SAN JUAN RIVER BASIN

RECOVERY IMPLEMENTATION PROGRAM

FISCAL YEAR 2008
ANNUAL BUDGET AND WORK PLAN

Approved: September 7, 2007

San Juan Recovery Implementation Program Proposed FY 2008 Funding					
SOW	Title	Agency	Estimated Funding		
			Base	Capital	Other
	Biology Committee Projects				
	Monitoring				
1	Sub-Adult/Adult Large Bodied Fish Comm. Monitoring	FWS, GJ	$115,298		
2	YOY/Small Bodied Fish Monitoring	NMDGF	$94,043		
3	Larval Colorado Pikeminnow Survey	UNM,NMDFG	$72,290		
4	Larval Razorback Sucker Survey	UNM,NMDFG	$65,632		
5	Specimen Curation/Identification	UNM	$24,942		
	Subtotal		**$372,205**		
	Peer Review				
6	Peer Review	BOR/FWS	$40,000		
	Program Workshops	BOR/FWS	$30,000		
	Subtotal		**$70,000**		
	Research				
7	Long Term Channel Monitoring, Habitat Mapping, and Water	RFP	$320,000		
	- River Videography (part of above project)		$13,000		
	Fish Capture Data Analysis		$28,000		
	Subtotal		**$361,000**		
	Recovery				
8	Nonnative Species Control - Upper San Juan River	FWS, Abq	$314,169		
9	Nonnative Species Control - Lower San Juan River	UDWR	$173,964		
10	PIT Tags	BR	$20,000		
11	Stocking of Fingerling Colorado Pikeminnow	FWS, GJ	$23,566		
12	Colorado Pikeminnow Fingerling Production	FWS, DNFHTC	$88,433		
13	Razorback Sucker Production Uvalde	FWS,UNFH	$106,120		
14	Rearing Razorback Suckers Dexter	FWS,DNFHTC	$60,904		
15	RBS Augmentation/NAPI Pond Management	FWS/NN	$146,228		
	Subtotal		**$933,384**		
	Biology Committee Total		**$1,736,589**		
	San Juan RIP All Activities, Proposed FY 08 Funding				
	Title	Agency	Estimated Funding		
			Base	Capital	Other
	Hydrology Committee Projects				

16	Maintenance and Operation of Model	BR, Durango	$82,625		
17	Improve Stream Gaging and Flow Measurements	USGS	$6,700		
	Subtotal		**$89,325**		
	Program Coordination and Management				
18	Program Management FWS	FWS Abq	$210,068		$120,899
19	Base Fund Management BR	BR, SLC	$146,500		
20	Update and Maintenance of Program Database	FWS Abq	$37,735		
21	Capital Projects Management	BR		68300	
	Capital Hogback Canal				
	Subtotal		**394,303**	**$68,300**	**$120,899**
	Program Facilities Operations and Maintenance				
	PNM O&M	PNM	$25,000		
22	Operation of PNM Fish Passage Structure	FWS/NN	$56,918		
	Subtotal		**$81,918**		
	SJ RIP Total		**$2,302,135**	**$68,300**	**$120,899**
	Estimated Available Annual Base Funds		**$2,330,485**		
	Amount of remaining 2008 funds not obligated		$28,350		
	Projects under Consideration Not recommended for Funding				
	Larvel Cyprinid		**$29,079**		
	Program Evaluation	RFP	**$200,000**		
	Total		**$229,079**		

2008 WORK PLAN PROJECTS	DELIVERABLES	DATE DUE
08-BC-01		
Sub-Adult & Adult Large-Bodied Fish Monitoring Dale Ryden and Chuck McAda U.S. Fish and Wildlife Service Colorado River Fishery Project 764 Horizon Drive, Building B Grand Junction, CO 81506-3946 (970) 245-9319 cmcada@fws.gov dryden@fws.gov	• Draft Progress Report • DBASE Files • Final Progress Report	03-31-09 03-31-09 06-01-09
08-BC-02		
YOY/Small Bodied Fish Monitoring David L. Propst and Yvette Paroz Conservation Services Division New Mexico Department of Game and Fish One Wildlife Way, P.O. Box 25112 Santa Fe, NM 87504 (505) 476-8103 dpropst@state.nm.us yparoz@state.nm.us	• Draft Report including electronic database	03-31-09
08-BC-03		
Larval Colorado Pikeminnow Survey Michael A. Farrington and W. Howard Brandenburg Division of Fishes, Museum of Southwestern Biology University of New Mexico Albuquerque, NM 87131 (505) 277-3218 mporter@unm.edu whburg@unm.edu *and* David L. Propst New Mexico Department of Game and Fish Conservation Services Division One Wildlife Way, Santa Fe, NM 87505 (505) 476-8103 dpropst@state.nm.us	• Draft Report • Final Report	03-31-09 06-01-09
08-BC-04		
Larval Razorback Sucker Survey W. Howard Brandenburg and Michael A. Farrington Division of Fishes - Museum of Southwestern Biology University of New Mexico Albuquerque, NM 87131 (505) 277-3218 whburg@unm.edu *and*	• Draft Report • Final Report	03-31-09 06-01-09

David L. Propst
New Mexico Department of Game and Fish
Conservation Services Division
One Wildlife Way
Santa Fe, NM 87505
(505) 476-8103
dpropst@state.nm.us

08-BC-05

Specimen Curation/Identification

Alexandra M. Snyder and Thomas F. Turner
Division of Fishes - Museum of Southwestern Biology
University of New Mexico
Albuquerque, NM 87131
(505) 277-6005
amsnyder@unm.edu
turnert@unm.edu

• Draft Report	03-31-09
• Final Report	06-01-09

08-BC-06

Peer Review

Mark McKinstry
U.S. Bureau of Reclamation
125 S. State St.
Salt Lake City, UT 84138-1147
(801) 524-3835
mmckinstry@uc.usbr.gov

• Letter or verbal reports from each reviewer.	Upon request

08-BC-07

Habitat Mapping

Ron Bliesner
Keller-Bliesner Engineering
78 East Center, Logan, UT 84321
(435) 753-5651
bliesner@kelbli.com

• Habitat Mapping Draft Report	03-31-09
• Habitat Mapping Final Report	06-30-09
• ArcMap shapefile and database w/habitat data	06-30-09

08-BC-08

Nonnative Species Monitoring and Control in the Upper San Juan River

Jason E. Davis, D. Weston Furr, and James E. Brooks
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
Weston_Furr@fws.gov
Jim_Brooks@fws.gov

• Electronic data file	03-31-09
• Summary Report	03-31-09
• Final Annual Report	06-01-09

08-BC-09

Nonnative Species Control in the Lower San Juan River

Darek S. Elverud Utah Division of Wildlife Resources Moab Field Station 1165 S. Hwy 191, Suite 4 Moab, UT 84532 (435) 259-3782 darekelverud@utah.gov	• Draft Report • Final Report	03-31-09 06-01-09

08-BC-10

Pit Tag and Readers

Mark McKinstry U.S. Bureau of Reclamation 125 S. State St. Salt Lake City, UT 84138-1147 (801) 524-3835 mmckinstry@uc.usbr.gov	• Purchase as necessary	Annually

08-BC-11

Stocking of Fingerling Colorado Pikeminnow

Dale Ryden and Chuck McAda U.S. Fish and Wildlife Service Colorado River Fishery Project 764 Horizon Drive, Building B Grand Junction, CO 81506-3946 (970) 245-9319 cmcada@fws.gov dryden@fws.gov	• Draft Progress Report • DBASE Files • Final Report	03-31-09 03-31-09 06-01-09

08-BC-12

Colorado Pikeminnow Fingerling Production

Roger L. Hamman and Manuel E. Ulibarri Dexter National Fish Hatchery and Technology Center U.S. Fish and Wildlife Service PO Box 219, 7116 Hatchery Road Dexter, NM 88230-0219 (505) 734-5910 Work (505) 734-6130 FAX Roger_hamman@fws.gov Manuel_ulibarri@fws.gov	• Transport and distribute 300,000 fish age-0 fingerlings and 3,000 age-1 fish from Dexter to the San Juan River	Annually

08-BC-13

Razorback Sucker Production – Uvalde

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	• Delivery of 12,000, 300mm fish to the San Juan River	Annually

08-BC-14

Razorback Sucker Production - Dexter

Roger L. Hamman and Manuel E. Ulibarri
Dexter National Fish Hatchery and Technology Center
U.S. Fish and Wildlife Service
PO Box 219, 7116 Hatchery Road
Dexter, NM 88230-0219
(505) 734-5910 Work
(505) 734-6130 FAX
Roger_hamman@fws.gov
Manuel_ulibarri@fws.gov

- Delivery of 20,000, 200mm fish to Uvalde NWR and 10,000 200mm fish to NAPI ponds

Annually

08-BC-15

Razorback Sucker Augmentation at NAPI Ponds

U.S. Fish and Wildlife Service, Regions 2 and 6
Navajo Nation Department of Fish and Wildlife
Principal Investigators:
Jason E. Davis and D. Weston Furr
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
Weston_Furr@fws.gov

- Harvest 300mm fish from 3 NAPI grow-out ponds and transport to San Juan River

Annually

08-HC-16

Maintenance & Operation of the San Juan River Basin Hydrology Model

Pat Page
U.S. Bureau of Reclamation
835 E. 2nd Avenue, Suite #300
Durango, CO 81301
(970) 385-6560
ppage@uc.usbr.gov

- Hydrology analysis of water development scenarios or other scenarios in accordance with the HC's document entitled, "SJRIP Recommendations for Conducting and/or Requesting Model Runs"

Upon request

08-HC-17

Improve Stream Gaging and Flow Measurements

Pat Page U.S. Bureau of Reclamation 835 E. 2nd Avenue, Suite #300 Durango, CO 81301 (970) 385-6560 ppage@uc.usbr.gov	• Technical presentation	End of year

08-PM-18

Program Management – USFWS

Program Coordinator and Program Support Assistant U.S. Fish and Wildlife Service 2105 Osuna Road NE Albuquerque, NM 87113 (505) 761-4745 david_campbell@fws.gov (505) 761-4739 joann_perea-richmann@fws.gov	• Misc. tasks completed as per SOW and Program document	

08-PM-19

Base Funds Management - Bureau

Mark McKinstry U.S. Bureau of Reclamation 125 S. State St. Salt Lake City, UT 84138-1147 (801) 524-3835 mmckinstry@uc.usbr.gov *and* Pat Page U.S. Bureau of Reclamation 835 E. 2nd Avenue, Suite #300 Durango, CO 81301 (970) 385-6560 ppage@uc.usbr.gov	• Funding requests processed • Annual Report	Upon request December

08-PM-20

Update and Maintenance of GIS Database

Kevin Winter and Larry Baca NMESFO - U.S. Fish and Wildlife Service 2105 Osuna NE Albuquerque, New Mexico 87113 (505) 761-4723 kevin_winter@fws.gov (505) 761-4740 larry_baca@fws.gov	• Update and disseminate database • Make it available via a password protected ITP site	

08-PM-21

Capital Improvement Program

Brent Uilenberg U.S. Bureau of Reclamation 2764 Compass Dr., Suite 106 Grand Junction, CO 81506 (970) 248-0641 builenberg@uc.usbr.gov	• Financial reports presented to Coordination Committee giving status of Federal appropriations and non-Federal cost sharing contributions.	Every Meeting
08-O&M-22		
Operation PNM Fish Passage Structure Jeffrey Cole, Albert Lapahie, and Viola Willeto Navajo Nation Department of Fish and Wildlife Box 1480 Window Rock, AZ 86515 (928) 871-7068 jcole@navajofishandwildlife.org, alapahie@navajofishandwildlife.org vwilleto@navajofishandwildlife.org	• Monthly Fish Passage Reports • Draft Annual Report • Final Annual Report	 03-30-09 06-30-09

Sub-Adult & Adult Large-Bodied Fish Community Monitoring
(a.k.a. Adult/Juvenile Fish Community Monitoring)
Fiscal Year 2008 Project Proposal
6 February 2007

Principal Investigators: Dale Ryden and Chuck McAda
U. S. Fish and Wildlife Service, Colorado River Fishery Project
764 Horizon Drive, Building B
Grand Junction, Colorado 81506-3946
(970) 245-9319
dale_ryden@fws.gov and chuck_mcada@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 1991-1997 Adult Monitoring study was raft-borne electrofishing, although radio telemetry was also heavily employed. Data collected during the 1991-1997 Adult Monitoring study provided information on specific habitat usage by rare fish species. In addition, data gathered during the 1991-1997 Adult Monitoring study aided in the selection of specific sites for detailed hydrologic measurements and larval drift sampling. Integration of 1991-1997 Adult Monitoring data 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 1991-1997 Adult Monitoring study. This study is one of a suite of long-term monitoring efforts detailed in the San Juan River Monitoring Plan and Protocols (Propst et al. 2000) that are designed to help evaluate progress under the San Juan River Recovery Implementation Program (SJRIP) and the SJRIP's Long Range Plan. The current Adult Monitoring study incorporates essentially the same monitoring protocols as did its 1991-1997 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 1991-1997 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 a highly effective tool for monitoring populations of both stocked razorback sucker and Colorado pikeminnow.

Relationship to the Recovery Program

At present, both the Long Range Plan and the long-term Monitoring Plan and Protocols are undergoing revision. However, the need for the Adult Monitoring study is specified in element numbers 1, 3 and 4 of the latest draft of the Long Range Plan (dated October 30, 2006), specifically task numbers 1.1.9, 3.1.1, 3.1.5, 3.1.6, 3.1.7, 4.1.5, 4.1.6, and 4.1.9. The existence of the long-term data set compiled by the Adult Monitoring study since 1991 also makes task 3.1.9 possible. The monitoring protocols discussed in the Methods section of this workplan reflect those that are currently included in the latest draft of the revised long-term Monitoring Plan and Protocols.

Description of Study Area

The study area for Adult Monitoring extends from river mile (RM) 180.0 (just downstream of the Animas River confluence) in Farmington, New Mexico, downstream to RM 2.9 (Clay Hills Landing) just upstream of Lake Powell in Utah.

Objectives

1. Monitor the San Juan River's fish community, specifically the large-bodied fish species, to identify shifts in fish community structure, species relative abundance and distribution, and length/weight frequencies that are occurring over time. Determine whether these shifts in fish community parameters correspond to management actions that are being implemented by the SJRIP. These include (but may not be limited to) the following:
    a) Reoperation of water releases from Navajo Reservoir
    b) Mechanical removal of nonnative fishes
    c) Modification or removal of instream water diversion structures
    d) Augmentation efforts for both federally-listed endangered fish species -- Colorado pikeminnow and razorback sucker

2. Monitor population trends (e.g., distribution and abundance, growth rates, recruitment, possible range expansion) of the rare San Juan River fish species -– Colorado pikeminnow, razorback sucker, and roundtail chub (both wild and stocked fish).

3. Remove nonnative fish species which prey upon and may potentially compete with native fish species in the San Juan River.

Methods

Objectives 1-3: One Adult Monitoring trip will take place in the fall of 2008. This trip will sample the entire study area, from near the Animas River confluence in New Mexico (RM 180.0) to Clay Hills Landing in Utah (RM 2.9). 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.

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 120 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.

Electrofishing will follow the methods set forth above and in the SJRIP's long-term monitoring plan (as detailed in Propst et al. 2000). Alternate sampling techniques (e.g., seining, trammel netting, backpack electrofishing, etc.) may be employed where suitable habitat is available or if low-water conditions preclude the use of raft-mounted electrofishing, at the principal investigator's discretion.

The U.S. Fish and Wildlife Service 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 2008 is scheduled to be available by 31 March 2009. The "draft final" of this interim progress report which incorporates comments received, is scheduled to be completed by 1 June 2009. Data files containing information on total catch and length/weight data gathered on Adult Monitoring trips will be submitted for inclusion in the SJRIP's integrated database by 31 March 2009.

Qualifications of Personnel Included in the Budget

Principal Biologist (GS-12) -- Dale Ryden
Holds a BS degree. Has 17 years experience performing fisheries research/management in the Colorado River Basin. Dale has been performing fisheries research/management in the San Juan River Basin for the last 16 years.

Biological Technicians (GS-7) – Bio. Techs from USFWS-CRFP
All hold at least a BS degree. Depending upon the individual, they have from 1-8 years experience performing fisheries research/management in the Colorado River Basin. Most have
1-3 years of experience performing fisheries research/management on the San Juan River.

Project Leader (GS-14) -- Chuck McAda
Holds an MS degree. Has 27 years experience performing fisheries research/management in the Colorado River Basin. Chuck was chairman of the San Juan River Recovery Implementation Program's Biology Committee for three years (2004-2006).

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). This suite of long-term monitoring studies were initiated in 1999 and are scheduled to run through the termination of the San Juan River Recovery Implementation Program.

Literature Cited:

Propst, D. L., S. P. Platania, D. W. Ryden, and R. L. Bliesner. 2000. San Juan River Monitoring

Plan and Protocols. San Juan River Recovery Implementation Program; U. S. Fish and Wildlife Service, Albquerque, NM. 20 pp. + appendices.

San Juan River Recovery Implementation Program Biology Committee. 1995. Long Range Implementation Plan. San Juan River Recovery Implementation Program; U. S. Fish and Wildlife Service, Albquerque, NM. 30 pp.

San Juan River Basin Recovery Implementation Program. 2006. Draft Long Range Plan (dated 30 October 2006). San Juan River Basin Recovery Implementation Program; U. S. Fish and Wildlife Service, Albquerque, NM.

YOY/Small Bodied Fish Monitoring
Fiscal Year 2008 Project Proposal

Principal Investigators: David L. Propst and Yvette Paroz
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Background

As set forth in Section 5.7 of the San Juan River Basin Recovery Implementation Program (SJRIP) Long-Range Plan, a long-term monitoring program "to identify changes in the endangered and other native species populations, status, distributions and habitat conditions" was to be developed by the SJRIP Biology Committee. The ichthyofaunal monitoring portion of the San Juan River Monitoring Plan and Protocols (Propst, et al., 2000) was divided into four primary areas, larval fish drift sampling, larval fish seining, young-of-year/small bodied fishes, and subadult and adult/large-bodied fishes. The portion of the San Juan River to be monitored extends from the confluence of the Animas and San Juan rivers (Farmington) to Lake Powell (Clay Hills Crossing). The purposes of small-bodied fish monitoring are to document occurrence and mesohabitat of young-of year Colorado pikeminnow, razorback sucker, and roundtail chub; characterize the fish assemblages of primary channel shoreline and near-shoreline mesohabitats, secondary channels, and backwaters; and document and assess changes in the abundance of common native and nonnative small-bodied fishes (including age 0 flannelmouth sucker, bluehead sucker, common carp, and channel catfish). The following work proposal for 2008 is to conduct young-of-year/small-bodied fishes monitoring effort per protocols set forth in the San Juan River Monitoring Plan and Protocols (SJRMPP). Beginning in 2003, specimens collected from each mesohabitat were preserved separately, data were recorded in database by mesohabitat, and annual reporting included summary of species occurrences by mesohabitat. During 2004 and 2005 autumn monitoring, sampling of primary channel near-shore riffle and run mesohabitats was accomplished, on a trial basis, by using a backpack electrofisher to stun fishes and capture them in a bag seine. This sampling was done every six miles in Geomorphic reaches 6 through 3. This effort demonstrated there was no significant difference between methods in number of specimens captured. Speckled dace captured by electrofishing, however, were significantly larger than those captured seining. Electrofishing was discontinued in 2006.

In addition to accomplishing work (field, laboratory, data analyses, and report writing) specific to the young-of-year/small-bodied fish monitoring effort, NMGF personnel participate, native-nonnative interactions and removal studies (upper and lower San Juan) and larval fish sampling of the San Juan River Basin Recovery Implementation Program. This work and budgeting for NMGF participation in these activities is included with Scopes of Work for each activity and submitted by Principal Investigator(s) for each.

Study Area

The study area for YOY/small bodied fish monitoring extends from river mile RM 180.0 (Animas River confluence) in Farmington, New Mexico, downstream to RM 2.9 (Clay Hills Crossing), just above Lake Powell in Utah.

San Juan River Larval Colorado Pikeminnow Survey
Fiscal Year 2008 Project Proposal

Principal Investigators: Michael A. Farrington, and W. Howard Brandenburg,
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University of New Mexico
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and

Co-principal Investigator: David L. Propst
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Background

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 with only minor changes in sampling protocol. Data collected from this research activity provided several discrete types of information on the fishes of the San Juan River. Data that can be obtained on the endangered fishes of the San Juan river include determining approximate spawning period, identifying approximate location of spawning sites, and assessing effects of annual hydrology (and temperature) on their reproductive activities. Similar data could also be obtained for other members of the ichthyofaunal community and contrasted with previously drift-net sampling to assess the effects of that year's flow regime on fish reproduction.

Between 1993-2006, a total of eight larval Colorado pikeminnow have been collected (Table 1). The two YOY Colorado pikeminnow collected in 1993 (at Mexican Hat) were the same length (9.2 mm TL) and were taken on consecutive days in late July (26-27). From these two individuals, we determined the date of spawning to be about 8-9 July 1993.

Two larval Colorado pikeminnow were taken at Mexican Hat during the 1995 larval fish passive drift-netting study. The first specimen, a 9.5 mm TL mesolarva was taken between 2114-2310 hours on 2 August 1995. The next morning (3 August 1995) between 0531-0800 hours, a second Colorado pikeminnow, (9.0 mm TL mesolarva) was collected. The similar size and developmental stage of these two individuals, in combination with the fact that the two fish were collected within 12 hours of each other, strongly suggested that they were cohorts from a spawning event. From these two individuals, a spawning date between 15-17 July 1995 was determined.

A single larval Colorado pikeminnow was collected in 1996. That specimen was an 8.6 mm TL yolked-mesolarva taken on 2 August 1996 in a drift net at The Mixer sampling locality (RM 128.0). The 1996 back-calculated spawning date for that Colorado pikeminnow (18 July 1996) was similar to that predicted in 1995 despite considerable differences in spring peak discharge (1995 - 12,100 cfs; 1996 - 3,450 cfs) and total annual discharge. The 1997-2000 drift netting samples did not yield any Colorado pikeminnow.

A single larval Colorado pikeminnow was collected in 2001 at The Mixer sampling locality (RM 128.0). The specimen was collected on 1 August 2001, and was a 8.5mm TL yolked-mesolarva. From this specimen a spawning date of 17 July 2001 was determined.

Two larval Colorado pikeminnow were collected in 2004 using the larval seining technique. The first individual was collected on 22 July 2004 at river mile 46.3, while the second was collected at river mile 17.0 on 26 July 2004. The first individual was a 14.2mm TL metalarva, with the second being a 18.1mm TL metalarva. Spawning dates for these two individuals was determined to be 24 and 25 June 2004 respectively.

No larval Colorado pikeminnow were collected from the San Juan river in either 2005 or 2006.

Table 1. Summary of larval and YOY Colorado pikeminnow collected in the San Juan River during larval drift-netting/larval seining (1993-2006) and back-calculated dates of spawning.

Field Number	MSB Catalog Number	Number of Specimens	Total Length	Date Collected	Date Spawned	River Mile	Sample Method
MH72693-2	18098	1	9.2	26 Jul 1993	08 Jul 93	53.0	drift netting
MH72793-2	18099	1	9.2	27 Jul 1993	09 Jul 93	53.0	drift netting
JPS95-205	26187	1	9.2	02 Aug 1995	15 Jul 95	53.0	drift netting
JPS95-207	26191	1	9.0	03 Aug 1995	17 Jul 95	53.0	drift netting
WHB96-037	29717	1	8.6	02 Aug 1996	18 Jul 96	128.0	drift netting
FC01-054	50194	1	8.5	01 Aug 2001	17 Jul 01	128.0	drift netting
MAF04-046	53090	1	14.2	22 Jul 2004	24 Jun 04	46.3	larval seine
MAF04-059	53130	1	18.1	26 Jul 2004	25 Jun 04	17.0	larval seine
TOTAL		8					

The specimen collected in 2001 represents the first larval progeny Colorado pikeminnow collected in the drift since August 1996. In 2001, fewer than 1,000 specimens were collected during a year replete with intense summer rainstorm events. These flushing flows transported considerable detritus into the river and overwhelmed drift collecting gear with debris. This excessive amount of debris required over a year of processing before fish could be separated from all samples and identified. The sampling conducted in 1999 occurred during an extremely low flow year, which was reflected in the collection of a very limited number of drifting larval fish (only 84 at Four Corners and 79 at Mexican Hat). Conversely, 2000 was a more "normal" flow year resulting in the collection of over 2,100 specimens (1,370 at Four Corners and 768 at Mexican Hat).

The limited number of wild adult San Juan River Colorado pikeminnow (versus stocked individuals) is reflected in the extremely low catch rate of larval Colorado pikeminnow. However, numerous adult and sub-adult pikeminnow have been stocked into the San Juan River over the last ten years in an effort to augment the diminished wild population. The Colorado pikeminnow augmentation plan calls for continued stocking efforts in the San Juan River over the next 10 years. The Biology Research Team expects, as was

documented with stocked razorback sucker, that reproduction among stocked pikeminnow will occur and can be documented through the sampling of larval fish. There are no means to differentiate between larval progeny of wild and stocked larval Colorado pikeminnow.

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 Biology Committee charged us with 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). Another suggestion for FY 2003 Colorado pikeminnow studies was to perform targeted sampling for Colorado pikeminnow similar to that being performed for larval razorback sucker. Collections targeting larval Colorado pikeminnow could be accomplished either by expanding the duration of the current larval razorback sucker survey (April-June) or through development of a discrete (new) project.

These and other items were considered and evaluated during the February 2002 San Juan Biology Committee meeting. The team recommended the immediate expansion of the larval razorback sucker survey (April-June) to encompass the months of June, July, and August with seining efforts to target sampling for Colorado pikeminnow. This change in sampling protocol required deviation from the FY 2002 Scope of Work and was initiated July 2002 (using FY 2002 funds).

Approval for this change in sampling was acquired at the 19-21 February 2002 San Juan Biology Committee meeting in Farmington, New Mexico. This new sampling protocol resulted in the collection of over 95,000 specimens for the Colorado pikeminnow larval survey in 2002, and over 70,000 specimens in 2003. Nevertheless, no larval Colorado pikeminnow were collected in either 2002 or 2003. Sampling during 2004 yielded over 145,000 specimens, including two larval Colorado pikeminnow. These were the first larval Colorado pikeminnow collected using the new sampling protocol approved by the San Juan Biology Committee in February 2002.

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.

Study Area

The principal sampling area for this study will be the San Juan River between the Cudei New Mexico (RM 141.5) and the Clay Hills boat landing (RM 2.9) just above Lake Powell Utah. This study will include acquiring collections in reaches of the San Juan River under the jurisdiction of the National Park Service.

Objectives

1. Determine the relative annual reproductive success of Colorado pikeminnow (Task 4.1.3)
2. Provide annual summaries of monitoring results.
3. Provide detailed analysis of data collected to determine progress towards endangered species recovery in three years and thence every five years.
4. Provide comparative analysis of the reproductive success of the San Juan River fishes. (Tasks 4.1.5 and 4.1.6)
5. Attempt to validate presumed spawning period of Colorado pikeminnow.

Methods

Sampling for Colorado pikeminnow larvae will be conducted in the San Juan River between river mile 141.5 and river mile 2.9 from early July through early September 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. Sampling efforts for larval fish will be concentrated in low velocity habitats. Samples in those habitats will be collected with small mesh seines.

Mesohabitat type, length, maximum and minimum depths, water clarity, water quality, and substrate will be recorded for each sampling locality. A minimum of one digital photo will also be taken at each of the sampling localities. 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 2003 Standardized Map Set. For seine samples, the length and number of hauls made will be recorded Catch per unit effort for seine samples will be recorded as the number of fish per $100m^2$.

All retained specimens will be placed in plastic bags containing a solution of 5% buffered formalin and a tag inscribed with unique alphanumeric code that will also be recorded on the field data sheet. Universal Transverse Mercator (UTM) coordinates and zone will be determined with a Garmin Navigation Geographic Positioning System Instrument for each sampling locality and recorded on a field data sheet whose unique alphanumeric code matches that of the tag in the retained sample.

Preserved collections will be returned to the laboratory where they will be sorted, specimens identified to species, enumerated, measured (minimum and maximum size [mm SL] for each species at each site), transferred to 70% ethyl alcohol, and catalogued in the Division of Fishes of the Museum of Southwestern Biology (MSB) at the University of New Mexico (UNM). Specimens whose species-specific identity is dubious or merit additional verification will be forwarded to Darrel E. Snyder (Larval Fish Laboratory, Colorado State University) for review.

Catch rates will be compared across and within reaches by species and temporally. Specimens will be distinguished and compared by residence status (native versus non-native) and catch rate will be over-lain with the annual hydrograph.

Products

Draft reports for the 2008 larval Colorado pikeminnow sampling activities (combined with 2008 larval razorback sucker sampling activities) and collection efforts will be prepared and distributed by 31 March 2009 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 2009. Fish collected from those studies will be curated in the Division of Fishes, Museum of Southwestern Biology (MSB), Department of Biology, at the University of New Mexico. Original field notes will be retained in the Division of Fishes and collection information will be electronically stored in a permanent MSB database program. These data and any maps generated from them will be available to the San Juan River Biology Committee via hard-copy reports and electronically. Electronic copies of the field notes and collection data will be transferred to the San Juan River database manager.

San Juan River Larval Razorback Sucker Survey
Fiscal Year 2008 Project Proposal

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Background

In 1994, the first series of razorback sucker (n=672) were stocked in the San Juan River between Bluff, Utah and Hogback, New Mexico. Mean length and mass of those individuals, at the time of stocking, was about 400 mm TL and 710 g, respectively. In 1995, 13 recaptured razorback sucker were tuberculate males and six of those individuals were ripe. Four recaptured 1995 razorback sucker were determined to be female but, unlike the males, none were sexually mature. In their 1995 report of activities, Ryden and Pfeifer (1996) suggested that the majority of the experimentally stocked San Juan River razorback sucker reached sexual maturity in 1995-96 and that spawning of these individuals might begin in the following two years.

The UNM-NMGF larval fish drift study, the primary focus of which was to determine spawning period, identify approximate location of spawning sites, and assess the effects of annual hydrology (and temperature) on Colorado pikeminnow reproductive activities, provided similar information for other members of the ichthyofaunal community. At the November 1996 San Juan River Biology Committee integration meeting, it was suggested that a portion of the UNM-led larval fish drift study be expanded to allow for documentation of razorback sucker spawning. However, because reproduction by razorback sucker (March-May) occurred considerably earlier than Colorado pikeminnow (June-July), separate investigations of spawning periodicity and magnitude were necessary for each species.

The most significant potential difference identified between the two studies, besides temporal differences in spawning, was that we were attempting to provide the first documentation of reproduction by individuals (razorback sucker) whose spawning potential had not been determined. Sampling for larval razorback sucker was being conducted with no assurance that the stocked population of adult razorback sucker would spawn in this system. Conversely, we knew from previous studies that Colorado pikeminnow reproduction had and was still occurring in the San Juan River and, because of this certainty, our larval fish sampling efforts for this minnow could be different than those for razorback sucker.

Numerous Upper Colorado River basin researchers had reported light-traps as one of the best means of collecting larval razorback sucker, we elected to use that sampling procedure during the first year (calendar year 1997) of sampling. The only previous San Juan River fish investigation that had employed light-traps was in 1994-1995 (conducted by the National Park Service) near the San Juan River-Lake Powell

confluence. The 1994 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. No Colorado pikeminnow or razorback sucker were taken in the 1994-1995 light-trap sampling efforts.

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 1997. 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 probably several factors to account for the poor light trap catch rate, a principal factor was the limited access to suitable habitats. Light-traps are most effective when set in habitats with little or no water velocity. During our driving survey of riverine habitats in the region (March 1997), we identified numerous locations that appeared to be suitable sites for light trap sampling. However, we found that high flow in the San Juan River eliminated virtually all previously identified low velocity habitats. Further driving reconnaissance failed to yield additional locations to set light traps. We determined that being limited to specific collecting sites was not the most efficient means of collecting large numbers of individuals.

In 1998 we modified our sampling technique 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 over a wider reach of the river. We conducted sampling forays (n=6) at approximately bi-weekly intervals from 17 April to 6 June 1998 between the Four Corners drift-net station (RM 128.0) and river mile 76.4 (near Bluff, Utah) and used both active (seining) and passive (drift-netting, light-traps) sampling techniques to collect larval fish. The primary sampling method was a fine mesh larval seine (in 1998, we collected more larval sucker in a single seine sample than in all of the 1997 light trap samples). Drift-nets were set periodically to determine if larval sucker comprised a significant portion of the drift community while light-traps were set adjacent to campsites if appropriate aquatic mesohabitats could be located. An inflatable raft was used to traverse this river reach and allowed us the opportunity to sample habitats that were either not formerly accessible or observable under the constraints of the previous sampling protocol.

The 1998 sampling protocol resulted in 183 collections containing ca. 13,000 specimens between river miles 53.3 and 128.0. The majority of these individuals (n=9,960) were larval catostomids. This 43-fold increase in number of specimens, as compared with 1997, provided substantially better resolution of spawning periodicity of the sucker 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. These specimens provide verification of spawning by the re-established population.

In 1999, the study area was expanded to include the San Juan River from upstream of Four Corners (River Mile 128.0) to Clay Hills boat landing (River Mile 2.9). The scope of work for that year included at least one collecting effort between Sand Island and Clay Hills. Seven larval razorback sucker were collected in 1999 between 4 May and 14 June. The seven larvae were taken in backwaters or low velocity habitats located between river miles 96.2 and 11.5. Almost half (n=3) of these individuals were in the newly expanded reach.

There was no substantive change in the sampling protocol or methodology for this project in 2000. There was a marked increase in the number of larval razorback sucker taken in 2000 as compared with 1999 and 1998. Identifications of individuals revealed 129 larval razorback sucker in 24 separate collections. Individuals were collected in low velocity habitats between river miles 124.8 and 8.1. The lower-most

sampling location that yielded larval razorback sucker (RM 8.1) produced over 85 individuals in a single sample (26 May 2000). The uppermost collection of larval razorback sucker was less than four river miles downstream of the upper boundary of the study area on 1 June 2000.

In 2001 the study area was expanded once more to include an additional 14 miles upstream, to Cudei NM (RM 141.5). There was a decline in the overall catch of larval razorback in 2001 (n=50). The decreased number in 2001 compared with 2000 (n=129) is within the normal boundaries of expected sample variation. Razorback sucker were collected at 15 sites, two of which produced more than 10 individuals, and for the first time since 1999, larval razorback (n=2) were collected in light-traps.

The results in 2002 produced informative and interesting data. A total of 813 larval and juvenile razorback sucker was collected during 2002, the largest number taken to date. Twenty collections contained >10 individual razorback sucker and five samples contained >50 individuals. In 2002 razorback sucker exhibited a more uniform longitudinal distribution compared to previous years. Much larger juveniles were collected in 2002 than in previous years. The largest juvenile razorback sucker collected was 54.4 mm TL as compared to 28.8 mm TL for the largest specimen collected prior to 2002. Juvenile razorback sucker comprised 15.9% of all razorback sucker collected in 2002 and were taken throughout the study area.

Due to the continued documentation and increased numbers of razorback sucker larvae collected over the previous years, the study design was altered in 2003. Rather than breaking the river up into upper and lower reaches as was done in previous years, the entire study area was sampled each trip and data analyzed according to the accepted San Juan River Reaches. This change facilitated integration of the larval surveys with that of the other monitoring activities (i.e., small bodied fish, adult monitoring, habitat, etc). Although there was a 41.9% decrease in razorback sucker collected in 2003 (n= 472) compared with 2002 (n= 813), there were 60.2% more individuals collected in 2003 than 1998 through 2001 combined. A total of nine razorback sucker collected in 2003 had pasted from the larval stage into the juvenile stage.

The methods and study area has remained the same since 2003. A total of 41 larval razorback sucker were collected in 2004. Only 19 larval razorback sucker were collected in 2005, but that number increased to 202 in 2006. Juvenile razorback suckers have not been observed since 2003.

To date the results of this investigation have provided nine 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. The sampling process has proven an extremely effective means of monitoring the spatial and temporal range of individuals in this ontogenetic stage of razorback sucker.

This work is being conducted as required by the San Juan River Basin Recovery Implementation Program Monitoring Plan and Protocol dated 31 March 2000. 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.

Study Area

The principal sampling area for this study will be the San Juan River between Cudei New Mexico (RM 141.5) and the Clay Hills boat landing (RM 2.9) just above Lake Powell in Utah. As in all post 1999 sampling efforts, the study will include making collections in reaches of the San Juan River under the jurisdiction of the National Park Service.

Objectives

1. Determine the spawning periodicity of catostomids between mid-April and early June and examine potential correlation with temperature and discharge (Task 4.1.5)

2. Attempt to validate presumed spawning period of San Juan River catostomids using data from the razorback sucker and Colorado pikeminnow larval fish studies.

3. Provide comparative analysis of the reproductive effort of catostomids.

4. Determine the relative annual reproductive success of razorback sucker (Task 4.1.1)

5. Provide annual summaries of monitoring results.

6. Provide detailed analysis of data collected to determine progress towards endangered species recovery in three years and thence every five years.

Methods

Sampling for razorback sucker larvae will be conducted in the San Juan River between river mile 141.5 and river mile 2.9 from early April through early June using sampling techniques that will provide sufficient number of individual fish necessary to meet study objectives. Access to the river shall be acquired through the use of an inflatable raft. The tentative sampling schedule will be once a month between April and June and each sampling effort will encompass the entire study area. Digital photos, GPS readings, and water quality (dissolved oxygen, conductivity, temperature, and salinity) will be taken at each sampling locality.

As previous San Juan River investigations have clearly demonstrated, larval fish most frequently occur and are most abundant in low velocity habitats (i.e., backwaters, pools, and secondary channels), sampling efforts will be concentrated in these mesohabitats. Small mesh seines (1 m x 1 m x 0.8 mm) will be used to collect larval fish from low-velocity habitats. Mesohabitat type, length, maximum depth, and substrate will be recorded for each sample. The length of each seine haul will be determined in addition to the number of seine hauls per site. Catch per unit effort (CPUE), for each seine sample, will be determined as the number of fish per 100 m^2 of water sampled.

All retained specimens will be placed in plastic bags containing a solution of 5% buffered formalin and a tag inscribed with unique alphanumeric code that will also be recorded on the field data sheet. River Mile, standardized for the San Juan River Basin Recovery Implementation Program, will be the primary descriptor used to designate the location of sampling sites. Universal Transverse Mercator (UTM) coordinates and zone will be determined with a Garmin Navigation Geographic Positioning System Instrument for each sampling locality and recorded on a field data sheet whose unique alphanumeric code matches that of the tag in the retained sample.

Preserved collections will be returned to the laboratory where they will be sorted, specimens identified to species, enumerated, measured (minimum and maximum size [mm SL] for each species at each site), transferred to 70% ethyl alcohol, and catalogued in the Division of Fishes of the Museum of Southwestern Biology (MSB) at the University of New Mexico (UNM). Specimens whose species-specific identity is dubious or merit additional verification will be forwarded to Darrel E. Snyder (Larval Fish Laboratory, Colorado State University) for review.

The annual 2008 razorback sucker survey report will present, in summarized tabular form, fish catch rate (per species) for the entire study period as well by river reach. In addition, catch rate between and within reaches will be compared temporally. Detailed collection information (i.e., catch methodology, species composition of the sample, mesohabitat description, physical-chemical habitat characteristics, length and

developmental stage of razorback sucker specimens) will be provided for samples that contain larval razorback sucker.

Specimens will be distinguished and compared by residence status (native versus non-native) and catch rate over-laid with the annual hydrograph. Mean daily discharge data during the study period will be obtained from U.S. Geological Survey Gauge at Four Corners (#09371010), Colorado. The river discharge data will be used to assess the effect of discharge volume on species density estimates.

Products

A draft report for the 2008 larval razorback sucker sampling activities (combined with 2008 larval Colorado pikeminnow sampling activities) will be prepared and distributed to the San Juan River Biology Committee for review by 31 March 2009. Upon receipt of written comments, that report will be finalized and disseminated to members of the San Juan River Biology Committee by 1 June 2009. 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. Original field notes will be retained in the Division of Fishes and collection information will be electronically stored in a permanent MSB database program. These data and any maps generated from them will be available to the San Juan River Biology Committee via hard-copy reports and electronically. Electronic copies of the field notes and collection data will be transferred to the San Juan River database manager.

San Juan River Specimen Curation
Fiscal Year 2008 Project Proposal

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Background

Personnel from the Division of Fishes, Museum of Southwestern Biology (MSB), at the University of New Mexico are responsible for two inter-related programs on the San Juan River. The Fish Division is the repository for specimens collected and retained by researchers with the San Juan River Recovery Implementation Program. Fish taken under these programs are initially sorted by the principal investigator, held until they have submitted their yearly-progress report, and then received by MSB personnel. The collection is accessioned, specimens transferred from formalin to alcohol, identifications verified, individuals enumerated, length ranges recorded (largest and smallest specimen in a collection), collection data verified and transferred to wet labels, and incorporated into a database. It is standard policy at all major Natural History museums (i.e., Smithsonian Institution, Carnegie Museum, University of Michigan Museum of Zoology) that, prior to incorporation into the collection, all specimens be examined by qualified personnel (in that particular field of study) in an effort to verify the original identification and collection information. This system provides a final check (safeguard mechanism) to minimize the likelihood of misidentification of San Juan River fish species with particular attention on Colorado pikeminnow and razorback sucker. Any changes in species identifications that are detected are noted and returned to the principal investigator along with the entire data set (listing of collection locality, collectors, date, original field number, species, number of specimens, length ranges, and museum catalog number).

In addition to performing duties associated with collections curation, we are also responsible for complete processing (sorting, identifying, counting, curating, and reporting) of selected San Juan River collections (Colorado pikeminnow larval fish sampling and razorback sucker larval fish sampling). The samples generated by the aforementioned studies resulted in the collection of over 20,000 larval fish during 1999, 15,000 during 2000, and 96,000 during 2001. In 1999 and 2001, we processed almost 200,000 larval and juvenile fishes collected by the New Mexico Department of Game and Fish and Utah Division of Wildlife Resources. As in the past, deviations in the identifications of those samples have been noted and forwarded to the principal investigators.

The number of fish processed by the MSB Division of Fishes under the San Juan River Basin Recovery Program can fluctuate greatly between years. One reason for vacillation in number of specimens is that samples sent to MSB by non-MSB researchers are not processed until almost one year following collection. This lag between time of collection and MSB processing is necessary as individual researchers must perform preliminary sorting and require the specimens for preparation of their reports. Other factors such as annual variability of sampling conditions and initiation of new or completion of old projects has resulted in marked changes in the number of samples and specimens (As occurred between 2001 and 2002 when drift sampling for larval Colorado pikeminnow was eliminated in favor of seine sampling).

Discussion of this issue with the San Juan River Biology Committee resulted in the recommendation that the annual budget for the San Juan River Specimen Curation and Larval Fish Identification reflect an "average" year of sample processing. Almost all MSB-San Juan River Basin archived samples are the

result of collections made under the San Juan River Basin Recovery Implementation Program Monitoring Plan and Protocol. The Biology Committee recognized that some years would require more effort from MSB than budgeted while other years might not require the same high level of activity. A relatively stable budget allowed for uninterrupted processing of samples and was sufficient to allow the processing of backlogged samples generated during years of exceptionally high fish capture. To date, over 1,000,000 specimens (along with associated locality and ecological data) have been curated into the MSB Division of Fish Collection and are available to researchers.

Study Area

This project does not involve the collection of specimens but instead the processing and curation of samples gathered by the different research components of the San Juan River Research program. The collective sampling area for other researchers will be the San Juan River between the outfall of Navajo Reservoir and the Clay Hills boat landing (RM 2.9) just above Lake Powell in Utah.

Objectives

1. Provide a permanent repository for San Juan River fish collections, field notes, and associated data
2. Verify species identifications, enumerate specimens, and report to principal investigators
3. Maintain a GIS reference database for current material
4. Assist principal investigators with secondary collection sorting and identifications as time and resources permit

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. Samples are transferred to the Division of Fishes, by the principal investigator of a project, once that individual has completed their work and prepared the necessary reports. (This usually infers a lag-time of one year between collection of specimens and transference to the Division of Fishes). Collections are matched with the appropriate data-sheet, transferred from formalin to alcohol, stored in museum quality jars, re-identified, counted, measured (range), labeled, and catalogued into the permanent MSB Fish Division collection and placed on the shelves in the light and temperature controlled collection room. All data associated with the specimens are entered into the database of the Division of Fishes and subsequently copied to the San Juan River database.

In addition to the aforementioned responsibilities, the Division of Fishes is available and has frequently assisted principal investigators by taking on the added responsibility of processing (a limited number) of their unsorted collections (without requesting additional funding). Specimens are sorted, identified, counted, measured, catalogued, and data submitted to the principal investigator for inclusion in reports. In cases where the amount of backlogged material in the possession of the principal investigator was beyond our capabilities, supplemental funds have been sought so that additional personnel can be hired (under the supervision of the permanent staff) to process the excess material.

Products

A draft report of the 2008 San Juan River specimen curation and larval fish identification sampling activities will be prepared and distributed by 31 March 2009 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 2009. 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. Original field notes will be retained in the Division of Fishes and collection information will be electronically stored in a permanent MSB database program. Electronic copies of the field and collection data will be transferred to the San Juan River database manager following the successful protocol previously employed.

Peer Review for 2008
Fiscal Year 2008 Project Proposal

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Background

A Peer Review Panel was established in 1997 to assist the SJRIP with reports and plans for future studies. The 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 2008. It is anticipated that the Panel will meet with the Biology Committee at three meetings during the year; the December 2007 Planning meeting, the February/March, 2008 Researcher's meeting (combined with the Coordination Committee), and a May, 2008 meeting to finalize 2009 SOWs. Additionally, the Peer Reviewers will likely be asked to attend an additional meeting in conjunction with the Annual Researcher's meeting whereby they are asked to comment as a group on all aspects of the Program and Workplan. At this meeting the Peer Reviewer's will be tasked to review all activities of the SJRIP and possibly assist in the development of a Sufficient Progress Report. In 2008 the SJRIP will begin another Data Integration Review and the Program expects that the Peer Reviewers may be asked to participate in that activity.

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 FY2008 three times to review monitoring and research progress and to discuss scopes of work for 2008. 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, letter or verbal reports from each peer reviewer on an as-requested basis.

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Geomorphology-Temperature-Habitat Mapping
William Miller

Technical Approach

Element 1. Water Temperature

Background

Eight temperature recorders have been in place since summer of 1992 at the locations shown in Table 1. 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. Table 1 also shows the periods of record at each site. The missing data were caused by equipment problems or vandalism.

Proposed Methods

Data Collection

Onset Corporation HOBO Water Temp Pro loggers with built-in thermocouple temperature sensors will be installed in the locations described in Table 1. Loggers will be installed in existing enclosures that have been used over the past 15 years. Where enclosures are deteriorated, missing or badly placed, they will be upgraded as necessary to provide protection to the equipment.

The recorders will be inspected and read twice each year, once in the spring and once in the fall. Battery condition will be monitored and loggers changed out when the battery life falls below that required to continue until the next reading point.

Following each download, data will be quality checked and bad data removed. As noted in the background, 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 will be 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 2. 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 3. Table 4 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

- An annual draft report prepared and submitted by March 31, 2008
- A final report submitted by June 1, 2008.

- An updated temperature database with all data collected to date, updated through September 2007 by June 1, 2008.
- Attendance at the annual report meeting and one additional Biology Committee meeting

Table 1. Water temperature monitoring locations and period of record

Location	RM	Period of Record
Active Temperature Recording Sites		
Near Navajo Dam	225.0	7/9/1999 to 9/15/06
Archuleta - San Juan at USGS Gage Location	218.6	7/23/92 to 9/15/06
Farmington - San Juan at USGS Gage Location	180.1	8/5/92 to 1/16/96, 7/8/99 to 11/4/01, 10/3/02 to 9/15/06
Shiprock - San Juan at USGS Gage Location	148.0	7/8/99 to 9/16/06
Four Corners - San Juan at USGS Gage Location	119.4	10/7/94 to 3/11/96*, 7/9/99 to 10/19/06
Montezuma Creek - San Juan at Montezuma Creek Bridge	93.6	8/9/92 to 1/11/93, 2/25 to 3/14/93, 4/14 to 5/10/93, 5/28/93 to 3/11/05, (sensor stolen. Replaced 10/31/05) 10/31/05 to 9/16/06
Mexican Hat - San Juan near Bluff Gage Location	52.1	7/9/99 to 3/27/02 , 9/18/02 to 8/1/06
Farmington - Animas at USGS Gage Location	n/a	8/5/92 to 4/14/97, 5/7/97 to 8/26/97, 10/15/97 to 6/4/98, 7/8/99 to 9/15/06

Table 2. 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 3. Daily temperature summary table format

AnimasFarminton				
ID	**RecDate**	**Tmax**	**Tmin**	**Tavg**
AF	7/8/1999	22.11	18.36	19.2225580437239
AF	7/11/1999	20.13	15.81	17.9729165037473

Table 4. 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

Element 2. Habitat Mapping

Background

Habitat mapping completed during the period 1992 - 1997 has been used to develop flow/habitat relationships used in the flow recommendation process (Holden, 1999). Annual habitat mapping was included in the San Juan River Basin Recovery Implementation Program (SJRIP) long-term monitoring program in 1998 and has continued through 2006. Results from 1998 through 2002 where used to evaluate the flow recommendations, resulting in a recommendation to examine modification of operating rules to focus more heavily on the high flow portion of the recommendations (Miller, 2005).

Proposed Methods

Base Photography Preparation

USBR will acquire digital videography of the San Juan River from the San Juan River at the Animas River confluence (RM 180) downstream to below Clay Hills Crossing (RM 0). We will coordinate with USBR to acquire the videography at a flow of 500 to 1,000 cfs in late July. Digital single frames will be captured from this videography to provide full coverage of the river with about 20% overlap. River mile marks will be placed on these frames using the SJRIP standard river mile GIS coverage. These frames will be printed in color on 8 ½" by 11" sheets marked and numbered by rivermile and a sequential letter designator for the number of frames per mile (e.g. 180a, 180b, etc). The map scale depends upon the scale of the photography, so we will coordinate with USBR to obtain a map scale between 150 and 200 ft/inch when printed on 8 ½" by 11" sheets. Each map sheet is also marked with match lines, placed in plastic sheet protectors and organized in binders for the field mappers.

In addition, base photography maps will be prepared at a scale of approximately 1inch = 75 feet for the two detailed study reaches discussed in Element 3. The digital frames captured for these detailed reaches will be rectified to 2005 digital orthographic quads (DOQ's) prior to printing the field maps. Field maps will be printed on 11" x 17" pages and included in sheet protectors for field mapping.

Field Mapping

The 27 aquatic habitat types and 5 associated terrestrial types listed in Table 5 will be delineated on the base photographs by visual inspection. Mapping will be completed by floating the river in rafts in autumn at flows between 500 and 1,000 cfs. Secondary channels that cannot be floated or seen from the main channel will be walked. Reaches of the river that are very complex may be floated twice or by two boats to

provide access to all the channels. Each polygon delineated will be marked with its corresponding code, as shown in Table 5. The date of mapping will be recorded on the beginning map sheet for each day's mapping along with the name of the mapper.

All mappers will be experienced in mapping aquatic habitat in the San Juan River. 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.

Mapping will be completed in as short a time span as is practical. A minimum of one week is typically required, but disruption by storms or flow changes can extend the period while flows recede to within target range. In some years it is difficult to find a period when flows are below 1,000 cfs for the required time. In the event that this occurs, mapping will be completed before the end of November at the lowest flow possible.

Following field mapping, the field sheets will be reviewed and missing codes or non-closed polygons corrected prior to processing.

The detailed reaches will also be mapped at a scale of 1 inch = 75 feet at the same time as the standard mapping, focusing on capturing increased level of detail. Mapping detail will be calibrated to habitat use data collected as a part of Element 3.

Data Processing

Once the field mapping sheets are reviewed and edited, they will be scanned at a resolution of 300 dpi and then rectified to 2005 DOQ's to remove distortion. After rectification, the habitat polygons will be digitized and coded in ArcView 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 river mile for analysis. Average flow at mapping by geomorphic reach will also be extracted from USGS gage data, using the gage or gages most representative of the reach.

The same process will be used for the detailed reach mapping. The detailed reach results will be processed for inclusion in the March 2008 report.

Table 5. Eight general categories of habitat types on the San Juan River

Low Velocity Types	Run Types	Riffle Types	Back-Water Types	Shoal Types	Slack-Water Types	Vegetation Associated Habitat Types	Associated Terrestrial Types
pool	shoal/ run	riffle	back water	sand shoal	slack water	overhanging vegetation	cobble bars
debris pool	run	shore riffle	back water pool	cobble shoal	pocket water	Inundated vegetation	sand bars
rootwad pool	scour run	riffle chute	embay-ment				islands
eddy	shore run	shoal/ riffle					boulders
edge pool	undercut run	chute					rootwad piles
riffle eddy	run/riffle	rapid					

Data Analysis
The habitat data will be summarized by the eight main habitat categories and change analyzed from previous mapping runs at similar flow rates. Habitat distribution of the major categories will be mapped to demonstrate spatial distribution and for comparison to previous years.

Change in channel complexity will be assessed by examining island count and habitat polygon abundance per river-mile.

Since all mapping has not been completed at the same flow rate and some habitat categories are very sensitive to changes in flow in the 500 to 1,000 cfs range, habitat area will be normalized by computing flow-habitat relationships and then analyzing the residuals, adjusted to reflect mean habitat area with time, for trend analysis. Trend analysis will be completed by geomorphic reach and as a whole for habitat categories that show change with time.

Response of key habitat categories to antecedent river flow conditions, particularly during spring runoff will be analyzed after the 2007 data have been processed, per the schedule indicated in the long-term monitoring program (2002 and every 5-years thereafter).

Data analysis for the detailed reaches is included in Element 3.

Schedule

Base photography will be acquired in late July 2007 (flow permitting) and the base maps prepared in early August 2007. Mapping will be completed anytime between late September and November 2007, depending on flow conditions. Data processing will occur between December 2007 and September 2008, with data analysis and reporting by March 31, 2009. The report produced in March 2008 will include the results from the 2006 mapping. The scanning and digitizing process cannot be completed in time for the March 2008 report deadline, postponing the report until March 2009. This has historically been the schedule.

Deliverables

The following deliverables are associated with this task:

- Report of findings at annual researcher's meeting
- Draft report, March 2009
- Final report, June 2009
- ArcMap shapefile and database with habitat data, June 2009
- Attendance at the annual report meeting and one additional Biology Committee meeting

Element 3. Geomorphology

Background

The data integration analysis (Miller, 2005) 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 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.

In 2005, detailed reaches were established at RM 137 and RM 82 to study the response of these complex reaches to flow, 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 fish in the San Juan River (Bliesner and Lamarra, 2006).

The objectives as listed in the RFP are:

1. Annually survey each of the two detailed reaches, identified in Element 2 above, at sufficient density and detail to allow two-dimensional modeling of the hydrologic processes involved in forming and maintaining the reach.

2. Based on the survey data collected under Objective 2, select a modeling platform and develop a two-dimensional steady state model of each detailed reach.

3. Use the data collected through habitat mapping to better define the relationships between hydrology and channel morphology and habitat in response to both river stage and antecedent conditions.

Proposed Methods

Following are the methods proposed to meet each of the objectives listed above.

Annual Survey of Detailed Reaches

Each detailed reach will be surveyed with sub-centimeter real time kinematic GPS equipment at low flows in late summer or early autumn after the runoff hydrograph is complete. Only areas below high water in 2007 will be surveyed, as the base data for topology above this elevation completed in 2005 and 2006 is adequate. The 2005 surveys were completed in cross-sections (Bliesner and Lamarra, 2006). In 2006 the survey method was changed to longitudinal survey lines with an average point density of about 30 m^2 to better accommodate modeling requirements (Bliesner and Lamarra, 2007). Longitudinal surveys are proposed for this work as this allowed better model calibration. In areas of complexity, point density will be increased as needed to describe the topology. In addition, break lines and waters edge will be surveyed.

At each survey point the substrate will be noted as cobble/gravel, sand or bedrock. At the same time as the survey, Wolman pebble counts (Wolman 1954) with 100 samples each, will be completed in areas of cobble/gravel substrate to further define the substrate size. Up to ten locations in each reach will be characterized. The zones will be selected to describe a range of gradient and velocity conditions and to cover areas of both deposition and scour. Locations will be practically limited to water depths less than 0.75 m.

Data collected in this survey will be used to develop the topology of the channel and floodplain in each reach. A three-dimensional surface will constructed in AutoCad for this survey and compared to a similarly constructed surface using the 2006 survey data. Scour and deposition in each detailed reach will be determined by subtracting the three-dimensional surface created with the 2006 survey from that created from the 2007 survey. The difference represents average net change in elevation, with a positive difference indicating net deposition and a negative difference indicating net scour. Perspective images will be generated showing locations of scour and deposition to identify where change occurred in response to antecedent flow conditions. Only the active channel up to the high water line in 2007 will be included in the analysis.

For areas of cobble/gravel scour and deposition, the median cobble diameter (D50) determined from the Wolman pebble counts will be computed. Boundary shear stress calculations will be completed for the velocities predicted by the model in these areas at the high flow in 2007. These values will be compared to insipient and significant motion requirements for the D50 cobble sizes the major scour/deposition areas of the reach. If the insipient and significant motion calculations indicate transport possibility at less than high flow, the threshold flow for these conditions will be estimated at the major deposition or scour locations.

Two-dimensional steady state model

The resulting topology of the channel and floodplain in each reach described above will also be used for hydrodynamic modeling. The model chosen for analysis is River2D[1]. River2D is a two dimensional depth averaged finite element hydrodynamic model that has been customized for fish habitat evaluation studies. Three of the four modules that are a part of the River2D model suite will be used: R2D_Bed, R2D_Mesh and River2D.

The modules are used in succession. A preliminary bed topography file (text) is first developed from the field survey data, then edited and refined using R2D_Bed. The resulting bed topography file is used in R2D_Mesh to develop a computational discretization as input to River2D. River2D is then used to solve for the water depths and velocities throughout the discretization. Finally, River2D is used to visualize and interpret the results and can be used to perform PHABSIM type fish habitat analyses. In the San Juan River, habitat mapping data will be compared to velocity and depth information generated by the model for interpretation at calibration points and extrapolation to other flow conditions. This is an iterative approach at various stages, including modification of the bed topography, for refinement and calibration of the model of the two reaches.

The model is initially calibrated to measured water surface elevations at the time of survey. The roughness is adjusted to calibrate to water surface elevation. The model refinement and calibration is an extensive process whereby the field data points are supplemented with the placement of break lines to best describe the topology and input of roughness height that is judged by the attributes of the bed (fines, gravel, cobble, or vegetation type) collected during survey. Additional calibration is accomplished by measurement of water surface elevation (water's edge) at higher stage flows during spring runoff.

The model will be operated with the 2006 calibration against 2007 water surface profile prior to re-calibration to 2007 data. In 2006, there was substantial improvement in calibration by updating the bed file with the 2006 data, so it is probable that all but extreme drought years will require recalibration.

Refine the Hydrology/Morphology/Habitat Relationships by Integrating Habitat Data

A four-step process is involved in refining the hydrology/morphology/habitat relationships that were used in defining the flow recommendations using detailed reach data:

Step 1. The first step is to refine the habitat definitions by completion of Element 4 of this proposal. In 2006, model results indicate availability of a substantial amount of low velocity habitat along channel margins, confirming field observations over the last 10 years that such habitat exists. This edge habitat has been very difficult to map in the standard habitat mapping because of the small scale and the lack of identification of its relative importance. Element 4 provides information on its importance and the edge features that are needed, while model results help in developing mapping criteria (e.g. typical width of a desired depth and velocity). Data collection for Element 4 will occur in late July or early August, 2007. This will help refine definitions of habitats used by age 1 Colorado pikeminnow and other native fishes.

Step 2. The refined definitions developed in this data collection effort will be utilized in the fall detailed mapping of the detailed reaches. These data will be processed to assess other factors that may be important such as distance to waters edge, proximity to other habitats, etc.

Step 3. The calibrated model will be used to predict depth, velocity and substrate conditions as well as proximity to channel margins that may provide cover at flows other than those mapped. While this does not directly indicate location of these habitats within detailed reaches, it will allow an assessment of relative availability between flow rates.

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[1] Developed by the University of Alberta. www.river2d.ualberta.ca

For this step, a range of depth/velocity preferences may be developed for a certain habitat category based on data collected in step 2. The availability of these weighted conditions at the mapped flow will be assessed and related to mapped habitat. With the assumption of constant relationship between the modeled and mapped condition, availability at different flow may be estimated by applying this relationship to the weighted usable area calculated by the model at another flow for each habitat so defined.

Step 4. The relationship of habitat availability to antecedent runoff flow conditions (e.g. duration and frequency of flows above a certain level) can be analyzed only to the extent that the change in morphology in the detailed reaches can be related to flow conditions and then flow conditions to habitat availability. This requires multiple years of data over a range of flow conditions to calibrate the model. After the 2007 season, there will only be two data sets to begin developing these relationships and only the 2007 data set will include cobble size data. The study was originally proposed as a 5-year study to provide sufficient data to begin relationship development. Data collected in 2007 will be adequate to begin forecasting channel change, but insufficient calibration data will be available to complete the analysis. The cobble transport calculations begun in 2007 can be used in future years for this analysis, but no attempt will be made to develop this relationship in 2007.

Deliverables

The following will be provided for this element:

- Configured and calibrated River-2D model for each of the two detailed reaches with associated bed-files and output, June 1, 2008
- Report of findings at annual researcher's meeting
- Draft report, March 31, 2008
- Final report, June 1, 2008
- Attendance at the annual report meeting and one additional Biology Committee meeting

Element 4. Habitat Use of Young-of-Year Endangered Fish

Background

During integration of San Juan River Basin Recovery Implementation Program (SJRIP) monitoring data from 1999-2003, it became obvious that integration of habitat data and fish data was extremely difficult (Miller 2005) since these two data sets were taken at different levels of detail. Adult fish monitoring data were too coarse to allow correlation with habitat data while habitat mapping units were too large to see details that were often the focus of sampling by larval and juvenile fish sampling programs. While larval and small-bodied fish sampling collect habitat data, the habitat categories do not match those in the habitat mapping program. Finally, although GPS locations are provided for recently collected larval and small-bodied fish sampling programs, the accuracy is not sufficient to place them on the habitat maps with sufficient precision to correlate the two data sets.

Backwater habitat has been theorized as important to larval and young juvenile endangered fishes. Backwater habitat is low in abundance in the San Juan River and has declined substantially since 1995 (Bliesner and Lamarra, 2006). However, sampling for age 0 and age 1 Colorado pikeminnow in the last several years has indicated that they use other low velocity habitat that is not necessarily mapped by the standard mapping program (Golden, et al, 2006).

To identify the habitat utilized by young endangered fishes and to provide information to allow this habitat to be mapped more broadly in the river, the following objectives as stated in the RFP will be addressed in Element 4:

1. Sample for young-of-year Colorado pikeminnow and razorback sucker within the two complex reaches to determine habitat use of endangered fish.

2. Map habitat in each complex reach each time fish sampling occurs.

3. Use supplemental data on young Colorado pikeminnow and razorback sucker captures of any size class throughout the San Juan River from other SJRIP sampling efforts and use these data to add to the habitat use information in the complex reaches.

The mapping, combined with detailed channel topology measurements and hydraulic modeling, would also provide insight into the mechanism or process for creation and maintenance of these complex reaches and provide a better understanding of the loss or creation of backwater habitats or other low velocity habitats used by the endangered fishes.

Proposed Methods

Detailed Reach Fish Survey and Habitat Mapping:
The two complex reaches will be sampled once in late July or August 2007 during base flow (normally recommend March and July for pre- and post-runoff conditions) for young endangered fishes. Each complex reach will be thoroughly sampled twice for a total of three days per reach to increase sample density in all habitat types and improve the likelihood for sampling the rare fish. The second sample will be conducted at each site with at least one day of "rest" to minimize impacts from sampling activities. The two samples will allow for a more thorough sampling of the complex reach at essentially one time/flow period, increasing the chance that young endangered fish will be caught. The following procedure will be followed:

- Habitat will be mapped for a reach at the detailed level described Element 2 above.
- Each of the previously defined habitat types (Bliesner and Lamarra, 2006) mapped will be identified for abundance, and habitats to be sampled will be randomly selected in general relation to their abundance before each of the two sampling runs, except for runs and riffles which dominate the San Juan River. Runs and riffles will be sampled but to a lesser degree than they are represented in the reach since they generally are over 90 percent of the habitat in the San Juan River. All backwaters, shoals, and other low-velocity habitats, habitats known to be preferred by young Colorado pikeminnow (Golden et al. 2006) will be sampled. A block seining technique using a 9 m x 2 m x 6 mm double-weighted seine at the bottom of a sample and another similar seine to work down to the bottom seine will be used in the July-August monitoring trip.
- The approximate area sampled in each location will be drawn on the base map overlaying the habitat mapping as the sample is taken.
- During fish sampling, additional habitats will be mapped that correspond to areas sampled for fish that were too small to include in the original mapping. Habitat descriptions will also be refined if needed to best describe sampling sites.
- Following sampling, depth, substrate, velocity and cover will be measured in the sampled area. Depths and velocities will be taken at three locations with both depth and velocity measured at the same location to represent the average conditions in the sampled area. Care will be taken to target only one habitat type during individual seine hauls. If the sampled area crosses several habitats, at least one set of depths and velocities will be taken in each habitat type. Velocity vectors will be sketched on the habitat map at each location.

Information collected at each seining location will include: river mile location, GPS location (UTM), habitat type, cover, seine type, water temperature, area sampled (length and width), depth and velocity at three or more locations, cover, and substrate type. All fish collected, except for larvae, will be identified to species and counted. Up to 50 randomly selected individuals of each species will be measured at each complex reach except for Colorado pikeminnow and razorback sucker, which will all be measured. This

will provide information on the general size and age of the fishes that are collected at each reach during each sampling trip and the habitat use of these fishes. Native fishes will be returned to the habitat alive, and nonnative fishes will be retained. A separate data sheet will be used for each seine location. Multiple seine haul runs may be made in large (>100 m^2) habitats.

A PIT tag reader will be taken on sampling trips. All Colorado pikeminnow and razorback sucker over 150 mm TL captured during sampling will be scanned for PIT tags and tagged if they do not already have a PIT tag. If PIT tags are present, the number will be recorded.

Obtain Other Endangered Fish Capture Data.
It is anticipated that data on Colorado pikeminnow and razorback sucker habitat use will also be collected by other SJRIP studies within the complex reaches, as well as outside those reaches. In 2007, one trip each will be scheduled with the larval fish study and the small-bodied monitoring program to standardize nomenclature for habitat mapping. Maps of the detailed reaches will be provided to crews for each study. Data on larval fishes will be obtained during the annual April-June razorback sucker larval fish and July-September larval Colorado pikeminnow surveys currently being conducted under the SJRIP (Brandenburg and Farrington 2006). Additionally, the fall standardized small bodied fish sampling (Paroz et al. 2006) will also provide information on fish captures by habitat type in the complex reaches and at other locations. Adult monitoring (Ryden 2006), and nonnative removal studies (Davis 2006, Jackson 2006) will begin to obtain GPS points for larger endangered fish captures in 2007, which may provide a means to correlate pikeminnow and razorback habitat use at the time of capture to larger scale mapped habitats, although at a gross scale. With sampling efforts occurring throughout the year, these data can provide greater seasonal habitat use information. Capture data and the associated habitat information will be gathered from the respective researchers for all sections of the river and any captures that occurred within the complex reaches will be analyzed with the capture data from the field efforts from this study. Additional captures and the corresponding habitat information outside the complex reaches will be evaluated, but habitat mapping for these areas will be coarse and will not provide the same scale for detailed analysis as gathered by this study in the complex reaches. The results will be used to verify the more detailed habitat use information collected within the detailed reaches as the level of detail of this opportunistically gathered data allows.

Analyze Fish Capture/Habitat Utilization Data.
Habitat use information for endangered fish will be developed using all capture data from this complex reach study, as well as information from other studies with reliable habitat information. Data from the second pass will be tested to determine influence of the first sampling pass on the second pass results. Any influence found will be considered in the analysis of the full data set. Individual sample habitats noted during the fisheries sampling efforts will be compared with the habitat availability developed from the habitat mapping portion of the study during each sample period. It is intended that the proportional use of individual habitat types will be evaluated relative to all habitats sampled using a chi-square goodness-of-fit test (Muhlfeld et al. 2001, Golden et al. 2006) to show habitat preference. Other statisitical methods may be employed as the data warrant. The habitat use/preference information developed through this analysis will be used to determine the habitats important to the fish and those to be looked at closely in modeling.

Information on fish gathered by other studies noted in #4 above may not fit all the requirements (all habitat types sampled, randomness, available habitat mapping) of the chi-square goodness-of-fit analysis. These data, along with capture data from outside of the complex reaches, will be summarized and compared to the habitat use information from this study. This may provide information on habitats not easily sampled with seines, potentially expanding the habitat use information.

In addition, the basic fishery information from the complex reach sampling will be collated and summarized to show effort, fish captured, CPUE, endangered fish size and other pertinent information.

These data will be presented for all fish species and the summary of this information included in the annual report.

In addition to analysis of habitat use by the endangered fishes, the habitat usage by each member of the fish assemblage will be analyzed (when sufficient data exist) and compared to usage by the endangered fish. By using the full assemblage, statistical power is added to the relationship analysis, particularly in the event that endangered fish captures are small in number in the two reaches.

If the number of fish captures is too small to provide statistically significant results, recommendations will be made to modify the sampling plan for any future studies to obtain adequate numbers of young Colorado Pikeminnow.

Deliverables

The following will be provided for this element:

- Draft report, March 31, 2008
- Final report, June 1, 2008
- GIS shape files and database files of habitat mapping and fish capture data
- Attendance at the annual report meeting and one additional Biology Committee meeting

Non-native species Monitoring and Control in the Upper San Juan River
Fiscal Year 2008 Project Proposal

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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 (Element 3). Sub-elements encompassed within this scope of work include:

Task 3.1.2	Annually conduct removal efforts in river sections determined to be of highest priority (e. g., lower section containing nursery habitat and upper sections with large concentrations of nonnative fish).
Task 3.1.3	Develop a schedule of removal actions that incorporate river flows and seasons that provide the desired results.
Task 3.1.4	Evaluate mechanical removal effectiveness by analyzing trends in catch rates, length distributions and populations size of nonnative fishes with emphasis on channel catfish and common carp including small bodied fishes.
Task 3.1.6	Evaluate both large and small-bodied native fish response to mechanical removal efforts.
Task 3.1.11	Conduct annual review of nonnative fish removal program; evaluate whether nonnative fish program is adequate to achieve goals, update the nonnative fish program as needed.

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 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 Fishery Resources Office (NMFRO) 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 scaled back 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 increase our number of sampling trips to include four trips from Shiprock to Mexican Hat in FY 2008. 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 Montezuma Creek, Utah (RM 93.6). In addition, one sampling trip will continue downstream of Montezuma Creek to Mexican Hat, Utah (RM 52.9).

Objectives

1. Continue data collection and mechanical removal of large bodied non-native fish during main channel and rare fish monitoring efforts.

2. Evaluate distribution and abundance patterns of non-native species to determine effects of mechanical removal.

3. Characterize distribution and abundance of endangered fish in the upper and middle reaches of the San Juan River.

4. Relate distribution and abundance patterns of both common and uncommon native fishes to nonnative removal.

5. Establish measurable criteria for evaluating removal effectiveness of nonnative fishes in the system to achieve recovery goals.

6. Continue and expand transplantation of channel catfish to closed impoundments isolated from the San Juan River with the assistance of New Mexico Department of Game and Fish, Navajo Nation Fish and Wildlife Service and the SWTFC.

Methods/Approach

Data Collection:

Mechanical removal will continue during the fall main channel monitoring efforts. During these sampling efforts, all non-native fishes collected will be sacrificed and data recorded for species identification and enumeration, ontogenetic stage (young-of-year, sub-adult, adult) at non-designated miles, and standard and total lengths and weight at designated miles.

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 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.

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.

Data Analysis

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 comparisions 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 2008):

PNM to Hogback-	4 trips
Hogback to Shiprock-	4 trips
Shiprock to Mexican Hat	4 trips
Total # of trips-	**12 trips in FY 2008**

Products/Schedule

An electronic data file will be provided for inclusion in the centralized database by 31 March 2009. A draft summary report detailing findings will be submitted to the San Juan River Implementation Program, Biology Committee, by 31 March 2009. Revisions will be completed and a final annual report will be submitted by 1 June 2009.

Literature Cited

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Nonnative Species Control in the Lower San Juan River
Fiscal Year 2008 Project Proposal

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Background

The lower San Juan River is particularly important in the recovery of the Colorado pikeminnow (*Ptychocheilus lucius*) and razorback sucker (*Xyrauchen texanus*) since it contains typical nursery habitat similar to what is present on the Green and Colorado rivers. Within the past five 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). In 2003 and 2004, 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). 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) 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 (*Sander vitreus*) 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 2006. In 2006, two adult gizzard shad were captured below the waterfall indicating another possible nonnative fish of concern.

Over 45,000 channel catfish and approximately 2,900 common carp were mechanically removed from the lower San Juan River from 2002 to 2006. A decrease in mean total length (TL) of channel catfish was observed between 2002 and 2004, indicating that removal efforts are causing a shift in the population size structure to smaller individuals. Additionally, shifts in sized structure of channel catfish have been reported further upstream (Davis 2005) and on a river-wide scale (Ryden 2005). Catch rate of adult channel catfish also decreased from 4.9 adult catfish per electrofishing hour in 2002 to 2.0 adult catfish per electrofishing hour in 2006 in the lower San Juan. Furthermore, similar shifts in yield and population structure have been observed in sport and commercial fisheries as the rate of exploitation increased (Bennet 1971; McHugh 1984, Pitlo 1997). Continued removal of all size classes of channel catfish in the San Juan River may eventually lead to decreased fecundity and a reduction of the overall population, therefore lessening the impact that these fish have on the native and endangered fish community.

A significant decline in catch rates of common carp was observed from 2002 to 2006. Between 2002 and 2006, 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 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 in the lower San Juan River stocked from 2002 to 2005. Preliminary population estimates for juvenile Colorado pikeminnow residing in the lower San Juan River were generated in 2004, 2005 and 2006 from recapture data. And finally, during 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 3.1 of the Long Range Plan, in the lower San Juan River from Mexican Hat to Clay Hills, and sampling just below the waterfall at Piute Farms. Since it is likely that striped bass and other fish are unable to navigate the waterfall, sampling below the waterfall will determine their presence or absence. If they are there, we can continue to document the riverine and lacustrine conditions related to their movement. This study will serve to determine the most effective time for removal actions, so that more intensive and specific removal efforts may be employed in the future when Lake Powell is once again influencing the lower San Juan River. The presence of the waterfall at Piute Farms may provide a rare opportunity to concentrate on removal of other nonnative fish while influx from the lake is eliminated. Continuing 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 document the progress of Colorado pikeminnow and razorback sucker in the lower San Juan River. Recapture data for juvenile Colorado pikeminnow collected during nonnative removal will serve in determining population size, growth and movement of these fish in the

lower San Juan River. Furthermore, conducting work below the waterfall will provide information on endangered fish that may be present and unable to move upstream.

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. Additionally, sampling will be conducted just below the waterfall at RM-0.5. 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 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. Characterize 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.
5. Characterize abundance of endangered fish in the San Juan River just below the waterfall.
6. Characterize abundance of reservoir immigrants (striped bass and walleye) moving out of Lake Powell into the San Juan River upstream to the new waterfall.
7. Relate striped bass movement from Lake Powell into the San Juan River to lake and river conditions (including temperature, flows and turbidity).

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. In addition, a variety of sampling methods will be used below the waterfall, including hoop and trammel netting, seining, hook and line, and electrofishing, if possible. Five sampling events will take place at the waterfall, most likely between April and August.

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 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 2009. 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 2009. Electronic copies of the field and collection data will be transferred to the San Juan River database manager following the successful protocol previously employed.

PIT TAGS
2008 Project Proposal

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801-524-3835

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 Chuck McAda 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 – 2008

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

In FY2007, $45,000 was allocated in the workplan to purchase PIT tags. In January, 2007 an additional $115,000 was used to purchase another 38,360 PIT tags using money that was leftover from FY2006 annual funding. The purchase of PIT tags and readers was done under a fully competed contract with BioMark in Boise, ID.

The purchase of additional PIT tags in 2007 resulted in surplus tags that can be used in 2008. As a result, the estimated annual budget for the purchase of tags in 2008 was reduced to $20,000. In subsequent years when no tag surplus exists, it is expected that a full allocation will be needed to purchase tags.

Stocking of Fingerling Colorado Pikeminnow and Reporting of 2007 Results
Fiscal Year 2008 Project Proposal
6 February 2007

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Background

Colorado pikeminnow is a federally-listed endangered fish native to the San Juan River. The capture of low numbers of Colorado pikeminnow of all life stages over the past ten years has confirmed that a small, but reproducing population of Colorado pikeminnow still exists in the San Juan River. In 1996, experimental stocking of Colorado pikeminnow into the San Juan River was undertaken by the Utah Division of Wildlife Resources (UDWR). The purpose of this effort was to evaluate dispersal and retention of stocked juvenile Colorado pikeminnow as well as determining the availability, use, and selection of habitats critical to early life stage Colorado pikeminnow. Between 1996 and 2000, approximately 832,000 larval and age-0 Colorado pikeminnow were stocked into the San Juan River by the UDWR. In addition, 197 adult Colorado pikeminnow have been stocked into the San Juan River, 49 in 1997 and 148 in 2001. To date, there have been several thousand recapture events with stocked juvenile and adult Colorado pikeminnow during either seining or electrofishing efforts. A handful of the individuals stocked in 1996 and 1997 have been documented as having recruited into the San Juan River adult Colorado pikeminnow population. Based on data collected from these experimentally stocked fish, it was apparent that stocked, hatchery-reared, juvenile Colorado pikeminnow could survive in the San Juan River and could provide a viable method of supplementing the numbers and expanding the range of the wild San Juan River Colorado pikeminnow population.

The need for artificial propagation and augmentation of this species in the San Juan River is apparent for several reasons. Augmentation of Colorado pikeminnow would increase population numbers, provide more individuals for research purposes, add genetic diversity to the existing gene pool, and provide a riverine refugia population that would, hopefully, remain stable until further research can identify factors limiting successful recruitment of this species in the San Juan River. The San Juan River Long Range Plan identifies the need to assess the feasibility of, and then implement the augmentation of Colorado pikeminnow. In January 2003, ***An Augmentation Plan For Colorado Pikeminnow In The San Juan River*** was finalized.

At present, the Long Range Plan is undergoing revision. However, the need to artificially augment the San Juan River's Colorado pikeminnow population is specified in element numbers 1 (specifically in sub-element 1.2), 2 (specifically in sub-element 2.2), and 4 of the latest draft of the Long Range Plan (dated October 30, 2006). Relevant task numbers include: 1.2.3, 1.2.4, 1.2.5, 1.2.6, 1.2.7, sub-element 2.2, 4.1.3, 4.1.4, and 4.1.5.

The first stocking of age-0 Colorado pikeminnow under the direction of this augmentation plan took place in October 2002 (while the augmentation plan was still in draft form). Since that time, age-0 Colorado pikeminnow have been stocked annually into the San Juan River, in roughly equal numbers at two separate sites (RM 180.2 and RM 158.6). These stockings have taken place in either late October or early November of each year. Between 2002 and 2006, some 1,282,470

age-0 Colorado pikeminnow were stocked into the San Juan River at these two stocking sites. The 2007 stockings of age-0 Colorado pikeminnow have not yet taken place, but are scheduled to be conducted in fall 2007. The Colorado pikeminnow augmentation plan calls for a minimum of 300,000 age-0 Colorado pikeminnow to be stocked at roughly the same stocking locations in each of the next two calendar years (i.e., 2008 and 2009).

In 2005, an addendum to the Colorado pikeminnow augmentation plan was finalized (Ryden 2005). This addendum justified the need to stock an additional 3,000 age-1 (~150 mm TL) Colorado pikeminnow annually to supplement concurrent stockings of age-0 fish. These stockings of age-1 fish were to occur in each of the last four years (2006-2009) of the scheduled eight-year stocking period. On 3 October 2006, the first stocking of age-1 Colorado pikeminnow (n = 3,200) into the San Juan River under the direction of the stocking plan addendum occurred at RM 158.6.

Since 2003, various groups of Colorado pikeminnow being reared by other agencies for recovery efforts outside the San Juan River basin have become available to SJRIP for a variety of reasons. These fish have been stocked into the San Juan River, opportunistically, as they have become available. They include groups of age-1, age-2, and age-3 fish obtained from CDOW's Mumma Native Species Hatchery (n = 13,777) between 2003 and 2006, a group of age-1 fish obtained from Dexter NFH&TC (n = 500) in 2005, and a group of age-5 fish obtained from AZGF's Bubbling Ponds Hatchery (n = 1,981) in 2006. These opportunistic stockings of older Colorado pikeminnow have helped to greatly boost the number of Colorado pikeminnow occuring in the San Juan River.

Objectives

1. Coordinate with Dexter National Fish Hatchery to procure and stock fish according to guidelines set forth in ***An Augmentation Plan For Colorado Pikeminnow In The San Juan River***.

    a.) This includes expanding the current range of Colorado pikeminnow in the San Juan River by stocking fish into river reaches between the Animas River confluence and the Hogback Diversion.

2. Coordinate the acquisition and opportunistic stocking of additional groups of Colorado pikeminnow (if deemed genetically appropriate) that may become available from outside sources (e.g., fish from state fish hatcheries such as CDOW's Mumma Native Species Hatchery near Alamosa, CO or AZGF's Bubbling Ponds Hatchery near Sedona, AZ).

3. Provide a report that gathers information from various sources on fingerling production, numbers of fish stocked, subsequent recaptures during various sampling efforts, and makes recommendations (if necessary) for modifying methods being employed for Colorado pikeminnow augmentation efforts.

Methods

Objective 1: Young Colorado pikeminnow will be reared in grow-out ponds (under a separate workplan) at Dexter National Fish Hatchery (NFH) until late October or early November, at which time they will be harvested and stocked into the San Juan River in river sections specified in the augmentation plan (i.e., between Fruitland diversion and PNM weir; between Hogback diversion and Shiprock bridge). Once young Colorado pikeminnow are transported to the San Juan River, CRFP crews (two crews of two people each) will load them into live wells and transport them downstream via boat, stocking them in several appropriate low-velocity locations in the two target sections of river. Fish will be stocked in roughly equal numbers in each of the two river reaches. This will allow young Colorado pikeminnow to be introduced into numerous appropriate low velocity habitats and avoid their grouping up in large numbers and thus becoming more susceptible

to predation (e.g., by channel catfish) or catastrophic loss due to other factors. Lots of age-0 and age-1 Coloradp pikeminnow willed be hauled separately from one another to prevent cannibalism.

Objective 2: Groups of Colorado pikeminnow that become available to the SJRIP (i.e., outside those specified in the Colorado pikeminnow augmentation plan and its addendum) will be obtained, PIT-tagged, and transported to the San Juan River where they will be stocked. CRFP personnel will coordinate the acquisition, tagging, and stocking of these fish.

Objective 3: After stocking, CRFP personnel will collect information on all stocked Colorado pikeminnow (numbers produced, size at stocking, locations stocked at) and on subsequent recaptures of these fish during monitoring and sampling efforts by various agencies/entities involved in SJRIP research projects. This data will be examined to help determine if augmentation efforts are successful. Success will be determined by examining post-stocking dispersal patterns, analyzing age and growth data, and using either CPUE trends or mark-recapture population estimators (e.g., Programs CAPTURE and/or MARK, or alternately the Lincoln-Petersen and/or Schnabel population estimate models) to determine survivorship, with the end goal of determining if progress is being made towards reaching target numbers set forth in the Colorado pikeminnow augmentation plan. Results obtained will be used to make recommendations for modifying (if necessary) methods being employed for augmentation efforts in future years.

Products

An interim progress report detailing the field activities performed during 2008 is scheduled to be available by 31 March 2009. The "draft final" of this interim progress report which incorporates comments received, is scheduled to be completed by 1 June 2009. Data files containing information on stocked and recaptured Colorado pikeminnow will be submitted for inclusion in the SJRIP's integrated database by 31 March 2009.

Qualifications of Personnel Included in the Budget:
Principal Biologist (GS-12) -- Dale Ryden
Holds a BS degree. Has 17 years experience performing fisheries research/management in the Colorado River Basin. Dale has been performing fisheries research/management in the San Juan River Basin for the last 16 years.

Biological Technicians (GS-7) – Bio. Techs from USFWS-CRFP
All hold at least a BS degree. Depending upon the individual, they have from 1-8 years experience performing fisheries research/management in the Colorado River Basin. Most have
1-3 years of experience performing fisheries research/management on the San Juan River.

Project Leader (GS-14) -- Chuck McAda
Holds an MS degree. Has 27 years experience performing fisheries research/management in the Colorado River Basin. Chuck was chairman of the San Juan River Recovery Implementation Program's Biology Committee for three years (2004-2006).

Projected Duration Of Project:
This project was initiated in October 2002 in support of the eight-year Colorado pikeminnow augmentation effort (2002-2009) and has continued annually since that time. The stocking efforts are currently scheduled to run through the end of the eight-year augmentation effort (i.e., 2009), as specified in An Augmentation Plan For Colorado Pikeminnow In The San Juan River (Ryden 2003) and its addendum (Ryden 2005), while the subsequent reporting of results would end in FY-2010.

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Colorado Pikeminnow Fingerling Production
San Juan River Basin Recovery Implementation Program
Fiscal Year 2008

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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**, (Ryden 2003) calls for annual stocking of age-0 fish over an eight year augmentation program (2002-2009). The year 2008 completes the 7th year of the age-0 and 3rd year of the age-1 augmentation program. As per the modified work plan, dated 6 April 2005 age-1 fish have been produced at Dexter and will be delivered annually from 2006-2009 to the San Juan River for stocking, (Ryden 2005, Addendum #1 to Augmentation Plan For Colorado Pikeminnow In The San Juan River).

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 San Juan RIP. The major emphasis has been on the reproductive biology, broodstock development and culturing age-0, 1 and adults. This work plan proposes to continue the production of 300,000 age-0 fingerlings (50 mm TL) and 3,000 age-1 (150mm TL) fish annually for reintroduction in the San Juan River. In order to meet the target size and number of phase II fish, Dexter will maintain approximately 6,000, young-of- year fingerlings annually for growout.

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.

FY 2008

Rear 300mm Razorback Sucker and Assess Potential for Rearing Bonytail at the Uvalde National Fish Hatchery, Uvalde, Texas

Aerial Photo of Uvalde National Fish Hatchery 2001
USFWS

Prepared for:
Biology Committee
The San Juan Recovery Implementation Program

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Introduction

Uvalde National Fish Hatchery (UNFH) submits the following proposal to continue rearing 6,000 300mm razorback sucker sub-adults annually for the San Juan River Recovery Implementation Program (SJRIP) and conduct research activities related to rearing 300mm bonytail for the Lower Colorado River Multi–Species Conservation Program (LCR MSCP). The project will use 15 one acre ponds at the UNFH, Uvalde, Texas. Dexter National Fish Hatchery and Technology Center (DNFH&TC) will provide fry and fingerlings of both species to UNFH 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 and DNFH&TC to produce the target number of razorback sucker and conduct research on bonytail growth and performance. 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 the past two years of work completed at Uvalde has been incorporated into the current razorback and bonytail production program. Funding is being requested for operations at UNFH. Staff guidance and direction in every phase of the production and research program will be provided by DNFH&TC. UNFH will provide the infra-structure for stability in the production program. Fish hauling will be conducted by the Regional Distribution Unit stationed at Inks Dam NFH, Burnet, Texas.

Background

UNFH is located 3 miles Southwest of Uvalde, Texas on FM 481 and approximately 85 miles West of San Antonio. This is a large warm water fish culture facility that utilizes earthen and lined ponds to produce fish.

The hatchery is located on 100 acres of 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 and six more in FY 1993 for water conservation purposes. 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, chemical/fertilizer building, and four living quarters with two double garages, two pump houses, and four concrete/two fiberglass raceways. Water for fish culture purposes is pumped from two deep wells.

Station Operations

Historically UNFH has been one of the top producing warm water fish culture facilities in the nation. During the mid 90's as many as 6 species were cultured producing 2.6 million fish, weighing 60,000 pounds. Over the past 15 years threatened and endangered fish species like Yaqui catfish, paddlefish, Comanche Springs pupfish and fountain darters have all been propagated and maintained successfully at the facility.

The climate in Southwest Texas provides 300 days (10 months) of growing season. Two deep wells provide 72^{o} water year round.

Razorback sucker and bonytail have been reared at UNFH, since April 2006. On November 11^{th}, 1,150 PIT tagged 300mm Age-1 razorbacks were stocked in the San Juan River (Hogback diversion area). The fish were marked with 134 kHz tags provided by the SJRIP. In 2006, 16% of all razorbacks stocked into Uvalde ponds reached the 300mm target size in six months. Approximately 75% of the remaining fish were 250+ mm in length. These fish were kept on station for future grow out and eventual stocking in 2007. Bonytail growth and survival was excellent as well. On November 16^{th}, 2,397 300mm bonytail were stocked into the Lower Colorado River, near Park Moabi. 80% of all bonytail stocked into Uvalde ponds reached the 300mm target size in six months. Survival over the 180 day growing period for all ponds averaged 92%.

Facilities

This project will utilize 15 ponds to fulfill the production and research commitments of the proposal. These ponds will need minor earth work to the bottoms and banks and are fully functional with water supplies, catch basins and drains.

Water
An abundant amount of fish culture water is supplied by a deep aquifer well (660 feet in depth) capable of pumping 1,500 gallons per minute. The well water is a constant 72^{o}F, pH of 7.5-8.05, total hardness of 496 ppm, and alkalinity of 224 ppm. Water rights total 1,500 acre-feet per annum.

Lake Mohave Razorback and Bonytail Broodfish
Staff at DNFH&TC successfully propagate and maintain 17 federally listed fish species; and produce over 1.0 million fish annually for recovery and restoration programs throughout the southwest. Razorback sucker and bonytail broodstock have been maintained and cultured at facility since 1981. Captive broodstock representing the Lake Mohave population exist at DNFH&TC and will be spawned and fry/fingerlings transported and stocked in Uvalde ponds for growout and research purposes.

Uvalde's growing scenario includes receiving fry and fingerlings from DNFH&TC in April. The fish are stocked into earthen or lined ponds and grown out- door from April to November. 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. 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 for sorting and tagging. Following a 7 to 10 day rest and recovery period they will be loaded into distribution trucks and hauled to their stocking locations. The USFWS RDU successfully hauled 300+mm bonytail to the Lower Colorado River in 2006 and 2007. These distribution trips log 660 miles (12 hours) of hauling time in one direction.

Objectives

There are two main objectives of this proposed work: continue rearing 6,000 – 300mm razorback sucker sub-adults annually and deliver them to the San Juan River and determine optimal rearing densities for bonytail at UNFH that will enable the consistent production of 300mm fish annually for augmentation programs in the (LCR LMSCP).

Additional objectives include:

1. Improve, maintain and staff facilities at Uvalde NFH necessary to rear and distribute the target # of fish and conduct the target research.

2. Test effects of long distance hauling, water quality differences and elevation on RBS and BTC cultured at the UNFH. Determine survival rates over time of fish hauled from DNFH&TC to UNFH.

Methods

DNFH&TC will conduct captive propagation activities that include spawning of a minimum of 25 pairs of broodstock, incubation of fertilized eggs, enumeration and stocking of swim up fry/fingerlings into UNFH ponds. UNFH will conduct the harvest of target sized fish from ponds, enumerate, tag and coordinate the distribution of these fish to the San Juan and Lower Colorado Rivers.

The project will utilize indoor and outdoor facilities. At Dexter all spawning and incubation activities will be conducted indoor in the fish culture building. At Uvalde razorback sucker and bonytail will be reared in as many as fifteen ponds and potentially four 6' wide X 40' long concrete and two 8' wide by 50' long fiberglass raceways.

Spawning

Broodfish will be harvested from DNFH&TC ponds in mid March and early April and held indoor for spawning. Over the next week eggs will be incubated and swim up fry/fingerlings shipped to Uvalde for rearing. This scenario will continue till adequate numbers of fingerlings are held at UNFH to rear to the target size. The facility will maintain approximately 50,000 fish in a given year to meet commitments for future years.

Ponds

Razorback Rearing

Sufficient numbers of razorback fingerlings were cultured at UNFH during the 2006 and 2007 growing season to meet requirements of a five year production program. Approximately 35,000 fry will be shipped every other year from Dexter to UNFH in order to continue the production cycle for the future. To meet the production goal of 6,000 (300mm) fish annually, the rearing ponds will be stocked at the following densities:

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

Pond 1- 1 acre @ 35,000 fry

Age I Growth : (March thru November - 244 day growing period)

Harvest Age–I fish from the ponds, enumerate and stock into 8 ponds.

Pond 2-	1 acre @ 4,000	fingerlings
Pond 10-	1 acre @ 4,000	fingerlings
Pond 11-	1 acre @ 4,000	fingerlings
Pond 12-	1 acre @ 4,000	fingerlings
Pond 18-	1 acre @ 3,000	fingerlings
Pond 22-	1 acre @ 3,000	fingerlings
Pond 28-	1 acre @ 3,000	fingerlings
Pond 29-	1 acre @ 3,000	fingerlings

Bonytail Research

Stocking densities per pond will be adjusted annually based on the previous years fish growth and survival. (April thru November - 210 day growing period)

Pond 19-	1 acre @ 1,000	fingerlings
Pond 20-	1 acre @ 1,000	fingerlings
Pond 21-	1 acre @ 1,500	fingerlings
Pond 30-	1 acre @ 1,500	fingerlings
Pond 31-	1 acre @ 1,500	fingerlings
Pond 32-	1 acre @ 1,000	fingerlings

Any earthen pond used 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. Lined ponds will be cleaned out every other year to reduce the amount of organic material in the ponds which could cause water quality deterioration. 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

Sonar, Diuron, Reward and 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.

Sonar - 20 lbs per acre (dry broadcast)
Diuron- 25 lbs per acre (dry broadcast)
Reward-

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 Uvalde ponds are 2 to 3lbs per acre. A secondary benefit derived from using CuSo4 is its effectiveness in controlling external parasites.

Zooplankton and invertebrate insect populations for razorback and bonytail Age-0 will be cultured with the proper fertilization regime. Age-I fish are fed a prepared diet.
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.

Escapement

Staff will reduce the potential for escapement by installing draining screens in the ponds when they are initially prepped to receive fish. Screen mesh size will be 250 micron in Age-0 ponds and 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 insure there is no over flow of water or leaks in the dam boards. Sawdust will be used to stop all leaks that develop in the catch basin. Water levels will 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 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. Fry and fingerlings will receive a starter grower diet purchased from Nelson and Sons, Silver Cup, Murray, Utah. 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 ^{o}F feed 3 % BW per day, Mon thru Fri.
- water temp 60-70 ^{o}F feed 2 % BW per day, Mon thru Fri.
- water temp < 60 ^{o}F feed 1.5 % BW per day, Mon, Wed, Fri.

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
9-14"	4.0 mm

Projected Harvest Dates and Delivery Date

Based on harvest data from 2006 and 2007 the production target of 6,000 300mm fish can be achieved in an fourteen month period. Fish will be harvested from the ponds and stocked into the San Juan River in November of each calendar year. In order to establish a consistent long term production cycle UNFH will maintain 24,000 to 30,000 Age–I fish on station in a production year.

All bonytail will be harvested from the study ponds in the fall of each year and transferred to the fish holding house for enumeration. Length/weight, survival and fish health data will be collected, analyzed and adjustments made to the stocking densities for the following year. All fish achieving the target size of 300mm will be available for use in the augmentation effort of the LCR MSCP program. The projected date of stocking is November as well.

Predator Control

During the summer grow-out all ponds are monitored daily by on-site staff and predators are taken by rifle and traps. If fish remain outdoor during the winter season the ponds will be netted with 2" X 2" block nylon netting. A minimum of 12,000 razorbacks and 6,000 bonytail reared for this project will be maintained in four 6"X 40' concrete raceways during the winter months. These facilities contain 72^{o}F flow through water, supplemental aeration and alarm system.

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. If fish are held in ponds O_2 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 and BTC database. Wet mounts will be examined for parasites and bacteria. Routine condition exams will be conducted and an examination will be conducted on all lots one month prior to delivery to the San Juan River. Brood and refuge stock will have health checks annually and only when needed to minimize handling stress.

The Region 2 Fish Health Unit @ Dexter will provide bacterial and viral testing for razorback propagation and rearing activities. Treatment of disease will be the responsibility of the Uvalde and Dexter staff. Fish health experts are available to advise on proper treatment, and to examine fish for infection.

Stocking will require coordination with New Mexico FRO, CRFP-Grand Junction, New Mexico Department of Game and Fish, Colorado Division of Wildlife and Utah Department of Wildlife Resources.

Objectives

1. Produce 300,000 age-0 fingerlings (50 mm) and 3,000 age-1 (150mm) fish for stocking in the San Juan River in 2008.
2. Continue data collection on induced spawning of Colorado pikeminnow under controlled conditions.
3. Provide staff to PIT tagging age -1 fish.
4. Transport and distribute 300,000 Colorado pikeminnow age-0 fingerlings and 3,000 age-1 fish from Dexter to the San Juan River.
5. Maintain 400 Colorado pikeminnow broodstock for recovery efforts.

Methods

Broodstock will consist of 400 (F1) adults. These fish are 1981 and 1991 year-class progeny from wild adults collected from the Yampa, Green and Colorado Rivers, respectively.
A maximum of 40 paired matings (1 female X 1 male) will be spawned during 2008. Given the past history of hormonal induced ovulation, 30 females (75%) should produce viable eggs during a given year. All members of the broodstock are PIT tagged and records of spawning pairs will be maintained at Dexter.

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 and kept separate in Heath trays until hatching occurs, about 96 hours following fertilization.

When eggs begin hatching, larvae will be transferred to hatchery tanks and held until swim-up occurs, approximately five to seven days. Fry will be enumerated and stocked into four earthen ponds ranging from .33 to .35 ha. Fry will be cultured in earthen ponds for 120 days and age-1 fish for 240. The target size fish will be stocked in the San Juan River in October and November of 2008.

Rearing Razorback Sucker Sub-Adults at Dexter National Fish Hatchery and Technology Center FY 2008

Aerial Photo of Dexter National Fish Hatchery & Technology Center 2004
Photo courtesy of Dr. Robert Flynn, NM State University – Agriculture

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Background

The following scope of work identifies the facilities and methodologies that will be used at Dexter to continue producing 20,000, 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. Dexter 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 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 (Figure 1.). The hatchery was authorized under the White Act of 1930 (46 Stat. 371 - 05/21/30), to meet the demands for warm water 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 during FY-2004 consisted 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 17 federally listed fish species; and produces over 1.0 million fish annually for recovery and restoration programs throughout the southwest (Appendix 1 and 2). Razorback sucker have been maintained and cultured at 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 112 adult fish (Table 2). 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 19 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 1,000 fish currently held as PM future broodstock at DNFHTC (Table 2). A third broodstock has been developed at DNFHTC, 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 2).

Table 2. Dexter NFH & TC Razorback Sucker Captive Broodstock

Year Class	Origin	Numbers on hand	Represented	Founders Designation	Lot
1981	F_1 Mohave	112		adults / Mohave	'81
1994-2003	Mohave	1000		90 / Mohave	PM
1999-2004 WC	Mohave		800	fry /Mohave	
2003	F_2 Mohave	500		25/ '81 captive stock	F_2

'81-1981 year class, Mohave-Lake Mohave, AZ, PM-Pair Matings, WC-Wild Caught, WB-Willow Beach, P- Production.

From 2001-2006 production of subadult razorbacks at DNFH&TC yielded excellent survival and growth. The overall survival for razorback sucker grown to 300mm was 88.5%, while 44.8% of the fish achieved the target growout size of 300 mm. 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. Dexter has successfully hauled 300+mm razorbacks and Bonytail to Lake Mohave, Arizona, in the lower Colorado River. These distribution trips log 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 20,000, 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. Continue data collection on induced spawning of razorback sucker under controlled conditions.
3. Continue data collection on stocking densities in Dexter ponds for optimal growth of razorbacks and evaluate and adjust as necessary to meet required numbers and size.
4. Maintain razorback sucker captive broodstock for recovery efforts.

Methods

DNFH&TC will conduct captive propagation activities that include spawning of a minimum of 25 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 reared in four earthen and lined ponds at surface acres of 0.72, 0.79, 0.82, and 0.86.

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 20,000 (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 @ 25,000 fry
Pond 2- .79 acre @ 25,000 fry

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

Harvest Age I fish; enumerate and stock fingerlings into 4 ponds.

Pond 1- .72 acre @ 10,000 fingerlings
Pond 2- .79 acre @ 10,000 fingerlings
Pond 3- .82 acre @ 10,000 fingerlings
Pond 4- .86 acre @ 10,000 fingerlings

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

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

Sonar - 20 lbs per acre (dry broadcast)
Diuron- 25 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 3 to 5 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 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 ^{o}F feed 3 % BW per day, Mon thru Fri.
- water temp 60-70 ^{o}F feed 2 % BW per day, Mon thru Fri.

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

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 2008 marks the third year of razorback production at Dexter for distribution to the NAPI ponds. On November 11^{th,} 2006, 7,000 razorback's averaging 200mm in length were stocked into East and West Avocet ponds; 3,500 in each. An additional 13,000 are scheduled to be stocked in the spring of 2007. Based on historical growth rates for razorback at Dexter, the production target of 20,000, 200+mm fish can be achieved in a fifteen month period. Fish delivery will be in the spring and fall of each year based on the new rotational production plan (single cohort) being implemented by NAPI personnel. Approximately 10,000 fish will be stocked each trip and Dexter staff will coordinate the deliveries with the Navajo Nation Department of Fish and Wildlife and BIA 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 recirculating systems during the winter months. The recirculating 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) 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. 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, Regional Fish Health Unit @ Dexter 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.

Razorback Sucker Augmentation at NAPI Grow-Out Ponds
Fiscal Year 2008 Project Proposal

U. S. Fish and Wildlife Service, Region 2 and 6
Navajo Nation Department of Fish and Wildlife
Principal Investigators: Jason E. Davis and
D. Weston Furr, NM Fishery Resources Office

Background

The Long Range Plan for recovery of endangered fishes in the San Juan River calls for propagation of Razorback Suckers (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 FY2008. The Six-pack Ponds will lay fallow during FY2008.

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 has no siphon, so draining is accomplished by renting a battery of water pumps. A siphon will be installed in Avocet East during FY2008.

In October of 1999, Hidden Pond was built to rear razorback suckers. 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 FY2000 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 FY2007, 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 and the BIA assist the NNDFW with pond harvest as needed. All of the ponds are being drained and harvested during FY2007. As each pond is harvested and drained, issues with manpower needs, trapping effort prior to draining and mortality were

documented for future consideration and development of a pond management plan. Issues with regards to pond design will be documented so that cost estimates can be developed for future funding consideration.

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)

Cooperatively manage East Avocet, West Avocet, and Hidden ponds to provide an additional source of RBS to supplement the RBS augmentation program. Harvest, 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 the razorback sucker augmentation plan.

1. Manage three grow-out ponds using a single cohort strategy; including passive and active harvest techniques
2. Stock RBS @ 3,000-3,500 (200mm) fish per pond (expectation to harvest 40-60%)
3. Initial harvest frequency - every year/all ponds

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 Service, Region 2, will provide overall coordination for management of the grow-out ponds on NAPI. The NNDFW will be assisting the Service with daily management of the three grow out ponds on NAPI under this proposal. Harvesting, tagging, and stocking will be conducted by the two Service Regions and NNDFW. Associated data management and reporting for the project will be handled by staff from the Service, Region 2.

Pond management requires that staff monitor and record water quality and quantity, and feed the razorback suckers 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 FY2008, East Avocet, West Avocet, and Hidden ponds will be managed for a single cohort of RBS. NNDFW and Service staff will cooperatively trap, tag, and stock RBS into the SJR for several days 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. Other 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 2008, Dexter National Fish Hatchery will deliver 10,000 200 mm RBS to the three NAPI grow-out ponds. In the fall of 2008, 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.

Maintenance and Operation of the San Juan River Basin Hydrology Model
San Juan River Basin Recovery Implementation Program - Hydrology Committee
Fiscal Year 2008 Project Proposal

Principal Investigator: Pat Page
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Background

The Third Generation San Juan Basin Hydrology Model (SJBHM) was essentially completed in FY2004, though revisions and modifications are continually being made and as such, the Third Generation SJBHM has not yet been approved by the San Juan River Basin Recovery Implementation Program. This scope of work includes the annual operation and maintenance of the model and necessary data. The Bureau of Reclamation has the primary responsibility for model O&M.

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

Study Area

San Juan River Basin

Objectives

The objective for this work is to ensure that the model is available for run requests. This will be accomplished by adjusting model configurations or operating rules to correct for errors or other changes, and evolving the data set forward through time. In addition, the FY2008 request includes funds to continue to provide technical transfer from the model developers to the model users and maintainers.

Tasks

1. Maintain data to evolve the data set forward through time.

2. Maintain the model, and associated documentation, to update and test data and to adjust model configuration, methodologies, or assumptions. Apply all RiverWare updates and patches as they become available.

3. Update and maintain data management interfaces and other software associated with the data and models

4. Generate and analyze model runs associated with Section 7 consultations or special requests from the Biology and/or Coordination Committees. Assumes that three consultations in FY2008 will be requested, requiring five model runs/consultation. It also assumes that the Coordinating Committee will request two special runs in FY2008. A consultation run will usually require a model reconfiguration and the implementation of operating criteria. Each consultation request will require approximately eleven staff days; each special run will require five staff days.

5. Program management and coordination including development of status updates.

6. Provide technology transference to Reclamation's Western Colorado Area Office staff in the details of maintaining the data and models, and in operating the models.

Products

Hydrological analysis of water development scenarios or other scenarios as requested by stakeholders or Program committees.

Improve Stream Gaging and Flow Measurements
San Juan River Basin Recovery Implementation Program - Hydrology Committee
Fiscal Year 2008 Project Proposal

Principal Investigator: Pat Page
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Background

There are five USGS streamflow gaging stations on the main stem of the San Juan River that are very important to the operation of the river and play an important role in the implementation of the flow recommendations. Stream gaging data on the San Juan River are needed to attempt to reliably develop and implement 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. (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.

Program Coordinator's Office
Fiscal Year 2008 Project Proposal

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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 overall Program. As stated in the Program Document, the Service will appoint a Program Coordinator who will be responsible for overall Program coordination, a senior level biologist and a Program Assistant to dissemination of information about Program activities. Public Law 106-392 specifically authorizes the use of base funding to fund program management.

Tasks

1. Coordinate the activities of the Biology, Hydrology and Coordination Committees.
2. Insure that approved recovery activities are implemented.
3. Disseminate information to involved state, federal, and tribal agencies.
4. Coordinate Program activities with the Upper Basin Recovery Implementation Program.
5. 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.
6. Forward plans and recommendations to the Coordination Committee for review and approval.
7. Annual Work Plan:
    A. Work with the Biology and Hydrology Committees to identify and expedite individual projects that are needed to accomplish the long range plan for each of the recovery elements.
    B. Draft an annual work plan consisting of high priority individual projects, formulated within the available funding.
    C. Forward the work plan to the Coordination Committee for review and approval.
8. Coordinate an annual assessment of the Program's recovery progress as outlined in the Program Document.
9. Maintain a list of interested parties and provide those parties with the meeting dates, times, locations, and agendas for Program meetings.
10. Provide draft and final summaries of meetings to committee members.
11. Report to the Coordination Committee at each meeting the status of Program activities and research projects, and accomplishment of milestones; report any problems with maintaining schedules and provide recommendations for solving those problems; implement the recommendations of the Coordination Committee to resolve scheduling problems.
12. Provide support materials for annual funding efforts with the U.S. Congress and state legislatures.

Reclamation Program Management
Fiscal Year 2008 Project Proposal

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Relationship to SJRIP

Supports Program goals and management by supporting approved activities

Study Goals, Objectives, and End Product

Program Management funds support Reclamation staff involved in program management. Funds are used for the administration of funding agreements, including issuing requisitions for program supplies, and the preparation and oversight of work conducted under interagency agreements, cooperative agreements, contracts, and grants. The funds are also used for formation and participation of the technical and peer-review committees, implementation of committee assignments not specifically identified in a scope of work, reporting, and coordination of water operations. Management support for Capital fund projects, including technical oversight, budgeting, preparation of bids and funding agreements is covered in a separate scope of work. Participation in Hydrology and Biology Committee meetings and business is paid for separately by Reclamation with funds unrelated to the SJRIP.

Task Description and Schedule

Task 1: Manage and administer funding and Hydrology Committee activities. Coordinate and manage the hydrology-related tasks performed by the Hydrology Committee, including administering cooperative agreements and contracts with consultants, accounting for expenditures, developing and providing status reports, and coordinating work items to ensure work is completed as planned.

Task 2: Manage and administer funding for Recovery Program projects related to the Biology Committee activities. Funding Recovery Program projects requires establishment or modification of approximately 45 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; 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 submitted in Decemberfor each year.

Update and Maintenance of San Juan River Basin Recovery Implementation Program Database
Fiscal Year 2008 Project Proposal

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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 activates.

Preparation of the integration report was difficult due to the absence of an updated, standardized, and easily accessible SJRBRIP database. An updated SJRBRIP database has not been distributed to the researchers since 1998, the last time Keller-Bliesner Engineering, LLC (previously the organization responsible for maintaining the database until the end of 2002, when the project was transferred to UNM) produced and distributed a CD containing the database. A project was initiated to develop and maintain a web-based system. This project has been terminated.

The purpose of this proposal is to fund an effort to update, maintain and distribute the SJRRIP's Database. In addition, continuation of funds to cover the cost of maintenance and distribution of the database are requested.

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 GIS Database.
2. Maintain, perform Quality Control, annually update, and distribute current San Juan River Recovery Implementation Program GIS 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).
    a. Generate for distribution and maintain a standardized set of hard-copy aerial photos with river mile, 10^{th} of mile, and appropriate landmarks connoted.

Methods

1. Update and Maintain GIS Database.

   In 2006, the existing GIS Database, will be transferred to USFWS-NMESFO. The database and data will be inspected and a list of tasks developed for updating the system for the SJRRIP.

   In consultation and coordination with Keller-Bliesner, the NMESFO will integrate existing and new data into the existing San Juan River Recovery Implementation Program's Database. Data will be checked for Quality Control 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.

3. Generate and Maintain standardized and customized maps. Appropriate base layers, including Digital Orthophoto Quarter Quadrangles (DOQQs) will be obtained and additional layers, including 10^{th} of mile designations will be generated in order to provide researchers with a standardized set of hard copy aerial photo maps for use in the field. These standardized maps will allow for seamless integration of field data with the GIS database. In addition, at researchers' request, customized maps will be generated for use in reports and presentations.

Products

The database, once updated, will be disseminated to all committee members and be made available via a password-protected project ITP site. The database will reside with NMESFO -Region 2 (Albuquerque) of the U.S. Fish and Wildlife Service, the designated repository for the data.

Capital Improvement Program Management
San Juan River Recovery Program
Fiscal Year 2008 Project Proposal

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Background

The purpose of the San Juan Capital Improvements Program is to implement capital projects which have been identified by the Program as necessary for the recovery of the endangered fish. As defined in Public Law 106-392 capital projects include "...planning, design, permitting or other compliance, pre-construction activities, construction, construction management, and replacement of facilities, and the acquisition of interests in land or water, as necessary to carry out the Recovery Implementation Programs".

Study Area

San Juan River Basin

Objectives

1. Coordinate the preparation of Federal budget requests.
2. Develop and manage cooperative agreement with the National Fish and Wildlife Foundation which provides the mechanism to utilize non-Federal cost share funds to implement capital projects.
3. Develop and manage contracts and agreements to accomplish construction and acquisition of capital projects.
4. Account for and provide capital project expenditure reports to the Coordination Committee.
5. Coordinate planning, design, permitting, pre-construction, construction and acquisition of capital projects.

Products

Financial reports will be periodically provided to the Coordination Committee documenting the status of Federal appropriations and non-Federal cost sharing contributions.

Operation of Public Service Company of New Mexico Fish Passage Structure
Fiscal Year 2008 Project Proposal

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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, 2008. 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 forebay 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 gear boxes 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' 2008. School groups visit the facility to learn about the purpose of the facility and the endangered fish program on the San Juan River.

Objectives

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, 2008. 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.

Program staff will attend SJRRIP Biology Committee meetings and provide reports as needed throughout the year. Service staff will assist the NNDFW in preparing presentations for the Biology Committee meetings.