

COLORADO RIVER RECOVERY PROGRAM  
FY 2017 ANNUAL PROJECT REPORT

RECOVERY PROGRAM  
PROJECT NUMBER: 123a

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

II. Bureau of Reclamation Agreement Numbers:

USFWS: R15PG00083  
Start date: 10/01/2014  
End date: 09/30/2019

UDWR: R14AP00007  
Start date: 05/01/2014  
End date: 09/30/2018

Reporting period end date: 09/30/2017

Is this the final report? Yes    No   X  

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IV. Abstract: This project consisted of two components: **a**) remove smallmouth bass on the Green River in Dinosaur National Monument between Echo Park and Split Mtn. (RM 344.5-319.5) and **b**) remove smallmouth bass in Desolation/Gray Canyons (Green River RM 215.3-129.8). All components were completed. Combined, the United States Fish and Wildlife Service (USFWS) and the Utah Division of Wildlife Resources (UDWR) completed twelve passes and one targeted sampling pass for spawning bass in the Echo-Split reach, resulting in the removal of 813 smallmouth bass. UDWR-Moab also tagged and released 45 smallmouth bass on the second pass in order to estimate abundance in this reach. A Lincoln-Petersen model produced a point estimate of 874 bass  $\geq$ 100 mm, or 35 bass/mile. UDWR-Moab completed one removal pass in Desolation and Gray Canyons and removed 36 bass; catch rates there were lower than the past three years. Smallmouth bass distribution in Desolation/Gray Canyons continued to encompass the entire reach. An additional 62 smallmouth bass were removed in Desolation and Gray Canyons by USFWS during Project 128. Removal of walleye and other nonnative fishes in the lower Green and lower Colorado Rivers, as required in this project's scope of work, will be reported in Evaluation of Walleye Removal in the Upper Colorado River Basin Annual Report (Michaud et al. 2017).

V. Study Schedule: 2004-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.

## 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.b.(3) Smallmouth bass in middle and lower Green River.
- VII. Accomplishment of FY 2017 Tasks and Deliverables, Discussion of Initial Findings and Shortcomings:

### ***Tasks 1 & 2: Smallmouth bass removal-Echo Park to Split Mtn.***

The USFWS and UDWR collaborated to complete one marking pass and eleven removal passes in the Echo-Split reach between July 5 and September 8; the USFWS also completed one targeted pass aimed at removing spawning smallmouth bass (SMB) adults in the Island Park area on June 30. The overall catch rate for all bass during this season was 3.19 fish/hour, which is lower than 2016. The catch rate for fish  $\geq 100$  mm (adults and sub-adults) was 2.28 bass/hour, similar to last year (Fig. 1). We caught 0.75 fish/h for adults and 1.53 fish/h for sub-adults when using absolute size classes, not adjusted for growth. These results demonstrate a shift from adult catch rates to higher sub-adult catch rates from 2016.

The first pass of the year, the FWS targeted removal pass, occurred June 30, 2017, when water temperature recorded in the field was 14.2°C. Mean discharge (Q) and mean water temperature (T) recorded at the USGS Jensen gage on this date were 13,900 cfs and 16.4°C, respectively. River conditions were largely driven by Flaming Gorge Dam releases, which were at full bypass (8,600 cfs) due to well above average run-off. Bureau of Reclamation reduced releases beginning July 5, and mean daily water temperatures rapidly increased from around 16°C to above 20°C by July 10.

USFWS conducted the first full pass in this reach on July 5-7 (mean  $Q \leq 10,100$  cfs; mean  $T \geq 16.4^\circ\text{C}$ ), and noted 9 of 15 adult SMB were expressing gametes. On the second pass (July 11-14) UDWR marked 45 bass (34 adults  $\geq 200$ mm, 11 sub-adults 100-199mm) with green Floy tags and released them. The subsequent ten passes consisted only of removal, yielding a total of 813 smallmouth bass (167 adults, 400 sub-adults, and 246 SMB  $< 100$ mm; Table 1).

Overall, catch rates increased from the surge pass through pass 6, then decreased until the end of the season (Fig. 2). For adults, catch rates were highest on pass 2 and declined afterwards. Results this year were driven largely by sub-adult and age-1 (fish  $< 100$  mm but not age-0) numbers, and these size classes made up over half of the bass captured (61%; Fig. 3a-b). Compared to previous years, the population size structure was shifted towards smaller sizes, and overall numbers of bass were low (Fig. 4). Starting with pass 6, we also caught 140 fish that appeared to be age-0 bass, ranging from 28-95 mm. By the last pass in early September, the mean size of age-0 fish was 65 mm. Although young-of-

year bass were captured in all reaches sampled, a majority were captured in the most upstream reach from Echo Park to the CO/UT state line (Fig. 5). This pattern is unusual for this reach, where most spawning activity and young fish are caught from Island Park downstream. Due to extended high flows resulting from Flaming Gorge releases this spring, we believe these age-0 fish were a result of spawning in the lower Yampa River just upstream of the confluence. Conditions there were conducive to bass reproduction much earlier than the Green, and ripe bass and nesting males were observed in mid to late June (see Project 110 report). This year we also caught 28 bass that were large enough to be considered piscivores that pose a competitive threat to Colorado pikeminnow (total length  $\geq 325$  mm). This number is up slightly from 2016 (n=23), but comparable to the average for 2008-2017 (mean = 28.2).

To calculate a population estimate, UDWR tagged and released 45 bass on the second pass (July 11-14). Pass three, the primary recapture component, occurred immediately after, but only two tagged bass were recaptured (1 adult, 1 sub-adult). Sampling for project FR-115 (Lodore fish community) the following week of July 17-20 recaptured three tagged bass from Whirlpool Canyon. There were no other tagged bass recaptured until pass 6 (August 2). We used only the second and third pass captures to generate a Lincoln-Petersen estimate for bass  $\geq 100$ mm, which should reduce bias due to fish movement or growth from the sub-adult into adult size class. This produced a point estimate of 874 bass, or 35 bass/mile (Table 2). This estimate had a wide confidence interval and high coefficient of variation, so it should be viewed with caution. The estimate for bass  $\geq 100$  mm in 2017 was similar to 2016, but lower than 2015 (Fig. 6). Based on the point estimate and the removal of 549 bass during passes 3-12, we were able to remove 63% of SMB  $\geq 100$ mm during the season. A total of eight tagged bass were recaptured during all passes and the CSU trip, which results in an exploitation rate of 18% based on tag returns. For these eight recaptures, all of the fish remained in the geomorphic reach where they were tagged. Growth rates for these tagged bass averaged 0.63 mm/day. Using this average daily growth rate, a bass tagged as a 200 mm adult on pass 2 could have theoretically grown to 234mm by the last pass. An analysis of exploitation, size class distribution, and catch rates adjusted for within year growth did not significantly change results for removal reported elsewhere in this report.

Ten tagged bass were captured from tagging in previous years, ranging back to 2011. Five of these fish were recaptured in the same reach where they were tagged, three had moved upstream, and two had moved into the reaches below Split Mtn. sampled by UDWR-Vernal. One fish of note was a bass tagged in 2015 at 162mm. It was recaptured as a 200mm adult in 2016 during the marking pass and given a new tag. This fish was recaptured this year at 266mm in September. Another interesting recapture was a bass tagged in Island Park in 2011 at 351mm. It was recaptured 50 miles downstream in May during Colorado pikeminnow estimates as a 412mm adult. For fish at large more than one year, the average growth rate was 0.12 mm/day (43 mm/year).

We also captured nine species of nonnative fishes, including black bullhead, creek chub, green sunfish, gizzard shad, northern pike, white suckers and hybrids, yellow perch, and one fish tentatively identified as a white crappie (Table 3). The suspected white crappie had 5 pre-dorsal spines and lacked the typical lateral bars present on black crappie. This

fish has been preserved and identification will be confirmed by the Larval Fish Lab. Captures of green sunfish and white sucker were much higher than 2016. Of the 18 northern pike captured, thirteen were <300 mm, and ranged in size between 126-294 mm. This is unusual for this reach and likely indicates pike reproduction in this portion of the Green River or upstream, resulting from increased habitat availability from extended dam releases (Bestgen et al. 2016). Roundtail chub and small, unidentified chub captures were also higher this year than recent years.

#### *Island Park spawning disruption*

We coordinated passes through Island Park between UDWR-Vernal, UDWR-Moab, and USFWS to focus effort during river conditions that should be conducive to spawning, in an effort to disrupt nesting and spawning success in that reach. The Island Park reach has been shown to contain suitable spawning habitat, and nesting SMB and age-0 fish have been observed in those sites. As mentioned above, water temperatures remained low through June, so spawning disruption passes were limited before the full removal passes commenced. UDWR-Vernal contributed three days of effort on June 26, 28, and July 3, totaling 10.4 hours of effort. During those passes they captured a total of 14 sub-adult and 22 adult bass (3 piscivores), resulting in catch rates of 2.11 sub-adults and 1.34 adults per hour. This compares to catch rates in the same reach over the rest of the season of 0.44 and 0.91 fish/h for adults and sub-adults, respectively. Based on observations of fish expressing gametes, spawning activity in this reach likely lasted over the month of July, covering passes 1-6. Catch rate for adults in all reaches over those six passes was 1.13 fish/h.

#### ***Task 3: Smallmouth bass removal- Desolation and Gray Canyons***

UDWR-Moab completed one targeted smallmouth bass removal electrofishing pass in Desolation and Gray Canyons. Instead of a second pass, effort was reallocated to an additional pass in the Echo Park to Split Mountain reach. This decision was based on a combination of factors influencing the Desolation reach: relatively low catch rates in 2016, smallmouth bass removal that occurred during pikeminnow sampling, and predictions of hydrology that would likely disadvantage bass numbers. Prior to this targeted removal pass, USFWS-Vernal removed bass during three electrofishing passes for Colorado pikeminnow monitoring (Project 128). Total numbers of bass removed, size structure and distribution information in this report will draw from both projects. However, sampling strategies differ between Projects 123a and 128, thus catch rate comparisons and ancillary captures refer only to targeted bass removal.

A total of 98 smallmouth bass were removed from Desolation and Gray Canyons in 2017. USFWS-Vernal removed 62 smallmouth bass between Tabyago Riffle (RM 207) and the Tusher Diversion (RM 128) during Colorado pikeminnow sampling. UDWR-Moab subsequently completed a single targeted bass removal pass from Tabyago Riffle to Swasey's Rapid (RM 132) on June 26 – July 2, 2017. The final pass removed 36 smallmouth bass during 48.4 hours of electrofishing (0.74 fish/hour). River discharge during this pass decreased from 13,700 to 11,100 cu. ft./sec. (USGS Gauge in Green River, UT) and water temperatures measured on-site ranged from 19.5-21.7 degrees Celsius.

Targeted smallmouth bass catch rate in 2017 was much lower than 2014, 2015, and 2016 indicating a declining population (Figure 7). Smallmouth bass continue to be found throughout the Desolation/Gray reach. However, 53% of bass captured during targeted removal were between river mile 170 and river mile 160, potentially representing an area of high density to be monitored in future years.

Size structure of smallmouth bass was primarily comprised of adults 200-325mm in total length (87%) (Figure 8). Piscivorous adult bass over 325 mm in length (5%) and juveniles 100-199 mm (8%) comprised the remainder of catch. Smallmouth bass recruitment appears to have been limited since 2014 sampling yielded extremely high catch rates. The cohort identified in 2014 continues to be present (Figure 9) but low catch rates of 2017 along with favorable environmental conditions suggest that the population is being suppressed. No fish were observed nesting (we were unable to get into Range Creek) but 18 smallmouth bass removed during the targeted removal pass were females containing eggs upon dissection.

**Tasks 4 and 5: Walleye Removal-Lower Green and Lower Colorado Rivers-** These tasks will be reported on in Evaluation of Walleye Removal in the Upper Colorado River Basin Annual Report (Michaud et. al. 2017).

**Task 6: Data entry, analysis and reporting-** Data has been entered and will be submitted to the database manager by January 2018. An annual progress report including a summary of the 2017 data will be submitted by November 13, 2017.

VIII. Additional noteworthy observations:

***Desolation and Gray Canyons***

One Walleye, three brown trout, two green sunfish, one channel catfish (>450mm), and a single creek chub were also removed during the targeted removal pass (Table 4). Thirty-six razorback suckers were encountered during this pass and was the most abundant endangered species captured during this targeted sampling effort. Colorado pikeminnow (nine encountered) and humpback chub (six encountered) were also present, though less abundant.

IX. Recommendations:

***Echo-Split Reach***

- Continue smallmouth bass removal at current levels.
- Continue multi-agency “surge” effort to target spawning bass in Island Park.
- Continue marking smallmouth bass. Although abundance estimates yielded imprecise estimates of the bass population, it did allow some comparison to previous years. With only one marking pass devoted to tagging fish, this project has several consecutive passes where removal can be accomplished, and we are not constrained by flows in this reach.

***Desolation and Gray Canyons***

- Continue annual targeted removal of smallmouth bass and other predatory fishes by UDWR-Moab. Monitoring and removal of invasive predatory fishes in this reach may delay expansion of their distribution into critical endangered fish nursery and spawning habitat of the Lower Green River.

- Consider increasing removal effort following low water-years to address correlated spikes in bass recruitment as observed in 2014.
- Target additional off-channel spawning habitats (e.g. flooded tributaries) as time allows when spring flows are sufficient to delay or depress mainstem bass nesting and reproduction.

X. Project Status:  
 Tasks 1-3, 6: on track and on-going.  
 Tasks 4-5: on track and on-going. Progress reported in Walleye Removal in the Upper Colorado River Basin Annual Report (Michaud et. al.).

XI. FY 2017 Budget Status  
 A. Funds Provided: \$223,200  
 B. Funds Expended: \$223,200  
 C. Difference: -0-  
 D. Percent of the FY 2017 work completed: 100%  
 E. Recovery Program funds spent for publication charges: -0-

XII. Status of Data Submission:  
 USFWS-data are compiled and will be submitted to database manager by December 2017.  
 UDWR- data are compiled and will be uploaded to STReAMS database by January 2018.

XIII. Signed: M. Tildon Jones and John Caldwell 13 Nov. 2017  
 Principal Investigators Date

Literature Cited:

Bestgen, K.R., E. Kluender, K. Zelasko, and T. Jones. 2016. Monitoring effects of Flaming Gorge Dam releases on the Lodore and Whirlpool Canyon fish communities. Project FR-115 annual report to the Upper Colorado River Endangered Fish Recovery Program, U. S. Fish and Wildlife Service, Denver, CO.

Michaud, C., T. Francis, R.Staffeldt, M. Fiorelli, M.T. Jones, and E. Kluender. 2017. Evaluation of walleye removal in the upper Colorado River Basin. Project 123d annual report to the Upper Colorado River Endangered Fish Recovery Program, U. S. Fish and Wildlife Service, Denver, CO.

**Table 1. Total bass caught in Echo-Split reach by pass and size group, 2017. Piscivores are adult fish above the 325mm threshold. \*Adults and sub-adults were tagged and released on pass 2.**

Pass	<100mm	Sub-adults	Adults	Piscivores	Total
Surge-FWS, June 30	1	1	1	0	3
1-FWS, 5-7 July	3	0	15	3	18
2-UDWR, 11-14 July	19	12*	34*	3	65
3-UDWR, 14-16 July	28	24	32	5	84
4-UDWR, 25-28 July	11	36	21	0	68
5-UDWR, 28-31 July	13	44	17	1	74
6-FWS, 1-3 August	21	81	22	2	124
7-UDWR, 8-11 Aug.	13	32	12	3	57
8-UDWR, 11-14 Aug.	12	46	13	2	71
9-FWS, 15-17 Aug.	17	67	10	2	94
10-FWS, 23-25 Aug.	27	31	5	1	63
11-FWS, 29-31 Aug.	6	14	13	4	33
12-FWS, 6-8 Sept.	75	23	6	2	104
Totals	246	411	201	28	858

**Table 2. Abundance estimates for smallmouth bass, 2017.**

Size class	Method	Abundance	95% CI	SE	Fish/mile
All bass $\geq$ 100mm	Lincoln-Petersen	874	23-1,725	425	35

**Table 3. Ancillary fish captures in the Echo-Split study reach, 2017. Piscivores are northern pike >450mm and walleye >375mm.**

Species	Number Captured	Piscivores
Black bullhead ( <i>Ameiurus melas</i> )	4	
Creek chub ( <i>Semotilus atromaculatus</i> )	5	
Gizzard shad ( <i>Dorosoma cepedianum</i> )	1	
Green sunfish ( <i>Lepomis cyanellus</i> )	602	
White sucker and hybrids ( <i>Catostomus commersonii</i> )	1451	
Northern pike ( <i>Esox lucius</i> )	18	3
Walleye ( <i>Sander vitreus</i> )	3	3
White crappie ( <i>Pomoxis annularis</i> )	1	
Yellow perch ( <i>Perca flavescens</i> )	1	
Colorado pikeminnow ( <i>Ptychocheilus lucius</i> )	6	
Bonytail ( <i>Gila elegans</i> )	2	
Roundtail chub ( <i>Gila robusta</i> )	31	
Small unidentified <i>Gila</i>	9	
Razorback sucker ( <i>Xyrauchen texanus</i> )	16	
Razorback x flannelmouth hybrids ( <i>X. texanus</i> x <i>Catostomus latipinnis</i> )	2	

**Table 4. Project 123a ancillary fish captures in Desolation/Gray Canyons, 2017. Piscivores are channel catfish > 450mm and walleye > 375mm.**

Species	Number captured	Piscivores
Channel catfish ( <i>Ictalurus punctatus</i> )*	1	1
Green sunfish ( <i>Lepomis cyanellus</i> )	2	
Walleye ( <i>Sander vitreus</i> )	1	1
Brown trout	3	
Creek chub	1	
Colorado pikeminnow ( <i>Ptychocheilus lucius</i> )	9	
Humpback chub ( <i>Gila cypha</i> )	6	
Razorback sucker ( <i>Xyrauchen texanus</i> )	36	

\* sampling targeted only piscivorous channel catfish.

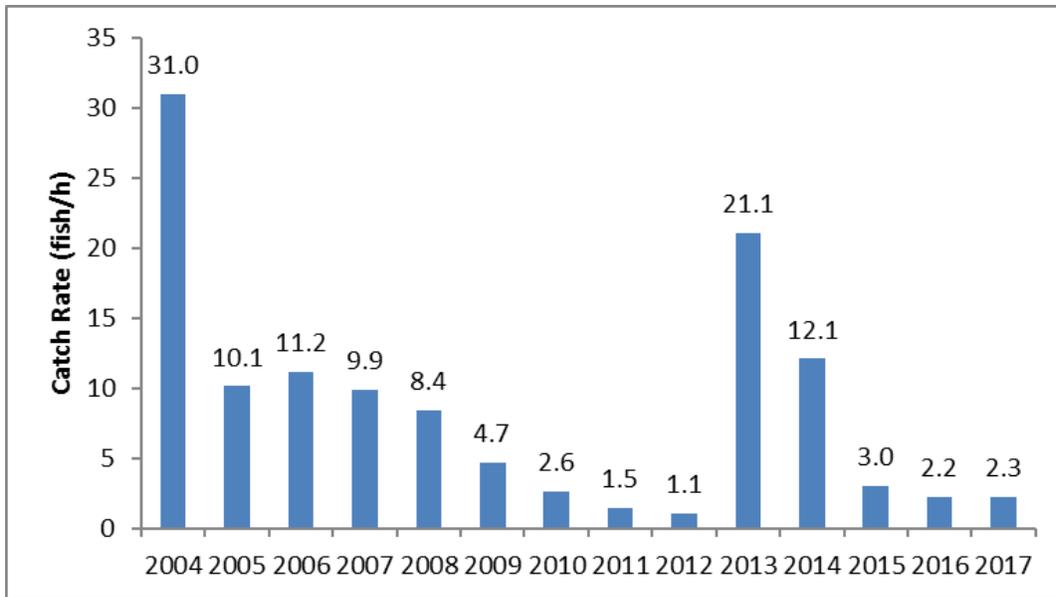


Figure 1. Catch rates for all bass >100mm in the Echo-Split reach, 2004-2017.

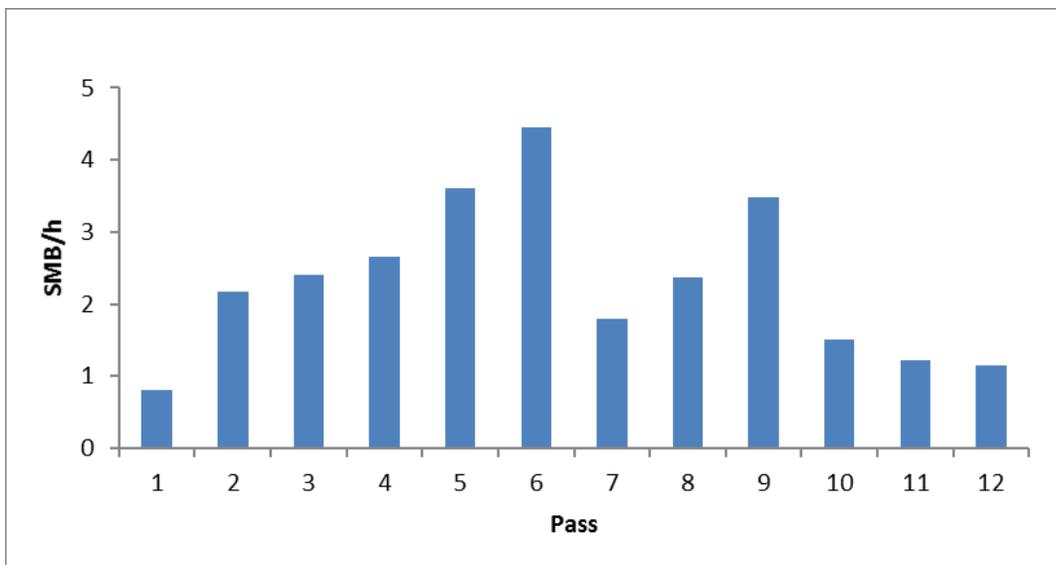


Figure 2. Catch rates by pass for all bass  $\geq$ 100mm, Echo-Split reach 2017.

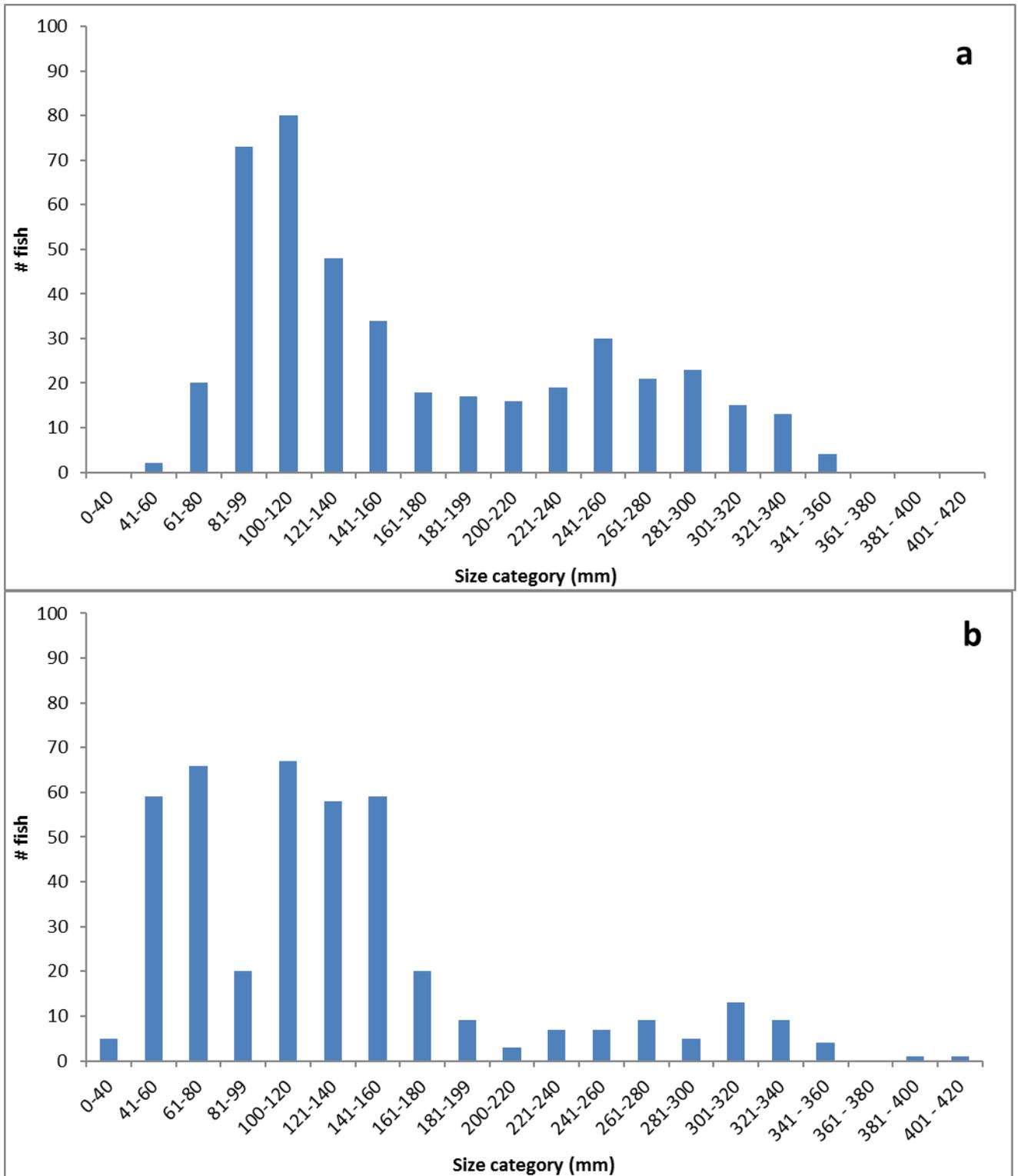


Figure 3a-b. Length-frequency histograms for smallmouth bass captured in passes 1-6 (a) and passes 7-12 (b), Echo-Split reach 2017.

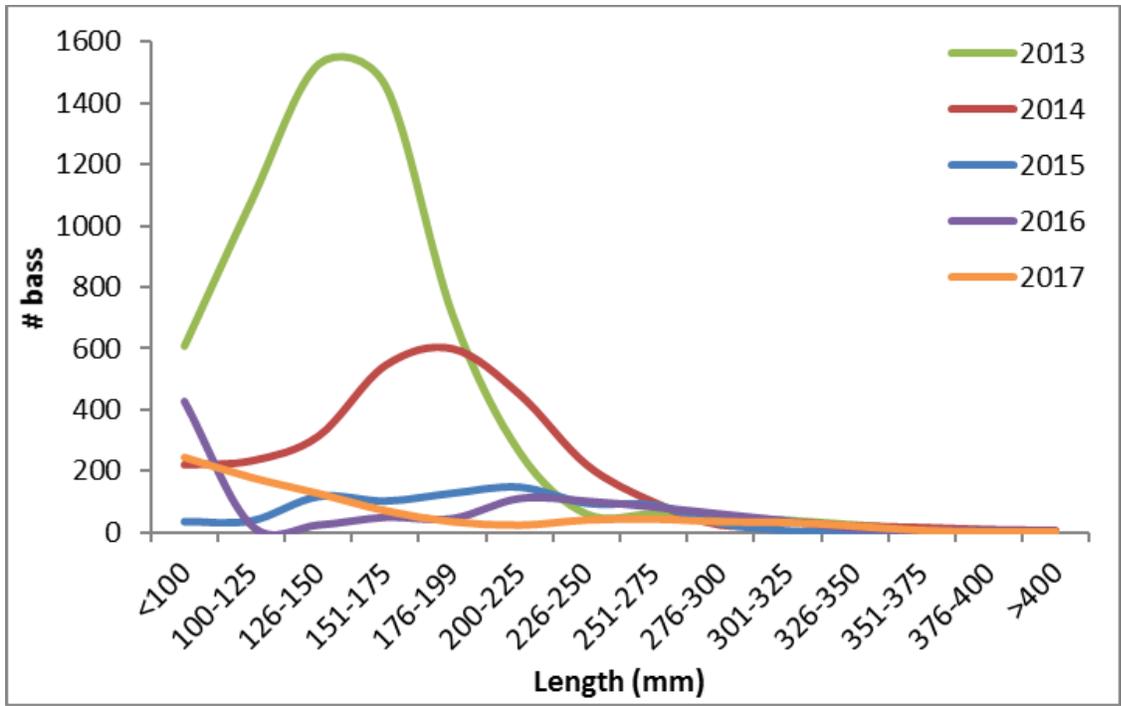


Figure 4. Length-frequency of smallmouth bass in Echo-Split, 2013-2017.

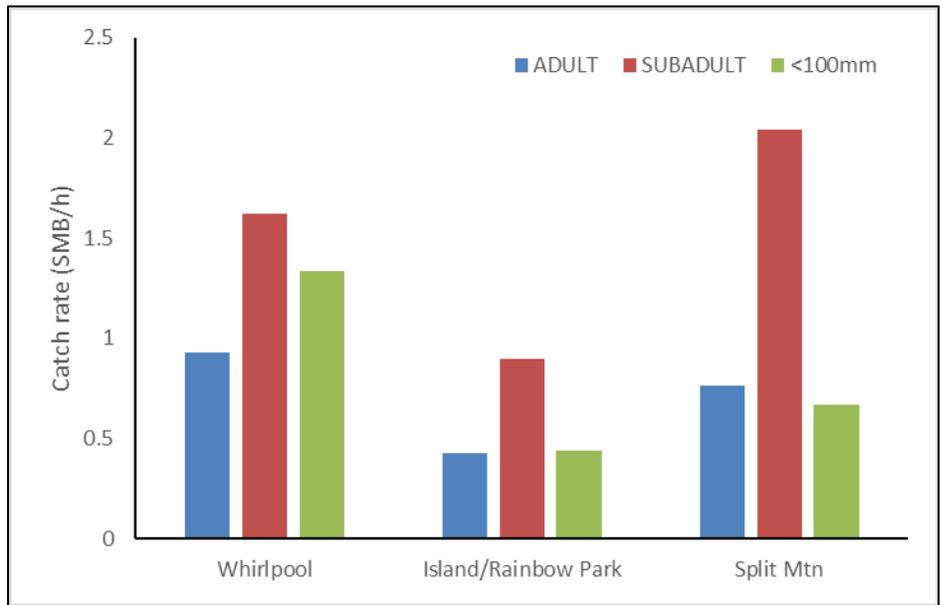


Figure 5. Catch rates by size class and reach for the Echo-Split reach, 2017.

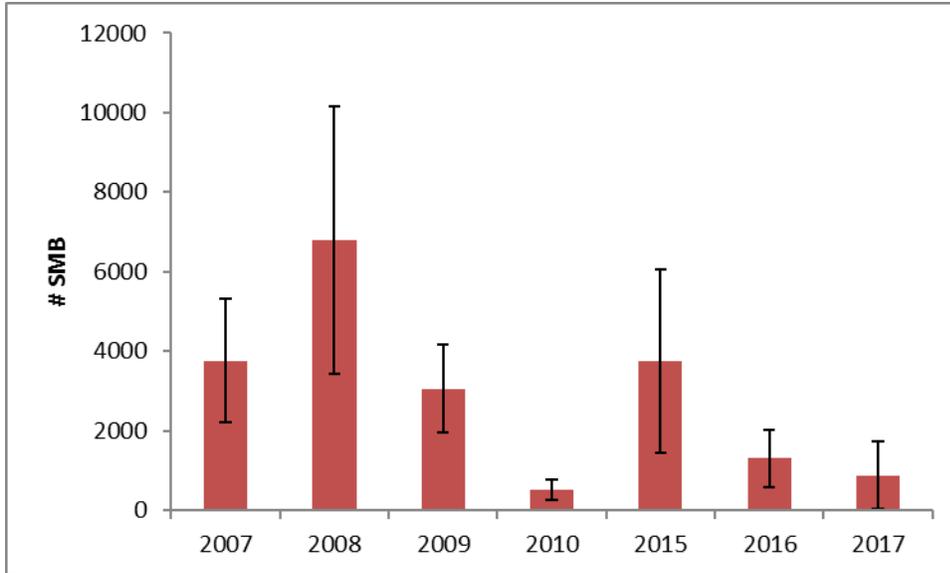


Figure 6. Abundance estimates with 95% confidence intervals for smallmouth bass in the Echo-Split reach, 2007-2010 and 2015-2017.

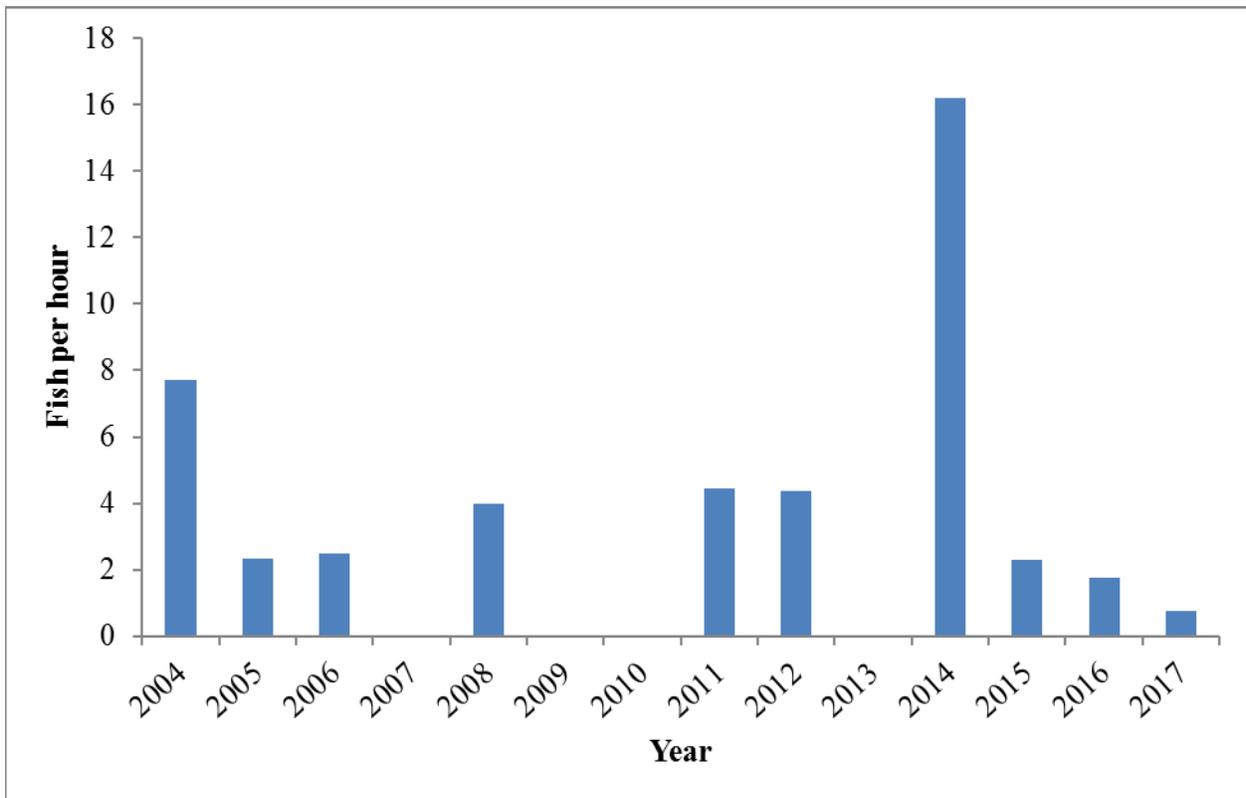


Figure 7. Catch per unit effort (fish per hour) from targeted smallmouth bass removal in Desolation/Gray Canyons.

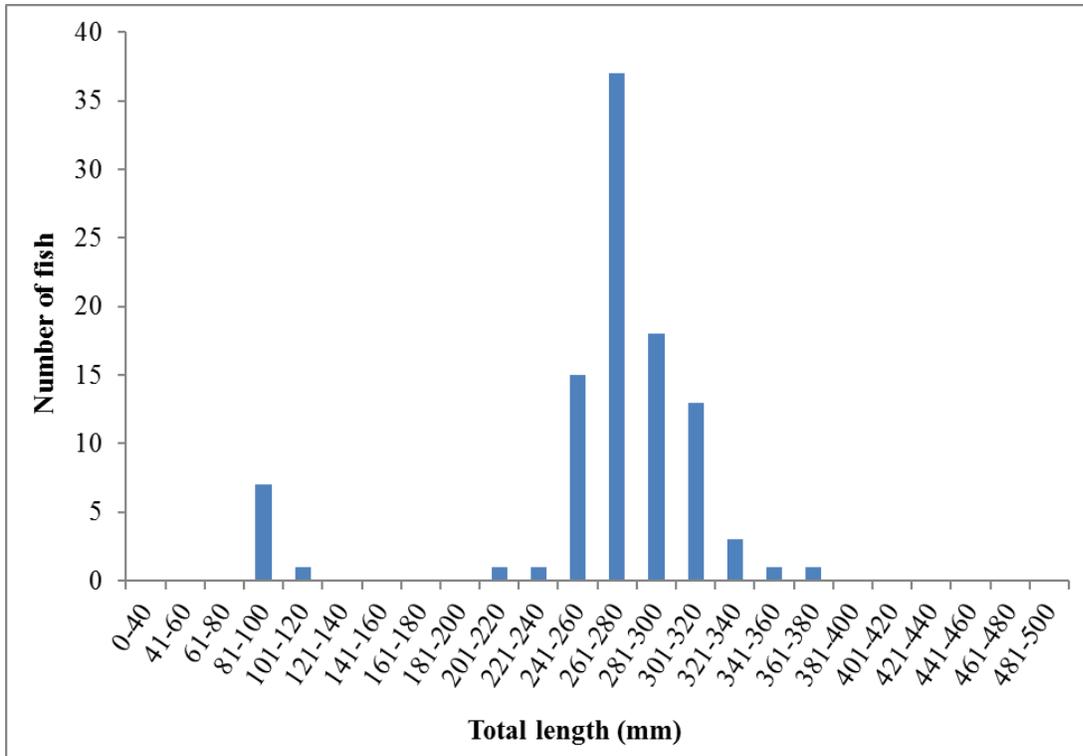


Figure 8. Smallmouth bass length-frequency distribution in Desolation/Gray Canyons, 2017. Number of fish includes captures from one UDWR Moab pass of targeted removal and the ancillary captures from three FWS Project 128 passes.

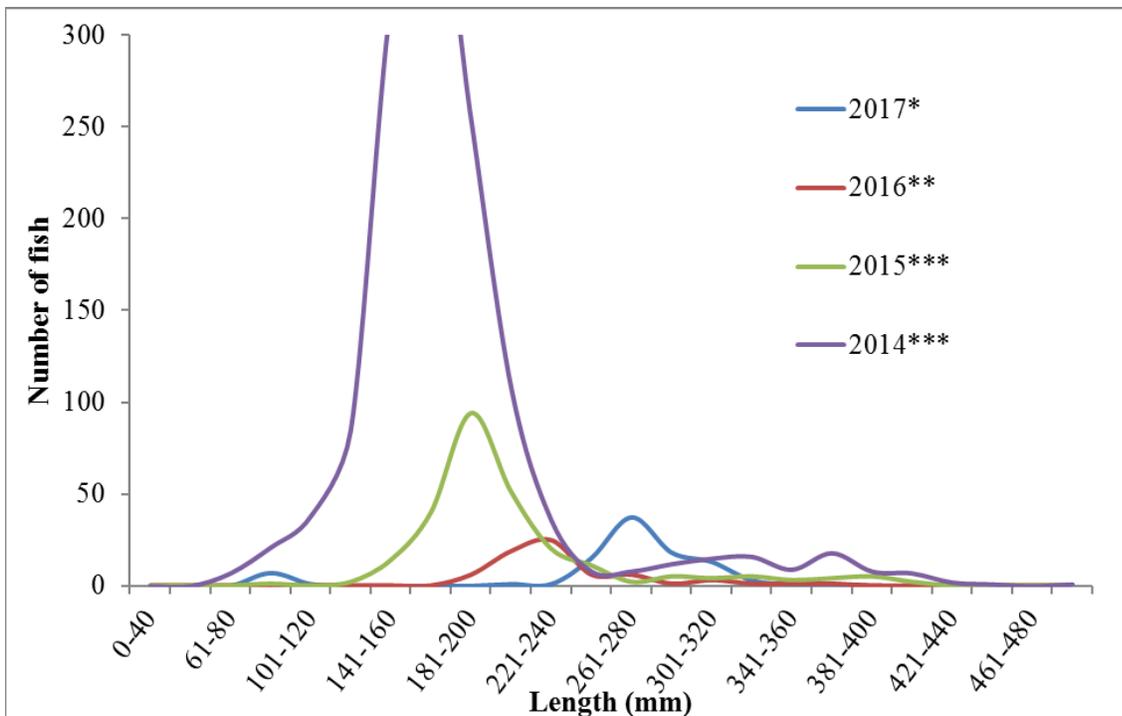


Figure 9. Smallmouth bass length-frequency distribution in Desolation/Gray Canyons, 2014-2017. \*2017 includes captures from one UDWR Moab pass of targeted removal and the ancillary captures from three FWS Project 128 passes. \*\*2016 includes captures from one UDWR Moab targeted removal pass. \*\*\*2015 and 2014 include captures from two UDWR Moab target removal passes

## ANNUAL PERFORMANCE PROGRESS REPORT (PPR)

BUREAU OF RECLAMATION AGREEMENT NUMBER: R15PG00083

UPPER COLORADO RIVER RECOVERY PROGRAM PROJECT NUMBER: 123a

Project Title: Nonnative fish control in the Green River

Principal Investigator: M. Tildon Jones, USFWS  
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Project/Grant Period: Start date: 10/01/2014  
End date: 09/30/2019  
Reporting period end date: 09/30/2017  
Is this the final report? Yes  No

### Performance:

USFWS completed all eight passes identified in task 1. These passes were conducted between late June and early September, as flows were declining and water temperatures were more conducive to capturing smallmouth bass. This report satisfies the reporting and analysis requirements of task 6. All work identified in the scope of work for 2017 has been completed.

## ANNUAL PERFORMANCE PROGRESS REPORT (PPR)

BUREAU OF RECLAMATION AGREEMENT NUMBER: R14AP00007

UPPER COLORADO RIVER RECOVERY PROGRAM PROJECT NUMBER: 123a

Project Title: Nonnative fish control in the Green River

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Project/Grant Period: Start date: 05/01/2014  
End date: 09/30/2018  
Reporting period end date: 10/30/2017  
Is this the final report? Yes \_\_\_\_\_ No X

### Performance:

**Task 2 was completed:** *Six passes were successfully completed (7/11-7/14/17, 7/14-7/16/17, 7/25-7/28/17, 7/28-7/31/17, 8/8-8/11/17, 8/11-8/14/17) on the Green River from Echo Park (RM 344.5) to Split Mountain (RM 319.5). A total of 419 smallmouth bass were captured during these passes. Of these, 52 were marked to obtain a population estimate. All other smallmouth bass were removed from the river along with three black bullhead, 129 brown trout, 76 rainbow trout, 188 green sunfish, nine northern pike, one gizzard shad, two walleye, one yellow perch, three channel catfish (over 450 mm), two creek chub, two white sucker-bluehead sucker hybrids, 18 white sucker-flannelmouth sucker hybrids, and 797 white suckers. These data were analyzed and reported within the annual report for project #123a by November of 2017 (task 6 was completed).*

**Task 3 was completed:** *One removal pass was successfully completed (6/26-7/2/2017) in Desolation and Gray Canyons on the Green River from Sand Wash boat ramp (RM 215.3) to Swasey's boat ramp (RM 129.8). Thirty-six smallmouth bass were removed during this targeted removal pass. Additionally, three brown trout, one creek chub, one channel catfish (over 450 mm), two green sunfish and one walleye were removed. Nine Colorado pikeminnow, six humpback chub, and 36 razorback sucker were also encountered during this effort. These fish were enumerated, measured, tagged and returned to the river. These data were analyzed and reported within the annual report for Project #123a by November of 2017 (task 6 was completed).*

**Task 4 was completed:** *This effort will be reported in Evaluation of Walleye Removal in the Upper Colorado River Basin Annual Report (Michaud et. al.).*

**Task 5 was completed:** *This effort will be reported in Evaluation of Walleye Removal in the Upper Colorado River Basin Annual Report (Michaud et. al.).*