 383 mm TL bass was captured at the same location and day with a green GRBFWCO floy tag #10706. These fish were likely tagged between Echo Park and Split Mountain, under Recovery Program Project #123a. Data has been provided to Project #123a investigators and will be submitted to the STReaMS database.

Additional noteworthy observations:

Ancillary captures—Table 4 lists additional nonnative fishes removed and native fishes released alive during all sampling efforts in the middle Green River in 2021.

A single burbot (*Lota lota*; 629 mm TL) was captured at RM 318.8 near the Split Mountain boat ramp on 26 August 2021. This burbot had no visible scars or marks that would suggest recent passage through a hydroelectric turbine.

Recommendations:

Despite dry hydrology that generally coincides with high smallmouth bass catch rates, we observed similar catch rates in 2021 compared to 2020 and much lower juvenile catch rates than similarly dry years such as 2012 and 2013 (Skorupski et al. 2012, 2013). One possible explanation is the implementation of a flow spike from Flaming Gorge Dam in June 2021 intended to disadvantage

spawning and recently hatched smallmouth bass (Bestgen 2018). If similar flow spikes are implemented in the future, we recommend that some level of pre- and post-flow manipulation monitoring be extended downstream to the middle Green River to determine if these flow experiments have beneficial effects farther downstream than initially expected.

High catch rates of sub-adult smallmouth bass occurred from the Sand Wash boat ramp to the Tabyago Riffle (RM 215.8-206.8). Unfortunately, this is also one of the most remote and difficult to access areas covered under this project. If this cohort of bass remain in the area, crews conducting removal efforts under Recovery Program Project 123a should consider electrofishing this habitat during Desolation Canyon removal passes rather than skipping down to Tabyago Riffle, to provide as much removal effort in this area as possible (i.e., a combination of 123a and 123b efforts).

Project Status:
On track, ongoing.

FY 2021 Budget Status
Funds Provided: $260,670
Funds Expended: $260,670
Difference: -0-
Percent of the FY 2021 work completed, and projected costs to complete: 100%
Recovery Program funds spent for publication charges: -0-

Status of Data Submission
Data will be uploaded into STReaMS by January 2022.

Signed:
Michael S. Partlow & Keena R. Elbin
Principal Investigators
11/17/2021

References:

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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 nonnative removal phases in the middle Green River during 2021.

Project	Captures	Electrofishing CPUE	Fyke CPUE	Mean TL	Range TL
Tributary electrofishing	3	0.47	-	578.3	510-675
Tributary fyke netting	13	-	0.45	643.5	445-845
Walleye removal	6	0.07	-	627.7	430-795
Smallmouth bass removal	2	0.01	-	671.5	649-694

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 nonnative removal phases in the middle Green River during 2021.

Project	Captures	Electrofishing CPUE	Fyke CPUE	Mean TL	Range TL
Tributary electrofishing	0	0.00	-	-	-
Tributary fyke netting	1	-	0.05	520	-
Walleye removal	16	0.20	-	532.9	445-721
Smallmouth bass removal	4	0.02	-	549.8	472-689

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 nonnative removal phases conducted in the middle Green River during 2021.

Project	Captures	Electrofishing CPUE	Fyke CPUE	Mean TL	Range TL
Tributary electrofishing	112	17.55	-	208.3	120-330
Tributary fyke netting	3	-	0.1	252.3	195-322
Walleye removal	212	2.60	-	204.9	69-390
Smallmouth bass removal	615	2.32	-	176.9	74-395

Table 4. Additional nonnative species removed and native species released alive during all sampling efforts in the middle Green River in 2021.

Species	Captures
Black crappie	6
Brown trout	27
Burbot	1
Creek chub	1
Gizzard shad	3
Green sunfish	228
Rainbow trout	1
White X bluehead sucker hybrid	4
White X flannelmouth sucker hybrid	10
Bonytail	6
Colorado pikeminnow	38
Razorback sucker	150
Razorback X flannelmouth sucker hybrid	3
Razorback X bluehead sucker hybrid	1

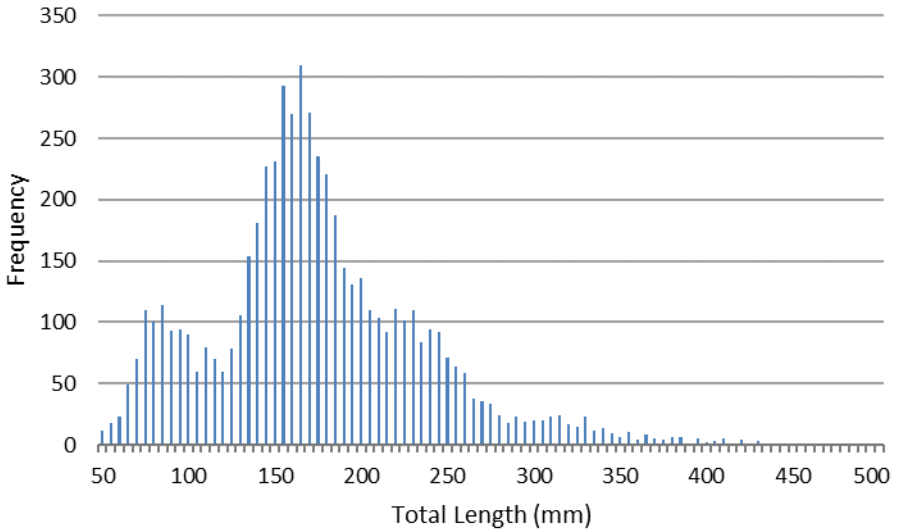

Figure 1. Size distribution of smallmouth bass electrofishing captures in the middle Green River during 2021; includes captures during tributary electrofishing, targeted walleye, and smallmouth bass removal efforts.

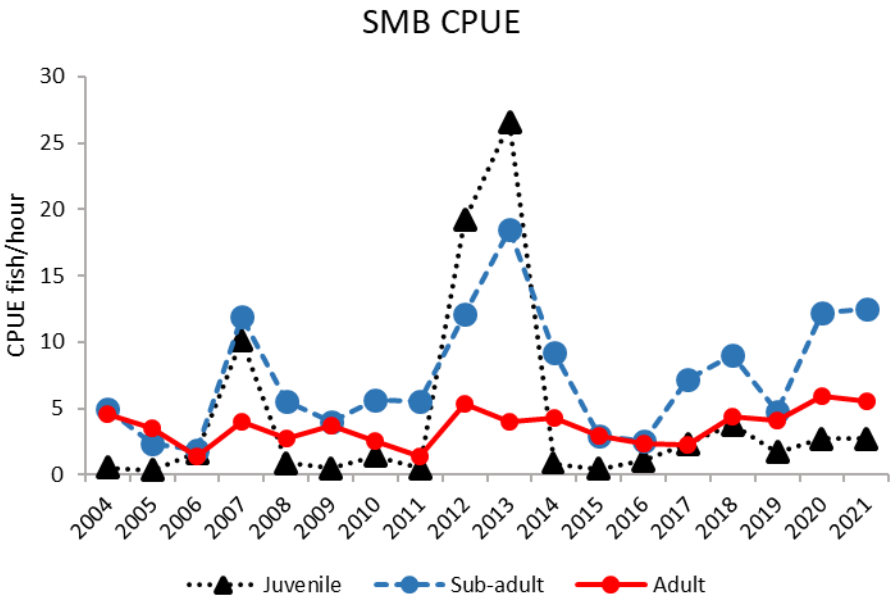

Figure 2. Catch-per-unit-effort (CPUE; fish/hr) of juvenile (< 100 mm total length [TL]), sub-adult (100-199 mm TL), and adult (≥ 200 mm TL) smallmouth bass (SMB) in the middle Green River during targeted smallmouth bass removal, 2004-2021.

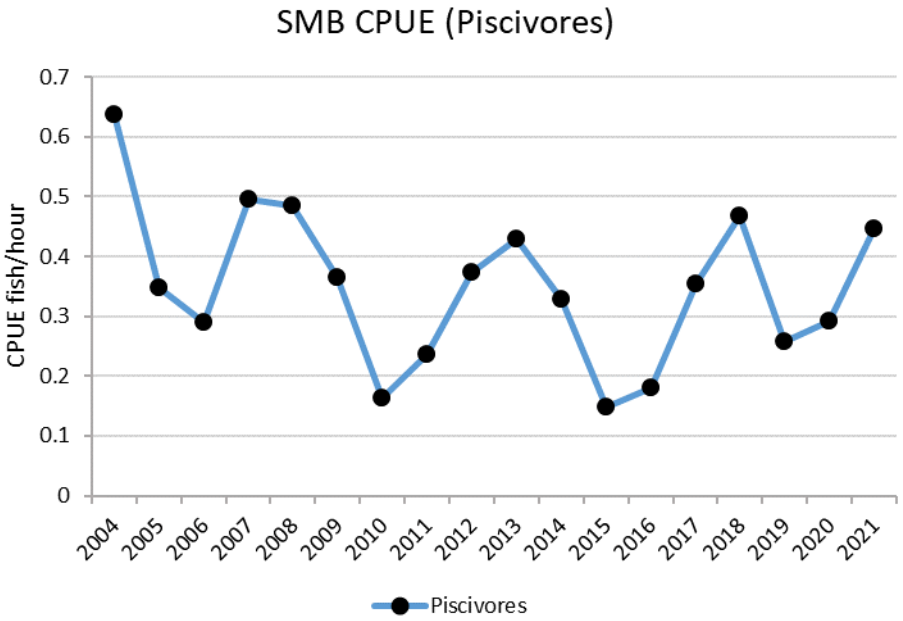

Figure 3. Catch-per-unit-effort (CPUE; fish/hr) of piscivore (≥ 375 mm total length) smallmouth bass (SMB) removed from the middle Green River during targeted smallmouth bass removal, 2004-2021.

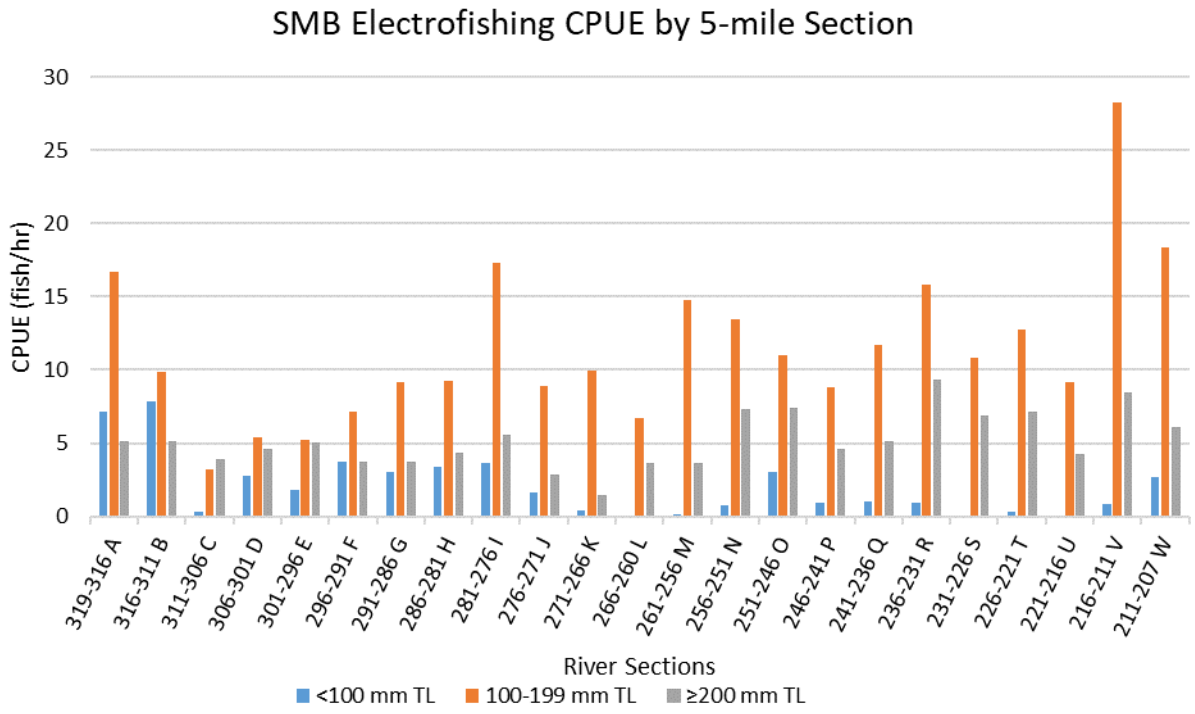

Figure 4. Smallmouth bass (SMB) juvenile (< 100 mm total length [TL]), sub-adult (100-200 mm TL), and adult (> 200 mm TL) catch rates from Split Mountain boat ramp (A) to Tabyago Riffle (W) in the middle Green River from 3 June to 7 October 2021.

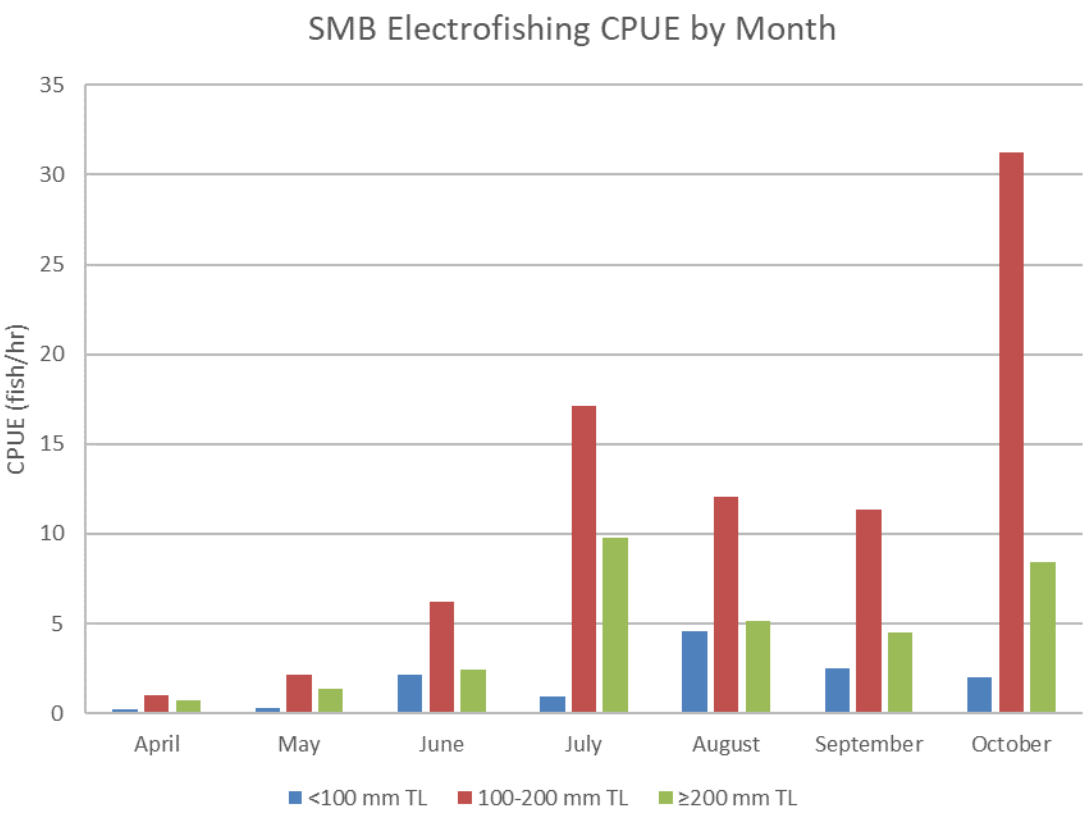

Figure 5. Smallmouth bass (SMB) juvenile (< 100 mm total length [TL]), sub-adult (100-200 mm TL), and adult (> 200 mm TL) catch rates by month in the middle Green River in 2021. Catch-per-unit-effort (CPUE) in April and May correspond to walleye removal (spring fyke netting and tributary electrofishing excluded for data consistency); CPUE from 3 June to 7 October correspond to sampling that targeted smallmouth bass.