

Population size, mobility, and early life history of Razorback Suckers in the San Juan River – Lake Powell complex

(Annual Report March 2019)

Casey A. Pennock

Keith B. Gido

Division of Biology

Kansas State University

Manhattan, Kansas 66506

pennock@ksu.edu

kgido@ksu.edu

EXECUTIVE SUMMARY

Research conducted in the San Juan River-Lake Powell habitat complex in 2017-2018 has yielded important insights into the occurrence, abundance, and movement ecology of endangered Razorback Sucker. We estimated the population size of Razorback Sucker using the Piute Farms Waterfall and Neskahi Bay and the Great Bend of the San Juan River in Lake Powell. Generally, re-capture rates were low and both population estimates, along with PIT tag detection data at the waterfall, suggest the population size is less than 2,000 individuals. Most fish encountered in the San Juan River-Lake Powell habitat complex were stocked into the San Juan River. The number of fish encountered downstream of the waterfall from different stocking classes is highly variable. Relatively high proportions of fish from 2013 and 2014 stocking classes have been encountered downstream of the waterfall, and stocking events for these fish coincided with late-season monsoonal rains that raised river discharges during or shortly after stocking. Sampling of small-bodied and larval fishes in 2017 found the fish community to be dominated by non-native species such as Red Shiner *Cyprinella lutrensis* and Gizzard Shad *Dorosoma cepedianum*, and also found a suite of native species including over 200 juvenile Colorado Pikeminnow *Ptychocheilus lucius* and 17 young of the year Razorback Sucker *Xyrauchen texanus* distributed throughout the San Juan River-Lake Powell habitat complex from directly below the waterfall to the Great Bend of the San Juan River. Analysis of movements of Razorback Sucker in Lake Powell showcase long distance movements upstream into upper Colorado River basin rivers with some individuals moving at least 600 km. Our data suggest that at least a third of the population of Razorback Sucker in Lake Powell move into upstream rivers on an annual basis. We also found that 39% of acoustic-tagged fish released into the Colorado River arm of Lake Powell in 2014-2016 have been detected in the San Juan River arm of Lake Powell suggesting that the reservoir is not a barrier to movement and that managers should consider Razorback Sucker in the upper Colorado River basin as a metapopulation.

INTRODUCTION

Sampling efforts dating back to the 1980s in the San Juan River arm of Lake Powell have documented the occurrence of Razorback Sucker (*Xyrauchen texanus*). Between the 1980s and 2010, regular captures of Razorback Suckers have been made by different investigators and different sampling gears. In 2011 and 2012, U.S. Fish and Wildlife Service conducted intensive surveys on the San Juan River arm of Lake Powell and captured 147 adult Razorback Suckers. Population estimations from samples in 2012 suggested a population size of 527 (239 – 1312) in the reservoir, but due to poor recapture rates and limited sampling of a large geographical area, these estimates are likely biased low and inaccurate. Furthermore, additional sampling in the Colorado River arm of Lake Powell has identified even greater numbers of Razorback Suckers, including many fish that use areas outside of the inflow area, suggesting that the lake may provide suitable habitat for adult Razorback Suckers. Indeed, Cathcart et al. (2018) used a combination of remote PIT antennas and sampling to document the occurrence of over 755 Razorback Suckers below the San Juan River waterfall near Piute Farms in spring 2017 (hereafter termed Piute Farms Waterfall, Figure 1). The detection of these fish at the waterfall during 3 months in 2017 suggests a much larger number of fish are using this area, especially if 20-40% of Razorback Sucker are untagged (C. N. Cathcart and M. M. McKinstry, unpublished). Preliminary detection data from 2017 (February 11th-March 26th) show that 503 unique Razorback Suckers have been detected. Fish caught in the 1980s and 1990s were clearly wild fish, however, more recent captures of PIT tagged fish, indicate at least some of the Razorback Suckers in the river-reservoir habitat complex were stocked in the upper San Juan River and have dispersed downstream. However, a relatively large percentage of fish (i.e., 20 – 40%) captured in Lake Powell and in the river below the waterfall were not PIT tagged. This might be due to tag loss or fish that were never tagged prior to stocking; however, there is the potential for natural recruitment in the river-reservoir habitat complex.

Given the uncertainty in the size of the population of Razorback Sucker in the river-reservoir habitat complex, potential for natural recruitment, and the seemingly high abundance of fish below the Piute Farms Waterfall, the overarching goals of this project are centered on hypothesized life history strategies of Razorback Sucker. Specifically, we hypothesize three potential life history strategies of Razorback Sucker in this river-reservoir complex. First, some Razorback Sucker are river-residents that spawn in the San Juan River and offspring remain in the river and recruit to mature adults. Some are reservoir-resident that spawn in Lake Powell and offspring remain in the reservoir and recruit to mature adults. Finally, some are transient that would move between the river and reservoir if not impeded by the waterfall.

Specific objectives

- 1) Estimate adult population size of Razorback Sucker in the San Juan River – Lake Powell habitat complex.
- 2) Determine the number of Razorback Suckers stocked in the San Juan River that move to Lake Powell and the San Juan River below the waterfall.

- 3) Identify if spawning and recruitment of Razorback Sucker occurs in the San Juan River – Lake Powell habitat complex.
- 4) Characterize movement behaviors of Razorback Sucker within the San Juan River – Lake Powell habitat complex and fish transplanted above the Piute Farms Waterfall.

Preliminary Results

Estimate adult population size of Razorback Sucker in the San Juan River – Lake Powell habitat complex

In May 2018, we used a combination of acoustic telemetry and trammel netting to estimate the population size of Razorback Sucker in the San Juan River-Lake Powell habitat complex. In 2017-2018, we tagged 133 Razorback Sucker with acoustic telemetry tags at the waterfall and in Lake Powell. We deployed an array of passive acoustic receivers from Piute Canyon to the apex of the Great Bend of the San Juan River in Lake Powell. Detections of telemetry-tagged Razorback Sucker were used as a “mark” sample and then trammel netting was used to recapture marked individuals (i.e., those with transmitters that were known to be in the area). We sampled three weeks in May, which is in the middle of the typical sampling period conducted by USFWS for Razorback Sucker monitoring in Lake Powell. To be “marked”, a fish had to be detected within a week of when trammel netting surveys occurred. We systematically sampled the entire shoreline of the Neskahi Bay and Great Bend areas of Lake Powell by dividing up the shoreline into 500 m sections. During a sampling period (1 week), we set a trammel net in every 500 m segment. Recapture rates were generally low, and Razorback Sucker were captured throughout the study area. The estimated population size in May 2018 was 647 individuals with a 95% CI of 410-884.

Population estimates at the waterfall and in Lake Powell are likely conservative. From 2015-2018, 1,377 unique individual Razorback Sucker have been detected on PIT antennas at the waterfall. Thus, the total population size of Razorback Sucker in the San Juan River-Lake Powell habitat complex is likely less than 2000 fish.

Determine the number of Razorback Suckers stocked in the San Juan River that move to Lake Powell and the San Juan River below the waterfall

We queried the STReAMS database (STReAMS, 04/05/2019) to determine the number Razorback Sucker stocked in the San Juan River that have moved to the San Juan River-Lake Powell inflow area (Table 1). Based on a high proportion of fish captured below the Piute Farm Waterfall originating from 2013 stockings near Montezuma Creek, we assessed stocking years 2012-2017. Late monsoonal events occurred in both 2013 and 2014 that coincided with stocking periods (Figure 1), and may have influenced the relatively higher proportion of fish from these stocking classes moving downstream to Lake Powell.

Table 1: Number of Razorback Sucker stocked in the San Juan River basin from 2012-2017 that have been encountered (PIT tag detection, physically captured) downstream of

the Piute Farms Waterfall and in the San Juan River-Lake Powell habitat complex in 2017 or 2018.

Stocking year	Number stocked	Number encountered in 2017	Percent of stocking class	Number Encountered in 2018	Percent of stocking class
2012	15,810	0	0%	3	<1%
2013	15,338	342	2%	319	2%
2014	6,545	205	3%	249	4%
2015	5,206	28	<1%	80	2%
2016	7,630	40	<1%	134	2%
2017	10,304	---	---	45	<1%

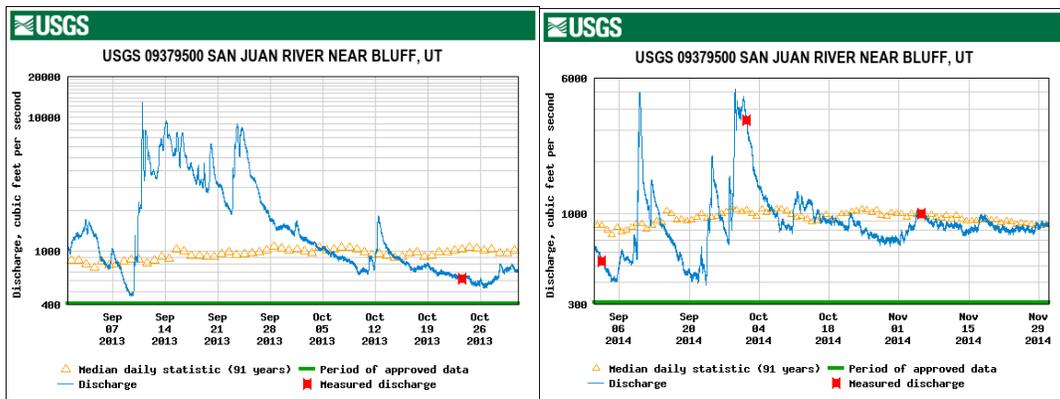


Figure 1: Discharge of the San Juan River near Bluff, Utah over stocking periods in 2013 (top panel) and 2014 (top panel).

Identify if spawning and recruitment of Razorback Sucker occurs in the San Juan River – Lake Powell habitat complex

Because ASIR intensively sampled larval fish below the waterfall in 2018, we are presenting our seine sampling of larval and small-bodied fish from March, May, July, and November 2017. Sampling occurred between the Piute Farms Waterfall and the Great Bend of the San Juan River in Lake Powell. A variety of habitats were sampled including backwater, slackwater, sandbar shoreline, and main channel habitats. Twelver young of the year Razorback Sucker were captured from a combination of backwaters, sandbar shorelines in flowing water, and in the mouth of a lateral wash (Mike’s Canyon). The majority of Colorado Pikeminnow less than 100 mm total length (88% of catch) were collected from a single backwater approximately 4 miles downstream of the Piute Farms Waterfall. The rest were captured at the confluences of lateral washes or side canyons and along sandbar shorelines in flowing water.

Table 2: Fishes captured during small-bodied and larval sampling downstream of the Piute Farms Waterfall in the San Juan River-Lake Powell habitat complex.

Species	Number captured	Relative abundance	Total lengths (range; mm)
---------	-----------------	--------------------	---------------------------

Black Bullhead <i>Ameiurus melas</i>	1	<0.01	152
Channel Catfish <i>Ictalurus punctatus</i>	89	0.02	37-428
Colorado Pikeminnow <i>Ptychocheilus lucius</i>	274	0.06	32-200
Common Carp <i>Cyprinus carpio</i>	383	0.08	16-415
Fathead Minnow <i>Pimephales promelas</i>	1	<0.01	23
Flannelmouth Sucker <i>Catostomus latipinnis</i>	5	<0.01	146-400
Gizzard Shad <i>Dorosoma cepedianum</i>	874	0.19	23-550
Green Sunfish <i>Lepomis cyanellus</i>	2	<0.01	48-106
Razorback Sucker <i>Xyrauchen texanus</i>	17	<0.01	26-528
Red Shiner <i>Cyprinella lutrensis</i>	2029	0.44	16-72
Smallmouth Bass <i>Micropterus dolomieu</i>	2	<0.01	322-334
Speckled Dace <i>Rhinichthys osculus</i>	2	<0.01	36-55
Threadfin Shad <i>Dorosoma petenense</i>	345	0.07	22-103
Walleye <i>Sander vitreus</i>	2	<0.01	408-449
Western Mosquitofish <i>Gambusia affinis</i>	583	0.13	17-43
Yellow Bullhead <i>Ameiurus natalis</i>	2	<0.01	202-297
<i>Total fishes captured</i>	4,611		

Characterize movement behaviors of Razorback Sucker within the San Juan River – Lake Powell habitat complex and fish transplanted above the Piute Farms Waterfall

These data are detailed in a draft manuscript Pennock et al. (in prep) that also includes data from the Colorado River arm of Lake Powell. See attached draft manuscript.

References

Cathcart, C. N., C. A. Pennock, C. A. Cheek, M. C. McKinstry, P. D. MacKinnon, M. M. Conner, and K. B. Gido. 2018. Waterfall formation at a desert river-reservoir delta isolates endangered fishes. *River Research and Applications* 8:949-956.

Pennock, C.A., M.C. McKinstry, C.N. Cathcart, K.B. Gido, T.A. Francis, B.A. Hines, P.D. MacKinnon, S.C. Hedden, E.I. Gilbert, C.A. Cheek, D.W. Speas, K. Creighton, D.S. Elverud, and B.J. Schleicher. In preparation. Razorback Sucker movements: River-reservoir exchanges and experimental translocations.