Razorback Sucker Growout Ponds Operations Manual

Navajo Indian Irrigation Project
New Mexico

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Operations Manual

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PREFACE
Razorback Pond Operations Plan

The razorback sucker *Xyrauchen texanus* is an endemic Colorado River Basin catostomid threatened by extinction in the San Juan River due to habitat loss, predation from introduced species, and a lack of recruitment (Tyus1987; Papoulias 1988; Lanigan & Tyus 1989; Tyus and Karp 1990; Plantania 1990; Brooks et al. 1993; Ryden & Pfeifer 1994a). In 1997, a Five-Year Augmentation Plan for Razorback Sucker in the San Juan River was drafted by the San Juan River Basin Biology Committee (SJRBC) (Ryden 1997). The goals of the plan include a sustainable target population of 15,900 razorback suckers in the San Juan River between the Hogback Diversion (river mile 158.6) and Lake Powell (river mile 0.0). In order to meet this target population, it was estimated that 73,482 razorback suckers would have to be stocked between 1997 and 2001 (Ryden 2000,2001). Initially, hatchery reared razorbacks were obtained from rearing facilities associated with other Colorado River Basin razorback sucker augmentation programs. However, in order to meet such a high stocking goal, Navajo Indian Irrigation Project land just south of Farmington, New Mexico was obtained in 1998 for project specific rearing facilities. A total of nine rearing ponds were constructed on Navajo Indian Irrigation Project lands between 1998 and 2002 with a total surface area of approximately 25 acres.

During the initial phase of the rearing pond program, members of the SJRBC expected the ponds to produce 500 lbs of fish per acre. However to date, none of the ponds have had that level of production. A variety of problems have plagued the rearing ponds including water quality and quantity, avian and terrestrial predation, overcrowding, staff limitations, and a lack of communication among involved parties. A prescriptive operational plan was needed in order to maximize production at these rearing ponds. This operational plan is intended to provide protocols for the daily, weekly and monthly operations of the Razorback growout ponds with the sole purpose of maintaining a high level of aquatic productivity.

It has been previously stated that the management goal of these ponds is to maximize the growth rates and harvest of razorback suckers to a size of 300+ mm and stocked into the San Juan River. In order to attain that goal several approaches have been and are being employed.

Firstly, in the past, the ponds have been stocked with age 0+ fish obtained from a variety of sources and stocked into the ponds in the spring at various densities. The fish have not been consistently monitored for growth until they are harvested with passive gear prior to stocking into the river. For the various cohorts stocked into the ponds, the year to year growth rates in individual ponds cannot be determined at this time. The ad hoc approach for the production of razorback suckers is to have multiple cohorts in all the ponds. Because passive gear is used in the harvest older fish from the initial stockings are still present in the ponds. In addition, natural reproduction has been observed in the ponds. This was evident when Avocet West pond was drained for refurbishing. The utilization of food resources by the fish greater than 300+mm may result in under production of smaller fish.

Secondly, the SJRIP has contracted with the USFWS National Fish hatchery at Dexter to provide 20,000 razorback suckers at 200+ mm to the program for final growout to 300+mm in the nine ponds located at NIIP. According to Dexter, they will need 15 months to grow the razorbacks to 200+mm, with a first delivery to the NIIP ponds in June 2006. Given the current populations of fish in the nine ponds (various cohorts) combined with the fact that the CRFP personnel are also recommending that excess age 0+ fish from the 24 Street Hatchery also be stocked into the ponds, it seems prudent that a consensus be reached on the stocking and harvest protocols for the ponds (single cohort vs multiple cohort; timing of Dexter fish deliveries vs pond harvesting, etc).

The following operational protocols are somewhat independent from the stocking and harvest plan for the ponds. This operational plan is intended to maintain the ponds at an elevated level of primary productivity to stimulate zooplankton production as well as developing significant secondary benthic production without compromising water quality criteria.

1.0 INTRODUCTION

The intent of this manual is to provide the pond operator with protocols and compliance criteria with which to manage the growout ponds at a high level of production. The activities covered in this manual are based on daily, weekly, monthly and annual actions that will facilitate the goal of producing 300+mm razorback sucker subadults for stocking into the San Juan River. These activities are summarized in Table 1. Activities for each time period are described briefly below with detailed protocols available in Appendices I through V.

2.0 DAILY OPERATIONS

The daily operations at the nine ponds located on the NIIP project lands involve the day to day monitoring of the ponds hydrology and water quality. In all cases, the ponds are filled with irrigation water used on the NIIP site. From previous investigations, water quality is excellent at the site. In addition to hydrology, in situ water quality parameters which are diurnally dynamic will be monitored daily.

2.1 Hydrology

The surface water elevations of each pond will be monitored daily. In Appendix II, the stage (elevation) volume tables for each pond are provided as reference (provided by Keller-Bliesner Engineering). Pond elevation data are to be recorded into the "Daily Log" in the format shown in Appendix VI. It is anticipated that without water inflows, the ponds will lose approximately 0.05 feet per day. If any pond loses more than 0.20 feet per day, corrective action must be taken. See Appendix I for criteria.

2.2 Water Quality

Surface water quality will be measured *in situ* on a daily basis. Parameters include; Dissolved oxygen (mg/l), pH (units), Temperature (˚C), turbidity (ntu), and conductance (µmhos/cm). These daily values are to be compared to the minimum criteria provided in Appendix I. Sampling protocol are given in Appendix III and should be followed exactly. Special attention should be given to instrumentation calibration.

2.3 Biological

On a daily basis, each pond must be inspected for fish mortalities. The methodology will be to walk the circumference of each pond and inspect for dead fish. If encountered, all fish will be counted and measured. Formatted data sheets are provided in Appendix V. If mortalities exceed the criteria levels corrective action must be taken as prescribed in Appendix I.

In addition to the visual inspection of the ponds, predator controls must also be undertaken on a daily basis. Inspection and maintenance of predator harassing equipment should be done daily. Faulty or malfunctioning equipment must be fixed or replaced immediately.

Table 1. Summary of all actions related to all monitoring activities for the razorback ponds.

INDICATOR	ACTIVITY	ACTIONS
Daily: All Year (for each pond)		
Hydrology	Check pond elevations	Record data in log
Water Quality (Field measurements)	Sample ponds for: Dissolved Oxygen (Mg/l) pH (Units) Temperature (˚C) Conductance (µmhos/cm) Turbidity (NTU)	Record data in log. Adjust aeration as necessary (see Appendix I for criteria)
Biological	Check for fish mortalities	Count and record lengths in log
	Predator reduction	As needed using available methodologies
Weekly: February - October (For Each Pond)		
Hydrology	Check pond elevations	Adjust all ponds to full pool (see appendix ii for elevations). Record data in log.
Monthly (For Each Pond) February Through October		
Hydrology	Examine outlet works and banks for erosion	Repair as needed
Pond Productivity	Fertilize using alfalfa hay	Amount as specified in Appendix IV
Biological	Determine fish growth rates	Follow protocols in Appendix V
	Remove exotic riparian vegetation	Manual removal of tamarisk and Russian olive trees
	Manage macrophyte densities	Manual removal to less than 30% of pond surface area
Water Quality	Sample ponds for: Ortho and Total Phosphorous Nitrate, Nitrite, and Ammonia Total Alkalinity	Follow QA/QC protocol (see Appendix III for methods)
Annual (for all ponds)		
Hydrology	Fill ponds in September	Surcharge all ponds for non-irrigation season carryover

3.0 WEEKLY OPERATIONS

As with the daily operations, certain activities must also be done on a weekly basis. The exact day of the week will be left to the field staff, however, there should be seven days between activities (i.e., Wednesday to Wednesday for a given pond). The activities are by major category.

3.1 Hydrology

As noted above, the ponds are inspected daily for elevations. Once a week, each pond is filled to its operational level.

3.2 Water Quality

No weekly activities.

4.0 MONTHLY OPERATIONS (FEBRUARY-OCTOBER)

The activities undertaken on the ponds monthly are intended to offset major maintenance problems (structural and biological) as well as monitor the overall success of the production goals.

4.1 Hydrology

Because a number of the ponds have the capacity of spilling water, a visual inspection of the ponds outlet works will be done formally on a monthly basis. The observations will be logged into the database (Appendix VI). In addition, because of wind erosion, pond banks may become weathered. Inspection of these areas on a monthly basis and the remediation of problem areas will be undertaken. Addition of riparian vegetation, placement of gravel or cobble are acceptable activities.

4.2 Water Quality

Grab samples will be collected for laboratory chemical analysis for each pond. Sample protocol and QA/QC will follow the procedures described in Appendix III. Parameters will include ortho and total phosphorous, nitrate, nitrite and ammonia. In addition, the ponds will be sampled for total alkalinity.

4.3 Biological

Prior experience at the pond locations has indicated that exotic riparian vegetation has been a problem. Tamarisk and Russian olive trees must be removed from the pond sites. Manual removal is the preferred mode of control. The use of chemicals is discouraged but if necessary, prior clearance for the use of specific formulations must be given from the CRFP Grand Junction Office. Aquatic macrophytes can cause problems within the ponds if they obtain large biomass levels. Because they provide some cover from bird predation, complete removal is not needed. If macrophytes cover more than 30 percent of the pond surface area, plants must be removed by mechanical harvest (the use of drag lines, etc). Chemicals are discouraged, however if necessary, prior clearance for the use of specific formulations must be given from the CRFP Grand Junction Office. In addition, constant monitoring of dissolved oxygen and continuous aeration will need

to be undertaken.

The second biological monthly activity will be to monitor the growth rates of the razorback suckers in each pond. This is a critical parameter especially if the ponds are used in a multiple cohort production mode. The protocols for this activity are provided in Appendix V. This activity need not be undertaken on ponds that are being harvested by the CRFP. Data can be obtained from that activity and substituted for the monthly monitoring.

4.4 Pond Fertilization

The ponds will be fertilized with organic materials (alfalfa hay) monthly at the rate prescribed in Appendix V. The purpose of the organic load is to build up the benthic organic materials and to foster benthic invertebrates. The secondary reason will be to increase the inorganic nitrogen, phosphorous and carbon in the pond systems.

5.0 ANNUAL

The only annual activity that will occur on all the ponds is the surcharge filling of all the ponds at the conclusion of the irrigation season (September) and the refilling at the beginning of irrigation (typically in May). It is anticipated that the ponds will lose approximately 1.75 feet in elevation during the winter.

APPENDIX I.

Hydrology and Water Quality Criteria - Corrective Actions

Hydrology and Water Quality Critera - Corrective Actions

This appendix is intended to provide operating criteria and corrective actions to be taken if parameter criteria are exceeded for hydrology or water quality

PARAMETER	CRITERIA	CORRECTIVE ACTION
Hydrology		
Pond Elevation	> 0.20 feet/day water drop	Fill pond, check for leaks
Water Quality		
Dissolved Oxygen	< 3.0 mg/l	Check calibration,(1) aerate, Flush pond
pH	>10.0	Stop fertilization, flush
Conductance	>1500 µmhos/cm	Flush
Turbidity	none	
Temperature	>30 ˚C	Flush
Biology		
Fish Mortalities	>10 per pond	Contact USFWS CFRP

(1) When any *in situ* water quality parameter exceeds criteria, the first course of action is to recheck the instrument calibration

Contact Telephone Numbers:

USFWS CFRP Grand Junction

Chuck McAda (970) 245-9319 x19

Navajo Fish and Wildlife

Albert Laphie (928) 871-6451 or (928) 871-6452

Navajo Indian Irrigation Project

APPENDIX II.

Geomorphology

W.S. Elev	Max. Water Depth (ft)	Acreage	Volume Increment (af)	Volume (af)	Notes
HIDDEN POND					
5,628	0	0.11			
			0.22	0.22	
5,629	1	0.34			
			0.44	0.67	
5,630	2	0.55			
			1.34	2.01	
5,631	3	2.14			
			2.20	4.21	
5,632	4	2.27			
			2.34	6.55	
5,633	5	2.41			
			2.48	9.03	
5,634	6	2.55			
			2.62	11.66	
5,635	7	2.70			
			2.77	14.43	
5,636	8	2.85			
			2.92	17.35	
5637	9	3.00			
			1.50	18.85	FULL POOL
AVOCET WEST					
5,451	0	0.00			
			0.02	0.02	
5,452	1	0.04			
			1.09	1.11	
5,453	2	2.14			
			2.20	3.31	
5,454	3	2.26			
			2.33	5.63	
5,455	4	2.39			
			2.46	8.09	
5,456	5	2.52			
			2.59	10.68	
5,457	6	2.66			
			2.72	13.40	
5,458	7	2.79			
			2.86	16.26	
5,459	8	2.93			
			1.47	17.73	FULL POOL

W.S. Elev	Max. Water Depth (ft)	Acreage	Volume Increment (af)	Volume (af)	Notes
AVOCET EAST					
5,453	0	0.00			
			1.50	1.50	
5,454	1	3.01			
			3.06	4.56	
5,455	2	3.11			
			3.16	7.73	
5,456	3	3.21			
			3.26	10.99	
5,457	4	3.32			
			3.37	14.36	
5,458	5	3.42			
			3.47	17.83	
5,459	6	3.52			
			1.76	19.59	
91.25	0	0.00		0.00	
			0.04		
92.25	1	0.07		0.04	
			0.12		
93.25	2	0.17		0.16	
			0.90		
94.25	3	1.62		1.06	
			1.70		
95.25	4	1.77		2.75	
			1.85		
96.25	5	1.93		4.60	
			2.00		
97.25	6	2.08		6.61	
			2.16		
98.25	7	2.25		8.77	
			2.33		
99.25	8	2.41		11.10	Design capacity and minimum operation
			2.50		
100.25	9	2.58		13.60	FULL POOL
			2.67		
101.25	10	2.75		16.26	Capacity when spilling

APPENDIX III.

Pond Sampling Protocol

1.0 INTRODUCTION

This manual was developed as a guide to cover all the processes and methods for collecting, handling, and processing samples collected at the Razorback ponds. It is also a guide to maintaining quality data for a long term monitoring program. In order to maintain quality assurance throughout the data collection process, simple procedures need to be followed each time a sampling event occurs. By maintaining quality assurance throughout the process, water quality and biological data generated or used will be scientifically valid, defensible, and of known precision and accuracy.

2.0 FIELD SAMPLING TECHNIQUES

2.1 Water Quality Sampling Procedures

Water quality samples collected at the Razorback ponds are grab samples. Grab samples are collected without the aid of a sampling device. Since the mass of water being investigated is usually great relative to the sample size, care must be taken when samples are collected. The sample must be representative of the mass of the water body. Therefore it is imperative caution be used when collecting water samples.

Water samples are the first samples collected on the ponds to ensure the water has not been disturbed by other sampling activities. Samples should be taken in two- three feet of water. Collection of water samples must follow procedures from the laboratory. Different chemical analysis of water quality requires different methods of collection and/or preservation.

Chemical analysis of the Razorback ponds include total and ortho phosphorus, nitrate, nitrite, ammonia, and chlorophyll-*a*.

2.2 Field Measurements Sampling Procedures

In addition to field samples, water quality investigations will also be recording various instantaneous field measurements which include temperature, pH, dissolved oxygen, turbidity, and conductivity. These measurements are recorded electronically and/or manually, depending on the multi-parameter instrument being used. Prior to any sampling, the sample must make sure the instrument is functioning properly, has been properly calibrated to record accurate data, and has the ability to operate the instrument.

The probe should be lowered in an undisturbed area of water, suspending in the water column. The sampler must allow time for the parameters being recorded to stabilize before recording any data. With most multi-parameter probe one minute is generally enough time for complete stabilization. But not all instruments are the same, be familiar with your instrument prior to use.

3.0 QUALITY ASSURANCE/ QUALITY CONTROL

Valid measurement of data in the field is an essential component of project activities and is closely related to QA/QC procedures. In fact, the Field QA Program, through its goals of maintaining quality work and complete project records, uses many of the procedures associated with data management. The following discussion describes the procedures linking Field measurements to the QA/AC Program.

3.1 Field Quality Control Procedures

The following procedures are used in all data collected on the Razorback Ponds.

3.1.1 Sample Labeling

The validation of samples and sampling data is a crucial step in data management and QC. In view of the importance of knowing from where the data originated, care will be exercised in the marking, labeling, and recording of samples in the field. This procedure depends upon duplication of labels and separation of the discrete samples or sample sets. Each sample will be assigned a unique identification number or name (generally the name of the lake, river, pond). This number or name will be permanently assigned to the sample site. Additionally the date and time are recorded on all sample collected in the field.

The sample labels will be affixed with high-quality, clear tape, masking tape, filament tape and be marked by grease pencil or ink pen. Labels should be placed inside (only inside invertebrates and zooplankton sample) and also on plastic bags. Glass should be marked with grease pens and/or adhesive labels. Bottle tops or sets of samples will be additionally marked for maximum security.

3.1.2 Sample Transport

Samples brought in from the field will be inspected for damage and immediately logged in on a Laboratory Log Sheet so that the chain-of-custody remains intact. Any poorly affixed or written labels will be replaced with fresh ones. The old label will be stapled to the new one so that in case of question, the original label is available for inspection. If samples are to be sent to a laboratory, a transmittal sheet noting station name (s), station number, date (s), time, and sampling staff will be included. A copy of this transmittal sheet will be retained in the project files. Arrangements should be made with the laboratory to insure the samples are received within specified times. To protect samples from damage or leakage during transport, care should be taken to see that samples are properly packed and sealed. Enough ice should be included to refrigerate water samples during transport.

3.1.3 Sample Verification

All field data forms will be checked in the office to verify that the label on the sample matches that on the field form. Should any discrepancy arise, it will be rectified immediately. In no instance will a discrepancy be allowed to exist without resolution; failure to do so will negate the use of that sample.

3.1.4 Field Data Measurements

In addition to field samples, water quality investigations will also be recording various continuous and instantaneous field measurements such as temperature, pH, dissolved oxygen, and conductivity. These measurements require careful calibration of instruments and data processing through use of computer programs. Data recorded from field instruments used for water quality monitoring is documented on specific field forms.

3.1.5 Instrument Calibration

Instruments mentioned above must be calibrated periodically to ensure the accuracy of the date. Normally, calibrations are conducted just prior to instrument use so that the meter of machine is operating within its optimal limits. Calibration must be conducted according to manufacturer's instructions and be within a specified tolerance. When performing a calibration, a calibration form must be filled out. This form will indicate the serial number, model number, date of calibration, the person doing the calibration, and the measurements both before and after calibration, that were recorded. In addition, any error and/or percentage error (difference between the standard value and the calibrated datum divided by the standard value) should also be shown. This will allow the person doing the calibration to determine if the machine is within operating limits.

3.2 Laboratory Quality Control Procedures

After proper field collection, the collector records all information on the bottle label. The sample is iced in a cooler and transported to the laboratory as soon as possible. Sample containers must be clean and free of any debris. Containers without preservative should be rinsed once with the sample then filled completely. Once the bottle is filled, the lid is to be replaced. Sample bottles with preservative should not be rinsed and one to two inches of air should be left at the top for more preservative if needed. It is best to fill the preserved bottle with water from another clean bottle to avoid overflow and loss of preservative. Each sample or group of samples must include trip blanks, field blanks, equipment blanks, duplicates or other field-submitted quality control measures as required by the method.

To ensure samples have not been contaminated throughout the sampling process, sample blanks are included in the cooler prior to departure from the lab. Trip blanks are filled at the lab were the bottles were received. Trip blanks are not to be opened during the duration of sampling trip. Field blanks are filled by the sampler in the field with filtered de-ionized water from the laboratory. All procedures should be followed as instructed by the lab. Since grab samples are collected on the ponds, equipment blanks are not used on the ponds.

APPENDIX IV.

Pond Fertilization Protocol

Pond Fertilization Protocol

Organic Fertilization

In order to accumulate organic materials in the benthos as well as increase the nitrogen and concentrations in the water, organic material will be added to the ponds on a monthly basis. This loading was determined on a surface area basis. Care must be taken not to overload the ponds with organics because of their high oxygen demand. Monthly applications are:

Pond Name	Alfalfa Hay Pellets
Hidden Pond	360 pounds
Avocet West	340 pounds
Avocet East	360 pounds
Six Pack Ponds (each)	280 pounds

APPENDIX V.

Fish Sampling Protocol (Growth Rate Determination)

Fish Sampling Protocol (Growth Rate Determination)

To determine the growth rate and condition of the razorback suckers in the ponds, monthly sub-sampling shall occur. Multiple hoop nets will be placed along the shore of the selected pond and left overnight. For proper deployment, three fence posts will be needed, two for the net wings and one for the hoop end of the net. When setting the hoop net, make sure the lead line is in contact with bottom of the pond and the floats are not submerged.

The hoop nets shall be checked 24 hours later for fish. A minimum of twenty fish should be captured from each pond. If more than twenty fish are captured, all fishes shall be sampled. This will help in determining growth rates within each pond.

The fish captured in the nets shall be removed and immediately placed in live wells or multiple five gallon buckets. If necessary the anesthesia MS-222 will be added to the live wells. Fishes should be weighed to the nearest gram and measured to the nearest millimeter. Additionally fishes should be checked for any growths, wounds or any other anomaly and recorded on the data sheet. Immediately place the fish in fresh water if anesthesia is used, this accelerates their recovery. If not place them back into the pond.

This shall be done for each of the nine rearing pond on a monthly basis.

APPENDIX VI.

Field Sampling Data Sheets

Razorback Pond Field Sheet
Monthly Sampling

Date: _____ Sampler(s): _____

Weather: _____

Site	Date	Time	Hydrology	Pond Production	Water Samples		Biological Maintenance		
			Outlet and Bank Erosion	Alfalfa Fertilization (lbs/pond)	Water (non-acid)	Water (Acid)	Fish (#/pond)	Riparian Veg Removal	Macrophyte Removal
AW									
AE									
HP									
SP1									
SP2									
SP3									
SP4									
SP5									
SP6									

Additional Observations: _____

Razorback Pond Field Sheet
Weekly Sampling

Date: _____ Sampler(s): _____

Weather: _____

Site	Date	Time	Water Elevation	
			Stage Elev. (start)	Stage Elev. (final)
AW				
AE				
HP				
SP1				
SP2				
SP3				
SP4				
SP5				
SP6				

Additional Observations: _____

Razorback Pond Field Sheet
Daily Sampling

Date: _____ Sampler(s): _____

Weather: _____

In-situ Troll 9000 Calibration:

BAR: _____ Temp:_____ DO: _____ pH: _____ Cond: _____ Turb:_____

Site	Date	Time	Water Quality Samples					Pond Observations		
			Temp (˚C)	pH	Turb (NTU)	DO (mg/L)	Cond (µmho/cm)	Stage (feet)	Fish (mortality)	Notes (length of fish)
AW										
AE										
HP										
SP1										
SP2										
SP3										
SP4										
SP5										
SP6										