

COLORADO RIVER RECOVERY PROGRAM
FY 2012 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): 11/21/2008
End date: (Mo/Day/Yr): 11/30/2013
Reporting period end date: 09/30/2012
Is this the final report? Yes _____ No X

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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 185 northern pike and 903 white sucker were removed in the spring and during other projects, which is higher than any previous years. Smallmouth bass effort was adjusted throughout the field season, which allowed us to have our highest catch rates since the existence of the project and remove 15,624 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 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 2012 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 in the mainstem Green River. Fyke nets and boat electrofishing were utilized to target these areas. During 2012, a total of 185 northern pike and 903 white suckers were removed from Island Park to Tabyago Riffle and selected concentration areas.

Northern pike captures were greatest during tributary sampling; 115, 45 and 25 individuals were captured during spring tributary sampling, spring mainchannel sampling and smallmouth bass removal, respectively (Table 1). Of the 115 fish, 78 were removed from Stewart Lake Drain. Catch per unit effort (CPUE) was greatest for electrofishing, but fyke-netting should not be discredited based on CPUE values (Table 1). Fyke-netting effort was 65 set days (typically 12 hour sets), which reflects low catch rates, but greatly reduces man hours spent in the field. In addition, fyke nets assisted in the capture of additional northern pike when they were used in conjunction with block and shock electrofishing. These values are more than three times as many northern pike captured in 2011 (Skorupski and Breen 2011) and most were in a smaller size class, likely representing age-1 fish. This large age class likely represents the amount of spawning success in 2011. High flows in 2011 created additional habitat during the spring in the middle Green River, which allowed for a more successful spawning year for northern pike.

During spring tributary sampling, white suckers were predominantly found in Ashley Creek and Stewart Lake Drain. Greater abundances were observed in spring mainchannel sampling and during smallmouth bass removal (Table 2). However, larger size classes and a greater proportion of mature and ripe white suckers were sampled during spring

sampling (Table 2). Based on 2011 data, it was suggested that additional mainchannel (2 passes) sampling would greatly increase our white sucker captures from Island Park to Rainbow Park and Split Mountain boat ramp to river mile 298. Unfortunately, these passes only added 36 white suckers to the total removed during spring mainchannel sampling. The other 88 fish were removed during the pikeminnow estimate as ancillary captures. In addition, fish were larger on average from our ancillary captures. Therefore, the two mainchannel passes could be better used in tributary sampling to target both white sucker and northern pike where catch rates were higher and when spring pikeminnow population estimate passes occur (Table 1 and 2). Although a large number of white suckers were removed throughout the field season, the average size and proportion of mature individuals was low, possibly demonstrating the effectiveness of our effort to reduce the average size of white suckers. Sixty-two white sucker hybrids (13 white sucker x bluehead sucker, 48 white sucker x flannelmouth sucker, and 1 bluehead sucker x flannelmouth sucker) were removed during the entire season (pikeminnow population estimates and nonnative removal) which represents 7% of fish removed. 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 passes from Split Mountain boat ramp to Tabyago Riffle.

Our goal was to complete four removal passes for smallmouth bass in the middle Green River from Split Mountain boat ramp (RM 319.3) to Tabyago Riffle (RM 206.8). In addition, conduct one marking pass and eight removal passes from the Duchesne River confluence (RM 248) to Tabyago Riffle. Several adjustments were made from our proposed scope of work. Two full passes from Split Mountain boat ramp to Tabyago Riffle, one marking pass and 14 removal passes focusing on concentration areas were completed. During the second full pass, it was apparent that multiple smallmouth bass concentration areas were present, due to a high level of spawning success under low flow conditions (Figure 1). Thus, we used an adaptive fisheries management strategy to target “hot spots” maximizing our catches with the funds and time available. To do so, we eliminated two full passes and adjusted the eight removal passes from the Duchesne River confluence to Tabyago Riffle. Only seven of the eight passes were completed and of those, three were shortened (~ nine miles) to Sand Wash boat ramp (RM 215.8). By discontinuing two full passes, one pass below Duchesne River and only sampling to Sand Wash on three of the seven occasions, we added a substantial amount of effort to areas observed to have high concentrations of smallmouth bass (Table 3). Our adjustments were extremely successful, producing high catch rates and removing 15,624 smallmouth bass.

Population estimate. — Smallmouth bass were marked with red Floy and PIT tags on the fourth pass to calculate a Lincoln-Peterson population estimate with the Chapman correction and to potentially detect PIT-tagged fish at the newly installed White River stationary antenna. From Duchesne River to Tabyago Riffle, we estimated 4,079 (102

bass/mile) sub-adult (100-199 mm TL) and 3,376 (84 bass/mile) adult (>200 mm TL) bass (Tables 4 and 5). Age class estimates were adjusted for growth (sub-adults = 0.95 mm/day; adults = 1.03 mm/day), based on recaptured individuals (Table 6). Exploitation rates were 11 and 18% for sub-adult and adult smallmouth bass, which represent limited recapture success throughout the season (Table 4). The 2012 sub-adult and adult population estimate decreased compared to previous years (Figure 2). Although the population appears to be lower in 2012, results should be interpreted with caution. All annual estimates have low recapture rates (Tables 6 and 7), which creates a large amount of variability around each estimate. In addition, sample reaches were not consistent among point estimates (Figure 2). What is apparent is a large sub-adult and adult population that still exists below the Duchesne River (Figure 2). Catch rates by sample reach show a similar pattern of high concentrations of sub-adult fish below the Duchesne River, which appears to extend ~ 30 miles above this point (Figure 3).

Catch rates. — Smallmouth bass catch rates were low in the beginning of the season, slowly increased through time, and steadily increased after pass 7 (Figure 4). Catch rate increases are likely due to the occurrence of age-0 fish recruiting to a more catchable size as the season progressed and the implementation of our adaptive management strategy (Figure 4). One strategy we added to our netting protocol was designing a net that was capable of capturing age-0 fish (i.e., additional layers of mesh), which greatly aided in our success to net small individuals. Catch rates by river mile section displays multiple patterns: (1) smallmouth bass sub-adult and adults captures increase below river mile 267, (2) two areas had a high success of young-of-year recruitment and (3) age-0 fish appear to have recruited into sub-adults within the same field season (Figure 3). CPUE in 2012 is the highest on record in the middle Green River (Table 8). When comparing 2012 to a similar water year (2007), there was a 24% increase in catch rates. This explosion of age-0 fish can be linked to the low flows similar to 2007, creating optimal spawning conditions (Figure 1). 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 270.8 -245.8. In these 39 river miles, we captured 78% of the total catch. This demonstrates the two areas were highly successful spawning grounds and should continue to be targeted with high effort. Although catch rate patterns are alarming, this information will aid in targeting spawning areas in the future.

Population size structure. — Length frequencies of bass captured in 2012 were dominated by individuals < 100 mm (Figure 5). This pattern was consistent when percent catch of size classes are separated by month (Figure 6). However, as stated earlier, it appears that age-0 fish recruited into larger size classes within the 2012 field season. August was dominated by <100 mm individuals, whereas September and October had higher proportions of 100-125 and 125-150 mm fish (Figure 6). When considering environmental conditions and observed growth rates it is not unrealistic that age-0 smallmouth bass recruited into larger size groups. Compared to previous years, the size structure is similar to 2007 and 2006 (Figure 7). When considering growth rates and similarities to 2007, it is likely 2012 fish will continue to be persistent.

Movement. — A total of 77 marked fish were recaptured in 2012, seven of which were tagged in prior years (6 in 2011 and 1 unknown). From the 2012 fish, 39 were sub-adults and 28 were adults. Twenty-one percent of all fish moved downstream, 6% moved upstream and 78% were caught within the same five mile section. Sub-adults grew 0.95 mm/day and adults grew 1.03 mm/day. Of the six 2011 recaptures, two did not exhibit movement, two moved upstream and two moved downstream. If fish move, they typically move downstream (21%). Therefore, it is probable that the two concentration areas with highly successful spawning can be considered source populations and will repopulate the middle Green River and potentially further into Desolation Canyon.

Ancillary captures. — Additional nonnatives of concern were walleye, gizzard shad, Utah chub, black crappie and green sunfish because of high abundance and first occurrence of Utah chub (Table 9). Twenty-nine walleye were removed throughout the field season; including all captures, the average size was 448 mm and two individuals under 100 mm. Only one age-0 walleye has ever been caught in 2009, thus this finding should be monitored closely for their presence and increase in the future. Otolith samples were taken from walleye and gizzard shad and cataloged for future microchemistry signature work. Gizzard shad were abundant and had a successful recruitment year from approximately river mile 240 to Sand Wash (RM 215). The majority were presumably age-0 fish and located in backwaters; 1,180 ranged from 31-186 mm and 30 ranged from 392-491mm. This represents a highly successful spawning run likely due to the drought conditions. The amount and distribution pattern of gizzard shad should be closely monitored in the future. Additional smallmouth bass were caught during pikeminnow population estimates during the spring from Split Mountain boat ramp to Sand Wash. A total of 177 fish were removed (range 95-444 mm; mean TL 257 mm). The size structure is drastically different from the summer, with most of the individuals in the adult size class. It is likely that during this effort adult bass staging to spawn were targeted more effectively.

Task 3. Data entry, analysis, and reporting.

Recovery Program annual progress report (November 2012).

VIII. Recommendations:

- We recommend a minimum of two complete passes from Split Mountain boat ramp to Tabyago Riffle and to apply a similar adaptive management strategy as in 2012 that will greatly increase our catch rates and target concentration areas. A complete pass takes approximately 55 hours of effort and within the 2012 field season, we performed 458 hours of electrofishing. Therefore, that would allow us to utilize 348 hours of effort in concentration areas. We recommend increasing effort from Split Mountain boat ramp to RM 305.8, RM 275.8-245.8 and below the Duchesne River confluence to Tabyago Riffle. 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.

- We recommend discontinuing mark-recapture population estimates. Based on the poor recapture success throughout the duration of the project (Table 8), we believe it would be of greater value to remove these fish rather than release them. Since 2004, we have not exploited more than 18% of tagged fish and in 2012, we tagged and released over 500 fish below the Duchesne River, which was our highest catch in the area for the season. Based on these results we ask the Recovery Program to evaluate the value of continuing to perform mark-recapture estimates in the middle Green River.
- Continue northern pike and white sucker removal during early spring when fish are concentrated in spawning areas. Northern pike numbers are high, therefore an increase in effort in tributaries and backwaters is recommended. The majority of white suckers removed were during other mainchannel sampling. Thus applying the mainchannel spring passes to concentration areas would greatly increase our northern pike catches and allow us to target larger white sucker. In addition, we recommend adding one pass of effort above the Utah state line, due to 2012 reports of northern pike (Ryan Mosely–UDWR , personal communication). This effort will be exploratory to see if there is value in conducting additional work in the area.

IX. Project Status: On track and ongoing

X. FY 2012 Budget Status

- A. Funds Provided: \$205,734
- B. Funds Expended: \$205,734
- C. Difference: \$0
- D. Percent of the FY 2012 work completed, and projected costs to complete: 100%
- E. Recovery Program funds spent for publication charges: \$0

XI. Status of Data Submission (Where applicable): We will submit all data to the database manager by December 2012.

XII. Signed: Joseph A. Skorupski Jr. 11/9/12
Principal Investigator Date

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 2012. Spring mainchannel sampling includes captures during Colorado pikeminnow population estimates.

Project	Abundance	Electro. CPUE	Fyke CPUE	Mean TL	Range TL
Spring tributaries sampling	115	4.95	0.9	489	360-820
Spring mainchannel sampling	45	0.01		789	378-704
Smallmouth bass removal	25	0.05		530	385-693

TABLE 2. — Total abundance, CPUE (electrofishing (fish/hr)and fyke net (fish/day)), mean total length, range of lengths, percent mature, and percent ripe white sucker removed for three projects in 2012. Spring mainchannel sampling includes captures during Colorado pikeminnow population estimates.

Project	Abundance	Electro. CPUE	Fyke CPUE	Mean TL	Range TL	% Mature	% Ripe
Spring tributaries sampling	82	6.3	0.17	187	89-405	15	8.5
Spring mainchannel sampling	124	0.27		213	55-438	22	9.7
Smallmouth bass removal	697	1.5		161	42-421	2	0.03

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.

Section	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
319-316	2.0					2.2		2.8	3.3	8.3	5.2	7.4	3.0			
316-311	2.4					3.8		4.4	5.0	12.9	5.6	9.5	4.6			
311-306	3.1					2.3		3.7	3.6	9.6	2.7	5.3	3.0			
306-301	2.1					1.7		1.6								
301-296	2.6					1.8										
296-291	3.0					1.6										
291-286	3.0					1.6										
286-281	2.6					2.0										
281-276	0.0					0.0										
276-271	3.2					2.0			0.5			0.8	0.5		0.5	0.5
271-266	2.8					2.0			3.1			3.5	3.0		3.2	3.3
266-261	3.5					1.4			3.2			3.1	3.3		3.4	2.9
261-256	2.5					1.1			2.4			2.1	2.1		2.4	1.8
256-256	2.4					2.3							3.5		3.5	2.4
251-246	3.7	1.2	1.6	1.4	1.4	2.8	1.4					1.9	4.3	1.2	5.5	4.0
246-241	2.8	3.8	3.8	3.4	4.1	3.7	2.9					3.5	3.7	2.6		
241-236	1.9	2.5	2.8	2.3	2.9	2.7	2.2					2.4	3.2	3.1		
236-231	3.6	2.8	3.4	3.1	3.3	2.8	2.7					2.7	3.1	2.3		
231-226	2.7	3.1	3.3	2.8	2.5	2.7	2.6					2.9	2.8	2.1		
226-221	3.5	3.9	3.8	3.0	3.9	3.0	3.1					3.3	2.8	2.7		
221-216	2.8	3.3	3.2	2.8	2.7	2.6	2.1					2.5	2.9	2.3		
216-211	3.1	3.2	3.6	2.3	2.9	2.0							2.3			
211-207	1.0	2.7	2.4	2.3	2.5	0.0							1.6			

TABLE 4. — Smallmouth bass population estimates and exploitation rates in the middle Green River.

Size Class	Estimate	Captured (pass 4)	Recaptured (pass 5-16)	95% CI	SE	Exploitation (%)
Duchesne River - Tabyago						
Sub-adult	4,079	351	39	2,507-5,555	778	11
Adult	3,376	157	28	1,278-5,475	1,070	18

TABLE 5. — Number of sub-adult (100 – 199 mm) and adult (>200 mm) smallmouth bass per river mile from 2004 – 2012. Population estimates were not conducted for 2005 and 2006.

Year	Sub-adult	Adult
2004	130	138
2007	282.2	23.4
2008	66	25
2009	47	27
2010	86.6	26.6
2011	90.5	19.2
2012	102	84

TABLE 6. — Total smallmouth bass caught and recaptured during 2012. Five hundred eight fish caught in pass 4 were tagged and returned, whereas all other passes were removed.

Pass	Caught	Recapture
1	124	NA
2	166	NA
3	383	NA
4	556	NA
5	525	27
6	960	11
7	338	11
8	361	0
9	1362	0
10	1544	0
11	709	0
12	2025	6
13	2684	10
14	264	5
15	2062	0
16	1561	0

TABLE 7. — Smallmouth bass tagged and recaptured from 2004-2012, with total exploitation rates provided.

Year	Tagged	Recaps	Exploitation
2004	295	47	15.9
2005	315	0	0.0
2006	98	1	1.0
2007	122	22	18.0
2008	91	16	17.6
2009	265	45	17.0
2010	413	46	11.1
2011	273	23	8.4
2012	508	70	8.7

TABLE 8. — Smallmouth bass total catch rates (fish/hour) from 2004 – 2012.

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

TABLE 9. — Additional nonnatives removed during smallmouth bass removal in the middle Green River in 2012.

Species	Abundance
Black crappie	73
Bluegill	1
Bluehead x white sucker	11
Brown trout	9
Flannelmouth x white sucker	30
Green sunfish	2947
Gizzard shad	1210
Largemouth bass	1
Rainbow trout	2
Utah chub	1
Walleye	63

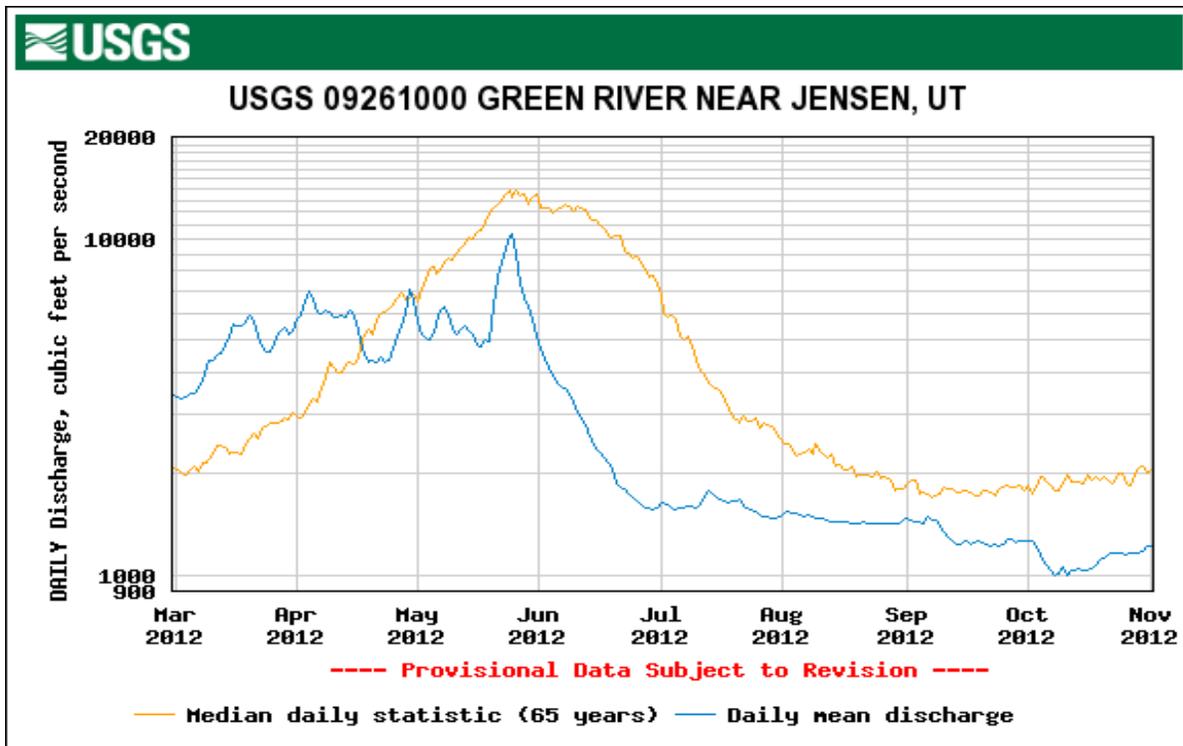


FIGURE 1. — Mean daily discharge of the Green River near Jensen, Utah from March to October 2012.

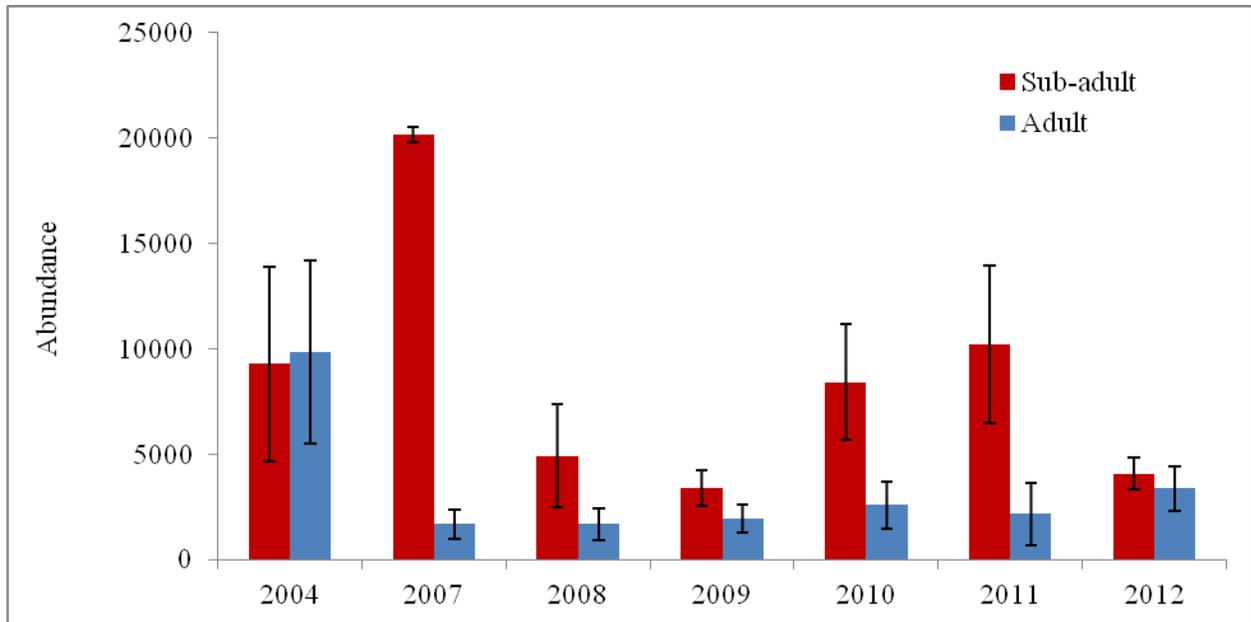


FIGURE 2. — Smallmouth bass sub-adult and adult population estimates and standard errors (SE) in the middle Green River. Start and stop points for each year are: Split Mountain Boat Ramp to Tabyago Riffle for 2010 and 2011; Split Mountain Boat Ramp to Sand Wash in 2004; Split Mountain Boat Ramp to Duchesne River 2007, 2008 and 2009; Duchesne River to Tabyago Riffle in 2012. Population estimates were not conducted in 2005 and 2006.

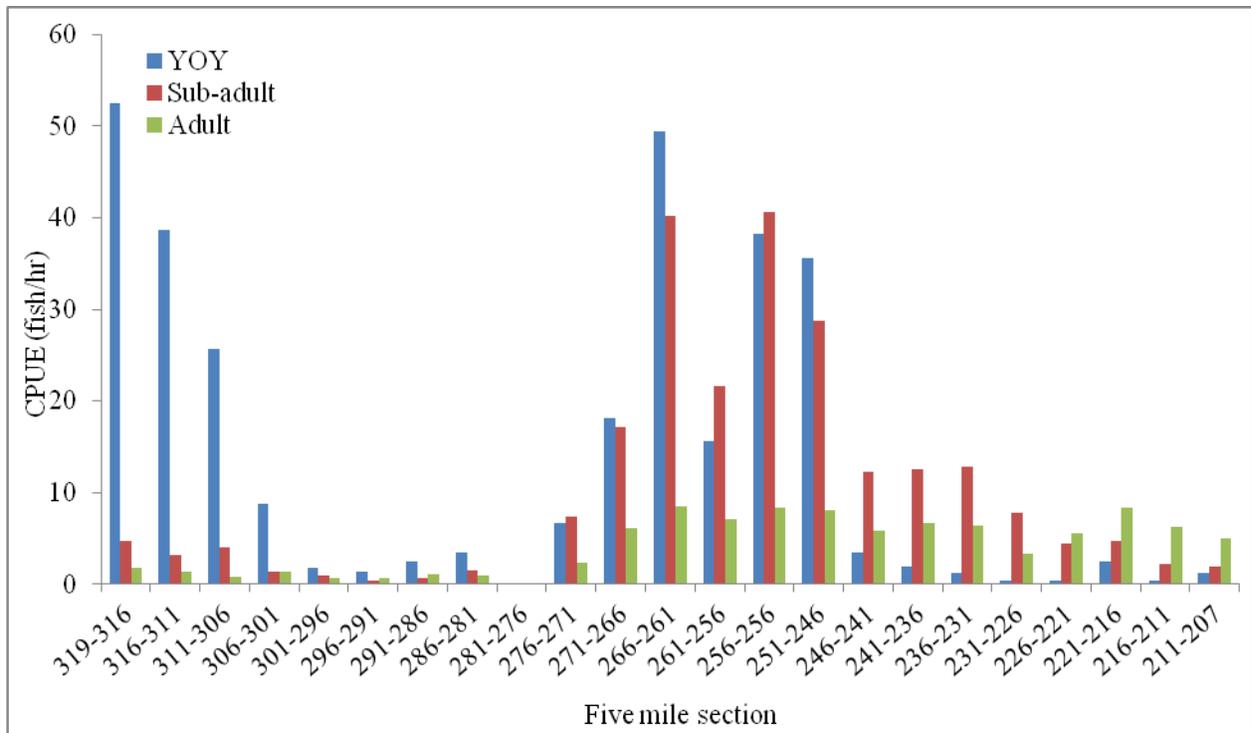


FIGURE 3. — Smallmouth bass young-of-year, sub-adult and adult catch rates separated by sample reach in the middle Green River in 2012 from Split Mountain Boat Ramp to Tabyago Riffle.

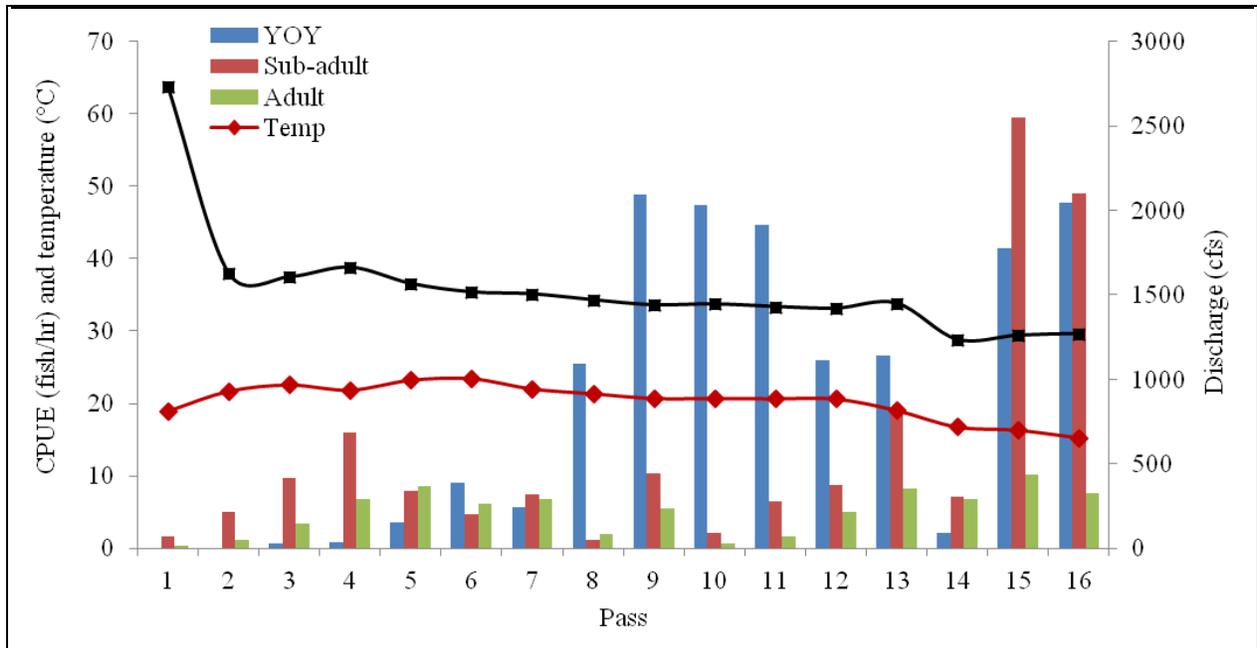


FIGURE 4. — Smallmouth bass young-of-year, sub-adult and adult catch rates in the middle Green River by pass with mean discharge (black dots) and mean temperature (red dots) in 2012.

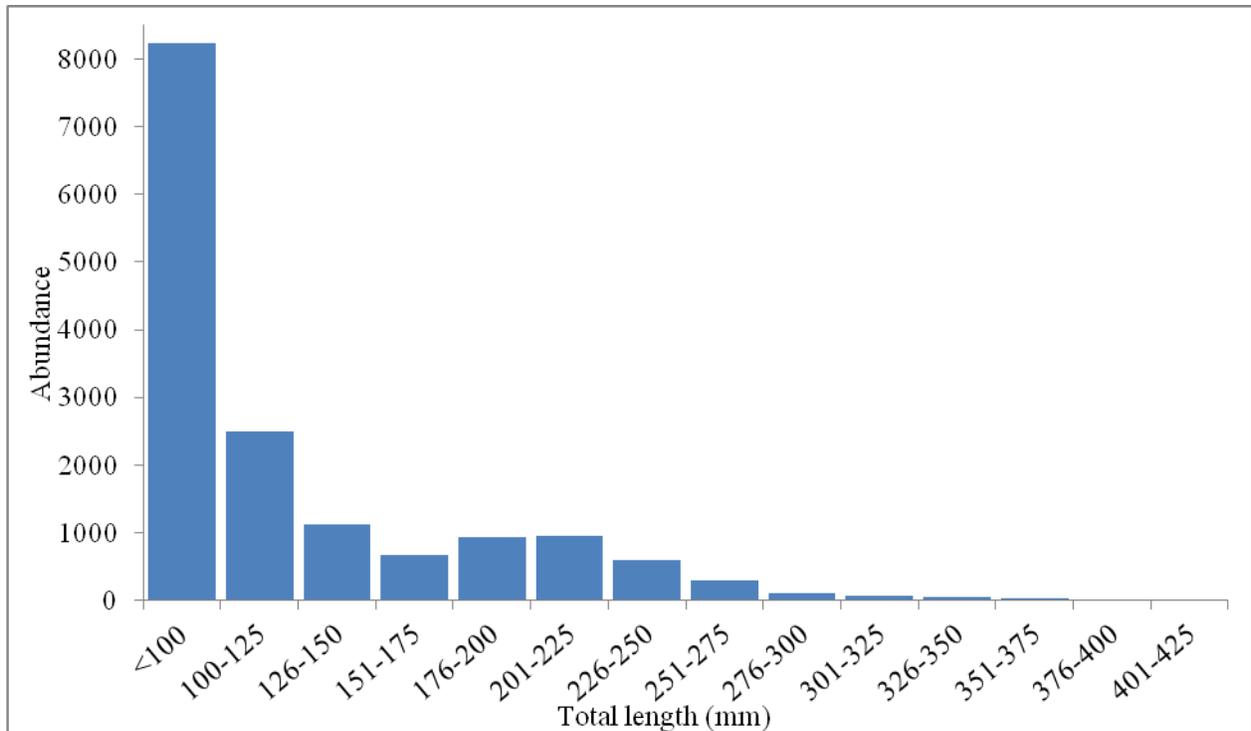


FIGURE 5. — Length frequency of smallmouth bass captured in the middle Green River in 2012.

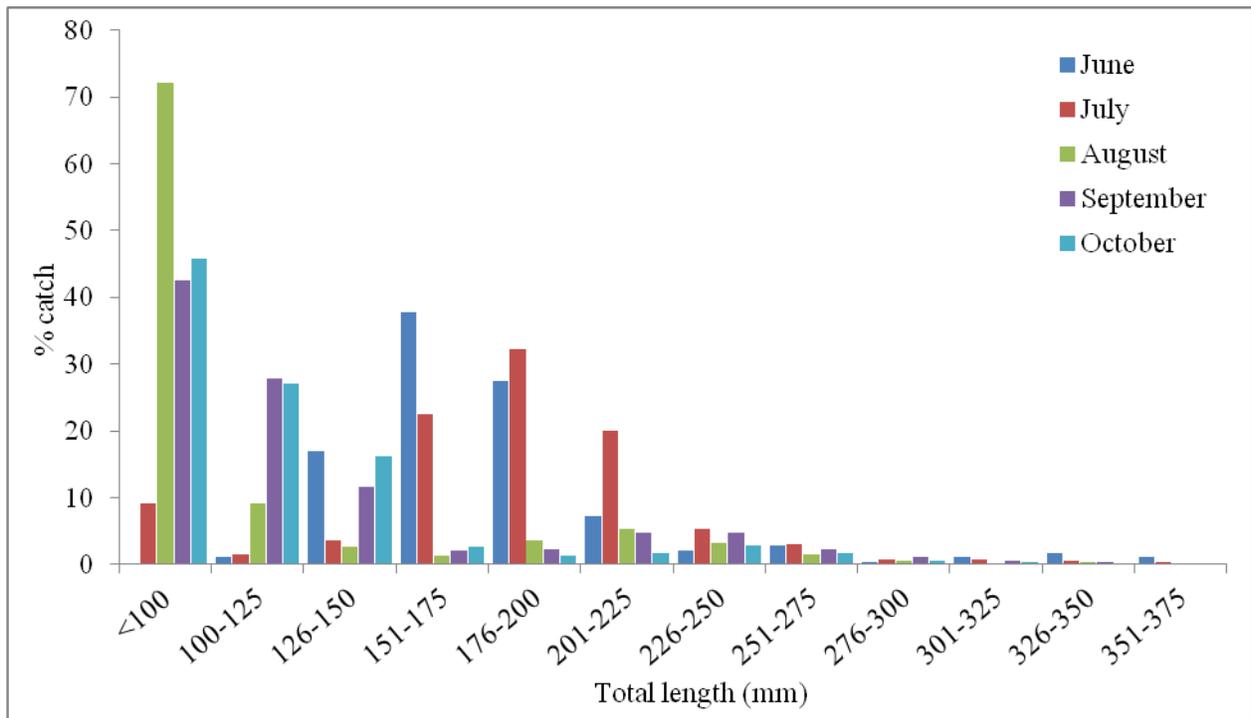


FIGURE 6. — Length frequency of smallmouth bass captured in the middle Green River in 2012 during each month of the field season.

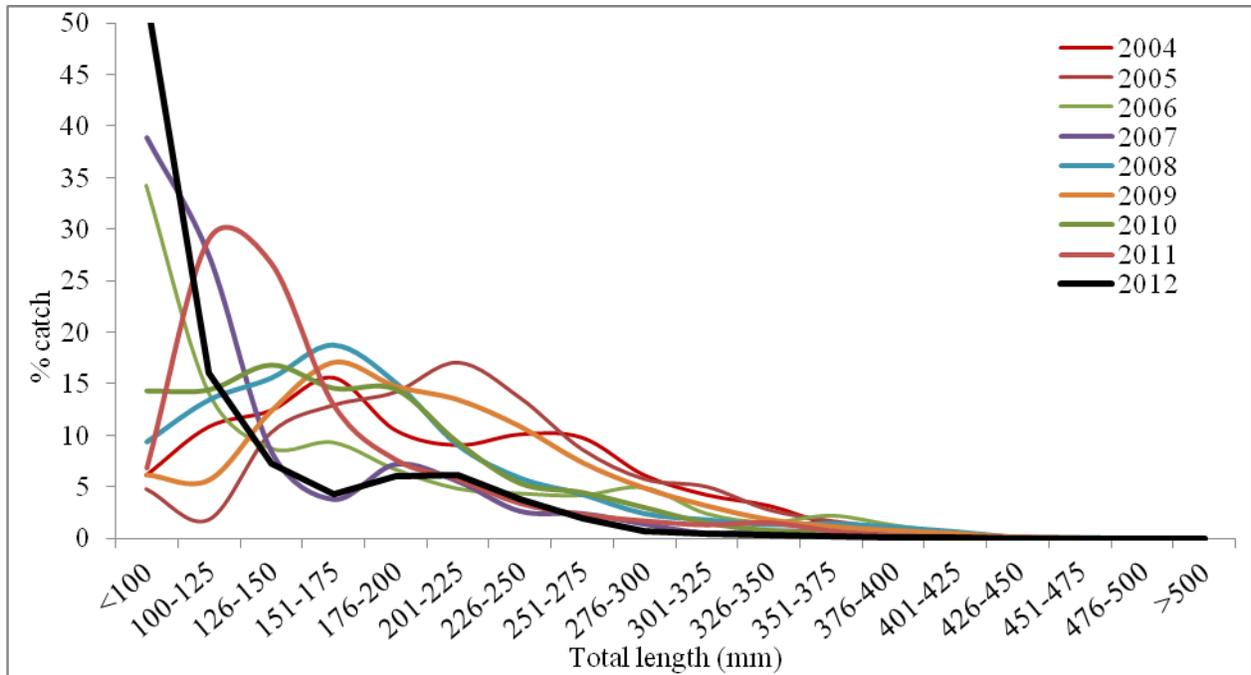


FIGURE 7. — Length frequency of smallmouth bass captured in the middle Green River from 2004 – 2012.