COLORADO RIVER RECOVERY PROGRAM
FY 2015 ANNUAL PROJECT REPORT

RECOVERY PROGRAM
PROJECT NUMBER: 126a and 126b

I. Project Title: **Removal of Smallmouth Bass in the Upper Colorado River between Price-Stubb Dam near Palisade, Colorado, and Westwater, Utah.**

II. Bureau of Reclamation Agreement Number(s): R15PG400083

Project/Grant Period:
Start date (Mo/Day/Yr): 10/1/2014
End date: (Mo/Day/Yr): 9/30/2019
Reporting period end date: 9/30/2015
Is this the final report? Yes _____ No _X_

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IV. Abstract: The purpose of this study is to remove as many nonnative smallmouth bass as possible, of all size-classes, from main channel riverine habitats in two distinct sections of the Colorado River: 1) a 66-mile reach from between the Grand Valley Water User's (GVWU) dam in CO, downstream to the Westwater boat landing in eastern UT; and 2) a 45-mile reach between Rifle and Beavertail Mountain in CO. This is the twelfth year of this study, which started in 2004. Although we were tasked with completing eight passes in these reaches, we were able to complete up to eleven passes in some reaches based on extra available resources. 2015 is the first year that an additional walleye removal component was fully funded. These removal efforts covered a 64-mile reach from Cisco boat landing in Eastern UT downstream to Potash boat landing. We also began experimental nonnative fish removal in a few gravel pit ponds that serve as grow out ponds for our hatchery reared endangered fish. CDOT pond (in Debeque Canyon), Beswicks pond (near Clifton, CO), and Butch Craig pond (on the Gunnison River near Whitewater, CO) were our primary focus in 2015.

In our riverine sections we removed 542 smallmouth bass, 1,425 largemouth bass, 75 walleye, and various amounts of other nonnative fish in 2015. Catches of age-0 smallmouth bass indicate a weak year class (< 100 mm) was produced in 2015 in the Grand Valley reaches of the Upper Colorado. However, the young-of-year (YOY) smallmouth bass that were able to survive experienced many more degree days greater than 13.9° (Celsius) prior to winter and have a good chance of surviving until next spring (Figure 10). The catch rate for YOY and juvenile size smallmouth bass < 100 mm increased (40%) from 2014. The catch rate for adult smallmouth bass > 200 mm decreased (43%) from 2014. Catches of largemouth bass from 2012 through 2015 suggest that survival of juvenile largemouth bass to adults in the river is relatively low.

Removal efforts for walleye demonstrated similar catch rates when comparing fall and spring in 2015. All walleye captured were adults. Adult walleye pose a particularly high threat to native species recovery because of their overlapping niche (with Colorado pikeminnow) and their high predatory threat (with all native fishes). This was demonstrated by the discovery of three juvenile Colorado pikeminnow (*Ptychochelius lucius* {2014 (n=2), 2015 (n=1)}) and four bonytail (*Gila elegans*{2014 (n=1); 2015 (n=3)}) in the stomachs of walleye.

V. Study Schedule: 2004-Ongoing

VI. Relationship to RIPRAP:

Colorado River Action Plan: Mainstem

III. Reduce negative impacts of nonnative fishes and sportfish management activities.

III.A. Develop and implement control programs in reaches of the Colorado River occupied by endangered fishes.

VII. Accomplishment of FY 2015 Tasks and Deliverables, Discussion of Initial Findings and Shortcomings:

Task 1.

Remove all sizes of smallmouth bass, other centrarchids, and other nonnative species as deemed appropriate and described in state (Colorado and Utah) collection permits.

Task completed. The FY 2015, 126a scope of work, called for eight removal passes in the Grand Valley. However, with additional employees and equipment available we expanded our effort from eight to eleven passes, depending upon the reach (see methodology below). In one river reach (Price-Stubb to Riverbend Park) we completed only seven passes. This was due to very low river flows, which made this river reach impassable to electrofishing boats for most of the August through October time period. The FY 2015, 126b scope of work, called for one removal pass from Silt to Beavertail Tunnel and this work was completed.

All age groups of smallmouth bass (age-0, juveniles, and adults) were present in the 2015 summer/fall collections. These ranged from age-0 (23 mm) to adult (454 mm) fish with a mean of 201 mm. However, adult smallmouth bass ($\geq$ 200 mm) made up a larger proportion of our total catch when compared to the last 4 years (59%; Figure1). A total of 542 smallmouth bass were removed, including 25 considered piscivorous competitors to Colorado pikeminnow ($\geq$ 325 mm). A weak year class of smallmouth bass (< 100 mm) was produced, in 2015, in the Grand Valley reaches of the Upper Colorado, as only 123 were collected and removed (Figure 4). In fact, the catch rate for YOY/juvenile size fish < 100 mm only increased slightly from 0.17 fish/hr (2014) to 0.28 fish/hr, similar to catch rates during 2004, 2008, 2009 and 2011 (Figure 6). During 2015, the catch rate for juvenile and adult size classes of smallmouth bass declined ($\geq$ 200 mm {42%}, 100-199 mm {73%}) from the 2014 catch rates, most likely in response to

two years of larger in magnitude and longer in duration spring runoffs when compared to recent years. In 2014 and 2015, the highest rate of removing Upper Colorado River Endangered Fish Recovery Program (UCRRP) defined 'piscivorous sized (> 325 mm)' smallmouth bass occurred from Cisco, UT to Coates Creek, UT at 0.6 and 0.3 fish/hr (2014{n=11}, 2015{n=7}; Figure 4).

A total of 1,425 largemouth bass were removed from all reaches, in 2015, a substantial decrease from 2012's catch (n=5,227, Table 2), but similar to 2013 and 2014's catch. Our catch ranged from age-0 fish (35 mm) to adult fish (415 mm) with a mean of 109 mm (Figure 2). Sixteen were of piscivore size ($\geq$ 325 mm TL) and are considered a competitive threat to Colorado pikeminnow. Our catch was also proportionate in size classes to our 2014 catch: 96% (n = 1,370) were less than 250 mm, 60% (n = 861) were less than 100 mm and only 4% (n = 55) were adults greater than 250 mm. Data from 2013 through 2015 suggest that the rate of survival for juvenile largemouth bass recruiting into adulthood in the river is relatively low, based on the very low numbers of adult largemouth bass (> 250 mm) observed in our electrofishing collections versus the comparatively high number of juvenile largemouth bass in those same collections.

A total of 75 walleye were removed from Cisco to Potash, UT, in Fall 2015. This is a decrease from 2014's catch (n=107; Table 3, Figure 3). Our catch consisted completely of adults fish, with total lengths ranging from 303-626 mm (mean = 495 mm; Figure 3). Our spring 2015 removal efforts, conducted from Cisco, UT downstream to the confluence of the Green River during spring/summer Colorado pikeminnow abundance estimation sampling, resulted in 83 walleye removed (Table 3, Figure 3). This is a substantial decrease from the 2013 catch (n = 268), but a less severe decrease from the 2014 catch (n = 109) during similar sampling efforts conducted during the spring/summer of those years.

Large numbers (n = 368) of walleye captured during our spring 2013 and 2014 Colorado pikeminnow collections in lower reaches of the Colorado River (RMI 111.0 to 0.0) warranted additional investigation in these reaches during the summer and fall. In fall 2015, four full passes from Cisco to Potash, UT (RMI 111 to 47.2) were completed.

Task 2. a) Analyze data; b) Prepare annual RIP reports.

B. Findings (2015 Highlights) General

Study Direction. The removal of centrachids from the Colorado and Gunnison rivers under Recovery Program guidance began in 2004. From 2004 to 2011, the Grand Valley portion of the study area encompassed a 61-mile section of the Colorado River in western Colorado from the Price-Stubb Dam downstream to the Westwater, UT BLM River Ranger Station. It also included a 2.3-mile section of the Lower Gunnison River from the Redlands Diversion Dam to the Colorado/Gunnison River confluence. In 2014 and 2015, the study area was lengthened 72 miles to include river segments from GVWU dam (RMI 193.7) to Price-Stubb

dam (RMI 188.3), Westwater Ranger Station, UT (RMI 127.6) to Westwater Wash (RMI 124.8), and Cisco boat launch, UT (RMI 111.0) to Potash boat launch, UT (RMI 47.2).

Upstream portions of the study area have changed over time as well. From 2004-2006, a 45-mile reach of the Upper Colorado River from the Rifle Bridge (RMI 240.4) to Beavertail Mountain in Debeque Canyon (RMI 195.7) was sampled with raft electrofishing. In 2007 and 2008, a 7.6-mile reach from Silt to the Rifle Bridge was added to assess distribution of smallmouth bass upstream of Rifle. This reach was eliminated from sampling in 2009 because only one smallmouth bass was collected in this reach in 2007 and 2008. During 2011, the number of passes in the Rifle Bridge to Beavertail Mountain reach was reduced from three to one. The only reaches sampled during 2011 were from Rifle to Rulison and Rulison to Cottonwood Park boat landing at Parachute, CO (RM 222.2). Starting in 2012 and continuing through 2014, CPW conducted all of the removal (see PPR) from Silt to Beavertail Mountain. Starting in 2015, UDWR conducted additional removal passes from Westwater Ranger Station to Fish Ford, UT (RMI127.7-105.7; see PPR).

Beginning in 2013, project study goals were slightly modified (from those specified for 2007- 2012 sampling). An abundance estimate for juvenile (100-199 mm) and adult (≥ 200 mm) smallmouth bass in concentration areas of the Grand Valley reaches of the Upper Colorado and Lower Gunnison rivers was calculated in 2006-2012; however, an abundance estimate was not calculated from 2013-2015. Catch per effort (CPE) has been calculated for all years of the study, throughout all of the reaches, including 2015, as a metric to compare yearly fluctuations of nonnative fish populations and size classes.

Methodology

General

In 2015, up to 11 removal passes were made using raft-based or aluminum jet powered Jon boat electrofishing to collect nonnative fishes in the Colorado and Gunnison Rivers in Colorado and Utah (Table 7). Colorado Parks and Wildlife (CPW) performed the removal between Rifle and Beavertail Mountain, while the U.S. Fish and Wildlife Service (FWS), Colorado River Fishery Project office performed all but one of the other sampling passes. Utah Division of Wildlife Resources (UDWR, Moab Field Station) completed one fall removal pass between Westwater Ranger Station and Fish Ford, UT. Two electrofishing boats were used in all river segments during the removal passes.

Although smallmouth bass and walleye were our target fish for removal during this project, many other nonnative fishes encountered were collected and removed. These fishes included largemouth bass, green sunfish, bluegill, black crappie, gizzard shad, grass carp, walleye, perch, and northern pike. Since 2013, the majority of white sucker and white sucker x native sucker hybrids encountered have also been collected and removed (Figure 8). All fishes removed were frozen and then taken to the Mesa County landfill, near Grand Junction, CO.

Number of individuals collected, total length, and weight were recorded for most non-native fishes caught and removed. Capture date and corresponding river mile for each nonnative fish collected were recorded along with effort expended (i.e., time electrofished in seconds, then converted to number of hours electrofished).

Catch Rate

Catch rate or catch/effort (CPE) is often used as an index of population size if it is consistently proportional to absolute abundance (Ricker 1975). Unfortunately, catch/effort can be highly variable and is not the most reliable metric for population analyses or comparing trends in population abundance densities among years (Hangsleben et al. 2013). It is more likely that unexplained variations in capture probability or "catchability" (not catch per unit of effort per se) preclude the use of catch per unit of effort as an abundance estimate. However, it was determined during the UCRRP 2012 Nonnative Workshop that CPE will suffice as an index of population size during most years (starting in 2013), and that during a yet to be determined interval (e.g., every third year) a mark-recapture abundance estimate will be performed to track actual abundance of smallmouth and largemouth bass in the Colorado River.

The initial study objective (during 2004 and 2005) was to lethally remove as many smallmouth bass and other centrarchids as possible; as such, fish were not marked nor released and a population estimate was not possible. For those years' data, effort was recorded, catch/effort (CPE) was calculated, and CPE was used to monitor increases and declines in centrarchid populations. To determine if densities of smallmouth bass and largemouth bass were being depleted as a result of the removal effort, catch effort indices (e.g., fish/hr) over time (i.e., by pass) in each river sub-reach were calculated and interpreted. Since population estimates for smallmouth bass were not available for 2004, 2005, and now 2013-2015, catch/effort was computed for use as a trend to compare annual abundance of smallmouth bass and other centrarchids during the entire 2004-2013 time period. This was possible because effort expended was recorded during all sampling years. Where abundance estimates were not performed for a population statistic, catch/effort was a useful metric in comparing relative abundance and interpreting year class strengths among years, particularly for juvenile smallmouth and largemouth bass (< 100 mm, Tables 1-2 & 4; Figures 4-7).

Results and Conclusions

Results presented herein are a compilation of the efforts of the FWS in the Grand Valley reaches, Ruby-Horsethief reaches, and Cisco to Potash reaches of the Upper Colorado River during 2015. Removal passes performed by the CPW in the Upper Colorado River between Silt and Beavertail Mountain are also reported here. UDWR results can be found in their appended PPR. Data are presented for main channel habitats only. This includes backwaters that are hydrologically connected to the mainstem river. Integration and comparison of results from earlier years (2004-2014) of this study are provided where appropriate.

Size Distribution–Length Frequency:

Smallmouth Bass

Length frequency distribution of all sizes of smallmouth bass collected, by CPW and FWS, with electrofishing during 2015 between Rifle, CO and Potash, UT were plotted (Figure 1). All age groups of smallmouth bass (age-0, juveniles, and adults) were present in the 2015 summer/fall collections. These ranged from age-0 (23 mm) to adult (454 mm) fish with a mean total length of 201 mm. A total of 542 smallmouth bass were removed, including 25

considered to be piscivourous competitors to Colorado pikeminnow (≥ 325mm). A weak year class of smallmouth bass (< 100 mm) was produced in 2015 in the Grand Valley reaches of the Upper Colorado, when considering only 123 were collected and removed (Figure 4). However, adult smallmouth bass (≥ 200 mm) made up a larger proportion of our total catch when compared to the last 4 years (59% {n = 318/540}; Figure 1).

In 2009, age-0 smallmouth bass were first detected in the Grand Valley reaches starting in mid-August (39 mm TL). Length frequency comparison between 2008 (see 2008 annual report no. 126(a)) and 2009 suggest that the 2009 year class may be stronger than 2008. However, overall catch rates for juvenile smallmouth bass (< 100 mm) in the Grand Valley sections of the Upper Colorado and Lower Gunnison rivers are almost identical during these two years (Figure 6).

However, in 2010, there was some reason for concern. The highest number of juvenile smallmouth bass (< 100 mm) from the Grand Valley reaches of the Upper Colorado and Lower Gunnison rivers during this eight-year study was collected in 2010. The catch rate for this juvenile size class of fish (C/E=5.82fish/hr, n=2,054) exceeded catches during the 2007 removal passes (C/E=4.15fish/hr, n=1,358) (Table 1). A strong year class of smallmouth bass was produced in 2007 which was documented throughout upper Colorado River basin rivers. During the 2010 marking pass in the Grand Valley reaches, age-0 smallmouth bass were first detected during the last week of July (31 mm).

In 2014 and 2015, the catch rate for juvenile size fish < 100 mm declined precipitously (80%) from 2013 from 3.33 fish/hr to 0.17 and 0.28 fish/hr, similar to catch rates during 2004, 2008, 2009 and 2011 (Figure 6). The hypothesized reason for this decline was the prolonged large (magnitude) discharge from the 2014 and 2015 spring runoff. Elevated discharge extended into July, which delayed the warming of river waters. Decreased and prolonged cooler river temperatures may have resulted in delayed smallmouth bass spawning, later hatching of larvae, or even weak, young smallmouth bass being swept away from nests or quiet near-shore habitat resulting in high mortality. This in turn probably led to a shorter growing season and, ultimately, reduced growth for age-0 smallmouth bass. In any event, these environmental conditions probably led to a shorter growing season and a weak year class of smallmouth bass in 2014. However, in 2015, the river temperatures stayed elevated above 13.9° (Celsius) well into late fall (late October) and the few age-0 smallmouth that successfully survived after hatching may have benefited from a long growing season (the most degree days above 13.9 since 2007{n=184}; Figure 10).

In 2012, a smaller (magnitude) and shorter (duration) than average peak runoff season and lower (magnitude) and longer (duration) base flows, that began earlier in the season hypothetically produced an increase in our catch rate for juvenile and age-0 size fish < 100 mm from 0.55 fish/hr (2011) to 2.62 fish/hr (2012). 2013 was a similar hydrologic year to 2012 with the exception of a few rain spikes in late summer and throughout the fall. Once again, hypothetically two years of drought that aided increasing our juvenile and age-0 size fish < 100 mm catch rate even more to 3.92 fish/hr (third highest catch rate since project inception, Figure 6).

In the 15-mile reach (GVIC Diversion Dam to the Colorado/Gunnison River confluence) and 18-mile reach (Colorado/Gunnison River confluence to the Loma Boat Landing), smallmouth

bass reproduced during 2011 as they did between 2004 and 2010. It is unknown whether these fish were produced in the river, or in off-channel habitats (e.g., ponds or irrigation returns that connect to the main river) and later escaped to the river. In the Grand Valley reaches, the numbers of smallmouth bass within the 2008 and 2009 year classes (< 50 mm or < 100 mm) were noticeably less than those of the three previous years (2005, 2006, and 2007) as shown by catch rate data. Catch rates for smallmouth bass < 100 mm declined significantly from the high in 2007 (4.15 fish/hr) to 0.63 fish/hr in 2008 and 0.55 fish/hr in 2009 (Table 1; Figure 6). Except for the 2007 and 2010 year classes, YOY smallmouth bass (< 100mm) had demonstrated poor survival to age-1. The strong 2012 year class (age-0) coupled with the strong 2013 year class (age-0) have produced enough individuals to provide concern as to how many adults (> 200 mm) may have survived (Figures 1 & 5). However, the reduced 2015 adult catch (Figure 5) suggests that both our removal and recent river hydrological conditions have helped suppress the 2011 and 2012 age classes.

Largemouth Bass

A total of 1,425 largemouth bass were removed from all reaches, in 2015, a substantial decrease from the 2012 catch (n = 5,227, Table 2), but similar to the 2013 and 2014 catch. Our catch ranged from age-0 fish (35 mm) to adult fish (415 mm) with a mean of 109 mm (Figure 2). Sixteen were of piscivore size ($\geq$ 325 mm TL) and are considered a competitive threat to Colorado pikeminnow. Our catch was also proportionate in size classes to our 2014 catch: 96% (n = 1,370) were < 250 mm, 60% (n = 861) were < 100 mm and only 4% (n=55) were adults > 250 mm.

Specifically, in 2014, a total of 1,389 largemouth bass were collected during the 8-11 removal passes (depending upon the river section). Of these fish, 97% (n=1,349) were less < 250 mm; and 76% (n=1,052) were < 100 mm. Only 3% (n=50) of the total number of largemouth bass were > 250 mm. Data from 2013-2015 suggest that survival of juvenile largemouth bass into adulthood in the river is relatively, based on the very low number of adult fish (i.e., >250 mm) in our electrofishing collections versus the comparatively high number of juvenile size fish in those same collections.

Walleye

A total of 75 walleye were removed from Cisco to Potash, UT in Fall 2015, a decrease from the 2014 catch (n=107; Table 3, Figure 3). Our catch consisted exclusively of adult fish, with total lengths ranging from 303-626 mm (mean = 495 mm; Figure 3). Our spring/summer 2015 removal efforts, conducted while collecting Colorado pikeminnow for abundance estimation from Cisco, UT to the confluence of the Green River, resulted in 83 walleye removed (Table 3, Figure 3). This is a substantial decrease from the 2013 catch (n = 268), but a less severe decrease from the 2014 catch (n = 109). In all three years, our catch consisted exclusively of adult walleye (Figure 3).

Actual Numbers:

From 2004-2006 the number of removal passes were identical (4) and direct comparison of actual numbers of fish removed was justified. However, starting in 2007 and continuing through 2010, four additional removal passes were added. In 2011, two additional removal passes were added to bring the total number of passes to ten. In 2012 and 2013 passes were

reduced to six. 2014 and 2015 passes increased from seven to eleven depending upon the river reach (Table 7). Therefore, comparing actual numbers of fish removed per pass or by combining passes and river reaches with the earlier sampling years is not warranted. Actual numbers of smallmouth bass removed are provided among the various figures and tables by major river section and year in the attached appendices.

There is one location that could be consistently used to compare total number of fish captured to establish annual trends. This is the fish trap at the Redlands Diversion Dam fish passageway on the Lower Gunnison River. The number of smallmouth bass collected in the fish trap of the Redlands Diversion Dam passageway has been recorded for 18 years. From 1996–2001, only one smallmouth bass was captured. However, 13 were collected in 2002, 6 in 2003, 9 in 2004, and 21 in 2005. Keeping with the pattern of lower smallmouth bass catches in main channel habitats, no smallmouth bass were found in the Redlands fish trap during 2006 or 2007. In 2008, 4 smallmouth bass were collected in the Redlands fish trap, 0 in 2009, and 3 in 2010. No smallmouth bass were collected at Redlands in 2011. 2012 produced the third largest total of smallmouth bass (n = 14) collected at Redlands. The largest annual catch of smallmouth bass in the Redlands fish trap was 2013 (n = 22). Only 2 smallmouth bass were collected in 2014 and 1 in 2015.

Catch/Effort:

General

Mean catch/effort (fish/hr) was computed separately for smallmouth bass and largemouth bass for each of the 12 sampling years, 2004-2015 (Tables 1 & 2; Figures 4, 5, & 6). To view the "big picture," for some analyses, river reaches and removal passes were consolidated. Catch rates were computed separately for Rifle to Beavertail Mountain, the Grand Valley River reaches (Government Highline Dam to Westwater Wash, UT, plus the Lower Gunnison River), and Cisco to Potash, UT.

Effort Fished

Electrofishing effort in 2004 (168.665 hours) was similar to 2005 (174.560 hours) between Price-Stubb dam and the Westwater, UT, ranger station and the Lower Gunnison River. In 2006, electrofishing effort in these reaches was 161.906 hours. The electrofishing effort increased to 327.101 hours in 2007 because of the addition of four removal passes. The total effort (1 marking and 8 removal passes) during 2008 was 349.889 hours. In 2009, the total effort (1 marking and 8 removal passes) was 416.851 hours. A 3.9-mile reach between Government Highline Dam (GVWU) and the Cameo XCEL Bridge was added in 2009 which accounts for some of the increased effort in 2009 over earlier years. In 2010, the total effort was (1 marking and 8 removal passes) was 413.555 hours. In 2011, the total effort was (1 marking and 10 removal passes) was 449.934 hours. Effort was decreased in 2012 because low water levels in certain reaches (2.3-mile section of the Lower Gunnison River from the Redlands Diversion Dam to the Colorado/Gunnison River confluence, the additional reach between the Government Highline Dam and the Cameo Bridge, and from Cameo Bridge to GVIC) made them impassible by electrofishing craft. In addition, no passes were conducted from Loma boat landing to Westwater Ranger Station. Three pre-marking passes, one marking pass, and six post-marking passes expended 290.326 hours of electrofishing effort. In 2013, six removal passes between GVWU dam and Loma boat launch and three

removal passes from Loma to Westwater Ranger Station expended 364.39 hours of electrofishing effort. An additional 2.8 mile reach (Westwater Ranger Station to Westwater Wash) and eight to eleven passes per reach significantly increased our effort by 29% to 511.19 hours of electrofishing effort in 2014. Electrofishing effort, in 2015, was 442.278 hours (Figure 11).

Between Rifle and Beavertail Mountain, the effort expended in 2004 was 19.750 hours compared to 39.799 hours during 2005 and 37.512 hours during 2006. During 2007, electrofishing effort increased to 86.84 hours which was related to adding the river reach from Silt to Rifle and an additional removal pass from Silt to Beavertail Mountain. In 2008, the total effort was 86.038 hours, which was almost identical to 2007. The total effort during 2009 was 62.321 hours and in 2010, 78.985 hours. During 2011, the total effort (12.626 hours) was much less than former years due to only one pass being performed and some reaches not being sampled. In 2012 and 2013, CPW conducted two passes; one pass included two boats electrofishing both banks in all reaches except the reach between Parachute and DeBeque, and the second included electrofishing all backwaters and slack water sloughs in the same reaches this pass also included experimental gill netting effort. In total, CPW expended 45.68 electrofishing hours in 2012, 54.58 hours in 2013, 44.2 hours in 2014, 43.21 hours in 2015, and 10.8 gill net hours in 2012, 5.2 hours in 2013, and 0 gill net hours in 2014 and 2015. The increased effort was in response to the increase in northern pike catch in this reach in 2011 (Figure 11).

In response to an elevated catch of walleye (n = 268) by our crews during our spring 2013 Colorado Pikeminnow abundance collections from Cisco, Utah to the confluence of the Green River (Table 3), 73.6 hours of electrofishing effort was expended in 2013 and 146.77 hours of effort was expended in 2014 experimentally to target walleye from Cisco to Potash, Utah. Four complete passes were completed in 2015, and our crews expended 222.54 hours of electrofishing (Figure 11).

Smallmouth Bass

For the Grand Valley river reaches, the trend for smallmouth bass relative abundance from 2006-2009 was downward. Overall mean catch rate was highest for smallmouth bass juveniles (100-199 mm) and adults (≥ 200 mm) during 2004 (6.37 fish/hr) and 2005 (6.36 fish/hr). However, a 51% decline in catch rate was detected from 2005 to 2006. In 2007, the catch rate dropped even lower to a 4-year low (2.27 fish/hr; 27 % decline from 2006; Figure 4). Again in 2008 and 2009, the overall catch rate continued to decline to 1.19 and 0.9 fish/hr, respectively. This catch effort decline is consistent with the decline observed with the population estimate between 2006 and 2007, and between 2007 and 2008 (Table 3). During 2010, the catch rate for smallmouth bass > 99 mm (0.98 fish/hr) increased slightly from 2009. During 2011 and 2012, another increase in catch per effort occurred from the juvenile and adult size classes to 1.83 and 2.55 fish per hour, respectively. A large recruiting class of smallmouth < 100 mm collected in 2012 represented the third highest catch rate of juvenile and adults, in 2013 (5.57 fish/hr). During 2014, the catch rate for all size classes of smallmouth bass declined 46% to 95% (≥ 200 mm = 46%, 100-199mm = 78%, > 100 mm = 95%) most likely in response to a larger (magnitude) and longer (duration) spring runoff. 2015 (0.88 fish/hr) marked another decline (55%) in smallmouth bass > 99 mm catch rate when compared to 2014 (1.95 fish/hr; Table 1, Figure 6).

During the summer of 2010, for the Grand Valley river reaches, overall mean catch rate for smallmouth bass < 100 mm total length was the highest in this eight-year removal study (5.82 fish/hr). Formerly, 2007 had the highest catch rate (4.15 fish/hr) and the lowest two years were 2014 (0.17 fish/hr) and 2015 (0.28 fish/hr; Table 1, Figure 6). Initially, it appeared that the 2007 cohort was one of the strongest in five years of sampling between 2004 and 2009. However, the 2010 cohort exceeded the strong year class of 2007. These young life stages can be subject to high mortality to age-1 due to a myriad of environmental factors over the winter. Small age-0 smallmouth bass going into winter may be susceptible to higher overwinter mortality because their relatively small body size limits energetic reserves that may run out before spring arrives. Therefore, overwinter survival is not known until the following summer sampling season. The 2011 catch rates for the juvenile size class (100-199 mm) increased from 0.45 fish/hr in 2010 to 1.47 fish/hr in 2011, a 3.3 fold increase. The 2012 catch for juvenile smallmouth bass was 1.09 fish/hr. The juvenile catch for 2013 was second in size only to 2004 (2013 was 3.52 fish/hr, and 2004 was 3.66 fish/hr; Table 1). Both 2012 and 2013 were moderately strong cohorts that were well documented in our recent years catch data (Figure 6). The strong year classes produced in 2007, 2010, 2012 and 2013 recruited to the adult smallmouth bass population which may contribute to the persistence of this species in the Grand Valley reaches of the Upper Colorado and Lower Gunnison Rivers.

It also appeared that weaker year classes of YOY (< 100 mm) smallmouth bass were produced in 2015 (0.28 fish/hr), 2014 (0.17 fish/hr) and 2008 (0.63 fish/hr; Table 1, Figure 6). The high spring flows during the 2015, 2014 and 2008 runoff in the Upper Colorado River could have swept weak swimming young smallmouth bass away from nests or quiet near-shore habitat resulting in high mortality. From catch/effort comparisons, the 2011 (0.55 fish/hr) and 2009 year class (0.55 fish/hr) also appeared to be similar to 2015, 2014 and 2008.

The hydrologic conditions of 2008, 2009, 2011, 2014, and 2015 in the Upper Colorado River were similar, with 2011, 2014 and 2015 being the most dramatic because of the prolonged high discharge extending into July. These five years have been characterized as average or moderately wet with sustained runoff compared to former years (2003-2007, 2010, 2012 and 2013) that were dryer with shorter runoff magnitude and duration. The five wetter years with accompanying prolonged cooler water temperatures may have disrupted or delayed spawning resulting in slower growth of early-life stages (i.e., age-0) of smallmouth bass, and ultimately reducing survival and recruitment. However, the 2012 catch of juvenile (100-199 mm) smallmouth bass (1.09 fish/hr) suggests that 2011 recruitment may have been negatively impacted, but a mild winter may have allowed for better survival of the few fish that were still alive after the high run-off. In addition, YOY smallmouth bass produced in 2015 that survived coming off of the nests, experienced many more degree days greater than 13.9° (Celsius) prior to winter and may have had a good chance of surviving into the next spring (Figure 10). Coble (1975) suggests that smallmouth bass growth does not occur until water temperatures reach 10-14° (Celsius). The Edwards et al. (1983) models suggest that optimal temperature for smallmouth bass fry first peaks at 13.9° (Celsius).

Survival of smaller age-0 fish entering the winter period could be reduced under these hydrologic scenarios. The timing or detection of the first captures of age-0 smallmouth bass may provide one means to predict recruitment success into later years. For example, the first date age-0 smallmouth bass were detected in wetter years (2008, 2009) in which weak year classes were produced was 8 and 14 of August, respectively. It appears that smallmouth bass

spawned later in 2011 than any previous years of this eight-year study. In 2011, age-0 smallmouth bass were first detected on 24 August (n = 3; 22, 35, and 46 mm). Other age-0 smallmouth bass (n = 12; 25-32 mm) were collected between 5 October and 11 October. Compared to dryer years, 2007, in which a strong year class was produced, age-0 fish were first detected on 23 July, some 2-3 weeks earlier than 2008 and 2009. In 2010, age-0 smallmouth bass were first detected on 28 July. In 2012, the earliest detection of age-0 fish (n = 6; 36-56 mm) occurred on 21 June, a full month earlier than the strong year class detected in 2007. In 2013, crews were not out in the field in June. However, they were out in early July and had an early first detection of age-0 fish (n = 15; < 70 mm) on 9 July. Two anomalies for this theory occurred in 2014 and 2015, wet years that still had age-0 smallmouth bass collected 1 July (in 2014; 86 mm) and 22 July (in 2015; 79 mm) however; these fish may have been produced in an off channel source and entered the river at a later time.

Catch rates for all size classes of smallmouth bass, in the reaches between Rifle and Beavertail Mountain, decreased from 0.62 in 2013 to 0.44 in 2014 and again to 0.18 in 2015. These values are an increase following a drop in mean catch per effort in 2012 (0.09 fish/hr), the lowest value was achieved during 2009 (0.24 fish/hr) compared to 2011 (0.49 fish/hr), 2010 (0.92 fish/hr), 2008 (0.95 fish/hr), 2007 (1.04 fish/hr), 2006 (2.11 fish/hr), and highest during 2005 (5.75 fish/hr; Table 1). Spawning success in these reaches appears not to be as successful as that in the Grand Valley reaches. Age-0 (< 100 mm) smallmouth bass catches have been less than that of the Grand Valley reaches throughout the eight-year project. Only 57 age-0 smallmouth bass (0.72 fish/hr) were collected in these upper reaches during 2010. No age-0 smallmouth bass were collected in these upper reaches during 2009 or 2011. One age-0 smallmouth bass was collected in 2012, four were collected in 2013, eight were collected in 2014, and two were collected in 2015. Only one smallmouth bass (237 mm) was collected between Rifle and Beavertail Mountain at RM 241.2 during 2007 and 2012; none were collected during 2008. Mean catch rates for smallmouth bass < 100 mm was the lowest in 2009 (0.00 fish/hr); the highest was during 2005 (1.46 fish/hr; Table 1). During 2013 and 2014, the catch rate for smallmouth bass < 100 mm was 0.07 fish/hr and 0.14 fish/hr, respectively. The 2015 catch rate for smallmouth bass < 100 mm was 0.05 fish/hr.

Catch rates for all size classes of smallmouth bass in Ruby-Horsethief Canyon (Loma to Westwater Ranger Station, UT) were consistently low from 2004 to 2012 ranging from a low in 2007 and 2008 of 0.07 fish/hr to a high in 2011 of 2.65 fish/hr. Budget constraints for 2012 necessitated a reduction in work and the decision was made to drop this reach. However, large numbers of largemouth bass caught in Black Rocks during our fall humpback chub (*Gila cypha*) work, in 2012, prompted restored effort in these reaches in 2013. The largest catch rate of smallmouth bass, in any of the reaches covered by projects 126a and 126b during the ten year study period, occurred in 2013 and 2014 in Ruby Horsethief Canyon at 6.53 fish/hr and 3.94 fish/hr (Figure 4 & 5). Late summer and fall rain events may have washed a portion of this population downstream in 2013 and 2014. In 2015, our catch of all size classes of smallmouth bass in Ruby Horsethief Canyon (0.87 fish/hr) decreased 78% from our 2014 catch (3.94 fish/hr; Figure 4 & 5).

New effort was expended experimentally, in 2013 and 2014, from Cisco to Potash, Utah. This effort was fully funded in 2015. While the primary species being targeted was walleye, juvenile and adult smallmouths were removed from these reaches in 2013 at a rate of 0.48 fish/hr which decreased to a rate of 0.42 fish/hr in 2014 and again decreased to a rate of 0.21

fish/hr in 2015 (Table 2; Figure 4). In 2014 and 2015, the highest rate of removing UCRRB defined 'piscivorous sized (> 325 mm)' smallmouth bass occurred from Cisco, UT to Dewey Bridge, UT at 0.9 fish/hr (2014, n=20) and 0.37 fish/hr (2015, n = 9; Figure 4).

Largemouth Bass

Unlike the downward trend in catch rate for smallmouth bass juveniles and adults, for the Grand Valley river reaches, overall mean catch rate for largemouth bass juveniles (100-199 mm) and adults (> 200 mm) steadily increased from 2004-2007 and peaked in 2007 (4.2 fish/hr; n = 1,375; Table 2). This was 6.7 times greater than the catch rate for 2004 (0.63 fish/hr). During 2008, this trend was reversed for largemouth bass ≥ 100 mm. The catch rate declined to 1.3 largemouth bass/hr (n = 383). In 2009, the catch rate increased slightly to 1.83 fish/hr. The catch rate increased to 3.31 fish/hr in 2010. Juvenile and adult largemouth bass catch rates declined in 2011 to 1.96 fish/hr. 2012 produced the largest catch of juvenile and adult largemouth bass to date at 6.0 fish/hr (n = 1,743). We hypothesize that the large (magnitude) extended peak flows in 2011 inundated off channel gravel pits and ponds and fish from these sources made it into the river and available to our catch in 2012. An 83% decrease in our juvenile and adult largemouth bass catch rate occurred from 2012 (6.0 fish/hr) to 2013 (1.06 fish/hr, n = 293) and the catch rate continued to decline in 2014 (0.5 fish/hr, n = 255). Our juvenile and adult largemouth catch rate increased 50% in 2015 (1.01 fish/hr, n = 447) when compared to 2014 (Table 2, Figure 7).

Perhaps enough adults escaped from off channel spawning and nursery areas during the high flows in 2011, and were removed from the population by unfavorable river conditions and our efforts so that a large reduction in production occurred from 2013 through 2015 largemouth bass < 100 mm (1.28 fish/hr, n = 467 {2013}, 2.1 fish/hr, n = 1,071{2014} and 1.8 fish/hr, n = 797 {2015}; Figure 7). This reduction follows the 2012 (12 fish/hr) year class which has been the second strongest in this twelve-year study. In 2011, catch rate for largemouth bass < 100 mm (6.05 fish/hr) declined 50 % from 2010 (12.13 fish/hr). Overall mean catch rate for largemouth bass < 100 mm total length steadily increased since 2004 from 1.03 fish/hr to a high of 12.13 fish/hr in 2010 (Table 2; Figure 7). The 2008 year class of largemouth bass was only slightly less (4.32 fish/hr) than 2007 and 2009. So, where the 2008 high spring runoff flows reduced the spawning success of smallmouth bass, it did not appear that largemouth bass young were as negatively impacted. This may be attributed to differences in spawning habitat and/or timing (temperature conditions) between smallmouth bass and largemouth bass spawning. In the Upper Colorado River, largemouth bass may be spawning in off main channel riverine habitats (e.g., gravel pit ponds) that may shelter young fish from the high velocities during runoff, thus increasing survival, whereas young smallmouth bass, which are typically spawned in main channel riverine habitats, may suffer higher mortality during such high flow events. The high abundance of largemouth bass found during summer removal passes in main channel habitats may be due to young fish that have moved out of off-channel habitats into main channel habitats following high spring runoff.

There has been no definite trend in largemouth bass abundance (all length sizes) for the Rifle to Beavertail Mountain reaches. The highest catch rate was recorded during 2008 (7.6 fish/hr; Table 2). The second highest year was in 2006 (5.6 fish/hr), the third highest in 2013 (5.5 fish/hr); lowest in 2010 (0.86 fish/hr). In 2007 the catch rate declined to 3.30 fish/hr (Table 2). In 2015, catch effort (0.72 fish/hr) was the lowest in this twelve-year study. Prior to 2008,

spawning success in these reaches appeared not to be as successful as that in the Grand Valley reaches. Mean catch rate for largemouth bass < 100 mm was lowest in 2005 (0.25 fish/hr); the highest during 2008 (6.05 fish/hr). In 2015, largemouth < 100 mm catch rate (0.39 fish/hr) in this reach was the third lowest during this twelve-year study (Table 2).

New effort was expended experimentally, in 2013 and 2014, from Cisco to Potash, Utah. In 2015, this effort was fully funded. While the primary species being targeted was walleye, juvenile and adult largemouth bass were removed from these reaches at a rate of 0.29 fish/hr in 2013, 0.05 fish/hr in 2014, and 0.75 fish/hr in 2015 (Table 2).

Walleye

Our 2015 walleye fall catch (0.34fish/hr) was similar to our spring catch (0.29fish/hr) which was a decline when compared to our 2014 walleye fall catch (0.73fish/hr) and spring catch (0.44fish/hr). Walleye catch rates varied amongst reaches when comparing the spring and fall in 2014 (Table 3); however there was a substantial increase in the fall catch rates (2.11 fish/hr) when compared to the spring catch rates (1.13fish/hr) in the reaches from Cisco to potash, UT. Cisco to Dewey Bridge, UT provided 61% (n=65; Table 3) of our fall 2014 catch and was 90% more productive in the fall when compared to the spring. In 2015, this same reach was the most productive in both spring and fall (0.46fish/hr during both seasons). Cisco to Dewey Bridge, UT provided 30% (n=48) of our 2015 catch (Table 3 & Figure 12). Coincidently, the Dolores and Colorado River confluence is found in this reach, and McPhee Reservoir (which spills into the Dolores River) has a large illicitly stocked population of walleye. Otoliths were collected from 2013 to 2015 to hopefully determine the origin of these fish. These fish could also be the result of immigration from Green River sources or from Lake Powell, which also has a robust population of walleye. A USFWS science support and quick response proposal was awarded in 2015, that will fund USGS to use otolith microchemistry as a tool to determine natal origins of these fishes.

Population Size.

Increased effort is needed to achieve exploitation rates that the UCRRP has adopted as necessary to achieve smallmouth and largemouth bass population failure. However, a limited amount of funding coupled with logistical constraints (e.g. length of field season, amount of equipment, and staffing) has limited how we can achieve extra effort. In 2014 and 2015, Colorado River Fishery Project had an increase in crew and equipment because of the Colorado pikeminnow estimate and razorback sucker monitoring in Lake Powell; thus, increased effort was volunteered outside of the 2014 and 2015 SOW budget. Certainly, this additional effort helped us move nearer to the exploitation rates UCRRP has adopted. During the 2012 nonnative workshop, it was determined appropriate to have smallmouth bass removal years (from the Gunnison and Colorado Rivers), set at a predetermined interval (e.g., 2 or 3 years) coupled with abundance estimate years to track population size in an effort to reduce the number of nonnatives being collected and returned to the river with a mark and to increase removal effort. Therefore, 2013 through 2015 were removal years and no abundance estimates were calculated. However, for reference purposes, abundance estimate text and results were included in this report from past years (Table 4).

Smallmouth Bass

In 2015, we removed 264 adult smallmouth bass (≥ 200mm) in the Grand Valley reaches. We completed 9 to 11 passes in these reaches (Table 7). Our average p-hat calculated for adult smallmouth bass collected in previous population estimates (7 years; 2006-2012; Table 4) was 0.051 per pass. We averaged 10 passes in the Grand Valley reaches (2015) and could estimate (from previous years calculated p-hat) that 0.51 (51%) of the population may have been removed (or exploited). The pre-removal estimate would have been around 522 adults and the post removal estimate would be around 258 adults. This adult estimate would be lower than most of the years (2006, 2007, 2009, 2010, and 2012) where we conducted abundance estimation (Table 4).

During the marking pass performed in July 2012, a total of 132 smallmouth bass (50 juvenile size [100-199 mm], 82 adult size [≥ 200 mm]) were marked and released alive. Seventeen (9 juvenile, 8 adult) of these marked fish were later recaptured during six removal passes (Table 4). Since a 'batch' mark was employed and smallmouth bass were not marked with a serially numbered tag, movements of individual fish were not possible. Eight marked fish (six juvenile, two adult) were recaptured in removal pass 1. One marked fish (one adult) was captured during pass 2, four marked fish (two juvenile, two adult) were captured during pass 3, one marked adult was captured during pass 4, two marked fish (one juvenile, one adult) were captured during pass 5, and one marked adult was captured during pass 6. Crews were instructed to look for marked fish during all six removal passes. Starting in 2010, a different mark was employed and it appeared that this new mark could be more reliably detected throughout all removal passes than previous batch marks employed (e.g., fin punches) which extended from early-August through late-October. All 17 marked smallmouth bass were recaptured within the original marking reaches. The total number of smallmouth bass removed over six removal passes after the marking pass was 201 juveniles (100-199 mm) and 233 adults (≥ 200 mm; Table 3). During the three pre-marking passes, 70 juveniles and 78 adult smallmouth bass were removed.

The 2012 population point estimate (95% C.I. in parenthesis) was 232 ± 133 (99 –365) for smallmouth bass 100-199 mm and 1,853 ± 1,748 (105 – 3,601) for smallmouth bass ≥ 200 mm. The weighted probability of capture (p-hat) was computed as 0.159 and 0.037, respectively, for these two length groups. The CV was 29.2 % and 48.0 %, respectively, for these two length classes. The CV can be used as a measure of estimate precision and Pollock et al. (1990) suggests a good 'rule of thumb' is to achieve a CV of 20% or less.

The proportion or percentage of smallmouth bass of these sizes removed during the first removal pass or the exploitation rate for this first pass based on the population estimate was as few as 10 % (37/365) for juvenile fish 100-199 mm which computes to about an average of 6.6 juvenile smallmouth bass/mile. For smallmouth bass ≥ 200 mm, the proportion or percentage of smallmouth bass of these sizes removed annually or the exploitation rate for this first pass based on the population estimate was a few as 2 % (68/3,601) or an average of 52.5 adult smallmouth bass/mile.

The 2011 population point estimate (95% C.I. in parenthesis) was 1,718 ± 1,115 (603 – 2,833) for smallmouth bass 100-199 mm and 110 ± 108 (2 – 218) for smallmouth bass ≥ 200 mm. The weighted probability of capture (p-hat) was computed as 0.056 and 0.071,

respectively, for these two length groups. The CV was 10.4 % and 50.0 %, respectively, for these two length classes. The CV can be used as a measure of estimate precision and Pollock et al. (1990) suggests a good 'rule of thumb' is to achieve a CV of 20% or less. The proportion or percentage of smallmouth bass of these sizes removed during the first removal pass or the exploitation rate for this first pass based on the population estimate was as few as 4 % (117/2,833) for juvenile fish 100-199 mm which computes to about an average of 48.7 juvenile smallmouth bass/mile. For smallmouth bass ≥ 200 mm, the proportion or percentage of smallmouth bass of these sizes removed annually or the exploitation rate based on the population estimate was a few as 7 % (16/218) or an average of 3.1 adult smallmouth bass/mile.

The 2010 population point estimate (95% C.I. in parenthesis) was 255 ± 196 (59-451) for smallmouth bass 100-199 mm and 823 ± 671 (152-1,494) for smallmouth bass ≥ 200 mm. The weighted probability of capture (p-hat) was computed as 0.097 and 0.053, respectively, for these two length groups. The CV was 39.3 % and 41.6 %, respectively. The proportion or percentage of smallmouth bass of these sizes removed during the first removal pass or the exploitation rate for this first pass based on the population estimate was as few as 7 % (31/451) for juvenile fish 100-199 mm which computed to about an average of 7.2 juvenile smallmouth bass/mile. For smallmouth bass ≥ 200 mm, the proportion or percentage of smallmouth bass of these sizes removed annually or the exploitation rate based on the population estimate was a few as 4 % (60/1,494) or an average of 23.3 adult smallmouth bass/mile.

The 2009 population point estimate (95% C.I. in parenthesis) was 2,044 ± 2,238 (- 194-4,282) for smallmouth bass 100-199 mm and 755 ± 802 (- 471-1,557) for smallmouth bass ≥ 200 mm. The weighted probability of capture (p-hat) was computed as 0.014 and 0.017, respectively, for these two length groups. The CV was 55.9% and 54.2%, respectively. The proportion or percentage of smallmouth bass of these sizes removed during the first removal pass or the exploitation rate for this first pass based on the population estimate was as few as 1% (46/4,282) for juvenile fish 100-199 mm which computes to about an average of 57.9 juvenile smallmouth bass/mile. For smallmouth bass ≥ 200 mm, the proportion or percentage of smallmouth bass of these sizes removed annually or the exploitation rate based on the population estimate was a few as 1 % (20/1,557) or an average of 21.4 adult smallmouth bass/mile.

The low number of recaptured marked juvenile and adult smallmouth bass during the first removal pass compared to earlier years obviously contributed to very poor capture probabilities, abundance estimates, and exploitation rates for 2009. The same could be said for the 2011 and 2012 adult smallmouth abundance estimate where only one and two (respectively) adult fish were recaptured in the first removal pass to compute the abundance estimate. This low precision of the abundance estimate was reflected in the high CVs (50 % and greater) for 2009 and 2010 (adults; Table 4). In 2009 as in 2008, declining catch rates reflected a downward trend in relative abundance. The 2009 abundance estimate did not correlate well with the calculated catch effort indices for juvenile and adult smallmouth bass (≥ 100 mm; see Figure 6) during 2009 in the Grand Valley reaches of the Upper Colorado and Lower Gunnison rivers. Therefore, the abundance estimates for 2009, as well as the adult abundance estimate for 2011 and 2012, should be viewed with caution with earlier and future year comparisons.

The 2008 population point estimate (95% C.I. in parenthesis) was 804 ± 423 (381-1,227; Table 4) for juvenile smallmouth bass (100-199 mm). The weighted probability of capture (p-hat) was computed as 0.10; the CV: 26.9%. The proportion or percentage of smallmouth bass of these sizes removed during the first removal pass or the exploitation rate for this first pass based on the population estimate was as few as 6.7 % (82/1,227) or as many as 21.5% (82/381). This computes to an average of about 22.8 fish/mile. For adult smallmouth bass (≥ 200 mm) the population point estimate (95% C.I. in parenthesis) was 393 ± 276 (117-669). The weighted probability of capture was computed as 0.07; the CV: 35.9%. The proportion or percentage of smallmouth bass of these sizes removed during the first removal pass or the exploitation rate for this first pass based on the population estimate was as few as 4.2 % (28/669) or as many as 23.9% (28/117). This computed to an average of about 11.1 fish/mile.

The 2007 population point estimate (95% C.I. in parenthesis) was 1,007 ± 686 (321-1,693; Table 4) for adult smallmouth bass ≥ 200 mm. The weighted probability of capture (p-hat) was computed as 0.06; the CV: 34.8%. The proportion or percentage of smallmouth bass of these sizes removed during the first removal pass or the exploitation rate for this first pass based on the population estimate was as few as 6.4 % (109/1,693) or as many as 3.4% (109/321). This computed to an average of approximately 28.5 fish/mile.

The 2006 population point estimate (95% C.I. in parenthesis) was 2,295 ± 1,500 (795-3,795; Table 4) for adult smallmouth bass ≥ 200 mm. The weighted probability of capture (p-hat) was computed as 0.04; the CV: 33.3%. The proportion or percentage of smallmouth bass of these sizes removed during the first removal pass or the exploitation rate for this first pass based on the population estimate was as few as 4.3 % (163/3,795) or as many as 20.5% (163/795). This computed to an average of about 65 fish/mile.

A weak year class of fish produced in 2011 produced a small abundance estimate (232 fish) for juvenile smallmouth bass (100-199 mm). Abundance estimates for juvenile (100-199 mm) smallmouth bass peaked in 2011 (1,718 fish) due to a strong year class of smallmouth bass being produced in 2010. Juvenile smallmouth abundance was most similar in 2010 (255 fish) to 2012 in the 35.3 miles of the Upper Colorado and Lower Gunnison rivers in the Grand Valley reaches. Abundance of adult smallmouth bass (≥ 200 mm) slowly decreased from a high of 2,295 fish in 2006, 1,007 in 2007, 393 in 2008, but increased to 823 during 2010. The adult abundance increase in 2010 could be attributed to the strong year class of smallmouth bass produced in 2007. Abundance estimates for both juvenile and adult smallmouth bass in 2009 and adult smallmouth bass in 2011 and 2012 were not included here because of the low number of recaptures necessary to generate a reliable estimate.

Exploitation Rates. Exploitation rates were computed for two length groups (100-199 mm and ≥ 200 mm) of smallmouth bass from the Upper Colorado and Lower Gunnison rivers for 2006-2012 (Table 4). Exploitation rates by year and length class were:

2006		(fish ≥ 200 mm): 27.9
2007		(fish ≥ 200 mm): 39.1
2008	(fish 100-199 mm): 57.0	(fish ≥ 200 mm): 44.0
2009	(fish 100-199 mm): 10.7	(fish ≥ 200 mm): 12.8
2010	(fish 100-199 mm): 55.7	(fish ≥ 200 mm): 35.2

2011 (fish 100-199 mm): 42.0 (fish ≥ 200 mm): 52.1
2012 (fish 100-199 mm): 64.7 (fish ≥ 200 mm): 20.1

This method attempts to reduce bias from fish moving outside the sampling area, mortality during the sampling period, and growth (personal communication, Bruce Haines, USFWS [ret.], Vernal, Utah). This method attempts to extrapolate the exploitation rate over the number of removal passes for the six years abundance estimates have been computed.

Largemouth Bass

The first year attempting at a mark-recapture population estimate for largemouth bass was 2012. During the marking pass performed in July 2012, a total of 41 largemouth bass (32 juvenile size [100-199 mm], 9 adult size [≥ 200 mm]) were marked and released alive. Fifteen (10 juvenile, 5 adult) of these marked fish were later recaptured during six removal passes. Since a 'batch' mark was employed and largemouth bass were not marked with a serially numbered tag, movements of individual fish were not possible. Ten marked fish (7 juvenile, 3 adult) were recaptured in removal pass 1. Three marked fish (2 juvenile, 1 adult) were captured during pass 3, and two marked fish (1 juvenile, 1 adult) were captured during pass 4. All 15 marked largemouth bass were recaptured within the original marking reaches. The total number of largemouth bass removed over six removal passes after the marking pass was 1,616 juveniles (100-199 mm) and 47 adults (≥ 200 mm). During the three pre-marking passes, 17 juveniles and 10 adult largemouth bass were removed.

The 2012 population point estimate (95% C.I. in parenthesis) was 399 ± 219 (180-618) for largemouth bass 100-199 mm and 34 ± 20 (14-54) for largemouth bass ≥ 200 mm. The weighted probability of capture (p-hat) was computed as 0.258 and 0.471, respectively, for these two length groups. The CV was 27.9 % and 30.1 %, respectively, for these two length classes. The CV can be used as a measure of estimate precision and Pollock et al. (1990) suggests a good 'rule of thumb' is to achieve a CV of 20% or less. The proportion or percentage of largemouth bass of these sizes removed during the first removal pass or the exploitation rate for this first pass based on the population estimate was as few as 17 % (103/618) for juvenile fish 100-199 mm which computes to about an average of 11.3 juvenile largemouth bass/mile. For largemouth bass ≥ 200 mm, the proportion or percentage of largemouth bass of these sizes removed annually or the exploitation rate for this first pass based on the population estimate was as large as 30% (16/54) or an average of 1.5 adult largemouth bass/mile.

Exploitation Rates. Exploitation rates were computed for two length groups (100-199 mm and ≥ 200 mm) of largemouth bass from the Upper Colorado and Lower Gunnison rivers for 2012. Exploitation rates by year and length class were:

2012 (fish 100-199 mm): 83.3 (fish ≥ 200 mm): 97.8

These rates are perplexing considering more fish were actually removed than what were estimated to be in the population, a strong indication that simple closed population models are not suitable to a large complex riverine system.

Walleye

While no mark recapture abundance estimates have been conducted for walleye, we feel that extrapolation using Colorado pikeminnow probabilities of capture is reasonable considering the two species occupy the same niche in the river. Mean probability of capture for adult Colorado pikeminnow in the lower Colorado River reach (Cisco to the confluence of the Green River), during the spring, is 0.065 per pass (Doug Osmundson, *personal communication*). During spring 2013, 268 walleye were removed during three passes, and during spring 2014 and 2015, 109 and 83 walleye were removed during four passes. In spring 2013, an extrapolated 19.5% of the population should have been exploited making the pre-removal abundance estimate 1,374 and post removal abundance estimate 1,106. In spring 2014 and 2015, an extrapolated 26% of the population should have been exploited making the pre-removal abundance estimates 419 (2014) and 319 (2015), and post removal estimates 310 (2014) and 236 (2015). Considering the mean estimated abundance for adult Colorado pikeminnow through 2010 in this same reach is 302, there is cause for alarm (Figure 9).

Of the 158 walleye removed in 2015 (spring n = 83, fall n = 75) 156 were dissected. Of the 156, 104 had their gender identified and 62% (n = 64) were identified as female and 38% (n = 40) were identified male. Of those fish, six were running ripe. Two females and two males were collected running ripe 16 April in the reach between Onion Creek rapid and the Daily Takeout (RMI 85-74.2) and two other males were collected running ripe 1 April in the same reach. Of the 156 dissected walleye, one hundred two (65%) had empty stomachs. Of the remaining fifty four walleye, twenty four (44%) had fish remains that were digested to a point where identification wasn't possible, eight (15%) had channel catfish in their stomachs, four (7%) had fathead minnows in their stomachs, three (6%) had shiners in their stomachs, three (6%) had endangered bonytail in their stomachs, two (4%) had native bluehead sucker in their stomachs, two (4%) had native flannelmouth sucker in their stomachs, two (4%) had black bullheads in their stomach, one (2%) had an endangered young-of-year Colorado pikeminnow (107 mm TL) in its stomach, one (2%) had green sunfish in its stomach, one (2%) had gizzard shad in its stomach, one (2%) had a mix of nonnative fish in its stomach, and one (2%) had a mouse in its stomach. Therefore, of the 26 walleye that stomach contents that could be identified to species, eight (31%) had consumed native fishes and four (15%) had consumed endangered fishes.

Of the 107 walleye collected in the fall 2014, seventy were dissected to be identified as male or female and the contents of their stomachs were identified. Thirty seven walleye (53%) were male and thirty three (47%) were female. Twenty eight walleye (40%) stomachs were empty, three walleye (4%) stomachs contained single black bullheads, three walleye (4%) stomachs contained young-of-year channel catfish (11, 2, and 3 per stomach), and two walleye (3%) stomachs contained juvenile Colorado pikeminnow (289 and 323 mm TL; appended photos). Considering the possibility of nonnative walleye occupying the same niche as native endangered Colorado pikeminnow, they are not only a potential competitor they are a documented predator. These two Colorado pikeminnow found in the stomachs of walleye represent a much larger consumptive rate of Colorado pikeminnow and other rare native fishes throughout the year. The lower portions of the Colorado and Green Rivers are important nursery areas for young-of-year and juvenile Colorado pikeminnow and razorback sucker. If large concentrations of piscivorous walleye are left unmanaged in these river reaches, recovery of these two listed species could be severely hindered.

Other Nonnative Game Fishes Captured in the Main-stem River (Figure 8):

In coordination with the private land owner, CPW began an effort to remove nonnative fishes from a gravel pit pond between Rifle and Silt, Colorado now referenced as Snyder Pond (a.k.a. Mamm Creek Pond, LaFarge Pond, or United Pit Pond). While these fish do have opportunities to escape into the river during certain peak flows, they are isolated from the river during lower water years. Therefore, these efforts and results are included in the PPR section at the end of this report. It is possible that the elevated peak flows experienced in 2011, which did connect Snyder Pond with the river, contributed to the increase in catch of northern pike experienced in the main stem in both 2011 and 2012. In 2015, CPW sampled Snyder Pond while the inlet was inundated and kept fish from being able to emigrate and immigrate into and out of the pond by installing a Merwin trap. CPW has had great success, in terms of CPE, removing largemouth bass, northern pike, green sunfish, and yellow perch.

Three adult northern pike were removed by CPW and USFWS crews in 2015 (Figure 8). Two (598 mm and 729 mm TL) and one was collected between Rifle and Rulison (737 mm TL). In addition, three northern pike (470, 732, and 842 mm TL) were removed from the Grand Valley reaches during the spring Colorado pikeminnow project. All otoliths have been preserved from these fish for future aging and natal origin microchemistry research. Such analyses can help in determining their possible origin. In other words, had these fish escaped from off-channel riverine habitats such as isolated gravel pits (breached by the high spring flows that connected to the mainstem river), escaped from nearby reservoirs, or were they possibly illicitly translocated?

Captures of adult gizzard shad in the Upper Colorado and Lower Gunnison rivers exploded during 2007 (n = 179). One hundred thirty-nine adult gizzard shad were collected during the 2007 smallmouth bass removal project. An additional 43 were collected in the fish trap of the Redlands Dam fish passageway. This compares to 12 captured during the smallmouth bass removal study in 2006 and only 3 in the Redlands fish passageway fish trap. One gizzard shad (66 mm TL = age-0 or age-1) was collected in the Upper Colorado River during 2009.

Young-of-year, juvenile and adult gizzard shad were collected in all reaches sampled in 2015 from the Grand Valley downstream to Potash (n = 811; 50-512 mm). This is the largest number of gizzard shad removed in project 126a's history. In 2015, two gizzard shad were collected at Redlands fish trap and seven gizzard shad were collected at GVWUs fish trap. It appears that drought years may be favorable to the upstream expansion of gizzard shad range in the Colorado and Gunnison rivers.

In 2012, 614 white sucker and white sucker hybrids were removed from the Grand Valley reaches. Their total length ranged from 53-519 mm with a mean total length of 255 mm. Our effort in 2013 removed 2,627 white sucker and white sucker hybrids (80-510 mm TL), our effort in 2014 removed 3,787 white sucker and white sucker hybrids (34-518 mm TL), and our effort in 2015 removed 1,425 (40-527 mm TL) from all sampled reaches. These fish were

removed opportunistically when white sucker catch wouldn't overwhelm the crew's primary focus of centrarchid removal.

Task completed. Report submitted to the Program Office in November, 2015

VIII. Additional noteworthy observations:

River:

During most years, Colorado pikeminnow aren't collected during the smallmouth bass removal project. However, in an effort to increase the number of marked (i.e., PIT-tagged) Colorado pikeminnow in the river, 30 additional fish were captured during the nonnative removal project. Of the 30 Colorado pikeminnow collected, 19 were previously untagged juvenile and adult fish. During 2015, 369 individual razorback sucker, 1 bluehead sucker X razorback sucker hybrid, 69 bonytail, and 9 flannelmouth sucker X razorback sucker hybrids were collected by CPW and USFWS crews while working on projects 126a and 126b. For endangered fish tag histories see Tables 5 & 6.

An important observation to consider from fall 2014 and 2015 is that our catch rates for walleye increase markedly after rain events, when river water becomes more turbid. This suggests that perhaps a "walleye removal team" should be ready to deploy extra effort in known concentration reaches on the descending limb of these hydrologic spikes. This extra effort would likely need to come from more than one office. It is our recommendation to have multiple agencies/entities prepared to redirect some of their ongoing sampling efforts in other reaches of river into known walleye concentration areas following rain events.

Grand Valley Ponds:

Beswick's Pond: Beswick's Pond (managed by CPW) is an old gravel pit pond that has been historically used for razorback sucker grow-out. This pond is located on the north side of the Colorado River at RMI 174.9 and will connect with the river during high spring runoff. Our office opportunistically samples this pond to further augment the Colorado River razorback sucker population. In 2015, we sampled this pond 19 March, 29 April, 6 and 7 June, and the 16 and 27 October. We used a combination of gears which included fyke nets, trammel nets, and cast nets. In 2015, we collected PIT-tagged and stocked 76 razorback sucker. In addition to our primary focus, we also removed 105 invasive fishes. We removed 41 black crappie (mean TL 180, range 49-279 mm), 35 gizzard shad (mean TL 331, range 167-416 mm), 21 bluegill, green sunfish or hybrids (mean TL 126, range 86-156 mm), six largemouth bass (mean TL 255, range 180-364 mm; Figure 14), and 1white sucker (272 mm TL; Figure 13).

Butch Craig Pond: Butch Craig Pond (managed by BLM) is an old gravel pit pond that has been historically used for razorback sucker and bonytail grow-out. This pond has had two notches installed in the berm so that during high flow years this pond would be a flow through wetland. This pond is located on the west side of the Gunnison River at RMI 12.7. Our office opportunistically samples this pond to monitor the endangered fish stocked. In 2015, we sampled this pond the 28 and 29 October. On the 28 October trammel nets were utilized; however, a vast majority of our catch was collected on the 29 October during two hours of electrofishing. In 2015, we collected two already PIT-tagged razorback sucker. In addition to our primary focus, we also removed 1,813 invasive fishes. We removed 1,320 largemouth (TL range 60-399 mm {most < 100 mm TL}; Figure 14), 397 green sunfish (TL range 38-152 mm{most > 100 mm TL}), 91 white sucker and native hybrids,

and 4 common carp (Figure 13). Largemouth bass had to have been illegally introduced into this pond sometime between late fall 2013 and the end of 2014, as multiple year classes were present in our 2015 catch (obvious reproduction) and we last sampled this pond during the fall 2013 with no largemouth bass in our catch.

CDOT Pond: CDOT Pond (managed by CDOT) is an old gravel pit pond that has been historically used for razorback sucker and bonytail grow-out. This pond is located on the South side of the Colorado River at RMI 204.5 between the east- and west-bound lanes of Interstate 70. This pond connects with the river during high spring runoff. Our office opportunistically samples this pond to further augment the Colorado River razorback sucker and bonytail population. In 2015, we sampled this pond 8-10 and 14-17 July. We used a combination of gear types which included fyke nets, trammel nets, and cast nets. In 2015, we collected, PIT-tagged, and stocked 274 razorback sucker and one bonytail. In addition to our primary focus, we also removed 648 invasive fishes. We removed 84 black crappie (TL range 54-220 mm), 604 bluegill, green sunfish or hybrids (TL range 21-190 mm), 17 largemouth (TL range 133-423 mm; Figure 14), 3 black bullhead, and 2 common carp (Figure 13).

IX. Recommendations:

1. Continue to collect and lethally remove all centrarchids from the Colorado and Gunnison rivers during all CRFP field station activities that include sampling on the Colorado and Gunnison rivers and adjacent habitats (e.g., CDOT and Butch Craig Pond).

2. During years when we're conducting a population estimate for smallmouth bass, continue using three electrofishing boats during the marking pass in an attempt to capture, mark, and release as many smallmouth bass as possible that are $\geq$ 100 mm.

3. Investigate and implement management measures to prevent escapement of smallmouth bass and other piscivorous fishes into riverine areas from bodies of water known to be occupied by species that could negatively impact native riverine fishes. In support of this concept, the Recovery Program has funded additional removal efforts in streamside gravel PIT ponds in FY-16.

4. Target specific in-river features that provide habitat for centrarchid fishes. These include but are not limited to beaver lodges, tree stumps and logs, rock piles, and concrete rip-rap. Using targeted sampling on these instream features with electrofishing may increase our catch of centrarchid fishes.

5. Continue having CPW sample the Upper Colorado reaches from Silt to Beavertail Mountain in DeBeque Canyon.

6. Continue with two nonnative fish removal passes in river reach between the Loma Boat Landing and Westwater Ranger Station, Utah.

7. Evaluate the feasibility of sampling floodplain ponds in addition to Snyder's

(specifically those tied to gravel pit operations and others that have hydrologic connections directly to the Colorado River) in the Silt and Rifle areas to determine fish species presence and abundance/density. In support of this concept, the Recovery Program has funded additional removal efforts in streamside gravel PIT ponds in FY-16.

8. Complete otolith microchemistry analyses to determine the origin of northern pike and walleye collected in the Colorado River, and evaluate other potential habitable locations these fish may have occupied beyond their origination. In support of this concept, USGS will be analyzing Colorado River basin wide otolith samples in FY-16.

9. Suspend all electrofishing operations when it is determined that Colorado pikeminnow show signs of preparing to spawn (e.g., mid- to late-June). Electrofishing will be suspended during this period to eliminate the likelihood of harassment, interference, and injury to spawning Colorado pikeminnow.

10. Downstream from Price-Stubb fish passage, electrofishing should commence following cessation of spawning of Colorado pikeminnow which should be sometime in mid- to late-July.

11. In future years, keep the number of removal passes at eight (or more) to further exploit a smallmouth bass population that currently appears to be in decline in the Upper Colorado River.

12. With adult Colorado pikeminnow abundance estimates falling in both the Green and Colorado Rivers and with the expansion of the walleye population, it is recommended that we implement 'Surge' type effort in the lower rivers (which are important nursery areas for YOY and juvenile Colorado pikeminnow and razorback sucker) in both the spring and fall. Such an effort could be critical to insuring successful recruitment of Colorado pikeminnow and razorback sucker in these nursery areas.

X. Project Status: On track and ongoing.

XI. FY 2015 Budget Status

A. Funds Provided: 126a = $156,836 131(22a-3) for WE removal = $56,672
B. Funds Expended: $213,508
C. Difference: -0-
D. Percent of the FY 2015 work completed, and projected costs to complete: 100%
E. Recovery Program funds spent for publication charges: -0-

XII. Status of Data Submission (Where applicable): Will be submitted to UCRRP database by January 2016.

XIII. Signed: Travis Francis 11/16/2015
Principal Investigator Date

APPENDIX:

A. References

Burdick, B. D. 2008. Removal of smallmouth bass and four other centrarchid fishes from the Upper Colorado and Lower Gunnison Rivers: 2004–2006. Final Report prepared for the Upper Colorado River Endangered Fish Recovery Program. Recovery Program Project Number 126. U. S. Fish and Wildlife Service, Colorado River Fishery Project, Grand Junction, Colorado. 61 pp + appendices.

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Attachments include:

7 Tables
14 Figures
2 Photos
2 PPRs

Table 1. Catch/effort (CPE, fish/hr) comparison by year for four different length classes (total length) of smallmouth bass (< 100mm = age-0; 100–199 mm = juveniles; > 200 mm = adults; > 325 mm = piscivore) for the Upper Colorado River Silt to Beavertail Mountain reaches (river miles 248.0– 195.7), the Upper Colorado River from Government Highline Dam to the Westwater Wash, Utah (river miles 193.7.7 – 124.8) and the Lower Gunnison River from the Redlands Diversion Dam to the Colorado/Gunnison River confluence (river miles 3.0 – 0.7), and the Upper Colorado River from Cisco to Potash, Utah (river miles 111.0 – 47.2) from 2004 – 2015. Note: a) all removal passes and all reaches were combined within years for the Silt to Beavertail Mountain and Government Highline Dam to Westwater, Utah, plus the Lower Gunnison River reaches, and the Cisco to Potash reaches b) Silt to Rifle reach sampled only during 2007, 2008, 2014, and 2015, and c) Government Highline to Cameo XCEL Bridge reach added in 2009, d) in 2011, some reaches were not sampled which included Black Rocks to Westwater Ranger Station, Government Highline to Cameo, and Cottonwood Park boat landing to Beavertail Mountain, e) some reaches not sampled in 2012 include the 2.3- mile section of the Lower Gunnison River from the Redlands Diversion Dam to the Colorado/Gunnison River confluence, the additional reach between the Government Highline Dam and the Cameo Bridge, from Cameo Bridge to GVIC, and Parachute to Debeque , f) Cisco to Potash, Utah reaches were added in 2013, and g) Westwater Ranger Station to Westwater Wash was added in 2014.

			Smallmouth Bass											
River Section	Length Class (mm)		Year											
			2015	2014	2013	2012	2011	2010	2009	2008	2007	2006	2005	2004
	< 100	No. of fish	2	8	4	1	0	57	0	21	17	36	58	3
		C/E	0.05	0.14	0.07	0.02	0	0.72	0	0.25	0.2	0.96	1.46	0.15
Rifle Beavertail Mountain	100-199	No. of fish	1	5	29	1	6	0	3	29	28	2	54	4
		C/E	0.02	0.08	0.53	0.02	0.48	0	0.05	0.34	0.32	0.05	1.36	0.2
	> 200	No. of fish	4	13	1	3	5	39	12	32	45	41	118	14
		C/E	0.09	0.22	0.02	0.05	0.01	0.49	0.19	0.37	0.52	1.09	2.96	0.71
	> 325	No. of fish	1	2	0	not calculated	not calculated	not calculated	not calculated	not calculated	not calculated	not calculated	not calculated	not calculated
		C/E	0.02	0.03	0									
Government Highline Dam Westwater, Utah + Lower Gunnison River	< 100	No. of fish	123	86	1,213	761	226	2,054	191	185	1,358	261	254	93
		C/E	0.28	0.17	3.33	2.62	0.55	5.82	0.55	0.63	4.15	1.61	1.46	0.55
	100-199	No. of fish	93	399	1,281	316	611	159	137	214	250	54	345	618
		C/E	0.21	0.78	3.52	1.09	1.47	0.45	0.39	0.73	0.76	0.33	1.98	3.66
	> 200	No. of fish	283	566	754	423	147	188	177	135	429	449	768	456
		C/E	0.64	1.11	2.07	1.46	0.35	0.53	0.51	0.46	1.31	2.77	4.39	2.7
	> 325	No. of fish	14	31	41	not calculated	not calculated	not calculated	not calculated	not calculated	not calculated	not calculated	not calculated	not calculated
		C/E	0.03	0.06	0.11									
	< 100	No. of fish	3	0	0	NA	NA	NA	NA	NA	NA	NA	NA	NA
		C/E	0.01	0	0									
Cisco Potash Utah	100-199	No. of fish	5	3	3	NA	NA	NA	NA	NA	NA	NA	NA	NA
		C/E	0.02	0.02	0.04									
	> 200	No. of fish	28	38	21	NA	NA	NA	NA	NA	NA	NA	NA	NA
		C/E	0.13	0.26	0.29									
	> 325	No. of fish	10	20	5	not calculated	not calculated	not calculated	not calculated	not calculated	not calculated	not calculated	not calculated	not calculated
		C/E	0.05	0.14	0.07									

Table 2. Catch/effort (CPE, fish/hr) comparison by year for four different length classes (total length) of largemouth bass (< 100mm = age-0; 100–199 mm = juveniles; > 200 mm = adults, > 325 = piscivore) for the Upper Colorado River Silt to Beavertail Mountain reaches (river miles 248.0 – 195.7), the Upper Colorado River from Government Highline Dam to the Westwater Wash, Utah (river miles 193.7.7 – 124.8) and the Lower Gunnison River from the Redlands Diversion Dam to the Colorado/Gunnison River confluence (river miles 3.0 – 0.7), and the Upper Colorado River from Cisco to Potash, Utah (river miles 111.0 – 47.2) from 2004 – 2015. Note: a) all removal passes and all reaches were combined within years for the Silt to Beavertail Mountain and Government Highline Dam to Westwater, Utah, plus the Lower Gunnison River reaches, and the Cisco to Potash reaches b) Silt to Rifle reach sampled only during 2007 and 2008, 2014 and 2015, and c) Government Highline to Cameo XCEL Bridge reach added in 2009, d) in 2011, some reaches were not sampled which included Black Rocks to Westwater Ranger Station, Government Highline to Cameo, and Cottonwood Park boat landing to Beavertail Mountain, e) some reaches not sampled in 2012 include the 2.3- mile section of the Lower Gunnison River from the Redlands Diversion Dam to the Colorado/Gunnison River confluence, the additional reach between the Government Highline Dam and the Cameo Bridge, from Cameo Bridge to GVIC, and Parachute to Debeque , f) Cisco to Potash, Utah reaches were added in 2013, and g) Westwater Ranger Station to Westwater Wash was added in 2014.

			Largemouth Bass											
River Section	Length Class (mm)		Year											
			2015	2014	2013	2012	2011	2010	2009	2008	2007	2006	2005	2004
		No. of fish	17	24	232	37	9	24	36	462	122	125	10	53
	< 100	C/E	0.39	0.4	4.25	0.66	0.71	0.3	0.58	6.05	1.4	3.33	0.25	2.68
Rifle		No. of fish	12	18	53	35	13	31	29	90	109	71	10	11
Beavertail	100-199													
Mountain		C/E	0.28	0.3	0.97	0.62	1.03	0.39	0.47	1.05	1.26	1.89	0.25	0.56
		No. of fish	2	14	15	0	5	13	5	43	56	15	17	2
	> 200	C/E	0.05	0.24	0.28	0	0.4	0.16	0.08	0.5	0.64	0.4	0.43	0.1
		No. of fish	0	1	2	not calculated	not calculated	not calculated	not calculated	not calculated	not calculated	not calculated	not calculated	not calculated
	> 325													
		No. of fish	797	1,071	467	3,484	2,463	4,281	1,952	1,272	1,507	573	465	173
	< 100													
Government		C/E	1.8	2.1	1.28	12	6.05	12.1	5.58	4.32	4.61	3.54	2.66	1.03
Highline Dam														
Westwater, Utah +		No. of fish	332	188	323	1,674	712	1,141	609	344	1,332	487	86	85
Lower Gunnison River	100-199	C/E	0.75	0.37	0.89	5.766	1.72	3.23	1.74	1.17	4.07	3.01	0.49	0.5
		No. of fish	102	67	62	69	102	29	32	39	43	36	38	21
	> 200	C/E	0.23	0.13	0.17	0.24	0.25	0.08	0.09	0.13	0.13	0.22	0.22	0.12
		No. of fish	13	20	5	not calculated	not calculated	not calculated	not calculated	not calculated	not calculated	not calculated	not calculated	not calculated
	> 325	C/E	0.03	0.04	0.01									
		No. of fish	47	3	1	NA	NA	NA	NA	NA	NA	NA	NA	NA
	< 100	C/E	0.21	0.02	0.01									
Cisco		No. of fish	106	5	4	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potash	100-199													
Utah		C/E	0.48	0.03	0.05									
		No. of fish	10	1	13	NA	NA	NA	NA	NA	NA	NA	NA	NA
	> 200	C/E	0.05	0.01	0.23									
		No. of fish	3	0	2	not calculated	not calculated	not calculated	not calculated	not calculated	not calculated	not calculated	not calculated	not calculated
	> 325	C/E	0.01	0	0.03									

Table3. Catch/effort (CPE, fish/hr) comparison by year for four different length classes (total length) of walleye (< 200mm = age-0; 200-299 mm = juveniles; 200–374 mm = adults, > 375 = piscivore) for the Upper Colorado River Cisco to Dewey Bridge reach (river miles 112.3 – 94.6), Dewey Bridge to takeout Beach reach (river miles 94.6 – 74.2), Takeout Beach to Potash, UT reach (river miles 74.2 – 47.2), and Potash, UT to the confluence of the Green River reach (river miles 47.2 – 0.0). Catch/effort data is partitioned by spring work (Colorado pikeminnow estimate) and experimental fall work (non-native removal). Note: a) Effort hasn't been electronically entered into a spreadsheet for Spring 2013 data, and b) spring collections occur by two methods; electrofishing and backwater scare and snare with trammel nets, catch/effort is reported only for electrofishing.

	Walleye							
River Section	Length Class (mm)		Time Period					
			Fall 2015	Spring 2015	Fall 2014	Spring 2014	Fall 2013	Spring 2013 No Effort Key Punched
Cisco UT to Dewey Bridge	< 200	No. of fish	0	0	0	0	0	0
		E-fish C/E						
	200-299	No. of fish	0	0	0	0	0	0
		E-fish C/E						
	300-374	No. of fish	0	0	1 E-fish	0	0	0
		E-fish C/E			**0.02**			
	> 375	No. of fish	30 E-fish	18 E-fish	64 E-fish	(5 total) 4 E-fish	19 E-fish	20
		E-fish C/E	**0.46**	**0.46**	**1.32**	**0.1**	**0.62**	NA
Dewey Bridge to Takeout Beach (Professor Valley)	< 200	No. of fish	0	0	0	0	0	0
		E-fish C/E						
	200-299	No. of fish	0	0	0	0	0	0
		E-fish C/E						
	300-374	No. of fish	3 E-fish	0	0	0		0
		E-fish C/E	**0.04**					
	> 375	No. of fish	25 E-fish	18 E-fish	8 E-fish	(19 total) 18 E-fish	3 E-fish	67
		E-fish C/E	**0.34**	**0.28**	**0.44**	**0.29**	**0.18**	NA
Takeout Beach to Potash, UT	< 200	No. of fish	0	0	0	0	0	0
		E-fish C/E						
	200-299	No. of fish	0	0	0	0	0	0
		E-fish C/E						
	300-374	No. of fish	2 E-fish	0	0	1 E-fish	0	0
		E-fish C/E	**0.02**			**0.02**		
	> 375	No. of fish	15 E-fish	(18 total) 14 E-fish	34 E-fish	(45 total) 39 E-fish	1 E-fish	94
		E-fish C/E	**0.18**	**0.22**	**0.35**	**0.74**	**0.04**	NA
Potash, UT to the confluence of the Green River	< 200	No. of fish	No sample		No sample	0	No sample	0
		E-fish C/E						
	200-299	No. of fish	No sample		No sample	0	No sample	1
		E-fish C/E						
	300-374	No. of fish	No sample	1 E-fish	No sample	0	No sample	2
		E-fish C/E		**0.01**				
	> 375	No. of fish	No sample	(28 total) 26 E-fish	No sample	(39 total) 31 E-fish	No sample	84
		E-fish C/E		**0.23**		**0.35**		

Table 4. Population estimate with 95% confidence intervals (CI) and other statistics for smallmouth bass (100-199 mm and > 200 mm) for the 15- and 18-mile reaches (river miles 185.6 to 152.6) of the Upper Colorado River and 2.3 miles of the Lower Gunnison River (Redlands Diversion Dam to the Colorado/Gunnison River confluence) for the summers of 2006 - 2015. Note: length of the area for the population estimate was 35.3 miles.

Year	Fish Length Size (mm)	Pop Estimate with 95% CI	SE	SM Bass/ mile	Number Marked; No. Removed 1st Removal	Number Recaptured on 1st Removal Pass	Total Number Recaptured on all removal passes	Total Number of Removal Passes	Total Number of SM Bass Removed on all removal passes	Percentage Removed on all removal passes	CV (%)	p-hat (weighted)
2004/2005	NO POPULATION ESTIMATE PERFORMED											
2006	100-199	No Pop Est.	- - -	- - -	25; 18	0	0	4	54	- - -	- - -	- - -
	≥ 200	2,295 ± 1,500	765	65	97; 163	6	8	4	449	19.6	33.3	0.043
2007	100-199	No Pop Est.	- - -	- - -	13; 16	0	0	8	250	- - -	- - -	- - -
	≥ 200	1,007 ± 686	350	28.5	54; 109	5	14	8	429	42.6	34.8	0.06
2008	100-199	804 "± 423	216	22.8	96; 82	9	10	8	214	26.6	26.9	0.101
	≥ 200	393 ± 276	141	11.1	67; 28	4	17	8	135	34.4	35.9	0.073
2009	100-199	2,044 ± 2,238	1,142	57.9	86; 46	1	6	8	138	6.8	55.9	0.014
	≥ 200	755 ± 802	409	21.4	71; 20	1	4	8	178	23.6	54.2	0.017
2010	100-199	255 ± 196	100.2	7.2	31; 31	3	11	8	159	62.4	39.3	0.097
	≥ 200	823 ± 671	342	23.3	53; 60	3	9	8	188	22.8	41.6	0.053
2011	100-199	1,718 ± 1,115	569	48.7	101; 117	6	10	10	611	35.6	10.4	0.056
	≥ 200	110 ± 108	55.1	3.1	12; 16	1	3	10	147	135	50	0.071
2012	100-199	232 ± 133	67.7	6.6	50; 37	6	9	6	201	86.6	29.2	0.159
	≥ 200	1,853 ± 1,748	889	52.5	82; 68	2	8	6	233	12.6	48	0.037
2013 to 2015	NO POPULATION ESTIMATE PERFORMED											

Table 5. 2015 razorback sucker captured during nonnative fish removal projects 126a & b stock event histories.

Stock or Tagged in the Field Year	# Captured during 126a & b 2015	Source Hatchery or Field Station	Stock or Capture River	Stock or Capture RMI	Location Description	Notes
2000	2	Grand Jct.	CO	177.4	Corn Lake Boat Launch near Clifton	1 was recaptured twice in 2005, 1 was recaptured in 2007, twice in 2014 and once spring 2015
2002	3	Grand Jct.	CO	152.6	Loma Boat Launch	
2002	1	Grand Jct.	GU	57.1	Delta, CO	recaptured in 2009 and 2014
2004	2	Grand Jct.	CO	177.4	Corn Lake Boat Launch near Clifton	1 was recaptured in 2007 and twice in 2014
2004	4	Grand Jct.	CO	152.6	Loma Boat Launch	1 was recaptured twice in 2014 and twice in spring 2015
2005	4	Grand Jct.	CO	177.4	Corn Lake Boat Launch near Clifton	1 was recaptured twice in 2008.
2005	1	Grand Jct.	CO	152.6	Loma Boat Launch	recaptured twice in spring 2015
2007	1	Grand Jct.	CO	177.4	Corn Lake Boat Launch near Clifton	
2007	2	Grand Jct.	CO	166.7	Redlands Parkway boat launch	
2007	1	Grand Jct.	GU	57.1	Delta, CO	1 was recaptured spring 2015
2008	4	Grand Jct.	CO	185.1	Palisade, CO	1 was recaptured in 2012, 2014 and spring 2015, 1 was recaptured in 2009, 1 was recaptured in 2013
2008	4	Grand Jct.	CO	177.4	Corn Lake Boat Launch near Clifton	1 was recaptured in 2013
2008	2	Grand Jct.	CO	166.7	Redlands Parkway boat launch	1 was recaptured in 2010 and 2014
2008	1	Grand Jct.	GU	42.6	Escalante Boat Ramp	recaptured twice in 2014
2009	1	Grand Jct.	CO	240.7	Rifle, CO	recaptured twice in 2011 and three timed in 2014
2009	5	Grand Jct.	CO	185.1	Palisade, CO	1 was recaptured in 2010
2009	1	Grand Jct.	CO	177.4	Corn Lake Boat Launch near Clifton	recaptured in 2011
2009	1	Grand Jct.	CO	171.8	Upstream of GU confluence	Caught w/o tag had one inserted in field and recaptured twice in 2009
2009	1	Grand Jct.	CO	99	Sagars Wash	Caught w/o tag had one inserted in field and recaptured in 2013
2009	2	Vernal	GR	120	Green River State Park	1 was recaptured in 2013 and 2014
2010	1	Grand Jct.	CO	227.6	Battlement Mesa, CO	
2010	1	Grand Jct.	CO	183.6	Palisade, CO	recaptured in 2011 and 2013
2010	1	Grand Jct.	CO	57	Downstream of Moab	Caught w/o tag had one inserted in field
2010	1	Grand Jct.	CO	45	Potash, UT	Caught w/o tag had one inserted in field
2010	1	Grand Jct.	CO	42.2	Canyonlands NP	Caught w/o tag had one inserted in field and recaptured in 2014
2010	2	Grand Jct.	GR	120	Green River State Park	1 was recaptured spring 2015

Table 5. Cont.

Stock or Tagged in the Field Year	# Captured during 126a & b 2015	Source Hatchery or Field Station	Stock or Capture River	Stock or Capture RMI	Location Description	Notes
2011	1	Grand Jct.	CO	240.7	Rifle, CO	
2011	9	Grand Jct.	CO	227.6	Battlement Mesa, CO	3 were recaptured in 2014, 1 was detected by the Price-Stubb antenna, 1 was recaptured spring 2015
2011	10	Grand Jct.	CO	184.7	Palisade, CO	4 were recaptured in 2014
2011	5	Grand Jct.	CO	177.3	Corn Lake Boat Launch near Clifton	1 was recaptured in 2014, 1 was recaptured twice in spring 2015
2011	3	Grand Jct.	CO	170.7	Jarvis Wetland	1 was recaptured twice in 2014 and once spring 2015, 1 was recaptured spring 2015
2011	2	Grand Jct.	GU	12.7	Butch Craig Wetland	1 was recaptured spring 2015
2011	5	Vernal	GR	120	Green River State Park	1 was recaptured in 2014, 1 was recaptured twice in 2014
2012	6	Grand Jct.	CO	240.7	Rifle, CO	1 was recaptured in 2012 and 2013
2012	2	Grand Jct.	CO	183.6	Palisade, CO	
2012	5	Grand Jct.	GU	12.7	Butch Craig Wetland	
2012	5	Vernal	GR	120	Green River State Park	1 was recaptured in 2014 and spring 2015, 1 was recaptured spring 2015
2013	9	Grand Jct.	CO	240.7	Rifle, CO	1 was recaptured spring 2015
2013	3	Grand Jct.	CO	183.6	Palisade, CO	2 were recaptured in 2014
2013	1	Grand Jct.	CO	170	Near Gunnison River Confluence	Caught w/o tag had one inserted in field
2013	13	Grand Jct.	CO	157.1	Fruita State Park Launch	
2013	1	Grand Jct.	CO	138.9	Ruby Horsethief Canyon	Caught w/o tag had one inserted in field
2013	1	Grand Jct.	CO	52.6	Above Potash, UT	Caught w/o tag had one inserted in field, recaptured in 2013
2013	8	Grand Jct.	GU	57.1	Delta, CO	3 were recaptured in 2014, 2 were recaptured spring 2015
2014	44	Grand Jct.	CO	240.7	Rifle, CO	1 was recaptured spring 2015
2014	46	Grand Jct.	CO	183.6	Palisade, CO	1 was recaptured in 2014, 2 were recaptured twice in 2014, 7 were recaptured spring 2015
2014	1	Grand Jct.	CO	168.2	Near Gunnison River Confluence	Caught w/o tag had one inserted in field
2014	7	Grand Jct.	CO	166.7	Redlands Parkway boat launch	2 were recaptured in 2014, 2 were recaptured in 2014 and spring 2015
2014	1	Grand Jct.	CO	99.9	Near Cisco, UT	Caught w/o tag had one inserted in field
2014	1	Grand Jct.	CO	75.4	Above Moab, UT	Caught w/o tag had one inserted in field, recaptured in 2014
2014	18	Grand Jct.	GU	57.1	Delta, CO	4 were recaptured spring 2015
2015	18	Grand Jct.	CO	240.7	Rifle, CO	
2015	11	Grand Jct.	CO	204.5	Debeque Canyon, CO	
2015	47	Grand Jct.	CO	166.7	Redlands Parkway boat launch	4 were recaptured spring 2015
2015	4	Grand Jct.	GU	57.1	Delta, CO	
2015	28	Grand Jct.				Fish tagged during 2015
??	4	Grand Jct.				3 were recaptured once in 2014, 1 was recaptured spring 2015. Stock data absent in database
Total	369					

Table 6. 2015 rare fish captures (excluding razorback sucker) captured during nonnative fish removal projects 126a & b stock event histories. Note: BT = bonytail, BR = bluehead X razorback sucker hybrid, CS = Colorado pikeminnow, FR = flannelmouth X razorback sucker hybrid.

Species	# Captured during 126a & b 2015	Field Tagging Year	Stocking Year	River	RMI	Notes
BT	1		2014	CO	184	
BT	6	2015		CO	Between 51 and 165	Tagged during 126a
BT	17		2015	CO	184	
BT	33		2015	CO	167	
BT	12		2015	CO	157	
BR	1	2015			56.2	Rare bluehead by razorback hybrid tagged during 126a
CS	1	2005		CO	66	recaptured in 2014
CS	1	2013		CO	107.2	recaptured twice in 2014
CS	3	2014		CO	50.8, 54.5, 101.1	1 was recaptured in 2014
CS	6	Spring 2015		CO	Between 50 and 73	
CS	19	2015		CO	Between 50 and 108	Tagged during 126a
FR	1	2014		CO	18.2	
FR	1	Spring 2015		CO	11.1	
FR	7	2015		CO	Between 55 and 105	Tagged during 126a

Table 7. Nonnative fish removal effort on the Colorado and Gunnision Rivers in 2015.

River Reach	River Miles	# of passes	Dates fished	Agency
Silt to Beavertail Tunnel	248.0 to 195.7	1	16 July to 23 July	CPW
GVWU Dam to Riverbend Park	193.7 to 184.6	9	13 July to 23 October	FWS
Riverbend Park to Corn Lake	184.6 to 177.4	11	21 July to 21 October	FWS
Corn Lake to Redlands Parkway	177.4 to 166.7	11	23 July to 13 October	FWS
Redlands Diversion Dam to Redlands Parkway	3.0 (Gunnison River) to 0.8 and 170.9 (Colorado River) to 166.7	9	27 July to 8 September	FWS
Redlands Parkway to Fruita State Park	166.7 to 157.1	10	16 July to 22 September	FWS
Fruita State Park to Loma Boat Launch	157.1 to 152.6	9	10 July to 18 September	FWS
Loma Boat Launch to Mee Corner	152.6 to 139	5	14 July to 23 October	FWS
Mee Corner to Westwater Ranger Station	139 to 127.6	2	15 July to 27 August	FWS
Westwater Ranger Station to Westwater Wash	127.6 to 124.8	8	13 July to 24 September	FWS
Westwater Ranger Station to Fish Ford	127.6 to 105.7	1	6 October to 8 October	UDWR
Cisco to Coates Creek	111.0 to 104	4	9 September to 14 October	FWS
Coates Creek to Dewey Bridge	104 to 94.6	5	10 September to 22 October	FWS
Dewey Bridge to Takeout Beach	94.6 to 74.2	4	15 September to 20 October	FWS
Takeout Beach to Potash	74.2 to 47.2	4	21 September to 21 October	FWS

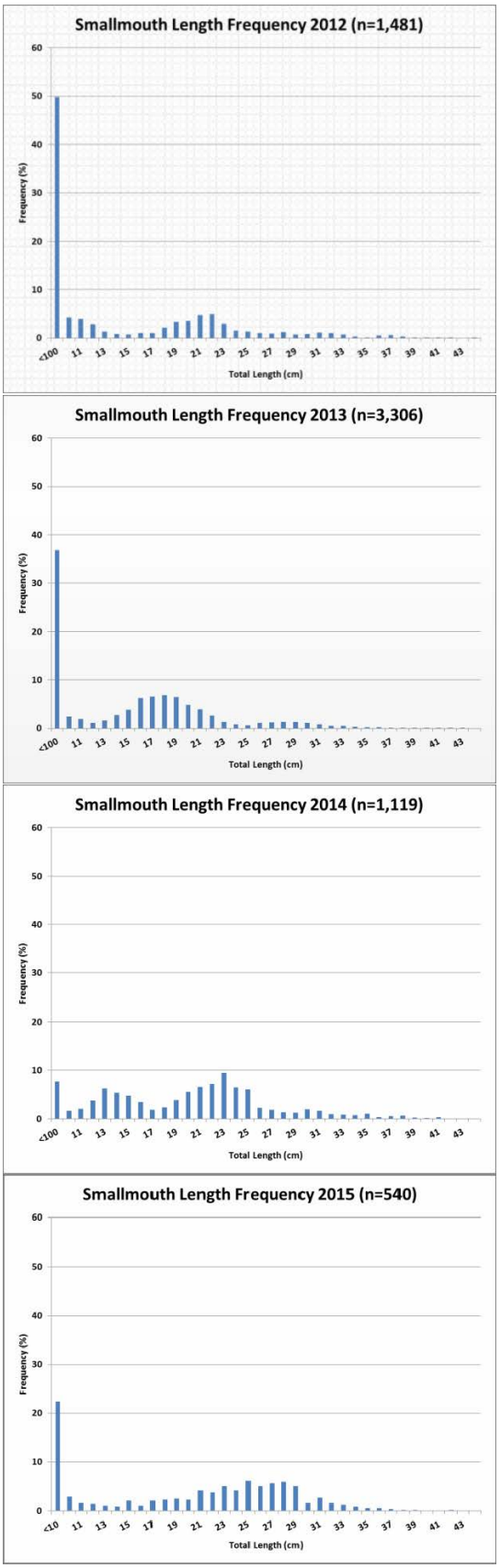

Figure 1. Length frequency histograms for smallmouth bass removed from the Colorado River from Silt, CO to the confluence of the Green River (RMI 0.0), UT from 2012 through 2015.

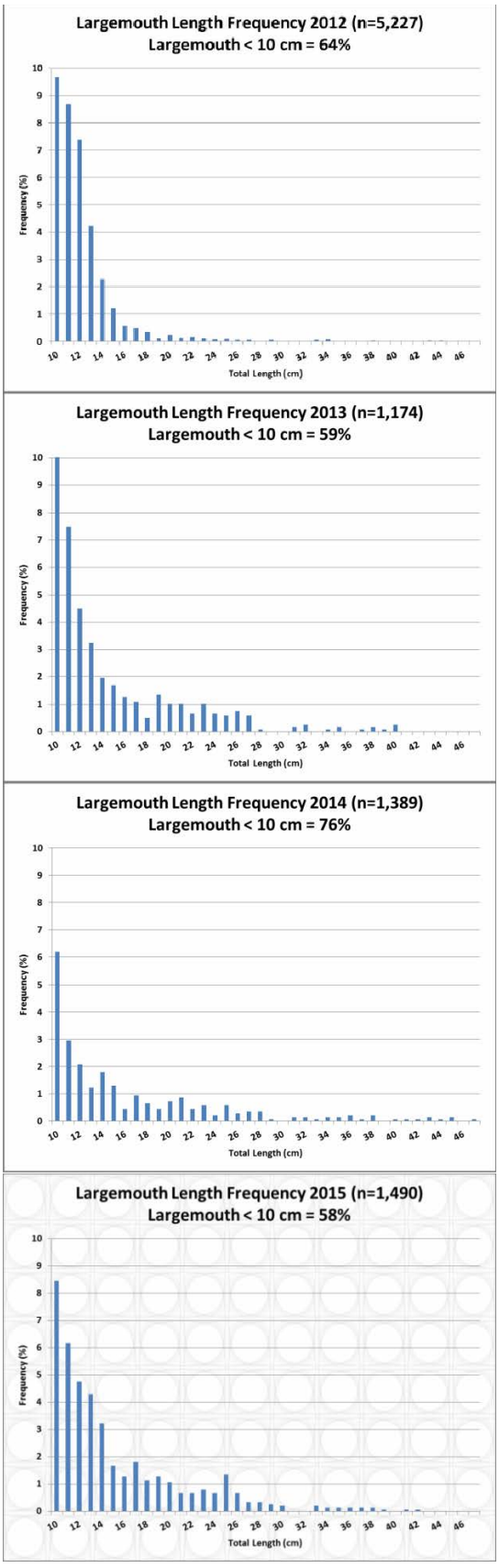

Figure 2. Length frequency histograms for largemouth bass removed from the Colorado River from Silt, CO to the confluence of the Green River (RMI 0.0), UT from 2012 through 2015.

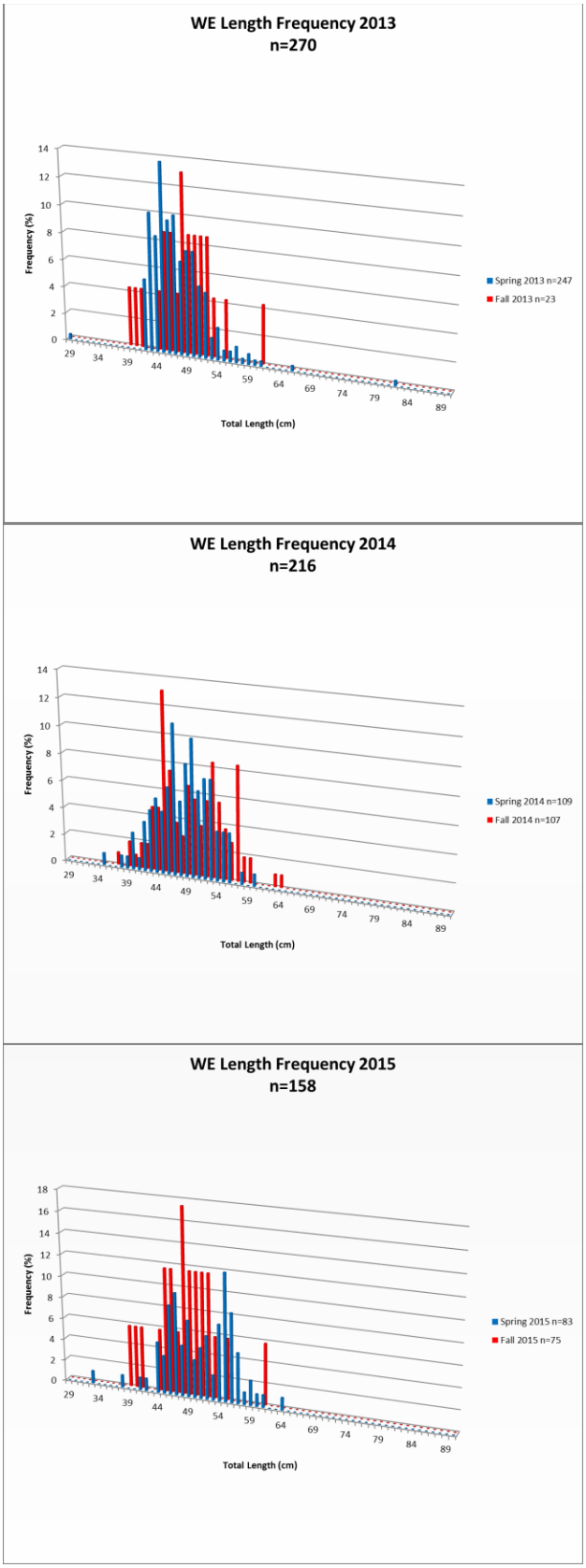

Figure 3. Length frequency histograms for walleye removed from the Colorado River from river mile 112.6 to the confluence of the Green River (RMI 0.0), UT 2013 through 2015.

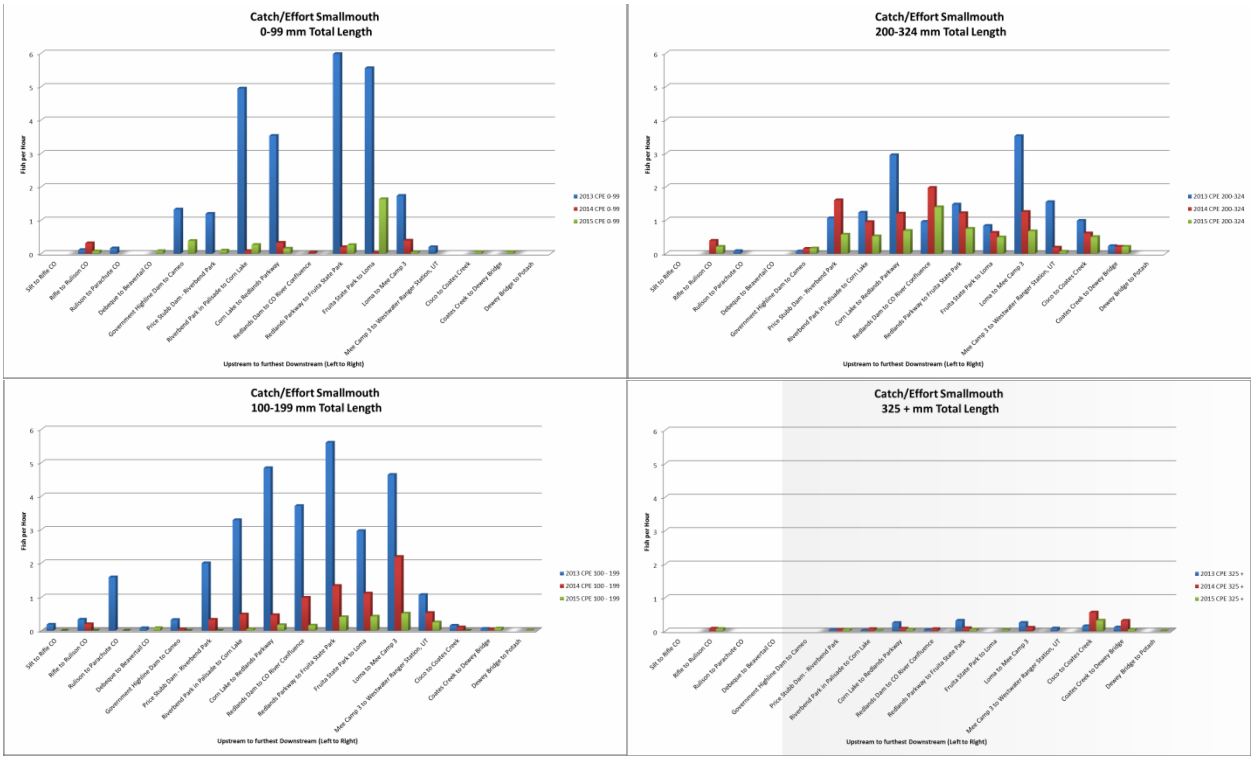

Figure 4. Catch/Effort (number of fish caught per hour electrofishing) by reach for smallmouth bass removed from the Colorado River from Silt, CO (RMI 248.0) to Potash, UT (RMI 47.2), UT during 2015. Smallmouth less than 100 mm are young-of-year, 100-199 mm are juvenile fish, > 200 mm are adults, and > 325 mm are 'piscivorous'.

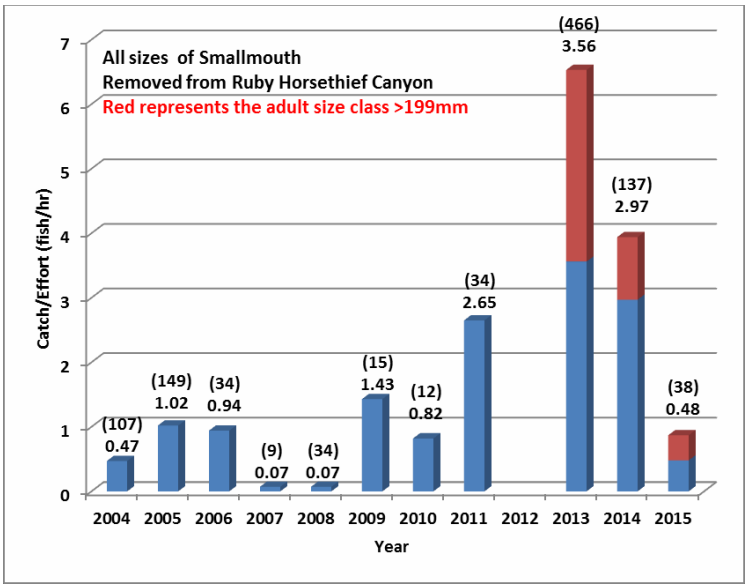

Figure 5. Eleven year comparison of catch/effort (fish/hr) for young-of-year, juvenile and adult smallmouth bass, 2004-2015, for Ruby Horsethief Canyon of the Upper Colorado River. Note: numbers of smallmouth bass collected in parentheses.

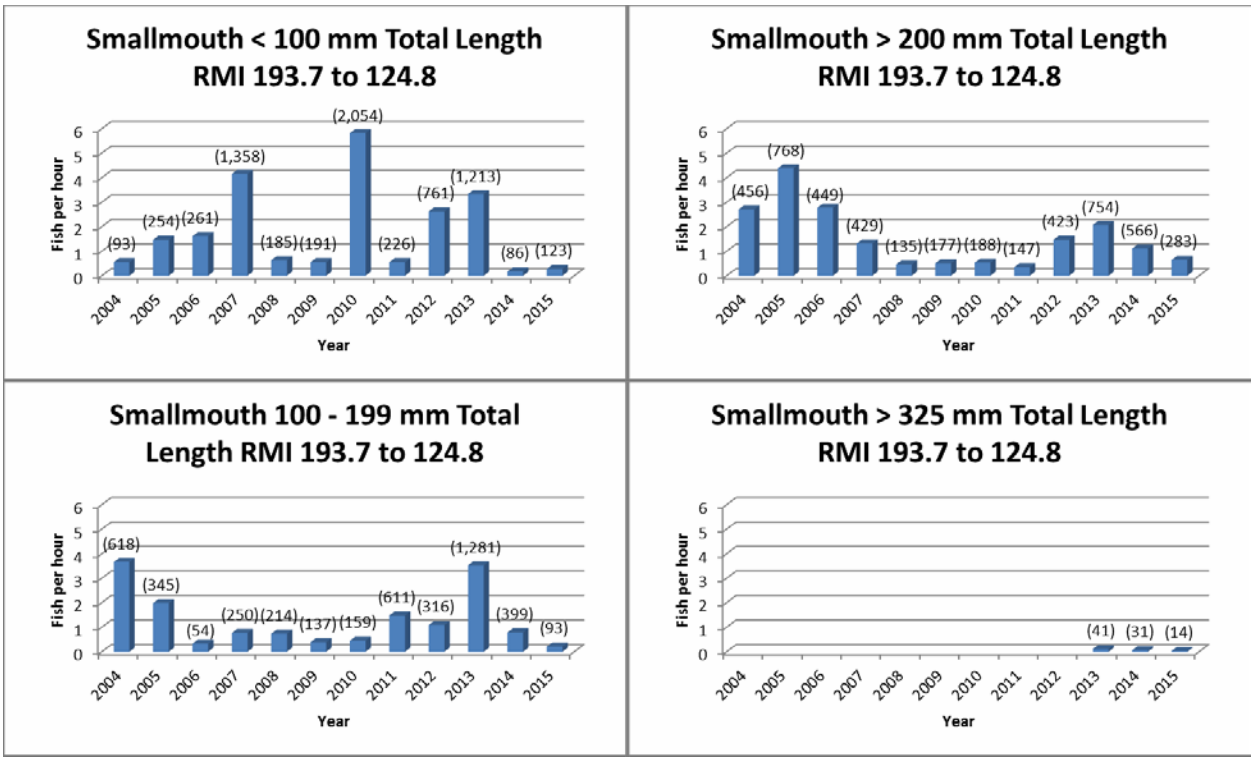

Figure 6. Catch/Effort (number of fish caught per hour electrofishing) by year for smallmouth bass removed from the Colorado River from Government Highline Dam, CO (RMI 193.7) to Westwater Wash, UT (RMI 124.8), UT from 2004 to 2015. Smallmouth less than 100 mm are young-of-year, 100-199 mm are juvenile fish, > 200 mm are adults, and > 325 mm are 'piscivorous'.

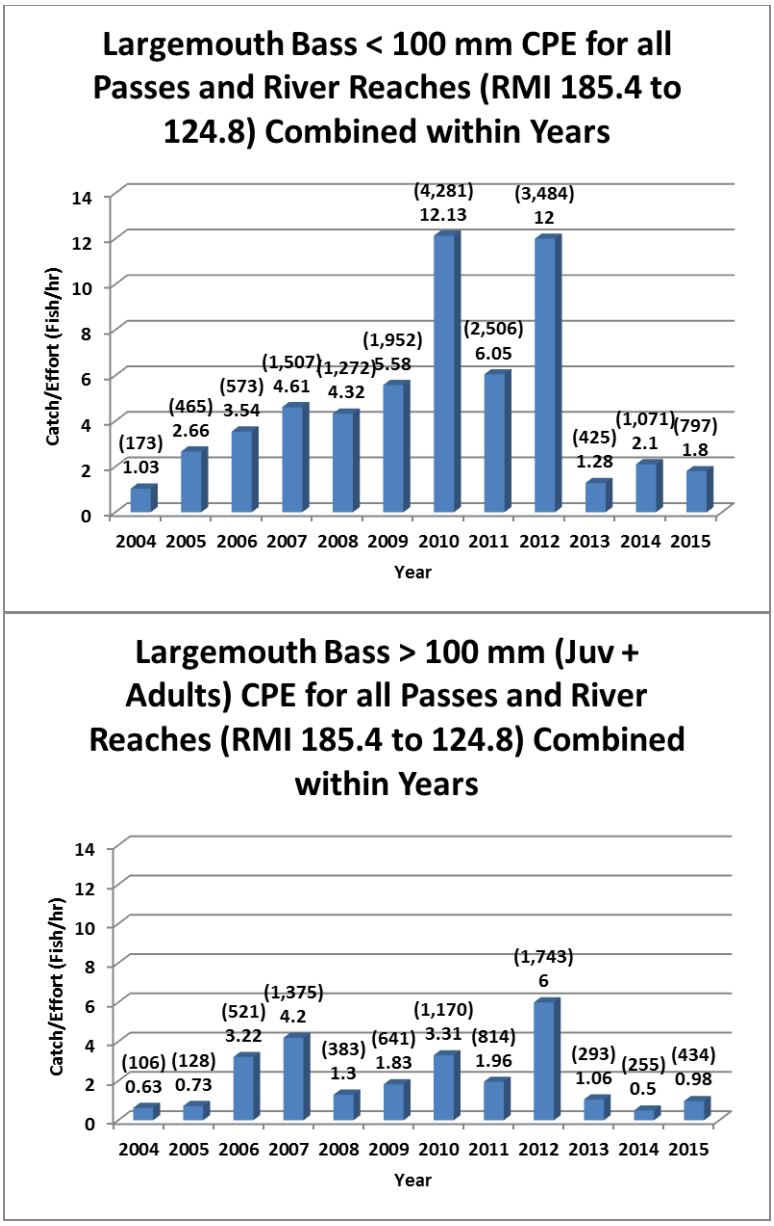

Figure 7. Twelve year comparison of catch/effort (fish/hr) for largemouth bass (< 100 mm) (upper) and juvenile and adult largemouth bass (≥ 100 mm) (lower), 2004-2015, for the Grand Valley reaches of the Upper Colorado and Lower Gunnison rivers. Note: numbers of largemouth bass collected in parentheses.

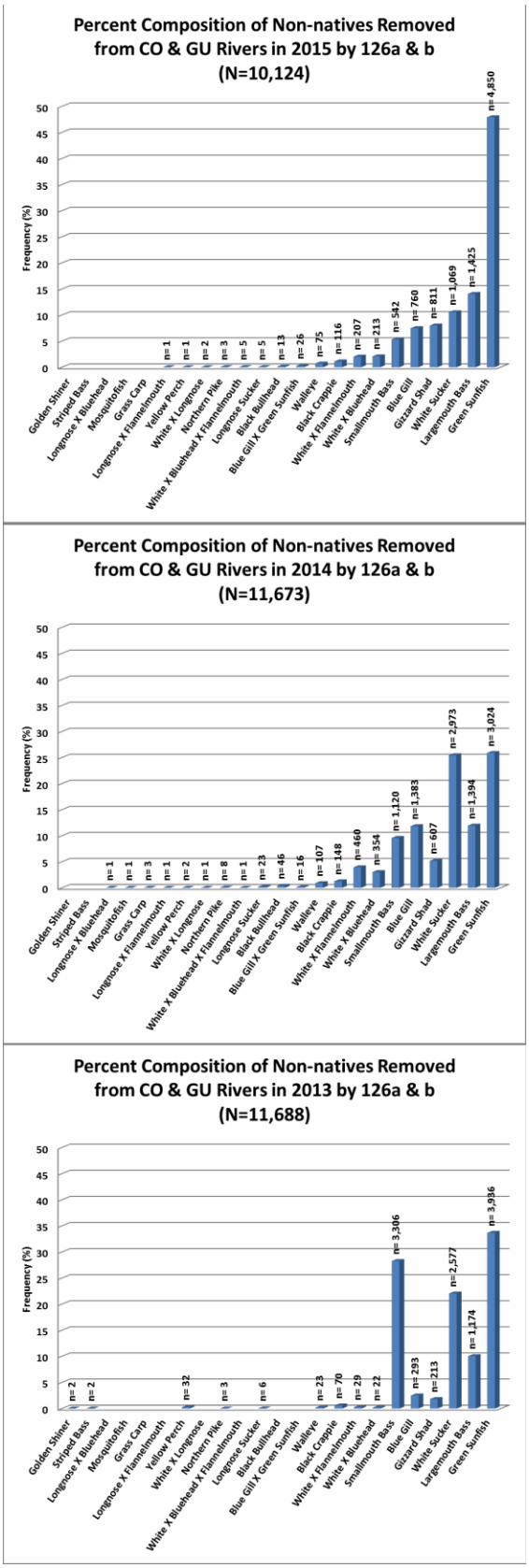

Figure 8. Percent composition of nonnative fish removed from the Colorado (river mile 240.7 to 47.2) and Gunnison (river mile 3.0 to 0.0) rivers in 2013, 2014 and 2015. Note: numbers of fish collected above bars.

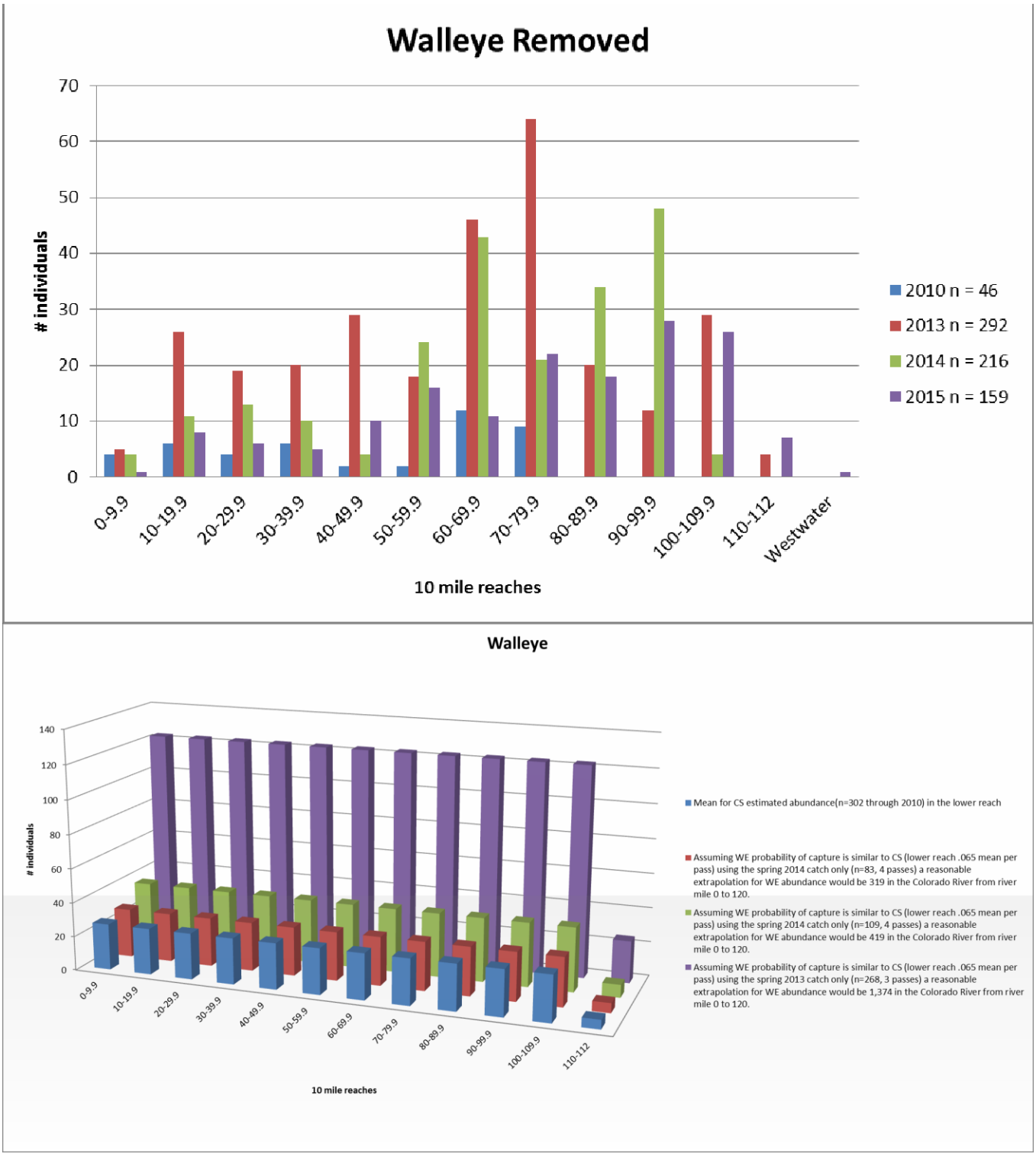

Figure 9. Top figure - distribution of WE captured during both the CS estimate and nonnative removal projects, broken down into 10 mile reaches (Cisco, UT to the confluence of the Green River) in 2010, 2013, 2014, and 2015. Bottom figure – assuming equal distribution and extrapolating walleye abundance by Colorado pikeminnow probabilities of capture, estimated densities of walleye and Colorado pikeminnow, in 2013, 2014 and 2015, by ten mile reach.

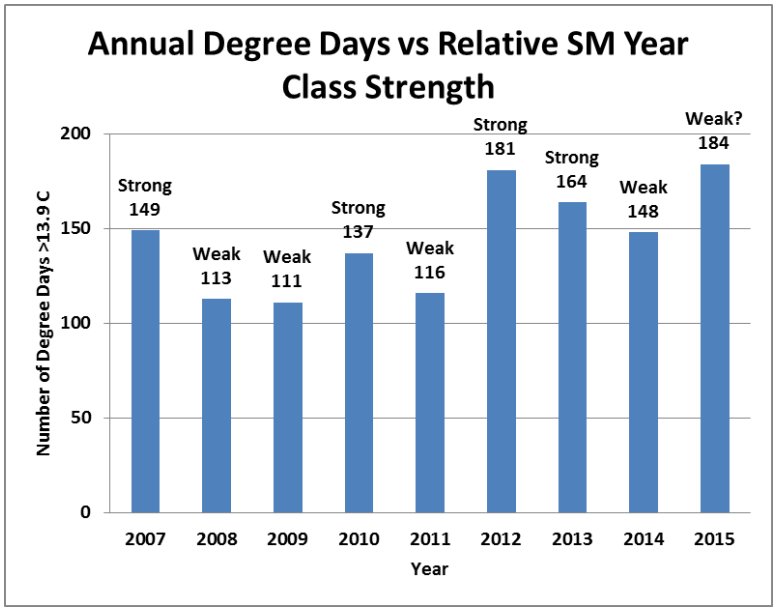

Figure 10. Annual degree days exceeding 13.9° (Celsius) as measured at the USGS 09163500 Colorado River near Colorado- Utah state line gauge.

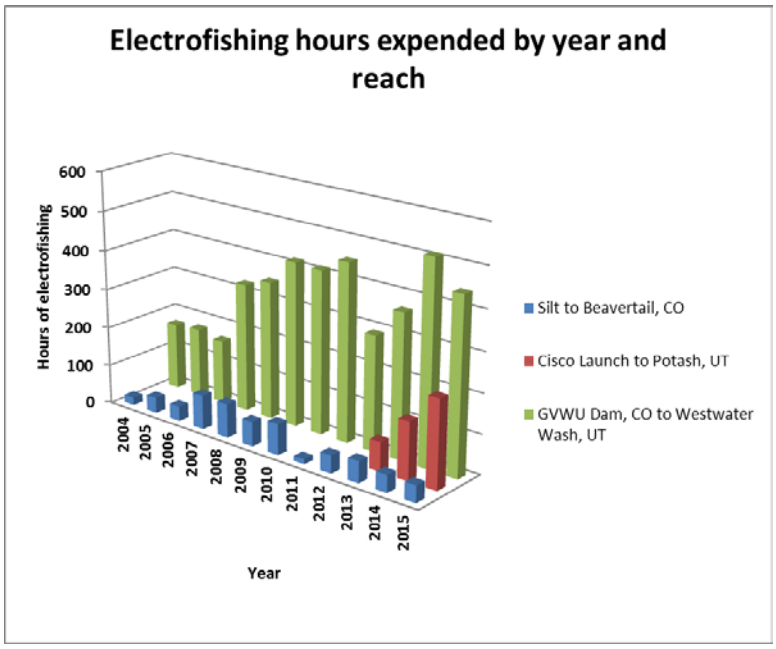

Figure 11. Electrofishing effort for 126a & 126b by year and reach.

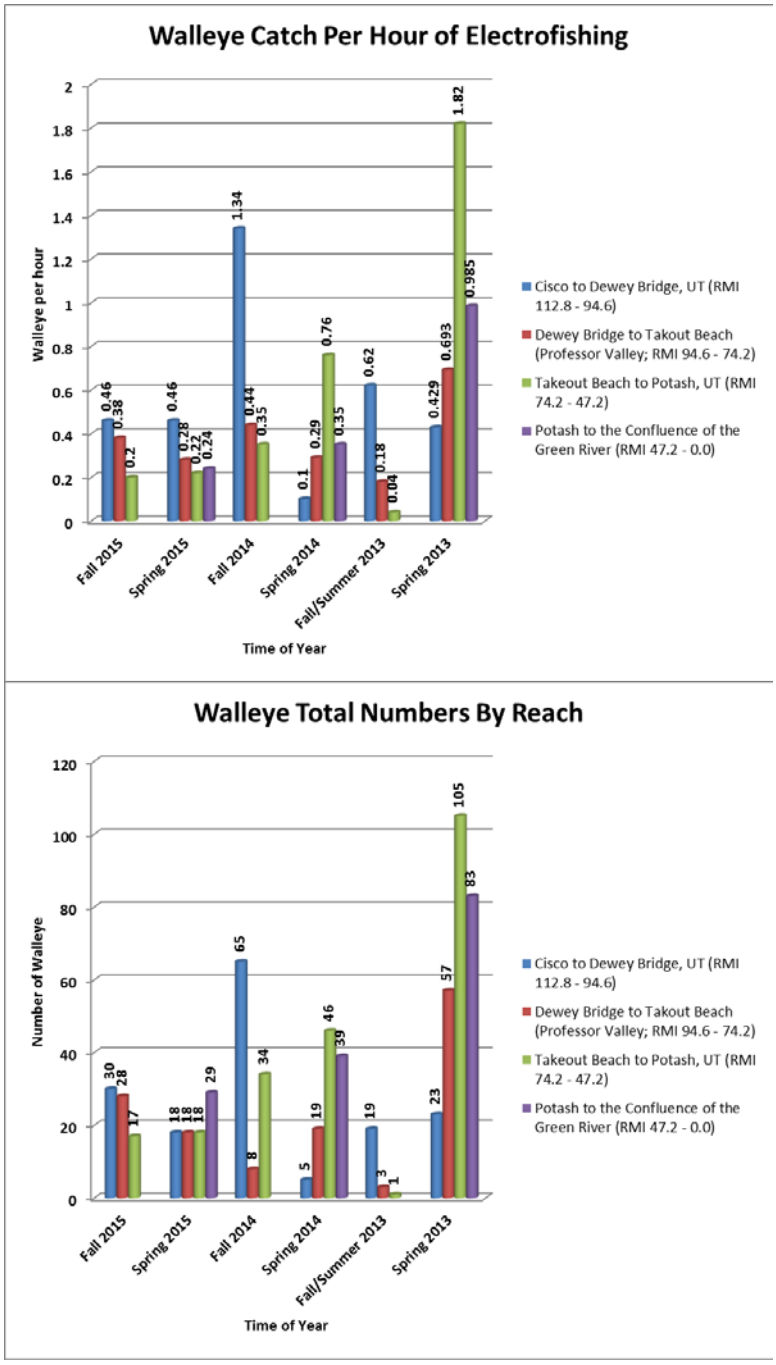

Figure 12. Walleye catch per effort and total numbers removed by season 2013-2015.

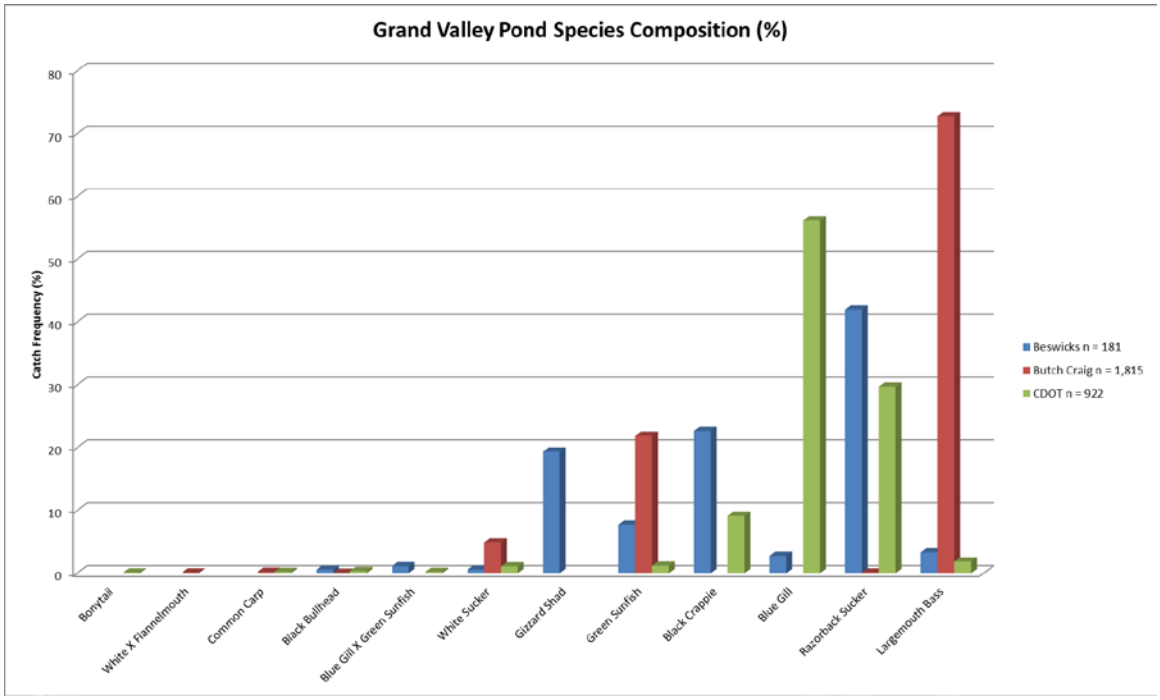

Figure 13. Species composition of fishes handled in Beswicks, Butch Craig and CDOT pond 2015.

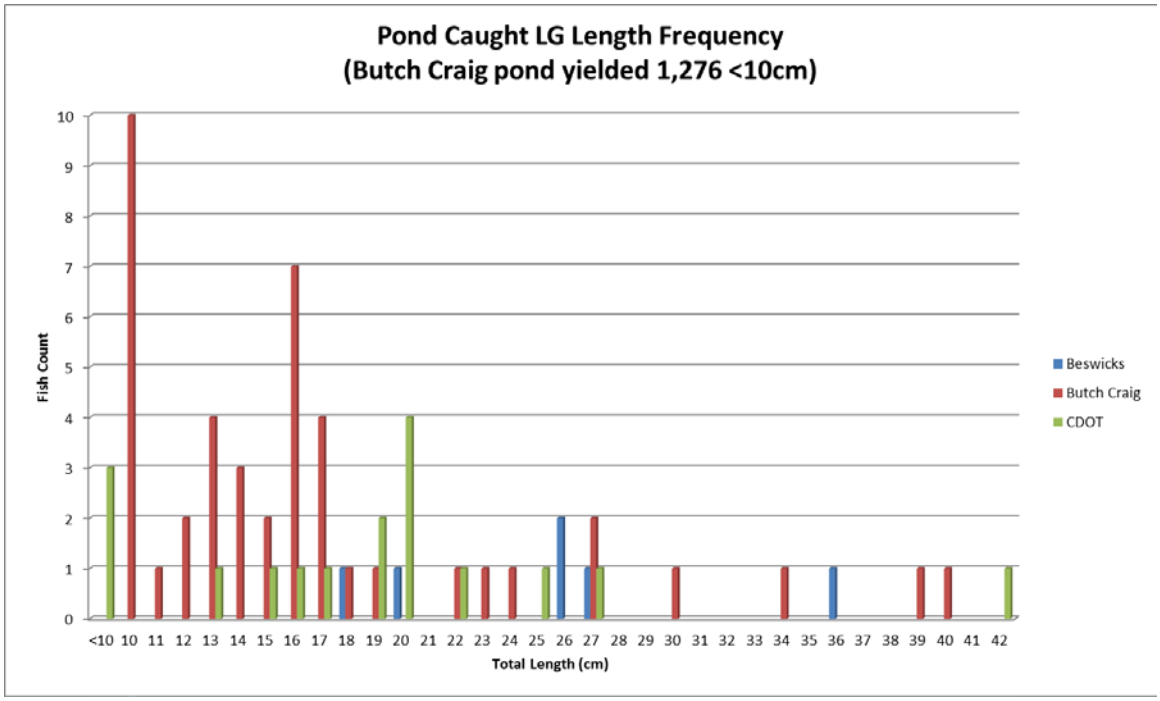

Figure 14. Beswicks, Butch Craig and CDOT ponds largemouth bass length frequency histogram 2015.

Walleye captured with Colorado pikeminnow in their stomachs. Top photo taken 10/8/2014 by Travis Francis. Bottom photo taken 10/15/2014 by Brendan Crowley.

For projects where more than one agency/entity receives funds from the Bureau of Reclamation, append one PPR from each agency/entity. Otherwise, delete.

ANNUAL PERFORMANCE PROGRESS REPORT (PPR)

BUREAU OF RECLAMATION AGREEMENT NUMBER: R13AP40028

UPPER COLORADO RIVER RECOVERY PROGRAM PROJECT NUMBER: 126b

Project Title: **Colorado River and White River Supplemental lethal removal of smallmouth bass and northern pike**

Principal Investigator: Lori Martin, Aquatic Biologist
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Project/Grant Period: Start date (Mo/Day/Yr): July 7, 2013
End date: (Mo/Day/Yr): September 30, 2017
Reporting period end date (Mo/Day/Yr): September 30, 2015
Is this the final report? Yes_____No _X_

Performance:

Summary of CPW's Project 126b: Colorado River Nonnative Removal for 2015

- The Colorado River was sampled between Silt (RM 248.0) and Beavertail Tunnel (RM 195.7) by CPW crews as part of Project 126b. Crews used two, 16' rafts equipped with ETS mounted electrofishing gear to complete the project. Rafts electrofished downstream along both shorelines within the main channel, and utilized experimental gill nets at the mouths of and within backwaters to complete "block and shock" sampling. Fish captured were measured in length to the nearest millimeter and weighed to the nearest gram. Nonnative, non-salmonid fish captured were lethally removed, with the exception of catostomids and common carp which were released alive. Otoliths will be extracted from the northern pike collected to assist in determination of fish origination.

- One electrofishing pass was completed from Silt (RM 248.0) to Beavertail Tunnel (RM 195.7), where the main channel and backwaters were electrofished. In the lower four miles of the Rifle (RM 240.4) to Rulison (RM 230.1) reach, only backwater/slackwater/and eddy habitats were targeted due to time constraints on that particular sampling day. This was the second year that CPW was able to sample the river reach from Parachute (RM 222.2) to Debeque (RM 209.7). In previous years, this reach was inaccessible to CPW crews, mainly due to low river flows prohibiting crews from crossing a dangerous river diversion (Bluestone Ditch) upstream of Debeque. In general, northern pike, black bullheads, and most centrarchids were all captured within backwater/slackwater/eddy habitats.

- Total Number of Fish Removed = 300

  Total Number of Black Bullhead = 13 (Total length ranged from 85mm-220mm)
  Total Number of Green Sunfish = 248 (Total length ranged from 31mm-150mm)
  Total Number of Largemouth Bass = 31 (Total length ranged from 38mm-270mm);
  18 fish $\leq$ 100mm; 10 fish > 100mm and < 150mm; 3 fish $\geq$ 150mm
  Total Number of Northern Pike = 1 (Total length = 737mm)
  Total Number of Smallmouth Bass = 7 (Total length ranged from 79mm-449mm);
  2 fish $\leq$ 100mm; 1 fish > 100mm and <150mm; 4 fish $\geq$ = 150mm

- Total Electrofishing Effort Expended = 43.21 hours

- Centrarchid CPUE = 6.62 fish/hour;
  -Green Sunfish = 5.74 fish/hour
  -Largemouth Bass = 0.72 fish/hour
  -Smallmouth Bass = 0.16 fish/hour

- Northern Pike CPUE = 0.023 fish/hour

Summary of CPW's Project 126b: Mamm Creek/Lafarge/United Pit Nonnative Removal for 2015

- The Mamm Creek/Lafarge/United Pit (pond approximately 37 surface acres) was sampled by CPW crews using both active (16' hard bottom jet boats equipped with Smith Root mounted electrofishing gear) as well as passive (fyke and gill nets, as well as a Merwin trap) sampling gears. Electrofishing was completed during the day and across some evenings in the spring and early summer of 2015. In the spring and concurrent with day/night electrofishing, eight fyke nets were strategically placed along the shorelines, and used to capture fish throughout the day and night hours. In addition, three to six gill nets were deployed during daylight hours while concurrently electrofishing. Both methodologies were used across six days in March (18^{th}-25^{th}). On April 13^{th} and presumably post-spawn of northern pike, a Merwin trap (an oversized trap net typically used to collect kokanee salmon during the spawning season in Colorado) was stationed in the pond across the downstream dam breach (outlet) to preclude nonnative fishes from escaping the pond and entering the Colorado River during run-off conditions. This trap passively caught fish until July 27^{th}, when the trap was removed from the pond. CPW crews visited the pond on 14 occasions between April 13^{th} and July 27^{th} to check the Merwin trap. On most of those visits, CPW crews

also day electrofished and set gill nets. Fish captured were measured in length to the nearest millimeter and weighed to the nearest gram. Nonnative, non-salmonid fish captured were lethally removed, with the exception of three dozen largemouth bass (> 300 mm TL) that were translocated to Harvey Gap Reservoir.

- The Colorado River breached the pond inlet notch during high flows in early summer 2015. As a result, water level within the pond rose high enough to spill back into the Colorado River through the outlet notch. The Merwin trap may have been effective in blocking fish from leaving the pond, in addition to passively capturing nonnative fishes within the pond across the three months the trap was deployed. All fish species captured via traditional sampling techniques in the pond were also captured within the Merwin net. CPW is in the process of purchasing an additional Merwin trap that will be dedicated for use in the Mamm Creek/Lafarge/United Pit beginning in the spring of 2016. CPW crews plan to further exploit northern pike by using the new Merwin trap to target northern pike prior, during, and post spawn in the spring and early summer months.

- Total Number of Fish Removed = 2,984 fish
  Total Number of Black Bullhead = 1 (Total length = 95mm)
  Total Number of Common Carp = 140 (Total length ranged from 33mm-772mm)
  Total Number of Fathead Minnow = 71 (Total length ranged from 40mm-78mm)
  Total Number of Green Sunfish = 597 (Total length ranged from 25mm-130mm)
  Total Number of Largemouth Bass = 1,693 (Total length ranged from 42mm-481mm):
  1,650 fish $\leq$ 100mm;
  4 fish > 100mm and < 150mm;
  39 fish $\geq$ = 150mm
  Total Number of Northern Pike = 326 (Total length ranged from 202mm-1,016mm):
  0 fish <200mm;
  35 fish $\geq$ 200mm and < 400mm;
  86 fish $\geq$ 400mm and < 500mm;
  106 fish $\geq$ 500mm and < 600mm;
  79 fish $\geq$ 600mm and < 700mm;
  14 fish $\geq$ 700mm and < 800mm;
  6 fish $\geq$ 800mm
  Total Number of Yellow Perch = 34 (Total length ranged from 40mm-132mm)
  Total Number of White Sucker and Hybrids = 122 (Total length ranged from 56mm 510mm)

- Total Effort Expended (Electrofishing = 16.1 hours; Fyke Net Sets = 759.2; Gill Net Sets = 181.0 hours; Merwin Trap Set = 2,515.6 hours) = 3,471.9 hours overall

- Centrarchid (Green Sunfish and Largemouth Bass, combined) CPUE across all methods = 0.6 fish/hour
  - Electrofishing CPUE = 22.4 fish/hour
  - Fyke Nets CPUE = 0.3 fish/hour
  - Gill Nets CPUE = 0.6 fish/hour
  - Merwin CPUE = 0.6 fish/hour

- Green Sunfish CPUE
  - Electrofishing =12.7 fish/hour
  - Fyke Nets = 0.3 fish/hour
  - Gill Nets = 0.1 fish/hour
  - Merwin Trap = 0.1 fish/hour

- Largemouth Bass CPUE
  - Electrofishing = 9.6 fish/hour
  - Fyke Nets = 0.0 fish/hour
  - Gill Nets = 0.5 fish/hour
  - Merwin Trap = 0.5 fish/hour

- Northern Pike CPUE across all methods = 0.1 fish/hour
  - Electrofishing CPUE = 5.4 fish/hour
  - Fyke Nets = 0.1 fish/hour
  - Gill Nets = 0.8 fish/hour
  - Merwin Trap = 0.01 fish/hour

ANNUAL PERFORMANCE PROGRESS REPORT (PPR)

BUREAU OF RECLAMATION AGREEMENT NUMBER: R14AP00007

UPPER COLORADO RIVER RECOVERY PROGRAM PROJECT NUMBER: 126a

Project Title: **Colorado River Nonnative Fish Removal.**

Principal Investigator: Christopher Michaud, Fish Biologist
Katherine Creighton, Project Leader
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katherinecreighton@utah.gov

Project/Grant Period: Start date (Mo/Day/Yr): 5/1/2014
End date: (Mo/Day/Yr): 9/30/2018
Reporting period end date (Mo/Day/Yr): 9/30/2015
Is this the final report? Yes_____No __X__

Performance:

Walleye removal on the Colorado River

Targeted walleye removal within Westwater Canyon began on 06 October and was completed on 08 October 2015. UDWR crews conducted one electrofishing pass on this reach of the Colorado River, covering 22 miles, from the Westwater Ranger Station to Fish Ford Landing (RM127.7-105.7). Researchers omitted three river miles from sampling (RM 119.6-116.5) due to the presence of class II-III whitewater and lack of accessible habitat. Turbidity during sampling ranged from 100-295 mm (mean=170 mm) and temperature ranged from 14.9-16.2 °C (mean=15.7 °C). One walleye was encountered over 10.8 hours of effort (CPUE=0.09 fish per hour). This fish was captured at RM 112.6, approximately two miles upstream of the Cisco Landing boat ramp. Fourteen endangered fish were encountered during sampling, all were weighed, measured and scanned for PIT tags (Table 1). Researchers also encountered 11 species of nonnative fishes, removing 63 individuals (Table 1).

Targeted walleye removal on the lower Colorado River, conducted by UDWR-Moab, began on 13 October and was concluded on 16 October 2015. Crews completed four removal days between Fish Ford Landing and Take Out Beach (RM 127.7-74.3). Turbidity during this period ranged from 275-650 mm (mean=394 mm) and temperature ranged from 14.4-15.8 °C (mean=15.2 °C). No walleye were encountered during 31.8 hours of electrofishing within this section. Crews documented two endangered fish and removed 18 nonnative fish (Table 2).

Table 1. Ancillary fish captures for electrofishing passes on the Colorado River within Westwater Canyon (RM 127.7-105.7), 2015.

Species	Number Captured	CPUE (fish/hr)	Median Total Length (mm)	Range (mm)
Black bullhead (*Ameiurus melas*)	3	0.28	163	119-190
Yellow bullhead (*Ameiurus natalis*)	1	0.09	155	—
Black crappie (*Pomoxis nigromaculatus*)	1	0.09	144	—
Bluegill (*Lepomis macrochirus*)	2	0.19	142.5	140-145
Brown trout (*Salmo trutta*)	4	0.37	203	190-244
Gizzard shad (*Dorosoma cepedianum*)	2	0.19	308.5	237-380
Green sunfish (*Lepomis cyanellus*)	17	1.57	96	66-115
Largemouth bass (*Micropterus salmoides*)	10	0.93	121	100-265
Smallmouth bass (*Micropterus dolomieu*)	9	0.83	112.7	87-330
White sucker (*Catostomus commersonii*)	10	0.93	315.5	125-378
White x bluehead sucker hybrid	3	0.28	393	322-434
Humpback chub (*Gila cypha*)	10	0.93	277.5	199-373
Colorado pikeminnow (*Ptychocheilus lucius*)	1	0.09	495	—
Razorback sucker (*Xyrauchen texanus*)	3	0.28	460	436-466

Table 2. Ancillary fish captures for electrofishing passes on the lower Colorado River (RM 105.7-74.3), 2015.

Species	Number Captured	CPUE (fish/hr)	Median Total Length (mm)	Range (mm)
Brown trout (*Salmo trutta*)	4	0.13	210	195-244
Gizzard shad (*Dorosoma cepedianum*)	7	0.22	285	237-426
Green sunfish (*Lepomis cyanellus*)	2	0.06	108.5	107-110
Largemouth bass (*Micropterus salmoides*)	4	0.13	178.5	100-325
Smallmouth bass (*Micropterus dolomieu*)	1	0.03	37	—
Razorback sucker (*Xyrauchen texanus*)	1	0.03	454	—
Bonytail (*Gila elegans*)	1	0.03	320	—

Recommendations: Due to the low walleye catch rate achieved in Westwater Canyon, we do not recommend continued targeted removal at this time. During the fall of 2016 and 2017 UDWR will be sampling for Project 132: Population estimate of humpback chub in Westwater Canyon, Colorado River, Utah. Any uptick in walleye numbers should be detected through the electrofishing and trammel netting occurring as part of this project.