

UPPER COLORADO RIVER ENDANGERED FISH RECOVERY PROGRAM

FY 2021 ANNUAL REPORT

PROJECT: 138

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:

Start date: 10/01/2018

End date: 09/30/2023

Reporting period end date: 09/30/2021

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 2021, YOY Colorado pikeminnow were not encountered on the lower Colorado River (Reach 1) or on the lower Green River (Reach 3), and only one was detected on the middle Green River (Reach 4). 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

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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 2021 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 16 September 2021 and concluded on 23 September 2021. 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 40 backwater habitats (21 primary and 19 secondary) that met ISMP criteria, yielding a total sampling area of 4,340 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 9,830 cubic feet per second (cfs) on 25 May 2021. The river reached base flow ($\leq 3,000$ cfs; see Bestgen and Hill 2016) on 14 June 2021. During ISMP sampling in 2021, flows averaged 1,784 cfs. Main channel temperatures averaged 17.2 °C (range = 14.5-21.1 °C), while habitat temperatures averaged 18.4 °C (range = 13.1-27.9 °C) in 2021. Main channel turbidity (mm visibility; mean \pm standard deviation [SD]) was 169 \pm 70 mm, while habitat turbidity was 126 \pm 59 mm.

We encountered one YOY Colorado pikeminnow in Reach 4 during ISMP sampling in 2021; catch-per-unit-effort (CPUE) was 0.023 fish/100 m². This figure is down from the 32-year median value of 0.34 fish/100 m² for this reach. Native and nonnative fish encounters for 2021 are listed in Tables 1 and 2; note that Table 1 accounts for primary and secondary backwaters. Nonnative fish species encountered, but not summarized in Table 2 (i.e., secondary backwaters and second seine hauls within primary backwaters) included common carp (*Cyprinus carpio*).

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

Lower Green River (Reach 3):

Utah Division of Wildlife Resources Moab began sampling for ISMP in Reach 3 on 7 September 2021 and concluded on 9 September 2021. Crews sampled 120 river miles, in accordance with ISMP

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protocols, from Green River State Park (RM 120) to the confluence with the Colorado River (RM 0). Altogether, we sampled 18 habitats (12 primary, 6 secondary) that met ISMP criteria, yielding a total sampling area of 1,301 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 9,650 cfs on 28 May 2021. The river reached base flow (\leq 3,800 cfs; see Bestgen and Hill 2016) on 16 June 2021. During ISMP sampling in 2021, flows averaged 1,753 cfs.

Main channel temperatures averaged 20.6 °C (range = 20-22 °C), while habitat temperatures averaged 23.6 °C (range = 19-30 °C) in 2021. Main channel turbidity was 68 ± 5 mm, while habitat turbidity was 176 ± 46 mm.

Researchers did not encounter YOY Colorado pikeminnow within ISMP compliant habitats in reach 3 during sampling in 2021, CPUE = 0.00 fish/100 m². This is substantially lower than the 35-year median (6.41 fish/100 m²). Two YOY pikeminnow were detected within an isolated pool during an ancillary seine haul to assess conditions for the broodstock collection effort (see below). However, because isolated pools are not included in the ISMP protocol these fish were excluded from this analysis. 2021 is the first year where no Colorado pikeminnow were detected within this reach for this project. Additional native and nonnative encounters for 2021 are listed in Tables 3 and 4.

Lower Colorado River (Reach 1):

Sampling on the lower Colorado River began on 10 September 2021 and ended on 16 September 2021. All sampling followed ISMP protocols from Cisco boat ramp (RM 110.5) to the confluence with the Green River (RM 0). Crews sampled 25 habitats (17 primary, 8 secondary) that met ISMP criteria, consisting of 1,597 m² of rearing habitat.

Discharge on the lower Colorado River is measured at USGS gage #09180500 near Cisco, Utah (Figure 3). The Colorado River peaked on 07 June 2021 at 8,300 cfs. An analysis of base flows to benefit Colorado pikeminnow YOY recruitment, using methods similar to Bestgen and Hill (2016), was conducted for the Colorado River (Valdez et al. 2017). This analysis identified base flow conditions where age-0 densities were higher than the long-term mean. Flows reached the identified upper threshold of 6,400 cfs on 11 June 2020 (at the state line USGS gage #09163500). Discharge vacillated around the lower threshold of 3,000 cfs for most of the summer, supported mainly by multiple monsoon related flow spikes. Mean discharge for the period of study was 2,788 cfs.

Average main channel temperature was 19.8 °C (range = 19-22 °C), and average habitat temperature was 21.5 °C (range = 18-28 °C) in 2021. Main channel turbidity was 288 ± 49 mm, while habitat turbidity was 240 ± 83 mm.

Crews did not capture YOY Colorado pikeminnow on the lower Colorado River during 2021 (CPUE = 0.00 fish/100 m²). This is substantially lower than the 35-year median (2.94 fish/100 m²). Crews detected no native fish during sampling; nonnative encounters for 2021 are listed in Table 5.

Task 4. Colorado pikeminnow broodstock collection

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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 capture and transport of wild YOY Colorado pikeminnow to Southwestern ARRC. This captive stock augmentation project is aimed at increasing the genetic diversity of the existing broodstock. Crews optimized capture effort and fish health, limiting data collection and, more importantly, fish handling. Consequently, figures reported under Task 4 should be considered estimates.

The 2021 broodstock collection effort began on 21 September and concluded on 22 September. Researchers targeted the lower Colorado River between river miles 63–32.5, and visited 37 sites, sampling 9,661 m² of low-velocity habitat. Crews collected two Colorado pikeminnow (estimated total length – 140 mm and 200 mm), both of which were transported to Southwestern ARRC. Researchers decided to cancel the remaining nine collection days due to poor habitat conditions and low densities of the target species.

Additional noteworthy observations:

High sediment loads were pervasive in the Colorado and Green rivers throughout much of the base flow period in 2021, likely having a detrimental impact on the small-bodied fish community in low-velocity nursery habitats and subsequent fall recruitment of native fishes. Similar to habitat conditions observed following a particularly heavy monsoonal rain event in 2014 (Breen et al. 2014), many nursery habitats were largely filled in with fine sediments due to numerous flash-flood events throughout the months of August and September 2021 (Figures 1-3). Moreover, water clarity never recovered following the first of several extreme rain events in the upper Colorado River basin beginning the last week of July 2021, and high turbidity levels persisted throughout the summer and into autumn (i.e., continued disruption of nursery habitats). Furthermore, for all sampling reaches, sediment depth exceeded water depth in numerous nursery habitats surveyed in 2021, likely limiting valuable resources for growth and survival of small-bodied fishes relying on these areas. Sand shiners encountered on the lower Green and Colorado rivers, for example, appeared noticeably emaciated, while other species looked generally similar to previous years.

Limited age-0 Colorado pikeminnow recruitment was observed basin-wide in 2021, a very concerning result. Among many possible reasons, limited recruitment may have resulted from poor habitat conditions as mentioned above, but also could be related to larval transport indices (Bestgen and Hill 2016), which can be much lower under a drier hydrologic regime (e.g., 2012; Breen and Jones 2019) as was observed during the beginning of the larval drift period in 2021.

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).

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.

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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 2021 Budget Status

Funds Provided: \$67,618

Funds Expended: \$67,618

Difference: -0-

Percent of the FY 2021 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 2022.

Signed:

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Principal Investigators

11/15/2021

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Table 1. Native fish captures on the middle Green River during ISMP sampling, fall 2021.

Species	Number	Density (fish/100 m ²)
Colorado pikeminnow	1	0.02
flannelmouth sucker	1	0.02

Table 2. Nonnative fish captures on the middle Green River during ISMP sampling, fall 2021. Nonnative fish are enumerated only during the first seine haul within primary habitats.

Species	Number	Density (fish/100 m ²)
black bullhead	7	0.59
black crappie	5	0.42
channel catfish	1	0.08
fathead minnow	225	19.09
green sunfish	11	0.93
red shiner	4,480	380.11
smallmouth bass	1	0.08
sand shiner	1,540	130.66
white sucker	12	1.02

Table 3. Native fish captures on the lower Green River during ISMP sampling, fall 2021.

Species	Number	Density (fish/100m ²)
flannelmouth sucker	1	0.08

Table 4. Nonnative fish captures on the lower Green River during ISMP sampling, fall 2021. Nonnative fish are enumerated only during the first seine haul within primary habitats.

Species	Number	Density (fish/100m ²)
red shiner	1,021	246.02
sand shiner	678	163.37
fathead minnow	119	28.67
gizzard shad	5	1.20
green sunfish	2	0.48

Table 5. Nonnative fish captures on the lower Colorado River during ISMP sampling, fall 2021. Nonnative fish are enumerated only during the first seine haul within primary habitats.

Species	Number	Density (fish/100m ²)
red shiner	1,290	169.96
sand shiner	830	109.35
fathead minnow	216	28.46
gizzard shad	79	10.41
western mosquitofish	68	8.96
black bullhead	11	1.45
smallmouth bass	4	0.53
green sunfish	3	0.40
plains killifish	2	0.26
channel catfish	1	0.13

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Species	Number	Density (fish/100m ²)
carp	1	0.13
flannelmouth sucker x white sucker	1	0.13

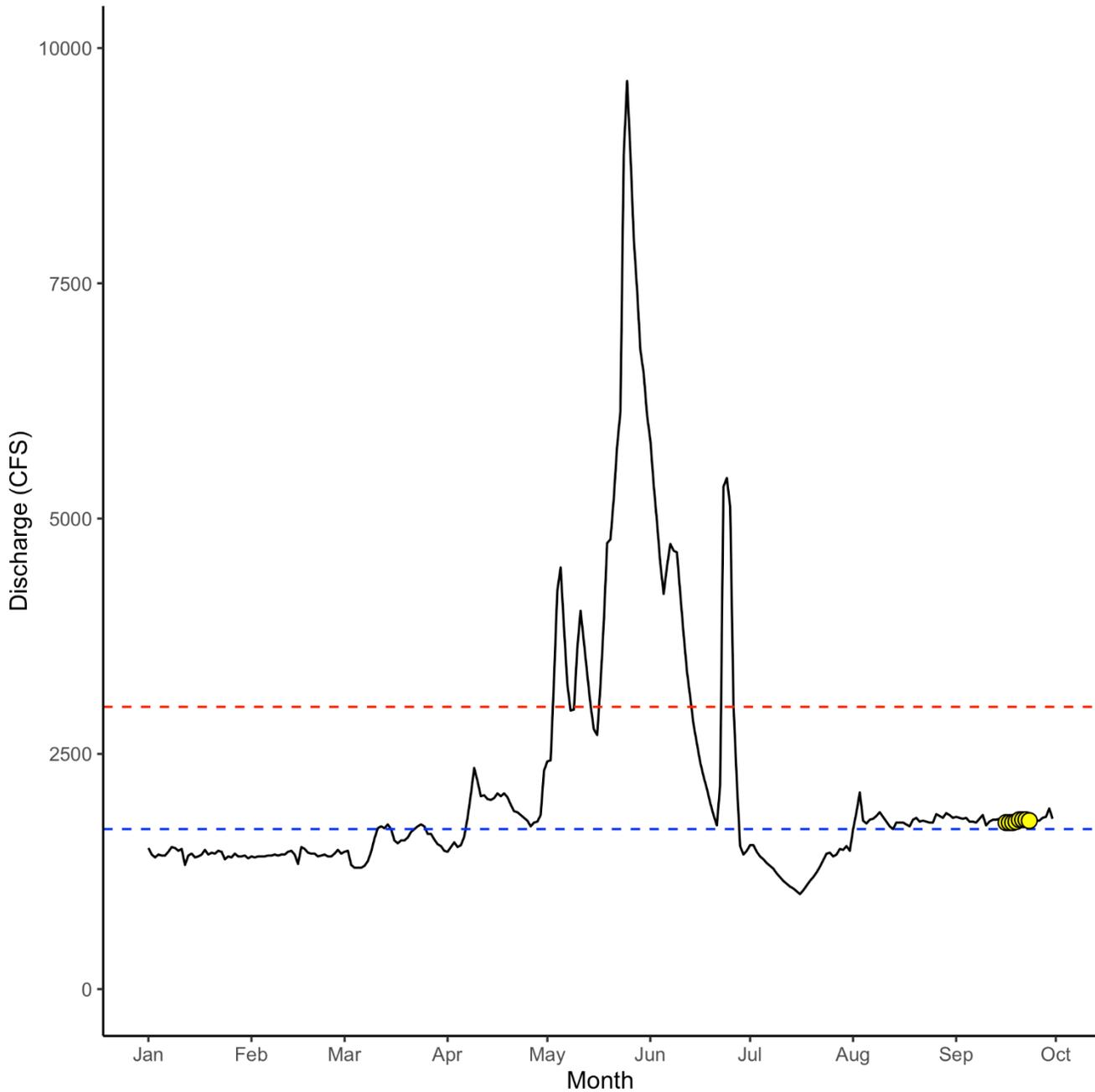


Figure 1. Discharge recorded in 2021 at USGS gage #09261000 at Jensen, UT. Red and blue dotted lines represent recommended base flow ranges for the middle Green River (1,700-3,000 cfs) identified in Bestgen and Hill (2016). Yellow points denote sampling events.

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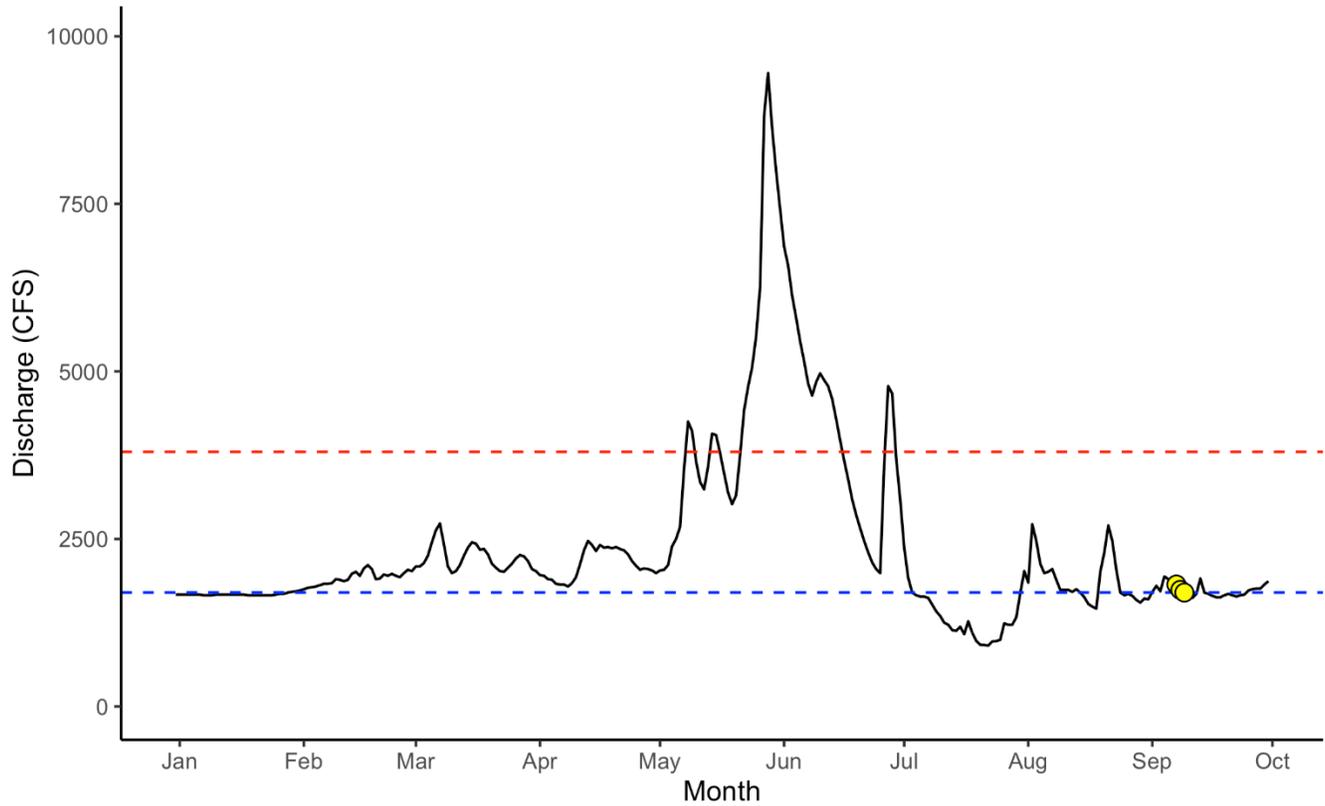


Figure 2. Discharge recorded in 2021 at USGS gage #09315000, Green River, UT. Red and blue dotted lines represent recommended base flow ranges for the lower Green River (1,700-3,800 cfs) identified in Bestgen and Hill (2016). Yellow points denote sampling events.

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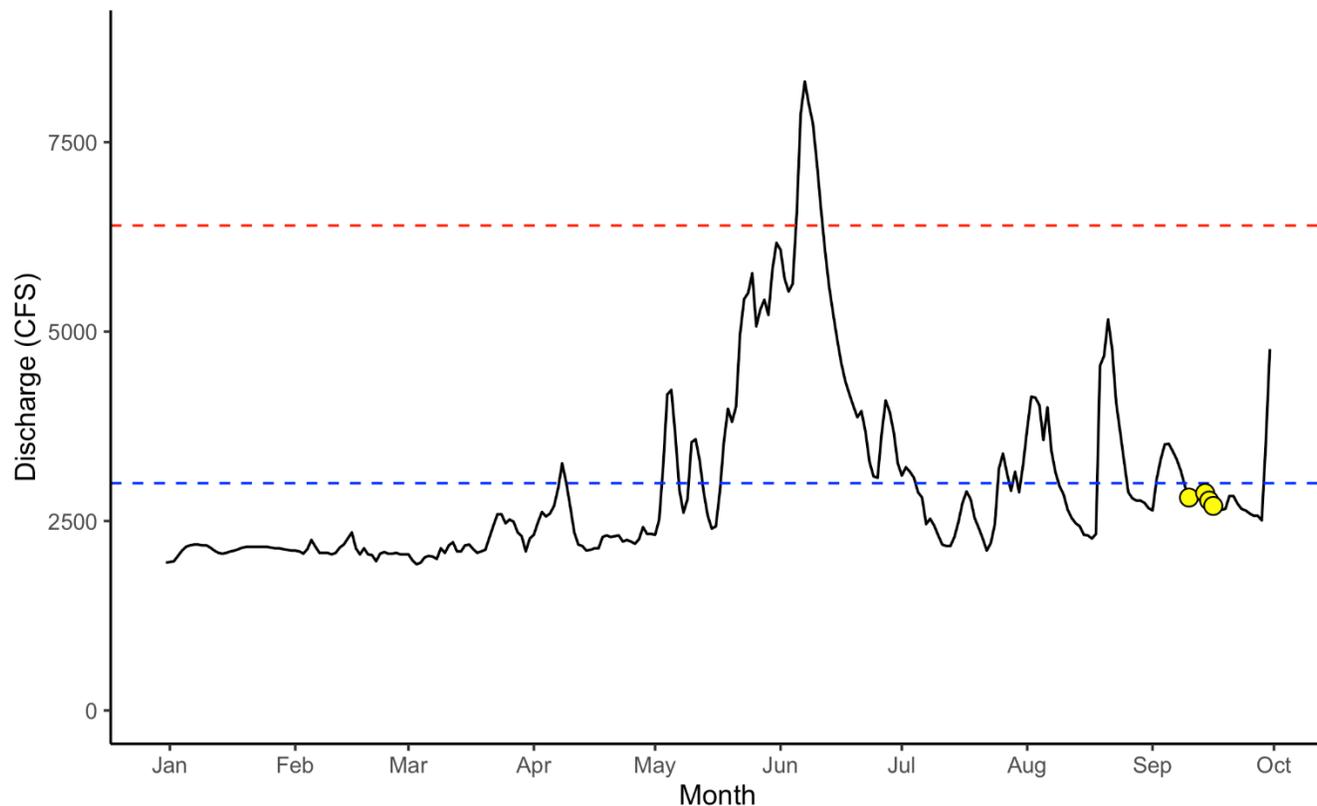


Figure 3. Discharge recorded in 2021 at USGS gage #09180500, near Cisco, UT. Red and blue dotted lines represent recommended base flow ranges for the lower Colorado River (3,000-6,400 cfs) identified in Valdez et al. (2017). Yellow points denote sampling events.

Literature Cited

Breen, M.J. and M.T. Jones. 2019. Assessment of larval Colorado pikeminnow presence and survival in low velocity habitats in the middle Green River: 2009-2012. Final report to the Upper Colorado River Endangered Fish Recovery Program, Denver, CO. Utah Division of Wildlife Resources, Salt Lake City, UT. Publication number 19-05.

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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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Valdez, R.A., T. Francis, D. Elverud, and D. Ryden. 2017. Colorado Pikeminnow PVA Scenarios for the Upper Colorado River Subbasin. Report prepared for the Colorado Pikeminnow PVA Technical Team.