SAN JUAN RIVER BASIN RECOVERY IMPLEMENTATION PROGRAM

FISCAL YEAR 2006 ANNUAL BUDGET AND WORK PLAN

Approved: August 12, 2005

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San Juan RIP Biology Committee, Estimated Fiscal Year 2006 Funding				
Title	Agency	Estimated Funding		
		Base	Capital	other
Monitoring				
Sub-Adult/Adult Large Bodied Fish Comm. Monitoring	FWS, GJ	$93,992		
YOY/Small Bodied Fish Monitoring	NMDGF	$72,885		
Larval Colorado Pikeminnow Survey	UNM,NMDFG	$66,240		
Larval Razorback Sucker Survey	UNM,NMDFG	$60,030		
Specimen Curation/Identification	UNM	$24,725		
Habitat Mapping Data Analysis	KB/ERI	$52,040		
Update and Maintenance of GIS Database	UNM	$39,097		
Subtotal		**$409,009**		
Peer Review				
Peer Review	Bio/West	$25,000		
Subtotal		**$25,000**		
Research				
Population Model Maintenance	MEC, ERI	$32,536		
Assessment of Colorado Pikeminnow Augmentation	Bio/West, UNM, NMDGF, UDWR	$192,743		
Subtotal		**$225,279**		
Recovery				
Nonnative Species Control in the Upper San Juan River	FWS, Abq	$149,238		
Nonnative Species Control in the Lower San Juan River	UDWR	$149,263		
Razorback Sucker Augmentation and Monitoring	FWS, GJ	$142,624		
Purchase of PIT Tags and Readers	BR	$20,450		
Stocking of Fingerling Colorado Pikeminnow	FWS, GJ	$20,108		
Colorado Pikeminnow Fingerling Production	FWS, DNFHTC	$86,005		
Rearing Razorback Sucker Sub-Adults	FWS, DNFHTC	$77,930		
Razorback Augmentation Ponds Limnology Monitoring	KB/ERI	$52,746		
Operation of PNM Fish Passage Structure and NAPI Pond Management	Navajo GF	$117,038		
Subtotal		**$815,402**		
Biology Committee Total		**$1,474,690**		

San Juan RIP All Activities, Estimated FY 06 Funding				
Title	Agency	Estimated Funding		
		Base	Capital	Other
Biology Committee				
Ongoing Projects				
Biology Committee Total		**$1,474,690**		
New Starts				
Long Term Channel Monitoring	RFP	$181,000		
Habitat Mapping	RFP	$54,000		
Water Temperature Monitoring	RFP	$10,199		
Larval Cyprinid Key		$31,090		
NAPI Pond Aeration and Bird Control		$9,000	$185,000	
Subtotal		**$285,289**		
Hydrology Committee				
Maintenance and Operation of Model	BR, Durango	$102,250		
Streamflow Measurements	USGS	$6,100		
Subtotal		**$108,350**		
Program Management				
Program Coordinator and Assistant	FWS Abq	$134,373		$39,923
Base Management	BR, SLC	$85,750		
Capital Projects Management	BR		$58,100	
Capital Hogback Canal	BR		$300,400	
Subtotal		**$220,123**	**$358,500**	**$39,923**
SJ RIP Total		**$2,088,452**	**$543,500**	**$39,923**
Estimated Available Annual Base Funds[a]		**$2,192,475**		
Amount of remaining 2006 funds not obligated		$104,023		
Other Projects under Consideration but Not Funded				
Trophic Relationships Among Colorado Pikeminnow and its Prey in the San Juan River	NMDGF, KSU	$44,928		
revised 8/15/05				

[a] FY05+2.5% (2,139,000 + 53,475)

Project Deliverables

PROJECTS	DELIVERABLES	DATE DUE
Adult/Juvenile Fish Community 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	3-31-07 3-31-07 6-01-07
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	• Annual Report	03-31-07
Larval Colorado Pikeminnow Survey Michael A. Farrington, W. Howard Brandenburg, and Sara J. Gottlieb Division of Fishes, Museum of Southwestern Biology University of New Mexico Albuquerque, NM 87131 (505) 277-3218 mporter@unm.edu (505) 277-3218 whburg@unm.edu (505) 277-6005 gottlieb@unm.edu	• Draft Report • Final Report	3-31-07 6-01-07
Larval Razorback Sucker Survey W. Howard Brandenburg, Michael A. Farrington and Sara J. Gottlieb Division of Fishes - Museum of Southwestern Biology University of New Mexico Albuquerque, NM 87131 (505) 277-3218 whburg@unm.edu (505) 277-6667 gottlieb@unm.edu 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	03-31-07 06-01-07

PROJECTS	DELIVERABLES	DATE DUE
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 • Final Report	03-31-07 06-01-07
Habitat Mapping Data Analysis Ron Bliesner Keller-Bliesner Engineering 78 East Center, Logan, UT 84321 (435) 753-5651 bliesner@kelbli.com Vince Lamarra Ecosystems Research Institute 975 South State Highway, Logan, UT 84321 (435) 752-2580 vincel@ecosysres.com	• Draft Report • Final Report	07-31-06 09-30-06
Update and Maintenance of GIS Database Sara J. Gottlieb and Justin T. Smith Division of Fishes - Museum of Southwestern Biology University of New Mexico Albuquerque, NM 87131 (505) 277-6667 gottlieb@unm.edu	• Database and associated documentation will disseminate via password-protected project web page.	
Peer Review Paul B. Holden BIO-WEST, Inc., Logan, Utah Jicarilla-Apache Nation (435) 752-4202 pholden@bio-west.com	• Letter or verbal reports from each reviewer.	
Population Model Maintenance Bill Miller Miller Ecological Consultants 1113 Stoney Hill Dive, Suite A Fort Collins, CO 80525-1275 (970) 224-4505 mec@millereco.com Vince Lamarra Ecosystems Research Institute Research Institute 975 South State Highway, Logan, UT 84321 (435) 752-2580 vincel@ecosysres.com	• Brief report that documents the model maintenance and model runs. • Summary table of model simulations for each model run. • Summary of model maintenance activities submitted to standardized data base.	

PROJECTS	DELIVERABLES	DATE DUE
Assessment of Colorado Pikeminnow Augmentation Paul Holden and Michael Golden BIO-WEST, Inc. 1063 W. 1400 N. Logan, UT 84321 (435) 752-4202 pholden@bio-west.com mgolden@bio-west.com David L. Propst Conservation Services Program New Mexico Department of Game and Fish State Capitol, Villagra Bldg., PO Box 25112 Santa Fe, NM 87504 (505) 476-8103 dpropst@state.nm.us W. Howard Brandenburg and Michael A. Farrington Museum of Southwestern Biology University of New Mexico Albuquerque, Nm 87131 (505) 277-6667 whburg@unm.edu mporter@unm.edu Julie A. Jackson Utah Division of Wildlife Resources-Moab Field Station 1165 S. Hwy 191- Suite 4 Moab, UT 84532 (435) 259-3782 juliejackson@utah.gov	• Trip reports for each trip sending to BC. • Annual Report • Data Reports	 03-31-07 03-31-07
Nonnative Species Monitoring and Control in the Upper Colorado 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 • Summary Report • Final Annual Report	03-31-07 03-31-07 06-01-07
Nonnative Species Control in the Lower San Juan Julie A. Jackson Utah Division of Wildlife Resources Moab Field Station 1165 S. Hwy 191, Suite 4 Moab, UT 84532 (435) 259-3782 juliejackson@utah.gov	• Draft Report • Final Report	03-31-07 06-01-07

PROJECTS	DELIVERABLES	DATE DUE
Razorback Sucker Augmentation and Monitoring Dale Ryden and Chuck McAda U.S. Fish and Wildlife Service Colorado River Fishery Project 764 Horizon Drive, Building B Grand Junction, CO 81506-3496 (970) 245-9319 cmcada@fws.gov dryden@fws.gov	• Draft Progress Report • DBASE Files • Final Report	03-31-07 03-31-07 06-01-07
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		
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	03-31-07 03-31-07 06-01-07
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 Roger_hamman@fws.gov Manuel_ulibarri@fws.gov		
Rearing Razorback Sucker Sub-Adults 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 Roger_hamman@fws.gov Manuel_ulibarri@fws.gov	• Delivery of 20,000 fish in June of each year.	Annually

PROJECTS	DELIVERABLES	DATE DUE
Razorback Sucker Augmentation Pond Limnological Monitoring Dr. Vince Lamarra Ecosystems Research Institute 975 South State Highway Logan, UT 84321 (435) 752-2580 vincel@ecosysres.com Ron Bliesner Keller-Bliesner Engineering 78 East Center, Logan, UT 84321 (435) 753-5651 bliesner@kelbli.com	• Annual Reports	03-30-06
Operation PNM Fish Passage Structure and NAPI Pond Management Training Dr. Vince Lamarra Ecosystems Research Institute 975 South State Highway Logan, UT 84321 (435) 752-2580 vincel@ecosysres.com Jeffrey Cole Navajo Nation Department of Fish and Wildlife Box 1480 Window rock, AZ 86515 (928) 871-7068 jcole@navajofishandwildlife.org	• Monthly Fish Passage Report • Annual Progress Report • Draft and Final Report	 09-30-06 03-30-06
Long Term Channel Monitoring	RFP Process	
Habitat Mapping	RFP Process	
Water Temperature Monitoring	RFP Process	
Larval Cyprinid Key Darrel E. Snyder Department of Fishery and Wildlife Biology Rm 33, Wagar Bldg Colorado State University Fort Collins, Colorado 80523-1474 (970) 491-5295 DESnyder@cnr.ColoState.edu	• Larval Fish Conference • Annual Reports • Presentation • Annual Report	Spring or Summer 2007 Nov or Dec 2007 Jan 2008 Nov or Dec 2008
NAPI Pond Aeration and Bird Control Ron Bliesner Keller-Bliesner Engineering 78 East Center, Logan, UT 84321 (435) 753-5651 bliesner@kelbli.com		

PROJECTS	DELIVERABLES	DATE DUE
Maintenance & Operation of Model 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 as requested by stakeholders or Program Coordinator.	Upon Request
Streamflow Measurements Pat Page U.S. Bureau of Reclamation 835 E. 2nd Avenue, Suite #300 Durango, CO 81301 (970) 385-6560 ppage@uc.usbr.gov		
Program Management 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		
Base Funds Management Mark McKinstry U.S. Bureau of Reclamation 125 S. State St. Salt Lake City, UT 84138-1147 (801) 524-3835 mmckinstry@uc.usbr.gov Pat Page U.S. Bureau of Reclamation 835 E. 2nd Avenue, Suite #300 Durango, CO 81301 (970) 385-6560 ppage@uc.usbr.gov		
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
Capital Improvement Program (Hogback Canal) Brent Uilenberg U.S. Bureau of Reclamation 2764 Compass Dr., Suite 106 Grand Junction, CO 81506 (970) 248-0641		

Sub-Adult & Adult Large-Bodied Fish Community Monitoring
(a.k.a. Adult/Juvenile Fish Community Monitoring)
Fiscal Year 2006 Project Proposal
12 April 2005

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. 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 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 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

The need for a long-term, standardized monitoring program, of which the Adult Monitoring study is a part, is addressed in objective 5.7.1, a Milestone in the SJRIP Long Range Plan. Additionally, future monitoring will help determine fish community response to reoperation flows from Navajo Dam (Objective 5.2.10), as well as monitoring both wild and augmented populations of Colorado pikeminnow and razorback sucker (Objective 5.3.9). Protocols for the Adult Monitoring study (as detailed in Propst et al. 2000) were developed under the guidance of and approved by the SJRIP Biology Committee. These criteria were accepted as final by the San Juan River Biology Committee on 31 March 2000.

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, habitat use, spawning and staging areas, growth rates, recruitment) 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 2006. This trip will sample the entire study area, from 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 8-9 people (4 for electrofishing, 2 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 (i.e. - walleye, striped bass, largemouth bass, smallmouth bass) collected will be weighed, measured, and have stomach contents 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 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 2006 is scheduled to be available by 31 March 2007. The "draft final" of this interim progress report which incorporates comments received, is scheduled to be completed by 1 June 2007. DBASE files containing information on total catch and length/weight data gathered on Adult Monitoring trips will be submitted to the University of New Mexico's Museum of Southwestern Biology (Division of Fishes) for inclusion in the SJRIP's integrated database and web page by 31 March 2007.

Qualifications of Personnel Included in the Budget

Principal Biologist (GS-12) -- Dale Ryden
Holds a BS degree. Has 16 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 15 years.

Biological Technicians (GS-7) – Bio. Techs from USFWS-CRFP
All hold at least a BS degree. Depending upon the individual, they have from 1-7 years experience performing fisheries research/management in the Colorado River Basin. Most have at least 1-2 years of experience performing fisheries research/management on the San Juan River.

Project Leader (GS-14) -- Chuck McAda
Holds an MS degree. Has 26 years experience performing fisheries research/management in the Colorado River Basin. Chuck is the current chairman of the San Juan River Recovery Implementation Program's Biology Committee.

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.

YOY/Small Bodied Fish Monitoring
Fiscal Year 2006 Project Proposal

Principal Investigators: David L. Propst and Yvette Paroz
Conservation Services Division
New Mexico Department of Game and Fish
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yparoz@state.nm.us

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 2006 is to conduct the 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 enclosing a 30 m^2 area and using a backpack electrofisher to drive fishes into a bag seine. This sampling was done every six miles in Geomorphic reaches 6 through 3.

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 in telemetry studies, native-nonnative interactions studies (upper and lower San Juan), Colorado pikeminnow augmentation evaluation, 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.

Collections

Specimens collected will be inspected to determine if any rare fishes (Colorado pikeminnow, roundtail chub, and razorback sucker) are present in a sample or collection. All identifiable rare fish and all large-

bodied native fish (i.e., flannelmouth and bluehead suckers)>150 mm TL will be released. Specimens from each sampled mesohabitat will be preserved separately. All other specimens will be preserved in 10% formalin and returned to the New Mexico Department of Game and Fish Laboratory for identification, enumeration, and measurement (total length). After processing, all specimens will be accessioned to the UNM Museum of Southwestern Biology, Fish Section.

Objectives

The objectives of this portion of the San Juan River monitoring effort are to document occurrence and primary channel shoreline and near-shoreline mesohabitats, secondary channel, and backwater use by age 0 Colorado pikeminnow, razorback sucker, and roundtail chub; obtain data that will aid in the evaluation of the responses (e.g., reproduction, recruitment, and growth) of native and nonnative fishes to different flow regimes and other management actions (e.g., impediment modification); track trends in species populations (e.g., abundance and relative condition); and characterize patterns of mesohabitat use by common native and nonnative small bodied fishes (including age 0 flannelmouth sucker, bluehead sucker, common carp, and channel catfish). The data will also be available to all researchers and may be used in conjunction with data obtained in other studies to evaluate future management activities.

Methods

The study reach (Farmington to Clay Hills Crossing) includes geomorphic reaches 6 through 1, with Reach 1 being the most downstream. Primary channel sampling will occur every third mile within the study reach. Enclosure sampling of near-shoreline primary channel mesohabitats with electrofishing gear will occur every sixth mile. To the extent possible, all secondary channels will be sampled. Secondary channels are defined as channels having less than 25% of the volume of flow at the time of sampling and are at least 300 m in length. Inflow at the top of a channel is not necessary for it to be classified as a secondary channel. Young-of-year/small-bodies fish monitoring will occur in conjunction with the large-bodied fish monitoring effort. Fieldwork will be accomplished in autumn (late-September through mid-October) and involves one foray through each of three macro-reaches (Farmington-Shiprock, Shiprock-Four Corners, and Four Corners-Cray Hills Crossing).

In addition to structured primary channel sampling, all backwaters and embayments (>25 m^2) associated with the primary channel within each third-mile will be sampled. Large backwaters (ca. 250 m^2) outside designated sample-miles will be sampled, if possible.

Sample sites within secondary channels will be a sufficient distance from inflow to and outflow from the secondary channel to minimize primary channel faunal and physiochemical influences. Secondary channel sample sites will be at least 100 and not more than 200 m in length. Each mesohabitats (e.g., pool, riffle, riffle-eddy, and shoal) within the site will be sampled in rough proportion to its availability within the site; typically, at least five mesohabitat types will be sampled in each secondary channel with inflow. Mesohabitat of secondary channels lacking inflow is typically only pool. Each mesohabitat will be sampled separately with 3.2 x. 1.6 m (4 mm mesh) drag seines. Each secondary channel sampling effort will be a minimum of 5 seine hauls (= 5 mesohabitats). The number of seine hauls, area (m^2) of seined portion of each mesohabitat, and types of mesohabitats sampled will be recorded on standard field forms. Specimens collected in each mesohabitat will be inspected to determine if any rare fishes (Colorado pikeminnow, roundtail chub, and razorback sucker) are present in the seine. If a rare fish is captured, it will be identified, total length (±1.0 mm) and mass (±1.0g) determined, and released. Any rare fish >150 mm TL will be scanned to determine presence of a PIT tag. If none is present, the specimen will be implanted with a PIT tag having a unique alphanumeric code. All pertinent data (i.e., total and standard lengths, mass, PIT tag code, mesohabitat, water depth, substrate, and cover) on rare fish captured will be recorded. All large-bodied native fish (i.e., flannelmouth and bluehead suckers) will be weighted, measured, and released. All other specimens will be preserved separately by mesohabitat in 10% formalin and returned to the New Mexico Department of Game and Fish Laboratory for

identification, enumeration, and measurement (total length). Field collection number, habitat number, and river mile will be recorded on a water-proof label and placed in each specimen container. Location of site (UTM) will be determined with a GPS unit. Identification of all retained rare fishes will be confirmed by personnel of the Museum of Southwestern Biology. Preserved specimens will be accessioned to the New Mexico Department of Game and Fish Collection of Fishes or the University of New Mexico Museum of Southwestern Biology.

Within each third-mile, shoreline habitats of the primary channel will be sampled. At each designated mile, all mesohabitats (e.g., riffle, debris pool, and shoal) along 200 m (near center of mile) of shoreline will be sampled. All mesohabitats present will be sampled in rough proportion to their availability within the site. Regardless of number of mesohabitats present at a primary channel site, at least 5 seine hauls will be made with a drag seine (3.2 x 1.6 m, 4mm mesh). Shoreline (river right or left) sampled will be dependent upon accessibility of the shoreline. Where more than one shoreline is accessible (and can be seined efficiently), that with greater habitat diversity/complexity will be sampled. Alternatively, primary channel island shorelines may be sampled. Procedures for specimen processing, retention, and accounting will be same as for secondary channels.

In addition to seining primary channel shoreline mesohabitats, a primary channel near-shore riffle, near-shore run, and near-shore shoal (if present) will be sampled with backpack electrofishing gear every sixth mile (in conjunction with primary channel seine sampling). Electrofishing samples will not be made downstream of RM 67; downstream of RM 67, primary channel habitats are generally not suitable for sampling with backpack electrofishers. Where feasible, area electrofished will be enclosed on three sides with seines. Regardless of enclosure, or not, a 20 bag seine will be used to capture stunned fish. If lateral seines are used to form enclosure, one 30 ft seine (1/4 in mesh) will be held parallel to shore. The shoreline will serve as parallel "fence" to lateral seine, if feasible. If not, a second seine will be placed to provide parallel fence. A 20 ft bag seine (¼ in panel mesh and 1/8 in bag mesh) will be placed across downstream opening. A backpack shocker will be used to stun and drive fish into bag seine. One electrofishing pass will be made within each enclosure. Fish captured in each enclosure will be identified, enumerated, and measured (except nonnatives $\leq$ 100 mm TL, which will be preserved). Location (UTM) will be determined with a GPS unit. Specimen and habitat data will be obtained and recorded as required for secondary channel seine sampling. All retained specimens from primary channel sampling will be preserved by mesohabitat. All retained specimens will be accessioned to the New Mexico Department of Game and Fish Collection of Fishes or the University of New Mexico Museum of Southwestern Biology.

Backwaters and embayments (>25 m²) not located within structured primary channel sampling sites, but within each designated mile, also will be sampled. During periods of low flow, secondary channel mouths frequently function as backwaters or embayments. In this monitoring effort, secondary channel mouths without surface inflow from upstream will be treated as backwater/embayment habitat. The maximum number of backwaters or embayments sampled will be one per mile. Three seine hauls typically will be made in each backwater or embayment sampled. One seine will be across mouth of backwater (or embayment), one in middle, and one near head of backwater (or embayment). Specimens collected in each seine haul will be preserved separately. All specimens collected, except rare fishes, will be retained and returned to the laboratory for identification and enumeration. All rare fish will be measured and released; those >150 mm will be PIT tagged. Data collection and recording of relevant information (including GPS determined location) will be the same as for secondary and primary channels.

Sampling effort for all seine collections will be number fish/unit area. Electrofishing sampling effort will be number fish/unit area and number fish/electrofishing minute.

Ambient temperature and water quality data (water temperature, dissolved oxygen, conductivity, and salinity) will be measured in each sampled secondary channel, at primary channel sites, and in

backwaters/embayments. Secondary channel water quality data will be obtained a sufficient distance from the inflow to the secondary channel to minimize primary channel influences. All water quality data for each sample will be recorded on standard field forms.

Products

Data collected during the 2006 monitoring effort will be summarized by geomorphic reaches. Minimally, the annual report will report density per species (number/m^2) per geomorphic reach (primary and secondary channels and backwaters) and rare fishes and the mesohabitats in which each was found. A comparison of off-shore enclosure versus shoreline mesohabitat sampling catch (species and catch-per-unit effort) and a preliminary evaluation of each method will be presented. Community-comparison metrics, such as the Shannon-Wiener Index and Morisita's Index of Diversity, will be used for longitudinal and annual comparisons. River discharge data (Four Corners gage) will be used to assess the effect of discharge volume on species density estimates. All data obtained during 2006 monitoring activities will be electronically recorded in format determined by the SJRIP Biology Committee. The annual report (including electronic database) will be submitted to the SJRIP Biology Committed by 31 March 2007.

Literature Cited

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

San Juan River Larval Colorado Pikeminnow Survey
Fiscal Year 2006 Project Proposal

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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 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. Samples collected during this research program were and will continue to be processed and curated by Fish Division personnel at the University of New Mexico.

Between 1993-2004 a total of eight larval Colorado pikeminnow have been collected. The two YOY Colorado pikeminnow collected in 1993 (at Mexican Hat) were the same length (9.2 mm TL; MSB 18098, 18099) 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 1995.

Two larval Colorado pikeminnow were taken at Mexican Hat during the 1995 larval fish passive drift-netting study. The first specimen, 9.5 mm TL mesolarvae (MSB 26187) 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 mesolarvae (MSB 26191) 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 suggest that they were cohorts from a spawning event. From these two individuals, a spawning date (between 15-17 July) was determined.

A single YOY Colorado pikeminnow was collected in 1996. That specimen was an 8.6 mm TL yolked-mesolarvae taken on 2 August 1996 in a drift net at the Mixer sampling locality (RM 128.0). The 1996 back-calculated spawning date for Colorado pikeminnow (18 July 1996) was similar to that predicted in

1995 despite considerable difference 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 mesolarvae. From this specimen a spawning date (between 17-18) July was determined.

Two larval Colorado Pikeminnow were collected in 2004. 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 metalarvae, with the second being a 18.1mm TL metalarvae. Spawning dates for these two individuals was determined to be 24 June and 25 June respectively.

Table 1. Summary of larval and YOY Colorado pikeminnow collected in the San Juan River during larval drift-netting (1993-2004) and back-calculated dates of spawning.

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

The specimen collected in 2001 represents the first non-stocked larval Colorado pikeminnow collected in the drift since August 1996. In 2001, less 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 Amore 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 reflective 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 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 stock pikeminnow will occur

and can be documented through the sampling of larval fish. There are no means to differentiate between native versus 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 in (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 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. Unfortunately, no larval Colorado pikeminnow were collected in 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 in the aforementioned document (1a, 3a, 3b) and listed below.

Study Area

The principal sampling area for this study will be the San Juan River between Cudei Diversion Dam (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 (1a)
2. Provide annual summaries of monitoring results (3a)
3. Provide detailed analysis of data collected to determine progress towards endangered species recovery in three years and thence every five years (3b)
4. Provide comparative analysis of the reproductive success of the San Juan River fishes
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 Cudei (Rm 141.5) and Clay Hills (RM 2.9) from early July through mid-September using sampling techniques that will provide sufficient numbers of individual 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.

Meso-habitat type, length, maximum and minimum depths, water clarity, water quality, and substrate will be recorded for each sampling locality. Digital photos as well as GPS coordinates 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 $100m^2$.

Catch rate date will be compared across and within site by species. In addition, catch rate between and within site will be compared temporally. Specimens will be distinguished and compared by residence status (native versus non-native) and catch rate over-laid with the annual hydrograph.

Products

Draft reports for the 2006 larval sampling activities and collection efforts will be prepared and distributed by 31 March 2007 to the San Juan River Biology Committee for review. Upon receipt of written comments, that report will be finalization and disseminated to members of the San Juan River Biology Committee by 1 June 2007. 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 where the geo-referenced collection information will be maintained in a consistent database and GIS format. 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 and collection data will be transferred to the San Juan River database manager following the successful protocol previously employed.

San Juan River Larval Razorback Sucker Survey
Fiscal Year 2006 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 of the 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 next two years.

The UNM-NMGF larval fish drift study, whose primary focus was determining spawning period, identifying approximate location of spawning sites, and assessing 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 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 too elected to use that sampling procedure during the first year (calendar year 1997) of sampling. The only previous San Juan River fish investigation that 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 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 quite 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. Being tied 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 (first trip - no larval suckers) to 6 June 1998 between the Four Corners drift-net station (RM 128) and Bluff (RM 80) and used both active and passive 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). Passive sampling techniques were both drift-netting and the use of light-traps. 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 investigators 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 and 13,000 specimens between river miles 68.7 and 126.1. 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 investigators 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) to near Clay Hills (River Mile 4.9). The scope of work for that year included at least one collecting effort between Sand Island and Clay Hills. A total of 174 fish collections were made in 1999 producing over 20,000 fishes. Over 37% of these individuals were sucker larvae (n=7,635). Seven larval razorback sucker were collected in 1999 between 4 May and 14 June. The seven larvae (razorback) 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 new-downstream reach first sampled in 1999.

There was no substantive change in the sampling protocol or methodology for this project in 2000. A total of 210 collections were made between 4 April and 23 June 2000. These collections yielded 11,316 specimens of which 7,587 (67%) were larval sucker. 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 8.0. The lowest-most sampling location that yielded larval razorback sucker (RM 8.1) produced over 85 individuals in a single sample (26 May 2000). Conversely, 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. There was a substantial increase in the number of fish collected in 2001. A total of 206 collections were made between 10 April 2001 and 14 June 2001 yielding 95,628 specimens. The majority of these fishes were represented by non-native larval cyprinids accounting for 94% of the total number of fish collected in 2001. Catostomids comprised only 8.4% of the total catch. 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 sample variation that would be experienced in annual fish collections of such a magnitude. 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 152 fish collections were made between river mile 141.6 and 2.8 from 15 April 2002- 29 June 2002. 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. The most upstream larval razorback sucker collection was RM 134.5 (Reach 5) while the most downstream site of collection was Clay Hills, Utah (RM 2.8). Reaches 3 and 4 produced the greatest number of razorback sucker (n=312 and n=320 respectively). 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 along the predestinated 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). The 2003 larval razorback sucker survey produced a total of 208 fish collections and a total effort of 7,329.5 m^2 in which 41,181 specimens were collected. Catostomids comprised 15.2% (n= 6,275) of the total fish catch. For the sixth consecutive year razorback sucker reproduction was documented on the San Juan River in 2003. Although there was a 41.9% decrease in larval 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. The distribution of razorback sucker in 2003 was reduced from previous years to reaches 3, 2, and 1, with reaches 3 and 1 producing the greatest numbers of individuals (42.4% and 40.2%, respectively).

The methods and study area remained the same in 2004 as in 2003. A total of 182 collections were made from 19 April and 15 June 2004 with a total effort of 6,645.3 m^2. Catostomids comprised 43.7% of the total catch in 2004 (n=6,393). For the first time since the projects inception, bluehead sucker was the dominant sucker species and comprised the second highest CPUE in 2004 (49.7 fish per 100m^2). A total of 41 larval razorback sucker were collected in 2004. This represents a substantial decline in the number

of larval razorback sucker compared to previous years. There was a larger spatial distribution of larval razorback sucker in 2004 (RM 130.1 – 8.0) compared with 2003. Juvenile razorbacks sucker were not observed in the 2004 collections.

To date the results of this investigation has provided seven consecutive years of unequivocal documentation of reproduction in the San Juan River by members of a razorback sucker cohort 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 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 in the aforementioned document (1a, 3a, 3b) and listed below.

Study Area

The principal sampling area for this study will be the San Juan River between Cudei (near RM 141.5) and the Clay Hills boat landing (ca. RM 2.9) just above Lake Powell in Utah. A spring 2000 collection of larval razorback sucker at RM 124.8 indicated the need to expand the upstream boundary of the study area (formerly RM 128). Beginning in 2001, sampling included an additional 14 river miles of the San Juan River (the reach between Cudei and RM 128). 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.
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. Determine if reproduction by razorback sucker occurred in the San Juan River (upstream of Mexican Hat, UT).
4. Provide comparative analysis of the reproductive effort of catostomids.
5. Determine the relative annual reproductive success of razorback sucker (1a).
6. Provide annual summaries of monitoring results (3a).
7. Provide detailed analysis of data collected to determine progress towards endangered species recovery in three years and thence every five years (3b).

Methods

Sampling for razorback sucker larvae will be conducted in the San Juan River between Cudei (RM 141.5) and Clay Hills (RM 2.9) from early April through early June using sampling techniques that will provide sufficient number of individual fish necessary to meet study objectives. GPS readings and digital photos, and water quality (dissolved oxygen, conductivity, temperature, and salinity) will be taken at each sampling locality, and researchers will record UTM coordinates and zone corresponding with each field number as agreed upon at the May, 2001 meeting of the San Juan River Biological Committee. Access to the river shall be acquired through the use of an inflatable raft. The tentative sampling schedule will be once a month and encompass the entire study area (Cudei to Clay Hills).

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, isolated 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 the primary means of collecting larval fish from low-velocity habitats. Meso-habitat type, length,

maximum depth, and substrate will be recorded for each sample. For seine samples, the length of each seine haul will be determined in addition to the number of seine hauls per site.

In prior years, a number of samples were taken utilizing light-traps when suitable sampling sites coincided with the evenings' campsite. This method was determined to provide no additional information that the seining method alone could not provide, and furthermore complicated data analysis. At a 4-6 May 2004 Biology Committee meeting, it was agreed that this method would no longer be employed during larval razorback sucker sampling.

All retained specimens will be placed in plastic bags containing a solution of 5% buffered formalin and a tag inscribed with unique alpha-numeric 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. Global Positioning System (GPS) readings (the principal numeric descriptor) will be taken at each sampling locality as stipulated at the May 2001 meeting of the San Juan River Biological Committee. 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 alpha-numeric 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 per unit effort (CPUE), for each seine sample, will be determined as the number of fish per 100 m^2 of water sampled. The annual 2006 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.

Community-comparison metrics, such as the Shannon-Wiener Index and Morisita's Index of Diversity, will be used for longitudinal and annual comparisons. 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.

For reporting purposes, pre-2003 larval razorback sucker data were separated into upper and lower reaches with the former including collections between RM 141.5 and Bluff and the latter containing collections from Bluff downstream to Clay Hills Crossing (RM 2.9). A new protocol for reporting on annual monitoring activities was agreed to by the San Juan River Basin Biology Committee and initiated beginning with 2002 reports. One component of the new reporting was that data were to be analyzed along the predesignated San Juan River Reaches. A second component was to run the San Juan River collecting trips in a single continuous effort. This allowed for meaningful between reach comparisons as well as maintaining a similar format to other well established monitoring activities (i.e., small bodied fish, adult monitoring, habitat, etc) on the San Juan River.

Products

A draft report for the 2006 larval razorback sucker sampling activities (combined with 2006 larval Colorado pikeminnow sampling activities) will be prepared and distributed to the San Juan River Biology Committee for review by 31 March 2007. Upon receipt of written comments, that report will be finalized and disseminated to members of the San Juan River Biology Committee by 1 June 2007. 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 where the geo-referenced collection information will be maintained in a consistent database and GIS format. 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 and collection data will be transferred to the San Juan River database manager.

San Juan River Specimen Curation/Identification
Fiscal Year 2006 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. 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 the vacillation in number of specimens is because the samples sent to MSB by non-MSB researchers are not processed until almost one year following their collection. This lag between time of collection and MSB processing is necessary as individual researchers must perform the preliminary sort 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 2006 San Juan River specimen curation and larval fish identification sampling activities will be prepared and distributed by 31 March 2007 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 2006. 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.

Habitat Mapping Data Analysis
Fiscal Year 2006 Project Proposal

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Study Area
The study area consists of the San Juan River from RM 180 (Farmington, NM) to RM 2 (Clay Hills Crossing).

Collections
There are no collections associated with this study.

Background
Habitat mapping completed during the period 1992 - 1997 has been used to develop flow/habitat relationships used in the flow recommendation process. Monitoring from 1998 through 2003 has documented a loss of backwater habitat during this drought period. 2005 was the last year of funded field work under this cooperative agreement. Activity in 2006 under this contract is for processing and analysis of field data collected in the fall of 2005 and preparation of a final report. It is the intent of the SJRIP to competitively bid this work beginning in 2006, allowing continuance of the study as it is part of the long-term monitoring program.

Objectives
1. Monitor aquatic habitat abundance and distribution by habitat type.
2. Analyze response of habitat to flow.

Methods
1. Digitize and process data utilizing GIS. 2005 videography prints with habitat mapping data collected in 2005 will be rectified to 1997 digital ortho-photo quads. Habitat polygons and codes will be digitized on-screen from the rectified habitat maps. All data processing will be in ARC GIS.
2. Analyze mapping data and produce final report. The mapping data will be analyzed to determine trends in habitat abundance with time and flow and to summarize data collected since 1997.

Products
An annual report and GIS coverages for inclusion in the GIS database will be produced under this task. The final report and coverages will be for the 2005 mapping. The draft progress report and data submittal to the database are due 31 July 2006. Final report is due 30 September 2006.

Update and Maintenance GIS Database and Development of a Web-Based Interactive Interface
Fiscal Year 2006 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 (SJRBRIP), 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 aforementioned integration report was made 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.

During the second half of 2003 (funds for the SJRBRIP GIS/Database project were received by UNM in June 2003) and first half of 2004, the major development (programming and data formatting) of the SJRBRIP GIS/Database had been accomplished. At the end of 2004, a working version of the SJRBRIP GIS/Database containing all data from 1998 through 2003 (and possibly some older data as time permits) became “live” and available to Biology Committee members and researchers (and others at various levels pending the outcome of access discussions).

Some unexpected hardware upgrades were necessary in 2005, which slowed progress towards a fully functional interface, but after the new server is installed, access to the GIS/Database will be much faster. Decisions regarding authorization of access to the web-based interface should be discussed in 2005 by the Biology Committee and will be finalized under consultation with the SJRBRIP Coordination Committee. After the new hardware configuration is in place in early spring of 2005 and continuing into 2006 and beyond, the project will move into a maintenance phase, in which the majority of work will involve integrating data submitted by individual researchers, supporting database users, and upgrading hardware and software as necessary.

The purpose of this proposal, initiated in 2003, is to fund this effort with the goal of developing a user-friendly web-based interface to SJRBRIP’s GIS Database. Another important objective of this proposal is to provide for the generation of distribution maps that result from user-initiated queries. In addition, continuation of funds to cover the cost of maintenance and distribution of the database are requested.

Study Area

This project will initially encompass the San Juan River Basin downstream of Navajo Reservoir but should ultimately be expanded to include the entire San Juan River Basin.

Objectives (continued from FY2003, with completion projected for out years)

1. Maintain and incorporate researchers' comments into the web-based interface to 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).
4. 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. Maintain a web-based interface to the GIS Database.

In 2004, a web page interface was developed which authorized researchers can use to access and analyze the data geographically. The interface provides the ability to create custom multiple-parameter queries within the researchers' datasets and result in generation of maps and data reports that can be used in analysis as well as reporting activities. Comments on the interface will be continually solicited and incorporated, as appropriate, in future versions of the interface.

2. Update and Maintain GIS Database.

In 2003, the existing GIS Database, which has been maintained by Keller-Bliesner since its inception, was transferred to UNM/USFWS. The database format was being modified (under consultation and coordination with Keller-Bliesner) to better integrate with the data program being prepared for GIS interface application. Starting in 2003, UNM assumed responsibility for tracking and acquisition of annual datasets to be submitted by 31 March of each year by individual researchers. New data will be incorporated with the existing San Juan River Recovery Implementation Program's GIS Database. Existing data will be checked for Quality Control and updated as necessary.

3. Coordinate Database Updates and Maintenance with FWS-Region 2. The close proximity of UNM to the U.S. Fish and Wildlife Service's - Region 2 Albuquerque Office provides for extensive coordination of updates, maintenance, and development of the database. The UNM staff will consult and coordinate closely with appropriate staff (including the San Juan River Program Coordinator and San Juan River Program Assistant) in the FWS-Region 2 office in all aspects of the work. This effort will result in the collaborative production of the database and web-based interface.

4. 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.

5. 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 and associated documentation will be disseminated via a password-protected project web page. The database and interface will reside with Region 2 (Albuquerque) of the U.S. Fish and Wildlife Service, the designated repository for the data, and on a UNM server.

Peer Review
Fiscal Year 2006 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 participated in meetings in 1997 where the flow recommendations were discussed, and continued involvement in the flow recommendation report process by commenting on the pre-draft report and attending a Biology Committee meeting to discuss the pre-draft report in 1998. They also met with the Biology Committee in 1999 to discuss the draft flow recommendation report that the Biology Committee sent to the Coordination Committee for review. In addition, in 1999 the Peer Review Panel reviewed the draft Monitoring Plan, and initial drafts of the final research reports.

In 2000 and 2001, the Peer Review Panel reviewed and commented on the final research reports, the long term monitoring plan, and the Program Evaluation Report.

In 2002, the Peer Review Panel was changed somewhat. Drs. Ron Ryel and David Galat were retained from the existing panel and two new members were added. Dr. John Pitlick from the University of Colorado was selected as the geomorphologist and Dr. Stephen Ross from the University of Southern Mississippi was selected as the fishery ecologist after a lengthy selection process. During 2003 the Peer Review Panel participated in subcommittee and Biology Committee meetings related to integration of 1999-2002 monitoring data, as well as attending Biology Committee meetings related to the Work Plan. Dr. Galat resigned from the panel and the Biology Committee selected Dr. Wayne Hubert, U.S. Geological Survey, University of Wyoming, to fill that position as a river aquatic ecologist for the Panel. Dr. Hubert resigned in late 2003 and Dr. Mel Warren was selected to replace him on the panel. During 2004 the Peer Review panel remained involved in the integration effort with Dr. Ryel taking a larger role in conducting statistical analyses of fishery data. The committee also became involved in reviewing scopes of work for new projects that were solicited by the Bureau of Reclamation.

This proposal provides for funding for the Peer Review Panel activities during 2006. It is anticipated that the Panel will meet with the Biology Committee at two meetings during the year, the February, 2006 summary meeting and another meeting typically in May to discuss Scopes of Work for 2007. If any new scopes of work are identified, the Panel may again be asked to assist in the review and ranking of the proposals that are submitted.

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 to produce scientific credible documents and will assist the Biology Committee in maintaining a highly scientific direction to the Program.

Methods

The Peer Review Panel will meet with the Biology Committee in 2006 two times to review monitoring and research progress and to discuss scopes of work for 2007. 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 Dr. Paul Holden 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 Dr. Paul Holden.

Products

Peer review participation at 2 Biology Committee meeting, letter or verbal reports from each peer reviewer.

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Population Model Maintenance
Fiscal Year 2006 Project Proposal

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Background

A modeling effort to construct a conceptual framework for the fish community and endangered fishes in the San Juan River began in 1998. This effort relates to Sections 5.1; 5.1.1; 5.1.2; 5.1.3.; 5.1.4 of the Long Range Plan. These models have helped direct a focused field effort with the intent of using key site specific data to determine the carrying capacity of Colorado pikeminnow and razorback sucker in the river. A mechanistic population model has been constructed from the original conceptual model.

The San Juan River population model includes bioenergetics, population, and trophic components. Data for fish populations by age class and habitats as well as other trophic components are required as model parameters. The population model was demonstrated to the Biology Committee, Researchers and Peer Review Panel in May 2004. The Committee requested that a scope of work be developed to continue model maintenance and conduct model runs during FY 2005. That scope of work was developed and approved for FY2005. The intent of the FY2006 program is to continue to refine the structural and functional components of the mechanistic model, present an updated version of the model to the Biology Committee members, and make additional model runs with updated input data from the monitoring in the San Juan River.

Objectives

1. Maintain Stella model software for the San Juan population model, which includes updating the model parameters with new information from the monitoring program.
2. Update the user interface and run-time version of the model.
3. Make model additional model runs that incorporate the information from the monitoring data to evaluate SJRIP Program objectives.

Methods

The model will be updated with current data on species distributions and abundance from population estimates and the standardized monitoring program. Model simulations will be made to evaluate the change in population dynamics as a result of stocking Colorado pikeminnow and razorback sucker. Model simulations will be conducted for a maximum of 10 different simulations.

Schedule

Model maintenance will be concurrent with model simulations. Model maintenance will consist of updating the model with new model parameters based on new information and updating the model software as needed. Model maintenance will begin with the notice that funding has been secured and would continue through September 30, 2006.

Products

A brief report will be prepared that documents the model maintenance and model runs. Summary tables of model simulations will be produced for each model run. A summary of model maintenance activities will be completed and submitted to the standardized data base.

Assessment of Colorado Pikeminnow Augmentation
Fiscal Year 2006 Project Proposal

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Background

In 1996 and again in 1997, approximately 100,000 young-of-year (YOY) Colorado pikeminnow were stocked in the San Juan River to characterize growth and retention in the river and quantify and characterize nursery habitat used by stocked fish (Trammel and Archer 2000). This experiment showed that habitat for young Colorado pikeminnow was available and reasonably common in the San Juan River, that YOY survived for at least 2 years, grew up to 250 mm TL, and that a large proportion remained in the river, rather than dispersing to Lake Powell. Differences in survival and retention observed between sampling trips and years were attributed to storm events and flow patterns. Storm events and runoff events tended to reduce survival and move the fish downstream. Fish in the lower river tended to be more susceptible to flow-induced changes in retention than fish in the upper river.

Based on the success of this experimental study, the SJRIP stocked 100,000 pikeminnow above the Fruitland Diversion in Farmington, NM, and another 100,000 at the Shiprock Bridge in Shiprock, NM, on October 24, 2002. The SJRIP also funded BIO-WEST, the New Mexico Department of Game and Fish, and the University of New Mexico to follow the progress of the stocked pikeminnow seasonally through 2002-2003. The overall goal of the study was to characterize retention of stocked Colorado pikeminnow and what, if any, changes should be made to the augmentation program to increase retention. In addition, an important objective of the current augmentation program is to establish Colorado pikeminnow in the area above Shiprock, especially the area above the PNM Weir. The adult Colorado pikeminnow recovery goals (USFWS 2002) were based on the assumption that Colorado pikeminnow could be expanded into this area to utilize the abundant available forage (native suckers and dace). Therefore, determining whether the area upstream of PNM Weir could retain stocked pikeminnow was an important objective of the pikeminnow monitoring project in 2002-2003.

Results of the December 2002 and March 2003 samplings showed that retention above the Hogback Diversion appears to have been poor, and few if any pikeminnow appear to have moved upstream from the Farmington stocking site. Only 12 pikeminnow were collected in approximately 14 miles of sampling between the Farmington stocking site and the Hogback Diversion in December 2002. By the March 2003 sampling, only 1 pikeminnow was found in 9 miles of river sampled between the Farmington stocking site and the Hogback Diversion. Below the Hogback Diversion retention seems to have been better. In December 2002, 111 pikeminnow were captured in 29 miles of river sampled between the Shiprock Bridge and Sand Island. In March 2003, 96 pikeminnow were collected in the 29 miles sampled between the Shiprock Bridge and Sand Island. Bot the number and catch per effort of Colorado pikeminnow collected in December 2002 and March 2003 were lower than sampling at similar times after the 1996 and 1997 experimental stockings by the Utah Division of Wildlife Resources (UDWR), even though more pikeminnow (4 times more in this area) were stocked in 2002.

In early November 2003 175,000 YOY pikeminnow were stocked in the upper San Juan River. A number of experiments were conducted by stocking the fish into low velocity habitats in two 5 mile river reaches (Dale Ryden, USFWS, personal communication), and holding fish in two other 5 mile reaches for almost a week prior to release. An extensive mortality event occurred in the fish that were held for a week, prompting concern for the way the fish were handled prior to stocking. Monitoring in December 2003 found relatively few of the stocked fish (281), but more than was found in December 2002. Monitoring in March 2004 also found more fish and a higher catch rate than was found in March 2003 (Golden and Holden 2005). While more pikeminnow were collected in March 2004 than in December 2003, catch rates declined indicating that fish continued to move out of the system during that time period. Adult monitoring in September 2004 captured the highest numbers of young pikeminnow since the Program began (Dale Ryden, personal communication, Golden and Holden 2005). Hence, retention of the stocked Colorado pikeminnow may have been somewhat higher from the 2003 stocking than the 2002 stocking.

In late October 2004 about 280,000 pikeminnow were stocked in the upper San Juan River, but the handling period prior to stocking was elongated by Dexter National Fish Hatchery and Technology Center. Acclimation studies were conducted on 20,000 of the stocked fish by BIO-WEST. A monitoring trip in early November found 1,433 YOY pikeminnow, nearly 4 times the number found in 2003. Additional monitoring in March and July 2005 will determine if retention was actually higher in 2004-2005 or if the high number caught in November 2004 was caused by the time of sampling or some other factor.

Stocking Colorado pikeminnow into the San Juan River is expected to continue annually (Ryden 2003) with the intent of developing an adult population capable of sustaining itself in the river and meeting the recovery goals of 800/1,000 adult Colorado pikeminnow (USFWS 2002). At least 300,000 YOY pikeminnow are scheduled for stocking in October 2005. Some of the 2005 fish will be stocked over several miles of river at each stocking area, rather than in only two locations (Dale Ryden, USFWS, personal communication).

In this scope of work, we propose continuing the YOY Colorado pikeminnow monitoring that was initiated in 2002. This includes monitoring fish that will be stocked in 2005 and any pikeminnow remaining in the study area from the 2002, 2003, and 2004 stockings. This monitoring will help to more clearly understand factors affecting pikeminnow growth and retention in the San Juan River. We proposed some changes to study reaches in 2005, by deleting the two upper stations where no stocked fish have been found yet, and adding portions of the river now uncovered by a lowering Lake Powell, and that will be continued in 2006

The study will also continue to help refine augmentation protocols. Due to the low retention from the 2002 stocking, studies related to acclimating the fish to the river environment were experimented with in 2003 and 2004. The fish used in the acclimation study in 2003 were marked with a calcein dye that was not readable in field conditions. Hence, it could not be determined if more fish retained from those held in the experiment. In addition, nearly 75 % of the fish used in the study exhibited a delayed mortality. A VIE (visible implant elastomer) mark was used in 2005 and preliminary indications from November 2004 and March 2005 monitoring suggests it worked well hence it will be used in 2006.

The 2003-2006 data will provide a baseline to compare against future years. Continued sampling will allow the SJRIP to judge the success of new stocking protocols, habitat restoration efforts which may be implemented in the future, and different flow conditions between years, at improving the retention of stocked YOY pikeminnow. This information can be used to make management decisions regarding future augmentation efforts.

In addition, a population estimate of the fish stocked in October 2005 will be attempted in late summer and fall 2006. Precise population estimates may be the best way to determine differences in retention and survival to age-1 between the different stocking year-classes.

Study Area

The study area will be the same as for 2005 and will encompass the San Juan River from the Lake Powell water elevation (approximately RM-25) to the mouth of the Animas River (RM180.2). Similar to 2004-2005, nine stations from Farmington to Clay Hills and one river reach from Clay Hills to the Lake Powell water line will be utilized to represent the study area, two in Geormorphic Reach 6 near Farmington, two in Reaches 2 and 3, and one each in Reaches 1, 4, and 5. Within geomorphic reaches 1-6 the study stations will remain the same as in the past to allow for retention comparisons between years. Table 1 provides the stations to be sampled, along with their river mile boundaries.

Table 1. Stations to be sampled for the 2003-2004 Colorado pikeminnow monitoring.

Station
Fruitland Diversion to Hatch Trading Post
APS Weir to Hogback Diversion
Shiprock Bridge to Cudei
Drift station to Four Corners Bridge
Aneth
Bluff
Below Mexican Hat
Johns Canyon
Grand Gulch
Clay Hills to Lake Powell

Specific experiments to improve retention will occur between the Animas River confluence (RM 180.2) and the Shiprock Bridge (148.9).

Objectives

The objectives of the study are listed below.

1. Characterize growth and retention of 2005 stocked YOY Colorado pikeminnow during the first year after stocking in the San Juan River.
2. Identify factors such as river flow, storm events, and canal locations, with emphasis on the area above the PNM Weir, that are related to high or low retention of stocked YOY Colorado pikeminnow during the first year after stocking.
3. Characterize growth and retention of stocked YOY Colorado pikeminnow from the 2002-2004 stockings during additional years in the river.
4. Compare growth and retention between 2002-2005 stocked fish and relate to changes in stocking protocol, river conditions, habitat improvements, and habitat availability.
5. Compare growth and retention of the 2002-2005 stocked fish with historical stockings, and relate to changes in stocking protocol, river conditions, habitat improvements, and habitat availability.especially in the upper river.

Methods

Protocol Experiments - BIO-WEST proposes to continue experiments of the benefits of site acclimation in 2005-2006. In addition, experiments of stocking fish earlier, at a warmer river temperature, will be conducted.

Conducting multiple stocking protocol studies at the same time can be complicated unless fish in the different experiments can be marked or different study areas are used. In 2003-2004 we experimented with a calcein marker that Dexter National Fish Hatchery is studying. Our results found the calcein mark to be very difficult to read in the field and, hence, have decided not to use calcein in 2005. An elastomer dye mark was used in 2005 that is injected under the skin of the fish in various colors and locations to separate different experiments. The dye mark is clearly visible with the naked eye. BIO-WEST has used the elastomer dye tag on native fish in other basins with great success, and Dexter used it in 2003 on several other endangered fish with great success. During the November 2004 monitoring the mark was easy to see. The disadvantage of the elastomer is the time and cost associated with marking the fish. Dexter estimates a crew of 7-10 individuals can mark 20,000 pikeminnow in 2-3 days, whereas the calcein mark takes 1-2 people a few hours. The advantages of the elastomer include ease of positive identification in the field and the availability of multiple colors and/or locations on the fish to mark different experiments. All fish used in the acclimation and earlier stocking experiments proposed in this

SOW will be elastomer marked to differentiate them from the bulk of the YOY pikeminnow to be stocked by the USFWS. The USFWS is proposing to use the same stocking protocol initiated in 2003 by stocking pikeminnow over two 10-12 mile reaches of the San Juan River in October 2005. The YOY pikeminnow will be stocked directly into low velocity habitats throughout the river from the confluence of the Animas (RM 180.2) to the Hatch Trading Post (RM 169.5), and also from the Hogback Diversion (RM 159) to the Shiprock Bridge (RM 148.9) (D. Ryden, USFWS, personal communication). A GPS location will be taken at each area where pikeminnow are released.

Acclimation studies will occur in the San Juan River between the Animas confluence (RM 180.2) and Shiprock, NM (148.9). The habitat available in each reach of river at any given time is largely a function of prevailing flow conditions. Therefore, BIO-WEST will perform a reconnaissance trip through the aforementioned 31-32 miles of river a few days prior to the stocking to identify appropriate backwater and side channel habitat available for acclimation studies. During the reconnaissance trip, BIO-WEST will attempt to find a 5 to 10 mile reach with enough low velocity habitats suitable for acclimation. Experience the past two years has suggested that a broader review of potential habitats is needed than continuing to use the two discrete reaches used in the past. If a suitable 5 to 10 mile reach can not be found, BIO-WEST will use the best habitats available in a proximity that can be feasibly stocked and monitored. A GPS location will be taken for all acclimation study sites. Block nets with < 2 mm mesh will be used to enclose the low velocity habitat to prevent the escape of introduced pikeminnow and the entrance of other fish. Block nets will be set in place several days prior to stocking to determine any obvious problems with the maintenance of the acclimation study sites. The USFWS will be stocking fish in all available low velocity habitats from the mouth of the Animas River to Hatch Trading Post, and Hogback Diversion to Shiprock reaches so some overlap may occur between our acclimation study and their stocking.

BIO-WEST personnel will receive a subset of approximately 20,000 fish from Dexter National Fish Hatchery. These fish will be marked with an elastomer dye mark. The dye will allow identification of those fish that were site-acclimated during the 2005-2006 YOY Colorado pikeminnow monitoring. BIO-WEST will place these marked pikeminnow into each selected acclimation habitat. Block nets will be monitored every day or two for 7 days after the stocking, at which point block nets will be removed.

In addition to stocking YOY pikeminnow, BIO-WEST will also assist the USFWS with stocking 3,000 approximately 150 mm pikeminnow reared at Dexter and delivered to the river at the same time as the YOY fish. BIO-WEST will use one of the selected acclimation sites to hold 200 of these larger pikeminnow for up to one week. PIT tag numbers of the acclimated fish will be recorded so they can be identified later.

Early Stocking Experiment

In 1996 and 1997 YOY Colorado pikeminnow were stocked in the San Juan River, but stocking times were different between the two years. In 1996 the fish were stocked in early November, in 1997 they were stocked on August 15. Fish stocked in 1996 showed little growth until the following spring, whereas the 1997 stocked fish grew during the fall after stocking. Some of the 1997 fish were found over 8 miles upstream of the stocking site, indicating they had moved upriver that distance. No fish in 1996, or in the recent 2002-2004 stockings, have been found upriver from the stocking sites. The growth and movement of young pikeminnow stocked earlier in the year when river temperatures are warmer suggested they may have become more acclimated to their new river environment. Warmer river temperatures may have contributed to this behavior since most fish tend to become fairly inactive as water temperature declines.

We propose to stock a group of 20,000 YOY Colorado pikeminnow with an elastomer dye mark (different than for the acclimation experiments) to test the hypothesis that earlier stocking will lead to

increased retention in the river, and to increased retention in the upper river. The fish will be stocked in low velocity habitats in the Animas River to Hatch Trading Post reach of the San Juan River in late August, 2006. BIO-WEST personnel will coordinate with Dexter National Fish Hatchery for the fish tagging and will conduct the actual stocking. A similar early stocking will occur in August 2005 as part of the 2005 scope of work.

The early stocking and acclimation studies are proposed to run for another 3 years since different techniques may work better under different flow/habitat/temperature conditions.

Monitoring

Three sampling trips will be made between the 2005 YOY pikeminnow stocking and September 2006. The first trip will be 2 to 4 weeks following stocking, most likely in early November 2005. The second will be post-winter, but pre-runoff, most likely in March 2006. The third trip will be post-runoff, most likely in August, 2006. Trips will be scheduled to avoid periods of changing flow conditions.

During each trip, each of the 9 sampling stations will be sampled for one day. Access to the stations will be made with a raft. The river reach below Clay Hills will be sampled as one long station since we are not sure at this time what type of habitat occurs in this reach. Within each station or reach, as many backwaters, shoals, and other low-velocity habitats available for young Colorado pikeminnow (Trammel and Archer 2000) will be sampled as is practicable in a day. Random sampling between stations will occur in Reaches 1 and 2 and below Clay Hills as the entire area below Mexican Hat will be floated. Sampling will be conducted using a 4 m x 2 m x 3 mm, 3 m x 2 m x 3 mm or a 9 m x 2 m x 6 mm double-weighted seine during the fall 2004 and spring 2005 sample. Electrofishing was experimented with in the July 2004 trip, but was not very efficient. A block seining technique using a 9 m x 2 m x 6 mm double-weighted seine at the bottom of a sample and a another similar seine to work down to the bottom seine, worked well in July 2004 and will be used in the August monitoring trip in 2005 and 2006.

Information collected at each seining location will include: river mile location, GPS location (UTM), habitat type, seine type, water temperature, area sampled (length and width), average depth, maximum depth, and substrate type. All fish collected, except for small larvae, will be identified to species and counted. A minimum of 50 randomly selected individuals of each species will be measured at each station except for Colorado pikeminnow, which will all be measured. This will provide information on the general size and age of the fishes that are collected at each station and during each sampling trip. 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 hauls runs may be made in large (>100 m^2) habitats. The emphasis will be to take as many samples as possible rather than to gather detailed information on each fish captured.

A PIT tag reader will be taken on monitoring trips. All pikeminnow over 150 mm TL captured during monitoring will be scanned for PIT tags and tagged if they do not already have a PIT tag.

It is anticipated that data on stocked Colorado pikeminnow will also be obtained during the annual April-June razorback sucker larval fish and July-September larval Colorado pikeminnow surveys currently being conducted under the SJRIP, as was the case in 2003 and 2004. Additionally, the fall standardized sampling (Propst et al. 2000), adult monitoring (Ryden 2004), and nonnative removal studies (Davis and Coleman 2004, Jackson 2003) should provide some information on pikeminnow retention during various other times of the year. Since University of New Mexico (UNM) personnel responsible for the two aforementioned larval fish studies, the New Mexico Department of Game and Fish (NMGF) personnel responsible for the fall small-bodied fish standardized sampling, and the Utah Division of Wildlife Resources personnel responsible for the nonnative monitoring study are the co-principal investigators on this proposal, we expect seamless integration of data between the respective projects.

Data analysis will include an evaluation of changes during the course of the year in YOY Colorado pikeminnow catch rate, size, and location in the river. Information from the razorback sucker spring-summer sampling, as well as the September-October standardized monitoring, will be included in the analysis to provide a complete first year picture of the fate of the stocked fish. As the fish grow, information from the large-bodied fish electrofishing surveys will also be added. Changes in YOY Colorado pikeminnow catch rates will be compared with factors such as flow, river location, presence of canals, and other factors that may influence growth or retention. The results from the first year of the study will be compared with the second year of the study to determine changes in retention and identify potential causes for those changes. Information from earlier pikeminnow stocking efforts and follow-up sampling will be reviewed and compared where appropriate to the 2002, 2003, 2004, and 2005 information. YOY pikeminnow habitat use will be examined with chi-square analysis. Potential changes to the augmentation program will be suggested based on the results of the study, especially if growth or retention are not within the range of expected results as noted in the Augmentation Plan (Ryden 2003).

Collection information will be compared with physical information such as river flow, storm event timing, and habitat availability that will be obtained from the physical monitoring activities of the SJRIP (Keller-Bliesner Engineering data). This physical information will be compared to the catch information to determine possible reasons for changes in retention between years and between sampling periods. In addition, if habitat improvements are implemented in 2005, the effect of those actions will be evaluated by comparing catch rates between years at appropriate stations.

Population Estimate

A population estimate of the fish stocked in October 2005 will be attempted near the end of their first year in the river. During the summer monitoring trip, BIO-WEST will mark all pikeminnow captured with either a PIT (fish over 150 mm) or VIE mark. In addition, the Utah Division of Wildlife will also mark all pikeminnow captured during a concurrent electrofishing trip in the lower river (below Mexican Hat) in the same manner, and the USFWS will also mark fish during non- native sampling in the upper river during August. The recapture portion of the experiment will be the fall adult and small-bodied monitoring in September or October. BIO-WEST will gather the mark and recapture data from the various researchers and develop population estimates using the program MARK.

Data Analysis

Data collected during the 2004-2006 YOY Colorado pikeminnow monitoring will be used to judge the success of each of the above methods in increasing the retention of stocked pikeminnow. All pikeminnow captured during monitoring will be scanned for the presence of the elastomer dye. A comparison of pikeminnow CPE between years in the Fruitland to Hatch and APS Weir to Hogback stations will provide information on whether site acclimation studies increased the retention of fish in these stations. Examining all fish captured during the monitoring for dye marks should provide information on how far site-acclimated fish drifted from their stocking site, whether site acclimated fish had better retention than non-acclimated fish, and if stocking earlier increased retention. Pikeminnow CPE will be compared between years to provide information on whether stocking fish into individual habitats increased retention. Finally, comparing the overall pikeminnow CPE between years should indicate whether the suite of protocols implemented during the 2004 stocking had an impact on the retention of pikeminnow throughout the river. Where appropriate, we plan to use parametric tests, such as Analysis of Variance and t-tests, to compare catch per effort between years and stations. If data can not be transformed to approximate the normal distribution, alternative distributions and visual trends will be used to evaluate the data.

BIO-WEST personnel will have the lead role in the study. Mr. Michael Golden will be the team leader. Personnel from NMGF and UNM will assist with field collection efforts and provide equipment as

necessary for the upper eight stations. Personnel and rafts from UDWR will be used to access the lower three stations and the reach below Clay Hills. A standard field crew of four people is anticipated for all trips.

The study is planned for a minimum of 3 more years to allow for an evaluation of the various factors that may be impacting YOY Colorado pikeminnow retention.

Products

Letter-type trip reports summarizing what was found will be prepared following each trip. These short reports will be sent to the Biology Committee via the listserver once data have been preliminarily analyzed.

BIO-WEST personnel will also attend the annual researchers' meeting in February 2004 and provide a Microsoft Powerpoint presentation of the results of the project.

The annual draft report for 2005-2006 will be prepared and distributed to the SJRIP Biology Committee on or before March 31, 2007. Upon receipt of comments, a final report will be prepared on or before June 1, 2007, and provided to the SJRIP for distribution. All data will be presented in a Microsoft Access database and provided to the SJRIP for inclusion in the standardized database by March 31, 2007.

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Non-native Species Monitoring and Control in the Upper San Juan River
Fiscal Year 2006 Project Proposal

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Background

From 1991 to 1997, non-native species studies on the San Juan River focused on the identification of impacts to native fishes. Research characterized non-native species distribution and abundance in main channel habitats, seasonal movements of both channel catfish *Ictalurus punctatus* and common carp *Cyprinus carpio*, food habits of non-native predators, overlap of resource use between native and non-native fish species, and the relation of these findings to differing flow regimes. Channel catfish were the most abundant large bodied non-native fish in main channel collections (Ryden, 2000). Data showed channel catfish occupied a variety of main channel habitats, exhibited localized movement, and fish > 450 millimeters total length (TL) preyed upon native fishes (Brooks et al., 2000).

Beginning in 1999, emphasis on removal of channel catfish and common carp was placed on a portion of Reach 6, PNM Weir to Hogback Diversion (River Mile [RM] 166.6 to 159.0) and was designed to address efficacy of mechanical removal and minimization of the reproductive effort in the upper portion of these species ranges. This sub-reach was selected based on studies conducted from 1991 to 1997 indicating low numbers of both channel catfish and common carp above PNM Weir and channel catfish collected within this reach were almost exclusively large adult fish, > 300 mm (Ryden, 2000).

Intensive non-native removal completed its fourth consecutive year in 2004. Removal efforts have focused on the PNM Weir to Hogback Diversion Section but were expanded to include the Hogback to Shiprock Section in 2003. This downstream expansion in effort was a result of frequently low catch rates (CPUE), < 5.0 channel catfish/hour of electrofishing, from PNM to Hogback during removal trips and an associated high abundance, > 40.0 channel catfish/hour of electrofishing downstream of Hogback Diversion.

Channel catfish CPUE throughout intensive removal reaches has varied from 2001-2004 and between Sections. Mark/recapture data suggest that these flucuations in CPUE are a result of channel catfish emigration from areas adjacent to intensive removal reaches. Although an overall reduction in CPUE has not been observed since 2001, increases in juvenile fish and associated decreases in adult fish have been observed (Davis, 2005). Juvenile catfish comprised < 1% of the total catch in 1999 and > 45% in 2004. Fish > 500 mm comprised 52.6 % of the catch in 1999 and 3.5% in 2004.

A shift to smaller sized channel catfish is important to the control of this species due to attainment of sexual maturity and increased reproductive potential of larger sizes. Helms (1975) found that length was positively correlated with fecundity. In this study, 1 of 10 channel catfish were sexually mature at 330 mm TL, producing about 4,500 eggs compared to 5 of 10 at 380 mm TL, producing over 41,000 eggs. These shifts to smaller individuals coupled with declines in seasonal abundance throughout this reach may have long term effects to the channel catfish populations in adjacent downstream reaches.
In addition, common carp CPUE from PNM Weir to Hogback Diversion have decreased among 2001-2004 comparisons. No apparent decrease in size class distribution of common carp has been noticed with the majority of the catch consisting of individuals > 400 mm TL.

Supplementing intensive removal trips are the opportunistic removal of non-native fish during juvenile/adult fish monitoring trips (RM's 147.9 – 0.00). Monitoring trips in 2004 showed riverwide declines in CPUE for both channel catfish and common carp (Davis, 2005 and Ryden, personal communication). Although these trends cannot be attributed exclusively to removal efforts, the observed declines in CPUE of non-native fish is encouraging. Declining shifts in channel catfish size structure, most notably in Reaches 4-2 (RM 131.0 – 17.0), may be effecting overall recruitment in the San Juan River.

Since 2002, elevation at Lake Powell has been decreasing resulting in the formation of a waterfall near Piute Farms, RM -0.50 (Jackson, 2004). Researchers with the SJRIP have hypothesized that the formation of this waterfall may be limiting movement by non-native fishes from Lake Powell into the lower reaches of the San Juan River. This hypothesis is supported by the lack of striped bass *Morone saxatilis* and walleye *Sander vitreus* in various electrofishing collections since 2002 (Jackson 2005; Ryden 2004; Davis 2005). This waterfall may also be limiting upstream movement by channel catfish and common carp.

For the past several years the Utah Division of Wildlife Resources have focused non-native removal efforts in the lower San Juan River (RM 52.7 – 0.00) while U.S. Fish and Wildlife Service efforts have focused on 18.7 river miles in the upper portions of critical habitat for both Colorado pikeminnow *Ptychocheilus lucius* and razorback sucker *Xyrauchen texanus*. Current conditions including declining trends in riverwide CPUE for both species, a shift to smaller less fecund individuals, and the presence of a waterfall preventing upstream movement of non-native fish provide researchers with a unique opportunity to expand removal efforts. If removal efforts continue, while a high percentage of the population are small less fecund individuals, a continued decrease in overall abundance can be expected. Expansion of removal to areas where exploitation occurs only once or twice a year (RM's 147.9 – 52.7) may be critical in accomplishing significant riverwide declines in distribution and abundance of these two non-native fish.

Expansion of removal efforts will include sampling trips to be conducted from Shiprock to Montezuma Creek, Utah (RM 147.9 – 93.6), when deemed feasible. These trips will only be conducted when channel catfish and common carp CPUE are at levels from PNM to Shiprock Bridge that researchers feel a shift in effort would be beneficial to overall goals. The addition of this stretch will add 54.3 river miles of removal to the 69.7 river miles where intensive removal currently takes place.

Given the popularity of channel catfish as a sport fish and the concerns expressed by the public regarding disposal of removed fish, a program to transplant removed fish to isolated fishing impoundments within the Basin was initiated in 1998 and continues through the present. Channel catfish are transported by the New Mexico Department of Game and Fish or the Navajo Nation to closed impoundments. This effort is strongly supported by the State of New Mexico and the local public and expansion of the program is highly recommended.

The USFWS has a long standing working relationship with Native American tribes in assisting in various fisheries related issues including non-native recreational fishing programs on tribal lands. The Service has long provided recreational game fish to tribal partners throughout the Southwest with emphasis on rainbow trout, *Oncorhyncus mykiss*, and channel catfish. Many hatchery programs which supplied these fish for tribal use have suffered cutbacks or complete closures causing many tribal programs to suffer. The Southwest Tribal Fisheries Commission (SWTFC) was formed to restore and enhance tribal sport fishery resources and may provide additional support for distribution of removed channel catfish.

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. Expand intensive removal efforts downstream to Montezuma Creek, Utah (RM 93.6) while still maintaining sufficient effort to maintain current accomplishments within upstream sub-reaches.
4. 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.
5. Characterize the seasonal distribution and abundance of striped bass upstream of Shiprock, NM during removal efforts and continue to document the predative impacts via stomach content analysis.

Methods

Mechanical removal will continue during the fall main channel monitoring efforts. During these sampling efforts, all non-native species 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. Data will be summarized by geomorphic reach and sampling will occur two out of every three river miles. Data for recaptured channel catfish and common carp tagged during all studies will be recorded in the field and integrated into existing databases for movement and abundance. Catch per unit effort (CPUE) will be calculated as number of fish collected per hour electrofishing time and be calculated for the total collection and for each species. Analyses will include comparison of 1998-2004 data summaries.

Initial sampling efforts, minimum of one trip, will be conducted from PNM Weir to Hogback Diversion to monitor and evaluate prior year's effort and to remove fish that remain or have moved upstream of Hogback Diversion. If catch rates remain low (< 5.0 catfish/hour of electrofishing) during initial sampling, removal efforts will shift to the adjacent downstream reach. After high spring flows sampling efforts again will be shifted to the PNM Weir to Hogback Diversion reach to address any upstream emigration that occurred.

Removal from PNM Weir 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 1 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/weight, and, for lacustrine predators, stomach contents. Total and individual daily catch rates will be calculated to evaluate efforts of short-term suppression efforts to locally deplete non-native species numbers. Fish collected with the support raft will be kept separate from fish collected by electrofishing rafts and will be analyzed both independently and combined to determine if significant differences in CPUE exist. If lack of significant differences exists, support raft fish will be included in CPUE effort comparisons among trips and years.

Colorado pikeminnow < 150 mm collected during removal efforts in August 2006 will be implanted in a predetermined location with a VIE (Visible Implant Elastomer) tag. These efforts will assist other SJRIP researchers in acquiring population estimates for Colorado pikeminnow through mark/recapture efforts.

In addition, removal trips will be tentatively conducted from Shiprock to Montezuma Creek, Utah. Trips throughout this Section will occur when researchers determine CPUE in upstream reaches are at low enough levels to warrant a shift in effort. These trips will follow similar protocol to removal efforts conducted by UDWR in the lower portion of the San Juan River. Two shocking rafts will sample the entire reach with a support raft following to collect fish not captured by the electrofishing rafts. Fish will

be processed, weighed and measured, every three river miles. If rare species are collected, sampling will be immediately halted and the fish will be weighed, measured, checked for the presence of a radio transmitter or PIT tag and will be released within the general area of collection. Notes on the condition of the fish and location of collection (RM) will be recorded. In addition, both catch rate and length/weight relationship data on native fish (flannelmouth sucker *Catostomus latipinnis* and bluehead sucker *Catostomus discobolus*) collected during fall adult monitoring and spring razorback sucker trips will be analyzed to determine effects non-native removal has had on distribution and abundance of these species.

Tentative intensive removal trips by Section (FY 2006):

PNM to Hogback-	minimum of one trip
Hogback to Shiprock-	3-6 trips
Shiprock to Montezuma Creek-	3-5 trips
Total # of trips-	**10 trips in FY 2006**

Deliverables

An electronic data file will be provided for inclusion in the centralized database by 31 March 2007. A draft summary report detailing findings will be submitted to the San Juan River Implementation Program, Biology Committee, by 31 March 2007. Revisions will be completed and a final annual report will be submitted by 1 June 2007.

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Nonnative Species Control in the Lower San Juan River
Fiscal Year 2006 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) 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 will provide in 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 in 2003 and 2004.

Over 24,000 channel catfish and approximately 2,700 common carp were mechanically removed from the lower San Juan River from 2002 to 2004. 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). 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 2004. 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 2004. Preliminary population estimates for juvenile Colorado pikeminnow residing in the lower San Juan River were generated in 2004 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 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 2005 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, 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. Colorado pikeminnow collected during Bio-West's sampling in the lower river will augment the number of marked fish, which will ultimately strengthen the resulting estimate.

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 2007. 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 2007. Electronic copies of the field and collection data will be transferred to the San Juan River database manager following the successful protocol previously employed.

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Razorback Sucker Augmentation and Monitoring
Fiscal Year 2006 Project Proposal
12 April 2005

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Background

Razorback sucker is a federally-listed endangered fish native to the San Juan River. At present this species remains rare in the San Juan River. In order to gain information on habitat use, possible spawning areas, and survival and growth rates of hatchery-reared razorback sucker in the wild, it was necessary to experimentally stock a small number of fish. Experimental stocking of razorback sucker into the San Juan River began in 1994, as outlined in An Experimental Stocking Plan For Razorback Sucker In The San Juan River. Between 1994 and 1996, a total of 940 razorback sucker were stocked into the San Juan River by personnel from the U.S. Fish and Wildlife Service's (Service) Colorado River Fishery Project (CRFP) office in Grand Junction, Colorado. All fish were PIT-tagged before release into the wild. Based on the success of this experimental stocking study the decision was made to implement a full-scale augmentation program for razorback sucker in the San Juan River. Information obtained during the evaluation of stocked razorback sucker will help address objectives 5.1 through 5.5 in the San Juan River Long Range Plan.

In August 1997, a Five-Year Augmentation Plan for Razorback Sucker in the San Juan River was finalized. The five-year augmentation plan, recommended the stocking of 73,482 razorback sucker into the San Juan River between 1997 and 2001. Stocking of razorback sucker from various sources into the San Juan River began in early September 1997. However, between 3 September 1997 and 1 November 2001 a total of only 5,896 razorback sucker were stocked into the San Juan River. If razorback sucker stocked as part of the experimental stocking plan (1994-1997) are included, 6,836 razorback sucker have been stocked into the San Juan River since 1994. The 5,896 razorback sucker stocked as part of the five-year augmentation effort represents a shortfall of 67,586 fish when compared to numbers recommended in the five-year augmentation.

The inability to achieve San Juan River razorback sucker augmentation goals has been due to a suite of circumstances all of which ultimately result in a lack of fish. However, the main problem is that rearing facilities outside of the San Juan River Basin lack the capabilities to hold and rear razorback sucker for the San Juan River Recovery Implementation Program (SJRIP). To alleviate this problem, the SJRIP undertook efforts to obtain or build grow-out ponds within the San Juan River basin that would afford a measure of self-sufficiency (for holding/rearing fish) to the San Juan River razorback sucker augmentation program. Beginning in 1997, a series of grow-out ponds were established on NAPI lands southwest of Farmington, New Mexico. Presently there are about 25 surface acres of grow-out ponds (i.e., nine individual ponds) being used to rear razorback sucker.

In spring 2005, the 6-Pack grow-out ponds, Hidden Pond, and East Avocet Pond (West Avocet Pond is currently being renovated) were all stocked with age-0 razorback sucker obtained from the Service's 24-Road hatchery. These razorback sucker were excess fish that were being culled from the UCRB razorback sucker broodstock lots. In subsequent years, these nine ponds will be stocked with age-0 and

age-1 razorback sucker (~ 20,000 fish ≥ 200 mm TL annually) that are being reared at Dexter National Fish Hatchery (NFH).

Because of the large shortfall in numbers of stocked fish during the 1997-2001 augmentation effort, the San Juan River Biology Committee adopted an addendum to the 1997 stocking plan (finalized in February 2003) that extends the intensive stocking period for razorback sucker for an additional eight-year time period. The addendum called for stocking a minimum of 11,400 age-2 razorback sucker per year, with the goal of establishing an adult population of 5,800 adult razorback sucker in the San Juan River. This eight-year stocking period was originally supposed to begin in 2004 and continue through 2011. However, because of several different factors (i.e., West Avocet Pond currently being out of production, the lack of a finalized pond management plan and an "on-the-ground" pond manager, the need to wait for Dexter NFH to get "up to speed" in delivering annual shipments of 200+mm fish), the San Juan River Biology Committee has decided to delay "starting the clock" on this eight-year stocking period (i.e., realistically trying to meet the annual stocking goals of 11,400 age-2 fish as specified in the stocking plan addendum) until all corrective measures are completed/in-place.

In the meantime, razorback sucker stocked into the grow-out ponds in spring 2005 (as well as holdover fish from previous years' harvest efforts) will be harvested and stocked throughout 2006 (and outyears, if necessary) as an interim effort to continue bolstering numbers of razorback sucker in the San Juan River. In 2006, the grow-out ponds currently in use will be sampled multiple times (approximately five weeks of harvest effort) and fish ≥ 300 mm TL will be selectively removed, PIT-tagged, and stocked into the San Juan River. This selective removal of larger fish from grow-out ponds will allow for accelerated growth of smaller razorback sucker remaining in the grow-out ponds.

Description of Study Area

Razorback sucker will be reared in ponds southwest of Farmington, New Mexico for two full growing seasons (to TL ≥ 300 mm), at which time they will be harvested, PIT-tagged, and stocked into the San Juan River at RM 158.6, just downstream of the Hogback Diversion (between Farmington and Shiprock, New Mexico).

The study area for monitoring razorback sucker stocked into the San Juan River extends from RM 158.6 (just downstream of Hogback Diversion in New Mexico) downstream to RM 2.9 (Clay Hills boat landing) just upstream of Lake Powell in Utah.

Objectives

1. Obtain, rear, harvest, and stock razorback sucker in order to fulfill the tasks and objectives outlined in the current version of the razorback sucker augmentation plan addendum (*2003 final*)
2. Monitor stocked razorback sucker in the wild for various parameters, including:
    a. Spawning season habitat use and movement patterns
    b. Survival and growth rates
    c. Determine whether hatchery-reared razorback sucker will recruit into the adult population and successfully spawn in the wild
3. Remove nonnative fish species which prey upon and compete with native fish species in the San Juan River.

Methods

USFWS personnel will coordinate the obtaining of larval razorback sucker from appropriate sources during March and April 2005. CRFP personnel will determine when it is appropriate to transfer larval razorback sucker from holding facilities to grow-out ponds (presumably late May to early June). This transfer and disposition of larvae will be determined and coordinated by CRFP personnel.

CRFP personnel will coordinate obtaining any excess larval or juvenile razorback sucker that may become available from UCRB recovery efforts (e.g., those from the 24-Road hatchery). CRFP personnel will transport these fish and stock them in the appropriate grow-out pond.

Razorback sucker will be reared in grow-out ponds for two full growing seasons (or until they are $\geq$ 300 mm TL) before being stocked. Management of ponds, including maintenance of water level, fertilization, and monitoring of pond water quality, invertebrate, and plant communities will be performed by personnel from cooperating agencies/entities under a separate workplan. Once a pond management plan has been developed, it is assumed that long-term management of the grow-out ponds will become the responsibility of a locally-based, "on-the-ground" pond manager.

Starting in 2005, the process of rearing razorback sucker will enter a two-step process. In the first step larval razorback sucker will be intensively-reared at Dexter NFH to maximize growth of these fish in their first year. It is anticipated that intensively-managed age-0 fish will be fed an artificial diet and precautions will be taken to eliminate, or at least minimize, threats from avian and aquatic predators (e.g., tiger salamanders), which can take a very heavy toll on larval fish. In the fall of their first growing season or early in the spring of their second growing season (i.e., when these fish reach $\geq$ 200 mm TL), these fish will be harvested, transported to, and stocked into the existing grow-out ponds near Farmington, NM. Fish will spend their second growing season in the more passively-managed, grow-out ponds before being harvested, PIT-tagged, and stocked into the San Juan River. This approach should allow fish being stocked into existing grow-out ponds to avoid predation by aquatic predators (specifically tiger salamanders) due to their larger size and increased mobility.

Harvest of grow-out ponds will occur for approximately five weeks during the year. Ponds will be harvested using fyke nets (6-8 per pond), working a maximum of three grow-out ponds at any one time. During harvest, razorback sucker $\geq$ 300 mm TL will be harvested from ponds, PIT-tagged, and stocked into the San Juan River just downstream of Hogback Diversion (RM 158.6). Razorback sucker < 300 mm TL will be returned to grow-out ponds. However, the first 50 sub-harvestable and the first harvestable fish (100 fish total) collected from each pond will be weighed and measured. This will allow for the tracking of fish growth in the ponds throughout the year.

To monitor fish that have been stocked into the river, CRFP personnel (along with personnel from cooperating agencies) will monitor stocked fish on two electrofishing/netting trips in 2006. One trip will sample RM 158.6-76.4, followed shortly thereafter (or possibly concurrently) by a second trip that will sample RM 52.9-2.9. These two sampling trips will occur on the ascending limb of the hydrograph, from late April to late May. The canyon-bound river section from RM 76.4-52.9 will not be sampled due to the paucity of razorback sucker collections that have historically occurred there and in order to avoid conflicting with the heavy recreational rafting usage in this section of the San Juan River. Raft-borne electrofishing will be the primary sampling technique (although selective seining and trammel netting may also be used at the sampling crews' discretion) used to determine dispersal, and relative abundance of stocked razorback sucker. Razorback sucker captured on the April/May razorback sucker monitoring trips will be counted as "marked" fish for use in a capture-recapture population estimate. The fall 2006 main channel fish community monitoring trip will act as the second "riverwide" pass to monitor stocked razorback sucker. Population estimates can then be generated using mark-recapture models (e.g., Programs CAPTURE and/or MARK, or alternately the Lincoln-Petersen and/or Schnabel population estimate models). Electrofishing and handling of rare fish species will follow the protocols found in the **Sub-Adult and Adult Large-Bodied Fish Community Monitoring** workplan, except that only data on rare fish species collected (i.e., razorback sucker, Colorado pikeminnow, and roundtail chub) will be recorded. When rare fish species are collected, PIT tag number, length, weight, reproductive status (if evident), and information about health abnormalities (if any) will be recorded.

Electrofishing recapture efforts will be aimed at gaining data on age, growth, and sexual status, as well as trying to identify groups of razorback sucker that are aggregating to spawn. If spawning aggregations of razorback sucker are identified, crews from other research elements monitoring razorback sucker larval drift (i.e., Steven Platania) and habitat quality and quantity (i.e., Ron Bliesner and Vince Lamarra) will be notified.

In support of objective 3, mechanical removal of nonnative fish species will continue to take place on all razorback sucker monitoring trips.

The Service (CRFP) will have the lead for the razorback sucker monitoring with the Service's New Mexico Fishery Resources Office (NMFRO) providing field personnel and equipment for monitoring trips. Other cooperating agencies may provide personnel and equipment for these trips as needed.

Products

An interim progress report for razorback sucker monitoring trips conducted in 2006 is scheduled to be completed by 31 March 2007. A "draft final" incorporating all comments received is scheduled to be completed by 1 June 2007. DBASE files containing information on total catch and length/weight data gathered for rare fish species will be submitted to the University of New Mexico's Museum of Southwestern Biology (Division of Fishes) for inclusion in the SJRIP's integrated database and web page by 31 March 2007.

Qualifications of Personnel Included in the Budget

Principal Biologist (GS-12) -- Dale Ryden
Holds a BS degree. Has 16 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 15 years.

Biological Technicians (GS-7) – Bio. Techs from USFWS-CRFP
All hold at least a BS degree depending upon the individual they have from 1-7 years experience performing fisheries research/management in the Colorado River Basin. Most have at least 1-2 years of experience performing fisheries research/management on the San Juan River.

Project Leader (GS-14) -- Chuck McAda
Holds an MS degree. Has 26 years experience performing fisheries research/management in the Colorado River Basin. Chuck is the current chairman of the San Juan River Recovery Implementation Program's Biology Committee.

Projected Duration Of Project

This project was initiated in 1997 in support of the razorback sucker augmentation efforts that were ongoing at the time and it has continued annually since that time. This augmentation and monitoring effort is scheduled to run through the end of the eight-year razorback sucker augmentation effort specified in An Augmentation Plan For Razorback Sucker In The San Juan River: An Addendum To The Five-Year Augmentation Plan For Razorback Sucker In The San Juan River (Ryden 1997) (Ryden 2003). The eight-year stocking period in question was specified in the 2003 stocking plan addendum as being from 2004-2011. However, because of several different factors (i.e., West Avocet Pond currently being out of production, the lack of a finalized pond management plan and an "on-the-ground" pond manager, the need to wait for Dexter NFH to get "up to speed" in delivering annual shipments of 200+ mm fish), the San Juan River Biology Committee has decided to delay "starting the clock" on this eight-year stocking period (i.e., realistically trying to meet the annual stocking goals of 11,400 age-2 fish as specified in the stocking plan addendum) until all corrective measures are completed/in-place. Therefore, this project is scheduled to continue annually as an interim stocking effort until the San Juan River Biology Committee

"starts the clock" on the eight-year stocking period. At that time, the razorback sucker augmentation and monitoring effort will be scheduled to end at the end of that eight-year time period.

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Pit Tag Procurement
2006 Project Proposal

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Background

Pit tags are used to individually mark fish for use in movement studies and for mark-recapture estimates in the San Juan River Basin. Pit tags are not specific to any particular project, but are used by several different projects. Pit tags and readers purchased for the SJRIP will be combined with the purchase made for the UCRIP to save money by purchasing larger quantities and save expenses associated with administering the contract. All pit tags and readers will be shipped to USFWS in Grand Junction C/O 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 – 2006

1. Research information for RFP
2. Develop RFP and advertise
3. Purchase pit tags and readers and distribute to end-users

In FY2005, $40,000 was allocated in the workplan to purchase pit tags. An RFP was developed in early 2005 and advertised as a Single-Source Contract to BioMark. During the RFP process Reclamation became aware of other pit tagging manufacturers as well as other alternatives to the Biomark pt tags. Based on the limited information included in the first RFP, Reclamation employees decided to cancel the RFP and gather more information to specifically address what the two Recovery Programs wanted to purchase. Enough pit tags were available to address 2005 tagging needs in both Recovery Programsso plans were made to convene a pit tagging group with the goal of developing specification criteria for inclusion in a second RFP. This SOW includes the development of the RFP as well as the purchase of pit tags in FY2006.

In FY2005 the Hydrology Committee identified $28,000.00 of unobligated money that they would not be able to expend within FY2005. The BC decided that they could use the $28,000 in FY2005 to purchase pit tags and allow the HC to use $28,000 of the BC's money in FY2006 to apply towards hydrology model runs.

A Pit Tag Group, comprised of participants from the UCRIP and SJRIP, has been formed and they are in the process of developing criteria to be included in an RFP. A meeting is scheduled August 17th in Grand Junction, CO to review the various pit tag technologies available to the two programs. We expect that an RFP will be developed shortly after this meeting and an award made by February 2006.

Stocking of Fingerling Colorado Pikeminnow and Reporting of 2005 Results
Fiscal Year 2006 Project Proposal
12 April 2005

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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. 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, several hundred stocked juvenile and adult Colorado pikeminnow have been recaptured during either seining or electrofishing efforts. A handful of the individuals stocked in 1996 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. This augmentation plan provides the necessary guidance for augmentation efforts as well as directly fulfilling objective 5.3.8.2 of the San Juan River Long Range Plan.

The first stocking of Colorado pikeminnow under the direction of this augmentation plan took place on 24 October 2002 (plan was still in draft form), when 210,418 age-0 Colorado pikeminnow were stocked into the San Juan River, half each at RM 180.2 and RM 158.6. The second stocking of 176,933 age-0 Colorado pikeminnow occurred on 6 November 2003, with fish being stocked into numerous low velocity habitats between RM 188.4 and RM 148.5. The third stocking (actually two separate stocking efforts, totaling 280,000 age-0 fish) occurred on 21 and 28 October 2004, with age-0 fish being stocked into numerous low velocity habitats between RM 188.4 and RM 148.5.

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 five years (i.e.,

through 2009). In December 2002, a study was begun (under a separate workplan) to intensively monitor newly-stocked age-0 Colorado pikeminnow at several stations, throughout the river on three to four occasions during the year.

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***.
2. Provide a report that gathers information from various sources on fingerling production, numbers of fish stocked, subsequent recaptures during various sampling efforts (other than the intensive monitoring effort), 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 many 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.

Objective 2: After stocking, CRFP personnel will collect information on stocked fish from Dexter NFH (numbers produced, size at stocking, locations stocked at) and on recaptures during subsequent monitoring and sampling efforts by various agencies/entities involved in SJRIP research projects (other than the intensive Colorado pikeminnow monitoring effort). 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 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 in 2006 will be produced by 30 March 2007. A “draft final” of this report, incorporating all comments received will be completed by 1 June 2007. DBASE files containing information on stocked and recaptured Colorado pikeminnow will be submitted to the University of New Mexico’s Museum of Southwestern Biology (Division of Fishes) for inclusion in the San Juan River Recovery Implementation Program integrated database and web page by 31 March 2007.

Qualifications of Personnel Included in the Budget

Principal Biologist (GS-12) -- Dale Ryden
Holds a BS degree. Has 16 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 15 years.

Biological Technicians (GS-7) – Bio. Techs from USFWS-CRFP
All hold at least a BS degree. Depending upon the individual, they have from 1-7 years experience performing fisheries research/management in the Colorado River Basin. Most have at least 1-2 years of experience performing fisheries research/management on the San Juan River.

Project Leader (GS-14) -- Chuck McAda
Holds an MS degree. Has 26 years experience performing fisheries research/management in the Colorado River Basin. Chuck is the current chairman of the San Juan River Recovery Implementation Program's Biology Committee.

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. These stocking and subsequent reporting 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).

Literature Cited

Ryden, D. W. 2003. An augmentation plan for Colorado pikeminnow in the San Juan River. U. S. Fish and Wildlife Service, Grand Junction, CO. 63 pp. + appendices.

Colorado Pikeminnow Fingerling Production
San Juan River
Fiscal Year 2006 Project Proposal

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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's 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 subadults 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.

Dexter NFH & TC has been the leader in propagating and culturing Colorado pikeminnow (Ptychocheilus lucius) since 1981. The facility maintains several captive stocks as genetic reserves and has successfully produced fish for the Upper and Lower Colorado River Basin programs and the SJ RIP. The major emphasis has been on the reproductive biology, broodstock development and culturing fry, fingerlings and adults. This work plan proposes to continue the production of 300,000 fingerlings (50 mm TL) annually and initiate a phase II growout program to produce an additional 3,000, 150mm fish 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, 05YC fingerlings for two growing seasons.

Funding is also requested to provide proper care of broodstock necessary to successfully carry out this study for future years and aide in restoration of the species. Stocking will require coordination with New Mexico 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 fingerlings (50 mm) and 3,000 phase II fish (150mm) for stocking in the San Juan River in 2006.
2. Continue data collection on induced spawning of Colorado pikeminnow under controlled conditions.
3. Provide staff to assist with PIT tagging phase II fish.
4. Transport and distribute 300,000 Colorado pikeminnow fingerlings and 3,000 Phase II 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 1974, 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 2006. 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 after fertilization.

When eggs begin hatching, larvae will be transferred to hatchery tanks and held until swim-up occurs, five to seven days. Fry will be enumerated and stocked into three earthen ponds ranging from .33 to .35 ha. Fry will be cultured in earthen ponds for 120 days and phase II fish for 240 days and will then be available for stocking in the San Juan River during October, 2006.

Proposal
FY 2006

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

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

Prepared for:
U.S. Bureau of Reclamation RFP 04-SF-40-2250 and
The San Juan Recovery Implementation Program

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I. Table of Contents

Executive Summary

Dexter National Fish Hatchery and Technology Center (DNFH&TC) continues to play a vital role in the restoration and recovery of endangered and threatened fishes of the Southwest. Following a 10 year span of facility improvements, Dexter has developed into a state-of-the-art fish culture and research facility. In 2004 aquatic species propagation and conservation programs continued to advance under static operating budgets and major renovations to the physical plant. Throughout the year, Dexter staff fostered new and existing partnerships in order to successfully propagate and maintain 17 federally listed fish species; and conduct applied research in the fields of molecular ecology, nutrition, marking, and water reuse. A major emphasis was placed on meeting fish propagation and augmentation needs for several resource implementation/management programs which included the Colorado, San Juan, Mimbres and Virgin Rivers and the Rio Grande.

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.

The following scope of work identifies the facilities and methodologies that will be used at Dexter to produce 20,000, 200+ mm razorback sucker for use by the San Juan River Basin Implementation Program (SJRIP) to meet its augmentation objectives for the species in the San Juan River. Production guides have been developed for the species based on historical growth rates at Dexter. Most recently the facility successfully reared large numbers of razorback sub-adults (300+mm) for stocking into Lake Mohave, Arizona, Lower Colorado River. This scope of work also identifies one capital improvement to the rearing facilities. Four earthen ponds will be lined with plastic to more efficiently utilize water resources at Dexter and effectively manage the rearing ponds.

Background

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.

Mission

Dexter National Fish Hatchery's early mission was to produce warm water fish for distribution in the southwest. Largemouth bass, smallmouth bass, bluegill, and channel catfish were distributed to federal reservoirs, state lakes, farm ponds and Indian reservations, for recreational fishing. This mission was very successful and continued for over 40 years.

In 1974 DNFH&TC was selected as the place to establish a threatened and endangered holding facility and was totally devoted to the propagation and culture of imperiled fishes by 1978. With its establishment, three main goals were set for this new program: (1) establish a refuge for critically

imperiled fishes of the American Southwest; (2) implement studies and develop projects investigating spawning and culture techniques; and (3) produce and rear selected species for reintroduction programs. Center objectives were also established to further define the new mission and operations: (1) maintain a viable and protected gene pool of various imperiled fishes of the Southwest; (2) develop culture techniques for native fishes; (3) study their biological requirements; (4) provide live and preserved fish specimens to authorized agencies and institutions; (5) provide an exchange of expertise and data on holding, culture, and management of these species; (6) publish findings when appropriate.

A total of 16 listed and 1 species of special concern were maintained at DNFH&TC during FY-2004. With the exception of one species, the Pahranagat roundtail chub, all species are from New Mexico or a state contiguous to New Mexico borders (Arizona, Utah, Colorado, Texas, and the Mexican states Chihuahua and Sonora). Dexter NFH & TC's responsibility to provide for the long-term maintenance of these fish is indeed unique, as is the development of culture and production techniques for selected species in order to provide fish for reintroduction under recommended and approved recovery programs.

Dexter National Fish Hatchery was designated a Technology Center in FY-1991, one of seven currently in the Fish and Wildlife Service. This was in recognition of the pioneering fishery research work that has been carried out at the facility to further the recovery of native fishery resources of the Southwest.

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 133 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 1,200 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	Founders Represented	Lot Designation

1981	F_1 Mohave	133	adults / Mohave	'81
1994-2003	Mohave	1200	90 / Mohave	PM
1999-2004	Mohave	1000	fry /Mohave	WC
2003	F_2 Mohave	1000	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.

In 2001-2004 production of subadult razorbacks at DNFH&TC yielded excellent survival and growth. The overall survival for razorback sucker grown to 300mm was 92.5%, 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 swim up 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 ponds at surface acres of 0.72, 0.79, 0.82, and 0.86. Within this scope DNFH&TC proposes to line these four ponds with plastic due to associated water seepage, water conservation and pond management purposes.

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:

Phase I Growth: (April thru May - 60 day growing period)

Pond 1- .72 acre @ 22,500 fry
Pond 2- .79 acre @ 22,500 fry

Phase II Growth: (June thru October - 150 day growing period)

Harvest ponds from phase I growing period; 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 ponds will be used for the first year of production or until the ponds are lined with plastic. Pond 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
1-2"	1.0 mm
3-5"	2.0 mm
6-8"	3.0 mm

Projected Harvest Dates and Delivery Date

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. This time frame indicates that the initial delivery of fish would be in June of 2006. In order to initiate a consistent production cycle DNFH&TC proposes to spawn and maintain 40,000 to 50,000 fingerlings in a production year in order to produce the requested number of fish in subsequent years. Following the initial year of production the spawning effort would be reduced to 20,000 annually, and these fish will be incorporated into the production cycle. At any given point of the production cycle there will be 40,000 fish in the system. With this scenario there will be no spawning conducted in the final year of the project in order to allow the final 20,000 fish to exit the production cycle. Approximately 20% of the razorbacks being cultured will reach the target size in DNFH&TC 8 month annual growing season. If the program desires those fish could be sorted from the population and stocked in late October or early November of 2005. The remainder of the fish would be stocked as scheduled in September of 2006.

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.

Dexter Water Quality Analysis

Well and pond water samples are submitted to the Soil, Water, Air, Testing Lab (SWAT) at New Mexico State University in Las Cruces, NM on an annual basis. Over the past three years DNFH&TC has established the following baseline for water quality to monitor changes over time.

Element	Recommended Criterion	Well No.1	Pond 6-B
Alkalinity	>20 mg/l	188 mg/l	165 mg/l
Calcium	4-160 mg/l	18 mg/l	20 mg/l
Carbon dioxide	0.10 mg/l	N/D	N/D
Chlorides	<250 mg/l	145 mg/l	168 mq/l
Oxygen	>5 mg/l	3.7 mg/l	9.68 mg/l
Hydrogen	<0.002 mg/l	N/S	N/S
Iron	<0.015 mg/l	0.13 mg/l	0.03 mg/l
Lead	<0.03 mg/l	N/D	N/D
Nitrogen gas	<110 %	94%	94%
Nitrate (NO3)	<1 mg/l	2.0 mg/l	2.03 mg/l
Nitrate (NO2)	<0.1 mg/l	N/D	N/D
pH	6.7-8.6 mg/l	7.02 mg/l	7.87mg/l
Phosphates (total)	0.05 mg/l	.04 mg/l	.09 mg/l
Selenium	<0.005 mg/l	N/D	N/D
Sodium	<75 mg/l	230 mg/l	315 mg/l
Sulfur	<1 mg/l	N/S	N/S
Sulfate (SO4)	<50 mg/l	2059 mg/l	2109 mg/l
TDS	< 400 mg/l	3800 mg/l	4748 mg/l
Zinc	<0.003 mg/l	N/D	N/D

*Dissolved oxygen measurements were taken by Dexter personnel.

*N/D- Not Detected, N/S- Not Sampled

*SWAT Lab
New Mexico State University
Box 30003
Las Cruces, NM 88003
(505) 646-4422

Handling and Transport Protocol

Transport of all eggs and 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, sub-adults 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, Pinetop Fish Health Center 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.

Reporting

Staff will abide to the reporting requirements as identified in section B.11- a, b and c “Reporting requirements and distribution” of the RFP 04-sf-40-2250.

Schedule
Broodfish were spawned in March 2005 and fish are reared in earthen ponds for the first season (April - October 2005); held indoor during winter (November 2005- March 2006) stocked into newly lined ponds in March 2006 and available for distribution in September 2006.

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

Personnel

Manuel E. Ulibarri, Center Director
Education:
B.S. 1985, Biology, Western New Mexico State University
1986 to 1988 Graduate work in Fisheries Science, New Mexico State University

Professional Experience:
Dexter NFH & TC - 2001 to present (EOD at Dexter NFH & TC 11/04/01)
Willow Beach NFH - 1998 to 2001
Uvalde NFH - 1991 to 1998
Mescalero NFH - 1986 to 1991
Rock Lake State Fish Hatchery, Santa Rosa, NM 1981 to 1984

Roger L. Hamman, Assistant Center Director
Education**:**
B.S. - 1975, Fishery Biology, Southeastern Oklahoma State University
B.S. - 1975, Wildlife Biology, Southeastern Oklahoma State University
A.S. - 1973, Murray State College

Professional Experience**:**
Dexter NFH & TC - 1986 to present
Dexter NFH - 1982 to 1986
Willow Beach NFH - 1982 to 1982
Leetown Fish Hatchery Manager Long Course - 1981 to 1982
Willow Beach NFH - 1978 to 1981
Tishomingo NFH - 1975 to 1978,

Dave Hampton - Fisheries Biologist
Education:
B.S. 1994 - Environmental Ecology, Eastern Illinois University,

Professional Experience:
Dexter NFH & TC - 1995 to present
Army National Guard - 1995 to 2001
Manpower Inc. - 1994, Illinois
Garrison Dam NFH - 1993
U.S. Army - 1988 to 1990

Atha Sharon Coats - Administrative Officer
Education:
Computer programming - college course, New Mexico Military Institute
Hagerman High School

Professional Experience:
Dexter NFH & TC - 1980 to present
Leetown Fish Hatchery Manager Long Course - 1981 to 1982
Willow Beach NFH - 1978 to 1981
Tishomingo NFH - 1975 to 1978,

Phillipe Sosa – Engineering Equipment Operator & Fish Distribution
Education:
Dexter High School

Professional Experience:
Dexter NFH & TC – 1984 to present
U.S. Postal Service – 1982 to 1984 Dexter NFH – 1978 to 1982 Levi Strauss & Co. – 1970 to 1978 Glover Meat Packing Plant – 1969 to 1970 General Tire & Rubber Co. – 1968 to 1969 Villa Solano State School for the Handicapped – 1967 to 1968
U.S. Army – 1964 to 1967

Appendix Table 1.

FIVE YEAR HATCHERY PRODUCTION SUMMARY

Station: Dexter NFH&TC

	Fiscal Year				
	1999	2000	2001	2002	2003
1. Fish Production Data					
Intensive Culture:					
Fish Weight Gain (lbs.)			228.5	91.1	110.2
Fish Numbers			13288	14209	9,595
Percent Survival			69.4	98.0	98.3
Feed Conversion			4.8	3.7	6.4
Extensive Culture:					
Fish Weight Gain (lbs.)	5440	2689	1449	5344	4571
Fish Numbers	936884	640400	449611	827910	1027943
Percent Survival	-	-	-	-	-
Pounds per Acre	363	266	161	661	466
2. Broodstock Production Data:					
Number of Females Spawned	41	34	23	154	169
Number of Eggs	3230203	1594194	851676	3239157	5387086
Number of Fish	1030434	546808	294570	1630616	1435543
3. Management Data:					
Full-Time Equivalents	8	10	9	9.8	11.38
Operational Costs	436,856	439,314	641,226	710,737	661,549
Vehicle/Equipment Costs (Items over $1,000)	1,936	10,481	9,773	8,558	0
Cyclical Maint. Costs	33,500	53,000	208,500	35,000	20,000
Quarters Costs	1,784	2,024	4,560	5,264	19,602

Form 3-115 (Rev. 8/96)

Appendix Table 2.

FY2003 Razorback Sucker Subadult Production Summary

Station: Dexter NFH & TC						Period Covered: October 1, 2002 thrcugh September 30, 2003				
Species/Strain and Lot Number	Fish on Hand Last Day of Period					To Date This Fiscal Year				
	Number	Weight	Length	D.I.	F.I.	Weight Gain	Feed Expended		Conver-sion	Percent Survival
							Pounds	Costs		
1	2	3	4	5	6	7	8	9	10	11
Bonytail Lake Mohave 02LMDX	1,861	62.0	4.8	-	-	57.0	421	316	7.4	98.0
Bonytail Lake Mohave 03LMDX	3,017	2.0	1.5	-	-	1.9	14	11	7.4	98.0
Razorback sucker Lake Mohave 02LMDX	2,204	61.0	3.5	-	-	45.0	261	196	5.8	99.0
Razorback sucker Lake Mohave 03LMDX	2,513	6.6	1.4	-	-	6.3	13	10	2.1	98.0
	9,595	131.6				110.2	709	533	6.4	98.3

Form 3-103a (Rev. 8/96)

Appendix Table 3.

Dexter National Fish Hatchery and Technology Center
Razorback Sucker Spawning Protocols: 2005

Roger Hamman

March 1, 2005
- screen, board and start filling broodstock summer pond.

March 12, 2005
- start draining broodstock pond

March 13, 2005
- continue draining broodstock pond

March 14, 2005
- Harvest pond and bring all broodstock in to Fish Culture Building
- sort males/females and place in separate tanks
- record pit tag numbers, lengths, weights and take genetic samples of each fish
- inject 25 females with 0.1cc HCG/lb in preparation for spawning
- inject 25 males if necessary with 0.3 cc HCG/lb in preparation for spawning
- Move all broodstock not used in spawning activities to summer pond.

March 15, 2005
- inject 25 females with 0.1cc HCG/lb

March 16, 2005
- inject 25 females with 0.1cc HCG/lb
- prepare incubation system to receive eggs
- gather other equipment and supplies needed for spawning trials

March 17, 2005
- spawn razorbacks using 1 female X 1 male spawning procedure
- inventory each individual spawn
- place eggs in incubators

March 18, 2005
- move spawned broodstock to summer pond
- check eggs in incubators
- individual egg lots can be moved at this time
- prepare a minimum of two 12' tanks to receive fry

March 19, 2005
- check eggs in incubators

March 20, 2005
- check eggs in incubators begin filling 12' tanks with heatec water

March 21, 2005
- check incubators (morning and afternoon) and transfer fry to 12' tanks

March 22, 2005
- check incubators (morning and afternoon) and transfer fry to 12' tanks

March 23, 2005
- transfer remaining fry to 12' tanks
- clean incubators

March 24, 2005
- observe fry in 12' tanks

March 25, 2005
- observe fry in 12' tanks

March 26, 2005
- observe fry in 12' tanks

March 27, 2005
- observe fry in 12' tanks
- clean 12' tanks in preparation for stocking fry into rearing ponds

March 28, 2005
- fry stocked into rearing ponds at 20,000 per acre.

Razorback Sucker Augmentation Ponds Limnological Monitoring
Fiscal Year 2006 Project Proposal

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

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

Study Area

The study area for this project involves the razorback sucker augmentation ponds recently built on the Navajo Indian Irrigation Project.

Background

This work plan represents a continuation of the monitoring program established as part of the limnological investigation of the razorback sucker augmentation ponds located on the Navajo Indian Irrigation Project. The Navajo Nation has requested that the long-term operations and maintenance be undertaken by the Navajo Fish and Game staff. This work plan is a bridge towards that goal. The major objective of this work is to continue to collect limnological data on the ponds (given that two ponds have been retooled and now have no data) and finalize a training and support program for its implementation by Navajo Nation.

Objectives

1. Continue monitoring the 9 ponds located on the NAPI project site
2. Continue a training and support program for the long-term operations and maintenance of the razorback augmentation ponds
3. Implement the Pond Management Plan (pond fertilization, weed control, etc.)

Methods

1. *Implement a long term water quality and hydrologic monitoring program.*

During the first year of this investigation, a systematic set of biological and chemical samples were collected to better define the factors which are limiting the growth rates of razorback suckers in the grow-out ponds located on the NAPI facility. In year two, data were collected only quarterly. The results of these investigations are being incorporated into the draft plan, which will be reviewed by the San Juan RIP Biology Committee. In general, the plan will require a moderate level of monitoring especially following pond fertilization. Secondary problems may occur if over-fertilization affects the dissolved oxygen levels. Parameters will include quarterly water quality grab samples (ortho-P; total-P; NH3; NO2-NO3; heavy metals; Field parameters such as pH, Dissolved Oxygen and temperature will also be measured. Water chemistries will include nitrogen, phosphorous, pH, and TDS.

2. *Implement a long term biological monitoring program*

Investigations of the literature and site specific data indicated the density of zooplankton are critical for the first years growth of razorbacks. Having a high survival rate during the first year is critical in meeting our target stocking rates. It is anticipated that a long-term water quality and biological monitoring program will be needed to track the results of the ongoing management of the ponds. This program will include both the

growth rates of the target fish as well as limnological parameters including phytoplankton biomass (Chl a); and invertebrates (zooplankton and benthic) biomass.

3. *Undertake a training and support program for the long-term operations and maintenance of the razorback augmentation ponds*
This task will train Navajo Nation staff to fully implement the Final Grow-out Pond Management Plan. This training will include instructions on appropriate field methodologies, QA/QC procedure, water supply operation and maintenance training, reporting requirements and periodic facilities inspections.

Products
Annual reports will be produced as part of this ongoing management program. This report will include the summation of the analytical water quality data as well as the biological parameters including the growth rates of the target species. Comparisons will be made to previous year's results. The annual report is due September 30, 2006.

This is the last year of this program to develop and implement a rearing pond management plan, conditioned upon the performance of the ponds and need for continued support.

Operation of Public Service Company of New Mexico Fish Passage Structure and NAPI Ponds Management Training
Fiscal Year 2006 Project Proposal

Principal Investigator: Dr. Vincent Lamarra
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and

Principal Investigator: Jeffrey Cole Navajo Nation Department of Fish and Wildlife Box 1480 Window rock, AZ 86515 (928) 871-7068
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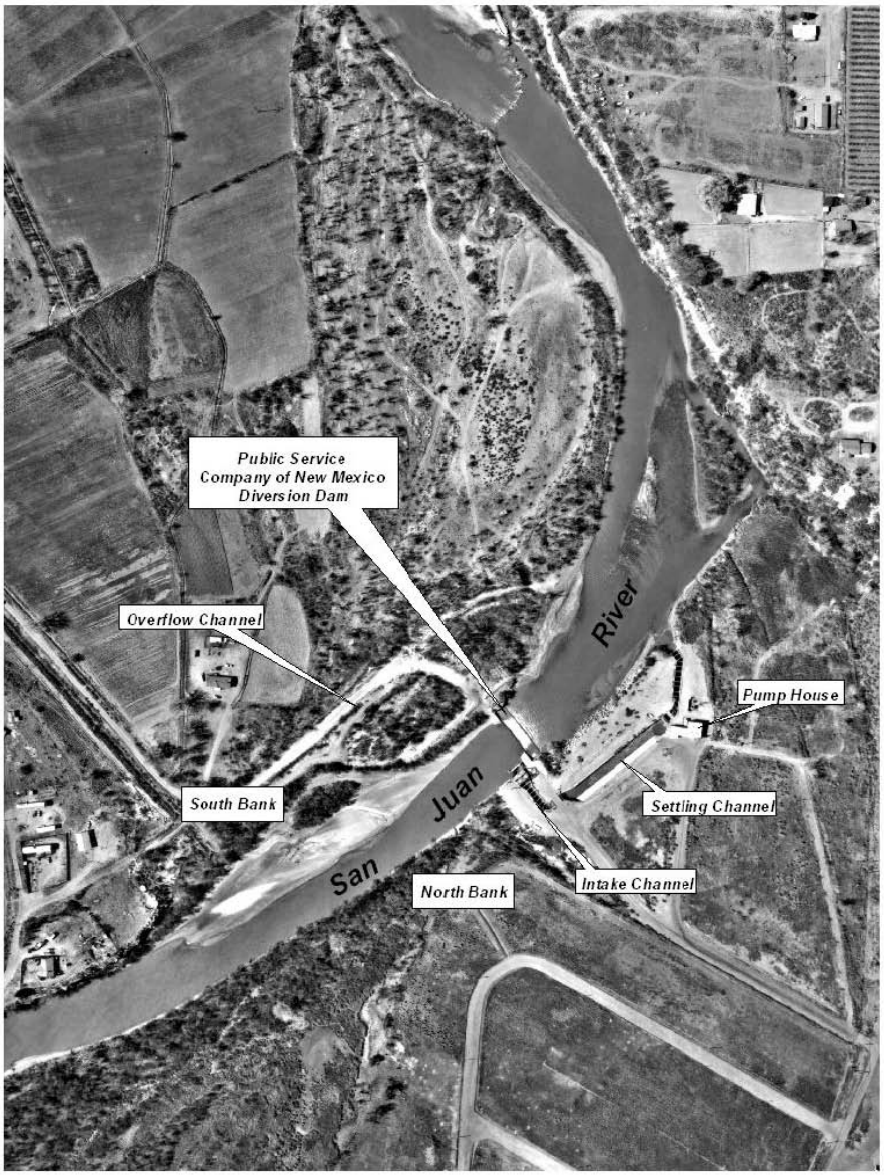
Study Area
Public Service Company of New Mexico Diversion Dam is located at RM 166.6. SJRIP razorback rearing ponds are located on the Navajo Indian Irrigation Project, south of Farmington, New Mexico.

Collections
The fish trap at the upstream end of the fish passage provides the ability to capture all fish that use the passageway. Specimens collected will be inspected to determine if any rare fishes (Colorado pikeminnow, roundtail chub, and razorback sucker) are present in the trap. All identifiable rare fish and all large-bodied native fish (i.e., flannelmouth and bluehead suckers) will be released. All other specimens will be removed from the river.

Background
The PNM Diversion Dam (see Figure 1) 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 4-foot by 6-foot sluiceway in the weir located on the north side of the river is used to sluice the inlet structure of sediment. Normal sluice gate operations have the sluice gate open between 8 and 12 inches. Trash racks and isolation gates are located at the point of diversion. A concrete settling channel about 490 feet long conveys river water to the pump house or returns it to the river. Diverted water moves through traveling screens to three pumps, together they are capable of pumping a maximum of 17,000 gallons per minute (37 cfs) to a 110-acre storage reservoir (Figure 2). From the storage reservoir, the water is pumped to San Juan Generating Station (SJGS).



The facility provides an average of approximately 1 million gallons of water per hour (24,200 acre-feet per year) to PNM for cooling operations for the SJGS (Tetra-Tech 2000).

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 would be 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 fish passageway will extend the range of these two native fishes upstream about 50 miles into historical habitat and may allow Colorado pikeminnow to naturally re-colonize these upstream reaches.

A fish trapping facility located at the upper end or forebay of the fishway allows researchers to sort, examine, and count fish and remove nonnative fish from the system.

Objectives

1. Determine the use of the fish passageway 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.

End Products

1. Definitive data on passage--number of species; numbers per species; seasonal use and distribution by species.

2. Well maintained and operable fish passage facility.

Methods

Working with the Program, Reclamation will contract with the Navajo Nation to perform the long-term operation and maintenance of the passageway. Work performed by the Nation is grouped in 2 general areas, operation and maintenance.

Fish and Wildlife Service personnel will provide necessary fish passageway training. Training will be provided in Grand Junction, Colorado at the Redlands Fish Passage on the Gunnison River. The training will assure the follow proficiencies:

1. Proper fish handling skills.
2. Species identification
3. PIT Tagging skills

Operation

1. Operate the fish trap and passage way from April 1 through October 31 each year.

2. Passage is visited once a day to check trap, sort fish, and remove trash as needed.

Steps are as follows:

1. Lower water in trap
2. Collect fish in nets and remove from trap
3. Sort fish by native and non-native species (dispose of non-native species)
4. Enumerate and record all fish 4" in length or longer.
5. Check Colorado pikeminnow and razorback sucker for presence of a PIT tag.
6. If tag is present record number, tag fish if no tag is found.
7. Weigh and measure each Colorado pikeminnow and razorback sucker (use total length in mm, weight in grams).
8. Return all native species to the river via the fish return pipe.
9. Raise water in trap.

3. Crews checking the fish trap are also responsible for periodic cleaning of riverborne sediment in the fish trap that usually builds up during runoff.

4. Daily cleaning of surface and submerged trash, debris, and riverborne 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.

5. Analyze and evaluate data and prepare annual progress report.

6. Prepare draft and final report.

Maintenance

1. Maintain the fish passage facility as necessary. Maintenance will include inspection of facilities for items that need to be repaired. Painting as necessary to control corrosion. Lubrication of moving equipment. Checking fluid levels in gear boxes and cooling radiators, if any.

2. During the first 2 years of operation representatives from the Navajo Nation, Reclamation, and FWS will inspect the facility to identify any design deficiencies and maintenance requirements.

3. After the first 2 years of operation, representatives from the Navajo Nation, Reclamation and the FWS will perform an inspection every 3 years.

4. In the event of a significant flood event, representatives from the Navajo Nation will notify Reclamation, BIA and the FWS and all parties will inspect the facility for damage.

Deliverables/Schedule

1. Fish number will be recorded daily and a monthly fish passage report shall be submitted to the U.S. Fish and Wildlife Service by the 15th of each following month including time and date each time the trap was checked, number of species, and lengths, weights and PIT Tag numbers of each endangered fish.

2. Analyze and evaluate data and prepare annual progress report.

3. Prepare draft and final report.

NAPI Ponds Management

The individual that is operating the PNM Fish Ladder will also work with Vince Lamarra (ERI), Ron Bliesner (KBE) and BIA staff for staff training and managing the NAPI Razorback sucker grows out ponds. Manager will be responsible for daily pond inspections, and regulation of water levels. Water quality will be monitored daily for temperature, dissolved oxygen, pH and electrical conductivity. Dikes, fence, piping and ancillary equipment will be monitored weekly. Water levels will be maintained as necessary. No major maintenance is included in this budget. The ponds will be managed as per the Razorback Pond Management Plan.

COLORADO RIVER RECOVERY PROGRAM Project No.:
FY-2006–2007 PROPOSED SCOPE OF WORK for:
Guide to Cyprinid Larvae

Lead Agency: Larval Fish Laboratory, Colorado State University
Submitted by: Kevin R. Bestgen, Project Manager
Darrel E. Snyder, Principal Investigator
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Date: 28 April 2005

Category:
_ Ongoing project
_ Ongoing-revised project
x Requested new project
_ Unsolicited proposal

Expected Funding Source:
x Annual funds
_ Capital funds
x Other (Co-Sponsors being sought)

I. Title of Proposal:
Guide to Cyprinid Larvae and Early Juveniles of the Upper Colorado River Basin with Computer-Interactive Key.

II. Relationship to RIPRAP:
General Recovery Program Support Action Plan items V.B (conduct research to acquire needed life history information) and V.C (develop and enhance scientific techniques required to complete recovery actions).

III. Study Background/Rationale and Hypotheses:
Collections of the early life stages of fish are essential for research on and monitoring of Colorado pikeminnow, humpback chub, bonytail, and other fish spawning sites and seasons, larval production, transport, distribution, nursery habitat, and survival, as well as other aspects of early life history. Such research cannot proceed effectively without accurate identification of at least the target species among collected specimens.

Morphological identification requires knowledge of the appearance of not only the target species but all similar species in the waters sampled and the diagnostic criteria for segregating them. For the early life stages of many species, including the catostomids (suckers) and cyprinids (minnows) of the Upper Colorado River Basin (UCRB), morphological criteria for identification change dramatically as the fish grow and develop, making diagnosis especially difficult and complicated. This is well exemplified by the 60-page key by Snyder and Muth (1990) which covers the larvae and early juveniles of just six of the seven species of catostomids in the UCRB.

Descriptive information and diagnostic criteria for larval fish identification must be well founded, sufficiently detailed, and documented in such a way that they are retrievable, usable, and verifiable by any interested researcher, now or in the distant future. Any such knowledge retained only in the minds of one or a few specialists cannot be effectively used, verified, or further developed by others. Taxonomic expertise must be shared and transferred to avoid risk of sudden loss and need for rediscovery and redevelopment.

Nearly 25 years ago the Larval Fish Laboratory published *Contributions to a Guide to the Cypriniform Fish Larvae of the Upper Colorado River System in Colorado* through the U.S. Bureau of Land Management (Snyder 1981). That document, which was based on descriptive information and illustrations from the literature and several developmental studies funded in part by the Colorado Division of Wildlife, was intended to serve as the foundation for a comprehensive guide. With publication of the guide to catostomid larvae by Snyder and Muth (1990) and the recent expansion and update thereof with a computer-interactive key (Snyder and Muth 2004), Part 1 of the cypriniform guide is now complete and only the cyprinid portion of the 1981 publication, Part 2, remains to be similarly completed.

In 1990, Dr. Robert Muth completed a doctoral dissertation documenting the early morphological development of roundtail chub (*Gila robusta*), the endangered humpback chub (*G. cypha*), and the endangered, nearly extirpated, bonytail (*G. elegans*). His detailed and well-illustrated species accounts purposely followed the format employed by Snyder and Muth (1990) for catostomid larvae and required little modification for inclusion of roundtail chub and bonytail in a similarly formatted final-report guide to *Native Cypriniform Fish Larvae of the Gila River Basin* (Snyder et al. 2005). Species accounts for Colorado pikeminnow (*Ptychocheilus lucius*), speckled dace (*Rhinichthys osculus*), carp (*Cyprinus carpio*), red shiner (*Cyprinella lutrensis*), and fathead minnow (*Pimephales promelas*) were similarly adapted and minimally updated from Snyder (1981) for the Gila River Basin guide. However, the data in most of these accounts still remain incomplete and new three-view illustrations will be needed for all but the roundtail chub account in the proposed guide to cyprinid larvae of the UCRB.

Developmental series, mensural and meristic data, and (or) illustrations are needed to complete early life stage descriptive accounts for 13 of the 15 species of to be covered by this guide. Complete sets of 8 three-view drawings are available only for humpback chub, roundtail chub, and Colorado pikeminnow. However, two the drawings for Colorado pikeminnow from Seethaler (1978) should be replaced with more complete or representative illustrations. Much of the specimen material for needed developmental studies is available as part of the Larval Fish Laboratory Collection. However, full series of specimens for four species and just the eggs and recently hatched larvae (protolarvae) for four additional species will need to be reared, collected, or borrowed from elsewhere.

Computer-interactive keys for catostomid larvae of the UCRB (Snyder and Muth 2004) and for the larvae of native catostomids, selected cyprinids, and families of fishes in the Gila River Basin (Snyder et al. 2005) have proven that such taxonomic tools can be effectively applied to the early life stages of fish. For complex data sets, such keys are much more user friendly and flexible than printed dichotomous or polychotomus keys. They are also much easier to prepare, correct, and update. The cyprinid and family level keys prepared for Snyder et al. (2005) will be adapted and refined for UCRB species.

Building on information, species accounts, and keys already assembled by Snyder (1981), Muth (1990), and Snyder et al. (1995) and other information and illustrations from the literature, this four-year project will result in a comprehensive guide to the cyprinid larvae and early juveniles of the UCRB. Combined with the recent update and expansion of the catostomid guide (Snyder and Muth 2004), this project will finally complete work on cypriniform fish larvae as a whole, except for formal publication. Publication will be pursued separate from this project as the manuscript nears completion, preferably as a companion to the catostomid guide recently published by the Colorado Division of Wildlife.

IV. Study Goals, Objectives, End Product: *[Include measurable outcomes and their expected due dates.]*

Goal—

- To improve the ability of Recovery Program and other researchers to accurately identify cyprinid larvae and early juveniles collected in the UCRB.

Objectives—

- To fully document the early morphological development of UCRB cyprinids and publish selected descriptions in technical journals.
- To verify existing, and uncover new, diagnostic criteria for identification of cyprinid larvae and early juveniles.

- To prepare a computer-interactive key to cyprinid larvae and early juveniles complementary to the key for UCRB catostomids (Snyder and Muth 2004) and comparable to the key for selected Gila River Basin cyprinids (Snyder et al. 2005).
- To prepare as manuscript guide to the cyprinid larvae and early juveniles of the UCRB with a proposal for its publication (both print and electronic).

End Products—
Annual project reports.

- Preserved developmental series of the early life stages of needed cyprinids for study and reference to supplement existing specimens in the LFL Collection.
- Publication of selected descriptions in technical journals.
- Online (web) access to the key.
- Proposal for publication of that manuscript.
- Final report in the form of a manuscript guide for publication.

V. Study Area: Entire UCRB.

VI. Study Methods/Approach:

Task 1: Acquisition of specimens needed for developmental study (Table 1)—

- Assemble available specimens in the LFL Collection.
- Borrow needed specimens available in other museums and collections.
- Arrange for cooperative preservation of needed developmental series by fish hatcheries or other facilities rearing those species.
- Rear remaining needed developmental series from collected eggs and larvae or from artificially fertilized eggs from captured brood stock.
- Supplement above, as needed, with targeted or opportunistic collections of larvae and early juveniles.

Task 2: Description and illustration of eggs, larvae, and early juveniles of UCRB cyprinids, as needed (Table 1)—

- Determine or verify unique size or shape characters of eggs and conduct or complete detailed study of the morphological ontogeny of the larvae and early juveniles of each species, including meristics, morphometrics, size relative to state of development, gut morphology, and pigmentation as in prior descriptions (Snyder 1981, Muth 1990, Snyder and Muth 1990 and 2004, Snyder et al. 2005).
- Prepare or complete standard sets of eight three-view drawings of larvae and juveniles.
- Prepare or complete descriptive species accounts comparable to those in Snyder and Muth (1990, 2004) and Snyder et al. (2005).
- Compare above data and observations for diagnostically useful characters and summarize criteria for identification.

Task 3. Preparation of computer-interactive key to the larvae and early juveniles of UCRB cyprinids—

- Prepare or refine descriptive data assembled for above species accounts in DELTA format for use by INTKEY (Dallwitz 1993; Dallwitz et al. 1993 et seq., 1995 et seq., and 1999 et seq.) in a manner comparable to that previously prepared for UCRB catostomids and Gila River Basin catostomids and cyprinids; prepare, test, and refine a draft version of the computer-interactive key for UCRB cyprinids.
- Modify introduction and instructions previously prepared for the computer-interactive key to UCRB catostomids for use with the key for UCRB cyprinids.
- Submit draft key and instructions for use of the computer-interactive key to critical review and testing by LFL staff and external volunteers (e.g., USFWS, CDOW, or UDWR researchers, and Dr. Dallwitz) and refine and finalize the key and instructions accordingly.

Task 4. Synthesis, publication, presentation, and reporting of results—

- Prepare and submit annual project (progress) reports.
- Present papers on development and identification of UCRB cyprinids with hands-on demonstration of draft and final computer-interactive key at annual Larval Fish Conferences (American Fisheries Society Early Life History Section) and annual meetings of UCRB researchers (use feedback on draft versions of the key to further refine the key). Presentations may be opportunistically offered at annual meetings of the American Fisheries Society (AFS), AFS Western Division, AFS Colorado/Wyoming Chapter, American Society of Ichthyologists and Herpetologists, and Desert Fishes Council.
- Prepare and submit descriptions of selected species for publication in technical journals.
- Prepare and submit the project final report to the Recovery Program and other co-sponsors of the project. The report will consist of the manuscript guide to cyprinid larvae of the UCRB with the computer-interactive key on a companion CD-ROM disk; like the catostomid guide and key, both will be made available for viewing or download over the Internet.
- Prepare and submit proposal(s) for print publication of the cyprinid guide.

VII. Task Description and Schedule:

Task 1: Acquisition of specimens needed for developmental study—FY 2006-2007 (possibly beginning in July 2005 if funded early by a co-sponsor).
Task 2: Description and illustration of eggs, larvae, and early juveniles—FY 2006-2008.
Task 3: Preparation of computer-interactive key—FY 2006-2009.
Task 4: Synthesis, publication, presentation, and reporting of results—FY 2006-2009.
Note: If progress during the first two years of the project exceed expectations, the last two years could be combined, concluding the project in three rather than four years.

VIII. FY-2006 Work:

-- Deliverables/Due Dates:

- Annual report—November or December 2006.

TABLE 1.
Specimens, illustrations, and data needed for an illustrated manual and computer-interactive key for larval and early juvenile cyprinids of the Upper Colorado River Basin. F = full set needed, P = partial set needed, P/F = partial set needed but full set preferred (available published illustrations may not of desired quality), H = only embryos and recently hatched specimens needed. Existing mensural and count data for most species will need to be verified. All species will need to be examined for qualitative and quantitative documentation of pigmentation patterns and structural features.

	Study Specimens Needed	Mensural & Count Data Needed	3-View Illustrations (Drawings) Needed
Cyprinella lutrensis red shiner	H	H	P/F
Cyprinus carpio common carp	–	–	P/F
Gila atraria Utah chub	F	P	P/F
Gila cypha humpback chub	–	–	–
Gila elegans bonytail	–	–	P
Gila robusta roundtail chub	–	–	–
Hybognathus hankinsoni brassy minnow	F	F	F
Notropis stramineus sand shiner	H	H	F
Pimephales promelas fathead minnow	–	P	P
Ptychocheilus lucius Colorado pikeminnow	–	–	P
Rhinichthys cataractae longnose dace	F	F	P/F
Rhinichthys osculus speckled dace	H	H	H
Richardsonius balteatus redside shiner	H	H	H
Semotilus atromaculatus creek chub	F	F	P
Notemigonus crysoleucas [a] golden shiner	–	P	P

[a] Non-native species rarely reported in the basin.

San Juan River Recovery and Implementation Program
NAPI Pond Aeration and Bird Control
2006 Capital Projects Proposal

September 13, 2005

Principle Investigator: Ron Bliesner
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An evaluation of the production capacity of the razorback rearing ponds located on the Navajo Indian Irrigation Project (NIIP) indicates that oxygen levels and bird predation are significantly impacting the ability of the ponds to produce the required number of fish to meet the stocking goals in the San Juan River. Fish kills at avocet pond in 2004 and six-pack ponds in 2005 resulted from reduced oxygen levels. Observations at certain times of the year indicate substantial bird predation on smaller fish. These losses have led the San Juan River Basin Recovery Implementation Program (SJRIP) to consider installing aerators and bird control at each pond. The purpose of this proposal is to detail the plan for implementing aeration and bird control at each pond.

Aeration

The recent fish-kill events that occurred at Avocet Pond and 6-Pack Pond were due to low levels of oxygen in the water. While many factors were involved in the depletion of oxygen at the ponds, it is probable that these events will occur in the future unless aeration equipment is installed. Therefore, SJRIP proposes to add aeration to the NIIP fish rearing ponds in order to reduce risk and increase the production capacity of the ponds.

Due to pond size and depth, subsurface aeration is recommended. Three options for operating the compressors were compared: wind power, solar power, and bringing electric power to the fish ponds. Table 1 summarizes all three options. It is estimated that a minimum of two aerators will be required for each pond. The annualized costs were calculated by assuming a 10 year life span and a planning interest rate of 5.7%.

The wind power compressor uses a windmill to power the compressor. This is the cheapest option but only supplies a maximum of 3 cfm (cubic feet per minute) of air per windmill. The cost estimate for installing two windmills at each pond is $0. The annual maintenance cost for the windmill option is estimated to be $0. Although this is the least cost option, it also has the lowest oxygenation capacity and is the least reliable. Wind data obtained from the weather station located in Block 2 of NAPI indicates that sufficient wind only occurs 66 percent of the time and is typically inadequate during times of greatest oxygen demand.

The large load requirement by the compressor makes solar power very expensive. Approximately six 120-watt solar panels coupled with five batteries would be required for each aerator. The solar powered compressor has a flow rate of 4.2 cfm. The cost estimate for installing a two solar powered compressors and bubblers at each pond site is $0. The maintenance cost for maintaining the solar panel powered compressors is estimated to be $0. The problem with solar panels is vandalism. While the perimeter fence would safeguard the panels from theft; little protection can be taken against shooters, a common problem with remote solar panels in the area. Further, the capacity is somewhat limited, even with this enhanced capacity.

Table 1. ~~Summary of the subsurface aeration options~~.
Table 1 omitted for confidentially.

Introducing electric power lines to the pond locations is the second most expensive capital option but has the greatest total annual cost. The plan consists of bringing overhead power lines to the pond location and then installing a service tap which includes disconnect and meter. The service tap at 6-Pack Pond would be for a 200-amp service while the service taps at Avocet and Hidden Ponds would only be 100-amp. Electrical outlets would be installed at each pond so that the compressors can be installed. With electrical service, each compressor can produce a flow rate of 9.5 cfm. The cost for bringing electric power to each pond site and for installing a two compressors and bubblers for each pond is $0. The power and maintenance cost for this option is estimated to be $0 annually. The cost per unit of capacity is the least for this option.

Since the cost per unit of capacity is the least for the power line option and the most flexibility is delivered, this is the recommended option. Bringing a power line to the fish ponds would ensure an adequate rate of aeration and allow for further development at the fish ponds. It is recommended that power be brought to all three locations and two electric powered aerators be installed in each pond.

Bird Control

Problems with birds at the NIIP Fish Rearing Ponds include fish predation by blue herons and avocets. Both blue herons and avocets are common sights at the ponds and are known to feed on fish. Nutrient loading from large population of geese in the winter may also be a problem.

A review of literature indicates that a variety of methods must be employed to prevent birds from staying at the sites over a long period of time. Not only should different methods be used, but the frequency and the locations of the control devices should be altered over time.

The most cost effective method for bird control suitable for the NIIP Fish Rearing ponds is sound. There are two types of sound devices that can be used. The first is a propane compressor cannon which makes a loud bang similar to a shotgun. The second is an electronic sound device that can be programmed to reproduce distressed sounds and dying sounds of birds of specific species. The programming will allow for a variety of sounds and different time increments to be used at each location. If both the cannons and the speakers for the electronic equipment are moved around the pond periodically, then the spontaneous requirement of effective bird control can be achieved. If additional measures are required in the future, then strobe lights and visual barriers can be added.

Table 2 lists the cost estimate for implementing bird control at the Block 3 fish rearing ponds. The costs shown will allow for one cannon to be located at each Hidden and Avocet Ponds, three cannons to be located at 6-Pack Ponds, and two programmable sound units each to be installed at Hidden and Avocet, with six units at Six-Pack, allowing two simultaneous sounds at each location.

Table 2. ~~Cost estimate for implementing bird control at the Block 3 fish rearing ponds~~.
Table 2 omitted for confidentially.

Proposal Details

Cost estimates for electric service were obtained from NTUA, the local power provider. An application was filed for obtaining electric service from NTUA. The capital cost would be paid as a part of this proposal. After completion, the Navajo Nation Department of Fish and Wildlife or whomever holds the contract for pond operation will become responsible for the electric service. Once this proposal is accepted, NTUA will be given the notice to proceed for installing power. NTUA will be responsible for all work from the existing power line to the meter location. All work required beyond the meter will be completed by hiring contractors.

Concrete pads will be installed by a contractor at each pond location. Each pad would have electric service installed. Two aerator compressors would be installed on each concrete pad with each compressor wired directly to a manual motor switch or timer. The bubbler would then be installed underwater.

The electric service at each pond will include a 110 volt receptacle and a 240 volt receptacle. The 110 volt receptacle can be used for connecting any bird control equipment requiring power. Separate concrete pads would be installed for housing the propane cannons. Multiple concrete pads for the propane cannons will be installed at each pond site to facilitate moving the propane cannon around the pond.

The total cost estimate for completing the proposed work is $186,000. The detailed cost estimate can be found in Table 3. Total annual operation and maintenance cost, less labor, is estimated to be $22,700 per year. This cost would be in addition to the present operation and maintenance cost of the ponds.

Table 3. ~~Detailed Cost Estimate for Proposed Work~~
Table 3 omitted for confidentially.

Maintenance and Operation of the San Juan River Basin Hydrology Model
San Juan River Basin Recovery Implementation Program - Hydrology Committee
Fiscal Year 2006 Project Proposal

Principal Investigator: Pat Page
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Background

The Third Generation San Juan Basin Hydrology Model (SJBHM) was completed in FY2004. However the Hydrology Committee has been requested to investigate alternative flow recommendations. While this work was anticipated to be completed in FY2005, the information needed to initiate this work was not received until May 2005, therefore some of the work has slipped to FY2006. This scope of work includes completing the development and testing of the model to support revisions in the flow recommendations, as well as the annual operation and maintenance of the model and necessary data. The Bureau of Reclamation has the primary responsibility for model O&M. Keller-Bliesner Engineering will assist Reclamation in testing and implementation of flow recommendation alternatives.

The model will be made available to generate and analyze runs associated with Section 7 Consultations and/or special requests from the Biology or Coordination Committees related to the flow recommendations or other hydrological aspects of the Program. In order for the model to be available for such requests, the model and data must be maintained to adjust configurations, correct for errors, and evolve the data set forward through time. The FY2006 request includes funds to provide technical transfer from the model developer to the model users and maintainers.

Study Area

San Juan River Basin

Tasks

1. Complete testing of the third Generation SJBHM to examine the impacts of changes recommended for examination by the Biology Committee. Reclamation would implement rule changes and Keller-Bliesner would assist Reclamation in analyzing the model runs, summarizing results, and examining impacts to the flow recommendations. Prepare report to the Biology Committee on testing of changes in operating rules with summary of test results and recommendations for implementation. This task would include Reclamation revising the existing SJBHM documentation to reflect changes made in operating criteria with Keller-Bliesner reviewing the changes. This task could also include other modeling activities to evaluate the Flow Recommendations as agreed to by Hydrology Committee, so long as it was within the budget for FY06. *Note: Funding for Keller-Bliesner to complete the work identified in this task was obligated via contract in FY2005 using FY2005 funds.*

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

3. Maintain the model to update and test data and to adjust model configuration, methodologies, or assumptions.

4. Maintain software associated with data and model.

5. 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 FY06 will be requested,

requiring five model runs/consultation. It also assumes that the Coordinating Committee will request two special runs in FY06. 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.

6. Program management and coordination.

7. 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.

Costs

FY2006 costs are shown in the following table. They include a $6,000 contingency fund to cover unanticipated costs associated with implementation of the revised flow recommendations. The contingency fund would be used only on an "as-needed" basis, and only after Hydrology Committee approval.

Backup Information for Scope of Work Objectives:

- Data maintenance is to evolve the data set forward through time and make other adjustments to the data.
- Model maintenance is to adjust the model configuration or operating criteria to correct for errors or other changes.
- Software maintenance is for updating and maintaining data management interfaces and other software associated with the data and models.
- Program support is to make and analyze all model runs that are associated with Section 7 Consultations or to make special runs for the Coordinating Committee. The above computation assumes that 3 consultations per year will occur, requiring 5 model runs/consultation. It also assumes that the Coordinating Committee will request 2 special runs/year. A consultation run will usually require a model reconfiguration and operating criteria implementation and testing. Special runs may also require some setup time. The cost estimate assumes that a consultation run will require 3 days of setup time, 1 day to run and analyze each run, and 3 days to report the results. Therefore, each consultation run will take approximately 11 days. It is assumed that special runs will require 2 days of setup time, 1 day to run and analyze, and 1 day to report results.
- Technical transfer is to provide transfer of technology necessary to operate and maintain the data and model.

Improve Stream Gaging and Flow Measurements
San Juan River Basin Recovery Implementation Program - Hydrology Committee
Fiscal Year 2006 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

Objectives

1. 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.

USFWS - Program Management
Fiscal Year 2006 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 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. See that approved recovery activities are implemented.
3. Disseminate information to involved state, federal, and tribal agencies.
4. Coordinate activities with the Upper Basin Recovery Implementation Program.
5. Coordinate and disseminate information on Program activities to the public through brochures, newsletters and/or the website.
6. Forward plans and recommendation 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. Maintain records showing distribution and expenditures of all annual and capital funds expended under the work plan by each funding source.
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.

Base Funds Management
Fiscal Year 2006 Project Proposal

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and

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Background

Program Management funds support Reclamation staff involved in program administration. 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 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

Tasks – 2006

1. 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.
2. Coordinate, administer, and manage Biology Committee and Program Coordination funding agreements (cooperative agreements, grants, interagency acquisitions, and service orders) and equipment purchase requisitions as identified in the annual Work Plan (Other than those covered in Task 1.).
3. Develop Technical Proposal Evaluation Committees (TPECs) which evaluate and recommend proposals that have been submitted to the SJRIP in support of Program goals. TPEC members will be recruited from both inside and outside of the Program and will serve as advisors to the Biological Committee concerning Requests for Proposals and Scopes of Work that have been submitted.

Capital Improvement Program
San Juan River Recovery Program
Fiscal Year 2006 Project Proposal

Principal Investigator: Brent Uilenberg
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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.

Capital Improvement Program Hogback Canal
San Juan River Recovery Program
Fiscal Year 2006 Project Proposal

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Background

The Hogback Canal diverts approximately 230 cubic-feet-per-second (cfs) for irrigation uses (200 cfs Hogback Canal system and 30 cfs Cuedi Canal system). The San Juan River Recovery Program has identified unacceptable levels of entrainment of native fish into the Hogback Canal and presumed mortality of razorback sucker and Colorado pikeminnow.

Study Area

Hogback Canal from the diversion dam to the pump station.

Objectives

1. Conduct design data collection activities including topographic surveys, geologic investigations, collection of data supporting historic diversion rates, characterize debris loading and sedimentation potential, and other site specific characteristics related to the design of the proposed fish screen.
2. Conduct scoping process to identify natural and human environmental issues. Prepare Draft Environmental Assessment. If appropriate, prepare Final Environmental Assessment and Finding of No Significant Impact.
3. Review records to determine if cultural resource surveys have been conducted in the project area. If necessary, conduct site specific cultural resource survey. File report with Navajo Nation and State cultural resource agencies. Avoid or minimize cultural resource impacts.
4. Negotiate and secure temporary construction access easement(s), long term operation and maintenance access easement(s), and operation and maintenance contract(s).
5. Prepare designs and specifications for fish screen facility. Solicit bids and award construction contract.
6. Provide construction management and force account services.
7. Prepare as-built drawings and operating criteria for the fish screen facility.

Products

Fish screen facility which minimizes entrainment of aquatic species.