

I. Project Title: Razorback emigration from the Stirrup floodplain (RM 275.7)

II. Principal Investigator(s): Trina Hedrick
Utah Division of Wildlife Resources
Northeast Region
152 East 100 North
Vernal, Utah 84078
Phone: (435) 781-9453 fax: (435) 789-8343
E-mail: trinahedrick@utah.gov

III. Project Summary:

Important rearing habitat for razorback sucker (*Xyrauchen texanus*) is thought to be floodplain wetlands (Wydoski and Wick 1998; Muth et al. 1998; Lentsch et al. 1996; Modde 1996; Tyus and Karp 1990). Reproduction by razorback suckers occurs on the ascending limb of the spring hydrograph allowing enough time between hatching and swim up for larvae to enter the system when highly productive floodplain habitats are accessible (Muth et al. 1998). This seasonal timing of razorback sucker reproduction indicates possible adaptation for using floodplain habitats for rearing purposes (Muth et al. 1998). It is unclear, however, how long young razorback sucker tend to stay in the floodplain before moving back out into the river.

The Green River Floodplain Management Plan (2003) identifies the Stirrup floodplain as a high priority habitat for recovery of the endangered razorback sucker, bonytail (*Gila elegans*), and Colorado pikeminnow (*Ptychocheilus lucius*). The natural levee surrounding the Stirrup was breached at the downstream end in March 1997 in an effort to increase the frequency of connectivity of the floodplain to the river. The floodplain now connects at around 14,000 cfs and can fill to approximately 20 acres during spring peak flows (Birchell and Christopherson 2004).

Though it is not extremely large, the Stirrup floodplain is one of the few floodplain habitats in the middle Green River that retains enough water and overall depth to over-winter fish and therefore, it may provide habitat to support razorback suckers over multiple years. Because of its potential to overwinter fish and singular breach, this site was chosen for a study to research the timing of razorback sucker emigration from highly productive floodplain habitats to the river. Surplus PIT tagged razorback suckers from Ouray National Fish Hatchery were stocked into the Stirrup floodplain in 2007, 2008, and 2009 after connection. In May 2010 during spring peak flows, a stationary PIT tag reader was set up to monitor tagged fish movement into and out of the floodplain.

IV. Study Schedule: Initial year - FY - 2007 Final year - FY 2010

V. Relationship to RIPRAP:
GENERAL RECOVERY PROGRAM SUPPORT ACTION PLAN

- II. Restore habitat (habitat development and maintenance)
 - II.A. Restore flooded bottomland habitats
 - II.A.1. Conduct inventory of flooded bottomlands habitat for potential restoration

GREEN RIVER ACTION PLAN: MAINSTEM

- II. Restore habitat (habitat development and maintenance)
 - II.A. Restore and manage flooded bottomland habitat
 - II.A.1. Conduct site restoration
 - II.A.2. Acquire interest in high-priority flooded bottomland habitats between Ouray NWR and Jensen to benefit endangered fish
 - II.A.2.a. Identify and evaluate sites
- IV. Manage genetic integrity and augment or restore populations (stocking endangered fishes)

VI. Accomplishment of FY 2010 Tasks and Deliverables, Discussion of Initial Findings and Shortcomings:

Task 1. Pump water from the river into the Stirrup floodplain. This includes preparation of compliance documents for both the BLM and Utah Division of Water Rights. This may also be conducted again between tasks 3 and 4.

We started the pump on 8 April 2010 and ran it 24-7 through 27 April 2010.

Task 2. Stock razorback sucker in the Stirrup floodplain.

Razorback suckers stocked by Ouray National Fish Hatchery 2007-2009:

2007 – 1632 Age-2 stocked 6/25/2007 (2005 age class)
 1633 Age-1 stocked 10/16/2007 (2006 age class)

There was a severe fish kill overwinter 2007. We know we had some survival, but we also know that many of the fish died from low oxygen levels.

2008 – 1000 YOY stocked 10/09/2008 (125 mm average) (2008 age class)
 2000 Age-1 stocked 7/1/2008 (256 mm average) (2007 age class)
 1047 Age-1 stocked 7/23/2008 (excess?) (2007 age class)
 952 Age-2 stocked 7/1/2008 (2006 age class)

We did not document a fish kill overwinter between 2008 and 2009.

2009 – 1727 Age-1 stocked 6/10/2009 (2008 age class)

There was a partial winter kill between 2009 and 2010 due to low oxygen levels. However, we

did record 2008 RZ moving out of the Stirrup in June 2010.

Task 3. Monitor water quality and species assemblage in Stirrup floodplain.

Water quality was monitored on 22 December 2009, 12 January 2010, and 13 April 2010. Shallow readings were made within one foot of the surface. Deep readings were made within one foot of the substrate.

	22 Dec - shallow	22 Dec – deep	12 Jan – shallow	12 Jan – deep	13 Apr – shallow	13 Apr - deep
Snow depth (in)	3-4	3-4	1.5	1.5	-	-
Ice depth (in)	5-6	5-6	6.5	6.5	-	-
Water depth (in)	36	36	46	46	-	-
DO (mg/L)	5.2	2.19	0.67	0.38	5.61	1.78
pH	13.9	9.02	5.63	7.03	8.02	7.19
Cond. (µS)	594	594	643	644	578	644
Temp (C)	3.04	3.57	2.76	2.86	12.63	12.58

We sampled fish on 13 April 2010 using trammel nets. Four trammel nets were set around the floodplain for two nights. Nets were checked on the morning of the 14th and the morning of the 15th. Catch predominantly consisted of carp, bullheads, and a few green sunfish and white sucker; however, 11 razorback suckers were captured between the two nights. No razorbacks captured during the netting were subsequently picked up leaving the floodplain in June. In order to increase the number of razorbacks contacted in pre-connection sampling, crews electrofished the Stirrup on 27 April 2010. Only carp, bullheads, and white sucker were captured during this effort.

Task 4. Set up stationary PIT tag reader during spring peak flows.

The reader was in place on 13 April 2010. High noise was an issue at first; however, through much iteration, both antenna 3 (nearest the river) and antenna 4 (nearest the floodplain and separated from antenna 3 by about 20 feet) were in tune and working by 23 April 2010. Some of the project expenditures were allocated to bring Peter MacKinnon on site to help with the tuning. Data was downloaded regularly, even before connection, to ensure antennas maintained their tuning. Once flows came up, the antennas required re-tuning. Even with the tuning and re-tuning, detection efficiency¹ for antenna 3 remained lower than that for antenna 4. Antenna 4 read at 97-100% over the period between 23 April and connection (when test tags were no longer fired because the reader was detecting real tags). The reader efficiency for antenna 3 was closer to 85-90% for this same period. This lower (yet still high) detection efficiency likely meant that some fish passed through antenna 3, but were not picked up during the connection period. Based on

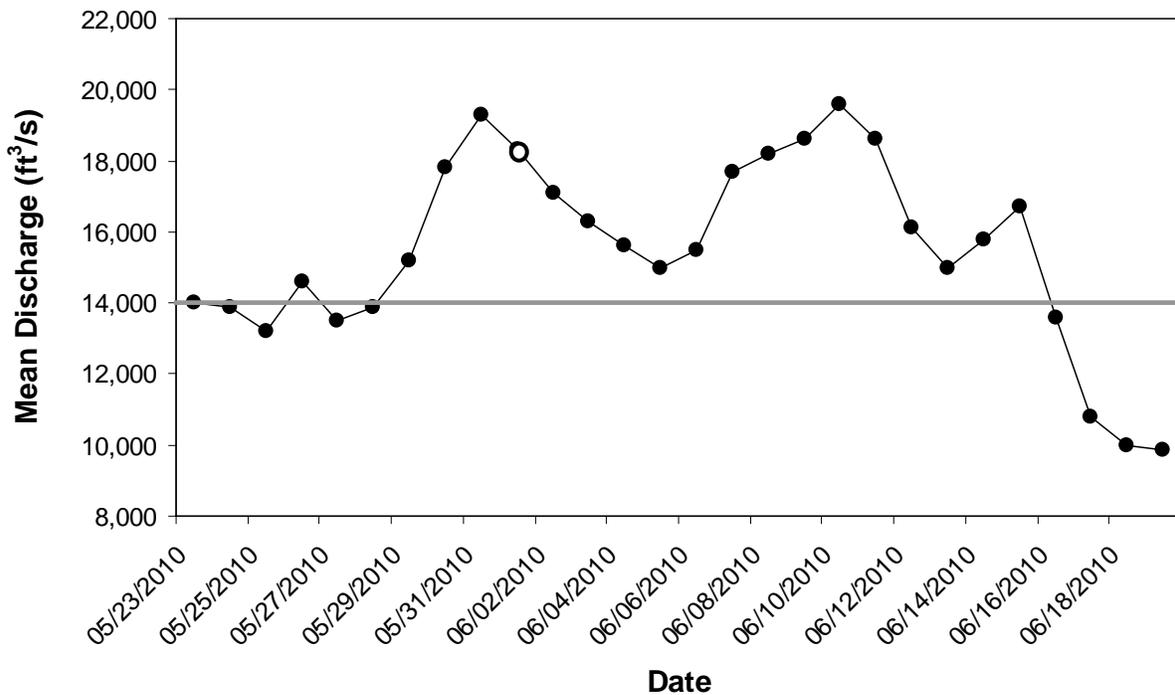
¹ Detection efficiency is defined here as the number of test tags actually fired / the number of test tags that should have been fired by that antenna (set to occur once per hour) x 100.

our detection probability before connection, this would only have been 15% of fish and would only have hindered our ability to detect direction since antenna 4 was reading at such a high efficiency.

Task 5. Download PIT tag data and monitor PIT tag array

The first fish was detected in the breach on 24 May. Minimum water depth over the antennas was 28 cm at this time. However, minimum depth at the interface between floodplain and breach was much less, thus fish were only moving into the breach, not into or out of the floodplain at this time.

Flows can limit the movement of fish into and out of the Stirrup. Average daily flows at Jensen (at least 24-hr travel time between Jensen and Stirrup) were:



The Stirrup connects to the river at approximately 14,000 cfs (grey line); however, at this flow, water is entering the breach, but without depth of 25 cm the entire route to the floodplain, fish will not move. Therefore, fish did not start moving into/out of the floodplain until 1 June (open circle). We would have assumed this based on flows, but we also verified it based on tags detected by the reader.

Please note that the antenna configuration was such that antenna 3 was closest to the river; antenna 4 was closest to the floodplain. The reader picked up the following individual fish

movements from bonytails (BT), Colorado pikeminnow (CS), and razorback suckers (RZ):

49B8 – This BT, stocked into the Green River in 2009 by Wahweap, attempted to enter the floodplain on 23 May. It stayed in the breach around the antennas for about 4.5 hours and then left and never returned to the breach.

587E – This fish, a CS tagged in 2008 at RM 273.8 and then observed at the Stirrup in 2009, returned on 1 June in the early evening. It was detected on inner antenna first and therefore potentially overwintered in the Stirrup. This fish was again detected entering the Stirrup midday on 8 June and leaving within the hour.

BD3F – This is the first RZ detected moving out of the floodplain on 1 June. This was a 2008 RZ stocked into the Stirrup in 2009.

8240 – This fish is a CS initially tagged in 2008 at RM 276.8. It was detected at the Stirrup in 2009 and returned many times in 2010. This fish initially moved in to the Stirrup on 1 June. It left and returned again that evening. It wasn't detected again until 7 June and was detected entering the floodplain, but had not been detected leaving during that time period (likely due to the lower detection efficiency of antenna 3). The fish was then detected entering the floodplain again on 8 June. This time, antenna 3 picked it up leaving the floodplain as well. It entered and left the floodplain multiple times that evening. It entered again on 11 June and was then recorded leaving the floodplain on 15 June.

8C3A – This was a 2008 RZ stocked in 2009. It was detected around antenna 4 on 1 June, but did not actually leave the floodplain until 6 June.

8190 – This was another 2008 RZ stocked in 2009. It likely left the floodplain on 1 June, though it was only detected on antenna 4. Given the lower detection efficiency of antenna 3, it is possible that it moved out. It is also possible that it decided not to leave the floodplain and got no further than antenna 4.

8990 – This RZ entered the floodplain on 1 June and remained there. It was originally tagged in Baeser and released to the river on 7 October 2009.

5484 – This RZ entered the floodplain on 1 June and remained there. It was originally tagged in Baeser and released to the river on 7 October 2009.

3DEC – This RZ entered the floodplain on 1 June and remained there. It was originally tagged in Baeser and released to the river on 10 September 2009.

C384 – This is a BT, stocked by Wahweap in 2009. It was first detected on 1 June on antenna 4; however, given its origin, it must have passed through antenna 3 as well. It remained in the breach for a few hours over night, but then moved into the floodplain. It left the floodplain on 4 June. It returned on 6 June and was detected in the breach around antenna 4 on 7, 8, and 10 June as well. It left again overnight on 11 June, but came back on 12 June and then again overnight on

16 June. It left the floodplain on 17 June.

F723 – This was a 2008 RZ stocked into the Stirrup in 2009. It left overnight on 1 June.

F103 – This was a RZ stocked into the river on 15 September 2009 by Ouray National Fish Hatchery (ONFH) at RM 319. It entered the breach in the early morning of 2 June, but given its continued detection at antenna 3, it did not appear to enter the floodplain.

684C – This was a CS, originally tagged at RM 293.8 in 2008. It was detected entering the floodplain on 2 June during the early morning, but was not detected leaving.

9089 – This was a RZ from Baeser originally tagged and released into the river on 2 October 2009. It was detected entering the Stirrup overnight 3 June.

One item of interest was the observation of no fish moving overnight between June 2nd and 3rd, as flows dropped back down. On-site observations made on 3 June revealed that since water was leaving the breach, all of the sediment had dropped out and water in the breach was clear. Minimum depth in the breach was greater than 40 cm, suggesting that fish could easily move through there. However, no native fish (the author observed carp) were seen (as detected by the reader) overnight suggesting that native fish need depth *and* turbidity to enter floodplain environments.

7EC5 – This was a BT initially detected entering the floodplain the morning of 4 June. It left on 9 June, but returned less than an hour later. It was then detected in the breach again on 11 June, left on 13 June and then returned on 16 June.

439E – This was a BT (stocked in 2009 by Wahweap) detected entering, milling about, and then leaving the breach over 43 minutes on 4 June.

4ED0 – This was a BT (stocked in 2009 by Wahweap) detected entering the floodplain on 4 June. It entered the breach to leave, but then went back into the floodplain on 8 June. It again moved into the breach on 9 and 10 June, but appears to have stayed in the floodplain.

E701 – This was a 2006 RZ stocked into the floodplain in 2008. It left on 5 June and represents the fish with the longest recorded stay in the Stirrup.

DCFA – This was a 2008 RZ stocked into the Stirrup in 2009. It moved back and forth in the breach and back into the floodplain on 6 and 7 June, but finally left on 8 June.

E77F – This was a 2008 RZ stocked into the Stirrup in 2009. It stayed in the breach for four hours before finally leaving. All of this activity occurred on 7 June.

123F – This was a 2008 RZ stocked into the Stirrup in 2009. It either left entirely or just stayed in the breach and was detected again on antenna 4 (not antenna 3) on 10 June. It appeared to stay around antenna 4, perhaps moving from the antenna to the floodplain before finally leaving on

15 June.

0431 – This was a 2008 RZ stocked into the Stirrup in 2009. It left on 8 June.

5F9F – This was a CS originally tagged in 2008 at RM 275.8. This fish appears to have entered the floodplain on 8 June and despite moving into the breach on numerous occasions, remained in the floodplain until 12 June. It entered the floodplain again on 15 June and left the following morning.

BD46 – This was a 2008 RZ stocked into the Stirrup in 2009. It left on 8 June.

0266 – This was a RZ originally tagged in the Green River by Brunson on 11 May 2005. It was detected in the breach on 8 June, appeared to leave on 9 June. It returned a number of times on 10 and 11 June before finally leaving on 12 June.

49CD – This was a CS originally tagged at RM 302.8. This CS also visited the Stirrup in 2009. It entered the Stirrup this year on 8 June and was not detected leaving the floodplain.

8737 – This was a 2008 RZ stocked into the Stirrup in 2009. It was detected leaving the floodplain on 8 June.

59BE – This was a CS originally tagged at RM 278.6. It moved in from the river and was picked up numerous times within the breach overnight on 8 and 9 June and then again 9 and 10 June. It returned again on the morning of 11 June, but left mid-afternoon.

60E8 – This was a Baeser RZ captured, tagged, and moved to the river on 8 October 2009. It was detected entering the Stirrup on 8 June and left the floodplain on 13 June.

AFEA – This was a 2008 RZ stocked into the Stirrup in 2009. It was detected at antenna 4 on the afternoon of 8 June and again in the early morning of 9 June. It was not detected on antenna 3.

AB69 – This was a 2008 RZ stocked into the Stirrup in 2009. It appeared to attempt to leave on 8 June, but eventually returned. It appeared to attempt to leave again on 11 June, but again returned to the floodplain.

1781 – This was a RZ originally stocked by ONFH into the Green River on 16 August 2006 at RM 212. It was detected moving into the floodplain on 8 June and left the following morning. It returned that evening (9 June), stayed through the early afternoon of 11 June, returned that night and finally left in the early morning on 13 June.

EE09 – This was a 2008 RZ stocked in 2009. It left, but immediately came back (7 minutes later) on 9 June.

BA48 – This was a Baeser RZ captured, tagged, and moved into the river on 29 July 2009. It

entered the floodplain on 10 June and left on the 19 June. This is a very late date for movement out, given the Jensen flows. It is possible that it actually remained in the breach until the 19th or that it did enter the floodplain, but sometime before the floodplain disconnected from the breach, it moved into the floodplain side of the breach and remained until moving out on the 19th.

24AD – This was a 2008 RZ stocked into the Stirrup in 2009. It left the Stirrup on 10 June.

0B39 – This was a 2008 RZ stocked into the Stirrup in 2009. It left the Stirrup on 10 June.

F5F7 – This was a RZ detected at the Stirrup in 2008. It entered the breach on 11 June, remained in the breach until finally entering the floodplain early the morning of 12 June.

B53F – This was a RZ stocked by the ONFH into the Green River (RM 319) on 15 September 2009. It entered the floodplain 11 June and was not detected leaving.

FC60 – This was a RZ originally stocked by the ONFH on 15 September 2009 at RM 319. This fish entered and remained in the breach for a few hours overnight between 11 and 12 June. It finally entered the floodplain the morning of 12 June and was not detected leaving.

C26C – This was a RZ originally stocked by ONFH on 27 October 2005 at RM 120. This individual *left* the Stirrup on 12 June. Given that it was not detected at the Stirrup in 2009, this individual may have been in the floodplain for many years before moving out this spring.

73C6 – This was a Baeser RZ that was captured, tagged, and moved to the river on 7 October 2009. It entered the floodplain on 12 June and was not detected leaving.

C9BE – This was a RZ originally stocked by the ONFH on 15 September 2009 at RM 319. It entered the floodplain on 16 June.

Task 6. Summarize results/findings/submit final report

The final report will be submitted December 2010.

VII. Recommendations:

- If the intent is to overwinter the remaining razorback suckers, the floodplain should be pumped to better ensure adequate DO levels through winter.
- If the reader is put out again in the spring, the floodplain should be pumped before connection to speed up timing of connection of the floodplain. This same goal could be accomplished through dredging of the higher end (the end closer to the wetland) of the breach.
- Discontinue efforts to sample the Stirrup pre- and post-connection unless more time/effort can be put towards the project or a more effective gear can be used.

- Three antennas should be the minimum number of antennas used for detecting movement. If the project is continued, the third antenna should be rebuilt.

VII. Project Status:

The project is ongoing and on track.

IX. FY 2010 Budget Status

- A. Funds Provided: \$18,500
- B. Funds Expended: \$18,500
- C. Difference: \$0
- D. Percent of the FY 2010 work completed, and projected costs to complete: 100%
- E. Recovery Program funds spent for publication charges: \$0

X. Status of Data Submission:

I worked out a data format for the 2009 data that seems to work well. I will submit the 2010 data in the same format by December 2010.

XI. Signed: Trina Hedrick 10/25/2010
Principal Investigator Date

XII. Literature Cited

Birchell, G.J. and K. Christopherson. 2004. Survival, growth, and recruitment of larval and juveniles razorback sucker (*Xyrauchen texanus*) introduced into floodplain depressions of the Green River, Utah. Utah Division of Wildlife Resources, publication no. 04-15, Salt Lake City, Utah.

Lentsch, L., T. Crowl, P. Nelson, and T. Modde. 1996. Levee removal strategic plan. Utah Division of Wildlife Resources, Salt Lake City, UT. 21 pp.

Modde, T. 1996. Juvenile razorback sucker (*Xyrauchen texanus*) in a managed wetland adjacent of the Green River. Great Basin Naturalist 56:375-376.6

Muth, R.T., G.B. Haines, S.M. Meismer, E.J. Wick, T.E. Chart, D.E. Snyder, and J.M. Bundy. 1998. Reproduction and early life history of razorback sucker in the Green River, Utah and Colorado, 1992 – 1996. Final Report submitted to the Recovery Implementation Program for Endangered Fish Species in the Upper Colorado River Basin. U.S. Fish and Wildlife Service, Denver, CO. 62 pp.

Tyus, H.M. and C.A. Karp. 1990. Spawning and movements of razorback sucker, *Xyrauchen texanus*, in the Green River basin of Colorado and Utah. Southwestern Naturalist 35:427-433.

Wydoski, R.S. and E.J. Wick. 1998. Ecological value of floodplain habitats to razorback suckers in the Upper Colorado River Basin. Final Report submitted to the Recovery Implementation Program for Endangered Fish Species in the Upper Colorado River Basin. U.S. Fish and Wildlife Service, Denver, SO. 55 pp.