

COLORADO RIVER RECOVERY PROGRAM
FY 2019 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: R19AP00059
Start date: 10/01/2018
End date: 09/30/2023

Reporting period end date: 09/30/2019
Is this the final report? Yes No X

III. Principal Investigators:

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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 ten full passes in the Echo-Split reach and three additional days of effort in Island and Rainbow Parks, resulting in the removal of 1,500 smallmouth bass. UDWR-Moab also tagged and released 56 smallmouth bass on the first pass in order to estimate abundance in this reach. A Lincoln-Petersen model produced a point estimate of 7,879 bass ≥ 100 mm, or 315 bass/mile. UDWR-Moab completed two targeted removal passes in Desolation and Gray Canyons removing 172 bass. Catch rates were similar to the past four years and much lower than 2014. Smallmouth bass distribution in Desolation and Gray Canyons continued to encompass the entire reach with fish concentrated upstream of river mile 160 in Desolation Canyon. Conditions during 2018 appeared to be similar to those that facilitated the large cohort detected in 2014. However, low catch rates during 2019 do not indicate large scale successful spawning of smallmouth bass in 2018.

V. Study Schedule: 2004-ongoing

VI. Relationship to RIPRAP:

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 2019 Tasks and Deliverables, Discussion of Initial Findings and Shortcomings:

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

The USFWS and UDWR Moab (UDWRM) collaborated to complete one marking pass (pass 1) and ten removal passes in the Echo-Split reach between July 6 and September 26 (Table 1). Additional bass removal was conducted using the Surge approach (Hawkins 2010; Breton et al. 2014) in Island and Rainbow Parks by UDWR Vernal (UDWRV) on July 3, 5, and 8. During pass 1, UDWR marked and released 56 bass (4 adults ≥ 200 mm, 52 juveniles 100-199mm). All other passes, including UDWRV's surge efforts, consisted only of removal, and resulted in the capture of 1,444 fish (392 adults, 933 juveniles, and 119 fish < 100 mm). Only 6 individuals or 2.5% of adult SMB caught during passes 1 -10 expressed gametes compared to 4 or 40% of adults caught during surge efforts. We believe the first two passes and surge effort covered at least part of the spawning period for SMB in this reach. Mean water temperatures at the Jensen gage consistently exceeded 16°C beginning June 28 when mean discharge was 11,800 cfs. However, these higher flows appear to have reduced at least some notable SMB spawning habitat such as cutoff side channels in upper Island Park until mid-July.

The overall catch rate for all sizes of bass in 2019 was 6.6 fish/hour, which is moderate in comparison to 2018 (9.06 fish/h) and 2017 (3.19 fish/h). The catch rate for fish ≥ 100 mm (adults and juveniles) was 6.23 bass/hour, which is higher than 2018 and twice that of 2017 (Fig. 1). We captured 1.79 fish/h for adults and 4.44 fish/h for sub-adults when using absolute size classes, not adjusted for growth. Adult values mark an increase in catch rates from 2018. In contrast, catch rates for bass < 100 mm TL were much lower in 2019 than 2018, likely the result of the extended 2019 runoff period, corresponding cooler water temperatures, and a delayed SMB spawn. Catch rates peaked during surge efforts and extended beyond 10 fish/hr in passes 5 and 6 as well (Fig. 2). Overall catch rates by pass were driven by juvenile (100-199 mm TL) numbers; adult catch rates started relatively low, and although variable, peaked in passes 6 and 10.

The size structure of SMB captured in 2019 as displayed in Fig. 3a-b illustrates the influence of juvenile bass on this year's results. A large proportion of bass captured were juveniles ranging from 100-199 mm TL (66%). We believe this reflects successful spawning of SMB in the Yampa River in 2017 and 2018, and these fish entered into this reach (Jones and Caldwell 2017; Jones and Smith 2018). Figure 4 shows the size structure of SMB from selected years. Given what appeared to be favorable conditions for smallmouth bass spawning and growth in 2018, a strong 2018 cohort was expected to be evident in 2019 and beyond as was observed after a similar low water year in 2012. Fortunately this was not realized in total catch, catch rates, or size structure. We also captured 11 bass large enough to be classified as piscivores posing a competitive threat to adult Colorado pikeminnow (Table 1). This metric was noticeably lower than 2018 (n=34) and 2017 (n=28).

In order to estimate the SMB population, we conducted a mark-recapture estimate using Floy tags. UDWR tagged and released 56 bass (52 juveniles, 4 adults) during pass 1 (6-9 July). We then used recaptures (n=8) from passes 2-4 (9 July-26 July) to derive a Lincoln-Petersen estimate for bass ≥ 100 mm. The estimate resulted in a point estimate of 5,909 fish (236 fish/mile, Table 2), with a large confidence interval and high coefficient of variation. Despite this imprecise estimate, 2018 and 2019 estimates are significantly greater than estimates from 2016-2017 (Fig. 6). A total of 8 tagged bass were recaptured across all passes, which represents 14% of the bass marked. We also recaptured nine SMB that were tagged in 2018. These fish grew an average TL of 56 mm within the past year.

We collected ten additional species of nonnative fishes, including black bullhead, black crappie, one burbot, creek chub, green sunfish, northern pike, walleye, white sucker and hybrids, and one yellow perch (Table 3). In general, nonnative ancillary captures decreased from 2018, most notably white sucker and white sucker hybrid captures. The single burbot was captured near the entrance of Mitten Park (RM 342.9). It measured 474mm and 662g. This individual was preserved for documentation along with a fin clip for possible genetic analysis. The yellow perch was caught in Split Mountain and could have possibly escaped nearby Red Fleet Reservoir during the 2019 spilling period. Unfortunately this fish was not preserved. Of the 16 northern pike captured, only 12 were large enough to classify as piscivores. Only three walleye were captured this year, marking a significant decrease for the species in this reach which began in 2018.

Task 3: Smallmouth bass removal- Desolation and Gray Canyons

UDWR-Moab completed two targeted smallmouth bass removal electrofishing passes in Desolation and Gray Canyons beginning at Tabyago Riffle (RM 207) and ending at Swasey's Rapid (RM 132) from June 20 – June 25 and from August 15 – 21, 2019. Overall, 172 bass were removed (1.5 fish/hour; Figure 7) for an average of 1.3 bass per river mile.

During the first pass, 38 smallmouth bass were removed with a total effort of 47.1 hours of electrofishing (0.8 fish/hour). River discharge decreased during the pass from 28,700 to 24,100 cu. ft./sec. (USGS Gauge 09315000 in Green River, UT) and water

temperatures measured on-site ranged from 15.6 – 17.4 degrees Celsius.

During the second pass, 134 smallmouth bass were removed with a total effort of 69.5 hours of electrofishing (1.9 fish/hour). River discharge remained stable during the pass ranging from 2,940 to 2,850 cu. ft./sec. (USGS Gauge 09315000 in Green River, UT) and water temperatures measured on-site ranged from 21.8 – 25.5 degrees Celsius.

Targeted smallmouth bass removal catch rates in 2019 was similar to the previous four years (Figure 7) and lower than 2014. Smallmouth bass continue to occupy the entire Desolation/Gray reach. However, fish appear to be concentrated in the upstream portion of the reach. During 2019 targeted removal 79% of bass removed were captured in Desolation Canyon upstream of river mile 160.

Smallmouth bass from multiple size classes were present in 2019 sampling (Figure 8). Piscivorous adult bass over 325 mm in total length comprised 13% of the total catch, adults from 200-324 mm comprised 21%, and juveniles less than 199 mm comprised 66% (97% 100 – 199 mm; 3% < 100 mm). Given that multiple size classes were present, some smallmouth bass recruitment appears to be occurring in the reach. However, the large 2014 cohort appears to be in decline and no substantial cohort appears to have resulted from the low flow of 2018 (Figure 8). No fish were observed actively spawning but three smallmouth bass were found to be females containing eggs.

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 (123d; Michaud et. al. 2019).

Task 6: Data entry, analysis and reporting

Data has been entered and submitted to the database manager. This report will serve as the annual progress report including a summary of the 2019 data.

VIII. Additional noteworthy observations:

Echo-Split Reach

Several threatened or endangered species were captured including 7 Colorado pikeminnow (three were recaptures), 21 recently stocked bonytail, 5 roundtail chub, and three razorback sucker (all recaptures). Among the razorback sucker was one individual that had not been encountered since it was stocked at Green River, Utah (RM 120) in 2013 (STReAMS database search 12 Nov. 2019).

Desolation and Gray Canyons

Endangered species encounters during targeted removal passes include 72 razorback sucker (70 were recaptures), 18 Colorado pikeminnow (seven were recaptures), 12 humpback chub (two were recaptures) and two bonytail (all recaptures).

IX. Recommendations:

Echo-Split Reach

- Continue smallmouth bass removal at current levels
- Coordinate targeted sampling to disrupt bass spawning 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 the distribution of smallmouth bass in Desolation and Gray Canyons provides important information so appropriate management decisions can be made if smallmouth bass are found to expand their range into the critical endangered fish nursery and spawning habitat of the Lower Green River.
- We recommend returning to a single targeted removal pass in Desolation and Gray Canyons in 2020 with the option of scheduling a second pass if the need arises (keeping two passes in the budget). A single targeted removal pass appears to be sufficient to monitor distribution and spawning success of smallmouth bass in the reach. However, situations such as poor sampling due to flow conditions, equipment malfunction, or the discovery of a concentration of non-native predators would be instances when a second pass would be useful. If a second pass is not needed the effort can be reallocated to the Echo Park to Split Mountain reach.

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 2019 Budget Status

- A. Funds Provided: \$191,495
- B. Funds Expended: \$191,495
- C. Difference: -0-
- D. Percent of the FY 2019 work completed: 100%
- E. Recovery Program funds spent for publication charges: -0-

XII. Status of Data Submission:

USFWS- data are compiled and have been submitted to database manager.

UDWR- data have been compiled and submitted to the database manager.

XIII. Signed:

Chris Smith and John Caldwell
Principal Investigators

15 Nov. 2019
Date

Literature Cited:

Breton, A.R., D.L. Winkelman, J.A. Hawkins, and K.R. Bestgen, 2014. Population trends of smallmouth bass in the upper Colorado River basin with an evaluation of removal effects. Final report to the Upper Colorado River Endangered Fish Recovery Program, Denver, CO. Larval Fish Laboratory Contribution 169.

Hawkins, J.A. 2010. Evaluation of smallmouth bass and northern pike management in the middle Yampa River. Project 125. 2010 Annual Report to the Colorado River Endangered Fish Recovery Program, U.S. Fish and Wildlife Service, Denver, CO.

Jones, M.T. and J. Caldwell. 2017. Nonnative fish control in the Green River. Project 123a annual report to the Upper Colorado River Endangered Fish Recovery Program, U. S. Fish and Wildlife Service, Denver, CO.

Jones, M.T. and C. Smith. 2018. Smallmouth bass control in the lower Yampa River. Project 110 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, 2019. Piscivores are adult fish above the 325mm threshold. ¹During Surge pass, only Island and Rainbow Park were sampled. ²Adult and sub-adult smallmouth bass were tagged and released on pass 1.

Pass-Agency, Date	<100 mm	Juveniles	Adults	Piscivores	Total
1-UDWRM, 6-9 July	4	53	4	1	61
2-UDWRM, 9-12 July	6	55	6	2	67
3-UDWRM, 20-23 July	10	135	33	2	178
4-UDWRM, 23-26 July	6	61	20	0	87
5-FWS, 13-15 August	1	191	49	5	241
6-FWS, 20-22 August	1	170	69	0	240
7-FWS, 27-29 August	0	50	21	0	71
8-FWS, 3-5 September	2	81	56	4	139
9-FWS, 10-12 September	43	66	61	0	170
10-FWS, 24-26 September	32	52	67	2	151
Surge-UDWRV, 3,5, & 8 July	14	71	10	1	95
Totals	119	985	396	17	1500

Table 2. Abundance estimates for smallmouth bass, 2019.

Size class	Method	Abundance	95% CI	SE	Fish/mile
All bass \geq 100mm	Lincoln-Petersen	5,909	29-11,789	5880	236

Table 3. Ancillary fish captures in the Echo-Split study reach, 2019. Piscivores are northern pike >450mm and walleye >375mm.

Species	Number Captured	Piscivores
Black bullhead (<i>Ameiurus melas</i>)	1	
Black crappie (<i>Pomoxis nigromaculatus</i>)	11	
Burbot (<i>Lota lota</i>)	1	
Channel catfish (<i>Ictalurus punctatus</i>)	30	
Creek chub (<i>Semotilus atromaculatus</i>)	30	
Green sunfish (<i>Lepomis cyanellus</i>)	41	
White sucker and hybrids (<i>Catostomus commersonii</i>)	572	
Northern pike (<i>Esox lucius</i>)	16	12
Walleye (<i>Sander vitreus</i>)	3	3
Yellow perch (<i>Perca flavescens</i>)	1	
Colorado pikeminnow (<i>Ptychocheilus lucius</i>)	7	
Bonytail (<i>Gila elegans</i>)	21	
Roundtail chub (<i>Gila robusta</i>)	5	
Razorback sucker (<i>Xyrauchen texanus</i>)	3	

Razorback x flannelmouth hybrids (<i>X. texanus</i> x <i>Catostomus latipinnis</i>)	1
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Table 4. Project 123a ancillary fish captures in Desolation and Gray Canyons, 2019.

Species	Number Captured
Black bullhead (<i>Ameiurus melas</i>)	3
Black crappie (<i>Pomoxis nigromaculatus</i>)	3
Brown trout (<i>Salmo trutta</i>)	1
Channel catfish >450 mm (<i>Ictalurus punctatus</i>)	1
Green sunfish (<i>Lepomis cyanellus</i>)	9
Walleye (<i>Sander vitreus</i>)	2
White sucker (<i>Catostomus commersonii</i>)	3
Bonytail (<i>Gila elegans</i>)	2
Colorado pikeminnow (<i>Ptychocheilus lucius</i>)	18
Humpback chub (<i>Gila cypha</i>)	12
Razorback sucker (<i>Xyrauchen texanus</i>)	72

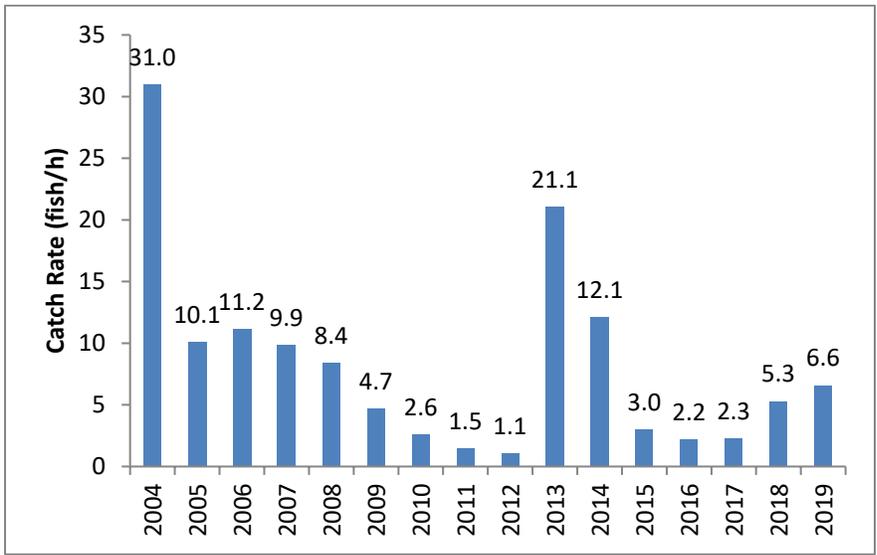


Figure 1. Catch rates for all bass >100mm in the Echo-Split reach, 2004-2019.

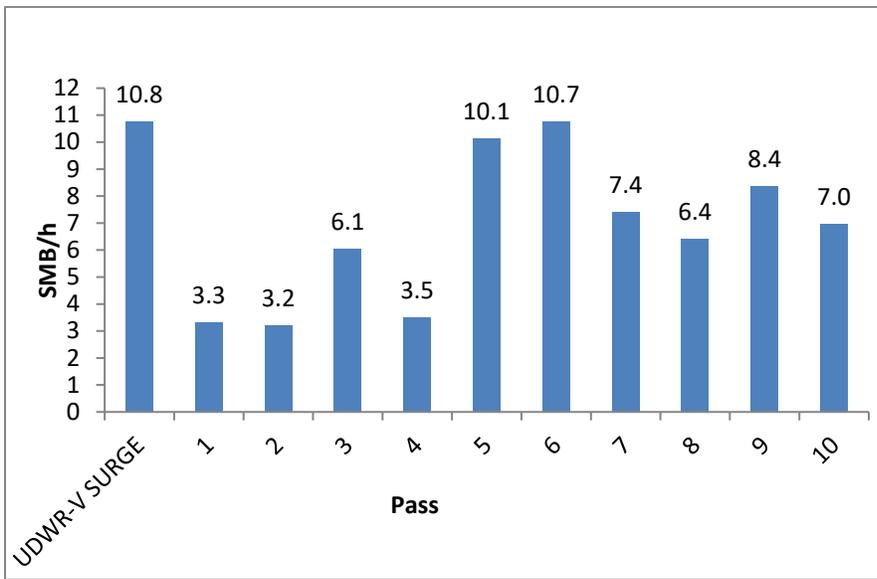


Figure 2. Catch rates by pass for all bass \geq 100mm, Echo-Split reach 2019.

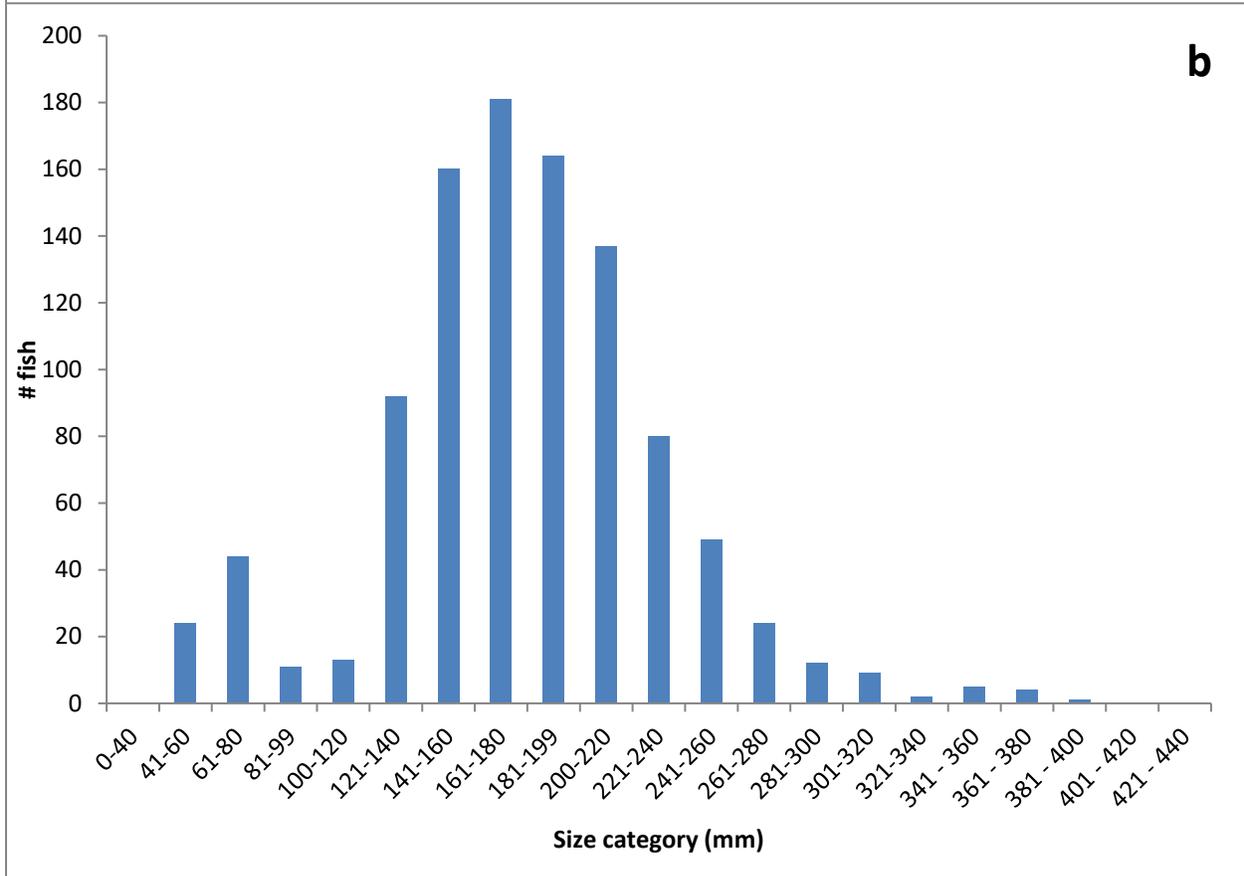
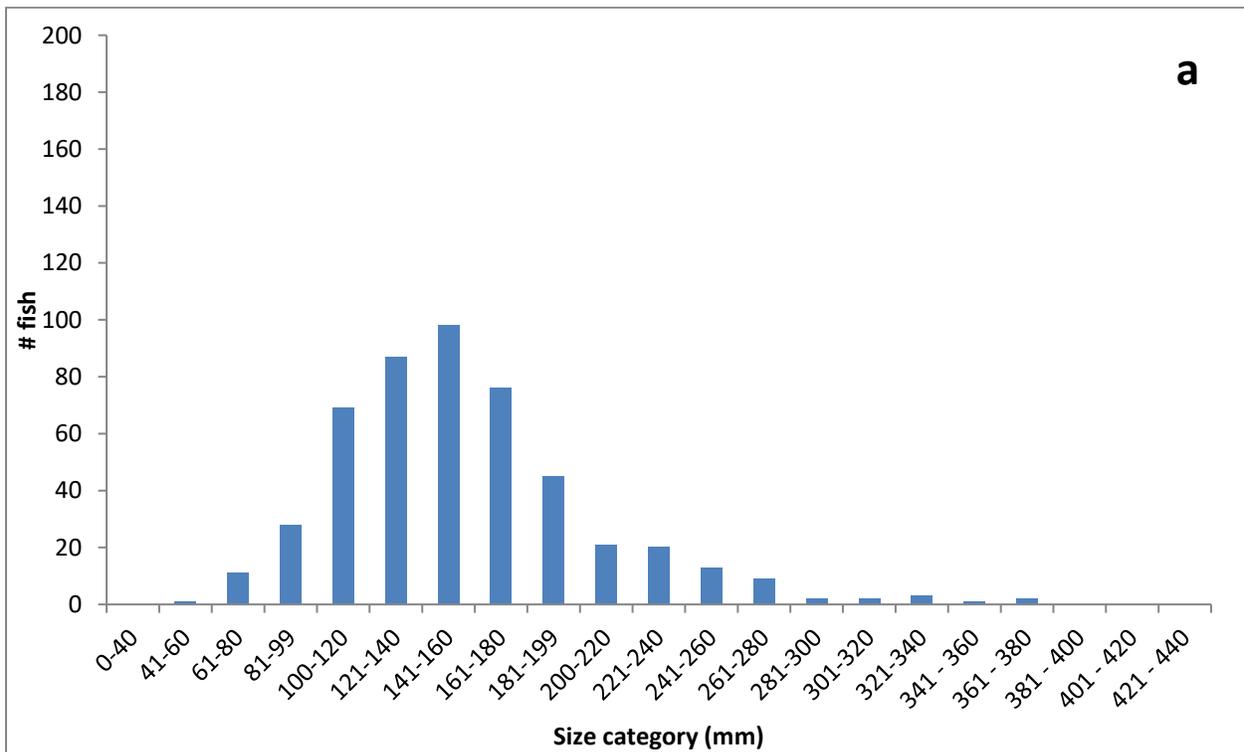


Figure 3a-b. Length-frequency histograms for smallmouth bass captured in July (passes 1-4, Fig. 3a) and August-September (passes 5-10, Fig. 3b), Echo-Split reach 2019.

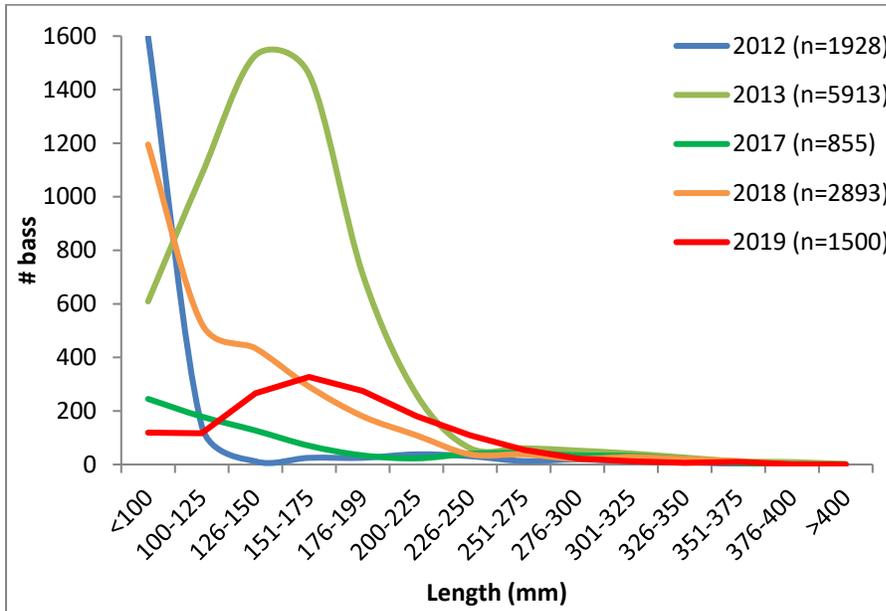


Figure 4. Length-frequency of smallmouth bass in Echo-Split, 2012-2013, 2017-2019.

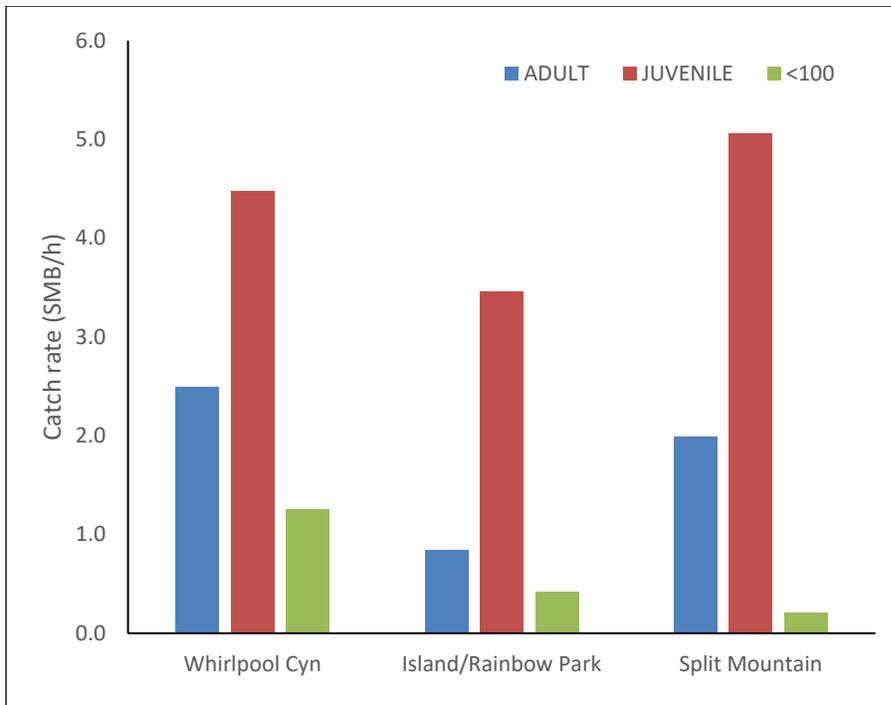


Figure 5. Catch rates by size class and reach for Echo Park to Split Mountain, 2019.

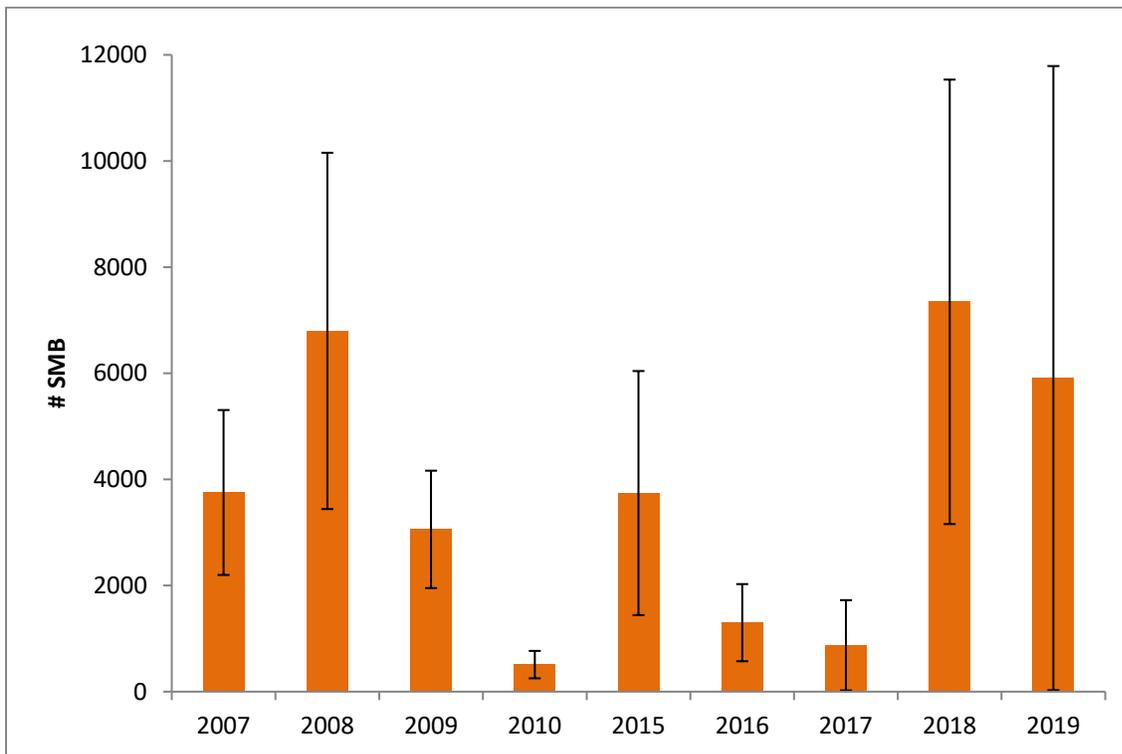


Figure 6. Abundance estimates with 95% confidence intervals for smallmouth bass in the Echo-Split reach, 2007-2010 and 2015-2019.

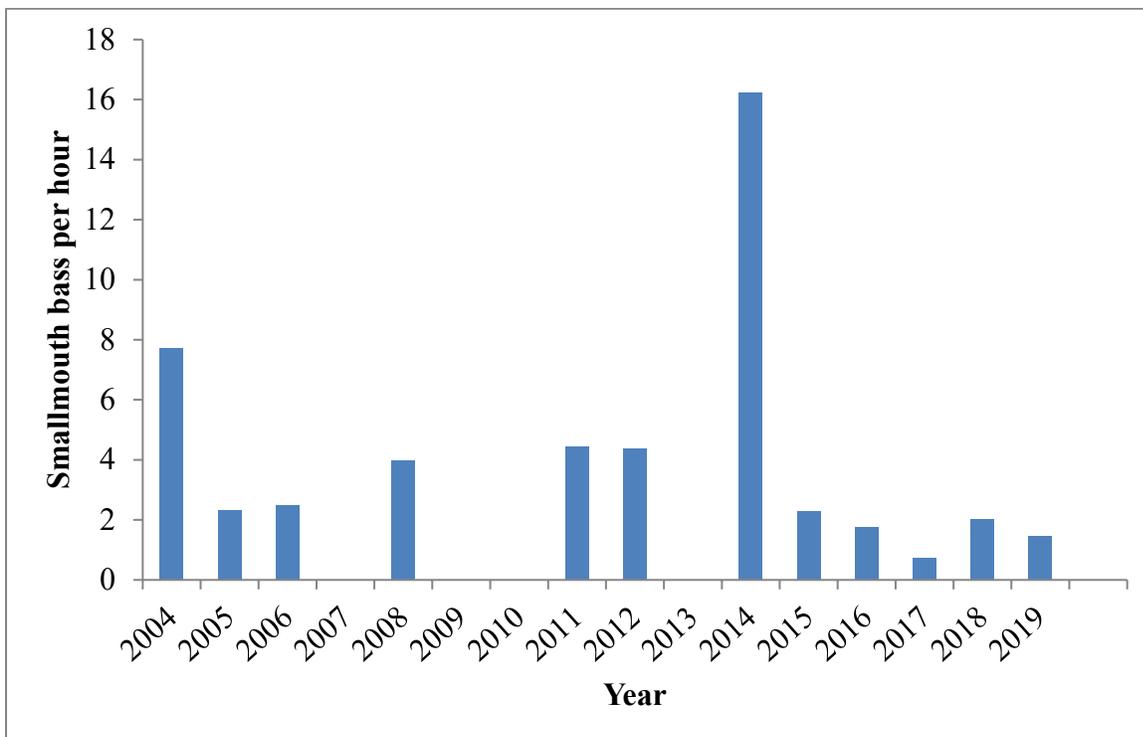


Figure 7. Catch per unit effort (fish per hour) from targeted smallmouth bass removal in Desolation and Gray Canyons, 2004 – 2019.

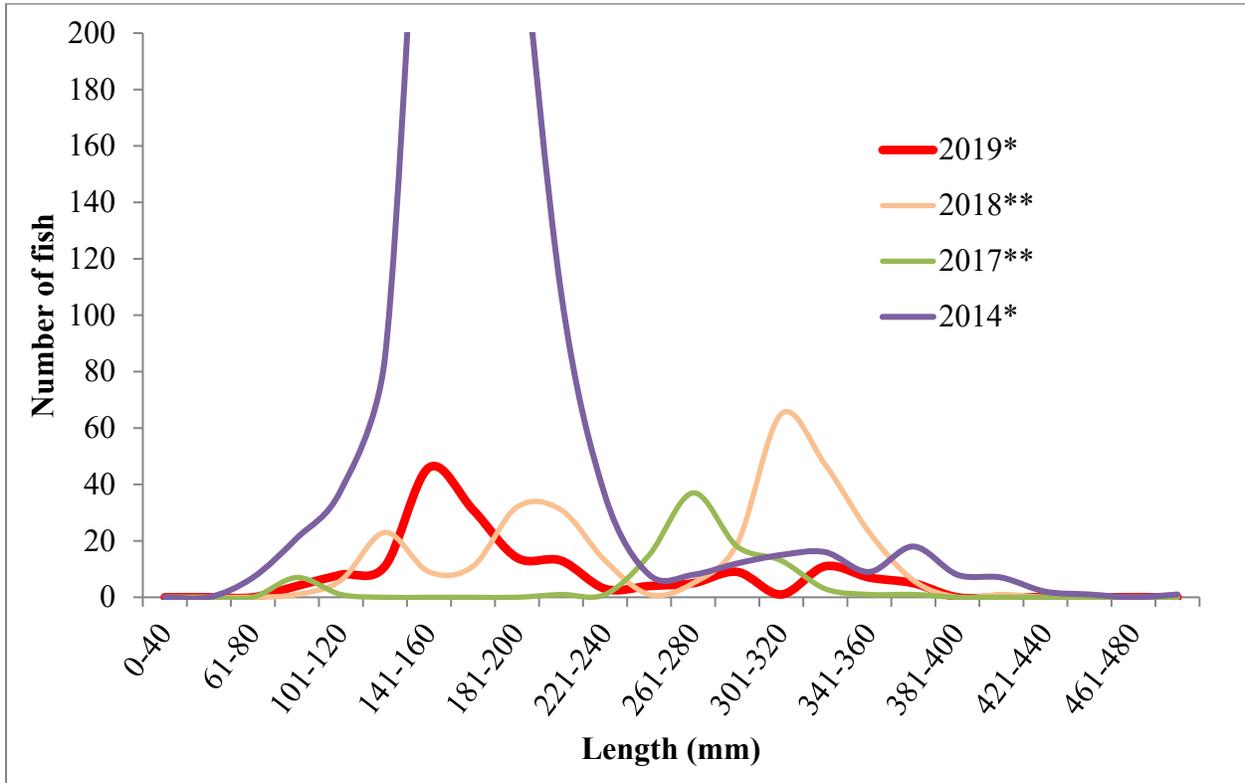


Figure 8. Smallmouth bass length-frequency distribution in Desolation and Gray Canyons, 2014, and 2017-2019. 2014 is included for comparison.*2019 and 2014 include captures from two UDWR Moab targeted removal passes; **2018 and 2017 include captures from one UDWR Moab targeted removal pass and the ancillary captures from three FWS Project 128 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: Christian Smith, USFWS
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Project/Grant Period: Start date: 10/01/2014
End date: 09/30/2019
Reporting period end date: 09/30/2019
Is this the final report? Yes No

Performance:

USFWS completed six of eight passes identified in task 1. These passes were conducted between early August and late September as flows during the base flow period when water temperatures were conducive to capturing smallmouth bass. This report satisfies the reporting and analysis requirements of task 6, and all data have been submitted to the Recovery Program database manager for inclusion into the STReAMS database. All work identified in the scope of work for 2019 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

Principal Investigator: *John Caldwell*
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Project/Grant Period: Start date: 05/01/2014
End date: 09/30/2019
Reporting period end date: 10/30/2019
Is this the final report? Yes _____ No X

Performance:

Task 2 was completed: *Four passes were successfully completed (7/6 – 7/9/19, 7/9 – 7/12/19, 7/20 – 7/23/19, 7/23 – 7/26/19) on the Green River from Echo Park (RM 344.5) to Split Mountain (RM 319.5). A total of 393 smallmouth bass were captured during these passes. Of these, 56 were marked to obtain a population estimate. All other smallmouth bass were removed from the river along with one black bullhead, two black crappie, 18 brown trout, three channel catfish (over 450 mm), 30 creek chub, 23 green sunfish, four northern pike, 25 rainbow trout, and 238 white sucker and white sucker hybrids. These data were analyzed and reported within the annual report for project #123a by November of 2019 (Task 4 was completed).*

Task 3 was completed: *Two removal passes were successfully completed (6/20 – 6/25/2019, 8/15 – 8/21/2019) in Desolation and Gray Canyons on the Green River from Sand Wash boat ramp (RM 215.3) to Swasey's boat ramp (RM 132). A total of 172 smallmouth bass were removed during this targeted removal pass. Additionally, three black bullhead, three black crappie, one brown trout, one channel catfish (over 450 mm), nine green sunfish, two walleye, and three white suckers were removed. Eighteen Colorado pikeminnow, twelve humpback chub, two bonytail, and 72 razorback sucker were also encountered during this effort. These endangered species were enumerated, measured, tagged (if not already) and returned to the river. These data were analyzed and reported within the annual report for Project #123a by November of 2019 (Task 4 was completed).*