

COLORADO RIVER RECOVERY PROGRAM
FY 2011 ANNUAL PROJECT REPORT

RECOVERY PROGRAM
PROJECT NUMBER: RZ-Recr

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

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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 sucker 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.

IV. Study Schedule: Initial year - FY - 2007 Final year - FY 2011

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.

To increase overwinter survival of remaining stocked razorback sucker and bonytail, water was pumped into the floodplain in the fall of 2010 (November 9–23) and 2011 (November 15–21) just prior to ice cover. On both occasions, pumping was discontinued when we observed backflow out of the floodplain (i.e., wetland completely full).

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 (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 RZ, stocked in 2008, moving out of the Stirrup in June 2010.

Following extensive floodplain augmentation in 2010, we did not document a fish kill overwinter between 2010 and 2011 and did observe RZ stocked in 2009 moving out in 2011.

2011 – 6804 Age-2 bonytail (2009 age class; 205 mm average when tagged previous fall) were stocked by Wahweap Fish Hatchery on 4/7/2011

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

Water quality was monitored on seven dates in 2011 (Table 1) following 2010 fall pumping and floodplain connection in 2011. Measurements from our multi-probe sonde, set to record at 30 second intervals, were averaged for approximately five minute readings taken during each sampling event. It appears that adequate oxygen levels were maintained year-round (Table 1), which likely prevented a fish kill entirely overwinter between 2010 and 2011.

We sampled fish on two separate occasions following the additional bonytail stocking and the extensive floodplain connection observed in 2011 (Figure 1) in order to determine bonytail residence following connection and whether larval razorback sucker were entrained in the floodplain (i.e., present as young-of-year). From 26-29 July 2011 we set 10 fyke nets (small and large mesh) throughout the wetland for three nights (i.e., 30 fyke net sets altogether) and conducted boat electrofishing along three transects that encompassed near shore and deepwater habitats (total effort = 5,795 s). Catch predominantly consisted of green sunfish, black bullhead, fathead minnow, and carp during the July sampling effort (Table 2). However, one razorback sucker (TL = 383 mm) was captured twice during successive electrofishing transects. This fish was not stocked in the Stirrup floodplain or detected moving into the floodplain; it was originally stocked into the mainstem Green River by ONFH in the fall of 2010. From 14-18 November 2011 we strategically placed 13 fyke net sets and two trammel net sets to take advantage of inflow currents during fall pumping that likely attracted fish to the area near the floodplain breach. Catch predominantly consisted of red shiner, fathead minnow, black bullhead, carp, and green sunfish during the November sampling (Table 2). Although we did not collect any endangered fishes during November fyke-netting, of particular interest is an unknown darter spp. that was collected during each sample date and in multiple nets (Table 2). These individuals were preserved and we are awaiting final species identification (Larval Fish Lab). The trammel net was placed just below the inflow where the floodplain narrows towards the breach (i.e., last defense for fish that were missed by fyke nets). Only two trammel net sets were used because fyke nets proved extremely effective (Table 2) and overnight ice near the edges of the wetland affected trammel net sets. Although only two fish were collected with trammel nets, one was an untagged juvenile pikeminnow (TL = 322 mm).

Additionally, a trial run using a floating PIT-reader (Peter MacKinnon, with the help of Vernal CRFP) was conducted to determine if PIT-tagged fish could be detected in the Stirrup floodplain on 10 May 2011. Using a raft rigged with a trolling, also pushed at times in shallower water, the crew searched the inflow area (during initial connection) for about one hour. Altogether, 12 unique tags were detected; crews ensured that these were from live fish. Five of these fish were bonytail stocked into the Stirrup in 2011, five fish were razorbacks stocked into the Stirrup (4 from 2008 and 1 from 2009), and two fish were razorbacks tagged and released at the Baeser floodplain (one was released into the Green River). Three of these fish, all bonytail, were detected in the floodplain breach.

Table 1. Water quality measurements at the Stirrup floodplain. Open water measurements were taken from mid-water column and measurements during ice cover were taken near the substrate, at mid-water column, and just below the ice surface.

Date	Temp. (°C)	DO (mg/L)	pH	Cond. (µS)	Ice Depth (in.)	Snow Depth (in.)
1/20/2011	4.7	9	8.2	596	10-12	1-2
2/15/2011	4.4	8.1	7.6	670	10-12	2-3
3/14/2011	7.5	16.6	8.6	662	9.5*	0
4/21/2011	13.1	7.4	9.3	498	-	-
8/1/2011	26.9	11.3	9.7	383	-	-
9/13/2011	22.6	9.7	9.7	379	-	-
10/24/2011	12.3	7.9	9.3	402	-	-

* Ice conditions unstable during measurement (i.e., soft ice that was melting fast).

Table 2. Fish sampling conducted at the Stirrup floodplain. Data from similar gear types used during each sampling event (July or November) was combined.

Species	July Sampling		November Sampling	
	Fyke Nets	Electrofishing	Fyke Nets	Trammel Nets
black bullhead	176	-	1033	1
bluegill	17	34	135	-
carp	76	72	393	-
Colorado pikeminnow	-	-	-	1
darter spp.	18	-	52	-
fathead minnow	176	-	1148	-
green sunfish	622	15	220	-
razorback sucker	-	1	-	-
red shiner	7	-	1554	-
redside shiner	-	-	1	-
sand shiner	4	-	5	-
white sucker	7	3	28	-

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

The reader and antennas were in place on 13 April 2011; antenna 1 was closest to the river, antenna 4 was closest to the floodplain, and antenna 3 was in between – all antennas were separated by approximately 20 feet. Antennas were initially tuned until 21 April 2011 when we were able to replace an underwater connector to the exciter cable, at which time all antennas were functioning well (i.e., minimal noise levels and detecting all field test tags easily). Even without conducting any fine-tuning prior to floodplain connection (21 April to 8 May), detection efficiency¹ remained relatively high for antenna 1 (89.7%) and antenna 4 (92.4%). Once flows came up, the antennas required re-tuning which was conducted on 8 May 2011. After this time, test tags were no longer fired because the reader was detecting real tags (most of the time). The first tag was detected by the antennas in the floodplain breach on 11 May 2011 at 0603. However, we may have experienced some data loss due to a full memory on the multiplexer, which maxes out at 5,310 records and deletes the earliest records to add new information. This occurred because communication with the reader was not possible during site visits on the 9th and 10th of May (disallowing a download) because the HyperTerminal routing information to the field computer was reset and required IT assistance. Unfortunately, during this time the unique mode (set at one minute intervals hereafter) was disabled which quickly filled the memory. Despite this discrepancy, data loss was probably minimal during this time and we feel that the first fish detection is an accurate reflection of when they began moving out of the floodplain. Specifically, 25 cm depth is required throughout the entire breach before fish begin to move freely between the river and floodplain (see previous annual report). On 10 May 2011, breach depth was measured at four locations (between 1100 and 1200) and was 11 cm near the floodplain, which only consisted of sheet flow at the time. Given the lag time in flows (Figure 1), breach depth great enough for fish movement likely did not occur until the morning of 11 May 2011, which would also be consistent with the timing from our 2010 results.

Although antenna 3 was fully operational during the entire connection period, antennas 1 and 4 stopped functioning due to water damaged from prolonged inundation (antennas were completely submerged for an extended period due to high peak flows). Antenna 1 was detecting test tags and real tags until 5 June 2011, after which time it did not detect anything due to lack of antenna current. Antenna 4 stopped firing test tags after 3 June 2011, but continued to detect real tags on 4 June 2011, which was its last day of detections. Once flows receded we determined that there was moisture inside of the antennas that affected the wire coils. We have since consulted with other researchers using this same equipment and determined that an appropriate solution to prevent future leaks and antenna damage will be using a final seal using water weld.

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

Over the entire connection period, which lasted for 69 days (Figure 1), we had a total of 20,884 detections with all three antennas combined. Of these detections, we identified 1,216 unique fish

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.

that were detected in the floodplain breach; only one that is not yet accounted for. In the interest of providing an annual report to the Recovery Program in a timely fashion, we will only briefly summarize fish detected by stationary antennas at the Stirrup floodplain breach during operation in 2011. We will provide an addendum to this report that will consist of a complete summary of capture histories at a later date (prior to the 2012 field season).

Of the 1,216 unique individuals we detected 1,129 bonytail that were stocked in the Stirrup on 7 April 2011, which constitutes 16.6% of the stocked fish. Although we have not assessed directional movement for this report, we suspect that the majority of these fish were moving out of the floodplain. Regardless, this is likely a gross underestimate of the number of stocked bonytail that left the floodplain given that extremely high peak flows (Figure 1) substantially widened and deepened the breach providing new avenues of movement around the antennas. One of these bonytail was subsequently recaptured during trammel netting in the Baeser floodplain on 21 October 2011. In addition, we detected 10 bonytail that were stocked by the Wahweap Fish Hatchery in other locations in 2011.

Overall, we detected 63 razorback suckers in the floodplain breach. Six of these fish were from the 2008 year class that were originally stocked in the Stirrup floodplain in 2009 (now age 3 fish). Twenty-two of these fish were originally stocked in the Baeser floodplain, including three fish that were previously documented at the Stirrup. Thirty-five of these razorbacks were originally stocked in the middle Green River by ONFH.

Finally, we detected 13 Colorado pikeminnow in the floodplain breach. Eight of these fish were originally tagged in the middle Green River, many with previous detections at the Stirrup. Five were originally tagged in the lower Green River. We did come across an interesting capture history for one fish that deserves a brief mention. One Colorado pikeminnow was originally tagged in 2001 in the Green River at RM 26.8 during pikeminnow population estimates. In 2008, this fish was recaptured during pikeminnow population estimates in the White River at RM 17.2. The following year, smallmouth bass removal crews recaptured this fish in the Green River at RM 329.8 before we finally detected it once again at the Stirrup in 2011.

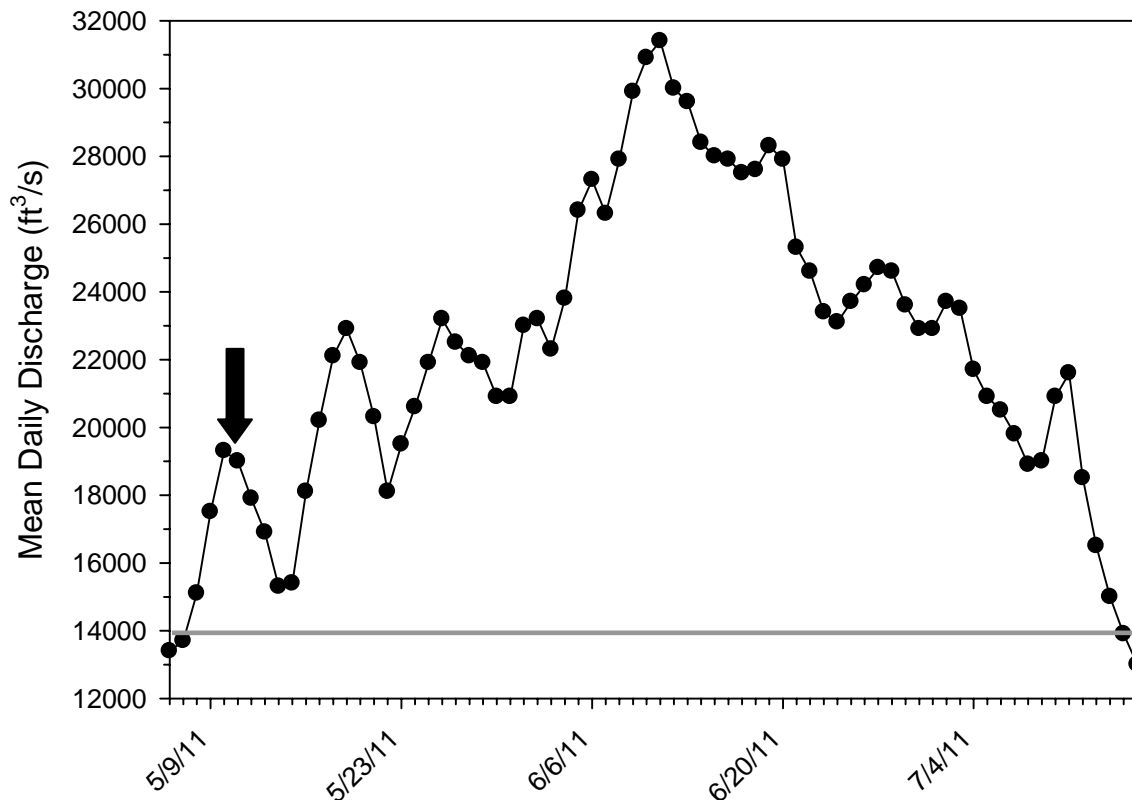


Figure 1. Mean daily discharge for the Green River at Jensen, Utah (USGS; provisional data). The Stirrup floodplain connects to the river at approximately 14,000 cfs (grey line); however, at this flow, water is entering the breach, but without depth of approximately 25 cm the entire route to the floodplain, fish will not move. Therefore, fish did not start moving into/out of the floodplain until 11 May 2011 (indicated by an arrow). Note that lag time for flows from Jensen to the Stirrup is approximately 24 hours.

Task 6. Summarize results/findings/submit final report

Annual report to Recovery Program November 2011.

The revised version of the final report will be submitted in January 2012.

VII. Recommendations:

- Given that an abundance of fish (bonytail, razorback sucker, and Colorado pikeminnow) originally stocked in Green River floodplains or main channel habitats were detected moving into or out of the Stirrup floodplain during the extensive floodplain connection period in 2011, we suggest that stationary PIT antennas provide an integral tool for

determining vital life-history and habitat use information on endangered Colorado River fishes. Although single breach wetlands are ideal for detecting movement of fishes between wetland and riverine habitats, we recommend that this work or a similar study be focused on another wetland other than the Stirrup. Due to increased depth, which may provide refugia from low DO levels overwinter and avian predation (identified in Hedrick et al. In Review), a larger surface area, and the ability to manipulate water levels and outflow for a movement study, we recommend that the Stewart Lake floodplain would provide an ideal setting for continuation of this project and/or further development of a similar floodplain habitat use study.

- We recommend continuation of this work (stationary antennas) in the Stirrup if additional fish are stocked there.
- We recommend that future stocking, regardless of species, should occur in the fall so that overwinter survival estimation can be incorporated into the study design and as mentioned, future stockings would be more appropriate for the Stewart Lake floodplain.
- Three antennas should be the minimum number of antennas used for detecting movement, especially during longer sampling durations when equipment difficulties are inevitable. If the project is continued, all three of our antennas will require repairs and rebuilds, which should be a normal consideration for field equipment that is used for multiple seasons.

VIII. Project Status:

The project is ongoing and on track.

IX. FY 2010 Budget Status

- A. Funds Provided: \$17,579
- B. Funds Expended: \$17,579
- 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:

2011 data will be submitted in December 2011.

XI. Signed: Matthew J. Breen 11/30/2010
Principal Investigator Date

XII. Literature Cited

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