

# UPPER COLORADO RIVER ENDANGERED FISH RECOVERY PROGRAM

FY 2022 ANNUAL REPORT

PROJECT: 110

## **Project Title**

Smallmouth Bass Control in the Lower Yampa River

## **Bureau of Reclamation Agreement Number:**

R20PG00024

## **Project/Grant Period:**

Start date: 10/1/2019

End date: 9/30/2024

Reporting period end date: 9/30/2022

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

## **Principal Investigators:**

Christian Smith, Supervisory Biologist

U.S. Fish and Wildlife Service

Utah FAC Complex

Green River Basin Fish and Wildlife Conservation Office

1380 S. 2350 W.

Vernal, UT 84078

Phone: (435) 789-0351

Fax: (435) 789-4805

Email: [christian\\_t\\_smith@fws.gov](mailto:christian_t_smith@fws.gov)

## **Abstract:**

Green River Basin Fish and Wildlife Conservation Office completed four Smallmouth Bass removal passes in the lower Yampa River (Colorado) in 2022, removing 4,728 Smallmouth Bass. This total consists of 66 fewer bass than last year when we removed 4,794 individuals. The majority of bass (87.2%) captured in 2022 were < 200 mm in length, most of which were likely spawned in 2020, and the catch rate for Smallmouth Bass  $\geq 100$  mm was the highest recorded since this project's inception. We also sampled reaches established to monitor fish community composition in addition to targeted Smallmouth Bass removal. Smallmouth Bass were the most abundant species for the first year since fish community monitoring began in this project in 2002, another indication of Smallmouth Bass expansion in Yampa Canyon within the past three years.

## **Study Schedule:**

2004-Ongoing

## **Relationship to RIPRAP:**

Green River Action Plan: Yampa River

III.B.2. Control nonnative fishes via mechanical removal

III.B.2.e. Remove Smallmouth Bass

III.B.2.d. Remove Northern Pike from Yampa River designated critical habitat

III.B.2.f. Control Channel Catfish in Yampa Canyon

## **Accomplishment of FY 2022 Tasks and Deliverables, Discussion of Initial Findings and Shortcomings:**

### Nonnative Fish Removal

Green River Basin Fish and Wildlife Conservation Office (GRB FWCO) completed four electrofishing passes encompassing 127.9 hours of effort in the lower Yampa River from June 6 to July 1 2022. During this period, daily average streamflow ranged from 8,461 cfs to 1,613 cfs (Figure 1), and mean daily water temperature ranged from 14.7°C to 21.3°C (Figure 2). Although water temperature exceeded 16°C on June 6, it dropped below this threshold when Smallmouth Bass *Micropterus dolomieu* (SMB; bass) spawning is likely to commence from June 14-16. This was likely the result of rain during this 3-day period. We began noting ripe bass on the first pass; however, most (80.4%) of the adults captured were not ripe. Of those noted as expressing gametes, 84 were females and 35 were males.

We removed 4,728 SMB, including 559 juvenile fish (<100mm total length [TL]), 3,562 sub-adults (100-199 mm TL), and 607 adults ( $\geq$ 200mm TL) (Table 1). Most of the sub-adult SMB removed this year likely hatched during the dry year of 2020. Although we removed more bass from Yampa Canyon in 2021 than in any year on record, only 66 less were removed in 2022. The overall mean TL of these fish was 156.5 mm (Standard Error =  $\pm$ 0.75 mm).

The overall SMB catch per unit effort (CPUE; catch rate) in 2022 was 37 bass/hr. Using CPUE for bass  $\geq$ 100 mm TL as the annual metric as in past reports, 2022 produced the highest catch rate on record (32.6 bass/electrofishing hr) and doubled the 2021 CPUE (Figure 3). This catch rate was driven by sub-adult bass (CPUE= 27.8 fish/hr; Figure 4) and less influenced by adult SMB than last year's CPUE (Smith and Lawry 2021). Catch rates peaked in pass 4 (Figure 5), and were again, dominated by sub-adult bass (n = 1,685; Table 2).

Within a spatial context, sub-adult SMB catch rates peaked (CPUE= 51.5 bass/hr) midway through Yampa Canyon (RM 24.5-19.7) and were very high (CPUE  $>$ 30 bass/hr) in 6 out of 10 removal reaches (Figure 6). Juvenile catch rates were highest (CPUE= 7.1 bass/hr) in the upstream reach (RM 46.5-40.9) and adult CPUE peaked at 7.2 bass/hr in reach 8 (RM 14.9-10.1).

Length frequency in 2022 displays a unimodal distribution and like catch rates, is dominated by sub-adult SMB (Figure 7). This size class is likely comprised of bass produced in 2020 that were well represented as juvenile (<100 mm TL) SMB in 2021 (Figures 8a and 8b).

Several other nonnative fish species were collected over the course of the four passes, including Channel Catfish *Ictalurus punctatus*, Green Sunfish *Lepomis cyanellus*, Northern Pike *Esox lucius*, Walleye *Sander vitreus*, White Sucker *Catostomus commersonii*, and White Sucker hybrids (Table 3). A component of this project is to remove Channel Catfish  $>$ 400mm. We removed 23 Channel Catfish meeting this size threshold in 2022. We also captured 12 Northern Pike, and all but one were  $\geq$  450 mm TL. Northern Pike were caught in 6 of 10 removal reaches and at least one pike was caught per pass. The Walleye (n=2) captured in 2022 were the first of this species removed from Yampa Canyon since 2019.

## UPPER COLORADO RIVER ENDANGERED FISH RECOVERY PROGRAM

### Sampling for Fish Community Composition

We sampled five, one-mile sub-reaches during pass 4 (June 28-July 1) to monitor fish community species composition. These reaches were established in 2002 to assess the overall fish community response to nonnative fish removal, and were chosen specifically based on previous capture locations of Humpback Chub *Gila cypha* (Fuller and Modde 2002). Unlike in all previous years, native suckers (Flannelmouth Sucker *C. latipinnis* and Bluehead Sucker *C. discobolus*) were outnumbered by Smallmouth Bass (Figure 9). In addition, the SMB catch rate increased dramatically in 2022 (Figure 10). Other species captured, in decreasing abundance, were White Sucker, Channel Catfish, Roundtail Chub *Gila robusta*, Brown Trout *Salmo trutta*, Green Sunfish, Northern Pike, Mottled Sculpin *Cottus bairdii*, White Sucker x Flannelmouth Sucker *C. commersoni* x *C. latipinnis* and Mountain Whitefish *Prosopium williamsoni* (Tables 3 and 4; Figure 9). The proportion of SMB captured within monitoring reaches was higher than Roundtail Chub in 2020-2022 (Figure 11). This was not the case between 2015 and 2019 and another indication of SMB expansion in Yampa Canyon within the past three years. Furthermore, bass outnumbered Roundtail Chub by a factor of 20:1 in 2022.

We encountered 16 Colorado Pikeminnow this year. Thirteen of the Pikeminnow were recaptures that already had PIT tags, but no old frequency tags (400 kHz) were detected. All but one of these fish were caught in the lower 16-miles of Yampa Canyon. Only two pikeminnow were noted as being ripe upon capture, yet 11 were noted as being tuberculate, which suggests that our electrofishing effort occurred prior to spawning.

### Roundtail Chub Monitoring

Roundtail Chub marking was conducted during the initial pass (June 6-9) when flows ranged between 6,030 cfs to 7,680 cfs (USGS gauge # 9260050 located at Deerlodge Park, CO). Using a similar strategy first employed in 2021 but with reduced effort, all *Gila* species >120 mm TL captured in our fish community monitoring reaches (n= 13) were PIT-tagged during the marking pass. We also processed all Roundtail Chub encountered in the same reaches in subsequent passes. Between all 4 passes, 46 Roundtail Chub were captured, consisting of 41 adults ( $\geq 200$  mm TL) and 5 juveniles. We also recaptured 4 Roundtail Chub that were previously tagged, none of which were tagged during this year's marking pass.

### **Additional Noteworthy Observations:**

Despite the record CPUE for bass >100 mm TL and near-record number of SMB removed in 2022, we did not observe the same dominance of smaller (<100 mm TL) bass as in 2021. If runoff magnitude were the sole driver of SMB spawning success, we would expect to see 2022 juvenile catch rates as high as those produced in 2021. It seems possible that somewhat frequent rainstorm induced turbidity events in the Yampa River during the summer of 2021 inhibited growth and reduced survival of last year's SMB cohort.

New tools such as eDNA (Schumer et al. 2019, Sepulveda 2020, Shen et al. 2022) could be considered to benefit our endangered fish recovery efforts in Yampa Canyon. More specifically, eDNA has the potential to focus removal efforts for Smallmouth Bass by comparing eDNA concentrations to CPUE. Perhaps more importantly, eDNA could bolster this project's fish community monitoring component by detecting fish species not captured while electrofishing.

## UPPER COLORADO RIVER ENDANGERED FISH RECOVERY PROGRAM

### Recommendations:

1. Smallmouth Bass removal efforts in Yampa Canyon should continue to focus on the period when water temperatures are likely to initiate bass spawning ( $>16^{\circ}\text{C}$ ).
2. Increased catch rates and apparent bass densities over the past three years, combined with the prospect of Humpback Chub reintroduction in Yampa Canyon, warrant the reconsideration of allotting more resources to nonnative removal within this project in the future and/or supplementing with alternative methods.
3. During years with extended periods of high-water clarity and/or low flows in the Yampa River, angling could bolster Smallmouth Bass removal. Given the consistent increase in bass CPUE in recent years, alternative methods to raft electrofishing appear necessary to expand this project's potential for success.
4. Discuss whether Roundtail Chub PIT-tagging should continue as part of Project 110. Roundtail Chub marking will likely be a necessary component of future Humpback Chub monitoring efforts. However, the low Roundtail Chub recapture rates produced by this project to date warrant the examination of the utility of PIT-tagging efforts prior to Humpback Chub augmentation.
5. Continue fish community monitoring to characterize any changes in the overall species composition through time. This work has recently been used to make comparisons between fish communities in the regulated Lodore Canyon reach of the Green River and Yampa Canyon which is virtually unregulated. Our fish monitoring in the Yampa has also been useful in tracking native fish response to invasion by Smallmouth Bass and corresponding effects based on bass abundance.
6. If resources and funding are available in the future, consider expanding the scope of fish community monitoring and non-native species removal throughout Yampa Canyon and include small-bodied fish monitoring (seining) as well. This type of monitoring has been conducted on the Green River in the regulated Lodore Canyon and semi-regulated Whirlpool Canyon for years, yet our knowledge of the unregulated Yampa Canyon's fish community is much more limited.

**Project Status:** On track and ongoing.

### FY 2022 Budget Status

Funds Provided: \$91,737

Funds Expended: \$91,737

Difference: \$0

Percent of the FY 2022 work completed, and projected costs to complete: 100%, \$0

Recovery Program funds spent for publication charges: \$0

### Status of Data Submission

Data was submitted to the STReaMS database in October 2022.

### Science/Technical Reviewer:

Andrew A. Schultz Ph.D., USFWS, Utah FAC Complex Manager / Project Leader

[andrew\\_schultz@fws.gov](mailto:andrew_schultz@fws.gov)

### Signed:

Christian Smith, Principal Investigator

December 2 2022

## UPPER COLORADO RIVER ENDANGERED FISH RECOVERY PROGRAM

### References

Fuller, M. and T. Modde. 2002. Development of a Channel Catfish control program in the lower Yampa River. Project #110. Annual report to the Recovery Implementation Program, U.S. Fish and Wildlife Service, Denver, CO.

Jones, M.T. 2017. Smallmouth Bass control in the lower Yampa River. Annual Report to the Upper Colorado River Endangered Fish Recovery Program. Denver, CO.

Jones, M.T. and C. Smith. 2018. Smallmouth Bass control in the lower Yampa River. Annual Report to the Upper Colorado River Endangered Fish Recovery Program. Denver, CO.

Schumer, G., Crowley, K., Maltz, E., Johnston, M., Anders, P. and Blankenship, S., 2019. Utilizing environmental DNA for fish eradication effectiveness monitoring in streams. *Biological Invasions*, 21(11), pp.3415-3426.

Sepulveda, A.J., Nelson, N.M., Jerde, C.L. and Luikart, G., 2020. Are environmental DNA methods ready for aquatic invasive species management?. *Trends in ecology & evolution*, 35(8), pp.668-678

Shen, Mei., Ningning, G., Zunlan, L., Xiaochen, G., Guang, S. and Xiao, N. 2022. Explore the distribution and influencing factors of fish in major rivers in Beijing with eDNA metabarcoding technology. *Biodiversity Science*, 30(7), p.22240.

Smith, C. 2019. Smallmouth Bass control in the lower Yampa River. Annual Report to the Upper Colorado River Endangered Fish Recovery Program. Denver, CO.

Smith, C. 2020. Smallmouth Bass control in the lower Yampa River. Annual Report to the Upper Colorado River Endangered Fish Recovery Program. Denver, CO.

Smith, C. and K. Lawry. 2021. Smallmouth Bass control in the lower Yampa River. Annual Report to the Upper Colorado River Endangered Fish Recovery Program. Denver, CO.

UPPER COLORADO RIVER ENDANGERED FISH RECOVERY PROGRAM

**Table 1. SM encounters and CPUE in Yampa Canyon by period.**

Season	Juveniles	Sub-adults	Adults	Juveniles/hour	Sub-adults/hour	Adults/hour
Early Summer	559	3,562	607	4.37	27.84	4.74

**Table 2. Electrofishing removal passes and Smallmouth Bass captured by size class in Yampa Canyon 2022.**

Pass	Date	Juvenile	Sub-Adult	Adult
1	June 6-9	59	760	154
2	June 14-17	64	462	72
3	June 21-24	104	655	112
4	June 28-July 1	332	1,685	269
Total		559	3,562	607

**Table 3. Nonnative fish species captured in Yampa Canyon, 2022**

Common Name	Number of Fish	Median Length	Length Range
White Sucker	1,029	195.0	68 - 488
Channel Catfish	74	351.0	282 - 555
Brown Trout	18	173.5	130 - 408
Northern Pike	12	651.0	392 - 771
Flannelmouth Sucker x White Sucker	11	351.0	127 - 436
Green Sunfish	8	136.0	118 - 145
Walleye	2	548.0	476 - 620
Bluehead Sucker x White Sucker	1	142.0	142 - 142

UPPER COLORADO RIVER ENDANGERED FISH RECOVERY PROGRAM

**Table 4. Native fish species captured in Yampa Canyon in 2022.**

Common Name	Number of Fish	Median Length	Length Range
Flannelmouth Sucker	217	301	80 - 464
Bluehead Sucker	135	280	135 - 416
Roundtail Chub	45	290	150 - 486
Colorado Pikeminnow	18	642	474 - 865
Bluehead Sucker x Flannelmouth Sucker	1	196	196 - 196
Mottled Sculpin	3	72	61 - 93
Mountain Whitefish	1	210	210 - 210

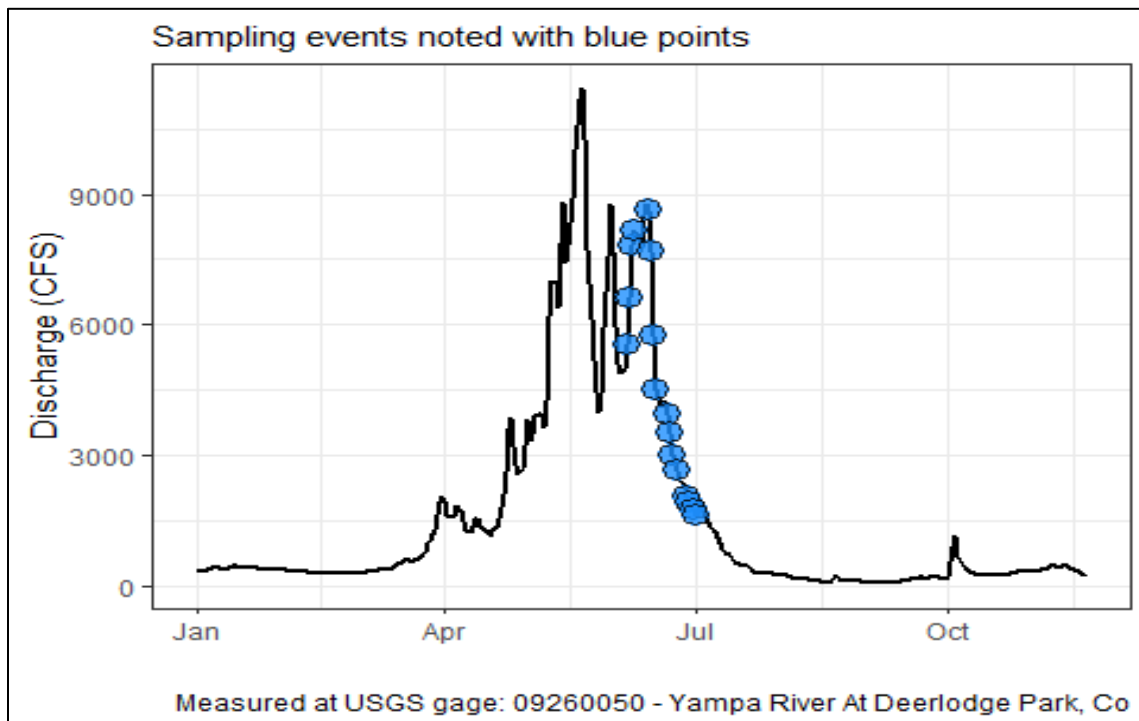


Figure 1. Sampling events and discharge on the Yampa River through the 2022 field season.

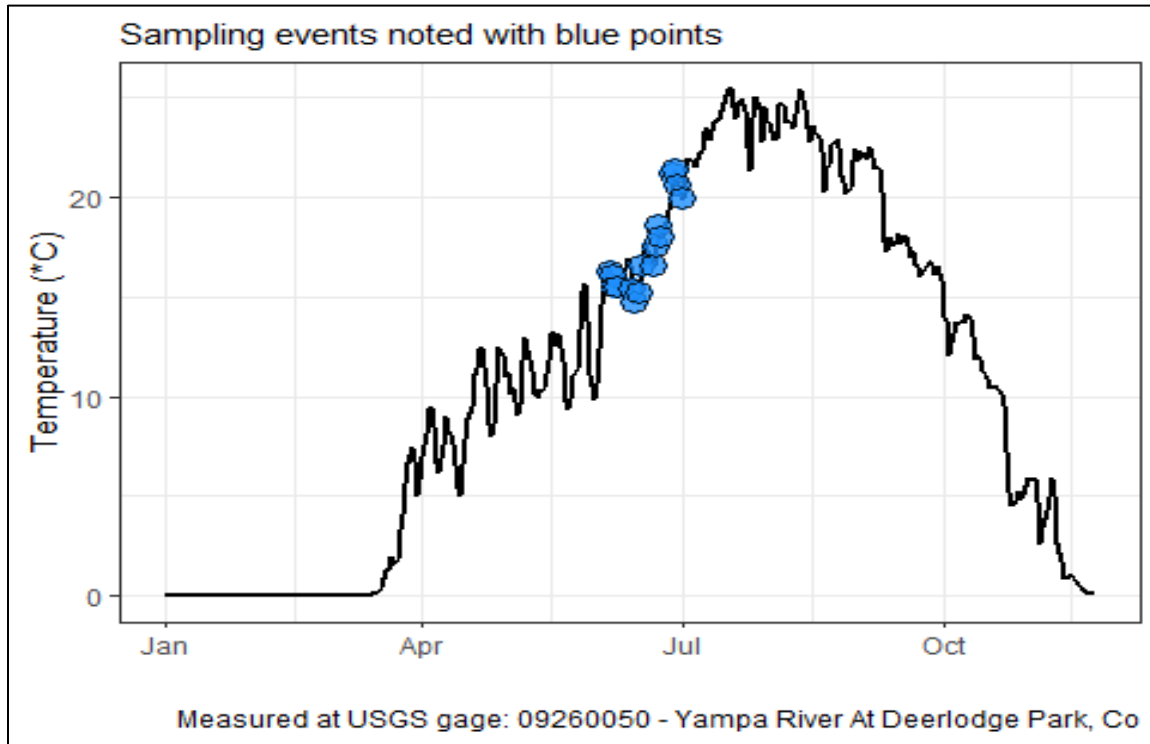


Figure 2. Sampling events and temperatures on the Yampa River through the 2022 field season.

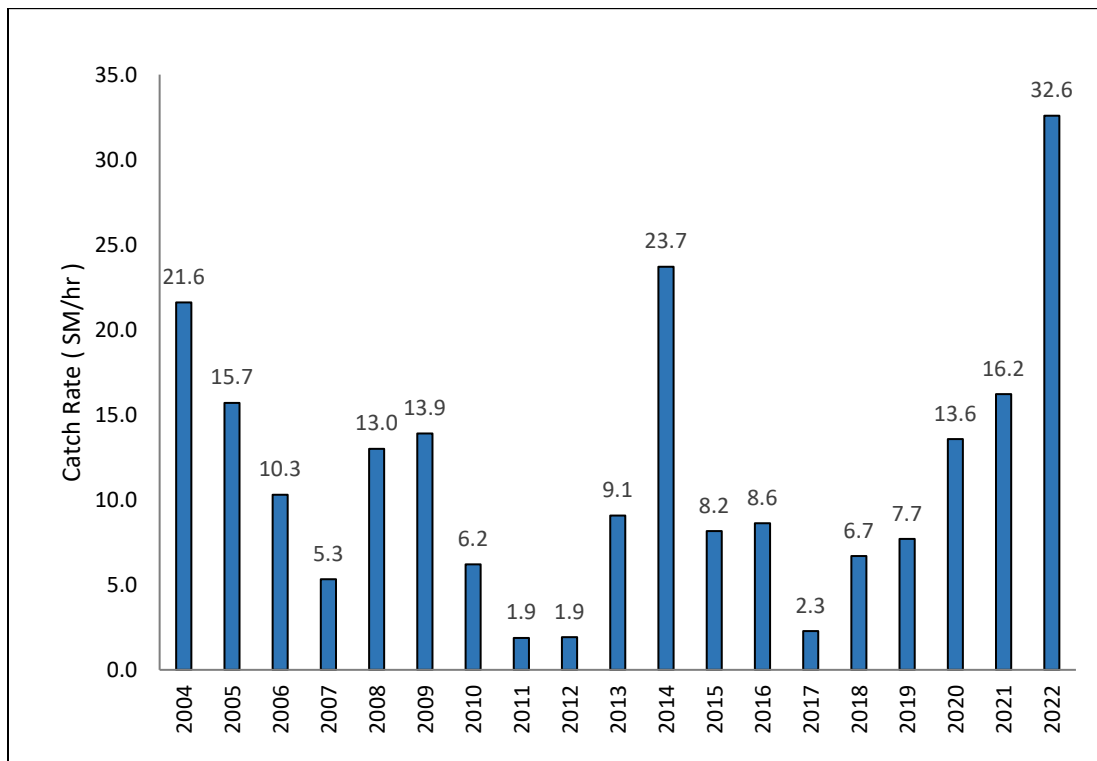


Figure 3. Electrofishing catch rates for Smallmouth Bass  $\geq 100\text{mm}$  in Yampa Canyon,



2004-2022.

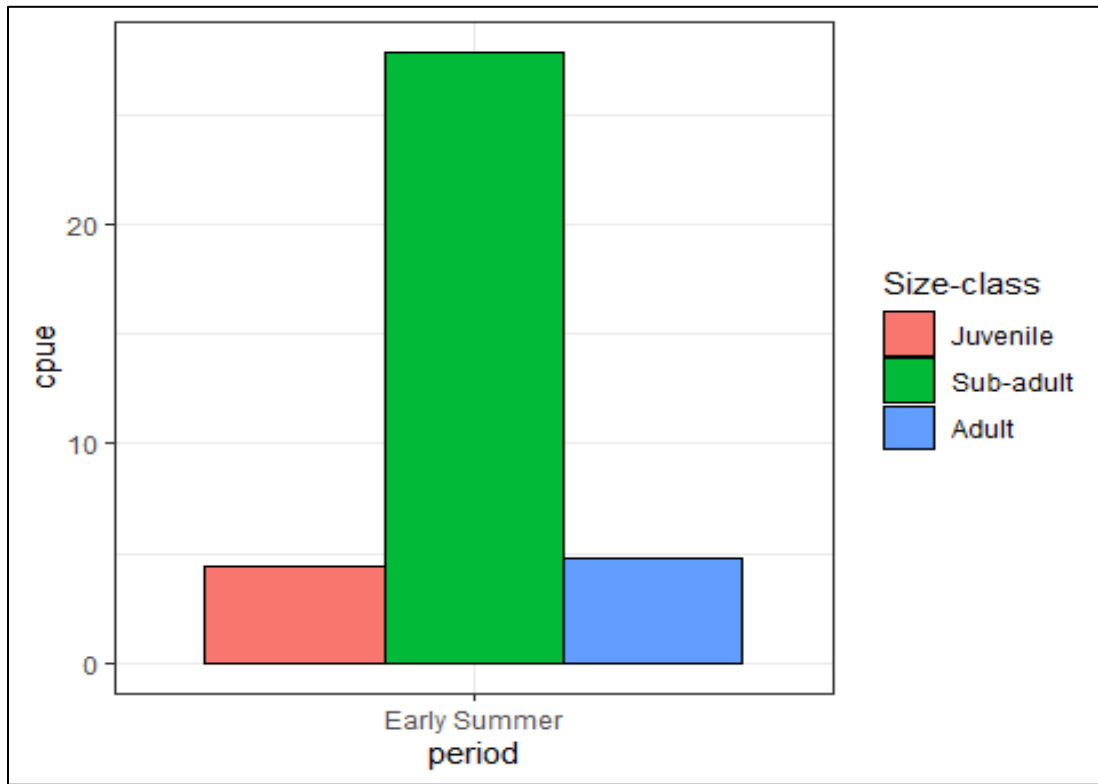


Figure 4. Smallmouth Bass CPUE by period during 2022 within Yampa Canyon.

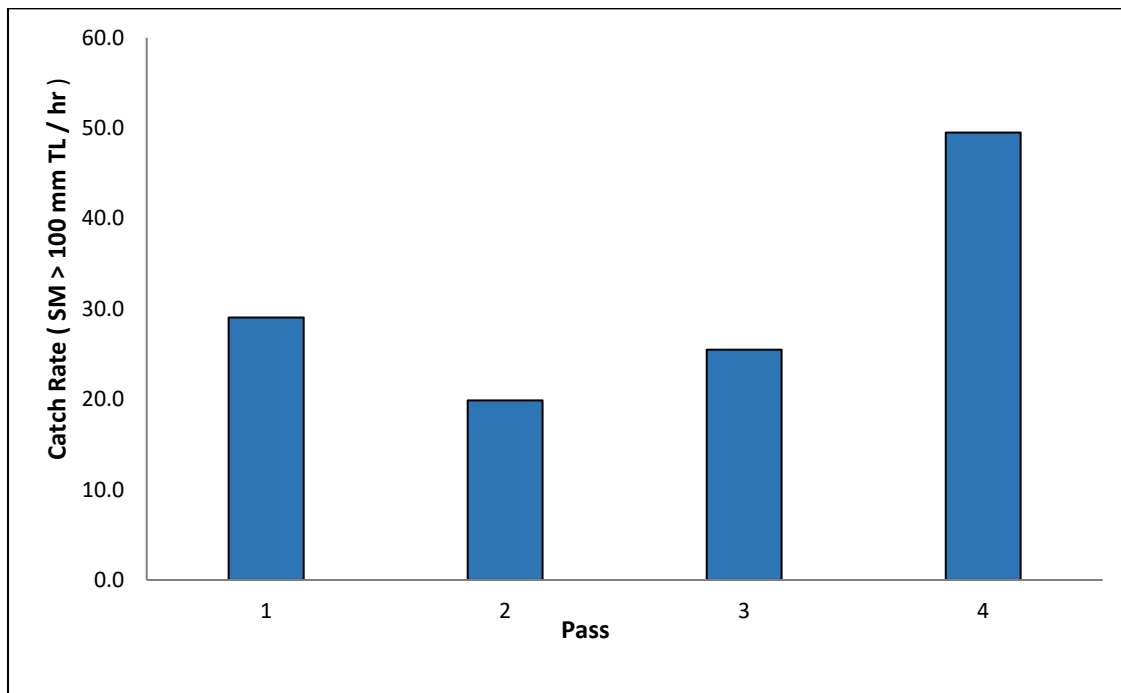


Figure 5. Electrofishing catch rates of Smallmouth Bass  $\geq 100$ mm TL in Yampa Canyon

by pass, 2022.

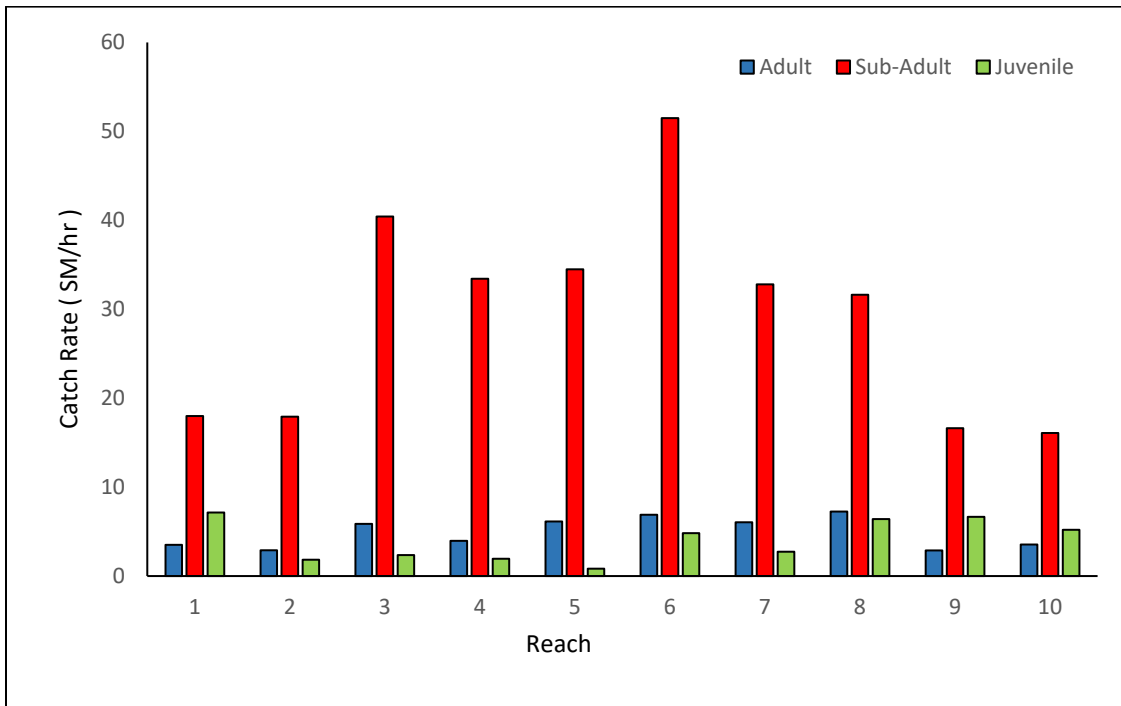
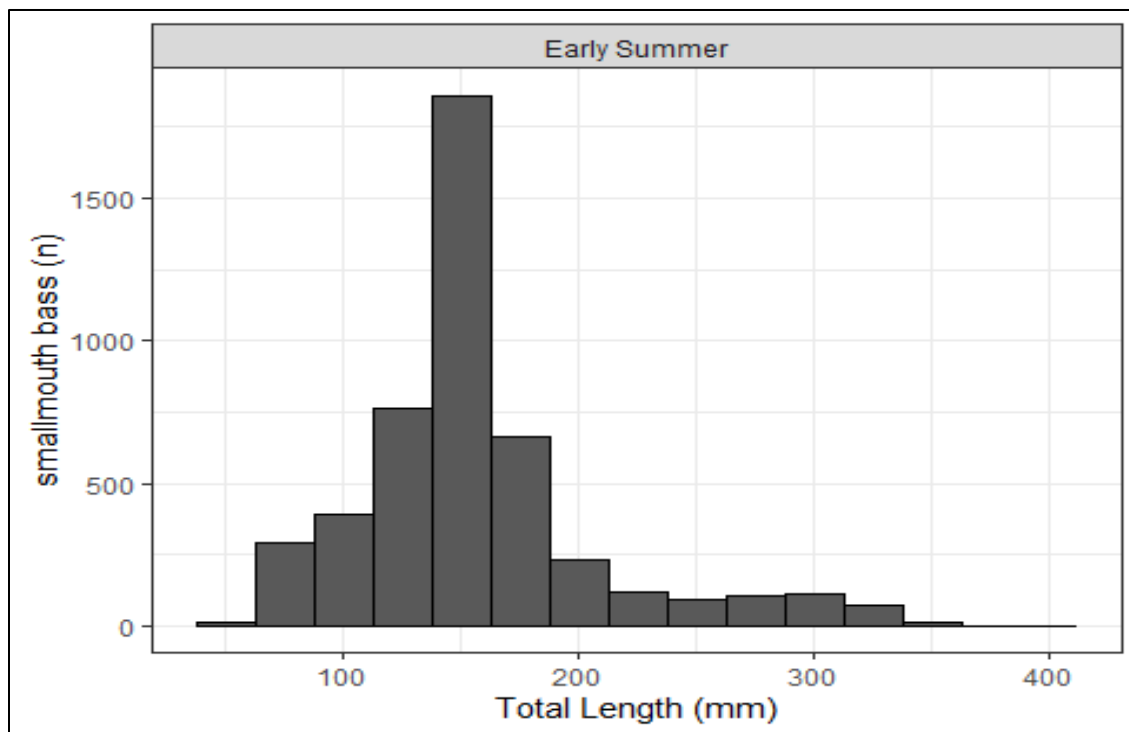
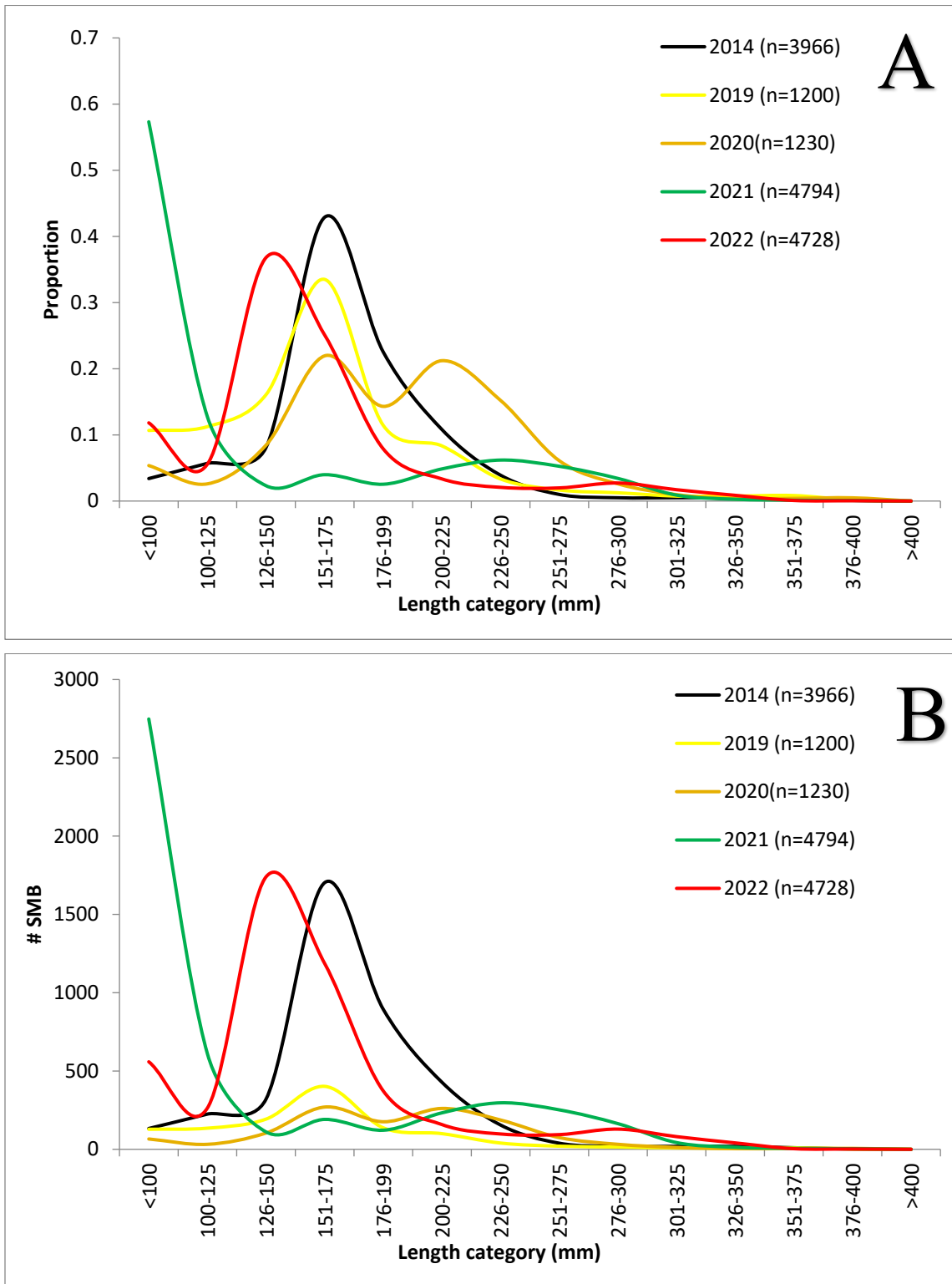


Figure 6. Electrofishing catch rates for different size classes of Smallmouth Bass in Yampa-Canyon by reach, 2022.



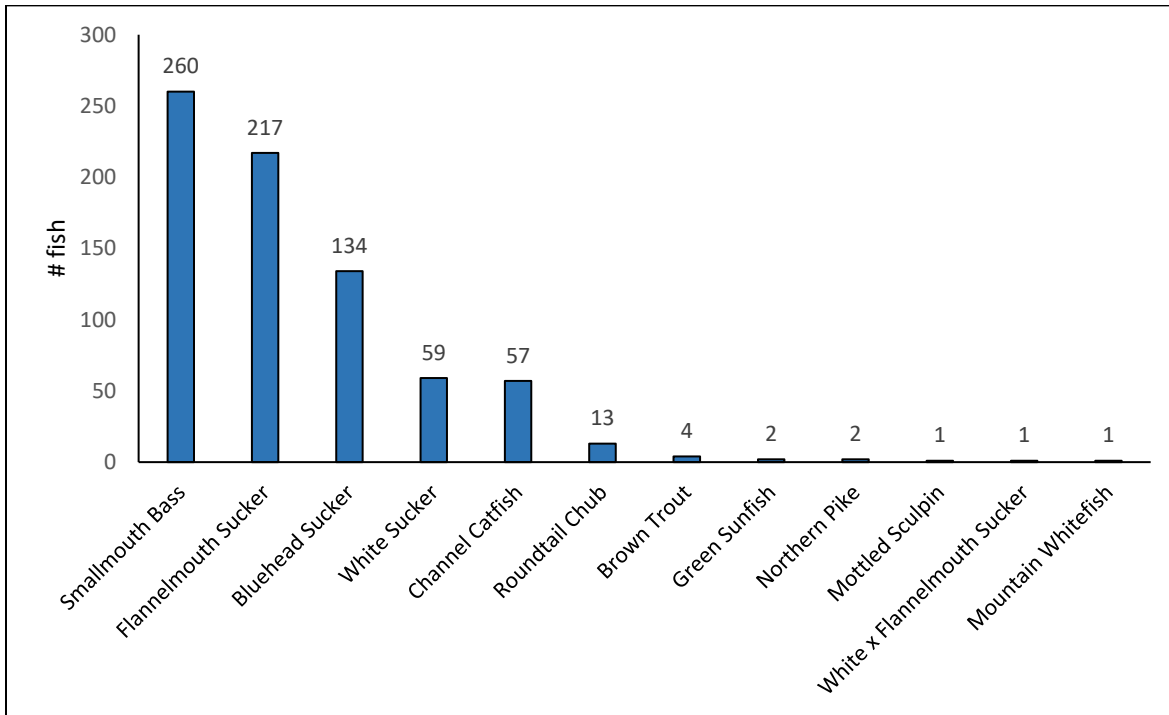
UPPER COLORADO RIVER ENDANGERED FISH RECOVERY PROGRAM

**Figure 7. Length frequency histogram for Smallmouth Bass encountered in Yampa Canyon in 2022.**

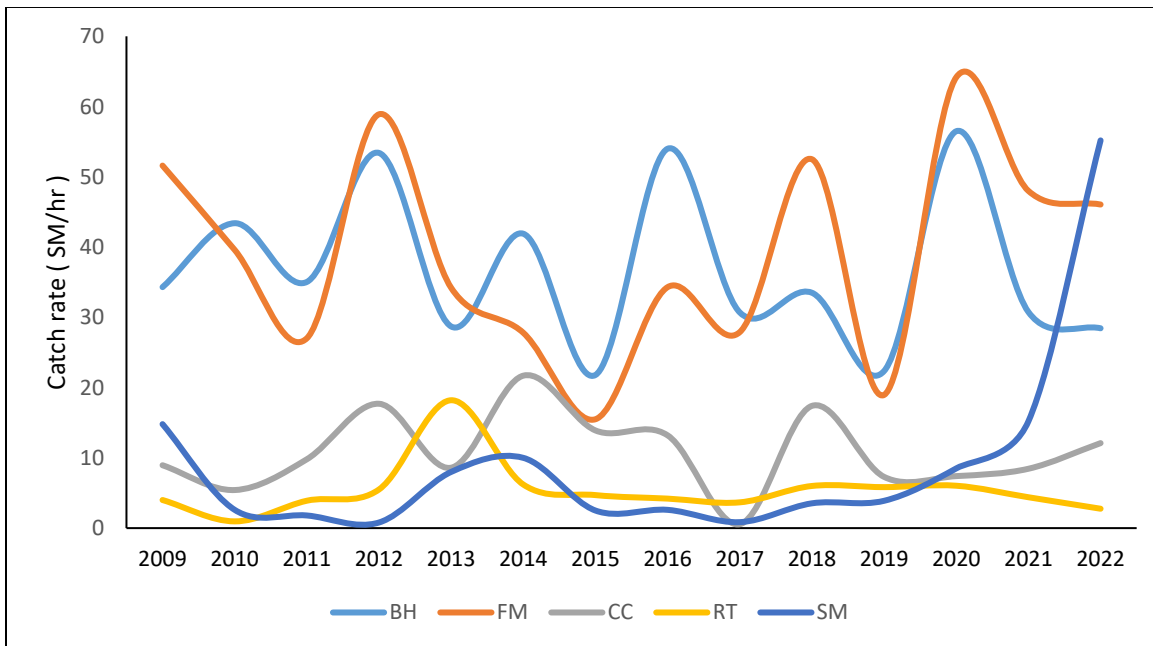


UPPER COLORADO RIVER ENDANGERED FISH RECOVERY PROGRAM

**Figures 8a-b. Length-frequencies for Smallmouth Bass captured in Yampa Canyon in 2014 and 2019-2022.** Figure 5a shows percent fish caught in each size range, as a proportion of total catch each year, and Figure 5b shows total numbers of fish caught in each size range.

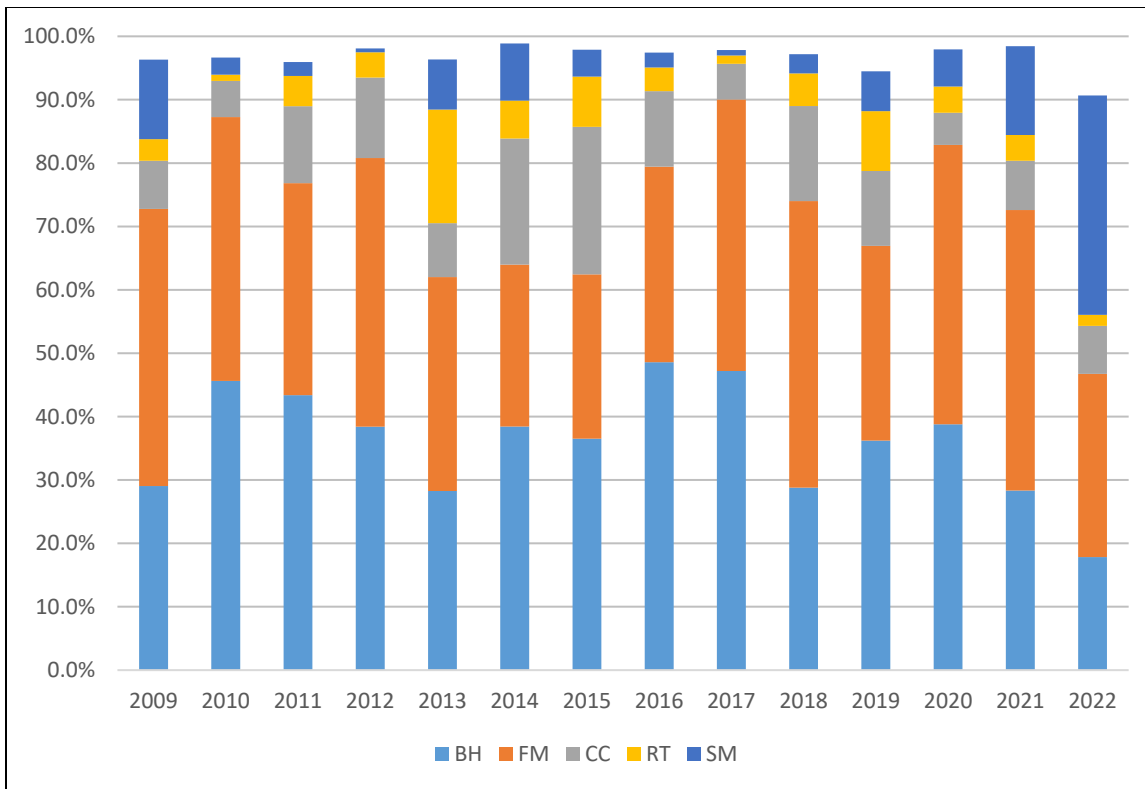


**Figure 9. Total species composition for five, 1-mile monitoring reaches in Yampa Canyon 2022 using electrofishing.**



**Figure 10. Electrofishing catch rates of five most common species found in 1-mile monitoring reaches in Yampa Canyon, 2009-2022. Species codes are BH (Bluehead Sucker), FM (Flannemouth Sucker), CC (Channel Catfish), RT (Roundtail Chub), and SM (Smallmouth Bass).**

UPPER COLORADO RIVER ENDANGERED FISH RECOVERY PROGRAM



**Figure 11. Percent electrofishing catch of five most common species encountered in annual fish community monitoring reaches in Yampa Canyon, 2009-2022. Species codes are BH (Bluehead Sucker), FM (Flannelmouth Sucker), CC (Channel Catfish), RT (Roundtail Chub), and SM (Smallmouth Bass).**