FISCAL YEAR 2013 ANNUAL BUDGET AND WORK PLAN

Approved August 28, 2012

SJRRIP FY2013 AWP Budget Estimate (*approved, August 28 2012*)

SOW	Title	Agency	Proposed Funding: Hydropower Revenue	Proposed Funding: Reclamation Funding	Proposed Funding: Capital Project Funding	Other Funding
	Element 1 - Management and Augmentation of Populations and Protection of Genetic Integrity					
7	Horsethief Canyon Ponds O&M at Ouray NFH	FWS, GJ	17,270			
8	Stocking & Acclimation of Age-0 CPM & Age-1+ RBS	FWS, ABQ	$37,186			
9	Colorado Pikeminnow Fingerling Production Dexter	FWS, DNFHTC	$103,693			
10	Rearing Razorback Suckers Dexter	FWS, DNFHTC	$82,469			
11	Razorback Sucker Production Uvalde	FWS, UNFH	$133,550			
12	RBS Augmentation/NAPI Pond Management	NN, FWS	$124,358			
	Subtotal		**$498,526**	**$0**	**$0**	**$0**
	Element 2 - Protection, Management, and Augmentation of Habitat					
13	Maintenance and Operation of Model	BR, SLC	$110,050			
14	Stream Gaging and Flow Measurements	BR, USGS	$7,600			
15	Operation of PNM Fish Passage Structure	NN, FWS	$86,494			
	Capital Projects Management	BR	$0		$56,000	
	Capital Hogback Canal	BR	$0		$400,000	
	PNM O&M	PNM	$0			
	SJR Channel and Floodplain Restoration, Phase II	TNC	$0			$88,800 [1]
	Subtotal		**$204,144**	**$0**	**$456,000**	**$88,800**
	Element 3 - Management of Non-Native Species					
17	Upper Nonnative Species Control & Rare Fish Monitoring	FWS, ABQ	$0	$330,634		
18	Lower Nonnative Species Control & Rare Fish Monitoring	UDWR	$0	$182,578		
	Subtotal		**$0**	**$513,212**	**$0**	**$0**
	Element 4 - Monitoring and Evaluation of Fish and Habitat in Support of Recovery Actions					
19	Sub-Adult/Adult Large-Bodied Fish Comm. Monitoring	FWS, GJ	110,568			
20	YOY/Small-Bodied Fish Monitoring	NMDGF	$92,353			$40,000 [2]
21	RBS/CPM Larval Surveys (Combined SOW)	ASIR	$217,291			
21a	Elemental Scale Analysis for Determining Natal Origin of RBS		$77,227			
21b	SJR Catostomid Opercular Deformity Study		$61,313			
22	Specimen Curation/Identification	UNM	$32,618			
25	Habitat Imagery (videography/satellite)		$22,000			
27	PIT Tags	BR	$50,000			
28	Integration and Synthesis of Long-term Monitoring Data	UNM	$82,658			
29	Database Management	FWS	$26,955			$8,475 [4]
30	Habitat/Temp Monitoring (w retrospective habitat analysis)	ERI, MEC	$127,750			
31	Peer Review	BR, FWS	$0	$50,000		
	2013 Workshop	BR, FWS	$0	$50,000		
	SJR Population Model Update, Maintenance, Model Runs	SUIT	$0			$72,000 [3]
	Subtotal		**$900,733**	**$100,000**	**$0**	**$120,475**

	Element 5 - Program Coordination and Assessment of Progress Toward Recovery					
32	Program Management FWS	FWS, ABQ	$0	$156,952		$200,079 [4]
33	Base Fund Management BR	BR, SLC	$0	$148,400		
	Subtotal		**$0**	**$305,352**	**$0**	**$200,079**
	Element 6 - Information and Education					
34	Education and Outreach	FWS, ABQ	$0	$25,577		
	Subtotal		**$0**	**$25,577**	**$0**	**$0**
	SJRRIP Total		**$1,603,403**	**$944,141**	**$456,000**	**$409,354**
	2013 Estimated Base Funds (2012 Amount x 3% CPI)		**$2,609,890**			
	Hydropower Revenue-Funded Projects		**$1,603,403**			
	Reclamation-Funded Projects		**$944,141**			
	Estimated available 2013 funds to proposed expenditures		**$62,346**			
	Carry over from FY2012		**$0**			
	Estimated available 2013 funds to proposed expenditures		**$62,346**			
	Notes					
	[1] TNC In-kind; [2] NMGFD In-kind; [3] SUIT In-kind					
	[4] USFWS contribution					

Operation & Maintenance of the Horse Thief Canyon Native Fish Facility Ponds Draft Fiscal Year FY-2013 Project Proposal 31 August 2012

Principal Investigators:
Dale Ryden, Thad Bingham and Brian Scheer
U. S. Fish and Wildlife Service
Colorado River Fishery Project
764 Horizon Drive, Building B
Grand Junction, Colorado 81506
(970) 245-9319
dale_ryden@fws.gov thad_bingham@fws.gov
brian_scheer@fws.gov

Contract or Agreement number(s):
None assigned yet

Period of Performance: 10/1/2012 through 9/30/2013

Operation & Maintenance of the Horsethief Canyon Native Fish Facility Ponds Fiscal Year 2013 Project Proposal 31 July 2012

Principal Investigator: Dale Ryden, Thad Bingham & Brian Scheer
U. S. Fish and Wildlife Service, Colorado River Fishery Project
764 Horizon Drive, Building B
Grand Junction, Colorado 81506
(970) 245-9319
dale_ryden@fws.gov thad_bingham@fws.gov brian_scheer@fws.gov

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 newly-constructed Horsethief Canyon Native Fish Facility (HCNFF) pond complex (about 7½ miles west of the main hatchery building) near Fruita, CO.

The newly-constructed 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 anticipated to be a multi-species broodstock, production, and rearing facility dedicated to rearing the four endangered Colorado River fishes: Colorado pikeminnow, 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.

Initially, the one surface acre of grow-out ponds allotted to the SJRBRIP will be 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. These progeny will be transferred as larvae and then reared at the main hatchery building for Ouray NFH-GVU. As these fish approach 200 mm TL, they will be stocked 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. It is anticipated that the first stocking of razorback sucker should be available to the SJRBRIP in fall 2013.

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 hatchery staff and allow 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.

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 completion and future operation of the HCNFF ponds represents a fundamental change to the way the Ouray NFH-GVU has operated in past years. Because of this, ascertaining the actual cost and commitment (money, manpower, equipment) necessary to operate and maintain this newly-constructed facility is still a work in progress. 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. As a starting point, the following staffing estimates were made for the overall O&M of the entire Ouray NFH-GVU for FY-2012:

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 newly-constructed 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

The overall budget for the Ouray NFH-GVU for FY-2013 is $465,816. Thus, the estimated fiscal breakdown of items 1) through 4) above would be as follows:
Costs for the entire Ouray NFH-GVU are broken down as follows:

1) 24-Road Hatchery: 100% staffing for 6 months	$232,908
2) 24-Road Hatchery: 50% staffing for 6 months	$116,454
3) Peter's ponds complex, Horsethief SWA ponds & lease-free grow-out ponds: 10 % staffing for 6 months	$ 23,291
4) HCNFF ponds: 40% staffing for 6 months	$ 93,163
Predicted total cost to fund all facilities for FY-2013	$465,816
a. One-sixth (16.7%) of the $93,163 for the O&M of the HCNFF ponds	$ 15,558

Possible Outyear Cost Increases

At this point, the budget figures presented here are only estimates and may need to be revised in future fiscal years, as actual costs incurred become more clearly defined. In addition, during the first year of production, the Ouray NFH-GVU has committed to absorbing the costs for PIT-tagging and transporting all fish to be stocked into the San Juan River. The actual costs for this PIT-tagging and stocking work may need to be added to this workplan in future years.

FY-2013 Budget:

Personnel/Labor Costs (Federal Salary + Benefits)

	UCREFRP Project 29a	SJRBRIP Cost
Principal Biologist (GS-11) – 1,948 hours @ $47.29/hr X 2 people (126 total hours covered by SJRBRIP or 63 hr/person)	178,254	5,954
Biological Technician (GS-9) – 1,844 hours @ $40.78/hr (60 total hours covered by SJRBRIP)	72,785	2,431
Biological Technician (GS-9) – 222 hours overtime @ $61.17/hr (7 total hours of overtime hours covered by SJRBRIP)	13,157	440
Biological Technician (GS-5) – 642 hours @ $17.95/hr X 2 people (41 total hours covered by SJRBRIP or 20.5 hr/person)	22,287	744
Sub Total	286,483	9,569

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

Project Leader (GS-14) – 1,450 hours @ $69.76/hr (47 total hours covered by SJRBRIP)	97,904	3,270
Administrative Officer (GS-9) – 418 hours @ $40.78/hr (13.5 total hours covered by SJRBRIP)	16,509	551
Sub Total	114,413	3,821

In-Kind Services

Bozeman Fish Technology Center		
Grind and sift fish food for larval razorback suckers	<$2,500>	<85>

Pond & Hatchery Operations & Maintenance

Fish Food	16,000	535
Chemicals and Fertilizer	8,000	267
Hatchery Supplies and Equipment Repair and Replacement	10,000	334
Office Supplies	1,500	50
Vehicles	10,100	337
Utilities (Snook's Bottom & Horsethief)	11,000	367
Travel	8,320	278
Sub Total	64,920	2,168
Total	$465,816	15,558

Total Incurred Costs for SJRBRIP:

USFWS-CRFP (Grand Junction, CO) Total	15,558
USFWS Region 6 Administrative Overhead (11.00%)	1,712
USFWS Region 6 Total	**17,270**

Augmentation of Age-0 Colorado pikeminnow and Age-1+ razorback sucker in the San Juan River Fiscal Year 2013 Project Proposal

Principal Investigators: D. Weston Furr, Ernest Teller, Sr. and Jason E. Davis
United States Fish and Wildlife Service
New Mexico Fish and Wildlife Conservation Office
3800 Commons Ave N.E.
Albuquerque, N.M. 87109
(505) 342-9900
Weston_Furr@fws.gov Ernest_Teller@fws.gov Jason_E_Davis@fws.gov

Cooperative Agreement #'s:
USFWS – NMWFCO R11PG40011

Period of Performance: 10/1/2012 through 9/30/2013

Background

Colorado pikeminnow (*Ptychocheilus lucius*) and razorback sucker (*Xyrauchen texanus*) are federally-listed endangered fish 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 while water development proceeds in compliance with all applicable federal, state, and tribal laws (USFWS 2008). 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 sub-basin and at least 700 adults in the upper Colorado River sub-basin, as well as a target of 1,000 subadults in the San Juan River sub-basin (USFWS 2002). Delisting criteria include a self sustaining population that exceeds 800 adults maintained in the San Juan River sub-basin. 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.

Fish community monitoring during the SJRIP seven year research period, 1991-1997, identified few wild Colorado pikeminnow inhabiting the San Juan River and 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 age-1+ Colorado pikeminnow 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, NM and Lake Powell, UT RM 0 (Maddux et al. 1993). This is the area designated as Critical Habitat for razorback sucker (USFWS 1994). Between March 1994 and October 1996, 942 razorback sucker 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 annual stocking of ≥11,400 razorback sucker from a combination of fish reared in a hatchery and razorback sucker 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 2010 SJRIP Draft Long Range Plan (LRP). These activities are specifically addressed in the following Elements, Goals, Actions, and Tasks:

Element 1. Management and Augmentation of Populations and Protection of Genetic Integrity

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

Action 1.1.1 Develop plans for rearing and stocking for CPM.

Task 1.1.1.3 Evaluate and adjust stocking goals of augmentation plan.

Task 1.1.1.4 Review and update augmentation plan 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 Annually stock >300,000 age-0 CPM**

***Phase II modification:*

Annually stock ≥ 400,000 age-0 Colorado pikeminnow. [2011-2020]

Task 1.1.2.3 Annually stock 3,000 age-1 CPM. **

*** Phase II modification:*

discontinue annual stocking of ≥ 3,000 age-1+ Colorado pikeminnow; except in instances under Task 1.1.2.4. [2011-2020]

Task 1.1.2.4 Opportunistically stock available CPM in excess of those described above.

** indicates that the LRP 2010 DRAFT does not reflect modifications to the augmentation program outlined in Augmentation of Colorado Pikeminnow (*Ptychocheilus lucius*) in the San Juan River: Phase II, 2010-2020 (Furr 2010), modifications are delineated in *italics*.

Goal 1.2--- Establish a Genetically and Demographically Viable, Self-Sustaining RBS Population.

Action 1.2.1 Develop plans for rearing and stocking RBS.

Task 1.2.1.3 Estimate and adjust stocking goals of augmentation plan.

Task 1.2.1.4 Review and update RBS augmentation plan as needed.

Action 1.2.2 Produce, rear, and stock sufficient numbers of RBS to meet stocking goals of augmentation plan.

Task 1.2.2.1 Produce and rear RBS at Dexter NFH for stocking to grow-out facilities.

Task 1.2.2.2 Annually stock three NAPI grow-out ponds with 3,000-3,500 fish per pond (> 200 mm TL) hatchery-reared RBS.

Task 1.2.2.3 Produce 12,000 RBS per year (>300 mm TL) at Uvalde NFH.

Task 1.2.2.4 Stock at least 91,200 RBS (> 300 mm TL) during 2009-2016 or 11,400 per year.

Task 1.2.2.7 Opportunistically stock available RBS in excess of the 11,400 described above. *(i.e. stock all razorback sucker from NAPI grow-out ponds annually)*

Goal 1.3— Monitor and Evaluate RBS and CPM Augmentation Program and Genetic Integrity.

Action 1.3.1 Monitor status and success of stocked RBS and CPM.

Task 1.3.1.1 Determine survival and recruitment of stocked RBS and CPM to assess stocking success

Action 1.3.2 Evaluate factors limiting RBS and CPM population recovery.

Task 1.3.2.1 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.

Action 1.3.4 Assemble information from population management and augmentation.

Task 1.3.4.1 Use data and information gathered from fish surveys, hatchery augmentation, and survival studies to describe best strategies for establishing wild populations of endangered fish and restoring the native fish community.

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 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 2013

1. Coordinate with Dexter National Fish Hatchery and Technology Center (NFH&TC) to procure and stock Colorado pikeminnow 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 Uvalde National Fish Hatchery and Navajo Nation Department of Fish and Wildlife to procure and stock razorback sucker according to guidelines set forth in *An augmentation plan for razorback sucker in the San Juan River* (Ryden 2003)
    a. Annually stock ≥11,400 age-1+ razorback sucker.

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. 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 sucker 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. 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 pikeminnow will be annually reared and harvested by Dexter NFH&TC 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. All age-0 Colorado pikeminnow will be acclimatized to a variety of conditions (i.e. flow, temperature, physical/environmental characteristic, etc.) for up to 24 hours prior to release into the San Juan River.

Objective 2.a. At least 11,400 razorback sucker will be reared at Uvalde NFH, implanted with a Passive Integrated Transponder tag (PIT tag), measured for total length and weight, and delivered via standard distribution unit to the San Juan River annually. Dexter NFH&TC will stock approximately 10,500 razorback sucker ($\geq$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. All razorback sucker, or a subset, from Uvalde NFH will be acclimatized to riverine conditions (i.e. flow, temperature, physical/environmental characteristic, etc.) for up to 24 hours prior to release into the San Juan River. A subset of fish that would serve as a control group may be hard released. Having this control group would aid the Program in comparing survival and retention of acclimatized fish by comparing differences in subsequent recapture rates.

Objective 3. New Mexico FWCO will identify various sites downstream of RM 180 and determine their suitability for use as stocking locations. 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 March 2014. A draft summary report detailing findings will be submitted to the San Juan River Implementation Program, Biology Committee, by 31 March 2014. Revisions will be completed and a final annual report will be submitted by 1 June 2014.

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.

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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.

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 2013 Proposed Budget:

Personnel/Labor Costs (Federal Salary + Benefits)	
Fish Biologist (GS-11-3) – 46 days @ $349/day	$ 16,054.00
Age-0 Colorado pikeminnow stockings (Objective 1.a): (1 person x 3 days/trip x 2 trips)	
Age-1+ razorback sucker stockings (Objective 2.a): (1 person x 2 days/trip x 10 trips)	
Reporting/Data Management (Objective 2) (1 person x 20 days)	
Bio. Science Technician (GS-8) – 26 days @ $328/day	$ 8,528.00
Age-0 stockings (Objective 1.a): (1 person x 3 days/trip x 2 trip)	
Age-1+ razorback sucker stockings (Objective 2.a): (1 person x 2 days/trip x 10 trips)	
Supervisory Fish Biologist (GS-13-4) – 5 days @ $513/day (Project oversight and review)	$ 2,565.00
Sub-total	$ **27,147.00**
Travel and Per Diem (Based on Published FY-2010 Federal Per Diem Rates)	
Hotel Costs – 14 nights (14 nights @ $77/night – single occupancy = $1,078)	$ 1,078.00
Per Diem (Hotel Rate) – 26 days @ $46/day	$ 1,196.00
Sub-total	$ **2,274.00**
Equipment	
Vehicle Maintenance & Gasoline 8,000 miles @ $0.51/mile (includes costs associated with gasoline/diesel fuel vehicle maintenance)	$ 4,080.00
Sub-total	$ **4,080.00**
USFWS-NMFWCO Total	$ 33,501.00
USFWS Region 2 Regional Office Administrative Overhead (11.00%)	$ 3,685.00
USFWS Region 2 Total	**$ 37,186.00**

Out-year funding

FY 2013	**$37,186**
FY 2014	**$38,726**
FY 2015	**$39,907**
FY 2016	**$41,113**
FY 2017	**$42,315**
FY 2018	**$43,593**

COLORADO PIKEMINNOW Age-0 PRODUCTION
San Juan River
FY-2013

Contract Number: IA# R10PG40022
Period of Performance: 10/1/2012 through 9/30/2013

Principal Investigators- William Knight and Manuel E. Ulibarri
Dexter National Fish Hatchery and Technology Center
U.S. Fish and Wildlife Service
P.O. Box 219, 7116 Hatchery Road
Dexter, NM 88230-0219
April 02, 2012

575-734-5910 Work
575-734-6130 Fax
william_knight@fws.gov
manuel_ulibarri@fws.gov

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 both 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 Dexter NFH&TC allow for ≥400,000 age-0 Colorado pikeminnow to be produced and stocked annually. This has been identified as the stocking target for 2013 and subsequent years unless further production capacity is identified and/or stocking targets modified by the SJRIP.

Dexter NFH & TC has been the leader in propagating and culturing Colorado pikeminnow (Ptychocheilus lucius) 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 major emphasis has been on the reproductive biology, 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 study for future years and aide in restoration of the species. Stocking will require coordination with New Mexico Fish & Wildlife Conservation Office, 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 2013.

(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 300 (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 Dexter 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 2013 a maximum of 50 paired matings (1 female X 1 male) will be spawned from the 1991/1999 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 Dexter.

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 DNFH&TC 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 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

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.

Predator Control

Historically, DNFH&TC 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. During the winter months Colorado pikeminnow reared for this project will be maintained in two outdoor earthen ponds covered with bird netting.

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 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) and 0.26 ml/L Stress Coat7 (1 ml 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 degrees towards equalizing per 15 minutes time. Due to the high alkalinity and TDS of DNFH&TC 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. 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. 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 Unit will provide bacterial and viral testing for Colorado pikeminnow propagation and rearing activities. Treatment of disease will be the responsibility of the Dexter 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 of the Phase II (2010 – 2020) *"draft"* **Augmentation Of Colorado Pikeminnow (*Ptychocheilus lucius*) In The San Juan River Plan ,** (Furr 2009). In the case of catastrophic loss (>25% of the stock) at the Dexter NFH&TC, 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.

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.

Reporting

Annual progress report detailing fish culture and distribution activities will be completed and provided to the SJRIP by January 31, 2014.

Schedule

Broodfish will be spawned in May 2013 and age-0 fish reared in earthen and plastic lined ponds from June - October 2013.

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.

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. 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.

Budget

RE: Colorado pikeminnow age-0 production at Dexter National Fish Hatchery and Technology Center. The following costs are associated with producing and stocking 400,000 age-0 fingerlingsin the San Juan River in 2013. Identified costs also include maintaining 400-500 adult Colorado pikeminnow broodstock for recovery efforts.

Budget -Detailed Spending Plan 2013

O&M Labor Costs

The labor costs identified in the 2013 Scope of Work are broken down as follows, and include fringe benefits and payroll additives for each position identified:

Dexter National Fish Hatchery & Technology Center

(1) Fish Biologist (1,280 hours -16pay periods) - GS 482-9 @$29.60/hr = $37,888

* Supervision, spawning, fish health and water quality monitoring, feeding, harvest and prep for distribution.

(1) Administrative Officer (240 hours- 3pay periods) - GS 341-9 @$28.95/hr =$ 6,948

* Budget tracking, purchasing, data base management & reporting.

Subtotal = $44,836.00

Equipment and Supplies:

Liquid oxygen and compressed oxygen 12 cylinders @ 74.50, Airgas	$ 894.00
Spawning Supplies Hormones (CCP 5 vials @ $180 per 10ml/vial)	$ 900.00
Fish health sampling prior to stocking	$ 3,000.00

Lab supplies for bacti, viral and parasite testing.	
Culture equipment (nets, seines, screens, etc.)	$1,000.00
Eager, Memphis Net & Twine	
Pond management supplies, Barrier $250/50# bag	$5,000.00
Van Diest	
Fish feed,1.45/lb, 6,000 lbs	$8,700.00
Nelson & Sons	
Cyclical Maintenance costs for:	$1,450.00
Tractors, mowers, gators, sweepers	
used in pond maintenance	
Subtotal	**$ 20,944.00**
Utilities:	
Pumping costs	
Electrical 200,257 kwh @ .085	$17,022.00
Heating water for hatching eggs to swim-up	
Natural gas 1,525 ccf @ .90	$ 1,372.50
Subtotal	**$18,394.50**
Reintroduction Costs:	
Salaries	
GS-9 Fish Biologist	
24 hrs @ $29.60	$710.00
GS-7 Fish Biologist	
24 hrs @ $22.00	$528.00
WG-7 Maintenance Worker	
24 hrs @ $20.00	$480.00
WG-5 Bio Science technician	
24 hrs @ $15.00	$360.00
Lodging &Per Diem $123/day (Dexter to Farmington, NM and return)	
$123.00/trip x 2 trips x 4 employees =	$984.00
Fuel costs and truck maintenance 1200 miles @ $5.15	$ 6,180.00
Subtotal	**$ 9,242.00**
Annual Totals (O & M Direst Costs)	**$ 93,416.50**
11% Administrative Overhead	**$ 10,275.82**

TOTAL REQUESTED FOR 2013 **$ 103,692.32**

Projected out year funding request:

FY 2014 - $106,739.88
FY 2015 - $110,344.33
FY 2016 - $113,666.22
FY 2017 - $117,163.84
FY 2018 - $120,326.81

Rearing Razorback Sucker Sub-Adults at Dexter National Fish Hatchery and Technology Center FY 2013

Contract Number: IA# R11PG40012
Period of Performance: 10/1/2012 through 9/30/2013

Prepared for:
The San Juan Recovery Implementation Program

Principal Investigators – William Knight, Manuel E. Ulibarri
Dexter National Fish Hatchery and Technology Center
P.O. Box 219, 7116 Hatchery Road
Dexter, New Mexico 88230-0219
575-734-5910
575-734-6130 Fax

William_Knight@fws.gov
Manuel_Ulibarri@fws.gov

Background

The following scope of work identifies the facilities and methodologies that will be used at Dexter National Fish Hatchery &Technology Center (DNFH&TC) to continue producing 11,000, 200+ mm razorback sucker 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 these fish to existing grow-out ponds located on the Navajo Indian Irrigation Project. DNFH&TC has developed production guides for the species based on historical growth rates and produces large numbers of razorback sub-adults (300+mm) for stocking into Lake Mohave, Arizona, Lower Colorado River.

The U.S. Fish and Wildlife Service (USFWS) has developed extensive infrastructure and expertise at DNFH&TC to successfully contribute to recovery programs. The DNFH&TC program has been totally devoted to the maintenance, propagation and culture of threatened and endangered fish species for thirty years. During that period it has successfully cultured razorback sucker, bonytail and Colorado pikeminnow of the Colorado River system. Currently DNFH&TC maintains a large genetically diverse razorback sucker broodstock and over the years has 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 1.5 million fish annually.

Location

Dexter National Fish Hatchery and Technology Center 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 hatchery was authorized under the White Act of 1930 (46 Stat. 371 - 05/21/30), to meet the demands for warmwater game fish throughout the southwest. The land, originally the property of the New Mexico State Game and Fish Commission, was acquired by the Federal Government on August 31, 1931. The station lands comprise a total of 640 acres in Section 16, T13S, R26E, Chaves County. Construction of the facility

started immediately after purchase with assistance of the Public Works Administration and Progress Administration. Operations began in 1932.

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 71 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.

Lake Mohave Razorback Broodfish

Staff at Dexter National Fish Hatchery and Technology Center successfully propagate and maintain 16 federally listed fish species; and produces over 1.5 million fish annually for recovery and restoration programs throughout the southwest. Razorback sucker have been maintained and cultured at the facility since 1981. Captive broodstock representing the Lake Mohave population exist at DNFH&TC. According to station records, the initial broodstock was founded with progeny from 136 wild adult fish collected from Lake Mohave in 1981.

An additional 147 wild individuals were collected from the lake in 1982, spawned that year, and contributed fry to the stocking efforts in the Gila, Salt and Verde rivers and Lake Mohave, but were not incorporated into the captive broodstock. In 1984, Dexter's RBS captive broodstock consisted of 360 three-year old fish derived from the wild adults spawned at Dexter in 1981. Wild caught adults collected in 1981 and 1982 had expired by the end of 1985. The first captive broodstock of RBS at DNFH&TC is referred to as the '81 broodstock. The '81 broodstock currently contains 75 adult fish (Table 1). Initial spawning of this broodstock occurred in 1984 (Hamman 1985). It should be noted that no progeny of the '81 broodstock are currently held as broodstock at any facility. Since the broodstock's inception, all offspring have been stocked to meet production commitments. Over the past 25 years, offspring from this stock have been stocked into Lake Mohave and Lake Havasu; Gila, Salt, Verde and San Juan rivers; Niland-Imperial Valley Hatchery, California; Page Springs SFH, Arizona; Buenos Aires, Cibola, Imperial, Havasu National Wildlife Refuges; and the Colorado River Fisheries Project (CRFP) at Vernal, Utah. The second broodstock is referred to as the Paired Matings (PM) broodstock. This stock, comprised of approximately 90 unique family groups is the product of paired matings of wild caught adults spawned at Willow Beach NFH from 1994 to 2004. Those efforts resulted in 500 fish currently held as PM future broodstock at DNFH&TC (Table 1). A third broodstock has been developed at DNFH&TC, and consists of six year classes of juvenile wild-caught fish from Lake Mohave. These fish were captured as fry from eight locations throughout Lake Mohave and given the designation of Wild Caught (WC) future broodstock (Table 1).

Table 1. Dexter NFH & TC Razorback Sucker Captive Broodstock

Year Class	Origin	Numbers on hand	Founders Represented	Lot Designation
1981	F_1 Mohave	75	adults / Mohave	'81

1994-2003	Mohave	500	90 / Mohave	PM
1999-2004	Mohave	500	fry /Mohave	WC
2003-2004	F_2 Mohave	400	25/ '81 captive stock	F_2

'81-1981 year class, Mohave-Lake Mohave, AZ, PM-Pair Matings, WC-Wild Caught

From 2001-2012 production of subadult razorbacks at DNFH&TC 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. DNFH&TC's 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. DNFH&TC staff have 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 DNFH&TC to rear and distribute the target # of fish.

(2) Passive Integrated Transponder (PIT) tag all fish prior to stocking into the NAPI ponds. PIT tags will be provided to Dexter NFH&TC by the SJRIP.

(3) Bi-annually provide 25,000 RBS larvae to the Uvalde NFH for growout.

(4) Maintain razorback sucker captive broodstock for recovery efforts.

Methods
DNFH&TC will conduct captive propagation activities that include spawning of a minimum of 20 pairs of broodstock, incubation of fertilized eggs, enumeration and stocking of swimup fry into DNFH&TC ponds, harvest of target sized fish from ponds, enumeration and distribution to Navajo Indian Irrigation Project.

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.

Spawning
Broodfish will be harvested from ponds in early March and held indoor for spawning. Razorback sucker spawning protocols developed at DNFH&TC that will be used are listed in Appendix Table 3.

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/l, 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 DNFH&TC 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 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

Projected Harvest Dates and Delivery Date

Year 2013 marks the eighth year of razorback production at Dexter for distribution to the NAPI ponds. Since 2006, Dexter staff have stocked a total of 52,348 razorback's averaging 225mm in length into East and West Avocet and Hidden ponds. An additional 11,000 will be stocked into the NAPI ponds in April 2013. Over the past four years DNFH&TC also provided over 300,000 (92,000 in 2009) razorback larvae to the Uvalde NFH for growout and eventual stocking into the San Juan River.

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. In 2007 a new single cohort fish rearing strategy was adopted by the SJRIP for the NAPI ponds. 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).

Predator Control

Historically, DNFH&TC 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 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 degrees towards equalizing per 15 minutes time. Due to the high alkalinity and TDS of DNFH&TC 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.**

PIT Tagging

Starting in 2012 all fish stocked into the NAPI ponds will be 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 dropped a tag will be retagged.

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 Navajo Indian Irrigation Project, SJRIP. 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 Dexter 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 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 the Dexter NFH&TC, 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.

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 Dexter NFH&TC could potentially continue till 2020 as per BOR RFP 04-SF-40-2250.

Reporting
A draft annual progress report detailing fish culture and distribution activities will be completed and provided to the SJRIP by January 31, 2014.

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 2013. Target sized fish are available for distribution in spring and fall of each year.

Budget

IA #R11PG40012, Rearing Razorback Sucker Sub-Adults at Dexter National Fish Hatchery and Technology Center, Costs associated with rearing 11,000 – 200mm fish for NAPI ponds and producing 25,000 larvae for Uvalde NFH Bi-annually. Detailed Budget Spending Plan, 2013.

O&M Labor Costs
The labor costs identified in the 2013 Scope of Work are broken down as follows, and include fringe benefits and payroll additives for each position identified:

Dexter National Fish Hatchery & Technology Center

(1) Fish Biologist (1,040 hours -13pay periods) - GS 482-9 @ $29.60/hr = $30,784
* Supervision, spawning, fish health and water quality monitoring, feeding, harvest and distribution.

(1) Administrative Officer (160 hours- 2pay periods) - GS 341-9 @$28.95/hr = $ 4,632
* Budget tracking, purchasing, data base management & reporting.

Subtotal = $35,416

Materials and Supplies
Cost based on Dexter NFH&TC historical purchases:

Fish Health

Fish health sampling prior to stocking	
Lab supplies for bacti, viral and parasite testing.	$ 3,000
Wet lab supplies (pipets, petri dishes, slides, probes, markers)	$ 250
Theriputents- salt, furacin, formalin, MS-222, stress coat	$ 600
Liquid and compressed oxygen for fish distribution	$ 200

Feed		
Production diet RBS0301 (1.5tons) 3,000 lbs $ 1.45 per lb		$ 4,350
Spawning Supplies		
Hormones (HCG 10 vials @ $ 50 per 10ml/vial)		$ 500
Fertilizer		
Alfalfa pellets (1,000 lbs) .25/lb		$ 250
Inorganic - Super Phosphate (10 bags) 7.50/bag		$ 75
Chemicals Aquatic Vegetation Control		
Barrier- (6 bags) $250/bag		$ 1,500
Diuron - (2 bags) $ 75/bag		$ 150
	Subtotal =	**$10,875**
Services		
Utilities & Equipment Maintenance		
* Electrical, fuel and phone		$ 3,500
* Boiler system, heat exchanger maintenance		$ 1,000
*#1 well and water tower and pumping station maintenance		$ 9,500
	Subtotal =	**$ 14,000**
Travel		
- Fish stocking/distribution.		
Dexter to Farmington (NAPI) & return- (1640 miles @ 5.15 per mile DX truck) =		$ 8,446
Fuel and routine vehicle maintenance.		
Perdiem- $123 per day X 2 trips X 2 individuals. =		$ 492
Dexter to Uvalde & return- (960miles @ 5.15 per mile X 1 trip) =		$ 4,944
Fuel and routine vehicle maintenance.		
Perdiem- $123 per day X 1 trip X 1 individual. =		$ 123
	Subtotal =	**$14,005**
Annual Totals		
O&M DIRECT COSTS		$74,296
INDIRECT COSTS (Admin Overhead @ 11%)		$ 8,173
TOTAL REQUESTED FOR 2013		**$82,469**

Projected out year funding request:

FY 2014 - $84,633
FY 2015 - $87,524
FY 2016 - $90,207
FY 2017 - $92,899
FY 2018 - $95,229

FY 2013-FY2017

Rear 12,000-300mm Razorback Sucker at the Uvalde National Fish Hatchery, Uvalde, Texas

Aerial Photo of Uvalde National Fish Hatchery 2001-USFWS

Prepared for:
Biology Committee
The San Juan River Basin Recovery Implementation Program

BOR Acquisition Number R11PG40013
Interagency Agreement Number 1448-21260-8-N001

Period of Performance: October 1, 2012 to September 30, 2013

Principal Investigator – Grant L. Webber
Uvalde National Fish Hatchery
754 County Road 203
Uvalde, Texas 78801
830-278-2419
830-278-6042 Fax

Grant_Webber@fws.gov

Introduction

Uvalde National Fish Hatchery (UNFH) submits the following proposal to rear 12,000 300mm razorback sucker sub-adults annually for the San Juan River Basin Recovery Implementation Program (SJRIP). The project will use a minimum of 15- one acre ponds at the UNFH, Uvalde, Texas. The Southwest Native Aquatic Resources and Recovery Center (SNARRC) (Previously known as Dexter National Fish Hatchery and Technology Center.) will provide fry and/or fingerlings to UNFH upon request, as well as technical assistance with fish health and culture methods.

The following scope of work identifies the facilities and methodologies that will be used at UNFH to produce the target number of razorback sucker. An initial production guide was developed for the species based on historical growth rates observed at Dexter, Willow Beach, and Achii Hanyo. The data generated from previous years of work completed at Uvalde have been incorporated into the current razorback production program. Funding is being requested for operations at UNFH. The UNFH will provide the infra-structure for stability in the production program. Fish hauling will be conducted by the Uvalde NFH.

Background

UNFH is located 3 miles southwest of Uvalde, Texas, on FM 481 and approximately 80 miles west of San Antonio. This is a large warm-water fish culture facility that utilizes earthen and lined ponds, and intensive culturing raceways to produce fish.

The hatchery is situated on 100 acres of former mesquite grasslands, in the Rio Grande plain of southwest Texas. There are 47 usable ponds totaling 50 surface acres of water. Five ponds were lined with high density polyethylene in FY 1987, six more in FY 1993, one in FY 2009, one in FY10, and two in FY11 for water conservation purposes. Netting is currently over six 1-acre ponds and one 0.75- acre pond to minimize avian predation. Buildings on the facility were renovated from 2001 to present, following a 100-year flood in 1998. Hatchery facilities include an office/fish culture building, shop/garage, fish holding house/nursery, feed room with cooler, two labs, and four living quarters with two double garages, two pump houses, and four outdoor concrete raceways and two outdoor fiberglass raceways. Water for fish culture purposes is pumped from two deep wells. Two water towers provide a back up water source for intensive culture purposes.

Station Operations

The UNFH is one of the top producing warm-water fish culture facilities in the nation. During the mid-90s as many as 6 species were cultured producing 2.6 million fish, weighing 60,000 pounds. In addition to the razorback sucker, over the past 15 years, the hatchery has successfully propagated and maintained threatened and endangered fish species. Yaqui catfish, Comanche Springs pupfish, fountain darter, San Marcos salamanders, bonytail, and Texas wild-rice have all been propagated and maintained successfully at the facility.

The climate in southwest Texas provides 300 days (10 months) of growing season. Two independent deep wells provide up to 3,000 gallons per minute of water year round.

Razorback sucker have been reared at UNFH since April 2006. All fish from Uvalde NFH are inserted with a 134.2 kHz Passive Integrated Transponder (PIT) tag before being stocked into their final destinations. Tags are annually provided by the SJRIP.

Facility

This project will utilize several hatchery ponds and an undetermined number of inside raceways/tanks to fulfill the production commitments of the proposal. Both lined and unlined (earthen) ponds will be used to produce the species. Ponds are prepared prior to the receipt of fish. Damaged liner material is repaired; and detritus material is removed through the use of specialized equipment. The earthen ponds are graded, disked, and packed prior to receipt of the fish. All ponds are fully functional with two water supply lines (one at shallow end and one at catch basin end), concrete catch basin (kettle) and drain lines. At a minimum, razorbacks that are smaller than 200mm will be placed into ponds that have the protection of bird deterrent netting. Other active predation control methods also occur throughout the year.

Water

Fish culture water is supplied by two deep wells on station. The first and primary water supply (Spurgeon Well) derives its water from the Austin Chalk formation, an aquifer which has excellent water quality. The well is capable of pumping up to 1,300 gallons per minute. The well water quality is fairly constant at: 73^{o}F, pH of 7.5-8.05, total hardness of 496 ppm, and alkalinity of 224 ppm. The station's secondary well (Wilson Well) is capable of producing an additional 1,600 gallons per minute. The Wilson Well derives its water from the Edwards Aquifer; it is a deep water well that has a year round temperature of 75^{o}F, pH of approximately 7.1, total hardness of 380 ppm, and alkalinity of 245 ppm. Through the design of the plumbing and valves, both wells can provide water at the same time to meet aquaculture needs of the facility. Due to the potential implications to threatened and endangered species utilizing the Edwards Aquifer system, the Service has established a limit on groundwater withdrawals from the Edwards Aquifer. That self-imposed water restriction for Uvalde NFH has been determined to be 472 acre-feet per annum (USFWS, Biological Opinion 2010). Since the Spurgeon Well derives its water from a source other than the Edwards Aquifer (Austin Chalk formation), there are no internal agency groundwater pumping limits set for its water withdrawals.

Lake Mohave Razorback Broodfish

The SNARRC has successfully propagated and maintained razorback sucker broodstock at the facility since 1981. Captive broodstock representing the Lake Mohave population exist at SNARRC and will be spawned and their progeny will be transported to Uvalde in the form of fry for grow-out.

Uvalde's typical growing scenario includes receiving fry from SNARRC in April. The fish are stocked into earthen or lined ponds and grown outdoors from April to November. Total dissolved oxygen, temperatures, and pH are monitored daily. Fry ponds are fertilized to produce and maintain phyto- and zooplankton for natural forage diet for approximately 45 days, at which time they are offered a prepared razorback sucker diet. All fry received will be placed only into lined ponds that have the protective cover of bird deterrent netting.

Objectives

The main objective of this SOW is to captively rear razorbacks on station in a manner that is sufficient to meet the annual stocking commitment of the San Juan RIP. The station's goal is to provide/distribute 12,000 – 300mm razorback sucker sub-adults annually for a period of five years to the San Juan River for recovery purposes.

Methods

UNFH will conduct extensive and intensive culturing of razorback sucker and harvest the target sized fish from ponds, enumerate, tag, and coordinate the distribution of these fish to the San Juan River.

Razorbacks that are to be distributed in the fall (October/November) will be implanted with a 134.2 kHz PIT tag during the preceding spring (March/April). Fish will be harvested from their overwintering pond and given a minimum of 2 days of flow through salt treatments. Post-harvest, the fish will not be handled again for approximately 7-10 days to provide sufficient time to de-stress. Following the rest period, the fish will then be implanted with a tag using a tag gun or syringe method. Post tagging, the fish will be given a flow through treatment of .5% salt. The following day the fish will undergo, for a minimum of two consecutive days, an 8 hour static bath treatment of nitrofurazone, followed up with a flow through treatment of .5% salt.

Upon completion of the tagging and treatments, the fish will remain in raceways for no less than 10 days to heal and de-stress. The fish will also be placed back on feed. Fish will be examined after the rest cycle to determine the condition of the fish and insertion point. Once the fish are healed, the fish will be placed back into earthen and lined ponds for summer grow out.

In the fall of the year when the fish reach target size they will be harvested from the ponds and transferred to the fish culture building, given a .5% flow through salt treatment, and allowed to rest. Upon completion of their rest period, all fish will be scanned for the previously implanted tag, and length and weight data collected and entered into a database. Fish are placed back into the raceway, fed, and following a 7 to 10 day rest period, will be loaded into a distribution tank and hauled to their stocking locations by the Uvalde NFH staff.

Ponds

Approximately 25,000 fry will be shipped every other year (depending upon needs and availability) from SNARRC to UNFH in order to continue the production cycle. Because of SNARRC's disease class, UNFH did not receive fish in the years 2010, 2011, and 2012. To make up for this deficit SNARRC will provide fish to UNFH in 2013 and 2014. To meet the production goal of 12,000 (300mm) fish annually, the rearing ponds will be stocked at approximately the following densities:

Age 0 Growth: (April through October -- approximate 214 day growing period)

2 acres @ 12,500 fry

Age I Growth: (March through November – approximate 244 day growing period)

Approximately 3,000 fish per acre.

Harvested age 0-fish from the ponds will be enumerated, graded, and split into ponds for overwintering. Fish below 200mm total length will be placed into lined ponds with bird deterrent netting.

Age I–fish will be harvested from the ponds, enumerated and stocked into culture ponds for summer grow out. Individual ponds will be identified at time of stocking; however, ponds with bird deterrent netting will be used to protect fish that are below 200mm in total length.

Ponds will be slowly filled and fertilized 10 to 14 days prior to stocking. Staff will monitor water quality on a daily basis. Water quality readings of temperature, dissolved oxygen and pH will be taken at 7:00 am and, if necessary, again at 3:00 pm at the kettle portion of the pond.

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

Pond Vegetation Control, Parasite Control, Water Quality and Fertilization

Sonar Q, Diuron, Reward, cutrine plus, and Navigate will be used in earthen ponds to control submersed aquatic vegetation. Staff will apply the chemical in its recommended form (granular or dissolved into well water) and distribute the chemical evenly throughout the entire pond at the recommended rates. Incremental, or partial treatments will be applied when a total treatment regime has a potential of lowering dissolved oxygen levels too rapidly.

Sonar Q- 20 lbs per acre (dry broadcast)
Diuron- 25 lbs per acre (dry broadcast)
Cutrine plus- 60 lbs per acre (dry broadcast)
Dimilin 2L – 2.2 L per acre (liquid broadcast)

Rodeo (glyphosate) will be used in earthen ponds to control submerged aquatic vegetation, including rushes, sedges, American lotus, and cattails. Both chemicals will be applied at a 2 to 5% solution.

Copper sulfate (CuSo4) will be used to control floating filamentous algae blooms. Treatments will begin approximately 45 days after fish are stocked into the ponds and repeated every 30 days. Application rates in Uvalde ponds are .25 ppm or 2 to 3 pounds per acre. A secondary benefit derived from using CuSo4 is its effectiveness in controlling external parasites.

Zooplankton and invertebrate insect populations for razorback Age-0 will be cultured with the proper fertilization regime. Age-I fish are fed a prepared diet.
Different fertilizer types may be used:

1) Wheat middlings
2) Liquid fertilizer 11-37-0
3) Cottonseed meal

Initial fertilization rates for earthen ponds are 100 lbs of cottonseed meal, 100 lbs. of wheat middlings, and 3.0 gallons of liquid fertilizer (11-37-0) per surface acre. Follow-up treatments of 0.5 gallons per surface acre every other day until water clarity is less than 2-feet, measured with a Secchi disk. Re-apply 11-37-0 at a rate of 1.0 gallon per acre when water clarity is greater than 2-feet.

Water temperature, dissolved oxygen (DO) and pH readings will be taken in all rearing ponds daily. All readings will be downloaded and maintained on station. If morning DO readings are below 3.0 mg/L or above 13.0 mg/L all fertilization will be stopped until DO's are brought back to accepted levels. If pH readings exceed 9.5, fertilization will be terminated.

Escapement

Staff will reduce the potential for escapement by installing kettle screens in the ponds prior to the pond's receipt of the fish. Screen mesh size will be 250 micron in Age-0 ponds and a minimum of ¼" in Age-I ponds. All Age-I fish will be graded prior to being stocked in the rearing ponds. Staff will monitor the ponds daily and ensure there are no leaks in the dam boards. Sawdust will be used to stop all leaks that develop in the catch basin. Water levels will be adjusted and maintained a minimum of six inches below the over flow mark until the fry average 30mm in length.

Feeding Schedule

Fish will be sampled (or projected if water temps are above 28°C) at the end of every month. Size, weight, and over-all condition will be recorded. Feed amounts will be adjusted on a monthly basis. In addition to a natural invertebrate diet, the fry and fingerlings will be hand fed a starter/grower diet. Fry will be fed 4 times daily and fingerlings twice daily, once at 10:00am 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 ≥ 70 °F (21 °C) feed 3 % BW per day.
- Water temp 60-70 °F (16-21 °C) feed 2 % BW per day.
- Water temp < 60 °F (16 °C) feed 1.5 % BW per day.

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-2")	starter and #1, 2, & 3 crumbles
2-3"	1.0 mm
4-6"	2.0 mm
7-9"	3.0 mm
9-20"	4.0 mm

Predator Control

During the summer grow-out all ponds are monitored daily by on-site staff and predators are taken by gun and/or traps. Fish (smaller than 300mm) remaining outdoors during the

winter season will be held in ponds that contain the protection of 2" X 2" block nylon bird predation netting. Approximately 12,000 razorbacks will be maintained under the protection of bird netting and/or intensive raceways during the winter months.

Back-Up Protection

The hatchery has three back-up generators that are located at the water supply, concrete raceways, and outdoor fiberglass raceways. The generators are programmed to immediately engage during any power outage, thereby providing uninterrupted water flows and supplemental aeration during power outages. An automated auto-dialer system monitors the continuous operation of the station's water supply and tankhouse power. Should the back-up system fail for the water supply or tankhouse, the security system automatically alerts staff via telephone.

Fish Health Monitoring Protocols

All fish will be handled with the best animal husbandry practices available. A feeding schedule will be developed and followed daily. All fish rearing/holding structures on station will have their O_2 levels monitored daily. Routine fish health condition exams will be performed on-site by hatchery staff to monitor the overall health of the razorback population. Non-lethal methods, if available, will be employed to obtain samples. Wet mounts will be examined for parasites and bacteria. Identification and treatment of disease will be the responsibility of the UNFH staff; however, assistance will be requested of the Region's Fish Health Center to assist in the diagnosis and treatment of any suspected disease or parasite.

Per U.S. Fish and Wildlife Service's Aquatic Animal Health Policy 713 FW 1-5, all year classes of razorback sucker, and other species on station, will receive a comprehensive annual examination prior to transferring off station. The Region 2 Fish Health Center located at the Dexter NFH&TC will provide the annual fish health inspection, which includes bacterial, parasitic, and viral testing for razorback. Typically 60 fish per species, split between individual year classes, are sacrificed to have a statistically valid sample. The Fish Health Center also provides diagnostic and treatment support of the razorback program throughout the production cycle.

Projected Harvest Dates and Delivery Date

Based on previous harvest data the production target of 12,000- 300mm fish can be achieved in approximately eighteen months. Fish will be harvested from the ponds, enumerated, scanned to ensure retention of PIT tags, and stocked into the San Juan River in October/November of each calendar year. In order to establish a consistent long term production cycle, UNFH will strive to maintain 25,000 to 38,000 Age–I fish on station in a production year.

Disposition of Fish

All fish propagated and cultured for this project are made available to the SJRIP for stocking and meeting augmentation requirements identified by the RIP. In the case of catastrophic loss (>25% of the stock) at UNFH, specimens will be collected for testing and diagnosis to determine (if possible) the reason for the 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 the results are available. Excluded from these reporting requirements are larvae and fish lost to natural attrition, including but not

limited to incidental predation mortalities. Any additional mortality 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.

Fiscal Year 2013 Budget Breakdown

Rearing Razorback Sucker at Uvalde National Fish Hatchery; Detailed Budget Spending Plan.

O&M Labor Costs-Specific to San Juan River RIP
The labor costs identified in this proposal are broken down as follows, and include benefits and payroll additives for each position identified:

Uvalde National Fish Hatchery

(1) Fishery Biologist (16 pp) - GS 482-9 @ $31.59/hour	$40,435
* On-site fish rearing, water quality monitoring, vegetation control, fish tagging and distribution	
Subtotal =	**$40,435**

Equipment, Materials and Supplies
Cost based on UNFH historical purchases:

Fish Health	
-Water quality monitoring supplies (test pillows/strips/DO caps)	
-Therapeutants- salt, formalin, MS-222, Nitrofurazone, Oxygen	$5,400
- Bacterial, viral, and parasite testing and diagnostics	$2,000
Feed	
-Production diet RBS # 350 -16,000 lbs @ $1.10 per lb (Approximately 4,000 adult & 15,000 YOY razorbacks)	$18,000
Fertilizer	
-Wheat Middlings & Cotton Seed meal	
-Inorganic – 11-37-0 liquid fertilizer	$180
Chemicals- Aquatic vegetation and pesticide control and other water quality	$7,500
- Copper Sulfate, Citric Acid, Sonar Q, Cutrine Plus, dimilin 2L, Vircon disinfectant	
Subtotal =	**$33,080**

Services and Aquaculture supplies

-Maintenance, electricity, fuel, aquaculture supplies $10,000

Subtotal = $10,000

Distribution

-8 trips @$4,600 per trip (2 drivers; per diem, overtime, fuel, oxygen, vehicle maintenance)

Subtotal= $36,800

TOTALS:

O&M DIRECT COSTS	**$120,315**
INDIRECT COSTS (Admin Overhead @ 11%) *New rate negotiated for FY13	**$13,235**
TOTAL O&M REQUESTED FOR FY 2013	**$133,550**

Razorback Sucker Augmentation at NAPI Grow-Out Ponds
Fiscal Year 2012-2016 Project Proposal

Principal Investigators: Jeff Cole
Navajo Nation Department of Fish and Wildlife
P.O. Box 1480
Window Rock, AZ 86515
(928) 871-6450

jcole@nndfw.org

Cooperative Agreement #'s:
Navajo Nation: R07AC40624
USFWS NMFWCO R10PG40071

Period of Performance: 10/1/2012 through 9/30/2013

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 2012.

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 2012, 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.

Whenever 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. 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

In the spring of 2012, Dexter National Fish Hatchery will deliver 10,500 ≥ 200 mm RBS to the three NAPI grow-out ponds. In the fall of 2012, 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 2012. A draft report will be submitted by 31 March 2012 and finalized by 1 June 2012.

Budget Fiscal Year 2013

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 $42,763	$ 28,161	$ 21,382
Wildlife Technician .5 FTE NNDFW X $23,416		$ 11,708
Fringe Benefits $33,090 X 41.25%		$ 13,650
Personnel Subtotal	**$ 28,161**	**$ 46,740**
Travel		
Per Diem Lodging and Meals	$ 538	$ 1,000
Vehicle Mileage and Maintenance	$ 2,040	$ 18,000
Travel Subtotal	**$ 2,578**	**$ 19,000**
Office Supplies and Equipment		$ 500
General Operating Supplies (includes fish transport costs, i.e. oxygen, salt, stress coat, etc.)		$ 2,500
Electricity Costs (Aeration)		$ 1,000
Feed Cost ($1.55/lb – 5,000 lbs)		$ 7,750
Uniforms		$ 500
Printing/Binding/Photocopying		$ 100
Fuel – Propane/Cannon Guns		$ 200
Repairs and Maintenance – Paint, sealant, lubricants, plumbing supplies, water quality probes, etc.		$ 500
Support Subtotal	**$ -0-**	**$ 13,050**
Total	**$ 30,739**	**$ 78,790**
NNDFW Admin charge (17%) $78,790/1.17 X .17 = $11,448	$ 3,381	$ 11,448
USFWS/NNDFW Totals	**$ 34,120**	**$ 90,238**
Grand Total		**$124,358**

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-2013.

Daily pond management activities	
.30 FTE (GS-8; $76,003*/year)	$ 25,081.00
Active Harvest	
Fish Biologist (GS-9-3*) - 5 days @ $288/day	$ 1,440.00
Biological Science Technician (GS-8*) – 5 days @ $328/day	$ 1,640.00
Personnel subtotal	$ 28,161.00
Travel and Per Diem (Based on Published FY-2011 Federal Per Diem Rates)	
Hotel Costs – 4 nights (4 nights @ $77/night – single occupancy)	$ 308.00
Per Diem (Hotel Rate) – 5 days @ $46/day	$ 230.00
Travel subtotal	$ 538.00
Equipment	
Vehicle Maintenance & Gasoline 4,000 miles @ $0.51/mile (based on GSA rates established on 01 January 2011 and includes costs associated with gasoline/diesel fuel vehicle maintenance)	$ 2,040.00
Equipment subtotal	$ 2,040.00
USFWS – NMFWCO Total	$ 30,739.00
USFWS Region 2 Regional Office Administrative Overhead (11.00%)	$ 3,381.00
USFWS – Region 2 Total	**$ 34,120.00**

*includes 32% overhead for benefits

FY 2013 Project Proposal
San Juan River Basin Hydrology Model Development, Operation and Maintenance

Katrina Grantz UC-432
Bureau of Reclamation
125 South State Street
Salt Lake City, UT 84138-1147
Phone 801-524-3635
kgrantz@ usbr.gov

Ryan Christianson
Bureau of Reclamation
835 E. 2nd Avenue, Suite #300
Durango, CO 81301
Phone 970-385-6590
rchristianson@usbr.gov

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 Riverbasin. 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. FY2012 activities are expected to complete major model development and validation through collaborative work with Program participants. The FY2013 scope of work includes the collaborative development of a revised hydrologic baseline and its incorporation into the model, updating model documentation, continued model streamlining, as well as annual operation and maintenance of the model and data management. FY2013 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, work on developing 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 further streamlining the model development performed in FY2012 as well as 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 FY2013 request also includes funds to continue to provide technical transfer from the model developers to the model users and maintainers as well as 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 Hydrologic Baseline Workgroup, complete and incorporate the modified hydrologic baseline into the model. In collaboration with the Biology Committee, begin work testing and implementing revised flow recommendation scenarios. At the Coordination Committee's discretion, begin work on a natural flow model. Document all modifications to the model, communicate changes to Program and interested parties. Continue streamlining of the various models, data sets and data loaders.

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 FY2014 budget and track FY2013 expenditures.

Budget Summary FY 2013

Model Development	$38,090
Model Maintenance	$12,160
Model Runs	$22,400
Program Management	$37,400
Grand Total	**$110,050**

FY-2014	**$75,000**	†
FY-2015	**$77,250**	† *
FY-2016	**$79,570**	† *

† Assumes major model development, documentation, and incorporation of revised hydrologic baseline completed in Sep 2013, with ongoing model maintenance, model runs, tech transfer, documentation and program management

* Includes ~3% adjustment

Task 1 Model Development

A) Labor

Task	Position	Salary total/hr	Total Days	Total Cost
Model streamlining, incorporation of new baseline and flow rec scenarios	UCRO[1] and TSC[2] Eng	$80	20	$12,800
	WCAO[3] Eng	$80	10	$6,400
Documentation	UCRO Eng	$80	20	$12,800

B) Travel

Purpose	Destination	Trips	Days / Trip	Airfare / trip	MI&E, Car, Lodging/day	Total Cost
TSC meeting w/ UCRO	SLC	1	3	$400	$230	$1,090

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	UCRO 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	SLC	1	2	$800	$230	$1,260
UCRO meet for Coordination	Durango	1	2	$800	$250	$1,300

Task 3 Model Runs

A) Labor

Task	Position	Salary total/hr	Total Days	Total Cost
Model Runs and Analyses	UCRO and 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	UCRO Engineer	$80	25	$16,000
	WCAO Engineer	$80	15	$9,600
Budget	UCRO Engineer	$80	5	$3,200

B) Travel

Purpose	Destination	Trips	Days / Trip	Airfare / trip	MI&E, Car, Lodging/day	Total Cost
UCRO to Hydro Wk Grp Mtg	Alb	3	2	$1,000	$200	$4,200
WCAO to Hydro Wk Grp Mtg	Alb	3	2	$400	$200	$2,400
UCRO to Annual Hydro Mtg	Alb/Den	1	2	$600	$200	$1,000
WCAO to Annual Hydro Mtg	Alb/Den	1	2	$600	$200	$1,000

[1] Upper Colorado Regional Office (Salt Lake City)

[2] Western Colorado Area Office (Durango)

[3] Technical Services Center (Denver)

SOW 13-14

Improve Stream Gauging and Flow Measurements

San Juan River Basin Recovery Implementation Program
Fiscal Year 2013 Project Proposal

Katrina Grantz
Bureau of Reclamation
125 S. State St.
Salt Lake City, UT 84138
(801) 524-3635 kgrantz@usbr.gov

Ryan Christianson
Bureau of Reclamation
835 E. 2nd Avenue, Suite #300
Durango, CO 81301
(970) 385-6590 rchristianson@usbr.gov

Background

There are five United States Geological Survey (USGS) streamflow gauging 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 gauging 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-2013:

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	6,200		
Travel			1,400	
Equipment and supplies				0
Total				$7,600

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

Fiscal Year 2014	$8,000
Fiscal Year 2015	$8,300
Fiscal Year 2016	$8,660

Operation of Public Service Company of New Mexico Fish Passage Structure
Fiscal Year 2012 - 2016 Project Proposal

Principal Investigators: Jeffrey Cole
Navajo Nation Department of Fish and Wildlife
Box 1480 Window Rock, AZ 86515
(928) 871-6450

jcole@nndfw.org

Cooperative Agreement #: R12AP40005
Period of Performance: 10/1/2012 through 9/30/2013

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 April 1 to October 31, for each year of the five year proposed budget (2012 – 2016). 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' 2012. 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, 2012. 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 – 2013 Budget

BUDGET WORKSHEET **2013 Operation of San Juan/PNM Fish Passage**	
Personnel (salary and benefits)	**NNDFW**
.5 FTE Fisheries Biologist X $42,762	$21,382
.5 FTE Wildlife Technician X $23,416	$11,708
Fringe Benefits $33,089 X 41.25%	$13,649
Personnel Subtotal	**$46,739**
Travel	
1 Tribal Vehicle	$18,000
Per Diem Lodging and Meals	$3,000
Travel Subtotal	**$21,000**
Office Supplies	$ 882
Office Equipment – LCD Projector and screen	--
General Operating Supplies Plumbing supplies, Hardware Supplies, Neoprene Waders, rubber boots, wet suit, landscaping supplies	$2,500
Nenahnezad Phone	$ 800
Uniforms	$500
Printing/Binding/Photocopying	$100
Fuel – Gasoline for water pump	$300
Sewage Services – Fish Passage	$700
Repairs and Maintenance – Paint, sealant, lubricants, water pump repairs	$1,000
Support Subtotal	**$6,782**
Training and Conference Registration	$1,000
Consultant/ Professional Sub-Total	**$1,000**
	Base Funding
Budget Subtotal	**$75,520**
FY 2011 Carry over funds	**0**
Total	**$75,520**
Administrative charge (17%) **75,520 /1.17 X .17 =**	**$10,973**
Grand Total	**$86,494**

San Juan Recovery and Implementation Program
San Juan River Channel and Floodplain Restoration, Phase 2

Principal Investigator: Patrick McCarthy
The Nature Conservancy
212 E. Marcy Street, Suite 200
Santa Fe, New Mexico 87501
505-946-2037 office; 505-310-2117 mobile
pmccarthy@tnc.org

Background

The goals of the San Juan Recovery River Implementation Program ("SJRIP") Long Range Plan include providing suitable habitat to support recovery of the Colorado pikeminnow and razorback sucker.

In 2010, The Nature Conservancy (TNC), acting in cooperation with the United States Fish and Wildlife Service, the Bureau of Reclamation, and the San Juan River Basin Recovery Implementation Program (SJRIP), contracted with the New Mexico Environment Department under their River Restoration Initiative (RERI) to assist in the restoration of secondary channels and backwaters in the San Juan River near Farmington and Shiprock, NM. Restoring these habitats will assist in the recovery of endangered species by increasing channel complexity and improving habitat conditions in the San Juan River.

In May 2011, a design report was presented to the SJRIP Biology Committee for completing habitat enhancement and restoration at six sites. Work began in October 2011 and was completed by the end of November. Planting vegetation at all sites was completed in Spring 2012.

One of the purposes of this project is to serve as a test case for evaluating methods of habitat restoration. The general method used for this project was to clean and excavate the inlets of selected secondary channels in order to re-establish a continuous flow of 5-10 cfs at a San Juan River base flow of 500-700 cfs. Cleaning the channel inlets will facilitate much larger flows during future storm events and spring runoff resulting in significant flushing of existing sediment. The expectation is that areas of low velocity habitat will increase as the main channel flow drops. Continuous secondary channel flow was achieved for five of the six sites at base flow. All of the sites will flow during storm events and spring runoff which will allow for some in-channel movement of cobble and other materials. The SJRIP is monitoring each site to assess the effectiveness of the selected approach.

TNC has made a commitment to pursue a second phase of channel and floodplain restoration at 2-4 additional sites along the San Juan River, following up on the RERI project. They expect to contribute non-federal funds to the SJRRIP for the next three federal fiscal years, FY 2012-2015, to conduct this work. A partial accounting of TNC's expenditures is included below. This budget includes the San Juan River fish habitat restoration project's second phase, which will be funded through a recent environmental damages mitigation settlement.

TNC Contribution to San Juan River Recovery Implementation Program: Non-Federal Funds

	Federal Fiscal Year			TOTAL
	2013	2014	2015	
Personnel	20,000	20,000	20,000	60,000
Contractual	30,000	120,000	30,000	180,000
Equipment & Supplies	20,000	20,000	10,000	50,000
Travel	4,000	3,000	3,000	10,000
Subtotal	*74,000*	*163,000*	*63,000*	*300,000*
*Indirect Costs**	*14,800*	*32,600*	*12,600*	*60,000*
TOTAL	**88,800**	**195,600**	**75,600**	**360,000**

*Project administrative overhead, including administrative support.

Endangered Fish Monitoring and Non-native species Monitoring and Control in the Upper/Middle San Juan River
Fiscal Year 2013 Project Proposal

Principal Investigators: Jason E. Davis, B.R. Duran and Ernest Teller Sr.
U.S. Fish and Wildlife Service
New Mexico Fishery Resources Office
3800 Commons N.E.
Albuquerque, NM 87109
(505)342-9900
Jason_E_Davis@fws.gov Bobby_Duran@fws.gov Ernest_Teller@fws.gov

and

Dale Ryden
U.S. Fish and Wildlife Service, Colorado River Fishery Project
764 Horizon Drive, Build B
Grand Junction, CO 81506-3946
(970) 245-9319
dale_ryden@fws.gov

Cooperative Agreement #'s:

USFWS – NMWFCO	R11PG40032
USFWS – CRFP	R10PG400024
UDWR – Moab	08FG402723
NMDGF – Santa Fe	07FG402632
NNDFW	R11AP40090

Period of Performance: 10/1/2012 to 9/30/2013

Background

The August 1, 2001 Colorado pikeminnow and razorback sucker Recovery Goals identified predation by and/or competition by 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 element in the San Juan River Basin Recovery Implementation Programs Long Range Plan (2011). Actions and Tasks associated with this Element encompassed within this scope of work include:

Goal 3.1 Control problematic nonnative fishes as needed

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 fishes to achieve objectives

Task 3.1.1.5 Develop a comprehensive non-native species management plan, including measurable river wide objective to determine effects of removal effort on native and nonnative fishes.

Task 3.1.1.6 Establish target criteria for reduction of problematic nonnative fish species to estimate time, effort, and cost for controlling nonnative fishes.

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 1.2 Evaluate RBS and CPM Augmentation Program and Genetic Integrity.

Action 1.2.1 Evaluate status and success of stocked RBS and CPM

Task 1.2.1.2 Determine survival and recruitment of stocked RBS and CPM to assess stocking success and to determine when to implement mark-recapture population estimates.

Action 1.2.2 Evaluate methods to improve RBS and CPM stocking successes.

Task 1.2.2.1 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

Goal 4.1 Monitor Fish Populations of the San Juan River.

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.

Action 4.1.4 Obtain reliable population estimates of RBS and CPM.

Task 4.1.4.1 Implement pilot mark-recapture population estimates to develop target criteria for full implementation of population estimates consistent with recovery goals requirements

Task 4.1.4.2 Use mark-recapture population estimators, when feasible, and in conjunction with catch rate estimators, to provide reliable estimates of adults, subadults, survival, and recruitment consistent with recovery goals criteria to gauge recovery of CPM and RBS

Intensive removal of non-native fishes, primarily channel catfish and common carp, has occurred in the upper reaches of the San Juan River since 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). Declines in catch rates, seasonal movement by channel catfish, and high abundance of non-native fishes downstream of Hogback Diversion prompted removal efforts to expand in 2003 to include the adjacent downstream reach, Hogback Diversion to Shiprock Bridge (RM 147.9). These efforts are ongoing with a total of eight (three passes/trip) trips divided between both reaches annually.

Multi-pass removal efforts were successful, to a degree, in suppressing non-native numbers within intensive removal reaches (Davis et al. 2009, Davis 2006; Jackson 2006). However, long term trend data collected during annual fall monitoring trips indicate an apparent increase in channel catfish abundance riverwide beginning in 2004. Much of this can be attributed to increased abundance of channel catfish in reaches that are between (RM 147.9 – 52.9) those where intensive removal efforts occur (Ryden 2006). Prior to 2006, non-native fishes within this portion of the San Juan River were only opportunistically removed during spring razorback sucker and fall annual monitoring trips.

Beginning in 2006, U.S. Fish and Wildlife Service (FWS) – New Mexico Fish and Wildlife Conservation Office (NMFWCO) shifted removal efforts to include two trips from Shiprock, New Mexico to Montezuma Creek, Utah (RM 93.6). Removal efforts upstream of Shiprock Bridge were reduced to accommodate non-native removal downstream to Montezuma Creek. In addition, at the direction of the San Juan River Recovery Implementation Program's (SJRIP) Biology Committee, trips specific to non-native removal were initiated in 2006 to encompass the Montezuma Creek to Mexican Hat, Utah portion of the river (22 February 2006 Biology Committee Meeting). Two trips were conducted from Montezuma Creek to Mexican Hat, Utah in 2006 by NMFRO and Utah Division of Wildlife Resources – Moab (UDWR).

It was determined at the February 2007 Biology Committee Meeting to increase efforts of nonnative removal from Shiprock to Mexican Hat to reflect similar efforts to intensively sampled reaches upstream. Therefore, we propose to continue our number of sampling trips to include four trips from Shiprock to Mexican Hat in FY 2011. These additional trips will allow removal

crews to expand removal into areas of increased importance while maintaining sufficient effort in upstream reaches to maintain current accomplishments.

Description of Study Area

Intensive nonnative fishes removal will occur in the San Juan River, New Mexico-Colorado-Utah, including three distinct reaches of the upper and middle portions of the San Juan River. These sections include PNM Weir (RM 166.6) to Hogback Diversion (RM 159.0); Hogback Diversion to Shiprock Bridge (RM 147.9); and Shiprock Bridge to Mexican Hat, Utah (RM 52.9).

Objectives

1. Continue to remove nonnative fishes, primarily channel catfish and common carp, from 113.7 river miles of the San Juan River.
2. Implement riverwide mark/recapture to determine exploitation rates for channel catfish.
3. Evaluate distribution and abundance patterns of non-native species to determine effects of mechanical removal.
4. Characterize distribution and abundance of endangered fish in the upper and middle reaches of the San Juan River.

Methods/Data Analysis

Removal efforts from PNM Weir to Hogback and Hogback to Shiprock will be conducted by two electrofishing rafts and one support raft. Captured channel catfish will be measured (nearest 1 mm) for standard (SL) and total lengths (TL), weighed (nearest 5 g), and, if not sacrificed for study purposes, transported by hatchery truck to isolated recreational angling impoundments. All other nonnative species sampled during these efforts will be sacrificed and appropriate data recorded for location, length, and mass.

Removal efforts from Shiprock to Mexican Hat will be conducted four times a year. Three of these four trips will be stand alone efforts while the fourth removal trip will be in concert with the Sub-adult/Adult Fish Community Monitoring conducted by FWS-GJ. Sampling for nonnative fishes will be conducted by four raft mounted electrofishing units. Two rafts will begin sampling approximately 1-2 hours after the initial two rafts begin essentially accomplishing two sampling passes per trip. Captured channel catfish will be measured (nearest 1 mm) for standard and total lengths, weighed (nearest 5 g), and, if not sacrificed for study purposes, transported by hatchery truck to isolated recreational angling impoundments. All other nonnative species sampled during these efforts will be sacrificed and appropriate data recorded for location, length, and mass.

In addition to nonnative fishes, all rare fishes seen will be netted. Rare fishes will be measured (nearest 1 mm) for standard and total lengths, weighed (nearest 5 g) and checked for the presence of a Passive Implant Transponder (PIT) tag. If no tag is present and fish are $\geq$ 150 mm total length a tag will be implanted. At the time of collection, GPS coordinates will be recorded using a hand held GPS unit. Preliminary population estimates for Colorado pikeminnow > age 2 and razorback sucker will be generated using data collected during NMFWCO and UDWR nonnative fish removal efforts.

Channel catfish collected during a trip early in the calendar year (i.e. April) will receive a T-bar anchor tag and returned to the river. Each tag will have a unique alphanumeric code for identification of individual fish. Additionally, each tagged fish will receive an adipose fin clip to estimate tag retention. The first 100 channel catfish captured each day will be measured for TL, SL and weight. All other channel catfish collected will be measured for TL only. Channel catfish collected on subsequent trips will be removed from the river. Population estimates will be generated for channel catfish captured during the first pass and recaptured in the second pass. Exploitation rates, *u*, will be estimated as the rate of recapture of marked fish (Deroba et al. 2005),

$$u = R/M$$

whereas *R* represents number of recaptured fish and *M* represents number of marked fish. Exploitation rates will be calculated for various size classes of fish throughout the sampling period (Elevrud 2010).

All available capture data will be analyzed independently by section and project (i.e. PNM to Hogback; Hogback to Shiprock; fall monitoring). To determine trends in distribution and abundance, mean CPUE and standard error will be calculated. Species CPUE represents the total number of fish collected divided by the total effort of sampling (hours of electrofishing). Data will be summarized by type of trip, year, section and by individual trips. 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. All CPUE data that does not meet the assumptions of an ANOVA and 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 by Section (FY 2013):

PNM to Hogback-	2 trips
Hogback to Shiprock-	3 trips
Shiprock to Mexican Hat	4 trips
Shiprock to Sand Island/Mexican Hat	1 trip (tagging trip)
Total # of trips-	**10 trips in FY 2013**

Products/Schedule

An electronic data file will be provided for inclusion in the centralized database by 31 March 2014. A draft summary report detailing findings will be submitted to the San Juan River Implementation Program, Biology Committee, by 31 March 2014. Revisions will be completed and a final annual report will be submitted by 1 June 2014.

Literature Cited

Davis, J.E, D.W. Furr and E. Teller. 2009. *Non-native species monitoring and control in the upper San Juan River, New Mexico: 2008*. Final Report prepared for the San Juan River Recovery Implementation Program. U.S. Fish and Wildlife Service, Albuquerque New Mexico.

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Ryden, D.W. 2006. *Long term monitoring of sub-adult and adult large-bodied fishes in The San Juan River: 2005*. Prepared for the San Juan River Recovery Implementation Program. U.S. Fish and Wildlife Service, Albuquerque, New Mexico.

Sokal, R.R. and F.J. Rohlf. 1995. Biometry: the principles and practice of statistics in biological research. 3rd edition. W.H. Freeman and Company, New York.

Fiscal Year 2013 Budget
Labor Costs (Federal Salary and Benefits)

PNM Weir to Hogback Diversion:

Fish Biologist (GS-9-3)-10 days @ $288/day
(1 person X 5 days/trip X 2 trips) ..... $ 2,880.00

Biological Science Technician (GS-8)-10 days @ $328/day
(1 person X 5 days/trip X 2 trips) ..... $ 3,280.00
$ 6,160.00

Hogback Diversion to Shiprock Bridge:

Supervisory Fish Biologist (GS-13-4)-10 days @ $513/day
(1 person X 5 days/trip X 2 trips) ..... $ 5,130.00

Fish Biologist (GS-9-3)-15 days @ $288/day
(1 person X 5 days/trip X 3 trips) ..... $ 4,320.00

Biological Science Technician (GS-8)-15 days @ $328/day
(1 person X 5 days/trip X 3 trips) ..... $ 4,920.00
$ 14,370.00

Shiprock to Mexican Hat:

Supervisory Fish Biologist (GS-13-4)-12 days @ $513/day
(1 person X 6 days/trip X 2 trips) ..... $ 6,156.00

Fish Biologist (GS-9-3)-48 days @ $288/day
(1 person X 12 days/trip X 2 trips) ..... $ 13,824.00

Biological Science Technician (GS-8)-48 days @ $328/day
(1 person X 12 days/trip X 4 trips) ..... $ 15,744.00

Fish Biologist (GS-5-1)-48 days @ $178/day
(1 person X 12 days/trip X 4 trips) ..... $ 8,544.00

Biological Science Technician (GS-4-1)-24 days @ $159/day
(2 people X 12 days/trip X 1 trip)..... $ 3,816.00
$ 48,084.00

Shiprock to Sand Island (tagging trip):

Supervisory Fish Biologist (GS-13-4)-12 days @ $513/day
(1 person X 12 days/trip X 1 trip)..... $ 6,156.00

Fish Biologist (GS-11-3)-12days @ $349/day
(1 person X 12 days/trip X 1 trip)..... $ 4,188.00
Fish Biologist (GS-9-3)-12 days @ $288/day
(1 person X 12 days/trip X 1 trip)..... $ 3,456.00

Biological Science Technician (GS-8)-12 days @ $328/day
(1 person X 12 days/trip X 1 trip)..... $ 3,936.00

Fish Biologist (GS-5-1)-12 days @ $178/day
(1 person X 12 days/trip X 1 trips) ..... $ 2,136.00
$ 19,872.00

Administrative and Reporting Costs

Administrative Officer (GS-9-8)-10 days @ $296/day ..... $ 2,960.00

Supervisory Fish Biologist (GS-13-4)-50 days @ $513/day ..... $ 25,650.00

Fish Biologist (GS-9-3)-25 days @ $288/day ..... $ 7,200.00

$ 35,810.00

Sub-Total for Labor Costs ..... $ 124,296.00

Travel and Per Diem (Based on published FY 2012 Per Diem Rates)

Hotel Costs – 56 nights @ $77/night ..... $ 4,312.00

Per Diem (Hotel Rate) – 65 days @ $46/day ..... $ 2,990.00

Per Diem (Camp Rate) – 179 days @ $29/day ..... $ 5,191.00

Sub-Total for Travel and Per Diem..... $ 12,493.00

Equipment

Removal Trips

PNM Weir to Hogback/Shiprock Diversion
3,000 miles @ $0.51/mile (400 miles/trip X 5 trips + 1,000 shuttling miles) ..... $ 1,530.00

Shiprock to Mexican Hat
8,400 miles @ $0.51/mile (700 miles/trip X 4 trips X 3 vehicles) ..... $ 4,284.00

Generator fuel – 320 gallons @ $4.00/gallon
20 gallons/trip X 5 trips; upper SJR trips
110 gallons/trip X 2 trips; camping trips ..... $ 1,280.00

Equipment Maintenance, Repair and Replacement
(i.e. life jackets, hip boots, generator repair, rubber gloves, dip nets
aluminum welding, raft repair, etc.) ..... $ 2,500.00

Tagging Trip

4,000 Floy T-Bar Anchor Tags
(FD-94 tags @ $610/1,000 tags) ..... $ 2,440.00

Six (6) Replacement Needles @ $10 ea. ..... $ 60.00

Generator Fuel – 55 gallons @ $4.00/gallon ..... $ 220.00

Vehicle Fuel
1,400 miles @ $0.51/gallon (700 miles roundtrip X 2 vehicles) ..... $ 714.00

Sub-Total for Equipment ..... $ 13,028.00

USFWS – New Mexico Fish and Wildlife Conservation Office ..... $ 149,817.00

USFWS– Administrative Overhead (11%) ..... $ 16,480.00

USFWS – Region 2 Total ..... $ 166,297.00

Funding for participating agencies

U.S. Fish and Wildlife Service – Colorado River Fishery Project ..... $ 82,130.00
Utah Department of Wildlife Resources – Moab Field Station ..... $ 23,541.00
New Mexico Department of Game and Fish- Conservation Services Division ..... $ 10,830.00
American Southwest Ichthyological Researcher, LLC ..... $ 44,008.08
Navajo Nation Department of Fish and Wildlife $3,828.00

Sub-Total for participating agencies $164,337.08

Grand Total for FY 2013 ..... $330,634.08

Out-year funding

FY 2013 ..... $330,634
FY 2014 ..... $339,919
FY 2015 ..... $350,160
FY 2016 ..... $361,369
FY 2017 ..... $371,428
FY 2018 ..... $382,425

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-2013 nonnative removal activities.

Personnel/Labor Costs (Federal Salary + Benefits)	
Principal Biologist (GS-11) – 304 hours @ $45.53/hr	$ 13,841.00
(1 person X 5 days/trip X 1 hotel trip)	
(1 person X 11 days/trip X 3 camping trips)	
Bio. Tech. Crew Leader (GS-6) – 392 hours @ $26.17/hr	$ 14,184.00
(1 people X 5 days/trip X 1 hotel trip)	
(1 person X 11 days/trip X 4 camping trips)	
(+ 100 hours overtime at $39.25/hr = $3,925.00)	
Biological Technicians (GS-5) – 528 hours @ $17.95/hr	
(3 people x 11 days/trips x 2 trips)	
(+ 25 hours overtime each at $26.92/hr = $2,019.00)	$ 11,497.00
	$ 39,522.00
Administrative Support (Federal Salary + Benefits)	
Administrative Officer (GS-9) – 110 hours @ $40.78/hr	$ 4,486.00
Project Leader (GS-14) – 110 hours @ $69.76/hr	$ 7,674.00
	$ 12,160.00
Reporting/Data Management (Federal Salary + Benefits)	
Principal Biologist (GS-11) – 266 hours @ $45.53/hr	$ 12,123.00
	$ 12,123.00
Travel and Per Diem (Based on Published FY-2012 Federal Per Diem Rates)	
Hotel Costs – 18 nights	$ 1,386.00
(18 nights @ $77/night – single occupancy = $1,386)	
Per Diem (Hotel Rate) – 16 days @ $46/day	$ 736.00
Per Diem (Camp Rate) – 80 days @ $28/day	$ 2,240.00
	$ 4,362.00
Equipment	
Vehicle Maintenance & Gasoline (GSA lease = $334 + $0.30/mile/truck/trip)	
(600 miles round trip from Grand Junction, CO to	
Farmington, NM + 200 miles of shuttling per trip X 6 trips)	$ 3,444.00
Generator Gasoline (110 gallons/trip x 2 trips @ $4.00/gallon)	$ 880.00
Equipment Maintenance, Repair, & Replacement	
(e.g., spark plugs and oil for electrofishing generators,	
generator repair, life jackets, hip boots, rubber	
gloves, dip nets, aluminum welding, raft repair, etc.)	$ 1,500.00
	$ 5,824.00
USFWS-CRFP (Grand Junction) Total	$ 73,991.00
USFWS Region 6 Regional Office Administrative Overhead (11.00%)	$ 8,139.00
USFWS Region 6 Total	$ 82,130.00

Under the heading "Funding for participation of other agencies." Cost for participation of Utah Department of Wildlife Resources – Moab Field Office in FY-2013 nonnative removal activities.

Personnel/Labor Costs (Salary + Benefits)		
Principal Biologist– 35 days @ $265/day (1 person X 10 days/trip X 3 camping trips and 5 office days for trip prep, gear cleaning, etc.)		$ 9,275.00
Biological Technicians – 35 days @ $185/day (1 person X 10 days/trip X 3 camping trips and 5 office days for trip prep, gear cleaning, etc.)		$ 6,475.00
Project Leader – 2 days @ $324/day		$ 648.00
	Subtotal	**$ 16,398.00**
Travel and Per Diem (Based on Published FY-2011 Federal Per Diem Rates)		
Per Diem (Camp Rate) – 60 days @ $20/day		$ 1,200.00
Vehicle Rent (1 truck @$250 month for 2 months)		$ 500.00
Vehicle Mileage (1,300 miles @ $0.49 per mile)		$ 637.00
	Subtotal	**$ 2,337.00**
Equipment Maintenance, Repair and Replacement		
Generator Gasoline (30 gallons/trip x 3 trips @ $3.50/gallon)		$ 315.00
Maintenance (spark plugs, air filters, oil, generator repair)		$ 400.00
Data Collection Supplies (spring scales, pencils, measuring boards)		$ 100.00
Camping Gear (tents, sleeping pads, dry bags)		$ 200.00
Rafting Supplies (oars, raft repair, life jackets, straps, pumps)		$ 200.00
	Subtotal	**$ 1,215.00**
UDWR – Moab Total		$ **19,950.00**
UDWR - Moab Administrative Overhead (18%)		$ **3,591.00**
UDWR – Moab Grand Total		$ **23,541.00**

Under the heading "Funding for participation of other agencies." Cost for participation of New Mexico Department of Game and Fish in FY-2013 nonnative removal activities.

Personnel/Labor Costs (State Salary + Benefits)		
Biologists - 20 @ $350/day		
(1 person x 5 days/trips x 4 trips)		$ 7,000.00
		$ 7,000.00
Travel and Per Diem (Based on Published FY-2007 State Per Diem Rates)		
Per Diem – 16 days @ $85/day		$ 1,360.00
		$ 1,360.00
Equipment		
Vehicle Maintenance & Gasoline (@ $0.55/mile)		
(2,700 miles for 4 trips from Albuquerque to Farmington		
and associated shuttling of vehicles)		$ 1,485.00
		$ 1,485.00
NMDGF – Santa Fe	**Total**	**$ 9,845.00**
Administrative Overhead (10%)		**$ 985.00**
NMDGF – Santa Fe – Total Budget		**$ 10,830.00**

Under the heading "Funding for participation of other agencies." Cost for participation of American Southwest Ichthyological Research, LLC in FY-2013 nonnative removal activities.

Personnel/Labor Costs (Salary + Benefits)		
Biologists – 704 hours x 43.10/hour	$	30,342.40
(2 people x 11 days/trip x 4 trips x 8 hours/day; camping trips)		
	$	30,342.40
Travel and Per Diem (Based on State Per Diem Rates)		
Hotel Per Diem		
1 day trip @ $95/day x 2 people x 4 trips = 8 days	$	760.00
Field Per Diem		
9 days trip @ $45/day x 2 people x 4 trips = 72 days	$	3,240.00
	$	4,000.00
Equipment		
Vehicle Maintenance & Gasoline		
450 miles round trip x 4trips = 1,800 miles		
(Albuquerque to Shiprock and return		
600 miles round trip x 4 = 2,400 miles		
(Albuquerque to Montezuma Creek and return)		
Total= 4,200 miles @ $0.555/mile	$	2,331.00
Subtotal	**$**	**36,673.40**
G & A (20%)	**$**	**7,334.68**
ASIR – Total Budget	**$**	**44,008.08**

Under the heading "Funding for participation of other agencies." Cost for participation of the Navajo Nation Department of Fish and Wildlife in FY-2013 nonnative removal activities.

Personnel/Labor Costs (Salary + Benefits)		
Fish Biologist – 6 days @ $154.16/day		$ 924.96
(1 person x 3 days x 2 trips)		
Biological Technician – 6 days @ $84.40/day		$ 506.40
(1 person x 3 days x 2 trips)		
	Sub-Total	$1,431.36
Fringe Benefits $1,431.36 X 42.48%		$ 608.04
	Total Personnel/Labor	**$ 2,039.40**
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**
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**
Navajo Nation Fish and Wildlife Total		**$3,242.56**
Navajo Fish and Wildlife Administrative Overhead (18.05%)		**$ 585.28**
Navajo Nation Total		**$3,827.84**

Nonnative Species Control and Rare Fish Monitoring in the Lower San Juan River
Fiscal Year 2013 Project Proposal and Estimated Budget for 2013-2017

Principal Investigator: Brandon S. Gerig
Utah Division of Wildlife Resources, Moab Field Station
1165 S. Hwy 191- Suite 4, Moab, Utah 84532
(435) 259-3782
brandongerig@utah.gov

BOR Cooperative Agreement #

UDWR Moab FS: R08AP40722

Navajo Nation: R11AP40089

New Mexico Dept of Game and Fish: 07FG402630

USFWS Grand Junction: R10PG40123

Period of Performance #

October 1, 2012 – September 30, 2013

Nonnative Species Control and Rare Fish Monitoring in the Lower San Juan River
Fiscal Year 2013 Project Proposal and Estimated Budget for 2013-2017

Principal Investigator: Brandon S. Gerig
Utah Division of Wildlife Resources, Moab Field Station
1165 S. Hwy 191- Suite 4, Moab, Utah 84532
(435) 259-3782
brandongerig@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 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). One of the most encouraging findings from 2004 was the collection of two wild spawned Colorado pikeminnow larvae at RM 46.3 and 18.1 (Brandenburg et al. 2005).

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, 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 86,000 channel catfish and approximately 3,000 common carp were mechanically removed from the lower San Juan River from 2002 to 2010. A decrease in mean total length (TL) of channel catfish was observed between 2002 and 2010, indicating that removal efforts may 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 2010. Between 2002 and 2010, 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 and 2004. 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 2010. Preliminary population estimates for juvenile Colorado pikeminnow residing in the lower San Juan River were generated from 2004 to 2010 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.

This work plan proposes the continuation of nonnative control, sub-element 4.1 of the Long Range Plan, in the lower San Juan River from Mexican Hat to Clay Hills. This study will serve to determine the most effective time for removal actions. 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.

Description of Study Area:

The study area for this project includes the San Juan River from Mexican Hat (RM 53) to Clay Hills (RM 2.9), Utah. The river from Mexican Hat to RM 16 is part of Geomorphic Reach 2 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.

Objectives

1.) Continue mechanical removal and monitoring of large-bodied nonnative species in the lower portion of the San Juan River from Mexican Hat to Clay Hills.

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

3.) Monitor distribution and abundance of endangered fish in the lower San Juan River.

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

Methods/Approach:

Mechanical removal of nonnative species will be conducted from Mexican Hat to Clay Hills, Utah. Sampling effort will be conducted via two raft mounted electrofishing boats. The entire study area will be electrofished in a downstream fashion with one boat on each shoreline. Each boat will have one netter and one rower. A third boat will follow behind to pick up nonnative fish missed by the electrofishing boats. These fish will not be included in catch rate calculations, so that comparisons can be made between trips and years. Nine five-day trips with 6 people are anticipated, and timing of sampling will be dependent on catch rate from past data. Bimonthly trips will be conducted, which will likely translate into every other week sampling from March through August. Data from the adult fall monitoring conducted by U.S. Fish and Wildlife Service- Grand Junction in October will be incorporated into data analysis. In an average water year, this schedule would allow for sampling a variety of habitat conditions, including variable flows, temperatures, and turbidity.
All nonnative fish collected will be identified, enumerated, measured to the nearest mm for total and standard 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, salinity, and dissolved oxygen. 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:

A draft report for the Nonnative Species Monitoring and Control in the Lower San Juan River activities will be prepared and distributed to the San Juan River Biology Committee for review by 31 March 2013. 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 2013. Electronic copies of the field and collection data will be transferred to the San Juan River database manager following the successful protocol previously employed.

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Nonnative Species Control and Rare Fish Monitoring in the Lower San Juan River Fiscal Year 2013-2017 Project Budget. BOR Cooperative Agreement with UDWR: R08AP40722

Principal Investigators: Brandon S. Gerig
Utah Division of Wildlife Resources, Moab Field Station
1165 S. Hwy 191 – Suite 4, Moab, Utah 84532
(435) 259-3782
brandongerig@utah.gov

Estimated Budget FY-2013:

Personnel / Labor Costs (State Salary + Benefits)	
Lead Biologist @ $265 per day for 152 days	$40,280.00
Technicians @ $185 for 260 man days	$48,100.00
Project Leader @ $290 for 20 man days	$6,400.00
Subtotal	$94,780.00
Travel and Per diem	
Mileage:340 mi round-trip @ $0.49 per mi	$3,165.00
Shuttle of three vehicles @ $510 per trip (9 trips)	$4,725.00
Vehicle rent - (1 x 6 x $250/month)	$1,500.00
Per diem	
Camp rate- 6 people @ $25 per day for 45 days	$6,750.00
Meeting Per diem	
Out-of-state per diem - $47 per day x 10 days	$430.00
Hotel costs - 4 meetings per year ($70.00/night for 10 nights)	$700.00
Subtotal	$17,270.00
Equipment Maintenance, Repair, & Replacement	
Fuel for generators (30 gal/ trip x 9 trips @ $3.75/gal)	$1,012.50
Wiring replacement for electrofishing system	$100.00
Repair of electrofishing frame (aluminum welding)	$300.00
Replacement of electrofishing equipment	
Dip nets	$200.00
Foot switch	$200.00
Life jackets	$300.00
First aid	$80.00
Waders	$200.00
Data collection supplies	
Paper, binders, pencils, CD's, staples, paperclips	$150.00
Measuring board	$100.00
Spring scales	$200.00
Plungers, needles, alcohol for PIT tags	$50.00
Colored Floy tags and supplies	$200.00
Tools	$100.00
Repair of GPS units	$50.00
Satellite phone charges ($30/month for 6 months)	$180.00
Repair of GPP	$500.00
Repair of generator	$500.00

Repair of trailer (bearings, axle, jack, winch)	$500.00
Repair and replacement supplies for rafts	
Raft	$5,000.00
Frame	$800.00
Oarlocks	$60.00
Oars	$400.00
Riverstraps	$125.00
Pump	$150.00
Raft repair (valves, d-rings, glue, patches)	$100.00
Carabiners	$100.00
Throw bags	$100.00
Maintenance of generator (oil, spark plugs, battery)	$100.00
Subtotal	$11,857.50
Training	
Swiftwater Rescue Course (Canyonlands Field Institute)	$450.00
Subtotal	$450.00
Misc.and camping equipment:	
Tables	$40.00
Tents	$200.00
Drybags	$200.00
Cookware	$50.00
Chairs	$60.00
Batteries	$100.00
Toilet supplies	$90.00
Charcoal	$45.00
Cleaners	$50.00
Food storage boxes	$40.00
Propane	$100.00
Groover disposal	$25.00
Subtotal	$1,000.00
Total UDWR Expenses	$125,357.50
Administrative Overhead (20%)	$25,071.50
Funding for Participating Agencies	
Navajo Nation (2 trips, 2 people includes salary and associated costs)	$9,123.61
USFWS GJ (2 trips, 2 people includes salaries and associated costs)	$17,305.00
NMFG (2 trips, 1 person includes salaries and associated costs)	$5,720.00
2013 Total	**$182,577.61**

Nonnative Species Control in the Lower San Juan River
Fiscal Year 2013 Estimated Project Budget

Principal Investigators: Brandon Gerig
Utah Division of Wildlife Resources, Moab Field Station
1165 S. Hwy 191 – Suite 4, Moab, Utah 84532
(435) 259-3782
bsgerig@utah.gov

Under the heading "Funding for participation of other agencies." Estimated Costs for participation of the Navajo Nation Department of Fish and Wildlife, in FY-2013. BOR Cooperative Agreement Number with Navajo Nation: R11AP40089

Personnel/Labor Costs (Salary+Benefits)	
Fish Biologist-14 days @ 154.16/day	$2,158.24
Bio Tech-14 days @ 84.40/day	$1,181.60
Fringe Benfits=Labor Costs* 42.48%	$1,418.76
Subtotal	$4,758.60
Travel and Per Diem	
Hotel- 4 nights @ $70.00	$280.00
Camping Rate-20 nights @ $29/night	$580.00
Vehicle Lease/Maintenance	$454.00
Gasoline-260 miles @ $0.30/mi	$156.00
Subtotal	$1,470.00
Equipment	
Maintenance, Repair, Replacement	$1,500.00
Subtotal	$1,500.00
Navajo Nation Total	$7,728.60
Navajo Nation Administration Fees (18.05%)	$1,395.01
Navajo Nation Total	**$9,123.62**

Nonnative Species Control and Rare Fish Monitoring in the Lower San Juan River Fiscal Year 2013 Estimated Project Budget

Principal Investigators: Brandon S. Gerig
Utah Division of Wildlife Resources, Moab Field Station
1165 S. Hwy 191 – Suite 4, Moab, Utah 84532
(435) 259-3782
brandongerig@utah.gov

Under the heading "Funding for participation of other agencies." Estimated costs for participation of the New Mexico Game and Fish in FY-2013. BOR Cooperative Agreement Number with New Mexico Department of Fish and Game: 07FG402630

Personnel/Labor Costs	
Fishery Biologist - 12 days @ $350/day	
(1 person x 6 days per trip x 2 trips)	$4,210.00
Subtotal	$4,210.00
Travel and Per Diem	
($85 per day per person - 12 days)	$1,020.00
Subtotal	$1,020.00
Equipment	
Vehicle & Gasoline ($0.35/mile)	
(700 miles round trip x 2 trips)	$490.00
Subtotal	$490.00
Total	$5,720.00

Participation in Non-native Species Control in the *Lower* San Juan River Fiscal Year 2013 Project Proposal 31 August 2012

Budget for Participation by U.S. Fish Wildlife Service, Colorado River Fishery Project (USFWS-CRFP) **in**
Non-native Species Control in the *Lower* San Juan River

Principal Investigator: Brandon Gerig
Utah Division of Wildlife Resources, Moab Field Station
1165 S. Hwy 191- Suite 4, Moab, Utah 84532
(435) 259-3782

Developed by: Dale Ryden
U. S. Fish and Wildlife Service
Colorado River Fishery Project
764 Horizon Drive, Building B
Grand Junction, Colorado 81506
(970) 245-9319
dale_ryden@fws.gov

Contract or Agreement number(s):
R10 PG 400023 for USFWS – Grand Junction, CO

Reporting Dates: 10/1/2012 through 9/30/2013

Fiscal Year 2013 Budget:

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

Personnel/Labor Costs (Federal Salary + Benefits)	
Principal Biologist (GS-11) – 80 hours @ $45.53/hr	$ 3,642.00
(1 person X 5 days/trip X 2 trips)	
Bio. Tech. Crew Leader (GS-6) – 80 hours @ $26.17/hr	$ 3,315.00
(1 people X 5 days/trip X 2 trips)	
(+ 30 hours overtime at $39.25/hr = $1,178.00)	
Biological Technician (GS-5) – 80 hours @ $17.95/hr	$ 2,244.00
(1 people X 5 days/trip X 2 trips)	
(+ 30 hours overtime each at $26.92/hr = $808.00)	
Sub Total	$ 9,201.00
Administrative Support (Federal Salary + Benefits)	
Administrative Officer (GS-9) – 23 hours @ $40.78/hr	$ 940.00
Project Leader (GS-14) -- 15 hours @ $69.76/hr	$ 1,047.00
Sub Total	$ 1,987.00
Travel and Per Diem (Based on Published FY-2012 Federal Per Diem Rates)	
Hotel Costs – 6 nights	$ 462.00
(6 nights @ $77/night – single occupancy = $420)	
Per Diem (Hotel Rate) - 6 days @ $46/day	$ 276.00
Per Diem (Camping Rate) 30 days @ $28/day	$ 840.00
Sub Total	$ 1,578.00
Equipment	
Vehicle Maintenance & Gasoline (GSA lease = $334 + $0.30/mile/truck/trip)	
(700 miles round trip from Grand Junction, CO to	
Clay Hills, UT X 2 trips)	$ 1,089.00
Generator Gasoline for Electrofishing	
(20 gallons/trip X 2 trips @ $4.00/gallon)	$ 160.00
Equipment Maintenance, Repair, & Replacement	
(e.g., spark plugs and oil for electrofishing generator,	
generator repair, life jackets, hip boots, rubber gloves,	
dip nets, aluminum welding, raft repair, etc.)	$ 1,575.00
Sub Total	$ 2,824.00
USFWS-CRFP (Grand Junction, CO) Total	$ 15,590.00
USFWS Region 6 Administrative Overhead (11.00%)	$ 1,715.00
USFWS Region 6 Total	$ 17,305.00

Sub-Adult and Adult Large-Bodied Fish Community Monitoring Fiscal Year 2013 Project Proposal 31 August 2012

Principal Investigators:
Travis Francis, Ben Schleicher, Dale Ryden
U. S. Fish and Wildlife Service
Colorado River Fishery Project
764 Horizon Drive, Building B
Grand Junction, Colorado 81506
(970) 245-9319
travis_francis@fws.gov benjamin_schleicher@fws.gov
dale_ryden@fws.gov

Contract or Agreement number(s):
R10 PG 40 021 (08-AA-40-2715) for USFWS – Grand Junction, CO
R10 PG 40 020 for USFWS – Albuquerque, NM
08 FG 40 2716 for UDWR – Moab, UT

Reporting Dates: 10/1/2012 through 9/30/2013

Sub-Adult & Adult Large-Bodied Fish Community Monitoring
(a.k.a. Adult Monitoring)
Fiscal Year 2013 Project Proposal
31 August 2012

Principal Investigators: Travis Francis, Benjamin Schleicher and Dale Ryden
U. S. Fish and Wildlife Service, Colorado River Fishery Project
764 Horizon Drive, Building B
Grand Junction, Colorado 81506
(970) 245-9319
travis_francis@fws.gov benjamin_schleicher@fws.gov
dale_ryden@fws.gov

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 Recovery Implementation Program's (SJRIP) Comprehensive Monitoring Plan (SJRIP 2010) that are designed to help evaluate progress of the two endangered fish species towards recovery under the SJRIP's Long Range Plan (SJRIP 2009). 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 SJRIP'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 SJRIP 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 actions under element numbers 1-5 of the Long Range Plan (SJRIP 2009): 1.1.1.1, 1.1.1.3, 1.1.4.3, 1.2.1.1, 1.2.3.1, 2.2.5.1, 2.2.5.2, 3.2.1.2, 4.1.1.4, 4.1.1.8, 4.1.1.9, 5.1.1.2, 5.1.2.3, 5.1.2.4, 5.1.2.5, and 5.1.4.1. The Comprehensive Monitoring Plan is currently undergoing revision. However, the monitoring protocols discussed in the Methods section of this report reflect those that are currently included in the latest draft of the revised Comprehensive Monitoring Plan (SJRIP 2010).

Description of Study Area:

As per the latest draft of the Comprehensive Monitoring Plan (USFWS 2010) 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 (which is just upstream of the Sand Island boat launch near Bluff, UT).

In 2013, three additional river sections in NM will be sampled in either August or September. These three river sections would include: 1) the lower Animas River from the Penny Lane Landing downstream to the San Juan River; 2) the San Juan River from the Bloomfield Riverside Landing (RM 196.0) downstream to the McGee Park Landing (RM 188.7); and, 3) the McGee Park Landing downstream to the Animas River confluence.

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 SJRIP. For example:
    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: One Adult Monitoring trip will take place in the fall of 2013. This trip will sample from RM 180.0 (the Animas River confluence in NM) downstream to RM 77.0 (just upstream of the Sand Island boat launch, near Bluff, UT). Raft-borne electrofishing will be the primary sampling technique. Sampling will begin in the second to third week of September and will be concluded by the second to third week of October.

Electrofishing will follow the methods set forth above and in the Comprehensive Monitoring Plan (SJRIP 2010). Two oar-powered rafts, with one netter each, will electrofish in a continuous downstream fashion, with one raft on each shoreline. 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 8-10 people (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 70 total sampled miles). 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 200 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 2012 is scheduled to be available by 31 March 2014. The final version of this interim progress report which incorporates comments received, is scheduled to be completed by 1 June 2014. 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 SJRIP's integrated database by 31 December 2013. 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 SJRIP's integrated database by 31 March 2014.

Qualifications of Personnel Included in the Budget:

Principal Biologist (GS-14) -- Dale Ryden, USFWS-CRFP
Dale has 22 years of experience performing fisheries research and management in the Colorado, Gunnison and San Juan rivers. For the last 21 years, Dale has been 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 (SJRIP). During his involvement with the SJRIP, 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 SJRIP. 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 off ice in Grand Junction, CO. Dale also represents the USFWS on the Biology Committee for both the San Juan River Recovery Implementation Program (for Region 6 of the USFWS) and the Upper Colorado River Endangered Fish Recovery Program (UCRRP).

Principal Biologist (GS-11) – Travis Francis, USFWS-CRFP
Travis has 11 years of experience performing fisheries research and management in the Colorado, Gunnison and San Juan rivers. For the last 10 years, Travis has been a fish biologist for Region 6 of the USFWS in charge of performing fisheries research and management associated with the UCRRP. During his involvement with the UCRRP, Travis' responsibilities have ranged across a number of areas including: 1) surveying the San Juan River arm of Lake Powell for endangered razorback sucker; 2) database manager for the upper basin; 3) humpback chub population monitoring in Black Rocks on the Colorado River; 4) razorback sucker propagation biologist at the Ouray National Fish Hatchery – Grand Valley Unit in Grand Junction Colorado; and, 5) leading field crews for other projects associated with both the UCRRP and SJRIP. Travis has authored 15 annual agency reports as well as numerous scopes of work. He authored Population Size and Structure of Humpback Chub, *Gila cypha* and Roundtail Chub, *G. robusta*, in Black Rocks, Colorado River, Colorado, 2007–2008, and an Overview of the Upper Colorado River Recovery Program propagation program with a preliminary assessment of survival of stocked fish in the rivers of the Upper Colorado River Basin. He has served as a member on the UCRRP bonytail ad hoc committee and propagation committee. He is the current alternate representative to the SJRIP's Biology Committee for Region 6 of the USFWS.

Principal Biologist (GS-7) – Benjamin Schleicher, USFWS-CRFP
Ben has three 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 nonnative removal and endangered species monitoring. He also spent an additional two years with the UDWR-Moab performing the same tasks in the Colorado, Green, and San Juan River basins.

Biological Technicians (GS-5) – USFWS-CRFP
All have at least a BS degree in biology. Depending upon the individual, they have from 2-3 years of experience performing fisheries research and management in the Colorado River Basin. All have at least one year of experience performing fisheries research and management on 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 SJRIP. 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 SJRIP's Comprehensive Monitoring Plan (SJRIP 2010). 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. 2009. Long-Range Plan. San Juan River Basin Recovery Implementation Program, U. S. Fish and Wildlife Service, Albuquerque, New Mexico.

San Juan River Basin Recovery Implementation Program. 2010. San Juan River Recovery Implementation Program Comprehensive Monitoring Plan (Draft dated 24 February 2010). San Juan River Basin Recovery Implementation Program, U. S. Fish and Wildlife Service, Albuquerque, New Mexico.

Fiscal Year 2013 Budget:

Personnel/Labor Costs (Federal Salary + Benefits)	
Objectives 1-3: Logistics, Electrofishing, Removal of Nonnative Fish	
Principal Biologist (GS-11) – 216 hours @ $45.53/hr	$ 9,833.00
(1 person X 10 days planning & organization)	
(1 person X 4 days/trip X 1 trip – work from hotel)	
(1 person X 10 days/trip X 1 trip – camping)	
(1 person X 3 days/trip X 1 trip – work from hotel)	
Biological Technicians (GS-6) - 112 hours @ $26.17/hr	$ 4,894.00
(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 $39.25/hr = $1963.00)	
Biological Technicians (GS-5) – 408 hours @ $17.95/hr	$ 12,270.00
(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 $26.92/hr = $4,220.00)	
(3 person X 3 days/trip X 1 trip – work from hotel)	
(+ 9 hours overtime each at $26.92/hr = $726.84)	
Sub Total	$ 26,997.00
Permitting; Coordination; Data Input, Analysis, Management & Presentation; Report Writing; Office & Administrative Support (Federal Salary + Benefits)	
Administrative Officer (GS-9) – 123 hours @ $40.78/hr	$ 5,016.00
Principal Biologist (GS-11) – 326 hours @ $45.53/hr	$ 14,843.00
Project Leader (GS-14) – 320 hours @ $69.76/hr	$ 22,323.00
Sub Total	$ 42,182.00
Travel and Per Diem (Based on Published FY-2012 Federal Per Diem Rates)	
Hotel Costs	
15 nights @ $77/night (in Farmington, NM)	$ 1,155.00
5 nights @ $112/night (in Cortez, CO)	$ 560.00
12 nights @ $77/night (in Farmington, NM)	$ 924.00
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)	
10 days X 5 people X $28/day	$ 1,400.00
Sub Total	$ 5,536.00
Equipment and Supplies	
Vehicle Maintenance & Lease (GSA lease = $334 + $0.30/mile/truck)	
(600 miles round trip from Grand Junction, CO to Farmington, NM + 350 miles of shuttling) X 2 vehicles – for working from hotel	$ 1,240.00
(425 miles round trip from Grand Junction, CO to Bluff, UT + 125 miles of shuttling) X 2 vehicles – for the camping portion	$ 1,000.00
(90 miles shuttling in & around Farmington, NM) X 2 vehicles – for three additional days sampling	$ 720.00

Generator fuel (70 gallons X $4.00/gallon)	$ 280.00
Generator fuel (30 gallons X $4.00/gallon)	$ 120.00
Equipment Maintenance, Repair, & Replacement (e.g., dip nets, oar-blades, PIT tag gear, rafts, raft trailer, life jackets, camping equipment, etc.)	$ 3,000.00
Purchase to upgrade aging electrofishing equipment ETS boat electrofishing control box, with options to meet standardized guidelines compatible with UCRB-RIP (1 unit @ $5,725.00)	$ 5,725.00
Sub Total	$ 12,085.00
USFWS-CRFP (Grand Junction, CO) Total	$ 86,800.00
USFWS Region 6 Administrative Overhead (11.00%)	$ 9,548.00
USFWS Region 6 Total	$ 96,348.00

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	$ 11,548.00
Utah Division of Wildlife Resources - Moab, UT	
See Attached Budget for Line Item Breakdowns	$ 2,672.00
	$ 14,220.00

FY-2013 WORKPLAN TOTAL **$110,568.00**

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-2013.

Personnel/Labor Costs (Federal Salary + Benefits)		
Fish Biologist (GS-9-3) – 12 days @ $288/day	$	3,456
(1 person x 11 days x 1 trip; Hogback to Sand Island)		
Biological Science Tech (GS-8) – 14 days @ $328/day	$	4,592
(1 person x 11 days x 1 trip; Hogback to Sand Island)		
(1 person x 3 days x 1 trip; Animas to Hogback Diversion)		
Administrative Officer (GS-9-8) – 1 day @ $296/day	$	296
Sub Total	**$**	**8,344**
Travel and Per Diem (Based on Published FY-2010 Federal Per Diem Rates)		
Hotel Costs – 2 nights	$	172
(1 night x 2 rooms @ $86/night; Cortez, CO)		
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	**$**	**672**
Equipment		
Vehicle Maintenance & Gasoline (@ $0.51/mile)		
(660 miles round trip from Albuquerque, NM to Blanding, UT + 100 miles shuttling)	$	388
Equipment Maintenance, Repair, & Replacement		
(e.g., life jackets, hip boots, generator repair, rubber gloves, dip nets, aluminum welding, raft repair, etc.)	$	1,000
Sub Total	**$**	**1,388**
USFWS-NMFWCO (Albuquerque) Total	**$**	**10,404**
USFWS Region 2 Regional Office Administrative Overhead (11.00%)	**$**	**1,144**
USFWS Region 2 Total	**$**	**11,548**

Under the heading "Funding for participation of other agencies." Cost for participation of the Utah Division of Wildlife Resources, Moab Field Station (Moab, UT) in FY-2013.

Personnel/Labor Costs (State Salary + Benefits)		
Principal Biologist– 6 days @ $265/day	$	1,590
Travel and Per Diem (Based on Published FY-2011 State Per Diem Rates)		
Hotel Costs – 1 night	$	70
(1 night @ $70/night)		
Per Diem (Hotel Rate) - 1 day @ $43/day	$	43
(Camp Rate) - 4 days @ $20/day	$	80
Subtotal	$	193
Equipment		
Vehicle Maintenance & Gasoline (@ $0.49/mile)		
(412 miles round trip from Moab, UT to Cortez, CO to		
Clay Hills, UT)	$	181
Equipment Repair, & Replacement		
(e.g., life jackets, oars, boat patching material, etc)	$	300
Subtotal	$	481
UDWR- Moab Total	$	2,264
UDWR- Administrative Overhead (18%)	$	408
UDWR TOTAL	$	2,672

Small-Bodied Fishes Monitoring
Period of Performance - Fiscal Year 2013
Statement of Work and Project Budget

Principal Investigators: Eliza Gilbert and Kirk Patten
Agreement Number: SJ2631
Conservation Services Division
New Mexico Department of Game & Fish
One Wildlife Way, P.O. Box 25112
Santa Fe, New Mexico 87504
505-476-8104
eliza.gilbert@state.nm.us
kirk.patten@state.nm.us

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 River Mile 76.4 (Sand Island, 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; 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 Sand Island (RM 76.4) and Clay Hills Crossing (RM 2.9) will be sampled every fifth year. Sampling procedures in these lower reaches will be the same as those between Animas-San Juan rivers confluence and Sand Island. This lower reach was sampled in 2010 and will be sampled again in 2015.

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). Regression analysis and MANOVA will be used to characterize biological responses to discharge attributes (e.g., mean spring discharge, mean base summer discharge, and number days summer discharge less than 500 cfs) and ANOVA will be used to compare size structure of populations across reaches within a year and across years in a reach. 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

Incorporated into this year's annual monitoring of small-bodied fish will be sampling of 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

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 by 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 Using Block Seining

In 2011 the SJRIP Biology Committee determined that a methodology called block seining should be experimentally incorporated into the small-bodied monitoring. This method is summarized and described in Golden and Holden (2005) as using two 9 m x 2 m (6 mm mesh) double-weighted seines, where one is held at the bottom of a mesohabitat and the second seine is used to sample down to the first seine. This method was used during the 2011 small-bodied sampling and will be included in the 2012 and 2013 autumn samples. Use of this method will occur at least once within every primary channel sampled. The method will be employed in suitable mesohabitat such as shoals and shoreline runs. Data analysis will include comparisons of species captured, CPUE and fish size structure between block seining and the single 3.0 x 1.2 m (3 mm mesh) seine method.

Additional Sampling on the Animas River and on the San Juan River above its confluence with the Animas River.

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. No monitoring of these sections of river is currently underway. The upper portion of the San Juan River will be 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 will also occur on the Animas River upstream from the Penny Lane Landing downstream to the San Juan River. This additional monitoring will incur three sampling days.

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 2004	63,545		
Fiscal Year 2005	72,645		
Fiscal Year 2006	72,885		
Fiscal Year 2007	81,246		
Fiscal Year 2008	91,882		
Fiscal Year 2009	89,479		

2013 Budget[1]

Field work as described above and all responsibilities as a Biology Committee representative

Field

Personnel[2]

Project Leader (1)

Tasks - Annual monitoring primary channel, secondary channel, and backwater habitats, San Juan River, Farmington, NM to Sand Island, UT; Block net seining; 3 sampling days on the Animas River and The San Juan River above its confluence with the Animas.

146 hrs[2,3]	146 hrs
$39.90/hr (base salary) + $13.17 (benefits)	$53.067/hr

Project Biologists (3)

Tasks—Annual monitoring primary channel, secondary channel, and backwater habitats, San Juan River, Farmington to Sand Island, UT.

146 hrs ea[2,3]	438 hrs
$28.35.00/hr (base salary) + $9.36 (benefits)	$37.71/hr

TOTAL PERSONNEL **$24,264.76**

Per Diem

10 days/project biologist (in-state rate) for 4 biologists	
- $85.00/day (standard NM in-state rate)	$3400.00
2 days/project biologist (out-of-state rate) for 4 biologists	
-$115.00/day (standard NM in-state rate)	$920.00

TOTAL PER DIEM **$4,320.00**

Vehicle

4 x 4 vehicles (2)- round-trip Farmington, NM	1000 miles
4 x 4 vehicles (1) - round-trip to Bluff, Utah	1280 miles
$0.55/mile (standard IRS rate)	

TOTAL VEHICLE **$1804.00**

Field Equipment & Supplies

Seines (6) @ $50.00 ea	$300.00
Whirlpacks (500) @ $50.00/500	$ 50.00
Formalin (30 gal) @ $25/5gal	$150.00

TOTAL EQUIPMENT & SUPPLIES **$500.00**

TOTAL FIELD **$30,888.80**

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). This requires approximately 32 hours per day of sampling to process data and specimens retained in the laboratory.

320 hrs ea.	640 hrs
$28.35.00/hr (base salary) + $9.36 (benefits)	$37.71/hr

TOTAL SPECIMEN MANAGEMENT **$24,134.40**

Data Synthesis and Report Preparation

Personnel

Project Leader (1)

Tasks—data analysis, data synthesis, report drafting (primary channel, secondary channel, backwater, and summary sections), report review, and report revision.

120 hrs	120 hrs
$39.90/hr (base salary) + $13.17 (benefits)	$53.067/hr

TOTAL PROJECT LEADER SALARY **$6,368.04**

Project Biologists (2)

Tasks—data management, data QA/QC, data analysis, data synthesis, table and graph preparation, report drafting (primary channel, secondary channel, and backwaters sections), and report revision.

200 hrs ea.	400 hrs
$28.35.00/hr (base salary) + $9.36 (benefits)	$37.71/hr

TOTAL PROJECT BIOLOGISTS SALARY **$15,084.00**

TOTAL DATA SYNTHESIS & RPT PREPARATION **$21,452.00**

Reviews and Meetings

Personnel

Project Leader (1)
Tasks—attendance at 1 Biology Committee meeting annually (28 hrs. ea)

28 hrs	28 hrs
$39.90/hr (base salary) + $13.17 (benefits)	$53.067/hr

Project Biologists (1)
Tasks—attendance at 4 Biology Committee meeting annually (28 hrs. ea)

112 hrs	112 hrs
$28.35.00/hr (base salary) + $9.36 (benefits)	$37.71/hr

Project Biologists (1)
Tasks—attendance report review (excluding NMGF; 24 hrs).

24 hrs	24 hrs
$28.35.00/hr (base salary) + $9.36 (benefits)	$37.71/hr

TOTAL SALARY **$6614.44**

Per Diem

Project Biologists (1) (includes 3 Biology & 1 Coordination Committee meetings)

6 days @ $85.00/day (standard NM in-state rate)	$510.00
6 days @ $115.00/day (standard NM out-of-state rate)	$690.00

Project Leader (1) (Coordination Committee meeting)

3 days @ $115.00/day (standard NM out-of-state rate)	$345.00

TOTAL PER DIEM **$1545.00**

Travel

Vehicle

3 Biology & Coordination Committee meetings (Farmington) @ 400 miles ea.	
1200 miles @ $0.55/mile (standard NM rate)	$660.00
2 Biology & Coordination Committee meetings (Durango) @ 500 miles ea.	
1000 miles @ $0.55/mile (standard NM rate)	$550.00

TOTAL VEHICLE **$1,210.00**

TOTAL REVIEWS & MEETINGS **$9,369.44**

Administrative

Personnel

Secretary/Clerk Duties

Tasks—purchasing, travel arrangements.

Project Biologist (1)	60 hrs
$28.35.00/hr (base salary) + $9.36 (benefits)	$37.71/hr

SECRETARY/CLERK SALARY	**$2,262.60**

Grant and Budgeting

Tasks - administration of agreements, tracking budget expenditures

Project Leader (1)	80 hrs
$39.90/hr (base salary) + $13.17 (benefits)	$53.067/hr

GRANT AND BUDGETING	**$4,245.36**
TOTAL ADMINISTRATIVE	**$6507.96**

FY 2013 TOTAL	**$92,352.60**
Field Work	**$30,888.80**
Specimen Management	**$24,134.40**
Data Synthesis and Report Preparation	**$21,452.00**
Reviews and Meetings	**$ 9,369.44**
Administrative	**$ 6,507.96**

[1]Budget does not include in-kind contributions of about $40,000 per year in salary and benefits for additional personnel who participate in the project including financial specialists and federal aid coordinator.

[2]Budget reflects the reduction in river miles sampled (i.e. river miles 3.2 to 76.4 not sampled in FY 2013) but also includes the additional personnel cost required for implementation of block net seining (4 biologist required).

[3]16 additional hours per biologist to cover overtime associated with field work

SAN JUAN RIVER LARVAL RAZORBACK SUCKER AND COLORADO PIKEMINNOW MONITORING FISCAL YEAR 2013 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 2012- 30 SEPTEMBER 2013

SAN JUAN RIVER LARVAL RAZORBACK SUCKER AND COLORADO PIKEMINNOW MONITORING FISCAL YEAR 2013 PROJECT PROPOSAL

Principal Investigators: W. Howard Brandenburg and Michael A. Farrington
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)
howard_brandenburg@asirllc.com, michael_farrington@asirllc.com

and

Co-Principal Investigator: Eliza Gilbert
New Mexico Department of Game and Fish
Conservation Services Division
One Wildlife Way
Santa Fe, New Mexico 87507
505.476.8104
eliza.gilbert@state.nm.us

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 suckers (either flannelmouth sucker or bluehead sucker). Larval razorback sucker were not present in the 1997 sampling survey. While there were 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 fourteen 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 catostomids in the San Juan River.

Table 1. Collection information of razorback sucker (Xyrtex) collected during the larval razorback sucker survey, 1998 – 2011.

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

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 forty wild larval Colorado pikeminnow to date. Larval Colorado pikeminnow were collected in surveys during 2004, 2007, 2009, 2010, and 2011 at fourteen discrete sites, within the study area. Between 1995 and 2011 the combined sampling methodologies (passive and active) resulted in the collection of forty-four larval Colorado pikeminnow. Back-calculated spawning dates, based on those forty-four individual larvae, range from 10 June 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 689,000 fish have been collected between 1995 and 2011 under the larval Colorado pikeminnow survey. Of those, about 87% (N=598,897) 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 (1993-2011) and back-calculated dates of spawning.

Field Number	*MSB Catalog Number*	*N=*	*Total Length (mm)*	*Date Collected*	*Calculated Spawn Date*	*River Mile*	*Sample Method*
JPS95-205	26187	1	9.2	02 Aug 1995	15 Jul 1995	53.0	drift netting
JPS95-207	26191	1	9.0	03 Aug 1995	17 Jul 1995	53.0	drift netting
WHB96-037	29717	1	8.6	02 Aug 1996	18 Jul 1996	128.0	drift netting
FC01-054	50194	1	8.5	01 Aug 2001	17 Jul 2001	128.0	drift netting
MAF04-046	53090	1	14.2	22 Jul 2004	24 Jun 2004	46.3	larval seine
MAF04-059	53130	1	18.1	26 Jul 2004	25 Jun 2004	17.0	larval seine
MAF07-139	70144	1	14.9	25 Jul 2007	27 Jun 2007	107.7	larval seine
MAF07-157	70145	1	17.5	27 Jul 2007	27 Jun 2007	74.9	larval seine
WHB07-078	64032	1	15.6	25 Jul 2007	27 Jun 2007	33.7	larval seine
MAF09-072	74264	1	25.2	27 Jul 2009	10 Jun 2009	24.7	larval seine
MAF10-140	82014	1	12.6	23 Jul 2010	27 Jun 2010	58.9	larval seine
WHB10-096	82040	3	19.7-21.4	20 Jul 2010	15-18 Jun 2010	41.5	larval seine
WHB10-106	82071	1	16.2	22 Jul 2010	23 Jun 2010	13.0	larval seine
MAF11-114	Not yet available	3	10.6-11.8	20 Jul 2011	23-25 Jun 2011	87.4	larval seine
WHB11-122	Not yet available	21	10.0-12.9	21 Jul 2011	30 Jun-4 Jul 2011	10.8	larval seine
WHB11-124	Not yet available	3	11.8-15.2	21 Jul 2011	4-6 Jul 2011	10.0	larval seine
WHB11-153	Not yet available	1	21.3	10 Aug 2011	10 Jul 2011	92.6	larval seine
MAF11-149	Not yet available	1	17.3	11 Aug 2011	17 Jul 2011	7.0	larval seine
TOTAL		**44**					

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, and 2001 by a total of 46.5% (64.4 river miles) to include the downstream half of Reach 5 (Cudei, New Mexico) through Reach 1 (Clay Hills Crossing, Utah; a total of 138.6 miles of critical habitat sampled). The study area is going to be expanded upstream by 6.4 river miles (Shiprock, New Mexico) in 2012 for 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). Since greater numbers of larval razorback sucker were 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 designated river reaches and facilitated integration of the larval survey data with that of the other 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 would also apply to Colorado pikeminnow however, to date, very few larval Colorado pikeminnow have been collected. 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) that were 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.

Table 3. Summary of annual projects and project modifications of the larval fish surveys from 1997 to 2011.

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 Drift-nets	127.5 – 2.9	20,711	study area expanded; upper-lower reaches 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		

Objectives:
This work is being conducted as required by the San Juan River Basin Recovery Implementation Program (Draft) Monitoring Plan and Protocol. 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 Long Range Plan set forth by the San Juan River Basin Recovery Implementation Program (SJRBRIP).

1) Determine if razorback sucker and Colorado pikeminnow reproduction occurred in the San Juan River and estimate 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) Quantify attributes of habitats important to each life-stage of endangered fish (Task 4.2.2.1).

5) Collect catch rate statistics to estimate relative abundance of endangered fish populations. (Task 4.1.2.5)

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.

8) Document and provide a comparative analysis of the reproductive effort of the entire ichthyofaunal community. (Task 4.1.1.1)

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 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 mid-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. 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 2013 must be scheduled by late January 2013 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. 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 seine samples, the lengths (to 0.1 m) of each seine haul and total number of hauls will be measures and recorded. Catch per unit effort 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% EtOH (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 San Juan River Basin Recovery Implementation Program 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. Multi-parameter water quality units will be used to determine the following water quality parameters at each site sampled: pH, temperature, salinity, conductivity, specific conductance, and dissolved oxygen. Both dissolved oxygen and pH will be recorded to a hundredth of a unit with all other parameters recorded to a tenth of a unit. A minimum of one digital photo will also be taken of each specific habitat sampled.

StowAway Tidbit temperature loggers will be set to record water temperatures hourly and deployed at Four Corners bridge (river mile 119.2), in McElmo Creek (river mile 100.5), and at Clay Hills Crossing (river mile 2.9). The data from each temperature recorder will be downloaded monthly during the study period but remain in the river after completion of the annual study effort to record river water temperatures throughout the year.

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).

Both 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.

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 with 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). Corrections to the data will be made directly to individual tables within the main database.

Analysis:

The results in our 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. Differences in mean CPUE are determined by species between years using a one-way Analysis of Variance (ANOVA). A Poisson distribution provided the best fit to the raw data. A variety of transformations (e.g., logarithmic, reciprocal, square root) were applied on the mean CPUE data for between year comparisons. A natural log transformation yielded the best variance-stabilizing qualities and produced a relatively normal distribution. Pair-wise comparisons between years (2003 – 2010) were made for each species and significance (i.e., $p<0.05$) was determined using the Tukey-Kramer HSD test. Finally, a nonparametric ANOVA (Kruskal–Wallis test) was used on various data sets to compare results to the parametric analyses. While both ANOVA and Kruskal-Wallis were used to analyze data, data transforms enabled use of parametric analysis in all cases. The assumption of homogeneity of variances was assessed using the more conservative variance ratio criterion of <3:1 (Box, 1954), as opposed to <4:1 (Moore, 1995), among years. All species data sets met this more rigorous criterion and in most cases the variance ratio was <2:1 among years. Additionally, the significance values between parametric and nonparametric techniques were nearly identical and so only the parametric analysis will be presented.

Hatching dates of razorback sucker larvae are calculated by subtracting the average length of larvae at hatching (8.0 mm TL) from TL at capture 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). 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 late summer (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 our temperature loggers and additional 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.

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 2013 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 2014. 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 2014. Electronic copies of the 2013 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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Muth, R. T., G. B. Haines, S. M. Meismer, E. J. Wick, T. E. Chart, D. E. Snyder, and J. M. Bundy. 1998. Reproduction and early life history of razorback sucker in the Green River, Utah and Colorado, 1992 - 1996. Final Report of Colorado State University Larval Fish Laboratory to Upper Colorado River Endangered Fish Recovery Program, Denver, CO.

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2013 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 11 days x 8 hrs/day): .....$ 18,630

Fisheries Technician (1 staff x 5 trips x 11 days x 8 hrs/day): .....$ 11,464

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): .....$ 16,935

Fisheries Technician (1 staff x 5 trips x 10 days x 8 hrs/day): .....$ 10,421

Lab Work

Upper and Lower Reach Samples Combined

Fisheries Biologist I (120 staff days/sampling year): .....$ 40,646
Tasks: Laboratory identification, developmental staging, specialized endangered fish processing, data entry, data query and review, database development

Fisheries Technician (120 staff days/sampling year): .....$ 25,012
Tasks**:** Post-trip sample processing, juvenile identification, post-identification – processing, measures, review of counts

Office Work (Report Development)

Fisheries Biologist I (80 staff days year): .....$ 27,097
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 (1 staff day/month): .....$ 6,878
Tasks: Project coordination, project and data review, data management, report review

Personnel (Field, Lab, Office, Oversight): ..... Subtotal $ 157,083

SJRBRIP Meetings

Four meetings/year required; 2 days/meeting

Fisheries Biologist I (8 staff days/year):		$ 2,710
Senior Fisheries Biologist (8 staff days/year):		$ 4,585
Personnel (Meetings):	**Subtotal**	**$ 7,295**
Personnel:	**Total**	**$ 164,378**

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 (2 units x 1,380 miles x $ 0.555/mile):		$ 3,830
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 x 5 trips:		$ 950
Truck and Trailer Shuttle from Sand Island to Clay Hills x 5:		$ 1,750
Travel and Per Diem (Field):	**Subtotal**	**$ 11,030**

SJRBRIP Meetings

Travel (one vehicle at 425 miles r.t. x 4 trips x $ 0.555/mile):		$ 943
Per Diem (3 per diem days/meeting x 4 meetings x 2 staff):		$ 2,280
Travel and Per Diem (Meetings):	**Subtotal**	**$ 3,223**
Travel and Per Diem:	**Total**	**$ 14,253**

2013 Project Totals

Personnel:	**Total**	**$ 164,378**
Materials and Supplies:	**Total**	**$ 4,820**
Project Subtotal Subject to IDC:		**$ 169,198**
IDC (13%):		**$ 21,996**
New Mexico Gross receipts Tax:		**$ 11,844**
Travel and Per Diem	**Total**	**$ 14,253**
2013 Scope of Work:	**GRAND TOTAL**	**$ 217,291**

Out-year funding

FY 2014	**$223,225**
FY 2015	**$229,317**
FY 2016	**$235,596**
FY 2017	**$242,061**
FY 2018	**$248,722**

DETERMINING THE NATAL ORIGIN OF SAN JUAN RIVER RAZORBACK SUCKER THROUGH ELEMENTAL ANALYSIS OF SCALES
FISCAL YEAR 2013 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)

TO BE FUNDED UNDER CONTRACT NO. GS10F0249X

1 OCTOBER 2012- 30 SEPTEMBER 2013

DETERMINING THE NATAL ORIGIN OF SAN JUAN RIVER RAZORBACK SUCKER THROUGH ELEMENTAL ANALYSIS OF SCALES
FISCAL YEAR 2013 PROJECT PROPOSAL

Principal Investigators:
Steven P. Platania, Mary A. Brandenburg, Robert K. Dudley, and Jennifer L. Hester

Affiliations:
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)

Steven P. Platania, steven_platania@asirllc.com; Mary A. Brandenburg, mary_brandenburg@asirllc.com; Robert K. Dudley, robert_dudley@asirllc.com; Jennifer L. Hester, jenlynnhester@gmail.com

Introduction:

Xyrauchen texanus, razorback sucker, were 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 has been provided by hatcheries. Two hatcheries that spawn and supplement wild populations in the San Juan River are the Dexter National Fish Hatchery & Technology Center (Dexter) and Uvalde National Fish Hatchery (Uvalde). To more effectively manage this endangered species, it is necessary to determine wild versus hatchery stock representation in the San Juan River. Wild fish will hereafter refer to fish naturally spawned in the San Juan River, and hatchery fish will refer to fish propagated in a hatchery.

While it is easy to determine natal origin of fish that have passive integrated transponder (PIT) tags, it is not always possible to ascertain if fish captured without PIT tags are actually wild fish due to non-tagging of hatchery fish or tag loss. The percent of non-PIT tagged razorback sucker taken in the San Juan River has fluctuated from 8.2% in 2004 to over 38% in 2006. Of the 1,633 sub-adult and adult razorback sucker collected in the San Juan River in 2011, 254 (15.6%) were not PIT tagged (Table 1). If fish captured without tags are considered wild fish, 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 ability to determine natal origins and thus define whether recruitment to adult stocks (of wild spawned young) is an important step necessary for recovery of razorback sucker.

Task 4.3.1.1 of the SJRBRIP Long-Range Plan is "Document and quantify reproduction, survival, and recruitment" of Colorado pikeminnow and razorback sucker. This task is listed under Goal 4.3: Integrate and synthesize monitoring data and information to evaluate fish community and ecosystem responses to recovery actions. In addition, razorback sucker recovery goals state : For razorback sucker populations to be self-sustaining, adults must reproduce and recruitment of young fish into the adult population must occur at a rate to maintain the population at a minimum of 5,800 adults. When this occurs, the definition of a "self-sustaining" population is met, and the "clock" starts on the downlisting and delisting process." (U.S. Fish and Wildlife Service. 2002). The importance (to recovery of this fish) of documenting recruitment of wild spawned razorback sucker to the adult (reproductive) stage is apparent throughout the SJRBRIP Long Range Plan and Razorback sucker Recovery Plan and can not be overstated. The larval fish monitoring project has documented the presence of wild spawned razorback sucker annually since 1998 and resulted in the collection of over 1,000 larval razorback sucker per year since 2010.

The ability to determine natal origins of adult fish and thus define whether there is recruitment of wild spawned razorback sucker (documented as larval fish) to adult (reproduce stage) stage is a valuable step necessary for recovery of this species.

Otolith microchemical analysis can be used to determine natal origins of fish, but this technique requires euthanizing specimens. Alternatively, scale microchemistry offers a non-lethal method to determine natal origins of fish. Although otoliths may provide more accurate classifications of fish origin (Wells et al. 2003; Clarke et al. 2007), Ramsay et al. (2011) showed that there was similar classification accuracy between using scales and otoliths for *Salmo trutta*, brown trout.

Pangle et al. (2010) reveal the importance of a fine-scale approach to analyze how individual stocks contribute to the population using otolith microchemical analysis. We hope to do the same using non-lethal scale microchemistry analysis. If this analysis is able to accurately determine natal origin of fish, it will provide a more complete understanding of razorback sucker stock (Dexter, Uvalde, wild) survival and natal origin composition in the San Juan River. This information will help guide restoration and supplementation efforts to be maximally effective.

There are two overlapping components to this study. The first is to determine the natal origin of San Juan River razorback sucker (Dexter, Uvalde, or wild) and the second is to determine natal origin of razorback sucker collected in the San Juan River arm of Lake Powell. The latter component expands the potential pool of source (=hatchery fish) material to include Upper Colorado Basin hatcheries.

YEAR	Number w/o PIT tags	Number with PIT Tags	Percent w/o PIT Tags	Total number collected	Number of larval rzb collected
2002					815
2003					472
2004	34	381	8.2	415	41
2005	34	307	10.0	341	19
2006	213	338	38.7	551	202
2007	357	708	33.5	1,065	200
2008	184	382	32.5	566	126
2009	184	440	29.5	624	272
2010	164	873	15.8	1,037	1,251
2011	254	1,379	15.6	1,633	1,065

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

Background - A 2011 Pilot Study using Scales and LA-ICP-MS

As this process (determining natal origin using elemental analysis of scales) had not been tested on San Juan River fish, we conducted an unfunded pilot study of the proposed technique in 2011. The process involved laser ablation (LA) of scales and analysis of the elemental composition using an inductively coupled plasma mass spectrometry machine (ICP-MS). Scales were collected from adult and sub-adult razorback sucker captured in the San Juan River during the July 2011 and September 2011 non-native removal trips. Scales were removed from a total of seven razorback sucker, six of which contained PIT tags when captured. In December 2011, we went to Dexter National Fish Hatchery and Technology Center (Dexter, NM) and Uvalde National Fish Hatchery (Uvalde, TX) and obtained scale samples from hatchery reared razorback sucker and water samples from each facility. Scales were obtained from five Dexter and eight Uvalde razorback sucker. Scales from all razorback sucker were processed (cleaned and mounted) in December 2011 and elemental analysis of scales and water samples performed at Woods Hole Oceanographic Institute (WHOI) in January 2012. Data generated from the WHOI elemental analysis were processed and interpreted during January-February 2012 and presented to the San Juan River Basin Recovery Implementation Program Biology Committee (February 2012) and Coordination Committee (May 2012).

Results of the Pilot Study

Elemental analysis showed distinct differences between the water chemistry at Dexter and Uvalde. The Mg:Ca ratio of the water at Dexter was 2.7 times that of Uvalde's water while the Dexter Sr:Ca ratio was over 3.2 times that of Uvalde. There were little between site differences in either the Mn:Ca or the Ba:Ca ratios. Otolith and scale Sr:Ca ratios are know to be linearly related and a good microchemical analysis marker to use in freshwater systems (Wells et al. 2003). For purposes of this preliminary study, determination of the natal origin of the seven San Juan River fish was based exclusively on analysis of their Sr:Ca ratio.

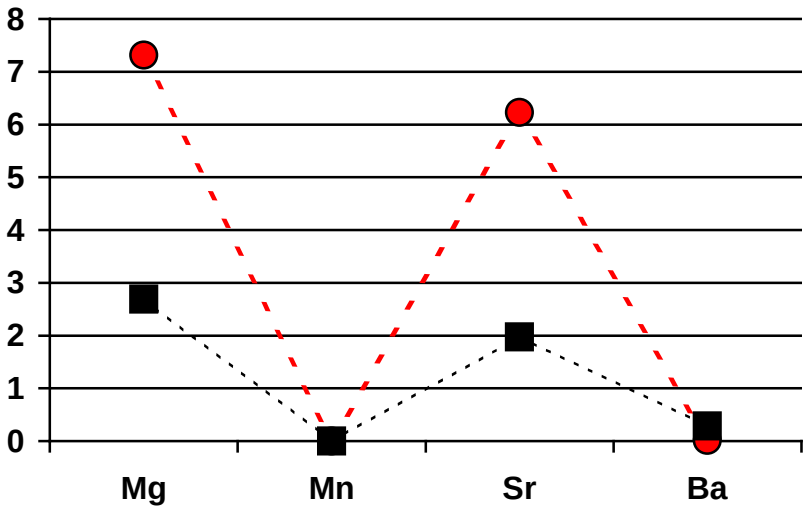

Figure 1. Elemental analysis of the water in which stocked San Juan River razorback sucker are reared at Dexter (circles) and Uvalde (squares).

Transverse elemental scale signatures (Sr:Ca ratio) from each of the seven San Juan River fish were plotted so that natal signature could be differentiated from recent signatures (Figure 2). Each of the seven San Juan River fish were assigned to one of four natal origin categories: Dexter, Uvalde, wild (i.e., had been spawned in the San Juan River), or unknown. The information associated with the six PIT tagged specimens was not revealed until after all specimens had been assigned to a natal origin category.

All six PIT tagged specimens were correctly assigned to their proper natal origin category (all from Dexter) and the one untagged specimen was also determined to have originated at Dexter. In addition to being able to detect the natal signatures of each of the seven specimens, we were able to detect the elemental signatures of the San Juan River and NAPI (Navajo Agricultural Products Industry) Ponds.

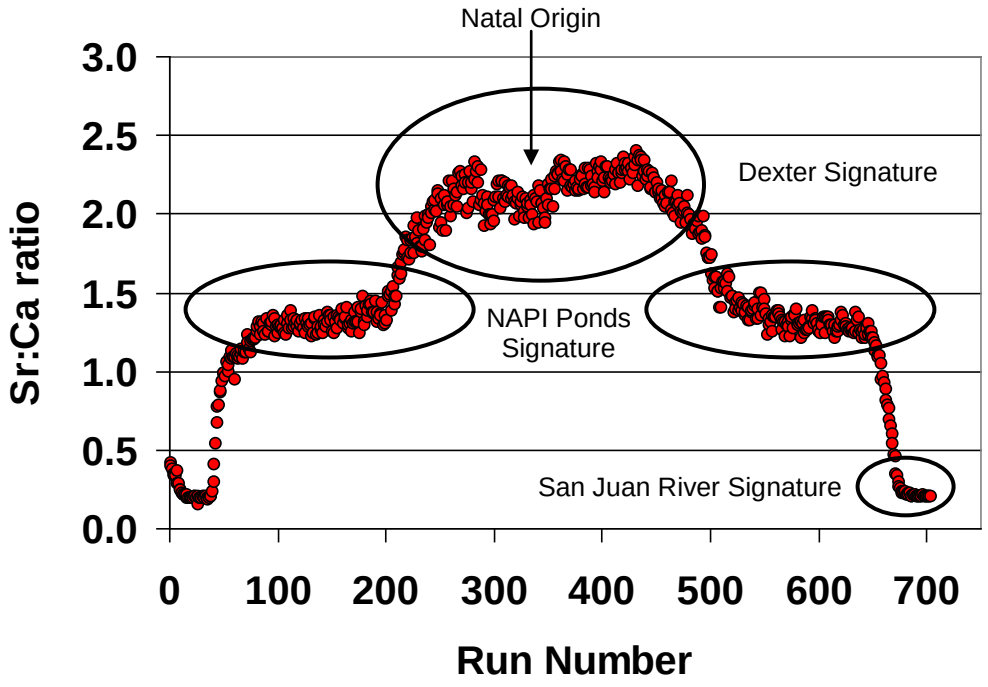

Figure 2. Elemental analysis (Sr:Ca ratio) from a scale of a PIT tagged San Juan River razorback sucker showing the elemental signatures of three water sources. This individual was assigned (correctly), based on the data in the oval labeled "natal origin" to Dexter.

Project Objectives:

1. Using elemental concentration data generated from LA-ICP-MS to determine a method for categorizing fish by natal origin (Dexter, Uvalde, wild).
2. Create a robust dataset of elemental measurements from hatchery specimens, so fish can be accurately classified by natal origin through statistical modeling.
3. Test the dataset for accuracy by using known natal origin fish scales (PIT tagged) from fish captured in the San Juan River or the San Juan River Arm of 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 — Scales will be removed from study specimens using antiseptic techniques. Field crews have been provided a water-proof scale sampling kit containing sampling instructions (Figure 3), a pen-knife, water-proof pens and pencils, isopropyl wipes, and pre-labeled sample envelopes. A knife will be used to remove scales from the right dorsal region above the lateral line of each fish. After scales are removed from an individual fish, the scales 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 knife blade will be cleaned with an isopropyl wipe each time scales have been removed from a specimen.

Instructions for Scale Collection from razorback sucker

Remove scales from the right side of the fish (fish facing forward) from one to three rows above the lateral line on the posterior half of the body (below the dorsal fin). Avoid areas that appeared scarred or deformed. Clean your knife by using an alcohol wipe before and after removing scales and between each fish.

Gently remove mucus from scale area to be sampled using the back of the knife. Wipe the knife clean again and remove a few scales at a time using the knife tip moving it toward the head of the fish (against the scales). Collect from 10 to 20 scales from each fish. Insert knife blade containing scales into the envelope and wipe knife blade clean while inside envelope.

Scales should be spread across the inside of the envelope to prevent clumping which can lead to fungal growth and scale degradation. Filled scale envelopes should be stored in dry conditions (plastic sample box) to ensure that the scales remain viable for analyses. Scale samples or filled envelopes should not be stored in sealed plastic bags because the scales will rot.

Rubbing mucus with your finger from the surrounding skin of the fish to the sampling area will restore mucus protection to the area where scales were removed. Record information requested on the labeled scale packet.

DATE:_____
Pit Tag #:_____
Length TL/SL:_____
Weight:_____
Location (RM):_____
Were scales removed from the recommended area? ☐ Yes ☐ No
If "No", scales from:_____

A small plastic sample box that includes knife, alcohol wipes, scale envelopes, and adhesive address labels is provided. Place the scale envelopes in a large envelope at the end of each trip and mail them back to us so the samples can be processed before they begin degrading.

Figure 3. Instruction sheet for collection of razorback sucker scales by San Juan River field crews.

Hatchery Specimens/Water Samples – Additional scales (ca. 5-10 per specimen; ca. 10 individuals per hatchery or unique water source) will be obtained from fish at Dexter National Fish Hatchery and Uvalde National Fish Hatchery. Scales from razorback sucker reared at Grand Junction Fish Hatcheries, (Horsethief Canyon Native Fish Facility, 24-Road Fish Hatchery, Grand Valley Propagation Facility), and Ouray National Fish Hatchery will also need to be included to address natal origin of razorback sucker collected in the San Juan River arm of Lake Powell. In addition, we will add NAPI water signatures to the analytical pool as all potential sources and their range of variation must be included and understood.

Laboratory processing of scales – Scales can be damaged or lost and subsequently regenerated (Figure 5) making them unsuitable for analysis to determine natal origin. All scales will be viewed under magnification for suitability for analysis. All suitable scales will be cleaned using aseptic techniques, sonified to remove any remaining tissue or contaminants, rinsed in Milli-Q water, and dried under a laminar flow hood. After processing, all useable scales will be mounted to glass slides using double-sided tape.

Laboratory – (Woods Hole Oceanographic Institution) – Water samples will be analyzed using inductively coupled plasma mass spectrometry for elemental concentrations of Barium, Calcium, Magnesium, Manganese, and Strontium to determine if hatchery, San Juan River, and San Juan River arm of Lake Powell water signatures differ enough from each other to de detectable in our scale samples. We will also use this data to determine if scale elemental signatures are linearly related to water elemental signatures.

Scales will be analyzed at WHOI via laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS) for elemental concentrations of Barium, Calcium, Magnesium, Manganese, and Strontium. Scales obtained from both Dexter and Uvalde hatcheries will serve as reference scales and create a reference data set of elemental measurements for known origin fish. Scales from non-tagged razorback suckers will be compared to the data set of known origin fish (Dexter or Uvalde) to determine natal origin. To determine natal origin of individual fish, the laser ablation path will be set to travel through the focus of each scale (Figure 4). Because the focus is the first part to grow in the scale, it is likely that this area of the scale will reveal elemental concentrations at the time of scale formation.

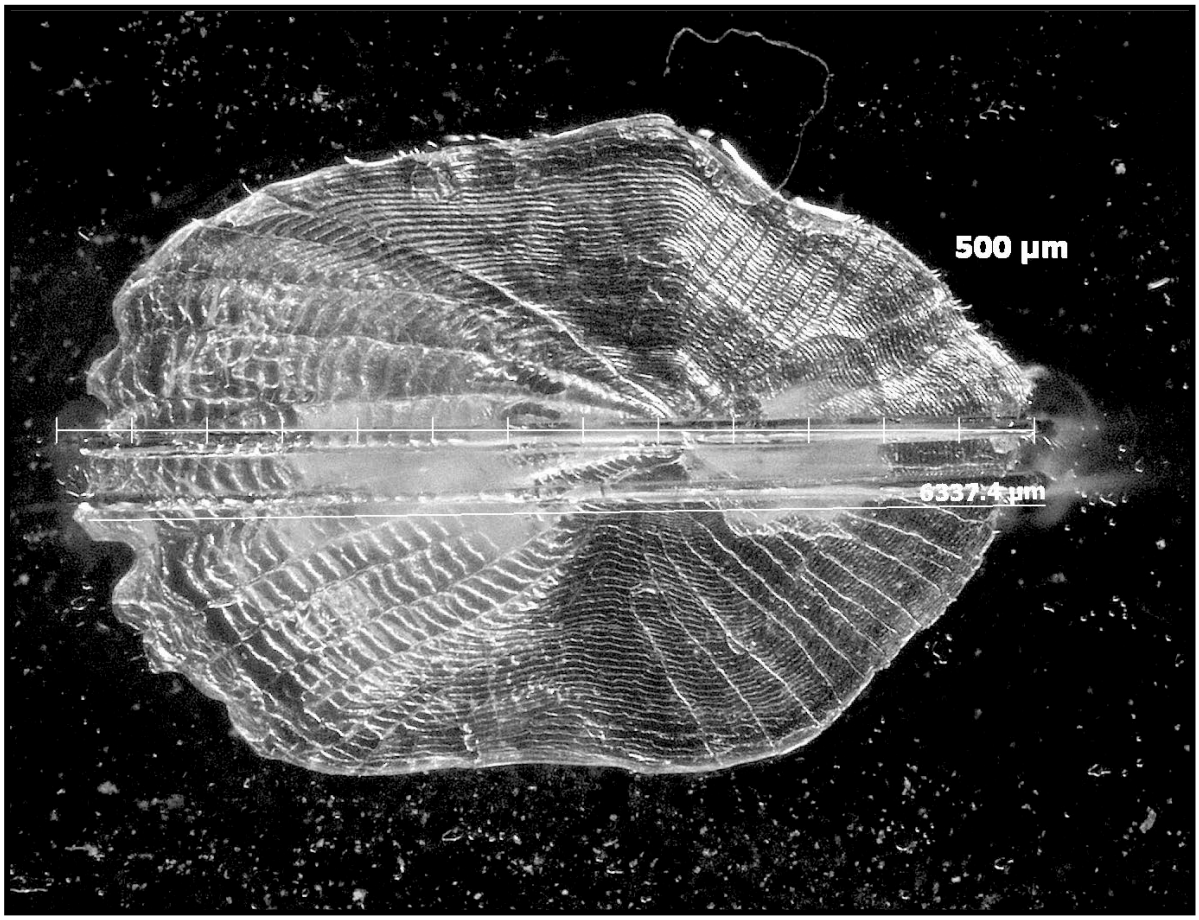

Figure 4. Image of a razorback sucker scale used in pilot LA ICP-MS study. This scale was ablated twice during microchemistry analysis. The upper ablation line follows the ideal path for performing the microchemistry analysis because it passes through the center of the scale. The distance between consecutive vertical bars on the upper ablation line is 500 µm.

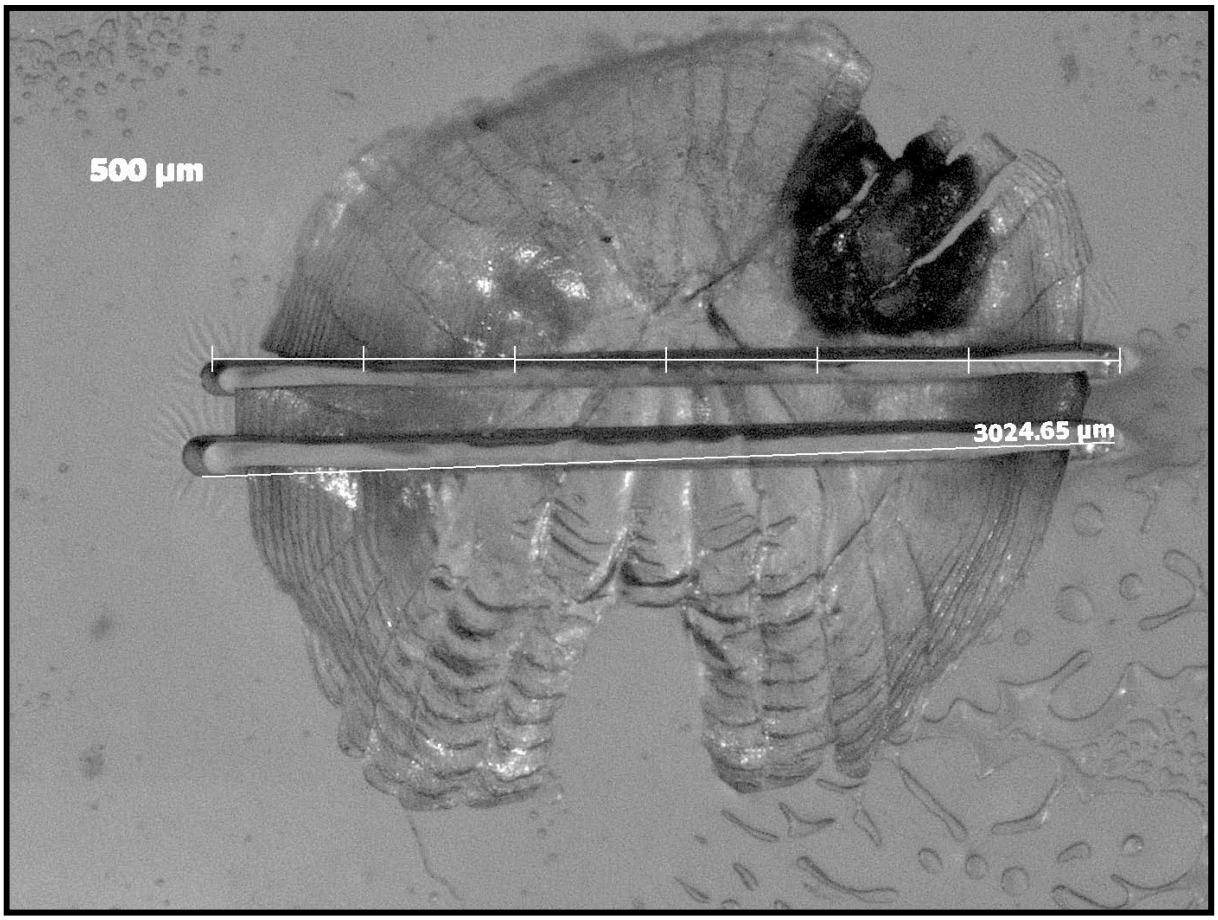

Figure 5. Image of a regenerated razorback sucker scale used in pilot LA ICP-MS study. This scale was ablated twice during microchemistry analysis. The distance between consecutive vertical bars on the upper ablation line is 500 µm.

Laboratory – (General Information on Data Generated by LA-ICP-MS) – Each ablation generates the same series of data with the only difference being the cumulative amount of data produced. The amount of data generated is proportional to the length of the ablation. Elemental analyses of five elements, Barium, Strontium, Manganese, Calcium, and Magnesium are recorded and within each element, data are recorded for the most common 10 isotopes of that element. A single reading is comprised of 50 data points (10 isotopes for each of the five elements). Single readings are generated at approximately one-second intervals with 70 individual readings (of 50 data points) generated across a 400 micron ablation (total of 3,500 data points for one 400 micron ablation on a scale). The first step in synthesis of the datasets is to average isotopic signatures of each element. This generates individual values along the length of the ablation at approximately 5 micron intervals for each element. These data-points are than used to track changes in the elemental composition of the scale across time.

Obviously, the longer the ablation, the larger the total data-set per individual scale. Ablation lengths for the seven unknown fish from the pilot study ranged from 2,700 to 6,300 microns and generated from 35,500 to 65,500 individual data points.

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 scale has been sampled. Elemental analysis of the blanks and standards is the same as performed on the scales (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 (generating 70 separate individual readings each containing 50 data points. 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 scales.

Analysis:

Data Analysis — Because of the complicated nature of the data generated, the experienced scientists and staff at WHOI strongly advised us 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 scale will be examined for analytical suitability. Adequate scales are those with elemental concentration 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; however, LOD will likely follow calculations used by Miller and Miller (1993).

Following data manipulation, to establish natal origin signature from elemental concentrations, a predictive model will be created and tested for classification accuracy. A data set (or library) of known natal origin fish scales will be created to determine if fish scales from unknown origin fish can be correctly classified to their site of propagation and rearing (specific hatchery or wild).

Products:

A draft report will be presented to the San Juan River Basin Biology Committee for review by 31 March 2014. 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 2014. Electronic copies of the data will be transferred to the San Juan River database manager. Fish scales 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.

Goals for Future Application of this Technique:

1) Reduce scale processing time
   a) explore the use of diluted SupraPur Hydrogen Peroxide Solution for cleaning of scales.
2) Increase number of scales processed per day at WHOI.
   a) reduce LA-ICP-MS time per scale by:
      1. determining optimal ablation location.
      2. determining optimal amount of ablation necessary for a useable elemental signature.
3) Reduce data processing analysis time.
   a) develop a program or code to convert the raw data to a form that is suitable for analysis.

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Caveats for the early (experimental/developmental) stages of this project

The first few sample runs for this project will help us refine techniques and determine the level of resolution required to determine the natal origin of razorback sucker. The scale analysis sampling effort described herein was estimated using up to five scales per fish and 50 total specimens (n= 250 scales). Throughout this effort we will track the time required to process the scale in the laboratory (deemed considerable at the moment) and also have a more precise understanding of the number of scales that can be analyzed per day at WHOI. In addition, we will acquire information on length of the ablation necessary to acquire unambiguous information from each scale, the variation present (based on five scales per fish) in individual fish, and axis along the scales that maximize the information acquired. This information will be incorporated into subsequent proposals to employ this technique on razorback sucker.

Terminology

WHOI Woods Hole Oceanographic Institution; Plasma Mass Spectrometry Facility = laboratory in the Marine Chemistry and Geochemistry Department where trace element and isotope ratio measurements of scales will be obtained. Their instruments include argon plasma source magnetic sector mass spectrometers equipped with a variety of sample introduction devices for gaseous, liquid and solid samples. (http://www.whoi.edu/page.do?pid=31615)

ICP-MS Inductively Coupled Plasma (refers to attachment of an instrument that allows samples to be analyzed to be "transported" to the Mass Spectrometer). The three argon plasma mass spectrometers at the WHOI facility are manufactured by Thermo Electron Corporation in Bremen, Germany.

Ablation Often referred to as "burns", ablation is the removal of material from the surface of an object by a controlled, slow burn, or vaporization. Solid materials (fish scales or otoliths) can be directly sampled and introduced into the core of inductively coupled argon plasma (ICP) which generates ions that are then introduced to either the Neptune or Element 2 mass spectrometer. This is achieved by the New Wave Research UP 213 LASER ablation (LA) sampling device.

Processing Scales and otoliths must be "prepared" (cleaned) prior to being ablated and analyzed. As the objective is to determine the elemental signature of the study material, it must be free of contamination. The processing of this material (scales) is done by the researcher (at their home institution) in a clean room or laboratory. Material to be analyzed is examined, cleaned, subjected to sonification, dried in fume hoods with laminar flow, and ultimately mounted on a glass slide and maintained under clean-room conditions.

1) Time required to perform ablation (LA)
   a) Based on 400 micron burns (=length of ablation) with duration of 1 minute
   b) Actual burns for scales of unknown origin will be about 3000 microns with 10 minute duration
   c) This will allow for burn across the entire length (or width) of scale
      1. This is necessary to capture entire history of fish (important for initial samples)
   d) We will experiment with burns through only half the scale (natal region to edge)
      1. This will allow us to determine if this technique can be used for future samples
      2. If the shorter burn works it would allow more samples to be run during future events

2) Instrument (LA-ICP-MS) breaks down
   a) We were told (from initial 2010 inquiry regarding technique) to allow one day in the event of problems with any of the instruments
   b) Each trip to WHOI will take a minimum of four days (two travel days and one LA-ICP-MS day plus one backup LA-ICP-MS day; even if we do not need the instruments the second day, we would not have used that day for travel as we would have worked a 24 hour shift.

2013 BUDGET: DETERMINING THE NATAL ORIGIN OF SAN JUAN RIVER RAZORBACK SUCKER THROUGH ELEMENTAL ANALYSIS OF SCALES

Based on scale samples from 100 fish and elemental analysis performed on five scales per fish (unless otherwise noted *)

Personnel

Field Work

Material Gathered Under Current Sow's

Lake Powell Project-no charge:	$	0
Non-native Removal-no charge:	$	0
PNM Fish Ladder-no charge:	$	0
Adult Monitoring-no charge:	$	0

Scale Preparation (100 Fish and 500 Scales)

Fisheries Technician (50 days x 8 hrs/day): $ 10,300
Tasks: Class 100 clean room processing of scales: selection, examination, sonification, preparation, mounting, and accounting of sample materials

WHOI Analytical Runs of Scales (100 Fish and 500 Scales)

Fisheries Technician (2 staff x 5 days x 8 hrs/day x 2 trips): $ 4,120
(Two individuals needed for 24 hr runs)
Tasks: Perform analytical runs of scales

Fisheries Biologist I (5 days x 8hrs/day x 2 trips): $ 3,348
Tasks: Perform analytical runs of scales

Office Work (Analysis of Data & Report Production)

Fisheries Biologist I (50 days x 8 hrs/day): $ 16,740
Tasks: Post-ablation scale processing (photography, review, lengths), data analysis, draft report preparation, review redraft and submission, development of presentation of study for annual meetings

Project Expert Assistance

Mass Spectrometry Research Associate (5 days x 8 hrs/day): $ 5,150
(Cost per project year *)
Tasks: Expert assistance with analysis, review, and interpretation of the data and consultation

Project Oversight And Review

Senior Fisheries Biologist (12 days x 8 hrs/day): $ 6,798
(Cost per project year *)
Tasks: Project oversight, data review, reporting duties, meeting presentation, updates of progress

Personnel (Lab, Office, and Oversight): ..... Total $ 46,456

Materials and Supplies

Scale Preparation (Class 100 clean room facility)

Slides and mounting media
Washing/cleaning (sonicator, hydrogen peroxide, HCl, etc.)
Non-metallic (ceramic) cleaning and mounting tools

Materials and Supplies (Scale Preparation): ..... Subtotal $ 500

Elemental Analysis at WHOI (Published rate) for two 3 day trips

Element 2 argon plasma mass spectrometer ($ 1,180/day x 6 days):	$ 7,080
193 nm LASER ($ 110/day x 6 days):	$ 660
"Night" argon for long analytical sessions ($ 110/day x 6 days):	$ 660

Materials and Supplies (WHOI): ..... Subtotal $ 8,400

Materials and Supplies: ..... Total $ 8,900

Travel and Per Diem

Elemental Analysis at WHOI

Travel - Airlines; Albuquerque, NM to Providence, RI (Round-trip tickets x 3 staff x 2 trips):	$ 4,800
Travel - Car rental and fuel (5 days/trip x 2 trips):	$ 900
Per Diem (5 days/trip x 3 staff x 2 trips):	$ 1,500
Hotel - Falmouth/Cape Cod (4 days/ trip x 3 staff x 2 trips):	$ 3,600

Travel and Per Diem (WHOI): ..... Total $ 10,800

2013 Project Totals

Personnel:	**Total**	**$ 46,456**
Materials and Supplies:	**Total**	**$ 8,900**
Project Subtotal Subject to IDC:	**Subtotal**	**$ 55,356**
IDC (13%):		**$ 7,196**
New Mexico Gross Receipts Tax:		**$ 3,875**
Travel and Per Diem:	**Total**	**$ 10,800**
2013 Scope of Work:	**GRAND TOTAL**	**$ 77,227**

Out-year funding

FY 2014	**$ 78,901**
FY 2015	**$ 80,621**
FY 2016	**$ 82,395**
FY 2017	**$ 84,224**
FY 2018	**$ 86,107**

SAN JUAN RIVER CATOSTOMID OPERCULAR DEFORMITY STUDY
FISCAL YEAR 2013 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)

TO BE FUNDED UNDER CONTRACT NO. GS10F0249X

1 OCTOBER 2012- 30 SEPTEMBER 2013

SAN JUAN RIVER CATOSTOMID OPERCULAR DEFORMITY STUDY
FISCAL YEAR 2013 PROJECT PROPOSAL

Principal Investigators:
Steven P. Platania, W. Howard Brandenburg, Michael A. Farrington, and Robert K. Dudley

Affiliations:
American Southwest Ichthyological Researchers, L.L.C.
800 Encino Place, NE,
Albuquerque, NM 87102-2606
505.247.9337 (Telephone)
505.247.2522 (Facsimile)

Steven P. Platania:	steven_platania@asirllc.com
W. Howard Brandenburg:	howard_brandenburg@asirllc.com
Michael A. Farrington	michael_farrington@asirllc.com
Robert K. Dudley	robert_dudley@asirllc.com

Introduction:

The three native catostomid (sucker) species that inhabit the San Juan River upstream of Lake Powell are *Xyrauchen texanus*, razorback sucker, *Catostomus latipinnis*, flannelmouth sucker, and *Catostomus discobolus*, bluehead sucker. Razorback sucker is the only sucker species in the drainage listed as endangered; however, the other two species are of particular concern due to decreasing populations. Flannelmouth sucker and bluehead sucker are considered sensitive species throughout their range by the Bureau of Land Management (Rees 2005) and conservation actions for these two species are conducted under the three species agreement (roundtail chub, flannelmouth sucker, and bluehead sucker; Colorado River Fish and Wildlife Council, 2004). This Range-Wide Conservation Agreement acknowledges that "Conservation action in tributary streams, where the three species are also found, have received less emphasis to date".

Decline in native catostomid populations is attributed to flow modifications and the resultant changes to the thermal regime, habitat fragmentation by instream barriers, channel simplification, interactions with non-native species, increased sediment input, reduction and alteration of habitat, and various organic/inorganic pollutants (Platania 1990, Ryden and Pfeifer 1994, Tyus and Saunders 2000, Rees 2005, Ptacek 2005). Flannelmouth sucker is known to hybridize with several other sucker species including razorback sucker, bluehead sucker, and the non-native white sucker (Tyus and Karp 1990, Douglas and Marsh 1998, Bezzerides and Bestgen 2002). Likewise, bluehead sucker can hybridize with the non-native white sucker (Bezzerides and Bestgen 2002).

Because there is significant overlap in habitat use and spawning periods for all three native suckers, recovery efforts for razorback sucker will likely also benefit the other sucker species. Early life history of fishes has a critical role in explaining the overall abundance of fish species; therefore, information gained from studying early life history is important for assisting efforts to decrease mortality rates and increase recruitment to spawning age.

Since 1998, the offerors of this proposal have conducted the San Juan River larval fish monitoring project under the San Juan River Basin Recovery Implementation Program (SJRBRIP). During laboratory processing of larval suckers retained during 2011 sampling, a large number of opercular deformities were observed in both larval and early juvenile (=age-0) razorback sucker, flannelmouth sucker, and bluehead sucker. Cursory examination of a subset of 2011 specimens of these three species revealed the occurrence of opercular deformities at rates between 16-47% (Table 1).

Opercular deformities (i.e. opercular shortening) expose gills and may increase environmental stress, gill disease, and mortality (Paperna et. al 1980, Lindesjoo 1994). Because of the possible lethal nature of this condition, it is important to determine the spatial and temporal nature of this deformity. Likewise, it is important to determine frequency (by ontogenetic stage) of occurrence in all suckers.

One of the goals of this proposed project is to document frequency of opercular deformity in early life history stages. To accurately accomplish this, it is necessary to determine the lower limit of detection for this deformity in regards to fish stage and length. Only specimens that have fully formed opercula will be re-examined and rated for deformity. To determine the size at which the opercular flap of San Juan River catostomids is fully developed (i.e., the size at which we could accurately assess the presence or absence of a deformity), we examined specimens from the April and May 2012 larval fish sampling effort (n=8,500). The results of that examination indicated that opercular deformities could not be consistently and accurately determined in specimens that had not yet achieved post-flexion mesolarval stage. Conversely, we were able to accurately assess the presence and level of opercular deformities in larval suckers that had grown to or larger than the post-flexion mesolarval stage. We determined the shortest lengths to be examined are: 18 mm total length (TL) for flannelmouth sucker, 16 mm TL for bluehead sucker, and 15 mm TL for razorback sucker. Appropriate sucker specimens collected during larval fish monitoring from 1998 -2012 will be examined and rated (bilaterally) for severity of opercular shortening. Fish without opercular shortening will be rated 0, slight shortening of the operculum will be scored with a value of 1, and severe shortening as 2 (Figure 1).

	razorback sucker	**flannelmouth sucker**	**bluehead sucker**
Total # Collected 2011	**1,065**	**5,849**	**4,503**
# Examined for deformities	163	1,776	237
# with deformities	76	280	73
Percent of sub-sample	**47%**	**16%**	**31%**

Table 1. Frequency of opercular deformities in a subset of the catostomids collected under 2011 San Juan River larval fish monitoring project.

Project Objectives:

The work proposed will be conducted under the SJRBRIP. The objectives of this specific project are identified and listed below.

1) Examine both sides of catostomid specimens from 1998 to 2012 collections obtained through the San Juan River larval fish monitoring project for opercular shortening.

2) Record species and severity of opercular shortening (bilaterally) on a scale of 0, 1, or 2.

3) Record ontogenetic stage of each specimen as either larval or juvenile.

4) Analyze species-specific spatiotemporal relationship of opercular shortening using severity, ontogenetic (larval or juvenile) stage and side affected.

Phase I: Laboratory rating of opercular deformity and staging of specimens.
Task #

1 Production of a list of all catostomid specimens to be analyzed.
2 Recording species, ontogenetic stage (larval or juvenile), side(s) with opercular shortening, and 0, 1, or 2 severity of opercular shortening rating for each side.

Phase II: Synthesis and Project Reporting.
Task #

3 Data entry and database management.
4 Analysis of opercular shortening frequency data.
5 Preparation and submission of DRAFT report to SJRBRIP.
6 Submission of electronic copies of the report after all changes to the draft have been incorporated into a fully revised and final document submitted to SJRBRIP.

Study Area:

This project does not require additional field sampling as 2012 specimens will be obtained through the SJR larval fish monitoring project and material from 1998-2011 will be obtained from the Division of Fishes at the Museum of Southwestern Biology. The study area designated for the larval fish surveys in the San Juan River encompasses 145 river miles (RM) of the San Juan River between Shiprock, NM (RM 147.9) and Clay Hills Crossing, UT (RM 2.9) and comprises five geomorphic river reaches in three states, NM, CO, and UT (Figure 2).

Methods:

Field — No fieldwork is necessary for this study. All samples have been or will be obtained through the SJR larval fish monitoring project. Specimens are collected using larval fish seines at various locations in the San Juan River accessed through multi-day rafting trips from Shiprock, NM to Clay Hills Crossing, UT.

Laboratory – Museum curated samples (1998-2011) will be obtained from the Museum of Southwestern Biology. A list of all catostomid specimens from the San Juan River (1998-2011) that fulfill the length requirements for inclusion in this study was generated (Tables 2 and 3). About 152,000 larval and early juvenile sucker have been collected during the study period (1998-2011). Of those specimens, about 120,000 (81%) are of sufficient length to be examined for opercular deformities. Additional filtering of the material will be investigated with the caveat that it can not affect the statistical validity of the study (i.e., samples containing $\leq$ specimens will not be examined, no more than 100 individuals from any single sample will be examined). Even with these additional filters applied to the 15 year dataset, the number of lots to be handled (=jar containing specimens of one species from one single collection) will be in excess of 2,000 and number of specimens will still exceed 100,000.

All specimens will be examined individually for opercular shortening following descriptions by Abdel et al (2004). In addition, both sides (both opercula) of each fish will be examined as suggested by Abdel et al (2004). Severity of opercular deformities will be assessed and rated as 0 (none), 1 (slight shortening), or 2 (severe shortening).

While many opercular deformity studies rate opercular shortening/abnormality as normal = 1 and abnormal = 2 (Koumoundouros et al. 1997, Gapasin et al. 1998, Gapasin et al. 2000, Sun et al. 2009), severity of shortening may prove to be an important factor. Likewise, specimens analyzed under a 0, 1, or 2 scale can be grouped into the two categories (normal/abnormal) if analysis proves useful. In addition, all specimens will be categorized by ontogenetic stage as either larval or juvenile. Laboratory work will be performed using a bottom-lighted dissecting scope. All laboratory work will require employees experienced in larval fish identification and larval morphometric/meristic analysis.

Figure 1. Visual representation of opercular deformity scale to be used (top to bottom): 0 (no opercular shortening), 1 (slight opercular shortening), 2 (severe opercular shortening).

YEAR	razorback sucker	flannelmouth sucker	bluehead sucker
1998	2	9,810	147
1999	7	7,432	197
2000	129	5,400	2,145
2001	50	7,641	338
2002	815	7,595	3,758
2003	472	5,120	1,339
2004	41	3,145	6,387
2005	19	3,021	7,387
2006	202	5,369	4,059
2007	200	16,330	7,635
2008	126	20,259	1,390
2009	272	3,722	1,012
2010	1,251	4,106	2,098
2011	1,065	5,849	4,503
TOTAL	**4,649**	**104,799**	**42,395**

Table 2. Number of specimens available by year from the San Juan River larval fish monitoring project (1998-2011) collections.

	razorback sucker	flannelmouth sucker	bluehead sucker
1998-2011	4,649	104,799	42,395
1998-2011 filtered to remove small fish	**2,315**	**83,115**	**37,243**
# lots in filtered subset	**146**	**1,478**	**883**

Table 3. Total number, with length filter applied, of specimens and museum lots to be examined . Specimens obtained from the San Juan River larval fish monitoring project (1998-2011).

Data Analysis — Data will be analyzed to elucidate any spatiotemporal patterns in frequency of occurrence in regards to opercular deformity. Frequency histograms will be constructed for opercular deformity occurrence by species, longitudinal river mile and a discrete temporal scale. Descriptive statistics such as means and ranges will be included. Parametric and/or non-parametric statistics may also be employed to determine any significant findings. Data analysis will not attempt to provide causation for opercular deformity in the San Juan River.

Products:

Attempts will be made to provide a draft report to the San Juan River Basin Biology Committee for review by 31 March 2013. Typically, this report would not be ready until 31 March 2014 but given the need for rapid processing of these data and availability of the material, we will strive to have a preliminary report available by 31 March 2013 (assuming availability of funds by late autumn 2012). 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 2013. Electronic copies of the 1998-2012 collection data will be transferred to the San Juan River database manager. Fish used in 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.

Products and Reporting – The rapid need for this information requires that the work be completed and reported in a timely manner (one year). Because of the large number of specimens covering the 15-year sampling period that will be examined for opercular deformities and assigned an ontogenetic stage (larval or juvenile), laboratory processing will require extensive effort. After all specimens are processed and entered in the database, statistical analysis will be performed on the dataset including variables such as species, longitudinal river mile and a discrete temporal scale. A draft report will be submitted to the SJRBRIP, which will include analysis and any significant findings. After draft revisions, a final report will be submitted to 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 to present PowerPoint presentations outlining results and that years findings. Each meeting lasts about three days (which includes travel time). No additional costs will be incurred for the presentation of this material as it will be incorporated into the San Juan River larval fish monitoring presentation.

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Bezzerides, N. and K.R. Bestgen. 2002. Status review of roundtail chub *Gila robusta*, flannelmouth sucker *Catostomus latipinnis*, and bluehead sucker *Catostomus discobolus* in the Colorado River basin. 2002. Colorado State University Larval Fish Laboratory, Fort Collins, CO.

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2013 BUDGET: SAN JUAN RIVER CATOSTOMID OPERCULAR DEFORMITY STUDY (1998-2012)

Personnel

Field Work

Material Gathered Under Current Sow's 1998-2011:	$	0
2012 (material processed and evaluated under current contract):	$	0

Specimen Evaluation (100,000 fish, 2,000 lots)

Fisheries Biologist I (5 months processing 15-20 lots/day = 100 days):	$	33,480

Tasks: Examine specimens, stage specimens, score opercular deformity

Office Work

Fisheries Technician (20 days):	$	4,120

Tasks: Data entry for all specimens (in spreadsheet)

Fisheries Biologist I (20 days):	$	6,696

Tasks: Data processing and analysis, draft report preparation, review redraft and submission, development of presentation of study for annual meetings

Project Oversight And Review

Senior Fisheries Biologist (12 days):	$	6,798

Tasks: Project oversight, data review, reporting duties, meeting presentation, progress updates, agency coordination

Personnel (Lab, Office, and Oversight):: Total	**$**	**51,094**

Materials and Supplies

Specimen Processing and Examination

Multi-zoom stereomicroscope (costs already contracted):	$	0
Miscellaneous laboratory supplies (costs already contracted):	$	0
Materials and Supplies: Total	**$**	**0**

Travel and Per Diem

SJRBRIP Meetings (2 meeting/year x 3 days/meeting)

Travel - (costs covered under larval fish project)	$	0
Per Diem - (costs covered under larval fish project)	$	0
Travel and Per Diem: Total	**$**	**0**

2013 Project Totals

Personnel:	**Total**	**$**	**51,094**
Materials and Supplies:	**Total**	**$**	**0**
Project Subtotal Subjected to IDC:	**Subtotal**	**$**	**51,094**
IDC (13%):		**$**	**6,642**
New Mexico Gross Receipts Tax:		**$**	**3,577**
Travel and Per Diem:	**Total**	**$**	**0**
2013 Scope of Work:	**GRAND TOTAL**	**$**	**61,313**

Out-year funding
FY 2014 ..... one time project/no future funds requested

San Juan River Specimen Curation by the Museum of Southwestern Biology
Fiscal Year 2013 Scope of Work

Principle Investigators: Alexandra M. Snyder and Thomas F. Turner
University of New Mexico MSC03-2020
Albuquerque, NM 87131
Contact (505) 277-6005 amsnyder@unm.edu

Award R11AP40025
1 October 2012 to 30 September 2013

Background

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, 35,259 lots or 1,382,572 fish specimens collected by the San Juan River research group have been processed, cataloged, and archived at the Museum of Southwestern Biology, Division of Fishes. San Juan River collection sites numbering 18,240 have been georeferenced and can be mapped in ArcView. Approximately 15,847 pages of field notes (locality data) and data sheets have been entered into the MSB database. 24,177 pages of original San Juan River field notes and data sheets have been digitally captured, cleaned, and saved in 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. (Collections are later sorted and identified by the principal SJRIP

investigators.) Specimen collections are assigned an accession number (tracking number) by MSB staff 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), verification of species identifications, 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, digitizing field notes, and filing jars of cataloged San Juan River specimens into the permanent 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 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.

Study Area

The object of this project is to process specimens of fishes collected for the San Juan River Recovery Implementation Program, 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 MSB Division of Fishes has two offices with a total of five computer workstations for data entry, a fully equipped laboratory for preparation of fish collections, and approximately 1,858 linear meters of compacted shelving for storage of cataloged collections. On average, four UNM students (three undergraduate and one graduate) are employed to process and curate the SJRIP collections.

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.

Methods

The primary task to be completed under this project is the processing and curation of fish specimens generated by research projects executed under the auspices of the San Juan River Basin Recovery Implementation Program. Specimen collections are deposited with the MSB Division of Fishes by SJRIP principal investigators. Unlike past years, collections of SJRIP fishes are now received and

processed within the year of collection.

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.

Products

SJRIP fishes and 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 2012 San Juan River specimen curation and larval fish identification sampling activities will be prepared and distributed by 31 March 2013 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 2013.

The MSB Division of Fishes has fully incorporated backlogged San Juan River collections from 1987-2000 received from Utah Division of Wildlife Resources, New Mexico Dept. Game and Fish, and US Bureau of Reclamation, Durango CO. In 2007 the NM Department of Game and Fish transferred all of their San Juan River collections to the MSB. Some of these collections, taken from 1990 to 1999 as part of the Secondary Channel Survey, are still being incorporated into the MSB archives.

Budget Fiscal Year 2013 **1 July 2012 to 30 June 2013**

Personnel:		
Curatorial Assistant Staff Temporary-1		$8,040.00
UNM Staff fringe benefit 20%		$3,960.00
Undergraduate student Curatorial Assistants-3		$9,000.00
UNM Undergraduate student fringe benefit 1%		$90.00
Section Subtotal		$21,090.00
Equipment and Supplies:		
95% ethanol, 37% formaldehyde, sodium phosphate		$3,500.00
Specimen jars, Buna-N gaskets, and polypropylene caps		$1,585.00
DataMax® Printer media and ribbon-specimen labels		$792.50
Gaylord document archive boxes for field notes		$792.50
Section Subtotal		$6,670.00
Total (Direct Costs)		**$27,760.00**
Administrative Overhead (17.5)		$4,858.00
Grand Total		**$32,618.00**

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SJRIP Videography
2013 Project Proposal

Bill Goettlicher
Physical Scientist
U.S. Bureau of Reclamation
Technical Service Center
Bldg 67 5th Floor MC 86-68211
P.O. Box 25007
Denver, CO 80225
(303)445-2275
bgoettlicher@usbr.gov

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.

METHODS

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.

TASKS – 2013

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.

FY 2012 BUDGET

Funding source	**Expenditure in FY2013**
FY2013 Annual funding	$22,000
Total	**$22,000**

Projected funding:
FY-2014 $22,000.00
FY-2015 $24,000.00

SJRIP PIT TAGS
2013 Project Proposal

Mark McKinstry UC-735
Bureau of Reclamation
125 South State Street, Room 6107
Salt Lake City, UT 84138-1147
Phone 801-524-3835
FAX 801-524-5499
mmckinstry@uc.usbr.gov

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 – 2013

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

In FY2013, $50,000 is allocated in the workplan to purchase 15,000 PIT tags. The purchase of PIT tags and readers is done under a fully competed contract that was awarded in June of 2011.

FY 2012 BUDGET

Funding source		**Projected expenditure in FY12**
FY2013 Annual funding		$50,000
Total		**$50,000**

Projected funding:
FY-2014 $55,000.00
FY-2015 $60,000.00

Integration and Synthesis of San Juan River Basin Recovery Implementation Program Long-term Monitoring Data

Fiscal Year 2013 Draft Project Proposal

Principal Investigators

San Juan River Recovery Implementation Program Office
U.S. Fish and Wildlife Service
2105 Osuna NE Albuquerque, NM 87113
david_campbell@fws.gov 505-761-4745
sharon _whitmore@fws.gov 505-761-4753
scott_durst@fws.gov 505-761-4739

Drs. Nathan Franssen, Thomas Turner, David Propst
University of New Mexico
Dept. of Biology
302 Yale Blvd NE, CERIA 83, Room 204
Albuquerque, NM 87131
nrfranssen@gmail.com 785-564-2553
turnert@unm.edu 505-277-7541
tiaroga@comcast.net 505-243-0853

Dr. Mark McKinstry
Bureau of Reclamation
125 South State Street-UC-735
Salt Lake City, UT 84138-1147
mmckinstry@usbr.gov 801-524-3835

Dr. Keith Gido
Kansas State University
Division of Biology
Ackert Hall
Manhattan, KS 66506
kgido@ksu.edu 785-532-5088

Dr. Bill Miller
Miller Ecological Consultants, Inc.
2111 S. College Avenue, Unit D
Ft. Collins, CO 80525-5404
wjmiller@millereco.com 970-224-4505

Background

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.

We propose that a postdoctoral research associate be hired for a two-year period to synthesize, analyze, and integrate relevant elements of this immense database in conjunction with the Program Office biologist. To successfully accomplish this effort, it is critical that this individual has strong quantitative, writing, and research skills, and be devoted to this project without other time commitments or demands. Products of the researcher's efforts will be presented to both the Program's Biology and Coordination committees, as well as interested publics, and ultimately will be submitted to scientific journals for peer review and publication. The research associate will collaborate 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.

Data Integration Tasks

Initially, a team of key Program personnel and researchers will meet to identify possible topics of investigation, the list of studies that will be undertaken will be reduced to several that all concur are especially important to achieving the overarching goal of this project.

The following is a list, in no particular order, of possible investigations the research associate might undertake. It is likely that discussions with key Program personnel, the Biology Committee, and researchers will identify additional studies.

- Integrate larval, small-bodied, and large-bodied monitoring data to characterize demographic responses to environmental drivers
- Using recapture data, estimate razorback sucker and Colorado pikeminnow population sizes
- Relate Colorado pikeminnow spatial distributions to habitat complexity
- Characterize stocking/recruitment relationships of Colorado pikeminnow and razorback sucker to enable evaluation of ongoing population augmentation activities
- Assess the role of invasive vegetation in changing channel complexity and distribution patterns of fish
- Synthesize food web data
- Characterize age-growth relationships (spatial and temporal variations)

- Calculate condition indices (spatial and temporal variations)
- Integrate spatial geomorphology and fish assemblage structure and dynamics
- Assess temporal dynamics of large-bodied fish populations
- Integrate adult monitoring with nonnative removal (exploitation models to identify critical thresholds)
- Assess spatial distribution patterns of rare fish (i.e., Colorado pikeminnow) and their potential prey.

Key personnel

Dr. Nathan Franssen is currently a postdoctoral research associate at the University of Southern Mississippi and will be dedicated to this project full time. In addition to collaborating with key Program personnel, the Biology Committee, and researchers, he will work with Drs. Mark McKinstry, Keith Gido, Kansas State University, and Thomas Turner and David Propst, University of New Mexico, in considering various analytical approaches and interpretation of results. Curriculae vitae of above individuals are available upon request.

Deliverables

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 5 manuscripts will be prepared.

Schedule

This project is proposed for 2 years, beginning 1 October 2012, with the option for a 3rd year.

Budget

Budget Item	FY 2013
12-mo Post-Doc salary	$40,000
Fringe Benefits	$10,200
Mentor Salary (summer)	$8,955
Fringe Benefits	$1,692
Travel and Misc	$9,500
Modified Total Direct Costs	$70,347
F&A (CPCESU) 17.5%	$12,311
Total Costs	**$82,658**

Update and Maintenance of San Juan River Basin Recovery Implementation Program Database
Fiscal Year 2013 Draft Project Proposal

Agreement number: R10PG40086 (07-AA-40-2629)
Period of Performance: 10/1/2012 – 9/30/2013

Principal Investigators: Scott Durst
U.S. Fish and Wildlife Service, SJRRIP Program Office
2105 Osuna NE Albuquerque, New Mexico 87113
(505) 761-4739
scott_durst@fws.gov

Background

San Juan River research efforts that preceded the establishment of the San Juan River Basin Recovery Implementation Program (SJRRIP), 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 research activities that have been conducted over the last 15 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 recommendation 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 SJRRIP database. Keller-Bliesner Engineering, LLC, was originally responsibility for maintaining the database and produced and distributed CDs containing the updated SJRRIP database to the researchers until 1998. In 2002, responsibility for maintaining the database was transferred to UNM They initiated a project to develop and maintain a web-based system. This project was been terminated in 2006. In 2007, the responsibility for maintaining the SJRRIP data was transferred to USFWS-NMESFO.

A great deal of effort was required to inspect, transfer, and integrate UNM's GIS Database into existing and new SJRRIP data housed in the NMESFO SJRRIP database. Between 2007 and 2008, USFWS-NMESFO IT staff transferred and incorporated a myriad of researchers' data into the SJRRIP's database; maintained, performed quality control, annually updated, and distributed GIS researcher database using appropriate format as necessary; 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, the SJRRIP created a full-time biologist position. One of the tasks of the position is to take over the responsibility of maintaining the SJRRIP database. During 2009, the Program biologist developed a data management system and performed Program data management activities. Continuation of funds to cover the cost of maintenance, updates, and distribution of the database are requested.

Relevant Long Range Plan Tasks

Task 1.2.1.1 Continue to develop a Standardized Database for all stocked and recaptured Colorado pikeminnow and razorback sucker in order to determine the fate of stocked fish.

Task 4.3.2.1 Continue to develop a centralized database that incorporates all data from standardized monitoring and integrate into the Program Database.

Task 5.2.1.1 Establish and maintain a Program Database of information collected under various Program projects.

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 San Juan River Recovery Implementation Program's Database.
2. Maintain, perform Quality Control, annually update, and distribute current San Juan River Recovery Implementation 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 Office, Albuquerque, New Mexico).
4. Maintain and update SJRRIP website with reports, data, and other relevant documents.

Methods

1. Update and Maintain Database in consultation and coordination with Program researchers, the Program Biologist will integrate existing and new data into the existing San Juan River Recovery Implementation Program's Database. Data will be checked for Quality Controlled and updated as necessary.
2. Contact and coordinate with appropriate personnel in the Upper Colorado River Basin 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.

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) of the U.S. Fish and Wildlife Service, the designated repository for the data.

San Juan River Recovery Program **Database Management Budget 2013**		
Personnel (salary and benefits)	USFWS Funding	Program Base Funding
Program Biologist (35% time)		$22,034
Database technician (.5% time)	3,995	
Program Asst. (.5% time)	2,630	
Personnel Subtotal	**6,625**	**$22,034**
Travel		
Travel Subtotal	**$**	
Equipment and Supplies		
General Office Supplies	500	500
ESRI (GIS software) license fees	500	0
GIS Extensions (Spatial Analyst, XTools, etc.)	250	0
FTP software license	100	0
Printer toner cartridges	500	500
Backup media		250
Printer paper		500
Computer Hardware upgrades	500	500
Support Subtotal	**1,850**	**$2,250**
Consultant/ Professional Fees		
		0
Consultant/ Professional Sub-Total		**0**
	USFWS Funding	**Base Funding**
Budget Subtotal		**24,284**
FY 2011 Carry over funds		**0**
Total		**2,671**
Administrative charge (11%)		
Grand Total	**$8,475**	**26,955**

Habitat and Water Temperature Monitoring 2013

Executive Summary

In 1998, flow recommendations were developed by the SJRIP for the San Juan River below the confluence with the Animas River (River Mile 180). The details of the flow recommendations 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. All river wide habitat mapping was conducted by ERI staff from 1992 to 2007.

During the data integration process of 2004–2005, it became evident that backwater habitat types during base flow periods (800-1200 cfs) have been reduced in number and surface area since September 1995. Backwater surface areas between River miles 180 to 2 have decreased from 140,000 m2 in September 1995 to less than 20,000 m2, river wide by October 2003. From 2005 to 2007, backwater surface areas have stabilized at approximately 40,000 m2.

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 these reaches with high complexity.

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.

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 8 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.

This work plan proposed by Ecosystems Research Institute (ERI) and Miller Ecological Consultants (MEC) is based in part on the current San Juan Recovery Program monitoring protocols. The team has amassed a significant amount of experience on the physical, chemical and biological conditions in the San Juan River. The data collections in each of these areas over the last 15 plus years makes the ERI and MEC team unique.

Within the major goals of the SJRIP monitoring program, the results of this proposed project will in part meet goal number (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”. Specifically, the major tasks to be undertaken are:

Task 1) Annual Habitat Mapping using geo-referenced video imagery

Task 2) Field Habitat of secondary channels

Task 3) RERI habitat restoration monitoring

Task 4) Retrospective Analysis of Geomorphology and Floodplain Vegetation Establishment

Task 5) Water Temperature Monitoring

The proposal time frame is for one year.

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 18 times.

Habitat Monitoring Status

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.

Several hypotheses have been proposed as possible causes, including channel simplification, secondary channel abandonment, or lack of high runoff flows. Additionally, the channel morphology-monitoring program (specifically the across-stream transects) indicated a slightly narrower, deeper channel, which can lead to channel simplification as a potential mechanism. However, review of a limited data set from the 1960s appears to support the lack of high flows as a probable cause.

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.

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 RFP 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 RFP 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.

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 …

PLAN OR STUDY DESIGN

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

Task 1) Annual Habitat Mapping using geo-referenced video imagery

Task 2) Field Habitat verifications of secondary channels

Task 3) RERI habitat restoration monitoring

Task 4) Retrospective Analysis of Geomorphology and Floodplain Vegetation Establishment

Task 5) Water Temperature Monitoring

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

Task 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 August or 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 2013, 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 August or early September 2013 (flow permitting). Image capture, and photo-interpretation will be completed by February 2014 The draft annual report will be completed by March 31, 2014 with the final report due June 1, 2014.

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

Task 2. Field Habitat Mapping RERI Sites - General Methods

1) Using seven general habitat categories and 27 sub-types of habitat (Table 1), map aquatic habitat at a scale of 1" = 300' or 400', depending upon the best available imagery provided to the contractor and,
2) Determine the amount of flow entering and leaving the reclaimed channels and controls.
3) Using pre-established bench marks, survey across stream transects after spring runoff at the entrance of each secondary channel as well as the control channels

4) Examine the relationships between hydrology (especially recent antecedent hydrology conditions) and habitat conditions throughout the six recently modified RERI secondary channels, especially low velocity habitats and habitat complexity.
5) Utilize several natural and flowing secondary channels within the immediate area as control reaches

Specific Methods for RERI Secondary Channel Monitoring

In 2013, post construction base photography maps will be used at a scale of approximately 1 inch = 200 feet for the RERI secondary channel mapping. The photos will be printed on 11 x 17 inch pages with the river-mile marks and provided in sheet protectors for field mapping.

Seventeen aquatic habitat types and seven associated terrestrial types (Table 1) will be delineated on the base photographs (1 inch = 200 ft scale) by visual inspection in the field by walking the entire reconstruction sites and controls. Each polygon delineated will be marked with its corresponding code as noted in Table 1. The date of mapping and the mapper's name will be recorded on the first map sheet for each day's mapping. All mappers used by ERI have direct experience in mapping the San Juan River using the proposed methodology. In as much as the mapping process is interpretive, annual reviews will be conducted among the mapping crews prior to mapping to assure the best possible reproducibility in interpretation among mappers. Following field mapping, the field sheets will be reviewed and missing codes or non-closed polygons corrected prior to processing.

Once the field mapping sheets are reviewed and edited, they will be scanned at a resolution of 300 dpi and then rectified to the latest available DOQs to remove distortion. After rectification, the habitat polygons will be digitized and coded in ArcGIS to produce a shape file and database with habitat perimeter and area by type and river mile. The data will then be extracted and summarized by count and area per site for analysis. Average flow at mapping for each detailed reach will also be extracted from USGS gauge data (approximately 1000 cfs, using the gage or gages most representative of the reach (Shiprock).

In addition, across stream transects will be established at the inflow area of each modified RERI secondary channels and multiple transects in the newly constructed channel. Each set of transects will be field surveyed and permanent benchmarks established such that the year to year variations can be determined. Surveys will occur at the time of field mapping (post runoff).

Flows will be determined in the field for each inflow and outlet channel.

Data Analysis

Data analysis will be the same whether photo-interpreted (river wide) or field mapped RERI sites), except that the number of habitat types 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.

RERI mapping schedule

The RERI mapping will occur in the fall of 2012 (post runoff) and in the spring and fall 2013. This will allow a comparison of the effects of two separate spring runoff events on the RERI sites.

Table 1. Categories of habitat types on the San Juan River with mapping codes (mapping codes shown in parenthesis).

Backwater Types
(1) Backwater
(2) Embayment

Other Low Velocity Types
(3) Pool
(6) Eddy

Run Types
(10) Run

Riffle Types
(15) Riffle
(19) Chute
(32) Rapid
(37) Waterfall
(41) Plunge

Shoal Types
(9a) Sand Shoal
(9b) Cobble Shoal

Slackwater Types
(20) Slackwater
(35) Pocketwater

Vegetation Types
(34) Inundated Vegetation

Other Wet Types
(21) Isolated Pool
(39) Diverted Water
(33) Irrigation Return
(29) Tributary

Dry Types
(28) Sand Bar
(31) Island
(26) Rootwad Pile
(38) Bridge Pier
(40) Diversion Structure
(25) Cobble Bar
(36) Boulder

Deliverables

RERI Habitat Mapping in 2013

1) Rectified habitat maps of RERI sites and controls
2) Polygon area, perimeter and geo-referenced location of 17 habitat types
3) Date of mapping for each daily segment
4) Flow at mapping for each site
5) Antecedent runoff hydrograph for both years between mappings
6) Data summarized by site
7) Distance and elevation for each across stream transect. Map showing location of each transect
8) Inflow and outflow of each RERI channel

Task 4) Retrospective Analysis of Geomorphology and Floodplain Vegetation Establishment

Introduction to Retrospective Analysis – General Approach

As part of the habitat workshop, the peer review comments stressed the need to have an ecological understanding and an historical perspective on the expansion of Russian Olive and Tamarisk vegetation in the floodplain of the San Juan River as related to historical hydrologic conditions. They suggested that the study should focus on 30-35 complex reaches in the river (as well as the associated secondary channels), and document changes over time. A temporal comparison of the vegetation changes in these

reaches of the San Juan River compared to the immediate antecedent hydrologic conditions would allow inferences as to the mechanisms of stability or change.

Retrospective Analysis - Methods

Initially, a review will be undertaken looking at the historical channel configuration from aerial images pre and post Navajo Dam (Prior to 1990). These images were previously obtained by Keller/Bleisner Engineering and ERI. Where available, the river channel, islands, sandbars, and vegetation cover will be spatially determined and the images overlapped to show channel change. Vegetation cover of the river floodplain will also be noted. Antecedent conditions will be inspected between the historical images to infer the effects of flow. In most cases, the historical photos will be in black and white format

In order to evaluate the effect of non-native vegetation encroachment on channel stability, multi-spectral satellite Images will be acquired from the Landsat imagery program (1990-2012), and from the higher resolution multi-spectral Geoeye1 (2008 – 2012) or IKONOS imagery programs (2000-2012). Initially, archived images will be acquired for the San Juan River floodplain from Navajo Dam (RM 224) downstream to below Chinle Wash (RM 68) starting in 1990. Approximately 30-35 island complexes, the associated secondary channels and the floodplain boundaries will be investigated for the following time frames. If available, images will be obtained for the river at 1) Pre and post high water years, 2) Pre and post low water years and 3) Five year increments between 1 and 2 above.

All pertinent Images will be processed using *ESRI Arcmap 10.0 Image analysis and classification module,* which enables vegetation types to be first, identified, and then separated using the Normalized Difference Vegetation Index (NDVI). Vegetation types will be manually classified using the ESRI image classification module, and field verified by selecting known patches of the target vegetation types (Tamarisk, Russian Olive, Cottonwood, and Willow). Using these spectral signatures from the image classification module for the known vegetation stands, the remaining floodplain will then be automatically separated and quantified to approximate square meter area for the entire river floodplain enclosing each island complex.

Once data capture is completed, the 30-35 reaches (island complexes and associated secondary channels) will be further analyzed for temporal trends in vegetation type changes and compared to antecedent flow conditions. At a minimum, the flowing hydrologic conditions will be investigated.

A) Peak-Runoff (cfs)
B) Runoff (af) March-July)
C) Runoff (af) (Annual)
D) Peak Runoff date
E) Days >10,000 cfs
F) Days > 8,000 cfs
G) Days > 5,000 cfs
H) Days > 2,500 cfs

Data Analysis

Once exported into a database format, the converted spectral data (expressed in square meters of surface area) will represent the density of each vegetation type (or mixed types) within the clipped floodplain/Island complexes. Temporal trends for the reaches will be undertaken using the pre and post

high and low water years and systematic inter-year intervals (at least 5 data points (years) for each reach.

Schedule

Historical multi-spectral satellite images will be acquired in October/November 2012. Photo-interpretation will be completed by February 2013. The draft annual report will be completed by March 31, 2014 with the final report due June 1, 2014

Deliverables

All multi-spectral satellite images will be provided to the program office. All summary data files will also be provided as part of the final report. The analysis associated with the effects of antecedent flow conditions on vegetation cover will be included in the final report.

Introduction to Temperature Monitoring

Miller Ecological Consultants, Inc (MEC) will be responsible for the water temperature monitoring in Task 3. Dr. William J. Miller is a recognized expert in water temperature modeling and co-author of Instream Flow Information Paper 16, Stream Network Water Temperature Model. Dr. Miller has over 25 years experience in water temperature monitoring and modeling in a wide range of stream environments. This experience will be used to insure that the ongoing water temperature data base is maintained. We have proposed two modifications to the Scope of Work for FY 2013 that we feel better meet the objective in the Long Range Plan to monitor water temperature changes as a result of management actions. These proposed modifications are: 1) discontinue temperature monitoring in two tributaries and at Navajo Dam and 2) add a monitoring location in the San Juan River upstream of the Animas River confluence.

Task 5) Water Temperature Monitoring

Eight temperature recorders have been in place since summer of 1992 at the locations shown in Table 2. From 1992-1999, OMNIDATA DP-230 data pod loggers sampled water temperature every 10 minutes and stored maximum, minimum and mean temperature for each day. Optic StowAway temperature loggers from Onset Corporation were utilized from 1999-2006. In 2006, these recorders were replaced with Onset Corporation HOBO Water Temp Pro loggers. They record water temperature every 15-minutes.

The HOBO Water Temp Tdibit 2 logger is accurate to $\pm$0.2 C and has a factory replaceable battery. These loggers can be quickly read by either the HOBO Optic Shuttle or OPTIC base station. The HOBOware Pro software is used to deploy and download the data from the logger. This software has built in capability to summarize data into daily values from the individual fifteen minute measurements. The following ojectives are proposed for the project.

Objectives

1) ***Monitor water temperature at 8 existing locations plus two new locations in the San Juan River, NM and UT (Table 2).***

We propose to modify the locations for the loggers beginning in FY 2013. The tributary locations proposed for Montezuma Creek and the Mancos River do not have continuous flow and as such, we propose to drop those two locations. We propose to add a logger in the San Juan River upstream of the Animas River confluence near County Road 5500. This location will provide data for the San Juan upstream of the Animas in the reach being used to release razorback sucker. The final modification is to discontinue monitoring at Navajo Dam. While there is some difference in water temperature between the dam and Archuleta, that section of river is managed for trout due to the cold water release. Thermal gain between Archuleta and the Animas can be tracked with the logger at Archuleta and at County Road 5500.

2) Create a database of water temperatures that can be posted and accessed at the SJRIP website.

Methods

Data Collection

At the request of Reclamation, we plan to install Onset Corporation HOBO Water Temp Tidbit2 loggers with built-in thermocouple temperature sensors in the locations described in Table 2. Each logger is deployed in a small enclosure that is secure and hard to detect by the individuals without knowledge of the deployment location. This system has been used in locations with high public use without loss of the logger or enclosure. These enclosures consist of a steel post driven flush with the stream bed and a PVC protective housing for the logger attached to the steel post by steel cable (Figures 1 and 2). These housings can withstand streambed movement and protect the logger from stream debris. New installations will be required at County Road 5500. We have installed redundant loggers at each location as insurance against malfunction, vandalism and data loss. The cost of the loggers is low (approximately $125 per logger), which makes redundant deployment feasible. We would designate one logger as the primary with the redundant logger listed as secondary. The primary logger would be used in the data base unless the primary logger malfunctions or is lost. The data from both the primary and secondary logger would be provided to the Recovery Program each year.

Figure 1. Example data logger housing (open) showing HOBO tidbit logger in housing.

Figure 2. Example data logger housing closed ready for deployment.

We will inspect and read the loggers four times each year on approximately a three month time interval (Fall, Winter, Spring {prior to runoff} and Summer {after runoff}. This is more frequent than the existing data set but helps to minimize data loss. Battery condition will be monitored and loggers changed out when the battery life falls below that required to continue until the next reading point.

The data from each logger will be checked at the deployment location to verify data download prior to proceeding to the next download location. The data will be transferred to computer at MEC's office after each field visit. Following each download, data will be quality checked and bad data removed. Vandalism, natural causes or equipment malfunction can cause loss of data that are beyond our control. Every attempt will be made to assure quality data within the scope described, but some missing data is likely inevitable. Data integrity similar to that in the existing database will be provided.

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 eight 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 logger 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.

Deliverables

Annual

1) Daily 15-minute, maximum, minimum, and average water temperature at 8 locations
2) Daily mean flow at each USGS gage

- An annual draft report prepared and submitted by February 28 of each year
- A final report submitted by June 1 of each year
- An updated temperature database with all data collected to date, updated through September 2012 by June 1, 2013.
- 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
Lee Acres – San Juan at County Road 5500 bridge	188.9
Farmington - San Juan at USGS Gage Location	180.1
Shiprock - San Juan at USGS Gage Location	148.0
Four Corners - San Juan at USGS Gage Location	119.4
Mexican Hat - San Juan near Bluff Gage Location	52.1
Farmington - Animas at USGS Gage Location	n/a
McElmo Creek at confluence with San Juan	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
MC	Montezuma Creek	Located left bank at sheet piling upstream side of the Mont. Ck bridge	37.2579	-109.3096	NAD83
MH	Mexican Hat	Located right bank near the USGS mini-monitor enclosure upstream of Mex Hat bridge	37.15059	-109.8669	NAD83
ND	Navajo Dam	Base of Navajo Dam on river left immediately downstream of outlet	36.80484	-107.6148	NAD83
SR	Shiprock	Located at the Shiprock USGS gage	36.781	-108.6899	NAD83
MA	Mancos R. at S.J. confluence	Site to be field located near the confluence with the San Juan	TBD	TBD	NAD83
ME	McElmo Cr. At S.J. confluence	Site to be located near the confluence with the San Juan	TBD	TBD	NAD83

2013 Budget

Task		**Cost**
Task 1 and 2.	Annual Habitat Mapping and Verification	$ 45,390
Task 3.	RERI Site Monitoring	$ 26,695
Task 4.	Vegetation Retrospective	$ 39,448
Task 5.	Temperature Monitoring	$ 16,218
	Total	**$ 127,750**

TASK	Labor	Direct Costs	Total by Task	Principal $150/hr	Ecologist $150/hr	Sr. Scientist $117/hr	Biologist $62.5/hr	GIS Analyst $103/hr	GIS Specialist $88/hr	Tech Editor $62.5/hr
Task 1and 2 Annual Habitat Mapping and Verification										
Satellite Clipping	$6,900.50		$6,900.50	$2		30		10	22	
Digitizing Waters Edge	$12,271.00		$12,271.00	2		20		40	60	
Back Water/ Embayment Identification	$5,316.25		$5,316.25			20	20	3	15	
Field Verification	$8,670.00	$2,160.00	$10,830.00	40			40			
Data Analysis	$3,780.25		$3,780.25	3		12	9	6	2	8
Reporting	$4,781.50	$153.50	$4,935.00	6		8	18		9	15
Meetings	$612.00	$744.60	$1,356.60	4						
Task 3 RERI Monitoring										
Field Mapping	$13,005.00	$2,320.00	$15,325.00	60			60			
Data Analysis	$6,409.75		$6,409.75	20		12	9	6	8	
Reporting	$4,781.50	$178.50	$4,960.00	6		8	18		9	15
Task 4 Vegetation Retrospective										
Satellite Clipping	$5,390.00	$4,000.00	$9,390.00			10		40		
Field Verification	$10,370.00		$10,370.00	20		40	40			
Data Analysis	$12,590.00		$12,590.00	10		40		60		
Reporting	$7,097.50		$7,097.50	10		20	20			30
Task 5 Water Temperature Monitoring										
Logger Deployment	$2,448.00	$897.60	$3,345.60		16					
Quarterly monitoring	$4,080.00	$4,814.40	$8,894.40				64			
Data analysis	$1,020.00		$1,020.00				16			
Draft report	$1,377.00		$1,377.00		4		12			
Final report	$561.00		$561.00		2		4			
Meetings	$612.00		$612.00		4					
Final report data delivery	$408.00		$408.00		1		4			
Total Cost Estimate	**$112,481.25**	**$15,268.60**	**$127,749.85**	**183**	**27**	**220**	**334**	**165**	**125**	**68**

Peer Review for 2013
Fiscal Year 2013 Project Proposal

Mark McKinstry, Ph.D. UC-735
Bureau of Reclamation
125 South State Street, Room 6107
Salt Lake City, UT 84138-1147
Phone 801-524-3835
FAX 801-524-5499
mmckinstry@uc.usbr.gov

Background:
A Peer Review Panel was established in 1997 to assist the SJRIP with reports and plans for future studies. The four 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 2013. It is anticipated that the Panel will meet with the Biology Committee at three meetings during the year; the December 2011 Planning meeting, the February/March, 2013 Researcher's meeting, and a May, 2012 BC meeting (combined with the Coordination Committee) to draft 2014 SOWs. Additionally, the Peer Reviewers will likely be asked to attend an additional workshop meeting whereby they are asked to comment as a group on all aspects of specific Program Elements.

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 FY2013 three to four imes to review monitoring and research progress and to discuss scopes of work for 2013. 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 David Campbell 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 David Campbell.

Products:
Peer review participation at 3 Biology Committee meetings and 1 workshop, letter or verbal reports from each peer reviewer on an as-requested basis.

Primary Contact: Dr. Mark McKinstry
Bureau of Reclamation
125 South State Street, UC-735
Salt Lake City, UT 84106
Phone:801/524-3835 FAX:801-524-5499
Email: mmckinstry@uc.usbr.gov

Personnel:

Dr. John Pitlick
Department of Geology
University of Colorado
Boulder, CO 80309-0260
Phone: 303-492-5906
Emial: pitlick@spot.colorado.edu

Dr. Stephen Ross
Curator Emeritus of Fishes, Department of Biology and Museum of Southwestern
Biology MSC 03-2020 University of New Mexico
Albuquerque, NM 87131-0001
Phone: 505-277-3893 Hm: 970-264-0158
Email: stross1@unm.edu

Dr. Mel Warren Jr.
Team Leader and Research Biologist
Center for Bottomland Hardwoods Research
Southern Research Station, USDA Forest Service
1000 Front Street
oxford, MS 38655
Phone: 662-234-2744, ext. 246
Fax: 662-234-8318
Email: mwarren01@fs.fed.us

Dr. Ron Ryel
Department of Forest, Range, and Wildlife
Utah State University
5230 Old Main Hill
Logan, UT 84322-5230
Phone: 435-797-8119
FAX: 435-797-3796
Email: ron.ryel@usu.edu

Budget FY-13:
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 25-40 days each in 2013.

The total budget is distributed among the four peer reviewers through individual Services Contracts with Reclamation.

Salaries:	$30,000
Travel:	$15,000
Total	**$50,000**

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 Outyear Funding:

2014 $55,000

San Juan River Population Model Update, Maintenance, Population Model runs. Project Scope of Work

Principle Investigators:
Bill Miller
Miller Ecological Consultants
2111 S. College Ave., Unit D, Fort Collins, CO 80525
(970) 224-4505 wjmiller@millereco.com

And
Vince Lamarra
Ecosystems Research Institute
Logan, Utah

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 relevant sections of the San Juan River Long Range Plan. These models 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 during a two day workshop in April 2007. The Biology Committee requested that a scope of work be developed to continue model maintenance and conduct model runs. The scope of work was developed but not funded due to fiscal constraints. In Biology Committee meetings in 2009 and 2010, it has been noted that much of the analysis regarding management actions and endangered species recovery in the San Juan River could be evaluated using the Population Model. The intent of this update is to continue to refine the structural and functional components of the mechanistic model, present an updated version of the model to the Biology Committee members, and make additional model runs with updated input data from the monitoring in the San Juan River.

Tasks:

1.) Update the Stella® model software for the San Juan population model from Version 8 to the newest version

2.) Update the model parameters with new physical and biological data from the San Juan River Recovery and Implementation Program.

3.) Update the user interface and run-time version of the model.

4.) Create an internet accessible model using Stella NetSim software.

5.) Complete the model documentation for the updated Population Model.

6.) Make additional model runs that incorporate the information from the monitoring data to evaluate SJRIP Program objectives.

Benefits to the Tribe and surrounding communities

The San Juan River Recovery Implementation Program (SJRIP) is the reasonable and prudent alternative developed for the ALP Project. The San Juan population model provides a means to quantitatively evaluate the management activities of the SJRIP for recovery of the federally listed Colorado pikeminnow and razorback sucker. An efficient and scientifically informed basis for management actions, such as using the model, would continue progress toward recovery for the endangered fish and allow current and future water development projects, in a timely manner. The completion of the model will allow the SJRIP to quickly evaluate ongoing and proposed management actions for recovery of the listed species using a rigorous scientifically based tool. In addition, the SJRIP is at a point where data integration of the past 5 years of monitoring is needed. The data integration is an integral component of the evaluation of progress toward recovery for the Program. This integration includes determination of population responses to management actions such as non-native fish removal, augmentation of endangered fishes, and flow manipulations. It has been pointed out by several members of the SJRIP Peer Review panel that the model, if updated could provide the means for integration. Because the model is a broad ecosystem based mechanistic model, all of the major ecosystem components that can be manipulated to benefit the endangered fish are included. The model can evaluate how current and future water development affects fish populations, in particular Colorado pikeminnow and razorback sucker.

Methods:

The current version of the model is in Stella Version 8. Newer Stella versions have substantial changes that would significantly improve model function. This update will include planning sessions to reconfigure the model to take advantage of new data handling capabilities in Version 9 and to update the user interface. The planning sessions will include discussion with the Biology Committee from San Juan River Recovery Program.

The model will be reconfigured to Stella Version 9 to improve its function. The reconfiguration will require conversion of the existing Stella 8 model code to Stella 9.

The user interface is critical to allow other participants in the Program to run simulations through a Web enabled simulation site. The user interface will allow Program participants to vary management parameters for model simulations. This interface will include the construction of a web enabled simulation site using web software available from Stella. The Web access will provide a secure means to control the model code while allowing a variety of users to run simulations.

The biological and physical model data only contain information through 2002. The San Juan Program has collected additional data on fish populations and habitat through 2009 including preliminary population estimates for endangered Colorado pikeminnow and razorback sucker. Data up through 2009 will be used to update species distributions, abundance and population estimates. The model parameters will be updated, as needed, with the new biological and physical data.

Documentation will be completed that includes instructions for model use, description of changes to model parameters, and full description of model components. A model report was completed in 2006, which described the model components and parameters. The original model report will be updated and included in the model documentation.

After completion of the model updates, model simulations will be made to test the model operation and evaluate the change in population dynamics. The main focus of the simulations is likely to be the expected endangered fish populations as a result of stocking Colorado pikeminnow and razorback sucker. Initial results will be presented to the Program. Any Program participant can conduct additional model simulations after the Web based access feature is complete.

Schedule:

Model code conversion from Stella 8 to the newest version of Stella, including planning, conversion and testing, will take 6-12 months.
Model documentation will be concurrent with model code conversion. The documentation will be complete two-three months after the code conversion is completed.
Model simulations will be completed as the final part of model conversion and testing. Simulation results will be available one-two months after model conversion.
Total time required for the model update with documentation is estimated at 6-12 months.

Model maintenance is an ongoing task that consists of updating the model with new model parameters based on new information and updating the model software as needed. Once the model is converted to the newest version of Stella, only minor revisions would be needed on an annual basis. These revisions include incorporating new data from the monitoring program and adjusting the model parameters with new values as they become available. The Stella software would not be updated unless a new version is released and only after review of the changes between versions shows a substantial advantage to the upgrade.

Products:

A revised model in the most recent Stella Version will be produced for the Tribe. A report will be prepared that documents the model update, software use, web access use, and basic model function. Summary tables of model simulations will be produced for each model run. A summary of model maintenance activities will be completed annually.

Program Coordinator's Office
Fiscal Year 2013 Draft Proposal

U.S. Fish and Wildlife Service
2105 Osuna NE Albuquerque, New Mexico 87113
David_Campbell@fws.gov (505) 761-4745
sharon _whitmore@fws.gov (505) 761-4753

Cooperative Agreement #: R10PG40064 (08-AA-40-2713)
Period of Performance: 10/01/2012 to 9/30/2013

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 and the water development interests, most of which have legal mandated responsibilities to the endangered fish and/or the water resources.

The 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 of the Program's Long Range Plan identifies Goals, Actions, and Tasks that the Program Office will undertake to administer the Program. The Program Office staff includes a Program Coordinator, Assistant Program Coordinator, Program Biologist, and part-time Program Assistant.

Tasks

Specific Service responsibilities for Program coordination are described in the September 23, 2010 Program Document and listed below. 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 sections entitled. "Biology Committee," "Long Range Plan Development and Annual Revision Process," and "Annual Work Plan Development Process" of the Program Document.

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.

San Juan River Recovery Program **Program Management Budget 2013**		
Personnel (salary and benefits)	USFWS Funding	Program Base Funding
Coordinator (80/20%)	97,266	24,317
Assistant Program Coordinator (50/50%)	65,594	65,594
Program Biologist (65%)	0	48,943
Program Assistant (17.5/17.5%)	11,519	11,519
IT-Support	6,000	0
USFWS Hydrologist	10,000	5,000
Personnel Subtotal	**$190,379**	**$155,373**
Travel		
Coordinator/Asst. Coordinator (70 days@$109 pd)	0	7,630
Coordinator/Asst. Coordinator (35 trips @400 miles) $0.55/gal	7,700	0
Program Biologist (35 days@$109 pd)	0	3,815
Program Biologist (12 trips @400 miles) $0.55/gal	0	2,640
Program Assistant (12 trips @400 miles) $0.55/gal	0	2,640
Senior Biologist Travel to Farmington (12 days@$109 pd) + gas	2,000	0
Airfare to DC	0	2,000
DC, 10 days @ $273	0	1,500
CRWUA, 10 days @ $190 + Airfare	0	3,900
Travel to UCRRIP	0	3,000
Hydrologist Support	0	5,000
Travel Subtotal	**$9,700**	**$32,125**
Committee Meeting Support		
General Office Supplies	0	5,500
Meeting space	0	0
Farmington@ $100/day	0	1,200
Durango @$400/day	0	1,200
Mailings	0	500
Public Notices - ($118/meeting)	0	2,500
Printing/publication	0	4,000
Gas	0	3,000
Misc	0	1000
Support Subtotal	**$ 0.00**	**$18,900.00**
	USFWS Funding	**Base Funding**
Budget Subtotal	**$200,079**	**$206,398**
FY 2011 Carry over funds	**0**	**$65,000**
Subtotal	**$200,079**	**$141,398**
Administrative charge (11%)	**0**	**$15,554**
Grand Total	**$200,079**	**$156,952**

FY 2013 Reclamation Program Management

Mark McKinstry UC-735
Bureau of Reclamation
125 South State Street, Room 6107
Salt Lake City, UT 84138-1147
Phone 801-524-3835
FAX 801-524-5499
mmckinstry@uc.usbr.gov

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 50—60 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. An annual report on program management activities will be delivered during the annual meeting each year (usually April/May).

Budget FY13

Task 1: Biology Committee Annual Funding Administration

A) Labor

Position	Salary total/hr	No. persons	Total Hours	Total cost
Reclamation Acquisitions Manager	$120.00	1	30	$3,600.00
Biology Committee Technical Representation for Contracts and Agreements*	$90.00	1	600	$54,000.00
Lead contract officer	$120.00	1	40	$4,800.00
Agreement/Contract Specialist	$70.00	1	600	$42,000.00
Agreement specialist	$55.00	2	800	$44,000.00
Total				$148,400.00

** 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 Technical representative	Farmington	Project evaluation or field trips	2 trips @ 6 days/trip	$100/600	$50/$300	$400	$2,000	$3,300.00
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 contract officer	Farmington, Durango	CC/BC mtg., or contract admin	2 trips @ 2 days	$100/$200	$50/$200	$100	$2,000	$2,500.00
Lead contract officer	Various locations	Contract Admin	1 trip @ 2 days	$125	$65/$130	$100	$300	$655.00
Total								$12,255.00

*Taxi $20; Parking $10; Rental car $100/trip

Budget Summary
FY-2013

Total labor	$148,400.00
Total travel	$12,255.00
Grand total	**$160,655.00**[1]

[1] **This total budget represents a 6.1% increase over the FY2012 budget due to higher contracting costs.**

Program Coordinator's Office Outreach
Fiscal Year 2013 Draft Proposal

Project Lead: Sharon Whitmore
U.S. Fish and Wildlife Service
2105 Osuna NE Albuquerque, New Mexico 87113
sharon_whitmore@fws.gov (505) 761-4753

Cooperative Agreement #: R10PG40064 (08-AA-40-2713)
Period of Performance: 10/01/2012 to 9/30/2013

Background

The San Juan River Recovery Implementation Program (SJR 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 and the water development interests, most of which have legal mandated responsibilities to the endangered fish and/or the water resources. The parties extended the Cooperative Agreement through 2023.

The SJR Program works jointly with the Upper Colorado River Recovery Program (UCRRP) 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. These goals are reviewed and revised every five years.

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 will help 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. Geographic reach of some of these audiences differ by Recovery Program.

Mission

To support the SJR 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. Outreach efforts will be coordinated with the UCRRP.

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.

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)

Tasks

1. Coordinate SJR Program activities with the Upper Basin Recovery Implementation Program.
2. Coordinate outreach activities with the Upper Basin Recovery Implementation Program; disseminate information on Program activities to the public through brochures, newsletters and/or the website.
3. Coordinate outreach activities with Water Users Student Fairs and local schools fairs.

San Juan River Recovery Program Program Management Outreach Budget 2013		
Personnel (salary and benefits)	USFWS Funding	Program Base Funding
Program Assistant - Outreach Program		0
Personnel Subtotal		**0**
Travel		
St. George, UT (6 days@$116)		696
Airfare		1,500
Denver, CO (3 days @ $198)		594
Farmington, NM (3 days@116)		348
Durango, CO (2 days@194)		388
Travel Subtotal		**$3,526**
Equipment and Supplies		
Outreach Materials		3,000
Registration Fees		300
Equipment and Supplies		**3,300**
	USFWS Funding	**Base Funding**
Budget Subtotal		**$6,826**
Administrative charge (11%)	**0**	**$751**
Direct expenses to UCRRIP		**$18,000**
Grand Total		**$25,577**