

I. Project Title: **Removal of Non-native Fish in the Upper Colorado River between Grand Valley Water User's Dam [Government Highline Diversion Dam] near Palisade, Colorado, and Potash, Utah.**

II. Bureau of Reclamation Agreement Number: R15PG400083

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III. Principal Investigator(s): Travis Francis, Fish Biologist
Dale Ryden, Project Leader
U.S. Fish and Wildlife Service
Grand Junction FWCO
445 West Gunnison Ave., Suite 140
Grand Junction, Colorado 81501
Phone: (970) 628-7204
Fax: (970) 628-7217
Email: travis_francis@fws.gov
dale_ryden@fws.gov

IV. Abstract: The primary 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 52-mile reach between Silt and Beavertail Mountain in CO. This is the fifteenth year of this study, which started in 2004. Beginning in 2015, an additional walleye removal component was fully funded. These removal efforts covered a 67-mile reach from Lower Westwater Canyon (Bighorn Camp) 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 since 2015.

Low base flows in 2018 made some reaches impassable for sampling. However, in our riverine sections we removed 8,945 smallmouth bass, 9,497 largemouth bass, 76 walleye, one northern pike, four striped bass and various amounts of other nonnative fish in 2018. Catches of age-0 smallmouth bass indicate a large year class (< 100 mm) was produced in 2018 in the Grand Valley reaches of the Upper Colorado. Small numbers of young-of-year (YOY) smallmouth bass were produced from 2014 to 2016, and a moderate sized year-class was produced in 2017. However, fish produced between 2015 and 2018 experienced many degree days greater than 13.9° (Celsius) prior to winter and had a good chance of surviving until next spring (Figure 9). The catch rate for juvenile smallmouth bass 100-199 mm increased (326%) from 2017 suggesting that many of these fish did

survive. Bestgen and Hill (2016) suggest that smallmouth bass greater than 50 mm total length prior to going into the winter have a good chance of survival and 98% of our 2017 age-0 smallmouth bass were greater than 50 mm. The catch rate for YOY and juvenile size smallmouth bass < 100 mm increased (1,700%) from 2017. The 2018 catch rate for adult smallmouth bass > 200 mm increased (597%) from 2017. Catches of largemouth bass from 2012 through 2018 suggest that survival of juvenile largemouth bass to the adult size-classes in the river is relatively low. However, there was a large influx of largemouth bass to the system, in 2018, that warrants further investigation. The walleye component of this work is now reported in a basin wide annual report (Michaud et al. 2018).

Non-native fish removal in Grand Valley gravel pit ponds resulted in the removal of 7,590 fishes. This work was dually beneficial to the program because these ponds were grow-out facilities for the Ouray National Fish Hatchery Grand Valley Unit for razorback sucker and bonytail. These removal efforts resulted in the additional stocking of 145 razorback sucker and one bonytail to the Colorado and Gunnison rivers.

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 2018 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 2018, 126a scope of work, called for eight removal passes in the Grand Valley. However, low summer base flows (during the time-period we conduct this work) made some reaches impassable and that missing effort was distributed to reaches that were navigable. We completed zero to fourteen passes in these reaches (see methodology below). Some of the missing effort in the Grand Valley was distributed further downstream. The FY 2018 126b scope of work called for one removal pass from Silt to Beavertail Tunnel. On alternating years sampling will occur in the reach from Silt to Rifle or Debeque to Beavertail. For FY 2018, Colorado Parks and Wildlife (CPW) sampled the river between Rifle (RM 248) and Beavertail Tunnel (RM 195.7). However, low base flows precluded their work from Parachute (RM 222.2) to Debeque (RM 209.7). Please see CPW's PPR in the appendix for more details of their work.

All age groups of smallmouth bass (age-0, juveniles, and adults) were present in the 2018 summer/fall collections. These ranged from age-0 (26 mm) to adult (413 mm) fish with a mean of 127 mm. Record catches occurred, in 2018, for YOY and juvenile smallmouth

bass collected by these projects (126a&b 123d). A total of 8,945 smallmouth bass were removed, including 73 considered piscivorous competitors to Colorado pikeminnow (≥ 325 mm; Table 1). A record year class of age-0 smallmouth bass (< 100 mm) was produced in 2018 in the Grand Valley and Ruby Horsethief Canyon reaches of the Upper Colorado, as 5,629 were collected and removed (Figure 2). In fact, the catch rate for YOY/juvenile size fish < 100 mm increased from 0.94 fish/hr (2017) to 15.98 fish/hr, an unprecedented catch rate (Figure 3). During 2018, the catch rate for adult size classes of smallmouth bass increased (≥ 200 mm {597%}) from the 2017 catch rates, most likely in response to a four year period of warmer than average Fall water temperatures when compared to the recent past. Juvenile smallmouth bass (100-199 mm) catch rates increased 326%. Small numbers of YOY smallmouth bass were collected in 2014-2017; however, these fish experienced many more degree days greater than 13.9° (Celsius) prior to winter and had a good chance of surviving until the next spring perhaps contributing to our increased catch of juvenile and adult smallmouth bass (Figure 9). In 2014, 2015, and 2017 the highest rate of removing 'piscivorous sized' (> 325 mm) smallmouth bass, as defined by the Upper Colorado River Endangered Fish Recovery Program (UCRRP), occurred from lower Westwater Canyon, UT to Coates Creek, UT at 0.6, 0.3, and 0.35 fish/hr (2014 {n=11}, 2015 {n=7}, 2017 {n=30}). In 2016, the highest rate of removing these large adults occurred upstream in the reaches from Price Stubb Dam to Riverbend Park in Palisade, CO and from Corn Lake to Redlands Parkway at .13 fish/hr. In 2018, the highest rate from removing the 'piscivorous sized' smallmouth bass occurred in the reach from Corn Lake to Redlands Parkway at 0.33 fish/hr (Figure 2).

A record total of 9,497 largemouth bass were removed from all reaches in 2018 (Table 2 and Figure 4). Our catch ranged from age-0 fish (24 mm) to adult fish (548 mm) with a mean of 128 mm (Figure 5). Five were of piscivore size (≥ 325 mm TL) and are considered a competitive threat to Colorado pikeminnow. Our catch was also proportionate in size classes to our 2014 through 2017 catch: 99% (n = 9,435) were less than 250 mm, 24% (n = 2,310) were less than 100 mm and only 1% (n = 62) were adults greater than 250 mm. Data from 2013 through 2018 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. However, the large catch experienced in 2018 warrants further investigation into off-channel sources that are leaking large numbers of these non-native predators into critical habitat.

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

B. Findings (2018 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. Beginning in 2014, 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). Beginning in 2016, lower Westwater Canyon (RMI 116.0) to Cisco, UT was added extending the lower reach an additional five miles.

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 2018, 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 Potash, UT (RMI 127.7-105.7; see PPR).

Beginning in 2013, project study goals were slightly modified (from those specified for 2007-2012 sampling). Abundance estimates 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 were calculated in 2006-2012; however, abundance estimates were not calculated from 2013-2018. Catch per effort (CPE) has been calculated for all years of the study, throughout all of the reaches, including 2018, as a metric to compare yearly fluctuations of nonnative fish populations and size classes.

Methodology

General

In 2018, up to 14 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 6). Colorado Parks and Wildlife (CPW) performed the removal between Rifle and Beavertail Mountain, while the U.S. Fish and Wildlife Service (FWS), Grand Junction FWCO performed sampling passes from Grand Valley Water User's Dam to Potash, Utah. Utah Division of Wildlife Resources (UDWR, Moab Field Station) completed one partial fall removal pass between Lower Westwater Canyon and Cisco, UT. UDWR (Price Field Station) completed one full pass doing Three Species work from Cisco to Moab Bridge (RM 64.2) and removed non-native fishes. Two electrofishing boats were used in most river segments during the removal passes.

Although smallmouth bass and walleye were our target species for removal during this project, many other nonnative fishes encountered were collected and removed. These fishes included largemouth bass, green sunfish, bluegill, black crappie, black bullhead, gizzard shad, grass carp, perch, striped bass, 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 7). 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, CPE 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 or every fifth 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 and released so a population estimate was not possible. For those years’ data, effort was recorded, 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 2013-2018, CPE was computed for use as an index of annual relative abundance of smallmouth bass and other centrarchids during the entire 2004-2018 time period. This was possible because effort expended was recorded during all sampling years. Where abundance estimates were not performed for a population statistic, CPE 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 1-3; Figures 3-6). However, in reaches where limited sampling occurs, environmental variables could skew this metric and make year-to-year comparisons inadvisable.

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 2018. Removal passes performed by the CPW in the Upper Colorado River between Silt and Beavertail Mountain are also reported here. UDWR results are also included. Data are presented for main channel habitats only. This includes backwaters that are hydrologically connected to the main-stem river. Integration and comparison of

results from earlier years (2004-2017) 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, FWS and UDWR, with electrofishing during 2018 between Silt, CO and Potash, UT were plotted (Figure 1). All age groups of smallmouth bass (age-0, juveniles, and adults) were present in the 2018 summer/fall collections. These ranged from age-0 (26 mm) to adult (413 mm) fish with a mean total length of 147 mm. A total of 8,945 smallmouth bass were removed, including 73 considered to be piscivorous competitors to Colorado pikeminnow (≥ 325 mm). A record year class of smallmouth bass (< 100 mm) was produced in 2018 in the Grand Valley and Ruby Horsethief Canyon reaches of the Upper Colorado, when considering 5,629 were collected and removed (Figure 2). Juvenile smallmouth bass (100-199 mm) total catch increased markedly, in 2018, when compared to any previous year (Figure 2).

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 have been 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 3). 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).

During the period from 2014 through 2016, the catch rate for juvenile size fish < 100 mm declined precipitously (80%) from 2013 from 3.33 fish/hr to 0.17 to 0.54 fish/hr, similar to catch rates during 2004, 2008, 2009, 2011 and 2014 (Figure 3). 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 and 2015. However, spring run-off in 2016 matched the median statistic; yet, our catch of YOY smallmouth bass suggests a weak year class being produced (Figure 8). From 2014 to 2016, 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 (Figure 9). Juvenile smallmouth bass (100-199 mm) catch rates, in 2017, increased 91% when compared to 2016 most likely the result of elevated fall water temperatures. These conditions most likely contributed to the new record, in 2018, catch rate of juvenile smallmouth bass of 5.96 bass per hour, an increase of 376% compared to the 2017 catch rate. Additionally, Bestgen and Hill (2016) suggest that smallmouth bass greater than 50 mm total length prior to going into the winter have a good chance of survival and 98-99% of our 2016-2018 age-0 smallmouth bass were greater than 50 mm.

In 2012, it is speculated that 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 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, we postulate that two years of drought aided in increasing our juvenile and age-0 size fish < 100 mm catch rate even more to 3.92 fish/hr (fourth highest catch rate since project inception, Figure 3). Peak run-off in 2018 was even smaller and shorter than average peak runoff, producing a record catch of age-0 size smallmouth bass (15.98 fish/hr, 5,629 individuals; Figure 3).

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 3). Except for the 2010 and 2012 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 of these fish recruited to adult size (> 200 mm, Figures 1 & 5). However, the reduced 2015 through 2017 adult catch (Figure 3) suggests that both our removal and recent river hydrological conditions have helped suppress the 2012 and 2013 age classes. Unfortunately, another strong cohort of juvenile smallmouth bass were collected in 2017 and 2018 (Table 1; Figure 3). Mild Fall temperatures that smallmouth bass experienced from 2014 through 2017 most likely aided the ability of the few young that were produced to grow and survive to adult sizes leading towards a 2018 adult catch rate that increased 597% (1.73 fish/hr {2018}; 0.29 fish/hr {2017}; Table 1 and Figure 3).

Largemouth Bass

A record total of 9,497 largemouth bass were removed from all reaches, in 2018, a substantial increase from the previous record 2012 catch (n = 5,227, Table 2). Our catch ranged from age-0 fish (24 mm) to adult fish (548 mm) with a mean of 128 mm (Figure 5). Five were of piscivore size (≥ 325 mm TL) and are considered a competitive threat to Colorado pikeminnow. Our catch was also proportionate in size classes to our 2014

through 2016 catch: 99% (n = 9,435) were less than 250 mm, 24% (n = 2,310) were less than 100 mm and only 1% (n = 62) were adults greater than 250 mm. Data from 2013-2018 suggest that survival of juvenile largemouth bass into adulthood in the river is relatively low, 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.

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. Beginning in 2014 passes increased from seven to eleven depending upon the river reach (Table 6). 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 23 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 both 2014 and 2017, and 1 in both 2015 and 2016. Four smallmouth bass were collected in the trap in 2018.

Catch/Effort:

General

Mean catch/effort (fish/hr) was computed separately for smallmouth bass and largemouth bass for each of the 15 sampling years, 2004-2018 (Tables 1 & 2; Figures 3 through 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 lower Westwater Canyon 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 (1 marking and 8 removal passes) was 413.555 hours. In 2011, the total effort (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, 341.1 hours in 2016, 472 hours in 2017 and 352.2 hours in 2018 (Figure 10).

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, 37.06 hours in 2016, 40.14 hours in 2017, 34.73 hours in 2018; and 10.8 gill net hours in 2012, 5.2 hours in 2013, and 0 gill net hours from 2014 through 2018. The increased effort was in response to the increase in northern pike catch in this reach in 2011 (Figure 10).

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, 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. In 2016, three to five passes were completed (dependent on the reach) and crews expended 243.27 hours of electrofishing. In 2017, crews expended 255.06 hours of electrofishing and in 2018 crews expended 195.46 hours (Figure 10).

Smallmouth Bass

For the Colorado 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 (6.37 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 (2.07 fish/hr; 27 % decline from 2006; Figure 3). 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 (5.59 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 (0.85 fish/hr) marked another decline (55%) in smallmouth bass > 99 mm catch rate when compared to 2014 (1.89 fish/hr) and 2016 was similar to 2015 (0.79 fish/hr). Catch rates for juvenile and adult smallmouth bass increased in 2017 to 2.22 fish per hour. A new record (projects 126a&b) catch for YOY and juvenile smallmouth occurred in 2018 with 15.98 YOY and 5.96 juvenile smallmouth bass being collected per hour; adult smallmouth catch rates also increased to 1.73 fish per hour (Table 1, Figure 3).

During the summer of 2018, for the Colorado River reaches, overall mean catch rate for smallmouth bass < 100 mm total length was the highest in this fifteen-year removal study (15.98 fish/hr). Formerly, 2007 and 2010 had the highest catch rates (4.15 fish/hr {2007}, 5.82 fish/hr {2010}) and the lowest two years were 2014 (0.17 fish/hr) and 2015 (0.28 fish/hr; Table 1, Figure 3). 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 3). 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 2014 through 2016 (0.17 to 0.54 fish/hr; Table 1, Figure 3). The high spring

flows experienced during the 2014 and 2015 runoff and moderate flows in 2016 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 (Figure 8). The 2017 hydrograph followed the median statistic and coincidentally our YOY smallmouth bass catch was moderate (0.94 fish/hr).

The hydrologic conditions of 2008-2009, 2011, 2014-2016 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. Bestgen and Hill (2016) suggests smallmouth bass spawning occurs at 16° C in the upper Colorado River basin, which generally coincides with the descending limb of the spring hydrograph. 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 2014-2017 that survived coming off of the nests, experienced many more degree days greater than 13.9°C prior to winter and may have had a good chance of surviving into the next spring (Figure 9) which correlates well with 2017 juvenile smallmouth bass catch rates (1.83 fish/hr), and 2018 record setting juvenile catch rates (5.96 fish/hr) and an increased 2018 adult catch rate (1.73 fish/hr). Coble (1975) suggests that smallmouth bass growth does not occur until water temperatures reach 10-14° C. The Edwards et al. (1983) models suggest that optimal temperature for smallmouth bass fry first peaks at 13.9° C.

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. Anomalies for this theory occurred in 2014 through 2017, wet or moderate years that still had age-0 smallmouth bass collected 1 July (in 2014; 86 mm), 22 July (in 2015; 79 mm), 14 July (in 2016; 68 mm) and 18 July (in 2017; n=23 mean TL 78 mm) however; these fish may have been produced in an off channel source and entered the river at a later time or were the result of a late spawn from the previous season. In 2018, the first age-0 capture occurred on 13 July (the first day of sampling; n=91 mean TL 80mm) however;

these fish may have been produced in an off channel source and entered the river at a later time or were the result of a late spawn from the previous season.

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. Both 2016 and 2017 produced similar catch rates at 0.27 and 0.29 smallmouth bass per hour. These values are an increase following a drop in mean catch per effort in 2012 (0.09 fish/hr). The highest combined smallmouth bass catch rate was achieved during 2005 (5.75 fish/hr). Smallmouth bass catch increased in 2018 to 3.69 fish/hr (Table 1). Spawning success in these reaches appears to be less than that found in the Grand Valley reaches. Age-0 (< 100 mm) smallmouth bass catches have been less than that of the Grand Valley reaches throughout the fifteen-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, 2011, 2016 and 2017. One age-0 smallmouth bass was collected in 2012, four were collected in 2013, eight were collected in 2014, two were collected in 2015 and fifty were collected in 2018. 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 and it was 1.44 fish/hr in 2018.

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. Prior to 2018, the largest catch rate of smallmouth bass, in any of the reaches covered by projects 126a and 126b during the fourteen year study period (2004-2017), occurred in 2013 and 2014 in Ruby Horsethief Canyon at 6.53 fish/hr and 3.94 fish/hr (Figure 4 & 6). Late summer and fall rain events may have washed a portion of this population downstream in 2013 and 2014. The new record catch is held in the Grand Valley Reaches, in 2018, at 23.67 smallmouth/hr. 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). Our catch of all size classes of smallmouth bass decreased again, in 2016, to 0.48 fish/hr. 2017 produced the third largest catch rate in this reach at 3.81 smallmouth bass per hour of electrofishing. The new record for this reach was collected in 2018 at 10.43 fish/hr (Figures 4 & 6).

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 smallmouth bass 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 (2014), 0.21 fish/hr (2015) and 0.10 fish/hr in 2016. 2017 catch rates increased 90% to 0.99 smallmouth bass per hour and the catch rates increased in 2018 to 2.45 smallmouth bass per hour (Table 2; Figure 2). In 2014, 2015 and 2017, the highest rate of removing UCRRB defined 'piscivorous sized (> 325 mm)' smallmouth bass occurred from lower Westwater Canyon, UT to Dewey Bridge, UT at 0.9 fish/hr (2014, n=20), 0.37 fish/hr (2015, n = 9) and 0.38 fish/hr (2017, n = 31; Figure 2).

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 from 2004-2017 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 sampling 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. Our 2016 juvenile and adult catch rate increased another 26% in 2016 (1.32 fish/hr, n = 449) when compared to 2015. Juvenile and adult catch rates increased another 24% in 2017 to 1.71 largemouth bass per hour (n=808). Juvenile and adult catch rates were the highest in project history, in 2018, at 18.21 largemouth bass per hour (n=6,415; Table 2, Figure 5).

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 2017 largemouth bass < 100 mm (1.28 fish/hr {2013}, 2.1 fish/hr {2014}, 1.8 fish/hr {2015}, 2.88 fish/hr {2016}, 1.32 fish/hr {2017}; Figure 5). This reduction follows the 2012 (12 fish/hr) year class which has been the third strongest in this fifteen-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 5). 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 channel 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. The 2018 YOY largemouth catch was the highest in the 15 year project at 6.88 fish/hr (Table 2). The large increases of largemouth bass in 2018 is surprising as we had an extremely dry runoff year (Figure 8). These fish must be coming from an off-channel source, perhaps from an unscreened outlet, and warrants additional investigation.

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 2018 (7.72 fish/hr; Table 2). The second highest year was in 2008 (7.2 fish/hr), the third highest in 2006 (5.6 fish/hr); lowest in 2015 (0.72 fish/hr). This could be related to the extra time spent in large backwaters that have historically held many non-native piscivores. 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). The 2018 catch rate for largemouth bass < 100 mm was 2.39 fish/hr.

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, all life stages of largemouth bass were removed from these reaches at a rate of 0.29 fish/hr in 2013, 0.05 fish/hr in 2014, 0.75 fish/hr in 2015, 1.01 fish/hr in 2016, 1.32 fish/hr in 2017 and 2.01 fish/hr in 2018 (Table 2).

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. From 2014 through 2018, GJ FWCO had an increase in crew and equipment because of the Colorado pikeminnow estimate and/or razorback sucker monitoring in Lake Powell; thus, increased effort was volunteered outside of the 2014 through 2018 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 2018 were removal years and no abundance estimates were calculated. However, for reference purposes, abundance estimate text can be found in past annual reports and results can be found in Table 3.

Other Nonnative Game Fishes Captured in the Main-stem River (Figure 7):

Northern pike are another large bodied predator that is known to cause severe impacts to endangered fish populations (Zelasko et al. 2014) and is therefore a species removed when encountered in the Colorado River. Northern pike are not common in Colorado River removal efforts. One adult northern pike (1,010 mm TL) was removed by USFWS crews in 2018 from the Colorado River just below Westwater Canyon (Figure 7). In 2018, USFWS crews working on project 163 (Aspinall Reoperation Fish Surveys) removed one other adult northern pike (1,002 mm TL) from the Gunnison River near Delta. 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.

Gizzard shad (*Dorosoma cepedianum*) were unintentionally introduced to the Colorado River basin in 1998, when they were stocked into Morgan Lake in the San Juan River basin. Gizzard shad have invaded the Colorado River from Lake Powell since this initial introduction. Captures of adult gizzard shad in the Upper Colorado and Lower Gunnison rivers exploded during 2007 (n = 179), an increase from 15 in 2006.

Young-of-year, juvenile, and adult gizzard shad were collected in all reaches sampled in 2018 from the Grand Valley downstream to Potash (n = 2,057; 43-492 mm TL, mean TL 178 mm). This is the second largest number of gizzard shad removed in project 126a history; 2017 produced the record of 2,832 (Figure 7). In 2018, 25 gizzard shad were collected at Redlands fish trap and one gizzard shad was collected at the GVWU fish trap. It appears that drought years may be favorable to the upstream expansion of gizzard shad range in the Colorado and Gunnison rivers.

No grass carp were collected in 2018.

Three of four striped bass were collected between Coates Creek (RMI 104) and Moab Bridge (RMI 64.2), and a fourth striped bass was collected in the Grand Valley (near Clifton, CO). Their total lengths were 486, 486, 516 and 517 mm. One additional striped bass was collected in Redlands Fish Trap, in 2018, with a TL of 556 mm. The two fish collected in the Grand Valley were the first in these projects history. The last time striped bass were removed from the Colorado River was 2017 (n=3), all collected from below Westwater Canyon.

White sucker are an additional nonnative species of concern because of their ability to hybridize with native sucker species. 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), our effort in 2015 removed 1,425 (40-527 mm TL), our effort in 2016 removed 1,277 (55-552 mm TL), our effort in 2017 removed 2,777 (30-512 mm TL), and our effort in 2018 removed 3,165 (23-465 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, esocid, and percid removal.

Management of off-channel nonnative fish populations

Many off-channel ponds and gravel pits in the upper Colorado River sub-basin harbor populations of nonnative fish. Some of these ponds are illegally stocked, and some are colonized through river connection. These off-channel habitats provide more suitable conditions for certain nonnative species (i.e. warmer and clearer) to reside.

Nonnative fish removal in these ponds was pursued recently in order to reduce the risk of escapement of fish from these ponds during a river connection. New since 2016, one month's worth of non-native fish removal from streamside gravel pit ponds was funded under 126a, and the creation of a Merwin trap for targeted removal was funded under 126b. In years past, these sites were used to grow listed species, and crews would opportunistically sample these ponds to further augment the Colorado and Gunnison rivers' razorback sucker and bonytail populations. During 2016 and 2017 work, crews discovered large numbers of undesirable

non-native fishes. In 2018, Grand Junction FWCO crews completed 44 total days of removal efforts in three different ponds, and CPW crews completed 17 total days in three different ponds.

Mamm Creek Ponds: In coordination with the private land owner, CPW began an effort to remove nonnative fishes from one such gravel pit pond between Rifle and Silt, now referenced as Mamm Creek Ponds (a.k.a. Snyder 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 Mamm Creek Ponds with the river, contributed to the increase in catch of northern pike experienced in the main stem in both 2011 and 2012. From 2015 through 2017, CPW sampled Mamm Creek Ponds 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. Springtime flows were so low in 2018 that the ponds did not connect to the river and the Merwin trap was not necessary. From 2016 to 2018, CPW also sampled and removed non-native fishes from two other ponds that can connect to Mamm Creek Pond #1. CPW has had great success, in terms of CPE, removing largemouth bass, northern pike, green sunfish, and yellow perch for a total of 610 non-native fishes removed in 2018. Please see appended PPR for more details.

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. In 2018, we sampled this pond sporadically between 12 April and 15 August (15 days). We used a combination of gears which included electrofishing, fyke nets, trammel nets, and cast nets. In 2018, we collected, PIT-tagged, and stocked 36 razorback sucker with a mean total length of 362 mm (range 180 to 508 mm) and one bonytail (233 mm TL) into the Colorado River. We also collected 16 additional razorback sucker, PIT tagged them, and released them back into Beswick's (mean TL 169 mm, range 74 to 262 mm). We also removed 526 invasive fishes. We removed 81 black bullhead (mean TL 171, range 80-284 mm), 107 black crappie (mean TL 153, range 97-308 mm), 193 bluegill (mean TL 112, range 46-156 mm), one hybrid sunfish, one common carp, 55 green sunfish (mean TL 111, range 60-162 mm), 29 gizzard shad (mean TL 338, range 82-496 mm), 57 largemouth bass (mean TL 197, range 62-443 mm; Figure 12), and one smallmouth bass (88 mm TL; Figure 11).

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. In 2018, we sampled this pond sporadically (15 days) from 6 June to 7 September. We used a combination of gears which included electrofishing, fyke nets, trammel nets, and cast nets. In 2018, we collected 19 previously PIT-tagged razorback sucker, one flannelmouth sucker, and nine roundtail chub. We also collected and PIT-tagged 1 razorback sucker (475 mm TL). All native fish were returned to the pond. We also removed 6,450 invasive fishes. We removed 3,374 black bullhead (mean TL 205mm, range 25-328 mm), caught and released 2 brown trout, removed 30 common carp (mean TL 164 mm, range 79-455mm), 802 green sunfish (mean TL 99, range 46-215 mm), 1,799 largemouth bass (mean TL 133mm, range 50-357

mm; Figure 12), one longnose sucker, and 442 white sucker and white by native sucker hybrids (mean TL 292mm, range 73-491 mm; Figure 11). 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 through 2017 sampling (indicating obvious reproduction). Very few largemouth bass have been collected from the mainstem Gunnison River in reaches above Redlands Dam; therefore, the river is an unlikely source for the largemouth bass in Butch Craig. When we sampled this pond during the fall 2013, no largemouth bass were present in our catch.

CDOT Pond: CDOT Pond (managed by Colorado Department of Transportation) is an old gravel pit pond that 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. In 2018, we sampled this pond sporadically (14 days) from 25 April to 29 August. We used a combination of gear types which included fyke nets, trammel nets, cast nets, and hoop nets. In 2018, we collected, PIT-tagged, and stocked 70 razorback sucker (mean TL 447mm, range 342-525 mm) into the Colorado River. We had one razorback sucker mortality in a trammel net. We also removed 615 invasive fishes. We removed one black bullhead (130 mm TL), 103 black crappie (mean TL 201mm, range 96-239 mm), 379 bluegill (mean TL 151mm, range 90-196 mm), one common carp (360mm TL), 69 green sunfish (mean TL 120mm, range 93-174 mm), 27 white sucker (mean TL 274mm, range 209-410 mm), and 35 largemouth bass (mean TL 177mm, range 95-431 mm; Figure 11 and 12).

Task completed. Report submitted to the Program Office in November, 2018.

VIII. Additional noteworthy observations:

A total of 342 individual endangered fishes were captured in 2018. During 2018, 276 individual razorback sucker, 38 bonytail (one that had been at large for a Program record twelve years), one bluehead X razorback sucker hybrid, two *Gila sp.* with both humpback and roundtail chub phenotypic traits, 18 Colorado pikeminnow, two flannelmouth sucker X razorback sucker hybrids, and five humpback chub were collected by CPW, UDWR and USFWS crews while working on projects 126a, 126b, and 123d. For endangered fish tag histories see Tables 4 & 5.

IX. Recommendations:

1. Continue to collect and lethally remove all centrarchids from the Colorado and Gunnison rivers during all Grand Junction FWCO field station activities that include sampling on the Colorado and Gunnison rivers and adjacent habitats (e.g., CDOT, Beswick's, 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 ≥ 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 began funding 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 Mamm Creek (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 began funding 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 was funded to begin 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.
- X. Project Status: On track and ongoing.
- XI. FY 2018 Budget Status
- A. Funds Provided: \$245,218
 - B. Funds Expended: \$245,218
 - C. Difference: -0-
 - D. Percent of the FY 2018 work completed, and projected costs to complete: 100%
 - E. Recovery Program funds spent for publication charges: -0-

XII. Status of Data Submission: Uploaded into STReAMS.

XIII. Signed: Travis Francis 11/29/2018
Principal Investigator Date

APPENDIX:

A. References

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Attachments include:

6 Tables

FY 2018 Ann. Rpt. Project # 126a & 126b - 19

12 Figures
2 PPR

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 – 2018. 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) Lower Westwater Canyon to Potash, Utah reaches were added in 2013, and g) Westwater Ranger Station to Westwater Wash was added in 2014. NC is an abbreviation for no calculation.

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 – 2018. 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) lower Westwater Canyon to Potash, Utah reaches were added in 2013, and g) Westwater Ranger Station to Westwater Wash was added in 2014. NC is an abbreviation for no calculation.

Table 3. 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 - 2018. Note: length of the area for the population estimate was 35.3 miles.

Year	Fish Length Size	Pop Estimate with 95% CI	SE	SM Bass/ mile	Number Marked; No. Removed 1 st 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	CV (%)	p-hat
	(mm)									all removal passes		(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 2018	NO POPULATION ESTIMATE PERFORMED											

Table 4. 2018 razorback sucker captured during nonnative fish removal projects 126a & b stock event histories.

Stock or Tagged in the Field Year	# Captured during 126a&b and 123d in 2018	Source Hatchery or Field Station	Stock or Capture River	Stock or Capture RMI	Location Description	Notes
2006	1	Grand Jct.	GU	12.7	Butch Craig Wetland	
2007	1	Grand Jct.	CO	177.4	Corn Lake Boat Launch near Clifton	
2008	1	Grand Jct.	GU	57.1	Delta, CO	
2008	1	Grand Jct.	CO	184.9	Palisade, CO	
2008	1	Grand Jct.	CO	177.4	Corn Lake Boat Launch near Clifton	
2009	1	Grand Jct.	CO	185.1	Palisade, CO	Recaptured 2016 at CO RMI 63.9
2009	2	Grand Jct.	CO	166.7	Redlands Parkway boat launch	1 was recaptured 2017 at CO RMI 60.8
2009	4	Vernal	GR	120	Green River State Park	1 was recaptured 2017 at CO RMI 57.5
2010	1	Grand Jct.	GU	57.1	Delta, CO	Recaptured 2014 at CO RMI 165.2
2010	1	Grand Jct.	CO	227.6	Battlement Mesa, CO	
2010	1	Vernal	GR	120	Green River State Park	Recaptured 2016 at GR RMI 195
2010	1	Vernal	GR	255.4	Ouray National Wildlife Refuge near Wvasket	Recaptured 2011 at GR RMI 190.5
2011	2	Grand Jct.	GU	12.7	Butch Craig Wetland	1 detected 2016 in Butch Craig Wetland, 1 recaptured 2017 in Butch Craig Wetland
2011	1	Grand Jct.	CO	227.6	Battlement Mesa, CO	Detected July 2012 and May 2013 at Price Stubb (CO RMI 188.3) and recaptured 2014 and 2016-2017 in the Grand Valley
2011	1	Grand Jct.	CO	185.1	Palisade, CO	
2011	1	Grand Jct.	CO	177.4	Corn Lake Boat Launch near Clifton	Recaptured 2015 at CO RMI 42.3
2011	2	Vernal	GR	120	Green River State Park	
2012	5	Grand Jct.	GU	12.7	Butch Craig Wetland	1 was detected 2016 and recaptured 2017 in Butch Craig Wetland, 1 was detected 2016 in Butch Craig Wetland
2012	6	Grand Jct.	CO	240.7	Rifle, CO	2 were recaptured 2016 at CO RMI 236.6, 1 was detected 2016 at Price Stubb (CO RMI 188.3) and recaptured 2014 at CO RMI 67
2012	2	Grand Jct.	CO	185.1	Palisade, CO	1 was recaptured 2015 at CO RMI 155.2
2013	4	Grand Jct.	GU	57.1	Delta, CO	2 were recaptured 2017 at CO RMI 165.2 and 178.4, 1 was detected 2016 and recaptured 2017 in Butch Craig Wetland, 1 was detected 2016 in Butch Craig Wetland
2013	6	Grand Jct.	CO	240.7	Rifle, CO	1 was recaptured 2016 at CO RMI 236.6, 2 were recaptured 2014 at CO RMI 67.2 and 178, 2 were recaptured 2015 at CO RMI 236.6 and 106.8
2013	2	Grand Jct.	CO	183.6	Palisade, CO	1 was recaptured 2014 at CO RMI 183.1
2013	4	Grand Jct.	CO	157.1	Fruita State Park Launch	1 was recaptured in both 2016 and 2017 near CO RMI 153, 1 was recaptured 2014 at CO RMI 158.1

Table 4. Cont.

Stock or Tagged in the Field Year	# Captured during 126a&b and 123d in 2018	Source Hatchery or Field Station	Stock or Capture River	Stock or Capture RMI	Location Description	Notes
2014	15	Grand Jct.	GU	57.1	Delta, CO	1 was recaptured 2015 at CO RMI 50.3, 1 was recaptured 2015 at CO RMI 75.5 and was detected 2016 near Rio Mesa Center on the DO, 1 was recaptured 2016 at CO RMI 165.6, 1 was recaptured 2015 at CO RMI 61.3 and 2017 at CO RMI 61.3, 1 was recaptured 2017 at GU RMI 2.7, 1 was detected 2015 in Roubideau Creek was recaptured 2016 at Redlands Fish Ladder (GU RMI 3.0) transferred the same date to Butch Craig Wetland and was detected in Butch Craig Wetland in 2016
2014	12	Grand Jct.	CO	240.7	Rifle, CO	2 were recaptured 2016 at CO RMI 236.6, 2 were recaptured 2015 at CO RMI 157.2 and 168.7
2014	16	Grand Jct.	CO	183.6	Palisade, CO	4 were recaptured 2015 in the Grand Valley, 1 was detected twice in 2017 at Price Stubb (CO RMI 188.3) and CO RMI 134.8
2014	1	Grand Jct.	CO	174.9	Beswick Pond	Recaptured 2016 at CO RMI 177.6
2015	3	Grand Jct.	GU	57.1	Delta, CO	2 were detected 2016 in Butch Craig Wetland, 1 was detected in 2016 and recaptured in 2017 in Butch Craig Wetland
2015	9	Grand Jct.	CO	240.7	Rifle, CO	1 was recaptured 2015 at CO RMI 236.6, 2 were recaptured 2016 at CO RMI 236.6
2015	1	Grand Jct.	CO	204.5	CDOT Pond	
2015	1	Grand Jct.	CO	168.8	Above Redlands PKWY	Tagged in field
2015	27	Grand Jct.	CO	166.7	Redlands Parkway boat launch	2 were recaptured 2015 at CO RMI 169.1 and 155.1, 1 was recaptured 2016 at CO RMI 48.3, 1 was recaptured 2017 at CO RMI 164.3
2015	1	Grand Jct.	CO	158.3	Old Fruita Bridge	No stock record just capture record
2015	1	Grand Jct.	CO	157.1	Fruita State Park Launch	
2015	1	Grand Jct.	CO	154.9	Between Fruita and Loma	Tagged in field
2015	1	Grand Jct.	CO	91.5	Professor Valley	Tagged in field
2016	4	Grand Jct.	GU	57.1	Delta, CO	
2016	13	Grand Jct.	CO	240.7	Rifle, CO	1 was detected 2016 at Price Stubb (CO RMI 188.3), 1 made passage 2017 and GVWU Fish Ladder (CO RMI 193.7)
2016	12	Grand Jct.	CO	183.6	Palisade, CO	2 were recaptured 2017 at CO RMI 181.5 and 181
2016	7	Grand Jct.	CO	174.9	Beswick Pond	1 was recaptured 2016 at CO RMI 168.2
2016	9	Grand Jct.	CO	157.1	Fruita State Park Launch	
2016	1	Grand Jct.	CO	100	Cisco Wash	Tagged in the field

Table 4. Cont.

Stock or Tagged in the Field Year	# Captured during 126a&b and 123d in 2018	Source Hatchery or Field Station	Stock or Capture River	Stock or Capture RMI	Location Description	Notes
2017	11	Grand Jct.	CO	240.7	Rifle, CO	
2017	17	Grand Jct.	CO	183.6	Palisade, CO	1 was detected 2017 at CO RMI 137.2
2017	1	Grand Jct.	CO	174.2	Before GU confluence	Tagged in the field
2017	8	Grand Jct.	CO	166.7	Redlands Parkway boat launch	
2017	1	Grand Jct.	CO	157.1	Fruita State Park Launch	
2017	1	Grand Jct.	CO	152.6	Loma Boat Launch	Tagged in the field
2017	1	Grand Jct.	CO	85.9	Professor Valley	Tagged in the field
2017	7					Original encounter not yet loaded into STReaMS
2018	1	Grand Jct.	GU	57.1	Delta, CO	
2018	1	Grand Jct.	CO	204.5	CDOT Pond	Mortality
2018	16	Grand Jct.	CO	174.9	Beswick Pond	Tagged and released back into Beswick
2018	12	Grand Jct.	CO	166.7	Redlands Parkway boat launch	
2018	1					Original encounter not yet loaded into STReaMS
2018	11	Grand Jct.	CO			Tagged in the field
Total	276					

Table 5. 2018 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, HB = humpback chub, RT = roundtail chub.

Species	# Captured during 126a&b and 123d in 2018	Field Tagging Year	Stocking Year	River	RMI	Notes
BT	1		2007	CO	111	At large the longest before recapture too date!!!
BT	1		2015	CO	166.7	
BT	1		2016	CO	166.7	
BT	1		2016	CO	157.1	
BT	3		2017	CO	183.6	1 was detected 2017 at CO RMI 135.7
BT	3		2017	CO	157.1	
BT	2		2018	CO	183.6	
BT	3		2018	CO	166.7	
BT	11		2018	CO	157.1	
BT	1		2018	Salt Creek	2.5	
BT	10		2018	DO	10.7	
BT	1	???	???			Original encounter not yet loaded into STReAMS
BR	1	2018		CO	65.1	Tagged during 126a
CH	2	2018		CO	95.8-169	Tagged during 126a
CS	1	1995		CO	163.3	Recaptured 1996, 2004, 2010, 2013, 2015 and 2016 all in the Grand Valley
CS	1	1998		GU	3	Recaptured 2000 CO RMI 175.5
CS	1	2008		CO	181.1	Detected 2014, 2016, 2017 in Green River Canal
CS	1	2008		GR	62	Recaptured 2010 at Redlands Fish Passage, detected 2016 and 2017 in DO near Rio Mesa Center
CS	1	2009		CO	168.3	
CS	1	2009		CO	16.5	Detected 2013, 2016, 2017 in Green River Canal. Recaptured 2017 at GR RMI 55.1
CS	1	2014		CO	45.8	Recaptured 2015 CO RMI 75 and recaptured 2016 CO RMI 73.8
CS	1	2015		CO	56.5	Detected 2016 in DO near Rio Mesa Center
CS	1	2015		CO	63.9	Recaptured 2016 CO RMI 65.5
CS	1	2016		GU	3	Transferred same day to GU RMI 42.7, recaptured later that year at CO RMI 181.5
CS	8	2018		CO	50-166.6	Tagged during 126a
FR	2	2018		CO	51.2-99.8	Tagged during 126a
HB	1	2016		CO	136	Detected 2017 CO RMI 136
HB	4	2018		CO	136-152.8	Tagged during 126a

Table 6. Nonnative fish removal effort on the Colorado and Gunnison Rivers in 2018.

River Reach	CO River Miles	# of passes	Dates fished	Agency
Silt to Rifle	248 to 240.1	0	skip year	CPW
Rifle to Rulison	240.1 to 230	1	5 September	CPW
Rifle to Rulison Backwaters	239.5 to 231	2	24 April, 5 September	CPW
Rulison to Parachute	230 to 222.2	1	4 September	CPW
Rulison to Parachute Backwater	228.8	2	4 and 6 September	CPW
Parachute to Una	222.2 to 216.6	0	Not enough water	CPW
Una to Debeque	216.6 to 209.7	0	Not enough water	CPW
Debeque to Beavertail Tunnel	209.7 to 195.7	1	23 April	CPW
GVWU Dam to Riverbend Park	193.7 to 184.6	0	Not enough water	FWS
Riverbend Park to Corn Lake	184.6 to 177.4	5	7 August to 30 August	FWS
Corn Lake to Redlands Parkway	177.4 to 166.7	4	6 August to 27 August	FWS
Redlands Diversion Dam to Redlands Parkway	3.0 (Gunnison River) to 0.8 and 170.9 (Colorado River) to 166.7	0	Not enough water	FWS
Redlands Diversion to Colorado River Confluence	3.0 to 0.8 (Gunnison River only)	0	Not enough water	FWS
Redlands Parkway to Fruita State Park	166.7 to 157.1	11	19 July to 27 September	FWS
Fruita State Park to Loma Boat Launch	157.1 to 152.6	14	13 July to 27 September	FWS
Loma Boat Launch to Fault Line 2	152.6 to 139	4	17 July to 28 August	FWS
Fault Line 2 to Westwater Ranger Station	139 to 127.6	4	18 July to 29 August	FWS
Westwater Ranger Station to Westwater Wash	127.6 to 124.8	0	Not enough water	FWS
Westwater Ranger Station to Potash	116 to 113.8	1 Partial	11 April	UDWR Moab
Bighorn Camp to Coates Creek	114.0 to 104	14	18 April to 26 September	FWS
Coates Creek to Dewey Bridge	104.0 to 94.6	3	24 May to 25 July	FWS
Dewey Bridge to Takeout Beach	94.6 to 74.2	2	30 May to 23 August	FWS
Takeout Beach to Potash	74.2 to 47.2	1	12 June to 14 June	FWS
Cisco to Moab Bridge	111.0 to 64.2	1	27 August to 30 August	UDWR Price

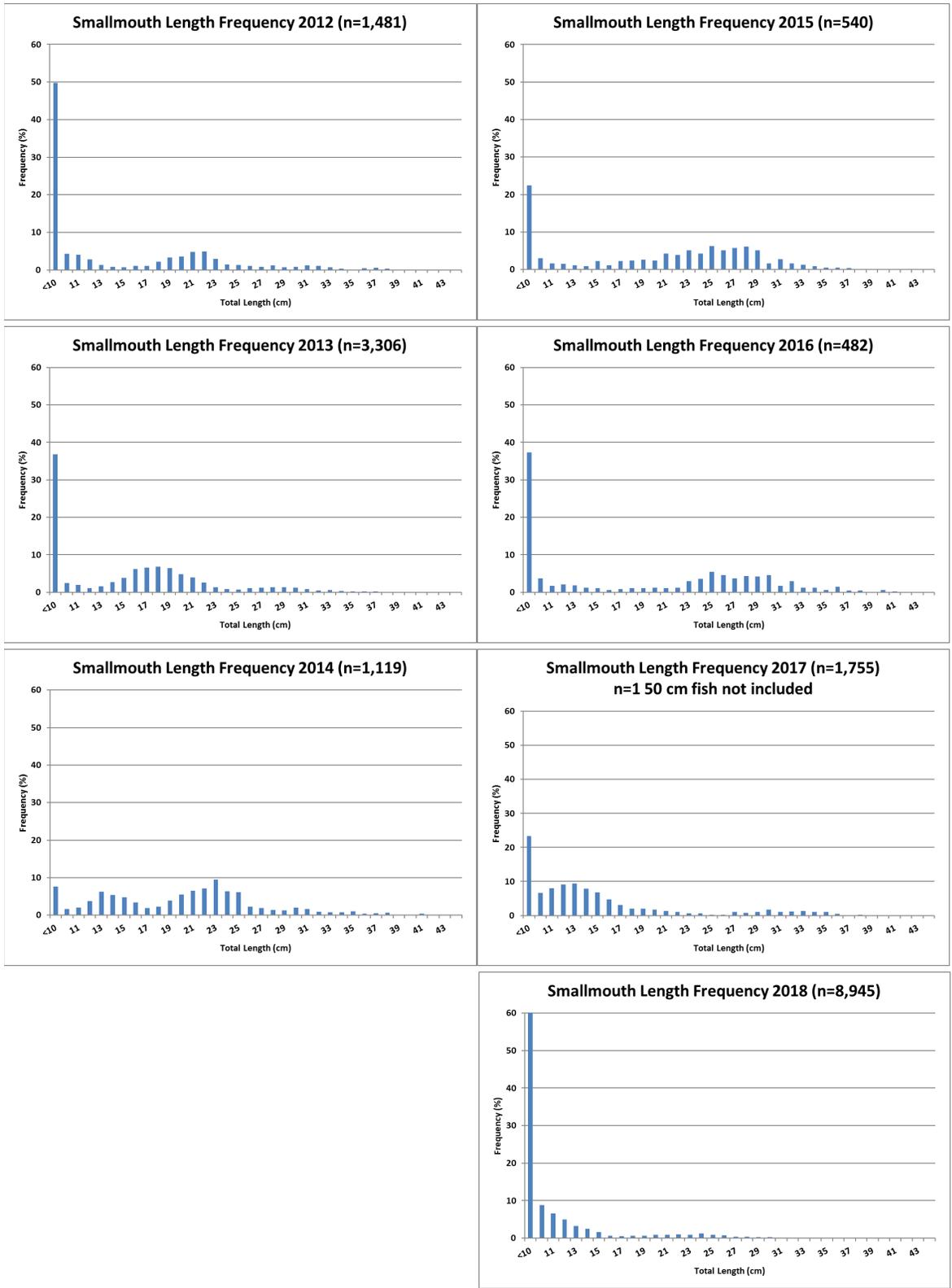
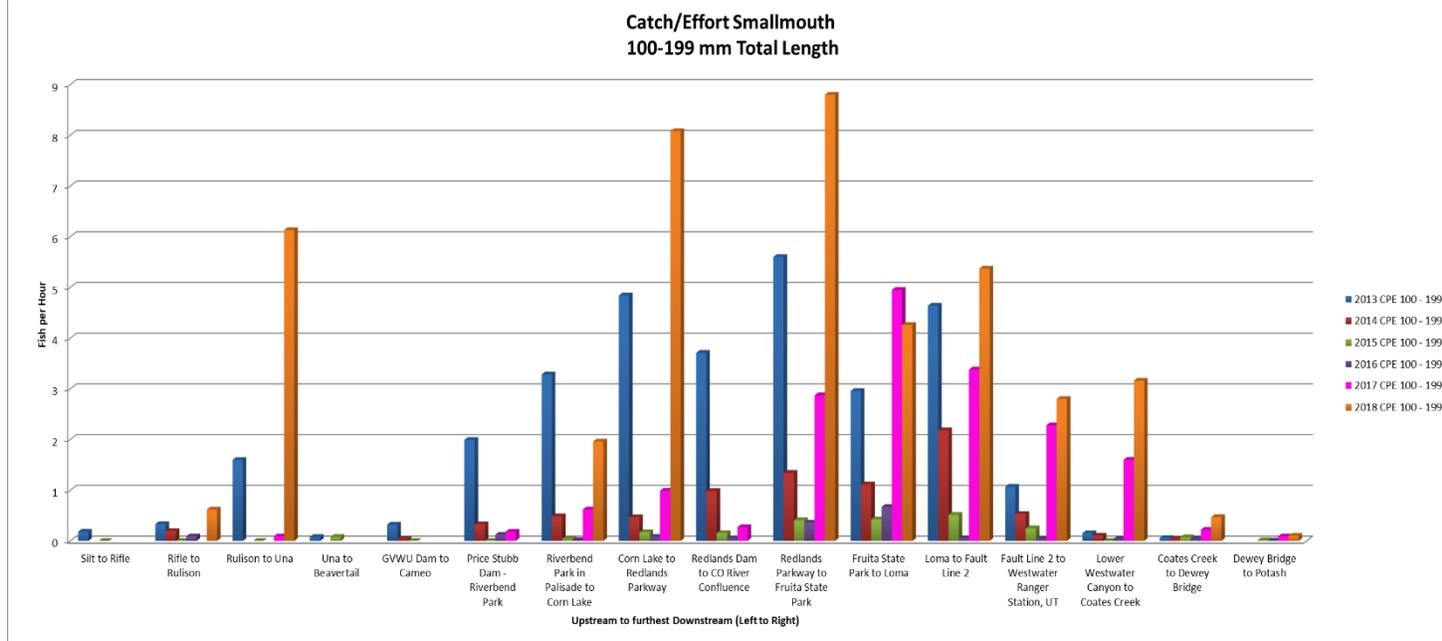
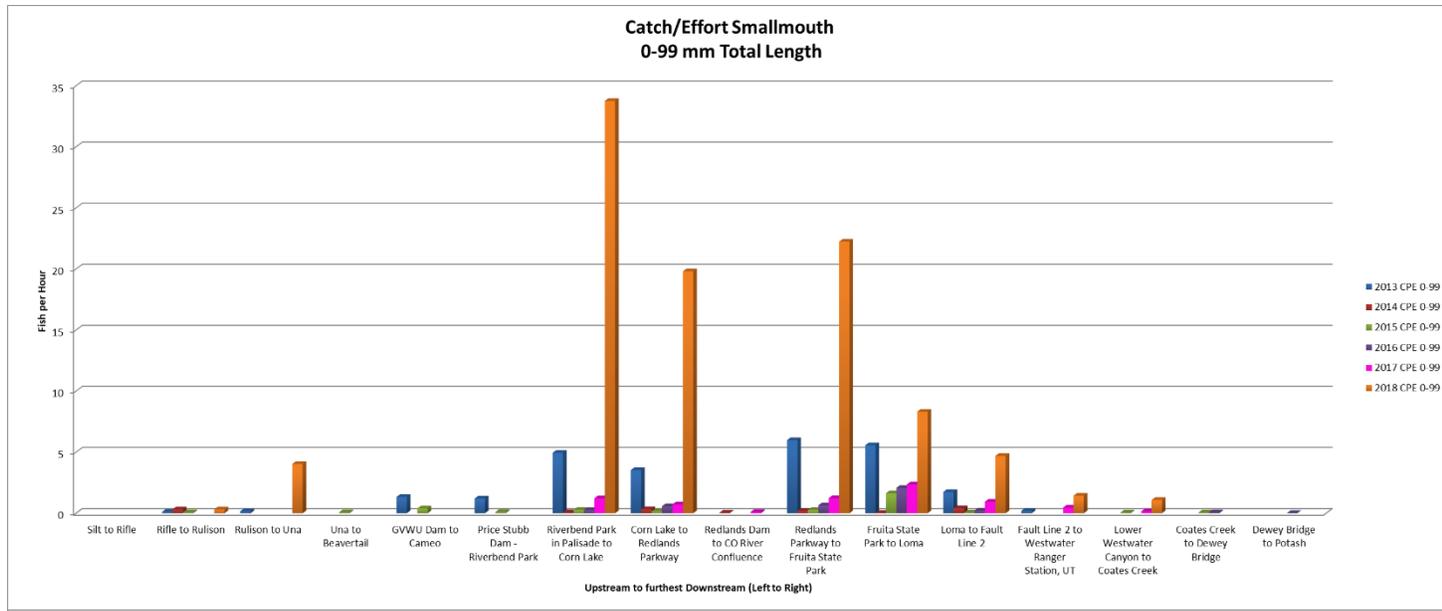


Figure 1. Length frequency histograms for smallmouth bass removed from the Colorado River from Silt, CO to the confluence of the Green River (RMI 0.0), UT from 2012 through 2018.



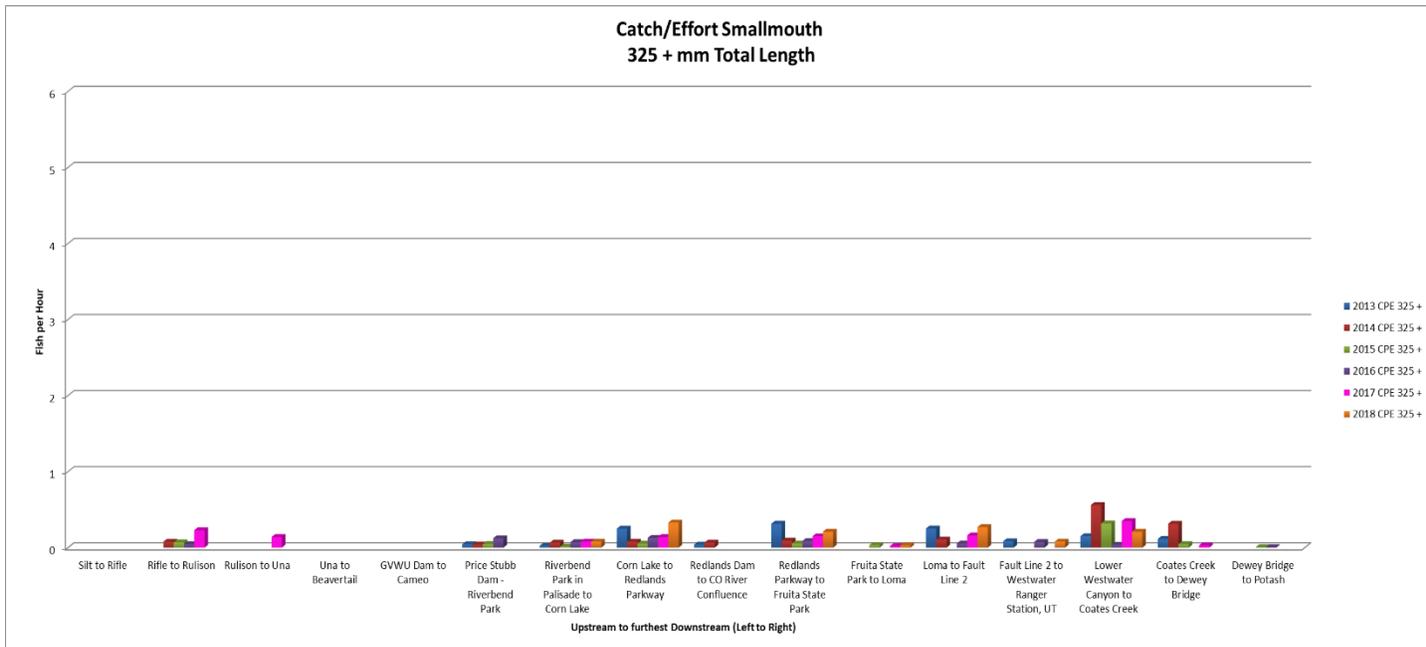
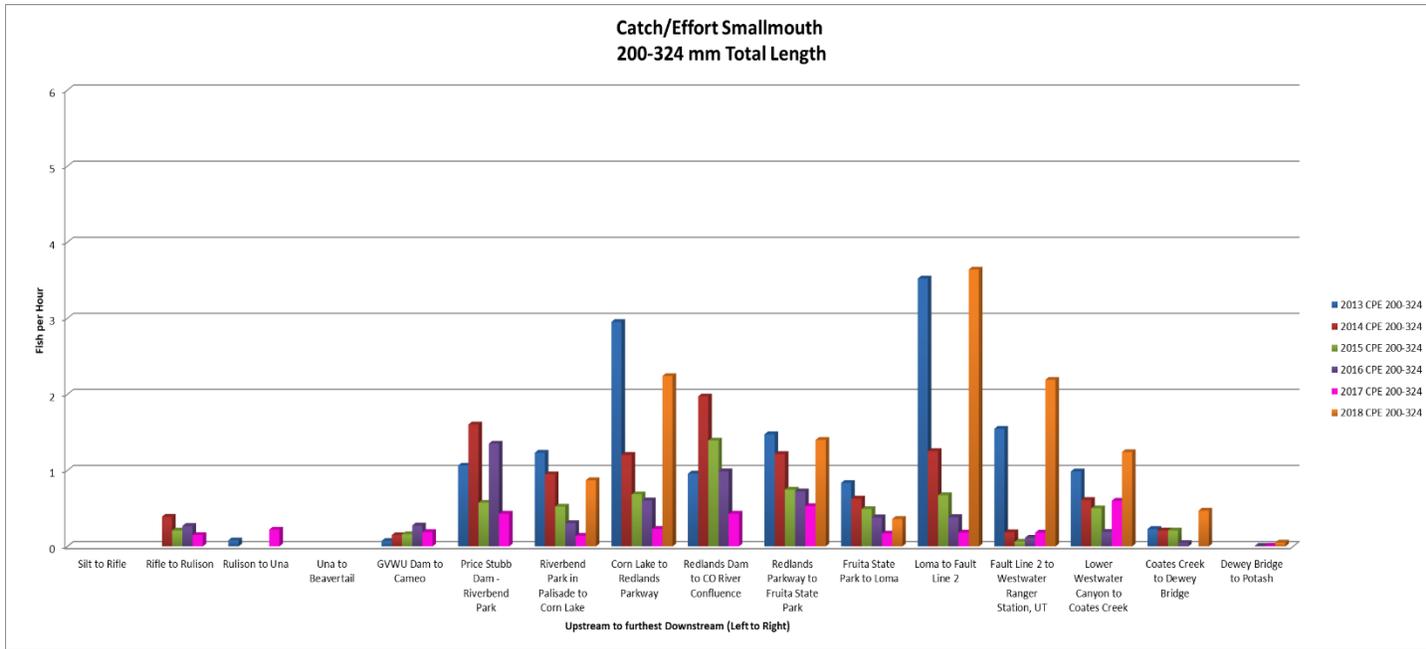


Figure 2. Catch/Effort (number of fish caught per hour electrofishing) by reach for smallmouth bass removed from the Colorado River from Silt, CO (RMI 248.0) to Potash, UT (RMI 47.2), UT 2013-2018. Smallmouth less than 100 mm are young-of-year, 100-199 mm are juvenile fish, > 200 mm are adults, and >325 mm are ‘piscivorous’.

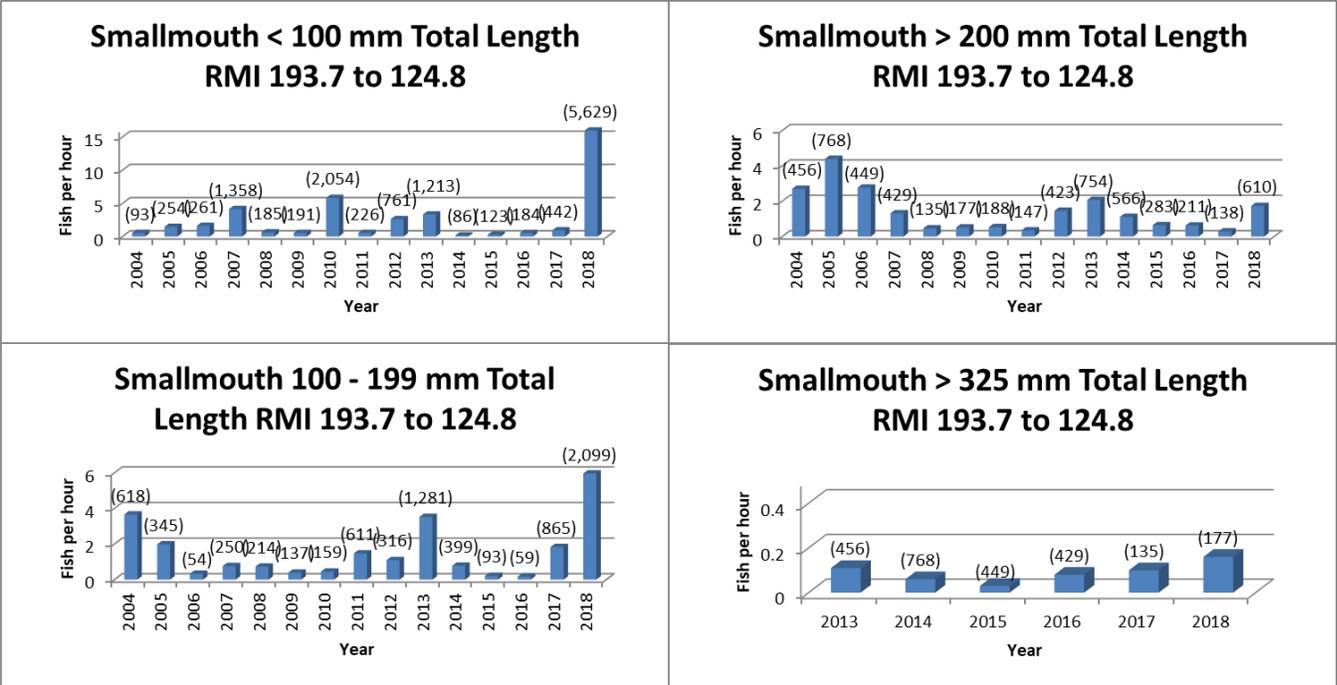


Figure 3. Catch/Effort (number of fish caught per hour electrofishing) by year for smallmouth bass removed from the Colorado River from Government Highline Dam, CO (RMI 193.7) to Westwater Wash, UT (RMI 124.8) from 2004 to 2018. Smallmouth less than 100 mm are young-of-year, 100-199 mm are juvenile fish, > 200 mm are adults, and > 325 mm are ‘piscivorous’. Ruby Horsethief Canyon data (separated out) can be seen in Figure 6.

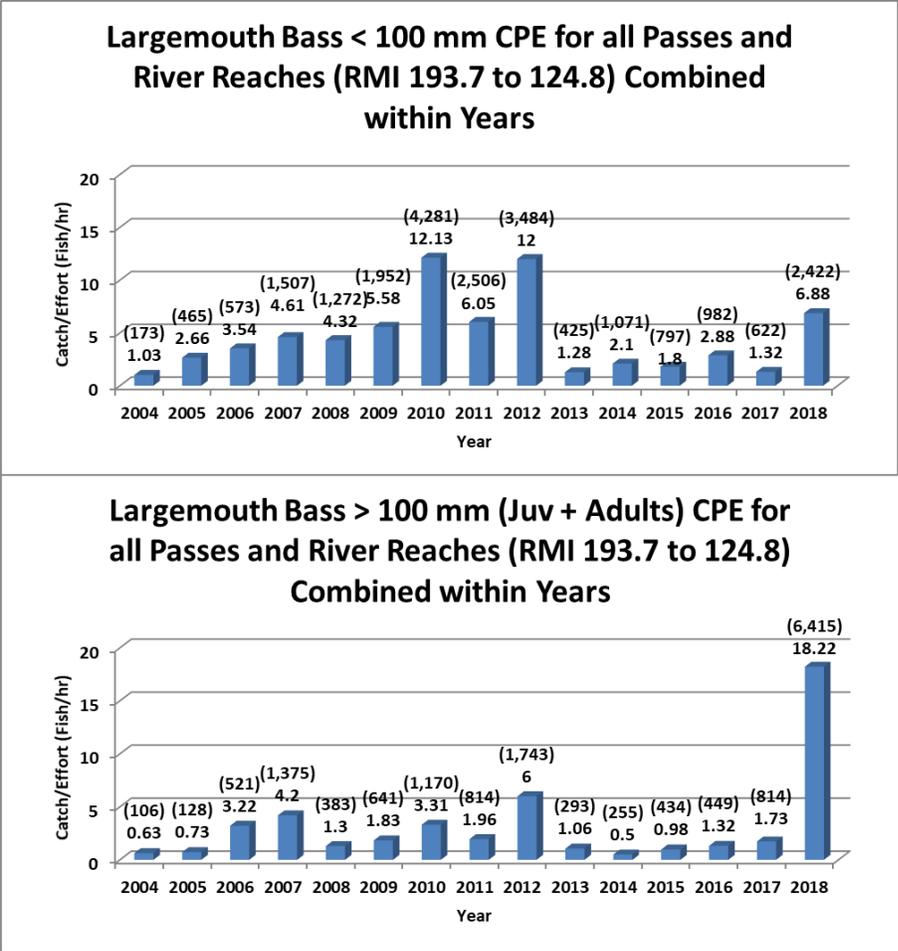


Figure 4. Fifteen year comparison of catch/effort (fish/hr) for largemouth bass (< 100 mm) (upper) and juvenile and adult largemouth bass (≥ 100 mm) (lower), 2004-2018, for the Colorado River (RMI 193.7 to 124.8). Note: numbers of largemouth bass collected in parentheses.

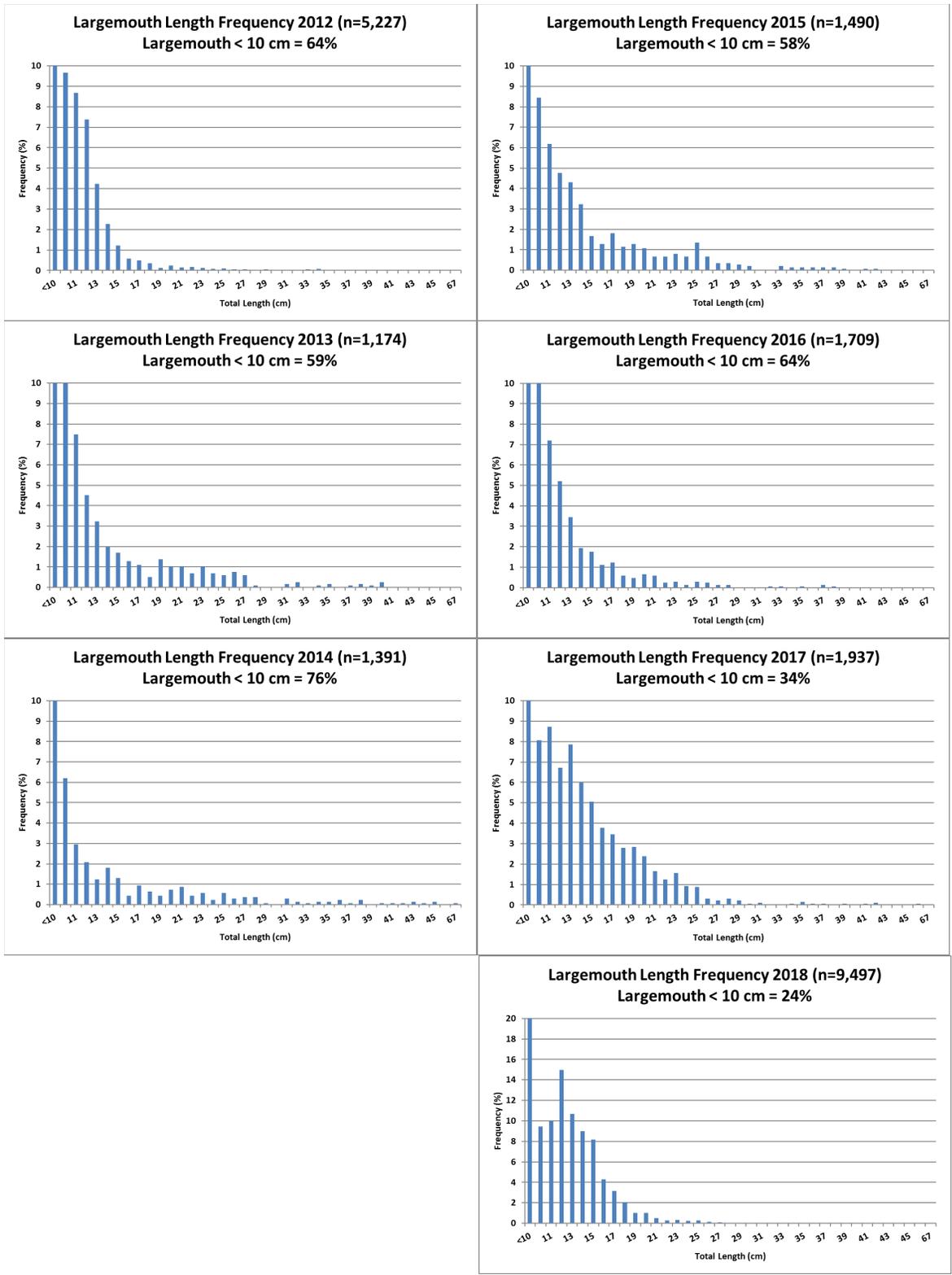


Figure 5. Length frequency histograms for largemouth bass removed from the Colorado River from Silt, CO to the confluence of the Green River (RMI 0.0), UT from 2012 through 2018.

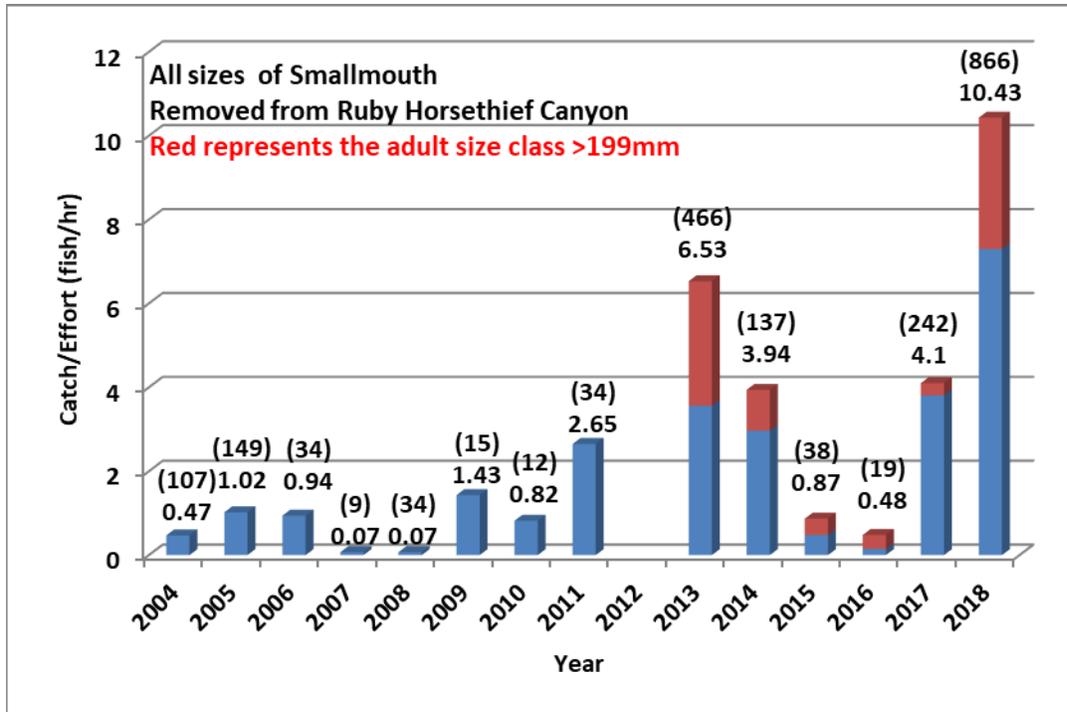


Figure 6. Fifteen year comparison of catch/effort (fish/hr) for young-of-year, juvenile and adult smallmouth bass, 2004-2018, for Ruby Horsethief Canyon of the Upper Colorado River. Adult size classes were calculated beginning in 2013. Note: numbers of smallmouth bass collected in parentheses.

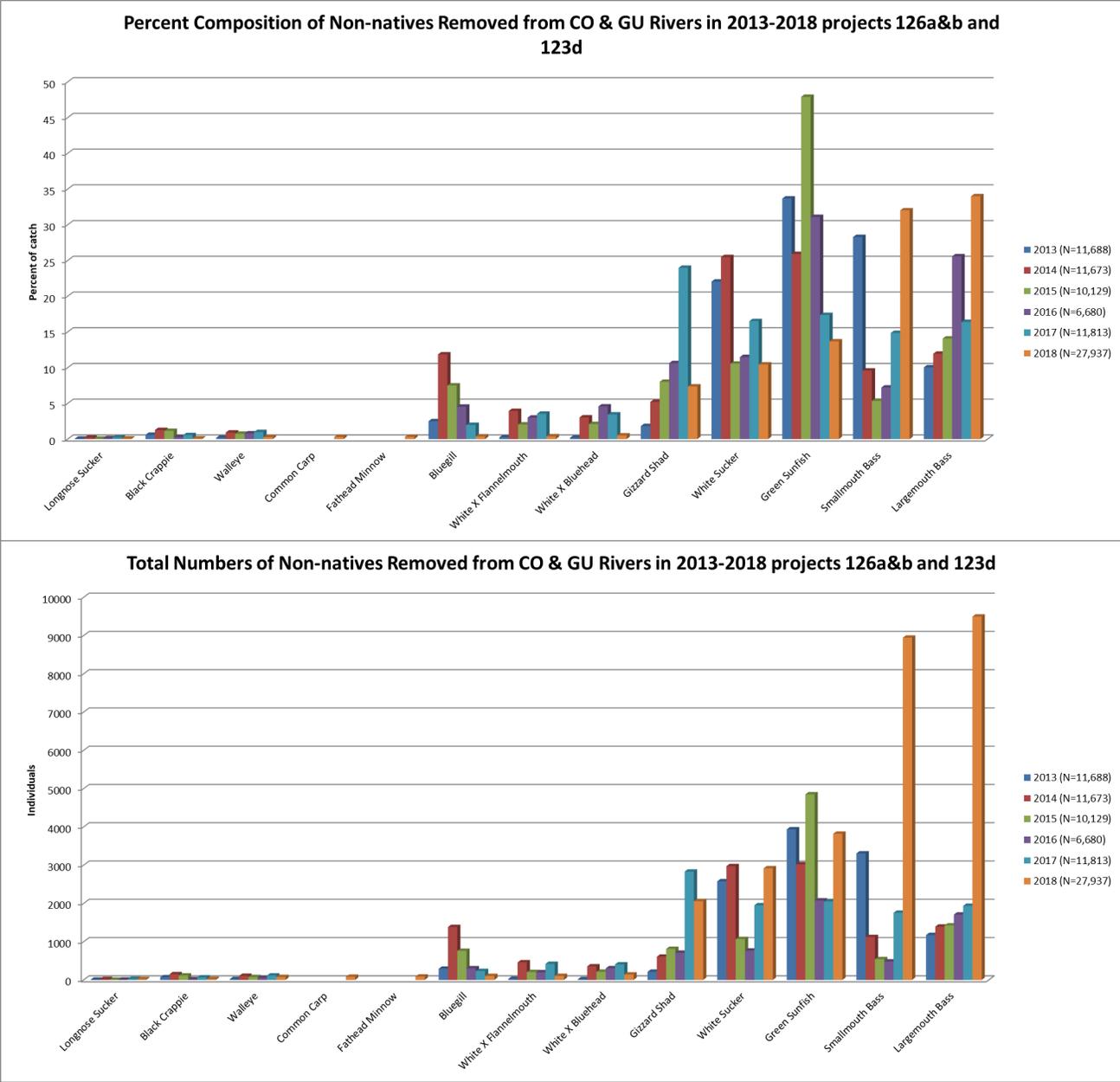


Figure 7. Percent composition and total numbers of nonnative fish removed from the Colorado (river mile 240.7 to 47.2) and Gunnison (river mile 3.0 to 0.0) rivers from 2013 through 2018.

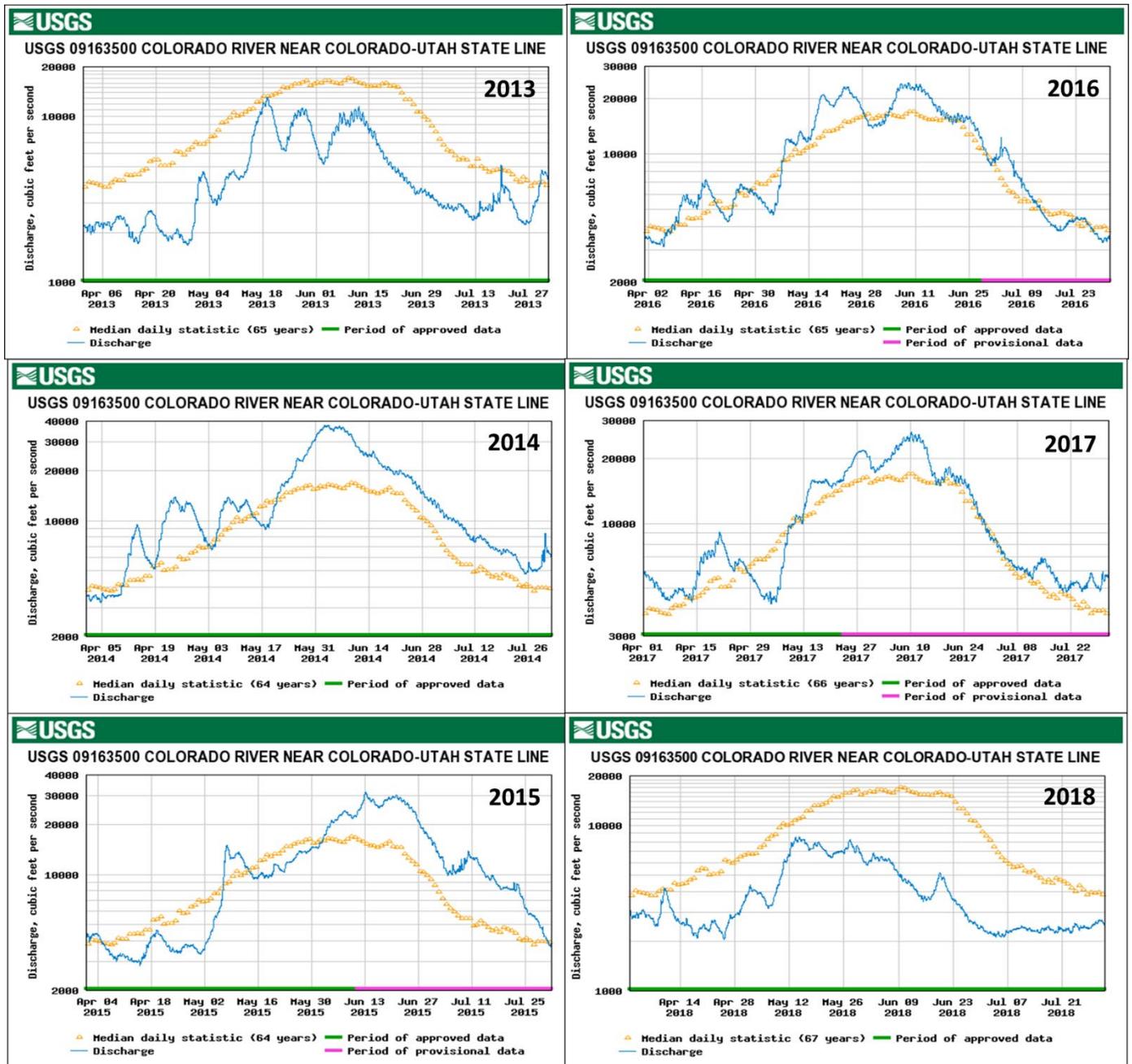


Figure 8. Spring Colorado River discharge as measured at the USGS gauge (09163500) near the CO/UT state-line; 2013-2018. Note: Notice the value change on the Y axis.

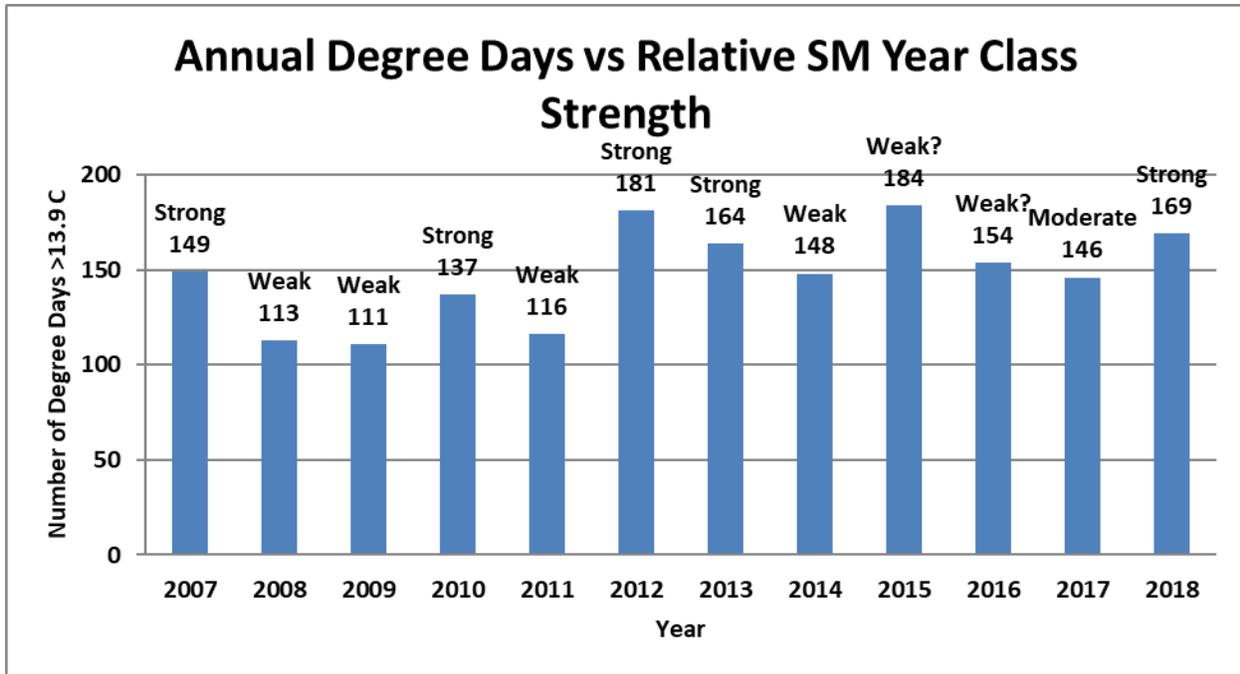


Figure 9. Annual degree days exceeding 13.9° (Celsius) as measured at the USGS 09163500 Colorado River near Colorado- Utah state line gauge.

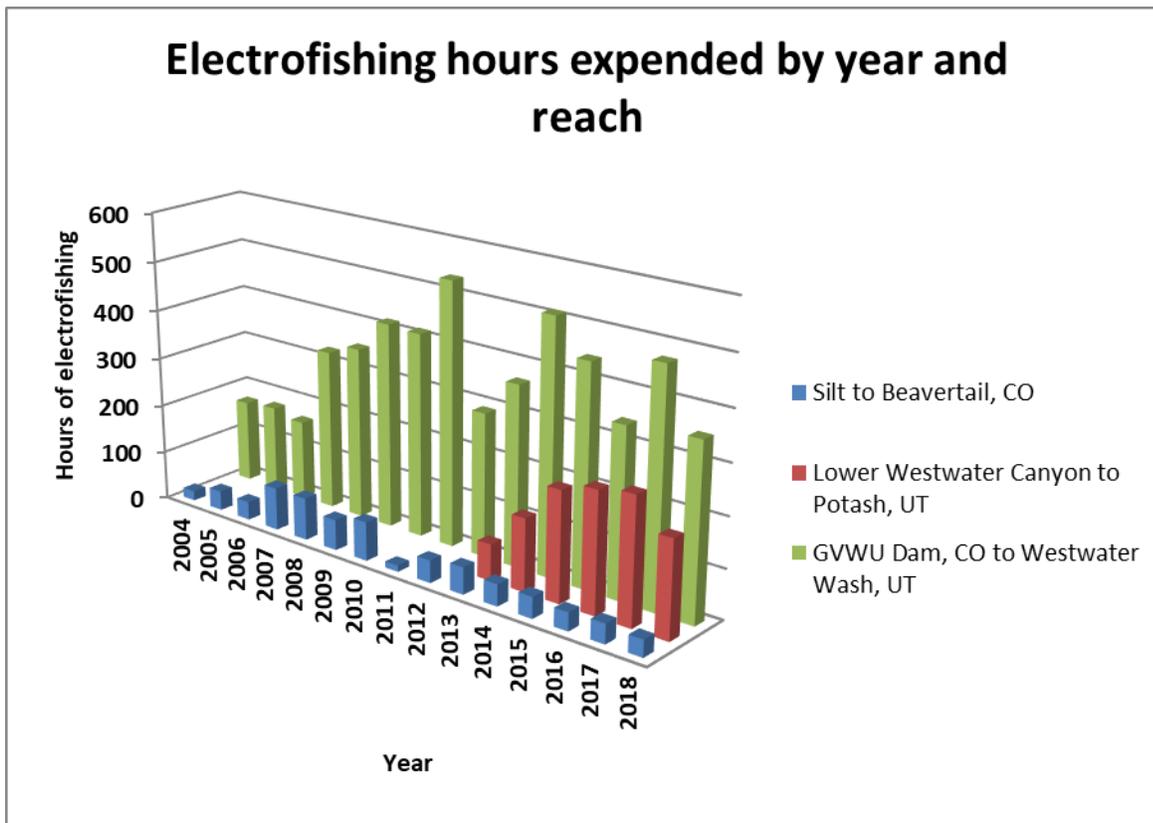


Figure 10. Electrofishing effort for 126a, 126b & 123d by year and reach.

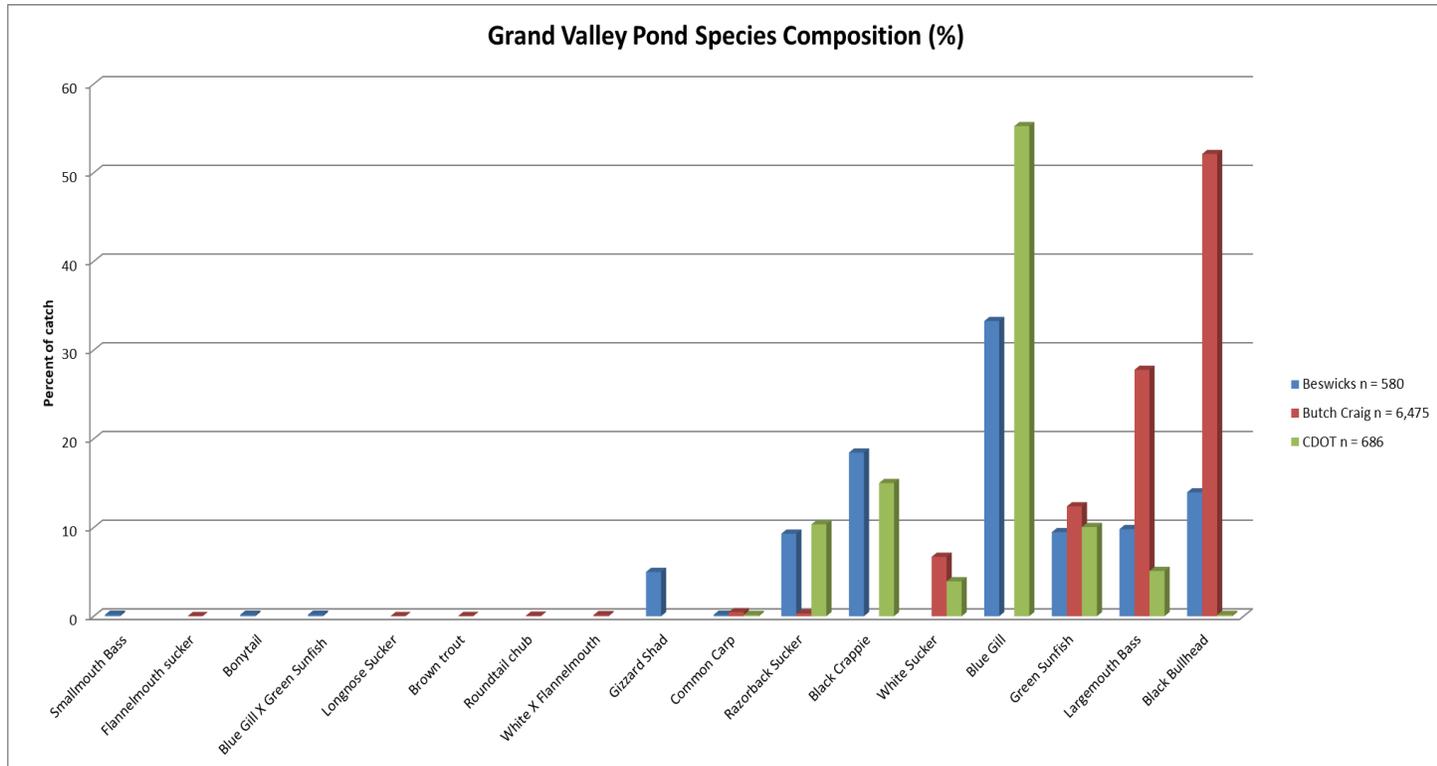


Figure 11. Species composition of fishes handled in Beswicks, Butch Craig and CDOT pond 2018.

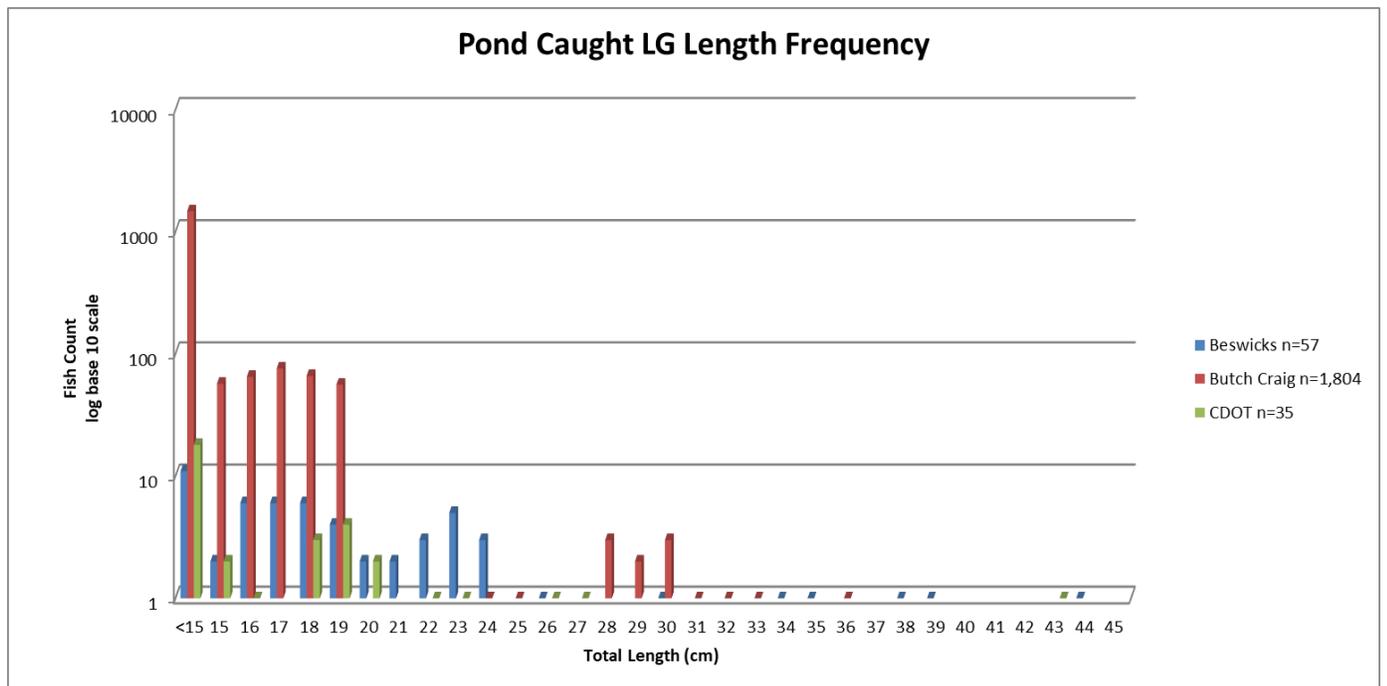


Figure 12. Beswicks, Butch Craig and CDOT ponds largemouth bass length frequency histogram 2018.

ANNUAL PERFORMANCE PROGRESS REPORT (PPR)

BUREAU OF RECLAMATION AGREEMENT NUMBER: R17AP00301

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:

Ben Felt, Aquatic Biologist
Colorado Parks & Wildlife
711 Independent Ave.
Grand Junction, CO
81505 970-255-6126
lori.martin@state.co.us

Jenn Logan, Native Aquatic Species Biologist
Colorado Parks & Wildlife
0088 Wildlife Way
Glenwood Springs, CO
81601 970-947-2923
jenn.logan@state.co.us

Project/Grant Period: Start date (Mo/Day/Yr): September 22, 2017
End date: (Mo/Day/Yr): September 30, 2022
Reporting period end date (Mo/Day/Yr): September 30, 2018
Is this the final report? Yes _____ No X

Performance:

Summary of Colorado Park and Wildlife's Project 126b: Colorado River Non-Native Removal for 2018

- The Colorado River was sampled between Rifle (RM 240.1) and Parachute (RM 222.2) as well as Debeque (RM 208.4) to Beavertail Tunnel (RM 195.7) by Colorado Parks and Wildlife (CPW) crews as part of Project 126b. Debeque Canyon and the backwater at RM 236.6 were sampled in April 2018. In the previous 3 years, CPW has sampled on the declining limb of the hydrograph as backwaters begin to form and are accessible. Generally, surveys take place in July and early August. The reach between Silt (RM 248.0) and Rifle (RM 240.1) was omitted in 2018. Silt to Rifle is sampled every other year and was last sampled in 2017. In addition, Parachute to Debeque was not sampled due to low flow conditions over the Bluestone ditch and the loss of the Una Bridge takeout. 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 gill nets at the mouths of large backwaters to complete "block and shock" sampling. Fish captured were measured in length to the nearest millimeter and weighed to the nearest gram. Non-native, non-salmonid fish captured were lethally removed, with the exception of large Common Carp. In 2018, non-native catostomids and hybrid catostomids were removed opportunistically.

- One electrofishing pass was completed from Rifle (RM 240.1) to Parachute (RM 222.2) and from Debeque (RM 208.4) to Beavertail Tunnel (RM 195.8), where the main channel and backwaters were electrofished. Additional efforts were expended in six backwaters, five downstream of Rifle and one downstream of Rulison. A backwater at RM 236.6 has been identified as a Northern Pike concentration area and was electrofished on two occasions. Block nets were deployed during both electrofishing events. An additional backwater downstream of Rulison (RM 228.8) was electrofished on two occasions. River mile 228.8 backwater has been known as a bass concentration area but has not been accessible in all years. In general, Black Bullhead and most centrarchids were captured within backwater, slackwater, and eddy habitats. No Northern Pike were collected in 2018.
- Due to low flow and high temperature water conditions throughout the summer, less overall effort was expended in 2018. No Northern Pike were captured in 2018.
 - Catch rates for all centrarchids combined from main channel efforts (backwaters not included) were lower in 2018 than 2017 (5.59 fish/ hour vs. 10.81 fish/hour). However, it should be noted that different reaches were included in 2018 efforts. In 2018, Silt to Rifle and Parachute to Debeque were not sampled. In 2017, those reaches were sampled while Debeque to Beavertail tunnel was omitted.
 - Catch rates for all centrarchids combined in the RM 236.6 backwater returned to levels similar to 2016 rates. Catch rates decreased to 56.67 fish/hour in 2017 from 94.95 fish/hour in 2016. In 2018, CPUE for all centrarchids combined in RM 236.6 backwater was 92.03 fish/hour. No Smallmouth Bass were captured in this backwater in 2018. Eighty-three percent of Largemouth Bass collected during this project were captured in this backwater and another backwater located at RM 228.8.
 - The backwater at RM 228.8 is located in a side channel downstream of Rulison. Changing sand bars and downed trees in this narrow channel prevent access during some years or passes. In 2018, RM 228.8 was electrofished on two occasions. CPUE for all centrarchids combined was 99.32 fish/hour. In 2017, access to this backwater was limited to a single pass and CPUE was 20.19 fish/hour for all centrarchids. Fifty-nine percent of all Smallmouth Bass captured during this project in 2018 were collected in this backwater. Only 12 of the 128 Smallmouth Bass captured were collected upstream of this backwater. Further investigation into the source of Smallmouth Bass in this backwater is recommended. The overall larger total length of juvenile Largemouth and Smallmouth Bass compared to previous years may be related to shifting removal passes to later in the growing season in 2018.
- CPW recommends continuing to electrofish the equivalent of 7 days in the reaches between Silt (RM 248.0) and Beavertail Tunnel (RM 195.7) in 2019. Due to low densities of target species, in general, Debeque to Beavertail Tunnel will be fished in even years and Silt to Rifle in odd years when hydrologic conditions are suitable. We recommend shifting efforts to focus on backwater and other slack water habitats across all days rather than shocking all shorelines through a reach. By shifting to a focus on slack water habitats, more effort will be expended in habitats where non-native species are more likely to be encountered. CPW also recommends continuing to use block and shock methods for larger backwaters in known concentration areas of Northern Pike, Smallmouth Bass and Largemouth Bass. In addition, further investigation into the source of bass in the backwater at RM 228.8 is recommended.
- Forty-three individual Razorback Sucker were captured, checked for PIT tags, measured, and released. One individual was captured on two occasions. Thirty-five of these fish were captured on a single day at the RM 236.6 backwater in April 2018. Several males appeared to be in spawning condition. Deploying a submersible antenna to detect PIT tagged fish in the Spring of 2019 may yield additional information about the use of this area by Razorback Sucker. Five of the 43 fish were captured in the RM 236.6 backwater in September and four were captured upstream of Debeque Canyon in April. According to the STreaMS database, all 43 individuals were stocked at the Rifle bridge between 2012 and 2017. Most of these fish were stocked in late summer and early fall time frames with four released in 2012, two released in 2013, 12

in 2016 and nine released in 2017. Nine Razorback Sucker were also stocked in April 2015. Capture information will be submitted to the STreaMS database.

- Total Number of Fish Removed = 1,415 (464 and 513 of these fish were removed from backwaters at RM 236.6 and RM 228.8, respectively.)
 - Total Number of Black Bullhead = 9 (total length ranged from 119 mm- 235 mm)
 - Total Number of Bluegill= 1 (total length 125 mm)
 - Total Number of Green Sunfish = 376 (total length ranged from 18 mm-147 mm):
 - a. 205 fish \leq 100 mm
 - b. 179 fish $>$ 100 mm and $<$ 150 mm
 - c. 0 fish \geq 150 mm
 - Total Number of Largemouth Bass = 268 (total length ranged from 48 mm- 370 mm):
 - a. 88 fish \leq 100 mm
 - b. 101 fish $>$ 100 mm and $<$ 150mm
 - c. 70 fish \geq 150 mm and $<$ 250 mm
 - d. 9 fish \geq 250
 - Total Number of Northern Pike = 0
 - Total Number of Smallmouth Bass = 128 (total length ranged from 70 mm-185 mm):
 - a. 58 fish \leq 100 mm
 - b. 69 fish $>$ 100 mm and $<$ 150 mm
 - c. 1 fish \geq 150 mm
 - Total Number of non-native sucker/hybrid sucker= 514 (total length ranged 40 mm- 508 mm)
 - Total Number of Common Carp and other non-native cyprinids= 119

- Total Electrofishing Effort Expended = 34.73 hours
 - 27.38 hours expended in main channel, shoreline habitats
 - 3.36 hours expended in backwater at RM236.6
 - 2.95 hours expended in backwater at RM228.8
 - 1.04 hours expended in four combined backwaters

Colorado River Non-native Fish Control 2018				
Rifle to Parachute and Debeque to Beavertail Tunnel CPUE (Fish/Hour)				
	Main Channel only	RM 236.6 Backwater	RM 228.8 Backwater	Other Backwaters Combined
All Centrarchids combined	5.59 n= 153	92.03 n= 309	99.32 n=293	17.31 n= 18
Bluegill	0	0.3 n=1	0	0
Green Sunfish	2.59 n= 71	45.87 n= 154	50.51 n=149	1.92 n= 2
Largemouth Bass	1.1 n= 30	45.87 n= 154	23.39 n= 69	14.42 n=15
Smallmouth Bass	1.9 n= 52	0	25.42 n= 75	0.96 n= 1

- CPW also conducted a fish community survey in addition to efforts for Project 126b. Two passes were completed between RM 180.4- 177.7 near Clifton, CO in October 2018. This reach was sampled by three 16' rafts equipped with ETS mounted electrofishing gear. Native non-listed fish species are the primary

interest of these surveys, but all species encountered are collected. Centrarchid species were removed during both the mark and recapture passes. White Sucker, Longnose Sucker, and their hybrids over 150 mm total length were marked and released during the first pass (the marking pass), but removed when encountered on the second pass (the recapture pass). White Sucker, Longnose Sucker, and their hybrids under 150 mm total length were removed during both passes. No Northern Pike, Striped Bass, Walleye, Yellow Perch, or Black Bullhead were encountered during these surveys. All Channel Catfish, Common Carp, and salmonids were released alive.

- Total number of fish removed= 105
 - Total number of Green Sunfish removed= 1 (total length 135mm)
 - Total number of Largemouth Bass removed= 1 (total length 98 mm)
 - Total number of Smallmouth Bass removed= 5 (total length ranged from 96 mm – 254mm)
 - a. 1 fish \leq 100 mm
 - b. 2 fish $>$ 100 mm and $<$ 150 mm
 - c. 1 fish \geq 150 mm and $<$ 250mm
 - d. 1 fish \geq 250 mm
 - Total number of White Sucker, Longnose Sucker, and hybrids removed= 105 (total length ranged from 67 mm- 520 mm)
- Total Electrofishing effort expended= 5.84 hours
 - Centrarchid CPUE= 1.20 fish/hour
 - Non-native sucker/hybrid sucker CPUE= 16.95 fish/hour

Summary of CPW's Project 126b: 2018 Mamm Creek Pits Non-Native Removal

Mamm Creek Pit #1

- The 37 surface acre Mamm Creek Pit #1 was surveyed by CPW crews using both active (16' hard bottom jet boats equipped with ETS mounted electrofishing gear) as well as passive (gill nets) sampling techniques. CPW crews visited Mamm Creek Pit #1 on nine occasions between March 5 and October 4. Daytime electrofishing was conducted on March 7, March 12, and March 14. Additionally, nighttime electrofishing was conducted during the fall survey on October 3. Overnight gill net surveys were conducted on March 6- 8, March 12- 14, March 20, April 20, and October 4. A combination of standard mesh (ranging from 1.25" to 1.5" bar size) and experimental mesh gill nets were utilized throughout the project for overnight sets. Historically, CPW utilizes a Merwin Trap (large trap typically used to collect kokanee salmon during the spawning season in Colorado) to preclude non-native fishes from escaping the pond and entering the Colorado River during run-off. However, the Merwin trap was not deployed in 2018 due to low river flows which resulted in no connection between the river and Mamm Creek Pit #1 through either the upstream or downstream breach. Fish captured during spring removal efforts were measured in length to the nearest millimeter and weighed to the nearest gram; only length and count data were taken on age-0 Largemouth Bass and Common Carp captured during the fall survey due to the large number of fish captured. Non-native, non-salmonid fish captured were lethally removed, except for Largemouth Bass surveyed during the fall survey conducted October 3 – October 4 which were released alive. Largemouth Bass were released to provide an alternative angling opportunity for the landowner because fishing success for Northern Pike has drastically decreased since CPW started removal efforts. CPW chose to release these fish to increase fishing success and is committed to deploying the Merwin Trap during times in which Mamm Creek Pit #1 connects to the Colorado River to prevent escapement of non-native fish, including Largemouth Bass. Additionally, from a fisheries management standpoint, Largemouth Bass serve as a predatory species that can aid in the suppression of undesirable fish species (e.g. White Sucker, Green Sunfish, Yellow Perch, Common Carp) that may become more numerous as Northern Pike numbers continue to decline. Furthermore, adult Largemouth Bass have the potential to compete with Northern Pike.
- The data gathered in 2018 indicate that Northern Pike numbers are declining and these apparent reductions are resulting in a rebound in other fish species present in the pit. Despite increased gill net effort in 2018 relative to 2017, the number of Northern Pike removed decreased by 41% (181 removals in 2018 compared

to 306 in 2017). Gill net CPUE for Northern Pike in 2018 was 0.09 fish/hour compared to 0.16 fish/hour in 2017. Northern Pike CPUE data from the spring removals conducted in 2018 show a pronounced depletion in numbers of fish caught in gill nets throughout the spring (Figure 1). Only three Northern Pike were surveyed during the fall electrofishing / gill net survey and there was an abundance of age-0 Largemouth Bass which further suggests the annual removal efforts are successfully suppressing the Northern Pike population in Mamm Creek Pit #1 (Figure 2 and Figure 3). No age-0 Northern Pike were surveyed during the fall survey.

- CPW recommends continued annual removal efforts on Mamm Creek Pit #1 using similar methods and effort as in previous years to continue further reduction of the Northern Pike population. As in the past, removal efforts should primarily be conducted during the spring, with a focus on intensive efforts during the early portion of the spawning season to specifically target pre-spawn (green) females to reduce the amount of successful Northern Pike reproduction. In 2018, CPW efforts focused on the early portion of the spawning season which presumably significantly reduced successful spawning; 78 green females were removed and 14 ripe females were removed. No spent females were captured during the removal effort. Gill net sets should continue to consist of overnight sets when feasible as overnight sets early in the year were responsible for the majority of the removals in 2018 and 2017. CPW will monitor flows throughout the spring of 2019 to determine if deployment of the Merwin trap is necessary. The Merwin Trap will be deployed if the outlet breach has any potential to connect with the Colorado River.
- Total Number of Fish Surveyed = 1,702
 - Total Number of Common Carp (all lethally removed) = 318 (Total length ranged from 79mm-810mm)
 - Total Number of Green Sunfish (all lethally removed) = 42 (Total length ranged from 51mm-145mm)
 - Total Number of Largemouth Bass (1,122 released alive during fall survey, 24 lethally removed during spring removal efforts) = 1,146 (Total length ranged from 70mm-502mm):
 - a) 1,101 fish \leq 100mm
 - b) 20 fish $>$ 100mm and \leq 200mm
 - c) 21 fish $>$ 200mm and \leq 300mm
 - d) 1 Fish $>$ 300 mm and \leq 400mm
 - e) 2 Fish $>$ 400 mm and \leq 500mm
 - f) 1 Fish $>$ 500 mm and \leq 600mm
 - Total Number of Northern Pike (all lethally removed) = 181 (Total length ranged from 434mm-673mm):
 - a. 0 fish \leq 400mm
 - b. 18 fish $>$ 400mm and \leq 500mm
 - c. 141 fish $>$ 500mm and \leq 600mm
 - d. 22 fish $>$ 600mm and \leq 700mm
 - e. 0 Fish $>$ 700mm
 - Total Number of Yellow Perch (all lethally removed) = 14 (Total length ranged from 128mm-335mm)
 - Total Number of White Sucker = 1 (Total Length was 349mm)
- Total Effort Expended (Electrofishing = 3.8 hours; Gill Net Sets = 2026.5 hours) = **2030.3 hours**
- Centrarchid (Green Sunfish and Largemouth Bass, combined) CPUE across all methods = 0.80 fish/hour
 - Electrofishing CPUE = 307.63 fish/hour
 - Gill Nets CPUE = 0.01 fish/hour
 - a. Green Sunfish CPUE
 - i. Electrofishing = 11.05 fish/hour
 - ii. Gill Nets = 0 fish/hour
 - b. Largemouth Bass CPUE

- i. Electrofishing = 296.58 fish/hour
- ii. Gill Nets = 0.01 fish/hour

- Northern Pike CPUE across all methods = 0.35 fish/hour
 - Electrofishing CPUE = 0.26 fish/hour
 - Gill Nets = 0.09 fish/hour
- Common Carp CPUE
 - Electrofishing CPUE = 79.47 fish/hour
 - Gill Nets = 0.01 fish/hour
- Yellow Perch CPUE
 - Electrofishing CPUE = 0.26 fish/hour
 - Gill Nets = 0.01 fish/hour
- White Sucker CPUE
 - Electrofishing CPUE = 0 fish/hour
 - Gill Nets = <0.01 fish/hour

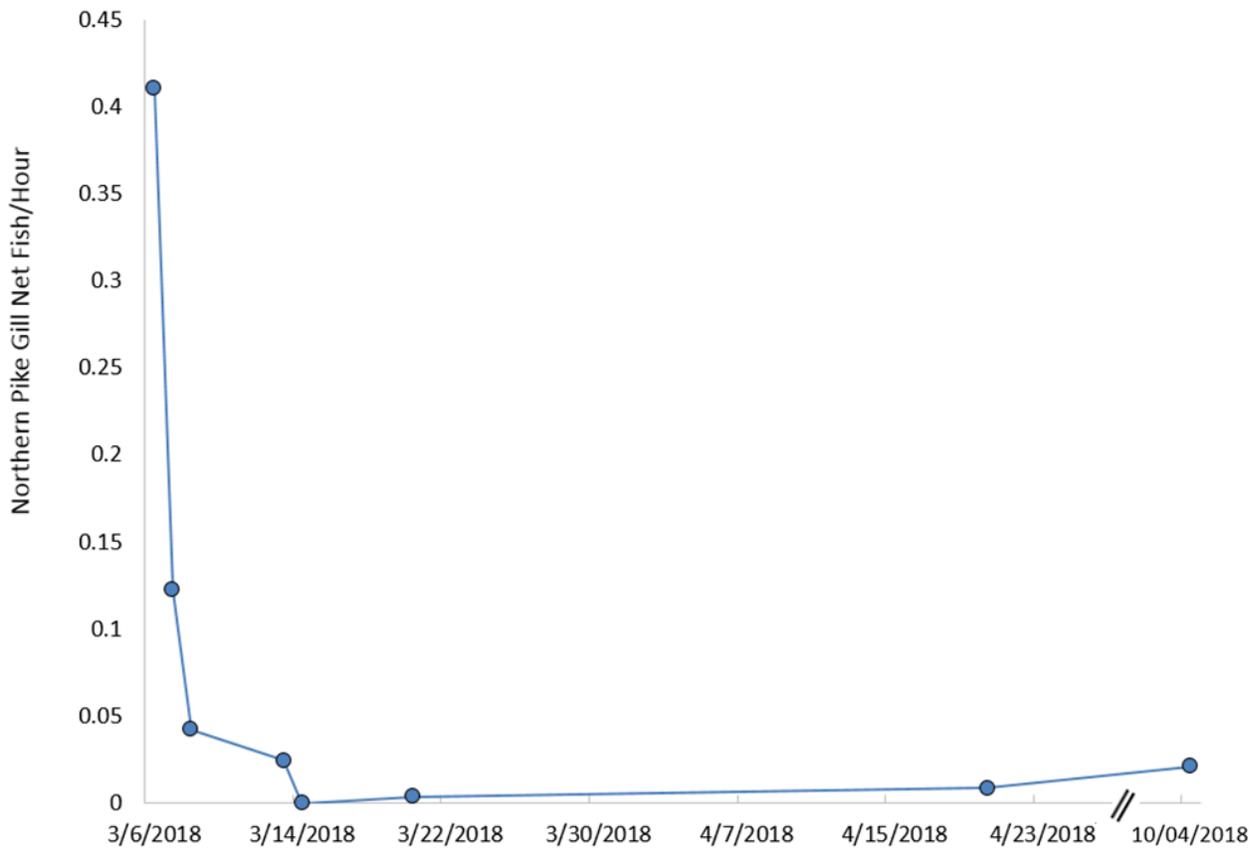


Figure 1. Catch per unit effort (in number of fish per hour of gill net effort) of Northern Pike removed from Mamm Creek Pit #1 between March 6 and April 20, 2018. Gill nets used were a combination of experimental mesh nets, and standard mesh nets ranging in mesh size from 1.25” to 1.5”. Specific gill nets were placed in consistent locations throughout the duration of the project to allow comparison in CPUE between dates. Note axis break on X-Axis between spring surveys and fall survey.

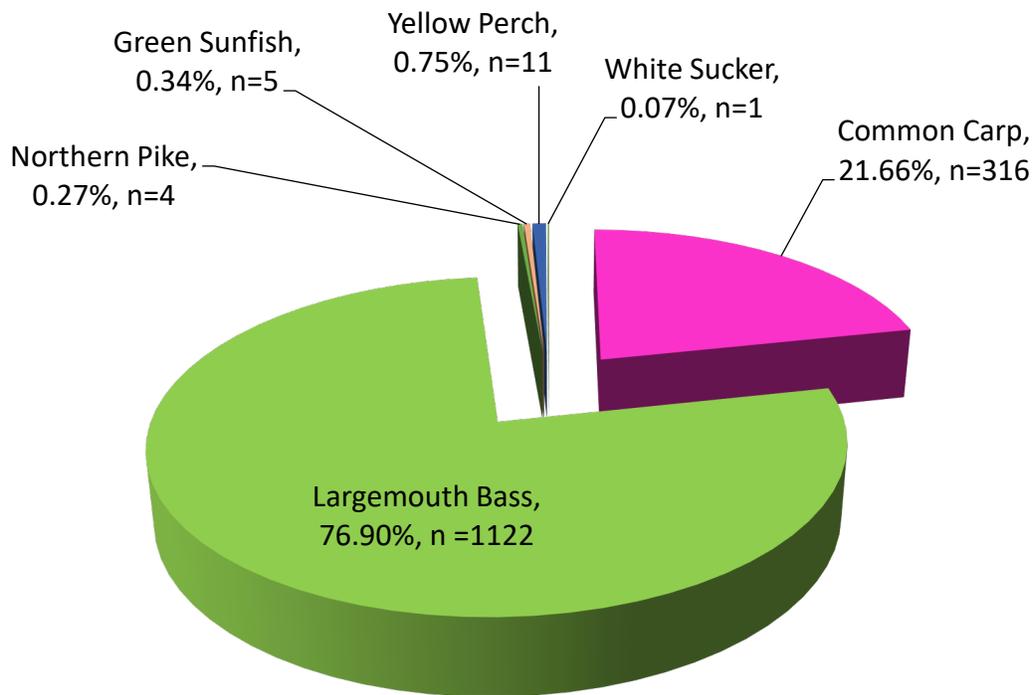


Figure 2. Species composition of fish surveyed in Mamm Creek Pit #1 on October 3 and 4, 2018. Survey utilized a combination of overnight gill net sets and nighttime electrofishing. Numerous age-0 Common Carp were not netted during electrofishing survey due to extremely high densities.

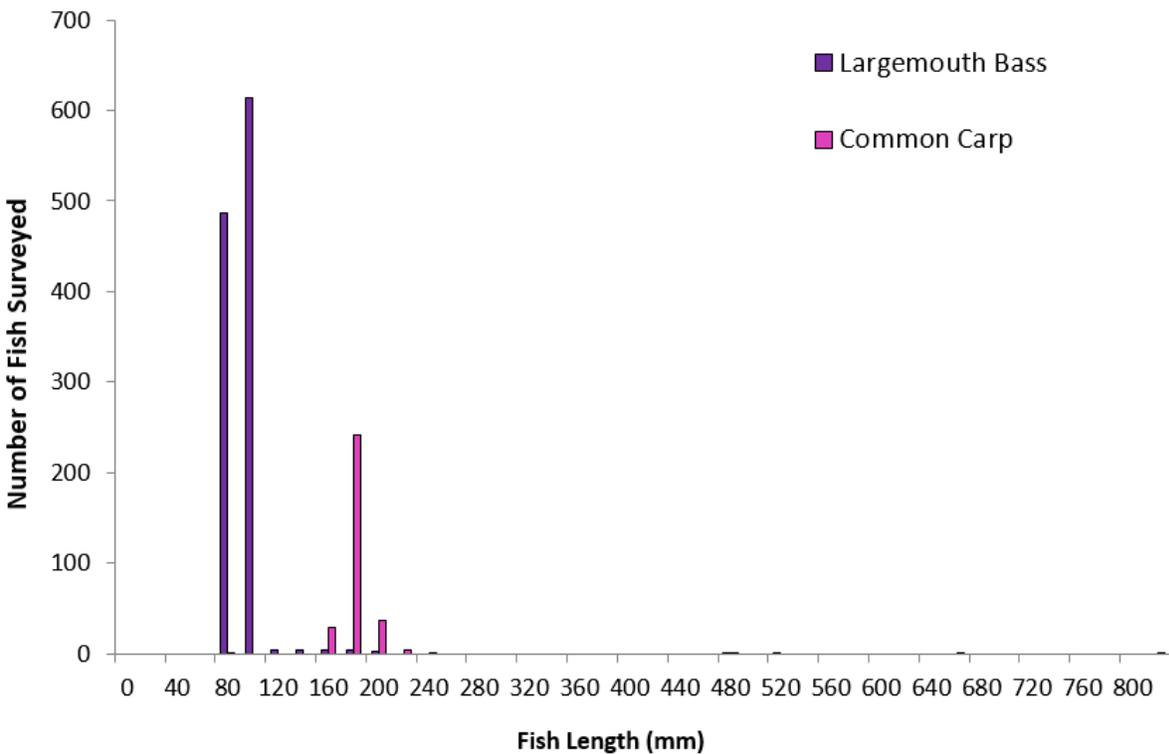
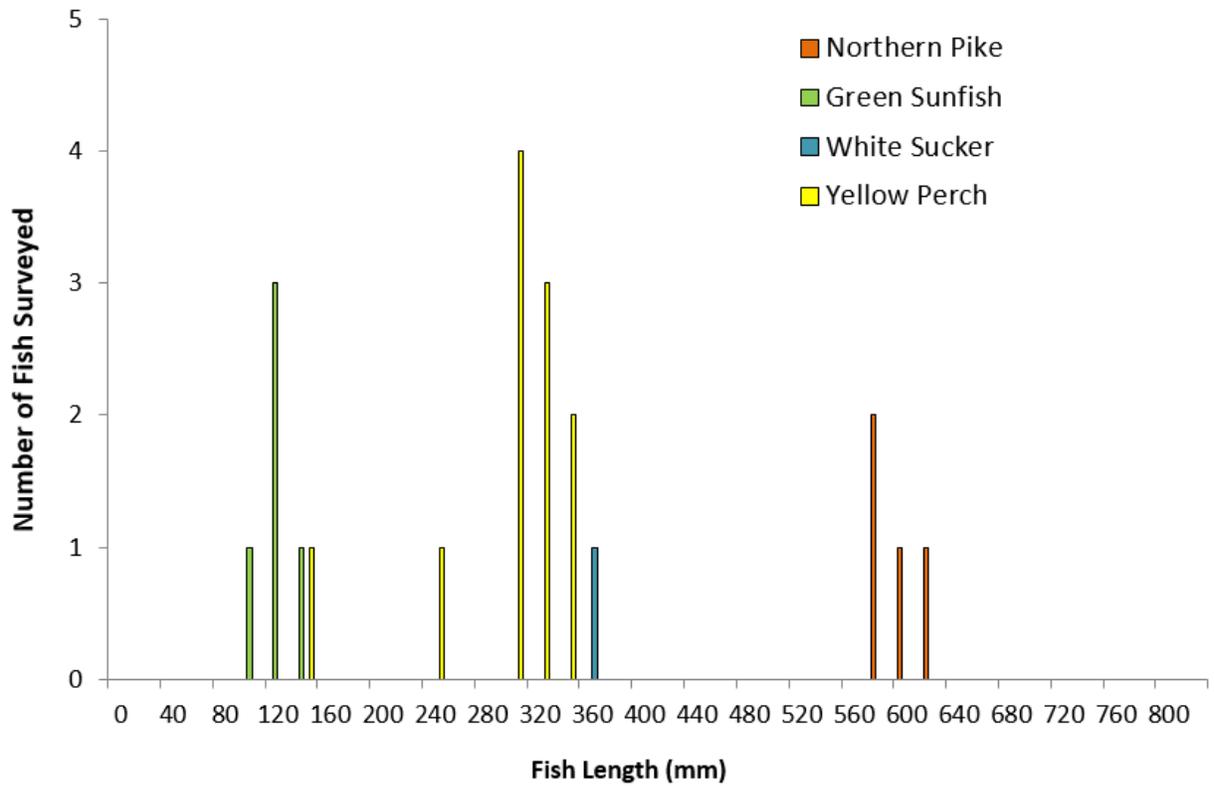


Figure 3. Length frequency histograms of fish surveyed in Mamm Creek Pit #1 October 3-4, 2018 during the fall survey which consisted of overnight gill net sets and nighttime electrofishing. Note that Largemouth Bass and Common Carp are shown in separate figures due to their higher abundances relative to other species (note that Y-axes are not equal between figures).

Mamm Creek Pit #2

- Mamm Creek Pit #2 is a 12.5 surface acre pond located approximately 0.25 miles west of Mamm Creek Pit #1. Northern Pike were first collected in Mamm Creek Pit #2 in 2016. During this survey in 2016, a single Northern Pike (male, 802 mm in total length) was caught during the survey which consisted of five gill nets set overnight. Prior to the 2016 survey, Northern Pike were suspected to potentially be in Mamm Creek Pit #2 because of its connection with Mamm Creek Pit #1 during high flows in 2011. In 2017, Mamm Creek Pit #2 was surveyed more intensively (six survey events using three or four gill nets set overnight) to more thoroughly evaluate species composition, including abundance of Northern Pike within the pond, and to determine if there was evidence of natural reproduction and recruitment. Despite the increased effort in 2017, only one large Northern Pike (green female, 1,000 mm in total length) was collected which suggests Northern Pike have not successfully reproduced in the pond and that the two Northern Pike collected in 2016 and 2017 may be fish that moved into the pond during high flows in 2011. It is also possible that these fish were illicitly stocked directly in Mamm Creek Pit #2. Based on the data gathered in 2016 and 2017, a reduced effort consisting of a single survey using four overnight gill nets was conducted on March 15, 2018; no Northern Pike were collected.
- CPW recommends continued monitoring of Mamm Creek Pit #2 annually using overnight sets of three to four gill nets. The amount of effort proposed, which is reduced relative to 2016 and 2017, is in response to the data gathered in the previous three years. A very low density of Northern Pike in the pond as well as the lack of successful reproduction and recruitment were observed. Removal efforts will be increased if future data provide evidence for increases in Northern Pike densities or if juvenile Northern Pike are collected.
- Total number of fish removed = 24
 - Total number of Largemouth Bass = 2 (total length of 318mm and 383mm)
 - Total number of White Sucker = 22 (total length ranged from 332mm – 395mm)
- Total effort expended (all gill netting): **82.69 hours**.
- Gill net CPUE:
 - Largemouth Bass: 0.02 fish/hour
 - White Sucker: 0.27 fish/hour

Mamm Creek Pit #3

- Mamm Creek Pit #3 is a seven surface acre pond located approximately 0.5 miles west of Mamm Creek Pit #1. Northern Pike were first collected in Mamm Creek Pit #3 in 2016. During this survey in 2016, four Northern Pike (3 males and one female, total length ranged from 717mm - 829mm) were collected which consisted of four gill nets set overnight. Prior to the 2016 survey, Northern Pike were suspected to potentially be in Mamm Creek Pit #3 because of its connection with Mamm Creek Pit #1 during high flows in 2011. In 2017, Mamm Creek Pit #3 was surveyed more intensively (five survey events using three-five overnight gill net sets) to more thoroughly evaluate species composition, including abundance of Northern Pike, within the pond, and to determine if there was evidence of natural reproduction and recruitment. Despite the increased effort in 2017, only one large Northern Pike (green female, 980 mm in total length) was collected, which suggests Northern Pike have not successfully reproduced in the pond and that the five Northern Pike collected in 2016 and 2017 may be fish that moved into the pond during high flows in 2011. It is also possible that these fish were illicitly stocked directly in Mamm Creek Pit #3. Based on the data gathered in 2016 and 2017, a reduced effort consisting of a single survey using four overnight gill nets was conducted on March 15, 2018; no Northern Pike were collected.
- CPW recommends continued monitoring of Mamm Creek Pit #3 annually using overnight sets of three to four gill nets. The amount of effort proposed, which is reduced relative to 2016 and 2017, is in response to the data gathered in the previous three years. A very low density of Northern Pike in the pond as well as the lack of successful reproduction and recruitment were observed. Removal efforts will be increased if future data provide evidence for increases in Northern Pike densities or if juvenile Northern Pike are collected.
- Total number of fish removed = 6
 - Total number of Largemouth Bass = 2 (total length of 319mm and 398mm)
 - Total number of White Sucker = 2 (total length of 389mm and 235mm)
 - Total number of Yellow Perch = 1 (total length of 272mm)
 - Total number of Bluegill/Green Sunfish hybrid = 1 (total length of 231mm)
- Total effort expended (all gill netting): **84.33 hours**.
- Gill net CPUE:
 - Largemouth Bass: 0.02 fish/hour
 - White Sucker: 0.02 fish/hour
 - Yellow Perch: 0.01 fish/hour
 - Bluegill / Green Sunfish Hybrid: 0.01 fish/hour

ANNUAL PERFORMANCE PROGRESS REPORT (PPR)

BUREAU OF RECLAMATION AGREEMENT NUMBER: R14AP00007
UPPER COLORADO RIVER RECOVERY PROGRAM PROJECT NUMBER: 123d

Project Title: Walleye control in the lower Green and Colorado Rivers

Principal Investigator:

Chris Michaud
Utah Division of Wildlife Resources
1165 S Hwy 191, Suite 4, Moab, UT 84532
Phone: 435-259-3784; E-mail: cmichaud@utah.gov

Project/Grant Period:

Start date (Mo/Day/Yr): 05/01/2014
End date: (Mo/Day/Yr): 09/30/2018
Reporting period end date: 9/30/2018
Is this the final report? Yes _____ No X

Performance:

Walleye removal on the Green River

Seven hours of electrofishing effort, targeting walleye on the lower Green River, was completed between 12 February and 10 April, 2018. All effort was focused on high value walleye habitat between Tusher diversion and Green River State Park (RM128-120). A total of 12 walleye were removed from the Green River (CPUE=1.66) in 2018. Razorback sucker (n=2, CPUE=0.49), black bullhead (n=3, CPUE=0.41) and white sucker (n=2, CPUE=0.28) were also encountered.

Walleye removal on the Colorado River

Utah Division of Wildlife Resources crews completed two hours of targeted walleye removal on the Colorado River between Big Hole and Cisco boat ramp (RM 115.8-110.5) in 2018. Sampling occurred on 11 April, 2018. No walleye were encountered over the sampling period. Notable ancillary encounters included razorback sucker (n=1, CPUE=0.49), black bullhead (n=3, CPUE=1.47), green sunfish (n=2, CPUE=0.98), gizzard shad (n=3, CPUE=1.47), smallmouth bass (n=5, CPUE=2.45) and a single white sucker/flannelmouth sucker hybrid (CPUE=0.49).

All work was completed under Tasks 1, 2 and 3 of the FY18 123d scope of work.