

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

II. Bureau of Reclamation Agreement Number(s): R14AP00007

Project/Grant Period: Start date (Mo/Day/Yr): 05/01/2014
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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. Total bass catch rates continue to decline likely due to two consecutive years of higher spring peak flows and cooler water temperatures unfavorable to bass recruitment, as well as nest disruption in prime spawning habitat in Island Park during the multi-agency spring surge effort.

V. Study Schedule: FY 2004 – FY 2018

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. Implement and evaluate the effectiveness of viable active control measures.

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 2015 Tasks and Deliverables, Discussion of Initial Findings and Shortcomings:

Task 1. Northern Pike, White Sucker, Walleye, and Island Park Smallmouth Bass removal.

To maximize effectiveness and efficiency, we implemented a diverse set of techniques to remove problematic nonnative fish at a variety of locations. Dedicated Walleye removal effort was implemented for the second consecutive year in 2015, another off-year for Colorado Pikeminnow population estimates. This effort, recommended by the Recovery Program to approximate two passes of a Pikeminnow population estimate, constituted 99.3 hrs of electrofishing effort from 02 April – 07 May 2015 (18.3 hrs of effort more than in 2014). Tributary electrofishing took place from 10 March – 17 June, targeting Stewart Lake drain, Ashley Creek, and Brush Creek, and comprising 9.36 hrs of effort. Fyke netting in backwaters and tributaries took place from 09 March – 10 May with 81 total overnight sets at the following locations: Ashley Creek, Brush Creek, Escalante Ranch outlet, Cliff Creek, and Stewart Lake drain. With a compressed period of sufficiently high flows (Figure 1), no additional backwaters within this reach presented suitable conditions for net sets this spring. Continuing for a second year the multi-agency (UDWR-Vernal, UDWR-Moab, Vernal-CRFP) spring "surge" effort to disturb Smallmouth Bass spawning, timed to coincide with the advent of 16°C water temperatures in Island Park, we contributed 21.37 hrs of electrofishing effort between 1 June and 15 June 2015 toward the goal of three electrofishing passes per week for three consecutive weeks in this reach. (Results from our Island Park sampling are included here with our dedicated Smallmouth Bass removal data; a summary of collaborative efforts will be described under Project 123a). Finally, following-up on our discovery in 2014 of large numbers of White Sucker in Duck Lakes (Parson's Unit Waterfowl Management Area) in Brown's Park, additional netting was conducted in those ponds on 14-15 October 2015, and discussions are currently underway on treatment options to reset the ponds and install a screening system to prevent re-colonization by White Sucker and other nonnatives.

Northern Pike – Captures of Northern Pike decreased in 2015, with a total of 38 fish removed from the middle Green River: 23 during fyke netting, three during tributary electrofishing, three during spring Walleye removal, and nine during Smallmouth Bass removal (Table 1). This is in contrast to the 114 and 177 Northern Pike removed in 2014 and 2013, respectively (Skorupski et al. 2013; Schelly et al. 2014). Size distribution was skewed towards larger individuals with 33 out of 38 fish (87%) in the piscivore size class

(≥ 450 mm TL). Fyke netting and electrofishing in tributaries and backwaters continues to be a more effective removal method than main channel electrofishing. This year's decline may be attributable to a lower spring peak flow and other conditions that disfavored concentrations of spawning Northern Pike in tributaries and backwaters at water levels suitable for fyke netting.

Walleye – The 142 total Walleye caught in 2015 was similar to the 149 removed in 2014 (Schelly et al. 2014), despite increased electrofishing effort. Just over half (75) of the Walleye removed in 2015 were captured during the spring Walleye targeting period; of those 75 individuals, 68 were captured in Dinosaur National Monument (specifically sections A and B; river miles [RM] 319.3-310.8). These fish were targeted because we discovered, and subsequently exploited, concentrations of spawning Walleye during routine passes beginning at Split Mountain boat ramp, primarily at two cobble bars approximately two miles downstream of the boat ramp. In both locations, the river is broad and shallow with a sloping gradient and large cobble; the Walleye were often captured in water shallow enough to impede the maneuverability of our jon boats. Between 9 April and 5 May, 37 male (of which 35 were ripe) and three spent female Walleye were removed from these bars in section A (with up to 15 individuals captured per day). Capture rates dropped markedly after late April, and removal efforts stopped as flows increased the first week in May. Monitoring for aggregations of Walleye in the early spring at these bars and similar habitats upstream as far as Island Park would be advisable.

The balance of the 2015 Walleye catch included 53 fish removed during Smallmouth Bass sampling and 14 fish removed during spring tributary sampling. In terms of catch-per-unit-effort (CPUE), main channel Walleye electrofishing continued to yield the highest catch rate with a CPUE of 0.76 fish/hr during dedicated spring Walleye removal, very similar to the 0.80 fish/hr catch rate obtained in 2014 (Table 2). Also consistent with previous years, 2015 Walleye size distribution was heavily skewed towards large adults, with 141 of the 142, or 99.3%, in the piscivore size class (≥ 375 mm TL).

With unseasonably warm temperatures in February 2015, and upon hearing angler reports of Walleye captures near Jensen, Utah on the Green River, early season spot shocking of gravel bars was conducted on multiple occasions that month. These efforts produced only one unripe Walleye. Additionally, one evening was spent experimenting with night electrofishing for Walleye during the spring targeting phase. Our lighting system overloaded the generator when used in conjunction with the electroshocker, so fishing was brief (and unsuccessful), but this tactic will be attempted again next year with a reconfigured lighting system.

White Sucker — Spring targeting of White Suckers in tributaries and backwaters of the middle Green River has historically produced high catch rates, but in 2015 White Sucker catch rates were considerably lower (Table 3). Only 618 White Suckers were removed in 2015 compared to 2,851 in 2014 (Schelly et al. 2014). Of the White Suckers removed, 35 were identified as hybrids with Flannelmouth or Bluehead suckers (Table 4), compared to 33 hybrids in 2014. Environmental factors, such as an early runoff and lower spring peak

flow, may have disfavored White Sucker spawning in backwaters and tributaries in similar fashion to Northern Pike, resulting in fewer captures. In the best case, lower catch rates may represent successful suppression of White Sucker numbers during recent years with higher catch rates.

As mentioned above, the Duck Lakes in Brown's Park were identified as a possible source population for White Suckers in 2014 (Schelly et al. 2014), and follow-up sampling took place this fall to better understand the scope of the problem. The Duck Lakes are an interconnected series of ponds on river right joined together through a canal system connected directly to the Green River. Another series of ponds on river left are alternatively filled with water pumped directly from the Green River and drained seasonally, and these ponds are believed to be devoid of fish (A. Vande Voort, pers. comm.). Both of these series of ponds were sampled with an assortment of trammel, standard fyke (with only a central wing, up to ~30' long, extending from the middle of the net mouth) and directional fyke nets (each with a 50' long central wing extending from the middle of the net mouth and another 50' long wing extending from one or the other side) for one overnight set (14 October-15 October 2015). From the Duck Lakes on river right, 291 White Suckers were removed from three trammel nets, one standard fyke net, and two directional fyke nets, resulting in a CPUE of 36.4 fish/overnight set. One standard fyke net and one trammel net set overnight in the pumped pond on river left yielded no fish, but additional sampling with more nets would be prudent before declaring these ponds fish-free. In addition to the Duck Lakes, another pond exists adjacent to the Green River on State land in Brown's Park, 0.25 miles west of the Utah-Colorado border. Sampling of this pond for potential source populations of nonnative fishes will be conducted when time allows.

Task 2. Smallmouth Bass removal passes from Split Mountain boat ramp to Tabyago Riffle.

Smallmouth bass — Two full electrofishing passes targeting Smallmouth Bass were implemented in the middle Green River from Split Mountain boat ramp (RM 319.3) to Tabyago Riffle (RM 206.8) during the 2015 season (1 June - 1 October) to identify Smallmouth Bass concentration areas for targeted electrofishing. The combined annual CPUE of 6.55 fish/hr is compared with previous years in Table 5, with 2015 representing the lowest CPUE since 2006. As mentioned above, two full passes, the first completed piecemeal between 16 June - 10 July 2015, and the second completed between 6 August - 20 August 2015, were used to direct subsequent fishing efforts on stretches with the highest catch rates (see Table 6 and Figure 2). During the Smallmouth Bass targeting phase, 2,738 fish were removed. Including the additional Smallmouth Bass captured during tributary electrofishing (n= 4), fyke-netting (n=6), and Walleye electrofishing (n= 507), the 2015 total is 3,255 individuals, approximately half of what was captured in 2014 and a small fraction of the 2013 catch (Schelly et al. 2014; Skorupski et al. 2013).

Catch rate.— Figures 2 and 3 display Smallmouth Bass CPUE values for three different size classes across five-mile sections and across months, respectively. Despite dry hydrologic conditions after a mild winter, late season precipitation resulted in higher than expected flows and high turbidity during the spring runoff, potentially disfavoring

Smallmouth Bass reproduction in 2015 (see Bestgen et al. 2006). This may help to explain the absence of a mid-season explosion in captures of age-0 Smallmouth Bass for a second consecutive year. Sections with higher catch rates identified in 2013 and 2014 (including A, B, and C) continued to exhibit elevated catch rates, with one noteworthy shift. Highest catch rates in 2015 appeared in sections N, P, Q, R, S, and T, between Ouray National Wildlife Refuge (ONWR) and Sand Wash, a stretch of river with lower relative catch rates in 2014. This downstream shift in relative catch rates may reflect successful suppression of Smallmouth Bass in the upstream ONWR reach after multiple years of elevated electrofishing effort in that location, rather than an increase in Smallmouth Bass densities downstream. After all, despite CPUE being highest in 2015, catch rates below ONWR were similar to—but still lower than—2014 catch rates in that reach, with the sub-adult class more abundant in sections P and R, and the adult class more abundant in N, Q, S and T. Catch rates by month show a somewhat consistent rate from April-August with an increase in CPUE in September and October (Figure 3). Note that only one day of electrofishing occurred in October; nevertheless elevated CPUE was observed late season, despite an increase in turbidity due to late season storms (Figure 4).

Population size structure. – Figure 5 displays the size distribution of Smallmouth Bass captured in the middle Green River in 2015, which is compared with previous year classes in Figure 6. As mentioned earlier, Smallmouth Bass <125 mm TL represented a small proportion of total catch in 2015; the vast majority ranged between 126-250 mm TL. Within the 126-250 mm TL size class, a fairly even distribution of CPUE was represented by three sub-classes: 151-175 mm TL, 176-200 mm TL and 201-225 mm TL, with 151-175 mm TL representing the most abundant sub-class. Only 2.4% of the Smallmouth Bass removed (77 individuals) were in the piscivore class (≥ 325 mm TL).

Movement. – Currently there are no mark-recapture studies being conducted by Vernal-UDWR. Three floy-tagged Smallmouth Bass were captured in 2015; one was a Vernal – CRFP tag (analysis in process) and the remaining two were deployed by UDWR-Vernal in 2012. One fish (UDWR tag #2393) was initially tagged on 16 July 2012 in section Q (RM 241-236) of the middle Green River, and was subsequently recaptured in section A (RM 319-316) on 18 June 2015, having grown 145 mm and migrated at least 75 miles. This particular Smallmouth Bass was a mature male (TL = 350 mm) that was not ripe at time of capture. The other Smallmouth Bass, a mature, ripe female (TL = 321 mm; UDWR tag # 2319) was initially tagged on 17 July 2012 in section R (RM 236-231) and recaptured on 08 June 2015 in Island Park (RM 334.2-329.5), having grown 118 mm and migrated at least 93 miles. These recaptures provide noteworthy evidence of fairly long-distance migrations by two mature Smallmouth Bass to known spawning locations.

Task 3. Data entry, analysis, and reporting

Recovery Program annual progress report submitted in November 2015.

VIII. Additional noteworthy observations:

Ancillary captures. — Table 4 lists additional nonnative species removed during Smallmouth Bass electrofishing. In general, all nonnative captures were reduced

compared to 2014. However, 1,504 Green Sunfish were removed from the middle Green River during the Smallmouth Bass phase compared to 464 in 2014. The extensive 2015 cohort of Green Sunfish was mainly comprised of YOY (young-of-year) and sub-adult fish, therefore limiting capture due to equipment restrictions (i.e., fish slip out of our nets). Although many factors may have contributed to the Green Sunfish explosion observed in 2015, it is worth noting that a mild winter, allowing over-winter survival of sub-adult fishes, may have amplified spawning success during summer months as observed by a greater abundance of smaller fishes.

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 2016.
- A large population of White Suckers persists in Duck Lakes (Parson's Unit Waterfowl Management Area) in Brown's Park, potentially serving as a source population for the middle Green River. Discussions of mechanical removal options as well as chemical treatments are currently underway. Screening options of the canal that feeds the ponds are also under examination to prevent re-colonization by White Suckers and other nonnatives. An un-sampled pond close to the Utah-Colorado border along the Green River in Dagget County, UT, may also harbor nonnative fish populations. We suggest visiting this body of water to determine whether or not it has potential to harbor nonnatives such as White Sucker and Northern Pike.
- In 2015, Walleye spawning riffles were discovered and large concentrations of Walleye were removed during early spring main channel electrofishing in Dinosaur National Monument (specifically sections A and B, RM 319.3-310.8). We recommend continuing to monitor and target these riffles in the spring whenever personnel and equipment are available. During Pikeminnow population estimate years, this can be accomplished prior to the period of increasing flows at the beginning of the spring runoff, so both projects can be completed at non-overlapping times. With similar cobble bar habitats existing upstream of the Split Mountain boat ramp as far as (and including) Island Park, we recommend exploratory electrofishing in Island Park (jon boat) and between Rainbow Park boat ramp and Split Mountain boat ramp (cataraft) once spawning Walleye are detected at the cobble bars below Split Mountain boat ramp, to determine whether spawning is occurring upstream and best exploit concentrations of Walleye at likely habitats within this reach.

X. Project Status: On track and ongoing.

XI. FY 2015 Budget Status

- A. Funds Provided: \$243,013
- B. Funds Expended: \$243,013
- C. Difference: \$0
- D. Percent of the FY 2015 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 in December 2015.

XIII. Signed: Robert C. Schelly 11/12/15
Principal Investigator Date

XIV. References.

Bestgen, K.R., Zelasko, K.A., Compton, R.I., and T. Chart. 2006. Response of the Green River fish community to changes in flow and temperature regimes from Flaming Gorge Dam since 1996 based on sampling conducted from 2002 to 2004. Final Report to Colorado River Recovery Implementation Program, Project Number 115.

Schelly, R.C., Boehm, A.M., and M.J. Breen. 2014. Nonnative fish control in the middle Green River. Annual Report of Utah Division of Wildlife Resources to Upper Colorado River Endangered Fish Recovery Program. Denver, CO.

Skorupski, J.A., Kiefer, B.P., and M.J. Breen. 2013. Nonnative fish control in the middle Green River. Annual Report of Utah Division of Wildlife Resources to Upper Colorado River Endangered Fish Recovery Program. Denver, CO.

Table 1. – NORTHERN PIKE. Total abundance, catch-per-unit-effort (CPUE; electrofishing (fish/hr) and fyke-netting (fish/overnight set)), and total length (mm) means and ranges for three projects during 2015.

Project	Abundance	ELECTRO. CPUE	FYKE CPUE	Mean TL	Range TL
Spring Tributary Sampling	26	0.23	0.28	691.5	507-885
Spring Walleye Removal	3	0.03		405.3	175-784
Smallmouth Bass Removal	9	0.02		483.6	159-834

Table 2. – WALLEYE. Total abundance, catch-per-unit-effort (CPUE; electrofishing (fish/hr) and fyke-netting (fish/overnight set)), and total length (mm) means and ranges for three projects during 2015.

Project	Abundance	ELECTRO. CPUE	FYKE CPUE	Mean TL	Range TL
Spring Tributary Sampling	14	0.38	0.11	500.6	327-642
Spring Walleye Removal	75	0.76		489.4	429-615
Smallmouth Bass Removal	53	0.13		500.6	386-616

Table 3. – WHITE SUCKER. Total abundance, catch-per-unit-effort (CPUE; electrofishing (fish/hr) and fyke-netting (fish/overnight set)), total length (mm) means and ranges, and biological data for three projects in 2015.

Project	Abundance	ELECTRO. CPUE	FYKE CPUE	Mean TL	Range TL	% Mature	% Ripe	% ≥275mm
Spring Tributary Sampling	159	9.2	0.47	189.3	72-440	15.1	11.6	10.6
Spring Walleye Removal	51	0.51		198.7	100-417	11.7	3.9	19.6
Smallmouth Bass Removal	408	0.98		184.5	74-586	5.9	0	13.5

Table 4. — Totals for additional nonnative species removed during Smallmouth Bass removal electrofishing efforts in the middle Green River in 2015.

Species	Abundance
Black Bullhead	1
Black Crappie	17
Bluehead x White Sucker*	6
Brown Trout	20
Flannelmouth x White Sucker*	23
Green Sunfish	1504
Gizzard Shad	5
Largemouth Bass	2
Rainbow Trout	1

*these hybrids are included in white sucker counts given in text

Table 5. — Smallmouth Bass catch-per-unit-effort (CPUE; fish/hr) from 2004 – 2015.

Year	CPUE (fish/hr)
2004	9.33
2005	4.02
2006	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

Table 6. — 2015 electrofishing effort totals for 5-mile sections of the middle Green River during Walleye (2 April-7 May) and Smallmouth Bass removal (1 June-1 October). Sections include Island Park (I.P.) in Dinosaur National Monument and the entire reach between Split Mountain boat ramp (A) to Tabyago Riffle (W).

SECTION	RIVER MILES	WE	SMB
		HRS EFFORT	HRS EFFORT
I.P.			21.37
A	319-316	17.72	29.23
B	316-311	15.83	39.25
C	311-306	1.42	10.72
D	306-301	8.95	9.57
E	301-296	3.98	7.10
F	296-291	3.43	27.73
G	291-286	3.41	21.90
H	286-281	2.06	25.23
I	281-276	2.11	21.94
J	276-271	3.16	22.56
K	271-266	3.20	27.03
L	266-261	3.86	15.75
M	261-256	13.70	8.20
N	256-256	5.90	7.88
O	251-246	10.55	7.35
P	246-241		17.79
Q	241-236		13.64
R	236-231		21.41
S	231-226		20.27
T	226-221		18.50
U	221-216		16.59
V	216-211		4.34
W	211-207		2.39
	TOTAL	99.28	417.74

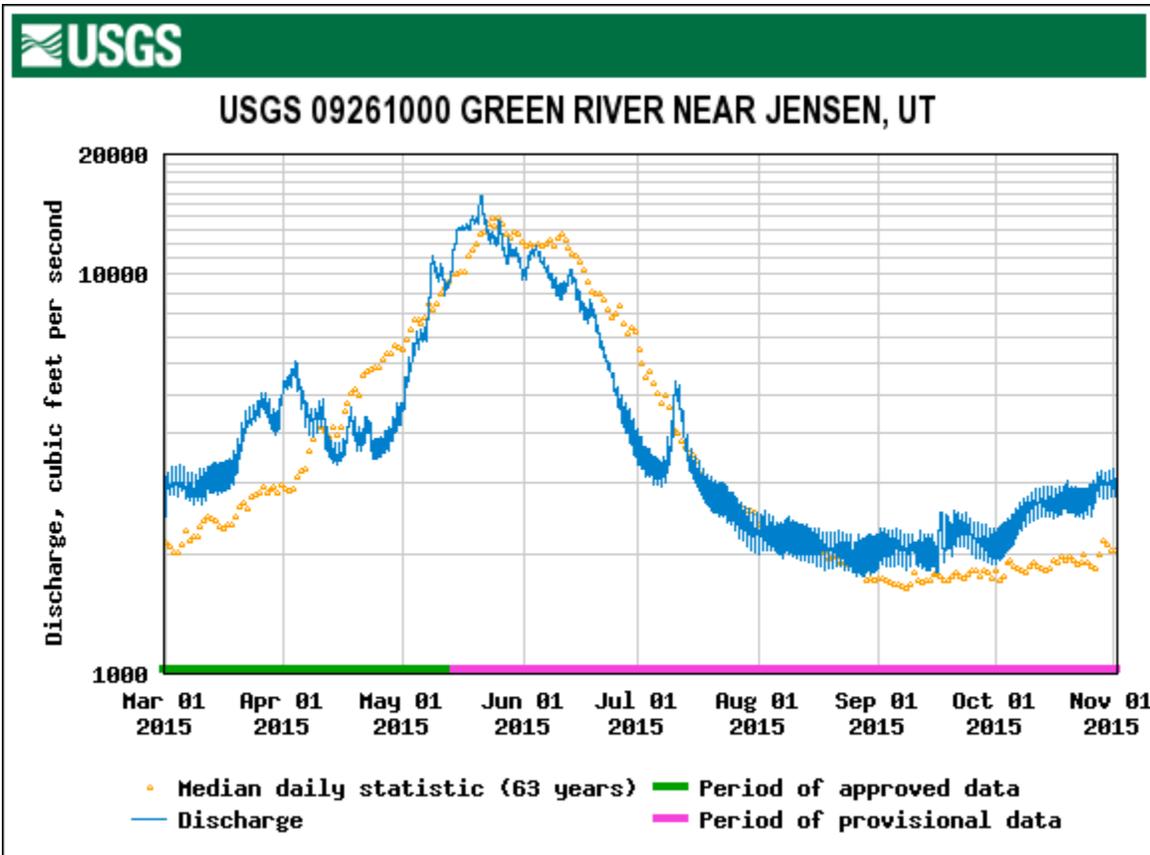


Figure 1. Green River hydrograph at Jensen, Utah, for March – October, 2015.

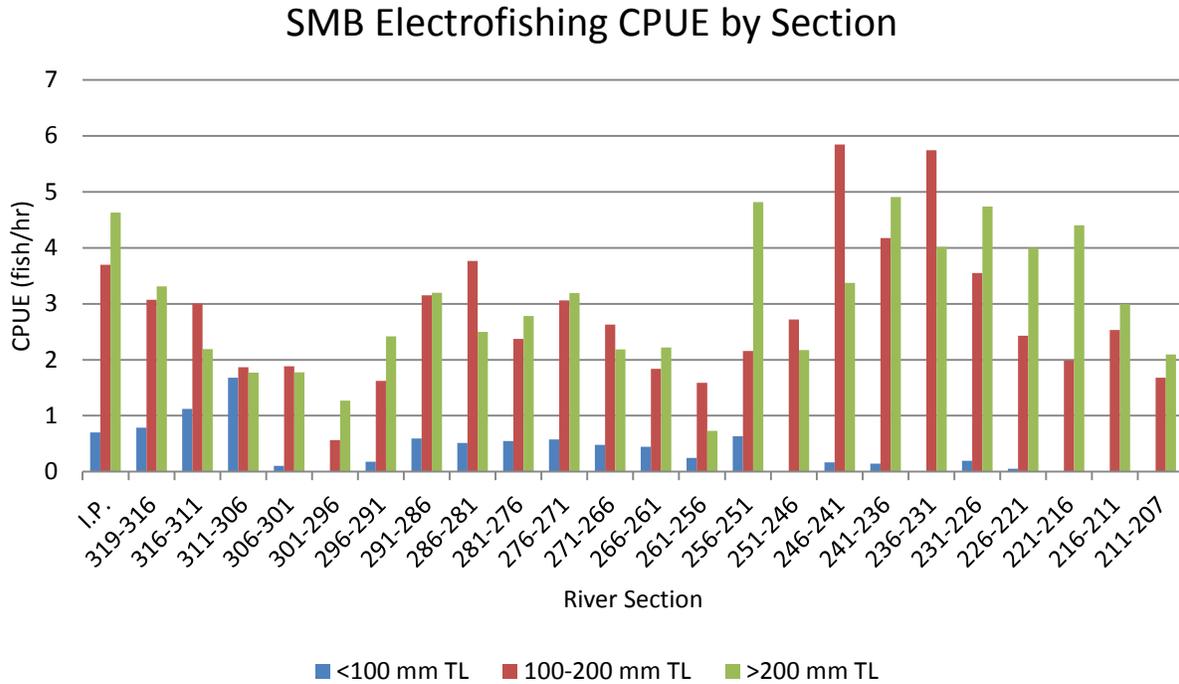


Figure 2. — 2015 Smallmouth Bass juvenile (<100 mm TL), sub-adult (100-200 mm TL), and adult (>200 mm TL) catch rates for Island Park (I.P.) and from Split Mountain boat ramp to Tabyago Riffle, middle Green River, 1 June—1 October (excluding Walleye sampling).

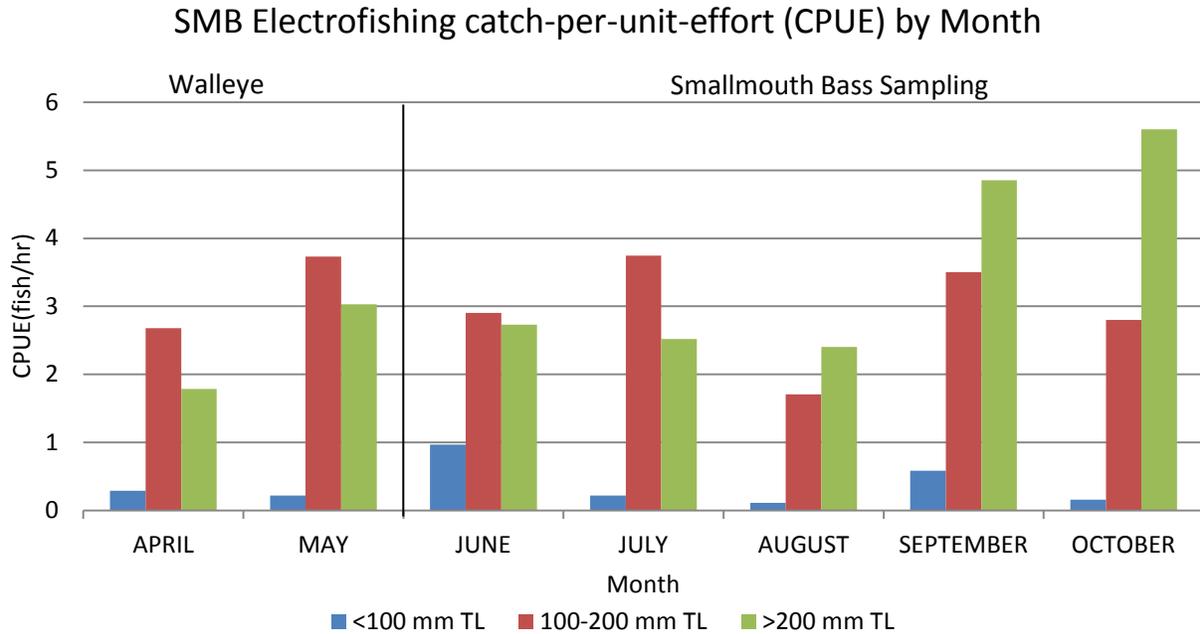


Figure 3. — 2015 Smallmouth Bass juvenile (<100 mm TL), sub-adult (100-200 mm TL), and adult (>200 mm TL) catch rates by month in the middle Green River. Catch rates in April and May (left of the dark line) correspond to sampling that specifically targeted Walleye; rates from June-October (right of the dark line) corresponds to sampling that targeted Smallmouth Bass.

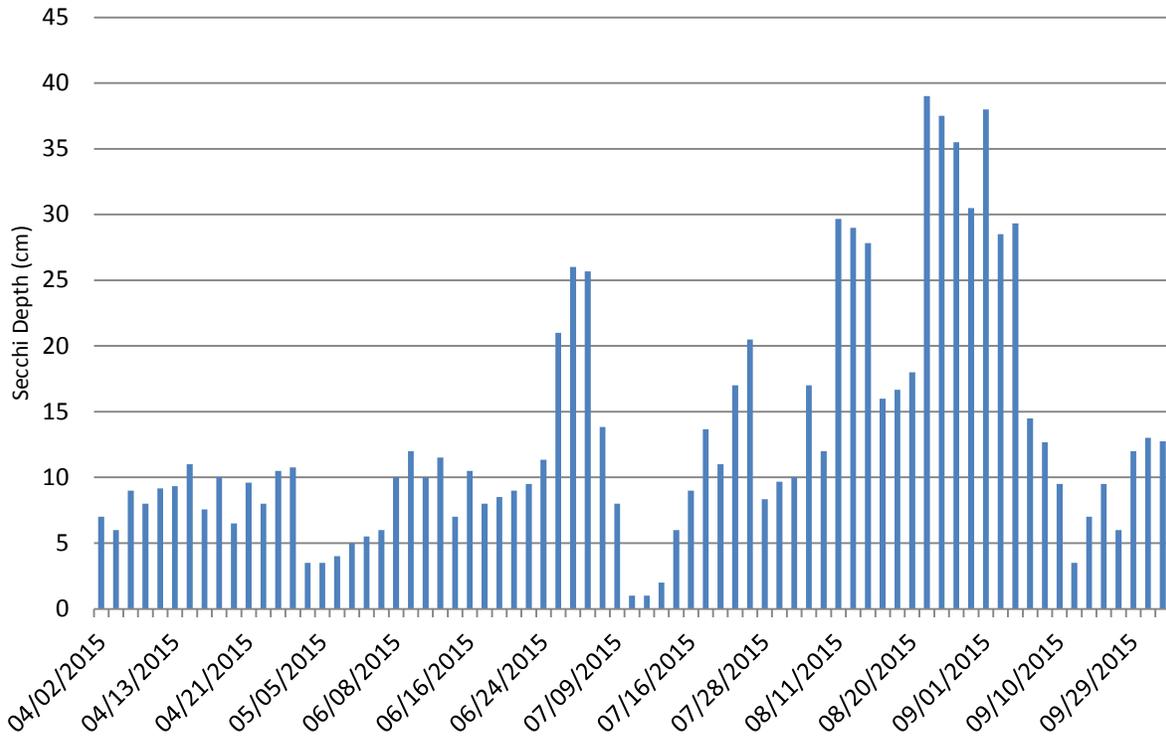


Figure 4. Water clarity, expressed as daily average Secchi depths (cm), in the middle Green River from April 1-October 1 2015.

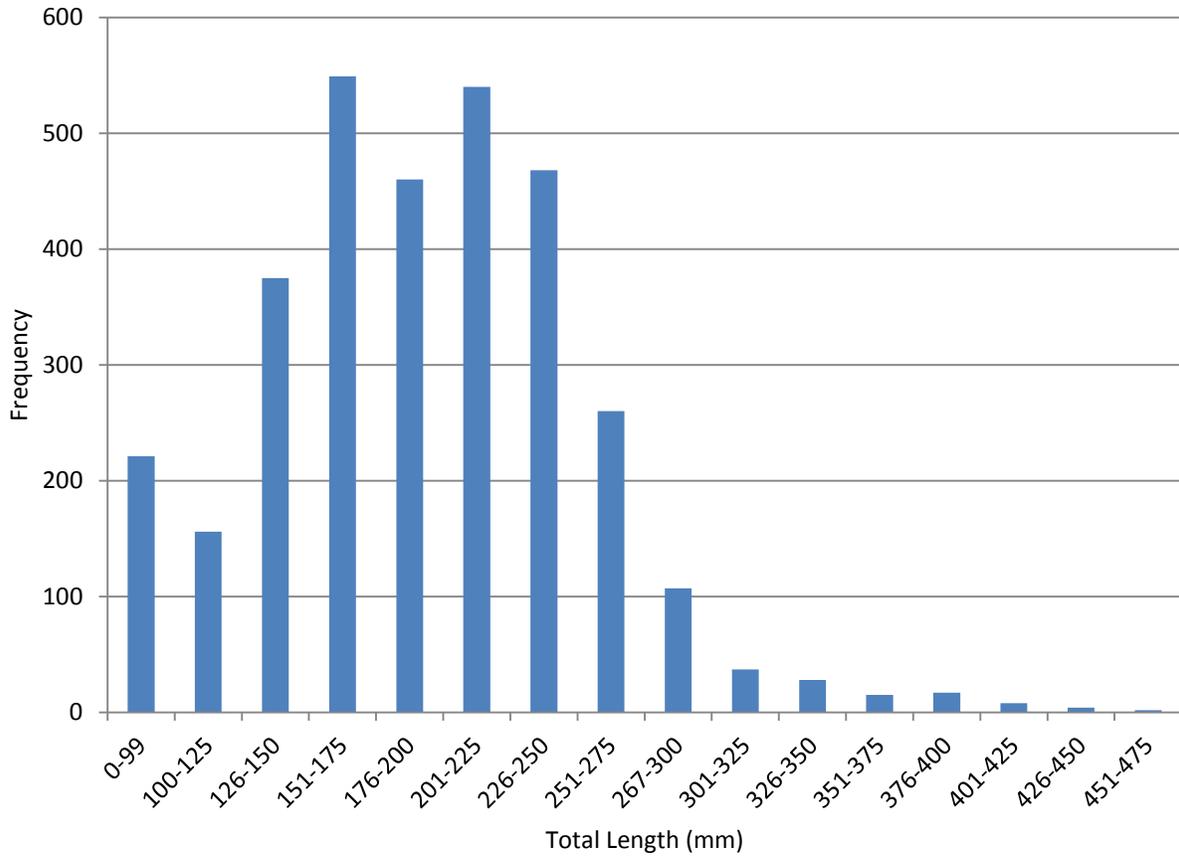


Figure 5. — 2015 size distribution of Smallmouth Bass electrofishing captures in the middle Green River (includes both Walleye and Smallmouth Bass sampling periods).

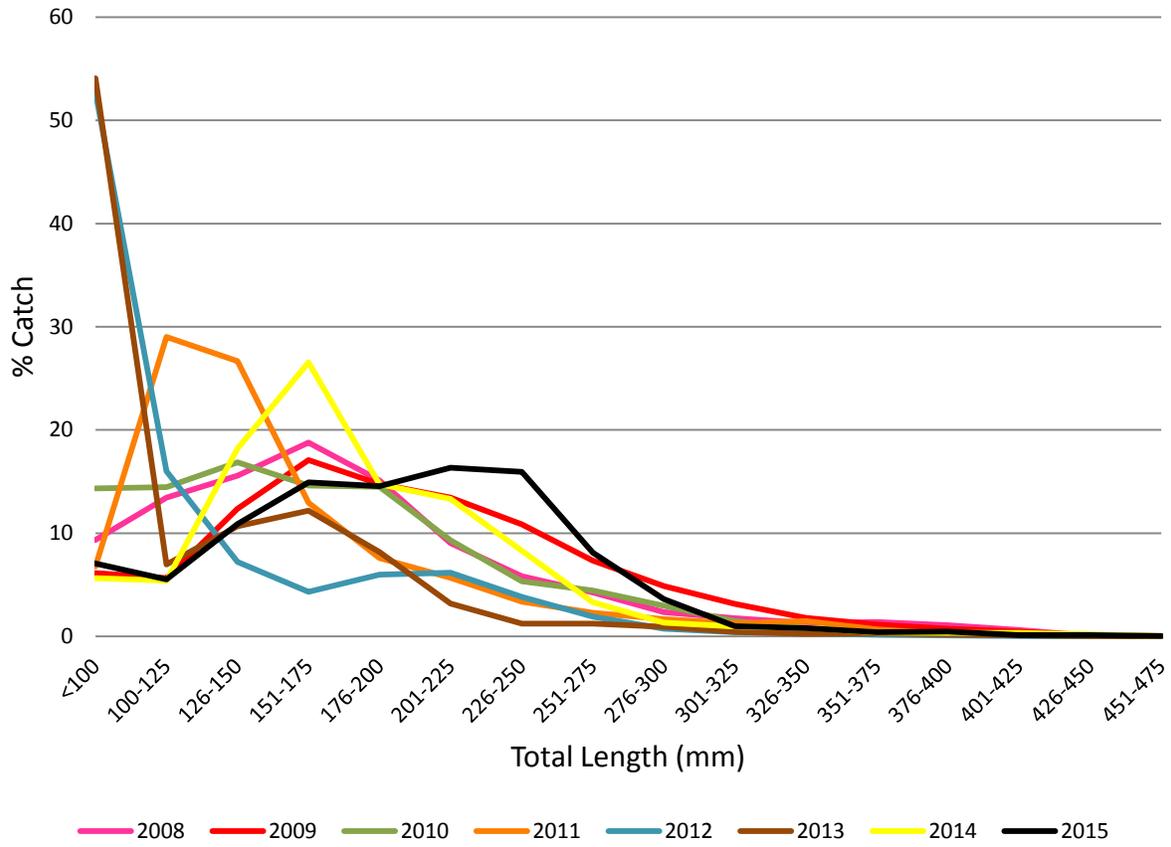


Figure 6. — Smallmouth Bass size-class frequency comparisons across years from 2008-2015 in the middle Green River.