

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.**

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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 sixteenth 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) have been our primary focus since 2015.

In our riverine reaches we removed 1,822 smallmouth bass, 2,270 largemouth bass, 88 walleye, one northern pike, 23 striped bass and various amounts of other nonnative fish in 2019. Catches of age-0 smallmouth bass indicate a weak year class (< 100 mm) was produced in 2019 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 a large number of degree days greater than 13.9° (Celsius) prior to winter and had a good chance of surviving until the following 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. Our 2019 catch rate (3.21 fish/hr) of juvenile smallmouth bass (100-199 mm) was reduced 46% when compared to our 2018 catch rate (5.96 fish/hr); however, it was still the fourth highest catch rate in this project's 16 year history. The larger (in magnitude) than average and prolonged spring 2019 hydrograph most likely displaced juvenile smallmouth bass downstream as catch rates of this size class in all reaches from Loma, Colorado to Potash, Utah were the highest documented since this projects inception (Figure 2). The catch rate for YOY and juvenile size smallmouth bass < 100 mm decreased (99%) from 2018. The 2019 catch rate for adult smallmouth bass > 200 mm decreased (58%) from 2018. Catches of largemouth bass from 2012 through 2019 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 (123d; Michaud et al. 2019).

Non-native fish removal in Grand Valley gravel pit ponds resulted in the removal of 1,016 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 that were "excess" to meeting annual stocking targets. These removal efforts resulted in the additional stocking of 62 razorback sucker 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 2019 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 2019, 126a scope of work, called for eight removal passes in the Grand Valley. Unfortunately, personnel issues (seasonal employee hiring) created from internal reorganization of Human Resources on an agency-wide scale left our field station understaffed to complete all nonnative fish removal passes in FY 2019. In addition, low base flows (beginning in August 2019) made it impossible to get boats into some river reaches (e.g., the Colorado River from the GVWU roller downstream to Riverbend Park) to complete the number of passes specified in our scope of work late in the season. However, we feel it's important to note that in all years from 2011-2018, our office completed more

nonnative fish removal passes than our scope of work called for (at no additional cost to the Recovery Program), because we had the staff available to do so in those years (a benefit

realized due to our office's native fish work in the San Juan River and on Lake Powell). In FY 2019, we completed between two and seven and one half passes in all river reaches (see methodology below).

The FY 2019 126b scope of work called for one removal pass from Silt to Beavertail Tunnel. In alternating years, sampling will occur in the reach from Silt to Rifle or Debeque to Beavertail. For FY 2019, Colorado Parks and Wildlife (CPW) sampled the river between Silt (RM 248) and Beavertail Tunnel (RM 195.7). CPW also completed "Three Species" surveys in these reaches where they also removed non-native fish. Please see CPW's PPR in the appendix for more details of their work. Utah Division of Wildlife's (Moab Office; UDWR-M) contribution to FY19 non-native fish removal work in the Colorado River is detailed in their PPR (please see appendix).

All age groups of smallmouth bass (age-0, juveniles, and adults) were present in the 2019 spring/summer/fall collections. These ranged from age-0 (48 mm) to adult (412 mm) fish with a mean of 179 mm. A total of 1,822 smallmouth bass were removed, including 22 considered piscivorous competitors to Colorado pikeminnow ( $\geq 325$  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). Fortunately, those numbers were not reflected in our 2019 juvenile smallmouth bass (100-199 mm) catch rate (3.21 fish/hr) which was reduced 46% from our 2018 catch rate (5.96 fish/hr). In fact, the catch rate for YOY/juvenile size fish  $< 100$  mm decreased from 15.98 fish/hr (2018) to 0.14 fish/hr, the lowest catch rate recorded in this project's history (Figure 3). During 2018, the catch rate for adult size classes of smallmouth bass increased ( $\geq 200$  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) 2018 catch rates increased 326% over 2017 catch rates. 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, in 2018 (Figure 9). A larger (in magnitude) than average and prolonged spring hydrograph most likely displaced juvenile smallmouth bass downstream as 2019 catch rates of this size class in all reaches from Loma, Colorado to Potash, Utah were the highest documented since this projects inception (Figure 2). Adult smallmouth bass (200-324 mm) 2019 catch rates (0.73 fish/hr) were reduced 58% from 2018 (1.73 fish/hr; Table 1). However, record catches of adults occurred in the Price-Stubb to Riverbend Park reach (4.11 fish/hr) and the lower Westwater Canyon, UT to Coates Creek reach (2.06 fish/hr; Figure 2). 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 and 2019, the highest rate of removing these large adults occurred upstream in the reaches from Price Stubb Dam to Riverbend Park in Palisade, CO at .13 fish/hr (2017) and .76 fish/hr (2019). 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 total of 2,270 largemouth bass were removed from all reaches in 2019 (Table 2 and Figure 4). Our catch ranged from age-0 fish (31 mm) to adult fish (467 mm) with a mean of 131 mm (Figure 5). Twenty were of piscivore size ( $\geq 325$  mm TL) and are considered a competitive threat to Colorado pikeminnow. Our 2019 catch was also proportionate in size classes to our 2014 through 2018 catch: 96% (n = 2,186) were less than 250 mm, 28% (n = 637) were less than 100 mm and only 4% (n = 92) were adults greater than 250 mm. Data from 2013 through 2019 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 and 2019 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 (2019 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 ( $\geq 200$  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 2013-2019. Catch per effort (CPE) has been calculated for all years of the study, throughout all of the reaches, including 2019, as a metric to compare yearly fluctuations of nonnative fish populations and size classes.

## Methodology

### **General**

In 2019, up to 7½ 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). A half pass means that only one side of the river was sampled during a particular pass. Colorado Parks and Wildlife (CPW) performed the removal between Silt 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 two spring and one partial fall removal pass between Lower Westwater Canyon and Cisco, UT. UDWR also conducted one spring experimental pass in the lower 9 miles of the Dolores River.

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, as per the stipulations of our CPW collecting permit.

Number of individuals collected, total length, and weight were recorded for most nonnative fishes caught and removed. Capture date and corresponding river mile for each nonnative fish collected were recorded along with effort expended (i.e., time sampled in seconds, 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 metric. 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 2013-2019, CPE was computed for use as an index of annual relative abundance of smallmouth bass and other centrarchids during the entire 2004-2019 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 makes year-to-year comparisons unadvisable.

### 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 2019. 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 (2004-2018) 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 2019 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 2019 spring/summer/fall collections. These ranged from age-0 (48 mm) to adult (412 mm) fish with a mean total length of 179 mm. A total of 1,822 smallmouth bass were removed, including 22 considered to be piscivorous competitors to Colorado pikeminnow ( $\geq 325\text{mm}$ ).

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 same trend occurred in 2019 when juvenile sized fish < 100 mm catch rates declined 99% (0.14 fish/hr) when compared to 2018 catch rates (15.98 fish/hr). The hypothesized reason for this decline was

the prolonged large (magnitude) discharge from the 2014, 2015 and 2019 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, 2015, and 2019. 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. Our 2019 catch rate (3.21 fish/hr) of juvenile smallmouth bass (100-199 mm) was reduced 46% when compared to our 2018 catch rate (5.96 fish/hr); however, was still the fourth highest catch rate in this projects 16 year history. The larger (in magnitude) than average and prolonged spring hydrograph most likely displaced juvenile smallmouth bass downstream as 2019 catch rates of this size class in all reaches from Loma, Colorado to Potash, Utah were the highest documented since this projects inception (Figure 2).

For years 2007, 2010, 2012, 2013, 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 (Figure 8) produced an increase in our catch rate for juvenile and age-0 size fish < 100 mm. 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}). Fortunately, the 2019 adult catch rate (0.73 fish/hr) declined 58% from the 2018 catch rate (Table 1 and Figure 3).

### **Largemouth Bass**

A reduced 2019 catch of 2,270 largemouth bass follows a record total of 9,497 removed from all reaches, in 2018, a substantial increase from the previous record 2012 catch (n = 5,227, Table 2). Our 2019 catch ranged from age-0 fish (31 mm) to adult fish (467 mm) with a mean of 131 mm (Figure 5). An annual record of twenty were of piscivore size ( $\geq$  325 mm TL) and are considered a competitive threat to Colorado pikeminnow. Our catch was also proportionate in size classes to our 2014 through 2018 catch: 96% (n = 2,186) were less than 250 mm, 28% (n = 637) were less than 100 mm and only 4% (n = 92) were adults greater than 250 mm. Data from 2013-2019 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 were increased to eight 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 24 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 and six were collected in 2019.

## *Catch/Effort:*

### **General**

Mean catch/effort (fish/hr) was computed separately for smallmouth bass and largemouth bass for each of the 16 sampling years, 2004-2019 (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). In 2019, due to personnel (seasonal employee hiring) issues created from internal reorganization of Human Resources on an agency-wide scale left our station understaffed to complete all of our work. We completed 318.3 hours of electrofishing in this reach in 2019. It is important to note that, in all years 2011-2018, we have completed more passes than our scope of work has called for because we have had more seasonal employees available than needed, a direct result of our native fish work on Lake Powell. We completed two to seven and one half passes in these reaches (Table 6).

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, 71.3 hours in 2019; 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, in 2018 crews expended 195.46 hours, and in 2019 crews expended 197.59 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 ( $\geq 200$  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% ( $\geq 200$  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. During 2019, the catch rate for all size classes of smallmouth bass declined 46% to 99% (similar to 2014;  $\geq 200$  mm = 58%, 100-199mm = 46%,  $< 100$  mm = 99%) most likely in response to a larger (magnitude) and longer (duration) spring runoff. (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 sixteen-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 2019 (0.14 fish/hr) and 2014 (0.17 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, 2019 in the Upper Colorado River were similar, with 2011, 2014, 2015, and 2019 being the most dramatic because of the prolonged high discharge extending into and beyond July. These six years have been characterized as average or moderately wet with sustained runoff compared to former years (2003-2007, 2010, 2012-2013, 2017-2018) that were dryer with shorter runoff magnitude and duration. The six 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. Our 2019 catch rate (3.21 fish/hr) of juvenile smallmouth bass (100-199 mm) was reduced 46% when compared to our 2018 catch rate (5.96 fish/hr); however, was still the fourth highest catch rate in this projects 16-year history. The larger (in magnitude) than average and prolonged spring hydrograph most likely displaced juvenile smallmouth bass downstream as 2019 catch rates of this size class in all reaches from Loma, Colorado to Potash, Utah were the highest documented since this projects inception (Figure 2).

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 captures occurred on 13 July (the first day of sampling; n=91 mean TL 80mm) and in 2019 the first age-0 captures occurred on 29 July (n=12 mean TL 87mm); 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 and precipitously declined to 0.07 in 2019 (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 sixteen-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 and 2019, 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. The 2019 catch rate for smallmouth bass < 100 mm was 0.02 fish/hr.

Catch rates for all size classes of smallmouth bass in Ruby-Horsethief Canyon (Loma to Westwater Ranger Station, UT) were consistently low from 2004 to 2012 ranging from a low in 2007 and 2008 of 0.07 fish/hr to a high in 2011 of 2.65 fish/hr. Budget constraints for 2012 necessitated a reduction in work and the decision was made to drop this reach. However, large numbers of largemouth bass caught in Black Rocks during our fall humpback chub (*Gila cypha*) work, in 2012, prompted restored effort in these reaches in 2013. 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 4.1 smallmouth bass per hour of electrofishing. The new record for this reach was collected in 2018 at 10.43 fish/hr only to be surpassed by the 2019 catch of 15.88 fish/hr (Figures 4 & 6). This increase is likely the result of an above average spring hydrograph extending (in duration) beyond July displacing juvenile fish from the Grand Valley downstream into Ruby Horsethief Canyon (Figure 8).

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 and again in 2019 to 2.53 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  $\geq$  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. An 84% reduction in catch of juvenile and adult largemouth bass occurred in 2019 (2.92 fish/hr, n=929; Table 2, Figure 5) when compared to 2018. However, the 2019 catch rate was still the fourth highest in this projects 16 year history.

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 7). 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 16 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. The 2019 catch of largemouth bass < 100 mm decreased (72%) to 1.95 fish/hr. This is surprising as we would have expected the higher than average spring runoff would have connected more off-channel habitat to the river (occupied with largemouth bass) providing for more largemouth bass in our summer/fall river surveys. Perhaps, cooler than average temperatures experienced in the Grand Valley during the spring 2019 suppressed and/or delayed the largemouth bass spawn in these off-channel sources (that connected to the river) preventing an increase in age-0 largemouth bass in the river population.

There has been no discernable trend in largemouth bass abundance (all length sizes) for the Silt 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. The catch rate for all size classes of largemouth bass, in 2019, was 1.05 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, 2.01 fish/hr in 2018, and 3.28 fish/hr in 2019 (Table 2). The consistent annual increases in catch (2014-2019) could be correlated to downstream migrants from larger production years in the Grand Valley. These fish may be searching for habitat better suited for their life history. Of note, in 2019, one juvenile largemouth bass (127 mm), collected in this reach, regurgitated a 76 mm Colorado pikeminnow.

#### *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 2019 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 (*Esox lucius*) 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 (901 mm TL) was removed by USFWS crews in 2019 from the Colorado River in the Grand Valley (Figure 7). 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 2019 from the Grand Valley downstream to Potash (n = 758; 35-492 mm TL, mean TL 201 mm). The largest number of gizzard shad removed in project 126a history was in 2017 (n= 2,832 (Figure 7). In 2019, one gizzard shad was collected at Redlands fish trap and no gizzard shad were 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.

One 800 mm grass carp (*Ctenopharyngodon idella*) was collected near Moab in 2019. All tissue samples (eyes, head, stomach and gametes) were collected and will be shipped out to the appropriate labs this winter.

Twenty three striped bass were collected and removed from the Colorado River in 2019. These fish ranged in total length from 375 to 581 mm with a mean total length of 517 mm. These fish were collected throughout the reaches from Cisco, UT (RM 111) to Potash, UT (RM 47.2). Two of the twenty three (9%) had juvenile Colorado pikeminnow (~140 and 180 mm TL) in their stomachs. In 2018, two striped bass were removed from Grand Valley reaches and three were removed from the reaches below Westwater Canyon. In 2017, three striped bass were removed from reaches 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), efforts in 2014 removed 3,787 white sucker and white sucker hybrids (34-518 mm TL), efforts in 2015 removed 1,425 (40-527 mm TL), efforts in 2016 removed 1,277 (55-552 mm TL), efforts in 2017 removed 2,777 (30-512 mm TL), efforts in 2018 removed 3,165 (23-465 mm TL), and our efforts in 2019 removed 3,389 (36-558 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, some of 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 2019, Grand Junction FWCO crews completed 11 total days of removal efforts in three different ponds and CPW crews completed 22 total days in four 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. CPW's 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 and 2019, 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 2019, CPW also sampled and removed non-native fishes from two other ponds that can connect to Mamm Creek Pond #1. CPW gained permission to access the East Rifle Municipal Pond to translocate largemouth bass to Harvey Gap Reservoir, in 2018, and discovered one large northern pike in their collections. Beginning in 2019, they conducted follow-up work and removed an additional 22 northern pike. The inlet pipe of this pond is not screened and may allow for immigration/emigration of fishes from the pond and the river. CPW has had great success, in terms of CPE, removing largemouth bass, northern pike, green sunfish, and yellow perch for a total of 5,505 non-native fishes removed in 2019. 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 2019, we sampled this pond 5 July (1 day). We used a combination of gears which included electrofishing, fyke nets, trammel nets, and cast nets. In 2019, we collected, PIT-tagged, and stocked 5 razorback sucker with a mean total length of 408 mm (range 340 to 480 mm) into the Colorado River. We also removed 22 invasive fishes. We removed four black crappie (mean TL 145, range 135-155 mm), one bluegill (130 mm TL), four green sunfish (mean TL 126, range 95-148 mm), four gizzard shad (mean TL 440, range 422-455 mm), and four largemouth bass (mean TL 197, range 108-380 mm; Figure 12).

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 2019, we sampled this pond sporadically (7 days) from 8 July to 22 August. We used a combination of gears which included electrofishing, fyke nets, trammel nets, and cast nets. In 2019, we collected 31 previously PIT-tagged razorback sucker (mean TL 422, range

305-560 mm), five bluehead sucker (mean TL 237, range 210-266 mm), four flannelmouth sucker (mean TL 182, range 128-294 mm), and 42 roundtail chub (mean TL 144, range 60-190 mm). We also collected and PIT-tagged three razorback sucker (mean TL 528, range 470-565 mm). All native fish were returned to the pond. We also removed 959 invasive fishes. We removed 410 black bullhead (mean TL 222, range 113-303 mm), removed 21 common carp (mean TL 167, range 64-551mm), 124 green sunfish (mean TL 119, range 57-164 mm), 24 largemouth bass (mean TL 123mm, range 43-362 mm; Figure 12), two red shiner, 18 fathead minnow, and 360 white sucker and white by native sucker hybrids (mean TL 271mm, range 105-480 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 2019 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 2019, we sampled this pond (3 days) from 22 July to 24 July. We used a combination of gear types which included fyke nets, trammel nets, cast nets, and hoop nets. In 2019, we collected, PIT-tagged, and stocked 54 razorback sucker (mean TL 344mm, range 298-468 mm) into the Colorado River. We had one razorback sucker mortality in a trammel net, and three razorbacks were released back into the pond because they were in rough shape from the trammel net. We also removed 40 invasive fishes. We removed six black crappie (mean TL 184, range 160-196 mm), 33 bluegill (mean TL 148, range 100-176 mm), and one largemouth bass (193 mm TL; Figure 11 and 12).

Task completed. Report submitted to the Program Office in November, 2019.

#### VIII. Additional noteworthy observations:

A total of 311 individual endangered fishes were captured. During 2019, 210 individual razorback sucker, 85 bonytail (one that had been at large for Program record twelve years), 10 Colorado pikeminnow, one flannelmouth sucker X razorback sucker hybrid, and six 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.

In 2019, project 127, Colorado pikeminnow abundance estimate work, began a new three year cycle on the Colorado River. Field crews for project 127 completed four full passes from Bighorn Camp (lower Westwater Canyon; RM 114) to the confluence of the Green River (RM 0.0), and four to six and one half passes (reach dependent) from Grand Valley Water User's Dam (RM 193.7) to Westwater Wash, UT (RM 124.8). Crews removed 1,060 non-native fish from the Colorado River and lower 2.3 miles of the Gunnison River during the spring 2019. It is important to note that only walleye are targeted outside of endangered fish for this project. Fishes removed included one red shiner, two grass carp, 10 black crappie, 28 bluegill, 28 green sunfish, 55 largemouth bass, 103 gizzard shad, 148 walleye (see annual report 123d), and 343 smallmouth bass (Figure 13). In 2019, project 127's

individual smallmouth bass captures were the second highest since 2003, and it was the highest for individuals captured in the lower reach (lower Westwater Canyon to the confluence with the Green River; Figure 14). The 69 smallmouth bass removed from the lower reach had a mean TL of 275 mm (range 105-386 mm), and the 274 smallmouth bass removed from the upper reach had a mean TL of 231 mm (range 76-398 mm; Figure 15).

#### 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  $\geq 100$  mm.
3. Investigate and implement management measures to prevent escapement of smallmouth bass and other piscivorous fishes into riverine areas from bodies of water known to be occupied by species that could negatively impact native riverine fishes. In support of this concept, the Recovery Program began funding additional removal efforts in streamside gravel pit ponds beginning in FY-16, due to program budget constraints this effort was not funded for FY-20.
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. In FY-19's PPR CPW recommends the following: "Due to low densities of target species between Silt and Beavertail Tunnel, CPW recommends shifting efforts to focus on backwater and other slack water habitats across all days rather than electrofishing all shorelines and habitats 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 or suspected concentration areas of Northern Pike, Smallmouth Bass and Largemouth Bass. Due to limited encounters with target species, the Silt to Rifle and the Debeque to Beavertail Tunnel reaches should be surveyed in alternate years with Silt to Rifle occurring in odd years and Debeque to Beavertail tunnel surveyed in even years".
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 beginning in FY-16.

8. Continue monitoring East Rifle Municipal Pond for northern pike. CPW plans to continue monitoring and removal efforts in the spring of 2020 during the Northern Pike spawning season to further reduce the abundance of Northern Pike in the pond and to evaluate abundance and population size structure. CPW will also continue discussions with City of Rifle personnel regarding access and operations of the pond and what options, if any, exist to reduce or eliminate the potential for fish escapement from the pond into the Colorado River when the inlet gate is open.
9. 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 walleye otolith samples in FY-16. We are still waiting on the final report.
10. Suspend all electrofishing operations when it's 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.
11. Downstream from Grand Valley Water User's fish passage, electrofishing should commence immediately following cessation of Colorado pikeminnow spawning) which should be sometime in mid- to late-July. This will allow sampling crews to maximize the number of sampling passes before low base flows preclude our ability to access and navigate this reach of river.
12. 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 Grand Valley reaches.

X. Project Status: On track and ongoing.

XI. FY 2019 Budget Status

- A. Funds Provided: \$250,002
- B. Funds Expended: \$250,002
- C. Difference: -0-
- D. Percent of the FY 2019 work completed, and projected costs to complete: 100%
- E. Recovery Program funds spent for publication charges: -0-

XII. Status of Data Submission: Will be uploaded into STReAMS by the end of November.

XIII. Signed: Travis Francis 11/14/2019  
Principal Investigator Date

## Literature Cited

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### **Attachments include:**

**6 Tables**  
**15 Figures**  
**2 PP**

**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 – 2019. 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, 2015, and 2019, 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.

River Section	Length Class		Smallmouth Bass															
			Year															
			2019	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007	2006	2005	2004
Silt to Beavertail Mountain	< 100	No. of fish	1	50	0	0	2	8	4	1	0	57	0	21	17	36	58	3
		C/E	0.02	1.44	0	0	0.05	0.14	0.07	0.02	0	0.72	0	0.25	0.2	0.96	1.46	0.15
	100-199	No. of fish	3	78	1	2	1	5	29	1	6	0	3	29	28	2	54	4
		C/E	0.04	2.25	0.03	0.05	0.02	0.08	0.53	0.02	0.48	0	0.05	0.34	0.32	0.05	1.36	0.2
	> 200	No. of fish	1	0	5	7	4	13	1	3	5	39	12	32	45	41	118	14
		C/E	0.02	0	0.13	0.19	0.09	0.22	0.02	0.05	0.01	0.49	0.19	0.37	0.52	1.09	2.96	0.71
	> 325	No. of fish	0	0	5	1	1	2	0	NC	NC	NC	NC	NC	NC	NC	NC	NC
		C/E	0	0	0.13	0.03	0.02	0.03	0									
Government Highline Dam to Westwater Wash, UT + Lower Gunnison River	< 100	No. of fish	43	5,629	442	184	123	86	1,213	761	226	2,054	191	185	1,358	261	254	93
		C/E	0.14	15.98	0.94	0.54	0.28	0.17	3.33	2.62	0.55	5.82	0.55	0.63	4.15	1.61	1.46	0.55
	100-199	No. of fish	1,021	2,099	865	59	93	399	1,281	316	611	159	137	214	250	54	345	618
		C/E	3.21	5.96	1.83	0.17	0.21	0.78	3.52	1.09	1.47	0.45	0.39	0.73	0.76	0.33	1.98	3.66
	> 200	No. of fish	231	610	138	211	283	566	754	423	147	188	177	135	429	449	768	456
		C/E	0.73	1.73	0.29	0.62	0.64	1.11	2.07	1.46	0.35	0.53	0.51	0.46	1.31	2.77	4.39	2.7
	> 325	No. of fish	22	57	45	27	14	31	41	NC	NC	NC	NC	NC	NC	NC	NC	NC
		C/E	0.07	0.16	0.1	0.08	0.03	0.06	0.11									
Lower Westwater Canyon to Potash, UT	< 100	No. of fish	4	84	12	5	3	0	0	NA	NA	NA	NA	NA	NA	NA	NA	NA
		C/E	0.02	0.43	0.05	0.02	0.01	0	0									
	100-199	No. of fish	346	266	156	4	5	3	3	NA	NA	NA	NA	NA	NA	NA	NA	NA
		C/E	1.75	1.36	0.61	0.02	0.02	0.02	0.04									
	> 200	No. of fish	132	129	57	10	28	38	21	NA	NA	NA	NA	NA	NA	NA	NA	NA
		C/E	0.67	0.66	0.22	0.05	0.13	0.26	0.29									
	> 325	No. of fish	18	16	29	2	10	20	5	NC	NC	NC	NC	NC	NC	NC	NC	NC
		C/E	0.09	0.08	0.11	0.01	0.05	0.14	0.07									

**Table 2.** Catch/effort (CPE, fish/hr) comparison by year for four different length classes (total length) of largemouth bass (< 100mm = age-0; 100–199 mm = juveniles; > 200 mm = adults, > 325 = piscivore) for the Upper Colorado River Silt to Beavertail Mountain reaches (river miles 248.0 – 195.7), the Upper Colorado River from Government Highline Dam to the Westwater Wash, Utah (river miles 193.7.7 – 124.8) and the Lower Gunnison River from the Redlands Diversion Dam to the

Colorado/Gunnison River confluence (river miles 3.0 – 0.7), and the Upper Colorado River from Cisco to Potash, Utah (river miles 111.0 – 47.2) from 2004 – 2019. 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, 2015 and 2019, 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.

		Largemouth Bass																
River Section	Length Class		Year															
			2019	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007	2006	2005	2004
Silt to Beavertail Mountain	< 100	No. of fish	31	83	98	34	17	24	232	37	9	24	36	462	122	125	10	53
		C/E	0.44	2.39	2.4	0.92	0.39	0.4	4.25	0.66	0.71	0.3	0.58	6.05	1.4	3.33	0.25	2.68
	100-199	No. of fish	27	136	59	17	12	18	53	35	13	31	29	90	109	71	10	11
		C/E	0.38	3.92	1.47	0.46	0.28	0.3	0.97	0.62	1.03	0.39	0.47	1.05	1.26	1.89	0.25	0.56
	> 200	No. of fish	16	49	4	4	2	14	15	0	5	13	5	43	56	15	17	2
		C/E	0.22	1.41	0.1	0.11	0.05	0.24	0.28	0	0.4	0.16	0.08	0.5	0.64	0.4	0.43	0.1
> 325	No. of fish	1	1	3	1	0	1	2	NC	NC	NC	NC	NC	NC	NC	NC	NC	
	C/E	0.01	0.03	0.07	0.03	0	0.02	0.04										
Government Highline Dam to Westwater Wash + Lower Gunnison River	< 100	No. of fish	619	2,422	622	982	797	1,071	467	3,484	2,463	4,281	1,952	1,272	1,507	573	465	173
		C/E	1.95	6.88	1.32	2.88	1.8	2.1	1.28	12	6.05	12.1	5.58	4.32	4.61	3.54	2.66	1.03
	100-199	No. of fish	777	6,284	747	414	332	188	323	1,674	712	1,141	609	344	1,332	487	86	85
		C/E	2.44	17.84	1.58	1.21	0.75	0.37	0.89	5.766	1.72	3.23	1.74	1.17	4.07	3.01	0.49	0.5
	> 200	No. of fish	137	131	61	35	102	67	62	69	102	29	32	39	43	36	38	21
		C/E	0.43	0.37	0.13	0.1	0.23	0.13	0.17	0.24	0.25	0.08	0.09	0.13	0.13	0.22	0.22	0.12
> 325	No. of fish	15	4	6	4	13	20	5	NC	NC	NC	NC	NC	NC	NC	NC	NC	
	C/E	0.05	0.01	0.01	0.01	0.03	0.04	0.01										
Lower Westwater Canyon to Potash Utah	< 100	No. of fish	82	18	24	153	47	3	1	NA	NA	NA	NA	NA	NA	NA	NA	NA
		C/E	0.42	0.09	0.09	0.69	0.21	0.02	0.01									
	100-199	No. of fish	534	324	217	62	106	5	4	NA	NA	NA	NA	NA	NA	NA	NA	NA
		C/E	2.7	1.66	0.85	0.28	0.48	0.03	0.05									
	> 200	No. of fish	27	50	94	8	10	1	13	NA	NA	NA	NA	NA	NA	NA	NA	NA
		C/E	0.14	0.26	0.37	0.04	0.05	0.01	0.23									
> 325	No. of fish	4	1	2	0	3	0	2	NC	NC	NC	NC	NC	NC	NC	NC	NC	
	C/E	0.02	0.01	0.01	0	0.01	0	0.03										

**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 - 2019. 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 <sup>st</sup> 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 (weighted)
	(mm)									all removal passes		
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 2019	NO POPULATION ESTIMATE PERFORMED											

**Table 4.** 2019 razorback sucker captured during nonnative fish removal projects 126a & b and 123d 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
2005	1	Grand Jct.	CO	152.6	Loma Boat Launch	Recaptured 2014 and 2015 (three times) at CO RMI 61-64
2007	1	Grand Jct.	CO	166.7	Redlands Parkway boat launch	
2008	1	Grand Jct.	GU	42.6	Escalante Boat Ramp	Recaptured 2013 at CO RMI 166
2008	1	Grand Jct.	CO	177.4	Corn Lake Boat Launch near Clifton	Recaptured 2010 CO RMI 176.2 and 2014 and 2017 near CO RMI 147
2008	1	Vernal	GR	120	Green River State Park	Recaptured 2010 at CO RMI 38 and 2013 at CO RMI 54.8
2009	2	Grand Jct.	CO	185.1	Palisade, CO	One was recaptured 2010 (twice) near CO RMI 186, salvaged from GVIC canal in 2011 and recaptured 2015 at CO RMI 161.3
2009	1	Grand Jct.	CO	177.4	Corn Lake Boat Launch near Clifton	Recaptured 2014 at CO RMI 63 and 2016 at CO RMI 47.7
2009	2	Grand Jct.	CO	166.7	Redlands Parkway boat launch	One was recaptured 2014 at CO RMI 17.1
2009	1	Vernal	GR	120	Green River State Park	Recaptured 2013 at CO RMI 53
2010	1	Grand Jct.	CO	227.6	Battlement Mesa, CO	
2010	1	Vernal	GR	255.4	Ouray National Wildlife Refuge near Wyasket Bottom	
2011	2	Grand Jct.	CO	227.6	Battlement Mesa, CO	One detected many times 2013 and 2014 at Price Stubb Antenna CO RMI 188.3, recaptured 2014 at CO RMI 185.2 and recaptured once in each year 2016-2018 near CO RMI 156
2011	2	Grand Jct.	CO	185.1	Palisade, CO	One was recaptured 2015 at CO RMI 65.8
2011	1	Grand Jct.	CO	177.4	Corn Lake Boat Launch near Clifton	
2011	1	Grand Jct.	CO	170.7	Near Clymers Pond, Gunnison/Colorado River confluence	Recaptured 2016 at CO RMI 47.5
2012	2	Grand Jct.	GU	12.7	Butch Craig Wetland	
2012	2	Grand Jct.	CO	240.7	Rifle, CO	One was recaptured once in 2013 and 2016 near CO RMI 237; one was recaptured 2016 at CO RMI 166.5
2012	1	Grand Jct.	CO	183.6	Palisade, CO	
2013	1	Grand Jct.	GU	57.1	Delta, CO	One was recaptured 2013 at CO RMI 93.8
2013	5	Grand Jct.	CO	157.1	Fruita State Park Launch	One was recaptured 2015 at CO RMI 154 and 2016 at CO RMI 163; one was recaptured 2014 at CO RMI 112.2; one was recaptured 2014 at CO RMI 59

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	7	Grand Jct.	GU	57.1	Delta, CO	One was detected 2016 by Butch Craig PIA at GU RMI 12.9
2014	11	Grand Jct.	CO	240.7	Rifle, CO	One was recaptured 2015 at CO RMI 156.6; one was detected 2018 by PIA at GVWU Ladder CO RMI 193.7; one made passage 2015 at GVWU Ladder CO RMI 193.7; one was detected 2019 at Price Stubb CO RMI 188.3
2014	8	Grand Jct.	CO	183.6	Palisade, CO	One was recaptured once in 2015 and 2017 near CO RMI 175; one was recaptured 2016 at CO RMI 63.6; one was recaptured once in all years 2015 through 2017 near CO RMI 175, was detected in both 2017 and 2019 at Price Stubb CO RMI 188.3; one was detected twice in 2017 at Price Stubb CO RMI 188.3 and detected by PIA at CO RMI 134.8 and was recaptured 2018 at CO RMI 174.1
2014	1	Grand Jct.	CO	177.4	Corn Lake Boat Launch near Clifton	
2014	1	Grand Jct.	CO	166.7	Redlands Parkway boat launch	Recaptured 2015 at CO RMI 62.7
2014	1	Grand Jct.	CO	157.1	Fruita State Park Launch	Recaptured 2015 at CO RMI 155.2
2015	2	Grand Jct.	GU	57.1	Delta, CO	One was recaptured 2015 in Butch Craig GU RMI 12.7 and was recaptured 2017 at CO RMI 167.7
2015	1	Grand Jct.	CO	240.7	Rifle, CO	One was recaptured 2018 at CO RMI 204.9
2015	1	Grand Jct.	CO	174.9	Beswick Pond	
2015	7	Grand Jct.	CO	166.7	Redlands Parkway boat launch	One was recaptured 2017 at CO RMI 161.1; one was recaptured 2017 at CO RMI 166.7
2015	1	Grand Jct.	CO	157.1	Fruita State Park Launch	One was detected 2017 by PIA at CO RMI 137.2
2015	1	Grand Jct.	CO	73	Professor Valley	Tagged in field
2016	10	Grand Jct.	GU	57.1	Delta, CO	Two were recaptured 2017 in Butch Craig GU RMI 12.7
2016	5	Grand Jct.	CO	240.7	Rifle, CO	One was recaptured 2018 at CO RMI 236.6
2016	2	Grand Jct.	CO	204.5	CDOT Pond	
2016	8	Grand Jct.	CO	183.6	Palisade, CO	One detected 2019 at Price Stubb CO RMI 188.3
2016	1	Grand Jct.	CO	174.9	Beswick Pond	
2016	11	Grand Jct.	CO	157.1	Fruita State Park Launch	One was detected many times 2017 by PIA at CO RMI 135.7
2017	4	Grand Jct.	GU	57.1	Delta, CO	
2017	3	Grand Jct.	CO	240.7	Rifle, CO	One detected 2018 at Price Stubb CO RMI 188.3
2017	3	Grand Jct.	CO	204.5	CDOT Pond	One recaptured 2017 at CO RMI 182.7
2017	7	Grand Jct.	CO	183.6	Palisade, CO	One recaptured 2018 at CO RMI 172.2
2017	3	Grand Jct.	CO	166.7	Redlands Parkway boat launch	
2017	1	Vernal	GR	120	Green River State Park	

**Table 4. Cont.**

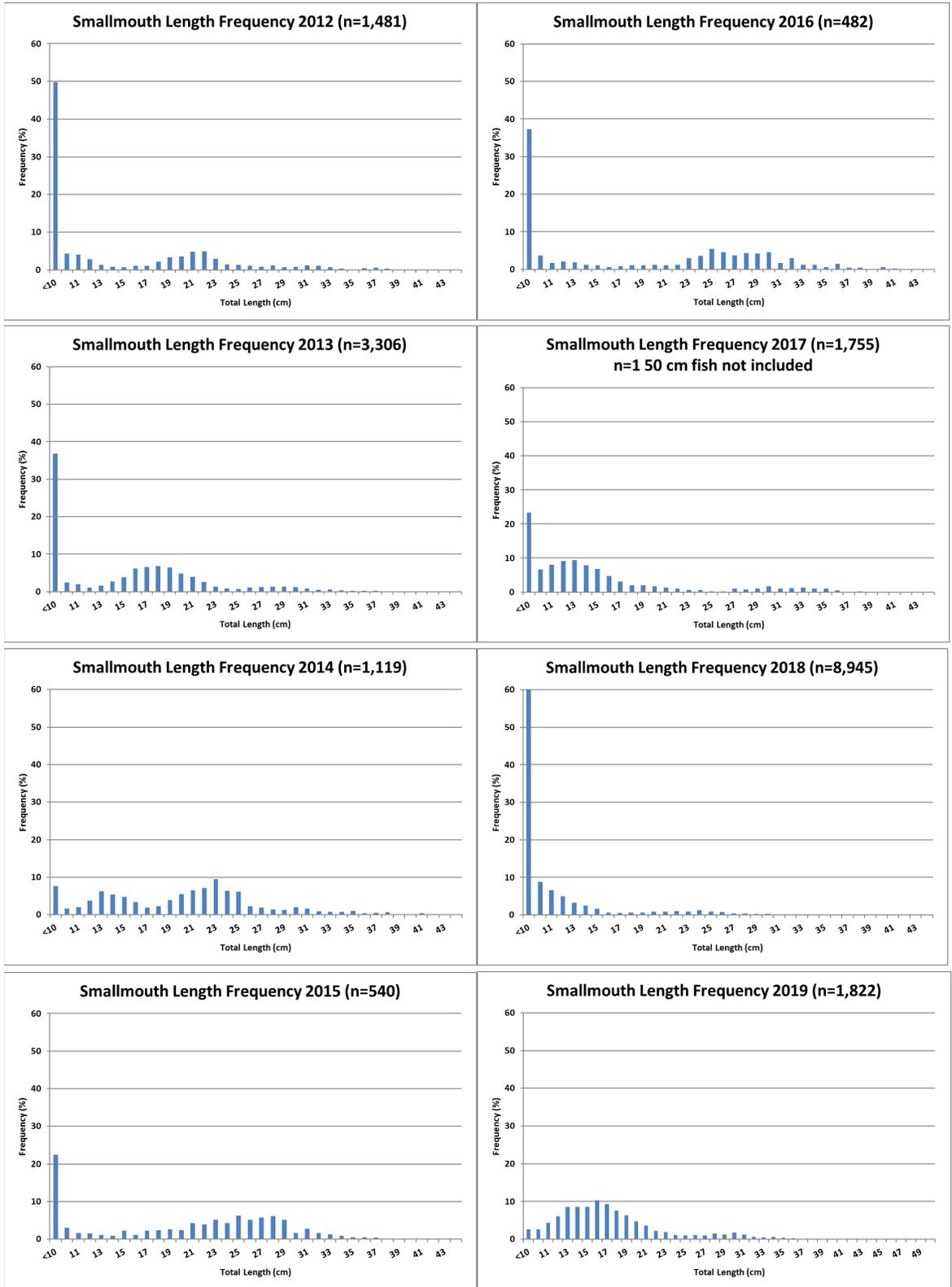
Stock or Tagged in the Field Year	# Captured during 126a&b and 123d in 2018	Source Hatchery or Field Station	Stock or Capture River	Stock or Capture RMI	Location Description	Notes
2018	14	Grand Jct.	GU	57.1	Delta, CO	
2018	7	Grand Jct.	CO	240.7	Rifle, CO	
2018	7	Grand Jct.	CO	177.4	Corn Lake Boat Launch near Clifton	
2018	2	Grand Jct.	CO	166.7	Redlands Parkway boat launch	
2019	9	Grand Jct.	GU	57.1	Delta, CO	
2019	9	Grand Jct.	CO	240.7	Rifle, CO	
2019	3	Grand Jct.	CO	183.6	Palisade, CO	
2019	2	Grand Jct.	CO	166.7	Redlands Parkway boat launch	
2019	15	Grand Jct.	CO	157.1	Fruita State Park Launch	
2019	8				Original encounter not is STReaMs	Recaptured 2015 at CO RMI 155.8
2019	6	Grand Jct.	CO			Tagged in the field
<b>Total</b>	<b>210</b>					

**Table 5.** 2019 rare fish captures (excluding razorback sucker) captured during nonnative fish removal projects 126a & b and 123d 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.

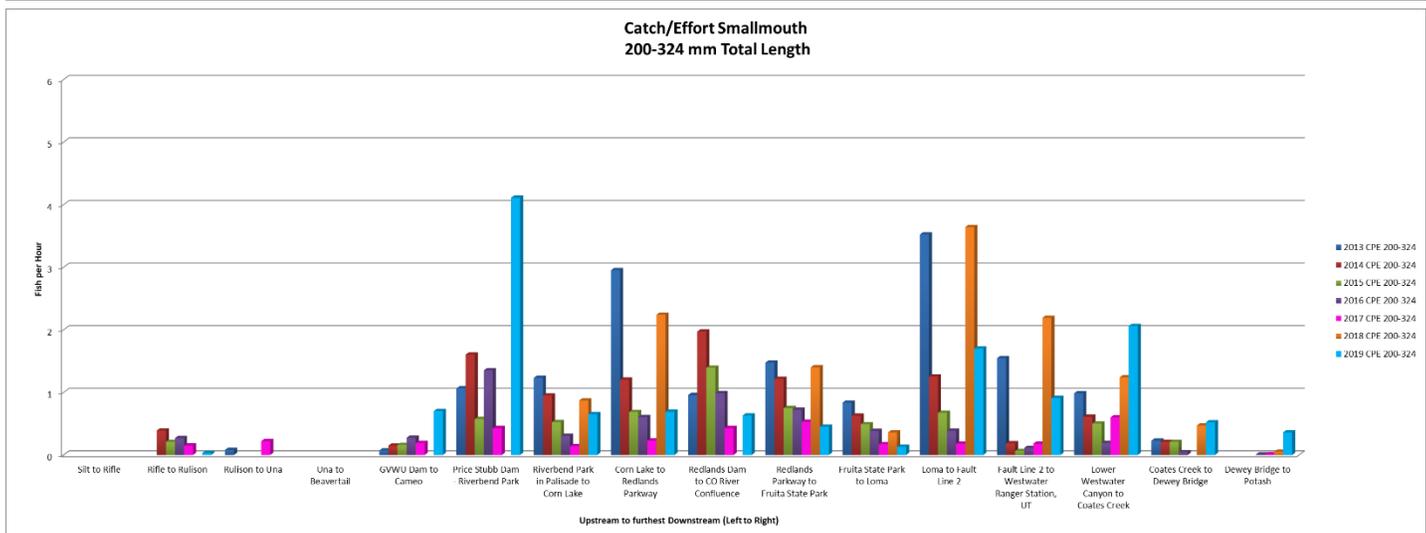
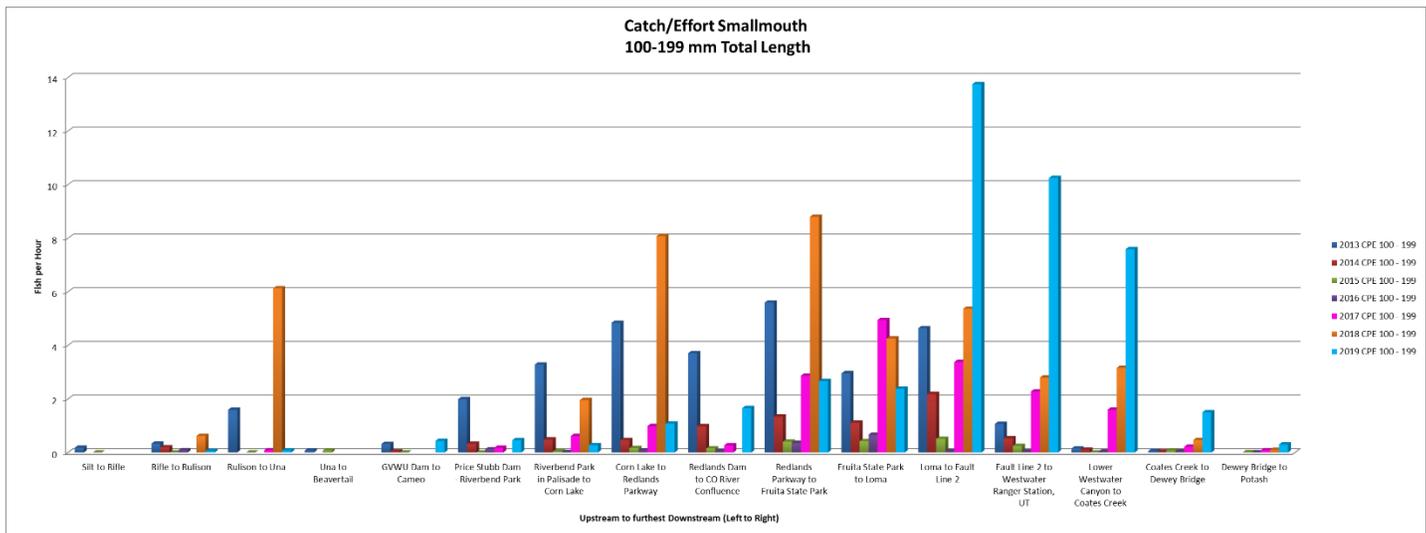
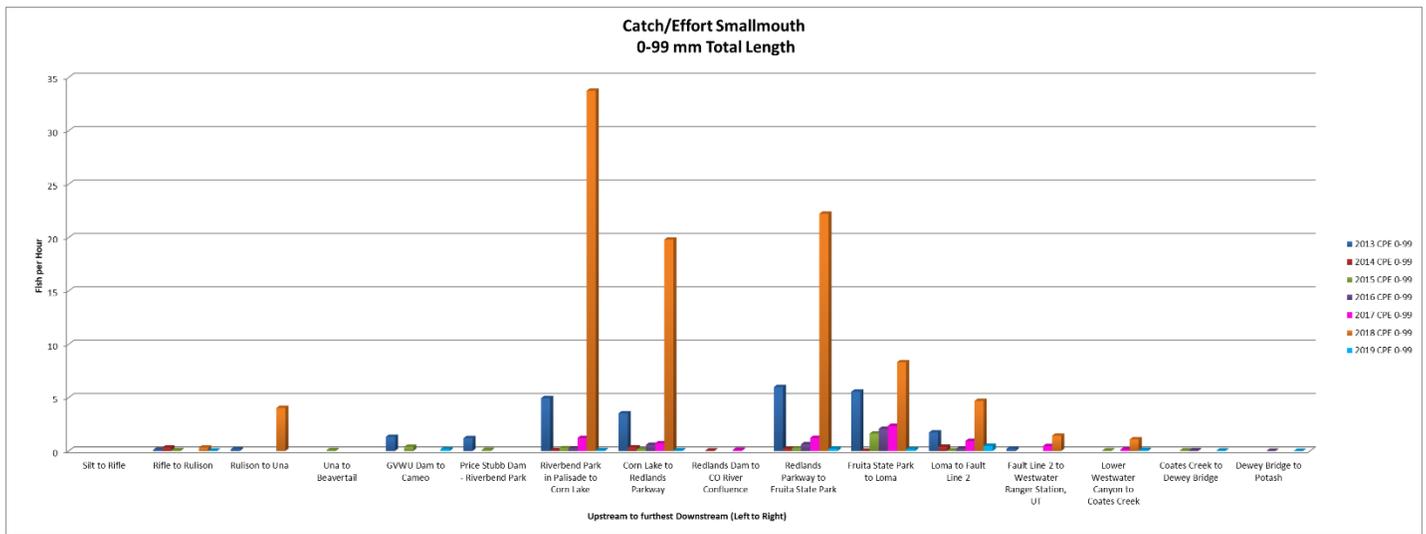
Species	# Captured during 126a&b	Field Tagging Year	Stocking Year	River	RMI	Notes
BT	1		2016	CO	157.1	
BT	1		2017	CO	183.6	
BT	2		2018	CO	166.7	
BT	4		2018	CO	157.1	One was detected 2018 at Price Stubb CO RMI 188.3 and GVWU Ladder PIA at CO RMI 193.7
BT	1		2019	Salt Creek	2.5	
BT	15		2019	CO	187.7	
BT	8		2019	CO	167.7	
BT	1		2019	CO	164.3	
BT	35		2019	CO	157.1	
BT	15	???	???			Original encounter not yet loaded into STReAMS
BT	1	2019		CO	62.2	Tagged during 126a
CS	1	???				Original encounter not yet loaded into STReAMS
CS	9	2019		CO	50-114	Tagged during 126a and 123d
FM	16	2019		CO	236.6	Tagged during 126b
FR	1	???		CO		Original encounter not yet loaded into STReAMS
HB	1	2016		CO	136	Detected 2016 CO RMI 136
HB	5	2019		CO	130-136	Tagged during 126a
RT	9	2019		CO	140	Tagged during 126a and 123d

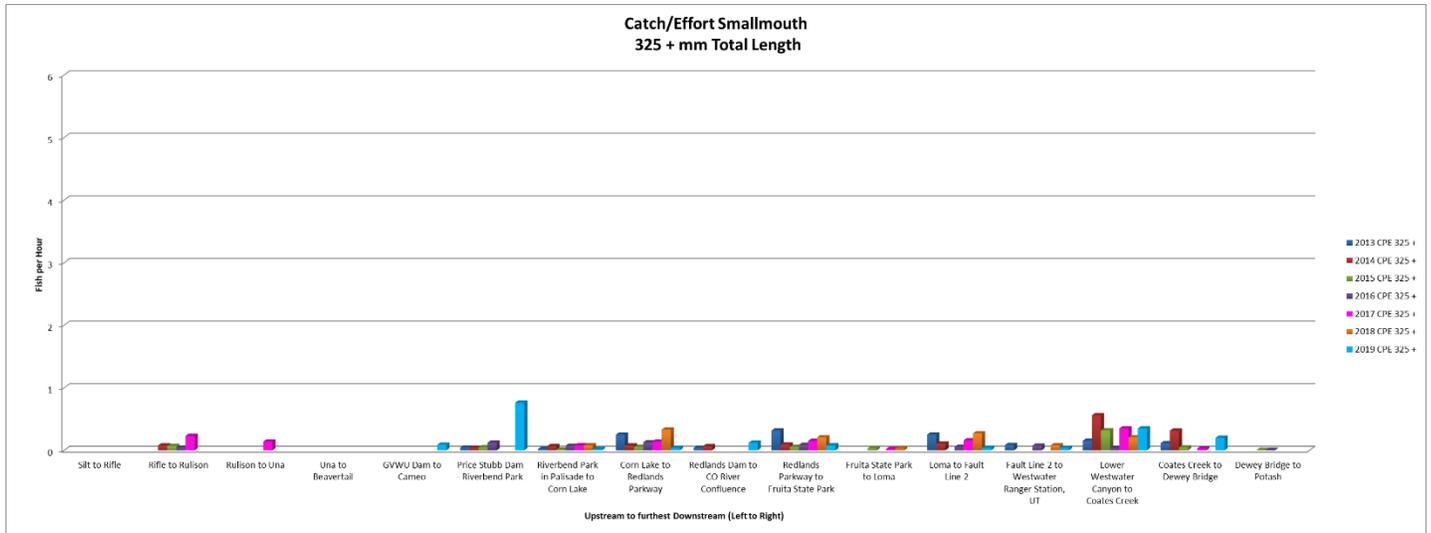
**Table 6.** Nonnative fish removal effort on the Colorado and Gunnison Rivers in 2019.

River Reach	CO River Miles	# of passes	Dates fished	Agency
Silt to Rifle	248 to 240.1	2	18 September to 24 October	CPW
Rifle to Rulison	240.1 to 230	3	15 May to 11 October	CPW
Rulison to Parachute	230 to 222.2	2	17 September to 24 October	CPW
Parachute to Una	222.2 to 216.6	2	18 September to 22 October	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 October	CPW
GVWU Dam to Cameo	193.7 to 189.8	3	2 August 16 September	FWS
Price Stubb to Riverbend Park	187.9 to 184.2	2	16 August to 9 September	FWS
Riverbend Park to Corn Lake	184.6 to 177.4	7	1 August to 15 October	FWS
Corn Lake to Redlands Parkway	177.4 to 166.7	7 1/2	12 August to 17 October	FWS
Gunnison River Confluence to Redlands Parkway	170.9 to 166.7	7	29 July to 21 October	FWS
Redlands Diversion to Colorado River Confluence	3.0 to 0.8 (Gunnison River only)	7	29 July to 21 October	FWS
Redlands Parkway to Fruita State Park	166.7 to 157.1	7	15 August to 16 October	FWS
Fruita State Park to Loma Boat Launch	157.1 to 152.6	6 1/2	15 August to 22 October	FWS
Loma Boat Launch to Fault Line 2	152.6 to 139	2	30 July to 10 September	FWS
Fault Line 2 to Westwater Ranger Station	139 to 127.6	2	31 July to 11 September	FWS
Westwater Ranger Station to Westwater Wash	127.6 to 124.8	2	19 August to 22 October	FWS
Lower Westwater Canyon to Cisco	116.6 to 111.0	3 Partial	7 March to 8 October	UDWR Moab
Bighorn Camp to Coates Creek	114.0 to 104	3 and 1 partial	20 August to 21 October	FWS
Coates Creek to Dewey Bridge	104.0 to 94.6	3	21 August to 2 October	FWS
Lower Dolores River	9.0 to 0.0 (Dolores River)	1	7 May	UDWR Moab
Dewey Bridge to Takeout Beach	94.6 to 74.2	3	13 August to 9 October	FWS
Takeout Beach to Potash	74.2 to 47.2	3	27 August to 17 October	FWS

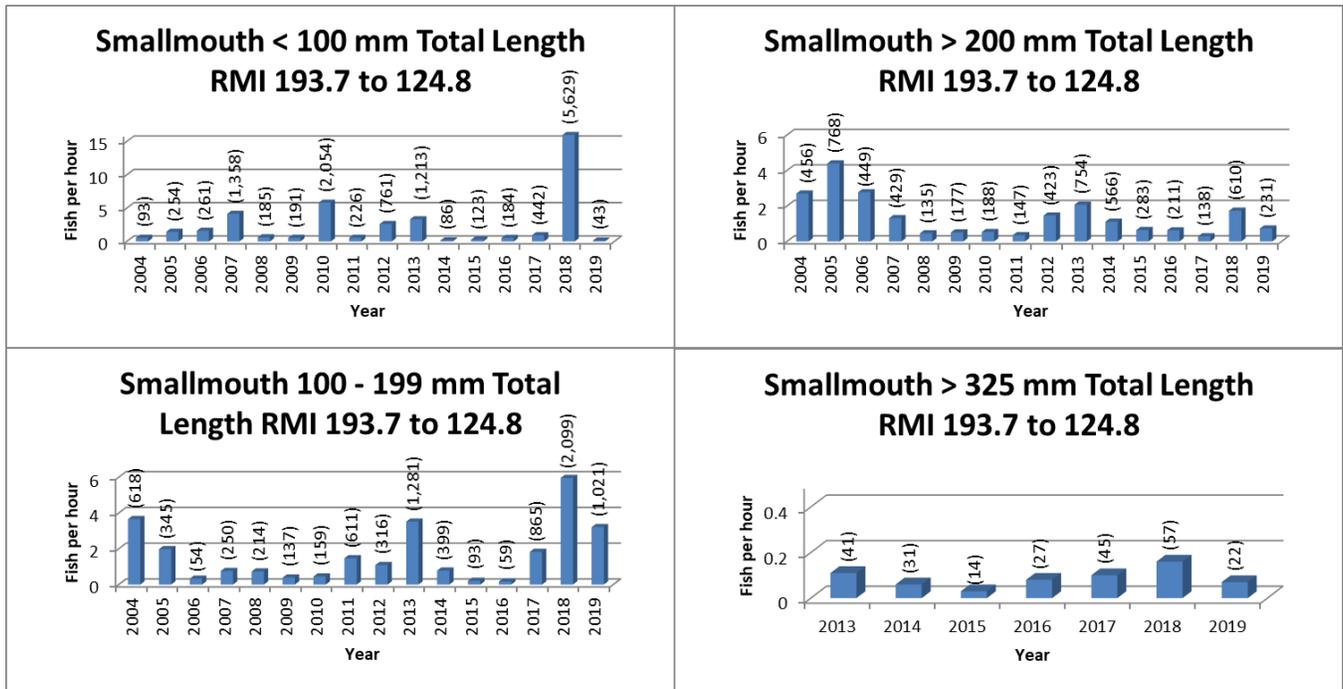


**Figure 1.** Length frequency histograms for smallmouth bass removed from the Colorado River from Silt, CO to Poatash, UT (RM47.2), UT from 2012 through 2019

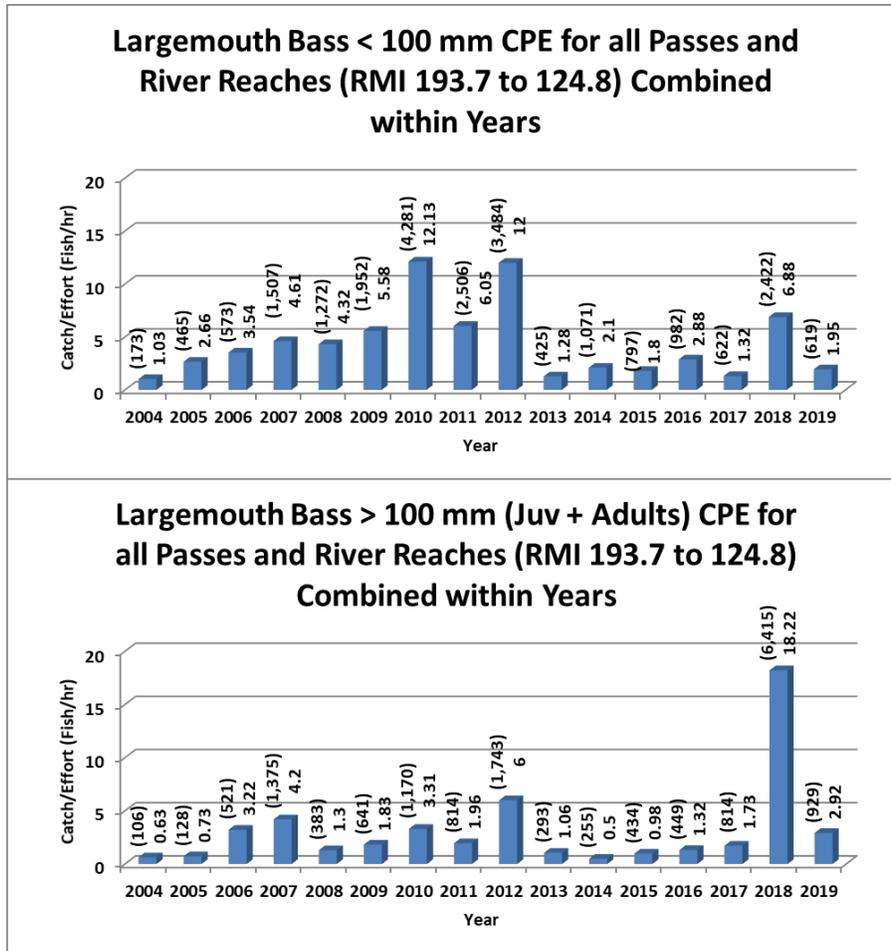




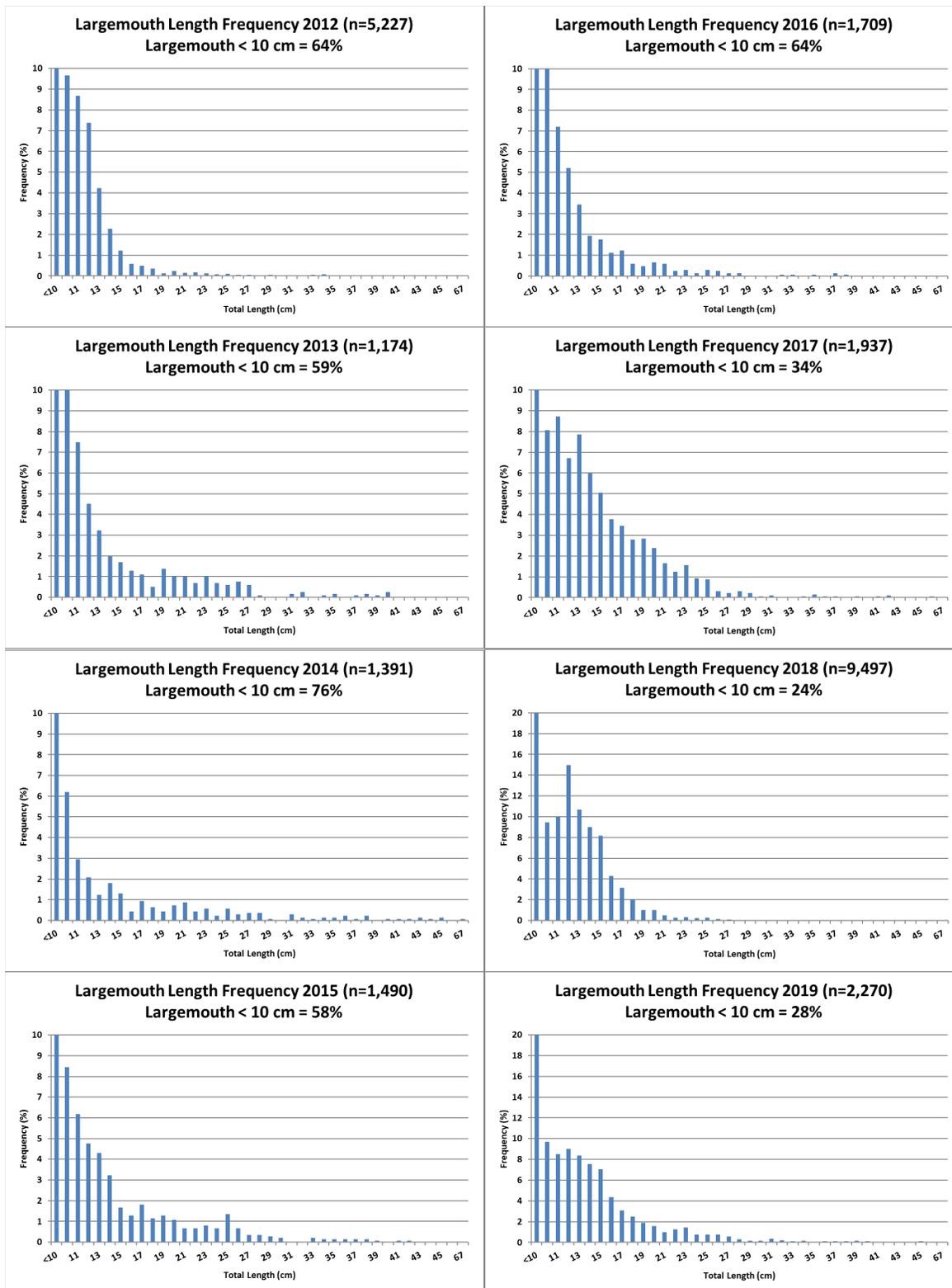
**Figure 2.** Catch/Effort (number of fish caught per hour electrofishing) by reach for smallmouth bass removed from the Colorado River from Silt, CO (RMI 248.0) to Potash, UT (RMI 47.2), UT 2013-2019. Smallmouth less than 100 mm are young-of-year, 100-199 mm are juvenile fish, > 200 mm are adults, and >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 2019. 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.

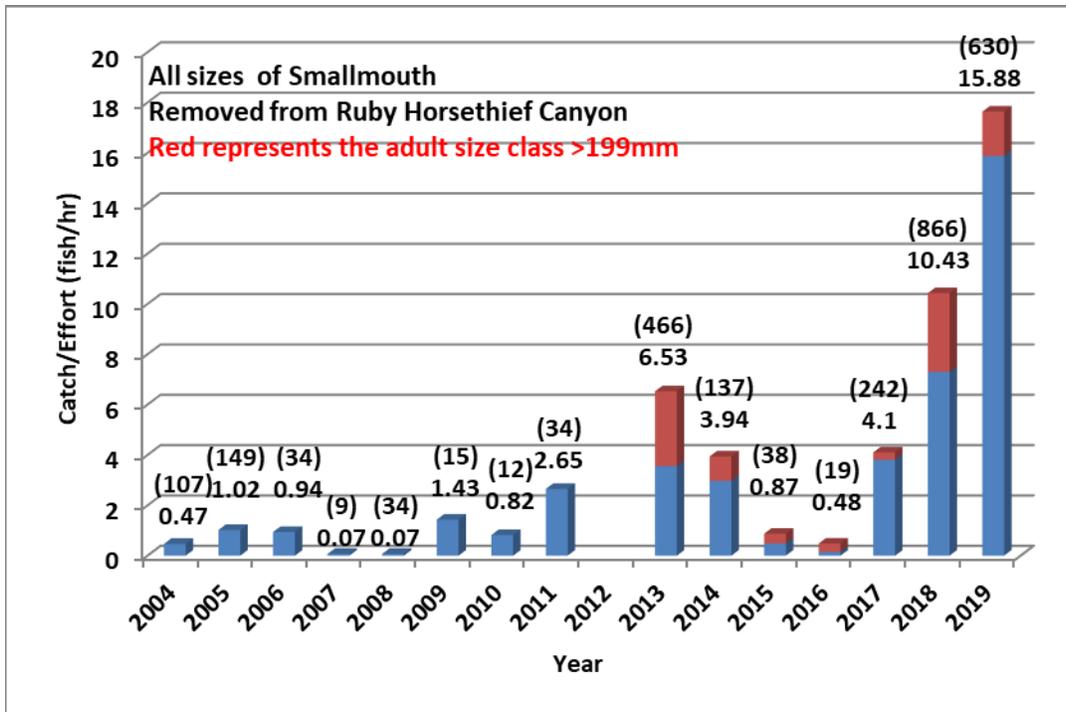


**Figure 4.** Sixteen year comparison of catch/effort (fish/hr) for largemouth bass (< 100 mm) (upper) and juvenile and adult largemouth bass ( $\geq$  100 mm) (lower), 2004-2019, for the Colorado River (RMI 193.7 to 124.8). Note: numbers of largemouth bass collected in parentheses.

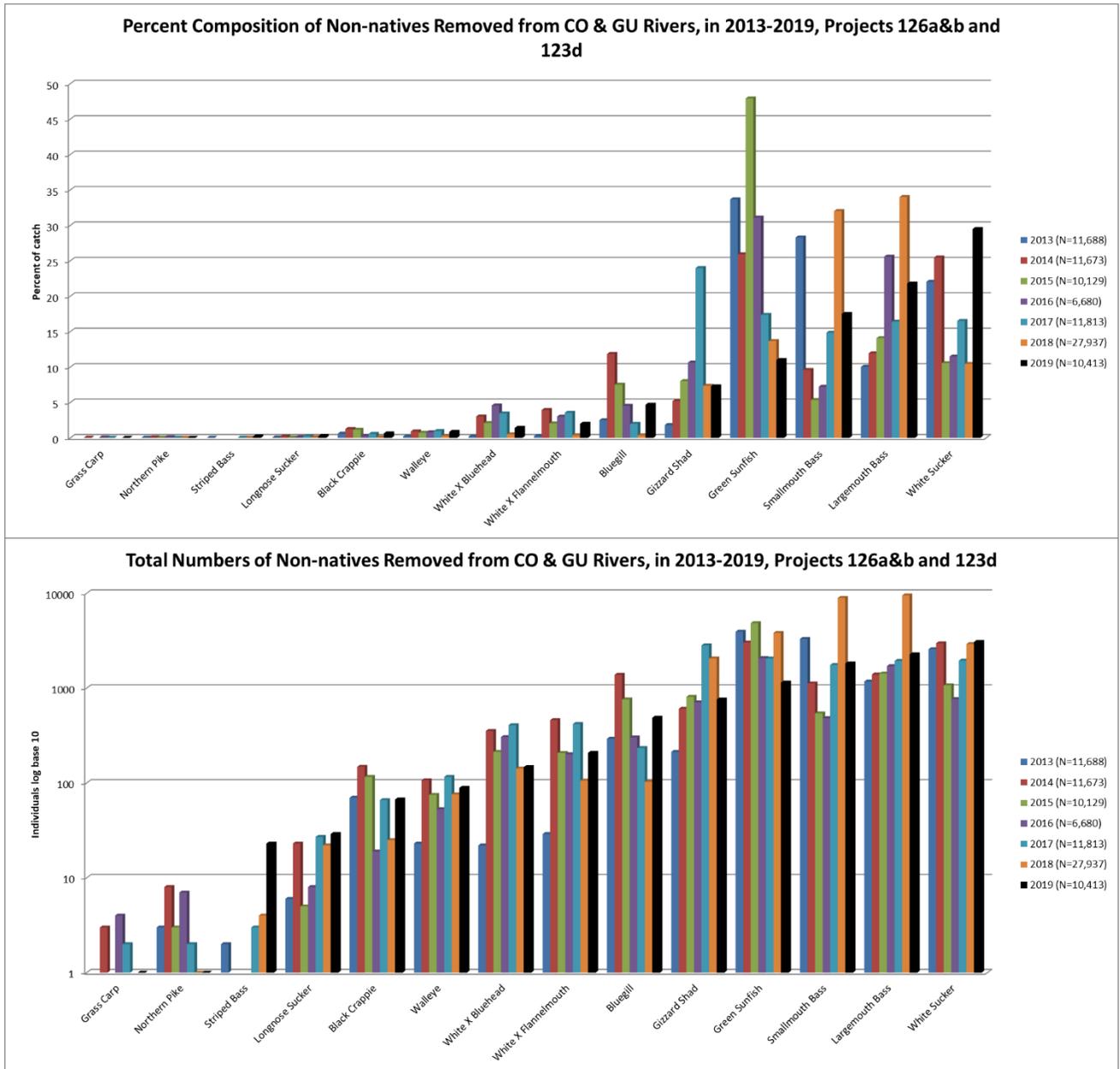


**Figure 5.** Length frequency histograms for largemouth bass removed from the Colorado River from Silt, CO to Potash, UT (RMI 47.2), UT from 2012 through 2019.

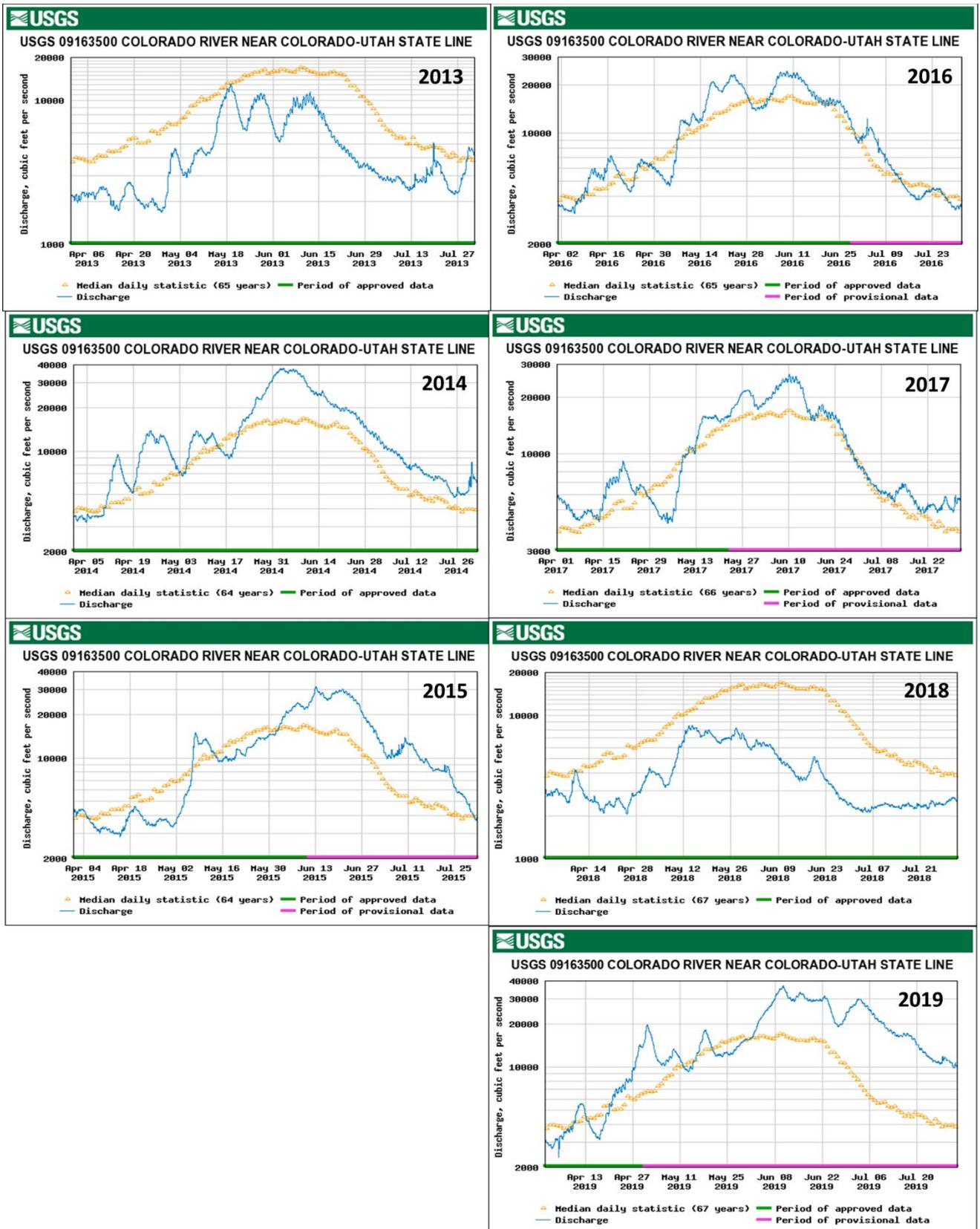
\*Note scale change in 2018 and 2019 panels, as catch was dominated by smaller individuals.



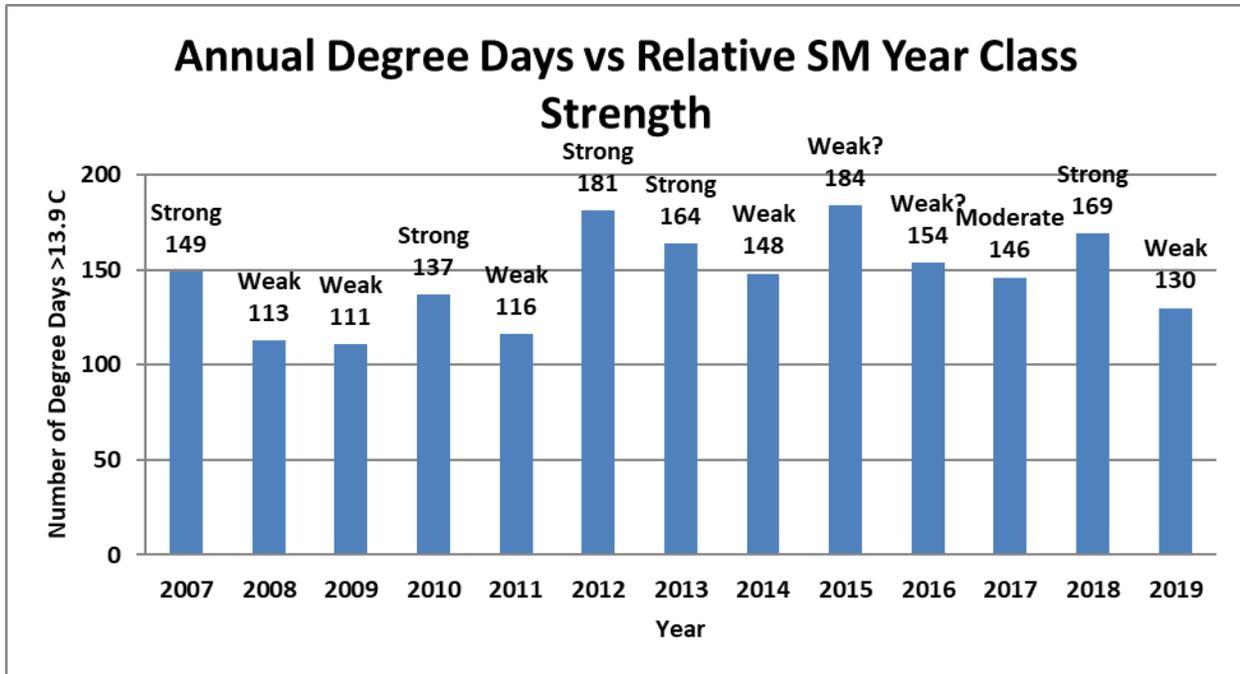
**Figure 6.** Sixteen year comparison of catch/effort (fish/hr) for young-of-year, juvenile and adult smallmouth bass, 2004-2019, for Ruby Horsethief Canyon of the Upper Colorado River. Adult size classes were calculated beginning in 2013. Note: numbers of smallmouth bass collected in parentheses.



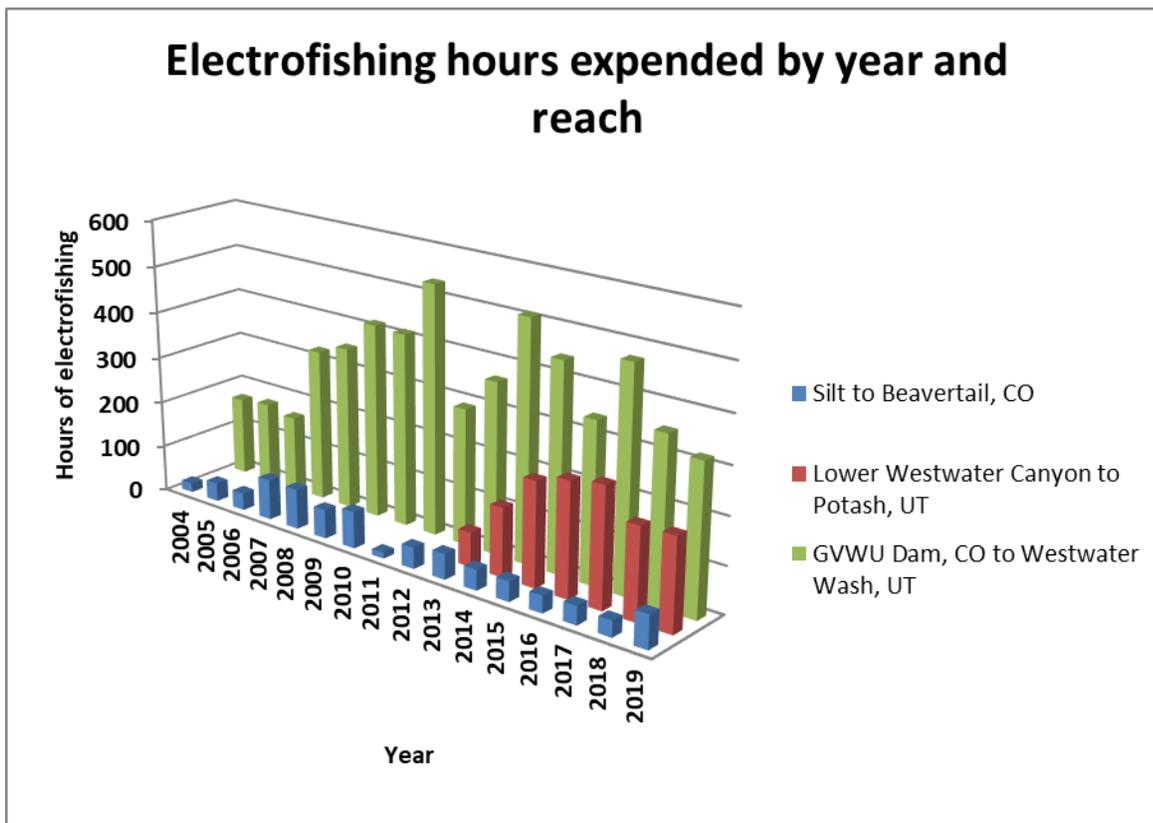
**Figure 7.** Percent composition and total numbers of nonnative fish removed from the Colorado (river mile 240.7 to 47.2) and Gunnison (river mile 3.0 to 0.0) rivers from 2013 through 2019.



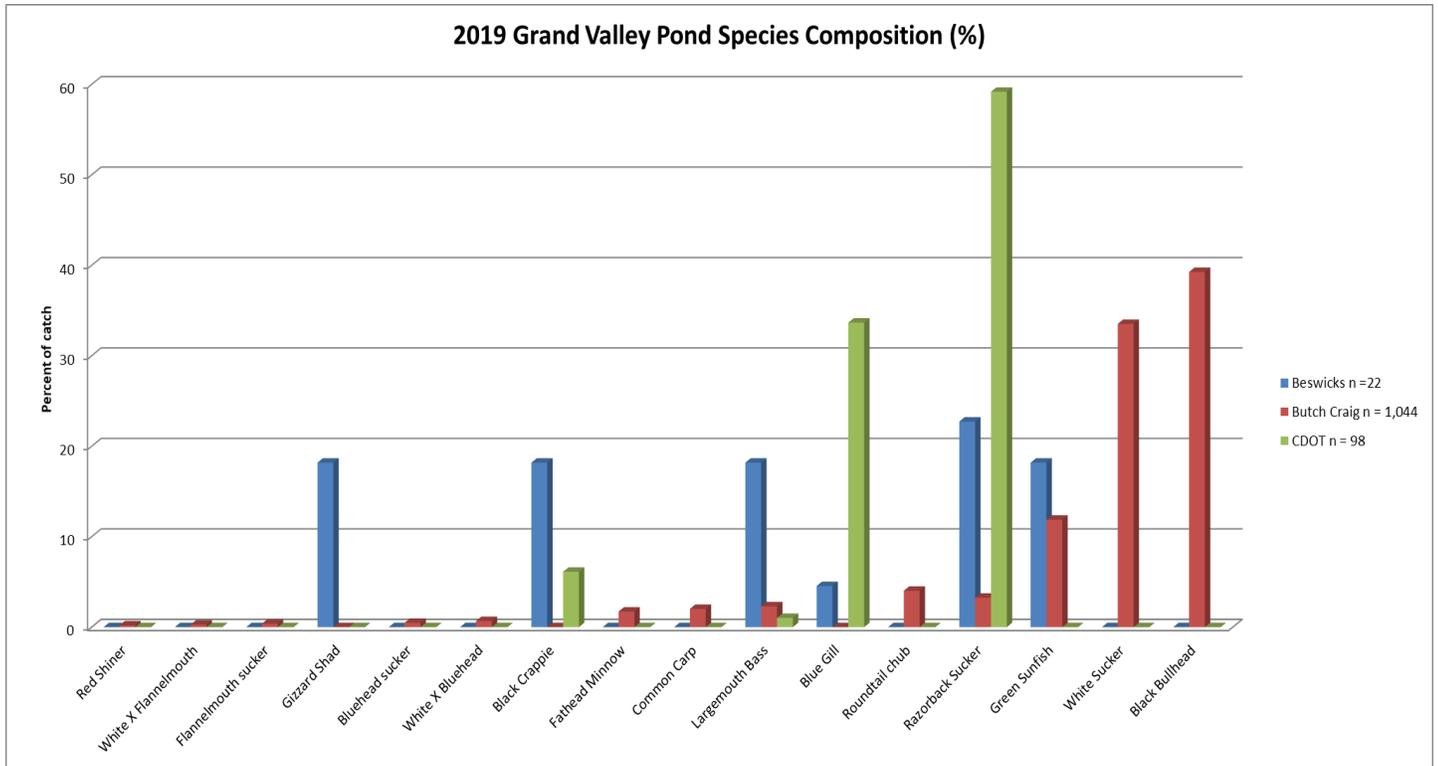
**Figure 8.** Spring Colorado River discharge as measured at the USGS gauge (09163500) near the CO/UT state-line; 2013-2019. Note: Notice the value change on the Y axis.



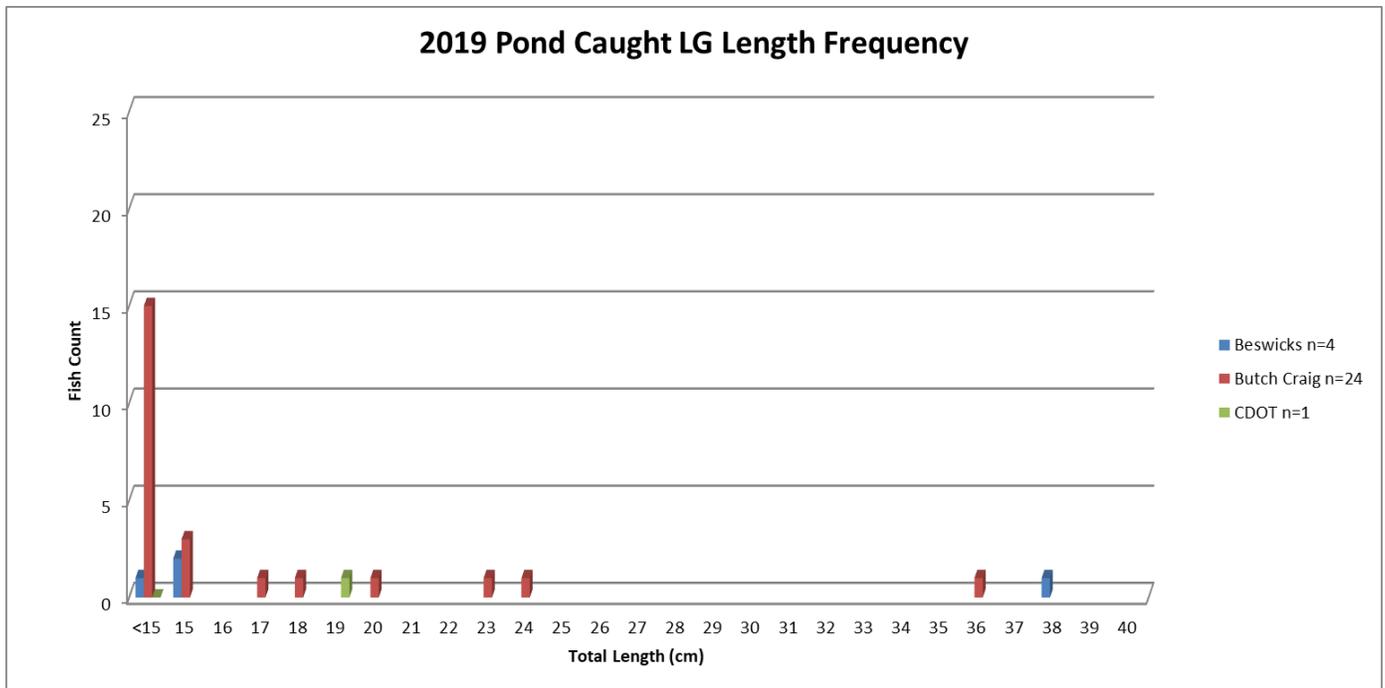
**Figure 9.** Annual degree days exceeding 13.9° (Celsius) as measured at the USGS 09163500 Colorado River near Colorado- Utah state line gauge.



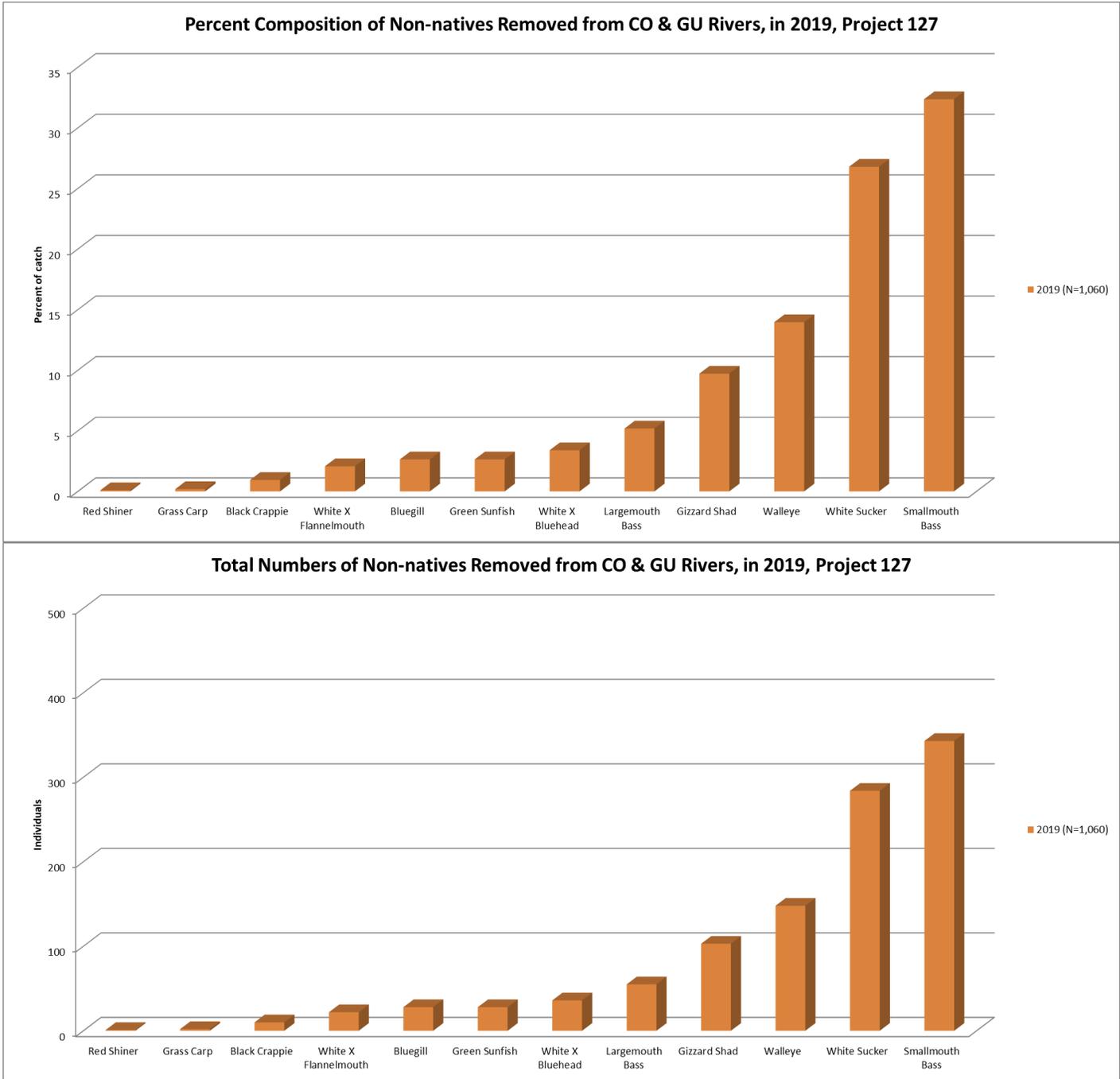
**Figure 10.** Electrofishing effort for 126a, 126b & 123d by year and reach.



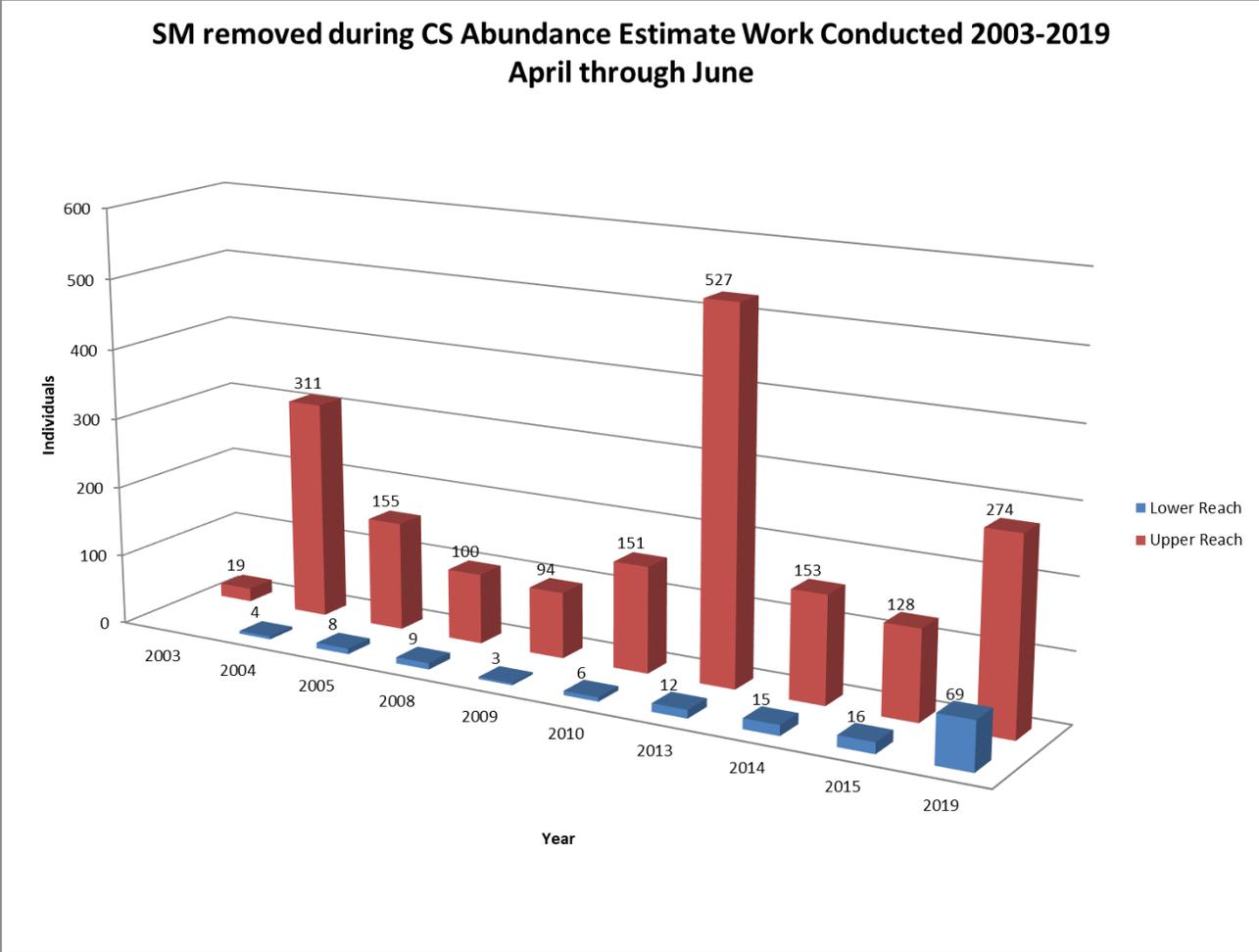
**Figure 11.** Species composition of fishes handled in Beswicks, Butch Craig and CDOT pond 2019.



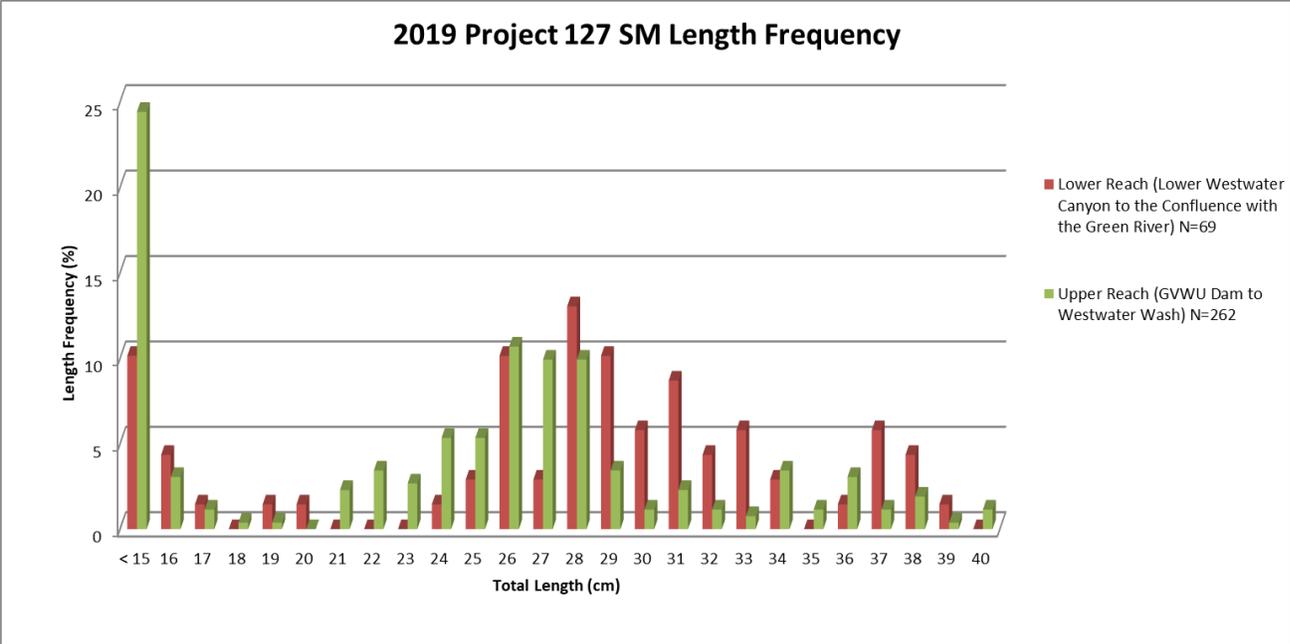
**Figure 12.** Beswicks, Butch Craig and CDOT ponds largemouth bass length frequency histogram 2019.



**Figure 13.** Percent composition and total numbers of nonnative fish removed from the Colorado (river mile 193.7 to 0.0) and Gunnison (river mile 3.0 to 0.0) rivers by project 127, spring 2019.



**Figure 14.** Total number of smallmouth bass removed from the Colorado and lower Gunnison rivers, by reach delineated by project 127, 2003-2019.



**Figure 15.** Length frequency histogram for smallmouth bass removed from the Colorado and Lower Gunnison rivers, by reach delineated by project 127, in 2019.

## 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**

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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, 2019  
   Is this the final report? Yes \_\_\_\_\_ No   X  

Performance:

### **Summary of Colorado Park and Wildlife's Project 126b: Colorado River Non-Native Removal for 2019**

- The Colorado River was sampled between Silt (RM 248.0) and Una Bridge (RM 216.5) by Colorado Parks and Wildlife (CPW) crews as part of Project 126b. Surveys took place in May and September in 2019. Prior to runoff and high flows, a backwater concentration pass was conducted on May 5, 2019. The remaining passes occurred on September 17<sup>th</sup> and 18<sup>th</sup>, 2019 with two crews fishing all habitats in separate reaches each day. An extended high flow season delayed sampling after runoff commenced as backwater habitats did not form until late July. 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 2019, non-native catostomids, hybrid catostomids, small Common Carp, Creek Chub, and Fathead Minnow were removed opportunistically.

- One electrofishing pass was completed from Silt (RM 248.0) to Una Bridge (RM 216.5) where the main channel and backwaters were electrofished. Five backwater areas were identified as potential non-native species habitat or concentration areas in 2019. Two of these backwaters are in the Rifle to Rulison reach, one in the Silt to Rifle reach, one in Rulison to Parachute and one in the Parachute to Una Bridge reach. A backwater at RM 236.6 (downstream of Rifle), identified as a Northern Pike concentration area in previous years, was electrofished on May 5<sup>th</sup> and September 17<sup>th</sup>, 2019. Block nets were deployed during both electrofishing events. The four other identified backwater areas were electrofished on a single occasion each. In previous years, a backwater downstream of Rulison at RM 228.8, was considered a concentration area for both Smallmouth and Largemouth Bass. However, in 2019, only a small number of Green Sunfish and a single Largemouth Bass were captured. In general, Black Bullhead and most centrarchids were captured within backwater, slack water, and eddy habitats. No Northern Pike were collected in 2019.
- Similar effort was expended in 2019 as in 2018. However, high flow conditions and an extended runoff season delayed most surveys until September in 2019. A backwater concentration pass was completed on May 5, 2019 prior to peak runoff. During all surveys, backwater and slackwater habitats were limited or less accessible than in previous years. Several backwaters that were previously accessible have filled in with sediment and are no longer productive habitat for fish species. In September, all habitats were fished in the reaches between Silt and Una Bridge. No areas exhibited a high concentration of non-native species and the additional concentration passes were not warranted.
  - Catch rates for all centrarchids combined from main channel efforts (backwaters not included) were lower in 2019 than in 2018 or 2017 (3.57 fish/hour vs 5.59 fish/ hour in 2018 and 10.81 fish/hour in 2017). However, it should be noted that different reaches were included in 2019 efforts. Una Bridge to Debeque was not sampled due to low flow conditions over the Bluestone Diversion in September 2019. In addition, Debeque to Beavertail Tunnel is sampled in even years and was last sampled in 2018.
  - Catch rates for all centrarchids combined in the RM 236.6 backwater decreased slightly from 2018 efforts. However, there was a sharp change in catch rates amongst species and overall centrarchid species composition. Catch rates decreased to 83.05 fish/hour from 92.03 fish/hour in 2018 for all centrarchid species combined. However, Largemouth Bass composed only 15% of the total number of centrarchid species captured in 2019 compared to 50% in 2018. Catch rates for Largemouth Bass decreased from 45.87 fish/hour in 2018 to 12.43 fish/hour in 2019. Green Sunfish increased from 45.87 fish/hour in 2018 to 69.49 fish/hour in 2019. 84% of centrarchid species captured at the RM 236.6 backwater were Green Sunfish. While no Smallmouth Bass were captured in this backwater in 2018, 2 juvenile Smallmouth Bass were collected in 2019.

- 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 and the CPUE for all centrarchids combined was 99.32 fish/hour. The 2018 catch contained both Smallmouth Bass and Largemouth Bass, with catch rates at 25.42 fish/hour and 23.39 fish/hour, respectively. In 2019, no Smallmouth Bass were encountered and only a single Largemouth Bass was captured (decreasing the Largemouth Bass catch rate to 0.67 fish/hour). The overall centrarchid species Catch Per Unit Effort (CPUE) declined to 23.33 fish/hour in 2019 with Green Sunfish as the predominant species captured. Due to extended high flows, this area likely remained a flowing side channel until later in the summer than in previous years and did not provide desirable habitat for centrarchid species.
- A backwater at RM 220.2 downstream of Parachute has filled in with sediment from a flood event in 2019. Available fish habitat is reduced in this former backwater. This backwater was not sampled in 2018 and only a small number of Largemouth Bass (n=14) and Green Sunfish (n=15) were captured in 2019.
- High flows and extended runoff may be partially to credit for the decreased catch rates and numbers of Smallmouth Bass and Northern Pike encountered in 2019. Formation of backwater habitats occurred much later in 2019 than in previous years and may have forced these species into less desirable habitats resulting in decreased survival and decreased spawning success. In addition, non-native fish control actions at the Mamm Creek Pit #1 have diminished Northern Pike populations to low densities and reduced escapement into the Colorado River.
- Due to low densities of target species between Silt and Beavertail Tunnel, CPW recommends shifting efforts to focus on backwater and other slack water habitats across all days rather than electrofishing all shorelines and habitats 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 or suspected concentration areas of Northern Pike, Smallmouth Bass and Largemouth Bass. Due to limited encounters with target species, the Silt to Rifle and the Debeque to Beavertail Tunnel reaches should be surveyed in alternate years with Silt to Rifle occurring in odd years and Debeque to Beavertail tunnel surveyed in even years.
- Six individual Razorback Suckers and one Bonytail were captured in 2019, checked for pit tags, measured and released. Five of the 6 Razorback Suckers were captured in the RM 236.6 backwater. According to the STreaMS database, all 7 individuals were stocked at the Rifle bridge between 2012 and 2019. All of these fish were stocked in late summer and early fall. One Razorback Sucker was released in 2012, one released in 2014, two in 2016 and two released in 2018. The single Bonytail captured was stocked in July 2019 at the Rifle bridge. Fewer Razorback Suckers were encountered in 2019 than 2018, which is likely due to shifting surveys to a fall timeframe rather than spring or

summer due to extended high flows and delays in backwater habitat formation. Capture information will be submitted to the STreaMS database.

- Total Number of Fish Removed = 1,440 (657 of these fish were removed from backwater habitats.)
  - Total Number of Black Bullhead = 23 (total length ranged from 80 mm-233 mm)
  - Total Number of Bluegill= 1 (total length 120 mm)
  - Total Number of Green Sunfish = 261 (total length ranged from 30 mm-145 mm):
    - a. 210 fish  $\leq$  100 mm
    - b. 51 fish  $>$  100 mm and  $<$ 150 mm
    - c. 0 fish  $\geq$  150 mm
  - Total Number of Largemouth Bass = 73 (total length ranged from 64 mm-349 mm):
    - a. 30 fish  $\leq$  100 mm
    - b. 15 fish  $>$  100 mm and  $<$  150mm
    - c. 19 fish  $\geq$ 150 mm and  $<$ 250 mm
    - d. 9 fish  $\geq$ 250
  - Total Number of Northern Pike = 0
  - Total Number of Smallmouth Bass = 4 (total length ranged from 84 mm-151 mm):
    - a. 1 fish  $\leq$  100 mm
    - b. 2 fish  $>$  100 mm and  $<$ 150 mm
    - c. 1 fish  $\geq$  150 mm
  - Total Number of non-native sucker/hybrid sucker= 935 (total length ranged 87 mm-508 mm)
  - Total Number of Common Carp and other non-native cyprinids= 143
- Total Electrofishing Effort Expended = 33.22 hours
  - 28.00 hours expended in main channel, shoreline habitats
  - 1.76 hours expended in backwater at RM236.6
  - 1.5 hours expended in backwater at RM228.8
  - 1.96 hours expended in three combined backwaters

<b>Colorado River Non-native Fish Control 2019</b>				
<b>Silt to Una Bridge</b>				
<b>CPUE (Fish/Hour)</b>				
	<b>Main Channel only</b>	<b>RM 236.6 Backwater</b>	<b>RM 228.8 Backwater</b>	<b>Other Backwaters Combined</b>
<b>All Centrarchids combined</b>	3.57 n= 100	83.05 n= 147	23.33 n=35	29.08 n= 57
<b>Bluegill</b>	.04 n= 1	0	0	0
<b>Green Sunfish</b>	2.25 n= 63	69.49 n= 123	22.66 n=34	20.92 n= 41
<b>Largemouth Bass</b>	1.21 n= 34	12.43 n= 22	0.67 n= 1	8.16 n=16
<b>Smallmouth Bass</b>	.07 n= 2	1.13 n= 2	0	0

- CPW also conducted six days of Three Species surveys in addition to efforts for Project 126b. Surveys took place in reaches between Silt and Una Bridge and in Debeque Canyon in October 2019. Three Species were the primary interest of these surveys, but Razorback Sucker and Bonytail were also captured when encountered. Centrarchid species, non-native sucker species and their hybrids were removed when encountered. Because the focus is on Three Species habitats and generally away from shoreline and backwater habitats, few centrarchids were captured during these surveys. No Northern Pike were captured.
  - Total number of fish removed= 291
    - Total number of Green Sunfish removed= 3 (total length 77 mm-102 mm)
    - Total number of Largemouth Bass removed= 2 (total length 72 mm and 303 mm)
    - Total number of Smallmouth Bass removed= 1 (total length 275 mm)
    - Total number of White Sucker, Longnose Sucker, and hybrids removed= 285 (total length ranged from 67 mm-520 mm)
  - Total Electrofishing effort expended= 38.03 hours
    - Centrarchid CPUE= 0.15 fish/hour
    - Non-native sucker/hybrid sucker CPUE= 7.49 fish/hour

## **Summary of CPW's Project 126b: 2019 Mamm Creek Pit 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 (Merwin Trap and gill nets) sampling techniques. CPW crews visited Mamm Creek Pit #1 on fifteen occasions between March 20 and July 22. Daytime electrofishing was conducted on March 20, March 27, March 28, April 7, and July 2. Overnight gill net surveys were conducted on March 21, March 22, March 27, March 28, and April 8. Sixteen 150' standard mesh (1.5" bar size) gill nets were utilized throughout the project for overnight sets. A Merwin Trap (large trap typically used to collect kokanee salmon during the spawning season in Colorado) was deployed across the outlet breach on May 7 to preclude non-native fish from escaping the pond and entering the Colorado River during run-off. The Merwin Trap was emptied of fish, adjusted (if necessary), and repaired (if necessary) on May 14, May 23, May 31, June 7, June 11, June 18, July 2, July 8, July 15, and July 22. All adult fish captured were measured in length to the nearest millimeter and weighed to the nearest gram. In some instances, only length and/or count data were taken on age-0 and age-1 Largemouth Bass and Common Carp due to the large number of fish captured. All non-native fish captured were lethally removed.
- No Northern Pike were captured or observed in Mamm Creek Pit #1. This continues a declining trend observed in Northern Pike catch per unit effort (CPUE) since 2017 (Figure 1). The data gathered in 2019 indicate that Northern Pike numbers are declining and that these reductions are resulting in an increase in CPUE of other fish species, especially age-0 and age-1 age-classes of Common Carp and Largemouth Bass (Figure 2, Figure 3, and Figure 4). Gill net CPUE of Northern Pike in 2018 was 0.09 fish/hour compared to 0.16 fish/hour in 2017 (Figure 1). In 2018, there was a significant reduction in catch rates as the project progressed, indicating substantial depletion had occurred during removal efforts. In addition to past years' removal efforts, it is likely that winterkill partially explains the absence of Northern Pike in 2019 despite significant removal efforts. Ice-out on the pond occurred on March 19, which is much later than the previous two years. Numerous dead Common Carp and Largemouth Bass were observed around the edge of the pond immediately following ice-out. However, this suspected winterkill event does not completely explain the absence of Northern Pike because other species such as Common Carp, Largemouth Bass, Yellow Perch, and Green Sunfish were present. It is likely that the winterkill event caused size-selective mortality in which higher mortality rates were seen in adult fish; this explains the low numbers of adult fish surveyed and the high relative abundance of age-0 and age-1 fish (Figure 3). In addition to significant depletion in the number of Northern Pike captured throughout the pre-spawn and spawning period in 2018, no age-0 Northern Pike were captured in 2018. Furthermore, no spent females were captured during 2018's effort, meaning that depletion of spawning fish in the pond occurred prior to spawning which severely limited or eliminated natural reproduction in 2018. The most likely explanation for the absence of Northern Pike in 2019 is that previous years' removal efforts reduced or eliminated Northern Pike reproduction which resulted in a low abundance or absence of age-0 and age-1 fish which would have been the most likely to survive a winterkill event; the adult population that remained was significantly reduced or eliminated by winterkill during the winter of 2018-2019.

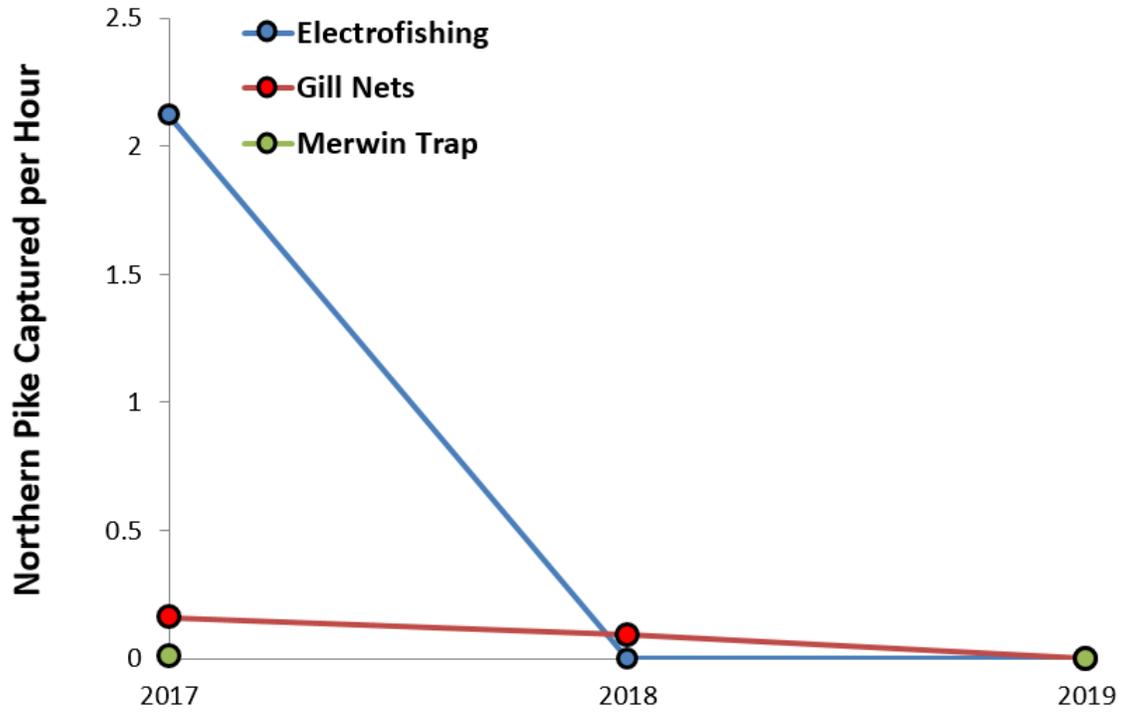
- It is possible that Northern Pike are still present and that they were not detected during 2019's efforts due to a low abundance. CPW recommends continued monitoring and removal efforts to evaluate the fishery and determine if Northern Pike are still present. If Northern Pike are found during future surveys, removal efforts should continue to be conducted during the spring, with a focus on intensive efforts during the early portion of the spawning season to reduce the amount of successful reproduction. 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 the fishery and the river flows throughout the spring of 2020 to determine if deployment of the Merwin Trap is necessary. CPW recommends a reduced effort at Mamm Creek Pit #1 if surveys in 2020 do not yield any Northern Pike.
  
- Total Number of Fish Removed = 5,465
  - Total Number of Common Carp (all lethally removed) = 2,165 (Total length ranged from 50mm - 756mm, average length of 173mm)
  - Total Number of Green Sunfish (all lethally removed) = 146 (Total length ranged from 46mm - 168mm, average length of 100mm)
  - Total Number of Largemouth Bass (all lethally removed) = 2,849 (Total length ranged from 19mm - 355mm, average length of 54mm):
    - a) 2,814 fish  $\leq$  100mm
    - b) 34 fish  $>$  100mm and  $\leq$  200mm
    - c) 0 fish  $>$  200mm and  $\leq$  300mm
    - d) 1 Fish  $>$  300 mm and  $\leq$  400mm
    - e) 0 Fish  $>$  400 mm
  - Total Number of Northern Pike = 0
  - Total Number of Yellow Perch (all lethally removed) = 81 (Total length ranged from 41mm - 261mm, average length of 113mm)
  - Total Number of White Sucker = 180 (Total Length ranged from 45mm - 140mm, average length of 77mm)
  - Other fish captured: 8 Creek Chub (lethally removed), 35 Fathead Minnow (lethally removed), 1 Smallmouth Bass (lethally removed), 2 Speckled Dace (released alive)
  
- Total Effort Expended (Electrofishing = 7.4 hours; Gill Net Sets = 1,882.2 hours; Merwin Trap = 1,821 hours ) = **3,710.6 hours**
  
- Centrarchid (Green Sunfish and Largemouth Bass, combined) CPUE across all methods =  
0.81 fish/hour
  - Electrofishing CPUE = 117.43 fish/hour
  - Gill Nets CPUE = 0 fish/hour
  - Merwin Trap = 1.17 fish/hour
    - a. Green Sunfish CPUE
      - i. Electrofishing =10.68 fish/hour

- ii. Gill Nets = 0 fish/hour
- iii. Merwin Trap = 0.04 fish/hour

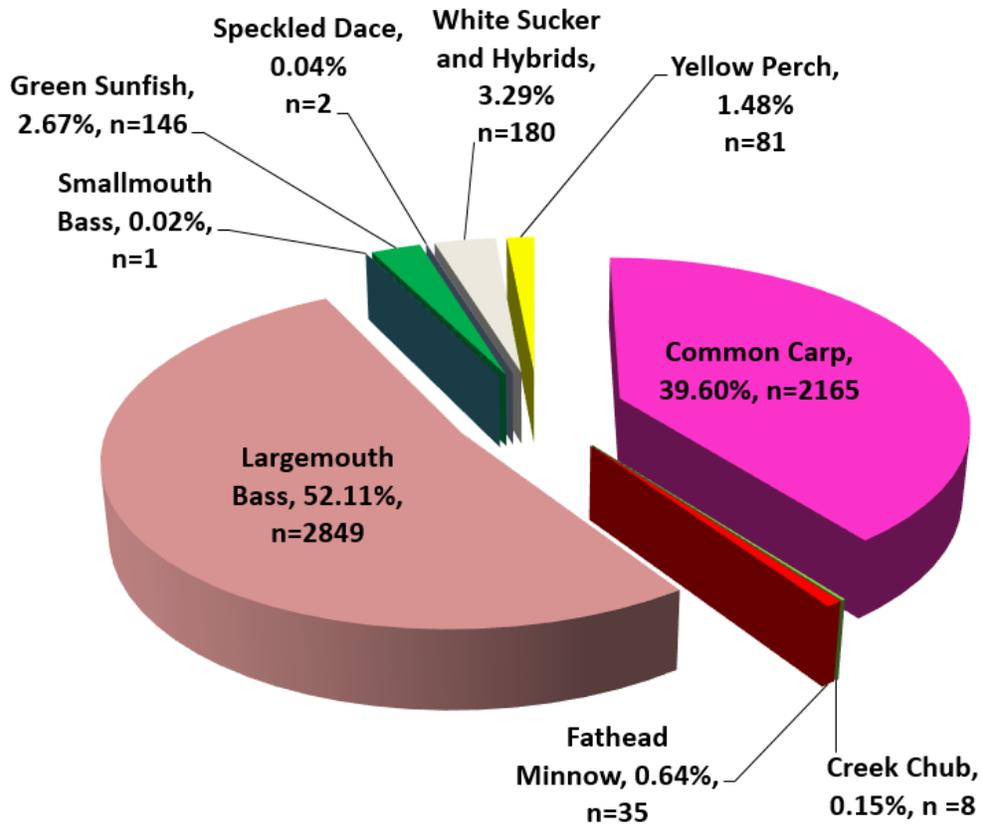
b. Largemouth Bass CPUE

- i. Electrofishing = 106.76 fish/hour
- ii. Gill Nets = 0 fish/hour
- iii. Merwin Trap = 1.13 fish/hour

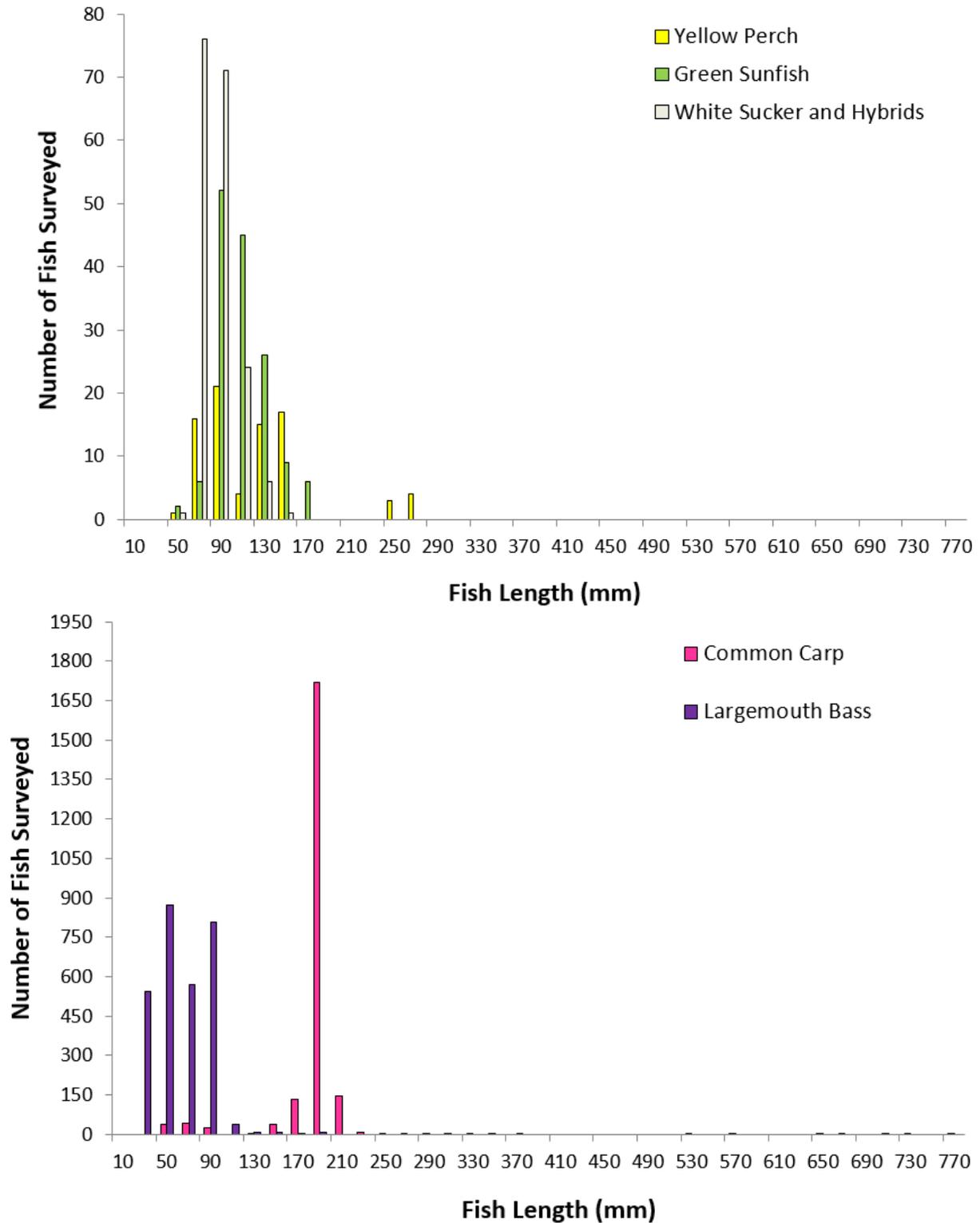
- Common Carp CPUE
  - Electrofishing = 273.24 fish/hour
  - Gill Nets = 0.01 fish/hour
  - Merwin Trap = 0.07 fish/hour
- Yellow Perch CPUE
  - Electrofishing CPUE = 6.49 fish/hour
  - Gill Nets = <0.01 fish/hour
  - Merwin Trap = 0.07 fish/hour
- White Sucker (and hybrids) CPUE
  - Electrofishing CPUE = 0 fish/hour
  - Gill Nets = <0.01 fish/hour
  - Merwin Trap = 0.02 fish/hour



**Figure 1.** Catch per unit effort of Northern Pike in Mamm Creek Pit #1 during removal operations (early spring to early summer) conducted in 2017, 2018, and 2019 that consisted of daytime electrofishing, overnight gill net sets, and a Merwin Trap set across the outlet breach. Data from 2018 fall survey were excluded due to differences in timing and sampling methods. The Merwin Trap was not deployed in 2018 due to low flows in the Colorado River.

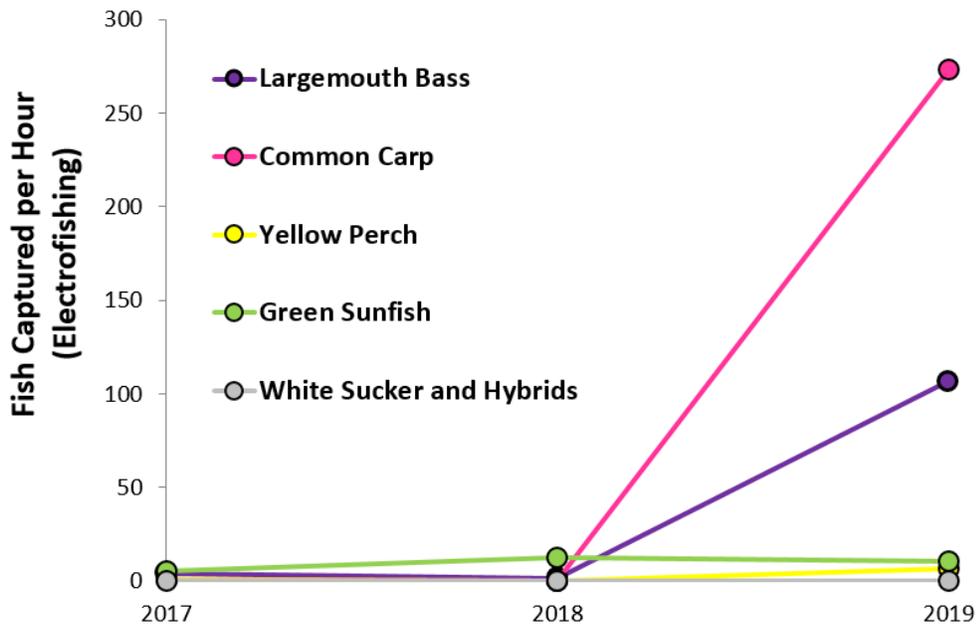


**Figure 2.** Species composition of fish surveyed in Mamm Creek Pit #1 during removal operations that occurred between March 20 and July 22, 2019. Removal operations consisted of a combination of overnight gill net sets, daytime electrofishing, and the operation of a Merwin Trap at the outlet breach.



**Figure 3.** Length frequency histograms of fish removed from Mamm Creek Pit #1 between March 20 and July 22, 2019. Sampling gears consisted of overnight gill net sets, daytime electrofishing, and the use of a Merwin Trap at the outlet breach. Note that Largemouth Bass and Common Carp are shown in a separate figure due to their higher abundances relative to other

species (note that Y-axes are not equal between figures).



**Figure 4.** Electrofishing catch per unit effort (CPUE) of Largemouth Bass, Common Carp, Yellow Perch, Green Sunfish, and White Sucker (and hybrids) in Mamm Creek Pit #1 during removal operations (early spring to early summer) in 2017, 2018, and 2019. CPUE for these species using gill nets and the Merwin Trap at the outlet breach are extremely low so only electrofishing CPUE is shown. Data from 2018 fall survey were excluded due to differences in timing and sampling methods.

## 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. In 2019, Mamm Creek Pit #2 was surveyed on March 26 using a single overnight set of four 150' standard mesh gill nets (1.5" bar size) for a total effort of 88.83 net-hours. No Northern Pike were captured or observed during the survey. Northern Pike were first collected in Mamm Creek Pit #2 in November of 2016 at which time a single Northern Pike (male, 802 mm in length) was caught during a survey that consisted of five gill nets set overnight. Prior to the 2016 survey, Northern Pike were thought 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 between March 29 and May 31 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 length) was collected (collected during March 29 survey), which suggests Northern Pike have not successfully reproduced and/or recruited 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 into Mamm Creek Pit #2. Based on the data gathered in 2016 and 2017, a reduced effort consisting of two surveys using four overnight gill nets were conducted on March 15, 2018 and March 26, 2019; no Northern Pike were collected during these surveys in 2018 and 2019.
- CPW recommends continued monitoring of Mamm Creek Pit #2 annually using a single overnight set of three to four gill nets. The amount of effort proposed, which is reduced relative to 2016 and 2017, is in response to the absence of Northern Pike in the 2018 and 2019 surveys. Furthermore, removal efforts in 2016 and 2017 showed that the Northern Pike population present at that time was limited to a small number of large adults and that there was no evidence of natural reproduction and recruitment. Removal efforts will be increased if future data show increases in Northern Pike densities or if juvenile Northern Pike are collected.
- Total number of fish removed = 7
  - Total number of Largemouth Bass = 1 (total length of 328 mm)
  - Total number of White Sucker = 3 (total length ranged from 355mm – 384mm)
  - Total number of Green Sunfish = 3 (total length ranged from 198mm – 220mm)
- Total effort expended (all gill netting): **88.83 hours**
- Gill net CPUE:
  - Largemouth Bass: 0.01 fish/hour

- White Sucker: 0.03 fish/hour
- Green Sunfish: 0.03 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. In 2019, Mamm Creek Pit #3 was surveyed on March 26 using a single overnight set of four 150' standard mesh gill nets (1.5" bar size) for a total effort of 89.33 net-hours. No Northern Pike were captured or observed during the survey. Northern Pike were first collected in Mamm Creek Pit #3 in November of 2016 at which time four Northern Pike (3 males and one female, total length ranged from 717mm - 829mm) were collected during a survey that consisted of four gill nets set overnight. Prior to the 2016 survey, Northern Pike were thought 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 between April 4 and May 31 using 3-5 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 (collected during April 4 survey), which suggests Northern Pike have not successfully reproduced and/or recruited 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 two surveys using four overnight gill nets were conducted on March 15, 2018 and March 26, 2019; no Northern Pike were collected during these surveys in 2018 and 2019.
- CPW recommends continued monitoring of Mamm Creek Pit #3 annually using a single overnight set of three to four gill nets. The amount of effort proposed, which is reduced relative to 2016 and 2017, is in response to the absence of Northern Pike in the 2018 and 2019 surveys. Furthermore, removal efforts in 2016 and 2017 showed that the Northern Pike population present at that time was limited to a small number of large adults and that there was no evidence of natural reproduction and recruitment. There was a prolonged direct connection between the pit and the Colorado River during high flows in 2019 via the pit's spillway. Removal efforts in 2019 were conducted prior to high flows so removal work in 2020 will allow CPW to evaluate the effects of this prolonged connection on the fishery. Removal efforts will be increased if future data show increases in Northern Pike densities or if juvenile Northern Pike are collected.
- Total number of fish removed = 11
  - Total number of Largemouth Bass = 3 (total length ranged from 294mm - 303mm)
  - Total number of Yellow Perch = 8 (total length ranged from 246mm to 288mm)

- Total effort expended (all gill netting): **89.33 hours.**
- Gill net CPUE:
  - Largemouth Bass: 0.03 fish/hour
  - Yellow Perch: 0.09 fish/hour

#### **Other Relevant Work not Included in Scope of Work**

##### **East Rifle Municipal Pond**

- East Rifle Municipal Pond is a 19.2 surface acre pond located on the north side of the Colorado River, approximately 1.25 miles west of Mamm Creek Pit #1. The pond is owned by the City of Rifle and it serves as a settling pond from which water is drawn for municipal use. The pond receives water from the Colorado River through an inlet pipe that is controlled by a head gate. The pond was closed to public access in 2018 due to safety concerns at which time City of Rifle personnel notified CPW of an opportunity to move Largemouth Bass out of the pond and into public waters to allow anglers to have access to these fish. CPW conducted the first translocations of Largemouth Bass from East Rifle Municipal Pond into Harvey Gap Reservoir on May 21, 2018 through May 23, 2018. During this work in 2018, a large Northern Pike (888mm) was captured and lethally removed during the project, which consisted of 5.75 hours of nighttime electrofishing and 11.9 hours of daytime sets of experimental mesh gill nets. Since that time, there have been periods when the public seem to be able to access the pond (gate open). CPW conducted follow-up work in 2019 using nighttime electrofishing (2.03 hours of effort) on May 6, and daytime gill netting using fourteen 150' standard mesh (1.5" bar size) gill nets on May 9 and May 10. Total gill net effort was 132.3 hours. During the efforts in 2019, a total of 22 Northern Pike were removed, ranging in length from 383mm to 1034mm. Other fish species surveyed included Common Carp, Largemouth Bass, Flannemouth Sucker, Brown Trout, Green Sunfish, White Sucker (and Hybrid Sucker), and Yellow Perch.
- The source of Northern Pike in this pond is unknown. It is possible that Northern Pike initially entered the pond from the river through the inlet pipe. Historically, Northern Pike were periodically documented during non-native fish control work on the Colorado River near this location. The presence of species such as Flannemouth Sucker, Brown Trout, and White Sucker also suggests that fish enter the pond from the inlet pipe. However, it is also possible that the Northern Pike and Yellow Perch were illicitly stocked directly into the pond. Although it is possible that Yellow Perch entered the pond from the Colorado River, an illicit introduction is the most likely explanation for their presence because the number of Yellow Perch seen in the Colorado River has historically been very low. The Mamm Creek Pits, which also have Northern Pike and Yellow Perch, are a short distance upstream of East Rifle Municipal Pond. It is possible that fish were illicitly stocked in all these waters at the same time or that fish from Mamm Creek Pits are the source of fish in East Rifle Municipal Pond either through

escapement into the Colorado River and entry through the inlet pipe, or illicit movement of these fish.

- CPW plans to continue monitoring and removal efforts in the spring of 2020 during the Northern Pike spawning season to further reduce the abundance of Northern Pike in the pond and to evaluate abundance and population size structure. CPW will also continue discussions with City of Rifle personnel regarding access and operations of the pond and what options, if any, exist to reduce or eliminate the potential for fish escapement from the pond into the Colorado River when the inlet gate is open.

**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  
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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): 09/30/2019  
  Reporting period end date: 9/30/2019  
  Is this the final report? Yes \_\_\_\_\_ No   X  

Performance:

*Walleye removal in the Green River sub-basin*

Utah Division of Wildlife Resources completed 43.4 hours of electrofishing effort, targeting walleye on the lower Green River between 28 February 2019 and 16 October 2019. All effort was focused on high value walleye habitat downstream of the Tusher diversion (RMI 128.3 - 114.5). A total of 151 walleye were removed from the Green River (CPUE = 3.51 fish/hour) in 2019. See Table 1 for ancillary captures.

*Walleye removal in the Colorado River sub-basin*

Utah Division of Wildlife Resources crews completed 6.6 hours of targeted walleye removal on the Colorado River between Big Hole and Cisco boat ramp (RMI 116.6 - 111) in 2019. Sampling took place between 7 March 2019 and 8 October 2019. UDWR removed 1 walleye during the sampling period (CPUE = 0.14 fish/hour). UDWR also completed 2.1 hours of sampling between RMI 9 - 0 on the lower Dolores River on 7 May 2019. No walleye were encountered. See Table 1 for ancillary encounters.

All work was completed under Tasks 1, 2 and 3 of the FY19 123d scope of work.

Table 1. Ancillary captures within the Green and Colorado River sub-basins during targeted walleye removal in 2019.

<b>Reach</b>	<b>Common name</b>	<b>Number</b>	<b>Fish/hour</b>
Lower Colorado	bluegill	1	0.14
	bonytail	3	0.43
	Colorado pikeminnow	1	0.14
	green sunfish	1	0.14
	roundtail chub	4	0.57
	razorback sucker	1	0.14
	smallmouth bass	12	1.71
	walleye	1	0.14
	white sucker	5	0.71
Lower Dolores	bonytail	4	2.00
	roundtail chub	4	2.00
	smallmouth bass	1	0.50
Lower Green	black bullhead	8	0.19
	black crappie	3	0.07
	bonytail	3	0.07
	Colorado pikeminnow	10	0.23
	grass carp	4	0.09
	green sunfish	8	0.19
	largemouth bass	51	1.19
	northern pike	2	0.05
	razorback sucker	5	0.12
	smallmouth bass	5	0.12
	walleye	151	3.51
white sucker	9	0.21	