COLORADO RIVER RECOVERY PROGRAM **Project No: C-6 rz entrainment**
FY-20062007 PROPOSED SCOPE OF WORK for:
(Entrainment of larval razorback sucker)

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Category:
_Ongoing project
_Ongoing-revised project
X Requested new project
_Unsolicited proposal

Expected Funding Source:
x Annual funds
_Capital funds
_Other (explain)

I. Title of Proposal:

Evaluation of larval razorback sucker drift and entrainment into depression floodplain wetlands of the middle Green River.

II. Relationship to RIPRAP:

GENERAL RECOVERY PROGRAM SUPPORT ACTION PLAN
1.1.1 Restore Habitat (Habitat Development and Maintenance)
II.A. Restore flooded bottomland habitats.

GREEN RIVER ACTION PLAN: MAINSTEM
1.1.2 Restore Habitat (Habitat Development and Maintenance)
II.A. Restore and manage flooded bottomland habitat.
II.A.3. Implement levee removal strategy at high priority sites.
II.A.3.d. Evaluation.

III. Study Background/Rationale and Hypothesis:

Floodplain wetlands are presumed important rearing habitat for the endangered razorback sucker (Wydoski and Wick 1998; Muth et al. 1998; Lentsch et al. 1996). Reproduction by razorback suckers occurs in the spring during peak flows of the hydrograph when highly productive flood plain habitats are accessible (Muth et al. 1998). This seasonal timing of razorback sucker reproduction indicates possible adaptation for utilizing floodplain habitats (Muth et al. 1998).

Based on the assumption that floodplain wetlands provide critical rearing habitat for razorback suckers, the Recovery Program initiated an extensive flood plain habitat restoration program (Levee Removal). The goal of the Levee Removal Program was to restore natural flood plain wetland habitats and functions that support recovery of endangered fish (particularly razorback sucker) (Lentsch et al. 1996). To accomplish this goal, levees at selected wetlands were lowered or breaches cut to increase the frequency of riverine-flood plain connections.

Data collected during 2004 pilot studies and in 2005 were instructive to address hypotheses about razorback sucker early life history and to guide sampling in 2006. Valdez (2003) developed a larval razorback sucker drift model to be used as a predictive tool for the number of floodplain acres and number of razorback larvae necessary to reach recovery goals. An hypothesis generated by the model was that abundance of razorback sucker larvae declined to near zero a short distance downstream from the spawning area they originated from, based on an exponential decay survival function. However, preliminary data gathered during 2004 and 2005 showed that near-neutrally buoyant beads and larvae were transported considerable distances downstream, and were entrained in flood plain wetlands near the spawning bar as well as 54 miles or more downstream. These data support the notion that a mosaic of flood plain wetland habitats dispersed up and down the river downstream from spawning areas may be an optimal management goal.

Results of 2004 and 2005 studies also suggested that flow-through floodplain sites were best at entraining beads (and larvae) because entrainment occurred at all flow levels sufficient to inundate breaches. Non-flow through sites that filled only from one breach entrained fewer beads and larvae, and in some cases, returned beads to the river as they drained. The 2004 and 2005 data also showed that beads (and larvae) were not mixed in the lateral dimension of the stream channel until well downstream, 10 miles or more. Rather, beads and larvae remained on the side of the river where they were released. The implication is that flood plain wetlands near the spawning areas require larvae produced on the same side of the channel, or the likelihood of entrainment will be low. Optimization of larval entrainment in the flood plain will be crucial for ensuring survival of larval razorback suckers, and ultimately recovery.

IV. Study Goals, Objectives, End Product:

Study Goal

Evaluate larval razorback sucker drift characteristics and use the data to revise management for middle Green River floodplains based on potential larval razorback sucker entrainment.

Study Objectives

1. Evaluate larval drift and entrainment patterns downstream from Razorback bar.

2. Evaluate larval drift and entrainment into floodplains from other potential spawning sites.

3. Continue to evaluate the effectiveness of breach connections for entraining drift at various points on the hydrograph.

4. Use data to refine the Floodplain Drift Model and for testing floodplain management scenarios.

End Product

Report entrainment rates of drifting beads and larvae released into the river upstream of flood plain wetland breaches and at varying flow levels. Releases in 2004 and 2005 were at the Razorback Bar and the downstream Escalante Bar. Releases in 2006 will be made in close proximity to selected wetland breaches to better understand entrainment rates when large numbers of beads are in close proximity to the wetland. We will also assess optimal breach configuration and orientation for entrainment of razorback sucker larvae into floodplains. Report due March 2007.

V. Study Area:

Razorback Bar (RM 311) to Thunder Ranch (RM 305), Stewart Lake (RM 299), Stirrup Floodplain (RM 276) and Ouray National Wildlife Refuge (RM 259) in the Middle Green River, Utah. Sampling in 2006 will focus on wetlands at Thunder Ranch, Stewart Lake, and Bonanza Bridge. These are all flow-through wetlands, are accessible and relatively easy to sample, are potentially important management areas for recovery of razorback suckers, and are optimal for testing the hypotheses about entrainment rates relative to flow levels. Stewart Lake was closed during a portion of the entrainment studies in 2005, which limited entrainment. However, in 2006 Stewart Lake will continue to flow-through for the duration of the ascending limb of the high spring flow period. Stewart Lake inlet and outlet will be closed after peak flow is reached for selenium management. We did not select a single-connection wetland (such as the Stirrup) for sampling in 2006 because a main goal is to determine optimal breach configuration for flow-through sites.

VI. Study Methods/Approach

We propose to sample floodplain wetland breaches at up to four flow conditions. These will include 14,000, 16,000, and 18,600 cubic feet per second (cfs) on the ascending limb of the hydrograph, and 16,000 on the descending limb of the hydrograph. We chose these levels because they span the range of flows where wetlands first begin to receive significant water (14,000 cfs) up to levels for peak flows (18,600 cfs) during years with average hydrology in the Green River Basin (Muth et al. 2000). Based on current snow pack conditions, we are anticipating a wet average flow condition. If we experience a lesser hydrologic condition and do not anticipate reaching a peak flow of 18,600 cfs, we will still attempt to sample at four flow conditions including once at 14,000 cfs, and once at the anticipated peak. The remaining two samples will be collected at a flow level intermediate between 14,000 cfs and the anticipated peak, once during the ascending limb and once during the descending limb. For example, if snow pack diminishes before runoff and a maximum flow peak of 17,000 cfs is anticipated, we will conduct ascending limb sampling in wetland breaches at 14,000 cfs, 15,500, and at the peak 17,000 cfs, and will also conduct descending limb sampling at 15,500 cfs. We recognize that sort of accuracy will not likely be realized, but even under a hydrologic condition something less than a wet average year, this design will provide information to estimate a flow level:entrainment rate relationship.

Larvae will be marked prior to release only with tetracycline (one mark). This will simplify the marking process for the hatchery and will permit identification of wild from released larvae. Using only a single mark for each batch of larvae will result in loss of information on which specific release a fish came from, if larvae are recaptured in subsequent light-trap or other sampling.

Flow forecasts will be closely monitored to determine timing of each flow event. When times are selected, biodegradable gelatinous neutrally buoyant beads and marked hatchery-reared razorback sucker larvae (if available) will be released simultaneously into the river upstream of wetland breaches. The Bonanza Bridge site will be sampled first. This will increase the likelihood that beads and larvae sampled there will be from the release intended for this site and not from a release the previous day at the upstream Thunder Ranch and Stewart Lake sites.

Prior to bead and larvae releases at each site, width-depth transects and flow measurements will be taken in each breach. This information is essential to determine the total flow volume entrained by the wetland at that flow level. At the transect where nets will be placed, we will measure the width, and then take depth and water velocity measurements at a minimum of 10 equidistant points across the transect, or one depth:flow measurement every meter up to 20 if the breach is wider than 10 m. This procedure should be repeated after sampling is completed, if water surface elevations change appreciably (> 5 cm) during the sampling period. Depth and transect sampling will be completed while other personnel release beads and larvae upstream.

Beads and larvae will be released about 1 mile upstream and will be distributed evenly within 10 m from the bank. This will ensure that large numbers of beads and larvae will be available for entrainment and sampling. This will allow the best evaluation of breach configuration, which is a main goal of 2006 sampling. We will sample all three inflowing breaches at Bonanza to determine optimal lateral configuration. Each breach will be sampled with four nets. We will also sample main channel nearshore bead density with two drift nets to understand the density of beads available for entrainment. Mid-channel and far-shore nets sampled in 2005 provided useful information but we feel that focusing on breach and nearshore sampling will best achieve the goals of this project. Assuming three people (four if available) for each of the four sampling locations (three breaches, one near shore, 14 nets total), a crew of at least twelve people will be required to complete releases and sampling at Bonanza at each flow level.

The following day (relatively early), we will release beads and larvae about 1 mile upstream of Thunder Ranch and Stewart Lake breaches. If available, beads released for each site will be differently-colored, to obtain more information on cross-channel distribution and mixing. Crews will be making the width:depth:velocity measurements across transects in breaches and positioning sampling gear while others release beads upstream. Communication to determine release timing and transport rates will be relayed via cell phone or walkie-talkie if needed. At Thunder Ranch, four nets will be set in each of two breaches, and two will be set near shore. It is not logistically possible to sample all five Thunder Ranch breaches so two with the most typical configuration and highest inflows will be chosen. A crew of about eight to ten people will be required for sampling this locality.

Similar transect sampling will occur in the single breach at Stewart Lake, where sampling gear and additional personnel have been pre-positioned. A minimum of four nets will be set in the breach and two near shore, about five to seven people will be required for this sampling. If Thunder Ranch and Stewart Lake sampling is completed on the same day, a total crew of about 13 to 17 people will be required as will 16 drift nets and flow meters (not including spares).

Net sets should begin well before beads or larvae arrive. Sampling should continue for a minimum of 2-3 hr after the first beads or larvae arrive, or until bead captures are minimal or non-existent (larvae will not be apparent).

At all sites, drift nets will be equipped with a functioning, calibrated flow meter in each net mouth. Samples will be removed as needed from drift nets such that each sample does not exceed 1/2 to 2/3 of a gallon. This will ensure that sample material, including fish larvae, can be properly preserved. Each sample will be properly labeled, including the sample date and time, location, site position (breach or near shore), sample position (near or far from shore, or breach location, up or downstream, use a diagram), flow meter start and stop reading, the depth of water at each net, net area including depth of flow (if net not totally submerged), and duration (min) of each sample. These data are needed to estimate the amount of flow sampled relative to that which flows into the wetland, so that entrainment rates can be estimated. Similar data should be recorded on a data sheet along with a diagram of the site, breaches, net locations, and personnel. Some of these data can be pre-recorded.

Samples will be held in Ziplock-brand Freezer-type plastic bags, and double-bagged. One-half of the samples from each site location (breach or near-shore) will be immediately preserved in 95% or 100% ethanol to preserve fish larvae. The amount of preservative should always exceed the volume of debris or nearly so, or larvae will not be properly preserved. Each type of sample (ethanol-preserved or not) should be stored in separate containers. The other samples will be held in bags and refrigerated until beads, which degrade in ethanol, can be picked from debris. If ample personnel are available on site, beads can be removed from samples and followed by preservation of larvae.

Flow meters in each net should be checked to ensure they are operating efficiently once they are set. If abnormally low readings result, the meter should be replaced with a spare. If meter failure is noted, a velocity measurement will be taken at the net mouth with the Marsh-McBirney. Meter malfunctions should be noted on data sheets so that readings from adjacent nets can be used to correct flow rates Nets should be set in breaches where inflow velocity is maximized to ensure proper meter functioning and to maximize bead and larvae captures. At least once during the sampling event at each site, water velocity at each net mouth should be taken with a Marsh-McBirney or other similar flow meter at 6/10 of depth (from the water surface). This is to ensure that a back-up set of velocities is available should meters malfunction or if current velocity is too low for detection by propeller-type meters.

Larvae and beads will be picked from drift net samples as soon as possible. If larvae are present in unpreserved bead samples, they will be preserved in ethanol. All larval fish will be sent to Colorado State University Larval fish lab for identification, and otoliths will be examined for marks. Bead and larvae data will be used to develop floodplain management scenarios.

VII. Task Description and Schedule

Task 1: Field Data Collection (UDWR)
Bead release and drift netting river-floodplain connection - Spring 2006

Task 2: Drift Net Sample Processing
Drift net initial picking (UDWR) - Summer 2006

Task 3: Larval Identification (CSU)
Fall-Winter 2006

Task 4: Data Management
Data entry Fall-Winter 2006

Task 5: Report Preparation
Annual RIP Report (December 2006)
Deliverables/due dates: Draft report to coordinator 15 March 2007; to peer review and Biology Committee 15 April 2007; final draft to Biology Committee 1 July 2007.

VIII. FY-2006 Work

-Deliverables/Due Dates
Annual RIP report 11/06

-Budget

Task 1: Bead release and drift netting (UDWR-Vernal)

Labor-	Work days	Cost
Project Leader (438/day)	10	4,380
Biologist (340/day)	40	13,600
Technician (195/day)	60	11,700
Travel (vehicle mileage and rental; $36/day/vehicle)[a]	20	720
Materials (Beads)[b]		5,000
Equipment (drift nets and flow meters)[c]		2,000
Other		500
Task 1 Subtotal		$37,900

[a] Calculated as average miles traveled per day * cost per mile + daily rental fee = 75 * $0.41 + $5 = $35.75/day.

[b] The price of a barrel of beads in 2005 was approximately $555 including shipping. A total of nine barrels were used for sampling on three occasions.

[C] Maintenance and replacement of older drift nets and flow meters.

Task 2: Drift Net Sample Processing (UDWR-Vernal)

Labor-	Work days	Cost
Project Leader (438/day)	3	1,314
Biologist (340/day)	20	6,800
Technician (195/day)	40	7,800

Travel ($36/day/vehicle)		0
Materials		200
Task 2 Subtotal		$16,114

Task 3: Larval marking and identification (CSU-LFL)

Labor-	Work days	Cost
Project Leader (438/day)	10	4,380
Biologist (340/day)	40	13,600
Technician (195/day)	80	15,600
Travel ($36/day/vehicle)		0
Materials		300
Task 3 Subtotal		$33,880

Task 4: Data management/data entry (UDWR-Vernal and CSU-LFL)

Labor-	Work days	Cost
Project Leader (438/day)	10	4,380
Biologist (340/day)	10	3,400
Technician (195/day)	10	1,950
Travel ($36/day/vehicle)		0
Materials		200
Task 4 Subtotal		$9,930

Task 5: Report preparation (UDWR-Vernal and CSU-LFL)

Labor-	Work days	Cost
Project Leader (438/day)	5	2,190
Biologist (340/day)	10	3,400
Technician (195/day)	10	1,950
Travel ($36/day/vehicle)		0
Materials		200
Task 5 Subtotal		7,740
FY2006 TOTAL		$105,564

FY-2007 Work

-<u>Deliverables/Due Dates</u>
Draft report to coordinator 15 March 2007; to peer review and Biology Committee 15 April 2007; final draft to Biology Committee 1 July 2007.

-Budget

Task 5: Report preparation (UDWR-Vernal and CSU-LFL)

Labor-	Work days	Cost
Project Leader (438/day)	20	8,760
Biologist (340/day)	15	5,100
Technician (195/day)	5	975
Travel ($36/day/vehicle)		0
Materials		200
Task 5 Subtotal		15,035
FY2007 TOTAL		$15,035

IX. Budget Summary

	UDWR	CSU	Total
FY-2006	57,005	48,559	105,564
FY-2007	7,518	7,518	15,035
Project Total	$64,522	$56,077	$120,599

X. Reviewers

XI. References

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