

UPPER COLORADO RIVER ENDANGERED FISH RECOVERY PROGRAM

FY 2023 ANNUAL REPORT

PROJECT: 128

Project Title:

Abundance estimates for Colorado Pikeminnow in the Green River Basin, Utah and Colorado

Bureau of Reclamation Agreement Number:

R14AP00001

Project/Grant Period:

Start date: 10/01/2018

End date: 09/30/2023

Reporting period end date: 09/30/2023

Is this the final report? No

Principal Investigator:

Kevin Bestgen (Lead), Donald Tuttle

Larval Fish Laboratory

Department of Fish, Wildlife, and Conservation Biology

Colorado State University

Ft. Collins, CO 80523

voice: KRB (970) 491-1848

fax: (970) 491-5091

email: kbestgen@colostate.edu,

Mike Partlow

Utah Division of Wildlife Resources

152 East 100 North

Vernal, UT 84078

voice: (435) 781-5315

fax: (435) 789-8343

email: MattBreen@Utah.gov

Christian Smith

USFWS

Green River Basin FWCO

1380 S. 2350 W.

Vernal, Utah 84078

Phone: (435) 789-0351

Email: Christian_T_Smith@fws.gov

Katie Creighton

Utah Division of Wildlife Resources

1165 So. Hwy 191, Ste 4

Moab, UT 84532

email: katherinecreighton@utah.gov

Abstract:

Sampling conducted during this project is designed to obtain capture-mark-recapture data needed to estimate abundance and vital rates of Colorado Pikeminnow *Ptychocheilus lucius* in the lower Yampa (exclusive of Yampa Canyon) and lower White rivers and the Green River

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downstream of the Yampa River confluence (Whirlpool and Split Mountain canyons excluded). Abundance estimates of endangered Colorado Pikeminnow are needed to better monitor population status and provide benchmarks against which progress toward recovery can be measured. This project segment was designed to have three years (2022-2024) of sampling followed by two years of data analysis and report writing; this follows a sampling hiatus of three years from 2019-2021. The design is essentially the same as that employed for sampling conducted from 2000-2003, 2006-2008, 2011-2013, and 2016-2018 in the same areas (Bestgen et al. 2005; Bestgen et al. 2010; Bestgen et al. 2018). Sampling during the most recent three-year period began in spring 2022, and will continue through 2024, with Colorado Parks and Wildlife and the Larval Fish Laboratory responsible for sampling the Yampa River, the U. S. Fish and Wildlife Service, Vernal, Utah, responsible for the reach of the Green River from downstream of the White River to Green River State Park in Green River, Utah, and the White River downstream of Kenney Reservoir, and the Utah Division of Wildlife Resources responsible for the Green River reaches from lower Whirlpool Canyon to downstream of the White River confluence and from Green River State Park downstream to the Colorado River. The Larval Fish Laboratory also provides coordination, data checking, and data analysis. Our primary goal was to capture, mark, and recapture as many Colorado Pikeminnow as possible on at least three different sampling occasions in each river reach. Sampling occurred before or during spring runoff and was finished before the Colorado Pikeminnow spawning migration. Electrofishing via raft or flat-bottomed boat was the primary sampling gear. Captured pikeminnow were scanned for the presence of a PIT tag, unmarked fish were marked, and all were released near the point of capture. This data will be used to obtain abundance estimates for each river reach if possible, noting captures and recaptures having been declining which makes abundance estimation more difficult.

Study Schedule:

Ongoing as needed, this segment is from 2022-2024.

Relationship to RIPRAP:

Green River:

V. Monitor populations and habitat and conduct research to support recovery actions (research, monitoring, and data management)

V.C. Conduct population estimate for Colorado Pikeminnow

Accomplishment of FY 2023 Tasks and Deliverables, Discussion of Initial Findings and Shortcomings:

Main objectives in FY 2023 were to finalize reporting of results from the 2016-2018 estimation period and conduct sampling for the next round of estimates. We have developed estimates for years 2016-2018 which were provided to the Recovery Program office. The final report is under construction and a draft is anticipated in late spring 2024.

Per 2023 sampling, we revised and used a Standard Operating Procedure (SOP) for field personnel for use during the Colorado Pikeminnow sampling season to ensure a consistent sampling approach and timely completion of tasks. The SOP reduced project and sampling complexity, which was due to the short duration of the sampling design each year, and also increased consistency among the five relatively autonomous units that completed this work. This was especially important for Green River crews, where

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large numbers of Razorback Sucker captured sometimes overwhelmed processing efforts and slowed the pace of sampling to the point that work could not be completed efficiently. Revised sampling strategies varied by sampling group and involved identifying river reaches, sometimes 1 out of every 10 river miles, where Razorback Suckers were netted and scanned for PIT tags while in other reaches, none were netted or scanned. This year we also provided a chase boat to the middle Green River crew to assist with Razorback Sucker sample workup. Excess fish were transferred to the chase boat for processing so Colorado Pikeminnow sampling could continue, which reduced the length of sampling days. This effort supplementation was only moderately successful due to the relatively few fish sampled in this high-water year. The chase boat may be more useful, if continued, when larger numbers of Razorback Sucker are captured. The overall goal of middle Green River Razorback Sucker sampling is to identify what type of sampling and fish capture is possible in the middle Green River, which will guide future sampling there and in other reaches.

During 2023, each field crew completed three sampling passes through the five Green River Basin reaches listed below to capture juvenile, sub-adult, and adult Colorado Pikeminnow:

- a) Green River between the confluence of the White River upstream to the lower end of Whirlpool Canyon (i.e., upper Rainbow Park, but not Split Mtn. Canyon).
- b) White River between its confluence with the Green River upstream to Taylor Draw Dam,
- c) Yampa River between Deerlodge Park and Craig, Colorado, excluding Cross Mountain Canyon,
- d) Green River from downstream of the White River confluence downstream to Green River State Park near Green River, Utah, and,
- e) Green River from Green River State Park near Green River, Utah, downstream to the confluence with the Colorado River.

In addition to the three standard sampling passes in all reaches, LFL and CPW attempted additional sampling passes in portions of the Yampa River, which were also associated with Smallmouth Bass *Micropterus dolomieu* and Northern Pike *Esox lucius* removal projects, which aids in obtaining a more precise and accurate Colorado Pikeminnow abundance estimate. Data were grouped under three passes for all reaches to accommodate the need for symmetrical capture histories among reaches.

2022-2023 results.--Specific results to report based on 2022-2023 sampling are below. The basic data for estimating abundance of various life stages of Colorado Pikeminnow are the numbers of unique individuals captured in various sampling passes and reaches among years. Based on the recapture rates of those same individuals, estimates of abundance can be developed. If recapture rates remain approximately the same over sampling years, the number of unique pikeminnow captured in each age class can also be used as a metric of abundance of Colorado Pikeminnow over time.

Number of unique captures for data collected through 2023 (Figure 1) have declined over time. For example, in 2001 when all reaches of the Green River basin were sampled, nearly 1,000 adult (≥ 450 mm TL) Colorado Pikeminnow were captured. Those numbers have declined steadily since that time and 2023 was the lowest level ever at 65 adult (≥ 450 mm TL) Colorado Pikeminnow captured. An additional two sub-adults (400-449 mm TL), and 31 juveniles (< 400 mm TL) were captured.

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Among reaches, no Colorado Pikeminnow were captured in the Yampa River, 14 were captured from the White River, 34 from the middle Green River, nine from the Desolation-Gray Canyon reach of the Green River, and 40 (not including fish too small to tag) were from the Lower Green River (Table 1). The low abundance of small fish in any reach was notable. A qualitative comparison of sampling effort in terms of electrofishing hours per pass during 2022 and 2023 compared to 2000-2003 (Bestgen et al. 2005; Bestgen et al. 2010; Bestgen et al. 2018) showed effort was similar, so low overall abundance of Colorado Pikeminnow in 2022-2023 is not likely to be an artifact of lower sampling effort.

Length frequency histograms showed the sizes of Colorado Pikeminnow and their abundance in each reach of the Green River basin in 2022 and 2023 (Figure 2 and 3). The 500-549 mm TL size group was the most abundant in the basin, followed by 550-599 mm TL. Most Colorado Pikeminnow captured < 450 mm TL were from the lower Green River but even those were infrequent.

The number of recaptures of fish among passes in a given year are the basis for abundance estimates, where greater numbers of recaptures reduce bias and increase precision of estimates. Only three individual adult Colorado Pikeminnow were recaptured among sampling passes completed in 2022; two were from the lower Green River and one was from the Desolation-Gray Canyon reach. Only a single adult was recaptured in 2023, and it was from the lower Green River. A single juvenile was recaptured twice in the lower Green River. Low recapture numbers among passes will make abundance estimation more difficult, and results will be imprecise. In reaches where no recaptures are observed, abundance estimates are not possible if conducted only for that year. Robust design, multi-state capture recapture models allow for estimation of population abundance in reaches where no recaptures were made because probabilities of recapture are estimated across reaches and time when pikeminnow were recaptured. In the past, absence of recaptures in reaches was rare. The 2022 and 2023 data will be incorporated into robust design, multi-state capture recapture models as time permits.

A total of 2,390 Razorback Suckers were sampled during the three electrofishing passes in the Green River basin and were from all three Green River reaches sampled for Colorado Pikeminnow, and the lower White River (Table 3). From up to downstream, the middle Green River yielded 639 Razorback Suckers (none in the upper portion in Dinosaur National Monument) among three passes, the Desolation and Gray Canyon reach 311, and the lower Green River 1,111 fish. A total of 321 Razorback Suckers were captured in the lower White River and none were captured in the Yampa River. High variation in capture rates per sampling pass in the study area—0.48 to 6.2 fish per electrofishing hour—indicated variation from environmental (flow magnitude), biological (varying fish concentrations), or other factors. Within reach variation among passes (e.g., lower White and middle Green reaches) may indicate fish movements to certain areas. The number of within-year recaptures and their spatial distribution will be a key factor determining utility of the data for abundance estimation.

Additional noteworthy observations: NA

Recommendations:

Continue sampling in 2024 and out years.

Project Status:

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Ongoing and on-track.

FY 2023 Budget Status

Funds Provided: \$133,895

Funds Expended: \$116,000

Difference: \$15,084

Percent of the FY 2022 work completed, and projected costs to complete: >85% completed, no new funds needed to complete.

Recovery Program funds spent for publication charges: 0

Status of Data Submission

NA

Signed:

Principal Investigator: Kevin R. Bestgen

Date: 11 December 2023

Recent products resulting from this project

Zelasko, K. A., K. R. Bestgen, and G. C. White. 2022. Incorporating passive antenna detections with physical recaptures in the Barker model increases Razorback Sucker survival rate estimates and their precision. Final report to the Upper Colorado River Endangered Fish Recovery Program. Denver, Colorado. Larval Fish Laboratory Contribution 225.

Zelasko, K. A., and K. R. Bestgen. 2022. Obstacles to abundance estimation for Razorback Suckers *Xyrauchen texanus* in the Green River, 2016–2018. Final report to the Upper Colorado River Endangered Fish Recovery Program. Denver, Colorado. Larval Fish Laboratory Contribution 229. DOI: 10.13140/RG.2.2.35137.02401

References

- Bestgen, K. R., J. A. Hawkins, G. C. White, K. Christopherson, M. Hudson, M. Fuller, D. C. Kitcheyan, R. Brunson, P. Badame, G. B. Haines, J. Jackson, C. D. Walford, T. A. Sorensen, and T. B. Williams. 2005. Population status of Colorado Pikeminnow in the Green River Basin, Utah and Colorado. Larval Fish Laboratory Contribution 140. 112 pp.
- Bestgen, K. R., J. A. Hawkins, G. C. White, C. D. Walford, P. Badame, and L. Monroe. 2010. Population status of Colorado Pikeminnow in the Green River Basin, Utah and Colorado, 2006–2008. Final report to the Recovery Implementation Program for Endangered Fishes in the Upper Colorado River Basin. U. S. Fish and Wildlife Service, Denver, CO. Larval Fish Laboratory Contribution 161. DOI: 10.13140/RG.2.2.30801.74085
- Bestgen, K. R., C. D. Walford, G. C. White, J. A. Hawkins, M. T. Jones, P. A. Webber, M. Breen, J. Skorupski, J. Howard, K. Creighton, J. Logan, K. Battige, and F. B. Wright. 2018. Population status of Colorado Pikeminnow in the Green River sub-basin, Colorado and Utah, 2000–2013. Final Report. Colorado State University, Larval Fish Laboratory to Upper Colorado River

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Endangered Fish Recovery Program, Denver, Colorado. Larval Fish Laboratory Contribution 200.

Zelasko, K. A., K. R. Bestgen, and G. C. White. 2009. Survival rate estimation and movement of hatchery-reared Razorback Suckers *Xyrauchen texanus* in the Upper Colorado River Basin, Utah and Colorado. Final report to the Recovery Implementation Program for Endangered Fishes in the Upper Colorado River Basin. U. S. Fish and Wildlife Service, Denver, CO. Larval Fish Laboratory Contribution 159.

Zelasko, K. A., K. R. Bestgen, and G. C. White. 2010. Survival rate estimation and movement of hatchery-reared Razorback Suckers *Xyrauchen texanus* in the Upper Colorado River Basin, Utah and Colorado. Transactions of the American Fisheries Society 139:1478-1499.

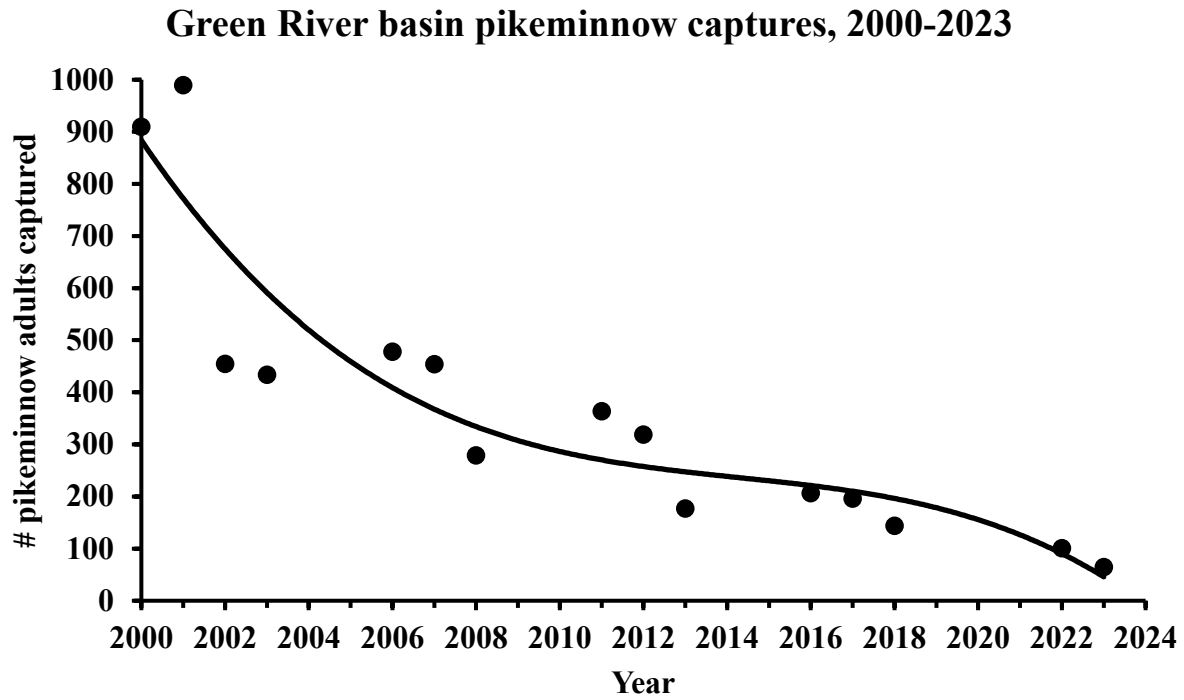
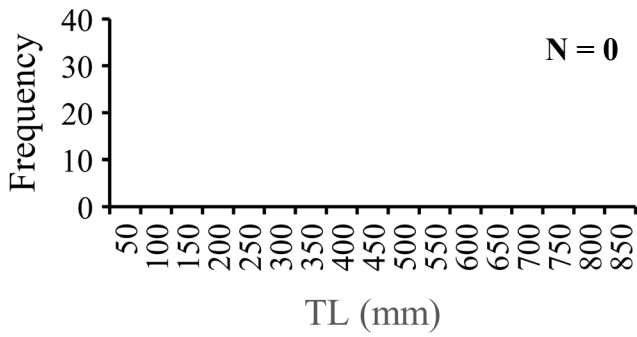
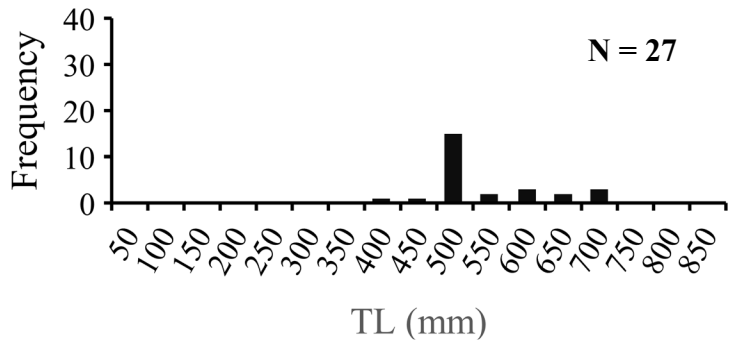


Figure 1. Number of unique Colorado Pikeminnow adults (≥ 450 mm TL) captured each year in the period 2000-2023, Green River basin, Utah and Colorado. The trend is steadily downwards since the study began from about 1,000 individuals in 2001 to 65 in 2023.

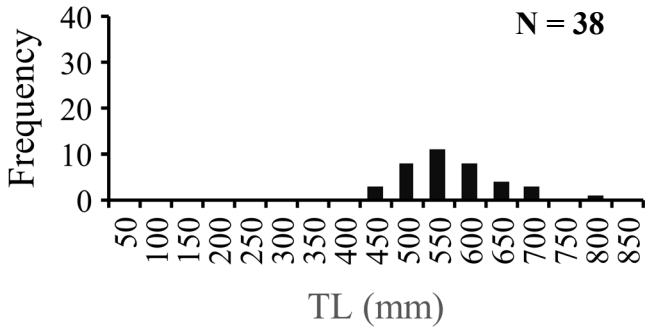
Yampa River



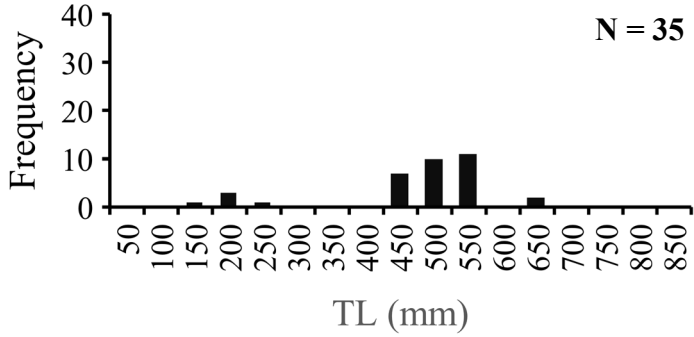
White River



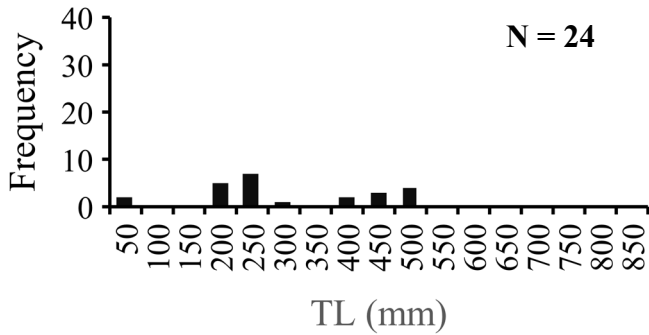
Middle Green River



Desolation-Gray Canyon, Green River



Lower Green River



All

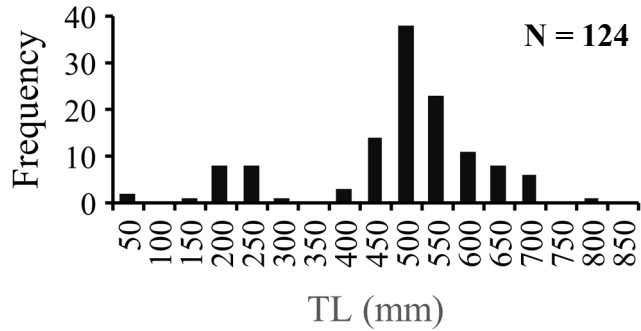
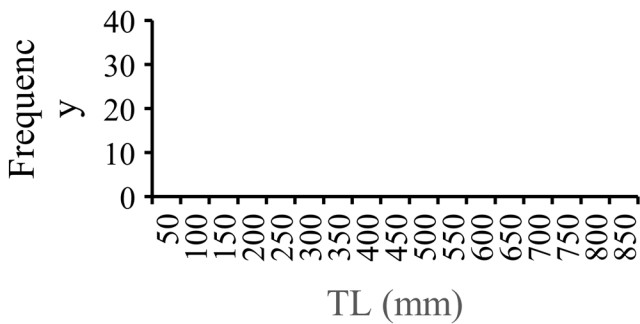
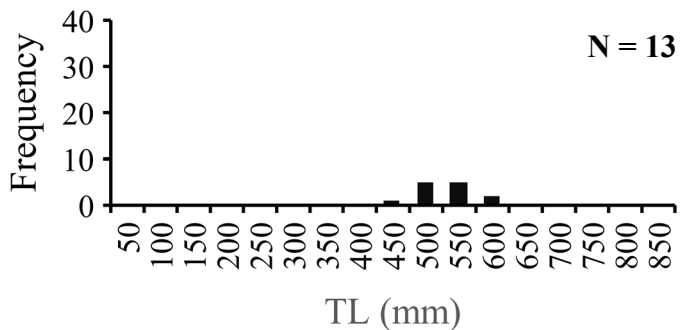


Figure 2. Length-frequency histograms for Colorado Pikeminnow captured in five reaches of the Green River basin, 2022. No pikeminnow were captured in the Yampa River. White River and middle Green River fish were mainly ≥ 450 mm TL. Only the Desolation-Gray Canyon and lower Green River reaches had a mixture of sizes including younger individuals, but overall, few individuals of any size were captured.

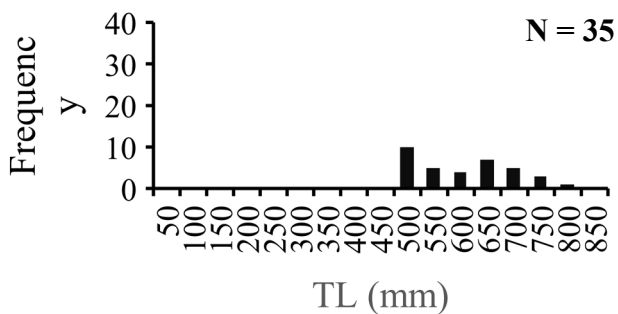
Yampa River



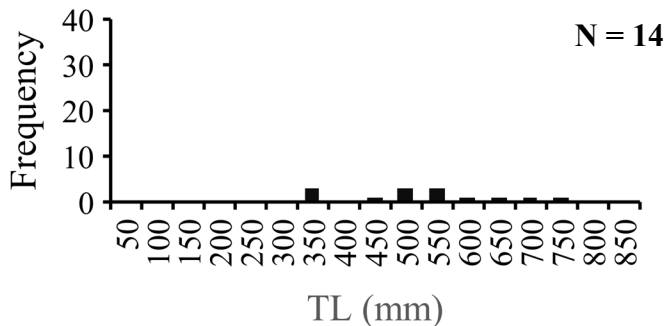
White River



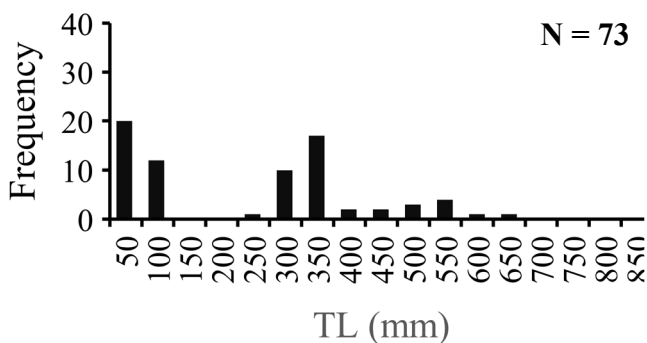
Middle Green River



Desolation-Gray Canyon, Green River



Lower Green River



All

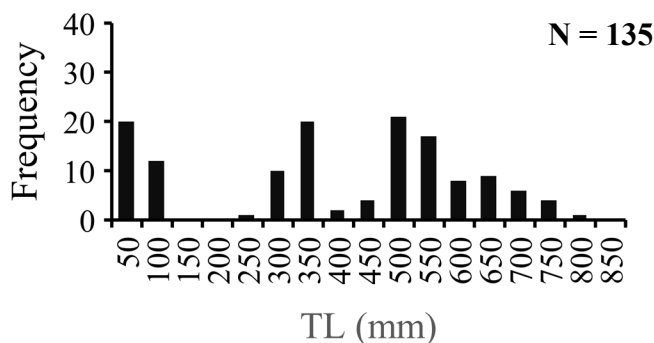


Figure 3. Length-frequency histograms for Colorado Pikeminnow captured in five reaches of the Green River basin, 2023. No pikeminnow were captured in the Yampa River. White River, middle Green River, and Desolation-Gray Canyon fish were mainly ≥ 450 mm TL. Only the lower Green River reach had a mixture of sizes including smaller and larger individuals, but overall, few individuals of any size were captured.

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Table 1. Project 128, 2022 sampling dates, number of days sampled (includes partial days), river reaches (river km), sampling effort, and numbers of juvenile, sub-adult, and adult Colorado Pikeminnow sampled (includes recaptures) or recaptured (all lengths are TL); the three recaptures were adults.

| Reach and Pass | Dates | Days | River km Sampled | Electrofishing Effort (hours) | Juveniles (< 400 mm) | Sub-adults (400-449 mm) | Adults (>=450 mm) | Pikeminnow Recaptured ² |
|--|-------------------|------|------------------|-------------------------------|----------------------|-------------------------|-------------------|------------------------------------|
| Yampa River | | | | | | | | |
| Pass 1 | April 21 - May 19 | 29 | 200-81 | 52.5 | | | | |
| Pass 2 | May 17 - 1 June | 16 | 200-76 | 57.3 | | | | |
| Pass 3 | June 4 - June 7 | 4 | 200-161 | 34.8 | | | | |
| Total | | 49 | | 144.6 | 0 | 0 | 0 | 0 |
| White River | | | | | | | | |
| Pass 1 | May 3 - 13 | 11 | 168-0 | 65.5 | | | | |
| Pass 2 | May 17 - 26 | 10 | 168-0 | 60.9 | | | | |
| Pass 3 | May 31 - June 3 | 4 | 168-0 | 64 | | | | |
| Total | | 25 | | 190.4 | 0 | 1 | 26 | 0 |
| Middle Green River | | | | | | | | |
| Pass 1 | April 4 - 21 | 18 | 534-372 | 47.9 | | | | |
| Pass 2 | April 25 - May 5 | 11 | 538-372 | 53.7 | | | | |
| Pass 3 | May 10 - 26 | 17 | 538-372 | 75 | | | | |
| Total | | 46 | | 176.6 | 0 | 0 | 38 | 0 |
| Desolation-Gray Canyon, Green River | | | | | | | | |

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| | | | | | | | | |
|--------------------------|------------------|-----|---------|-------|----|---|-----|---|
| Pass 1 | April 19 - 25 | 7 | 372-193 | 76.5 | | | | |
| Pass 2 | May 2 - 9 | 8 | 372-193 | 61.4 | | | | |
| Pass 3 | May 17 - 22 | 6 | 372-193 | 61.2 | | | | |
| Total | | 21 | | 199.1 | 5 | 0 | 30 | 1 |
| Lower Green River | | | | | | | | |
| Pass 1 | April 23 - 1 May | 9 | 193-0 | 86.8 | | | | |
| Pass 2 | May 10 - 18 | 9 | 193-0 | 95.2 | | | | |
| Pass 3 | 27 May - June 4 | 9 | 193-0 | 87.9 | | | | |
| Total | | 27 | | 269.9 | 15 | 2 | 7 | 2 |
| All reach totals | | 168 | | 980.6 | 20 | 3 | 101 | 3 |

¹ All Colorado Pikeminnow PIT tagged

² Only adults recaptured during 2022 sampling passes

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Table 2. Project 128, 2023 sampling dates, number of days sampled (includes partial days), river reaches (river km), sampling effort, and numbers of juvenile, sub-adult, and adult Colorado Pikeminnow sampled (includes recaptures) or recaptured (all lengths are TL); the recaptures were a single juvenile and adult.

| Reach and Pass | Dates | Days | River km Sampled | E-effort (hours) | E-effort hrs/km | ¹ Juveniles (< 400 mm) | Sub-adults (400-449 mm) | Adults (>=450 mm) | Pikeminnow Recaptured |
|--------------------------------|------------------|------|-------------------|------------------|-----------------|-----------------------------------|-------------------------|-------------------|-----------------------|
| Yampa River² | | | | | | | | | |
| Pass 1 | 2 - 8 May | 6 | 193-161, 86-77 | 35.1 | | | | | |
| Pass 2 | 16 - 19 May | 4 | " | 33.1 | | | | | |
| Pass 3 | 31 May - 6 June | 6 | " | 37.4 | | | | | |
| Total | | 16 | | 105.6 | 2.22 | 0 | 0 | 0 | 0 |
| White River | | | | | | | | | |
| Pass 1 | 25 April - 5 May | 8 | 168-0 | 72.7 | | | | 9 | |
| Pass 2 | 9 - 19 May | 7 | " | 49.9 | | | | 3 | |
| Pass 3 | 23 May - 1 June | 6 | " | 56.8 | | | | 2 | 0 |
| Total | | 21 | | 179.4 | 1.07 | 0 | 0 | 14 | |
| Middle Green River | | | | | | | | | |
| Pass 1 | 4 - 21 April | 9 | 534-372 | 49.9 | | | | 8 | |
| Pass 2 | 1 - 11 May | 7 | " | 56.5 | | | | 21 | |
| Pass 3 | 15 - 25 May | 7 | " | 56.3 | | | | 6 | |
| Total | | 23 | | 162.7 | 1.00 | 0 | 0 | 35 | 0 |

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**Desolation-
Gray Canyon,
Green River**

| | | | | | | | | | |
|--------|---------------|----|---------|-------|------|---|---|---|---|
| Pass 1 | 13 - 19 April | 7 | 372-193 | 63.5 | | 1 | | 4 | |
| Pass 2 | 25 - 30 April | 6 | " | 57.7 | | 1 | | 2 | |
| Pass 3 | 9 - 14 May | 6 | " | 62.7 | | 1 | | | |
| Total | | 19 | | 183.9 | 1.03 | 3 | 0 | 6 | 0 |

**Lower Green
River**

| | | | | | | | | | |
|--------|------------------|----|-------|-------|------|----|---|----|----|
| Pass 1 | 27 April - 5 May | 9 | 193-0 | 92.4 | | 10 | 1 | 2 | |
| Pass 2 | 14 - 22 May | 9 | " | 97.0 | | 9 | | 3 | |
| Pass 3 | 31 May - 8 June | 9 | " | 96.4 | | 9 | 1 | 5 | |
| Total | | 27 | | 285.8 | 1.48 | 28 | 2 | 10 | 2* |

| | | | | | | | | | |
|------------------|--|-----|--|-------|--|----|---|----|---|
| All reach totals | | 106 | | 917.5 | | 31 | 2 | 65 | 0 |
|------------------|--|-----|--|-------|--|----|---|----|---|

¹ only PIT tagged Colorado Pikeminnow

² Only LFL electrofishing effort data included

* One juvenile recaptured twice

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Table 3. Distribution of Razorback Sucker captures in the Green River Basin, 2023 (data and table courtesy of C. Michaud).

| River | Reach Name | Pass Number | Total Effort (hr) | Number of Razorback Suckers Encountered | Fish/Hour |
|-------------|----------------------------|-------------|-------------------|---|-----------|
| Green River | Dinosaur National Monument | 1 | 2.3 | 0 | 0.00 |
| Green River | Dinosaur National Monument | 2 | 4.4 | 0 | 0.00 |
| Green River | Dinosaur National Monument | 3 | 5.7 | 0 | 0.00 |
| Green River | Middle Green River | 1 | 60.5 | 93 | 1.54 |
| Green River | Middle Green River | 2 | 56.2 | 348 | 6.19 |
| Green River | Middle Green River | 3 | 55.7 | 198 | 3.55 |
| Green River | Desolation and Gray Canyon | 1 | 50.6 | 90 | 1.78 |
| Green River | Desolation and Gray Canyon | 2 | 53.5 | 105 | 1.96 |
| Green River | Desolation and Gray Canyon | 3 | 57.7 | 116 | 2.01 |
| Green River | Lower Green River | 1 | 92.4 | 252 | 2.73 |
| Green River | Lower Green River | 2 | 97.0 | 401 | 4.13 |
| Green River | Lower Green River | 3 | 96.4 | 458 | 4.75 |
| White River | Middle White River | 1 | 24.4 | 0 | 0.00 |

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| River | Reach Name | Pass Number | Total Effort (hr) | Number of Razorback Suckers Encountered | Fish/Hour |
|-------------|--------------------|-------------|-------------------|---|-----------|
| White River | Middle White River | 2 | 16.6 | 8 | 0.48 |
| White River | Middle White River | 3 | 23.6 | 0 | 0.00 |
| White River | Lower White River | 1 | 48.3 | 264 | 5.47 |
| White River | Lower White River | 2 | 33.3 | 52 | 1.56 |
| White River | Lower White River | 3 | 33.3 | 5 | 0.15 |
| Yampa River | Middle Yampa River | 1 | 35.1 | 0 | 0.00 |
| Yampa River | Middle Yampa River | 2 | 33.1 | 0 | 0.00 |
| Yampa River | Middle Yampa River | 3 | 36.5 | 0 | 0.00 |