Project Title
Annual fall monitoring of young-of-year Colorado pikeminnow and small-bodied native fishes

Bureau of Reclamation Agreement Number:
R19AP00059

Project/Grant Period:
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Is this the final report? No

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Abstract:
Monitoring of young-of-year (YOY) Colorado pikeminnow (*Ptychocheilus lucius*) is an ongoing project initiated in 1986 in the upper Colorado River basin as part of the Interagency Standardized Monitoring Program (USFWS 1987) to evaluate recruitment success of age-0 endangered fishes. In 2022, we encountered 53 YOY Colorado pikeminnow on the lower Colorado River (Reach 1), two on the middle Green River (Reach 4), and 28 on the lower Green River (Reach 3). We will continue to monitor the annual abundance of post-larval Colorado pikeminnow in the middle and lower Green River and the lower Colorado River to assess long-term trends in annual fall recruitment.

Study Schedule:
1986-Ongoing

Relationship to RIPRAP:

GENERAL RECOVERY PROGRAM SUPPORT ACTION PLAN

V.	Monitor populations and habitat and conduct research to support recovery actions (research, monitoring, and data management).
V.A.	Measure and document population and habitat parameters to determine status and biological response to recovery actions.
V.B.2.	Conduct appropriate studies to provide needed life history information.

GREEN RIVER ACTION PLAN: MAINSTEM

V.C.3.	Monitor age-0 Colorado pikeminnow in backwaters

COLORADO RIVER ACTION PLAN: MAINSTEM

V.D.1.	Monitor age-0 Colorado pikeminnow in backwaters

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

Task 1. Seining the middle Green River

Middle Green River (Reach 4):

Annual monitoring for young-of-year (YOY) Colorado pikeminnow (*Ptychocheilus lucius*) by the Utah Division of Wildlife Resources Vernal began in Reach 4 on 26 September 2022 and concluded on 29 September 2022. Beginning at Split Mountain boat ramp (river mile [RM] 319.3) and concluding at Sand Wash (RM 215.3), crews sampled 104 river miles in accordance with Interagency Standardized Monitoring Program (ISMP; USFWS 1987) protocols. Altogether, we sampled 39 backwater habitats (21 primary and 18 secondary) that met ISMP criteria, yielding a total sampling area of 5,578 m².

Discharge on the middle Green River is measured at USGS gage #09261000 at Jensen, Utah (Figure 1). At this location, the Green River peaked at 17,000 cubic feet per second (cfs) on 31 May 2022. The river reached base flows (≤ 3,000 cfs; see Bestgen and Hill 2016) on 01 July 2022. During ISMP sampling in 2022, flows averaged 2,122 cfs. Main channel temperatures averaged 18.6 °C (range = 15.6 - 21.8 °C), while habitat temperatures averaged 19.7 °C (range = 15.8 - 26.5 °C) in 2022. Main channel turbidity (cm visibility; mean ± standard deviation [SD]) was 24.7 ± 11.9 cm, while habitat turbidity was 25.5 ± 13.6 cm.

We encountered two YOY Colorado pikeminnow (total length [TL] = 71 and 75 mm) in Reach 4 during ISMP sampling in 2022; catch-per-unit-effort (CPUE) was 0.036 fish/100 m². This figure is down from the 33-year median value of 0.326 fish/100 m² for this reach. Native and nonnative fish encounters for 2022 are listed in Tables 1 and 2 (all species accounted for); note that Table 1 accounts for primary and secondary backwaters, whereas Table 2 summarizes nonnative fish collected from first seine hauls conducted in primary backwaters only.

Task 2. Seining the lower Green River and the Colorado River

Lower Green River (Reach 3):

Utah Division of Wildlife Resources Moab (UDWR Moab) began sampling for ISMP in Reach 3 on 15 September 2022 and concluded on 18 September 2022. Crews sampled 120 river miles, in accordance

with ISMP protocols, from Green River State Park (RM 120) to the confluence with the Colorado River (RM 0). Altogether, we sampled 11 habitats (10 primary and 1 secondary) that met ISMP criteria, yielding a total sampling area of 803 m².

Discharge on the lower Green River is measured at USGS gage #09315000 at Green River, Utah (Figure 2). At this location, the Green River peaked at 17,300 cfs on 03 June 2022. The river reached base flow (≤ 3,800 cfs; see Bestgen and Hill 2016) on 07 July 2022. During ISMP sampling in 2022, flows averaged 2,542 cfs. Main channel temperatures averaged 21.5 °C (range = 21-23 °C), while habitat temperatures averaged 22.0 °C (range = 20.5-24.0 °C) in 2022. Main channel turbidity was 11.5 ± 12.5 cm (cm visibility; mean ± standard deviation [SD]), while habitat turbidity was 76.5 ± 57.2 cm.

Researchers encountered 28 YOY Colorado pikeminnow in Reach 3 during ISMP sampling in 2022 (Table 3). Colorado pikeminnow CPUE was 3.49 fish/100 m². This figure is down from the 36-year median value of 5.39 fish/100 m² for this reach. Of 11 habitats sampled in Reach 3, 35% contained pikeminnow. Mean Colorado pikeminnow TL was 41.3 mm (range = 30-69 mm), which was similar to average length of Colorado pikeminnow observed in 2020, 2019, and 2018 (44.2 mm, 36 mm, and 48.2 mm, respectively). Additional native and nonnative encounters for 2022 are listed in Tables 3 and 4.

Lower Colorado River (Reach 1):
Sampling on the lower Colorado River began on 20 September 2022 and ended on 23 September 2022. All sampling followed ISMP protocols from Cisco boat ramp (RM 110.5) to the confluence with the Green River (RM 0). Crews sampled 16 habitats (11 primary and 5 secondary) that met ISMP criteria, consisting of 1,043 m² of rearing habitat.

Discharge on the lower Colorado River is measured at USGS gage #09180500 near Cisco. The Colorado River peaked on 20 May 2022 at 16,400 cfs. Recommended base flows to benefit Colorado pikeminnow YOY recruitment have been described for the Colorado River (Valdez et al. 2017). Flows reached and remained above the recommended upper threshold of 6,400 cfs starting on 08 May 2022. Discharge dropped below the lower threshold of 3,000 cfs on 12 July 2022 but fluctuated above and below this value throughout the summer and fall (Figure 3). Mean discharge for the period of study was 3,518 cfs. Average main channel temperature was 19.9 °C (range = 18-23 °C), and average habitat temperature was 20.6 °C (range = 18.5-24 °C) in 2022. Main channel turbidity was 6.4 ± 28.2 cm, while habitat turbidity was 142.8 ± 59.4 cm.

Crews captured 53 YOY Colorado pikeminnow in 2022 on the lower Colorado River (Table 5). Catch-per-unit-effort was 5.1 fish/100 m². This figure is up from the 36-year median value of 2.68 fish/100 m² for this reach. Of 16 habitats sampled in Reach 1, 31% contained pikeminnow. Mean TL was 29.8 mm (range = 22-43 mm). This mean length is substantially smaller than mean length observed in 2020 (59 mm) but is similar to the mean length value observed in 2019 (28.8 mm). Additional native and nonnative encounters for 2022 are listed in Tables 5 and 6.

Additional noteworthy observations:
Weather patterns characterized by significant monsoonal events throughout the summer and fall in the upper Colorado River basin greatly affected 2022 ISMP sampling efforts in the lower Green and lower Colorado River stretches (reaches one and three; Figures 2-3). Throughout both reaches, low-velocity backwater habitats were inundated with heavy loads of fine sediment, thus locating habitats that met

ISMP criteria proved challenging. As a result, total area sampled in the lower Green (803 m²) and lower Colorado rivers (1,043 m²) was much lower compared to 10-year averages for both stretches (1,865 m² and 1,669 m², respectively). Moreover, the total area sampled on the lower Green River was the lowest recorded during ISMP sampling in the last 10 years. Despite limited habitat availability, observed densities of YOY Colorado pikeminnow in seine hauls for reaches one and three were higher than those observed in 2021 (no Colorado pikeminnow captured) and comparable to densities observed in 2020 (lower Green River: 4.21 fish/100 m²; lower Colorado River: 5.4 fish/100 m²).

Additional sampling occurred on reaches one and three as a part of Colorado pikeminnow broodstock collection efforts. These broodstock collection efforts were part of task 4 in the FY21 scope of work and were rescheduled to 2022. This task is a collaborative effort between Utah Division of Wildlife Resources Moab, in cooperation with American Southwest Ichthyological Researchers (Albuquerque, NM) and Southwestern Native Aquatic Resource and Recovery Center (Southwestern ARRC, Dexter, NM). The purpose of this effort was to capture and transport YOY Colorado pikeminnow to Southwestern ARRC. During ISMP sampling on reaches one and three, habitats that did not meet ISMP criteria were sampled in order to assess locations for broodstock collection efforts. On the lower Green River an additional 508 m² of habitat was sampled; all were isolated pools (six unique habitats). During this additional sampling one Colorado pikeminnow was captured for a density of 0.20 fish/100 m². On the lower Colorado River an additional 352 m² of habitat was sampled, all of which occurred in isolated pools. During this additional sampling Colorado pikeminnow were absent. The 2022 broodstock collection effort began on 27 September 2022 and ended on 13 October 2022. Sampling occurred on the lower Colorado River between RM 60 and 24. No broodstock collection sampling occurred on the lower Green River due to road closures. Fifty-seven unique sites were visited with a total sampling area of 22,916 m². Crews collected and transported 297 YOY Colorado pikeminnow to Southwestern ARRC. This number of YOY pikeminnow is a preliminary estimate as fish handling in the field is minimized to reduce stress on fish. Colorado pikeminnow CPUE during broodstock collection was estimated at 1.30 fish/100 m². Significant late season monsoons caused a large spike in flows during collection efforts, inundating most low-velocity habitats and reducing sampling efficiency.

Recommendations:
Continue to monitor annual relative abundance of post-larval Colorado pikeminnow in the middle and lower Green River and the lower Colorado River to assess long-term trends in annual fall recruitment.

Consider the addition of a rapid sediment assessment protocol to future ISMP data collection so that sedimentation can be evaluated concurrently with fall YOY recruitment. For example, measure sediment depth at three locations along three transects for each habitat, rather than simply recording a categorical variable describing seine difficulty as in the ISMP protocol (USFWS 1987).

Consider designing and pursuing a habitat study to better understand how the quantity and quality of Colorado pikeminnow nursery habitats are changing through time and affecting recruitment.

Determine the best avenue (i.e., project or responsible entity) for pursuing additional analyses to provide historical context and a more comprehensive look at ISMP long-term data. Additionally, consider the creation of an analysis drawing data from all small-bodied fish work in the upper Colorado River basin; including data from projects 138, 158 and 160. Because the scope of this analysis would encompass multiple projects and agencies, an appropriate entity to produce this work should be identified.

Project Status:
On track and ongoing

FY 2022 Budget Status
Funds Provided: $61,577
Funds Expended: $61,557
Difference: -0-
Percent of the FY 2022 work completed, and projected costs to complete: 100%
Recovery Program funds spent for publication charges: -0-

Status of Data Submission
Data is formatted, has been QA/QC checked, and will be submitted by January 2023.

Signed:
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11/11/2022

Table 1. Native fish captures on the middle Green River during ISMP sampling, fall 2022.

Species	Number	Density (fish/100 m²)
Colorado pikeminnow	2	0.036
flannelmouth sucker	1	0.018

Table 2. Nonnative fish captures on the middle Green River during ISMP sampling, fall 2022. Nonnative fish are enumerated only during the first seine haul within primary habitats.

Species	Number	Density (fish/100 m²)
black bullhead	4	0.23
channel catfish	6	0.34
fathead minnow	423	24.21
green sunfish	2	0.11
red shiner	3,625	207.49
smallmouth bass	1	0.06
sand shiner	1,765	101.02
white sucker	2	0.11

Table 3. Native fish captures on the lower Green River during ISMP sampling, fall 2022.

Species	Number	Density (fish/100m²)
Colorado pikeminnow	28	3.49
flannelmouth sucker	1	0.12

Table 4. Nonnative fish captures on the lower Green River during ISMP sampling, fall 2022. Nonnative fish are enumerated only during the first seine haul within primary habitats.

Species	Number	Density (fish/100m²)
black bullhead	7	0.87
bluegill	4	0.50
channel catfish	3	0.37
fathead minnow	74	9.22
red shiner	789	98.26
sand shiner	371	46.20

Table 5. Native fish captures on the lower Colorado River during ISMP sampling, fall 2022.

Species	Number	Density (fish/100m²)
Colorado pikeminnow	53	5.08

Table 6. Nonnative fish captures on the lower Colorado River during ISMP sampling, fall 2022. Nonnative fish are enumerated only during the first seine haul within primary habitats.

Species	Number	Density (fish/100m²)
black bullhead	3	0.23
channel catfish	17	1.63

Species	Number	Density (fish/100m²)
common carp	1	0.10
fathead minnow	336	32.2
gizzard shad	12	1.15
green sunfish	10	0.96
plain killifish	11	1.05
red shiner	848	81.30
sand shiner	510	48.90
smallmouth bass	1	0.10
western mosquitofish	25	2.40

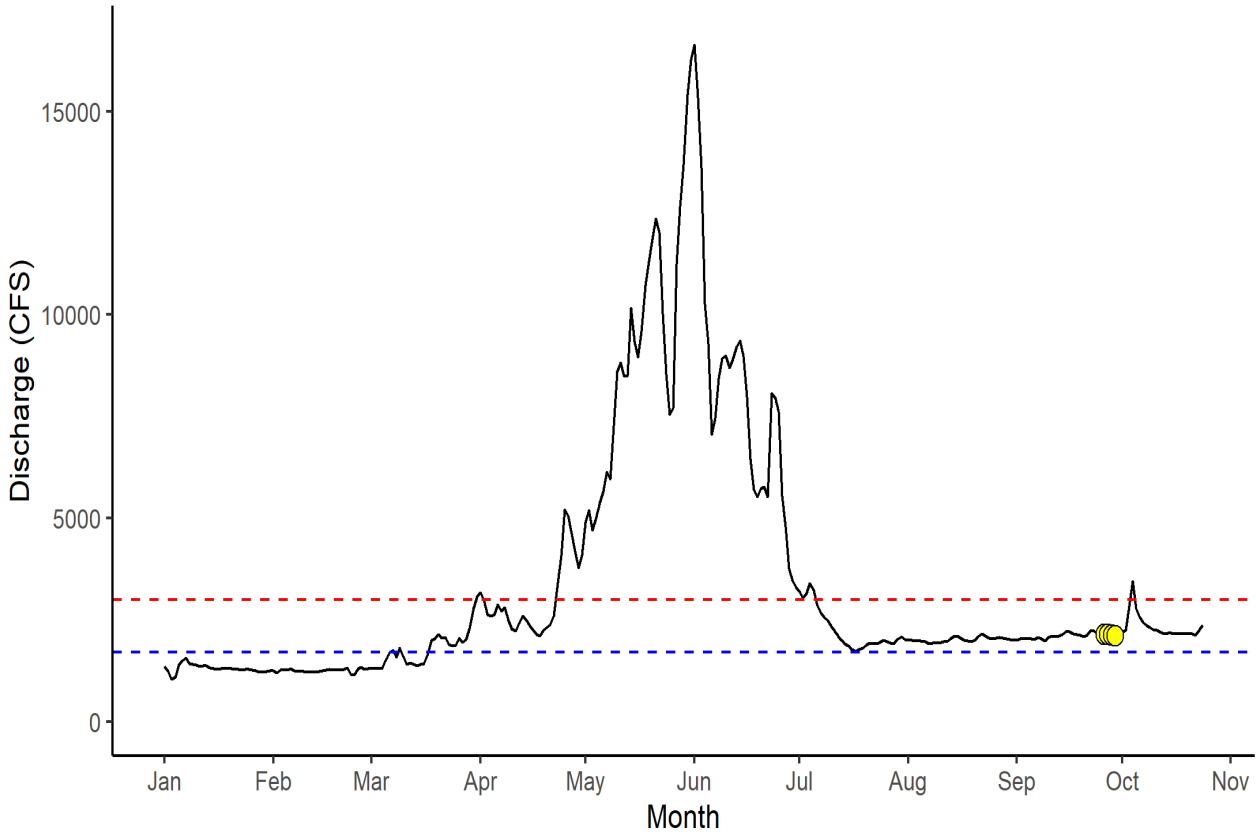

Figure 1. Discharge recorded in 2022 at USGS gage #09261000 at Jensen, UT. Red and blue dotted lines represent recommended base flow ranges for the middle Green River (1,700-3,000 cfs) identified in Bestgen and Hill (2016). Yellow points denote sampling events.

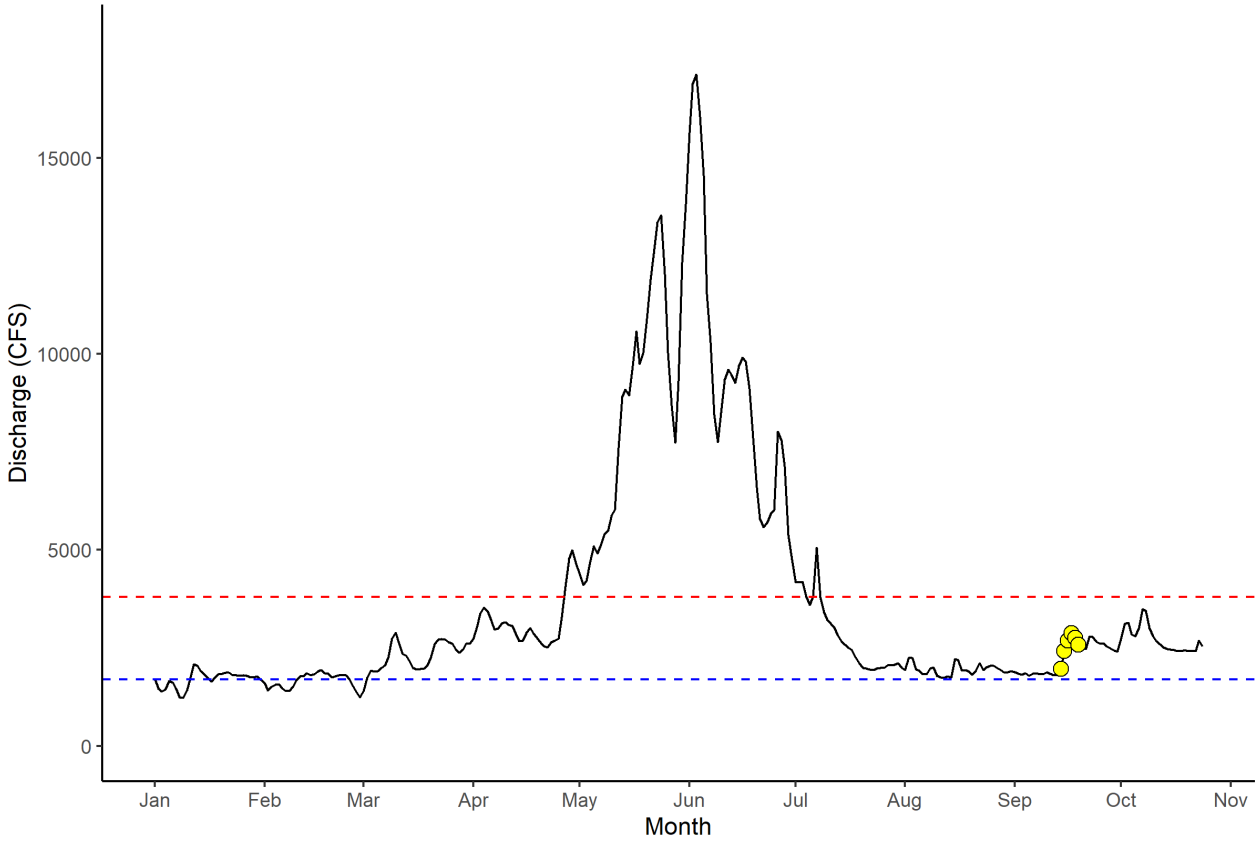

Figure 2. Discharge recorded in 2022 at USGS gage #09315000, Green River, UT. Red and blue dotted lines represent recommended base flow ranges for the lower Green River (1,700-3,800 cfs) identified in Bestgen and Hill (2016). Yellow points denote sampling events.

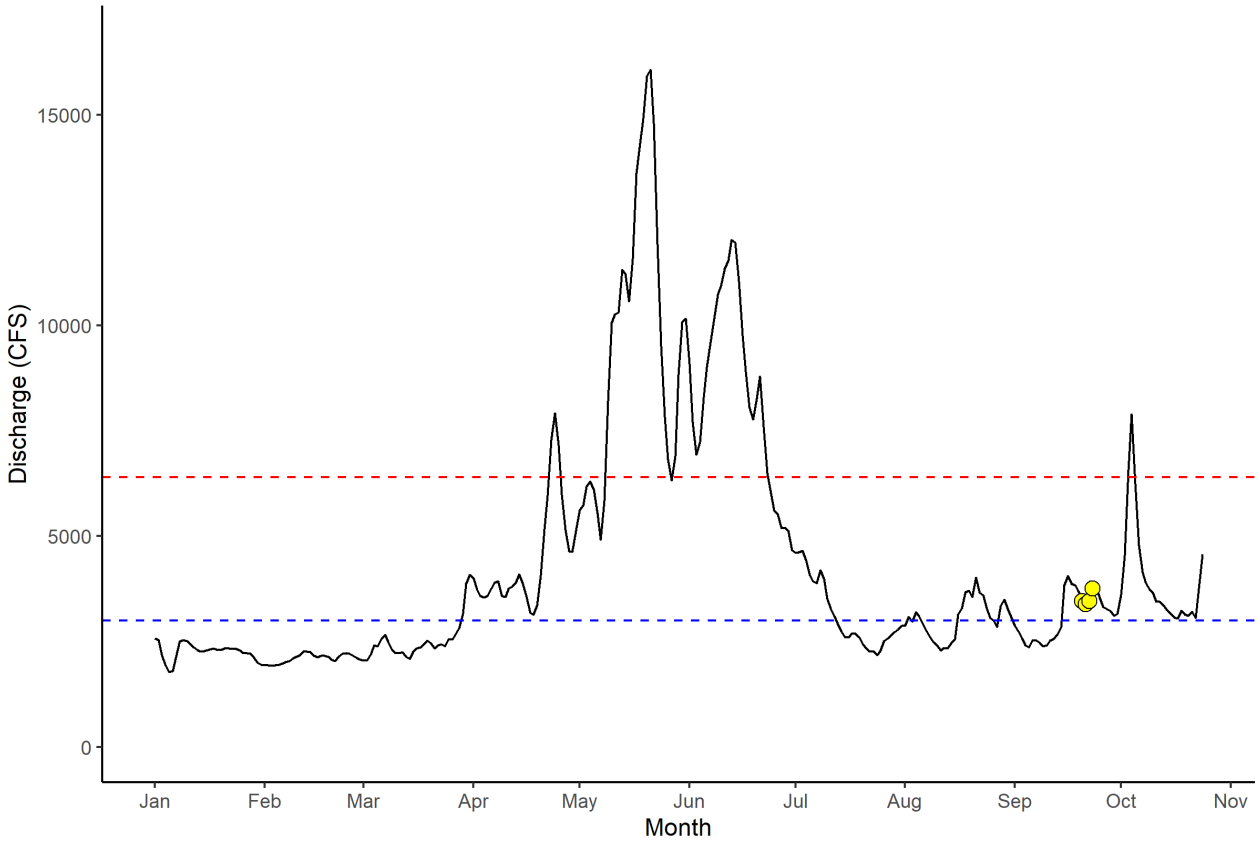

Figure 3. Discharge recorded in 2022 at USGS gage #09180500, near Cisco, UT. Red and blue dotted lines represent recommended base flow ranges for the lower Colorado River (3,000-6,400 cfs) identified in Valdez et al. (2017). Yellow points denote sampling events.

Literature Cited

Bestgen, K.R. and A.A. Hill. 2016. Reproduction, abundance, and recruitment dynamics of young Colorado pikeminnow in the Green and Yampa rivers, Utah and Colorado, 1979-2012. Final report to the Upper Colorado River Endangered Fish Recovery Program, Project FW 51 BW-Synth, Denver, CO. Department of Fish, Wildlife, and Conservation Biology, Colorado State University, Fort Collins, CO. Larval Fish Laboratory Contribution 183.

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