Upper Colorado River Endangered Fish Recovery Program

Noreen Walsh, Chairman
Implementation Committee

Thomas E. Chart
Program Director

U.S. Fish and Wildlife Service - P.O. Box 25486 - Denver Federal Center - Denver, CO 80225 - (303) 236-9881 - Fax (303) 236-8739

FWS/CRRP
K3a1
Mail Stop 65115
Memorandum

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To: Brent Rhees, Regional Director, Upper Colorado Region, Bureau of Reclamation

Heather Patno, Chair, Flaming Gorge Technical Working Group, Bureau of Reclamation

From: Thomas Chart, Director, Upper Colorado River Endangered Fish Recovery Program

Subject: Recovery Program's Research Request for 2015 Green River Spring Flows

The Upper Colorado River Endangered Fish Recovery Program (Recovery Program) supports the Bureau of Reclamation's (Reclamation) operations at Flaming Gorge Dam in 2015 consistent with the 2005 biological opinion (U.S. Fish and Wildlife Service 2005) and 2006 record of decision (ROD; U.S. Department of Interior 2006). As in the past four years, the primary objective of our request this year is to build on past research (Bestgen et al. 2011) to benefit the razorback sucker population throughout the Green River by timing the river-floodplain connection with the presence of wild-produced razorback sucker larvae.

The Recovery Program's 2015 spring flow request is based on objectives outlined in our *Study Plan to Examine the Effects of Using Larval Sucker Occurrence in the Green River as a Trigger for Flaming Gorge Dam* (LTSP; Larval Trigger Study Plan Ad Hoc Committee 2012). In the LTSP we describe a desired range of experimental floodplain connection scenarios and studies we would implement to evaluate those scenarios. Minimally, to complete the experiment, the Recovery Program requests three years with flows < 18,600 cfs and three years with flows ≥ 18,600 cfs and with connecting flows in each of these years of at least seven days duration. However, spring peak flow magnitude requests will be driven by hydrologic conditions in the upper Green River Basin and to some extent the Yampa River basin; therefore, it may not be possible to complete the experiment in six consecutive years. The LTSP experiment began officially in 2012; however, the Recovery Program was able to gather some pre-LTSP related information during 2011. Reclamation's spring operations in 2011 were dictated by flood control concerns, but resulted in

significant floodplain connection in Reach 2 after wild produced larvae were detected. Beginning in 2012, Reclamation's high spring releases (Figure 1) have been timed specifically to achieve LTSP objectives in Reach 2. The resulting Reach 2 flows and preliminary results of biological monitoring in Reach 2 floodplain habitats are summarized in Table 1 and discussed in greater detail in the attached Appendix. In 2012, Reclamation and the Recovery Program connected floodplain habitats (e.g. Stewart Lake and Old Charley Wash) after larvae were detected in the river and documented larval entrainment into those floodplains. In 2013, dam operations in accordance with the LTSP experiment again connected floodplains and entrained larval fish, but also progressed by supporting over-summer survival and rapid growth of entrained larvae. Further, the eventual release of these fish back to the Green River represented a major milestone in LTSP implementation and represents a positive step forward in the recovery of razorback sucker. In 2014, larval entrainment was documented at 5 of 6 sampled floodplains (Stirrup, Escalante, Stewart Lk, Above Brennan, and Leota 7 (confirmed via capture of Age-0 in the fall) (Webber et al. 2014; Schelly et al. 2014). The Bonanza Bridge floodplain was not sampled for larvae in the spring; only nonnative species were collected when UDWR sampled the site in the fall (Schelly et al. 2014). Age-0 razorback sucker were again released from Stewart Lake to the Green River in September; fish released to the Green River in 2014 were more numerous and larger in size than those in 2013 (Schelly et al. 2014). Even more importantly, later in September 2014, researchers collected wild produced Age-0 razorback sucker in Green River Reach 2 main channel backwater habitats for the first time since 2000 (Breen et al. 2014). Over the last three years, each LTSP implementation has yielded an increasingly positive response from razorback sucker.

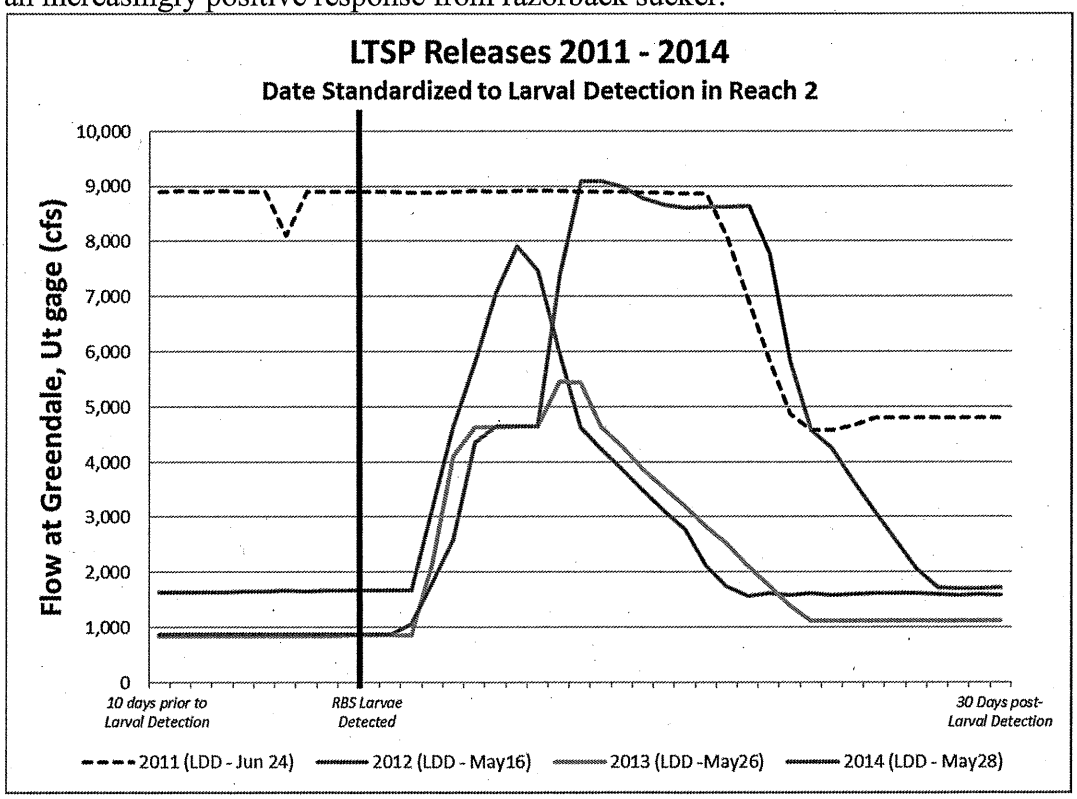


Figure 1. Reclamation's spring, LTSP releases from Flaming Gorge Dam 2012 – 2014. Spring 2011 releases (dashed line) were largely driven by flood control concerns, but are included here because significant floodplain connection occurred in Reach 2 after larvae were detected. Chronology of annual hydrographs has been standardized to 1st larval detection date (LDD). Actual annual LDD's are identified in the legend.

Table 1. A summary of Reach 2 flows and preliminary biological findings associated with LTSP operations and Recovery Program studies. Not all potential study floodplains are listed.

| Year / date of 1st RBS larval capture | Year type classification : Green River/ Yampa River | Flow (CFS) Days @ Jensen Gage after RBS Larvae Detected | | | Floodplains[1] – RBS Larvae Detected[2] | | | | | Floodplains[1] – RBS Juveniles Detected[2] | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | >8,300 | >18,600 | >20,300 | ER | SL | Le | St | AB | ER | SL | Le | St | AB |
| 2011 / Jun24 | ModWet/ Wet | 33 | 19 | 13 | Prior to start of LTSP study – larvae presumably entrained in all wetlands. | | | | | Juvenile RBS detected in Wyasket Lk. and Leota | | | | |
| 2012 / May16 | Dry / Dry | 5 | - | - | NA | Y | NA | NA | NA | NA | NA | NA | NA | NA |
| 2013 / May26 | Mod Dry / Mod Dry | 18 | - | - | NA | Y | NA | NA | NA | NA | Y | NA | NA | NA |
| 2014 / May28 | Avg (Above Med) / Mod Wet | 25 | 4 | - | Y | Y | N | Y | Y | N | Y | Y | N | N |

1 ER = Escalante Ranch; SL = Stewart Lk; Le = Leota Bottoms; St = Stirrup; AB = Above Brennan

2 NA = not available, i.e. particular floodplain did not connect; **Y,** N = yes or no - larvae or juvenile detected in floodplain

THE RECOVERY PROGRAM'S SPRING 2015 GREEN RIVER FLOW REQUEST:

**Implement the LTSP.** The Recovery Program requests that the Flaming Gorge Technical Work Group match Recovery Program research needs identified in the LTSP with the best available spring flow forecast information to develop a specific middle Green River floodplain connection scenario. Our LTSP study design matrix (Table 2) details the range of experimental conditions we would like to assess with recognition that more than one cell of that matrix could be accomplished in a single year. The Recovery Program Director's office will distribute the pertinent FGTWG recommendation to the Biology and Management committees and Principal Investigators as quickly as possible.

Table 2 . LTSP study design matrix

| Peak Flow (x) as Measured at Jensen, Utah | Proposed Study Wetlands[a, b] | Number of Days (x) Flow to Be Exceeded and Corresponding Hydrologic Conditions[c] | | |
|---|---|---|---|---|
| | | $1 \leq x < 7$ | $7 \leq x < 14$ | $x \geq 14$ |
| **8,300 ≤ x < 14,000 cfs** | Stewart Lake (f), Above Brennan (f), Old Charley Wash (s)[d] | Dry | Moderately dry | Moderately dry and average (below median) |
| **14,000 ≤ x < 18,600 cfs** | Same as previous plus Escalante Ranch (f), Bonanza Bridge (f), Johnson Bottom (s), Stirrup (s), Leota 7 (s) | Average (below median) | Average (below median) | Average (below median) |
| **18,600 ≤ x < 20,300 cfs** | Same as previous | Average (above median) | Average (above median) | Average (above median) |
| **20,300 ≤ x < 26,400 cfs** | Same as previous plus Baeser Bend (s), Wyasket (s), additional Leota units (7a and 4), Sheppard Bottom (s) | Moderately wet | Moderately wet | Moderately wet |
| **x ≥ 26,400 cfs** | Same as previous | Wet | Wet | Wet |

(a) f = flow-through wetland, s = single-breach wetland

(b) Up to eight wetlands would be sampled in a given year with the three in the lowest flow category being sampled in all years.

(c) Exceedance percentages and peak flow recommendations for each hydrologic condition as described in Muth et al. 2000. Note that the hydrologic conditions presented are the driest that could support a particular combination of peak flow magnitude and duration. For any combination, wetter hydrology could also support an experiment.

(d) Access to the Old Charley Wash floodplain has been denied since 2012.

The Recovery Program will provide a real-time assessment of razorback sucker larval presence (i.e., the 'larval trigger') through ongoing monitoring under Recovery Program Project No. 22f. Based on information provided in Bestgen et al. (2011), waiting for this larval trigger will likely cause Reclamation to make spring releases from Flaming Gorge Dam after the Yampa River has peaked, which may necessitate releases in excess of power plant capacity to meet the flow magnitude thresholds needed for river-floodplain connections. As addressed in the LTSP, the Recovery Program is prepared to direct sampling efforts each year to the appropriate floodplain habitats based

on hydrologic forecasting and the FGTWG request. The Recovery Program is poised and properly funded to follow through on specific LTSP field investigations again in 2015 (e.g., Project Nos. 22F, 164 and 165[3]). The Recovery Program hopes that Stewart Lake water levels can be maintained in 2015 for a duration similar to that realized in 2014, recognizing that prolonged favorable conditions for razorback sucker growth in late summer months results in larger fish with a higher probability of surviving their first winter.

The Recovery Program remains concerned about possible release of nonnative burbot from Flaming Gorge Reservoir, particularly during the spring when release volumes increase. Accordingly, the Recovery Program, the National Park Service, UDWR, and Western committed to initiating a risk assessment of burbot entrainment associated with Flaming Gorge spring operations (Trammell et al. 2014 *draft*; also referenced in the LTSP). The Recovery Program considers the risk of entraining burbot to be reasonably low at this time.

That conclusion is based on the following:

- The incidence of adult burbot in the portion of Flaming Gorge Reservoir nearest the dam is currently very low.
- The risk of entraining adults and juveniles through the spillway will always be fairly low based on the species' behavior.
- The risk of entraining larvae is of moderate concern. According to the literature and known water temperatures in the reservoir in late May-June, Age-0 burbot would likely range in size from 10 to 40 mm (total length). Young burbot of 30-40 mm should be entering a "settlement period", i.e. transitioning from using the full water column in near shore habitats to a primarily benthic behavior, remaining near the shoreline but on the substrate, and largely unavailable for entrainment. In June 2013, burbot larvae with lengths of 10-20mm were captured in the Sheep Creek inflow area, about 20 miles upstream of the dam (Carl Saunders, pers. comm.); thus, a portion of a larval cohort could still be found in open water during the spring runoff period. Therefore, if Reclamation is considering using the spillway[4], the Recovery Program will sample for burbot larvae in the reservoir near the entrance to the spillway. This type of sampling could be accomplished quickly and on short notice.
- If larvae are captured, the Recovery Program would determine if additional monitoring / management would be needed below the dam.

The Recovery Program assumes that a specific 2015 LTSP spring flow request will be developed in concert with the FGTWG using the best available flow forecast information.

Base Flow Requests

The Recovery Program will pursue experimentation outlined in the LTSP for the foreseeable future. We understand that spring operations could affect water availability for base flow operations. The

3 project scopes of work are available at: http://www.coloradoriverrecovery.org/documents-publications/work-plan-documents/project-scopes-of-work.html

4 As noted in Section 2.5.3.2 of the Flaming Gorge EIS, there were concerns regarding damage to the spillway and it was stated that excessive spillway damage would limit its use to cases of hydrologic necessity. Inspections since issuance of the ROD in 2006 have verified continued deterioration of the air slot in the spillway. As a result, Reclamation cannot support use of the spillway unless absolutely necessary for flood control or dam safety reasons.

Recovery Program is currently reviewing two draft reports (Bestgen and Hill 2014; Grippo et al. 2015) that synthesize biological and physical habitat information that will likely result in specific base flow experimentation in the future.

The Recovery Program will discuss with the FGTWG the best available information as it relates to 2015 base flow operations. A specific Recovery Program Base Flow request could be prepared later this year and likely in out years.

In closing, the Recovery Program appreciates Reclamation's efforts in the past to achieve the flow and temperature recommendations and assist in recovery of the endangered fishes. We recognize that greater reliance on the biological trigger (presence of larval razorback sucker) may require greater volumes of water during the spring in some years, but we believe this experiment is consistent with the biological intent of Muth et al (2000) and is research essential to the recovery of the endangered fish. The Recovery Program's sampling results from the past two years, and particularly the large number of juvenile razorback suckers collected at Stewart Lake in 2013 and 2014, clearly demonstrate the effectiveness of the LTSP operations. Thank you for considering this Recovery Program request for spring flows.

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Cc: Malcolm Wilson, Chief, Water Resources Group, USBR, 125 So. State, Salt Lake City, Utah

Beverley Heffernan, Manager, Environmental Resources Division, USBR, 125 So. State, Salt Lake City, Utah

Bridget Fahey, Endangered Species Branch Chief, Ecological Services, USFWS, Lakewood, Colorado

Henry Maddux, Chairman, UCREFRP - Management Committee, Utah Department of Natural Resources, 1594 W. North Temple Salt Lake City, UT 84114-5610

Krissy Wilson, Chairman, UCREFRP -Biology Committee, Utah DWR, 1594 W North Temple, Salt Lake City, UT

Larry Crist, Field Supervisor, Ecological Service, USFWS, Utah Field Office, 2369 West Orton Circle, Suite 50, West Valley City, Utah 84119-7603

Lynn Jeka, Manager, Western Area Power Administration, 12155 West Alameda Parkway Lakewood, CO 80228

Clayton Palmer, Environmental Specialist, Western Area Power Administration, 150 East Social Hall Avenue, Suite 300, Salt Lake City, UT 84111-1580

Appendix: A Discussion of LTSP Related Operations, Physical Conditions in Reach 2 of the Green River and Preliminary Biological Findings

***LTSP-Related Operations and Findings: 2011***

In 2011, the Recovery Program identified two spring flow objectives: a) to provide floodplain connection after larval razorback sucker were detected in the Green River; and, secondarily b) to connect the Stirrup floodplain as outlined in Recovery Program Project No. C6 RZ-RECR. Therefore, the Recovery Program requested: a) that Reclamation's spring 2011 operations be timed to coincide with the presence of larval razorback sucker in Reach 2 habitats; and b) that if the hydrology remains wet-average, moderately wet, or wet that Reclamation release flows that maintained 18,600 cfs or greater for two weeks or more in Reach 2 (post-larval detection). The Recovery Program's request also considered scenarios in the event that the hydrology trended drier; it did not.

The May final forecast of April-July unregulated inflow volume to Flaming Gorge Reservoir was classified moderately wet. The Yampa River forecast was wet. All of the wet hydrologic classification peak flow targets for Reach 2 under the ROD were met in 2011 (Reclamation 2013). Razorback sucker larvae were detected on June 24, 2011. The following spring flows conditions were recorded post-larval detection: ten days $\geq$ 22,700 cfs; 19 days $\geq$ 18,600 cfs; and 21 days $\geq$ 15,000 cfs.

USFWS field crews sampled 14 wetland habitats during September, October, and November 2011. Juvenile razorback sucker were collected in Wyasket Lake (n=15; size range 106-161mm total length) and in Leota Unit 4 (n=3; size range 85-110mm total length). This was the first evidence of over-summer survival of wild produced razorback sucker larvae since 1996 (Webber and Jones 2011). Breen (2011) reported 1,216 unique endangered fish detections at stationary PIT tag antennas set in the Stirrup floodplain levee breach during the extended period of riverine connection.

***LTSP Operations and Findings: 2012***

In 2012, hydrologic classifications for the Yampa River and Upper Green River basins were categorized as 'dry'. The Recovery Program and the Flaming Gorge Technical Work Group (FGTWG) ultimately agreed to focus the 2012 spring flow request on the driest category of experimental conditions outlined in the LTSP, i.e. a peak flow between 8,300 and 14,000 cfs for 1 to 7 days. The Recovery Program detected wild produced razorback sucker larvae on May 16, 2012 (Bestgen et al. 2012). Reclamation ramped up Flaming Gorge releases to a peak of 7,420 cfs, which resulted in a peak flow at Jensen, Utah of 10,200 cfs on May 24, 2012 (Reclamation 2013). Flows at Jensen, Utah were sustained above 8,300 cfs for 5 days after larvae were detected. Floodplain connection occurred at Stewart Lake and Old Charley Wash. Utah Division of Wildlife Resources (UDWR) crews documented larval entrainment into Stewart Lake and described physical conditions at that floodplain site (Breen and Skorupski 2012). Similarly, USFWS field crews documented larval entrainment into the Old Charley site. Unfortunately, all fish entrained at both locations likely perished, because water quality deteriorated quickly after flows declined. During the spring and summer months of 2012, USFWS crews (Webber and Jones 2012) sampled fish and monitored water quality at a variety of other floodplains that still held water from the extensive period of connection in 2011, but did not connect in 2012.

Personnel from Western Area Power Administration (Western), Argonne National Laboratory (funded by Western), and the Recovery Program surveyed Reach 2 levee breach elevations in

Autumn 2012 to better assess connection flows for future LTSP experiments. Those data, in preliminary form, were available for FGTWG discussions in Spring 2013.

***LTSP Operations and Findings: 2013***

In 2013, the spring hydrologic classification started off 'dry' but turned 'moderately dry'. Reclamation reviewed the FGTWG recommendation and decided to implement the LTSP recommendations for moderately dry hydrologic conditions and to increase releases when larvae were detected (Reclamation 2014; Draft Report). The Recovery Program and the Flaming Gorge Technical Work Group (FGTWG) ultimately agreed to focus the 2013 spring flow request on the moderately dry category of experimental conditions outlined in the LTSP, i.e. a peak flow between 8,300 and 14,000 cfs for 7 to 14 days. The Recovery Program detected wild produced razorback sucker larvae on May 26, 2013 (Bestgen et al. 2013). Flaming Gorge Dam releases were increased to full power plant capacity (~4,500 cfs) on May 29, 2013. Yampa River flows dropped below 4,000 cfs and Flaming Gorge Dam releases were increased 1,000 cfs on June 4th above power plant capacity for a total release of ~5,500 cfs to maintain flows in Reach 2 above 8,300 cfs. Releases returned to power plant capacity on June 5, 2013. The Green River measured at Jensen, Utah reached its peak of 10,700 cfs on June 6, 2013. Flows at Jensen, Utah were above 8,300 cfs for 25 days total and above 8,300 cfs during larval presence for 18 consecutive days. Prior to, during, and after floodplain connection, Stewart Lake proper and the Stewart Lake drain were sampled using an assortment of techniques to monitor the fish community. UDWR biologists documented that razorback sucker larvae were entrained into Stewart Lake and grew quickly (~1mm/day) during the ~2 month inundation period. On July 31, 2013, UDWR began draining Stewart Lake because of declining water quality. A total of 613 Age-0 razorback sucker were collected, of which 592 were released alive to the Green River (Skorupski et al. 2013). This was the largest number of juvenile razorback suckers ever documented in the Colorado River Basin, demonstrating the importance of appropriately timed connections between the river and floodplain wetlands. Razorback sucker larvae were not detected in the Escalante Ranch wetland; the only other wetland identified in the LTSP that connected to the Green River in 2013 (Webber and Jones 2013).

***LTSP Operations and Findings: 2014***

In 2014, Flaming Gorge Reservoir was expected to receive 135 % of average inflow. Observed volume was 118% by September 2, 2014. Reclamation targeted LTSP 'Average' hydrologic conditions (Reclamation 2014; Draft Report). The Recovery Program detected wild produced razorback sucker larvae on May 28, 2014 (Bestgen et al. 2014). Reclamation began their ramp up to bypass flows on May 30, 2014; ramp down to base flows was initiated 15 days later when Yampa River flows no longer supported meaningful floodplain connection in Reach 2 (see letter Figure 1 and Table 1).

UDWR and USFWS biologists documented that razorback sucker larvae were entrained into Stewart Lake, Escalante Ranch, the Stirrup and Above Brennan in 2014 (Schelly et al. 2014; Webber et al. 2014). Larval entrainment at Leota7 was confirmed in the fall via capture of Age-0 razorback sucker. UDWR biologists used floodgate structures to control flows and picket weirs to exclude large-bodied nonnative fishes at Stewart Lake. Stewart Lake filled to capacity in 2014 during the larval drift period. Stewart Lake was drained in September, beginning 92 days post-initial connection. A total of 749 razorback suckers were sampled returning to the Green River during drawdown of the wetland. Furthermore, the fish released back to the Green River had a mean length of 97 mm TL, with one fish reaching a length of 168 mm, indicating substantial growth while

in Stewart and improving these individuals' chances of overwinter survival when released back to the river. Later in September 2014, researchers collected wild produced Age-0 razorback sucker in Green River Reach 2 main channel backwater habitats for the first time since 2000 (Breen et al. 2014). For the second consecutive year, Stewart Lake has demonstrated the enormous potential of managed wetlands for razorback sucker recovery under the Larval Trigger Study Plan.

**Escalante Ranch** USFWS set larval light traps in late May through mid-June; wild larval razorback sucker were collected. They also sampled with 18 fyke nets from 24 -28 March to determine overwinter (2013-2014) survival of 989 bonytail stocked by the Ouray National Fish Hatchery on 19 September 2013. Five individuals (TL=255, 295, 254, 275, 300mm) were captured. The low number of fish caught suggests high winter mortality, which is possibly a result of the low dissolved oxygen levels in this wetland from October until ice-off as revealed by data recorded by a mini-DOT logger. Fall sampling in the Escalante Ranch wetland occurred from 20–22 October and 10 fyke nets were set to determine the relative abundance and recruitment of razorback sucker. Despite collections of larval razorbacks in this wetland in June 2014 only one adult (TL = 503mm) was collected in the fall.

**Above Brennan** USFWS set larval light traps in early to mid-June; wild larval razorback sucker were collected. This wetland reset (dried) in 2012. USFWS sampled the wetland in late August for larger sized fish. They caught one razorback sucker (TL=418mm) (in a fyke net) and many nonnatives. These included, in order of abundance, common carp, fathead minnow, black bullhead, young-of-year black crappie, red shiner, adult white sucker, and one young-of-year smallmouth bass. The razorback sucker was translocated into the Green River adjacent to the floodplain.

USFWS returned to Above Brennan in the fall from 27-29 October, their native fish catch consisted of one adult razorback sucker (TL=470mm), which was translocated into the Green River.

**Leota** USFWS sampled with larval light traps in late June – native flannelmouth sucker were collected, but razorback sucker were not (entrainment confirmed later in the year). Leota **7** reset in 2012 thru 2013 and connected directly to the Green River during 2014 peak flows. USFWS sampled with 10 fyke nets between 14-17 October; five young-of-year individuals (TL 101-152mm) were captured and released to a backwater near the Leota canal outlet at RMI 256. Nonnative fishes caught included common carp, fathead minnow, black bullhead, and green sunfish, of which almost all were young-of-year. The fact that few adult nonnative fish were observed suggests that razorback larvae can survive and recruit in the presence of similarly sized competitors or predators. The presence of these larger predator species in the other wetlands is likely responsible for the lack of razorback recruitment in those sites. The Leota complex was also very large, with the different sub-units connected through water control structures and canals. It is possible that juvenile razorback sucker are present throughout the complex.

MiniDOT loggers were set in Above Brennan wetland and Leota 7 to monitor water conditions throughout the winter of 2014-2015.

**Bonanza Bridge and Stirrup** UDWR conducted fall sampling of naturally functioning wetlands subject to inundation in 2014 to assess YOY razorback sucker survival elsewhere in the reach (Shelly et. al. 2014). Nonnative species comprised the entire fall catch at Bonanza Bridge and most of the catch at the Stirrup; 21 bonytail were also collected. Comparison of these results with the success at Stewart Lake suggests that modification of additional wetland breaches through installation of floodgates to control filling and improve water retention—in combination with blocking weirs to exclude adult nonnative fishes—would improve razorback sucker recruitment in these nursery habitats.