FISCAL YEAR 2016 ANNUAL BUDGET AND WORK PLAN

Approved October 2, 2015

SJRRIP FY2016 AWP Budget Estimate (approved October 2 *2015*)

SOW	Title	Agency	2016 Hydropower Revenue	Capital Project Funding	Other Funding	2016 Grand Totals
	Element 1 - Management and Augmentation of Populations and Protection of Genetic Integrity					
6	Horsethief Canyon Ponds O&M at Ouray NFH	FWS, GJ	$36,265			$36,265
7	Stocking & Acclimation of Age-0 CPM & Age-1+ RBS	FWS, ABQ	$34,343			$34,343
8	Colorado Pikeminnow Fingerling Production Dexter	FWS, SNARRC	$105,495			$105,495
9	Rearing Razorback Suckers Dexter	FWS, SNARRC	$83,563			$83,563
10	RBS Augmentation/NAPI Pond Management	NN, FWS	$154,268			$154,268
11	SJRIP PIT Tags (purchase)	BR	$60,000			$60,000
	Subtotal		**$473,934**	**$0**	**$0**	**$473,934**
	Element 2 - Protection, Management, and Augmentation of Habitat					
12	Maintenance and Operation of SJR Hydrology Model	BR, SLC	$78,550			$78,550
13	Stream Gaging and Flow Measurements	BR, USGS	$8,150			$8,150
14	Operation of PNM Fish Passage Structure	NN, FWS	$110,340			$110,340
16	Habitat Videography and Temperature Gages	BR	$43,000			$43,000
	Capital Projects Management	BR	$0	$50,000		$50,000
	PNM Fish Passage O&M[1]	PNM				$0
	Hogback Fish Weir O&M[1]					
	Subtotal		**$240,040**	**$50,000**	**$0**	**$290,040**
	Element 3 - Management of Non-Native Aquatic Species					
17	Upper/Middle River Nonnative Species Control & Rare Fish Monitoring[2]	FWS, ABQ	$356,233			$356,233
18	Lower/Middle River Nonnative Species Control & Rare Fish Monitoring[2]	UDWR	$188,085			$188,085
	Subtotal		**$544,318**	**$0**	**$0**	**$544,318**
	Element 4 - Monitoring and Evaluation of Fish and Habitat in Support of Recovery Actions					
19	Sub-Adult/Adult Lg-Bodied Fish Monitoring	FWS, GJ	$124,371			$124,371
20	YOY/Small-Bodied Fish Monitoring	NMDGF	$83,831		$40,000	$123,831
21	RBS/CPM Larval Surveys (Combined SOW)	ASIR	$236,467			$236,467
22	Specimen Curation/Identification	UNM	$47,312			$47,312
23	Integration of Long-term Monitoring Data	UNM	$89,005			$89,005
26	San Juan River Waterfall Endangered Fish Monitoring and Translocation	UDWR	$33,606			$33,606
27	SJR Population Model O&M and Model Runs[1]	ERI, MEC	$9,400			$9,400
28	Habitat/Temp Monitoring	ERI, MEC	$93,460			$93,460
30	Analysis for Determining Natal Origin Razorback Sucker in the Lake Powell	ASIR	$66,059			$66,059
31	SJR Phase II Channel Restoration Site Monitoring	TNC	$90,618			$90,618
32	PIT Tag Antennas O&M & Evaluation of Data	BR, FWS	$62,450			$62,450
33	Fish Entrainment - Site Re-Evaluations (RFP)[3]	BR	$0			$0
34	2015 Flow Release Criteria Development Workshop[4]	BR, FWS	$50,000			$50,000
	Subtotal		**$986,579**	**$0**	**$40,000**	**$1,026,579**

	Element 5 - Program Coordination and Assessment of Progress Toward Recovery					
35	Base Funds and Contract Management BR	BR, SLC	$223,255			$223,255
36	Peer Review[4]	BR, FWS	$60,000			$60,000
37	Program Management FWS	FWS, ABQ	$181,465		$213,803	$395,268
	Subtotal		**$464,720**	**$0**	**$213,803**	**$678,523**
	Element 6 - Information and Education					
	Education and Outreach (funds transfer to UCRRIP)	FWS, ABQ	$16,000			$16,000
	Subtotal		**$16,000**	**$0**	**$0**	**$16,000**
	SJRRIP Total		**$2,725,591**	**$50,000**	**$253,803**	**$3,029,394**
	Estimated Base Funds (2015 Amt. x 2% CPI for 2016)		**$2,778,577**			
	Hydropower Revenue-Funded Projects		**$2,725,591**			
	Carry over from FY2015					
	Estimated available 2016 funds to expenditures		**$52,986**			
	Notes					
	[1]Placeholder; [2]SOWs will be modified to include new study design; [3]Contract for project awarded and funded in FY2015 (2015 SOW was a draft; 2016 SOW is final); [4]Costs are estimates					
	Project Funding TBD:					
	Determining daily growth rates of larval Razorback Sucker in the San Juan River	ASIR	$52,111			
	Analysis for Determining Natal Origin Razorback Sucker in the San Juan River	ASIR	$32,918			

Rearing Endangered Fish at the Horsethief Canyon Native Fish Facility Ponds for Stocking into the San Juan River
Draft Fiscal Year FY-2016 Project Proposal
31 March 2015

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Contract or Agreement number(s):
R13PG40052 for USFWS – Grand Junction, CO

Reporting Dates: 10/1/2014 through 9/30/2015

Operation & Maintenance of the Horsethief Canyon Native Fish Facility Ponds Fiscal Year 2016 Project Proposal 31 March 2015

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The Ouray National Fish Hatchery – Grand Valley Unit (NFH-GVU) consists of several distinct facilities located in and around Grand Junction, CO. One of these facilities is the Horsethief Canyon Native Fish Facility (HCNFF) pond complex (about 7½ miles west of the main hatchery building) near Fruita, CO.

The HCNFF consists of 22 ponds, ranging in size from 0.1 to 0.5 surface acres, with a total surface acreage for the entire facility of 6.2 acres. Each pond is 5-6 feet deep and is equipped with a fabric liner to prevent seepage. Each pond also has a concrete kettle and drain structure to facilitate draining and concentrating of fish for ease of harvest. This facility is a multi-species broodstock, production, and rearing facility dedicated to rearing the three endangered Colorado River fishes: Razorback Sucker, Humpback Chub, and Bonytail.

Until 2012, the operation and maintenance (O&M) of the entire Ouray NFH-GVU complex (Project 29a: Operation and Maintenance of Ouray National Fish Hatchery – Grand Valley Unit) was funded by Upper Colorado River Endangered Fish Recovery Program (UCREFRP). On 25 March 2010, the Coordination Committee of the San Juan River Basin Recovery Implementation Program (SJRBRIP) voted to cost-share 1/6 of the operation and maintenance costs for the HCNFF pond complex. This equates to a total of one surface acre of pond rearing and production space.

Currently, the one surface acre of grow-out ponds allotted to the SJRBRIP is being used to rear Razorback Sucker that are progeny of paired matings of appropriate genetic lineage, produced annually from Razorback Sucker broodstock being held at Ouray NFH-GVU. After spawning, fertilized eggs are reared in flow-through egg jars at HCNFF. As these fish approach 200 mm TL, they are stocked back out into grow-out ponds at HCNFF to be reared until they reach their target stocking size ($\geq$ 300 mm TL). It is anticipated that 2,000-4,000 Razorback Sucker ($\geq$ 300 mm TL) can be reared in the one surface acre of ponds allotted to the SJRBRIP. Razorback Sucker of the appropriate target stocking size will be made available to the SJRBRIP in October of each calendar year for stocking (after the annual fall fish community monitoring studies are completed).

The SJRBRIP will have the option to change the management approach and species being reared in their ponds as they see fit, but will need to coordinate such changes with Ouray NFH-GVU hatchery staff, allowing enough lead time to prepare for changes in importation/exportation permitting, purchasing of feed proper for the species being reared, etc. Changes in numbers of fish desired, species being reared, etc. may lead to adjustments in future years' budgets. For instance, if the SJRBRIP decides to rear Colorado Pikeminnow (a species not currently being held on station at Ouray NFH-GVU), appropriate lead time will be needed to arrange attaining young fish from another facility.

Cost Share with Upper Colorado River Endangered Fish Recovery Program

As stated earlier, the SJRBRIP's Coordination Committee voted to cost-share 1/6 of the O&M costs for the HCNFF pond complex. However, the O&M of the HCNFF ponds is in reality part of a much larger picture of the overall

O&M of the Ouray NFH-GVU itself. So, the following staffing breakdowns were used to determine the overall O&M of the entire Ouray NFH-GVU:

1) 24-Road Hatchery building will require 100% staffing for 6 months of the year
2) 24-Road Hatchery building will require 50% staffing for the other 6 months of the year
3) Peter's ponds complex, Horsethief SWA ponds & lease-free grow-out ponds will require 10 % staffing for 6 months of the year
4) The HCNFF ponds will require 40% staffing for 6 months of the year
    a. One-sixth of the O&M of the HCNFF ponds will be paid for by the SJRBRIP

Possible Outyear Cost Adjustments

If the SJRBRIP decides to change stocking strategies (species, sizes, times of year at which fish are being stocked, etc.) outyear budgets may need to be adjusted to account for this. The costs presented in this workplan represent the best estimates we can develop, based on the species, numbers, and timing of fish to be stocked from our facility to the San Juan River.

FY-2016 Budget:

(Based on projected FY-2016 costs)

Note: The FY-16 and outyear costs have been adjusted for the GS-5 Bio Tech line items to reflect new guidance from Office of Personnel Management (OPM) to the USFWS requiring the USFWS to provide health insurance to all federal employees, if they work for the federal government longer than 60 days (480 total hours**).**

Costs Shared by UCREFRP and SJRBRIP (i.e. O&M Costs)

Personnel/Labor Costs (Federal Salary + Benefits)

	UCREFRP Project 29a	**SJRBRIP Cost**
Principal Biologists (GS-11) – 1,960 hours @ $53.03/hr	207,878	6,943
X 2 people		
(130 total hours covered by SJRBRIP or 65 hr/person)		
Biological Technician (GS-7) – 1,960 hours @ $33.70/hr	66,052	2,206
(65 total hours covered by SJRBRIP)		
Biological Technicians (GS-5) – 600 hours @ $24.96/hr	29,952	998
X 2 people		
(40 total hours covered by SJRBRIP or 20 hr/person)		
Overtime:		
Biological Technician (GS-7) – 120 hours overtime	6,066	203
@ $50.55/hr		
(4 total hours of overtime hours covered by SJRBRIP)		
Biological Technician (GS-5) – 40 hours @ $37.44/hr	2,995	101
X 2 people		
(2.7 total hours covered by SJRBRIP or 1.35 hr/person)		
Subtotal	312,943	10,451

Permitting; Coordination; Data Input, Analysis, Management & Presentation; Report Writing; Office & Administrative Support (Federal Salary + Benefits)

Project Leader (GS-14) – 320 hours @ $83.42/hr	26,694	892
(10.7 total hours covered by SJRBRIP)		
Administrative Officer (GS-9) – 320 hours @ $44.72/hr	14,310	478

(10.7 total hours covered by SJRBRIP)			
	Subtotal	41,004	1,370
In-Kind Services			
Bozeman Fish Technology Center			
Grind and sift fish food for larval Razorback Suckers		($2,732)	(92)

Operations (Fish Food, Chemicals and Fertilizer, Hatchery Supplies, Vehicles and Fuel, Electricity)

Fish Food (from Skretting USA)

Actual costs = 4 orders of fish food per year (1 order per fiscal quarter) at $18,350 each = $73,400. The line items below represent one of our four orders (placed April 2015). This fish food order will last us 90 days. We have several different sizes of fish on station, thus the different sizes of food in each order.

Trout # 1 Crumble: 1,000 lbs @ $1.18 per lb = $1,180
Trout # 2 Crumble: 1,000 lbs @ $1.17 per lb = $1,170
1.0 mm RZ Grower 2,000 lbs @ $1.00 per lb = $2,000
2.0 mm RZ Grower 4,000 lbs @ $1.00 per lb = $4,000
3.0 mm RZ Grower 8,000 lbs @ $1.00 per lb = $8,000
4.0 mm RZ Grower 2,000 lbs @ $1.00 per lb = $2,000

	Fish Food Subtotal	73,400	2,452

Chemicals and Fertilizer

Exact use of the money in this line item will vary from year to year depending on specific chemical/fertilizer/herbicide needs in a particular year. It will also depend on if there are outbreaks of pathogens that need to be treated (e.g., "Ich") in a given year. Funds for a "typical" field season for one study would likely include the following:

Sodium Bicarbonate (pH increaser) = $5,600
Eighty 50-lb bags @ $70 per bag annually
Copper Sulfate = $4,825
Ten 50-lb bags (pellets) @ $95 each = $950
50 gallons 10% solution @ $77.50/gallon = $3,875
Spartan Sparquat 256 Germicidal Cleaner = $300
10 gallons @ $30 per gallon
Chloram-X (dechloniater) = $1,440
Sixteen 10 lb buckets (4/case, 4 cases/year) @ $90/bucket
Finquel brand MS-222 anesthetic = $900
Two 1 kg bottles @ $450/bottle
Chloramine-T = $880
Two 55-lb containers @ $440 per container
Formalin (10% fixative) = $2,100
Four 55-gallon drums @ $275 each
Specialized Haz-Mat shipping @ $1,000
Denatured ethyl alcohol = $760
Eight 5-gallon jugs @ $95 per jug
Distilled water = $300

Ten 2-gallon jugs @ $30 per jug
Stress Coat (slime coat replacement) = $290
Two 5-gallon containers @ $145 each
No-Foam De-Foamer = $210
6 gallons @ $35/gallon
Weed killer (2,4-D and Roundup) = $3,200
2,4-D 40 quarts of concentrate @ $35 each
Roundup 10 gallons concentrate @ $180 each
Aquashade (water colorant) = $3,000
50 gallons @ $60 per gallon
Dimilin 25W (for anchor worm control) = $5,000
Twenty 5 lb boxes @ $250 per 5 lb box

Chemicals and Fertilizer Subtotal	28,805	962

Hatchery Supplies and Equipment Repair and Replacement

Exact use of the money in this line item will vary from year to year depending on specific equipment repair, replacement, or upgrade needs needs in a particular year. Funds for a "typical" field season for one study would likely include the following:

Egg hatching jars – Model J30 = $455
5 @ $85/each
24-hr belt feeder = $2,700
Repair/replace 10 annually @ $270 each
Waders = $225
Replace 3 pair annually @ $75 each
Duraframe dip nets = $1,500
Replace 5 annually @ $300 each
Digital scale repair, replace battery, recalibration = $1,500
(3 scales per year @ $500 per service per scale)
YSI brand water chemistry meters = $2,000
(dissolved oxygen, pH, salinity) – repair, replace, recalibrate annually
HVAC service = $1,200
Done annually
Service fish food cooler refrigeration unit = $750
Done annually
Service the backup generator = $700
Done annually
Pump & motor maintenance/service = $5,700
Labor & parts to rebuild:
One portable water pump/year = $1,700
One hatchery motor/pump set/year = $4,000
Fluorescent hatchery lights = $2,200
Replace ½ of all hatchery lights annually
Tank Cleaning Supplies = $235
Scotch-Brite pads, scrubbing handles
Maintenance tool replacement = $400
Screwdrivers, crescent wrenches, monkey wrenches, vise grips, hammers, rubber mallets, ratchets & sockets, drills & drill bits, chop saw

blades		
Plumbing supplies = $2,000		
PVC pipe, couplers, primer & glue		
Refill compressed oxygen bottles = $2,500		
50 per year @ $50 each		
Air stones, tubing couplers, hose clamps = $1,500		
0.4" air stones – 20 @ $50 each = $1,000		
Tubing, couplers, hose clamps = $500		
Screens and pond boards = $3,700		
10 screens @ $300/screen		
PVC lumber for making screen frames		
Metal mesh for making screens		
Redwood pond boards		
100 boards (2" X 8" X 6') @ $7 each = $700		
Koch rings = $500		
For aerating water in packed columns		
Sand = $2,000		
For sand filters - 1 pallet = twenty 80 lb bags		
Hatchery Supplies Subtotal	31,765	1,061
Office Supplies		
Staples, copier paper, pencils/pens, paperclips, note pads, cleaning supplies, toilet paper, paper towels, etc.		
Office Supplies Subtotal	1,500	50
Vehicles (maintenance & repair) and fuel		
Vehicles: GSA-lease rate (@ $365/month lease = $12.17 per day based on 30 days in an "average" month + $0.33/mile)		
Hatchery pickup truck = $9,803		
24-Road Hatchery Building to Horsethief Canyon Native Fish Facility ponds (45 mile round trip X 1 vehicle X 365 days per year = 16,425 total miles per year)		
Fuel		
Diesel fuel = $350		
For Kubota tractor – one 55-gallon drum of diesel @ $250 (includes fuel, barrel & delivery)		
For back-up generator at hatchery – 25 gallons @ $4.00/gallon		
Repair/replace shocks, struts, brakes = $800		
Vehicles and Fuel Subtotal	10,953	366
Electricity = $6,800		
For pump and spawning shed at the Horsethief State Wildlife Area brood ponds		
8 months operation at $850/month		
Electricity Subtotal	6,800	227
Operations Subtotal	153,223	5,118
Subtotal for All Shared Costs	507,170	16,939

Costs Unique to SJRBRIP (Harvest, PIT-Tagging & Stocking Costs)

Personnel/Labor Costs (Federal Salary + Benefits)

	SJRBRIP Cost
Pond Harvest, PIT-Tagging, Stocking and Database Management	
Principal Biologist (GS-11) – 80 hours @ $53.03/hr	4,242
(2 days X 2 people/day for fish harvest)	
(6 days X 1 person/day for PIT-tagging)	
Biological Technician (GS-7) – 136 hours @ $33.70/hr	4,583
(2 days for fish harvest)	
(6 days for PIT-tagging)	
(5 days for database and records management)	
(2 stocking trips X 2 days each X 1 person)	
Biological Technician (GS-5) – 320 hours @ $24.96/hr	7,987
(2 days X 3 people/day for fish harvest)	
(6 days X 5 people/day for PIT-tagging)	
(2 stocking trips X 2 days each X 1 person)	
Subtotal	16,812
Lodging and Per Diem (Based on Published FY-2015 GSA Per Diem Rates)	
Lodging	
2 nights lodging in Farmington, NM X 2 people at $83.00/night =	332
Per Diem	
4 days hotel rate (Farmington, NM) X 2 people at $46/day =	368
Subtotal	700
Fuel	
Stocking truck (gets 8 miles per gallon) X 2 trips from Grand Junction, CO to Farmington, NM (660 miles round trip) X 2 trips (= 1,320 total miles) = 170 gallons of gas at $4.00/gallon	678
Water pump for tempering fish = 20 gallons gas at $4.00/gallon	80
Subtotal	758
Subtotal for Costs Unique to SJRBRIP	18,270
Total of All Costs Incurred by SJRBRIP:	
USFWS-CRFP (Grand Junction, CO) Total	35,209
USFWS Region 6 Administrative Overhead (3.00%)	1,056
USFWS Region 6 Total	**36,265**

Cost/Fish Comparison:

Workplan total cost in FY-2016 = $36,265

Estimated production in FY-2016 = 2,000-4,000 fish

For 2,000 Razorback Sucker produced, the cost/fish = $18.13

For 3,000 Razorback Sucker produced, the cost/fish = $12.09

For 4,000 Razorback Sucker produced, the cost/fish = $ 9.07

Augmentation of Age-0 Colorado Pikeminnow and Age-1+ Razorback Sucker in the San Juan River Fiscal Year 2016 Project Proposal

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Cooperative Agreement #'s:
USFWS – NMWFCO R11PG40011

Period of Performance: 2/27/2012 to 9/30/2016

Background

Colorado Pikeminnow (*Ptychocheilus lucius*) and Razorback Sucker (*Xyrauchen texanus*) are federally-listed endangered fishes found in the San Juan River. The San Juan River Recovery Implementation Program (SJRIP) was initiated in 1992 to protect and recover populations of both Colorado Pikeminnow and Razorback Sucker in the San Juan River Basin (Basin) while water development proceeds in compliance with all applicable federal, state, and tribal laws (SJRIP 2014). Recovery of Colorado Pikeminnow, as listed in the recovery goals, is dependent on the maintenance of a wild population of at least 2,600 adults in the Green River subbasin and at least 700 adults in the Upper Colorado River subbasin, as well as a target of 1,000 age 5+ (>300 mm TL) in the San Juan River subbasin. Delisting criteria include a self-sustaining population that exceeds 800 adults maintained in the San Juan River subbasin. Razorback sucker recovery criteria are dependent on the establishment of four self-sustaining populations of 5,800 adult fish each; two populations in the Upper Colorado River Basin (one population in the Green River subbasin, the other in either the Colorado River or San Juan River subbasins) and two populations in the Lower Colorado River Basin (SJRIP 2014).

Fish community monitoring during the SJRIP's seven year research period, 1991-1997, identified few wild Colorado Pikeminnow inhabiting the San Juan River. This prompted investigation into the feasibility and implementation of augmenting the population with hatchery reared fish. As a result of these findings, an experimental stocking of Colorado Pikeminnow was conducted by Utah Department of Wildlife Resources in 1996 with the purposes of evaluating dispersal and retention of stocked Colorado Pikeminnow and determining the availability, use, and selection of habitats by early life stages of Colorado Pikeminnow (Ryden 2008). Stockings of larval, sub-adult, and adult fish after this initial stocking resulted in the subsequent recapture of stocked fish suggesting that Colorado Pikeminnow could survive in the San Juan River. In 2003, *An Augmentation Plan for Colorado Pikeminnow In The San Juan River* was finalized (Ryden 2003). This plan, and later amendments, called for the annual stocking of ≥ 300,000 age-0 and ≥3,000 age 1+ fish in the San Juan River until 2009. In early 2010 a revised plan, *Augmentation of Colorado Pikeminnow (*Ptychocheilus lucius*) in the San Juan River: Phase II, 2010-2020* (Furr 2010), was drafted that outlines the continuation of stockings through 2020. Phase II augmentation reflects changes requested by the SJRIP Biology Committee by discontinuing the stocking of Passive Integrated Transponder tagged age-1+ Colorado Pikeminnows in exchange for stocking increased numbers of age-0 fish (n≥ 400,000).

Similarly, after the failure to collect any wild Razorback Sucker in the San Juan River during three years of intensive studies (1991-1993) the SJRIP Biology Committee initiated an experimental stocking program for Razorback Sucker in the San Juan River (Ryden and Pfeifer 1994). Experimental stocking was implemented to provide needed insight about recovery potential and habitat suitability for the Razorback Sucker in the San Juan River between river mile (RM) 158.6 at the Hogback Diversion structure near Waterflow, NM and Lake Powell near Clay Hills, UT RM 3 (Maddux et al. 1993). Subsequently, Critical Habitat for Razorback Sucker and Colorado Pikeminnow was designated as between the Hogback Diversion structure (RM 158.6) downstream to Neskahai Canyon (RM-35.0) in Lake Powell; approximately 35 river miles below the waterfall which demarcates RM 0.0 on the San Juan River (USFWS 1994). Between March 1994 and October 1996, 942 Razorback Suckers were stocked into the San Juan River at four stocking sites (RM 158.6, 136.6, 117.5, and 79.6). Data gathered on these fish identified habitat types being used year-round by Razorback Sucker in the San Juan River, and provided information on movements, survival, and growth rates. Based on the successes of the experimental stocking study, a full-scale augmentation effort for Razorback Sucker in the San Juan River was initiated with the *Five-Year augmentation plan for razorback sucker in the San Juan River* (Ryden 1997). In February 2003 the SJRIP-BC extended the augmentation effort for Razorback Sucker with *An*

augmentation plan for razorback sucker in the San Juan River: An addendum to the five-year augmentation plan for razorback sucker in the San Juan River (Ryden 2003). However, due to changes in augmentation protocols and difficulties in producing requested numbers of fish the eight-year addendum to the original plan was delayed in initiation until 2009. The current augmentation plan calls for the stocking of 91,200 Razorback Suckers over an 8-year period, or ≥11,400 fish per year, from a combination of fish reared in a hatchery (currently, Ouray National Fish Hatchery – Grand Valley Unit [Ouray NFH-GVU] or the Southwest Native Aquatic Resources and Recovery Center [SNARRC]) and Razorback Suckers that are grown out in ponds on Navajo Agricultural Products Industry (NAPI) land.

The augmentation programs for the Colorado Pikeminnow and Razorback Sucker populations in the San Juan River are related to the 2014 SJRIP Draft Long Range Plan (LRP). These activities are specifically addressed in the following Elements, Goals, Actions, and Tasks:

Element 1. Specific goals, actions, and tasks

Goal 1.1— Establish a Genetically and Demographically Viable, Self-Sustaining CPM and RBS Populations.

Action 1.1.1 Develop plans for rearing and stocking for CPM and RBS.

Task 1.1.1.1 Review and update augmentation plan for CPM and adjust stocking goals as scheduled.

Task 1.1.1.2 Review and update augmentation plan for RBS and adjust stocking goals as needed.

Action 1.1.2 Produce, rear, and stock sufficient numbers of CPM to meet stocking goals of augmentation plan.

Task 1.1.2.2 Stock at least 400,000 age-0 (50–55 mm TL) CPM annually into the San Juan River.

Task 1.1.2.3 Opportunistically stock available CPM in excess of those described above.

Action 1.1.3 Produce, rear, and stock sufficient numbers of RBS to meet stocking goals of augmentation plan.

Task 1.1.3.4 Stock at least 91,200 RBS (> 300 mm TL) during eight year stocking period or 11,400 per year.

Task 1.1.3.5 Opportunistically stock available RBS in excess of the 11,400 per year described above.

Goal 1.2— Identify and Implement Strategies for Improving the RBS and CPM Augmentation Program and Genetic Integrity.

Action 1.2.1 Implement methods to evaluate status and success of stocked RBS and CPM.

Task 1.2.1.2 Identify, describe, and implement strategies for improving survival and retention of stocked razorback sucker and Colorado pikeminnow, including acclimation prior to stocking, size of fish stocked, time and location of stocking, physiological conditioning, and predator avoidance.

In addition to SJRIP Program priorities, the stocking of fish reared at U.S. Fish and Wildlife Service (Service) hatcheries in the Southwest Region (Region 2; New Mexico, Arizona, Texas and Oklahoma) are subject to Regional Policy No. 03-06, "Stocking of fish and other aquatic species". This policy applies to production, transport, and stocking for Service hatchery production and incorporates guidance and requirements from FWS Fish Health Policy (713 FWM 1-5), Policy for Controlled Propagation of Species Listed under the Endangered Species Act (Federal Register 65:183), and goals and objectives of the FWS Strategic Plan for the Fisheries Program. The Service's Fish and Wildlife Conservation Offices are the primary conduit for satisfaction of Policy requirements and ensures compliance with needs relative to fish health, stocking requests and priorities, deviation from approved stocking requests, pre-stocking treatments (e.g. nonnative fish removal from stocking sites), and applicable environmental compliance. The New Mexico Fish and Wildlife Conservation Office (NMFWCO) is the pertinent field office for the processing of SJRIP stocking requests under this policy directing the change in lead coordination and stocking responsibilities from FWS Region 6 to Region 2.

Objectives for Fiscal Year 2016

1. Coordinate with SNARRC, to procure and stock Colorado Pikeminnows according to guidelines set forth in *Augmentation of Colorado Pikeminnow (*Ptychocheilus lucius*) in the San Juan River: Phase II, 2010-2020* (Furr 2010)
    a. Annually stock ≥400,000 age-0 Colorado pikeminnow.
2. Coordinate with SNARRC, Navajo Nation Department of Fish and Wildlife (NNDFW), and Ouray NFH-GVU to procure and stock Razorback Suckers according to guidelines set forth in *An augmentation plan for razorback sucker in the San Juan River* (Ryden 2003)
    a. Stock at least 91,200 RBS (> 300 mm TL) during eight year stocking period or 11,400 per year.
3. Identify and use multiple stocking locations to expand range and reduce potential for catastrophic loss of an entire year class at a single stocking location (Furr 2011). Stock Colorado pikeminnow according to guidelines defined in *Stocking plan and protocol for the augmentation of Colorado pikeminnow (*Ptychocheilus lucius*) in the San Juan River* (Furr and Davis 2009). Stock Razorback Suckers according to guidelines defined in *Stocking plan and protocol for the augmentation of razorback sucker (*Xyrauchen texanus*) in the San Juan River* (in preparation)
4. Update the augmentation plans for Razorback Sucker and Colorado Pikeminnow.
5. Provide summarization report on timing and location of individual stockings, numbers, and age classes while relating information to fulfillment of recommended stocking numbers as outlined in the augmentation plan.

Methods and Approach

Objective 1.a. Age-0 Colorado Pikeminnows will be annually reared and harvested by SNARRC and delivered via standard distribution unit to the San Juan River. Fish will be stocked in the fall of each year, post irrigation season, to eliminate the risk of fish entrainment in irrigation canals. When possible, age-0 Colorado Pikeminnow will be acclimatized to a

variety of conditions (i.e. flow, temperature, physical/environmental characteristic, etc.) for up to 72 hours prior to release into the San Juan River.

Objective 2.a. SNARRC will stock approximately 10,500 Razorback Suckers (≥200 mm total length) into three NAPI ponds (3,500 fish/pond). Grow-out, harvesting, and stocking via standard distribution unit into the San Juan River will be conducted by NNDFW annually with assistance from NMFWCO. When possible, fish will be stocked in the fall of each year, post irrigation season, to eliminate the risk of fish entrainment in irrigation canals. Ouray NFH-GVU will provide the SJRIP Augmentation Program with 2,000-4,000 Razorback Suckers (≥300 mm TL) annually. All Razorback Suckers from Ouray NFH-GVU will be hard released at four specified locations as part of a stocking Source and Location comparison being conducted by NNDGF, the SJRIP Program Office, and the NMFWCO. By comparing differences in subsequent recapture rates, this stocking study will aid the Program in comparing survival and retention of fish stocked from Ouray NFH-GVU vs. NAPI, and determine if fish from either source had better survival and retention rates at a particular stocking location(s).

Objective 3. New Mexico FWCO will identify various sites upstream of Animas-RM 5.0 (Berg Park, Farmington, NM) and determine their suitability for use as stocking locations (Furr 2011). Site selection criteria for razorback sucker will be defined in *Stocking plan and protocol for the augmentation of razorback sucker (*Xyrauchen texanus*) in the San Juan River* (in preparation) and reviewed for approval by the SJRIP Biology Committee. Site selection for Colorado pikeminnow will continue under in *Stocking plan and protocol for the augmentation of Colorado pikeminnow (*Ptychocheilus lucius*) in the San Juan River* (Furr and Davis 2009).

Objective 4. New Mexico FWCO will collate all pertinent stocking information including, but not limited to, timing, location, environmental conditions, size of fish, and numbers stocked. These data will be entered into a standardized database that will be provided to the Program Coordinators office for deposition. These data and subsequent recapture data will be used to evaluate stocking effectiveness.

Products/Schedule

An electronic data file will be provided for inclusion in the centralized database by 31 December 2016. A draft summary report detailing findings will be submitted to the San Juan River Implementation Program, Biology Committee, by 31 March 2017. Revisions will be completed and a final annual report will be submitted by 1 June 2017.

Literature Cited

Furr, D. W. and J. E. Davis. 2009. Stocking Plan and Protocol for the Augmentation of Colorado pikeminnow (*Ptychocheilus lucius*) in the San Juan River. U.S. Fish and Wildlife Service, San Juan River Recovery Implementation Program, Albuquerque, NM. 13 pp.

Furr, D.W. 2010. Augmentation of Colorado Pikeminnow (Ptychocheilus lucius) in the San Juan River: Phase II, 2010-2020 (DRAFT). U.S. Fish and Wildlife Service, San Juan River Recovery Implementation Program, Albuquerque, NM. 20 pp + appendices.

Furr, D.W. 2011. Investigation of Stocking Sites in the San Juan and Animas Rivers Upstream of RM 166.6 (DRAFT). U.S. Fish and Wildlife Service, San Juan River Recovery Implementation Program, Albuquerque, NM. 19 pp + appendices.

Maddux, R. H., L. A. Fitzpatrick, and W. A. Noonan. 1993. Colorado River endangered fishes Critical Habitat: Draft Biological Support Document and appendices. U.S. Fish and Wildlife Service, Salt Lake City, UT. 222 pp.

Ryden, D. W., and F. K. Pfeifer. 1994. An experimental stocking plan for razorback sucker in the San Juan River. U.S. Fish and Wildlife Service, Grand Junction, CO. 26 pp.San Juan River Basin Recovery Implementation Program.

Ryden, D. W. 1997. Five-year augmentation plan for razorback sucker in the San Juan River. U.S. Fish and Wildlife Service, Grand Junction, CO. 27 pp.

Ryden, D.W. 2003. An Augmentation Plan for Razorback Sucker in the San Juan River: Addendum to the Five-Year Augmentation Plan for Razorback Sucker in the San Juan River (Ryden 1997). U.S. Fish and Wildlife Service, San Juan River Recovery Implementation Program, Albuquerque, NM. 63 pp. + appendices.

Ryden, D.W. 2008. Augmentation of Colorado pikeminnow in the San Juan River: 2007. Interim Progress Report (Final) submitted to U.S. Fish and Wildlife Service, San Juan River Recovery Implementation Program, Albuquerque, NM. 6 pp. + appendices.

San Juan River Basin Recovery Implementation Program. 2014. Long-range plan. San Juan River Basin Recovery Implementation Program, U.S. Fish and Wildlife Service, Albuquerque, New Mexico.

U.S. Fish and Wildlife Service. 1994. Determination of critical habitat for the Colorado River endangered fishes; razorback sucker, Colorado pikeminnow, humpback chub, and bonytail chub. Dept. of the Interior, U.S. Fish and Wildlife Service, Federal Register, 21 March 1994, 59:13374-13400.

U.S. Fish and Wildlife Service. 2002. Colorado pikeminnow (Ptychocheilus lucius) Recovery Goals: amendment and supplement to the Colorado Squawfish Recovery Plan. U.S. Fish and Wildlife Service, Mountain-Prairie Region (6), Denver, CO.

FY 2016 Proposed Budget:

Personnel/Labor Costs (Federal Salary + Benefits)	
Fish Biologist (GS-11-5) – 45 days @ $378/day	$ 17,010.00
Age-0 Colorado pikeminnow stockings (Objective 1.a): (1 person x 2 days/trip x 1 trip)	
Age-1+ razorback sucker stockings (Objective 2.a): (1 person x 2 days/trip x 4 trips)	
Age-1+ razorback sucker harvest (Objective 2.a): (1 person x 5 days/trip x 1 trips)	
Reporting/Data Management (Objective 2) (1 person x 30 days)	
Bio. Science Technician (GS-8) – 15 days @ $324/day	$ 4,860.00
Age-0 stockings (Objective 1.a): (1 person x 2 days/trip x 1 trip)	
Age-1+ razorback sucker stockings (Objective 2.a): (1 person x 2 days/trip x 4 trips)	
Age-1+ razorback sucker harvest (Objective 2.a): (1 person x 5 days/trip x 1 trips)	
Supervisory Fish Biologist (GS-13-5) – 5 days @ $540/day (Project oversight and review)	$ 2,700.00
Project Leader (GS-14-7) - 4 days @$674/day	$ 2,696.00
Sub-total	**$ 27,266.00**
Travel and Per Diem (Based on Published FY-2015 Federal Per Diem Rates)	
Hotel Costs – 9 nights ($83/night – single occupancy)	$ 747.00
Per Diem (Hotel Rate) – 15 days @ $46/day	$ 690.00
Sub-total	**$ 1,437.00**
Equipment	
Vehicle Maintenance & Gasoline 8,000 miles @ $0.58/mile (includes costs associated with gasoline/diesel fuel, vehicle maintenance)	$ 4,640.00
Sub-total	**$ 4,640.00**
USFWS-NMFWCO Total	$ 33,343.00
USFWS Region 2 Regional Office Administrative Overhead (3%)	$ 1,000.00
USFWS Region 2 Total	**$ 34,343.00**

Attachment A. – Out-year budgets for Augmentation of Age-0 Colorado pikeminnow and Age-1+ razorback sucker in the San Juan River

Out-year funding

FY 2017 ..... $35,405
FY 2018 ..... $36,484
FY 2019 ..... $37,588
FY 2020 ..... $38,748

COLORADO PIKEMINNOW FINGERLING PRODUCTION and RAZORBACK REARING of SUBADULTS at the SOUTHWESTERN ARRC, Dexter, NM
San Juan River
FY-2016

IA# R13PG0035

Principal Investigators- William Knight and Manuel E. Ulibarri
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In October of 2012 Dexter National Fish Hatchery and Technology Center's name was officially changed to the Southwestern Native Aquatic Resources and Recovery Center (Southwestern ARRC). The facility is located in the Pecos River Valley of southeastern New Mexico, 200 miles southeast of Albuquerque, 20 miles south of Roswell, and one mile east of Dexter on State Road 190.

The following scope of work identifies the facilities and methodologies that will be used to continue producing 400,000 age-0 Colorado Pikeminnow (CPM) and 11,000, 200+ mm razorback sucker (RBS) for use by the San Juan River Recovery Implementation Program (SJRIP) to meet its augmentation objectives for the species in the San Juan River. The primary purpose being the distribution of CPM to the San Juan River and RBS to existing grow-out ponds located on the Navajo Indian Irrigation Project. Southwestern ARRC has developed production guides for both species based on historical growth rates and produces large numbers of each species for distribution throughout the upper and lower Colorado River Basin.

The U.S. Fish and Wildlife Service (USFWS) has developed extensive infrastructure and expertise at Southwestern ARRC to successfully contribute to recovery programs and the facility has been totally devoted to the maintenance, propagation and culture of threatened and endangered fish species for forty years. During that period it has successfully cultured razorback sucker, bonytail, humpback chub and Colorado pikeminnow of the Colorado River system and currently maintains large genetically diverse broodstocks. Over the years staff have developed successful spawning, culture and distribution methodologies for the species that are still used today. The facility utilizes an abundant water supply to produce over 2.0 million fish annually.

Facilities

Situated on the northern fringes of the Chihuahua Desert, the elevation at Dexter is 3,500 feet; average rainfall is 12 inches, and the growing season of 180-200 days. Station facilities include: Administration/Laboratory Building; Fish Culture Building; Visitors Center; Maintenance/Shop Building; Vehicle Storage Building; Equipment Storage Building; Feed Building; General Storage Building.; three government houses; one mobile home, two RVs and one RV space.

Fish culture facilities in operation consist of 75 earthen/lined ponds ranging in size from 0.1-1.0 acres, four (6' X 40') fiberglass raceways, four (8' X 40') concrete raceways, Twenty (2' X 12') rectangular fiberglass tanks, forty (4') fiberglass circular tanks, fifty (3') fiberglass circular tanks and 80 ten-gallon and 20 forty-gallon aquariums. The facility utilizes three water reuse systems in the fish culture building. Phase III Facility Improvement Project was completed on June 5, 2003.

Water

An abundant supply of fish culture water is supplied by five shallow aquifer wells (150 feet in depth) capable of pumping a combined 2,000+ gallons per minute. The well water is a constant 64^0 F, pH of 7.5-8.5, total hardness of 2,100 ppm, and total dissolved solids of 3,500 ppm. Water rights, allocated through the New Mexico State Engineer's Office, total 2,185.5 acre-feet per annum or 10,927.5 acre-feet per five-year water period. Waste water from all fish culture operations collects in two sumps on the southeastern area of the facility and provides year round water to the wetlands.

I. Colorado Pikeminnow Fingerling Production

Background

Once very common throughout the Colorado River Basin, Colorado pikeminnow have declined from historic levels and are now found primarily in the Upper basin of the Colorado River. Various factors have contributed to the decline of the specie including alteration of natural stream flows and temperature regimes, loss of habitat and habitat fragmentation as a result of water development and the introduction of nonnative fish species.

Colorado Pikeminnow are native to the San Juan River. Its historic distribution included the entire mainstem San Juan River up to Rosa, New Mexico, located approximately 25 miles upstream from present day Navajo Dam. Currently the species is considered extremely rare and the small population is estimated at less then 20 adults. This small group of fish has persisted in the San Juan River since the closure of Navajo Dam in 1962. Recent studies being conducted by the San Juan Recovery Implementation Program (SJRIP) indicate that the Colorado pikeminnow is reproducing and recruiting in the river to at least a limited degree, however the low numbers collected do not satisfy recovery goal requirements for the specie. The Recovery criteria calls for a target of 1,000 subadult's fish established by the end of a five year down listing period, and 800 adults maintained during the 7 year delisting period. The Upper Colorado River Endangered Fish Recovery Program has recommended that the wild population be increased by augmenting with hatchery produced fish. The **Augmentation Plan for Colorado Pikeminnow in the San Juan River (Phase I)**, (Ryden 2003) called for annual stocking of age-0 fish over an eight year augmentation program (2002-2009). As per the modified work plan, dated 6 April 2005, age-1 fish were produced at Dexter from 2006-2010 to augment the age-0 stockings in the San Juan River, (Ryden 2005, Addendum #1 to Augmentation Plan For Colorado Pikeminnow In The San Juan River). The augmentation plan (Phase I) for age-0 and age-1+ Colorado pikeminnow ended in 2010. Augmentation efforts identified in the Phase II (2010 – 2020) "*draft*" **Augmentation Of Colorado Pikeminnow (*Ptychocheilus lucius*) in the San Juan River Plan** (Furr 2009); focuses primarily on culturing and stocking increased numbers of age-0 fish. Current facility and broodstock capabilities at Southwestern ARRC allow for ≥400,000 age-0 Colorado pikeminnow to be produced and stocked annually. This has been identified as the stocking target for 2016 and subsequent years unless further production capacity is identified and/or stocking targets are modified by the SJRIP.

Southwestern ARRC has been the leader in propagating and culturing Colorado pikeminnow since 1981. The facility maintains several captive stocks as genetic reserves and has successfully produced fish for the Upper

and Lower Colorado River Basin programs and the SJ RIP. The main emphasis has been on examining the reproductive biology of the species, broodstock development and culturing age-0, 1 and adults. This work plan proposes the production of 400,000 age-0 fingerlings (50 mm TL) annually for reintroduction in the San Juan River.

Funding requested also covers costs associated with proper care of broodstock necessary to successfully carry out this project for future years and aide in restoration of the species. Stocking will require coordination with New Mexico Fish & Wildlife Conservation Office, Navajo Nation Department of Fish and Wildlife, New Mexico Department of Game and Fish, Colorado Division of Wildlife and Utah Department of Wildlife Resources.

Objectives

1. Produce 400,000 age-0 fingerlings (50 mm) for stocking in the San Juan River in 2016.

2. Transport and distribute 400,000 age-0 Colorado pikeminnow from Dexter, to the San Juan River.

3. Maintain 400 Colorado pikeminnow broodstock for recovery efforts.

Methods

Broodstock consists of 250 (F1) and 500 (F2) adults. These fish are 1999, 2004 and 2006 year-class (YC) progeny from wild adults collected from the Yampa, Green and Colorado Rivers, respectively. In 2006 staff began culturing a second broodstock of 500 (F2) individuals for future use. This stock is referred to as the 06CRDX lot derived from the 1991broodstock.In 2016 a maximum of 50 paired matings (1 female X 1 male) will be spawned from the 1999 YC broodstock. Given the past history of hormonal induced ovulation, 38 females (75%) should produce viable eggs during a given year. All members of the broodstock are PIT tagged and records of spawning pairs are maintained at Southwestern ARRC.

Spawning

Broodfish will be harvested from the culture pond in early May, males and females sorted and held indoor for spawning. Ovulation will be induced with intraperitoneal injections of common carp pituitary (CCP) at the rate of 4 mg/kg of body weight. When eggs can be expelled using slight pressure, a female will be stripped and milt added from one male. Each individual egg lot will be enumerated, incubated and kept separate in Heath Trays until hatching occurs, approximately 96 hours following fertilization at a constant water temperature of 72^{o}F.

Rearing Ponds

To meet the production goal of 400,000 age-0 (50mm) fish, rearing ponds will be stocked at the following densities:

Age-0 Growth: (June thru October - 150 day growing period)

Pond 1B- .87 acre Earthen @ 100,000 fry
Pond 2B- .73 acre Earthen @ 100,000 fry
Pond 3A- .89 acre Lined @ 100,000 fry
Pond 6D- .25 acre lined @ 100,000 fry
Pond 7D- .25 acre lined @ 100,000 fry

Earthen and plastic lined ponds will be used for production. In earthen ponds, the bottoms will be packed and graded prior to receiving fish. Non-level pond bottoms can hinder fish harvest and aquatic vegetation can entrap fish at harvest time. Fertilization and slow filling of ponds will start 10 to 14 days prior to stocking. Staff will ensure that water quality is monitored. Temperature, dissolved oxygen and pH readings will be taken twice daily at 7:00am and 3:00 pm at the deepest part of the pond.

If the dissolved oxygen drops to < = 3 mg/I, supplemental aeration will be started. All feeding, fertilization and chemical applications will be stopped till adequate oxygen levels are restored. Aerators will be run all night for several days till the oxygen is back up to acceptable levels, (5-7 mg/1). Staff will avoid handling fish for 7 -10 days following a stress related circumstance.

Pond Vegetation Control and Fertilization

Diuron and Barrier will be used in earthen ponds to control rooted aquatic vegetation. Staff will use granular form when possible and broadcast the entire pond bottom at the recommended rates.

Diuron – 2.0 lbs per acre (dry broadcast)
Barrier- 100 lbs per acre (dry broadcast)

Copper sulfate (CUSo4) will be used to control floating filamentous algae blooms. Treatments will began approximately 45 days after fish are stocked into the ponds and repeated every 30 days. Application rates in Dexter ponds are 5 to 8 lbs per acre. A secondary benefit derived from using CUSo4 is its effectiveness in controlling external parasites.

Zooplankton and invertebrate insect populations are cultured with the proper fertilization regime. Four types of fertilizer will be used:

1) Alfalfa meal
2) Alfalfa pellets
3) Cottonseed meal
4) Super phosphate

Initial fertilization rates for earthen ponds are 100 lbs of cottonseed meal, 100 lbs of alfalfa meal or pellets and 3 lbs of super phosphate. Follow up rates are administered on Monday and Thursday with 10 lbs cottonseed meal, and 10 lbs, alfalfa meal or pellets.

Water temperature, dissolved oxygen (DO) and pH readings will be taken in all rearing ponds daily. All readings will be recorded on record charts. If morning DO readings are below 3.0 or above 13.0 all fertilization will be stopped until DO's are brought back to accepted levels. If pH readings are greater than 9.5 fertilization will be terminated.

Feeding Schedule

Fish will be sampled at the end of every month. Size, weight and over all condition will be recorded. Feed amounts will be adjusted and projected for the upcoming month. Trout starter, #1 and #2 feed will be used and purchased from SKRETTING (formerly Nelson and Sons, Silver Cup), Murray, Utah. Age-0 fish will be fed three to four times daily at approximately 9:00am, 11:00am, 1:00pm and 3:00pm.

Feeding rates are based on water temperature and fish densities in the ponds and will be calculated as follows:

- water temp > = 80 ^{o}F feed 3 % BW per day, Mon, Wed and Fri.
- water temp 61-78 ^{o}F feed 2 % BW per day, Mon thru Fri.

- water temp < 60 ^{o}F feed 1.5 % BW per day, Mon and Thurs.

Staff will use the following guide to determine the proper particle size to offer the fish. Feed sizes will be mixed at ½ rations of each size when making the transition to the next larger size feed.

Fish Size	Particle Size
Fry	Starter
20mm	#1 crum
40mm	#2 crum
2-3"	1.0 mm

Schedule
Broodfish will be spawned in May 2016 and age-0 fish reared in earthen and plastic lined ponds from June - October 2016.

Projected Harvest Dates and Delivery Date
Age -0 fish will reach the target size of 50mm by the end of October of each year. The fish will be harvested from the ponds the final week of October and hauled and distributed into the San Juan River the first full week in November of each year.

Projected Duration Of Project:
Phase I of this project was initiated in 2002 in support of the SJRIP Colorado pikeminnow augmentation effort (2002-2009) identified in the **Augmentation Plan for Colorado Pikeminnow (CPM) in the San Juan River**, (Ryden 2003). As per the modified work plan, dated April 06, 2005 age-1 fish were produced at Dexter and delivered annually from 2006-2011 to the San Juan River (Ryden 2005, Addendum #1 to Augmentation Plan For Colorado Pikeminnow In The San Juan River). The augmentation plan (Phase I) for both age-0 and age-1+ Colorado pikeminnow ended in 2010. Under Phase II, augmentation efforts focus on culturing and stocking ≥400,000 age-0 Colorado pikeminnow annually from 2011-2020 or as directed by the San Juan Recovery Implementation Program.

II. Rearing Razorback Sucker SubAdults at the Southwestern ARRC

Background

Lake Mohave Razorback Sucker Broodfish

Razorback sucker (RASU) have been maintained and cultured at The Southwestern ARRC since 1981. The captive broodstock represent the Lake Mohave population. Three separate broodstocks are maintained; the 1981, Paired Mated (PM) and Wild Caught (WC) broodstocks. The PM stock is comprised of 90 unique family groups produced from paired matings of wild caught adults spawned at Willow Beach NFH from 1994 to 2004. The WC broodstock consists of six year classes of larvae and juvenile wild-caught fish from Lake Mohave from 2000 to 2005. These fish were captured as fry from eight locations throughout Lake Mohave and given the designation of (WC) future broodstock .

From 2001-2013 production of subadult razorbacks at Southwestern ARRC has yielded excellent survival and growth. The overall survival for razorback sucker grown to 450mm is 90.5%, while 85% of the fish achieved the target growout size in two years. Spawning and growing season consists of fish being spawned in the early spring and fry stocked in to earthen or lined ponds and grown out-door from April to October. Total

dissolved oxygen and temperature are monitored daily and fish feed on phyto and zooplankton produced in fertilized ponds for approximately 45 days at which time they are offered a prepared razorback sucker diet. Fingerlings are routinely held and cultured in the Fish Culture building during the months of January - March to prevent mortalities associated with outdoor over wintering. In the fall of the year when the fish reach target size they are harvested from the ponds and transferred to the Fish Culture building for sorting and tagging. Following a 7 to 10 day rest and recovery period they are loaded into distribution trucks and hauled to their stocking locations. Southwestern ARRC staff has successfully hauled 300+mm razorbacks to the San Juan river and razorbacks and Bonytail to Lake Mohave, Arizona, in the lower Colorado River. The distribution trips to the San Juan average 400 miles (8 hours) and the trips to Lake Mohave average 660 miles (12 hours) of hauling time in one direction.

Production Plan

Objectives:
The main objective of this proposed work is to spawn razorback sucker adults and rear 11,000, 200+mm fish annually and deliver them to existing grow-out ponds located on the Navajo Indian Irrigation Project.

Additional objectives of the work include:

1. Improve, maintain and staff facilities at Southwestern ARRC to rear and distribute the target # of fish.

2. Maintain razorback sucker captive broodstock for recovery efforts.

3. Passive Integrated Transponder (PIT) tag all fish prior to stocking into the NAPI ponds. PIT tags will be provided by the SJRIP.

Methods
Captive propagation activities include spawning a minimum of 20 pairs of broodstock, incubating fertilized eggs, enumerating and stocking of swimup fry into rearing ponds, harvest of target sized fish from ponds, PIT tagging and distribution to the NAPI ponds near Farmington, NM on the Navajo Nation.

The project will utilize indoor and outdoor facilities. All spawning and incubation activities will be conducted indoor in the fish culture building. Razorback sucker will be initially reared in 2 earthen or lined ponds and in June of each year transferred to 3 ponds at surface acres of 0.79, 0.89 and 0.98.

Rearing Ponds
To meet the production goal of 11,000 (200mm) fish, rearing ponds will be stocked at the following densities:

Age 0 Growth: (April thru May - 60 day growing period)

Pond 1- .72 acre @ 12,000 fry
Pond 2- .79 acre @ 12,000 fry

Age I Growth: (June thru October - 150 day growing period)

Harvest Age I fish; enumerate and stock fingerlings into 3 ponds.

Pond 1- .79 acre @ 6,000 fingerlings
Pond 2- .89 acre @ 6,000 fingerlings
Pond 3- .98 acre @ 6,000 fingerlings

Earthen and lined ponds will be used for production. In earthen ponds the bottoms will be packed and graded prior to receiving fish. Non-level pond bottoms can hinder fish harvest and aquatic vegetation can entrap fish at harvest time. Fertilization and slow filling of ponds will start 10 to 14 days prior to stocking. Staff will ensure that water quality is monitored. Temperature, dissolved oxygen and pH readings will be taken twice daily at 7:00am and 3:00 pm at the deepest part of the pond.

If the dissolved oxygen drops to < = 3 mg/I, supplemental aeration will be started. All feeding, fertilization and chemical applications will be stopped till adequate oxygen levels are restored. Aerators will be run all night for several days till the oxygen is back up to acceptable levels, (5-7 mg/l). Staff will avoid handling fish for 7 -10 days following a stress related circumstance.

Pond Vegetation Control and Fertilization

Sonar, Diuron or Barrier will be used in earthen ponds to control rooted aquatic vegetation. Staff will use granular form when possible and broadcast the entire pond bottom at the recommended rates.

Diuron – 2.0 lbs. per acre (dry broadcast)
Barrier- 100 lbs. per acre (dry broadcast)

Copper sulfate (CUSo4) will be used to control floating filamentous algae blooms. Treatments will began approximately 45 days after fish are stocked into the ponds and repeated every 30 days. Application rates in ponds are 5 to 8 lbs per acre. A secondary benefit derived from using CUSo4 is its effectiveness in controlling external parasites.

Zooplankton and invertebrate insect populations are cultured with the proper fertilization regime.
Four types of fertilizer will be used:

1) Alfalfa meal
2) Alfalfa pellets
3) Cottonseed meal
4) Super phosphate

Initial fertilization rates for earthen ponds are 100 lbs of cottonseed meal, 100 lbs of alfalfa meal or pellets and 3 lbs of super phosphate. Follow up rates are administered on Monday and Thursday with 10 lbs cottonseed meal, and 10 lbs, alfalfa meal or pellets.

Water temperature, dissolved oxygen (DO) and pH readings will be taken in all rearing ponds daily. All readings will be recorded on record charts. If morning DO readings are below 3.0 or above 13.0 all fertilization will be stopped until DO's are brought back to accepted levels. If pH readings are greater than 9.5 fertilization will be terminated.

Feeding Schedule

Fish will be sampled at the end of every month. Size, weight and over all condition will be recorded. Feed amounts will be adjusted and projected for the upcoming month. Razorback grower (0301) feed will be used and purchased from SKRETTING (formerly Nelson and Sons, Silver Cup), Murray,Utah. Fish will be fed twice daily, once at 9:00am and at 2:00pm.

Feeding rates are based on water temperature and fish densities in the ponds and will be calculated as follows:

- water temp > = 80 ^{o}F feed 3 % BW per day, Mon, Wed and Fri.
- water temp 61-78 ^{o}F feed 2 % BW per day, Mon thru Fri.
- water temp < 60 ^{o}F feed 1.5 % BW per day, Mon and Thur.

Staff will use the following guide to determine the proper particle size to offer the fish. Feed sizes will be mixed at ½ rations of each size when making the transition to the next larger size feed.

Fish Size	Particle Size
2-3"	1.0 mm
4-6"	2.0 mm
6-8"	3.0 mm

Schedule

Broodfish will be spawned in March and the fish reared in earthen ponds for their first growing season (April – October); held indoor during winter (November - March) and stocked into the NAPI ponds in April of 2016. Target sized fish are available for distribution in spring and fall of each year.

Projected Harvest Dates and Delivery Date

Year 2016 marks the eleventh year of razorback production at Dexter for distribution to the NAPI ponds. In 2007 a new single cohort fish rearing strategy was adopted by the SJRIP for the NAPI ponds. Since 2006, staff have stocked a total of 74,948 razorback's averaging 225mm in length into East and West Avocet and Hidden ponds and in 2012 stocked an additional 1,000 target sized RBS into the San Juan River. An additional 11,000 will be stocked into the NAPI ponds in April 2016. Based on historical growth rates for razorback at Dexter, the production target of 11,000, 200+mm fish is achieved in a fifteen month period. Fish delivery will be in the spring of each year based on the new rotational production plan (single cohort). Approximately 11,000 fish will be stocked each trip and Dexter staff will coordinate the deliveries with the Navajo Nation Department of Fish and Wildlife, BIA and USFWS FWCO personnel. The estimated duration of the program is scheduled for a total of 15 years (2005- 2020).

PIT Tagging

Starting in 2012 all fish stocked into the NAPI ponds are PIT tagged prior to stocking. The fish will be graded and sorted approximately 6 to 8 weeks before the scheduled stocking date. Fish that average 200mm will be PIT tagged and allowed to recover for a minimum of 10 to 14 days after each handling. The PIT tagged fish will then be scanned for tag retention and any fish that lost a tag will be retagged.

Projected Duration Of Project:

This project was initiated in January 2005 in support of the SJRIP razorback augmentation effort (2004-2011) identified in the **Five-Year Augmentation Plan for Razorback Sucker in the San Juan River** (Ryden 1997, 2003). The rearing of razorback sucker subadults at Southwestern Native ARRC could potentially continue till 2020 as per BOR RFP 04-SF-40-2250.

General Fish Husbandry Requirements and Conditions

Predator Control

Historically, Southwestern ARRC has not experienced excessive avian or mammal predation on fish stocks. Salamander, crayfish, frog and turtle infestation of ponds are nonexistent. On an annual basis specific ponds are covered with bird netting during the winter months to eliminate predation by migrating birds. An additional strategy employed by the staff is the harvest and hold stocks of fish indoor during the winter months of November to March. Razorback reared for this project will be maintained indoor in two 40,000 gallon systems during the winter months. These systems contain biofiltration, supplemental aeration, temperature control and alarm systems.

Handling and Transport Protocol

Transport of all fish will follow guidelines described in the USFWS Protocols for Biological Investigations developed by Dr. Gary Carmichael, retired U.S. Fish & Wildlife Service employee. The protocol is as follows:

1. When Colorado pikeminnow and razorback fingerlings, subadults and broodfish are handled they will be placed in a .5% salt bath to help in osmoregulation and reduce the effects of handling stress.

2. Temperature should be 5 degrees Fahrenheit lower in the hauling truck than in the river.

3. Drivers must be informed of and follow a specified route.

4. Transport water will contain 0.5 percent NaCl (18.9 grams per gallon).

5. Oxygen levels will be greater than 6.0 mg/L as determined with an oxygen meter.

6. Nets must be functional. Aeration equipment must be in place and must be used. A fish holding container will be a minimum of 5 gallons in size and fish densities will not exceed 1 lb of fish per gallon of water. Small delta mesh (1/8") will be present to transfer the fish from one container to another, although it is preferred to have water to water transfer. Oxygenation/aeration equipment will be in place and working.

7. Prior to transfer and after the fish are concentrated, they should be quickly placed in the transport tank. When using nets to place fish in transfer buckets or tanks, nets should not be overloaded. The fish on the bottom will be crushed. Using a wet transfer with buckets is preferable. When emptying the nets and buckets, care will be taken to avoid adding algae and mud to the transport tank. Before loading, dissolved oxygen levels should be at saturation.

8. Immediately after loading, all equipment on the transport vehicle should be re-checked and the vehicle should depart. Oxygen concentrations and temperatures should be monitored at a minimum of every hour.

9. During unloading tempering water should be present and functional, and thermometers should be used to match water temperatures. Hauling water temperatures should be equal to receiving water temperature.

***Acclimatizing the fish to the receiving water temperature will be conducted in increments of 2^{o} F or (1^{o}C) towards equalizing per 30 minutes time. Due to the high alkalinity and TDS of Southwestern Native ARRC water, staff will temper and acclimate the transported fish to the receiving water quality for a minimum of 1 hour prior to release. This process will allow sufficient time for the fish to**

osmoregulate to the receiving water quality. Tempering can be accomplished in the shipping tank by adding receiving water to the tank at given intervals.

Fish Health Monitoring Protocols

All fish should be handled with the best animal husbandry practices available. A feeding schedule will be developed and followed daily. All tanks will be cleaned of uneaten food and feces daily. A daily log recording times of feeding, water temperature and comments on fish health will be maintained. If fish are maintained in a re-circulating system, all filters and pumps will be routinely cleaned and monitored. If fish are held in ponds O2 levels will be closely monitored. At least once a year, a fish health inspection will be conducted to examine fish for bacterial, viral and parasitic infections. Normally 60 fish per lot are sacrificed for an adequate sample. However, in the case of endangered or rare fish of genetic importance, numbers sampled may be less, depending upon availability. Non-lethal methods, if available, will be employed to obtain samples. Condition factors will be calculated on an annual basis and data added to a RBS database. Wet mounts will be examined for parasites and bacteria. Routine condition exams will be conducted and an examination will be conducted on all lots one month prior to delivery to the San Juan River and NAPI ponds on the Navajo Nation. Brood and refuge stock will have health checks annually and only when needed to minimize handling stress.

The U.S. Fish and Wildlife Service, Dexter Fish Health Program will provide bacterial and viral testing for razorback propagation and rearing activities. Treatment of disease will be the responsibility of the Southwestern ARRC fish culture staff. Fish health experts are available to advise on proper treatment, and to examine fish for infection.

Disposition of Fish

All fish propagated and cultured for this project are made available to the SJRIP for stocking and meeting augmentation requirements identified in Phase II (2010 – 2020) "*draft*" **Augmentation of Colorado Pikeminnow (*Ptychocheilus lucius*) in the San Juan River Plan ,** (Furr 2009) and the **Five-Year Augmentation Plan for Razorback Sucker in the San Juan River** (Ryden 1997, 2003). In the case of catastrophic loss (>25% of the stock) at Southwestern Native ARRC, up to 1,000 individuals will be collected for testing and diagnosis to determine (if possible) reason for loss. A written statement describing the loss will be provided immediately to the US Fish and Wildlife Service (Service) Fisheries Division and the SJRIP Coordinator, Albuquerque, NM; followed by a detailed report of the diagnosis once results are available. Excluded from these reporting requirements are gametes and fish lost to natural attrition, including but not limited to non-viable eggs prior to hatch and incidental predation mortalities. As per the guidelines identified in the 2003 Memorandum of Understanding between the Service and University of New Mexico, Division of Fishes, Museum of Southwestern Biology (MSB), fish carcasses (specimens) will be provided to the MSB who serves as the repository for vouchered specimens of native fishes. Any additional mortalities above the 1,000 mark will be recorded in the annual Threatened and Endangered Species report and disposed of by burial onsite or at a local land fill.

If any concerns are identified leading to potential questions about stocking of fish, in the instance of fish having cleared the Service's fish health testing for reportable pathogens and other agents of concern using established Fish Health Center SOPs and those of the American Fisheries Society – Fish Health Section Blue Book, the SJRIP has 30 days to formally respond with recommendations on the disposition of the fish. After 30 days, if no response is provided, in writing, the disposition action for the fish will be at the discretion of the Service.

Reporting
A draft annual progress report detailing fish culture and distribution activities will be completed and provided to the SJRIP by January 31, 2017.

Budget

RE: Colorado Pikeminnow Fingerling Production and Razorback Rearing of Subadults at the Southwestern ARRC, Dexter, NM. The following costs are associated with producing and stocking 400,000 age-0 fingerlings in the San Juan River and 11,000 200 mm subadults into the NAPI ponds on the Navajo Nation in 2016. Identified costs also include maintaining Colorado pikeminnow and Razorback broodstock for recovery efforts.

Budget -Detailed Spending Plan 2016

I. Colorado Pikeminnow Fingerling Production

O&M Labor Costs
The labor costs identified for 2015 are broken down as follows, and include fringe benefits and payroll additives for each position identified:

Southwestern Native Aquatic Resources and Recovery Center

(1) Fish Biologist (1,280 hours -16pay periods) - GS 482-9 @$32.33/hr. = $41,382
* Supervision, spawning, fish health and water quality monitoring, feeding, harvest and prep for distribution.

(1) Administrative Officer (240 hours- 3pay periods) - GS 341-9 @$31.63/hr. =$ 7,592
* Budget tracking, purchasing, data base management & reporting.

Subtotal = $48,974

Equipment and Supplies:

Liquid oxygen and compressed oxygen 12 cylinders @ $81.42 Airgas	$ 977
Spawning Supplies Hormones (CCP 5 vials @ $196 per 10ml/vial)	$ 980
Fish health sampling prior to stocking Lab supplies for bacti, viral and parasite testing.	$ 2,111
Culture equipment (nets, seines, screens, etc.) Eager, Memphis Net & Twine	$2,152
Pond management supplies, Barrier $273.19/50# bag (20 bags) Van Diest	$5,463
Fish feed,1.65/lb., 6,000 lbs. SKRETTING	$9,900
Cyclical Maintenance costs for: Tractors, mowers, gators, sweepers used in pond maintenance	$1,545
Subtotal	**$ 23,128**

Utilities:

Pumping costs	
Electrical 200,257 kwh @ .094	$18,824
Heating water for hatching eggs to swim-up	
Natural gas 1,525 ccf @ .99	$ 1,509
Subtotal	**$20,333**

Reintroduction Costs:

Salaries	
GS-9 Fish Biologist	
24 hrs. @ $32.35	$776
GS-7 Fish Biologist	
24 hrs. @ $24.04	$577
WG-7 Maintenance Worker	
24 hrs. @ $21.86	$525
WG-5 Bio Science technician	
24 hrs. @ $16.39	$393
Lodging &Per Diem $123/day (Dexter to Farmington, NM and return)	
$123.00/trip x 2 trips x 4 employees =	$ 984
Fuel costs and truck maintenance 1200 miles @ $5.61	$6,732
Subtotal	**$9,987**

Annual subtotal (CPM)	
(O & M Direct Costs)	**$ 102,422**

II. Rearing Razorback Sucker Subadults at the Southwestern ARRC

O&M Labor Costs

The labor costs identified in the 2015 Scope of Work are broken down as follows, and include fringe benefits and payroll additives for each position identified:

Southwestern Native Aquatic Resources and Recovery Center

(1) Fish Biologist (1,040 hours -13pay periods) - GS 482-9 @$32.33/hr. = $ 33,623
* Supervision, spawning, fish health and water quality monitoring, feeding, harvest and distribution.

(1) Administrative Officer (160 hours- 2pay periods) - GS 341-9@$31.63/hr. = $ 5,060
* Budget tracking, purchasing, data base management & reporting.

Subtotal = $38,683

Materials and Supplies

Cost based on SNARRC's historical purchases:

Fish Health

Fish health sampling prior to stocking	
Lab supplies for bacti, viral and parasite testing.	$ 1,218
Fish Culture Supplies	
Nets, seines, tubs, screens.	$ 2,060
Wet lab supplies (pipets, petri dishes, slides, probes, markers)	$ 274
Theriputents- salt, Oxytetracycline, formalin, MS-222, stress coat	$ 656
Liquid and compressed oxygen for fish distribution	$ 218
Feed	
Production diet RBS0301 (2.0 tons) 4,000 lbs. $ 1.55 per lb.	$ 6,200
Spawning Supplies	
Hormones (HCG 10 vials @ $ 54.64 per 10ml/vial)	$ 546
Fertilizer	
Alfalfa pellets (1,000 lbs.) .28/lb.	$ 280
Inorganic - Super Phosphate (10 bags) 8.20/bag	$ 82
Chemicals- Aquatic Vegetation Control	
Barrier- (6 bags) $273.19/bag	$ 1,639
Diuron -(2 bags) $ 81.96/bag	$ 164
Subtotal =	**$13,337**
Services	
Utilities & Equipment Maintenance	
* Electrical, fuel and phone	$ 4,854
* Boiler system, heat exchanger maintenance	$ 1,092
*#1 well and water tower and pumping station maintenance	$13,471
Subtotal =	**$ 19,417**
Travel	
- Fish stocking/distribution.	
Dexter to Farmington (NAPI) & return- (1640 miles @ 5.61 per mile DX truck) =	$ 9,200
Fuel and routine vehicle maintenance.	
Per diem- $123 per day X 2 trips X 2 individuals. =	$ 492
Subtotal =	**$ 9,692**
Annual subtotal (RBS)	
O&M DIRECT COSTS	**$81,129**
I. Colorado Pikeminnow Fingerling Production	$102,422
II. Rearing Razorback Sucker Subadults at the Southwestern ARRC	$81,129

Annual total:	**$183,551**
3 % Administrative Overhead	**$ 5,507**
TOTAL REQUESTED FOR 2016	**$ 189,058**

Projected out year funding request:

FY 2017 - $194,787
FY 2018 - $200,630
FY 2019 - $206,649
FY 2020 - $212,848

Literature Cited:

Furr, W. D. 2009. *Draft* Augmentation Plan, Augmentation of Colorado Pikeminnow (*Ptychocheilus lucius*) in the San Juan River, Phase II 2010-2020. U. S. Fish and Wildlife Service, Albuquerque, NM. 15 pages.

Hamman, R. 1985. Induced spawning of hatchery -reared razorback sucker. Prog. Fish-Cult. 47(3): 187-189.

Ryden, D. W. 2003. An Augmentation Plan For Colorado Pikeminnow In The San Juan River. U. S. Fish and Wildlife Service, Grand Junction , Co. 63 pp. + appendices.

Ryden, D. W. 2003. An augmentation plan for razorback sucker in the San Juan River: An addendum to the five-year augmentation plan for razorback sucker in the San Juan River (Ryden 1997). U. S. Fish and Wildlife Service, Grand Junction, CO. 32 pp.

Ryden, D. W. 2005. *Draft* Addendum #1, Stocking Age-1 Fish To Supplement Ongoing Augmentation Efforts. An Augmentation Plan For Colorado Pikeminnow In the San Juan River. U. S. Fish and Wildlife Service, Grand Junction , Co. 3 pages.

Razorback Sucker Augmentation at NAPI Grow-Out Ponds
Fiscal Year 2016 Project Proposal

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Background

The Long Range Plan for recovery of endangered fishes in the San Juan River calls for propagation and augmentation of razorback sucker (RBS). Nine ponds have been built on Navajo Agricultural Products Industry (NAPI) lands to grow out RBS for stocking into the San Juan River. The Coordination Committee has decided to only utilize three of the nine existing ponds on NAPI during FY 2014.

Avocet Pond was originally a single pond built for watering cattle. On March 2, 1998 Avocet was divided into 2 ponds known as Avocet East and West. Avocet West is 3.4 acres and holds 18 acre-feet of water. Avocet West has a siphon for draining the pond. Avocet East is 3.52 acres and holds 19.6 acre-feet of water. Avocet East had no siphon when the ponds were divided, so draining was accomplished by renting a battery of water pumps. A siphon was installed in Avocet East during FY 2008 and the water can now be managed independent of Avocet West and without the need for pumping.

In October of 1999, Hidden Pond was built to rear razorback sucker. Hidden Pond is 2.83 acres. The dam was breached due to a storm event and the fish were lost. The dam was re-built in FY 2000 and a toe drain and spillway were built to protect the dam. Hidden Pond was lined with bentonite and contoured and a kettle was installed to facilitate fish harvest. A siphon was installed in July 2003. A salamander fence was installed around the Hidden Pond perimeter in August of 2003 to exclude predatory tiger salamanders.

Responsibility for Management of the NAPI ponds was originally shared between the U.S. Fish and Wildlife Service (Service), Bureau of Indian Affairs (BIA), Keller-Bliesner Construction and Ecosystems Research Institute. The Service was responsible for determining which ponds would receive RBS and when. In addition, the Service conducted sample counts and harvested the ponds with the assistance of the BIA. Keller-Bliesner was responsible for design and construction of the Six Pack ponds and re-construction of Hidden Pond. The BIA was responsible for monitoring water quality and Ecosystems Research was responsible for fertilization of the ponds and for developing a pond management plan.

Original pond management was for multiple cohorts to be raised in the ponds. Harvesting would be done passively with fyke nets so that the ponds would not be drained on an annual basis. In FY 2007, it was determined to change pond management direction. All of the ponds would be drained and harvested and single cohort management would replace the multiple cohort approach. During the first harvesting and draining of a Six-pack Pond, high mortality resulted when the number of fish remaining in the pond could not be removed before they succumbed to the rapidly warming water. Adjustments were made to reduce the mortality in future harvesting and draining events. The adjustments consisted of increasing the trapping effort prior to de-watering to reduce the number of fish remaining in the pond. In addition, the final fish removal would be accomplished with a higher pool of water to slow the warming of the water during the time of final harvest. This resulted in less mortality.

The Navajo Nation Department of Fish and Wildlife (NNDFW) was contracted to assume responsibility for daily management of the NAPI ponds in 2007. The Service assists the NNDFW with pond harvest as needed.

The ponds have been fenced and electric lines have been installed at each of the ponds. Aerators have been installed

at each of the ponds to improve water quality. Water quality issues have caused fish mortalities in some of the ponds in the past. Water quality issues appear to have been resolved since installation of the aerators.

Objectives
(NAPI Ponds Management)

Manage razorback sucker grow-out in East Avocet, West Avocet, and Hidden ponds to provide an additional source of RBS to supplement the augmentation program. Harvest, Passive Implant Transponder (PIT) tag, and stock razorback sucker from the three grow-out ponds into the San Juan River, in order to assist in fulfilling the tasks and objectives outlined in the current version of *An Augmentation Plan for Razorback Sucker in the San Juan River* (Ryden 2003).

1) Manage three grow-out ponds using a single cohort strategy; including passive and active harvest techniques.

2) Annually stock 3,500 (≥ 200mm) razorback sucker per pond.

3) Harvest all ponds on an annual basis.
    a. Implant all razorback sucker with a PIT tag prior to stocking.
    b. Stock all fish regardless of size at harvest.
    c. Stock ~ 4,200 to 6,300 fish based on 40-60% return.
    3c. Investigate and utilize multiple stocking localities.

4) Experimentally acclimatize, as guided by SRRIP – Biology Committee, razorback sucker from both NAPI ponds and Uvalde National Fish Hatchery.

Location

The RBS grow-out ponds are located in Block III of Region 2 on NAPI lands, south of Farmington, New Mexico. Avocet East and West are located NW of the intersection of N 4062 and N 4087, which is approximately 3 miles southwest of the Ojo Amarillo NHA Housing Subdivision. Hidden Pond is located SE of the intersection of N 4087 and N 4095 approximately 1 mile northwest of the NAPI Region II Complex.

Methods/Approach

The NNDFW will be responsible for overall management of the NAPI ponds regarding daily management duties, harvesting, and stocking. The Service, Region 2, will be responsible for coordinating the stocking of the ponds with Dexter NFH and NNDFW per US Fish and Wildlife Service Region 2 stocking policy. The NNDFW will be responsible for daily management of the three grow out ponds on NAPI with assistance by the Service, Region 2. Harvesting, tagging, and stocking will be conducted by NNDFW, with assistance from the Service if additional personnel are needed. Associated data management and reporting for the project will be handled by staff from the NNDFW.

Pond management requires that staff monitor and record water quality and quantity, and feed the fish on a daily basis. In addition, staff manages water quantity to ensure that water quality is optimal. Maintenance includes operating and repairing valves and aerators, evaluating the pond perimeters for erosion problems, operating the propane cannons to scare away predators, repairing fences, monitoring aquatic vegetation and maintaining a log book and database for management of the ponds.

During FY 2014, East Avocet, West Avocet, and Hidden ponds will be managed for a single cohort of RBS. NNDFW will implement passive harvest using fyke nets to trap, tag, and stock RBS into the SJR for several days or months prior to dewatering the ponds. As the ponds are dewatered, NNDFW and Service staff will work together to do the final RBS removal, tagging, and stocking into the SJR.

Maintenance

In recent years maintenance has been conducted by NNDFW personnel (when able to do so), Keller-Bliesner

Construction and Ecosystems Research Institute, or NAPI maintenance personnel. Often repairs, installment of irrigation lines, valves repair/replacement, and other pond infrastructure require specialized tools and heavy equipment operation, which NNDFW does not have access to. NAPI has multiple equipment yards and an abundance of heavy equipment located near the ponds, which allow for frequent availability and can be onsite when called as problems and repair work is needed. Because of their extensive inventory of parts for irrigation on NAPI lands, they generally have valves, pipe, and miscellaneous parts on hand for repairs. Over the last two seasons (2010 and 2011) we have used NAPI exclusively for repairs and installations, then invoiced to either the NNDFW or Program office. It has been expressed that there is a need for a consistent process for repairs/maintenance to solve billing issues that have arisen in the past and which will indicate who will conduct the work.

When the ponds are drained, they will be evaluated for structural stability. Areas away from ponds that may be impacted by dewatering will also be evaluated. Staff will identify and document any structural damage to the ponds and dewatering areas if necessary. Feasibility will determine whether improvements are made or not. Repairs and general maintenance will be done as needed.

Under this Scope of Work, NAPI will be the obligated party under a sub-contract with NNDFW to conduct all maintenance, repair work, and future installations of which NNDFW is unable to do because of limited resources. NAPI will conduct this work as requested by NNDFW personnel and billed to NNDFW. Work will include [as needed] valve repairs/replacement, irrigation line repair/replacement, kettle dredging, graveling where needed, general dirt work (digging out irrigation lines, valves, etc.), and any other repairs/installations which are unforeseeable and can feasibly be done by NAPI personnel.

Products/Schedule

In the spring of 2014, Dexter National Fish Hatchery will deliver 10,500 ≥ 200 mm RBS to the three NAPI grow-out ponds. In the fall of 2014, the NAPI ponds will be de-watered and the RBS, which are targeted to be ≥ 300 mm will be harvested and transported to the San Juan River for stocking. A database summarizing numbers of fish, stocking locations and PIT tag numbers will be submitted to the SJRIP Program Coordinators Office by 31 March 2014. A draft report will be submitted by 31 March 2014 and finalized by 1 June 2014. Maintenance, repairs, installations, and billing records from NAPI will also be included in the annual report.

Budget Fiscal Year 2016

BUDGET WORKSHEET – Program Base Funding		
Razorback Sucker Augmentation at NAPI Grow-Out Ponds		
Personnel (salary/benefits)	**USFWS NMFWCO**	**NNDFW**
Daily Pond Management .30 FTE (GS-9-8) USFWS R2 and Active/passive Harvesting Assistance .5 FTE NNDFW X $42,554.72	$ 31,191	$ 23,249
Wildlife Technician .5 FTE NNDFW X $23,302.76		$ 12,732
Fringe Benefits $32,125 X 42.28%		$ 15,972
Personnel Subtotal	**$ 31,251**	**$ 51,954**
Travel		
Per Diem Lodging and Meals	$ 562	$ 1,092
Vehicle Mileage and Maintenance	$ 2,320	$ 19,669

Travel Subtotal	**$ 2,882**	**$ 20,761**
Office Supplies and Equipment		$ 546
General Operating Supplies (includes fish transport costs, i.e. oxygen, salt, stress coat, etc.)		$ 2,731
Electricity Costs (Aeration)		$ 1,092
Feed Cost ($1.55/lb – 5,000 lbs)		$ 8,469
Uniforms		$ 546
Printing/Binding/Photocopying		$ 109
Fuel – Propane/Cannon Guns		$ 218
Repairs and Maintenance – Paint, sealant, lubricants, plumbing supplies, water quality probes, etc.		$ 546
Support Subtotal	**$ -0-**	**$ 14,260**
NAPI maintenance (Large repairs/installations)		
Irrigation line and valve repair/installation		**$ 5,463**
Heavy equipment operation (graveling, dirt work, etc)		**$ 5,463**
Parts and labor		**$ 5,463**
NAPI maintenance Subtotal		**$ 16, 390**
Total	**$ 34,073**	**$ 103,367**
NNDFW Admin charge (18.05%) $93,625/1.1805 X .1805 = $	$ 1,022	$ 15,805
USFWS/NNDFW Totals	**$ 35,095**	**$ 119,173**
Grand Total		**$ 154,268**

Razorback Sucker Augmentation at NAPI Grow-Out Ponds
Fiscal Year 2016 Project Proposal

Under the heading "Funding for participation of other agencies." Costs for participation of the U.S. Fish and Wildlife Service, New Mexico Fish and Wildlife Conservation Office, Albuquerque, NM in FY-2016.

Daily pond management activities	
.30 FTE (GS-8; $76,003*/year)	$ 25,081.00
Active Harvest	
Fish Biologist (GS-9*) - 5 days @ $324/day	$ 1,620.00
Biological Science Technician (GS-8*) – 5 days @ $358/day	$ 1,790.00
Project Oversight and contract management	
Supervisory Fish Biologist (GS-13) – 5 days @ $540/day	$ 2,700.00
Personnel subtotal	$ 31,191.00
Travel and Per Diem (Based on Published FY-2015 Federal Per Diem Rates)	
Hotel Costs – 4 nights	$ 332.00
(4 nights @ $83/night – single occupancy)	
Per Diem (Hotel Rate) – 5 days @ $46/day	$ 230.00
Travel subtotal with 3% added for inflation	$ 562.00
Equipment	
Vehicle Maintenance & Gasoline 4,000 miles @ $0.58/mile (based on	$ 2,320.00
Equipment subtotal with 3% added for inflation	$ 2,320.00
USFWS – NMFWCO Total	$ 34,073.00
USFWS Region 2 Regional Office Administrative Overhead (3%)	$ 1,022.00
USFWS – Region 2 Total	**$ 35,095.00**

*includes 32% overhead for benefits

SJRIP PIT TAGS
2016 Project Proposal

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BACKGROUND:

PIT tags are used to individually mark fish for use in movement studies and for mark-recapture estimates in the San Juan River Basin. PIT tags are not specific to any particular project, but are used by several different projects. PIT tags and readers purchased for the SJRIP will be combined with the purchase made for the UCRIP to save money by purchasing larger quantities and save expenses associated with administering the contract. All PIT tags and readers will be shipped to USFWS in Grand Junction C/O Travis Francis at:

U.S. Fish and Wildlife Service
Colorado River Fishery Project
764 Horizon Drive, Building B
Grand Junction, Colorado 81506-3946
Phone: 970-245-9319 (19)

TASKS – 2016

1. Purchase PIT tags and readers and distribute to end-users

In FY2016, $60,000 is allocated in the workplan to purchase 25,000 PIT tags and associated equipment (readers, antennas, implanters, etc.). The purchase of this equipment will be done under a new contract to be awarded in FY2016.

FY 2016 BUDGET

Funding source		**Projected expenditure in FY16**
FY2015 Annual funding		$60,000
Total		**$60,000**

Projected funding:
FY-2017 $65,000.00
FY-2018 $70,000.00

FY 2016 Project Proposal
San Juan River Basin Hydrology Model
Operation and Maintenance

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Relationship to SJRIP: Supports Program goals and management by developing, operating and maintaining a hydrology model of the San Juan Basin. The model is key to hydrological analysis of water development scenarios or other scenarios in relation to the flow recommendations.

Background:
The San Juan Basin Hydrology Model (SJBHM) is a hydrologic model of the San Juan River Basin. The SJBHM actually consists of a series of models including evapotranspiration models, a natural flow model in StateMod, and a simulation model in Riverware. Revisions and modifications to the models and supporting data have occurred through a multi-year model development and validation phase. The FY2016 scope of work includes updates to data as available, annual operation and maintenance of the model and data management. FY2016 activities may also include initial steps in the collaborative testing and incorporation of revised flow recommendations as scenarios are developed by the Biology Committee. In addition, at the discretion of the Coordination Committee, scoping the development of a natural flow model may begin. The Bureau of Reclamation has the primary responsibility for model development and O&M.

Once approved, the model will be available to generate and analyze runs associated with Section 7 Consultations and/or special requests from the Biology or Coordination Committees related to the flow recommendations or other hydrological aspects of the Program.

Objective:
The objective for this work is to ensure that the San Juan Basin Hydrology Model is available for run requests. This will be accomplished by developing and incorporating a revised hydrologic baseline as well as potential flow recommendation scenarios. Adjusting model configurations or operating rules to incorporate new data and/or scenarios and evolving the data set forward through time is also necessary. The FY2015 request also includes funds to continue coordination and interaction with the Hydrologic Baseline Workgroup and Program participants and their technical designees.

Deliverables:
An annual hydrology meeting detailing the accomplishments of the model development, data development and model runs will be held for program participants. A report of the meeting will be provided to the coordination

committee. In addition, data, documentation and reports from model runs will be provided throughout the model run process. The modified model(s) and supporting data and scripts will also be delivered / made available.

Task Descriptions:

Task 1: Model Modifications In collaboration with the Biology Committee, begin work testing and implementing revised flow recommendation scenarios. Document all modifications to the model, communicate changes to Program and interested parties.

Task 2: Model Maintenance Includes maintenance of the actual model as well as the supporting data and software. Maintain data to evolve the data set forward through time. This includes an annual update of USGS data, Reclamation data, New Mexico non-irrigation data, New Mexico irrigation data, Arizona and Utah depletions, Colorado depletions, climate data, and natural flow data. Data must be obtained from various sources and processed for compatibility with the multiple data loaders. Load updated data into the model, run and test the new data. Adjust model configuration, methodologies, or assumptions, as needed. Update and expand documentation to reflect current state of model. Update and maintain data management interfaces and other software associated with the data and models. Apply all Riverware updates and patches as they become available. Provide technology transference to Reclamation's Western Colorado Area Office and Fish and Wildlife Service staff in the details of maintaining the data and models. Technology transfer will take place as model, data and software updates take place to ensure that several people are trained in the maintenance of the model.

Task 3: Model Runs and Analyses Generate and analyze model runs associated with the implementation of a revised hydrologic baseline, revised flow recommendation scenarios, Section 7 consultations or special requests from the Biology and/or Coordination Committees and/or special work groups. A consultation or scenario run usually requires model reconfiguration and the implementation of operating criteria. Provide technology transference to Reclamation's Western Colorado Area Office and Fish and Wildlife Service staff in the details of maintaining the data and models, and in operating the models. Technology transfer will occur as model runs and analyses are being executed to ensure that several people are trained in the operation of the model.

Task 4: Program Management and Coordination Attend or provide written reports for Coordination Committee meetings, as needed, to update the committee on the model status and model results. Attend and assist in conducting Hydrologic Baseline Workgroup meetings to provide model status updates, present results, and work on developing the revised hydrologic baseline. Conduct an annual hydrology meeting of Program participants to review and solicit input on accomplishments and activities relating to the model for the previous year, status of the model, and proposed activities for the coming year; and provide a report on the meeting to the Coordination Committee for their review and approval. Develop the FY2017 budget and track FY2016 expenditures.

Budget Summary FY 2016

Model Modifications	$22,150	
Model Maintenance	$10,500	
Model Runs	$22,400	
Program Management	$25,100	
Grand Total	**$78,550**	
FY-2017	**$73,400**	†
FY-2018	**$75,650**	†

FY-2019 **$77,970** †

† Assumes ongoing model maintenance, model runs, tech transfer, documentation and program management and includes ~3% adjustment

Task 1 Model Development

A) Labor

Task	Position	Salary total/hr	Total Days	Total Cost
Model incorporation of new flow recommendations and scenarios	TSC[1] Eng	$80	15	$9,600
	WCAO[2] Eng	$80	10	$6,400

B) Travel

Purpose	Destination	Trips	Days/ Trip	Airfare/ trip	MI&E, Car, Lodging/day	Total Cost
TSC meeting w/WCAO	DUR	1	3	$400	$250	$1,150

C) Other Costs

Task	Total Cost
Riverware technical support	$5,000

Task 2 Model Maintenance

A) Labor

Task	Position	Salary total/hr	Total Days	Total Cost
Annual Data Update	TSC Eng	$80	5	$3,200
	WCAO Eng	$80	5	$3,200
Annual Software Update	TSC Eng	$80	5	$3,200

B) Travel

Purpose	Destination	Trips	Days/ Trip	Airfare/ trip	MI&E, Car, Lodging/day	Total Cost
WCAO meet for Coordination	DEN	1	2	$400	$250	$900

Task 3 Model Runs

A) Labor

Task	Position	Salary total/hr	Total Days	Total Cost
Model Runs and Analyses	TSC Engineer	$80	20	$12,800
	WCAO Engineer	$80	15	$9,600

Task 4 Program Management Coordination

A) Labor

Task	Position	Salary total/hr	Total Days	Total Cost
Meetings and Coordination	WCAO Engineer	$80	25	$16,000
Budget	WCAO Engineer	$80	5	$3,200

B) Travel

Purpose	Destination	Trips	Days/ Trip	Airfare/ trip	MI&E, Car, Lodging/day	Total Cost
TSC to Hydro Wk Grp Mtg	ALB	1	2	$500	$250	$750
WCAO to Hydro Wk Grp Mtg	ALB	1	2	$500	$250	$750
TSC to Annual Hydro Mtg	DUR	1	4	$400	$250	$1,400
WCAO to Annual Hydro Mtg	DUR	1	4	$400	$250	$1,400

[1] Technical Services Center (Denver)

[2] Western Colorado Area Office (Durango)

Improve Stream Gaging and Flow Measurements
San Juan River Basin Recovery Implementation Program
Fiscal Year 2016 Project Proposal

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Background:

There are five United States Geological Survey (USGS) streamflow gaging stations on the main stem of the San Juan River that are very important to management of the river and the operation of Navajo dam to implement the San Juan Recovery Implementation Program (SJRIP) flow recommendations. Stream gaging data on the San Juan River are necessary to reliably implement and revise the SJRIP flow recommendations.

Study Area:

San Juan River Basin in New Mexico

Objective:

Provide funding to the USGS to take additional flow measurements as needed at the four San Juan River gages in New Mexico. The four gages are San Juan near Archuleta, San Juan at Farmington, San Juan at Shiprock, and San Juan at Four Corners. (Note: Base cost for operation of the stations is paid for by non-Program funds.)

Products:

1. Improved flow measurement and more accurate gage readings.

2. Technical presentation at the end of the year from USGS summarizing the activities completed and the value of obtaining additional readings.

Budget FY-2016:

Objective: Provide funding to USGS for 12 additional flow measurements at the four San Juan River Gages in NM.	Staff days	Labor	Travel	Equipment and supplies
Personnel	7.5	6,650		
Travel			1,500	
Equipment and supplies				0
Total				**$8,150**

Estimated Outyear Funding (Based on 4% adjustment for inflation):

Fiscal Year 2016	$8,220
Fiscal Year 2017	$8,550
Fiscal Year 2018	$8,890

Operation of Public Service Company of New Mexico Fish Passage Structure
Scope of Work Fiscal Year 2016

Principal Investigators: Jeffrey Cole, Kim Yazzie
Navajo Nation Department of Fish and Wildlife
Box 1480 Window Rock, AZ 86515
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jcole@nndfw.org kyazzie@nndfw.org

Background

The Power Company of New Mexico (PNM) Diversion Dam was constructed in 1971. The 3.25-foot high diversion dam (weir) is located on the San Juan River about 12 miles downstream of Farmington, New Mexico near the town of Fruitland at River Mile 166.6. Facilities at the diversion include a concrete weir, a series of screened intake structures, an intake channel, a settling channel, and a pump house.

Water flows over the dam into a stilling basin created by a concrete apron. The stilling basin is the width of the river. The presence of the dam and the basin creates a barrier to fish moving upstream. As flows increase, the difference in the upstream and downstream water levels is reduced. Although water levels are reduced, water velocities increase and the weir provides an impediment to upstream fish movement. Recovery studies conducted as part of the SJRRIP have shown that some fish are able to move upstream past the weir but their specific method of movement is not known and the number of fish discouraged from upstream movement by the presence of the weir is also unknown. One possible method of upstream movement could occur during high river flows. When the flow in the San Juan River is above 7,000 cfs, some of the flow goes around the dam making it possible for fish to go around the dam at these higher flows.

A need has been identified by the San Juan River Basin Recovery Implementation Program (SJRRIP) to restore endangered fish passage upstream past the PNM Diversion Dam. The purpose of establishing fish passage was to protect and recover native Colorado pikeminnow (*Ptychocheilus lucius)* and razorback sucker (*Xyrauchen texanus*) populations in the San Juan Basin while water development proceeds in compliance with all applicable Federal and State laws, including fulfillment of Federal trust responsibilities to the Southern Ute Indian Tribe, Ute Mountain Ute Tribe, Jicarilla Apache Nation and the Navajo Nation. In addition, other native fish species would benefit from restored passage. The facility has been operated and maintained by the Navajo Nation Department of Fish and Wildlife (NNDFW) since it was built in 2003. The U.S. Fish and Wildlife Service (Service), Bureau of Reclamation (BOR), Bureau of Indian Affairs (BIA), Navajo Indian Irrigation Project (NIIP), Navajo Agricultural Products Industry (NAPI), and PNM have provided the NNDFW with technical assistance, planning assistance, environmental clearance, maintenance and improvements to the facility and its access points.

The fish passage has facilitated movement of pikeminnow and razorback suckers upstream into a 50 mile stretch of river, which is historical habitat of these species.

Study Area

Public Service Company of New Mexico Diversion Dam is located at RM 166.6.

Methods/Approach

The Fish Passage facility will be operated from March15 to September 15, for each year of the five year proposed budget (2014 – 2018). The fish passage traps fish attempting to move upstream of the facility. All fish that are caught in the trap are transported to a sorting tray. All fish are identified and enumerated. Non-endangered native fish are released upstream of the facility. Rare native fishes are scanned for a pit tag, weighed and measured, marked with a pit tag if they do not have one and then released upstream of the facility. All non-native fishes are removed from the river system permanently. When feasible, channel catfish are transported to area fishing lakes that already have channel catfish in their systems to support the sport-fishing program.

Daily operation and maintenance includes cleaning of surface and submerged trash, debris, silt, and river-born algae from the trash racks and bar screens in the fore-bay of the fish passageway, and aluminum conduit screens in the fish trap. The amount of algae, debris, trash, and sediment that accumulates daily at this site is seasonally variable,

depending upon flow magnitude and water volume during the water year. Maintenance also includes painting as necessary to control corrosion, lubrication of moving equipment, and checking fluid levels in gearboxes and cooling radiators, as necessary. Representatives from the NNDFW, BOR, PNM and the Service will perform an inspection of the facility every 3 years. In the event of a significant flood event, representatives from the NNDFW will notify BOR, PNM and FWS and appropriate parties will inspect the facility for damage, as necessary.

The Fish Passage Program maintains a database of all fish processed through the facility. Staff that operate this facility also have initiated a public outreach and education program that will continue in FY' 2014. School groups visit the facility to learn about the purpose of the facility and the endangered fish program on the San Juan River.

Objectives of this project are as follows:

1. Determine the use of the fish passage by juvenile and adult native and nonnative fishes.
2. Identify any Colorado pikeminnow congregations that may be related to the spawning period in the San Juan River.
3. Maintain the facility in a manner that assures long-term benefit.

This proposal does not include any maintenance or repair work that is major and requires mobilization of heavy equipment and is outside of the constraints of this budget.

Products/Schedule

The Fish Passage facility will be operated from April 1 to October 31, 2014. Data will include definitive numbers of species, numbers per species, and seasonal use and distribution by species.

NNDFW staff will prepare and submit monthly reports and one draft and final annual report. Service staff will assist NNDFW with data analysis and draft and final report preparation, if needed.

NNDFW staff will attend SJRRIP Biology Committee meetings and provide reports as needed throughout the year.

Fiscal Year – 2016 Budget

BUDGET WORKSHEET **Operation of San Juan/PNM Fish Passage**		
Personnel (salary and benefits)	**USFWS Funding**	**NNDFW**
Fisheries Biologist 13 PPE		$23,239
Wildlife Technician 13 PPE		$12,059
Temporary Employment		$11,192
Fringe Benefits $35,298 X 42.96% $11,192 X 9.26%		$15,164 $1,036
Personnel Subtotal		**$62,691**
Travel		
1 Tribal Vehicle		$19,096
Per Diem Lodging and Meals		$3,182
Travel Subtotal		**$22,278**
Office Supplies		$ 935

Office Equipment – LCD Projector and screen		$1,591
General Operating Supplies Plumbing supplies, Hardware Supplies, Neoprene Waders, rubber boots, wet suit, landscaping supplies		$3,741
Nenahnezad Phone		$ 848
Uniforms		$530
Printing/Binding/Photocopying		$106
Fuel – Gasoline for water pump		$753
Sewage Services – Fish Passage		$742
Repairs and Maintenance – Paint, sealant, lubricants, water pump repairs		$1,060
Support Subtotal		**$10,310**
Training and Conference Registration		$1,060
Consultant/ Professional Sub-Total		**$1,060**
	USFWS Funding	**Base Funding**
Budget Subtotal		**$96,342**
FY 2015 Carry over funds		**0**
Total		**$96,342**
Administrative charge (17.0%) $96,342/1.17 X .17=$13,998		**$13,998**
Grand Total		**$110,340**

SJRIP Videography and San Juan and Animas Rivers Temperature Gauges
2016 Project Proposal

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BACKGROUND:

High definition videography is used in the SJRIP to develop maps of the river and evaluate habitat relationships and provide a database that can be used to compare future conditions. Videography is also used for habitat mapping and developing fish-habitat relationships when requested. The videography is done in the late summer during base-flow conditions in an attempt to standardize the information with flows. Often the video is flown in connection with another trip to control costs.

Temperature information is required at several gauges in the San Juan River at the following locations:
09355500 - San Juan River near Archuleta, NM - Real time on web
09365000 - San Juan River at Farmington, NM - Real time on web
09364500 - Animas River at Farmington, NM - Stand alone temperature probe until we can get access to install a wired probe.
09381010 - San Juan River at Four Corners, CO - Real time on web (after we configure our database on Monday).

METHODS:

Aerial Imagery

Aerial imagery is collected along the river by using a helicopter which enables following the river corridor. The helicopter is equipped with a belly camera port which allows interior mounting of 2 cameras. In this case an HD video camera and a high resolution digital camera. The imagery is collected at an altitude that produces 5-6 frames per river mile.

1) Office of Aviation Services (OAS) manages the flights with an executed modification to an existing IA
2) Richard Davis (208-334-9315) at OAS is the person to contact to get the flights scheduled
3) Both video (HD) and still photos (25mp) are shot and the equipment, including the Tyler mount for mounting the photo equipment to the helicopter, is provided by BOR (Bill Goettlicher and Andrew Pernick)
4) A Bell 206 L1 or L3 helicopter is required to do the work.
5) A completed AQD-91 "Order Request Form for Government Flight Services" is required. This form needs to be submitted to AQD91@ibc.doi.gov a minimum of 5 days before the planned start date. The website for the form and instructions: http://oas.doi.gov/apmd/

Mission requirements are:

1) All filming done at approx 1500 ft AGL (a laser altimeter is nice, but not required)
2) Filming speed at approx 40-60 kts
3) River level for flight should be less than 1,000 cfs
4) Day1 - Approx. 10 am - Start filming at the confluence of the San Juan R. and The Animas R. which is in Farmington, NM.

5) Film downstream (west) to approx. Four Corners or Bluff return to base of operations (Farmington/Durango,CO)
6) Day 2 - Approx. 12 noon - Be on river filming from previous stopping point
7) Continue filming downstream(including the Goose-necks) to Lake Powell (add 2 hours ferry time worst case to return once more to base of operations to disassemble equipment).
8. End of mission. (Ferry times may vary depending on logistics of helicopter/ personnel locations; but worst case is given here)
9. The total river mile distance to film is about 225 miles.

A. BOR will provide Tyler mount w/base plate.
B. BOR will provide all camera equipment.
C. BOR will provide staff to operate the equipment and provide route guidance during flight.

MISC.
A helicopter with a 12v DC source that we can connect our inverter to would be preferred. But we should be able to get by on batteries for all our photo equipment.

Animas River Gauge

The USGS has installed and maintains 4 temperature probes in the San Juan basin per our agreement. Probes were installed at:

09355500 - San Juan River near Archuleta, NM - Real time on web
09365000 - San Juan River at Farmington, NM - Real time on web
09364500 - Animas River at Farmington, NM - Stand alone temperature probe until we can get access to install a wired probe.
09381010 - San Juan River at Four Corners, CO - Real time on web (after we configure our database on Monday).
Data will be displayed real time via the USGS NWIS web.

The aerial images are obtained from OAS with the following contact:

Richard Davis
Personal (208) 890-1222
richard_davis@ios.doi.gov
300 E Mallard Dr, Suite 200
Boise, ID 83706-3991
Main Office Phone: 208-433-5076

The probes are maintained by USGS with the following contact:

Jay Cederberg
Albuquerque Field Office Chief
USGS, New Mexico Water Science Center
5338 Montgomery Blvd., NE, Suite 400
Albuquerque, NM 87109
505.830.7924 | fax: 505.830.7986
cederber@usgs.gov
Visit us on the web: http://nm.water.usgs.gov

TASKS – 2016

1. Fly San Juan River with vertically oriented camera and take HD video and high res. digital stills.
2. Periodically provide specific images that are rectified for detailed mapping.
3. Archive video/still frames and provide to researchers as requested.
4. Operate and maintain water temperature probes at four different locations in the San Juan River Basin

FY 2016 BUDGET

Task	**Expenditure in FY2016**
Aerial Flight	$23,000
Temperature probes	$20,000
Total	**$43,000**

Projected funding:
FY-2017 $45,000.00
FY-2018 $46,000.00

Endangered Fish Monitoring and Nonnative Species Monitoring and Control in the Upper/Middle San Juan River

Fiscal Year 2016 Project SOW

Bobby R. Duran
U.S. Fish and Wildlife Service
New Mexico Fish and Wildlife Conservation Office
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Cooperative Agreement #'s:

USFWS – NMFWCO	R13PG40051
USFWS – CRFP	R13PG40052
UDWR – Moab	R13AC40007
NMDGF – Santa Fe	
NNDFW	

Period of Performance: 9/20/2013 to 9/30/2017

Background

The August 1, 2001 Colorado pikeminnow and razorback sucker Recovery Goals identified predation by and/or competition with nonnative fish species as a primary threat to the continued existence or the reestablishment of self-sustaining populations of these endangered fishes. In addition, reducing the impacts of nonnative fishes has been identified as a critical Program Element in the San Juan River Basin Recovery Implementation Program's Long Range Plan (2014). Goals, Actions, and Tasks associated with this Element encompassed within this scope of work include:

Goal 3.1—Control Problematic Nonnative Fishes

> Action 3.1.1 Develop, implement, and evaluate the most effective strategies for reducing problematic nonnative fish.
>
> > Task 3.1.1.1 Mechanically remove nonnative fish to achieve objectives.
> >
> > Task 3.1.1.3 Remove nonnative fish during Program research and monitoring activities.
> >
> > Task 3.1.1.7 Evaluate and implement effective alternative nonnative fish reduction methods.

Secondarily, nonnative fish removal crews collect both spatial and temporal data on rare fish encountered during sampling efforts. These data have been used in assessing progress towards recovery and to evaluate the augmentation programs for both Colorado pikeminnow and razorback sucker. Additional Long Range Plan Actions and Tasks associated with this task include, but are not limited, to the following:

Goal—4.1 Monitor Fish Populations of the San Juan River Basin

> Action 4.1.3 Collect data on the endangered fish and native and nonnative fish communities during other Program management activities, when possible.
>
> > Task 4.1.3.1 Collect data on the endangered fish and native fish community during nonnative fish control activities to aid in tracking the presence, status and trends of endangered fish populations.

Nonnative channel catfish and common carp can threaten native fishes of the Colorado River Basin through direct predation of early life stages (Tyus and Saunders 1996) and through potential competition for resources (Tyus and Saunders 2000; Carey and Wahl 2010). Additionally, channel catfish and common carp were found to be the second and fourth most abundant fish in the San Juan River during fish community studies completed from 1991-1997 (Ryden 2000).
As a result, the removal of nonnative fishes from the San Juan River began on a limited basis in the late 1990's in concert with other management and monitoring activities. Intensified, focused, removal efforts began in the upper reaches of the San Juan River in 2001. Between 2001 and 2003, removal trips focused on a 7.6-mile reach of river from PNM Weir (RM 166.6) to Hogback Diversion (RM 159.0). A total of ten, 3-day passes, were completed in this section in 2001 and 2002. As a result, nonnative fishes occupying this section were subjected to over 181.4 hours of electrofishing (23.8 hours of electrofishing per river mile) in 2001 and 137.9 hours (18.1 hours of electrofishing per river mile) in 2002. This intensified effort corresponded with decreases in the abundance of juvenile and adult channel catfish (Frannsen et al. 2014). In this section, both channel catfish and common carp have remained at lower abundances, even as effort has declined over time.

To accommodate adaptive management and funding constraints, nonnative fish removal efforts have varied both spatially and temporally (Franssen et al. 2014). With shifting priorities and strategies, the nonnative fish community of the entire San Juan River from PNM Weir downstream to Clay Hill Landing, UT has experienced some level of exploitation; however, no other section of river has been subjected to the level of effort that was observed from PNM Weir to Hogback Diversion. For example, in 2008, nonnative fish removal was expanded to the middle section of the San Juan River from Shiprock, NM downstream to Mexican Hat, UT. It was thought that eight passes annually through this 95 RM section would result in declines in riverwide channel catfish abundance. Since 2008, channel catfish abundance has fluctuated, but no noticeable, riverwide declines have been observed (Duran 2014). A partial, and logical, explanation for this could be directly related to relative effort. Since 2010, expansion of the removal zone to 95 RM's has resulted in an average relative effort of 6.7 hours of electrofishing per river mile. This amount of effort is more than three times less than that observed from PNM Weir to Hogback Diversion in 2001, an area where declines in juvenile and adult channel catfish abundance has been documented.

The goal of nonnative fish removal is to increase mortality rates of nonnative fishes to facilitate population-level declines. To facilitate these declines, the ability to increase exploitation and, subsequently, mortality rates, will likely be needed. In order to do so, one of two management strategies could be implemented: 1) double or triple current riverwide effort, or 2) focus time and resources on smaller, more discrete reaches. Although the ability to increase current riverwide effort by 2.5 or 3 may be ideal, funding and logistical constraints would likely make this option difficult. It is estimated that a 2.5 to 3 fold increase in riverwide (e.g. RM 147.9-53) removal effort would cost over $1.2 million per year and would be limited by the availability of equipment and personnel.

Therefore, for FY 2016, we are proposing to focus nonnative removal efforts on one, 50-mile, section of river that can be subjected to multiple electrofishing passes and a much higher level of effort (e.g., hours/river mile electrofished) than what has occurred in the recent past. It is anticipated that this shift in strategy would result in approximately 16.75 hours of electrofishing/river mile; a 2.5 fold increase from the current effort. This increased effort will help managers determine if desired population declines of channel catfish can be realized within current financial and logistical constraints.

Description of Study Area

The proposed study area includes the mainstem San Juan River and all accessible secondary channels from Shiprock, NM (RM 147.9) downstream to Mexican Hat, UT (RM 53). The specific 50-mile section to be sampled in FY 2016 will be determined at a later date. Data from FY 2015 nonnative fish removal projects, small-bodied fish monitoring, and sub-adult and adult fish community monitoring, and other data will be evaluated to determine the area of highest priority. Once determined, the SJRIP's Biology Committee will be notified in writing.

Objectives

1. Focus nonnative fish removal on a 50-mile section of the San Juan River determined to be of highest priority.
2. Evaluate distribution and abundance patterns of nonnative species within the study reach to determine the effects of increased effort.
3. Evaluate distribution and abundance patterns of nonnative species in control (non- removal) reaches.
4. Characterize seasonal and annual immigration of channel catfish into the study reach.

5. Complete a tagging trip, prior to removal, to assess immigration into the study reach.

Methods/Data Analysis

Data from a variety of sources including, but not limited to, past nonnative removal efforts, small-bodied fish monitoring, sub-adult and adult fish community monitoring and other data will be used to determine the area of highest priority for FY 2015 nonnative removal.

One tagging trip will be completed prior to the initiation of intensive nonnative fish removal. Channel catfish (≥200mm) collected from Shiprock Bridge, NM to Mexican Hat, UT will be fitted with a T-bar anchor tag and returned to the river. Any channel catfish <200mm will be removed from the river. Coordination with Utah Department of Wildlife Resources (UDWR) will ensure that all channel catfish ≥200mm collected downstream of Mexican Hat, UT are tagged prior to intensive removal efforts.

Removal of nonnatives throughout the study area will be conducted ten (10) times during the year. Efforts will be made to limit the amount of electrofishing during spawning periods for Colorado pikeminnow. It is proposed that four to five trips will be conducted from April-May. The remaining trips would be completed in July/August after Colorado pikeminnow have completed spawning.

Sampling for nonnative fishes will be conducted by four raft-mounted electrofishing units. Two rafts will begin sampling approximately one hour after the initial two rafts begin, essentially accomplishing two sampling passes per trip or 20 passes/year. Total length (TL; mm) will be recorded from all fish collected at one stop per day. Fish will be enumerated by size class (i.e., young-of-year, sub-juvenile, juvenile, adult) at all other stops. If unique or uncommon species are collected, TL and weight (g) will be collected and any other pertinent information will be recorded.

In addition to nonnative fishes, all rare fishes seen by downstream rafts will be netted. Upstream rafts will not collect rare fishes and will cease electrofishing when these species are observed. Rare fishes will be measured (nearest 1 mm) for TL, weight (nearest 5 g) and checked for the presence of a Passive Implant Transponder (PIT) tag. If no tag is present and fish are ≥ 150 mm TL, a tag will be implanted. Other pertinent information (i.e. sex, reproductive stage, abnormalities) will be recorded.

Numbers of fish removed and catch-per-unit effort (CPUE) will be reported for each trip. To determine trends in distribution and abundance, mean CPUE and standard error will be calculated utilizing data collected during sub-adult and adult fish community monitoring. If CPUE data meet the assumptions of normality and variance, a One-Way Analysis of Variance (ANOVA) will be conducted to determine if significant differences exist. Multiple pairwise comparisons using Bonferroni post hoc tests will be used to determine where specific differences exist. Data that does not meet the assumptions of an ANOVA, or for which transformations are unsuccessful in normalizing the data, will first be analyzed using a non-parametric Kruskal-Wallis rank test. If significant differences are observed, among year comparisons of ranked data will be conducted using a Nemenyi post-hoc test (Sokal and Rohlf 1995). Statistical applications not mentioned here may be utilized if deemed appropriate.

Intensive removal trips in FY 2016:

Ten (10) trips in a yet to be determined 50-mile section of river

Products/Schedule

An electronic data file will be provided for inclusion in the centralized database by 31 March 2017. A draft summary report detailing findings will be submitted to the San Juan River Implementation Program, Biology Committee, by 31 March 2017. Revisions will be completed and a final annual report will be submitted by 1 June 2017.

Literature Cited

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Tyus, H.M. and J.E. Saunders III. 1996. Nonnative fishes in the upper Colorado River basin and a strategic plan for their control. Center for Limnology, Final Report to the U.S. Fish and Wildlife Service (Contract 14-48-0006-95-923), University of Colorado, Boulder.

_____. 2000. Nonnative fish control and endangered fish recovery: lessons from the Colorado River. Fisheries 25:17-24.

Budget: USFWS-NMFWCO

Labor Costs					
Sampling - Removal					
		People Days	**Grade/Step**	**Daily Rate**	
Fish Biologist	10 trips @ 8 days/trip	80	GS 9/5	$312.21	$24,976.80
Bio. Sci. Tech	10 trips @ 7 days/trip	70	GS 8/10	$321.12	$22,478.40
Fish Biologist	4 trips @ 6 days/trip	24	GS 11/5	$377.78	$9,066.72
Supervisory Fish Biologist	4 trips @ 6 days/trip	24	GS 13/5	$538.52	$12,924.48
Bio Sci. Tech (Seasonals)	10 trips @ 8 days/trip x 2 people	160	GS 5/1	$181.88	$29,100.80
					$98,547.20
Sampling - Tagging					
Fish Biologist	1 trip @ 12 days/trip	12	GS 9/5	$312.21	$3,746.52
Bio. Sci. Tech	1 trip @ 12 days/trip	12	GS 8/10	$321.12	$3,853.44
Fish Biologist	1 trip @ 12 days/trip	12	GS 11/5	$377.78	$4,533.36
Bio Sci. Tech (Seasonals)	1 trip @ 12 days/trip x 2 people	24	GS 5/1	$181.88	$4,365.12
					$16,498.44
Administrative and Reporting					
Fish Biologist		45	GS 9/5	$312.21	$14,049.45
Bio Sci. Tech (Seasonals)		35	GS 5/1	$181.88	$6,365.80
Supervisory Fish Biologist		5	GS 13/5	$538.52	$2,692.60
Adminstrative Officer		2	GS 9/7	$339.77	$679.54
					$23,787.39
				Sub Total	**$138,833.03**
Travel and Per Diem					
	Days	**Rate**			
Hotel Costs	45	$83.00			$3,735.00
Per Diem (Hotel Rate)	45	$34.50			$1,552.50
Per Diem (Camping Rate)	215	$29.00			$6,235.00
				Sub Total	**$11,522.50**
Equipment					
	Miles (round trip)/Quantity	**Total Miles**	**Rate**		
Vehicle Fuel					
3 trucks x 8 trips	660	15,840	$0.58		$9,187.20
2 trucks x 3 trips	660	3960	$0.58		$2,296.80
Generator fuel					
60 gallons x 11 trips	660		$2.50		$1,650.00
Maintenance, repair, replace					
(i.e. life jackets, waders					
generator repair, dip nets, etc.)					$3,000.00
Tagging Equipment					
4,000 Floy t-Bar Anchor Tags (FD-94)	3000		$610/1,000		$1,830.00
Six (6) Replacement Needles	6		$10.00		$60.00
				Sub Total	**$18,024.00**
USFWS - NMFWCO					**$168,379.53**
USFWS Region 2 Overhead (3%)					**$5,051.39**
USFWS Region 2 Total					**$173,430.92**
Funding for cooperators					
USFWS -CRFP					$88,874.00
UDWR - Moab					$29,748.00
ASIR, LLC					$47,399.00
NNDFW					$4,539.18
NMDGF-Santa Fe					$12,242.00
				Grand Total	**$356,233.10**

Grand Total $356,233

Endangered Fish Monitoring and Non-native species Monitoring and Control in the *Upper/Middle* San Juan River
Fiscal Year 2016 Project Proposal
31 March 2015

Budget for Participation by U.S. Fish Wildlife Service, Colorado River Fishery Project (USFWS-CRFP)

Developed by:
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Contract or Agreement number(s):
R13PG40052 for USFWS – Grand Junction, CO

Reporting Dates: 10/1/2015 through 9/30/2016

Under the heading "Funding for participation of other agencies." Cost for participation of U.S. Fish and Wildlife Service, Colorado River Project – Grand Junction, CO in FY-2016 nonnative removal activities.

Fiscal Year 2016 Estimated Budget:

Costs for participation of the U.S. Fish Wildlife Service, Colorado River Fishery Project (USFWS-CRFP) office, Grand Junction, CO.

(Based on projected FY-2016 costs)

Note: The FY-16 and outyear costs have been adjusted for the GS-5 Bio Tech line items to reflect new guidance from Office of Personnel Management (OPM) to the USFWS requiring the USFWS to provide health insurance to all federal employees if they work for the federal government longer than 60 days (480 total hours)

Personnel/Labor Costs (Federal Salary + Benefits)	
Principal Biologist (GS-11) – 264 hours @ $49.36/hr (1 person X 11 days/trip X 3 camping trips)	$ 13,031.00
Bio. Tech. Crew Leader (GS-6) – 216 hours @ $32.76/hr (1 person X 11 days/trip X 3 camping trips) (+ 40 hours overtime/per trip X 3 trips = 120 total hours of overtime at $49.14/hr = $5,897.00)	$ 12,973.00
Biological Technicians (GS-5) – 720 hours @ $24.96/hr (2 people X 11 days/trip X 3 camping trips) (2 people X 11 days/trip X 7 camping trips) (+ 40 hours overtime/per trip X 10 trips = 400 total hours of overtime at $37.44/hr = $14,976.00)	$ 32,947.00
Sub Total	$ 58,951.00
Administrative Support (Federal Salary + Benefits)	
Administrative Officer (GS-9) – 80 hours @ $44.72/hr	$ 3,578.00
Project Leader (GS-14) – 80 hours @ $83.42/hr	$ 6,674.00
Sub Total	$ 10,252.00
Travel and Per Diem (Based on Published FY-2014 Federal Per Diem Rates)	
Hotel – 1 night in Cortez, CO @ 4 people/trip X 3 trips (12 nights @ $111/night – single occupancy = $1,332)	$ 1,332.00
Hotel – 1 night in Cortez, CO @ 2 people/trip X 7 trips (14 nights @ $111/night – single occupancy = $1,332)	$ 1,554.00
Per Diem (Hotel Rate) – 1 day in Cortez, CO X 4 people per trip X 3 trips (12 days @ $51/day)	$ 612.00
Per Diem (Hotel Rate) – 1 day in Cortez, CO X 2 people per trip X 7 trips (14 days @ $51/day)	$ 714.00
Per Diem (Camp Rate) – 10 days X 4 people/trip X 3 trips (120 days @ $28/day)	$ 3,360.00
Per Diem (Camp Rate) – 10 days X 2 people/trip X 7 trips (140 days @ $28/day)	$ 3,920.00
Sub Total	$ 11,492.00
Equipment	
Vehicle Maintenance & Gasoline (@ $365/month lease = $12.17 per day based on 30 days in an "average" month + $0.33/mile) 3 trips from Grand Junction, CO to Cortez, CO to Shiprock, NM to Mexican Hat, UT and back to Grand Junction, CO X 2 trucks X 11 days per trip (610 miles/trip X 3 trips X 2 trucks = 3,660 miles X $0.33/mile) = $1,208 (2 trucks X 11 days/trip X 3 trips = 66 days X $12.17/day) = $803	$ 2,011.00

7 trips from Grand Junction, CO to Cortez, CO to Shiprock, NM to Mexican Hat, UT and back to Grand Junction, CO X 1 truck X 11 days per trip — $ 2,345.00
- (610 miles/trip X 7 trips X 1 truck = 4,270 miles X $0.33/mile) = $1,408
- (1 truck X 11 days/trip X 7 trips = 77 days X $12.17/day) = $937

Generator Gasoline
(500 gallons/trip X 2 trips @ $4.00/gallon) — $ 2,000.00
10 days @ 5 gallons/day X 1 raft X 10 trips

Equipment Maintenance, Repair, & Replacement — $ 1,245.00

Exact use of the money in this line item will vary from year to year depending on what equipment needs to be maintained, repaired, or replaced, but use of these funds for a "typical" field season for one study would include the following:

- Annual trailer maintenance & safety inspection = $175
  - Replace/repair trailer suspension, trailer lights, winch handle/straps/gears, trailer jack stand wheel bearings
- Replace trailer tires – 2 per year @ $100 each = $200
- Synthetic oil for generators - 5 quarts at $7 each = $35
- Generator repair/tune-up - 5 hrs @ $75/hr = $375
- Hip boots – 2 pair at $50/pair = $100
- Breathable chest waders - 2 pair @ $125/pair = $250
- Stearns Type III life jackets – 3 @ $70 each = $210
- Electrical Gloves - 3 pairs @ $65/pair = $195
- Repair raft frame
  - Aluminum welding – 3 hours @ $150/hr = $450
- Raft repair kits
  - Raft glue (urethane/hypalon) – Four 4-oz. cans @ $22.50/can = $90
  - NRS raft patch material – 5 feet @ $37/ft = $185
  - Acetone – 1 gallons @ $17.50/gallon = $17.50
  - Toluene – 1 gallon @ $17.50/gallon = $17.50
- Replace any missing NRS HD-brand tie-down straps, each boat needs:
  - Ten 2-ft straps @ $4.20 each = $42
  - Five 3-ft straps @ $4.30 each = $21.50
  - Ten 4-ft straps @ $4.70 each = $47
  - Five 6-ft straps @ $5.05 each = $25.25
  - Five 9-ft straps @ $5.7 each = $28.50
  - Five 12-ft straps @ $6.15 each = $30.75
- Replace any missing D-style carabiners, each boat needs:
  - 10 @ $7.50 each = $75
- Mesh rig bag – 1 @ $50 each = $50
- Rafting oars, oar blades, and oar rowing sleeves
  - Carlisle 10-foot oar shafts – 2 @ $90 each = $180
  - Carlisle Oars blades – 4 @ $65 each = $260
  - Oar sleeves – 4 @ $12 each = $48
- 5-gallon plastic gasoline jerry cans – 5 @ $20 each = $100
- River bags
  - NRS 3.8 heavy-duty Bill's Bag – 1 @ $100 each = $100
  - Clavey (green 7 X 17) dry bag – 3 @ $22 each = $66
  - Clavey (blue 10 X 24) dry bag) – 4 @ $26 each = $104
- 20 lb. propane tanks – 3 @ $20 each = $60

Pesola brand spring scales

20010 Micro-Line 10 gram – 1 @ $50 = $50
20060 Micro-Line 60 gram – 1 $46 = $46
20100 Micro-Line 100 gram – 1 @ $46 = $46
40300 Medio-Line 300 gram – 1 @ $54 = $54
40600 Medio-Line 600 gram – 1 @ $54 = $54
42500 Medio-Line 2,500 gram – 2 @ $56 = $112
41002 Medio-Line 1,000 gram – 3 @ $54 = $108
80005 Macro-Line 5 kg – 1 @ $107 = $107
80010 Macro-Line 10 kg – 1 @ $109 = $109

Other potential uses for these same funds could include replacing hand tools (ratchet and sockets, screw drivers, vise grips, pliers, Allen wrenches, crescent wrenches, hammer, etc.), WD-40, bailing wire, duct tape, electrical supplies (spark plugs, 12 and 14 gage wire for the boats, junction boxes, extra male & female plugs, wire nuts, fuses, Ohm meter, electrical tape), batteries (C, AA and AAA), camp stoves, lanterns, lantern mantles, small "pony" propane bottles for lanterns, Gott 5-gallon water jugs, shovels, 5-gallon buckets, cargo nets, fix chips or cracks in vehicle windshields, bulbs, lenses, and wiring to fix trailer lights and pigtails, new electrofishing spheres, wire rope for replacing electrofishing "witches brooms," Yeti 125-quart coolers, Dura-Frame electrofishing dip nets, 2-man dome tents, NRS Canyon Box for dry storage, Rite-In-The-Rain data sheets, data books, pencils, repair/replace river maps, etc.

Sub Total	$ 5,590.00
USFWS-CRFP (Grand Junction) Total	$ 86,285.00
USFWS Region 6 Regional Office Administrative Overhead (3.00%)	$ 2,589.00
USFWS Region 6 Total	$ 88,874.00

FY 2016 Scope of Work to Bureau of Reclamation:

Participation in Endangered Fish Monitoring and Non-native species Monitoring and Control in the Upper/Middle San Juan River

Fiscal Year 2016 Budget and Estimated Budgets for FY2017-FY2020

Prepared by: Katie Creighton
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BOR Agreement #: R13AC40007

FY 2016 Costs for UDWR- Moab

Participation in Middle San Juan River Non-native Control (2 people X 5 days X 6 trips)

Labor: salary + benefits + applicable overtime (personnel services)

	Rate	Hours	Cost
Project Leader	$33.87	80	$2,710
Biologist	$30.90	250	$7,725
Technician	$16.89	560	$9,458
		subtotal	**$19,893**

Food and Transport (current expense)

	Rate	Quantity	Cost
Fleet Costs (2 trucks for 3% of total fleet costs)	$40,800.00	0.030	$1,224
Food (2 people, 5 days, 6 passes)	$39.00	60	$2,340
Camping reimbursement	$25.00	48	$1,200
		subtotal	**$4,764**

Equipment (current expense)

	Rate	Quantity	Cost

Camping gear repair/replacement:			$450
Sampling gear repair/replacement:			$450
Boating gear repair/replacement:			$450
Fuel for generators	$4.00	90	$360
		subtotal	**$1,710**
Total Expenses			**$26,367**
Administrative Overhead (17% on all personnel services)			**$3,382**
Grand Total FY 2016			**$29,748**

[a] The State of Utah motorpool vehicles cost approximately $6,800/year/vehicle (includes fleet rental, mileage, and gas), which is based on the average annual cost for all trucks used in our program.

[b] Includes, but is not limited to, tents, sleeping pads, toilet system, cookware, stoves, propane, charcoal, satellite phone and service, drybags, coolers, first aid supplies.

[c] Includes, but is not limited to dip nets, tags, tagging equipment, electrofishing units, electrofishing wiring, anodes, cathodes, generators, data loggers, etc…

[d] Includes, but is not limited to, raft repair/replacement, oars, oar hardware, raft frame repair, dry boxes, straps, etc…

[b,c,d] Estimated costs are based on actual costs from previous years plus an estimated 3% cost of living increase each year following.

Under the heading "Funding for participation of other agencies." Cost for participation of American Southwest Ichthyological Researchers, LLC – Albuquerque, NM in FY-2016 nonnative removal activities

2016 BUDGET: SAN JUAN RIVER NON-NATIVE FISH REMOVAL
Based on eight sampling trips per year: Shiprock to Mexican Hat

Personnel

Field Data Collection
Shiprock to Mexican Hat - RM 148.0 - 53.3
Fisheries Biologist I (2 staff x 8 trips x 5 days x 8 hrs/day at $ 47.10/hr):..... $ 30,144
Personnel: ..... Total $ 30,144

Materials and Supplies

Rafts and associated sampling gear supplied by USFWS
Personal camping gear (we will use gear from SJR larval fish project)
Materials and Supplies:..... Total $ 0

Travel and Per Diem

Travel
Travel - (1 vehicle x 8 trips x 625 miles x $ 0.575/mile): .....$ 2,875
(roundtrip Albuquerque to Montezuma Creek, shuttle to Mexican Hat and return) [1]
Travel - (1 vehicle x 8 commercial shuttles x 170/per shuttle): .....$ 1,360

Per Diem
Per Diem - 1 hotel day per trip x 8 trips x 2 staff ($ 95/day):.....$ 1,520
Per Diem - 5 field days per trip x 8 trips x 2 staff ($ 45/day):.....$ 3,600
Travel and Per Diem: ..... Total $ 9,355

2016 Project Totals
Personnel: ..... Total $ 30,144
Materials and Supplies: ..... Total $ 0
Travel and Per Diem:..... Total $ 9,355
Project Subtotal:..... Total $ 39,499
IDC (20%): ..... Total $ 7,900

2016 Scope of Work: ..... GRAND TOTAL $ 47,399

nder the heading "Funding for participation of other agencies." Cost for participation of New Mexico Department of Game and Fish in FY-2016 nonnative removal activities.

Personnel/Labor Costs (State Salary + Benefits)		
Biologists - 20 @ $412/day		
(1 person x 5 days/trips x 4 trips)		$ 8,240.00
		$ 8,240.00
Travel and Per Diem (State Per Diem Rates)		
Per Diem – 16 days @ $85/day		$ 1,360.00
		$ 1,360.00
Equipment		
Vehicle Maintenance & Gasoline (@ $0.55/mile)		
(2,780 miles for 4 trips from Albuquerque to Farmington		
and associated shuttling of vehicles)		$ 1,529.00
		$ 1,529.00
NMDGF – Santa Fe	**Total**	**$ 11,129.00**
Administrative Overhead (10%)		**$ 1,113.00**
NMDGF – Santa Fe – Total Budget		**$ 12,242.00**

Under the heading "Funding for participation of other agencies." Cost for participation of the Navajo Nation Department of Fish and Wildlife in FY-2016 nonnative removal activities.

Personnel/Labor Costs (Salary + Benefits)	
Fish Biologist – 10 days @ $163.54/day	$ 1635.40
(1 person x 5 days x 2 trips)	
Biological Technician – 10 days @ $89.54/day	$ 895.40
(1 person x 5 days x 2 trips)	
Sub-Total	$1530.80
Fringe Benefits X 42.48%	$ 1075.08
Total Personnel/Labor	**$ 2,605.88**
Travel (Vehicle shuttling)	
Vehicle Lease/Maintenance & Gasoline	
$15.13/day X 12 days = $181.56 + 2 X 36miles X .30/mile=$21.60	$ 203.16
(36 miles round trip from Fruitland, NM to	
Shiprock x 6 trips)	
Total Travel/Per Diem	**$ 203.16**
Sub-total with 3% added for inflation	$ 209.25
Equipment	
Equipment Maintenance, Repair, & Replacement	
(e.g., life jackets, hip boots, generator repair, rubber	
gloves, dip nets, aluminum welding, raft repair, etc.)	$ 1,000
Total Equipment	**$ 1,000**
Sub-total with 3% added for inflation	$ 1,030
Navajo Nation Fish and Wildlife Total	**$3,845.13**
Navajo Fish and Wildlife Administrative Overhead (18.05%)	**$ 694.04**
Navajo Nation Total	**$4,539.18**

FY 2016 Scope of Work to Bureau of Reclamation:

Nonnative Species Control and Rare Fish Monitoring in the Lower and Middle San Juan River Fiscal Year 2016 Project Proposal and Estimated Budget for 2016-2020

Principal Investigator: Brian Hines
Prepared by: Katie Creighton and Brian Hines
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BOR Cooperative Agreement #

UDWR Moab Field Station: R13AC40007

Navajo Nation: R11AP40089

New Mexico Department of Game and Fish: 07FG402630

USFWS Grand Junction: R13PG40052

Reporting Dates: 10/1/2015 through 9/30/2016

Nonnative Species Control and Rare Fish Monitoring in the Lower and Middle San Juan River

Fiscal Year 2016 Project Proposal

Principal Investigator: Brian Hines
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Background:

The lower San Juan River is particularly important in the recovery of the Colorado pikeminnow (*Ptychocheilus lucius*) and razorback sucker (*Xyrauchen texanus*) since it contains typical nursery habitat similar to what is present on the Green and Colorado rivers. Within the past eight years, collections of endangered fish have been increasing in this section of river. The largest collection of razorback sucker larvae in 2002 was from Reach 2 (RM 21.2; Brandenburg et al. 2003) and the largest single collection of razorback sucker larvae in 2003 came from a backwater in Reach 1 at RM 8.1 (Brandenburg et al. 2004). Additionally, adult razorback sucker were found congregating around Slickhorn Rapid (RM 17.7) in the spring of 2002, apparently using this area for spawning (Jackson 2003). In spring of 2006, another congregation of adult razorback suckers and possible spawning area was located at river mile 23.4. Collections of adult Colorado pikeminnow in the San Juan River have been extremely rare. No wild adults have been collected since 2000 (Ryden 2003). From 2002 to 2004, Colorado pikeminnow adults and subadults, presumably from the 1996-1997 stocking efforts, have been found using the lower canyon (Reaches 1 and 2) of the San Juan River in the spring and summer (Jackson 2005). From 2003 to 2010, young-of-year Colorado pikeminnow stocked in the fall of the previous year near Farmington, NM, were also found using the lower portions of the San Juan River (Golden et al. 2005, Elverud 2009). Some of the most encouraging findings are the collections of two wild spawned Colorado pikeminnow larvae at RM 46.3 and 18.1 in 2004 (Brandenburg et al. 2005) and two wild spawn age 0 razorback sucker at RM 26.5 (Hines 2014).

Nonnative fish species remain prevalent in the lower San Juan River. Channel catfish (*Ictalurus punctatus*) and common carp (*Cyprinus carpio*) are typically the most abundant fish species collected during fall monitoring in Reaches 1 and 2 (Ryden 2003). Native and endangered fish are threatened by predation from adult channel catfish (Marsh and Brooks 1989, Brooks et al. 2000), and may compete for food and space with juvenile channel catfish. Additionally, Colorado pikeminnow have been found with channel catfish lodged in their throats in the San Juan (Ryden and Smith 2002, Elverud 2009, Hines 2015, personal observation) and Green (McAda 1983, personal observation) rivers. Common carp tend to feed on larval fish and eggs (Cooper 1987). In the spring and summer of 2004, recently stocked razorback sucker and Colorado pikeminnow were found in the stomachs of two different channel catfish (Jackson, 2005).

Since 1995, many nonnative species including striped bass (*Morone saxatilis*) and walleye (*Stizostedion vitreum*) have been able to move into the San Juan River from Lake Powell. From 1988 to 1995, a waterfall at approximately RM 0 acted as a barrier between the San Juan River and Lake Powell, preventing species from moving upstream. During 1995, rising lake levels inundated the waterfall. When lake levels receded in the winter of 1996, the waterfall did not reappear. Striped bass, walleye and threadfin shad (*Dorosoma petenense*), not previously documented in the San Juan River before waterfall inundation, were collected during large bodied fish sampling (Ryden 2001). Since then, striped bass and walleye have been collected periodically until 2000 when large numbers were collected near Farmington, NM (approximately 166 river miles upstream of Lake Powell). Many native suckers were found inside the stomachs of these striped bass

(unpublished data from San Juan River database). The San Juan River Recovery Implementation Program (SJRIP) determined in 2001 that control of striped bass and other nonnative species in the lower river was warranted. Utah Division of Wildlife Resources began nonnative fish control with the goal of removing striped bass and other nonnative species in the lower San Juan River, while documenting river and lake conditions that may correlate to striped bass movement out of Lake Powell. It was anticipated that these correlations would provide information for determining the most effective time to remove striped bass. During 2002, Lake Powell water temperature was positively correlated with the highest catch of striped bass in June, in the lower San Juan River (Jackson, 2003). A new waterfall at RM 0.5 has prevented striped bass and other fish from moving from Lake Powell since 2003. No striped bass or walleye were observed in the lower San Juan River from 2003 to 2009. In 2006, two adult gizzard shad were captured below the waterfall indicating another possible nonnative fish of concern. In 2007, seine sampling below the waterfall collected hundreds of young-of-the-year gizzard shad below the waterfall. Additionally in 2007, 2008 and 2009, adult gizzard shad, striped bass and adult walleye were collected below the waterfall. Colorado pikeminnow and razorback suckers have also been collected during sampling efforts below the waterfall indicating loss of stocked endangered fish over the waterfall and the waterfall acting as a barrier to all fish attempting to move upstream.

Over 114,000 channel catfish and approximately 3,500 common carp were mechanically removed from the lower San Juan River from 2002 to 2013. A decrease in mean total length (TL) of channel catfish was observed between 2002 and 2013, indicating that removal efforts are causing a shift in the population size structure to smaller individuals. Additionally, shifts in sized structure of channel catfish have been reported further upstream (Davis 2005) and on a river-wide scale (Ryden 2005). Catch rate of adult channel catfish also decreased from 4.9 adult catfish per electrofishing hour in 2002 to 2.0 adult catfish per electrofishing hour in 2006 in the lower San Juan. Furthermore, similar shifts in yield and population structure have been observed in sport and commercial fisheries as the rate of exploitation increased (Bennet 1971; McHugh 1984, Pitlo 1997). Continued removal of all size classes of channel catfish in the San Juan River may eventually lead to decreased fecundity and a reduction of the overall population, therefore lessening the impact that these fish have on the native and endangered fish community.

A significant decline in catch rates of common carp was observed from 2002 to 2013. Between 2002 and 2013, catch rate of common carp decreased from over 5 fish per electrofishing hour to < 0.2 fish per electrofishing hour. However, it is unclear if this decline was directly related to removal efforts, the presence of the waterfall, or the low water conditions that have been present over the period of this project. It is probable that a combination of these factors is causative to some extent. The continuation of removal efforts for channel catfish and common carp will aid in the illumination of contributory factors and the evaluation of the success of this project and similar nonnative control efforts.

Over the course of this project, important monitoring information has been obtained on the progress of the endangered fish community as well. We have observed the apparent spawning aggregation of razorback sucker in spring 2002 at Slickhorn Rapid and collected some of the first wild spawned juvenile razorback sucker in 2003, 2004, 2013, and 2014. Since 2002, we have documented the distribution and abundance of Colorado pikeminnow and razorback sucker in the lower San Juan River stocked from 2002 to 2014. Preliminary population estimates for juvenile Colorado pikeminnow residing in the lower San Juan River were generated from 2004 to 2014 from recapture data. In 2004, we documented the first cases of channel catfish predation on stocked juvenile razorback sucker and Colorado pikeminnow in the San Juan River.

The presence of the waterfall at Piute Farms may provide a rare opportunity to concentrate on removal of other nonnative fish while influx from the lake is eliminated. Continuing monitoring and removal in the lower river above the waterfall will aid in removal efforts being conducted further upstream, and suppress predation and competition impacts on the endangered and native fish community by nonnative fish in the lower San Juan River. In addition, we propose to continue to monitor and document the progress of

Colorado pikeminnow and razorback sucker in the lower San Juan River. Recapture data for juvenile Colorado pikeminnow collected during nonnative monitoring will serve in determining population size, growth and movement of these fish in the lower San Juan River.

This work plan proposes the continuation of nonnative control and monitoring of endangered fishes in the San Juan River in accordance with the Long Range Plan (Element 3, Task 3.1.1.1; Element 4, Task 4.1.3.1). This study will serve to determine the most effective time and sections for removal actions. Beginning in 2014, some effort was shifted from the lower canyon to the section between Montezuma Creek and Sand Island. This upstream effort is included in this budget under Task 2 and will be reported on under Scope of Work #17: Upper/Middle River Nonnative Species Control and Rare Fish Monitoring.

Description of Study Area:

The study area for this project includes the San Juan River from Four Corners Bridge (RM 119.2) to Clay Hills (RM 2.9), Utah. The river from Four Corners Bridge to RM 106 is part of Geomorphic Reach 4. Geomorphic Reach 3 stretches from RM 105 to RM 68. Geomorphic Reach 2 goes from RM 68 to RM 16 and is primarily bedrock confined and dominated by riffle-type habitat. River mile 16 down to Clay Hills contains Geomorphic Reach 1 where the river is canyon bound with an active alluvial bed. Habitats within this section are heavily influenced by the shifting thalweg, changing river flow, and reservoir elevations. This section of river has been identified as important nursery habitat for native and endangered fish species.

Task Description:

Task 1. Nonnative species control and rare fish monitoring in the lower San Juan River from Mexican Hat (RM 53) to Clay Hills (2.9) (four passes).

Task 2. Nonnative species control and rare fish monitoring in the middle San Juan River from Four Corners Bridge (RM 119.2) to Mexican Hat (RM 53) (five passes). Exact reach (approximately 50 miles) has yet to be determined and will be guided by the previous year's findings and coordination with other crews' effort.

Objectives:

1. Mechanically remove and monitor large-bodied nonnative species in the middle and lower San Juan River (Tasks 1 and 2).

2. Generate a population estimate of channel catfish by mark-recapture data from Mexican Hat to Clay Hills (Task 1).

3. Monitor distribution and abundance of endangered fish in the middle and lower San Juan River (Tasks 1 and 2).

4. Generate a population estimate of juvenile Colorado pikeminnow (>150 mm) by mark-recapture data from Mexican Hat to Clay Hills (Task 1).

Methods/Approach:

Sampling effort will be conducted via two raft mounted electrofishing boats. The study area will be electrofished in a downstream fashion with one boat on each shoreline. Each boat will have one netter and one rower. Nine five-day passes with 6 people are anticipated. Timing and location of sampling will be dependent on catch rate from past data. Spring effort (March-April) will focus on the lower reach (Task 1)

while summer effort (July-August) will focus on the middle reach (Task 2). In an average water year, this schedule would allow for sampling a variety of habitat conditions, including variable flows, temperatures, and turbidity. In drought years, when downstream movement is hindered by low flows, electrofishing effort may be concentrated on areas with higher catch rates or trips will be increased to six days while reducing the number of trips to eight.

All nonnative fish collected will be identified, enumerated, measured to the nearest mm for total length, weighed to the nearest gram, and removed from the river. Gender and reproductive status of lacustrine species will be determined and approximate location of capture by river mile recorded. Stomach contents of lacustrine species will be examined. Contents needing microscopic identification will be preserved. Any threatened and/or endangered fish encountered will be collected, identified, enumerated, measured to the nearest mm for total and standard length, weighed to the nearest gram, and scanned for a PIT tag. If a PIT tag is not present, one will be inserted. General condition of the fish will be recorded in addition to any parasites or abnormalities. All threatened and endangered fish collected will be returned to the river at the location in which they were caught. River mile and GPS coordinates will be recorded at the location in which threatened and endangered fish are collected. Catch rates for all fish will be calculated as number of fish caught per hour. Other native fish will not be netted.

Channel catfish collected during the first trip of the year will receive a floy tag and be returned to the river. Channel catfish collected on subsequent trips will be removed from the river. A Lincoln-Peterson population estimate will be generated for channel catfish captured during the first pass and recaptured in the second pass. Captures of channel catfish during subsequent trips will allow us to monitor ratios of marked to unmarked fish and use these ratios to calculate a rough population estimate thereafter. Ratios of marked fish to unmarked fish will help determine if assumptions of a closed population are being met.

Population estimates will be generated for juvenile Colorado pikeminnow (>150 mm) in the lower San Juan River using closed population models within program CAPTURE. Program CAPTURE will be used to determine confidence intervals around the estimate, the coefficient of variation, and the probability of capture. Population estimates between two passes will be calculated using the Lincoln-Peterson model. Conducting several trips in the lower San Juan River will allow for choosing the “mark” pass and the number of “recapture” passes. Use of different mark and recapture passes will allow for testing of the reality of the results generated. Furthermore, using several combinations of trips will allow for lessening the likelihood of violating assumptions of the models used.

General water quality parameters will be recorded including temperature, conductivity, and secchi depth. Daily river discharge, temperature and turbidity will be compared to catch rates for striped bass to determine the relationship between river conditions and movement of these fish upstream.

Costs for other cooperating agencies that may provide personnel and equipment as needed are included in this budget.

Products/Schedule:

Task 1. A draft report for the Nonnative Species Control and Rare Fish Monitoring in the Lower San Juan River activities will be prepared and distributed to the San Juan River Biology Committee for review by 31 March 2016 for 2015 field work completed. Historical information on nonnative fish species use of the lower San Juan River will be included; to the extent it is available. Upon receipt of written comments, that report will be finalized and forwarded to members of the San Juan River Biology Committee 1 June 2016. Electronic copies of the field and collection data will be transferred to the San Juan River database manager following the successful protocol previously employed.

Task 2. All activities associated with Nonnative Species Control and Rare Fish Monitoring in the Middle San Juan River will be reported on under Scope of Work #17: Upper/Middle River Nonnative Species Control and Rare Fish Monitoring.

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Nonnative Species Control and Rare Fish Monitoring in the Lower and Middle San Juan River

Estimated Budget for 2016-2020
BOR Cooperative Agreement #R13AC40007

Principal Investigator: Brian Hines
Prepared by: Katie Creighton and Brian Hines
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FY 2016 Costs for UDWR- Moab

Task 1. Lower San Juan River Nonnative Removal and Monitoring

Personnel Costs (salary + fringe costs)

	Rate	Hours	Cost
Project Leader	$33.71	125	$4,214
Biologist	$30.76	700	$21,531
Technician	$16.77	1400	$23,478
		subtotal	**$49,223**

Food and Travel

	Rate	Quantity	Cost
Fleet Costs[a] (3 trucks for 15% of total fleet costs)	$40,800.00	0.15	$6,120
Food (6 people, 5 days, 4 passes)	$30.00	120	$3,600
Shuttle (3 trucks, 4 passes)	$180.00	12	$2,160
Out-of-state per diem (Biologist and Project Leader)	$47.00	6	$282
Hotel- Durango (Biologist and Project Leader)	$95.00	4	$380
		subtotal	**$12,542**

Equipment

	Rate	Quantity	Cost
Camping gear repair/replacement[b]:			$1,936
Sampling gear repair/replacement[c]:			$2,316
Boating gear repair/replacement[d]:			$2,200
Fuel for generators (20 gallons/pass)	$4.00	80	$320
		subtotal	**$6,772**

Other

	Rate	Quantity	Cost
Swiftwater Rescue Training	$350.00	2	$700
		subtotal	**$700**

Task 1. Subtotal **$69,237**

Task 2. Middle San Juan River Nonnative Removal and Monitoring

Personnel Costs (salary + fringe costs)

	Rate	Hours	Cost
Project Leader	$33.71	125	$4,214
Biologist	$30.76	700	$21,531
Technician	$16.77	1400	$23,478
		subtotal	**$49,223**

Food and Travel

	Rate	Quantity	Cost
Fleet Costs[a] (3 trucks for 15% of total fleet costs)	$40,800.00	0.10	$4,080
Food (6 people, 5 days, 5 passes)	$30.00	150	$4,500
Shuttle (3 trucks, 5 passes)	$100.00	15	$1,500
Out-of-state per diem (Biologist and Project Leader)	$47.00	6	$282
Hotel- Durango (Biologist and Project Leader)	$95.00	4	$380
		subtotal	**$10,742**

Equipment

	Rate	Quantity	Cost
Camping gear repair/replacement[b]:			$1,799
Sampling gear repair/replacement[c]:			$2,514
Boating gear repair/replacement[d]:			$2,200
Fuel for generators (20 gallons/pass)	$4.00	100	$400
		subtotal	**$6,913**

Task 2. Subtotal	**$66,878**
Total Expenses	$136,115
Administrative Overhead (17% on all personnel services)	$16,736
UDWR-Moab Total	**$152,851**

Funding for Participating Agencies:

USFWS GJ Total	**$18,973**
NMFG Total	**$6,864**
Navajo Nation Total	**$9,398**

Grand Total FY 2016	**$188,085**

[a] The State of Utah motorpool vehicles cost approximately $6,800/year/vehicle (includes fleet rental, mileage, and gas), which is based on the average annual cost for all trucks used in our program.

[b] Includes, but is not limited to, tents, sleeping pads, toilet system, cookware, stoves, propane, charcoal, satellite phone and service, drybags, coolers, first aid supplies.

[c] Includes, but is not limited to dip nets, tags, tagging equipment, electrofishing wiring, anodes, cathodes, generator repair, data loggers, etc…

[d] Includes, but is not limited to, raft repair/replacement, oars, oar hardware, raft frame repair, dry boxes, straps, etc…

[b,c,d] Estimated costs are based on actual costs from previous years plus an estimated 3% cost of living increase each year following.

Under the heading "Funding for Participating Agencies." Estimated costs for participation of the Navajo Nation Department of Fish and Wildlife, in FY-2016-2020. BOR Cooperative Agreement Number with Navajo Nation: R11AP40089

FY 2016 Costs for Navajo Nation			
Personnel/Labor Costs (Salary+Benefits)	Rate	Quantity	
Fish Biologist	$158.78	14	$2,223
Bio Tech	$86.93	14	$1,217
Fringe Benfits (Labor Costs* 42.48%)	$43.75		$1,461
Subtotal			$4,901
Travel and Per Diem			
Hotel- (4 nights)	$72.10	4	$288
Camping Rate-(20 nights)	$29.87	20	$597
Vehicle Lease/Maintenance	$467.62	1	$468
Gasoline-(260 miles)	$0.62	260	$161
Subtotal			$1,515
Equipment			
Maintenance, Repair, Replacement	$1,545.00	1	$1,545
Subtotal			$1,545
Total Expenses			$7,961
Navajo Nation Administration Fees (18.05%)			$1,437
Navajo Nation FY16 Total			**$9,398**

Under the heading "Funding for Participating Agencies." Costs for participation of the New Mexico Game and Fish in FY 2016-2020. BOR Cooperative Agreement Number with New Mexico Department of Fish and Game: 07FG402630

FY 2016 Costs for New Mexico Game and Fish			
Personnel/Labor Costs (Salary+Benefits)	Rate	Quantity	
Fish Biologist	$412.00	12	$4,944
Subtotal			$4,944
Travel and Per Diem			
Per Diem	$115.00	10	$1,150
Gasoline-(260 miles)	$0.55	1400	$770
Subtotal			$1,920
New Mexico Game and Fish FY16 Total			**$6,864**

Under the heading "Funding for Participating Agencies." Costs for participation of the U.S. Fish and Wildlife Service Colorado River Fishery Project (USFWS-CRFP) in FY 2016-2020. BOR Cooperative Agreement Number with USFWS-CRFP: R13PG40052

Participation in Non-native Species Control in the *Lower& Middle* San Juan River Fiscal Year 2016 Project Proposal 31 March 2015

Budget for Participation by U.S. Fish Wildlife Service, Colorado River Fishery Project (USFWS-CRFP)

Developed by:
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Contract or Agreement number(s):
R13PG40052 for USFWS – Grand Junction, CO

Reporting Dates: 10/1/2015 through 9/30/2016

U.S. Fish Wildlife Service, Colorado River Fishery Project (USFWS-CRFP)
Budget for Participation in
Non-native Species Control in the *Lower* San Juan River
Fiscal Year 2016 Project Proposal
Updated: 31 March 2015 (by Ben Schleicher and Dale Ryden)

Principal Investigator(s):
Brian Hines and Katherine Creighton
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Fiscal Year 2016 Estimated Budget:

Costs for participation of the U.S. Fish Wildlife Service, Colorado River Fishery Project (USFWS-CRFP) office, Grand Junction, CO.
(Based on projected FY-2016 costs)
Note: The FY-16 and outyear costs have been adjusted for the GS-5 Bio Tech line items to reflect new guidance from Office of Personnel Management (OPM) to the USFWS requiring the USFWS to provide health insurance to all federal employees if they work for the federal government longer than 60 days (480 total hours)

Personnel/Labor Costs (Federal Salary + Benefits)	
Principal Biologist (GS-11) – 80 hours @ $49.36/hr	$ 3,949.00
(1 person X 5 days/trip X 2 trips)	
Principal Biologist (GS-7) - 80 hours @ $33.70/hr	$ 4,213.00
(1 people X 5 days/trip X 2 trips)	
(+ 30 hours overtime at $50.55/hr = $1,517)	
Biological Technician (GS-5) – 80 hours @ $24.96/hr	$ 3,120.00
(1 people X 5 days/trip X 2 trips)	
(+ 30 hours overtime each at $37.44/hr = $1,123)	
Sub Total	$ 11,282.00
Administrative Support (Federal Salary + Benefits)	
Administrative Officer (GS-9) – 23 hours @ $44.72/hr	$ 1,029.00
Project Leader (GS-14) -- 15 hours @ $83.42/hr	$ 1,251.00
Sub Total	$ 2,280.00
Travel and Per Diem (Based on Published FY-2015 Federal Per Diem Rates)	
Hotel Costs	
2 nights X 3 people X $83/night (standard hotel rate)	$ 498.00
Per Diem (Hotel Rate)	
2 days X 3 people X $46/day (standard hotel rate)	$ 276.00
Per Diem (Camping Rate)	
10 days X 3 people X $28/day	$ 840.00
Sub Total	$ 1,614.00
Equipment	
Vehicle Maintenance & Gasoline (GSA lease @ $365 = $12.17	
per day based on 30 days in an "average" month + $0.33/mile)	
2 trips from Grand Junction, CO to Clay Hills boat take-out	$ 584.00
in Utah X 1 truck X 5 days per trip (camping)	
(350 miles 1-way = 700 miles round trip X	
2 trips) = $462	
(1 truck X 5 days/trip X 2 trips X	

$12.17/day) = $122	
Generator Gasoline for Electrofishing	
(20 gallons/trip X 2 trips @ $4.00/gallon)	$ 160.00
Equipment Maintenance, Repair, & Replacement	$ 2,500.00

Exact use of the money in this line item will vary from year to year depending on what equipment needs to be maintained, repaired, or replaced, but probable uses for this incurred cost include the following:

- Annual trailer maintenance & safety inspection = $175
  - Replace/repair trailer suspension, trailer lights, winch handle/straps/gears, trailer jack stand, wheel bearings
- Replace trailer tires – 2 per year @ $100 each = $200
- Spark plugs for generators - 5 @ $7.50 each = $37.50
- Synthetic oil for generators - 5 quarts at $7.50 each = $37.50
- Generator repair/tune-up - 3 hrs @ $75/hr = $225
- Hip boots – 3 pair at $50/pair = $150
- Breathable chest waders - 4 pair @ $125/pair = $500
- Dura-Frame electrofishing dip nets – 3 @ $300 each = $900
- Stearns Type II life jackets – 3 @ $70 each = $210
- Electrical Gloves - 3 pairs @ $65/pair = $195
- Repair raft frame
  - Aluminum welding – 3 hours @ $150/hr = $450
- Restock raft repair kits
  - Raft glue (urethane/hypalon) – Two 4-oz. cans @ $22.50/can = $55
- NRS raft patch material – 5 feet @ $37/ft = $185
- Acetone – 1 gallon @ $17/gallon = $17
- Replace any missing NRS HD-brand tie-down straps, each boat needs:
  - Ten 2-ft straps @ $4.20 each = $42
  - Five 3-ft straps @ $4.30 each = $21.50
  - Ten 4-ft straps @ $4.70 each = $47
  - Five 6-ft straps @ $5.05 each = $25.25
  - Five 9-ft straps @ $5.7 each = $28.50
  - Five 12-ft straps @ $6.15 each = $30.75
- Replace any missing D-style carabiners, each boat needs:
  - 10 @ $7.50 each = $75

Sub Total	$ 3,244.00
USFWS-CRFP (Grand Junction, CO) Total	$ 18,420.00
USFWS Region 6 Administrative Overhead (3.00%)	$ 553.00
USFWS Region 6 Total	$ 18,973.00

Sub-Adult and Adult Large-Bodied Fish Community Monitoring Fiscal Year 2016 Project Proposal 31 March 2015

Principal Investigator:
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Contract or Agreement number(s):
R13PG40052 for USFWS – Grand Junction, CO
R13PG40051 for USFWS – Albuquerque, NM
R13AC40007 for UDWR – Moab, UT

Reporting Dates: 10/1/2015 through 9/30/2016

Sub-Adult & Adult Large-Bodied Fish Community Monitoring
(a.k.a. Adult Monitoring)
Fiscal Year 2016 Project Proposal
31 March 2015

Principal Investigator:
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Background:

Studies performed before 1991 documented a native San Juan River fish fauna of eight species, including Colorado Pikeminnow (previously known as Colorado Squawfish), Razorback Sucker, and Roundtail Chub and provided baseline information on distribution and abundance of native and introduced fish species in the San Juan River. These studies indicated that at least one of the two endangered fish species (i.e., Colorado Pikeminnow) was still a viable member of the San Juan River fish community.

Between 1991 and 1998, the Main Channel Fish Community Monitoring study (called "Adult Monitoring" for short), greatly refined our understanding of the San Juan River fish community. The main sampling technique employed during the 1991-1998 Adult Monitoring study was raft-borne electrofishing, although radio telemetry was also heavily employed. Data collected during the 1991-1998 Adult Monitoring study provided information on specific habitat usage by rare fish species. In addition, data gathered during the 1991-1998 Adult Monitoring study aided in the selection of specific sites for detailed hydrologic measurements and larval drift sampling. Integration of 1991-1998 Adult Monitoring data along with data from Colorado Pikeminnow macrohabitat studies, Razorback Sucker experimental stocking studies, tributary and secondary channel studies, fish health studies, contaminants studies, habitat mapping studies, and non-native species interaction studies, helped provide a logical framework upon which to make flow recommendations for the reoperation of Navajo Reservoir that would benefit the San Juan River's endangered fishes (as well as other members of the native fish community).

The Sub-Adult & Adult Large-Bodied Fish Community Monitoring study (also referred to as Adult Monitoring), which began in 1999, is a direct offshoot of the 1991-1998 Adult Monitoring study. This study is one of a suite of long-term monitoring efforts detailed in the San Juan River Basin Recovery Implementation Program's (SJRBRIP) Monitoring Plan and Protocols (SJRBRIP 2012) that are designed to help evaluate progress of the two endangered fish species towards recovery under the SJRBRIP's Long Range Plan (SJRBRIP 2014). The current Adult Monitoring study incorporates essentially the same monitoring protocols as did its 1991-1998 precursor study (e.g., sampling via raft-borne electrofishing). This allows for data collected during the current Adult Monitoring study to be validly combined with and compared to the older 1991-1998 Adult Monitoring data. The combination of these two data sets provides statistically-powerful, long-term trend data through which the SJRBRIP's Biology Committee can view changes in the San Juan River's large-bodied fish community over time. This long-term trend data allows the SJRBRIP Biology Committee to evaluate whether various management actions being implemented are having the desired effects on the San Juan River fish community. In addition, Adult Monitoring has proven to be an effective tool for monitoring populations of both stocked Razorback Sucker and Colorado Pikeminnow.

Relationship to the Recovery Program:

Adult Monitoring provides data for or makes possible (at least in part) the following Tasks under element numbers 1-

5 of the Long Range Plan (SJRBRIP 2014): 1.1.1.1, 1.1.1.2, 1.2.1.1, 1.2.1.2, 1.2.2.1, 2.6.1.1, 2.6.1.2, 2.6.1.3, 3.1.1.1, 3.1.1.3, 3.1.1.4, 3.1.1.5, 3.1.1.7, 4.1.1.1, 4.1.1.2, 4.1.1.3, 4.1.2.3, 4.1.2.4, 4.1.2.5, 4.1.3.1, 4.1.4.2, 4.1.5.1, 4.1.6.1, 4.1.6.2, 4.1.6.3, 4.1.7.1 4.3.1.1, 4.4.1.1, 4.4.2.1, 4.4.2.2, 4.4.2.3, 4.4.4.1, 4.4.4.2, 4.4.4.3, 5.2.1.1, 5.2.1.2, 5.2.2.2, 5.2.2.3, 5.2.2.4, and 5.2.2.5. The monitoring protocols discussed in the Methods section of this report reflect those that are currently included in the latest version of the revised SJRBRIP Monitoring Plan and Protocols (SJRBRIP 2012).

Description of Study Area:

As per the latest version of the SJRBRIP Monitoring Plan and Protocols (SJRBRIP 2012) the study area for Adult Monitoring extends from river mile (RM) 180.0 (just downstream of the Animas River confluence in Farmington, NM), downstream to RM 77.0 (just upstream of the Sand Island boat launch near Bluff, UT). The river section from RM 77.0 downstream to RM 2.9 (Clay Hills boat launch, just upstream of Lake Powell in UT) is scheduled to be sampled every fifth year. The last such sampling occurring in 2015, so that section of river should be sampled again in 2020.

In addition to sampling from the Animas River confluence to Sand Island boat launch, two additional river sections in NM will be sampled (5 total days of sampling). These two river sections would include: 1) the San Juan River from the Bloomfield Riverside Landing (RM 196.0) downstream to McGee Park Landing (RM 188.7) – three days of sampling; and, 2) McGee Park Landing downstream to the Animas River confluence – two days of sampling. Because extremely low water levels in the Animas River preclude sampling this river section in the fall, Animas River sampling will be done in the spring (March/April) of each year.

Objectives:

1) Annually, during autumn, document fish community structure, species abundance (presented as catch/time, CPUE) and distribution, and size structure among populations of both native and nonnative large-bodied fishes in San Juan River. Specific emphasis shall be placed upon monitoring the population parameters among the rare San Juan River fish species -- Colorado Pikeminnow, Razorback Sucker, and Roundtail Chub (both wild and stocked fish).

2) Obtain data that will aid in the evaluation of the responses (e.g., year-to-year survival, reproduction, recruitment, growth, and condition factor) of both native and nonnative large-bodied fishes to management actions.

3) Continue to perform activities that support other studies and recovery actions being implemented by the SJRBRIP. These may include the following:
    a. Remove nonnative fish species which prey upon and may compete with native fish species in the San Juan River.
    b. Collect GPS waypoints in habitats where endangered Colorado Pikeminnow and Razorback Sucker are collected.
    c. Collect tissue samples from various fish species for stable isotope, genetics, and contaminants studies.

Through the handling of large numbers of fish for other study objectives and because of its long-term dataset, Adult Monitoring provides chances to opportunistically observe and monitor other information on the San Juan River's large-bodied fish community. This includes, but is not limited to: 1) the incidence of disease and abnormalities among fish populations; 2) the distribution and abundance of nonnative white sucker and the rate of hybridization between this species and native sucker species; 3) hybridization rates among native sucker species, specifically the endangered Razorback Sucker and Flannelmouth Sucker; 4) negative interactions between Channel Catfish and native fish species, specifically endangered Colorado Pikeminnow and Razorback Sucker; and, 5) documenting episodic events, such as the invasion of the San Juan River by fish species from Lake Powell or collecting rare, but

potentially important fish species, such as Grass Carp.

Methods:

Objectives 1-3: Two Adult Monitoring trips will take place in the fall of 2016. The first will sample the lower Animas River from McGee Park Landing downstream to the Animas-San Juan River confluence. These two days of sampling will occur sometime between late March and late April. The second sampling trip will sample from RM 196.0 (Bloomfield Riverside Landing) downstream to RM 77.0 (Sand Island boat landing). Sampling will begin in the first to second week of September and will be concluded by end of September. Raft-borne electrofishing will be the primary sampling technique for both sampling efforts.

Electrofishing will follow the methods set forth above and in the SJRBRIP Monitoring Plan and Protocols (SJRBRIP 2012). Two oar-powered rafts, with one netter each, will electrofish in a continuous downstream fashion, with one raft on each shoreline. Depending upon water levels in the lower Animas River in the spring, only one electrofishing raft may be used in the lower Animas River (instead of two) at the Principal Investigator's discretion. Netters will net all stunned fish that can possibly be collected, regardless of species or body size. Trailing or "chase" rafts will not be used to collect fish. No outboard motors will be used. Sampling crews will consist of approximately 2-4 people for spring sampling (2 per electrofishing raft) and 8-10 people for fall sampling (4 for electrofishing, 2-3 for baggage rafts, and 2-3 for other research elements that are being done simultaneously with our sampling). Electrofishing will sample two out of every three miles (approximately 130 total sampled river miles each fall). All fish collected will be enumerated by species and life stage at the end of every sampled mile. Every fourth sampled mile (known as a "designated mile" or DM), all fish collected will be weighed and measured. All native fish collected will be returned alive to the river. All nonnative fish collected will be removed from the river. All nonnative predatory fishes (e.g. - Walleye, Striped Bass, Largemouth Bass, Smallmouth Bass) collected will be weighed and measured, and may have stomach samples taken, before being removed from the river. Tag numbers, total length, and weight will be recorded on all recaptured, FLOY-tagged fish (both native and nonnative), as well as any rare fish collected. Colorado Pikeminnow, Razorback Sucker, and Roundtail Chub greater than 150 mm TL will be implanted with 134 kHz PIT (Passive Integrated Transponder) tags. Notes will be kept on any parasites and/or abnormalities observed on collected fishes.

The U.S. Fish and Wildlife Service (USFWS) will assume the lead responsibility for Adult Monitoring trips and other cooperating agencies will provide personnel and equipment as needed. Costs for cooperating agencies are included in this budget.

Products:

An interim progress report for Adult Monitoring data collected during 2016 is scheduled to be available by 31 March 2017. The final version of this interim progress report which incorporates comments received is scheduled to be completed by 1 June 2016. Data files containing PIT tag information on the federally-listed endangered fish species (Colorado Pikeminnow and Razorback Sucker) collected during this Adult Monitoring trip will be submitted for inclusion in the SJRBRIP's integrated database by 31 December 2016. Data files containing the remainder of the information (e.g., data on common fish species) collected during this Adult Monitoring trip will be submitted for inclusion in the SJRBRIP's integrated database by 31 March 2017.

Qualifications of Personnel Included in the Budget:

Principal Biologist (GS-11) – Benjamin Schleicher, USFWS-CRFP
Ben has six years with the USFWS-CRFP performing fisheries research and management in the Colorado and San Juan River basins, leading crews on daily and multi-day trips dealing with endangered species population estimates, nonnative fish removal, and riverwide fish community monitoring. He also spent two years with the UDWR-Moab performing the same tasks in the Colorado, Green, and San Juan River basins. In summer 2012, Ben took over as principal fish biologist for Region 6 of the USFWS in charge of performing fisheries research and management

associated with the San Juan River Recovery Implementation Program (SJRBRIP). Specific to the San Juan River Basin recovery Implementation Program, Ben has been involved in a number of areas including: 1) long-term augmentation and monitoring of the San Juan River's two endangered fish populations; 2) performing and analyzing the effects of nonnative fish removal operations; and, 3) performing Razorback Sucker surveys in Lake Powell. Ben co-authored the 2012 Sub-Adult and Adult Large-Bodied Fish Community Monitoring Adult Monitoring report and was sole author of this report in 2013. Ben also was a co-author of the 2011 and 2012 San Juan River arm of Lake Powel Razorback Sucker Survey reports. Ben took over as the USFWS's Region 6 representative on the SJRBRIP Biology Committee in May 2013.

Principal Biologist (GS-14) -- Dale Ryden, USFWS-CRFP
Dale has 25 years of experience performing fisheries research and management in the Colorado, Gunnison and San Juan rivers. For over 22 years, Dale was the principal fish biologist for Region 6 of the USFWS in charge of performing fisheries research and management associated with the San Juan River Recovery Implementation Program (SJRBRIP). During his involvement with the SJRBRIP, Dale's responsibilities have ranged across a number of areas including: 1) initial reintroduction efforts for Razorback Sucker in the mainstem San Juan River; 2) long-term augmentation and monitoring of the San Juan River's two endangered fish populations; 3) annually monitoring the riverwide distribution and abundance of the entire large-bodied fish community in the San Juan River; 4) determining habitat use and preference and locating spawning areas of stocked Razorback Sucker and both stocked and wild Colorado Pikeminnow via radio-telemetry; and, 5) performing and analyzing the effects of nonnative fish removal operations. Dale has authored two peer-reviewed journal articles on his work in the San Juan River basin, as well as over 35 agency reports, and numerous augmentation plans and addendums. He co-authored a genetics management plan for the endangered Colorado Pikeminnow and Razorback Sucker in the San Juan River and has been a contributing author to both the flow recommendations report for the reoperation of Navajo Reservoir and the long-term monitoring protocols document currently being used by the SJRBRIP. During the development of the flow recommendations document, Dale acted as the chairman for the Native Fishes Workgroup. He is the Project Leader for the Colorado River Fishery Project office in Grand Junction, CO. From 2011-2013, Dale was the USFWS's Region 6 representative on the SJRBRIP Biology Committee. In May 2013, Dale became the USFWS's Region 6 representative on the SJRBRIP Coordination Committee.

Biological Technician Crew Leader (GS-6) – USFWS-CRFP
Our Crew Leaders have a minimum of three years with the USFWS-CRFP preforming fisheries research and management in the Colorado and San Juan River Basins. They have all led single and multi-day trips conducting sampling for endangered and other native fishes, as well as conducting non-native fish removal efforts. Our Crew Leaders also assist biologists at the Ouray National Fish Hatchery – Grand Valley Unit with day to day operations and fish culture.

Biological Technicians (GS-5) – USFWS-CRFP
All have at least a BS degree in biology. Depending upon the individual, they have up to 3 years of experience performing fisheries research and management in the Colorado River Basin, including the San Juan River.

Projected Duration Of Project:

The Adult Monitoring study began in 1991 (see Introduction for details). It has continued, annually, with a consistent sampling regime every year since that time. This has allowed for the compilation of one of the longest-running and most statistically powerful fisheries databases available to the SJRBRIP. The Adult Monitoring study was modified with just very slight changes (e.g., a reduction in sampling frequency from every RM to two out of every three RM's) when it was incorporated as an integral part of the long-term San Juan River Monitoring Plan and Protocols (Propst et al. 2000) and a second time (to sample only RM 180.0-77.0) with the development of the SJRBRIP's Monitoring Plan and Protocols (SJRBRIP 2012). The suite of long-term monitoring studies are scheduled to run through the termination of the San Juan River Recovery Implementation Program.

Literature Cited:

San Juan River Basin Recovery Implementation Program. 2012. San Juan River Basin Recovery Implementation Program Monitoring Plan and Protocols. San Juan River Basin Recovery Implementation Program, U.S. Fish and Wildlife Service, Albuquerque, New Mexico.

San Juan River Basin Recovery Implementation Program. 2014. Long-Range Plan. San Juan River Basin Recovery Implementation Program, U.S. Fish and Wildlife Service, Albuquerque, New Mexico.

Fiscal Year 2016 Estimated Budget:

Costs for participation of the U.S. Fish Wildlife Service, Colorado River Fishery Project (USFWS-CRFP) office, Grand Junction, CO.

(Based on projected FY-2016 costs)

Note 1: This budget DOES NOT include the additional 5 days of sampling needed to sample the lower San Juan River (river mile 53.0-3.0) that was added to last year's FY-2015 workplan.

Note 2: The FY-16 and outyear costs have been adjusted for the GS-5 Bio Tech line items to reflect new guidance from Office of Personnel Management (OPM) to the USFWS requiring the USFWS to provide health insurance to all federal employees if they work for the federal government longer than 60 days (480 total hours)

Note 3: As per conversations with the San Juan River Biology Committee on the 25 March 2015 conference call, costs have been added to this budget to reflect the separate springtime sampling that will occur in the lower Animas River.

Personnel/Labor Costs (Federal Salary + Benefits)

Objectives 1-3: Logistics, Electrofishing, Removal of Nonnative Fish

Principal Biologist (GS-11) – 216 hours @ $49.36/hr	$ 10,662.00
(1 person X 10 days planning & organization)	
Animas River sampling - spring:	
(1 person X 3 days/trip X 1 trip – work from hotel)	
San Juan River sampling - fall:	
(1 person X 4 days/trip X 1 trip – work from hotel)	
(1 person X 10 days/trip X 1 trip – camping)	
Bio. Tech. Crew Leader (GS-6) - 112 hours @ $32.76/hr	$ 6,126.00
San Juan River sampling - fall:	
(1 person X 4 days/trip X 1 trip – work from hotel)	
(1 person X 10 days/trip X 1 trip – camping)	
(+ 50 hours overtime at $49.14/hr = $2,457.00)	
Biological Technicians (GS-5) – 408 hours @ $24.96/hr	$ 17,036.00
Animas River sampling - spring:	
(3 person X 3 days/trip X 1 trip – work from hotel)	
(+ 9 hours overtime each at $37.44/hr = $1,011.00)	
San Juan River sampling – fall:	
(3 person X 4 days/trip X 1 trip – work from hotel)	
(3 person X 10 days/trip X 1 trip – camping)	
(+ 52 hours overtime each at $37.44/hr = $5,841.00)	
Sub Total	$ 33,824.00

Permitting; Coordination; Data Input, Analysis, Management & Presentation; Report Writing; Office &

Administrative Support (Federal Salary + Benefits)		
Administrative Officer (GS-9) – 200 hours @ $44.72/hr		$ 8,944.00
Principal Biologist (GS-11) – 400 hours @ $49.36/hr		$ 19,744.00
Project Leader (GS-14) – 320 hours @ $83.42/hr		$ 26,694.00
	Sub Total	$ 55,382.00

Travel and Per Diem (Based on Published FY-2015 Federal Per Diem Rates)

Hotel Costs		
15 nights @ $83/night (in Farmington, NM)		$ 1,245.00
5 nights @ $111/night (in Cortez, CO)		$ 555.00
12 nights @ $83/night (in Farmington, NM)		$ 996.00
Per Diem (Hotel Rate)		
3 days X 5 people X $46/day (in Farmington, NM)		$ 690.00
1 days X 5 people X $51/day (in Cortez, CO)		$ 255.00
3 days X 4 people X $46/day (in Farmington, NM)		$ 552.00
Per Diem (Camping Rate)		
15 days X 5 people X $28/day		$ 2,100.00
	Sub Total	$ 6,393.00

Equipment and Supplies

Vehicle Maintenance & Gasoline (@ $365/month lease = $12.17 per day based on 30 days in an "average" month + $0.33/mile)	
Animas River sampling - spring:	
1 trip from Grand Junction, CO to Farmington, NM X 2 trucks X 3 days/trip – work from hotel (296 miles one-way = 592 miles round-trip X 2 trucks = 1,184 total miles) = $390	$ 390.00
3 days sampling on lower Animas River – work from hotel (30 miles/day X 3 days X 2 trucks = 180 miles) = $59 (2 trucks X 3 days/trip X 1 trip X $12.17/day) = $73	$ 132.00
San Juan River sampling - fall:	
1 trip from Grand Junction, CO to Farmington, NM X 1 truck X 6 days/trip, sample from Animas river confluence down-stream to Shiprock, NM – work from hotel (296 miles one-way = 592 miles round-trip) = $195 (+ 70 miles shuttling/day X 5 days = 350 miles) = $116 (1 truck X 6 days/trip X 1 trip X $12.17/day) = $73	$ 384.00
3 additional days sampling on San Juan River upstream of Animas River confluence – work from hotel (30 miles/day X 3 days X 1 trucks = 90 miles) = $30 (1 trucks X 3 days X $12.17/day) = $37	$ 67.00
1 trip from Grand Junction, CO to Cortez, CO to Shiprock, NM to Mexican Hat, UT and back to Grand Junction, CO X 2 trucks X 10 days per trip – camping portion (610 miles/trip X 1 trip X 2 trucks = 1,220 miles) = $403 (2 trucks X 10 days/trip X 1 trip X $12.17/day) = $243	$ 646.00
Generator Gasoline	
Animas River sampling - spring:	
(30 gallons/trip X 1 trip @ $4.00/gallon) – work from hotel: 3 days sampling on lower Animas River	$ 120.00
San Juan River sampling - fall:	

(50 gallons/trip X 1 trip @ $4.00/gallon) – work from hotel $ 200.00
5 days @ 5 gallons/day X 2 raft X 1 trip
(30 gallons/trip X 1 trip @ $4.00/gallon) – work from hotel: $ 120.00
3 additional days sampling on San Juan River
upstream of Animas River confluence
3 days @ 5 gallons/day X 2 raft X 1 trip
(120 gallons/trip X 1 trips @ $4.00/gallon) – camping portion $ 480.00
4 days @ 5 gallons/day X 1 raft X 1 trip
5 days @ 5 gallons/day X 4 rafts X 1 trip

Equipment Maintenance, Repair, & Replacement $ 5,045.00

Exact use of the money in this line item will vary from year to year depending on what equipment needs to be maintained, repaired, or replaced, but use of these funds for a "typical" field season for one study would include the following:

Annual trailer maintenance & safety inspection = $175
Replace/repair trailer suspension, trailer lights, winch handle/straps/gears, trailer jack stand wheel bearings
Replace trailer tires – 2 per year @ $100 each = $200
Spark plugs for generators – 5 at $7 each = $35
Synthetic oil for generators - 5 quarts at $7 each = $35
Generator repair/tune-up - 5 hrs @ $75/hr = $375
Hip boots – 2 pair at $50/pair = $100
Breathable chest waders - 2 pair @ $125/pair = $250
Stearns Type III life jackets – 3 @ $70 each = $210
Electrical Gloves - 3 pairs @ $65/pair = $195
Dura-Frame electrofishing dip nets – 2 @ $300 each = $600
Raft trailer maintenance
Signal light pigtail adapters – 2 @ $30 each = $60
Repair raft frame
Aluminum welding – 3 hours @ $150/hr = $450
Raft repair kits
Raft glue (urethane/hypalon) – Four 4-oz. cans @ $22.50/can = $90
NRS raft patch material – 5 feet @ $37/ft = $185
Acetone – 1 gallons @ $17.50/gallon = $17.50
Toluene – 1 gallon @ $17.50/gallon = $17.50
Replace any missing NRS HD-brand tie-down straps, each boat needs:
Ten 2-ft straps @ $4.20 each = $42
Five 3-ft straps @ $4.30 each = $21.50
Ten 4-ft straps @ $4.70 each = $47
Five 6-ft straps @ $5.05 each = $25.25
Five 9-ft straps @ $5.7 each = $28.50
Five 12-ft straps @ $6.15 each = $30.75
Replace any missing D-style carabiners, each boat needs:
10 @ $7.50 each = $75
Mesh rig bag – 1 @ $50 each = $50
Yeti 125-quart coolers – 1 @ $500 each = $500
Rafting oars, oar blades, and oar rowing sleeves
Carlisle 10-foot oar shafts – 2 @ $90 each = $180
Carlisle Oars blades – 4 @ $65 each = $260

Oar sleeves – 4 @ $12 each = $48
5-gallon plastic gasoline jerry cans – 5 @ $20 each = $100
River bags
NRS 3.8 heavy-duty Bill's Bag – 1 @ $100 each = $100
Clavey (green 7 X 17) dry bag – 3 @ $22 each = $66
Clavey (blue 10 X 24) dry bag) – 4 @ $26 each = $104
20 lb. propane tanks – 3 @ $20 each = $60
Pesola brand spring scales
20010 Micro-Line 10 gram – 1 @ $50 = $50
20060 Micro-Line 60 gram – 1 $46 = $46
20100 Micro-Line 100 gram – 1 @ $46 = $46
40300 Medio-Line 300 gram – 1 @ $54 = $54
40600 Medio-Line 600 gram – 1 @ $54 = $54
42500 Medio-Line 2,500 gram – 2 @ $56 = $112
41002 Medio-Line 1,000 gram – 3 @ $54 = $108
80005 Macro-Line 5 kg – 1 @ $107 = $107
80010 Macro-Line 10 kg – 1 @ $109 = $109

Other potential uses for these same funds could include replacing hand tools (ratchet and sockets, screw drivers, vise grips, pliers, Allen wrenches, crescent wrenches, hammer, etc.), WD-40, bailing wire, duct tape, electrical supplies (12 and 14 gage wire for the boats, junction boxes, extra male & female plugs, wire nuts, fuses, Ohm meter, electrical tape), batteries (C, AA and AAA), camp stoves, lanterns, lantern mantles, small "pony" propane bottles for lanterns, Gott 5-gallon water jugs, shovels, 5-gallon buckets, cargo nets, fix chips or cracks in vehicle windshields, bulbs, lenses, and wiring to fix trailer lights and pigtails, new electrofishing spheres, wire rope for replacing electrofishing "witches brooms," 2-man dome tents, NRS Canyon Box for dry storage, camping kitchen gear (roll-up camp tables, anodized dutch ovens, plates, bowls, cups, silverware), data books, Rite-In-The-Rain data sheets, pencils, repair/replace river maps, etc.

Sub Total	$ 7,584.00
USFWS-CRFP (Grand Junction, CO) Total	$103,183.00
USFWS Region 6 Administrative Overhead (3.00%)	$ 3,095.00
USFWS Region 6 Total	$106,278.00

Funding for Participation by Other Agencies: (These figures are submitted to USFWS-CRFP by the listed cooperating agencies)

USFWS-NMFWCO - Albuquerque, NM (Region 2)	
See Attached Budget for Line Item Breakdowns	$ 12,464.00
Utah Division of Wildlife Resources - Moab, UT	
See Attached Budget for Line Item Breakdowns	$ 5,629.00
	$ 18,093.00

FY-2016 WORKPLAN TOTAL	**$124,371.00**

Under the heading "Funding for participation of other agencies." Cost for participation of the U.S. Fish and Wildlife Service, New Mexico Fish and Wildlife Conservation Office, NM in FY-2016.

Personnel/Labor Costs (Federal Salary + Benefits)		
Fish Biologist (GS-9)– 12 days @ $324/day	$	3,888
(1 person x 12 days x 1 trip; Shiprock to Mexican Hat)		
Biological Science Tech (GS-8) – 14 days @ $358/day	$	5,012
(1 person x 11 days x 1 trip; Shiprock to Mexican hat)		
(1 person x 3 days x 1 trip; Animas to Shiprock)		
Supervisory Fish Biologist (GS-13) – 2 days @ $540/day		
(Project participation oversight and contract management)	$	1,080
Administrative Officer (GS-9) – 1 day @ $342/day	$	342
Sub Total	**$**	**10,322**
Travel and Per Diem (Based on Published FY-2015 Federal Per Diem Rates)		
Hotel Costs – 2 nights	$	166
(1 night x 2 rooms @ $83/night; Farmington, NM)		
Per Diem		
Camping Rate - 20 days @ $29/day	$	580
(2 people x 10 days x 1 trip)		
Hotel Rate – 2 days @ $46.00/day	$	92
Sub Total	**$**	**838**
Equipment		
Vehicle Maintenance & Gasoline (@ $0.58/mile)		
(660 miles round trip from Albuquerque, NM to		
Mexican Hat, UT + 100 miles shuttling)	$	441
Equipment Maintenance, Repair, & Replacement		
(e.g., life jackets, hip boots, generator repair, rubber		
gloves, dip nets, aluminum welding, raft repair, etc.)	$	500
Sub Total	**$**	**941**
USFWS-NMFWCO (Albuquerque) Total	**$**	**12,101**
USFWS Region 2 Regional Office Administrative Overhead (3%)	**$**	**363**
USFWS Region 2 Total	**$**	**12,464**

FY 2016 Costs for UDWR-Moab

Participation in San Juan River Large-Bodied Fish Community Monitoring

Labor: salary + benefits + applicable overtime (personnel services)

	Rate	Hours	Cost
Project Leader	$33.87	0	$0
Biologist	$30.90	70	$2,163
Technician	$16.89	70	$1,182
		subtotal	**$3,345**

Food and Transport (current expense)

	Rate	Quantity	Cost
Fleet Costs (2 trucks for 1% of total fleet costs)	$40,800.00	0.010	$408
Food (1 person, 10 days, 1 pass)	$39.00	10	$390
Out-of-state Per Diem (travel day)	$45.00	1	$45
Hotel (Cortez, CO- GSA Rate)	$77.00	1	$77
Camping reimbursement	$25.00	9	$225
		subtotal	**$1,145**

Equipment (current expense)

	Rate	Quantity	Cost
Camping gear repair/replacement:			$150
Sampling gear repair/replacement:			$150
Boating gear repair/replacement:			$150
Fuel for generators	$4.00	30	$120
		subtotal	**$570**

Total Expenses	**$5,060**
Administrative Overhead (17% on all personnel services)	**$569**
Grand Total FY 2016	**$5,629**

[a] The State of Utah motorpool vehicles cost approximately $6,800/year/vehicle (includes fleet rental, mileage, and gas), which is based on the average annual cost for all trucks used in our program.

[b] Includes, but is not limited to, tents, sleeping pads, toilet system, cookware, stoves, propane, charcoal, satellite phone and service, drybags, coolers, first aid supplies.

[c] Includes, but is not limited to dip nets, tags, tagging equipment, electrofishing units, electrofishing wiring, anodes, cathodes, generators, data loggers, etc…

[d] Includes, but is not limited to, raft repair/replacement, oars, oar hardware, raft frame repair, dry boxes, straps, etc…

[b,c,d] Estimated costs are based on actual costs from previous years plus an estimated 3% cost of living increase each year following.

Small-Bodied Fishes Monitoring
Fiscal Year 2016 Statement of Work and Project Budget
Agreement Number: SJ2631

Principal Investigators: Michael Ruhl and Kirk Patten
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Background

In 1991, the San Juan River Seven-Year Research Program was initiated. Subsequently, in 1992, the Research Program was placed under the auspices of the San Juan River Basin Recovery Implementation Program (SJRIP). The Research Program involved a variety of activities designed to characterize the status of the resident fish community (particularly the federally-protected Colorado pikeminnow *Ptychocheilus lucius* and razorback sucker *Xyrauchen texanus)*; to identify and quantify those factors (biotic and abiotic) that may be limiting protected fish species, as well as other native fish species; and to identify management and conservation activities that may contribute to recovery of protected species. Much of the research begun under the Seven-Year Research Program has been completed and a variety of management and conservation activities initiated.

The SJRIP drafted the Long Range Implementation Plan to guide and provide a means of evaluating progress towards achieving species recovery. It was designed to provide for "adaptive management" wherein research and particularly management or conservation activities were modified to reflect new information. To aid in the practice of adaptive management, the Long Range Plan identified monitoring of the San Juan River native and nonnative fish populations as a necessary components to "evaluate management actions and to document the [SJRIP's] progress toward achieving species recovery" (Element 4).

The SJRIP Monitoring Plan and Protocols was initially implemented in 1999 based on protocols developed for specific life stages and abiotic factors (Propst et al. 2000). The monitoring protocols contained herein are the third revision to the Monitoring Plan and Protocols (2009 Monitoring Plan and Protocols Workshop). To aid in the evaluation of achievement of these SJRIP goals, the following Monitoring Plan and Protocols' goals were developed:

1. Track the status and trends of San Juan River's fish community.
2. Track changes in abiotic parameters, including water quality, channel morphology, and habitat, important to the fish community.

3. Evaluate endangered fish species progress towards recovery.
4. Evaluate the effect of management actions, especially endangered fish stocking, non-native fish removal, and mimicry of the natural flow regime on the populations of native and non-native fishes in the San Juan River.

Meeting these goals will be accomplished by achieving the following objectives. Objectives are listed as they relate to each of the following SJRIP Monitoring Plan and Protocol goals.

1. Annually, during autumn, document occurrence and density of native and nonnative small-bodied fishes in San Juan River.
2. Document primary channel shoreline and near-shoreline, secondary channel, and backwater mesohabitat use by age-0 Colorado pikeminnow, razorback sucker, and roundtail chub, as well as other native and nonnative fishes.
3. Obtain data that will aid in the evaluation of the responses (e.g., reproduction, recruitment, and growth) of native and nonnative fishes to different flow regimes and other management actions (e.g., impediment modification).
4. Track trends in species populations (e.g., abundance, relative condition, and size structure).

The monitoring protocols detailed herein were developed from methodologies used during the Seven-Year Research effort and subsequent modifications as developed and accepted by the SJRIP. These methods were based upon published literature, the professional experience of each researcher, peer discussions and review, and project evaluations.

Study Area

The study area for annual small-bodied fishes monitoring, covering this statement of work, extends from River Mile 180.6 (Animas and San Juan rivers confluence, near Farmington, New Mexico) downstream to River Mile 2.8 (Mexican Hat, Utah).

Methods

Small-bodied fishes monitoring is designed to sample efficiently and effectively those habitats having the greatest likelihood of supporting age-0 individuals of large-bodied species and all age classes of small-bodied species. During autumn, primary shoreline and near-shoreline, secondary channel, and backwater habitats of the San Juan River will be sampled at 3-mile intervals from the Animas-San Juan rivers confluence (RM 180.6) to Sand Island (RM 76.4). At each sample location (except backwaters), all mesohabitats present (8 to 10) will be sampled with 3.0 x 1.2 m (3 mm mesh) seine. For backwaters, a minimum of two samples will be obtained; one seine haul will be made across backwater mouth and a second will be made parallel to its long axis. Additional seine hauls may be made if deemed appropriate by sampling crew. All specimens obtained from a mesohabitat will be identified to species; specimens of uncertain identity will be retained for later identification. After measurement (mm total length), all identified native fishes will be released. If a rare fish is collected, and it is of

sufficient length (>150 mm TL), it will receive a uniquely numbered PIT tag. Total (mm TL) and standard (mm SL) lengths and mass (g) will be obtained from each rare fish captured. All nonnative specimens collected from a mesohabitat will be retained or destroyed. Fish data will be recorded by mesohabitat from each sampled area. Sampling effort will be reported as number of individuals captured per unit area. After fish collection, area, depth, and cover of sampled mesohabitats will be determined. With 8 to 10 samples per site, a total of 280 to 350 primary channel, 160 to 200 secondary channel (assuming 20 side channels are present), and 20 backwater (assuming 10 backwaters are present) samples will be obtained each year.

Geographic coordinates (UTM Zone 12, NAD 83) for each site will be recorded. Basic water quality parameters (water temperature, dissolved oxygen, conductivity, specific conductance, and salinity) will be measured at each site.

The San Juan River between San Island (RM 76.4) and Clay Hills Crossing (RM 2.9) is sampled every fifth year. Sampling procedures in these lower reaches are the same as those between Animas-San Juan rivers confluence and Sand Island. This lower reach was sampled in 2010 and will be sampled in 2015, but will not be sampled in FY2016.

Annual reports will be primarily a summation of data obtained each year, a synthesis of data across years to document and assess species population responses to environmental variables (mainly discharge), a summary of mesohabitat associations of fishes, and basic characterizations of species demographics (population size and age structure, recruitment, and survival). In addition to annual narrative reports, all data collected will be recorded on electronic spreadsheets and provided to USFWS Program Office in a format determined by the database manager and principal investigator, by June 30 of the year following data collection.

Additional Sampling for Sites Modified to Increase Habitat Complexity (The Nature Conservancy sites)

Incorporated into this year's annual monitoring of small-bodied fish will be the third year sampling newly modified habitat. Six secondary channels were modified during the fall of 2012 through excavation of sediment and removal of non-native plants. The location and length of channels re-opened are:

1. River Mile 132.2 - 6,600 feet in length
2. River Mile 132.0 – 2,000 feet in length
3. River Mile 130.7A – 1,500 feet in length
4. River Mile 130.7B – 700 feet in length
5. River Mile 128.6 - 3,700 feet in length
6. River Mile 127.2 – 3,700 feet in length
7. Additional sites – Additional RERI sites and/or sampling events may be sampled under a SOW provided by TNC in FY2016.

Methods used to sample secondary channels (as described in the Methods section above) will be used to sample these sites. The SJRIP Habitat Monitoring Program will be determining reference sites. These sites will also be sampled for small-bodied fishes. Data

analysis will include comparisons between the fish community present in these newly re-opened side channels and reference sites.

Additional Sampling on the Animas River and/or on the San Juan River above its confluence with the Animas River (Upstream sites).

The SJRIP recently began augmenting populations of razorback sucker and Colorado pikeminnow in the Animas River and San Juan River upstream of its confluence with the Animas River. Prior to 2012, no monitoring of these sections of river was underway. In 2012 and 2013, the upper portion of the San Juan River was sampled from the Bloomfield Riverside Landing (RM 196.0) downstream to the McGee Park Landing (RM 188.7) and from the McGee Park Landing downstream to the Animas River confluence. Small-bodied monitoring did not occur on the Animas River upstream from the Penny Lane Landing downstream to the San Juan River due to low water (2012) and inaccessibility (2013). At least one of these sites will be monitored in 2016 given water conditions and adequate launching sites allow sampling to occur.

References

Golden, M.E. and P.B. Holden. 2005. Retention, growth and habitat use of stocked Colorado pikeminnow in the San Juan River 2003-2004: Annual report. Prepared by BIO-WEST, Inc. for the San Juan River Basin Recovery Implementation Program, U.S. Fish and Wildlife Service, Albuquerque, New Mexico. PR 874-2: 87 p.

Propst, D.L., S.P. Platania, D.W. Ryden, and R.L. Bliesner. 2000. San Juan River Monitoring plan and protocols. San Juan Recovery Implementation Program, U.S. Fish and Wildlife Service, Albuquerque, NM.

Funding History:

Fiscal Year 2000	$57,200	Fiscal Year 2010	$89,479
Fiscal Year 2001	51,700	Fiscal Year 2011	82,929
Fiscal Year 2002	51,700	Fiscal Year 2012	83,417
Fiscal Year 2003	49,775	Fiscal Year 2013	92,353
Fiscal Year 2004	63,545	Fiscal Year 2014	84,307
Fiscal Year 2005	72,645	Fiscal Year 2015	95,054
Fiscal Year 2006	72,885		
Fiscal Year 2007	81,246		
Fiscal Year 2008	91,882		
Fiscal Year 2009	89,479		

FY 2016 Budget

Field

Personnel

Tasks - Annual monitoring primary channel, secondary channel, and backwater habitats, San Juan River, Farmington, NM to Mexican Hat, UT; The Nature Conservancy and upstream sites; 12 field days projected at 12 hours of work per day = 144 hours (project leader 7 days).

Project Leader (1)	
56 hrs regular	56 hrs
$34.59/hr (base salary) + $12.11 (benefits)	$46.70/hr
28 hrs overtime	28 hrs
$46.70/hr * 1.5 (time-and-a-half)	$70.05/hr
	$4,577
Project Biologists (3)	
96 hrs regular x 3 biologists	288 hrs
$27.71/hr (base salary) + $9.70 (benefits)	$37.41/hr
48 hrs overtime x 3 biologists	144 hrs
$37.41/hr * 1.5 (time-and-a-half)	$56.12/hr
	$18,855
TOTAL PERSONNEL	**$23,432**

Per Diem

7 days/project biologist (in-state rate) for 4 biologists	
- $85.00/day (standard NM in-state rate)	$2,380.00
5 days/project biologist (out-of-state rate) for 4 biologists	
-$115.00/day (standard NM out-of-state rate)	$2300.00
TOTAL PER DIEM	**$4,680**

Vehicles (2)

Round-trip Farmington/Shiprock, NM	
1500 miles @ $0.55/mile	$825.00
Round-trip to Mexican Hat, Utah ($0.55/mile)	
960 miles @ $0.55/mile	$528.00
TOTAL VEHICLE	**$1,353**

Field Equipment & Supplies

Water quality instrument maintenance 2@$400	$ 800.00
Life Jackets 5@$40	$ 200.00
Raft maintenance	$ 500.00
Whirlpacks (500) @ $50.00/500	$ 50.00
Formalin (6 gal) @ $25/5gal	$ 150.00
TOTAL EQUIPMENT & SUPPLIES	**$1,700**

TOTAL FIELD **$31,165**

Specimen Management

Personnel

Project Biologists (2)

Tasks—processing (sorting, identification, and data-entry). Since 2000, annual monitoring collections averaged of 31,000 specimens (retained and/or released) although the last two years of collection have resulted in lower numbers of fish captured. Approximately 8 hours per day of sampling may be required to process data and specimens retained in the laboratory.

15 days of sampling at 8 hrs each x 2 biologists	240 hrs
$27.71/hr (base salary) + $9.70 (benefits)	$37.41/hr

TOTAL SPECIMEN MANAGEMENT **$8,978**

Data Synthesis and Report Preparation

Personnel

Project Leader (1)

Tasks—data analysis, data synthesis, report drafting, report review, and report revision.

120 hrs	120 hrs
$34.59/hr (base salary) + $12.11 (benefits)	$46.70/hr
TOTAL PROJECT LEADER SALARY	**$5,604**

Project Biologists (2)

Tasks—data management, data QA/QC, data analysis, data synthesis, table and graph preparation, report drafting, and report revision.

200 hrs ea.	400 hrs
$27.71/hr (base salary) + $9.70 (benefits)	$37.41/hr
TOTAL PROJECT BIOLOGISTS SALARY	**$14,964**

TOTAL DATA SYNTHESIS & REPORT PREPARATION **$20,568**

Reviews and Meetings

Personnel

Project Leader (1)	
Tasks—2 Biology Committee meetings @28 hrs. ea; report review (40)	86 hrs
$34.59/hr (base salary) + $12.11 (benefits)	$46.70/hr
TOTAL PROJECT LEADER SALARY	**$4,016.20**
Project Biologists (1)	
Tasks—5 Biology Committee @28 hrs. ea(140 hrs); report review (60 hrs)	200 hrs
$27.71/hr (base salary) + $9.70 (benefits)	$37.41/hr
TOTAL PROJECT BIOLOGISTS SALARY	**$7,482.00**
TOTAL SALARY	**$11,494.20**

Per Diem - meetings requiring travel

Project Biologists (1) (includes 3 Biology & 1 Coordination Committee meetings)	
3days @ $85.00/day (standard NM in-state rate)	$255.00
9 days @ $115.00/day (standard NM out-of-state rate)	$1035.00
Project Leader (1) (includes 1 Biology & 1 Coordination Committee meetings)	
6 days @ $115.00/day (standard NM out-of-state rate)	$690.00
TOTAL PER DIEM	**$1980.00**

Travel

Vehicle	
1 Biology & Coordination Committee meetings (Farmington)	
400 miles@ $0.55/mile (standard NM rate)	$220.00
3 Biology & Coordination Committee meetings (Durango)	
500 miles ea. = 1500 miles @ $0.55/mile (standard NM rate)	$825.00
TOTAL VEHICLE	**$1,045.00**
TOTAL REVIEWS & MEETINGS	**$14,523**

Administrative

Personnel

Secretary/Clerk Duties

Tasks—purchasing, travel arrangements.

Project Biologist (1)	80 hrs
$27.71/hr (base salary) + $9.70 (benefits)	$37.41/hr

SECRETARY/CLERK SALARY	**$2,992.80**

Grant and Budgeting

Tasks - administration of agreements, tracking budget expenditures

Project Leader (1)	120 hrs
$34.59/hr (base salary) + $12.11 (benefits)	$46.70/hr

GRANT AND BUDGETING	**$5,604.00**
TOTAL ADMINISTRATIVE	**$8,597**

FY 2016 TOTAL	**$83,831**
Field Work	**$31,165**
Specimen Management	**$8,978**
Data Synthesis and Report Preparation	**$20,568**
Reviews and Meetings	**$14,523**
Administrative	**$ 8,597**

Out-Year Budgets within Current Agreement (Through FY2018)

FY 2017 TOTAL	**$86,346**
FY 2018 TOTAL	**$88,936**

Out-Year Budgets Beyond Current Agreement (FY2019 and 2020)

FY 2019 TOTAL	**$91,604**
FY 2020 TOTAL	**$116,337**

SAN JUAN RIVER LARVAL RAZORBACK SUCKER AND COLORADO PIKEMINNOW MONITORING FISCAL YEAR 2016 SCOPE OF WORK

SUBMITTED TO THE U.S. BUREAU OF RECLAMATION

FROM

AMERICAN SOUTHWEST ICHTHYOLOGICAL RESEARCHERS, L.L.C. (*ASIR*)
800 ENCINO PLACE NE
ALBUQUERQUE, NEW MEXICO 87102-2606
505-247-9337 (VOICE) 505-247-2522 (FACSIMILE)

CONTRACT NO. GS10F0249X

1 OCTOBER 2016- 30 SEPTEMBER 2017

SAN JUAN RIVER LARVAL RAZORBACK SUCKER AND COLORADO PIKEMINNOW MONITORING FISCAL YEAR 2016 PROJECT PROPOSAL

Principal Investigator: Michael A. Farrington
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Razorback Sucker project history:

The apparent absence of Razorback Sucker in the San Juan River drainage necessitated experimental stocking of adults (n=672) of this species in 1994 between Hogback, New Mexico, and Bluff, Utah. In their 1995 report of activities, Ryden and Pfeifer (1996) suggested that the majority of the 1994 experimentally stocked Razorback Sucker would achieve sexual maturity in 1996 and spawning by those individuals might begin a few years afterwards.

At the November 1996 San Juan River Basin Biology Committee integration meeting, it was suggested that the Colorado Pikeminnow, *Ptychocheilus lucius*, larval fish drift study (= Passive Drift Netting Study; RM 127.5 and RM 53.3; July-August) be expanded in an attempt to document spawning of the stocked Razorback Sucker (presumed to be during April-May). In addition to temporal differences in spawning between Colorado Pikeminnow and catostomids (suckers), researchers were attempting to document reproduction by hatchery reared Razorback Sucker whose spawning potential was unknown. Sampling for larval Razorback Sucker was to be conducted to determine if the stocked population of adult Razorback Sucker would spawn in this system. Conversely, data from the passive drift-netting study continued to document Colorado Pikeminnow reproduction in the San Juan River and, because of this certainty, larval fish sampling efforts for this fish would (initially) be different than those for Razorback Sucker.

Numerous Upper Colorado River Basin researchers reported light-traps as one of the best means of collecting larval Razorback Sucker. Most of their light trapping efforts was concentrated in floodplain habitats during high spring flows. Light-trap sampling was employed during the first year (calendar year 1997) of the San Juan River larval Razorback Sucker survey. The lack of inundated floodplain habitats in the San Juan River, in comparison to the Upper Colorado River Basin, meant that the light-traps would have to be set in low velocity riverine habitats. The only previous San Juan River fish investigations that had employed light-traps were in 1994 and 1995 (conducted by the National Park Service) near the San Juan River-Lake Powell confluence. That sampling effort produced an extremely large number of larval fish (ca. 25,000) from a modest number of samples (n=20), of which over 99% were red shiner. Similar sampling in 1995 yielded 25,455 specimens in 47 light-traps samples and as in 1994, red shiner numerically dominated the catch. Both sampling efforts were conducted during July-August but neither Colorado Pikeminnow nor Razorback Sucker was present in the 1994-1995 light-trap samples.

During the 1997 Razorback Sucker larval fish survey, light-traps were set nightly in low-velocity habitats between Aneth and Mexican Hat, Utah, from late March through mid-June. The traps were distributed at dusk and retrieved about four hours later. Fish taken in those samples were preserved in the field. Sampling success during the 1997 Razorback Sucker larval fish study was poor. While there were over 200 light-trap sets, those sampling efforts produced only 297 fish. Of those, about 200 (66%) were larval catostomids (either Flannelmouth Sucker or Bluehead Sucker). Larval Razorback Sucker was not present

in the 1997 sampling survey. While there were probably several factors to account for the poor light-trap catch rate, a principal factor was the limited access to suitable habitats. We determined that being limited to specific collecting sites was not the most efficient means of collecting large numbers of individuals; a prerequisite for this study.

In 1998 a new study design was developed to allow for the sampling of a greater portion of the San Juan River and the collection of a significantly larger number of larval fish throughout several river reaches. An inflatable raft was used to traverse the San Juan River and allowed us the opportunity to sample habitats that were either not formerly accessible or observable under the constraints of the previous sampling protocol. Six sampling forays were conducted at approximately bi-weekly intervals from 17 April to 6 June 1998 between the Four Corners drift station (RM 127.5) and Mexican Hat, Utah (RM 53.3). Both active (seining) and passive (light-traps) sampling techniques were used to collect larval fish. The primary sampling method was a fine mesh larval seine. If appropriate aquatic mesohabitats could be located, light-traps would be set adjacent to nightly campsites of the sampling crew.

The 1998 sampling protocol resulted in 183 collections containing over 13,000 specimens between river miles 127.5 and 53.3 with the majority of these individuals (n=9,960) being larval catostomids. This 43-fold increase in number of specimens, as compared with 1997, provided substantially better resolution of spawning periodicity of the catostomid community. In addition, the 1998 samples produced enough individuals for us to determine, with a high degree of confidence, if Razorback Sucker reproduction occurred in the San Juan River during that period. None of the aforementioned information was obtainable from 1997 light-trap samples. In 1998, two larval Razorback Sucker were collected providing verification of spawning by the hatchery reared stocked population.

The use of active sampling to determine the reproductive success of Razorback Sucker has proven to be effective. To date, the results of this investigation have provided seventeen consecutive years of unequivocal documentation of reproduction in the San Juan River by Razorback Sucker that have been stocked as part of the San Juan River Basin Recovery Implementation Program (Table 1). The data collected during the larval Razorback Sucker survey provide not only valuable data concerning the distribution (spatial and temporal), duration, and magnitude of Razorback Sucker reproduction but also equally informative data on the reproductive efforts of other native fishes in the San Juan River.

Table 1. Collection information of Razorback Sucker (Xyrtex) collected during the larval Razorback Sucker survey, 1998 – 2014.

Year	*Sampling method*	*Study Area (River Miles)*	*River Miles sampled*	*Percent change*	*Specimens collected*	*Xyrtex n=*
1998	Larval seine Light traps	127.5 – 53.3	74.2	na	13,608	2
1999	Larval seine Light traps	127.5 – 2.9	124.6	+ 40.4%	20,348	7
2000	Larval seine Light traps	127.5 – 2.9	124.6	na	11,473	129
2001	Larval seine Light traps	141.5 – 2.9	138.6	+ 10.1%	95,629	50
2002	Larval seine Light traps	141.5 – 2.9	138.6	na	56,164	813
2003	Larval seine Light traps	141.5 – 2.9	138.6	na	41,181	472
2004	Larval seine	141.5 – 2.9	138.6	na	14,648	41
2005	Larval seine	141.5 – 2.9	138.6	na	19,142	13
2006	Larval seine	141.5 – 2.9	138.6	na	25,127	202
2007	Larval seine	141.5 – 2.9	138.6	na	22,093	199
2008	Larval seine	141.5 – 2.9	138.6	na	23,599	126
2009	Larval seine	141.5 – 2.9	138.6	na	5,843	272
2010	Larval seine	141.5 – 2.9	138.6	na	23,385	1,251
2011	Larval seine	141.5 – 2.9	138.6	na	10,504	1,065
2012	Larval seine	147.9 – 2.9	145.0	+ 4.6%	18,131	1,778
2013	Larval seine	147.9 – 2.9	145.0	na	6,055	979
2014	Larval seine	147.9 – 2.9	145.0	na	6,490	612

Colorado Pikeminnow project history:

Beginning in spring 1995, personnel from the Division of Fishes, Museum of Southwestern Biology (MSB), at the University of New Mexico assumed responsibility for the San Juan River larval fish passive drift-netting study. This project, formerly conducted by the Utah Division of Wildlife Resources,

continued through 2001 with only minor changes in sampling protocol. Between 1995 and 2001, a total of four larval Colorado Pikeminnow were collected using this sampling method at two different collecting locations (Four Corners, NM and Mexican Hat, UT).

The limited number of wild adult Colorado Pikeminnow (versus stocked individuals) in the San Juan River was reflected in the extremely low catch rate of larval Colorado Pikeminnow. Numerous adult and sub-adult Colorado Pikeminnow have now been stocked into the San Juan River in an effort to augment the diminished wild population. The Colorado Pikeminnow augmentation plan (phase II) calls for continued stocking efforts in the San Juan River through 2020. The San Juan River Basin Biology Committee expects, as was documented with stocked Razorback Sucker, that reproduction among stocked Colorado Pikeminnow will occur and can be documented through the sampling of larval fish.

As the number of adult (reproductively mature) Colorado Pikeminnow in the San Juan River increases (due to both stocking and recruitment), so does the probability of elevated levels of spawning by this species. The San Juan River Basin Biology Committee began exploring the possibility of expanding the sampling effort for larval Colorado Pikeminnow in fiscal year 2003. One means of accomplishing this task was to include an additional sampling site (increasing from two to three sites) for the passive drift-netting study. Another suggestion was to perform targeted sampling for Colorado Pikeminnow similar to that performed for larval Razorback Sucker. In the case of the latter sampling effort, discussion regarding sampling that would target larval Colorado Pikeminnow centered around expanding the duration of the current larval Razorback Sucker survey (April-June) or development of a discrete (new) project. These and other items were considered and evaluated during the February 2002 San Juan River Basin Biology Committee meeting. The Committee recommended the immediate expansion of the larval Razorback Sucker survey (April-June) to include the months of July, August, and September with seining efforts to target larval Colorado Pikeminnow.

Beginning in July of 2002, using funds from FY 2002 that had been appropriated for use at the two larval drift-netting stations, Museum of Southwestern Biology (MSB) personnel began an active sampling regime that mirrored the sampling protocol successfully used in the larval Razorback Sucker survey. The results from the temporal expansion of the larval surveys have produced 364 wild larval Colorado Pikeminnow to date. The majority of those larvae (N=312) were collected in 2014. Larval Colorado Pikeminnow were collected in surveys during 2004, 2007, 2009, 2010, 2011, 2013, and 2014 at 55 discrete sites, within the study area. Between 1995 and 2014 the combined sampling methodologies (passive and active) resulted in the collection of 368 larval Colorado Pikeminnow. Back-calculated spawning dates, based on those 368 individual larvae, range from 23 May to 18 July (Table 2) and are generally associated with the descending limb of spring run-off and mean river temperatures >18^{o}C.

Over 1,000,000 fish have been collected between 1995 and 2014 under the larval Colorado Pikeminnow survey. Of those, 900,841 fish were collected after 2001 when the sampling protocol switched from passive to active sampling (2002).

Table 2. Summary of larval and YOY Colorado Pikeminnow collected in the San Juan River during larval drift-netting/larval seining (1993-2014) and back-calculated dates of spawning.

Year	*Sample Method*	*Study Area (River Miles)*	*N=*	*Length mm TL.*	*Collection Date*	*Spawning Date*
1995	Drift Netting	127.5, 53.3	2	9.0, 9.2	02, 03 Aug	15, 17 Jul
1996	Drift Netting	127.5, 53.3	1	8.6	02 Aug	18 Jul
2001	Drift Netting	127.5, 53.3	1	8.5	01 Aug	17 Jul
2004	Larval Seine	141.5 – 2.9	2	14.2, 18.1	22, 26 Jul	24, 25 Jun
2007	Larval Seine	141.5 – 2.9	3	14.9-17.5	25 Jul	27 Jun
2009	Larval Seine	141.5 – 2.9	1	25.2	27 Jul	10 Jun
2010	Larval Seine	141.5 – 2.9	5	12.6-21.4	20-23 Jul	15-27 Jun
2011	Larval Seine	141.5 – 2.9	29	10.0-21.3	20, 21 Jul, 10,11 Aug	23 Jun- 6 Jul
2013	Larval Seine	147.9 – 2.9	12	14.1-28.7	17-30 Jul ,	23 May-3 Jul
2014	Larval Seine	147.9 – 2.9	312	8.5-20.8	13-28 Jul	15 Jun-2 Jul

Project Modifications:

There have been numerous modifications to the field methodology of the larval fish survey over time as well as changes in reporting priorities, protocol, and format. The extent of the study area and aspects of the longitudinal sampling have been modified to improve spatial comparisons. The study area was expanded in 1999, 2001, and 2012 by a total of 70.8 river miles (nearly double the length of the original study area) to include most of Reach 5 (Shiprock, New Mexico) through Reach 1 (Clay Hills Crossing, Utah; a total of 145.0 miles of critical habitat sampled). Beginning in 2003, the entire study area was sampled in single uninterrupted trips (10-12 field days per trip) rather than in two temporally discrete sections as done in previous years (1998 – 2002). Because of the increasing numbers of larval Razorback Sucker collected (as well as detailed information regarding the native fish community), the SJRBRIP Biology Committee voted to elevate the larval fish surveys from an "experimental" project to a monitoring program. This change allowed for comparisons of catch per unit effort (CPUE) data with the programs monitoring activities (i.e., small bodied fish, adult monitoring, habitat, etc).

Conducting the larval Razorback Sucker and Colorado Pikeminnow surveys under this new protocol not only provided discrete reach information but also provided greater temporal resolution in respect to the longitudinal distribution of Razorback Sucker larvae and the ability to correlate potential environmental cues required by Razorback Sucker for spawning. These same advantages also apply to Colorado Pikeminnow. Disadvantages to this top to bottom approach were that the duration of the monthly

sampling trips (10-12 field days) made them more subject to abiotic fluctuations (floods, flow spikes). Large flood events reduce sampling efficiency as many low velocity habitats become flooded by rising water levels thereby transporting larval and early juvenile fish downstream. In addition, large flood events have necessitated premature termination of some survey runs, reducing the temporal resolution of the single-continuous pass effort. Annually, at least one trip (an average) had to be cut short due to large flood events or low water events in the lower canyon. The abbreviated trips were subsequently resumed once conditions improved (usually 1-2 weeks later). Additional costs were incurred because of the need to return to the field to complete the sampling effort for that month.

To reduces the variability of abiotic conditions as well as gain even greater temporal resolution of the longitudinal distribution of Razorback Sucker larvae, the protocol was modified to survey the upper and lower halves of the study area simultaneously. This effort began in 2007 and utilized two fully equipped and autonomous crews (Table 3). In 2008, additional participation of our staff with other SJRBRIP projects made the new simultaneous sampling effort a necessity so that our staff could meet obligations to assist the other researchers with their work.

Beginning in 2009, larval fish specimens collected in the field were preserved in 95% ethanol (as opposed to 10% buffered formalin). This change in preservation technique assured that specimens could be used for a variety of purposes, (such as genetic analysis and age determination via examination of otoliths) that was not possible under the formalin preservation protocol. Beginning in 2011, the September sampling trip was discontinued. The Biology Committee felt that the September survey did not provide enough data with respect to endangered fishes to warrant continuation.

The study area expanded 6.4 miles upstream in 2012. The expansion of the study area was a result of captures of larval Razorback Sucker at the top of the previous study area (river mile 141.5). Collections in 2012, 2013 and 2014 documented larval Razorback Sucker in this newly expanded area.

In 2013 a new analysis of Colorado Pikeminnow and Razorback Sucker trend data was developed using mixture models (White, 1978; Welsh et al., 1996; Fletcher et al., 2005; Martin et al., 2005.). Mixture models can be particularly effective at modeling ecological data with multiple zeros to estimate occurrence and abundance separately (e.g., combining a binomial distribution with a lognormal distribution). Data collection for this new approach meant each seine haul was preserved independently along with physical descriptors of each haul.
Beginning in 2014, the mixture model analysis was expanded to include annual trends for many of the common species collected.

Table 3. Summary of annual projects and project modifications of the larval fish surveys from 1997 to 2014.

Year	*Sampling method*	*Study area (River Miles)*	*Specimens collected*	*Field modification*	*Laboratory modification*
1997	Light Trap Drift-nets	99 – 75	297		
1998	Larval Seine Light Trap Drift-nets	127.5 – 53.3	13,608	study area expanded; active sampling	
1999	Larval Seine Light Trap	127.5 – 2.9	20,711	study area expanded; upper-lower reaches	

	Drift-nets			sampled separately; nonsynchronous	
2000	Larval Seine Light Trap Drift-nets	127.5 – 2.9	13,549		
2001	Larval Seine Light Trap Drift-nets	141.5 – 2.9	95,629	study area expanded; upper-lower reaches sampled separately; nonsynchronous	
2002	Larval Seine Light Trap	141.5 – 2.9	138,601	study period expanded to September. Drift-nets no longer used.	
2003	Larval Seine Light Trap	141.5 – 2.9	112,842	upper-lower reaches sampled monthly in one uninterrupted trip (11-12 day runs)	CPUE data used for integration in reporting
2004	Larval Seine	141.5 – 2.9	160,292		Reports merged Trend data
2005	Larval Seine	141.5 – 2.9	109,368		
2006	Larval Seine	141.5 – 2.9	50,616		
2007	Larval Seine	141.5 – 2.9	53,084	Two rafts-two crews; upper-lower reaches samples synchronous	Analyzed catch with habitat data
2008	Larval Seine	141.5 – 2.9	40,855		
2009	Larval Seine	141.5 – 2.9	72,404	Specimens preserved in 95% ethanol	
2010	Larval Seine	141.5 – 2.9	70,610		
2011	Larval Seine	141.5 – 2.9	28,045	September survey dropped from the monitoring	
2012	Larval Seine	147.9 – 2.9	29,384	Study area expanded	
2013	Larval Seine	147.9 – 2.9	26,557	Individual seine hauls preserved independently	Mixed Model analysis used for trend data
2014	Larval Seine	147.9 – 2.9	20,508		Mixture Model analysis used for several common species

Objectives:

This work is being conducted as required by the San Juan River Basin Recovery Implementation Program Monitoring Plan and Protocol (2012). The objectives of this specific monitoring effort are

identified and listed below. Where applicable, these objectives are related to the specific tasks listed in the 2014 Long Range Plan set forth by the San Juan River Basin Recovery Implementation Program (SJRBRIP).

1) Conduct larval fish sampling to determine if (Colorado Pikeminnow and Razorback Sucker) reproduction is occurring, locate spawning and nursery areas, and gauge the extent of annual reproduction. (Task 4.1.2.1)

2) Determine the spawning periodicity of Colorado Pikeminnow and Razorback Sucker (utilizing back-calculated spawning and hatching formulas) between mid-April and August and examine potential correlations with temperature and discharge.

3) Document and track trends in the use of specific mesohabitat types by larval Colorado Pikeminnow and Razorback Sucker. (Task 4.2.3.2)

4) Document and track trends in the use of specific mesohabitat types by larval Colorado Pikeminnow and Razorback Sucker. (Task 4.2.3.2).

5) Develop and revise a Standardized Fish Monitoring Plan to assess presence status and trends of Colorado Pikeminnow, Razorback Sucker and fish community (4.1.1.1).

6) Analyze and evaluate monitoring data and produce Annual Fish Monitoring Reports to ensure that the best sampling design and strategies are employed. (Task 4.1.1.2)

7) Provide detailed analysis of data collected to determine progress towards endangered species recovery in the San Juan River. (Task 5.1.1.3)

8) Identify principal river reaches and habitats used by various life stages of endangered fish. (Task 4.2.4.1)

9) Provide annual updates on the rate of opercular deformities found in Razorback Sucker. (Task 4.1.7.2)

10) Monitor TNC's restoration sites. (Task 4.3.2.1)

Study Area:

The study area encompasses the San Juan River between Shiprock, New Mexico (RM 147.9) and the Clay Hills Crossing boat landing (RM 2.9) just above Lake Powell in Utah (145.0 river miles). As in all post 1999 sampling efforts, the study will include making collections in reaches of the San Juan River under the jurisdiction of the National Park Service.

Methods:

Field Work:

Sampling for Colorado Pikeminnow and Razorback Sucker larvae will be conducted in the San Juan River between RM 147.9 and RM 2.9 from mid-April through early August using sampling techniques that will provide sufficient numbers of fish necessary to meet study objectives. Access to the river will

be gained through the use of inflatable rafts equipped with all of the necessary equipment and provisions needed for trips of up to seven days. A day and a half is added before and after each field survey for field preparation, gear maintenance, and clean up. The study area will be divided into an "upper" section (Shiprock, NM, to Sand Island, UT) and a "lower" section (Sand Island, UT, to Clay Hills crossing, UT). Separate field crews will launch simultaneously in each of the two sections and proceed through their designated study area. The vehicle and raft trailer used by the field crew working in the upper section will be left at the Shiprock launch site and subsequently be shuttled to the Sand Island BLM ranger station, UT. The vehicle shuttle (with trailer) for the upper reach sampling effort was typically performed gratis by personnel from the Farmington Office of the Bureau of Indian Affairs Office. Between 2008 and 2010, this service was performed by personnel from the N.M. Fishery Resources Office stationed in Farmington. Beginning in 2011, ASIR personnel shuttled vehicles for the upper end crew. At this time, there is no charge for this service.

The sampling crew for the lower reach will launch from, and store their vehicle and raft trailer at Sand Island, UT, where a commercial shuttle will take the vehicle to Clay Hills crossing, UT. The cost for this service is included under the travel and per diem section of our budget.

Because crews sampling the lower section of the study area will be in a high use recreational area, advance reservations are required. All trips for 2016 must be scheduled by late January 2016 and submitted to the Bureau of Land Management (BLM) Office at Monticello, Utah. Designated camping permits for our lower reach sampling crews will be obtained and must be strictly adhered to in addition to other BLM- San Juan River Recreation Area regulations (i.e., low impact and pack-out policies). Low flow conditions often prevalent during the study period make several sections of the river more difficult to navigate (especially in the lower reach). Our field crews are required to render assistance to boaters stuck in rapids or otherwise in distress and report all such encounters to the appropriate BLM personnel. Sampling efforts for larval fish will be concentrated in low velocity habitats and employ small mesh seines (1 m x 1 m x 0.8mm) to collect fish. Individual seine hauls will be preserved independently at each site. Habitat designations will also be recorded by seine haul. Retained specimens will be placed in Whirl-paks containing 95% ethanol and a tag inscribed with unique alphanumeric code that is also recorded on the field data sheet. For each sample site, the lengths (to 0.1 m) of each seine haul and total number of hauls will be measures and recorded. Capture densities for seine samples will be reported as the number of fish per 100 m^2.

Native species large enough to be positively identified will be measured (standard length) and returned to the river. Post-larval endangered fish species collected during this study will be photographed, a small portion of tissue from the fin clipped and retained in 95% ethanol (in the case of potential Razorback Sucker hybrids) and scanned with a FS2001 PIT tag reader for the presence of a PIT tag. Specimens of sufficient size but lacking a PIT tag will be injected with a tag following the protocols established by the program (Davis 2010). All PIT tag information will be recorded in the field data sheet and subsequently forwarded to the SJRBRIP for integration in the program's PIT tag database.

For each sampling locality, river mile will be determined to the nearest tenth of a mile using the SJRBRIP 2009 Standardized Map Set. Universal Transverse Mercator (UTM) coordinates and zone will be determined with a Garmin Navigation Geographic Positioning System Instrument for each sampling locality. Mesohabitat type, length, maximum and minimum depths, water clarity (determined with a Secchi disc), and substrata will be recorded for each sampling locality. A minimum of one digital photo will also be taken of each specific habitat sampled.

Field Work, Safety:

Personnel participating in field work are required to successfully complete an International Rescue Instructors Association (IRIA) level 2 swiftwater rescue class and American Red Cross CPR/AED training. Type III personal flotation devices (PFD's) will be worn by sampling personnel at all times while working. As PFD's lose flotation capacity due to UV exposure, compression of material, and oil and grit impregnation, and since each crewmember's PFD will be used for approximately 45 days per season, the PFD's will be annually replaced. Simms Guideweight Gore-Tex waders and boots will be issued to all personnel along with 3 mm neoprene gloves (necessary in April and May). In addition to personal camping gear and rain suits, all personnel will be required to provide and use wide brimmed hats, sunscreen, and sunglasses (provided at no cost to the program).

All rafts used for this project will carry an extensively stocked first aid kit replete with items necessary for most minor medical situation. Additionally, the first aid kit will contain a suite of items (i.e., splints, neck braces, butterfly stitches, snakebite kits) needed to address more serious medical conditions. Because ethanol is used in the preservation of specimens, several vials of eyewash solution will be incorporated into each first aid kit. First aid kits will be inventoried after each sampling trip and used and/or expired items replaced. In the upper reach of the study area, personal cell phones and PDA's will be used (at no cost to the program) to contact outside parties should a medical situation arise. In the lower study area reach (canyon bound; where cell phones do not have service) a Iridium 9505-satellite phone will be provided for sampling crews to be used in case of an emergency.

All preservation fluids will be transported in heavy-duty LPDE carboys. Extensive exposure to UV light makes the carboys susceptible to decomposition and cracking and requires that they be inspected monthly and not used for more than two years. Safety rope throw bags will be similarly inspected and retired from use accordingly. Rafts will be equipped with raft recovery (Z-line) kits, and repair kits, extra oars and oar blades, and two spare hand pumps to help ensure that crews do not become stranded due to raft damage. BLM regulations also mandate that an extra PDF be carried by all boaters.

Laboratory Work:

Samples will be returned to the lab immediately after each field trip is completed and processed following a multi-step procedure. To maintain the larval fish in good condition (necessary to ensure accurate identification) the samples must be transferred from whirl-packs to glass jars and the field fluids replaced with new 95% ethanol. Cyprinid and catostomid larvae are extremely small and transparent especially at early developmental stages. To minimize the potential loss of fish in individual seine hauls, it is best to retain the entire contents of each seine haul. A negative result of this technique is that, in addition to larval fish, whirl-pack samples usually contain considerable debris, detritus, and silt. Another important step in processing of individual samples is to separate fish from the detritus. This necessary portion of the process is labor intensive and can be quite tedious. During this process initial sorting of fish based on age class (age 0 [larvae] and age 1+) occurs. Samples that contain a large number of larval fish, especially proto or mesolarvae, often must be sorted twice to ensure all larvae are located within a sample.

After the fish are separated from the debris, personnel with San Juan River Basin larval fish identification expertise identify individual specimens to species. Stereomicroscopes equipped with transmitted light bases (light and dark field) and polarized filters (that enhance the delineation of myomeres, pterygiophores, and fin rays) are used to assist with the identifications. Larval fish keys are referenced to assist in species specific determinations (e.g., Contributions to a guide to the cypriniform fish larvae of the Upper Colorado River System [Snyder 1981], Catostomid fish larvae and early juveniles of the Upper

Colorado River basin, Morphological descriptions, comparisons, and computer interactive key [Snyder and Muth 2004], and Identifications of larval fishes of the Great Lakes Basin [Auer 1982]). Age-0 specimens are separated from age-1+ specimens using published literature on growth and development (Snyder 1981, Snyder and Muth 2004).

Age classes are enumerated, measured (minimum and maximum size [mm standard length] for each species at each site), and catalogued in the Division of Fishes of the Museum of Southwestern Biology (MSB) at the University of New Mexico (UNM). Both total length (TL) and standard length (SL) of Colorado Pikeminnow and Razorback Sucker are obtained using electronic calipers and stereomicroscope mounted micrometers. The ontogenetic stage of Colorado Pikeminnow and Razorback Sucker obtained in this study is determined based on the definitions provided by Snyder (1981).

Quality Assurance and Quality Control:

The qualifications of the investigators include extensive experience working on large data sets from multiple river systems over several decades. This experience has resulted in the implementation of numerous protocols that assure the quality of the finished data files. The field sampling crew has been kept constant, which ensures that the collection of the raw data is standardized between trips and that errors are minimized. Field notes and raw data sheets will be checked for any errors prior to being entered into spreadsheet data files. Any errors will be corrected by crossing out the original data and writing the correct data on the sheet in pencil (all corrections will include the initials of the person making them). All data will be entered into spreadsheet templates designed for the particular type of data being entered (i.e., site locality and physical conditions data, sample size and habitat data, fish species and age-class data). These template files are customized using drop-down lists to facilitate more efficient data entry while also assuring that the correct values are entered (i.e., eliminates typographical errors) within each field. After all data is imported into the main database, all data values will be checked. Data checking will include cross-referencing the field notes and raw data sheets with the values entered into the main database. Upon completion of the quality assurance and quality control steps listed above, the data will then be analyzed and tabulated. All the computed results will be examined and cross-checked with the original data files. Outlying values will be identified by using advanced sorting features on multiple data fields. Missing or incorrect data will be identified by using advanced sorting features and by running multiple queries written for this purpose. Checking the cross-tabulation of data will ensure that the sum of values is in agreement with the individual values (e.g., total number is equal to the sum of the total number of each age-class). Any corrections to the data will be made directly to individual tables within the main database.

Analysis:

Modeling ecological data with multiple zeros can be particularly effective when using mixture models (e.g., combining a binomial distribution with a lognormal distribution) to estimate occurrence and abundance separately (White, 1978; Welsh et al., 1996; Fletcher et al., 2005; Martin et al., 2005). Long-term Razorback Sucker (1999–2014) and Colorado Pikeminnow (2003–2014) sampling-site density data were analyzed using PROC NLMIXED (SAS, 2014), a numerical optimization procedure, by fitting a mixture model using the methods outlined in White (1978). Logistic regression was used to model the probability a site was occupied, and the lognormal model was used to model the distribution of abundance given that the site was occupied. Models provided four parameter estimates for each year (□ = probability of occurrence, □ = mean of the lognormal distribu□ = standard deviation of the lognormal distribution, and $E(x)$ = estimated density).

Additional samples (i.e. each seine haul preserved individually) were taken in 2013 and 2014 to increase the overall sample size and provide supplemental information on habitats (i.e., habitat type, habitat location, and cover type). Field sampling efforts occurred in nine habitat types (backwater [BW], cobble shoal [CS], eddy [ED], embayment [EM], pool [PO], pocketwater [PW], run [RU], sand shoal [SS], and slackwater [SW]). Additionally, four categories were assigned to habitat depending on where the sample was taken. Shoreline (SH) indicated all samples taken along the land-water interface, open-water (OP) indicated samples taken away from the shoreline, and mouth (MO) or terminus (TR) indicated samples taken from those locations within a backwater or embayment. Three categories were assigned to habitat depending on the type of cover encountered. Type 1 indicated the presence of inundated vegetation, type 2 indicated the presence of submerged woody debris, and type 3 indicated the presence of overhead cover (i.e., shade).

Habitat-specific density data (i.e., providing information on habitat type, habitat location, and cover type) have only been available since 2013. These data provide information on the specific habitat features used by Razorback Sucker and Colorado Pikeminnow. Habitat-specific density data were also analyzed using PROC NLMIXED (SAS, 2014), using the same methods outlined previously, to assess differences among models. A simplified list of five habitats (BW, EM, RU, LV [combining CS, PW, SS, and SW], and NZV [combining ED and PO]) was used for the purpose of statistical analysis since several habitats shared nearly identical low velocity (LV) or near zero velocity (NZV) conditions. General linear models were used to incorporate covariates to model nd, a . Covariates co specific density data were year, reach, habitat type, habitat location, and cover type. Random effects models were used with the joint binomial and lognormal likelihood to provide random errors for the Site*Year combinations. Bivariate normal errors with mean zero and covariance were assumed for each Site*Year combination. A random error was added to the logit of the binomial parameter , and a second random error was added to the log of the eter. Adaptive Gaussian quadrature as described in Pinheiro and Bates (1995) was used to integrate out these random effects in fitting the model using the SAS NLMIXED procedure. Goodness-of-fit statistics (logLike and AIC_C) were generated to assess the relative fit of data to various models.

The results in the annual report pertain almost exclusively to age-0 fish (i.e., age-1+ are not “larval fish” and are not the focus of this effort, they are not included in analysis). The only exception to this will be age-1+ augmented Colorado Pikeminnow. Capture data for all Colorado Pikeminnow is analyzed and trend data reported. The number of all other fish age-1+ collected during the study is presented in an Appendix.

Hatching dates of Razorback Sucker larvae are calculated by subtracting the average length of larvae at hatching (8.0 mm TL) from the total length at capture (for proto- and mesolarvae) divided by 0.3 mm (Bestgen et al. 2002), which was the average daily growth rate of wild larvae observed by Muth et al. (1998). Spawning dates for Razorback Sucker are then calculated once hatching dates have been established using the negative exponential equation $y=1440.3e^{-0.109x}$ (Bestgen et. al. 2011) where y is the temperature dependent incubation time (in hours), e is the base of the natural logarithm, and x is the mean daily temperature on the hatching date.

Hatching dates for larval Colorado Pikeminnow are calculated using the formula: $-76.7105+17.4949(L)-1.0555(L)^2+0.0221(L)^3$ for larvae <22 mm, where L=length (mm TL). For larvae 22-47 mm TL the formula A=-26.6421+2.7798L will be used.

Spawning dates for larval Colorado Pikeminnow are then estimated by adding five days to the post-hatch ages to account for incubation time at 20 – 22 ^{o}C (Nesler et al. 1988). Hatching and spawning dates for

both endangered species are then compared with the discharge and temperature data during that period within the study area.

This study is initiated prior to spring runoff and completed during mid-summer (late July or early August). Daily mean discharge during the study period is acquired from U.S. Geological Survey Gauge (# 09379500) near Bluff, Utah and Four Corners Bridge (#09371010). Water temperatures (mean, maximum, and minimum) are acquired from water temperature monitoring conducted by Miller Ecological Consultants, Inc. and data provided by the USGS gauging station at Mexican Hat, Utah (RM 53.3).

Reporting and Permitting:

Beginning in 2004, data from the two San Juan River larval fish surveys (Razorback Sucker and Colorado Pikeminnow) were analyzed collectively and presented in a single report. This created a whole picture of the reproductive activities of the entire ichthyofaunal community in the San Juan River using the same criterion used as the other monitoring programs. The report will be disseminated as outlined by the program office.

In addition to the annual report of the study provided to the SJRBRIP, reports summarizing fish collecting activities and specimens captured are also required annually under scientific collection permits provided by the New Mexico Department of Game and Fish, Navajo Nation, and state of Utah. The aforementioned reports include (at a minimum) site localities, GPS coordinates, and fish collected. An annual report of activities is a BLM (Monticello Field Office) requirement under our access permit to the San Juan River below San Island (Bluff UT) and designated camps in the lower reaches of the river. Annual Mussel-free permits will also be acquired by all trip leaders for use in Utah and Glen Canyon National Park.

Meetings:

Researchers are required to attend four meetings annually and report on annual monitoring projects. The two pre-set annual meetings (February and May) require researchers present PowerPoint presentations outlining the results and that years findings. Each meeting lasts about three days (which includes travel time).

Products:

A draft report of the 2016 larval Razorback Sucker and Colorado Pikeminnow sampling activities will be prepared and distributed to the San Juan River Basin Biology Committee for review by 31 March 2017. Upon receipt of written comments, that report will be finalized and disseminated to members of the San Juan River Basin Biology Committee by 30 June 2017. Electronic copies of the 2016 collection data will be transferred to the San Juan River database manager. Fish collected from this study will be curated in the Division of Fishes, Museum of Southwestern Biology (MSB), Department of Biology, at the University of New Mexico under a MSB contract with the SJRBRIP. Original field notes will be retained in the Division of Fishes and collection information electronically stored in a permanent MSB database program. These data and any maps generated from them will be available to the San Juan River Basin Biology Committee via hard-copy reports and electronically.

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2016 BUDGET: SAN JUAN RIVER LARVAL ENDANGERED FISH MONITORING
Based on five sampling trips per year

Personnel

Field Data Collection

Upper Reach (two staff, one raft) Shiprock to Sand Island - RM 148.0 - 76.0

Fisheries Biologist I (1 staff x 5 trips x 10 days x 8 hrs/day): .....$ 19,300

Fisheries Technician (1 staff x 5 trips x 10 days x 8 hrs/day): .....$ 12,092

Lower Reach (two staff, one raft) Sand Island to Clay Hills - RM 76.0 - 2.9

Fisheries Biologist I (1 staff x 5 trips x 10 days x 8 hrs/day): .....$ 19,300

Fisheries Technician (1 staff x 5 trips x 10 days x 8 hrs/day): .....$ 12,092

Lab Work

Upper and Lower Reach Samples Combined

Fisheries Biologist I (120 staff days/sampling year): .....$ 46,320
Tasks: Laboratory identification, developmental staging, specialized endangered fish processing, data entry, data query and review, database development

Fisheries Technician (120 staff days/sampling year): .....$ 29,021
Tasks**:** Post-trip sample processing, juvenile identification, post-identification – processing, measures, review of counts

Office Work (Report Development)

Fisheries Biologist I (70 staff days year): .....$ 27,020
Tasks: Data analysis, draft report preparation, post-review redraft and submission, development and submission of formal responses to reviewer comments, development of presentation of study for annual meetings, annual reporting related to state and tribal permitting of sampling activities

Project Oversight

Senior Fisheries Biologist (10 staff days year): .....$ 6,652
Tasks: Project coordination, project and data review, data management, report review

Personnel (Field, Lab, Office, Oversight): ..... Subtotal $ 171,797

SJRBRIP Meetings

Four meetings/year required; 2 days/meeting

Fisheries Biologist I (8 staff days/year): ..... $ 3,088

Senior Fisheries Biologist (8 staff days/year): ..... $ 5,322

Personnel (Meetings): ..... Subtotal $ 8,410

Personnel: ..... Total $ 180,207

Materials and Supplies

Safety dedicated first aid gear: ..... $ 1,750
Raft and rafting associated gear: ..... $ 1,416
Fish Sampling and associated electronic recording gear: ..... $ 1,234
Water quality measuring electronic meters: ..... $ 420

Materials and Supplies: ..... Total $ 4,820

Travel and Per Diem

Field Data Collection

Shiprock to Clay Hills (five trips) - RM 148.0 - 2.9 (Using two rafts & two crews)

Travel - 4 x 4 pickup truck and raft trailer (1380 miles x $ 0.575/mile x 5 trips): ..... $ 3,967
Per Diem - 10 field days per trip x 2 staff x 5 trips: ..... $ 4,500
Per Diem - 1 hotel day per trip x 2 staff (double occupancy) x 5 trips: ..... $ 950
Truck and Trailer Shuttle from Sand Island to Clay Hills x 5: ..... $ 1,750

Travel and Per Diem (Field): ..... Subtotal $ 11,167

SJRBRIP Meetings

Travel (one vehicle at 430 miles r.t. x 4 trips x $ 0.575/mile): ..... $ 989
Per Diem (3 per diem days/meeting x 4 meetings x 2 staff): ..... $ 2,280

Travel and Per Diem (Meetings): ..... Subtotal $ 3,269

Travel and Per Diem: ..... Total $ 14,436

2016 Project Totals

Personnel:	**Total**	**$ 180,207**
Materials and Supplies:	**Total**	**$ 4,820**
Project Subtotal Subject to Indirect Costs:		**$ 185,027**
Indirect Costs (13%)		**$ 24,053**
New Mexico Gross receipts Tax:		**$ 12,951**
Travel and Per Diem	**Total**	**$ 14,436**
2016 Scope of Work:	**GRAND TOTAL**	**$ 236,467**

Projected Out-year funding (Adjusted by 3% annually)

FY 2017	**$243,561**
FY 2018	**$250,867**
FY 2019	**$258,393**

San Juan River Specimen Curation, Upper Colorado River Basin Larval Fish Collections, and SJRIP Data Integration and Synthesis by the Museum of Southwestern Biology

Fiscal Year 2016 Scope of Work

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Award R13SS40013
1 October 2015 to 30 September 2016

Background

Collections Curation and Data Archives -- Personnel with the Division of Fishes, Museum of Southwestern Biology (MSB), at the University of New Mexico (UNM) are responsible for the curation of collections of fishes taken by principle investigators with the San Juan River Basin Recovery Implementation Program (SJRIP). Since 1991, the MSB Division of Fishes has been the permanent repository for large numbers of voucher specimens and associated data collected by SJRIP researchers. The numbers of specimen processed each year have fluctuated depending on the availability of these collections after the field season. For example, larval and juvenile San Juan River fishes (approximately 200,000) collected in the early 1990's by the Utah Division of Wildlife Resources were not completely processed by MSB staff until 2001. Specimens of San Juan River fishes, taken by the New Mexico Department of Game and Fish during the 1991-99 secondary channel surveys, were not received by the MSB until 2007and are still being incorporated into the MSB collections. Other factors such as annual variability of sampling conditions and changes in sampling techniques has affected numbers of specimens processed by MSB staff. For example, between 2001 and 2002 drift net sampling for larval Colorado pikeminnow and razorback sucker was eliminated in favor of larval seine sampling. Given the variability in number of fishes to process, the San Juan River Biology Committee has recommended that the annual budget for the San Juan River specimen curation and larval fish identification reflect an "average" year of sample processing. The SJRIP Biology Committee recognizes that some years would require more effort from MSB staff than budgeted, while other years might not require the same high level of activity. A relatively stable budget would allow for uninterrupted processing of new collections and yet be sufficient to cover the ongoing work of processing backlogged SJRIP collections due to circumstances previously discussed.

To date, 42,718 lots or 1,676,650 fish specimens have been collected (1987-2015) by the San Juan River research group and these specimens have been processed, cataloged, and archived at

the Museum of Southwestern Biology, Division of Fishes. A total of 19,413 San Juan River collection sites have been georeferenced and can be mapped in ArcView. Approximately, 18,514 pages of field notes (locality data) and data sheets have been captured in the MSB database. A total of 24,587 pages of original San Juan River field notes and data sheets have been digitally captured, cleaned, and saved in both tiff and pdf formats for the electronic archives; the original field notes and data sheets are permanently stored in acid-free document boxes for long-term conservation.

Incoming specimen collections are removed from WhirlPaks®, cleaned of debris, placed in known concentrations of fixative (either 5% buffered formalin, 10 % buffered formalin, or 95% ethanol), and organized on the accession shelves by MSB staff. Collections are later sorted and identified by the principal SJRIP investigators. Specimen collections are assigned an accession number (tracking number) and all associated documentation, like permits and field notes, are filed under that same number. Processing collections of fish specimens (adults and larvae) requires fluid transfers from formalin fixative to ethanol preservative (typically), sending out specimens for species verification as required, counting the number of individuals in each collection, recording the standard lengths for the largest and smallest specimen in each collection, entering all locality and specimen data into an electronic catalog, digital capture of field notes and data sheets, and labeling and filing vials and jars of cataloged San Juan River specimens into the permanent MSB collections. The basic principles for accessioning specimens of fishes in the MSB are standard for most museums of natural history (e.g., Smithsonian Institution, Carnegie Museum, and University of Michigan Museum of Zoology). Species identifications and locality/collection data are verified as necessary prior to incorporation into the MSB catalog. This step is very important for the SJRIP researchers so that any misleading information is not incorporated into subsequent reports on San Juan River fish species, particularly for the larval Colorado pikeminnow (*Ptychocheilus lucius*) and razorback sucker (*Xyrauchen texanus*) studies. For purposes of permitting, the MSB provides with field and species data in museum report format. This information includes species identification, catalog number (MSB number), number of specimens and size range per lot.

Upper Colorado River Basin Larval Fish Collections and Identifications—One graduate student RA will be dedicated to the collections, identifications, and integration of larval fishes taken from the Upper Colorado River Basin. This effort will help to understand the wider distribution of native fishes in order to support the San Juan River Restoration Implementation Program and associated collections. See note in budget summary.

Data Integration and Synthesis—Since its inception in 1992, the San Juan River Basin Recovery Implementation Program (Program) has been instrumental in managing and restoring native fish populations in the San Juan River Basin. During this time, numerous studies have been implemented with the collective goal of characterizing biotic and abiotic components of the environment that are thought to influence endangered fish populations. Information from these studies has been used to identify and implement appropriate management strategies. Most of these long-term projects focused on relationships between habitats and flow, flow mimicry and native/nonnative fish population dynamics, nonnative fish removal, native-nonnative fish interactions, and augmentation of endangered fish populations. While data collected from these projects have helped navigate management decisions over the course of the Program, most data

analyses are limited to individual projects. Limited effort has been directed toward integrating and synthesizing information across studies (e.g., larval, small-bodied, and adult fish datasets). Data accumulated over the past two decades are considerable and are a valuable and an indispensable source of information for determining future management options and opportunities. Consequently, making this information accessible and usable is essential for assessing the current status of native and endangered fish populations, informing and guiding management actions, and evaluating the Program's progress toward achieving recovery and minimizing limiting factors as required by the Program Section 7 Principles.

The U.S. Fish and Wildlife Service's Program Office is the clearinghouse for all Program data. The Program Office is responsible for compiling, integrating, and synthesizing all monitoring data, as necessary, to meet its obligations defined in the Program Document and Long Range Plan. In 2010, the Program Office proposed adding a senior Recovery Science Biologist to the Program Office to better accomplish data integration and synthesis to assess progress toward recovery and facilitate adaptive management decision-making. The Coordination Committee approved the proposal but for various reasons, the Service has been unable to hire another staff member and does not anticipate this will occur anytime soon. Existing Program Office staff has taken on some of this work but the need for additional data integration and synthesis still exists. Additionally, the information developed will help inform important relationships for integration into the San Juan Population Model being developed by the Southern Ute Indian Tribe and Miller Ecological Consultants for Programs use.

Nathan R Franssen, Ph.D. was hired (2012) as postdoctoral research associate to synthesize, analyze, and integrate relevant elements of this immense database in conjunction with the Program Office biologist. The work requires strong quantitative, writing, and research skills that address the questions without other time commitments or demands. Products/results from the research are presented to the Program's Biology and Coordination Committees, as well as interested public, and submitted to scientific journals for peer review and publication. The research associate collaborates closely with those responsible for directing relevant studies (e.g., adult monitoring, nonnative fish removal, and native fish reproduction) and key researchers associated with the Program to identify critical questions for integration and analysis (especially early in the process). Collaboration will continue with appropriate project leaders and researchers in analyzing data and drafting manuscripts detailing results of investigations. The overarching goal of these efforts will be to provide a data-driven and scientifically sound approach to making recommendations regarding flow management, recovery criteria for endangered species, and measurements of Program success.

Nathan Franssen has subsequently left this post doc position and has taken a permanent job with the Program Office. Therefore, a new person will be needed to fill Nathan's vacancy in FY16. The PI's mentioned above as well as staff in the Program Office are currently looking for new candidates to fill this position. Nonetheless, the new hire will work with the Program Office's staff to accomplish the proposed projects below.

Study Area

The object of this project is to process specimens of fishes collected for the San Juan River Recovery Implementation Program (San Juan River and Upper Colorado River Basin), capture

all field information into an electronic catalog, and incorporate the SJRIP collections into a phylogenetic system in the permanent museum archives. All of these activities take place in the Division of Fishes, Museum of Southwestern Biology, on the University of New Mexico campus in Albuquerque NM. The work and collaboration to synthesize, analyze, and integrate relevant elements of this large database takes place at the University of New Mexico, the USFWS SJRRIP Program Office in Albuquerque, and researchers meetings held in the Four Corners area, Colorado or New Mexico.

The MSB Division of Fishes has three offices with a total of six computer workstations for data entry, data management, and data analysis; a fully equipped laboratory for preparation of fish specimens, and approximately 1,858 linear meters of compacted shelving for storage of cataloged collections. On average, five UNM students and staff (three undergraduate, one graduate student, and part-time staff curatorial assistant) process and curate SJRRIP collections. One postdoctoral research associate is responsible for SJRRIP data synthesis and integration, meeting the research goals of the SJRRIP Program.

Curation and Collections Care Objectives

1. Provide a secure and organized permanent repository for San Juan River fish collections, field notes, and associated data thereby facilitating access to these resources by SJRIP researchers.
2. Insure that all SJRIP species identifications and associated data are verified and correctly represented in the MSB electronic catalog; report discrepancies to SJRIP principal investigators.
3. Georeference collection sites for SJRIP collections; maintain license for ArcView and make collection data available to SJRIP researchers in that format.

Curation and Collections Care Methods

Tasks to be completed under this project are processing and curation of fish specimens and all data from the San Juan River Basin Recovery Implementation Program synthesized and integrated in the form of reports to the Committee and peer review publications. Specimen collections are deposited with the MSB Division of Fishes by SJRIP principal investigators.

Upon receipt of newly collected San Juan River specimens, MSB staff transfer these collections from formalin fixative into stages of 35%, 50%, and 70% concentrations of ethanol. Exceptions to this protocol are made per request of PI, as in the case of using 95% ethanol for genetic or otolith studies. Fish specimens are removed from field containers and cleaned (debris removed) and placed into museum quality jars during the fluid transfers. Principle investigators sort, identify, count and measure each lot (discrete collection) once the collections are transferred to ethanol. MSB staff catalog, label, and file the specimens once the principle investigators have completed their work. SJRIP collections are organized in the permanent archives by drainage (San Juan River) and taxa. These archives are in a room that is controlled for temperature (18° Celsius) and light (complete darkness to low light levels). All data associated with the specimens are entered and organized in the electronic MSB Division of Fishes database (MS Access 2010) and georeferenced (GeoLocate Ver. 3). All original field notes and data sheets are

digitally captured and archived in acid-free document boxes for permanent storage.

Data Integration Tasks and Objectives

The research associate will conduct data analyses and syntheses in an office provided by the University of New Mexico, Museum of Southwestern Biology. They will work with researchers in the Program Office, USFWS Albuquerque NM to compile and analyze SJRRIP data.

The following is a list of suggested investigations by the PI's during the initial meeting (Fall 2012) and potential projects outlined since 2012 that have been the focus of data integration. It is likely that discussions with key Program personnel, the Biology and Coordination Committees, and researchers will identify additional studies or alterations to those suggested here. Some of these suggested investigations have been completed or near completion and their progress to date has been noted. In FY(16), completed projects (manuscripts) will be disseminated to the Biology and Coordination Committees upon submission for peer-reviewed publication.

1) What are the effects of nonnative fish removal on native and nonnative fishes in the San Juan River?

Results of this project were presented to the Biology Committee on February 21, 2013 and to the Coordination Committee on May 8, 2013 and subsequently published:

Franssen, N.R., J.E. Davis, D.W. Ryden, and K.B. Gido. 2014. Fish community responses to mechanical removal of nonnative fishes in a large southwestern river. *Fisheries* 39:352–363.

2) What factors are driving the spatial distribution of Colorado pikeminnow in the San Juan River and can these factors help elucidate biotic interactions that may be limiting recruitment success?

Results of this project were presented to the Biology Committee on February 21, 2013 and the Biology Committee and subsequently published:

Franssen, N.R. and S.L. Durst. 2013. Prey and nonnative fish predict the distribution of Colorado pikeminnow (*Ptychocheilus lucius*) in a south-western river in North America. *Ecology of Freshwater Fish* 23:395–404.

3) What are the growth and movement patterns of Colorado pikeminnow in the San Juan River and how are these linked to environmental variation (e.g., habitat, temperature)?

Results of this project were presented to the Biology Committee on February 21, 2013 and to the Coordination Committee on May 8, 2013 and was subsequently published:

Durst, S.L. and N.R. Franssen. 2014. Movement and growth of juvenile Colorado Pikeminnows in the San Juan River, Colorado, New Mexico, and Utah. *Transactions of the American Fisheries Society* 143:519–527.

4) How has flow manipulation, nonnative fish removal, and endangered fish augmentation influenced the fish community of the San Juan River?

This study was divided into two separate investigations, the first focused on large-bodied fishes while the second assessed small-bodied fishes.

The first study quantified spatial and temporal variation in the large-bodied fishes in the San Juan River between 1994 and 2012. Results of this project were presented to the Biology and Coordination Committees May, 2014 and was subsequently published:

Franssen, N.R., S.L. Durst, K.B. Gido, D.W. Ryden, V. Lamarra, and D.L. Propst. 2014. Long-term dynamics of large-bodied fishes assessed from spatially intensive monitoring of a managed desert river. *River Research and Applications*. doi: 10.1002/rra.2855

The second project assessed spatial variation in small-bodied fishes and specifically quantified habitat use of fishes in secondary channels was also investigated in FY(14). Results of this study were presented to the Biology and Coordination Committees in May, 2014 and was subsequently published:

Franssen, N.R., E.I. Gilbert and D.L. Propst. 2015. Effects of longitudinal and lateral stream channel complexity on native and non-native fishes in an invaded desert stream. *Freshwater Biology* 60:16–30.

5) Quantify Razorback sucker stocking and population estimates to assess future stocking needs.

Results of survival and detectability of Razorback sucker were presented to the Biology Committee February 19, 2015 and to the Coordination Committee May, 2015. This project was submitted to the Biology and Coordination Committees before submission for peer review. The paper was rejected from Transactions of the American Fisheries Society and is currently being revised for resubmission.

Franssen, N.R. and S.L. Durst. Survival and movement of stocked Razorback Suckers (*Xyrauchen texanus*) in the San Juan River, NM and UT.

6) How has annual variation in the San Juan River's flow regime altered densities of native and nonnative fishes?

This project is ongoing, but results were presented to the Biology Committee February 19, 2015 and the Coordination Committee May, 2015. After further investigation into the small-bodied data set, it was apparent substantial portions of data were incorrect or missing. These data inconsistencies need to be rectified prior to completing analyses. Researchers in the Program Office and at the New Mexico Department of Game and Fish are working on rectifying these data errors.

7) Characterize movement and reproductive strategy of Channel catfish.

Extensive efforts have been underway to reduce the density of Channel Catfish through mechanical remove with limited success. We propose to quantify the spatial distribution, movement patterns, and reproductive strategy of Channel Catfish in order to aid nonnative fish removal management actions. This should be completed in FY(15).

8) What are the environmental drivers of spawning and recruitment success of Channel Catfish?

This project is ongoing. Substantial progress was not made due to the limited amount of length at age data on Channel Catfish in the San Juan River. We plan to obtain better estimates of lengths at age and proceed with a population model assessing age structured responses to removal.

9) How do environmental factors (e.g., annual flow regime, population densities) affect condition of native and nonnative fishes?

Identifying environmental factors that drive variation in condition of fishes will aid in understanding relationships between flow management and biological responses. We propose to use the extensive Length-Weight data collected from large-bodied monitoring to construct condition indices of native and nonnative fishes. We will then be able to assess how spatial and temporal variation in fish condition is linked to local habitat conditions as well as annual variation in flow regimes.

Projects (7) should be completed in FY(15) while projects (8) and (9) should be completed in FY(16). Project (6) could be returned to in FY(16) provided data problems are rectified.

Products

SJRIP and Upper Colorado River Basin fishes and associated data will be curated in the Division of Fishes, Museum of Southwestern Biology (MSB), at the University of New Mexico. Collection sites will be georeferenced and available in ArcView format. Original field notes will be digitized and archived by the MSB Division of Fishes and collection data electronically stored in a permanent MSB database program. Species verifications and corrections and digital copies (PDF) of their field notes will be made available to SJRIP principle investigators. A draft report of the 2014 San Juan River, upper Colorado River Basin specimen curation, larval fish sampling and identification, and data integration activities will be prepared and distributed by 31 March 2015 to the San Juan River Biology Committee for review. Upon receipt of written comments, that report will be finalized and disseminated to members of the San Juan River Biology Committee by 1 June 2015.

Manuscripts, suitable for peer reviewed publication, will be prepared in collaboration with appropriate Program personnel, the Biology Committee, and researchers for each commonly agreed upon investigation. A minimum of two manuscripts will be prepared in FY(16).

REFERENCES

Bentley, A.C. 2004. Thermal transfer printers-applications in wet collections. Society for the Preservation of Natural History Collections Newsletter Vol. 18 (2):1-17

Cato, P. S. 2001. Best practices-what does that imply? Society for the Preservation of Natural History Collection Newsletter Vol. 15 (1):1-11 http://www.spnhc.org/media/assets/cato_BP.pdf

Chapman, A. D. 2005. Principles of Data Quality, Version 1.0. Report for the Global Biodiversity Information Facility, Copenhagen.

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Fink, W.L., K.E. Hartel, W.G. Saul, E.M. Koon, and E.O. Wiley. 1979. A Report on Current Supplies and Practices Used in Curation of Ichthyological Collections. American Society of Ichthyologists and Herpetologists, Ichthyological Collection Committee.

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2008. Scientific Collections: Mission-Critical Infrastructure for Federal Science Agencies. A Report of the Interagency Working Group on Scientific Collections (IWGSC) ISBN 978-0-9819500-0-6 http://www.whitehouse.gov/sites/default/files/sci-collections-report-2009-rev2.pdf

Budget Fiscal Year 2016 1 October 2015 to 30 September 2016

BUDGET ITEM DESCRIPTION	COMPUTATION		RECIPIENT FUNDING	OTHER FUNDING	RECLAMATION FUNDING	TOTAL COST
	$/Unit and Unit	Quantity				
SALARIES AND WAGES --Position title x hourly wage/salary x est. hours for assisted activity. Describe this information for each position.						
UNM Professional Staff	$13.00/HR	1582 HRS			$20,573.00	$20,573.00
UNM Student Assistants(2)	$12.00/HR	780 HRS			$9,360.00	$9,360.00
UNM Post-Doctoral Associate	$20.81/HR	2080 HRS			$43,286.00	$43,286.00
UNM Graduate Student RA	$9.64/HR	2080 HRS			$20,056.00	$20,056.00
UNM Faculty Summer Salary	$60.30/HR	161 HRS			$9,690.00	$9,690.00
FRINGE BENEFITS – Explain the type of fringe benefits and how applied to various categories of personnel.						
UNM Staff and Faculty	35.60%	1 EA			$7,324.00	$7,324.00
UNM Undergraduate	1%	2 EA			$94.00	$94.00
UNM Post-Doctoral	26.30%	1 EA			$11,385.00	$11,385.00
UNM Graduate Student	1%	1 EA			$201.00	$201.00
UNM Summer Faculty	22.0%	1 EA			$2,132.00	$2,132.00
TRAVEL—dates; location of travel; method of travel x estimated cost; who will travel						
Researcher & 3 others SJRRIP Meetings	$1,500/traveler	4 EA/YR			$6,000.00	$6,000.00
EQUIPMENT—Leased Equipment use rate + hourly wage/salary x est. hours for assisted activity—Describe equipment to be purchased, unit price, # ofunits for all equipment to be purchased or leased for assisted activity: Do not list contractor supplied equipment here.						
SUPPLIES/MATERIALS--Describe all major types of supplies/materials, unit price, # of units, etc., to be used on this assisted activity.						
Chemical Preservatives	$236.00	12 MOS			$2,830.00	$2,830.00
CONTRACTUAL/ CONSTRUCTION—Explain any contracts or sub-Agreements that will be awarded, why needed. Explain contractor qualifications and how the contractor will be selected.						
OTHER –List any other cost elements necessary for your project; such as extra reporting, or contingencies in a construction contract.						
UNM Graduate Student Tuition	$640.00	12 MOS			$7,679.00	$7,679.00
UNM Graduate Student Health	$134.00	12 MOS			$1,605.00	$1,605.00
TOTAL DIRECT COSTS--					$142,215.00	$142,215.00
INDIRECT COSTS – **17.5%**						
					$23,544.00	$23,544.00
TOTAL POJECT/ACTIVITY COSTS FY16					**$165,759.00**	**$165,759.00**

FY 2016 Budget Summary

2016 Grand Total Curation of SJRRIP Specimen Collections $47,312

2016 Grand Total Data Synthesis and Integration for SJRRIP Program $89,005

2016 Grand Total Graduate Student GA $29,541

Note: $29,541 has been added to the budget for a Graduate Student Assistantship (salary, tuition and health insurance) to expand the data base for SJRRIP. This amount is charged to another source of funding (USBR) and not the SJRRIP. The duties of this GA are to sort and identify larval fishes collected from the Colorado River, Grand Canyon in order to understand fish species distributions in the Upper Colorado River Basin.

FY 2016 Scope of Work to Bureau of Reclamation:

San Juan River Waterfall Endangered Fish Monitoring and Translocation Fiscal Year 2016 Project Proposal and Estimated Budget for 2016-2020

Principal Investigator: Brian Hines
Prepared by: Katie Creighton and Brian Hines
Utah Division of Wildlife Resources, Moab Field Station
1165 S. Hwy 191- Suite 4, Moab, Utah 84532
(435) 259-3782, (435) 259-3780
bhines@utah.gov, katherinecreighton@utah.gov

BOR Cooperative Agreement #

UDWR Moab Field Station: R13AC40007

Navajo Nation: R11AP40089

Reporting Dates: 10/1/2015 through 9/30/2016

San Juan River Waterfall Endangered Fish Monitoring and Translocation

Fiscal Year 2016 Project Proposal and Estimated Budget for 2016-2020

Principal Investigator: Brian Hines
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1165 S. Hwy 191- Suite 4, Moab, Utah 84532
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bhines@utah.gov, katherinecreighton@utah.gov

Background:

The lower San Juan River is particularly important in the recovery of the Colorado pikeminnow (*Ptychocheilus lucius*) and razorback sucker (*Xyrauchen texanus*) since it contains nursery habitat similar to what is present on the Green and Colorado rivers. Within the past eight years, collections of endangered fishes have been increasing in this section of river. The largest collection of Colorado pikeminnow larvae in 2014 was from Reach 1 (RM10.8) (Farrington et al. 2015) and the largest single collection of razorback sucker larvae in 2015 came from Reach 1 (Farrington et al. 2015). Additionally, there are congregations of spawning adult razorback sucker between RM 18 and 19 (Brian Hines per obs.). In spring of 2006 and 2015, another congregation of adult razorback suckers and possible spawning area was located at river mile 23.4.

In 2003, a new waterfall was created from a shifting river channel at RM 0.5 and has prevented fish from moving from Lake Powell into the river. This would typically be a good thing because it keeps the numerous nonnative fish in Lake Powell from entering the river, but unfortunately it also blocks the native fishes' upstream movements. For instance, Colorado pikeminnow and razorback suckers have been collected during sampling efforts below the waterfall indicating loss of stocked and naturally spawned endangered fish over the waterfall. Most recently, in the spring of 2015, crews sampled below the waterfall on several occasions and encountered numerous endangered fishes. One trip captured four untagged razorback immediately below the waterfall via castnets (Chris Cheek, unpublished data). A second trip deployed submersible and floating PIT tag antennae and detected 338 individual fish, which included 319 razorback sucker, one bonytail, one Colorado pikeminnow, and 19 unidentified tags (Cathcart et al., unpublished data).

The spawning and presence of larval endangered fishes in the lower San Juan River coupled with an impassible waterfall is likely leading to a sink rather than a source for recruitment. Determining endangered fishes abundance below the waterfall would illustrate what is actually being "lost" from the system. And by performing translocations of endangered fishes from below to above the waterfall those "lost" individuals would now have the opportunity to seek out adequate habitat for spawning in the river system.

This work plan proposes the investigation of monitoring and translocation of endangered fishes in the San Juan River below the waterfall in accordance with the Long Range Plan (Element 2, Task 2.3.1.7).

Description of Study Area:

The study area for this project includes the San Juan River immediately downstream of the waterfall near Paiute Farms (RM 0.5).

Objectives

1. Monitor abundance of endangered fishes below the waterfall (three trips).

2. Translocation of all endangered fishes captured below the waterfall to the San Juan River at Mexican Hat (RM 52.8).

Methods/Approach:

Monitoring and collection of endangered fishes for translocation will occur immediately downstream of the Paiute Farms waterfall (RM 0.5) during three separate events in March and April. Initial sampling will rely on submersible PIT tag antennas to indicate seasonal congregation of endangered fish, specifically razorback suckers. Submersible PIT antennas will also be used to increase resights and evaluate abundance and movement of tagged fish in the area.

Endangered fish will be captured using electrofishing boats, trammel nets, seine nets, hoop nets and/or fyke nets and will be identified, enumerated, measured to the nearest millimeter (mm) for total and standard length, weighed to the nearest gram and scanned for a PIT tag. If a PIT tag is not present, one will be inserted. General condition of the fish will be recorded in addition to any parasites or abnormalities. These fish will then be moved via stocking truck to an upstream river location (Mexican Hat, RM 52.8) where they will be returned to the mainstem of the San Juan River.

Nonnative fish collected will be identified and enumerated but not netted or measured unless time allows.

General water quality parameters (temperature, conductivity, secchi depth, and dissolved oxygen) will be recorded at both the capture site (RM 0.5) and translocation site (RM 52.8).

Costs for other cooperating agencies that may provide personnel and equipment as needed are included in this budget.

Products/Schedule:

A draft report for the San Juan River Waterfall Endangered Fish Monitoring and Translocation project will be prepared and distributed to the San Juan River Biology Committee for review by 31 March 2017 for 2016 field work completed. Upon receipt of written comments, that report will be finalized and forwarded to members of the San Juan River Biology Committee 1 June 2017. Electronic copies of the field and collection data will be transferred to the San Juan River database manager following the successful protocol previously employed.

Literature Cited:

Farrington, M. A., R. K. Dudley, J. L. Kennedy, S. P. Platania, G. C. White. 2015. Colorado pikeminnow and razorback sucker larval fish survey in the San Juan River during 2014. Draft report to the San Juan River Basin Recovery Implementation Program. U.S. Fish and Wildlife Service, Albuquerque NM.

San Juan River Waterfall Endangered Fish Monitoring and Translocation
Fiscal Year 2016 -2020 Project Budget
BOR Cooperative Agreement with UDWR: R13AC40007

Principal Investigator: Brian Hines
Prepared by: Katie Creighton and Brian Hines
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FY 2016 Costs for UDWR- Moab

San Juan Waterfall Monitoring and Translocation

Labor: salary + benefits + applicable overtime (personnel services)

	Rate	Hours	Cost
Project Leader	$33.71	100	$3,371
Biologist	$30.76	380	$11,689
Technician	$16.77	180	$3,019
		subtotal	**$18,078**

Food and Transport (current expense)

	Rate	Quantity	Cost
Fleet Costs (2 trucks for 3% of total fleet costs)	$40,800.00	0.030	$1,224
Food (5 people, 4 days, 3 trips)	$30.00	60	$1,800
		subtotal	**$3,024**

Equipment (current expense)

	Rate	Quantity	Cost
Camping gear repair/replacement:			$1,000
Sampling gear repair/replacement:			$2,500
Boating gear repair/replacement:			$1,500
Fuel for motors/generators	$4.00	45	$180
		subtotal	**$5,180**

Total Expenses	**$26,282**
Administrative Overhead (17% on all personnel services)	**$3,073**
UDWR-Moab Total	**$29,355**

Funding for Participating Agencies:

Navajo Nation	**$4,251**

Grand Total FY 2016	**$33,606**

[a] The State of Utah motorpool vehicles cost approximately $6,800/year/vehicle (includes fleet rental, mileage, and gas), which is based on the average annual cost for all trucks used in our program.

[b] Includes, but is not limited to, tents, sleeping pads, toilet system, cookware, stoves, propane, charcoal, satellite phone and service, drybags, coolers, first aid supplies.

[c] Includes, but is not limited to dip nets, tags, tagging equipment, electrofishing units, electrofishing wiring, anodes, cathodes, generators, nets, data loggers, etc…

[d] Includes, but is not limited to, raft repair/replacement, oars, oar hardware, raft frame repair, dry boxes, motor repair, straps, etc…

[b,c,d] Estimated costs are based on actual costs from previous years plus an estimated 3% cost of living increase each year following.

Under the heading "Funding for Participating Agencies." Estimated costs for participation of the Navajo Nation Department of Fish and Wildlife in FY 2016. BOR Cooperative Agreement Number with Navajo Nation: R11AP40089

Navajo Nation Budget for Assisting UTDNR Razorback Sucker Translocation at San Juan River Waterfall

Personnel/Labor Costs (Salary + Benefits)	
Fish Biologist – 9 days @ $163.54/day (1 person x 3 days x 3 trips)	$ 1471.86
Sub-Total	$1471.86
Fringe Benefits X 42.48%	$ 625.24
Total Personnel/Labor	**$ 2,097.11**
Travel (Vehicle shuttling)	
Vehicle Lease/Maintenance & Gasoline $15.13/day X 9 days = $136.17 + 3 x 360 miles X .30/mile=$324 (360 miles round trip from Fruitland, NM to Waterfall x 3 trips)	$ 460.17
Total Travel/Per Diem	**$ 460.17**
Sub-total with 3% added for inflation	$ 473.97
Equipment	
Equipment Maintenance, Repair, & Replacement (e.g. Oxygen tanks, oxygen, regulators, aerators, agitators, gauges, trailer maintenance, trailer tires, dip nets, etc.)	$ 1,000
Total Equipment	**$ 1,000**
Sub-total with 3% added for inflation	$ 1,030
Navajo Nation Fish and Wildlife Total	**$3,601.13**
Navajo Fish and Wildlife Administrative Overhead (18.05%)	**$649.99**
Navajo Nation Total	**$4,251.07**

San Juan River Population Model runs.
Fiscal Year 2016 Project Proposal

Principle Investigator: Bill Miller
Miller Ecological Consultants
2111 S. College Ave., Unit D, Fort Collins, CO 80525

and

Principle Investigator: Vince Lamarra
Ecosystems Research Institute Research Institute
975 South State Highway, Logan, UT 84321

Background:
A modeling effort to construct a conceptual framework for the fish community and endangered fishes in the San Juan River began in 1998. This effort relates to Goal 4.3 of the Long Range Plan. These models have helped direct a focused field effort with the intent of using key site specific data to determine the carrying capacity of Colorado pikeminnow and razorback sucker in the river. A mechanistic population model has been constructed from the original conceptual model.

The San Juan River population model includes bioenergetics, population, and trophic components. Data for fish populations by age class and habitats as well as other trophic components are required as model parameters. The population model was demonstrated to the Biology Committee, Researchers and Peer Review Panel in May 2007. The model was updated in 2011 through 2013 with funding from the Southern Ute Indian Tribe to Stella Version 9 software. The model update is complete and capable of use for making model runs.

The Coordination Committee requested a Scope of Work for additional model runs that could not be completed during Biology Committee meetings. The FY2016 SOW program is to make model runs that can not be made during the normal Biology Committee meetings.

Objective:
Make model additional model runs as requested through the Program Office and approved by the Coordination Committee that incorporate the information from the monitoring data to evaluate SJRIP Program actions.

Methods:
Model simulations will be made to evaluate the change in population dynamics as a result of Program management actions or other activities that may affect recovery of Colorado pikeminnow and razorback sucker. Model simulations will be conducted for a maximum of 10 different simulations.

Schedule:
Model runs will be made as requested and after approval by the Coordination Committee on an as needed basis for FY2016.

Products:
A brief report will be prepared that documents the model runs. Summary tables of model simulations will be produced for each model run.

Budget FY-2016:
All funding for FY 2016 activities are requested from the recovery program. Total funding requested is shown in the following table.

Population Model Runs	Miller		ERI		total cost
	Staff days	**Cost**	**Staff days**	**Cost**	
Labor	8	$6,840	2	$2,560	$9,400
Travel		$-		$-	$-
Supplies (software updates etc)		$-			$-
Total cost		$6,840		$2,560	$9,400

Habitat and Water Temperature Monitoring 2016

1.0 INTRODUCTION

In 2011 the San Juan Recovery and Implementation Program (SJRIP) developed water temperature and habitat monitoring protocols. During the period of time that habitat and temperatures have been collected in the San Juan River, the river has experienced a wide variety of flows. Habitat monitoring started in the San Juan River in 1991 and 1992 with work being conducted by the BOR. That mapping, which only looked at total wetted area and backwaters, was taken directly from videography without any field inspections. In the fall of 1992, Ecosystems Research Institute (ERI) started mapping the San Juan River using the current river wide mapping methodologies and habitat types. Between 1992 and 2007, base flow river wide habitat has been mapped by ERI 22 times. In the last four years, habitat in the San Juan Rive has been mapped using the protocols described in this 2016 work plan.

Habitat Monitoring

In 1998, flow recommendations were developed by the SJRIP for the San Juan River below the confluence with the Animas River (River Mile 180). Flow recommendation details were heavily based upon river channel and habitat response to flows determined from a 7-year research study of channel morphology and habitat. In 1999, long-term monitoring was established to monitor channel and habitat response to flows. The protocols were continuations of those established during the 7-year research period and continued through 2004.

During the data integration process of 2004–2005, it became evident that backwater habitat types during base flow periods (800-1200 cfs) had reduced in number and surface area since September 1995. Backwater surface areas between RM 180 to 2 decreased from 140,000 m^2 in September 1995 to less than 20,000 m^2 by October 2003. From 2005 to 2007, backwater surface areas stabilized at approximately 40,000 m^2. In the last four years backwater habitat has increased to over 53,600 m^2.

The data integration analysis in 2005 also indicated that complex channel reaches (those with high habitat diversity, islands, multi-threaded channels and complex channel margins) correlate to native fish abundance. Furthermore, capture of young-of-year (YOY) endangered fish also tends to be correlated with channel complexity. Finally, backwater and low velocity habitats are more likely to occur in reaches with high complexity. As a result, two detailed reaches were identified for long-term monitoring in the San Juan River during the summer of 2006 through 2010. The goal of this study was to better understand the mechanism or process for creation and maintenance of these complex reaches and to understand the processes resulting in the loss or creation of backwater habitat important for the rare and native fishes in the San Juan River.

To the extent possible, habitat monitoring is closely coordinated and integrated with fish community monitoring to allow assessment of changing habitat availability and fish use in response to management actions and population recovery. Standardized habitat monitoring for the San Juan River was included in the 2000 monitoring plan and was reviewed and revised for the 2011 version. The plan is designed to monitor and evaluate habitat changes through time. The data and information from habitat monitoring will be integrated with different monitoring activities to assess the effectiveness of management actions, such as flow management, fish population estimates, and nonnative fish population abundances. A focused habitat monitoring workshop was conducted in 2011 which evaluated, refined, and refocused the habitat monitoring program on the San Juan River to insure the program implements methodologies that are conducive to answering outstanding questions and provide the data necessary to evaluate and revise the SJRIP's flow recommendations. This work plan incorporates several of the workshop recommendations

Water Temperature Monitoring

Water temperatures have been recorded in the San Juan River at 15 different locations for various periods of record. Using the 1999-2003 integration studies, the Biology Committee (BC) decided to collect temperatures at eight locations to be used for long-term monitoring. The BC decided that temperatures should be recorded every 15 minutes, with a daily maximum, minimum and average calculated. These data are now being collected by the USGS at approved upon locations.

PROJECT JUSTIFICATION

The SJRIP has, as one of its two primary goals, the conservation of populations of Colorado pikeminnow and razorback sucker in the San Juan River basin. To aid in the evaluation of achievement of these program goals, the following monitoring plan goals were developed (San Juan Draft Monitoring Protocols, 2010):

1) Track the status and trends of endangered and other fish populations in the San Juan River;
2) Track changes in abiotic parameters, including water quality, channel morphology, and habitat, important to the fish community in particular and the aquatic community in general;
3) Utilize data collected under Goals 1 and 2 to help assess progress towards recovery of endangered fish species; and,
4) Assess effectiveness of management actions, implemented flows, and intra- and inter-annual variability in flows on recovery of Colorado pikeminnow, razorback sucker and population status of other fish species.

Relative to this proposal, SJRIP goal (2) above will be met in part. Specifically, achievement of this goal will occur through the tracking of species important backwaters (numbers and areas), as well as channel complexity necessary for all life stages of the two rare fish in the San Juan River. Updating the existing database and comparing the current information will provide a status and trends.

PROJECT OBJECTIVES

The specific objectives of this Proposal correspond to the overall objectives of the draft monitoring protocols (2010) as well as several recommendations of the program work shop held in 2011. Specifically the direct linkage of objectives between this work plan and protocol objectives (by number) that are in common include:

Objective 1) Annually, following spring runoff, document abundance and distribution of key habitats and geomorphic features (backwaters, embayments, islands and total wetted area) that indicate the response of the river channel and habitat to antecedent runoff conditions and specific management actions.

Objective 2) Maintain continuous water temperature recorders at key locations from Navajo Dam to Mexican Hat, Utah to examine the influence of artificial manipulation of water releases from Navajo Dam on water temperature.

Objective 4) Periodically map river-wide habitat abundance and distribution in the San Juan River from the Animas River confluence (RM 180) to Clay Hills Crossing (RM 2) to track long-term trends in habitat (Done in 2014)

Objective 8) Develop relationships between habitat availability and antecedent flow conditions. Use key habitats for this analysis.

Objective 9) Track long-term trends of habitat availability …

STUDY DESIGN

There are three major tasks included in the proposed monitoring program. They include:

Task 1) Annual Habitat Mapping using geo-referenced video imagery for Islands, Backwaters and embayments

Task 2) Field Habitat verifications of secondary channels

Task 3) Water Temperature Monitoring

Each of the above tasks are described in detail in the following sections and cover methods, data analysis, schedule and deliverables.

Tasks 1 and 2. Annual Habitat Mapping and Field Verification - General Methods

1) Using the habitat categories: backwaters, embayments, islands, and total wetted area, map aquatic habitat at a scale of 1" = 200', using geo-referenced video imagery provided to the contractor by the program,
2) Examine the relationships between hydrology (especially recent antecedent hydrology conditions) and habitat conditions throughout the river, especially backwater habitats and island complexity.
3) Field verify the conditions of secondary channels at the remote mapping flow levels

Specific Methods for Annual Habitat Mapping

Digital videography of the San Juan River from the Animas River confluence (RM 180) downstream to below Clay Hills Crossing (RM 0) will be acquired from Reclamation at a flow of from 500 to 1,000 cfs in late July to early September each year. Digital single frames will be captured from this videography to provide full coverage of the river with about 20% overlap. The digital images will be rectified to the most recent digital orthographic quads (DOQs) prior to photo-interpretation and will be archived to DVD. Photo-interpretation will be completed to identify backwaters, embayments, islands, and total wetted area annually for RM 0 to RM 180. Once the digital frames have been registered, ArcGIS will be used to digitize the boundaries of the wetted channel, backwaters, embayments and islands. The data will be processed and summarized by river-mile to match existing datasets. In 2012, using video mapping, it was difficult to determine if smaller secondary channels were flowing. In 2015, field verification will determine secondary channel conditions at the mapping flow

Data Analysis

Data analysis is the same whether photo-interpreted or field mapped, except that the number of habitats analyzed will be different. Trend analysis will be performed on all habitat types mapped to assess trend with time and flow at mapping. Trends with time will be analyzed with raw data (habitat count and area by river-mile with time) and with data normalized for flow at mapping.

Schedule

Base photography will be acquired in late July to early September 2015 (flow permitting). Image capture, and photo-interpretation will be completed by February 2016 The draft annual report will be completed by March 31, 2016 with the final report due June 1, 2016.

Deliverables

Annual tasks

1) Digital video image captures of channel and flood plane at a flow between 500 and 1,000 cfs.
2) Polygon area, perimeter and geo-referenced location of backwaters, embayments, islands, and channel margins
3) Flow at mapping (flight date) for each USGS gauge
4) Distribution and abundance (area and density) of backwaters, embayments and total wetted area in response to antecedent runoff conditions and other management actions. Channel complexity (e.g. island count and total wetted area per river mile
5) Date of mapping
6) Antecedent runoff hydrograph
7) Data summarized by river mile, geomorphic reach and full range

Introduction to Temperature Monitoring

Miller Ecological Consultants, Inc (MEC) has monitored water temperature in the San Juan River and selected tributaries since fall of 2011. During that time MEC has made several recommendations to modify the water temperature data collection. These recommendations include adding a water temperature data logger in the San Juan River upstream of the confluence with the Animas River and cease collecting water temperature data at the base of Navajo Dam. These recommendations were made to better meet the current objectives of the Long Range Plan. The added location upstream of the Animas River provided a more detailed analysis or the water temperature changes between Navajo Dam and the Animas River. The recommendation to remove the logger at Navajo Dam was based on several factors; 1) this location was originally chosen when the tailwater fishery was part of the San Juan Seven Year Research Program, the tailwater is no longer included in the San Juan annual work plans, 2) coordination with the dam tenders adds another factor to logistics for the location, and 3) the logger at Archuleta provides an upstream water temperature that is very close to the release from Navajo Dam.

The data reporting for FY2012 resulted in several other recommendations. These were:

- Transfer the water temperature monitoring to USGS real time monitoring at the following gages:
    - San Juan at Archuleta, San Juan at Farmington, Animas at Farmington, and San Juan at Four Corners.

  The USGS has a continuous monitor at Mexican Hat (USGS gage at Bluff). Transferring the data collection to USGS would provide a means to continue long term monitoring without some of the difficulties associated with separate loggers. It would provide real time retrieval for use by any researcher rather than end of year reporting. Further, the data would be archived in USGS permanent records and would simplify data base administration for the San Juan Program.

- Discontinue water temperature monitoring on ungaged tributaries to the San Juan River, such as McElmo Creek.

  The San Juan Program has no direct management of any of the tributary flows. The flows and resulting water temperatures are outside the control of the Program and therefore the Program does not have a means to directly change water temperature (e.g. through modified flow regimes). In addition, the remote PIT tag readers have the capability to monitor water temperature data.

- Continue the annual summary of water temperature data for inclusion in the annual meeting discussions and annual report.

– Conduct an analysis of water temperatures and the number, timing, and size of larval fishes in the San Juan River for the years 1998 through 2012, and, if practicable, for the years 1992 – 1997.

The following sections describe the tasks for the continued water temperature monitoring tasks

Task 3) Water Temperature Monitoring

The water temperature monitoring in the San Juan River and the Animas River at Farmington, New Mexico is now being collected by the USGS. The locations are as follows: San Juan River at Archuleta, NM; San Juan River at Farmington, NM; San Juan River at Four Corners, NM; San Juan River at Bluff (Mexican Hat), UT; and the Animas River at Farmington, NM. All locations except the Animas River at Farmington are real-time reporting stations at the USGS gage location. The Animas River at Farmington will be real-time reporting later in 2014.

Data Base and analysis

At the end of each water year, data for the water year will be compiled and the daily average temperatures plotted along with the daily hydrograph of the San Juan River at Four Corners, New Mexico. A summary report will be prepared that will include presentation of the daily average temperature data with a discussion of data collection procedures, data quality and repair requirements during the season. Anomalous data, if any, will also be discussed.

There will be an additional analysis in FY2054 that reviews the historical water temperature data base, USGS gage records and larval monitoring reports. This analysis will evaluate the data to determine if any patterns showing larval response in growth, number or timing of larval presence are apparent from the data set.

Proposed Methods

Data Collection

The data collection will be completed by USGS according to their standard protocols. Water temperature data for each location will be downloaded from the USGS web site and compiled for analysis.

Data Storage

The records will be maintained in a Microsoft Access database. The main data table will store the 15-minute data and will be constructed as shown in Table 3. Data tables summarizing daily maximum, minimum and average temperatures will be generated for each of the sites by query of the main data table and stored in the database in the format shown in Table 4. Table 5 shows the information stored to describe each session, including geo-spatial data to allow importation into a geographic Information System.

Data Analysis and Reporting

After the fall download, data for the water year will be compiled and the daily average temperatures plotted along with the daily hydrograph of the San Juan River at Four Corners, New Mexico. A summary report will be prepared that will include presentation of the daily average temperature data with a discussion of data collection procedures, data quality and repair requirements during the season. Anomalous data, if any, will also be discussed.

In addition to the data reporting, a retrospective analysis will be conducted on the existing water temperature data sets and larval fish data. The water temperature data for all years available will be evaluated in conjunction with the timing, size and number of larvae captured in the larval fish study. The objective of the analysis would be to determine if the data shows a linkage between the water temperature regime and the timing, size and number of larvae. These analyses would be used in evaluation of the review of flow recommendations and potential impacts from the water temperature depression on native fish larvae.

Deliverables

The water temperature monitoring will be conducted by USGS as per the FY2015 report recommendations. The tasks for FY2016 are analysis and evaluation of existing data. This analysis, while useful for integration with review of the flow recommendations, could be conducted in FY2016 with the initial work on the flow recommendation review.

The tasks for FY 2016 are:

Daily mean flow at each USGS gage

- Retrospective review of water temperature data for year data is available.
- Comparisions of larval capture rates, sizes and timing of capture with water temperatures.
- Report summarizing the analysis and submitted by March 31st of each year
- A final report submitted by June 1 of each year
- October 1, 2015 – September 30, 2016 data set from USGS gages for Recovery Program files
- An updated temperature database with all data collected to date, updated through September 2016.
- Attendance at the annual report meeting and one additional Biology Committee meeting

Table 2. Water temperature monitoring locations

Location	RM
Archuleta - San Juan at USGS Gage Location	218.6
Farmington - San Juan at USGS Gage Location	180.1
Four Corners - San Juan at USGS Gage Location	119.4
Mexican Hat - San Juan at Bluff Gage Location	52.1
Farmington - Animas at USGS Gage Location	n/a

Table 3. Temperature database main table format

Temp			
ID	**RecDate**	**RecTime**	**DegC**
4C	7/9/1999	4:04:27 PM	23.48
4C	7/9/1999	4:49:27 PM	23.74

Table 4. Daily temperature summary table format

AnimasFarminton				
ID	**RecDate**	**Tmax**	**Tmin**	**Tavg**
AF	7/8/1999	22.11	18.36	19.2
AF	7/11/1999	20.13	15.81	17.9

Table 5. Temperature station description database table

StationID					
ID	**Location**	**Notes**	**Lat**	**Lon**	**Datum**
4C	Four Corners	Located at the Four Corners USGS gage	37.00195	-109.0311	NAD83
AF	Animas at Farmington	Located an the Animas at Farmington USGS gage	36.72154	-108.2017	NAD83
AR	Archuleta	Located at the Archuleta USGS gage	36.80278	-107.699	NAD83
FM	Farmington	Located at the Farmington USGS gage	36.72221	-108.2251	NAD83
MH	Mexican Hat	Located right bank near the USGS mini-monitor enclosure upstream of Mex Hat bridge	37.15059	-109.8669	NAD83

2016 Budget

TASK	Labor	Direct Costs	Total by Task
Task 1 & 2 Annual Habitat Mapping			
Videography Clipping	$2,534.00		$2,534.00
Image rectification	$48,840.00		$48,840.00
Digitizing Mapped River	$11,141.00		$11,141.00
Back Water/ Embayment Identification	$3,016.00		$3,016.00
Data Analysis	$4,034.35		$4,034.35
Reporting	$5,070.45	$185.64	$5,256.09
Meetings	$650.00	$774.18	$1,424.18
Task 3 Water Temperature Monitoring			
Logger Deployment			$0.00
Quarterly monitoring	$1,623.60		$1,623.60
Data analysis	$10,882.60		$10,882.60
Draft report	$2,382.40	$30.64	$2,413.04
Final report	$595.60		$595.60
Meetings	$1,300.00		$1,300.00
Final report data delivery	$399.28		$399.28
Total Cost Estimate	**$92,469.28**	**$990.46**	**$93,459.74**

DETERMINING THE NATAL ORIGIN OF SAN JUAN RIVER RAZORBACK SUCKER THROUGH ISOTOPIC SIGNATURES AND ELEMENTAL ANALYSIS OF FIN RAYS
FISCAL YEAR 2016 PROJECT PROPOSAL

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Introduction:

Razorback Sucker, *Xyrauchen texanus,* was listed as endangered under the Endangered Species Act in 1991. Due to low numbers and natural recruitment to spawning age (Minckley 1983, Bestgen et al. 2002), population supplementation is provided by hatcheries. Hatcheries that produce Razorback Suckers and supplement wild populations in the San Juan River are Southwestern Native Aquatic Resources and Recovery Center (SNARRC), Uvalde National Fish Hatchery (NFH), and Ouray NFH-Grand Valley Unit (GVU). As of 2014, Razorback Sucker from Uvalde National Fish Hatchery were no longer raised for stocking into the San Juan River. To more effectively manage this endangered species, it is necessary to differentiate between wild spawned versus hatchery stock Razorback Sucker in the San Juan River. Wild fish are individuals naturally spawned in the San Juan River and hatchery fish are specimens propagated in a hatchery.

While it is easy to determine natal origin of fish with passive integrated transponder (PIT) tags, it is not always possible to ascertain if fish captured without PIT tags are actually wild fish as tags may have been lost or specimens not tagged. If fish captured without tags are considered wild, wild fish numbers may be inflated and may not accurately represent natal origin composition in the San Juan River. The inability to differentiate between wild and hatchery fish (i.e., determine natal origin) can hinder progress in recovery of the species (Barnett-Johnson et al. 2007). The percent of non-PIT tagged Razorback Sucker captured in the San Juan River has fluctuated between 38% in 2006 and 6.7% in 2014. Of the 1,256 sub-adult and adult Razorback Sucker collected in the San Juan River in 2014, 90 were not PIT tagged (Table 1).

Otolith microchemical analysis can be used to determine natal origins of fish, but this technique requires euthanizing specimens. Alternatively, fin ray microchemistry offers a non-lethal method to determine natal origins of fish. Fin rays are calcified structures that can be collected without sacrificing fish. Like otoliths, fin rays accrete isotopic and elemental materials that are linked with environmental conditions and can be used to ascertain natal origin and other details of their life history. The results of our 2014 study examining isotopic signatures and elemental analysis showed that, in the San Juan River, fin ray microchemistry is better correlated than otolith microchemistry with that of the environment.

In 2014, in the San Juan River, we completed creation of a Razorback Sucker fin ray and otolith microchemistry library, and used a combination of isotopic ($^{87}Sr/^{86}Sr$) and elemental (Sr/Ca, Ba/Ca) microchemistry to successfully categorize Razorback Sucker to their hatchery of origin (SNARRC, Uvalde NFH, Ouray NFH-GVU) or the San Juan River. This validity of the technique was determined by generating fin ray based “blind classifications” of PIT tagged Razorback Sucker with known natal origins. In addition to assigning Razorback Sucker to hatchery of origins, we were also able to confirmation the collection of a wild spawned Razorback Sucker.

Table 1. Number of sub-adult and adult razorback sucker collected per year and the number of specimens lacking PIT tags.

Adult Razorback Sucker Collected					
Sample Year	**# without PIT tags**	**# with PIT tags (Stocked only)**	**Total Collected**	**Percent without PIT tags**	**# Larval Razorback Sucker collected**
2004	34	381	415	8.2	41
2005	34	307	341	10.0	19
2005	213	338	551	38.7	202
2007	357	708	1,065	33.5	200
2008	184	382	566	32.5	126
2009	184	440	624	29.5	272
2010	164	873	1,037	15.8	1,251
2011	254	1,379	1,633	15.6	1,065
2012	318	1797	2115	14.4	1778
2013	134	1616	1750	7.1	979
2014	90	1256	1346	6.7	612

San Juan River Project Objectives:

1. Use previously developed microchemistry dataset to differentiate between wild spawned and hatchery reared Razorback Sucker.
2. Use previously developed microchemistry dataset to determine natal origin of hatchery reared Razorback Sucker.
3. Report results, accuracy of statistical model, and all pertinent findings.

San Juan River Arm of Lake Powell Project Objectives:

1. Develop a robust dataset of isotopic and elemental measurements from hatchery specimens of Razorback Sucker and water samples from Lake Powell (and it's tributaries).
2. Use isotopic and elemental concentration data generated from LA-ICP-MS to determine feasibility of discriminating natal origin of Lake Powell collected Razorback Sucker through statistical modeling.
3. Test discriminating power of the isotopic and elemental dataset developed under Objectives 1 and 2 for accuracy by using known natal origin fin rays (PIT tagged) from Razorback Sucker collected in the Lake Powell that are not included in the hatchery dataset.
4. Report results, accuracy of statistical model, and all pertinent findings.

Study Area:

The study area is the San Juan River and San Juan River Arm of Lake Powell.

Methods:

Field — Fin rays will be removed from study specimens using antiseptic techniques. Field crews will be provided a water-proof fin ray sampling kit containing sampling instructions, special fin ray clippers, water-proof pens and pencils, isopropyl wipes, and pre-labeled sample envelopes. The fin-ray clippers will be used to remove a 10-15 mm portion of the second fin ray from the right pectoral fin. After the fin ray is removed from an individual fish, it will be placed in a pre-labeled # 1 coin envelope (2.25 inches x 3.5 inches). The species, date of collection, PIT tag number, length (standard and total), weight, and location (river mile) of the captured individual will be recorded on each envelope. The fin ray clippers will be cleaned with an isopropyl wipe each time fin rays have been removed from a specimen.

Laboratory processing of fin rays – After removal and return to the laboratory, fin rays will be sonicated in Milli-Q water for and subsequently embedded in epoxy resin and cut transversely using an Isomet low-speed saw with diamond wafering blades to expose annuli. Fin rays will be mounted on microscope slides using Krazy glue, sonicated in Milli-Q water for five minutes, and air-dried for 24 hours. Sample slides will be placed in clean plastic petri dishes and taken to the Woods Hole Oceanographic Institution Plasma Mass Spectrometry Facility, Woods Hole, Massachusetts, for microchemical analysis.

Laboratory – (Woods Hole Oceanographic Institution) – For the San Juan Arm of Lake Powell, water samples will be analyzed using inductively coupled plasma mass spectrometry for strontium isotopes (isotopic analysis) and elemental concentrations of barium, calcium, magnesium, manganese, and strontium to determine if microchemical signatures of sources (hatcheries or wild) differ enough from each other to be detectable in our fin ray samples. This process was completed for microchemistry work in the San Juan River in 2014; however, due to the many possible sources of fish in the San Juan Arm of Lake Powell (Table 2), these analyses will be needed for any Lake Powell work.

Fin rays will be analyzed at WHOI via laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS) for strontium isotopes (isotopic analysis) and elemental concentrations of barium, calcium, and strontium. Fin rays obtained from hatcheries will serve as reference and create a reference data set of measurements for known origin fish. Fin rays from non-tagged Razorback Suckers will be compared to the data set of known origin fish to determine natal origin.

Precision and accuracy of sample analyses are determined by periodic analysis of reagent blanks and Canadian (FEBS-1; National Research Council [Canada] Institute for National Measurement Standards; Sturgeon et al. 2005) and Japanese certified otolith reference materials (NIES-022; Japan National Institute for Environmental Studies fish otolith; Yoshinaga et al. 2000). These materials are not only analyzed at the beginning and end of the daily session but are also introduced to the mass spectrometer (analyzed) after every fifth fin ray has been sampled. Analysis of the blanks and standards is the same as performed on the fin rays (i.e., same five elements and same 10 isotopes per element). As these samples are a liquid, they are not ablated but instead transported into the analytic chamber via argon gas and analyzed at approximately one-second intervals for about one-minute. These data are used to determine and correct (if necessary) the "drift" in the mass spectrometer during the daily session so that adjustments can be made to the elemental values of the individual fin rays.

Analysis:

Data Analysis — Because of the complicated nature of the data generated, we were strongly advised to have an expert in analytical chemistry review our data before attempting analyses and interpretation. ASIR will hire an expert to perform this review of the data prior to and after analyses to ensure that our interpretations are sound. Data analysis will include importing all data into a useable format for analysis using statistical software. Elemental concentration readings for each fin ray will be examined for analytical suitability. Adequate fin rays are those with readings above the limit of detection (LOD) for each element. The LOD for each element will be determined after blanks are run for each element. Following data manipulation, to establish natal origin signature from concentrations, a predictive model will be created and tested for classification accuracy. For the San Juan River, fin rays will be categorized to site of propagation and rearing by comparing fin ray microchemistry against the microchemistry dataset produced in 2014 (Table 2). For San Juan River Arm of Lake Powell, a data set (or library) of known natal origin fish fin rays will be created to determine if fish fin rays from unknown origin fish can be correctly classified to their site of propagation and rearing (specific hatchery or wild). Lists of sources that will need to be analyzed to complete the microchemistry dataset for the San Juan Arm of Lake Powell are included in Table 2.

Table 2. Status of microchemical dataset (isotope and elemental data) for the San Juan River[1] portion of the study and for the expansion of the proposed study to include Lake Powell[2].

Natal Origin/Source		
Hatcheries	**Isotopic Analysis**	**Elemental Analysis**

SNARRC [1]	Completed	Completed
Uvalde NFH [1]	Completed	**Incomplete**
Ouray NFH-GVU [1]	Completed	Completed
Ouray NFH [2]	**Needed**	**Needed**
Lentic and Lotic Systems	**Isotopic Analysis**	**Elemental Analysis**
San Juan River [1]	Completed	Completed
NAPI Ponds [1]	Completed	Completed
Colorado River [2]	**Needed**	**Needed**
Green River [2]	**Needed**	**Needed**
Yampa River [2]	**Needed**	**Needed**
Escalante River [2]	**Needed**	**Needed**
Lake Powell – San Juan River Arm [2]	**Needed**	**Needed**
Lake Powell – Colorado River Arm [2]	**Needed**	**Needed**

Products:

A draft report will be presented to the San Juan River Basin Biology Committee for review by 31 March 2017. Upon receipt of written comments, that report will be finalized and disseminated to members of the San Juan River Basin Biology Committee by 30 June 2017. Electronic copies of the data will be transferred to the San Juan River database manager. Fish fin rays collected from this study will be curated in the Division of Fishes, Museum of Southwestern Biology (MSB), Department of Biology, at the University of New Mexico under a MSB contract with the SJRBRIP.

Meetings:

Researchers are required to attend a minimum of two meetings annually and report on annual monitoring projects. The two meetings (February and May) require researchers present PowerPoint presentations outlining the results and that years findings. Each meeting lasts about three days (which includes travel time). No additional costs will be required for the presentation of this material as it will be incorporated into the San Juan River larval fish monitoring presentation.

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Project Title: Determining the natal origin of SAN JUAN RIVER Razorback Sucker through microchemical signatures of fin rays

Proposed budget based on fin ray samples from 200 fish and isotopic/elemental analysis performed on one fin ray per fish

Personnel			
FIELD WORK			
MATERIAL GATHERED UNDER CURRENT SOW'S			
Adult Monitoring	no charge	$	0
Non-native Removal	no charge	$	0
PNM Fish Ladder	no charge	$	0
FIN RAY PREPARATION (200 fish, 200 fin rays)			
Fisheries Technician	5 staff days	$	1,366
TASKS: *Class 100 clean room processing of fin rays: selection, examination, sonification, preparation, mounting, and accounting of sample materials*			
WHOI ANALYTICAL RUNS (200 fish, 200 fin rays)			
Fisheries Technician	10 staff days	$	2,733
10 staff days per trip x 1 trip (1 staff; includes travel &12 hr days)			
TASKS: *Perform analytical runs of fin rays*			
Fisheries Biologist I	10 staff days	$	4,442
10 staff days per trip x 1 trip (1 staff; includes travel &12 hr days)			
TASKS: *Perform analytical runs of fin rays*			
OFFICE WORK (ANALYSIS OF DATA & REPORT PRODUCTION)			
Fisheries Biologist I	20 staff days	$	8,883
Office effort – 20 staff days			
TASKS: *Post-ablation data processing (photography, review, lengths), data analysis, draft report preparation, review redraft and submission, development of presentation of study for annual meetings*			
	Personnel: Total	**$**	**16,058**
Materials and Supplies			
Fin Ray Preparation (Class 100 cleaning facility)			

Slides and mounting media		$ 100
Washing/cleaning (sonicator, hydrogen peroxide, HCl, etc.)		$ 200
Non-metallic (ceramic) cleaning and mounting tools		$ 100
Isomet 5" saw blade (11-4254)		$ 154
Buehler EpoThin^2 Resin and Hardener (48 oz)		$ 200
		$
	Fin Ray Preparation: Subtotal	$ 754

Analysis at WHOI (published rates) for two five-day trips		
Element 2 argon plasma mass spectrometer (daily user fee) x 2	$ 1,435/day	$ 2,870
Neptune isotope plasma mass spectrometer (daily user fee) x 2	$ 1,700/day	$ 3,400
193 nm LASER (daily user fee) x 4	$ 125/day	$ 500
"Night" argon daily user fee (for long analytical sessions) x 4	$ 125/day	$ 500
	Mass Spectroscopy: Subtotal	$ 7,270
	Materials and Supplies: Total	$ **8,024**

Travel and Per Diem		
Elemental Analysis at WHOI		
Off-season rates (15 November - 15 April)		
Travel - (airlines; Albuquerque, NM to Providence, RI)	$ 700/r.t.	$ 1,400
Round-trip (r.t.) tickets x 2 staff x 1 trip		
Travel - (car rental and fuel)	$ 90/day	$ 450
Five days per trip x 1 trip		
Per Diem - (food and expenses)	$ 50/day	$ 500
Five days per trip x 2 staff x 1 trip		
Hotel - (Falmouth/Cape Cod)	$ 100/night	$ 1,000
Five days per trip x 2 staff x 1 trip		
	Travel and Per Diem (WHOI): Total	$ **3,350**

Personnel Total	$	**16,058**
Materials and Supplies Total	$	**8,024**
Travel and Per Diem Total	$	**3,350**

Project Subtotal	$	**27,432**
IDC (20%)	$	**5,486**
2016 Estimated Costs: GRAND TOTAL	$	**32,918**

Project Title: Determining the natal origin of LAKE POWELL Razorback Sucker through microchemical signatures of fin rays

Proposed budget based on fin ray samples from 500 fish and isotopic/elemental analysis performed on one fin ray per fish

Personnel			
FIELD WORK			
MATERIAL GATHERED UNDER CURRENT SOW'S			
Lake Powell Project		no charge	$ 0
FIN RAY PREPARATION (500 fish, 500 fin rays)			
Fisheries Technician		10 staff days	$ 2,733
TASKS: *Class 100 clean room processing of fin rays: selection, examination, sonification, preparation, mounting, and accounting of sample materials*			
WHOI ANALYTICAL RUNS (500 fish, 500 fin rays)			
Fisheries Technician		20 staff days	$ 5,466
10 staff days per trip x 2 trips (1 staff; includes travel &12 hr days)			
TASKS: *Perform analytical runs of fin rays*			
Fisheries Biologist I		20 staff days	$ 8,883
10 staff days per trip x 2 trips (1 staff; includes travel &12 hr days)			
TASKS: *Perform analytical runs of fin rays*			
OFFICE WORK (ANALYSIS OF DATA & REPORT PRODUCTION)			
Fisheries Biologist I		30 staff days	$ 13,325
Office effort – 30 staff days			
TASKS: *Post-ablation data processing (photography, review, lengths), data analysis, draft report preparation, review redraft and submission, development of presentation of study for annual meetings*			
	Personnel: Total		**$ 27,674**
Materials and Supplies			

Fin Ray Preparation (Class 100 cleaning facility)			
Slides and mounting media		$	100
Washing/cleaning (sonicator, hydrogen peroxide, HCl, etc.)		$	200
Non-metallic (ceramic) cleaning and mounting tools		$	In SJR budget
Isomet 5" saw blade (11-4254)		$	In SJR budget
Buehler EpoThin^{2} Resin and Hardener (48 oz)		$	200
		$	
	Fin Ray Preparation: Subtotal	$	500

Analysis at WHOI (published rates) for two five-day trips			
Element 2 argon plasma mass spectrometer (daily user fee) x 5	$ 1,435/day	$	7,175
Neptune isotope plasma mass spectrometer (daily user fee) x 5	$ 1,700/day	$	8,500
193 nm LASER (daily user fee) x 10	$ 125/day	$	1,250
"Night" argon daily user fee (for long analytical sessions) x 10	$ 125/day	$	1,250
Isotopic Analysis of Lake Powell water samples (x 8)	$ 250/each	$	2,000
	Mass Spectroscopy: Subtotal	$	20,175
	Materials and Supplies: Total	$	**20,675**

Travel and Per Diem			
Elemental Analysis at WHOI			
Off-season rates (15 November - 15 April)			
Travel - (airlines; Albuquerque, NM to Providence, RI)	$ 700/r.t.	$	2,800
Round-trip (r.t.) tickets x 2 staff x 2 trips			
Travel - (car rental and fuel)	$ 90/day	$	900
Five days per trip x 2 trips			
Per Diem - (food and expenses)	$ 50/day	$	1,000
Five days per trip x 2 staff x 2 trips			
Hotel - (Falmouth/Cape Cod)	$ 100/night	$	2,000
Five days per trip x 2 staff x 2 trips			
	Travel and Per Diem (WHOI): Total	$	**6,700**

Personnel Total	$	**27,674**
Materials and Supplies Total	$	**20,675**
Travel and Per Diem Total	$	**6,700**

Project Subtotal	$	**55,049**
IDC (20%)	$	**11,010**
2016 Estimated Costs: GRAND TOTAL	$	**66,059**

San Juan River Phase II Channel Restoration Site Monitoring
Fiscal Year 2016 Project Proposal

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INTRODUCTION

Since the 1930s, the San Juan River's channel has become narrower, deeper and less complex; expansive sand bars and open portions of the floodplain have become vegetated by nonnative Russian olive and saltcedar, and stream banks have become densely armored by nonnative vegetation (Bliesner and Lamarra 2006). In addition, many of the secondary channels that historically supported backwaters and other low-velocity habitats are now disconnected from the main channel (perched above the river's primary channel) and are choked with nonnative vegetation (Stamp et al. 2006). As a result of these changes, there has been a greater than 50% loss of backwaters and secondary channel habitats between 1998 and 2005 (Miller 2006). Large floods that create and maintain these habitats are virtually nonexistent in the system and flow recommendations implemented since 2000 have not been successful in opening up secondary channels or in maintaining backwaters due to the extensive bank armoring by nonnative vegetation; this armoring reduces the capacity of high flows to scour sediments from secondary channels and reconnect them to main channel (Miller 2006; Michels-Boyce 2013). Backwaters and secondary channels are critical to the survival of young of the year and juvenile native fish, including Colorado pikeminnow and razorback sucker (Propst and Hobbes 1999; Archer et al. 2000). Retention studies after stocking of Colorado pikeminnow and razorback sucker showed that secondary channels are important habitats for stocked endangered fish, especially during the initial months after stocking (Golden and Holden 2005).

In 2009, The Nature Conservancy (TNC) received funds from the New Mexico Environment Department through their River Ecosystem Restoration Initiative to implement a large-scale

restoration experiment—restoring channel complexity at six sites using a variety of methods including: 1) re-establishing the secondary channel inlet (connection with the river) and cleaning out (excavating) the secondary channel; and 2) mechanical clearing and chemical treatment of Russian olive and saltcedar along the secondary channel banks.

The initial channel restoration project, which was completed in the fall of 2012, was monitored using existing resources from the Small Bodied Fish, Larval Fish, and Habitat Monitoring programs. In early 2013, TNC received additional funds for a Phase II restoration effort and in August, a complex site, located between RM 134 and 137, was selected (Figure 1).

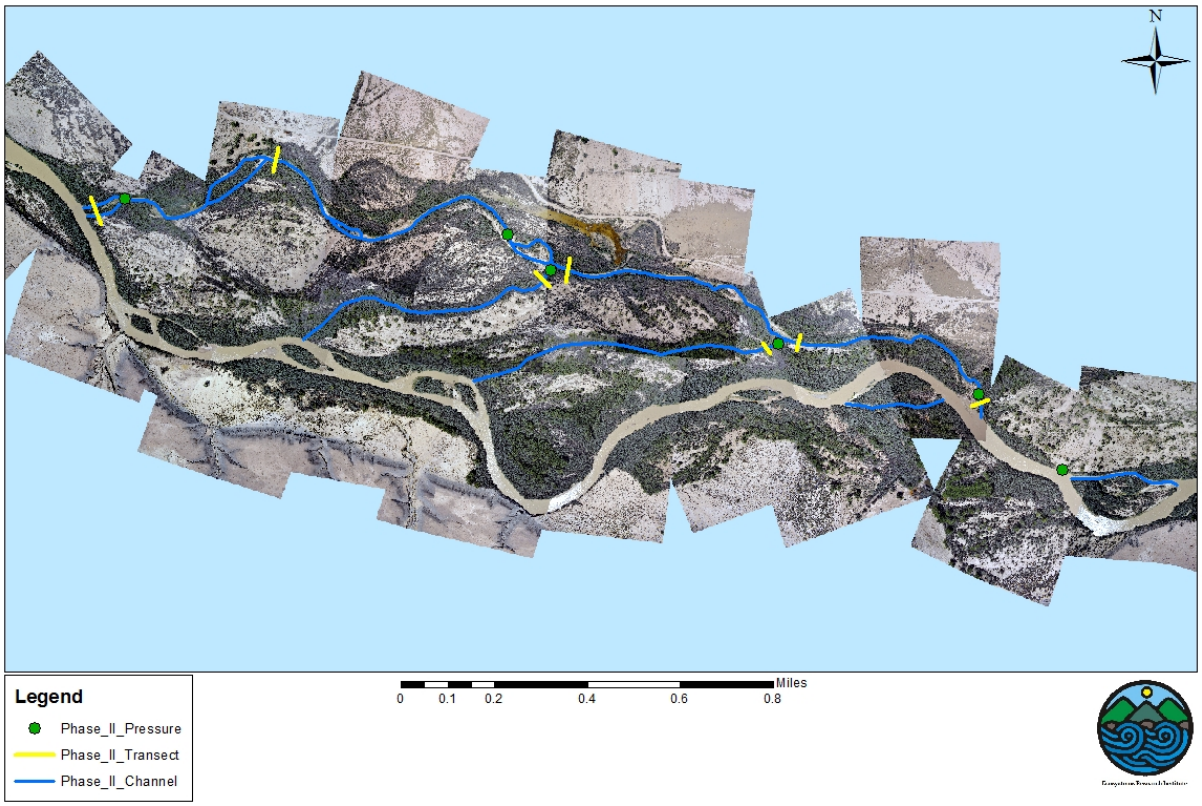

Figure 1. Phase II restoration site with the approximate location of channel cross-sections, pressure sensors, and field cameras.

As part of the site selection process, the historical habitat and the larval and small-bodied fish monitoring databases were queried to determine all available data that had been collected at the site. These data will be used as a baseline prior to construction. In terms of the Small Bodied Monitoring Program, the historical data are summarized in Table 1. There have been a total of 21 observations between 1998 and 2013. Similarly, there have been 36 collections of larval fish made during this time period.

In a similar manner, the historical habitat mapping data was queried specifically for the Phase II restoration site. The intent was to determine the status of the channel (flowing or non-flowing) at the time of mapping. In total, there were 31 observations between June 1993 and August 2013.

Flows at mapping ranged between 479 cfs and 9,453 cfs. A temporal summary can be seen in Figure 2.

Table 1. Summary of the historical collections from the Small Bodied Monitoring Program between RM 134 and 137.

Query19						
Year	Site (RM)	Channel	UTM Zone	UTM East	UTM North	Coordinate System
1998	135.2	Secondary				
1998	136.5	Secondary				
1999	136.5	Secondary				
2000	134.3	Secondary				
2000	136.6	Secondary				
2001	134.25	Secondary				
2001	136.6	Secondary				
2002	134.4	Secondary				
2002	136.55	Secondary				
2003	135.5	Secondary				
2003	136.8	Secondary				
2004	136.5	Secondary				
2006	134.3	Secondary				
2006	136.5	Secondary	12S	694014	4084091	
2007	134.3	Secondary	12S	108.86046	36.8923	
2010	133.9	Secondary	12S	690100	4085104	NAD83
2010	135.9	Secondary	12S	692934	4084055	NAD83
2011	134.3	Secondary	12S	690635	4085068	NAD83
2012	134.3	Secondary	12S	690646	4085061	NAD 83
2013	135.1	Secondary	12S	691404	4084314	NAD 83
2013	136.4	Secondary	12S	690041	4084140	NAD 83

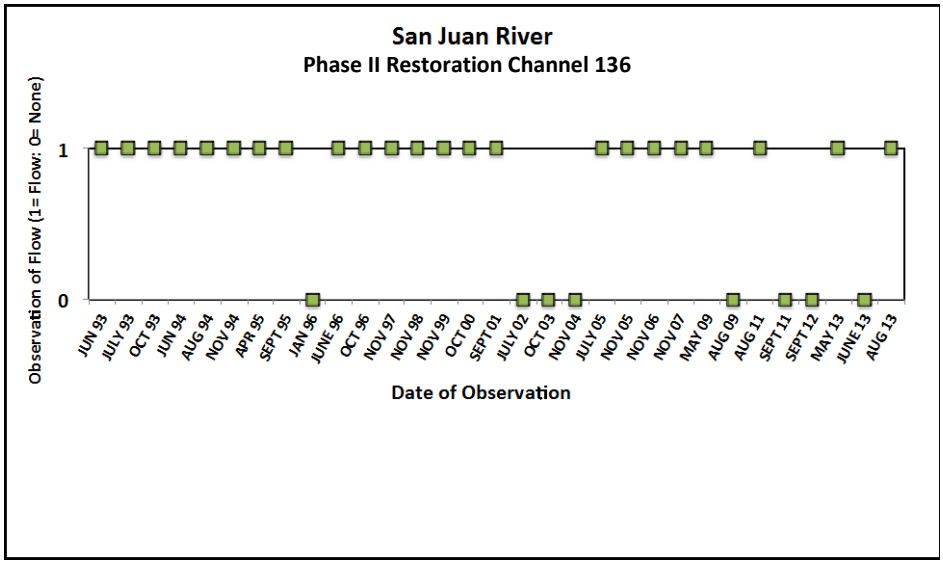

Figure 2. Temporal summary of the status (flowing or non-flowing) of the restored secondary channel located at River Mile 136 prior to its restoration.

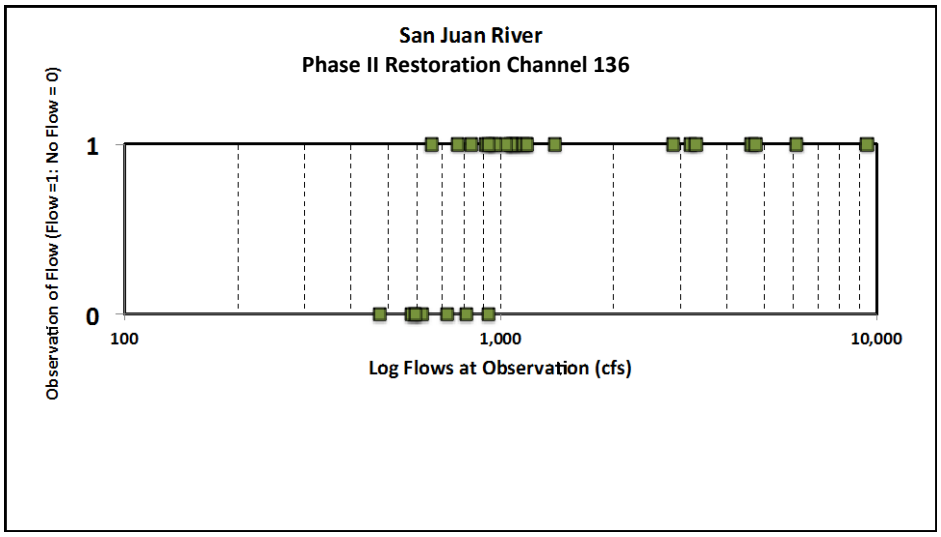

Figure 3. Status (flowing or non-flowing) of the restored secondary channel located at River Mile 136 prior to restoration as a function of flow at the time of observation.

As noted in Figure 2, there were three periods where there were over 5 continuous observations where the main secondary channel was flowing. In a similar manner, the data were plotted as a function of flow at observation time and status (Figure 3). As shown in this figure, the channel historically did not flow at river flows at or below 659 cfs and always flowed at river flows above 930 cfs. Between these two flows the channel was intermittent.

These three data sets obtained from the historical Larval Fish, Small-Bodied Fish and Habitat Monitoring Programs will be valuable in assessing the success of the restoration process. The restoration work at this site was completed in late fall 2014. Because of the need for better information on the availability and persistence of aquatic meso-habitats at the restored site and the occurrence and relative abundance of larval and small-bodied fish in these habitats over time and as a function of flow conditions, an integrated, stand-alone monitoring program is required. The intent of this proposal is to continue implementation of a monitoring study that addresses the following objectives:

1) To measure changes in habitat features of the restored secondary and tertiary channels, larval fish abundance, and small-bodied fish abundance over three years following completion of restoration treatments at the Phase II site; habitat features include: a) the number and surface area of different aquatic meso-habitats in restored channels, and b) channel cross-sections established in restored secondary and tertiary channels.
2) To measure seasonal changes in habitat features of the restored secondary and tertiary channels, larval fish abundance, and small-bodied fish abundance from prior to spring runoff to late fall during each of the three years following completion of restoration treatments.
3) To compare the relative abundance of small-bodied fish collected in different meso-habitats in the restored site to determine whether preferences for specific meso-habitats exist.

4) To measure changes in habitat features of the restored secondary and tertiary channels associated with environmental flow releases or large floods that may occur over three years following completion of restoration treatments.
5) To compare habitat features, larval fish abundance and small-bodied fish abundance between restored channels and a control secondary channel site.

These objectives were derived from four monitoring questions that were discussed at two Biology Committee meetings in 2014.

To address these objectives, we initiated a monitoring study in 2015 that involves simultaneous collection of habitat, larval fish, and small-bodied fish data so that spatial habitat data can be linked with fish species composition and abundance information. The monitoring activities and measurements include:

Aquatic habitat mapping: 1) hand-mapping of aquatic habitats in restored secondary and tertiary channels using methods developed by Lamarra (Bliesner el al. 2008); 2) surveying of channel cross-sections along permanent transects established along restored channels; and 3) electronic data collection using sensors that simultaneously record water temperature and pressure which will be used to measure water depth in the channel. The sensors were placed strategically in restored secondary channels and the main channel (Figure 1) and the two field cameras were placed in the mouth and near the outlet of the restored secondary channel.

At the same time that habitat mapping and surveying of channel cross-sections occur, a sample of available aquatic habitats in restored secondary and tertiary channels will be sampled for larval and small-bodied fish (see Methods for details). With these data, we can address the first four objectives. Our intent is two-fold: first, to determine the number, surface area, and proportionate abundance of different meso-habitats in the restored channels, and second, to estimate the relative abundance of identified larval and small bodied fish in different meso-habitats. To detect changes in the occurrence and relative abundance of habitats, small-bodied fish and larval fish, comparisons will be made in these parameters between sampling visits (e.g., from before spring runoff to late fall) and across years.

A secondary channel site located at RM 129 that was flowing more frequently than the restored site did prior to restoration (e.g., had water and habitat at almost all times and flows) was selected as a control (Figure 4). A parallel set of measurements will be collected at the control site, however, the site was not instrumented with a field camera and pressure-temperature sensors (see below). The control channel is located just downstream of the restoration site and was used as a control site for the RERI restored channels. There are no tributaries between the two sites and their proximity to each other should insure similar physical conditions. In addition, historic larval and small-bodied fish collections made over multiple years exist for the Phase II site prior to restoration so that a comparison of fish captures (abundance, species composition) for specific meso-habitats can be made before and after treatment. If the restoration effort is successful, we expect that the restored channels will provide aquatic habitat for larval and small-bodied fish when flows are between 500-700 cfs and higher just as the control channel does. Comparisons of the relative abundance of meso-habitats in restored and control channels and the relative abundance of identified larval and small-bodied fish collected in these meso-habitats will provide additional information to assess restoration success; the comparisons between restored and control channels will be made seasonally from before spring runoff to late fall within a year

and between years. In addition, comparisons of the relative abundance of small bodied fish collected in different meso-habitats will indicate whether fish are distributed randomly with respect to habitat or whether small-bodied fish disproportionately occur in certain meso-habitats (Table 2); these comparisons can be made seasonally from before spring runoff to late fall and between years.

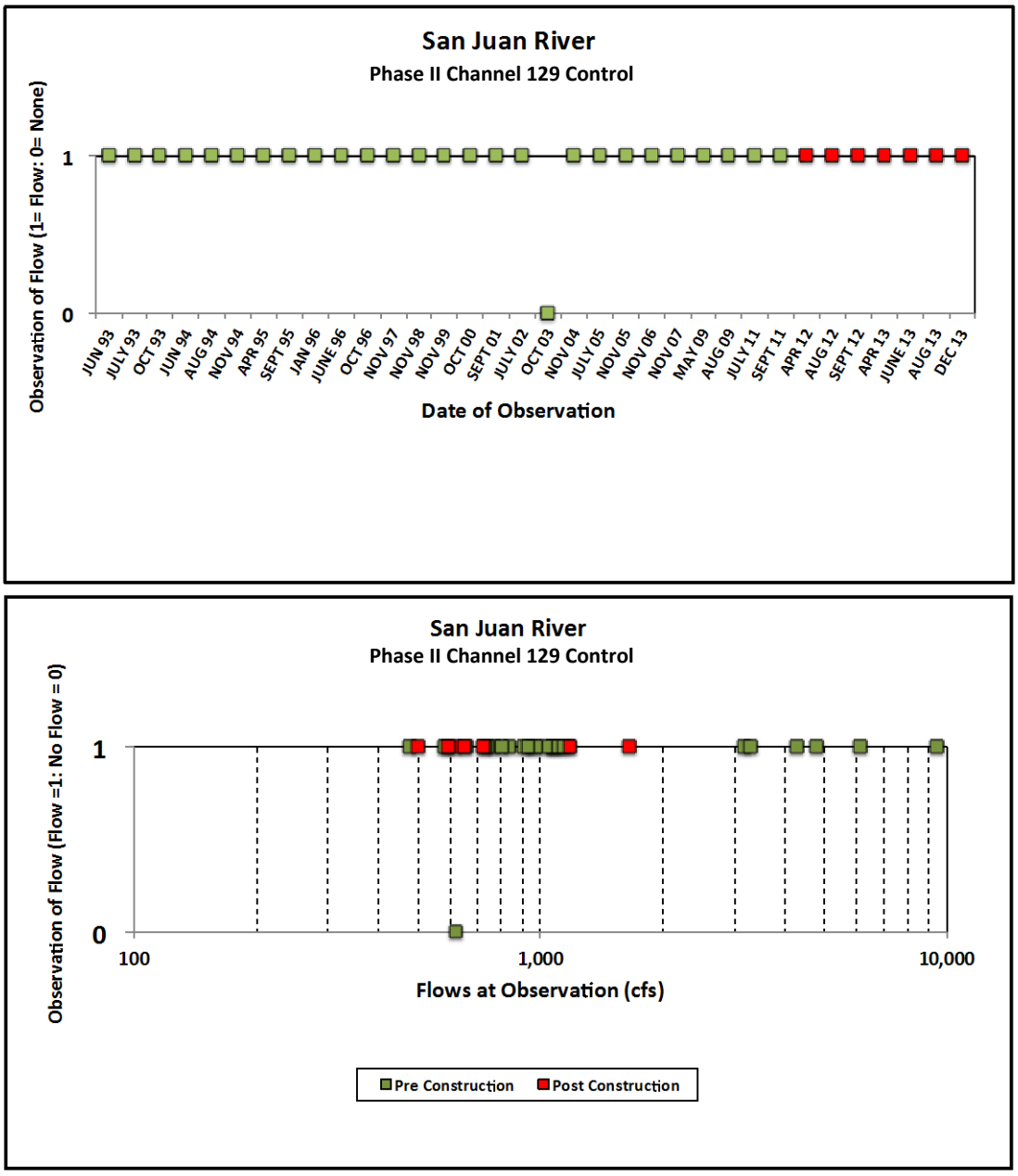

Figure 4. A temporal summary of the status (flowing or non-flowing) of the control secondary channel located at River Mile 129 in the San Juan River (above) and the observations of that same secondary channel as a function of flow at the time of observation (below). This channel was monitored as a control site before and after the Phase I channel restorations activities.

METHODS

To address the five objectives and measure changes in aquatic habitat in the restored and control sites seasonally, from pre-runoff to late fall, and between years as a function of changing flow conditions, we propose a combination of habitat mapping, measurement of channel cross-sections, and electronic data collection.

Habitat Mapping

Post-construction geo-referenced base photography maps will be used at a scale of approximately 1 inch = 200 feet for the secondary and tertiary channel mapping. Photos will be printed on 11 x 17 inch pages with the river-miles marked and provided in sheet protectors for field mapping. Ten aquatic habitat types and three associated terrestrial types (Table 2) will be delineated on the base photographs by visual inspection in the field. The high resolution photos allow the mapper to have a high degree of confidence as to the visual location of the habitat being mapped and available reference points on the photos (i.e. debris piles, cobble bars, shoreline cover, etc.). Each polygon delineated will be marked with its corresponding code as noted in Table 2. The date of mapping and the mapper's name will be recorded on the first map sheet for each day's mapping. In as much as the mapping process is interpretive, the mappers will initially overlap 10 percent of the area of the channels to be mapped during each mapping effort. Variability in habitat interpretation and surface areas of habitats will be determined based upon the comparison between mapping results.

Following field mapping, the field sheets will be reviewed and missing codes or non-closed polygons will be corrected prior to processing. Following this review, the habitat polygons will be digitized and coded in ArcGIS to produce shape files. Within each channel, all polygons areas and perimeters for each habitat type will be quantified and summarized by total count and total area in each channel and date mapped.

Table 2. The categories of habitat types on the San Juan River that will be used in this investigation.

(1) Backwater	(10) Inundated Vegetation
(2) Embayments	(11) Rootwad Piles
(3) Riffle	(12) Dry (Sand bar)
(4) Runs	(13) Dry (Channel)
(5) Rapids	(14) Dry (Cobble Bar)
(6) Slackwaters	(15) Islands

(7) Low Velocity Types: (7A) Pools, (7B) Eddies, (7C) Pocketwater

(8) Shoals (Sand and Cobble)

(9) Isolated Pools

Channel Cross Sections

Across channel transects were established at the inflow area of the restored secondary and tertiary channels in April 2015 (Figure 1). At each transect location, a field survey will be conducted and referenced to benchmarks established on the initial survey such that the year-to-year variations in the secondary and tertiary channel stream beds can be determined. The overall control benchmark will be outside the floodplain of the river with individual transect benchmarks being established on each side of the individual transects.

The survey will use a metered tape strung across the inflow channel starting at the established benchmark. The bed elevation will be measured every 0.5 m across the channel as well as in major landform topographic breaks (i.e. steep banks, substrate changes, root-wad piles, etc.). In addition, the location and elevation of the water's edge will be surveyed. All elevations will be measured to the nearest 2 cm using a metered stadia rod and a Spectra LL300N Self Leveling Laser. Surveys will occur at the time of field mapping. The main secondary channel entrance will have three transects, spaced 8 m apart, due to the size of the existing cobble/sand bar at its mouth. If sand or cobble shoals are mapped at the mouth of the restored secondary and tertiary channels, water and sediment depth will be measured. A transect and benchmarks, including an overall control benchmark outside of the floodplain, have already been established at the channel entrance of the control site; the cross-section has been surveyed annually from 2012-2014.

Electronic Surveillance

Electronic water level (pressure) and temperature sensors and loggers (HOBO U20L-001) will be used to collect hourly water levels at three locations in the secondary channel and one location in each tertiary channel immediately downstream of each channel split. Sensors were installed in an "L" shaped stilling basin adjacent to the channels. The bottom of the "L" is underwater and facing downstream; basins will be cleaned, if necessary, during each trip. The relative elevations of the sensors have been surveyed. In addition, a sensor was placed in the main stream of the San Juan River upstream of the reclaimed secondary channel. A relationship between gaged flows (USGS 0936800, San Juan River at Shiprock) and the pressure sensor in the main channel (Figure 1) and the entrance to the secondary channel will be established. It is anticipated that these initial relationships will change with time as the channels become altered. The sensors will, however, provide a continuous record of when the secondary and tertiary channels have water.

A Moultrie M-1100i mini game field camera was placed at both the entrance and outlet of the reclaimed secondary channel, pointing down- and upstream respectively. Cameras are programmed to take photographs three times a day and will provide a near-continuous record of the flow conditions at the channel complex entrance and outlet and field verification of the water level (pressure) sensor readings (e.g., sensors recording water and not sediment depth). No sensors or cameras were placed at the control site since the site has been flowing in 98% of the observations since 1993. Sensor readings and visual confirmation of the entrance and outlet conditions from the cameras will provide information on: 1) the persistence of aquatic habitats in restored channels between field visits; and 2) the effect of high flows on flow conditions in restored channels (e.g. flowing or not flowing). Habitat mapping and channel cross-sections will provide additional data to address the five study objectives, as well as periodic field calibration of the electronic data.

Larval and Small Bodied Fish

To measure changes in species composition and relative abundance (catch per unit effort) seasonally, from pre-runoff through late fall, and between years, small bodied fishes will be collected with a 2.2 m x 1.9 m x 3.0 mm mesh drag seine. During the first sampling period (April 2015), habitats were mapped in restored secondary and tertiary channels and at the control site and, using the map, seven 100-m transects were established at the restored site and one 100-m transect at the control site. The transect locations were selected so that all habitat types were represented on the combined transects roughly in proportion to their overall occurrence at each of the sites. The upstream end of each transect was marked with a fence post placed away from the restored channel and its location surveyed to the control benchmark outside of the floodplain at the restored and control sites. These transects will be sampled throughout the study. Within each of these transects, 6 to 8 samples (seine hauls) will be taken following the small-bodied fish protocol where habitats are sampled roughly in proportion to their occurrence along the transect (Gilbert 2014). This gives a total of 42-56 small-bodied fish samples at the restoration site and 6-8 samples at the control site each field visit (Table 3). Each catch will be inspected to determine presence of protected species. Total length (TL) and standard length (SL) will be measured on all Colorado pikeminnow and razorback sucker to be consistent with information gathered by the San Juan River Basin and Upper Colorado River Basin programs. Once measured, the fish will be released. Other native species will also be measured and released. When >50 individuals of a particular species are collected in a seine haul, these individuals will be fixed in formalin and taken back to the laboratory where a subsample of >50 individuals will be selected to approximate the proportion of sizes present and measured; non-selected individuals will be counted. If native fishes are too small to identify they will be fixed in formalin and returned to the laboratory. Nonnative fishes will be removed from the river after measurements are taken and recorded. If nonnative fishes are found in such abundance that it is not feasible to measure them in the field, they will be fixed in formalin and returned to the laboratory. For each meso-habitat sampled along the transect, the length (in meters) of each seine haul will be determined in addition to the number of seine hauls per meso-habitat.

Collection efforts for larval fishes will differ from the small-bodied fish sampling and will be concentrated in low velocity habitats, such as backwaters and embayments, along transects using fine-mesh larval fish seines (1 m x 1 m x 0.8 mm). Several seine hauls (between two and seven) will be made through an individual meso-habitat depending on the size of that habitat. Fishes collected in a seine haul will be preserved together as a single sample. For each meso-habitat sampled, the length (in meters) of each seine haul will be determined in addition to the number of seine hauls per meso-habitat. We will target 20 larval fish collections (meso-habitats sampled) per sample period (Table 3) with roughly 70% of collections made at the restored site and the rest at the control. For additional details on the larval fish sampling protocol, see the 2013 larval fish survey report (Farrington et al. 2014).

Habitat designations used in this study will follow the classification given in Table 2. All larval and small-bodied fish sample locations will be referenced on the habitat maps developed during that specific sample period.

Laboratory Processing

All retained larval specimens will be placed in plastic bags (Whirl-Paks) containing a formalin solution and a tag inscribed with a unique alpha-numeric code that was also recorded on the field data sheet and maps. Samples will be returned to the laboratory where they will be sorted and identified to species. Specimens will be identified by personnel with expertise in San Juan River Basin larval fish identification. Stereo-microscopes with transmitted light bases and polarized light filters will be used to aid in identification of larval individuals. Ontogenetic stage will be determined for all razorback sucker and Colorado pikeminnow collected. Age-0 specimens will be separated from age-1+ specimens using published literature to define growth and development rates for individual species (Auer 1982; Snyder 1981; Snyder and Muth 2004). Both age classes will be enumerated, measured (minimum and maximum size [mm standard length] for each species at each site), and cataloged in the Division of Fishes of the Museum of Southwestern Biology at the University of New Mexico.

Monitoring Frequency

The frequency and timing of field visits to measure habitat and fish at the restoration and control sites are summarized in Table 3. These correspond to times before and after spring runoff and monsoonal storm events when changes may occur to the channels and habitats at restored and control sites and when razorback sucker and Colorado pikeminnow larvae are present in the system. The sampling in late fall and early spring pre-runoff will be particularly interesting since the distribution and relative abundance of small-bodied fish in secondary channels is not known with certainty during the overwinter period.

Table 3. Field-sampling schedule for habitat, larval fish (LF), and small-bodied fish (SBF). Habitat measurements include aquatic habitat mapping (M) in secondary and tertiary channels, surveying channel cross-sections (XS) to assess changes in channel morphology after large flow events, and checking and downloading data from camera and sensors (E).

Sampling Date	**Measurements**
Pre-spring runoff (April)	M, XS, E, LF, SBF
Post-spring runoff; includes environmental flow releases, Navajo Dam; timed with presence of razorback sucker and Colorado pikeminnow larvae (mid- to late July)	M, XS, E, LF, SBF
Post-monsoon (August-September)	XS, E
Late fall (October); after irrigation season	M, XS, E, LF, SBF

Analysis

The focus of our analyses will be to address the five study objectives. Comparisons within and between the Phase II restoration site and the control site will be made for a number of variables to determine how habitat, larval fish and small-bodied fish abundance change over time (across the three sampling periods) at both sites and how changes in the restoration site compare to those in the control (Table 4). The habitat-fish data will also be analyzed to determine whether small-bodied fish are distributed randomly with respect to aquatic habitats at restored and control sites

or whether preferences or avoidance of specific habitats exist; this information will assist in identifying and refining fish-habitat relationships for small-bodied fish. Finally, the sensor and field camera data will provide information on the persistence of aquatic habitat at the restored site and, if they occur, the effect of large flows on channel cross-sections and status (flowing vs. not flowing) at both sites.

Products

A draft report summarizing the activities and analyzed results of the 2016 Phase II Channel Restoration Site monitoring, including a comparison with 2015 results, will be submitted to the Biology Committee for their review by March 31, 2017. The report will be revised and finalized based on comments received and re-submitted to the Biology Committee and Program Office by June 30, 2017. In addition, digital copies of all habitat and fish data collected in 2016 will be delivered to the SJRIP database manager.

Project Duration

This project is designed as 3-year study, with reports submitted each year. This proposal is for the second year of the study. At the end of the third year, the final report (submitted in 2018) will contain recommendations to the Biology Committee on: (1) the effectiveness of restoring secondary channels in recovery of razorback sucker and Colorado pikeminnow; and (2) how the electronic equipment and survey transects may be used in the future to test specific hypothesis about the effect of environmental flow releases on restored channel morphology and function.

The proposed monitoring project supports Goals 4.2 *Monitor Habitat Use and Availability* and 4.3 *Evaluate Habitat Restoration Strategies and Monitor Habitat Restoration Projects* and associated Actions (4.2.3 4.2.4, 4.3.1, 4.3.2) and Tasks (4.2.3.1, 4.2.3.2, 4.2.3.4; 4.2.4.4; and 4.3.1.1, 4.3.1.2, 4.3.1.3; 4.3.2.1) in the 2014 Long Range Plan.

Table 4. List of planned comparisons and statistical tests and the study objectives they address.

Objective No.	**Comparison**	**Statistical Test**
1	Comparison of number (count) of meso-habitats by habitat type seasonally (from before spring runoff to late fall) at restored site; comparison of the total areal cover of meso-habitats by habitat type seasonally (3 field visits in 2015) at the restored site; flow conditions will vary at time of field visits and between field visits which may result in changes in the count and areal cover of meso-habitats over time.	None required, all habitats mapped and counted in restored channels; table or graph for visual inspection Once we have sufficient data (more than three observations), use regression analysis to determine relationship between count and area of habitat by type and the flow at mapping.
5	Comparison of number (count) of meso-habitats by habitat type seasonally (from before spring runoff to late fall) at control site; comparison of the total areal cover of meso-habitats by type seasonally (3 field visits in 2015); flow conditions will vary at time of field visits and between field visits which may result in changes in the occurrence of meso-habitats over time.	None required, all habitats mapped and counted in control channel; table or graph for visual inspection. Once we have sufficient data (more than three observations), use regression analysis to determine relationship between count and area of habitat by type and the flow at mapping.
1, 5	Comparison of the relative proportion of different meso-habitats between field visits (from before spring runoff to late fall) at the restored site; similar comparison at the control site	Chi-square test, N (meso-habitats) x 3 (field visits); N x 3-way table
5	Comparison of the relative proportion of meso-habitats at restored vs. control sites	Chi-square test for each sampling visit
1, 5	Comparison of the relative abundance of native larval fish (CPUE) between sampling periods and by site (restored vs. control); same comparison using relative abundance of non-native fish; summarize data for razorback sucker and CO pikeminnow although probably too few individuals collected for statistical analysis.	Analysis of variance with season (sampling period) and site (restored vs. control) as factors; pairwise comparisons between field visits and between sites using the Tukey-Kramer HSD test. Alternatively, could adopt approach of larval fish monitoring study and use mixed linear models to estimate occurrence (presence-absence) and abundance separately with habitat, season, and site (restored vs. control) as covariates (Farrington et al. 2014). If samples sizes are insufficient to conduct the above analyses, restrict analysis to fewer factors, e.g., combine data across seasons and compare restored and control sites. If analyses are restricted, may use non-parametric Kruskal-Wallis one-way analysis of variance. Data will be summarized in table or graph to highlight specific comparisons of interest.
1, 5	Comparison of relative abundance of larval fish for specific species of interest between sampling periods and by site; these species may include bluehead and flannelmouth sucker, channel catfish, fathead minnow and redshiner.	Analysis of variance with season (sampling period) and site (restored vs. control) as factors. See above comments for additional details and possibilities.
1, 5	Comparison of number (count) of meso-habitats sampled for larval fish by type between sampling periods; comparison of the number of meso-	Sample sizes probably too small but, if not, Chi square test w/ continuity correction

	habitats sampled for larval fish by type at restored vs. control site	
Objective No.	**Comparison**	**Statistical Test**
1, 5	Comparison of the composition of native larval fish (number of individuals collected by species) by season for restored site and control site; comparison of the composition of native larval fish by site (either combining seasons or holding season constant depending on the results of the previous analysis); similar analysis for non-native larval fish	Chi-square test for independence
1, 3, 5	Comparisons of relative abundance of native small-bodied fish (CPUE) by meso-habitat type and by site for each of the 3 sampling periods; could add season as a factor if sample size permits; similar comparisons for non-native small-bodied fish (non-native spp. combined)	Analysis of variance with meso-habitat type and site as factors; pairwise comparisons between meso-habitats and sites using Tukey-Kramer HSD test. If sample sizes of fish abundance in specific meso-habitats are insufficient, restrict analysis to certain meso-habitats and compare restored vs. control sites. If analyses, are restricted may use non-parametric Kruskal-Wallis one-way ANOVA. Data will be summarized in a table or graph to highlight specific comparisons.
1, 5	Summarize number of small-bodied RBS & CPM individuals captured by meso-habitat type and by site for the 3 sampling periods	Probably not sufficient sample sizes for statistical comparisons between meso-habitats, sampling periods and sites.
1, 3, 5	Comparisons of the relative abundance of small-bodied fish (CPUE) for specific species (where we have an adequate sample) by meso-habitat, by season, and by site.	Repeated measures analysis of variance with meso-habitat type, season, and site as factors (see above). If sample sizes are insufficient, restrict analyses to specific meso-habitats, hold season constant, and compare by site.
3	Comparisons of the number of small-bodied fish by species captured in different meso-habitats by season; analyze restored and control site separately; can also combine restored and control sites to increase sample size.	Chi-square test for independence; two types of chi-square analysis will be used to test null hypothesis of "no selection"—Pearson chi square statistic (driven by differences between observed and expected number of fish collected in meso-habitats of each type) and log-likelihood Chi-square statistic; the latter tests the selection ratio, w, calculated by dividing the proportion of fish using a specific habitat type by the proportion of that habitat sampled (Bliesner et al. 2010).
1, 5	Comparison of the composition of native small-bodied fish (number of individuals collected by species) by season (holding site constant) and by site (either combining or holding season constant depending on the results of the previous analysis); similar comparisons for non-native small-bodied fish	Chi-square test for independence
1	Comparison of status of the restored site (flowing vs. not flowing) before vs. after restoration (see Figure 3)	Contingency table—status (flowing vs. not flowing) by flow category: 500-569, > 569 cfs; chi-square test of independence.
1	Summarize the number of larval RBS & CPM captured by meso-habitat type at the restored site before and after treatment	Probably not sufficient sample sizes for statistical comparisons between meso-habitats and between time periods (before & after restoration).

Objective No.	**Comparison**	**Statistical Test**
1	Comparison of relative abundance of native larval fish (CPUE) at restored site by meso-habitat, by season and by time (before vs. after treatment); a separate comparison/analysis will be run for non-natives.	Analysis of variance with habitat, season, and time (pre- vs. post-treatment) as factors. Alternatively could use the approach of larval fish monitoring study and use mixed linear models to estimate occurrence and abundance separately with habitat and time as covariates. If samples sizes are insufficient to conduct the above analyses, restrict analysis to fewer factors, e.g., analyze meso-habitats separately, combine data across seasons and compare restored and control sites. Data will be summarized in table or graph to highlight specific comparisons of interest.
1	Summarize the number of larval RBS & CPM captured by meso-habitat type at the restored site before and after treatment	Probably not sufficient sample sizes for statistical comparisons between meso-habitats and between time periods (before & after restoration).
1	Comparison of relative abundance of native small-bodied fish (CPUE) at restored site by meso-habitat, by season and by time (before vs. after treatment); a separate analysis will be run for non-natives small-bodied fish.	Analysis of variance with habitat, season, and time (pre- vs. post-treatment) as factors; see above comments regarding restricting analyses if sample sizes are insufficient for full analysis.
1	Comparison of the composition of native small-bodied fish (number of individuals by species collected) at restored site before and after treatment; could do a similar analysis for non-native small-bodied fish	Chi square test for independence

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PROJECT BUDGET

Budget for Participation of Ecosystem Research Institute and The Nature Conservancy under BOR Cooperative Agreement No. R09AP0004 to The Nature Conservancy

Task 1A Habitat Mapping (3 Trips)	**Cost**
Field Labor: Salary & Benefits	
Director of Science (TNC)	$7,501
Senior Fisheries Biologist (ERI)	$14,183
Travel & Per Diem (TNC & ERI)	$3,945
Laboratory Labor: Salary & Benefits	
Technician (ERI)	$8,034
Materials & Supplies (ERI)	$600
Task 1B Physical Transects (1 Trip)	
Field Labor: Salary & Benefits	
Director of Science (TNC)	$1,548
Senior Fisheries Biologist (ERI)	$2,966
Laboratory Labor: Salary & Benefits	
Technician (ERI)	$670
Travel & Per Diem (TNC & ERI)	$1,185
Task 1C Pressure Sensors & Electronic Data	
Field Labor: Salary & Benefits	
Senior Fisheries Biologist (ERI)	$464
Laboratory Labor: Salary & Benefits	
Technician (ERI)	$670
Equipment (pressure sensors, field camera) (ERI)	$2,300
Final Report	
Office Labor: Salary & Benefits	
Director of Science (TNC)	$2,381
Senior Fisheries Biologist (ERI)	$7,416
Editor (ERI)	$824
Materials & Supplies	$500
Total Habitat Monitoring & Report (Direct)	**$55,186**
TNC Federal Indirect Cost Rate (21.75%; FY16)	**$12,003**
TOTAL HABITAT MONITORING & REPORT	**$67,188**

(Budget continued on next page)

Budget for Participation of American Southwest Ichthyological Researchers, L.L.C. under Contract No. GS10F0249X-12PD40037

Laboratory Labor (Pre-Spring Runoff and late Fall samples): Salary & Benefits	
Fisheries Biologist	$3,451
Fisheries Technician	$1,069
Laboratory Labor (Post-Spring Runoff sample): Salary & Benefits	
Fisheries Biologist	$2,156
Fisheries Technician	$530
Materials & Supplies	$450
TOTAL LARVAL FISH IDENTIFICATION	**$7,656**

Budget for Participation of New Mexico Game and Fish Department (NMDGF) under Agreement Number SJ2631

Field Labor: Salary & Benefits	
NMDGF Biologists (3)	$9,877
Office Labor (Final Report Assistance): Salary & Benefits	
NMDGF Project Leader	$2,740
Travel & Per Diem	$3,158
TOTAL FISH COLLECTION & REPORT ASSISTANCE	**$15,774**

TOTAL PROJECT COST (HABITAT, FISH & REPORT) $90,618

SJRIP O&M of Existing PIT Tag Antennas and Evaluation of Data
2016 Project Proposal

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BACKGROUND

PIT tags are implanted in various fish species captured through various projects directly supported by the SJRIP, or funded through other agencies and projects (CDP&W, BOR, BLM, NMG&FD, and UDWR). Stationary PIT Tag antennas have been installed at various locations in the San Juan River Basin to passively detect fish as they swim above, through, or underneath the antennas. These antennas require periodic maintenance and support to keep them running and operational. Additionally, cell and satellite service is required to access the antennas and download data and perform diagnostics. Locations and numbers of antennas at various sites are listed below:

1) PNM Weir and Fish Passage
    a. Four pass-over antennas, modified with concrete bases are located below the weir
    b. Two pass through antennas are located in the fish passage.
    c. All six antennas are served by a single master controller located in a protected shed at the fish passage facility. The master controller is accessed using a Verizon cell data modem.
2) Hogback Irrigation Canal and Fish Weir, ~ 20 miles upstream of Shiprock, NM
    a. Seven pass-through antennas are installed at various locations in the Hogback Fish Weir facility.
    b. Five antennas are served by a master controller and bank of batteries in a protected shed at the Hogback Irrigation Site that controls the various gates connected to the fish weir. The master controller is accessed using a Verizon cell data modem.
    c. Two antennas are located approximately 0.5 mi upstream of the fish weir near the canal headgate. These antennas are served by a master controller and bank of batteries (connected to 110 AC power source) located at the antennas. This site is accessed using a Verizon cell data modem.
3) TNC Restoration Site ~ 20 miles west of Shiprock
    a. Four pass-over antennas are installed in a secondary channel created by restoration activities conducted by TNC.
    b. The four antennas are served by a single master controller and solar-energy supplied battery bank on an island created by the restoration activities. The site is accessed using a satellite data modem.
4) McElmo Creek, ~ 25 miles upstream of Bluff, UT
    a. Five pass-over antennas were installed in McElmo Creek approximately 200m upstream of the confluence with the San Juan River.
    b. The antennas are served with a multiplexing antenna controller and the controller is accessed using a Verizon cell data modem.
5) Submersible antennas located near the waterfall on the San Juan River near Gouldings, AZ.
    a. Submersible antennas are installed at various locations including the waterfall near Gouldings, AZ, and Colorado pikeminnow spawning bar near 4-Corners Bridge, CO, UT, AZ, NM.
6) Floating PIT tag antenna system
    a. A floating PIT Tag antenna system has been constructed and used in the San Juan in several locations including below the waterfall in the San Juan River and in the river between Hogback diversion and Bluff, UT. The system will also be deployed in the upstream portions of the San Juan Drainage including the Animas and upper San Juan rivers.

OBJECTIVE

Acquire detection data from all remote or passively operated PIT antennas on June 30, 2016 and package antenna detections in a database to ultimately provide a template for future data additions and to facilitate fast analyses and open access among other researchers (i.e., within the SJR Recovery Program and/or the STReaMS database).

METHODS

1) Stationary PIT tag antennas will be contacted periodically (bi-weekly) to check the settings, download the data, and perform diagnostics of the systems. Sometimes problems arise (batteries drain down due to lack of sun, antennas are washed away, wires are cut) that cannot be solved remotely. In these cases a site visit must be conducted by a technician to repair the system. The SOW and budget include the replacement of one antenna during the work period. If an antenna is not replaced the funding will be used to purchase additional PIT tags or submersible antennas to be used by other biologists.
2) Submersible antennas will be deployed at the waterfall for a continuous period from late February 2016 until August 2016 in an attempt to document fish movements and useage of the river immediately downstream of the waterfall.
3) The data manager will compile all detection data up to June 30, 2016 from any remote or passively operated PIT tag antenna used in the San Juan River. This would allow all antenna systems installed before early-2015 to collect detection data for over a full calendar year. Antenna data compiled will include, but not be limited to, detections from submersible (Four Corners bridge CPM spawning bar, waterfall), continuous stationary directional arrays (McElmo Creek since 2012; Hogback Diversion since 2014; PNM Fish Passage since 2014; and PNM weir since 2015); temporary portable antennas (Chaco Wash 2012 and 2013; Chinle Wash in 2013; McElmo Creek arrays seasonally since 2012; Yellow Jacket Creek seasonally since 2012), and floating antennas (Chaco Wash 2010; San Juan River 2014; and Waterfall 2015).

TASKS – 2016

1. Maintain and operate stationary and portable PIT tag antennas
2. Replace one PIT tag antenna (likely at McElmo or TNC Restoration site)

FY 2016 BUDGET

O&M of Existing Antenna Systems, Replacement of one Antenna, and Data Management

A) Labor

Position	Salary total/hr	No. persons	Total Hours	Total cost
BOR Technical Representation for Contracts and Agreements	$80.00	1	100	$8,000.00
BioMark or USU Staff (contract)	$80.00	1-2	200	$16,000.00
Contract Employee Data Management	$50.00	1	440	$22,000.00
Total				$46,000.00

B) Travel

Position	Destination	Purpose	Days	Lodging per day/total	Per diem per day/total	Total	Total
Reclamation Technical representative	Farmington, Shiprock	Project evaluation or field trips	4 trips @ 5 days/trip	$100/$500	$40/$800	$2750	$3,300.00
BioMark/USU representative	Boise, ID; Kennewick, WA; various	Field trips O&M Antennas	3 trips @ 5 days/trip	$100/$1000	$40/$600	$2500	$2000.00 $1,500.00
Contract Employee	Durango Farmington	Field work Reporting	2 trips @ 4 days/trip	$100/$800	$50/$400	$1200	$655.00
Total				$2300.00	$1,400.00	$6,450.00	$11,255.00

*mileage of 5,000 mi at $0.55/mile

C) Equipment

Item	Unit Cost	Number	Total cost
Antenna system	$10,000	1	$10,000
Total			$10,000.00

Budget Summary
FY-2016

Category	**Total**
Labor	$46,000.00
Travel	$6,450.00
Equipment	$10,000.00
Total FY2016 Budget	**$62,450.00**

Projected funding:
FY-2017 $63,000.00
FY-2018 $64,000.00

VOLUME I

Technical Approach for R15PS00493

Proposed Project:
Fish Entrainment on the San Juan and Animas Rivers

Request for Proposal Document Number:
R15PS00493

Request for Proposal Document Title:
Fish Entrainment for the San Juan River Basin Recovery Implementation Program

Principal Investigators:
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David Gori[2], Dale Lyons[2]

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Date of Receipt of Proposal: _____

Time of Receipt of Proposal: _____

Proposal Received By: _____

TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

Volume 1 – Technical Approach
EXECUTIVE SUMMARY

Colorado Pikeminnow and Razorback Sucker are two endangered species of cypriniform fishes native to the San Juan River, a large tributary of the Colorado River. The decline of these and other native fishes in the San Juan River has been attributed to flow modifications, instream barriers, changes to the thermal regime and channel simplification. In addition, the introduction of non-native fishes may have altered predation dynamics and competition for habitat and resources. Colorado Pikeminnow was listed as an endangered species by the U.S. Department of the Interior in 1974. It is endemic to the Colorado River Basin where it was once abundant and widespread. Currently this species occupies only about 20% of its historical range, with the majority of the remaining Upper Basin individuals occurring in the Green River. Both of these species have been stocked in the San Juan River as part of the attempt to recover these taxa.

The scientific literature is replete with studies of fish entrainment at diversion structures. This problem is particularly acute in the American West where the number of diversions is great. To evaluate entrainment susceptibility and the effectiveness of mitigation strategies such as fish screens, researchers have considered a number of factors, including water velocity into and across diversion structures, diversion rates, diversion as percent of total river flow, and avoidance behavior. These studies have found that diversion rates, sweeping velocities (flow rate in the direction parallel to a fish screen), diversion proportion, and the presence of screens can all significantly affect entrainment rates.

In the San Juan River Basin, several studies have addressed drift rates of larval fish (Dudley and Platania 2000, 2000a, 2002, 2007) and entrainment (presence/absence) of endangered fishes in selected canals (Renfro et al. 2006). Dudley and Platania (2000, 2000a, 2002) estimated the magnitude of displacement of drifting larval fish was large as a substantial proportion of the passively drifting particles and protolarval fish released just below Hogback Diversion Dam were displaced downstream of Mexican Hat and Clay Hills. Given the magnitude of drifting larval fish in the San Juan River, the numerous agricultural diversions could pose a significant risk to species recovery. Most recently, Renfro et al. (2006) documented early juvenile (ca. 100 mm TL) sub-adult Colorado Pikeminnow in the Hogback Canal and early juvenile in the Fruitland Canal. No endangered fish were collected in either the Farmers Mutual or Jewitt canals (although the authors cautioned that the sites were only sampled twice).

The objectives of this project (Fish Entrainment for the San Juan River Basin Recovery Implementation Program) is to produce a stand-alone document that provides a complete listing and risk evaluation of entrainment and impingement hazards to endangered fish in the San Juan and Animas rivers. Quantitative information on fish distribution and abundances will be obtained from SJRIP monitoring data and other previous studies in the San Juan River Basin. Assessment of potential entrainment and impingement sites will be acquired during field visits to sites and from private, tribal, and government sources.

The stated study objectives include:

1) identify locations in the San Juan and Animas rivers where entrainment and/or impingement could be a potential threat to Colorado Pikeminnow and Razorback Sucker;
2) document withdrawal amounts (CFS and acre-feet) for each diversion and relate these to proportion of river flows;
3) document withdrawal locations using a GIS and legal descriptions;
4) identify ownership of diversion facilities;
5) document diversion locations with digital images and descriptions of diversions (aspect to river, height, width, gate structure, width of canal, etc.);
6) prioritize risk of entrainment at each site using metrics based on proportion of flow, amount of screening currently present, proximity to stocking locations, quality of habitat upstream of diversion, and other metrics as identified by the SJRIP biology Committee during the initial contract meeting; and
7) produce a draft and final report that summarizes and details 1-6 above.

In early 2015, The Nature Conservancy completed a study of agricultural water use in the San Juan Basin in New Mexico, which identified several opportunities to reduce agricultural river diversions by improving diversion and conveyance efficiency. Given the importance of diversion rates and diversion as a proportion of total river flow to fish entrainment, reductions in agricultural diversions in the San Juan Basin could significantly reduce entrainment risk as well as improve environmental flow conditions. As a separate effort to the work proposed under this USBR procurement, The Nature Conservancy will develop estimates of reduced diversion through efficiency measures for identified projects in the recent report. This information constitutes an “added value” to the final work product and can be used by the USBR and San Juan River Basin Recovery Program to help prioritize limited resources and strategize implementation of eventual entrainment mitigation in the San Juan River Basin.

1.0 INTRODUCTION

1.1 Background

The scientific literature is replete with studies of fish entrainment at diversion structures. This problem is particularly acute in the American West where the number of diversions is great. Studies of salmonids in the Pacific Northwest have been conducted in the laboratory and the field to assess (quantify) not only the negative impact to populations, but to parameters that result in increased entrainment. In the Sacramento River watershed, Green Sturgeon may have to pass 3,300 unscreened diversions during their life (Mussen et al. 2014). The authors examined avoidance behaviors and entrainment susceptibility of juvenile Green Sturgeon (in a flume) when differing river flow velocities (sweeping velocities: 0.15, 0.38, 0.61 m/s) and water-diversion rates (0.28, 0.42, and 0.57 m^3/s) were present. They demonstrated a large percentage of sturgeon became entrained (26-61%). The most challenging flow for sturgeon were low sweeping velocities and high water diversion but entrainment could be reduced by 78% if water-diversion rates were decreased from 0.57 m^3/s to 0.28 m^3/s.

Swanson et al. (2004) used a flume to create two-vector flows that typify habitat near screened diversions. These two-vector flows were an approach flow whose velocity is perpendicular to the screen and a sweeping flow whose velocity is parallel to the screen. The swimming and behavioral response of the juvenile Chinook Salmon were tested using a combination of three approach velocities, three sweeping velocities, a 0-cm/s control, and day and nighttime conditions. While fish were able to swim at the same velocity of the highest velocity flow regimes the authors suggested this was energetically expensive. Contact with the screen differed between day and night trials. More contacts occurred at night and were independent of either sweeping or approach velocities. During the day, contacts with the screen were less as sweeping velocity increased. Sweeping velocity also had a positive relationship with the velocity at which a fish passed the screen. The authors state that this is contrary to assumption held by fish screen designers and resource managers. Fish contacts, during the day, were not impacted by changes in approach velocities.

In the field, Walters et al. (2012) modeled differences in entrainment rates of juvenile Chinook Salmon, using PIT tag readers, into unscreened diversions as a factor of water diversion rate and flow velocity. Modeling indicated entrainment probability was associated with the mean proportion of streamflow diverted. Variability in the proportion of fish entrained increased as the proportion of streamflow diverted increased, but values were similar (example: if the mean proportion of flow diverted was 0.22 the mean entrainment probability was calculated to be 0.19). Under median-streamflow conditions with unscreened diversions, the estimated cumulative effect of the diversions was a loss of 71.1% of emigrating fish. When screening was incorporated into the model, mortality at an individual diversion could be reduced by 1.9%. When 40 diversions with the highest entrainment rates were modeled as having screens, the cumulative mortality rate decreased to 39.6%.

An addition modeling study involved an assessment of mark-recapture data indicated hatchery juvenile Chinook Salmon migrating from the Sacramento and San Joaquin Rivers to the tidal delta of San Francisco Bay, California were entrained at a greater rate when water diversion increased and flows decreased (Zeug et al. 2014). Two diversions in the tidal delta, where smolt may reside for weeks before entering the ocean, divert up to 60% of total flow. These diversions have facilities that salvage entrained fish. During the study period, 749 stockings occurred comprising >28,000,000 fish throughout three runs (seasons: fall, late fall, and winter). Modeling of water diversion rates and mean daily flow indicated a strong positive relationship between the diversion rate and fish entrainment and a significant increase in the amount of fish salvaged from the Sacramento River was observed when flows decreased.

These issues are not limited to North America. Boys et al. (2013) performed a field-based experiment, in Murray-Darling Basin, Australia, to assess entrainment and injury rates of a fish assemblage comprised of 12 species. Their experiment tested rates of fish entrainment (10-200 mm TL) on intake screens using paired combinations of two approach velocities (0.1 m/sec and 0.5m/sec) and four mesh screen sizes (0.5 mm, 1.0 mm, 2.0 mm, and no screen ranged in size from. There was no effect of screen mesh size on the number of fish entrained but more fish were entrained at the 0.5 m/sec approach velocity as compared to 0.1 m/sec. The authors concluded that optimization of approach velocities was of greater importance than screen mesh size and that smaller sized fishes should be prioritized for protection from entrainment given their higher vulnerability.

A recent study applicable to the San Juan River was that of Ellsworth et al. (2010) who examined larval entrainment (during drift) of two species of endangered suckers (from the western United States) in proximity of an existing pump station. Results indicated that drift occurred almost exclusively at night with larval densities concentrated near the surface, closer to mid-channel than to shore, and more abundant on the edge of the mid-channel with higher velocities. During day, drift of larval fish were found throughout the water column. The authors suggested that a pump site where the river channel was wider would allow water withdrawal to occur further from mid-channel and reduce entrainment of larvae.

In the San Juan River Basin, several studies have addressed drift rates of larval fish (Dudley and Platania 2000, 2000a, 2002, 2007), entrainment (presence/absence) of endangered fishes in selected canals (Renfro et al. 2006), and potential effects of selected diversion structures in fish movement (Stamp et al. 2005). Dudley and Platania (2000, 2000a, 2002) estimated the magnitude of displacement of drifting larval fish was large as a substantial proportion of the passively drifting particles and protolarval fish released just below Hogback Diversion Dam were displaced downstream of Mexican Hat and Clay Hills. In their 2000 study they stated “It appears that a large magnitude of displacement occurred between Shiprock and Cudei as a result of larval Colorado Pikeminnow and passively drifting particles being entrained in the Cudei Diversion Ditch. This study provides, in the form of the loss of fishes into Cudei Diversion Ditch, a quantifiable impact to San Juan River native fish populations.”

Stamp et al. (2005) examined two main channel San Juan River diversion structures that might adversely affect endangered fish movement and thereby inhibit recovery efforts. Their work specifically addressed issues of passage at the Fruitland Diversion (RM 178.5) located on the western edge of Farmington, NM near the mouth of the La Plata River near and the Arizona Public Service (APS) Company diversion (RM 163.3), also known as the Four Corners Power Plant Diversion. This latter diversion is located approximately midway between Farmington and Shiprock, NM. The study goals were to quantify physical and hydraulic characteristics upstream, downstream, and at the diversion structures, and determine if and when the structures hinder or eliminate fish passage (Stamp et al. 2005). No attempt was made to quantify rates of entrainment. Most recently, Renfro et al. (2006) documented early juvenile (ca. 100 mm TL) sub-adult Colorado Pikeminnow in the Hogback Canal and early juvenile in the Fruitland Canal. No endangered fish were collected in either the Farmers Mutual or Jewitt canals (although the authors cautioned that the sites were only sampled twice).

In February of 2015, The Nature Conservancy completed the USBR funded study: Evaluation of Opportunities for Irrigation System Improvements and Water Markets to Support San Juan River Basin Environmental Flows (TNC, 2015). This study found that there is the potential to reduce agricultural and municipal diversions along the San Juan River and its tributaries in New Mexico by implementing diversion and conveyance efficiency measures, thereby supporting environmental flow conditions and also reducing entrainment risk of endangered native fish. This study identified the following potential projects in the Basin:

- Installation of automated diversion infrastructure to help Basin ditch organizations better control and limit river diversions, as well as to facilitate implementation of scheduled diversion/irrigation practices, all of which can support environmental flows.
- Installation of ditch lining and/or piping along high priority reaches of Basin ditches to minimize seepage losses and reduce river diversion, in support of environmental flows.
- Operation of a direct San Juan River diversion facility by the City of Bloomfield during the winter months, which will eliminate seepage and other inefficiency losses now incurred through delivery of municipal drinking water by the Bloomfield Irrigation District canal.
- Development of a water market program to either lease or acquire agricultural water rights from water right owners who are currently not using their full water allocation, in order to provide economic benefits to water right holders while reducing river diversions and supporting environmental flows.
- Basin-wide irrigation system optimization assessment to identify and prioritize irrigation system improvement projects among San Juan Basin ditch organizations that can reduce river diversions and support environmental flows, while at the same time benefit farmers through improved systems operation.

The primary purpose of this study is to produce a stand-alone document that synthesizes fish information (from SJRIP reports and other studies in the basin) and overlays those data with a comprehensive review of the diversion structures in the study area so that the risk of entrainment of endangered fishes can be assed by individual canal

To prioritize limited resources and strategize implementation of these projects, a necessary first step would be to develop estimates of diversion reduction/instream flow benefit associated with each project. As a separate effort to the work proposed in this proposal as part of this USBR procurement, The Nature Conservancy will develop these estimates and provide them as part of the final report. This information constitutes an “added value” to the final work product and can be used by the USBR and San Juan River Basin Recovery Program to consider means to mitigate endangered fish entrainment risk along the San Juan River and Animas River.

Study Area

The San Juan River is a major tributary of the Colorado River and drains 38,300 mi^2 in Colorado, New Mexico, Utah, and Arizona. The majority of water in the San Juan River Basin is derived from high elevation snowmelt in the San Juan Mountains in Colorado. San Juan River discharge is regulated by Navajo Dam in New Mexico. Constructed in 1963, Navajo Dam captures discharge from the Los Pinos, Navajo, Piedra, and San Juan rivers. Perennial tributaries of the San Juan River not bounded by Navajo Reservoir include the Animas, La Plata, and Mancos rivers and McElmo Creek, UT. (Figure 1).

In the San Juan River Basin numerous diversions extract water from the main-stem for agricultural and urban use. The Navajo Indian Irrigation Project (NIIP), San Juan-Chama Diversion, and Navajo-Gallup Water Supply Project allocate major depletions from the San Juan Basin at Navajo Reservoir. Downstream of Navajo Reservoir, smaller water diversion projects shunt water and act as potential portals for entrainment. Agricultural diversions include the Hammond Irrigation Project, supplying water for agricultural use from Blanco to Farmington, NM. The Public Service Company (APS) located downstream of the Animas River confluence extract water and create an instream barrier limiting fish movement. The Fruitland Irrigation Canal, Farmers Mutual, and Jewett Valley Canal, supply water for agricultural use between Farmington and the Navajo Nation. The Hogback Diversion, supplies water for crop development within the Navajo Nation between Shiprock and Cudei, NM. The Hogback Diversion is equipped with fish screens and an entrainment weir. Similarly the PNM weir supplying water to the San Juan Generating Station is equipped with a fish ladder. Downstream of these diversions small point diversions extract water from the San Juan River flowing through the Navajo Nation and in Bluff, UT.

There are numerous diversions on the Animas River in NM and CO. The largest diversion is the Animas-La Plata Project, completed in 2007 by the Bureau of Reclamation which draws water from the Animas River near Durango, CO filling an off channel reservoir, Lake Nighthorse. Over 15 small diversions exist on the Animas River flowing through NM.

Similar small diversions have been developed in the La Plata. The Mancos River has three impoundments for agricultural, hydroelectric and urban use. The Mancos River does not sustain perennial flow to the San Juan River. McElmo Creek near Aneth, UT is a perennial system due to irrigation returns back to the creek and provides important habitat to native catostomids.

1.2 Project Justification

Entrainment and impingement of any life stage is a recognized threat to the recovery of endangered fishes in the San Juan River (Goal 2.4, 2014 SJRRIP Long-Range Plan). Previous investigations have demonstrated that endangered species are susceptible to entrainment at diversion structures located on the San Juan River (Renfro et al., 2006.) This proposal will locate and identify, quantify, and rank all potential diversion risks to Razorback Sucker and Colorado Pikeminnow within the proposed study area.

The methodology outlined in this proposal directly addresses the following Tasks listed in the 2014 SJRRIP Long-Range Plan:

Task 2.4.1.2 Investigate the need for and construct, if appropriate, a fish screen or deflection weir at the Arizona Public Service Company (APS) Weir.

Task 2.4.1.3 Investigate the need for and construct, if appropriate, a fish screen or deflection weir at the Fruitland Canal.

Task 2.4.1.4 Investigate the need for and construct, if appropriate, a fish screen or deflection weir at the Jewett Valley Ditch.

Task 2.4.1.5 Investigate the need for and construct, if appropriate, a fish screen or deflection weir at the San Juan Generating Station.

Task 2.4.2.1 Investigate the need for and construct, if appropriate, a fish screen or deflection weir at diversion structures in the Animas River.

Task 2.4.2.2 Investigate the need for and construct, if appropriate, a fish screen or deflection weir at the Farmer's Mutual Ditch.

1.3 Project Objectives

The objectives of this project (Fish Entrainment for the San Juan River Basin Recovery Implementation Program) are to produce a stand-alone document that provides a complete listing and risk evaluation of entrainment and impingement hazards to endangered fish in the San Juan and Animas rivers. Quantitative information on fish distribution and abundances will be obtained from SJRIP monitoring data and other previous studies in the San Juan River Basin. Assessment of potential entrainment and impingement sites will be acquired during field visits to sites and from private, tribal, and government sources. The study objectives (listed below) are also in 2.0 (Plan or Study Design and Methods) along with detailed annotations about the information to be obtained and products to result from the effort.

1) Identify locations in the San Juan and Animas rivers where entrainment and/or impingement could be a potential threat to Colorado Pikeminnow and Razorback Sucker;
2) Document withdrawal amounts (CFS and acre-feet) for each diversion and relate these to proportion of river flows;
3) Document withdrawal locations using a GIS and legal descriptions;
4) Identify ownership of diversion facilities;
5) Document diversion locations with digital images and descriptions of diversions (aspect to river, height, width, gate structure, width of canal, etc.).
6) Prioritize risk of entrainment at each site using metrics based on proportion of flow, amount of screening currently present, proximity to stocking locations, quality of habitat upstream of diversion, and other metrics as identified by the SJRIP biology Committee during the initial contract meeting.
7) Produce a draft and final report that summarizes and details 1-6 above.

2.0 PLAN OR STUDY DESIGN AND METHODS

Project Outline
Phase I: Data Acquisition and Synthesis

Task #

Unless otherwise noted, tasks listed below will be collaboratively conducted and completed by ASIR and TNC.

1 Awarding of the contract is scheduled for April 2015.

2 Soon after the award of the contract, a preliminary one-day meeting with members of the SJRIP and other interested parties will be scheduled so that potential locations of diversions, methods

for data collection, and methods for determining potential risk of entrainment sites can be finalized.

3 The first major component of this project will be to identify all pertinent fish entrainment or impingement sites in the study area. While our initial assumption is that most of these (entrainment or impingement sites) will be withdrawal points for irrigation canals, we will not limit our review exclusively to irrigation diversions. For example: the City of Bloomfield, NM, operates a backup diversion facility which can withdrawal municipal drinking water from the San Juan River through a pipe. This review will result in a database (and subsequent map) containing all potential fish entrainment or impingement sites within the study area. The list of sites will be reviewed and form the foundation for the field trips to examine these locations. We anticipate being able to identify the majority of sites during the first month of the project and will have the final working list within one month of the award of the contract (by the end of June or July 2015).

4 Determination of the legal owners of the entrainment or impingement sites in the study area will likely occur concurrent with development of the draft working list of entrainment and impingement sites. Data on the legal owners of the sites will be recorded in a database and include:

a. Legal name of owner and/or entity operating the diversion.
b. Type of entity operating the diversion (i.e. individual, ditch association, municipality, state agency).
c. Contact information for representative(s) of entity operating the diversion (address, phone number(s), email address(es), and website, if available).

5 Four separate field trips will be made to visit each of the entrainment or impingement sites identified in the draft working list. Based on experience conducting field work (i.e. surveys, investigations, and construction) irrigation ditches/canals and related infrastructure, both in the Middle Rio Grande and San Juan River Basins, it is anticipated that the pertinent entrainment or impingement sites in the study area can be surveyed in three separate field trips. Part of the time involved in conducting these surveys will be to coordinate with ditch association representatives, many of whom work full-time and are only available to meet after normal office hours. For these field trips, a significant amount of time will also be spent driving from one survey location to another. The first three field trips will be attended by both ASIR and TNC staff. It is expected that the fourth field trip will be used to gather necessary follow-up data and to conduct surveys that were not able to be scheduled with ditch association representatives at the time of the first two surveys. Data to be acquired during the site visits include:

a. Coordinates of all diversion points and entrainments (GPS coordinates - UTM zone, UTM coordinates [easting and northing], UTM datum [i.e., NAD 27], longitude and latitude [degree decimals]);
b. Text description of location, river mile, USGS 7.5’ quadrangle of the diversion point, nation, state, and county.
c. Text description of access route used to survey the diversion structure.
d. Dimensions and condition of permanent structures in the river adjacent to diversion structures (including engineered/built grade control structures, dams, sills, or weirs) used to provide adequate head for diversion structures.
e. Text description of diversion structure, documenting the method of construction of the “headworks” (e.g., concrete, wood, pipe, or natural materials such as boulders) and method of diversion/flow rate control (e.g., radial or slide gate, spillways/returns, check dams)
f. Text description of any screens or grates across the face of diversion structures. This description will note the condition of the screen or grate.
g. Dimensions of diversion structure intake (i.e. height and width) when gates are fully open, dimension of major gates, and dimensions of diversion opening over the normal operating range. In the case of a pipe diversion, the diameter of the pipe will be documented

h. Dimensions of any screens or grates across the face of diversion structures, including the screen mesh or grate opening size.

i. Other measurements can be taken at each site including approach velocity (measured 8 cm in front of and perpendicular to diversion intake) and sweeping velocity (measured parallel to diversion intake) if identified as relevant measurements at the meeting with SJRIP and COTR; these variables have been shown to be important determinants of fish entrainment in other studies conducted outside of the American Southwest

j. Digital photographs of permanent structures in the river adjacent to the diversion structure, and digital photographs of diversion structures and other pertinent flow control structures such as gates and nearby spillways.

Ground measurements entrainment sites will acquired with Trimble GPS units and mapped in ArcInfo GIS to provide a detailed image for site. Pathfinder Office (or similar mapping software) will be used for all post-processing of raw data. Coordinates of the diversions and entrainment will be recorded with a backpack-mounted Pathfinder GPS Receiver and a Ranger Handheld Data Collector for reliable submeter (RMS) 2-D data collection with a published accuracy of about 20 cm RMS.

Field Work, Safety — Safety is paramount and working around diversion structures is inherently dangerous. At least one individual participating in field work are required to successfully complete an International Rescue Instructors Association (IRIA) level 2 swiftwater rescue class and American Red Cross CPR/AED training. Type III personal flotation devices (PFD's) will be worn by sampling personnel at all times while working. Safety briefings will occur before each field trip. High quality light-weight Gore-Tex waders and boots will be issued to all personnel. In addition, all personnel will be required to provide and use wide brimmed hats, sunscreen, and sunglasses (provided at no cost to the program).

Extensively stocked first aid kit replete with items necessary for most minor medical situation. Additionally, the first aid kit will contain a suite of items (i.e., splints, neck braces, butterfly stitches, snakebite kits) needed to address more serious medical conditions. First aid kits will be inventoried after each sampling trip and used and/or expired items replaced. Personal cell phones will be used (at no cost to the project) to contact outside parties should a medical situation arise. In addition, an Iridium 9505-satellite phone will be provided to field crews (at no cost to the project) for use in case of an emergency.

6 Acquisition and synthesis of the physical data acquired during the field trips as well as data acquired from other sources will be accomplished during autumn 2015. For each diversion, physical data recorded during the field trips will be summarized in a table, which will be included in an appendix in the final report. Maps depicting the entrainment and impingement sites will be prepared by the TNC. These maps will indicate the location of any permanent structures in the river adjacent to diversion structure, the location of the diversion structure itself, and any nearby pertinent flow control structures such as spillways. Photographs associated with each diversion will also be included in final report appendix.

7 The volume and timing of water withdrawals at individual diversions identified in this study will be acquired from available records. In the case of irrigation ditches, diversion records will be obtained from state agencies that administer water right use and that, in many cases, operate stream flow gages on irrigation ditches. In the case of irrigation ditches or canals not operated by private ditch associations, but rather operated by the Navajo Nation or the federal government, diversion records will be requested from the Navajo Nation or affiliated water users associations, or federal agencies that oversee operation of the diversions. In the case of municipal diversions, diversion records will be obtained from the municipality. If available, ditch diversion records will be compiled for 10 years. If digital diversion records are not available, then an effort will be made to obtain paper records from the ditch association, state agency or federal agency. If sufficient data are available, diversion rates (cfs) and volumes (acre-feet) will be summarized for each irrigation ditch on a daily and monthly average for each year.

8 Discharge data from the San Juan and Animas rivers will be acquired from USGS gaging stations throughout the study area and will match the period of records obtained under Task 8 for withdrawals. River discharge data from 2005 through 2014 are necessary to determine the percent of the river being diverted at various withdrawal points (see Task 7) over the past 10 years. Withdrawal data acquired for each of the pertinent diversion points will be analyzed and presented along spatial and temporal scales. Daily diversion amounts (in cfs and acre-feet) for each diversion will be combined with daily stream discharge to calculate percent of daily flow diverted for each of the years that withdrawal data are available (up to 10 years). Mean daily and mean monthly percent of flow diverted will be summarized by year and across years along with the number of diversion days each year. This information will be part of the risk assessment of each canal. A number of studies have shown that the percent of stream flow diverted, number of diversion days annually, and seasonality of diversion affect the magnitude of fish entrainment in diversions.

9 The 2005 – 2014 San Juan River fish monitoring and research dataset will be queried for endangered fishes. Specimens will be, following the monitoring objectives, divided into three life history stages: larval fish, small-bodied fish, and adult fish. Within each of these categories, fish distributions and relative abundance will be determined spatially and temporally (annually) so that these data can be overlaid with canal diversion information. Maps illustrating the differences in spatial and temporal distribution will be constructed and included in the final report. The endangered fish data will reported by life stage (larval, small-bodied, and adult) and presented temporarily (when available) and longitudinally. Catch rate metrics will be used as an indicator of relative abundance. The distributions and relative abundances of endangered fishes will be mapped and those data overlaid with discharge, canal withdrawal, and percent of river diverted to generate risk indices for each entrainment or impingement point.

10 This task ensures progress of the project through coordination with the COTR and contractor, and timely addressing of any issues that might arise during the tenure of the project. Project oversight, maintenance, and coordination (and monthly progress report) will be undertaken by ASIR. Tasks under this line item include coordinating project efforts between ASIR, TNC and the COTR for the USBR, being a liaison with the water users in the San Juan Basin as we acquire information related to irrigation canals, their history, workings, physical structure, and limitations, reporting as necessary to the SJRIP, and to coordinate billings and payments to contractors.

Phase II: Project Reporting

Task #

11 The monthly report will be submitted to the designated USBR point of contact and will use the Task timeline (Table 1) to track the progress of the project. The monthly report will also include a

brief summary of activities of the previous month. These reports will serve as project progress in reference to invoicing for work completed.

12 The draft final report will be written in scientific format and contain the following sections (Major Sections in **BOLD** followed by bulleted key topics for inclusion):

Executive Summary:
- Brief synopsis of the study and notable results,
- Summary of the main findings and interpretation of their importance to the entrainment of endangered San Juan River fishes.

Introduction:
- Summarizing pertinent literature on entrainment in the San Juan River and Upper Colorado River Basin with emphasis on Colorado Pikeminnow and Razorback Sucker.
- Synopsis of major findings from previous studies and their relation to the conservation of Colorado Pikeminnow and Razorback Sucker.
- Goals and objectives of the study.

Study Area:
- Description of the San Juan and Animas river, including connectivity, annual flow characteristics, and longitudinal characterization of flow and habitat.
- Summary of recent flow as measured at USGS gages in the study area.

Methods:
- Methods used for inclusion of canals in the study
- Methods used for collection, synthesis, and analysis of physical canal data,
- Description of data collected at each of study sites
- Methods used for synthesis and analysis of flow data by canal,
- Summary of the overall sampling structure/schedule for the study,
- Description of sources of fish data (for each life stage)
- Methods employed for the synthesis and analysis of fish data,
- Computational techniques used to quantify fish density,
- Methods used to determine level of risk by canal.

Results:
- Identification of pertinent diversion points,
- Longitudinal synthesis of diversion volumes,
- Longitudinal synthesis of percent of river diverted,
- Summary of longitudinal distribution of endangered fishes by life stage (larval, small-bodied, adult) and season in reference to pertinent diversion points,
- Risk identification and ordering of sites using criteria presented in Methods.

Discussion:
- Assess results of the study on the recovery of endangered fishes
- Propose means to minimize entrainment risks
- Propose means to mitigate entrainment risks
- Explore “win-win” options for water use
- Propose additional information needs that would move the process forward.

Acknowledgements:
- Individuals and institutions who assisted in the project,
- Source of funding,
- Reviewers

Literature Cited:
- List of references (in standard scientific format) used in the report.

Appendices:
- Detailed list containing location of all diversion points and entrainments including GPS coordinates (UTM zone, UTM coordinates [easting and northing], UTM datum [i.e., NAD 27],

longitude and latitude [degree decimals]), text description of location, river mile, USGS 7.5' quadrangle of the diversion point, nation, state, county, and legal owner of the canal or entrainment structure, type of entity operating the diversion, and contract information for representatives of the entity operating the diversion.

- Summary of physical characteristics for each diversion point, including photographs. Pertinent structures in canals (i.e., screens or grates, return flows to the river) will also be noted.
- Summary of discharge data for the river and for individual canals used in development of risk indices for each canal.
- Tabular presentation of endangered fish data by gross life stage (larval, small-bodied, adult) used in development of risk indices for each canal.
- Tabular presentation of fish data from individual canals presented in previous reports and used in development of risk indices for each canal.

The draft report will contain tables and figures that assist presentation of data acquired for this project. All pages, tables, figures, illustrations, and appendices will be sequentially numbered. Electronic copies of draft reports will be submitted by 31January 2016.

13 The draft final report will be distributed to SJRBRIP Peer Reviewers and to the Biology Committee for review and comment. After receipt of all comments, we will review and group comments by category of concern (i.e., similar questions will be addressed collectively) and make changes to the report accordingly. A written record of actions taken for reviewer comments will be maintained.

14 An oral presentation of this project will be given to the Biology Committee of the SJRBRIP (and interested parties) at their annual researchers meeting in February 2016. A PowerPoint presentation summarizing the purpose, methods, results, and conclusions of the project will be prepared and presented (up to 30 minutes) at the meeting. Reviewer comments or recommendation generated from the presentation will be reflected in the report and subsequent (May 2016) presentation.

15 An abbreviated version of the oral presentation of this project that was given in February 2016 to the Biology Committee of the SJRBRIP will be presented at a combined Biology Committee and Coordinating Committee meeting of the SJRBRIP in May 2016. The PowerPoint presentation that again summarizes the purpose, methods, results, and conclusions of the project will be created and presented (15 minutes) at the meeting. Reviewer comments or concerns generated from the presentation will be reflected in the final report.

16 The PI's will submit electronic copies of the fully revised final document after incorporating reviewer suggestions to the draft report (covered under Task 17). In addition, the database developed for this project will be submitted simultaneously with the final report. Five months have been allocated, from the submission of the draft final report (31 January 2016) to completion of the final report. The reason for allocating this time is so that the information can be presented to SJRBRIP Biology Committee (Feb 2016) and SJRBRIP Coordination Committee (May 2016) and so that the review process can track with all other SJRBRIP projects. Items completed under Task 19 include final proof reading of the report as well as review of the data included in the project database.

17 The contract end date is 31 July 2016. By this date, all deliverables will have been submitted to the contracting agency, all invoices for work accomplished will have been submitted and paid, and the report on the project will have been finalized.

2.1 CRITERIA BY WHICH PROJECT SUCCESS CAN BE DETERMINED

The product of this project will be a report, which, if successfully addressing the R15PS00493 scope of work, will be a stand-alone document (i.e., synthesizes information from other works and does not require the reader to review those supporting reports) document that provides the following information:

- Comprehensive list of canals in the study area
- Comprehensive list of diversion points in the study area
- Comprehensive list of entrainment/impingement points in the study area
- Documentation of the following for the above three items:
  - Ownership, contact information, operating entity, contact information, geographic location (GPS coordinates), physical characteristics (etc. See Task 5 for detailed listing)
- Geo-referenced maps of canal and entrainment/impingement points
- Volume of water diverted/duration of diversion/timing of diversion
- Discharge in the San Juan River, in proximity to canal diversion points, before, during, and after canal diversions
- Endangered fish (larval, small-bodied, adult) distribution and relative abundance in relation to canal diversion points
- Assessment (Priority List) of risk of entrainment/impingement of endangered fishes for each site
- Discussion of issues related to risk of endangered fish entrainment/impingement at each site
- Discussion of means to mitigate risk of endangered fish entrainment/impingement at each site

3.0 SCHEDULE

The schedule for completion of the Tasks listed under 2.0 (Plan or Study Design and Methods) is presented in Table 1. We have scheduled 16 months for the completion of the project and will be able to begin work immediately upon its award.

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TABLES

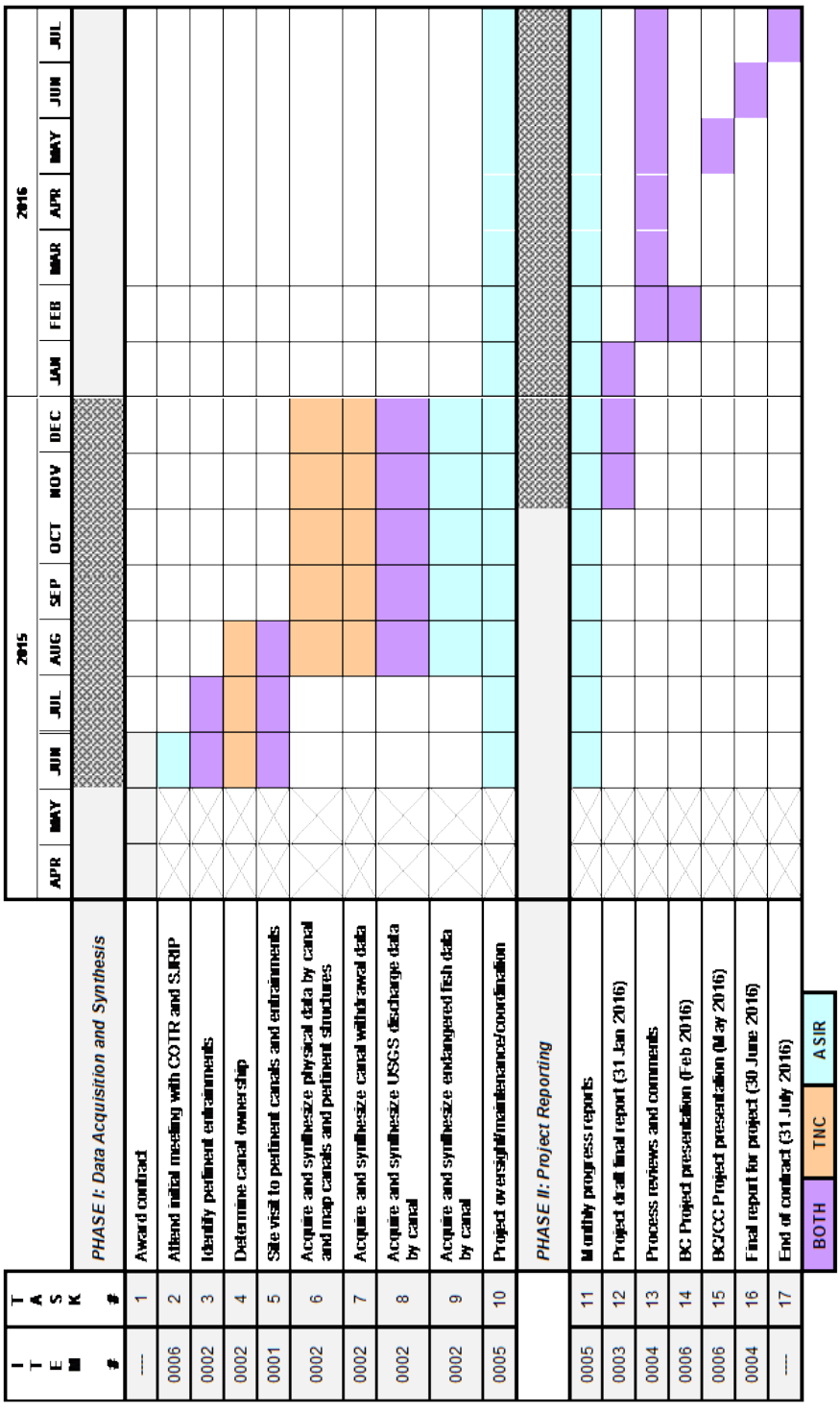

Table 1. Project timeline by Phase, Budget Item, and Task for the 2015 SJRIP fish entrainment study.

FIGURES

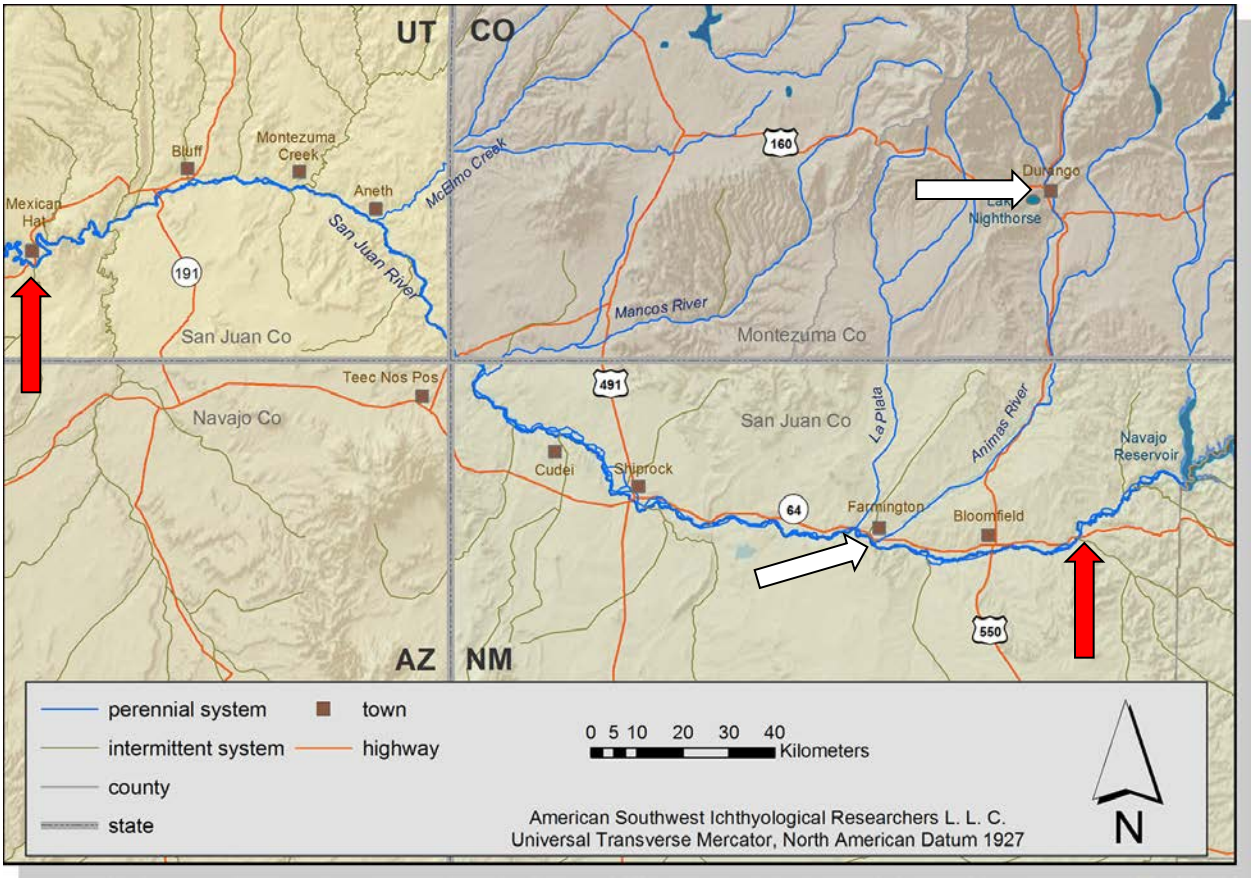

Figure 1. Map illustrating the portions (between the arrows) of the San Juan River (red arrows) and Animas River (white arrows) included in this project.

Fiscal Year 2016
Draft Scope of Work to Conduct
San Juan River Environmental Flows Workshop #2

Background

The San Juan River Basin Recovery Implementation Program (Program) held a workshop on environmental flows in the San Juan River on 12-13 February 2015. The goal of this workshop was to discuss and agree on an End of Water Year Storage Target (EOWYST) elevation for Navajo Reservoir. The group determined a target elevation of 6,063 feet (with an option to drop the reservoir to 6,050 feet for biological flexibility) was most appropriate to minimize the risk of shortage sharing, eliminate moderate releases that do not appear to accomplish intended results, and increase the frequency of larger releases from Navajo Dam. Water in excess of the storage target is considered "available water" that can be used for spring peak releases, elevated base flows, summer spikes, or other management as determined appropriate by the Program. A second and possibly third workshop was anticipated to evaluate and revise the 1999 Flow Recommendations. This scope-of-work details the process to evaluate the fish and habitat responses to flow recommendations that would culminate in a second San Juan River Environmental Flows Workshop.

Relevant Long Range Plan Tasks

Task 2.2.1.1. Implement flows that provide suitable habitat for endangered fishes and other native fishes in the San Juan River.

> Flow recommendations were developed in 1999 to provide sufficient water at times, quantities, and durations necessary to protect the endangered fishes and their designated critical habitat (Holden 1999). Reclamation has been operating Navajo Dam according to the Flow Recommendations since 1999. Reclamation implements the flow recommendations by making releases based on operations decision criteria developed in 2006 (Navajo Ops BO), hydrologic conditions, and operational constraints while maintaining the other authorized purposes of the Navajo Unit. Slight modifications to the 2006 operations decision criteria were made in 2015 primarily to adjust for prolonged dry hydrologic conditions in the San Juan River Basin.

Task 2.2.1.2. Develop and implement a process for revising flow recommendations.

> The Service will coordinate and oversee development of any revisions to the Program's flow recommendations (Program Document 2012). The process for revising flow recommendations will be based on monitoring data, the San Juan River Basin hydrologic model, updated climate change projections for stream flow, and scientific knowledge of flow-ecology relationships. The revised flow recommendations will be produced by the Program Office with technical guidance from the Biology Committee and outside experts. The revised flow recommendations will be reviewed and commented on by the Biology and Coordination Committees. Following review and any necessary revisions, the Program Office will submit the revised flow recommendations to the Service Regional Office and Reclamation for further review, revision, approval, and implementation.

Study Area

This project will encompass the San Juan River Basin downstream of Navajo Reservoir but analyses will be conducted on data that have already been collected.

Objectives

1. Evaluate the fish and habitat response to past flows.
2. Revise Flow Recommendations as appropriate.

Methods

A small team of Biology Committee (BC) members, San Juan River researchers, and Program Office staff will be convened to carryout pre-workshop tasks prior to the full workshop. Members of the team are yet to be identified but likely contributors would include: Ron Bliesner, Jason Davis, Scott Durst, Nathan Franssen, Dave Gori, Vince Lamarra, Mark McKinstry, Bill Miller, Steven Platania, and Tom Wesche.

Once members are identified, this sub-committee would meet over two days in Albuquerque to determine available data and assess how the information can be used. Specifically, during this meeting the sub-committee will: identify data, acknowledge limitations in the data, identify questions, review literature, agree on a process how to evaluate flow, and outline appropriate analyses to evaluate fish and habitat response to flow. Ideally, this meeting will be held in November or December 2015.

Analyses identified during the two day meeting in Albuquerque will be conducted in-house by sub-committee members over the course of one month. If necessary, a more detailed SOW to complete preliminary analyses and conduct the workshop will be developed.

The sub-committee will reconvene for a one day meeting in Albuquerque to share, discuss, and interpret results of analyses. Any additional analyses or alternative interpretations identified during this meeting will be investigated.

A two day workshop with the full BC, peer reviewers, and interested parties will be held in Albuquerque to share and discuss the findings of the sub-committee. Based on the evaluation of the fish and habitat response to flows and other relevant information, workshop participants will discuss possible revisions to the 1999 Flow Recommendations. Expected outcomes of Workshop #2 are: 1) the identification of revisions to the 1999 flow recommendations and, 2) the delegation of responsibility for making the revisions and finalizing the updated flow recommendations. The workshop will be moderated by an independent third party, likely Jim Brooks, and may include external experts to provide expertise and additional peer review. Ideally, the workshop will be held sometime from January-March 2016.

Products

The analyses conducted by the sub-committee will be summarized in a “whitepaper” and in presentation format during the workshop. The proceedings of the workshop will be summarized by an individual/entity not participating in the workshop.

Estimated FY-16 Budget

Anticipated costs for the two day workshop include expenses associated with preliminary analyses, workshop moderator, workshop note taker, and external expertise, if needed.

The total FY-16 budget for the workshop is estimated to be **$50,000.**

FY 2016 Reclamation Program Management

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Relationship to SJRIP: Supports Program goals and management by supporting approved activities

Study Goals, Objectives, and End Product: Program Management funds support Reclamation staff involved in program management. Funds are used for the administration of funding agreements, including issuing requisitions for program supplies, and the preparation and oversight of work conducted under interagency agreements, cooperative agreements, contracts, and grants. The funds are also used for formation and participation of the technical and peer-review committees, implementation of committee assignments not specifically identified in a scope of work, reporting, and coordination of water operations. Management support for Capital fund projects, including technical oversight, budgeting, preparation of bids and funding agreements is covered in a separate scope of work. Participation in Hydrology and Biology Committee meetings and business is paid for separately by Reclamation with funds unrelated to the SJRIP.

Task Description and Schedule

Task 1: Manage and administer funding for Recovery Program projects related to the Biology Committee activities. Funding Recovery Program projects requires establishment or modification of approximately 20—30 Reclamation funding agreements or contracts each year. Each financial agreement requires multiple steps and activities, including: submission of requests for Federal assistance for Recovery Program-approved projects; working with Recovery Program's office on funding issues; reviewing and approving (if warranted) project budgets; writing SOWs for RFPs, requesting obligations to cover funding agreement or contract awards; awarding agreements or contract funding to recipients; maintaining agreement and contract filing system including agreement instruments, invoices, and accruals; reviewing and tracking budgets; participating in audits; reviewing and approving invoices; performing periodic site visits to monitor project performance and progress; filing advanced procurement reports; organizing and participating on TPECs; drafting requests for proposals (RFPs); evaluating proposals and awarding contracts; performing agreement closeouts; answering agreement inquiries from auditors, assistance recipients, and the Recovery Program; recording project performance and status of deliverables; and filing recipient performance reports.

Deliverables/Due Dates: Requests from the Recovery Program for funding are processed as they are received. Other deadlines for committee activities are set by the Recovery Program participants during the development of the annual workplan.

Budget FY16

Task 1: Biology Committee Annual Funding Administration

A) Labor

Position	Salary total/hr	No. persons	Total Hours	Total cost
Reclamation Contract Manager	$120.00	1	20	$2,400.00
Biology Committee Technical Representation for Contracts and Agreements*	$90.00	1	700	$63,000.00
Lead Contract Officer	$120.00	1	80	$9,600.00
Contract Specialist	$70.00	1	1000	$70,000.00
Contract and agreement Auditor	$120.00	1	100	$12,000.00
Agreement specialist	$55.00	2	1000	$55,000.00
Total				$212,000.00

** Funding for Reclamation to participate in the Biology Committee is funded by Reclamation and not the SJRIP.*

B) Travel

Position	Destination	Purpose	Days	Lodging per day/total	Per diem per day/total	Other*	Airfare total	Total
Reclamation Technical representative	Farmington, Durango, or Albuquerque	Contract support for CC meetings, program funding meetings	3 trips @ 2 days/trip	$100/$600	$50/$300	$400	$2,500	$3,800.00
Reclamation	Farmington	Project evaluation or	2 trips @ 6	$100/600	$50/$300	$400	$2,000	$3,300.00

Technical representative		field trips	days/trip					
Reclamation Technical representative	Boise, ID; Kennewick, WA; various	Contract administration with suppliers	2 trips @ 3 days/trip	$100/$300	$50/$300	$400	$1,000	$2000.00
Lead agreement officer	Farmington, Durango	CC/BC mtg., or contract admin	1 trips @ 2 days	$100/$200	$50/$200	$100	$2,000	$1,500.00
Lead contract officer	Various locations	Contract Admin	1 trip @ 2 days	$125	$65/$130	$100	$300	$655.00
Total								$11,255.00

*Taxi $20; Parking $10; Rental car $100/trip

Budget Summary
FY-2015

Total labor	$212,000.00
Total travel	$11,255.00
Grand total	**$223,255.00**[1]

[1] **This total budget represents an 11% increase over the FY2015 budget due to the fact that the PIT Tag and Habitat contracts will need to be recompeted in FY2016 with a projected additional cost of $16,000. Additionally, auditing costs and additional labor required to process agreements has increased the costs of managing the agreements and contracts.**

Peer Review for 2016
Fiscal Year 2016 Project Proposal

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Background:
A Peer Review Panel was established in 1997 to assist the SJRIP with reports and plans for future studies. The five members of the panel participate in meetings and comment on pre-draft, draft, and final Scopes of Work, Workplans, reports, Integration analyses and reports, and other Program Documents.

This proposal provides for funding for the Peer Review Panel activities during 2016. It is anticipated that the Panel will meet with the Biology Committee at two regular Program meetings during the year and a Program workshop. The specific dates and tasks include:

1. Travel to and participate in a three (3) day San Juan RIP meeting being conducted in Durango, CO February 16-17, 2016. Review Documents prior to meeting.

2. Travel to and participate in a two (2) day San Juan RIP meeting being conducted in Durango, CO May 17-18, 2016. No review of documents required.

3. Travel to and participate in a two (2) day San Juan RIP workshop being conducted in Albuquerque, NM in 2016 (dates TBD) of for review of the Flow Recommendations. Review documents prior to meeting.

Goal:
The goal of peer review is to provide additional scientific oversight over San Juan River Recovery Implementation Program technical studies and reporting. The Peer Review Panel will work with the Biology Committee and Program Staff to produce scientific credible documents and will assist the Biology Committee in maintaining a scientific basis for the Program.

Methods:
The Peer Review Panel will meet with the Biology Committee in FY2016 two to three times to review monitoring and research progress, discuss scopes of work for 2016 and 2017, and participate in a workshop. They will provide verbal input during the meetings and provide written reviews of the progress of the Program. Their reviews will be provided to the Biology Committee through Mark McKinstry and Sharon Whitmore in letter form, or on the Biology Committee list server, and through discussions at the Biology Committee meetings. Biology Committee researchers may call Peer Review Panel members to ask for advice and Peer Review Panel members may call Biology Committee researchers if they have questions concerning Program activities. All correspondence between the Biology Committee and the Peer Review Panel will be coordinated through either Mark McKinstry or Sharon Whitmore.

Products:
Peer review participation at two Biology Committee meetings and one workshop, letter or verbal reports from each peer reviewer on an as-requested basis.

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Budget FY-16:
Payment for serving on the Peer Review Panel includes expenses for travel to and from meetings, and an hourly rate for services. It is anticipated that Panel Members will spend approximately 15-20 days each in 2016 (includes travel, meetings, and document review).

The total budget is distributed among the four peer reviewers through individual Services Contracts with Reclamation.

Salaries:	$52,000
Travel:	$ 8,000
Total	**$60,000**

Future use of the Peer Review Panel is not known but they likely will be used each year to provide guidance to the Biology Committee.

Estimated Out-year Funding:

2017 $60,000

San Juan River Recovery Implementation Program
Program Coordinator's Office
Fiscal Year 2016 Draft Proposal

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Cooperative Agreement #: R10PG40064 (08-AA-40-2713) and R10PG40086 (07-AA-40-2629)
Period of Performance: 10/01/2015 to 9/30/2016

Background

The San Juan River Recovery Implementation Program (Program) is designed to simultaneously address endangered fish species recovery and development of water resources within the Basin. The Program includes representatives from not only Federal agencies, but also the States of Colorado and New Mexico, the Jicarilla Apache Nation, the Southern Ute Indian Tribe, the Ute Mountain Ute Tribe, the Navajo Nation, conservation interests, and water development interests, most of which have legal mandated responsibilities to the endangered fish and/or the water resources.

Region 2 of the U.S. Fish and Wildlife Service (Service) is responsible for directing and coordinating the Program. As stated in the Program Document, the Service will appoint a Program Coordinator who will be responsible for overall Program coordination and dissemination of information about Program activities. Element 5, *Program Coordination and Assessment of Progress toward Recovery*, of the Program's Long Range Plan (LRP) identifies Program coordination goals, actions, and tasks that the Program Office will undertake to administer the Program. Numerous additional Program Office tasks are included in the LRP under other Recovery Elements. The Service's Program Office is located in the New Mexico Ecological Services Office (NMESFO) in Albuquerque, NM. Program staff includes a Program Coordinator, Assistant Program Coordinator, Recovery Science Biologist, Program Biologist, and part-time Program Assistant.

Program Coordination

Specific Service responsibilities for Program coordination are described in the May 17, 2012 Program Document as follows:

1. coordinating the activities of the Coordination Committee and the Program's technical committees, including providing notices, agendas, information packets, and providing draft and final summaries for committee and subcommittee meetings and conference calls as per the committee meeting procedures described in this document;
2. preparing and updating the LRP with research, monitoring, and recovery elements and goals;
3. ensuring consistency of the LRP with Service-approved species Recovery Plans;
4. prioritizing projects based on the LRP, and preparing AWPs, annual budgets, and annual progress reports;
5. ensuring the approved recovery activities as defined in the LRP and species Recovery Plans are implemented;
6. evaluating project accomplishments and shortcomings and providing an annual report to the Program;
7. monitoring implementation of all Program actions, including those Program actions identified as RPAs and RPMs in BOs, and reporting results to the Service on an annual basis;
8. developing an annual integration report that assesses the preceding year's monitoring data, progress toward recovery, and adaptive management recommendations, including recommendations for changes in direction, termination of projects, new projects, or other pertinent recommendations;

9. coordinating and overseeing development of any revisions to the Program's flow recommendations;

10. maintaining records showing the distribution and expenditures of all annual base and capital funds expended under AWPs by each funding source, and providing to the Coordination Committee at the end of each federal fiscal year an accounting of funds expended during the preceding year;

11. reporting to the Coordination Committee at each of its meetings the status of Program activities, the accomplishment of milestones or delays in meeting milestones, and any problems with maintaining Program work schedules along with recommendations for solving the problems;

12. disseminating information to state, federal, and tribal agencies;

13. ensuring that appropriate collecting permits are provided to each principal investigator;

14. advising Program participants of requests for initiation of consultation;

15. maintaining a list of interested parties as described in the committee meeting procedures provided in this document;

16. managing and maintaining the Program's data, central database, library, website, and listserves;

17. coordinating activities among the Program, the Upper Colorado Program, and the Colorado River Fishes Recovery Team, including participating in the five-year status review and in the updating of recovery goals for Colorado pikeminnow and razorback sucker;

18. implementing Coordination Committee recommendations to resolve problems or issues that may arise with regard to accomplishing Program activities;

19. providing materials and technical support to the non-federal participants for briefings with the members and committees of the U.S. Congress and state legislatures;

20. reviewing BOs for consistency with the Program's Principles;

21. preparing on a biennial basis a written "Sufficient Progress" assessment of the Program's progress towards recovery, the Program's ability to provide ESA compliance for water development and management activities, and any corrective actions needed to ensure future ESA compliance, in accordance with the Program's Principles;

22. working with Reclamation and other Program participants to improve, maintain, and utilize the Hydrology Model; and

23. implementing other activities needed to ensure the success of the Program as assigned by the Service or by the Coordination Committee.

It is recognized in the Program Document that some of these responsibilities will be carried out with the assistance from Program committees as more specifically defined in the Program Document sections entitled, "Biology Committee," "Long Range Plan Development and Annual Revision Process," and "Annual Work Plan Development Process" of the Program Document.

Maintenance of San Juan River Basin Recovery Implementation Program database and integration, synthesis, and analysis of data

San Juan River research efforts that preceded the establishment of the Program, in combination with those that have subsequently resulted from that program, form the basis of the suite of decisions already made and those to be made regarding biologic and hydrologic issues. An immense amount of information has been gathered through the San Juan River monitoring and research activities that have been conducted over the last 25 years. Most of this information has been synthesized and made available in the form of reports or publications. For example, in 2003 and 2004 researchers

consolidated and analyzed data from their individual long-term research projects and presented it as an integrated report of five years of research (1999-2003). Likewise, the flow recommendations report released in 1999 represented a synthesis between biological, hydrological, and habitat research activities.

Preparation of integration reports was difficult due to the absence of an updated, standardized, and easily accessible Program database. Keller-Bliesner Engineering, LLC, was originally responsible for maintaining the database and produced and distributed to the researchers CDs containing the updated Program database until 1998. In 2002, responsibility for maintaining the database was transferred to University of New Mexico (UNM). They initiated a project to develop and maintain a web-based system. This project was terminated in 2006. In 2007, the responsibility for managing Program data was transferred to the NMESFO's Computer and Geographic Systems Branch. A great deal of effort was required to inspect, transfer, and integrate UNM's GIS Database into existing and new Program data housed in the NMESFO Program database. Between 2007 and 2008, NMESFO IT staff transferred and incorporated a myriad of researchers' data into a Program database. They maintained, performed quality control, annually updated, and distributed the GIS researcher database using appropriate formats, and established electronic archives of the aforementioned database at the repository for this information (U.S. Fish and Wildlife Service Region 2 Office, Albuquerque, New Mexico).

In 2008, a full-time biologist position was created in the Program Office to take over the responsibility of maintaining the Program database. During 2009, the Program biologist developed an integrated data management system and performed Program data management activities. In 2011, The Program approved the addition of a recovery science biologist to the Program staff to oversee integration, synthesis, and analysis of the expansive Program database to assess and track the Program's progress and to determine the highest priority management actions needed to recover the endangered fish. The recovery science biologist position could not be filled until the first quarter of FY2015 due to government sequestration and Service hiring freezes and budget shortages. Starting in the last quarter of FY2015, the Program Office will be fully staffed.

Relevant Long Range Plan Tasks

Task 1.2.1.1 Maintain a standardized database for all stocked and recaptured RBS and CPM in order to determine the fate of stocked fish.

Task 4.4.2.1 Develop a centralized database that incorporates all data from standardized monitoring and integrate into the Program database.

Task 4.4.3.1 Identify, describe, and implement strategies for improving long-term survival and recruitment of razorback sucker and Colorado pikeminnow including but not limited to nonnative fish removal, enhancing habitat and food resources, enhancing genetic diversity and viability, and mitigating causes of range fragmentation.

Task 4.4.3.2 Use data and information gathered from fish surveys, hatchery augmentation, and survival studies to describe the best strategies for establishing wild populations of endangered fishes and restoring the native fish community.

Task 4.4.3.3 Use data and information gathered from the nonnative fish control program to evaluate effects of nonnative fish removal on distribution, abundance, and demographics (e.g., fish size, age, sexual maturity) of the endangered fish populations, the native fish community, and nonnative fish populations.

Task 4.4.3.4 Use data and information gathered from habitat assessments as the foundation for evaluating the effectiveness of the flow recommendations and operations decision criteria for Navajo Dam in providing suitable habitat for the endangered fishes.

Task 4.5.1.1 Annually, following review of the previous year's findings and data integration, identify and prioritize new projects, activities, questions, and information needs to be addressed in future work plans.

Task 5.1.1.4 Develop a list of prioritized actions and projects for the Annual Work Plan that most benefit recovery of the endangered fish populations.

Task 5.2.1.1 Establish and maintain a Program database of information collected under the various Program projects including all rare fish collections.

Task 5.2.1.2 Conduct annual Program reviews and develop annual reports that integrate monitoring and research data and results to track and assess yearly Program progress toward recovery.

Task 5.2.1.3 Conduct a biennial comprehensive review and assessment of Program progress towards recovery (i.e., Sufficient Progress Report).

Task 5.2.2.2 Develop positive population response criteria for the razorback sucker and Colorado pikeminnow to meet recovery demographic criteria for downlisting and delisting specified in recovery goals/plans adopted by the Service.

Task 5.2.2.3 Identify and evaluate limiting factors and determine research necessary research to identity actions that will minimize or remove these limiting factors.

Task 5.2.2.4 Use monitoring and research information to evaluate and use adaptive management strategies to modify recovery activities, as necessary, to ensure progress toward recovery.

Task 5.2.2.5 Develop interim recovery benchmarks for the Colorado pikeminnow and razorback sucker that are tied to monitoring data and are consistent with the species recovery plans and goals, positive population criteria, Sufficient Progress Assessment, LRP, and Program Document.

Study Area

This project will encompass the San Juan River Basin downstream of Navajo Reservoir but may ultimately be expanded to include the entire San Juan River Basin.

Objectives

1. Maintain and incorporate researchers' data into the Program's Database.
2. Maintain, perform Quality Control, annually update, and distribute current Program researcher database using appropriate format.
3. Establish electronic archives of the aforementioned database at the ultimate repository for this information (U.S. Fish and Wildlife Service, Region 2, Program Office, Albuquerque, New Mexico).
4. Utilize Program data and other information to analyze and assess progress toward recovery and to determine priority management actions to implement.
5. Maintain and update Program website with reports, data, and other relevant documents.

Methods

1. Update and Maintain Database in consultation and coordination with Program researchers, the Program biologists will integrate existing and new data into the existing Program Database. Data will be checked for Quality Control and updated as necessary.
2. Contact and Coordinate with appropriate personnel in the Upper Colorado River Recovery Program and Glen Canyon Environmental Studies offices to investigate the feasibility of linkage of the proposed San Juan River Recovery Implementation Database with other regional fish databases.
3. Analyze and Assess San Juan River Basin data and other information to track progress toward recovery and to determine priority management actions to implement. This work will be conducted on a year-round basis within the Program Office and be coordinated with Program researchers, other biologist within and outside the Service, and other Program participants on a regular basis.

FY2016 Priority

The Program's 1999 flow recommendations continue to be implemented and evaluated (Task 4.4.3.4). Considerable data have been collected and continue to be collected on habitats in the San Juan River. This information is continually assimilated, synthesized, and interpreted to assess and evaluate the effectiveness of Navajo Dam releases. Results from the past decade suggest that implementation of the 1999 flow recommendations may not be creating and maintaining enough habitat to achieve recovery goals for the endangered fish. In 2014, the Program initiated a process to begin

reviewing and revising the flow recommendations based on monitoring data, the new San Juan River Basin hydrologic model, updated climate change projections for stream flow, and expanded scientific knowledge of flow-ecology relationships. In February 2015, an environmental flow workshop was held to make minimal modifications to the process for implementing the current flow recommendations to partially address apparent weaknesses in the current process and improve flexibility in making releases. However, a comprehensive review and revision of the 1999 flow recommendations is needed (Objective 4; Method 3) and will be a priority of the Program's science staff in FY2016.

Products

The database will be disseminated to all committee members and be made available via a password-protected project website. The database will reside with the Program Office, NMESFO-Region 2 (Albuquerque), the designated repository for the data. Data analyses and integration of San Juan River Basin data and other information will be conducted throughout the year to track progress toward recovery and to determine priority management actions to implement. An environmental flows workshop (e-flow workshop #2) will be conducted in FY2016 to review and revise the Program's flow recommendations. Methodologies and results of data integration, synthesis, and analyses will be subject to independent peer-review and will be communicated to Program participants on a regular basis.

Education and Outreach

Element 6 of the Program's LRP identifies the goals, actions, and tasks the Program Office will undertake to accomplish Program Education and Outreach. The Program works jointly with the Upper Colorado River Recovery Program to conduct outreach activities for both Recovery Programs. Both programs operate under similar recovery elements with management actions that are consistent with the recovery goals for humpback chub, bonytail, Colorado pikeminnow, and razorback sucker. Because the Program Office does not have dedicated Information and Education staff, the Upper Colorado River Recovery Program's full-time, dedicated Information and Education Coordinator will be used to assist with certain education and outreach activities. An estimate of funds and activities to be provided to the Upper Colorado River Recovery Program include:

$ 6,000 Congressional Briefing Document (Program Highlights) printing
$ 4,000 Newsletter (Swimming Upstream) printing
$ 4,000 Exhibit fees
$ 2,000 Exhibit repairs/replacement
$16,000 Total

The Recovery Programs' continued success depends on coordinated efforts. Communication and outreach are areas where it makes sense to coordinate efforts. Using a shared approach helps to ensure that common audiences receive accurate, consistent information about the endangered fish species and efforts to recover them. Both programs reach out to the general public, elected officials, American Indian tribes, landowners, anglers, river rafter and guides, environmental organizations, water and power developers, teachers, students and Recovery Program participants. The geographic reach of some of these audiences differ by Recovery Program.

Education and Outreach Mission

To support the San Juan Program's success in recovering the endangered fishes by assuring that the public understands what is being done and why, and has confidence that the process is honest, open, sensitive, clear, and understandable. Education and Outreach efforts will be coordinated with the Upper Colorado River Recovery Program.

Goals

- To develop public involvement strategies at the beginning of any and all projects.
- To educate target audiences about endangered fish and to increase their understanding of, and support for, the recovery of these fish species at local, state, and national levels.
- To provide opportunities for the public to actively participate in activities that support recovery.
- To improve communication within the Recovery Program.
- To maintain an effective Program website

Target Audiences

- General public

- Elected Officials
- Land and pond owners
- Anglers
- River rafters and guides
- Environmental organizations
- Water users
- Power user interests
- Educators
- Recovery program participants (includes local, state and federal agencies)

Relevant Long Range Plan Tasks

Task 6.1.1.1 Provide information through news articles, press releases, radio and television ads, and other media in Farmington, Durango, Albuquerque, and others in the area to inform the public of Program activities.

Task 6.1.1.3 Maintain a Program website.

Task 6.1.2.2 Develop and exchange information and materials to incorporate into PowerPoint presentations, newsletters, Program highlights, and Program displays.

Task 6.1.2.3 Participate in selected outreach efforts at local, state, and regional water conferences.

Tasks

1. Coordinate San Juan Program outreach activities with the Upper Colorado River Recovery Program.
2. Proactively participate in education and outreach activities within the San Juan River Basin.
3. Disseminate information on Program activities to the public through brochures, newsletters, and/or the website.
4. Coordinate with outreach activities in the San Juan River Basin such as water users student fairs and local school fairs.

Fiscal Year 2016 Program Management Budget	**USFWS Funding**	**Base Funding**
Personnel/Labor Costs (Federal Salary + Benefits):		
Program Coordinator (GS-13) 1560/520 hours@ $66.55.29/hr	$103,740	$34,580
Asst. Program Coordinator (GS-13) 1040/1040 hours@ $50.13/hr (3/4 of the year)	$39,101	$39,101
Recovery Science Biologist (GS-12) 520/1560 @ $43.93/hr	$22,841	$68,523
Program Biologist (GS-9/11) 2080 hours @ 37.88/hr	$0	$78,780
Program Assistant (GS-7) 416/416 hours @ 32.26/hr	$13,421	$13,421
USFWS IT-Support	$14,000	--
USFWS Budget Analyst	$15,000	--
Personnel Sub-total	**$208,103**	**$234,405**
Travel/Lodging & Per Diem (based on published FY-2015 Federal Per Diem Rates):		
Hotel – 30 days in Farmington, NM @ $83/night		$2,490
Hotel – 35 days in Durango, CO @ $141/night		$4,935
Hotel – 15 days in Denver, CO @ $163/night		$2,340
Hotel - 6 days in St. George, UT @ $83/night		$510
Hotel – 8 days in Las Vegas, NV @ $96/night		$736

Per Diem – 30 days in Farmington, NM @ $46		$1,380
Per Diem – 35 days in Durango, CO @ $61		$2,135
Per Diem – 15 days in Denver, CO @ $66		$3,526
Per Diem - 6 days in St. George, UT @ $46		$306
Per Diem – 8 days in Las Vegas, NV @ $71		$568
Per Diem – 20 days camping @ $29 night		$580
Registration Fee – UT Water Users Workshop, St. George, UT		$300
Registration Fee CRWUA, Las Vegas $250 *2		$500
Travel/Lodging & Pier Diem Subtotal	**$0**	**$20,306**
Travel/Airfare & Mileage:		
Airfare to Denver, CO - $300 trip/6 trips		$1,800
Airfare to Las Vegas, NV - $600 trip/2 trips		$1,200
Airfare to St. George, UT - $800/1 trip		$800
Mileage to Farmington - 15 trips@190mi/trip*18 MPG=10.5gpt*4.00pg=$42.20)		$633
Mileage to Durango - 17 trips@220mi/trip*18 MPG=12.5gpt*4.00pg=$48.80)		$816
Rental Car @ $120/day*8 days		$960
Travel/ Airfare & Mileage Sub-Total	**$0**	**$6,209**
Equipment and Supplies:		
Supplies	$5,700	$5,700
Stamps		$515
Public Notices - costs for publishing public meeting notices in local newspapers; $40-150/meeting@ 50 meetings		$2,575
Printing/publication costs		$4,120
Computer Hardware Upgrades	$1,500	$1,500
Computer Software (ESRI GIS license fees, GIS extension (Spatial Analyst, Xtools, etc.), FTP software license, Stella license)	$1,500	$1,500
Outreach Materials		$3,000
Equipment and Supplies Sub-total	**$8,700**	**$18,910**
Facilities Rental Costs for Meetings:		
Farmington@ $100/day *35		$3,500
Durango @$300/day *15		$4,500
Facilities Rental Sub-Total	**$0**	**$8,000**
2016 Budget Subtotal	**$175,325**	**$285,796**
Administrative charge (3%)		**$8,574**
FY2016 Total	**$175,325**	**$294,370**
Carry-Over from 2015		**$115,000**
Grand Total	**$213,803**	**$181,465**