

Overwinter survival and spatial distribution of the wild Razorback Sucker in the San Juan River 2019

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Background

In 2018, the San Juan River saw one of the lowest run offs in recent history, leading to low, warm and very clear summer base flow conditions. This provided favorable conditions for Razorback Suckers spawned in the wild to successfully survive and potentially recruit to an older age class. A record number (n = 164) early juvenile life stage (larger than larval) Razorback Suckers were captured during sampling performed by American Southwest Ichthyological Researchers (Farrington et al., 2019), followed by six young of year Razorback Sucker collected during a longitudinally truncated fall small bodied monitoring conducted by the New Mexico Department of Game and Fish (Zeigler and Wick 2019). Interest created by these findings led to a sampling trip being done in spring 2019 to document over-winter survival of this 2018 cohort of wild Razorback Suckers.

The objective was to capture and identify wild-spawned Razorback Sucker early in the season, before these age-1 fish grow significantly. It was thought that sampling efforts that occur later in the calendar year may be unable to effectively distinguish these wild-produced, age-1 recruits from the smallest hatchery-reared Razorback Sucker that would be stocked into the river early that fall (minimum stocking length = 300 mm total length) and that might have lost their passive integrated transponder tag.

Methods

Between 25 March and 4 April 2019, the San Juan River was sampled from Shiprock Bridge in NM (RM 147.9) downstream to Clay Hills in UT (RM 2.9) using electrofishing rafts equipped with an ETS MBS unit. Peak voltage was kept around 9 amps. Each raft had one netter and one rower and worked each bank independently each day. Fish were collected using a 10' long dip net and placed in a live well. Razorback Sucker smaller than 300mm in total length (TL) were netted, as well as Colorado Pikeminnow below 300mm TL and larger than 400mm TL. At the end of each river mile (RM), everyone pulled over and collected data on captured fish. All targeted endangered fish were measured to the nearest mm TL, nearest mm standard length, and weighed to the nearest gram (g). Other data collected were date, location (start and end RM), and effort (measured in minutes and seconds of electrofishing) for each sample.

Results

Razorback Sucker

A total of 45 fish were identified as wild Razorback Sucker throughout the trip. Capture of these fish were from RM 119 at Four Corner's Bridge to RM 17.0 just below Slickhorn Canyon. These fish ranged in size from 100mm to 197mm TL. The majority of these fish, 75%, were between 140 and 179mm TL, with the highest frequency between 150 - 159mm TL (Figure 1).

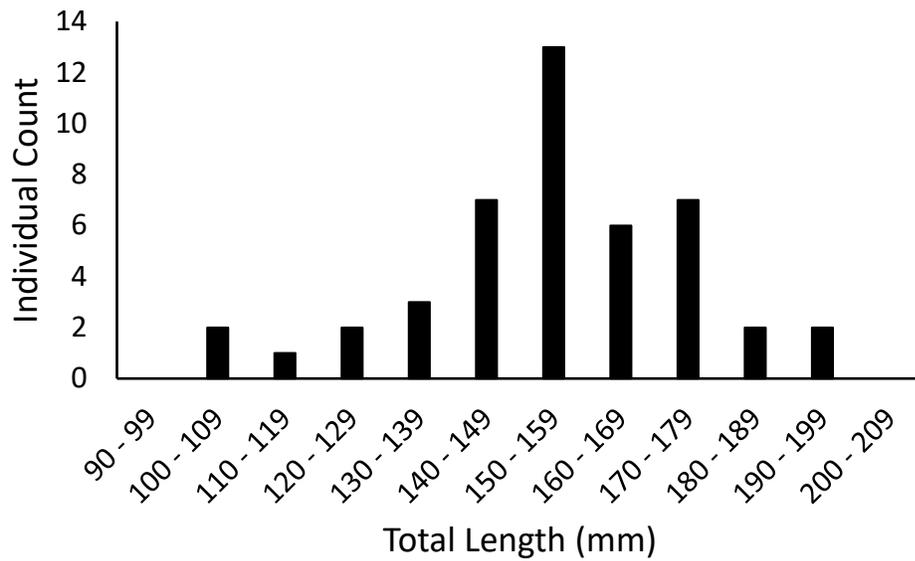


Figure 1. Length frequency histogram for wild age-1 Razorback Sucker.

Of the 45 individuals captured, 43 received PIT tags, two did not as they were considered too small to tag at time of capture. Catch rates for age-1 Razorback Sucker fall between 95% confidence intervals (CI) of 0.62 and 0.33 fish per hour of electrofishing with an average of 0.47 fish per hour (Figure 2.)

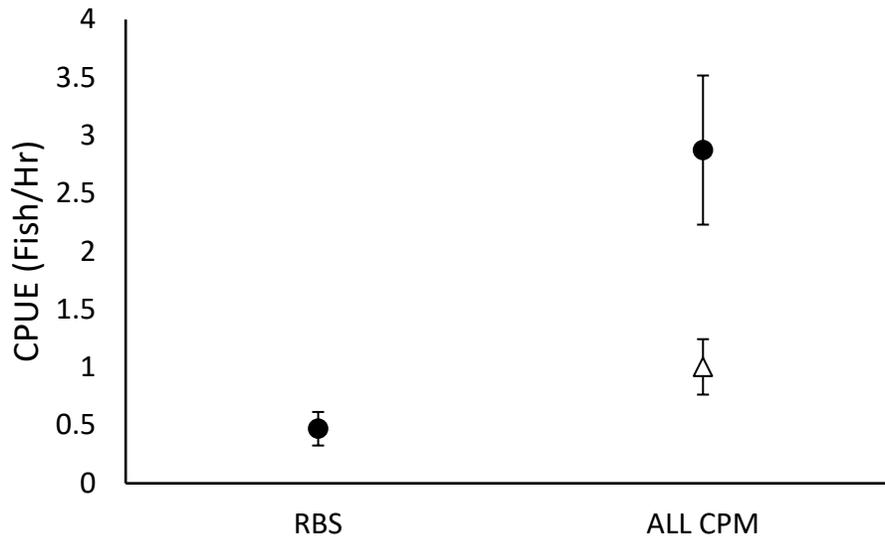


Figure 2. Catch per unit effort (CPUE) of age-1 Razorback Sucker (RBS) and Colorado Pikeminnow (CPM) during the spring trip of 2019. Open triangle is CPUE for CPM during 2015 Adult Monitoring. All confidence intervals are 95%.

Colorado Pikeminnow

In addition to Razorback Sucker, Colorado Pikeminnow were captured as well. To reduce potential handling stress on juvenile Colorado Pikeminnow (Clark et al. 2018), only adult and sub adult Colorado Pikeminnow (>400mm TL) were originally targeted for netting. However, the 2019 spring sampling trip was during a time period with cooler water temperatures, and handling smaller size classes (<300mm TL) would be less stressful to the fish compared to summer months when the smaller size classes were normally captured. A number of fish were captured for purposes of other studies that fell between the 300mm TL and 400mm TL.

A total to 274 individual Colorado Pikeminnow were captured during this trip with no within trip recaptures. Sizes of fish ranged from 152mm to 751mm TL with weights ranging from 23 to 4000g. The highest frequency of fish was between 210 and 299mm TL, encompassing 219 fish (76.6%) with a peak at fish between 280 and 289mm TL (Figure 3). Two recruiting sub adult size class fish (400-449mm TL) and eight adult size class fish (>450mm TL) were captured throughout this trip as well (Figure 3). Of the 274 individuals captured, 21 (7.66%) had a PIT tag, the other 253 individuals were implanted with one prior to release. Of the 21 fish that had a PIT tag, one was a recruiting sub adult (429mm TL), and eight were adult size class fish.

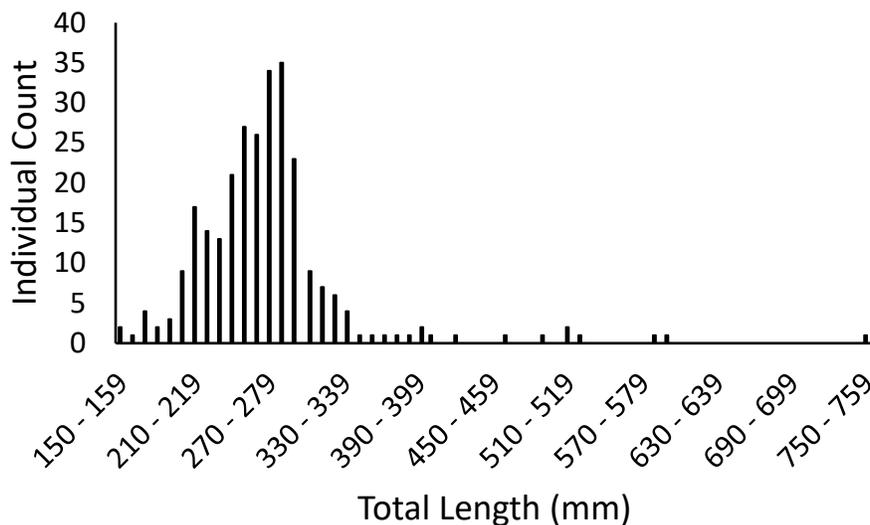


Figure 3. Length frequency histogram for Colorado Pikeminnow captured during 2019 spring sampling for age-1 Razorback Sucker.

Catch rates for all Colorado Pikeminnow were between 95% CI 3.52 and 2.23 fish per hour with an average of 2.87 (Figure 2). Comparatively, a similar effort with a single pass from Shiprock bridge, NM to Clay Hills, UT was conducted in the fall of 2015 with Adult Monitoring, the catch rates for all CPM for that trip was 1.00 with a 95% CI of 1.24 and 0.77 fish per hour (Schleicher 2016)(Figure 2).

Discussion

Razorback Sucker

This project set out to answer three questions: Did wild-spawned age-0 Razorback Sucker successfully overwinter in the San Juan River; what is the size variation of wild age-1 Razorback Sucker in the spring and what is the likelihood individuals will be >300 mm TL by fall; and does the spatial distribution of wild age-1 Razorback Sucker indicate spatial variation in recruitment success? The overall, capturing 45 fish that were identified as wild age-1 Razorback Sucker in a single pass was encouraging and answered the question if these fish successfully over-wintered.

For the second question of size and growth by fall, the size range varied from 100mm TL to 197mm TL, the largest nearly doubling the smallest. Two fish were recaptured during Demographic Monitoring later that fall that were tagged during the spring trip. The first, originally tagged at 155mm TL, was recaptured twice during Demographic Monitoring after growing 90mm (245mm TL) from 29 March to 20 September (175 days). The other was captured in the spring at 160mm TL, and recaptured during Demographic Monitoring at 275mm TL; however, it was identified as a Flannelmouth Sucker X Razorback Sucker hybrid after growing 115mm from 30 March to 4 October (188 days) (STReaMS 2019). Only being able to use these two fish, one of which being a hybrid, there is not enough data to say what the likelihood of an age-1 fish reaching 300mm TL by the fall of that year. The one Razorback Sucker that we can use was in the middle of the range for spring captures and did not make 300mm TL.

The third question looks into the spatial distribution of age-1 Razorback Sucker. The first positively identified age-1 Razorback Sucker was at Four Corners Bridge with consistent captures continuing downstream. Fish could have been missed upstream by failing to properly identify small suckers captured as wild age-1 Razorback Sucker, our search image was clearer after handling a 1-yr old wild Razorback Sucker. With a Razorback Sucker larvae being captured at the confluence of the Animas and San Juan Rivers, RM 180.6, (Farrington et al., 2019) there were 32.7 RM not sampled from the confluence down to Shiprock Bridge where these small fish could be present and another 28.9 RM from Shiprock Bridge down to where the first age-1 Razorback Sucker was identified on the spring 2019 sampling trip. The second part of the third question looks into being able to identify different successful spawns by location. With individual captures and areas not sampled directly below where larval fish were found the year prior, it is difficult to say if the data collected could answer the second part of that question. It is encouraging to find age-1 fish spanning 102 miles of river.

Of the 43 Razorback Suckers tagged on the spring trip, six individuals have had additional contacts. Four of the six fish were detected on PIT tag antennas in McElmo Creek at river mile .1, two of which were also detected upstream in McElmo Creek on antennas at river mile .2. The remaining 37 tags have not been detected or seen since the spring of 2019. See Appendix A below for STReaMS 2019 query results.

Colorado Pikeminnow

A large percentage of Colorado Pikeminnow that were captured were of a size that was difficult to distinguish between age-2 to age-3 year class given growth rates for Colorado Pikeminnow on the San Juan River (Durst and Franssen 2014). This would put them as 2016 or 2017 cohorts, a more specific look at Colorado Pikeminnow length at age in the spring may tease apart these two year classes however this was not objective of this fiscal year 2019 project. With a large number of fish observed, the catch rates for Colorado Pikeminnow were significantly higher than what was observed in 2015 Adult Monitoring. The adult monitoring pass in 2015 was the last time the whole river was sampled in a single pass.

In 2015 during Adult Monitoring there was a total of 10 adult size fish collected from the confluence of the Animas and San Juan Rivers down to Clay Hills, this sampling only covered three out of every four RMIs. There were eight adult size fish (≥ 450 mm TL) captured during the age-1 monitoring trip from Shiprock to Clay Hills when sampling every river mile. This equates to 133 river miles electrofished in 2015 compared to 145 in spring 2019. With similar captures of adult fish and similar effort, one can hypothesize that the smaller cohort(s) are driving the CPUE higher for that of spring sampling in 2019 versus fall sampling in 2015.

Acknowledgements

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Literature Cited

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Appendix A

STReaMS 2019 query results accessed 13 April 2020

MostRecentTag	TagDeployDate	CommonName	EncounterDate	EncounterTime	EncounterType	Recapture	RiverName	RiverMile	PIAName	ArrayName
3843B23993286	3/28/2019	razorback sucker	3/28/2019		Capture	No	San Juan River	110		
3843B23993286	3/28/2019	razorback sucker	10/23/2019	4:08:50 PM	Detection	No	McElmo Creek	0.1	McElmo Creek	Aneth Confluence
3843B23993286	3/28/2019	razorback sucker	10/23/2019	4:12:50 PM	Detection	No	McElmo Creek	0.1	McElmo Creek	Aneth Confluence
3843B23993766	3/30/2019	flannelmouth x razorback sucker	3/30/2019		Capture	No	San Juan River	85		
3843B23993766	3/30/2019	flannelmouth x razorback sucker	10/4/2019		Capture	Yes	San Juan River	83.8		
3843B2399B414	3/29/2019	razorback sucker	3/29/2019		Capture	No	San Juan River	96		
3843B2399B414	3/29/2019	razorback sucker	7/16/2019	2:21:50 PM	Detection	No	McElmo Creek	0.1	McElmo Creek	Aneth Confluence
3843B2399B414	3/29/2019	razorback sucker	7/16/2019	2:23:05 PM	Detection	No	McElmo Creek	0.1	McElmo Creek	Aneth Confluence
3843B2399F2EF	3/28/2019	razorback sucker	3/28/2019		Capture	No	San Juan River	104		
3843B2399F2EF	3/28/2019	razorback sucker	10/17/2019	3:11:05 PM	Detection	No	McElmo Creek	0.1	McElmo Creek	Aneth Confluence
3843B2399F2EF	3/28/2019	razorback sucker	10/17/2019	3:14:05 PM	Detection	No	McElmo Creek	0.1	McElmo Creek	Aneth Confluence
3843B2399F2EF	3/28/2019	razorback sucker	10/17/2019	4:50:12 PM	Detection	No	McElmo Creek	0.2	McElmo Creek	Aneth Bridge
3843B2399F2EF	3/28/2019	razorback sucker	10/17/2019	4:51:17 PM	Detection	No	McElmo Creek	0.2	McElmo Creek	Aneth Bridge
3843B2399F2EF	3/28/2019	razorback sucker	10/17/2019	4:52:17 PM	Detection	No	McElmo Creek	0.2	McElmo Creek	Aneth Bridge
3843B2399F2EF	3/28/2019	razorback sucker	10/17/2019	4:53:54 PM	Detection	No	McElmo Creek	0.2	McElmo Creek	Aneth Bridge
3843B2399F2EF	3/28/2019	razorback sucker	10/17/2019	5:00:55 PM	Detection	No	McElmo Creek	0.2	McElmo Creek	Aneth Bridge
3843B2399F2EF	3/28/2019	razorback sucker	10/17/2019	5:01:55 PM	Detection	No	McElmo Creek	0.2	McElmo Creek	Aneth Bridge
3843B2399F2EF	3/28/2019	razorback sucker	10/17/2019	5:03:00 PM	Detection	No	McElmo Creek	0.2	McElmo Creek	Aneth Bridge

3843B2399F2EF	3/28/2019	razorback sucker	10/17/2019	6:02:20 PM	Detection	No	McElmo Creek	0.2	McElmo Creek	Aneth Bridge
3843B2399F2EF	3/28/2019	razorback sucker	10/17/2019	4:54:54 PM	Detection	No	McElmo Creek	0.2	McElmo Creek	Aneth Bridge
3843B2399F2EF	3/28/2019	razorback sucker	10/17/2019	4:55:54 PM	Detection	No	McElmo Creek	0.2	McElmo Creek	Aneth Bridge
3843B2399F2EF	3/28/2019	razorback sucker	10/17/2019	4:56:55 PM	Detection	No	McElmo Creek	0.2	McElmo Creek	Aneth Bridge
3843B2399F2EF	3/28/2019	razorback sucker	10/17/2019	4:57:55 PM	Detection	No	McElmo Creek	0.2	McElmo Creek	Aneth Bridge
3843B2399F2EF	3/28/2019	razorback sucker	10/17/2019	4:58:55 PM	Detection	No	McElmo Creek	0.2	McElmo Creek	Aneth Bridge
3843B2399F2EF	3/28/2019	razorback sucker	10/17/2019	4:59:55 PM	Detection	No	McElmo Creek	0.2	McElmo Creek	Aneth Bridge
3843B2399F2EF	3/28/2019	razorback sucker	3/26/2020	10:05:05 PM	Detection	No	McElmo Creek	0.2	McElmo Creek	Aneth Bridge
3843B2399FA96	3/28/2019	razorback sucker	3/28/2019		Capture	No	San Juan River	100		
3843B2399FA96	3/28/2019	razorback sucker	5/13/2019	1:09:20 PM	Detection	No	McElmo Creek	0.1	McElmo Creek	Aneth Confluence
3843B2399FA96	3/28/2019	razorback sucker	5/13/2019	3:08:35 PM	Detection	No	McElmo Creek	0.2	McElmo Creek	Aneth Bridge
3843B2399FA96	3/28/2019	razorback sucker	5/13/2019	3:09:35 PM	Detection	No	McElmo Creek	0.2	McElmo Creek	Aneth Bridge
3843B2399FA96	3/28/2019	razorback sucker	5/31/2019	11:37:00 PM	Detection	No	McElmo Creek	0.1	McElmo Creek	Aneth Confluence
3843B23AC5A8C	3/29/2019	razorback sucker	3/29/2019		Capture	No	San Juan River	88.2		
3843B23AC5A8C	3/29/2019	razorback sucker	8/29/2019	2:33:07 PM	Capture	Yes	San Juan River	90		
3843B23AC5A8C	3/29/2019	razorback sucker	9/20/2019		Capture	Yes	San Juan River	87		

Response to Comments

Mark McKinstry comments:

I don't think we/you can say this yet. Do we really KNOW this??

Correct, we don't really know this year, all would be a best guess, changed some wording to not be so absolute.

I wonder if we can stop doing this??

If there is a reason to stop doing this then I would not have a huge problem with it. With this project, we were not strapped for time and more information is better than less. While SL is not used during this project, if a study down the road would require SL for condition factors we would have some historical data to pull from.

The logic of this doesn't really make sense since you are including this in the report, so it isn't "completed" yet.... It might be nice to know the dates when these fish were detected. It's interesting that they are hitting McElmo. Are they going all the way up to the bridge antennas or just hitting antennas at the mouth?

Edited wording and included STReAMS query output as an appendix

Define this at least as a < or > size.

Added ≥ 400 mm TL

Scott Durst comments:

Maybe consider adding age-1 to the legend for RBS?

Added

The Methods seem to indicate that CPM were captured < 300 and > 400. Figure 2 and Figure 3 seem to show all sizes classes. Clarify this.

Added addition information

How did the capture of a wild age-1 fish at 4 Corners result in consistent captures downstream? Suggest revising this wording.

Changed wording around with suggestions from a review from Mark McKinstry

So do you think you can wait until Demographic Monitoring to positively identify wild age-1 fish?

There is a possibility that some/most wild age-1 RBS could be under 300mm TL by the time Demographic Monitoring samples in the fall. Right now we have a sample size of one fish that was not larger than 300mm by Demographic Monitoring. That would be one out of 43 fish tagged in the spring. Demographic Monitoring only captured 15 RBS <300mm TL in three passes. Using those numbers, I would say that Demographic Monitoring is not an effective way to monitor age-1 RBS recruitment.

NMDGF comments:

The background information lacks context or the rarity of juvenile Razorback Sucker, particularly within a riverine system. There are numerous reports and peer reviewed articles that would provide this useful and pertinent information to the reader.

More review will be provided in future reports, e.g. sampling in spring 2021

I caution using “ideal conditions” to describe the 2018 water year. These conditions were likely far less than ideal but they were sufficient.

Terminology has been changed

While often this statement is true. The difference isn't in size attained. The difference is in development, juvenile stage is when there is no remaining fin fold and the fish has attained all of the finrays for its median fins. Consider expounding on this concept or deleting this

This was pulled from ACIR's 2018 larval sampling report. Statement will stay as is. Thank you for your clarification.

The SOW for this project had three really good questions. Those should be included in this report and addressed.

Included

Avoid using jargon / slang, revise to increase clarity

Revised

Consider including a map that displays the capture locations.

Opting out this year, however this is a good recommendation for next year's report

I would remove suspected, they are wild fish

Removed

Are these 95% Cis?

Yes, as stated in the caption in Figure 2. Now added to text as well.

Is this over the same section of river?

Yes

Are these 95% Cis?

Yes, added to text

Are these the range of catch rates per mile or 95% Cis?

Yes, added to text

Consider discussing the merits of sampling in the Spring vs. Fall or Summer. Also, please consider summarizing the goals and achievements of this project within the discussion.

Added questions "goals" from 2019 SOW. Rearranged and reworded Razorback Sucker Discussion section

It might help to provide the reader with the amount of small Razorback Suckers that have been previously handled during adult monitoring or similar projects.

In the upper reaches that these missed section are referring to, fall monitoring takes place right on top of passive stocking of fish from NAPI ponds. New protocols have been put into place for fish not to be stocked <300mm TL, however, these were not enacted prior to the last fall monitoring trip. Tag loss could be an easy explanation for any fish <300mm TL in the river up there.

It's easier and more informative to state the date. Completion is misspelled

Reworded

This # should be 43 correct?

Corrected

It is interesting that four fish were detected at the McElmo antennas. Can you provide more information on the fish that had additional contacts? Where were they originally tagged? How far did they move? Were all four fish detected around the same time?

Additional information has been added in the text. An appendix with a STReAMS query results from the 43 tags has been added as well.

What size were these fish when captured during Demographic Monitoring? Were they greater than 300 mm TL?

Added TL of fish when captured in the fall

Please check this number, see earlier comment.

Corrected

This statement could be simplified to say that capture rates were high in 2019 and the younger cohorts made up the majority of the catch. More importantly, you should give the reader some context to how often this number of 2-3 year old CPM are captured. Have any of the newly tagged (n=253) fish been recaptured on PIT antenna's or during other monitoring?

This project was originally intended to be a RBS project while still collecting small CPM to increase the number of PIT tags in the system as a large non-native removal effort was reduced and no longer handles T&E fish. A more thorough look at CPM will take place in FY2021 where the SOW addresses that. Thank you for the questions and feedback, these will be included in the write up of that report.