COLORADO RIVER RECOVERY PROGRAM
FY 2013 ANNUAL PROJECT REPORT

RECOVERY PROGRAM
PROJECT NUMBER: 123-b

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

II. Bureau of Reclamation Agreement Number(s): R09AP40870

Project/Grant Period: Start date (Mo/Day/Yr): 10/01/2008
End date: (Mo/Day/Yr): 11/30/2013
Reporting period end date: 9/30/2013
Is this the final report? Yes _____ No __X__

III. Principal Investigator(s):

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IV. Abstract:

The Upper Colorado River Endangered Fish Recovery Program has determined that control of nonnative fish in the upper Colorado River basin is essential to the recovery of the four endangered fish species. The purpose of this project is to minimize the threat of predation, competition and hybridization, especially from smallmouth bass, northern pike and white sucker in the Green River. A total of 177 northern pike and 3,544 white suckers were removed during spring sampling and other projects. Northern pike captures remain high, but did not increase over previous years, whereas white sucker abundance has increased greatly. Smallmouth bass effort was adjusted throughout the field season, allowing us to have our highest catch rates to date and remove 20,210 fish.

V. Study Schedule: FY 2004 – FY 2013

VI. Relationship to RIPRAP:

GENERAL RECOVERY PROGRAM SUPPORT ACTION PLAN

III.	Reduce negative impacts of nonnative fishes & sportfish management activities.
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.
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.
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 2013 Tasks and Deliverables, Discussion of Initial Findings and Shortcomings:

Task 1: Capture and remove northern pike and white sucker.

Northern pike and white sucker were targeted during spring in concentration areas (tributaries and backwaters) and the mainstem Green River, specifically Brown's Park. Fyke nets, trammel nets, gill nets, boat electrofishing and cataraft electrofishing were utilized to target these areas. A total of 177 northern pike and 3,544 white suckers were removed from Island Park to Tabyago Riffle, Brown's Park and selected concentration areas.

Northern pike captures were greatest during tributary sampling; 83, 49 and 39 individuals were captured during spring tributary sampling, spring main channel sampling and smallmouth bass removal, respectively. Of the 171 caught, 1 was juvenile <300mm, 1 was adult >300mm, and 169 were piscivores >450mm (Table 1). Of the 83 fish captured during spring tributary sampling, 39 were removed from Stewart Lake Drain and 30 from Ashley Creek. Catch per unit effort (CPUE) was greatest for electrofishing tributaries and considerably higher than fyke netting (Table 1). Total capture and fyke netting captures were less than 2012 (Skorupski and Breen 2012), which could be related to the differences in spring water conditions (Figures 1 and 2). High spring flows created additional habitat, allowing for sampling to occur for a longer duration in 2012 than in 2013. The period of sampling in the highest concentration areas, such as Stewart Lake Drain and Ashley Creek were greatly reduced because of 2013 flows. Effort and captures typically begin in March, but did not occur until the middle of May in 2013. Brown's Park sampling occurred on three separate occasions experimenting with a variety of techniques. From 6–7 May 2013, 11.1 hrs of cataraft electrofishing were conducted with no success collecting northern pike due to the depth of the habitat. Therefore fyke, gill and trammel netting surveys were conducted on 10–11 September and 22 October. Three areas were targeted from Duck Lakes to Swinging Bridge (RM 390.0 to 379.8), 166.5 hours of fyke netting, 51.5 hours of gill netting and 50.6 hours of trammel netting produced six northern pike (mean TL = 676 mm; range = 585-785 mm TL); one fish was captured by hook and line. Although captures were low, all sampling occurred in main channel habitat where capture is difficult. In addition, 12 northern pike were caught

between Burnt Tree and Swinging Bridge according to anglers (Ryan Mosley, UDWR, personal comm.). In years when other projects do not take priority (e.g., Colorado pikeminnow population estimates) we will attempt to sample backwater habitats during the spring when sampling is more effective. In addition, wetland habitats are present along the river corridor and were reported to have pike (Trina Hedrick, UDWR, personal comm.). These areas are of concern for the high potential for reproduction, but the extent of connection, number of fish using the habitat and the ability for fish to over-winter is unknown.

White sucker abundance was highest during smallmouth bass removal; 497, 384 and 2,663 individuals were captured during spring tributary sampling, spring main channel sampling and smallmouth bass removal, respectively (Table 2). The highest CPUE was during spring electrofishing and fyke netting, but considerably higher in tributaries. In addition, larger size classes and a greater proportion of mature and ripe white suckers were removed from tributaries, representing individuals queuing in on these habitats for spawning (Table 2). These observations were specifically higher in Ashley Creek; 219 individuals were captured, 163 were mature and 89 were ripe. In comparison, Stewart Lake Drain had the next highest captures (129 individuals), but only 5 were mature and 4 were ripe. Total white sucker captures nearly quadrupled compared to 2012, which was represented by a large cohort of smaller individuals, and we observed high abundances of large individuals that had a high potential for hybridization. Forty-seven hybridized suckers were removed which represents 0.1% of all suckers collected. This value is low and reflects the importance of maintaining small size classes of white sucker to limit their ability to hybridize with native catostomids.

Task 2: Smallmouth bass removal from Split Mountain boat ramp to Tabyago Riffle.

Our goal was to complete two removal passes for smallmouth bass in the middle Green River from Split Mountain boat ramp (RM 319.3) to Tabyago Riffle (RM 206.8) and the remainder of effort would focus on concentration areas. During the full passes, it was apparent that multiple smallmouth bass concentration areas were present, due to a high spawning success under low flow conditions in 2012 and 2013. Thus, we adapted our strategy to target "hot spots" maximizing our catches with the funds and time available. A substantial amount of effort was added to areas observed to have high concentrations of smallmouth bass (Table 3). No sampling occurred below Sand Wash boat ramp due to mechanical and safety issues. Our strategy was successful, producing high catch rates and removing 20,210 smallmouth bass.

Catch rates — Smallmouth bass catch rates were low in the beginning of the season, increased through time, and stayed relatively stable except for a large peak of age-0 fish (Figure 3). Catch rate increases are likely due to the occurrence of age-1 and age-0 fish recruiting to an exploitable size as the season progressed and the implementation of our adaptive management strategy. The large peak observed during passes 10–12 for age-0 fish was due to effectively sampling a concentration area below Split Mountain boat ramp. Unfortunately, we were unable to sample this area effectively for the remainder of

the field season due to several rain events that drastically increased turbidity and made water levels unpredictable (Table 3; Figure 4). Catch rates by river mile section displays multiple patterns: (1) smallmouth bass sub-adult and adult captures were relatively similar throughout sections and (2) two areas had high success of young-of-year (YOY) recruitment (Figure 5). Catch-per-unit-effort in 2013 is the highest on record in the middle Green River (Table 4). Compared to 2012, there was a 30% increase in catch rates, which was the highest catch rate before 2013. The 30% increase in catch rates is due to higher numbers of age-0 and age-1 fish. Most likely this is due to two consecutive low flows years, which created optimal spawning conditions (Figures 1 and 2). Although capture of YOY and sub-adult fish increased, adult capture decreased, but apparently does not reflect a reduction large enough to affect recruitment. A large proportion of the age-0 captures was in the two concentration areas; Split Mountain boat ramp to 14 miles downstream and river mile 290.8–260.8; in these 44 river miles 82% of the total catch occurred. This demonstrates a successful spawn and as fish recruited to larger sizes they were retained in these areas (Figure 5). Thus, these locations should continue to be targeted with high effort.

Population size structure — Length frequencies of bass captured in 2013 were dominated by individuals < 100 mm; 10,926 YOY (< 100 mm), 7,681 sub-adults (100-199 mm), 1,428 adults (200-325 mm) and 175 piscivores (> 325 mm) (Figure 6). This pattern was consistent when percent catch of size classes are separated by month (Figure 7). Beginning in August, the catch was dominated by < 100 mm individuals, and persisted through October (Figure 7). Compared to 2012, the size structure is similar in August, but the < 100 mm fish remained dominant instead of recruiting to larger size classes (Figure 8). Frequent storm events in September and October raised water levels (Figure 2), increased turbidity (Figure 4), and affected temperature (Figure 9 and 10). These events produced a slight decrease in temperature during September and less variability in daily fluctuations than was observed in 2012 (Figures 9 and 10). Turbidity likely played a role in a different temperature regime. Higher turbidity events will stabilize water temperatures (i.e. less warming during the day) and reduce foraging abilities. Thus, no one variable had large differences, but the combined effects of fall environmental conditions likely reduced growth rates in age-0 smallmouth bass.

Movement — A mark-recapture population estimate was not conducted in 2013. A total of 11 marked fish were recaptured in 2013; 1, 2, 5, and 3 from 2009, 2010, 2011, and 2012, respectively. Six of the fish were captured in the same five-mile section, 3 moved downstream and 2 moved upstream. In addition, a fish that was tagged in 2012 moved upstream ~20 miles and was recaptured on a flat plate antenna in Brush Creek (Vernal-CRFP). Smallmouth bass do not have a definitive pattern of movement, but a large proportion appear to stay within the same habitat. This is also demonstrated when following the 2012 cohort, the sub-adult captures were highest in the successful spawning locations found in 2012 (Skorupski and Breen 2012).

Task 3: Data entry, analysis, and reporting

Recovery Program annual progress report submitted November 2013.

VIII. Additional noteworthy observations:

Additional nonnatives of concern were walleye, gizzard shad, black crappie, green sunfish and pumpkinseed due to high abundance, first observations of the species and potential threat to the native population (Table 5). Of the 87 walleye captured, 84 were piscivores (>375 mm). An additional 146 walleye (143 piscivores) were removed during other sampling efforts including; three during spring tributary and 143 in spring main channel sampling. Walleye abundance was higher during all sampling events, specifically spring sampling. Compared to 2012, we captured 117 more walleye. These increases are alarming and should be continued to be monitored. Otolith samples were taken from walleye and cataloged for future microchemistry signature work (as directed by the Recovery Program).

Gizzard shad were less abundant and did not appear to have a successful spawn as compared to 2012 (Skorupski and Breen 2012). The majority of individuals were adults, but 15 were < 100 mm; some were caught early enough to be age-1. Regardless, due to large fluctuations their population should be monitored in the future.

Additional smallmouth bass were caught during spring tributary and main channel sampling; 90 and 382, respectively. The spring size structure was drastically different from the summer, with most of the individuals in the adult size class. It is likely that adult bass were staging to spawn specifically in Ashley Creek. Eighty-three of the 90 smallmouth were captured in Ashley Creek during high flows (mean TL = 332 mm; range = 242–432 mm; n = 115 fish > 325 mm). In 2013, Ashley Creek was inundated for a longer duration, which allowed bass to stage on spawning habitat and be susceptible to capture.

IX. Recommendations:

- We recommend a minimum of two complete passes from Split Mountain boat ramp to Tabyago Riffle and apply a similar adaptive management strategy as in 2012 and 2013 that will greatly increase our catch rates and target concentration areas. We recommend increasing effort from Split Mountain boat ramp to RM 305.8, RM 290.8-260.8, and during the spring when large bass are most susceptible, given that pikeminnow estimates will not occur in FY14-15. This will allow us to continue monitoring the entire reach on a temporal basis, while increasing our efficiency in capturing smallmouth bass where they are most abundant, including larger spawning adults.

- Continue northern pike and white sucker removal during early spring when fish are concentrated in spawning areas. Northern pike numbers are high, therefore a

continued effort in tributaries and backwaters is recommended. The majority of mature white suckers were removed during spring sampling, thus tributary sampling effort would benefit the removal of white sucker, but also additional main channel sampling.

- Continue the effort above the Utah state line (Brown's Park) to monitor northern pike distribution in the area and increase our knowledge of wetland use.

- Determine the potential for escapement of pike into the Green River from ponds just downstream of the Utah state line. If deemed necessary, we request guidance from the Program for appropriate action.

X. Project Status: On track and ongoing

XI. FY 2013 Budget Status

A. Funds Provided: $225,132
B. Funds Expended: $225,132
C. Difference: $0
D. Percent of the FY 2013 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 all data to the database manager by December 2013.

XIII. Signed: *Joseph A. Skorupski Jr.* 10/31/13
Principal Investigator Date

XIV. Literature Cited

Skorupski, J.A. Jr. and M.J. Breen. 2012. 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. — Total abundance, CPUE (electrofishing (fish/hr) and fyke net (fish/day)), mean total length and range of lengths of northern pike removed for three projects in 2013. Spring main channel sampling includes captures during Colorado pikeminnow population estimates (spring main channel sampling), but do not include Brown's Park sampling.

Project	Abundance	Electro. CPUE	Fyke CPUE	Mean TL	Range TL
Spring tributaries sampling	83	5.26	0.33	594	447-720
Spring main channel sampling	49	0.33		582	480-782
Smallmouth bass removal	39	0.09		615	260-822

TABLE 2. — Total abundance, CPUE (electrofishing (fish/hr) and fyke net (fish/day)), mean total length, range of lengths, percent mature, percent ripe and percent greater than 275 mm white sucker removed for three projects in 2013. Spring main channel sampling includes captures during Colorado pikeminnow population estimates.

Project	Abundance	Electro. CPUE	Fyke CPUE	Mean TL	Range TL	% Mature	% Ripe	% >275mm
Spring tributaries sampling	497	30.02	2.28	179	48-450	35.8	20.1	26.2
Spring main channel sampling	384	2.55		227	58-430	24.5	9.6	34.4
Smallmouth bass removal	2663	6.42		131	44-451	4.3	0.1	3.9

TABLE 3. — Matrix of effort (hrs. fished) during smallmouth bass removal passes for each river mile section and pass to demonstrate where and when work was conducted. River mile sections are rounded up. A new pass was started every time we stopped moving downstream and restarted somewhere upstream.

	June				July					August				September		October	
Section	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
319-316				2.3		2.8	3.1	2.2		2.8	3.9	3.1		3.7			
316-311				3.4		4.7	4.8	4.4		5.1	7.5	7.8		5.7			
311-306				3.6		3.2	3.4	2.4		3.1		1.8		1.6			
306-301				0.8	1.0	1.2											
301-296					2.1												
296-291				2.8	0.9	2.1											
291-286				4.0		3.6	3.7	3.1	3.2	4.1			2.4	2.4	3.5		
286-281				3.4		2.9	2.7	2.2	2.5	2.9			2.9	2.9	2.9		
281-276				4.7		3.5	3.8	3.7	3.6	4.9			2.5	1.5			
276-271			0.8	4.4		4.1	3.7	3.3	3.6	4.5		0.3					
271-266			5.1	4.9		4.1	1.3		3.6			3.2			4.1	4.3	4.2
266-261			2.3	3.6		3.3			3.4			2.9			3.7	3.8	
261-256				4.5		3.5			3.4			0.5			0.5		
256-251			4.5	2.8		2.6			2.9			2.6	2.5	3.7	3.5	3.3	
251-246	2.0	4.5	4.4	3.4		3.3		3.5	5.1			3.3	3.3	4.2	4.3	4.1	
246-241	1.1	4.1		4.0				3.4	3.7								
241-236				2.9				2.7	3.2								
236-231				3.2				3.6	3.1								
231-226				3.5				3.4	3.8								
226-221				3.5				3.1	3.3								
221-216				3.6				3.7	3.8								
216-211																	
211-207																	

TABLE 4. — Smallmouth bass total catch rates (fish/hr) from 2004 – 2013.

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

TABLE 5. — Additional nonnatives removed during smallmouth bass removal in the middle Green River in 2013.

Species	Abundance
Black Crappie	312
Bluegill	3
Bluehead x white sucker	22
Brown trout	15
Creek chub	1
Flannelmouth x white sucker	11
Green sunfish	2,149
Gizzard shad	37
Pumpkinseed	1
Rainbow trout	3
Walleye	87[A]
Yellow perch	1

[A] 84 Walleye were considered piscovores

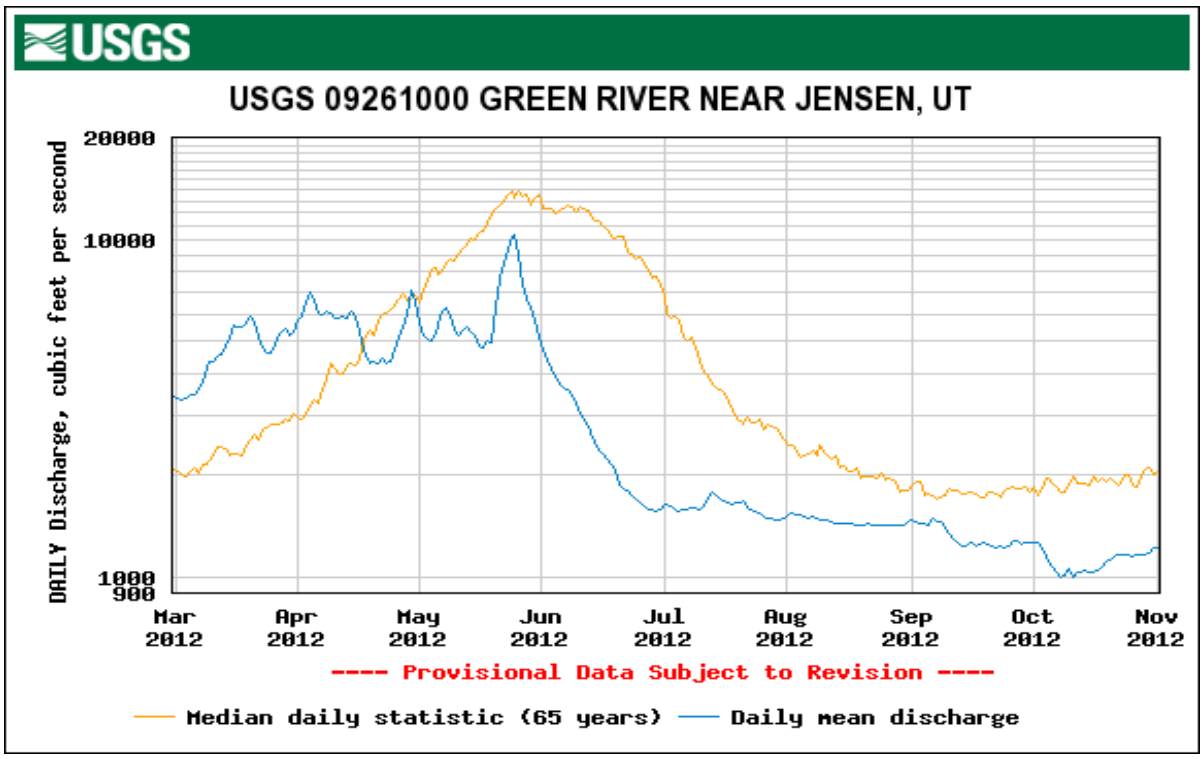

FIGURE 1. — Mean daily discharge of the Green River near Jensen, Utah from March to October 2012.

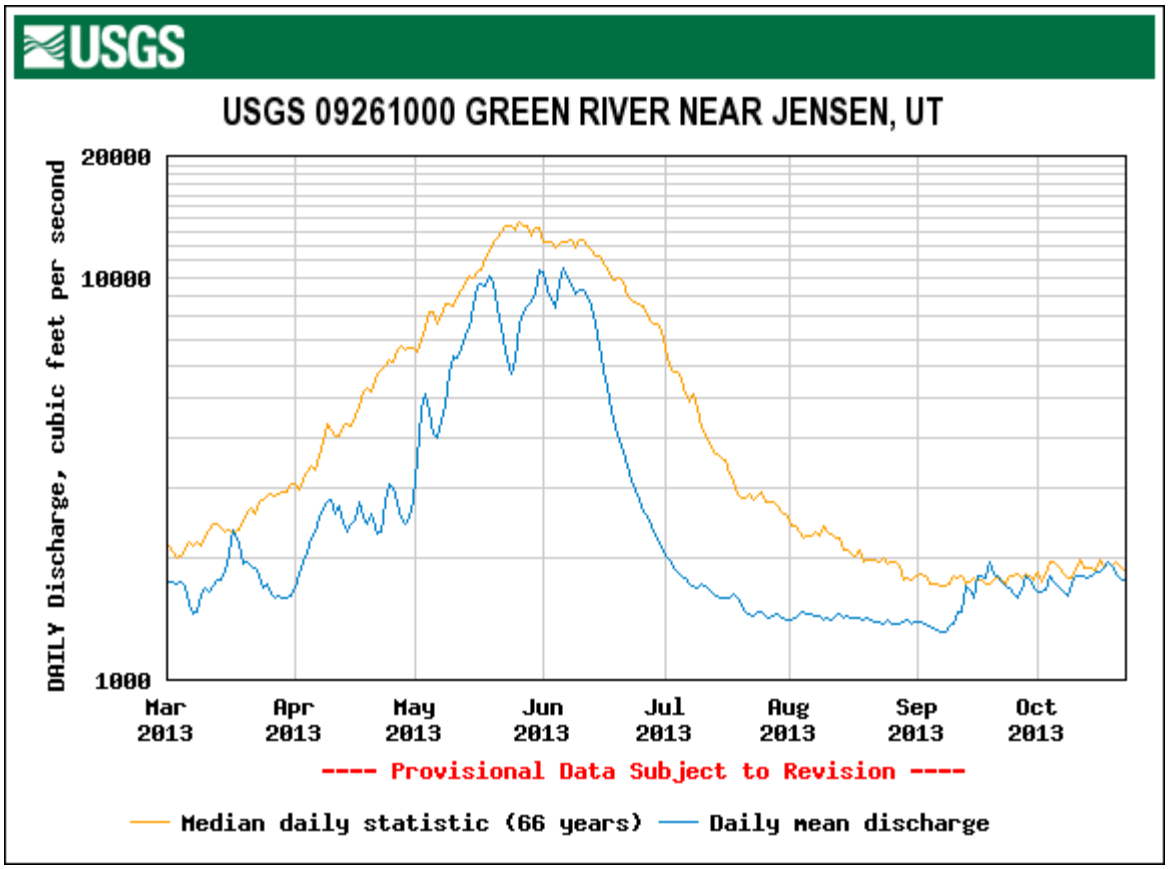

FIGURE 2. — Mean daily discharge of the Green River near Jensen, Utah from March to October 2013.

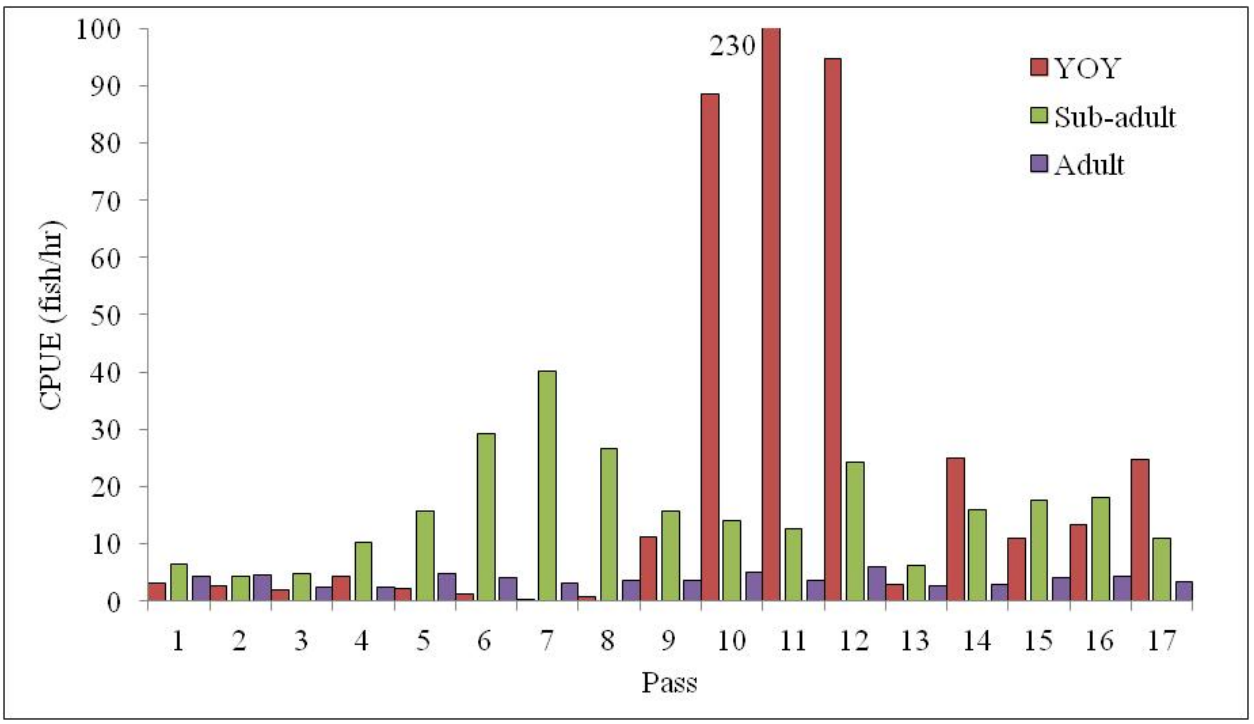

FIGURE 3. — Smallmouth bass young-of-year (YOY), sub-adult and adult catch rates in the middle Green River by pass in 2013. Note that YOY exceed the Y-axis scale on pass 11.

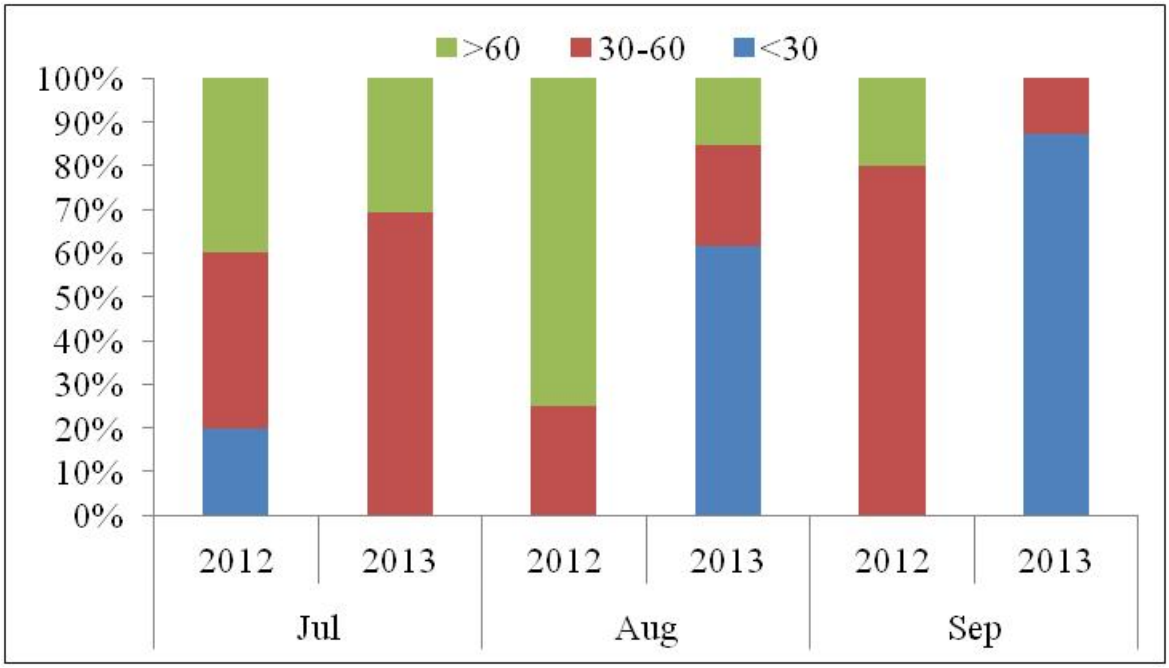

FIGURE 4. — Proportion of days a month for 2012 and 2013 that turbidity (daily maximum) measurements (depth of visibility) fell into the following categories: < 30 cm, 30-60 cm, > 60 cm. Measurements are representative from Split Mountain boat ramp to above the White River.

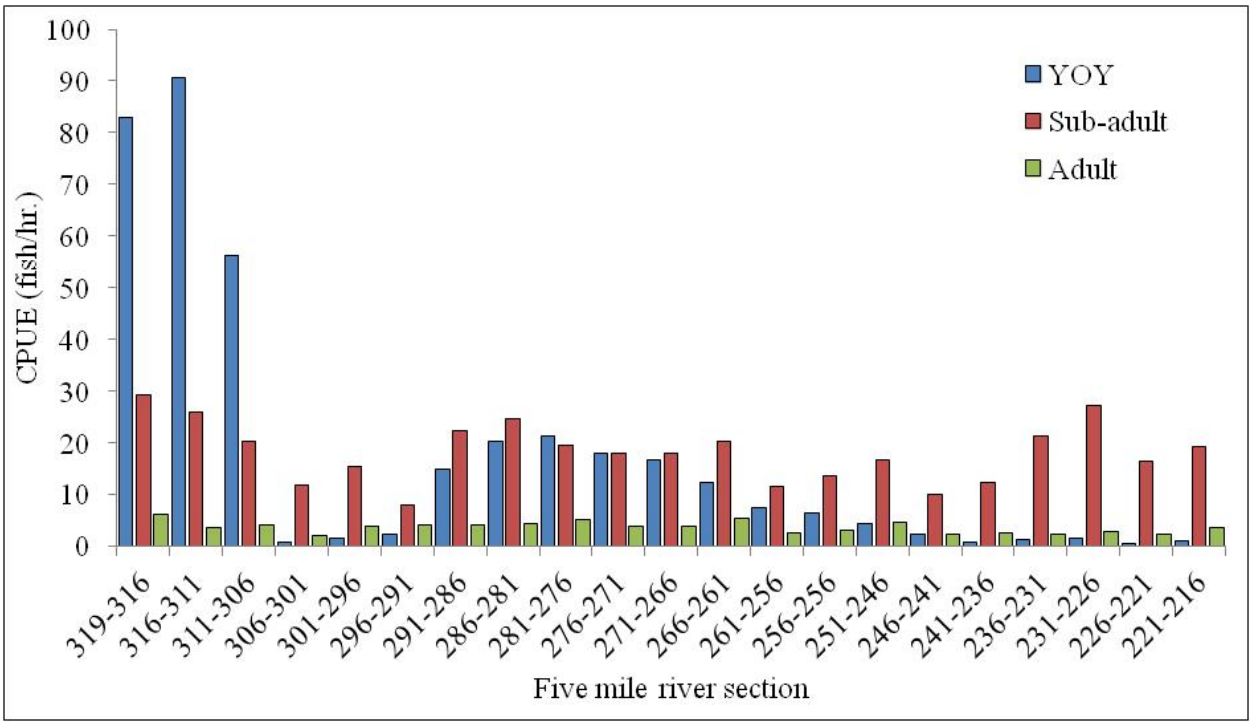

FIGURE 5. — Smallmouth bass young-of-year (YOY), sub-adult and adult catch rates separated by sample reach in the middle Green River in 2013 from Split Mountain boat ramp to Tabyago Riffle.

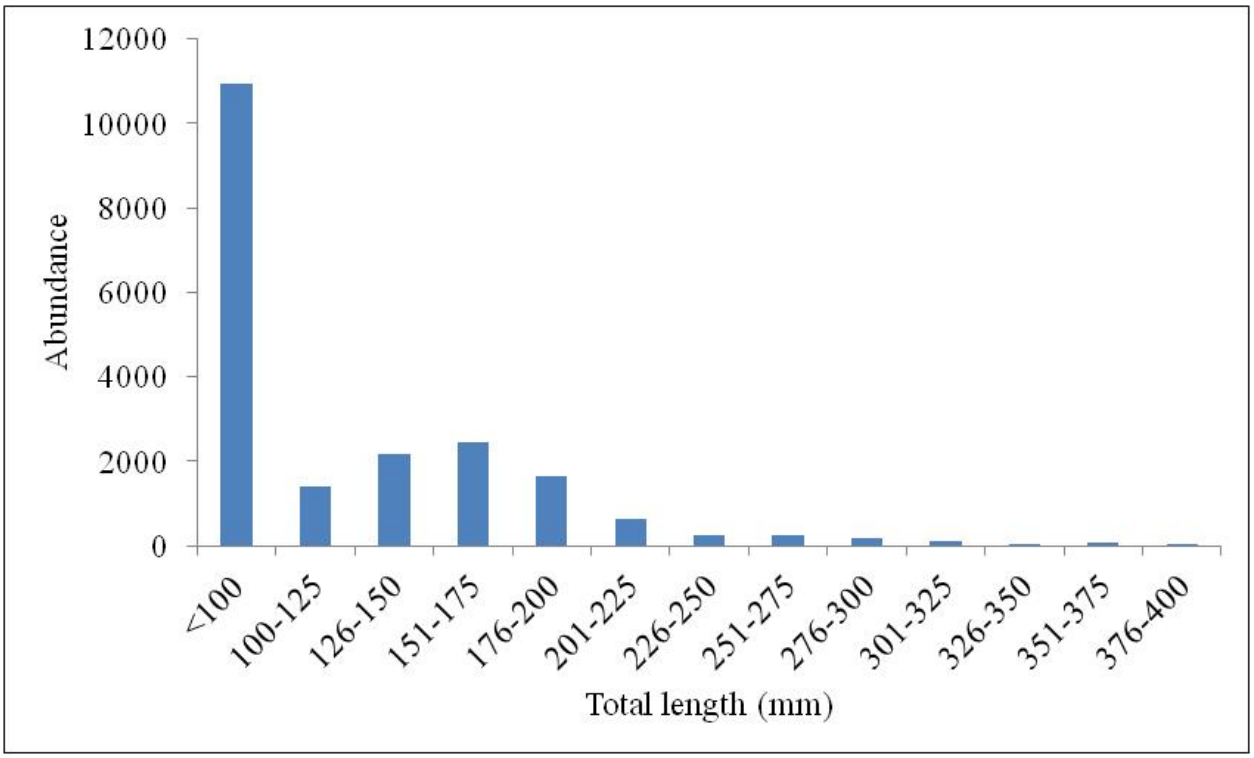

FIGURE 6. — Length frequency of smallmouth bass captured in the middle Green River in 2013.

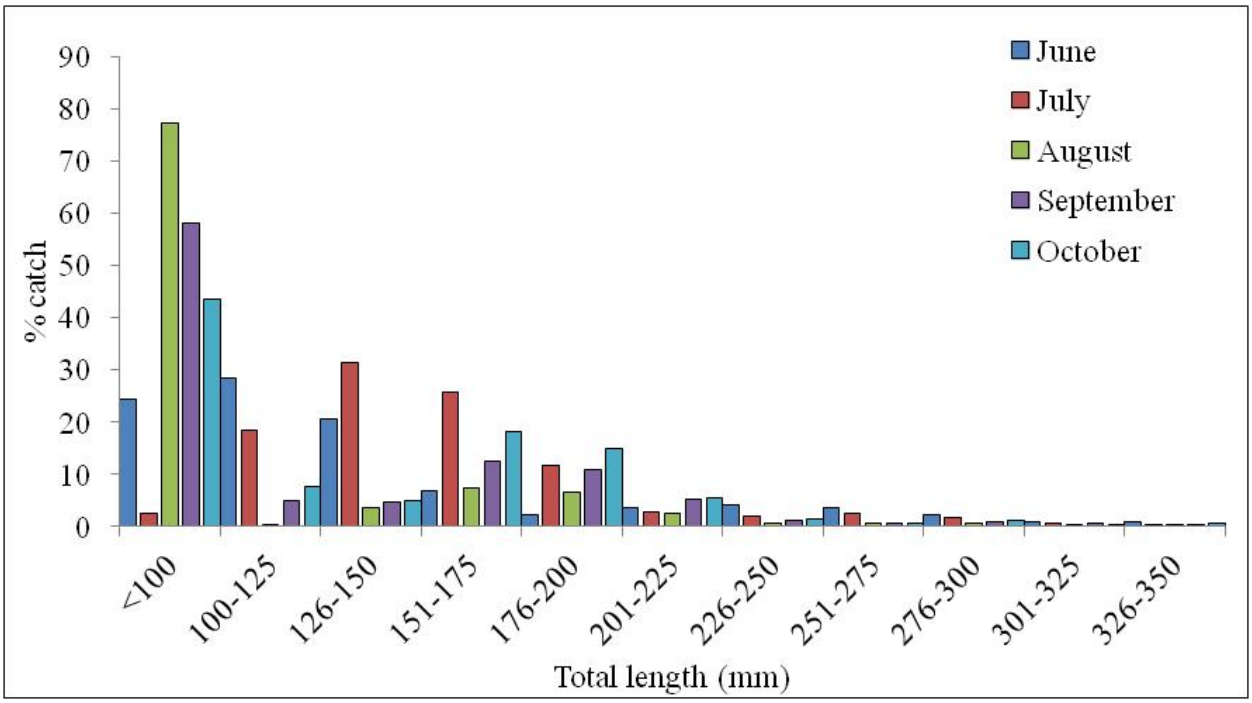

FIGURE 7. — Length frequency of smallmouth bass captured in the middle Green River in 2013 during each month of the field season.

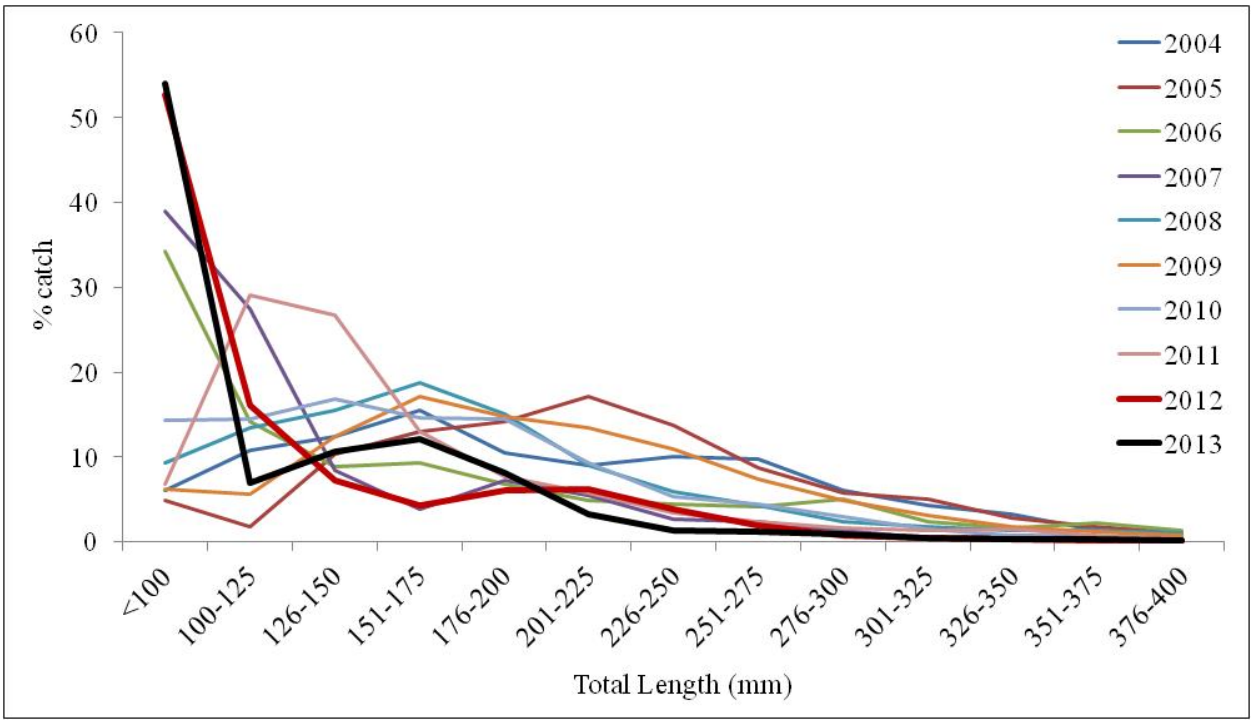

FIGURE 8. — Length frequency of smallmouth bass captured in the middle Green River from 2004 – 2013.

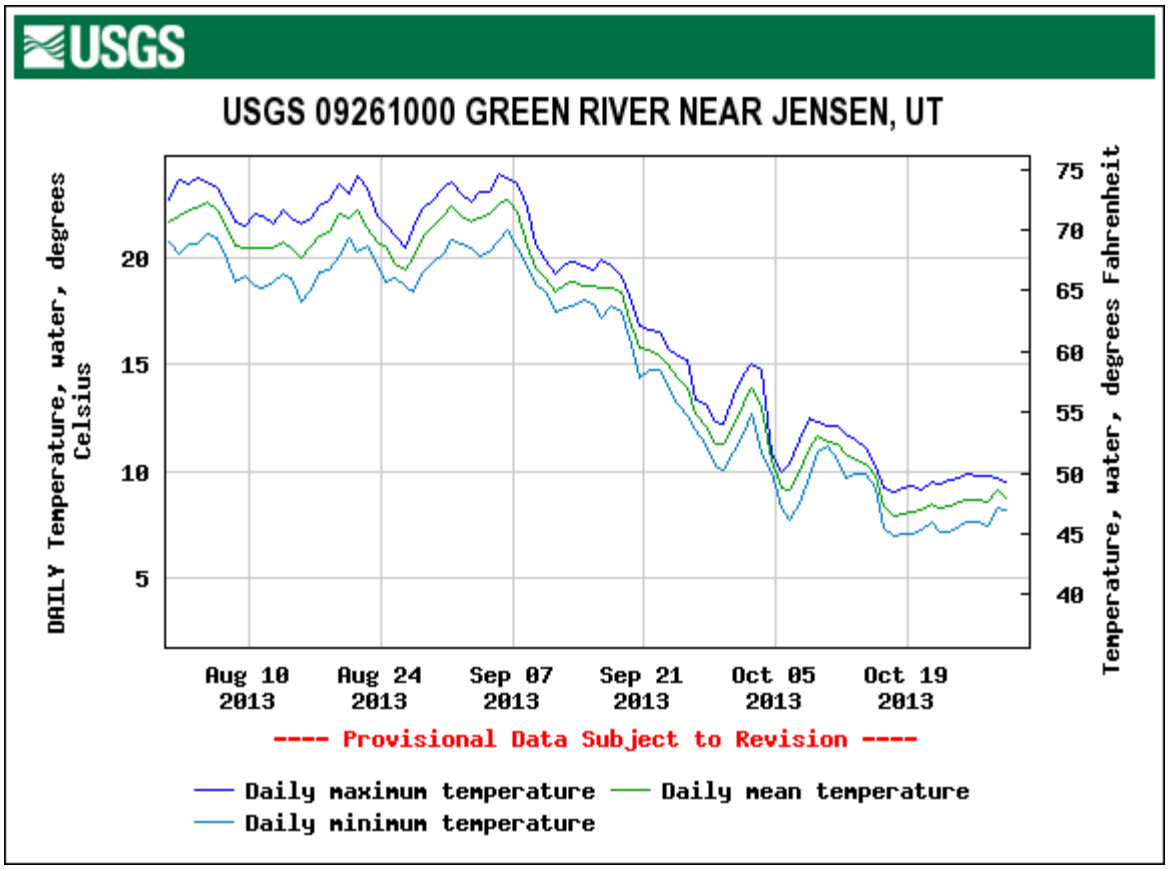

FIGURE 9. — Minimum, maximum and mean daily temperature of the Green River near Jensen, Utah from August to October 2013.

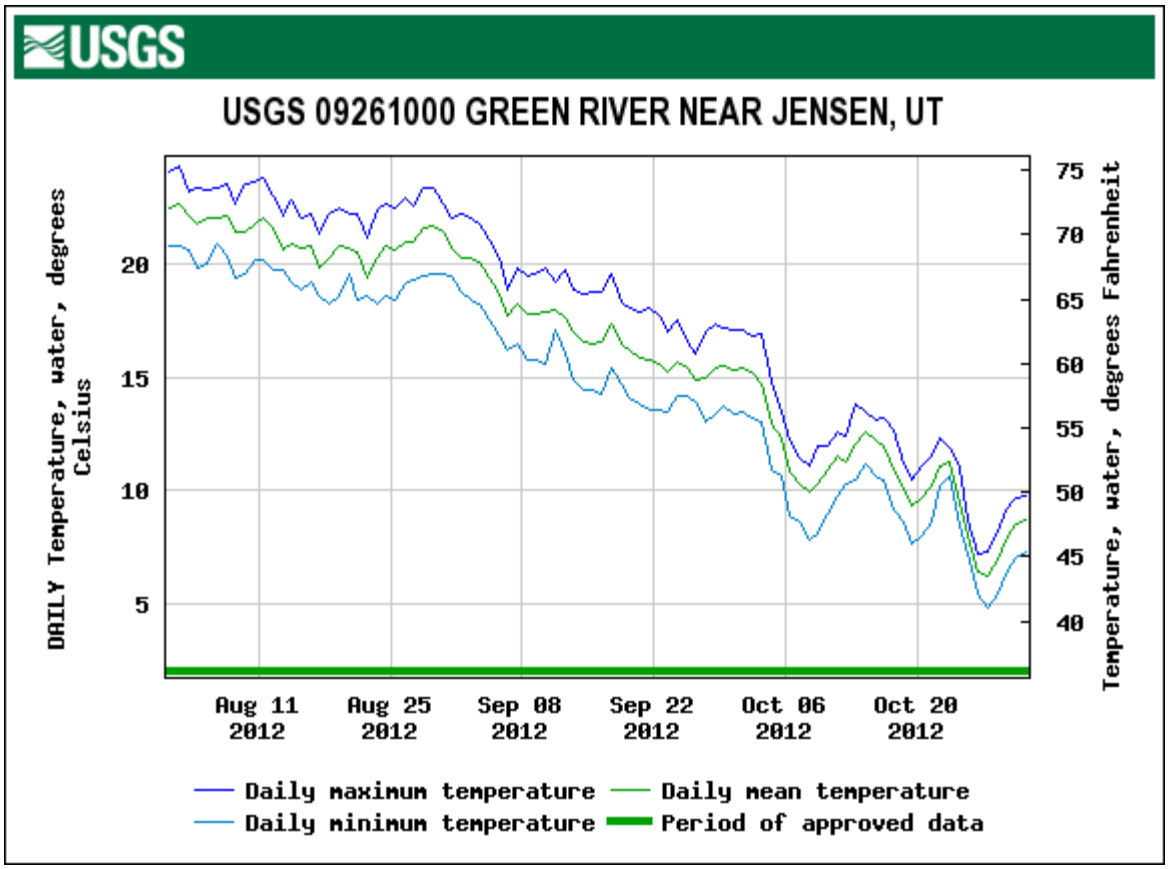

FIGURE 10. — Minimum, maximum and mean daily temperature of the Green River near Jensen, Utah from August to October 2012.