Colorado River at Parshall

Fishery management report
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Introduction

Located approximately 10 miles east of Kremmling, CO on US highway 40, this section of the Colorado River offers approximately 4 miles of public access on the Kemp-Breeze, Lone Buck, and Paul Gilbert State Wildlife Areas (SWA), which are managed by Colorado Parks and Wildlife (CPW), and the Bureau of Land Management's (BLM) Sunset property unit. This is one of the most well-known and heavily fished trout rivers in the state. Despite heavy angling pressure, trout populations here are generally excellent and this is a designated Gold Medal fishery.

Regulations

This section is under special regulations, restricted to fishing with flies and lures only, and all trout must be returned to the water immediately.

Stocking

Whirling disease-resistant strains of Rainbow Trout were stocked at various sizes through 2015 and again in 2020 with the goal of reestablishing a wild, self-sustaining Rainbow Trout population. Results of these efforts are discussed in more detail on pages 5-6.

Fishery surveys

The information in this report reflects trout population data collected on the two-mile reach of river beginning just upstream of the "Parshall Hole" and extending downstream through the Kemp-Breeze SWA to the irrigation diversion on the BLM Sunset property. This survey is conducted in the third or fourth week of September annually. Population estimates are obtained by raft electrofishing using standard mark-recapture methodology .

Total trout biomass in this reach has been on a general increasing trend since reaching a low point in 2011 (Figure 1). The 2020 survey produced the largest decline in the biomass estimate during the period since 2011; however this decline is not statistically significant. In all years this estimate has generously exceeded the minimum Gold Medal criteria of at least 60 lbs./acre. During this period the biomass estimate for all trout has averaged 145 pounds per surface acre, with Brown Trout comprising an average of 95% of the biomass while Rainbows have contributed 5%.

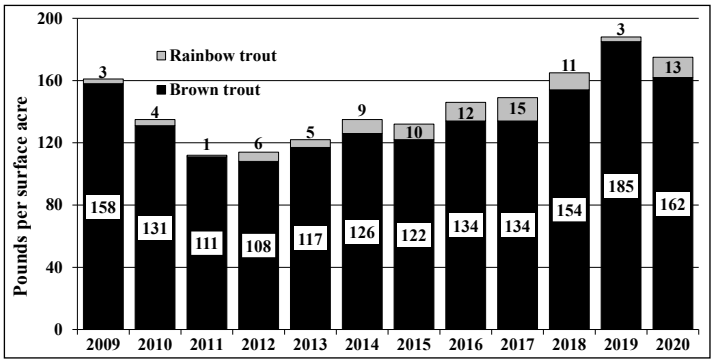

Figure 1. Biomass estimates for Brown and Rainbow Trout in pounds per surface acre, Parshall-Sunset, 2009-2020.

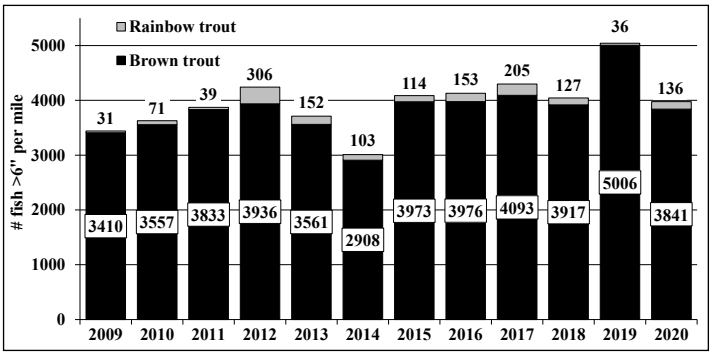

Figure 2. Estimates of fish per mile larger than 6", Parshall-Sunset, 2009-2020.

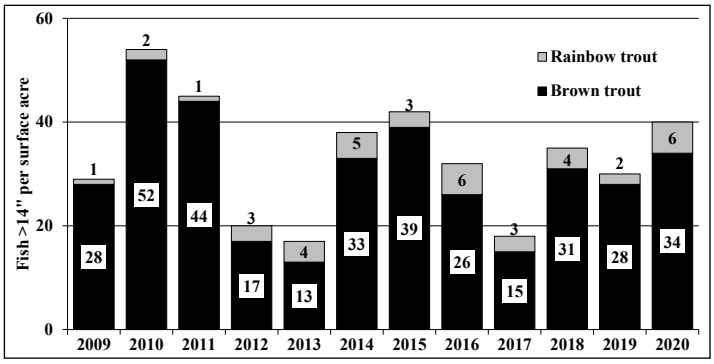

Figure 3. Estimates of fish per surface acre larger than 14" (defined as a "quality trout"), Parshall-Sunset, 2009-2020.

During the past 12 years, we have estimated an average of 3,957 trout per mile larger than 6" (Figure 2). Brown Trout have contributed 97% to this estimate on average and Rainbows have contributed 3%. The increase in Rainbow estimates beginning in 2012 reflects the introduction of Whirling Disease-resistant Rainbows to this section of river (see discussion on page 5-6).

The second biological criteria for Gold Medal designation is a minimum of 12 trout per surface acre 14" or larg-

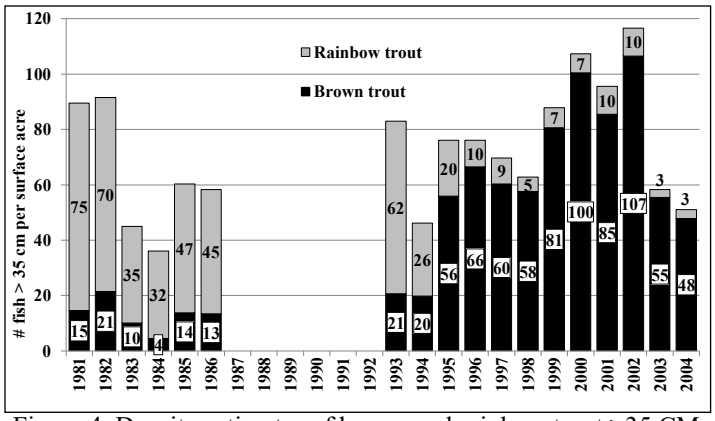

Figure 4. Density estimates of brown and rainbow trout >35 CM per surface acre, Parshall-Sunset, 1981-2004.

er. The average estimate from 2009-2020 is 33 trout per acre >14" (Figure 3). This estimate appears to "oscillate" in a cyclic pattern that repeats roughly every 4-5 years. In years at the bottom of this cycle such as 2013 and 2017, these estimates have come close to slipping below the Gold Medal standard. The 2020 survey yielded an unexpected result, because we anticipated a decline as we approached the low point of another such cycle.

Historic density estimates of trout >35cm (13.8") from the years 1981-2004, collected by Colorado Division of Wildlife research biologist Barry Nehring and colleagues, averaged 78 fish per acre in this reach (Figure 4). The parasite which causes Whirling Disease was first introduced to the Colorado River during this time, and its effects are evident in the decline of the Rainbow fishery and subsequent expansion of Brown Trout densities. Regardless, in 15 of the 18 sampling occasions during this period, quality trout estimates exceeded 50 fish per acre. The estimates for the most recent 12 years have never reached the average estimate for the historic period in Figure 4, suggesting that this fishery has undergone a long-term decline. All the reasons for this are not known, but two of the most likely culprits are a long-term degradation in the quality of forage, long-term degradation in the quality of physical habitat (particularly overwinter habitat), some combination of those two factors, or an issue not yet known.

Fish less than 15 cm are not effectively captured during these surveys, so it is difficult to assess the abundance of the Age-0 year class (fish that were born the year of the survey) from this data. However, the Age-1 year class (born the year prior to the sample), in the 12-20 cm range, is represented more accurately (Figure 5). These fish have successfully survived their first winter in the river and completed their first year of life, and thus are considered to be "recruited" to the population. The abundance of this size group is particularly important in predicting the future

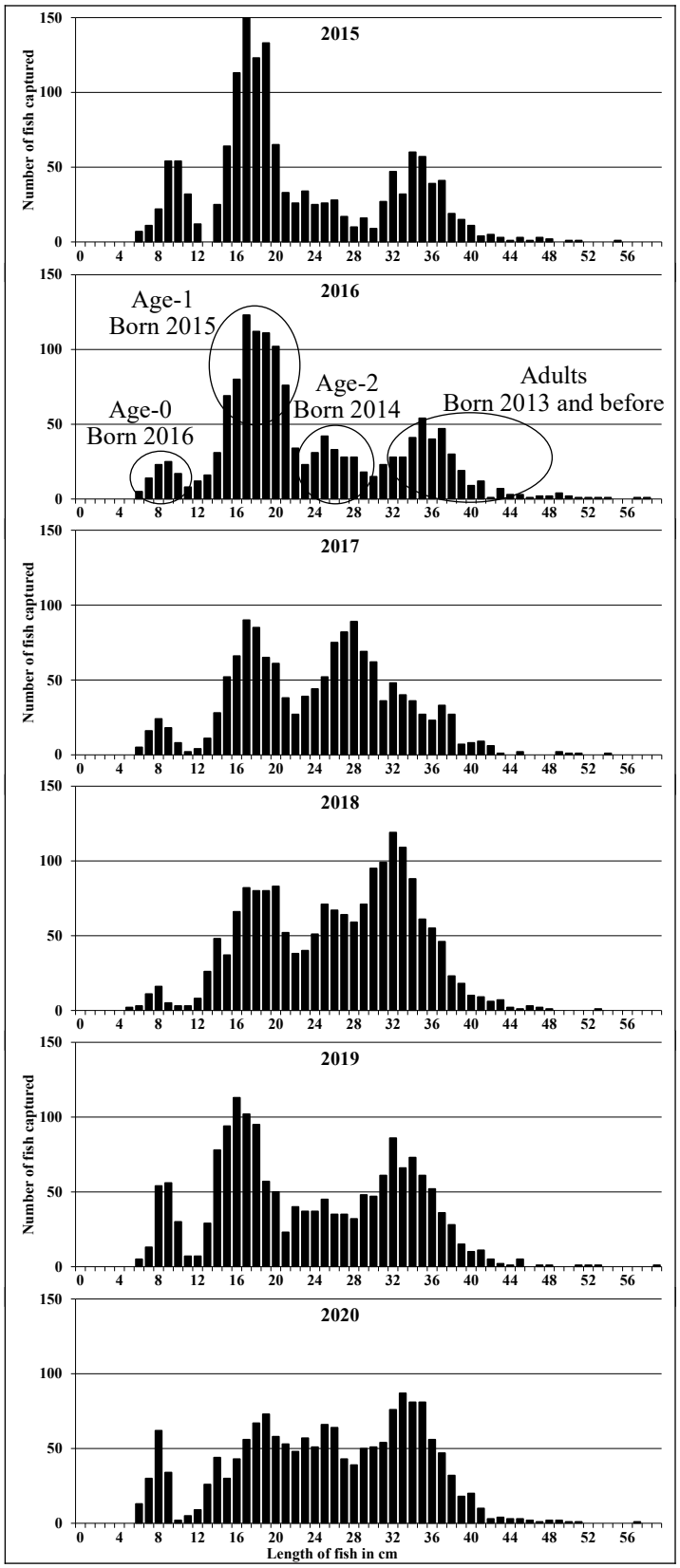

Figure 5. Size distribution of Brown Trout captured in Parshall-Sunset reach, 2015-2020.

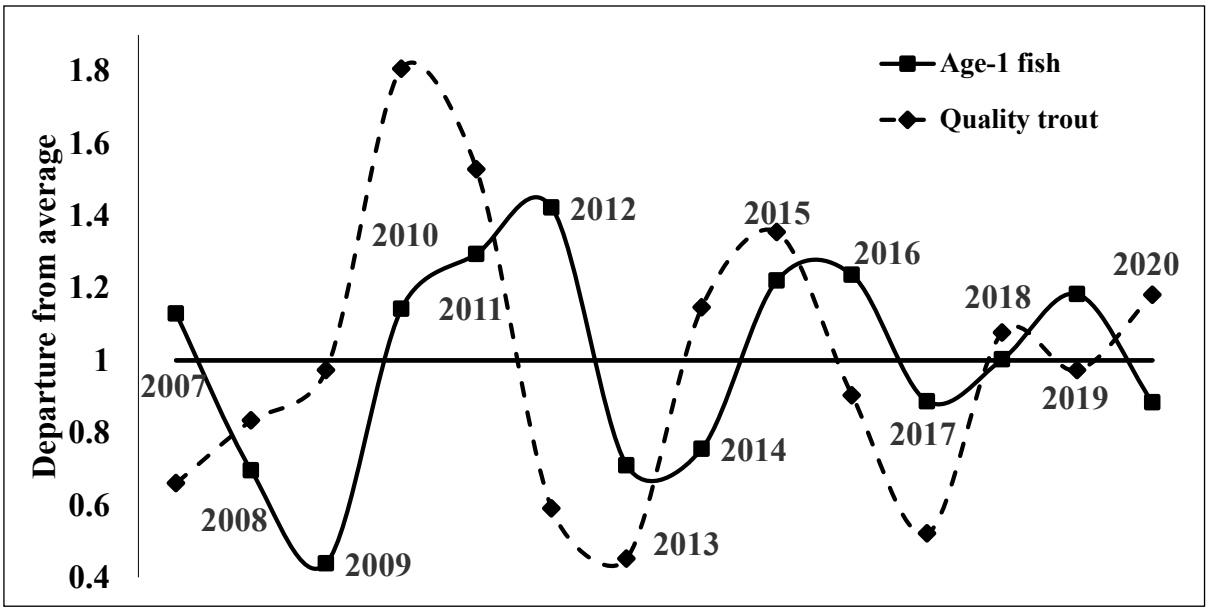

Figure 6. Oscillation in quality trout estimates (dashed line) and number of juvenile (12-23 cm) Brown Trout handled annually. Values for both parameters were standardized to the average for the period, represented by the flat line.

adult population, because mortality rates are highest in the first year of life, and multiple consecutive weak Age-1 year classes will result in a declining adult population due to lower numbers of juvenile fish recruiting into the adult population. The strong number of adults collected in 2018 are likely a result of the strong juvenile groups of 2015 and 2016. Conversely, weakening numbers of adult fish in 2019 and 2020 are likely the result of the weak juvenile groups that we observed in 2017 and 2018 (Figure 5).

Similar to our density estimates of quality trout, the strength of Age-1 year classes also appears to oscillate over time. In 2015 and 2016 we found strong Age-1 groups that outnumbered adult fish by a large amount. This was followed in 2017 and 2018 by comparatively weak Age-1 year classes. 2019 revealed a moderately strong Age-1 group, but this year class was weak again in 2020 (Figure 6). The oscillation of these two sectors of the Brown Trout population appear to be related to each other, but are temporally offset.

It is well known that Brown Trout become highly predatory beyond approximately 14" in size. Typically, waters that have high densities of large Brown Trout also have high densities of large prey items such as small fish species and large invertebrates such as Giant Stonefly (AKA Salmonflies). Cannibalism is also common in Brown Trout. CPW has documented a loss of large invertebrate diversity and an absence of Mottled Sculpin (a native fish that is also a valuable prey item for Brown Trout) in this part of the Colorado River over the past 40 years. These findings, coupled with the cyclical properties discussed above, suggest that the population of large Brown Trout in this reach is experiencing a self-perpetuating feedback loop. When densities of large Brown Trout are high, their main large food item in this reach is juvenile Brown Trout. This predation pressure results in weak year-classes of juveniles recruiting to the adult population, which in turn causes a decline in the density of large fish. This decline reduces predation pressure on juvenile fish, allowing strong year classes to recruit, which ultimately results in the cycle repeating itself again. We have not observed this dynamic occurring in reaches with abundant large prey items, because presumably there is enough diversity of prey that the large Brown Trout do not exert as much predation pressure on their own species.

The 2020 survey produced a quality trout estimate that did not follow the prediction that this cycle suggested (Figure 6). Based on the weak Age-1 classes of 2017 and 2018, we expected a decline in quality trout, which was also predicted by the downward phase in the cycle described above. However, this estimate increased. We believe it is possible that this reach received some large fish that emigrated downstream during the draining of Windy Gap Reservoir upstream of this site in late 2019. We have collected other data in support of this hypothesis, including finding lower than expected numbers of fish in the Colorado River upstream of Windy Gap in 2020.

We will continue surveying this reach annually and anticipate an increase in Rainbow Trout due to the resumption of stocking in 2020. We plan to stock again in 2021.

Figure 8. The largest brown captured in 2014. 21”, 4.6 lbs.

Figure 9. This Brown Trout in 2012 had recently eaten a smaller Brown Trout.

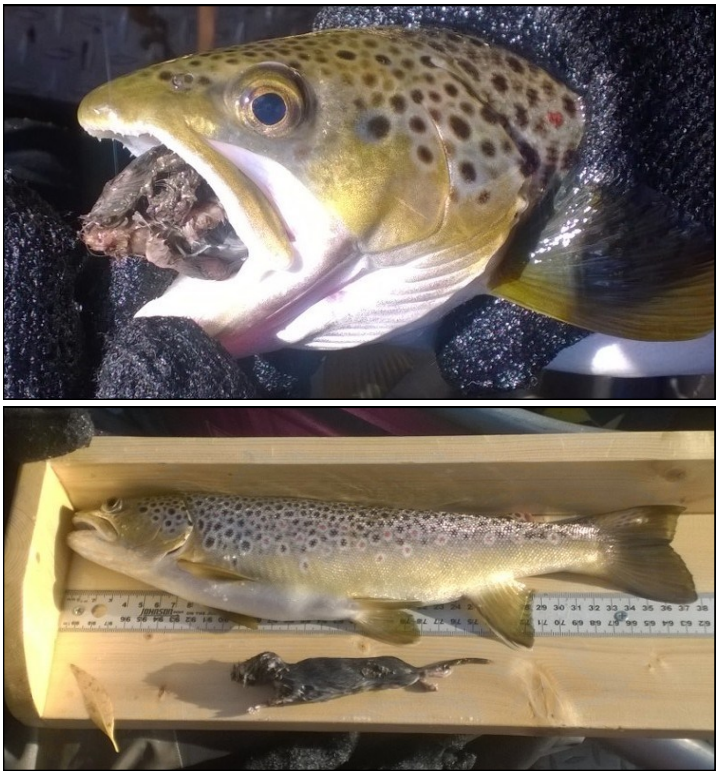

Figure 10. This 15” Brown Trout had recently eaten a rodent.

Status of wild Rainbow Trout

The Colorado River in Grand County historically supported one of the most productive wild rainbow trout fisheries in the world. In 1981, there were estimated to be 75 rainbow trout per acre over 14" (Figure 4). These fish were all the product of wild reproduction and unsupported by stocking. Brown trout comprised 25% of the trout population in the river that year. The proliferation of the whirling disease (WD) parasite ended virtually all successful Rainbow reproduction. In the following years, the Brown Trout population exploded to fill the habitat that was vacated due to the decline in the Rainbow population. It has always been the goal of CPW to restore some level of a wild Rainbow Trout fishery to this reach of the Colorado. Beginning in 1994, CPW began stocking fingerling Rainbows to attempt to compensate for the lost natural reproduction. Rainbow Trout mortality from whirling disease drops dramatically when the fish have reached a length of 5". Based on this information, that is the size of fish that was stocked throughout the 2000's. Due to the timing of Rainbow spawn in CPW hatcheries, fish of that size were not available until the fall, usually October. 40,000 5" fish per year were stocked annually in October in this reach of river. Even though 5" fish should be able to survive in the presence of WD, recruitment rates from stocking these fingerlings was abysmal, and Rainbow Trout continued to constitute a small fraction of the total trout population of this reach.

In recent years, CPW has developed strains of Rainbow Trout that are highly resistant to WD. We first stocked this strain in this reach in 2008. In 2008 and 2009, the fish were stocked at 5" in October. We did not observe any evidence that this strain was successful at recruiting into the population when stocked at that size.

In 2010, we adopted a different stocking strategy based on the hypothesis that the limitation on recruitment in the 5" plants was timing rather than WD infection. If this was

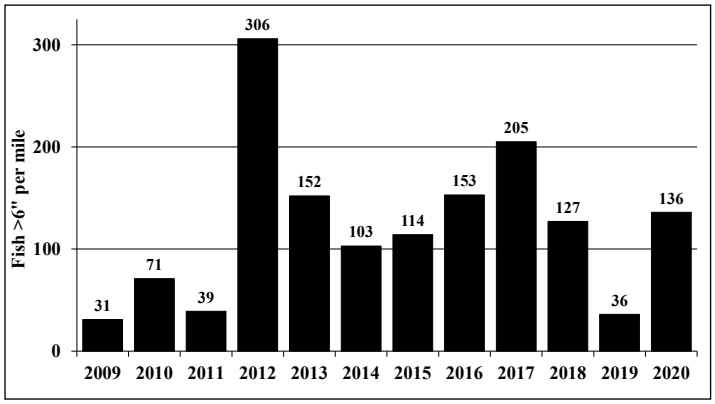

Figure 11. Estimates of rainbow trout >6" per mile, Parshall-Sunset 2009-2020.

Figure 12. This Parshall Hole Rainbow had recently eaten a 10" Brown Trout.

Figure 13. The largest rainbow we captured in 2018, measuring 22".

not the case we should have seen a positive response with the introduction of the WD-resistant strain in 2008. We stocked a larger number (60,000) of smaller (1.6 inches average) fish during the third week of July. We stocked these small fish out of a raft, only in the most ideal fry habitat. At this small size the fish are not habituated to being fed yet, and hopefully develop wild behaviors that are likely already lost in fish that have been raised to 5" in a hatchery. After encouraging results in 2010, in 2011 and 2012 we continued this stocking strategy and increased the number of fry stocked to 100,000.

Our 2012 survey detected the recruitment of these fish into the adult population for the first time (Figure 10). Subsequent surveys have not yielded estimates as high as 2012, but they have remained above pre-2012 levels. We have documented successful natural reproduction but it remains to be seen if it will be enough for the percentage of rainbows in the trout population to increase.

Due to a lack of availability, we did not stock in 2016-2019. This was an opportune time to cease stocking and evaluate whether or not natural reproduction would sustain and/or increase Rainbow numbers. The 8" age-1 year class seen in 2016, the 12" Age-2 group in 2017, and the robust 13"-17" adult group in 2018 represent the last stocked Rainbow fry from 2015. The 7-9" group in 2017 and 2018 are wild fish, and through fry monitoring we have observed some successful natural reproduction. However the numbers of juvenile fish we have observed in the past three years do not appear to be adequate to sustain or grow the Rainbow fishery. We stocked fry again in 2020. These fish are apparent in the 2-4" size range. We will continue to stock in the immediate future with the hope of continuing to increase Rainbow numbers.

Figure 14. Rainbow Trout fry on the raft ready to be stocked.

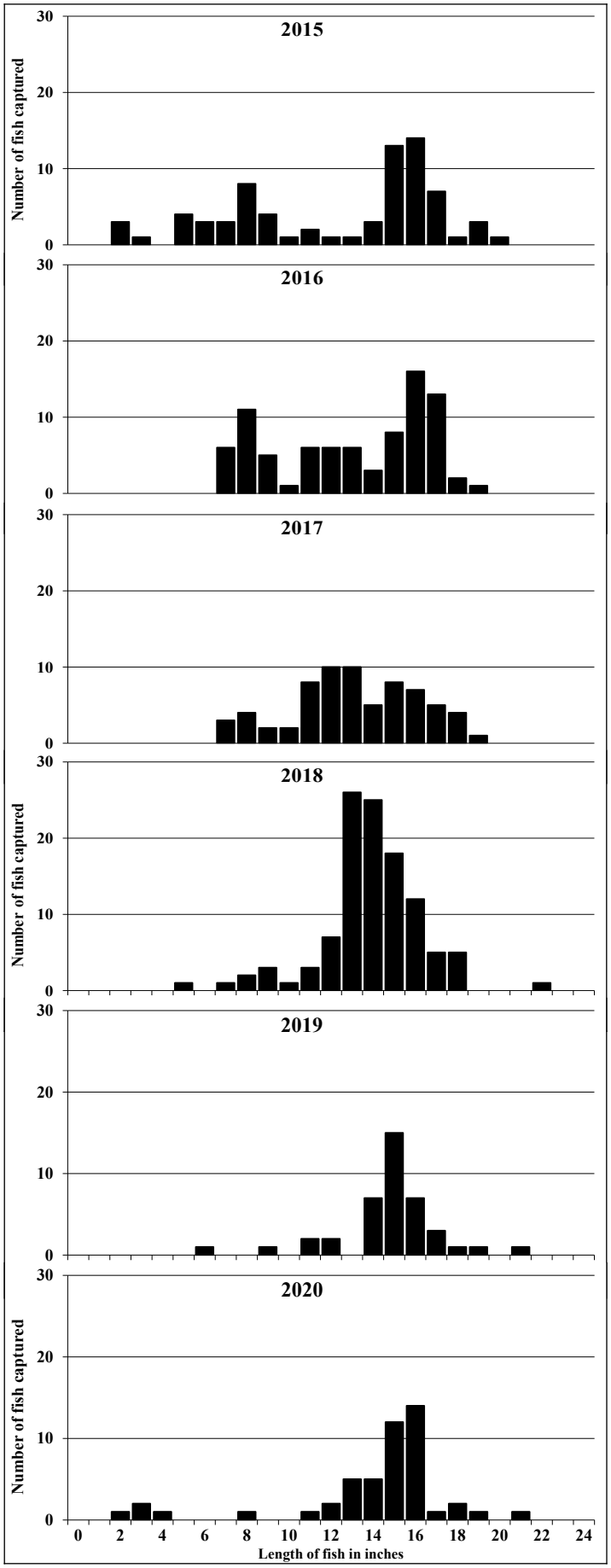

Figure 15. Size distribution of Rainbow Trout captured on the Parshall-Sunset reach, 2015-2020.

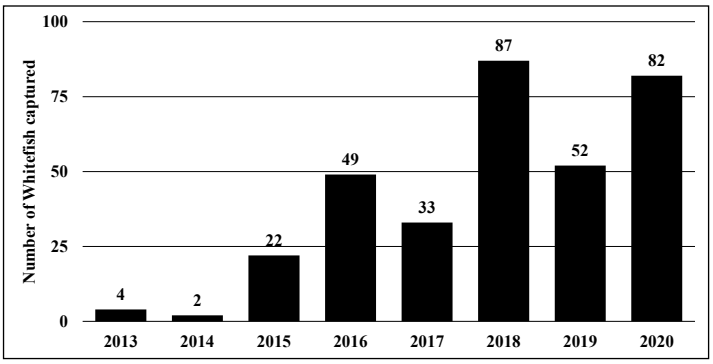

Figure 16. Number of Mountain Whitefish captured in electrofishing surveys of the Parshall-Sunset reach, 2013-2020.

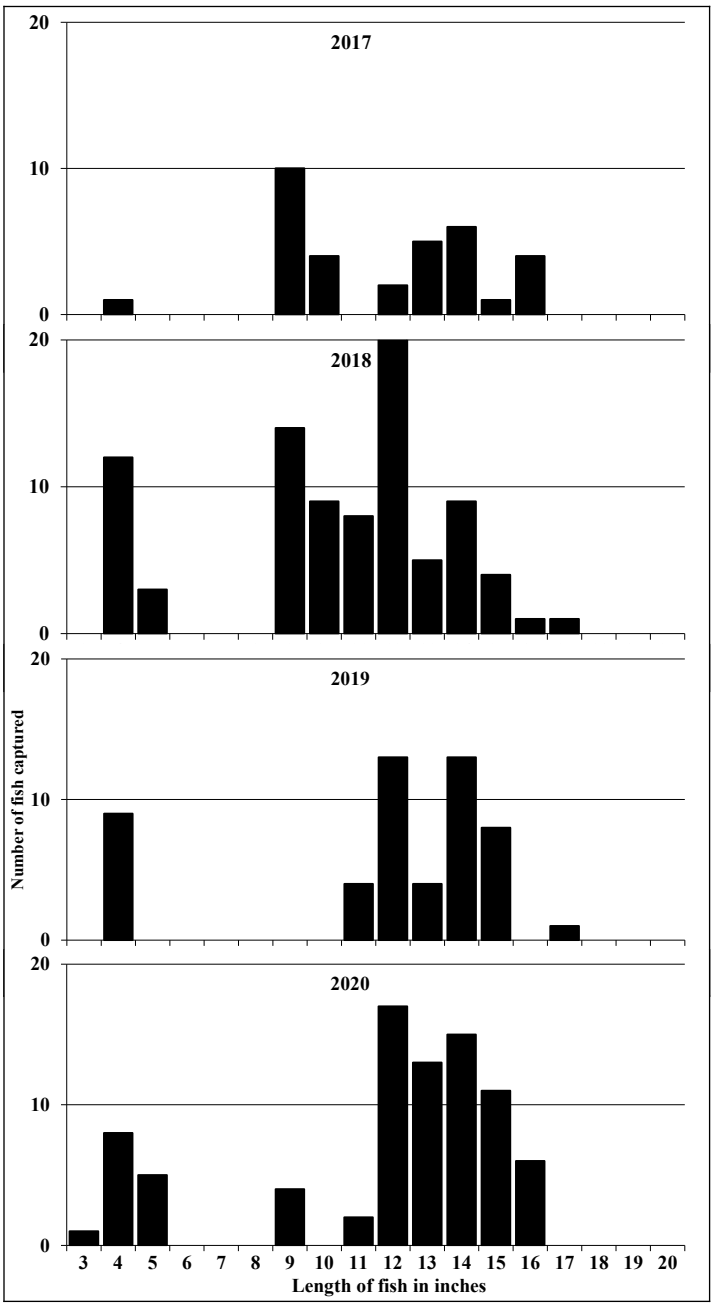

Figure 17. Size distribution of Mountain Whitefish captured in the Parshall-Sunset reach, 2018-2020.

Mountain Whitefish invasion

In 2013, we collected four juvenile Mountain Whitefish on this reach for the first time. This species had never been captured on this reach of river in a history of biological survey work that extends back to 1981. There are no known historical records of the species occurring anywhere in Middle Park upstream of Gore Canyon. Mountain Whitefish are native to the White and Yampa river drainages but not to the Colorado. There is an established population in the Colorado downstream of Gore Canyon.

The number of Whitefish that we have captured since 2013 has generally increased (Figure 16). We have seen evidence of successful natural reproduction, but there are some missing year-classes (Figure 17), so the rate of increase appears to be moderate at this time.

In other surveys, we have also captured whitefish as far upstream as Windy Gap dam. These findings suggest that we are witnessing the beginning of a significant invasion of the species into the upper Colorado. The reasons that this is occurring now are unknown. 2011 saw the highest flows on the Colorado River since the early 1980's, and our current theory is that the prolonged high flows during that summer allowed adult whitefish to find their way through Gore Canyon for the first time.

Impacts of mountain whitefish on the trout fishery are unknown at this time. There are ways in which they might benefit the fishery (for example, providing an additional prey source for large, predatory Brown Trout), but they may also present new competition with trout for food and habitat. Catch-and-release regulations on this reach apply to trout only, so these fish are available for angler harvest. We will closely monitor this invasion over the coming years and continually assess whether or not any management changes are warranted.

Figure 18. Mountain whitefish captured in the Parshall Hole.

Paul Gilbert—Lone Buck

In the spring of 2013, 2016, and 2019, we conducted raft electrofishing surveys of the Colorado River beginning just downstream of the Byers Canyon bridge and extending to the downstream border of the Lone Buck SWA. This encompassed a river reach of approximately 7,000 feet in length. The main reason for these surveys was to determine the number of spawning Rainbow Trout in this reach, which contains locations where Rainbows were known to spawn historically.

In 2016, we captured one 16" Mountain Whitefish. At that time this was the farthest-upstream location that we had captured a whitefish. The following month we captured two more upstream of Hot Sulphur Springs, indicating that they are present in the river up to Windy Gap dam.

The 2019 survey confirmed the trend of declining Rainbow Trout numbers that we have also seen on the Parshall-Sunset reach. We captured 10 Rainbows larger than 14" in that survey but no recaptures. Therefore we could not generate a population estimate of quality-sized Rainbow Trout. This section was also stocked in 2020.

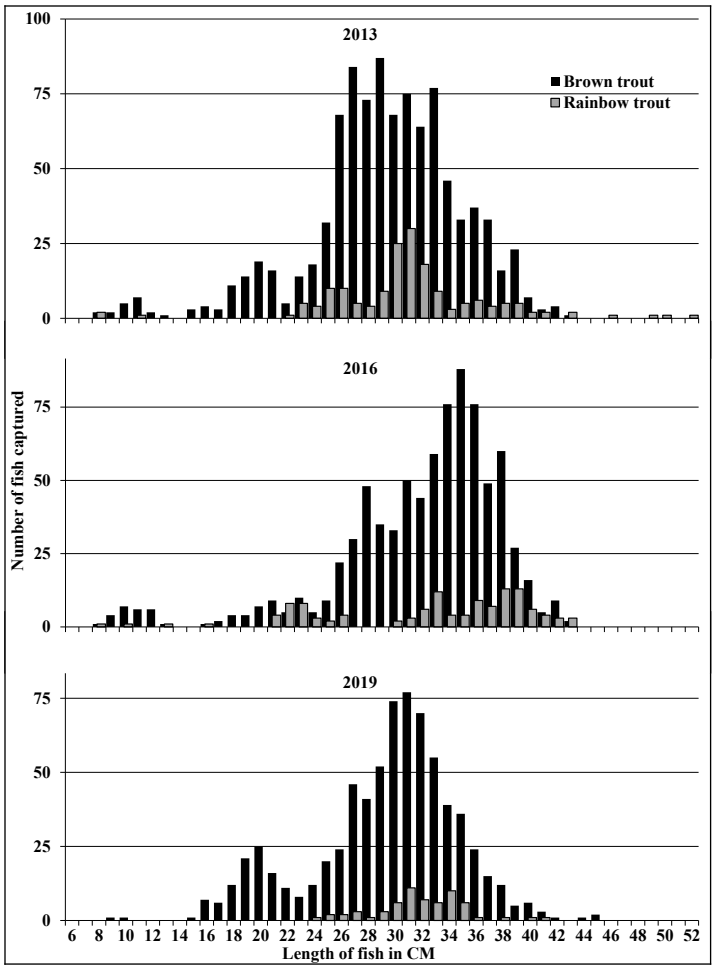

Figure 19. Size distribution of Brown and Rainbow Trout captured in the three surveys of the Paul Gilbert-Lone Buck reach.

Figure 20. Location of Paul Gilbert-Lone Buck survey station near Hot Sulphur Springs. Flow is right to left. Upstream and downstream ends of the station are indicated by white lines. The US Highway 40 bridge at Byers Canyon is at upper right.

Figure 20. A whirling disease-resistant Rainbow from the Lone Buck reach.

Table 1. Population estimates from the Gilbert-Lone Buck reach.

	2013	2016	2019
Date of survey	5/6 & 8	4/19 & 21	5/7 & 9
Rainbows:			
#> 6"/mile	214	182	124
#>14"/surface acre	5	6	-
Biomass (lbs./acre)	13	13	7
Browns:			
#> 6"/mile	1,537	1,178	2,180
#>14"/acre	11	28	12
Biomass (lbs./acre)	74	132	100