

Navajo Agricultural Products Industry (NAPI)
Razorback Sucker Rearing Ponds
2013
Annual Report



Submitted By:

Christopher Cheek, Fish Biologist
Navajo Nation Department of Fish and Wildlife
P.O. Box 1480
Window Rock, AZ 86515

April 7, 2014

To:

San Juan River Basin Recovery Implementation Program

Executive Summary

- 10,500 razorback suckers received from Dexter National Fish Hatchery and stocked in NAPI ponds
 - 6,243 harvested- 59.5% overall return rate
 - fish harvested from East Avocet- 56.1% return rate
 - fish harvested for West Avocet- 70.8% return rate
 - fish harvested from Hidden Pond- 51.5% return rate
- 1251 fish were passively harvested
- 4992 fish were actively harvested
- NAPI stocking accounted for 40.6% of the 15,362 razorback suckers stocked by the SJRIP into the San Juan River in 2013

Table of Contents

I.	Executive Summary	.....	ii
II.	Introduction	.....	1
	1. Justification/Relationship to SJRIP.....		1
	2. Razorback Augmentation/NAPI ponds.....		2
III.	Methods	.....	3
	1. Pond Preparation/Receiving Fish.....		4
	2. Daily Operations.....		5
	3. Monthly Operations.....		6
	4. Harvest and Stocking.....		7
	5. Contingency Plan.....		8
IV.	Results	.....	9
	1. Harvest.....		9
	2. Water Quality and Vegetation.....		11
	3. Disease.....		11
	4. P.I.T Tag Retention.....		11
V.	Discussion	.....	12
VI.	Literature Cited	.....	13

INTRODUCTION

Justification/Relationship to SJRRIP

The San Juan River, located in the upper portion of the Colorado River basin (Colorado, New Mexico, Utah) harbors a native fish community which is severely threatened by both human induced and natural, biotic and abiotic influences. The razorback sucker, *Xyrauchen texanus*, is one of eight historically occurring native fish species, accompanied by 21 established populations of non-native fishes (Holden 2000, SJRRIP 2006). The razorback sucker was listed as endangered under the Endangered Species Act in 1991 as a result of severe declines in population numbers and lack of recruitment across its native range, and is currently protected by federal, state, and tribal agencies (USFWS 1991, Furr 2009). The decline in historical abundances of San Juan River endangered fishes is thought to be a function of altered flow regime, loss of physical habitat through water development, and negative interspecific species interactions attributed largely to the introduction of non-native fish populations (Platania 1990, Brooks et al. 2000, SJRRIP 2010a). Protection and recovery efforts of two endangered fish species (razorback sucker, and Colorado pikeminnow, *Ptychocheilus lucius*) were initiated in 1992 through the formation and direction of the San Juan River Basin Recovery Implementation Program (SJRRIP). Principal to the program are two overarching goals (SRRJIP 2010a);

1. To conserve populations of Colorado pikeminnow and razorback sucker in the Basin consistent with the recovery goals established under the Endangered Species Act of 1973, as amended, 16 U.S.C. §§ 1531 *et seq.* (ESA).
2. To proceed with water development in the Basin in compliance with federal and state laws, interstate compacts, U.S. Supreme Court decisions, and federal trust responsibilities to the Southern Ute Tribe, Ute Mountain Ute Tribe, Jicarilla Apache Nation, and Navajo Nation.

The Navajo Nation did not initially participate in the program under the cooperative agreement developed with other tribal, state, and federal agencies in 1992. However, through consultation with the Navajo Nation tribal government and the SJRRIP program coordinator, the Navajo Nation agreed to become an active participant in 1996 (SJRRIP 2010b). This cooperative agreement, which was extended through 2023 in 1996, commits the Navajo Nation to represent tribal interests in flow releases from Navajo Dam as it relates to endangered fish recovery (SJRRIP 2010b). The Nation has also committed to operating the Navajo Agricultural Products Industry (NAPI) razorback sucker rearing ponds managed for razorback sucker augmentation and recovery efforts, through the Navajo Department of Fish and Wildlife (NNDFW). Under the broader goals and actions developed by the SJRRIP and outlined in the Long Range Plan, the Navajo Nation's obligation is specifically characterized under task 1.2.2.2 as "RBS will be stocked annually into three NAPI grow-out ponds with 3,000-3,500 (> 200 mm TL) hatchery-reared RBS produced at Southwest Native Aquatic Resources and Recovery Center (SNARRC) (expectation to harvest 40-60%) using a single cohort strategy; pit tag and stock 300 mm fish in 12 months. Eight-year time period, 2003-2011" (SJRRIP 2010a).

Razorback Augmentation/NAPI Ponds

Experimental stocking of razorback sucker occurred between 1994 and 1996 which led to a five year augmentation plan that called for the stocking of 73,482 razorback suckers in the San Juan River (Furr 2009). After shortfalls of stocking during the five-year plan, a revised augmentation plan was drafted in 2002 that called for the stocking of 11,400 age 2 (> 300 mm total length, TL) razorback sucker annually for a period of eight years (Ryden 2003). These fish would be produced and stocked by Uvalde National Fish Hatchery (Uvalde NFH) and the NAPI grow-out ponds. Augmentation efforts in 2008 were complicated by problems with moving fish off station at Uvalde NFH and only one of the three NAPI grow-out ponds were utilized for production (Furr 2009).

Razorback suckers provided by Southwest Native ARRC were stocked into three ponds on NAPI lands beginning in 1998, and in 2001 an additional six ponds were constructed for rearing razorback sucker. Young-of-year (YOY) razorback sucker were stocked in the spring and harvested in late summer/fall. Due to recommendations in size of fish stocked into the San Juan River, fish < 300 mm TL were left in ponds for one more year of growth. Overwintering fish, stocking YOY in the spring, and some limited in-pond reproduction, created multiple cohorts in the ponds (Furr 2009). Beginning in 2007, the SJRRIP adjusted the multiple cohort strategy in favor of a single cohort strategy to limit problems associated with harvesting multiple cohorts. Due to difficulties in harvesting the “six-pack” ponds constructed in 2001, in the fall of 2007 the SJRRIP Biology Committee requested that the six-pack ponds be taken out of production in 2008 and efforts focused on the three NAPI grow-out ponds (East Avocet, West Avocet, and Hidden Ponds) (Furr 2009).

METHODS

Management of the NAPI razorback sucker grow-out ponds is the responsibility of the NNDFW aided by U.S. Fish and Wildlife Service, Region 2 (hereafter known as the Service), under direction and guidance from the SJRRIP. Fish are spawned and reared at SNARRC prior to rearing efforts at the NAPI facility, and the remaining grow-out period to target size is achieved through active management of daily monitoring, monthly population sampling, and ultimately harvest and stocking into the San Juan River. The grow-out period typically spans from mid-April through the first week of November.

Pond Preparation/Receiving Fish

Prior to receiving fish, each pond is evaluated post-harvest during the de-watered period for structural integrity by examining bank erosion, bed slope, invasive vegetation, and graveled slopes. If modifications or repairs are needed, consultation with SJRIP is conducted and typically work is implemented through NAPI or Keller-Bliesner Engineering. Also examined for structural

soundness are the irrigation lines that feed water to the ponds from the NAPI distribution units (DU), the draining siphons, pond kettles, and associated valves. If repairs or replacement parts are needed, NAPI typically provides parts and labor if NNDFW is unable to implement the repairs.

Water becomes available through the NAPI irrigation network for pond filling by early to mid March, and NNDFW coordinates with the NAPI control center to pressurize the DU's associated with each pond and commence filling. Hidden pond fills in approximately 7 days, whereas Avocet East and West fill in approximately 9 days. The Avocet ponds are pressurized by the same DU, but achieve simultaneous filling through a split irrigation line. Once filling is completed, each pond's siphon is tested to ensure adequate drainage. Water quality (dissolved oxygen, pH, and temperature) is monitored each day to ensure an optimal environment before fish are released into the ponds. Typically, water quality monitoring is conducted no less than two weeks prior to receiving fish to establish there are no widely fluctuating metrics that may have negative effects on fish; however, the availability of the fish and the need to distribute fish from SNARRC and water availability often will dictate the amount of time available for pre-stocking water quality monitoring. Razorback sucker stocking into NAPI ponds is coordinated through the Service, DNHFTC, and NNDFW. Fish are received in early to mid April at approximately 3,500 fish per pond, with an average total length that ranges yearly from 150-250mm TL.

Daily Operations

Active management is achieved through daily water quality monitoring, feeding, and invasive aquatic vegetation removal. Water quality parameters include dissolved oxygen concentrations, pH, water temperature, and conductivity. Measurements are conducted twice a

day, morning and afternoon, at three locations of each pond (middle, east side, and west side). At each location measurements are taken at the surface and one foot above the bottom. This monitoring schedule allows evaluation of changes in abiotic conditions over day and night. It also allows evaluations of subtle changes that may be trending toward lower water quality standards and provides time to implement measures to reverse the trends.

Optimum D.O. concentrations range from 7 – 10 mg/L and pH from 7-9. No large fluctuations of pH outside of optimum range have been observed; however, liming would be implemented if extended periods of acidic conditions occurred. Protocol for liming will be developed and included in a NAPI pond management plan, currently being drafted. D.O. concentrations become a stressor for fish when levels drop to or below 5 mg/L for extended periods. If these levels are observed for greater than 24 hours, pond flushing is initiated and will last until a desired increase in D.O. is observed (usually 24-48 hours).

Fish are fed each morning (if needed) based upon growth-rate calculations from monthly sampling efforts (elaborated further under “Monthly Operations”). If aquatic vegetation is relatively dense, feeding is reduced, as razorback sucker will also feed on the vegetation. This helps minimize the potential of having too many nutrients in the system which can rapidly increase vegetation densities, thus decreasing oxygen availability as it decomposes, as well as adding excessive nitrogen. Both place unintentional stress upon the fish by limiting oxygen and limiting their ability to regulate nitrogen concentrations. Feed is distributed evenly throughout the pond via boat and manual hand feeding.

Table 1. Feeding Rates for NAPI ponds.

Water Temperature	% Body Weight to Feed	Feeding Schedule
≥80° F	3%	Mon, Wed, Fri
60°-80° F	2%	Mon- Fri
≤60° F	1.5%	Mon-Thurs

Aquatic vegetation poses problems with each pond through rapid growth of pond weed, *Potamogeton spp.*, often growing in densities above the recommended management target level of less than 30% surface area (Lamarra 2005). Some vegetation is welcome, as it helps produce oxygen and contributes to suspended solids, limiting light penetration, which in turn aids in limiting further vegetative growth. However, high densities of aquatic vegetation can dramatically reduce DO levels as it decomposes, a condition typically occurring in the hottest and longest days of the summer. Manual removal occurs when vegetation becomes too extensive. Vegetation can effectively be kept at manageable levels by towing an 8' x 1" diameter cable behind a boat at approximately twenty feet. We estimated that approximately 100-200 pounds of vegetation can be removed per week to maintain optimal water quality when vegetation is extensive.

Monthly Operations

Once each month (generally the 15th of each month), standardized sampling is conducted in each pond to track growth rates, calculate feeding rates, and evaluate the general condition of the fish. Three fyke nets (two throated, 3' x 4' rectangle front entrance, twelve feet long) are set in each pond the afternoon prior to sampling and left overnight with an effort of approximately 14 hours per net. A minimum of 30 fish must be captured for adequate representation and if there are greater than 30 individuals, all fish in the net are sampled to avoid biasing the sample. If there are less than 30 individuals, those fish are processed, as well as all the fish in the next net, and so on until a sufficient representation is met. Total length (mm) and weight (g) are recorded, as well as the general condition of the fish. As fish approach the target San Juan River stocking size (300 mm TL), the ponds may be sampled more frequently to ensure target size is reached before harvesting fish. Feeding rates are calculated on a monthly basis according to growth rates.

The calculation is based upon water temperature and average weight of the sampled individuals extrapolated to the total number of fish per pond (Table 1).

Harvesting and Stocking

Active and passive methods of harvest are implemented for removing fish from the pond. Fyke nets are used for passive harvest and active harvest consists of draining the ponds and capturing fish using a seine (10m x 1m x 8mm mesh). By reducing the total number of fish requiring immediate capture, passive harvest reduces stress that occurs when the ponds are drained. It also allows a more logistically feasible method for capturing a large number of individuals with limited personnel. Passive harvest begins when at least 80% of the population has reached or surpassed the target stocking size of 300 mm TL. This usually occurs after approximately 4 ½ to 5 months of grow-out after receiving the fish from SNARRC . During passive harvest, nine fyke nets of the same size are set overnight, for a total of approximately 126 fyke-net hours. Captured fish are held in an aerated tank located on the boat and each fish is measured for TL (mm), SL (mm), and weight (g). Fish captured which do not meet target size are returned to the pond for further growing. Any fish harvested without an Passive Integrated Transponder (PIT) tag is implanted and placed into a hauling tank with aeration and supplemental oxygen.

Active harvest generally occurs during the first week in November (approximately 7 months of growing) when pond temperatures and river temperatures are relatively similar, target size has been met for all individuals, and the Service is available to aid with the effort. Each pond is drained separately for harvesting to avoid de-watering and stranding fish. Each pond drains in roughly 30 to 36 hours. As a pond drains, fish are funneled toward a kettle (a low lying channel) where the siphon is located. The fish are then captured in a seine and hauled to portable

aerated tanks where the fish are processed as described for passive harvest. Total length, standard length, and weight are recorded for a sample of the first 100 to 200 individuals, and total length is the only metric recorded for the remaining fish. All fish receive a PIT tag and are placed into an aerated, oxygenated hauling tank.

San Juan River stocking of NAPI fish occurs in several areas of the river, generally between river mile 147.9 (Shiprock bridge) and 196.1 (Bloomfield Riverwalk Park). Before releasing, water temperatures of the tank and river are measured and the fish are acclimated according to the temperature differential one hour for every three degrees Celsius (Manuel Ulibarri, personal communication).

Contingency Planning

There are currently few protocols in place for managing the NAPI ponds during emergency periods of unforeseen water quality problems, fish health issues, and complications with physical aspects of the ponds (i.e., structure, irrigation, etc). The existing nature of management during problems with water quality (most commonly associated with low D.O. levels) is to flush the ponds, resetting water quality parameters. If issues occur regarding water quality or fish health that the NNDFW cannot attribute the cause to, personal communication with Manuel Ulibarri (SNARRC) and various personnel within the SJRRIP (e.g., Jason Davis and Weston Furr –the Service), is conducted and management actions are implemented upon expert recommendations. Matters regarding pond structural and irrigation repair are typically implemented through NAPI personnel or through consultation with the SJRRIP and a recommended action is taken.

Results

Harvest

In 2013, the NAPI ponds received 10,500 razorback suckers from SNARRC in April 2013. East Avocet, West Avocet and Hidden pond were stocked with 3500 razorback suckers each. Overall, 6,243 fish were harvested from the three ponds with an overall return rate of 59.5%. Passive harvest occurred between September 12 and October 1, resulting in the capture of 1251 fish, 20% of the total harvest. A total 4992 (80% of total harvest) fish were actively harvested from the three ponds (Table 2). All fish were acclimated to river temperatures and stocked at various locations in the upstream reaches of the river (Table 3).

Table 2. 2013 Passive and active harvest dates, effort, average total length, number, and percent return for East Avocet, West Avocet and Hidden Ponds

Pond	Date	Effort (Net Nights)	Avg Total Length (mm)	Number	% Return
<i>Passive</i>					
East Avocet	9/12-10/1	12	327	467	13.3
West Avocet	9/12-10/1	12	330	507	14.5
Hidden	9/12-10/1	9	341	277	8.0
<i>Active</i>					
East Avocet	10/18	--	337	1972	42.7
West Avocet	10/19	--	329	1496	56.3
Hidden	10/17	--	342	1525	43.6
<i>Total</i>					
East Avocet				1963	56.1
West Avocet				2479	70.8
Hidden				1801	51.5
			Overall	6243	59.5

Passively harvested fish ranged in size from 300-401 mm TL in Hidden Pond, 300-400 mm in East Avocet, and 300-405mm in West Avocet. Actively harvested fish ranged from 223-420 mm

TL in Hidden Pond, 235-350 mm TL in East Avocet, and 225-400 mm TL in West Avocet (Figure 1). Reproduction was noted within the ponds in 2012, but was not observed in 2013.

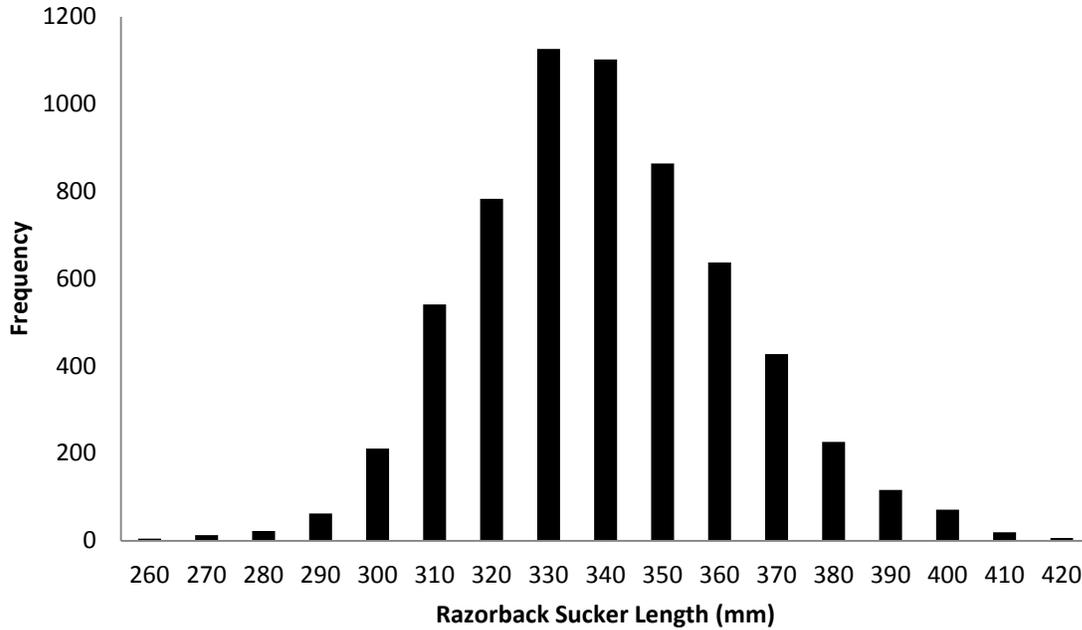


Figure 1. Total length and frequency of razorback suckers actively harvested from NAPI Razorback Sucker Grow-out Ponds in 2013.

Table 3. 2013 stocking locations, number of fish, and harvest type for NAPI grow-out ponds.

Stocking Location	River Mile	# Fish
Bloomfield	SJ 196.1	180
San Juan/Animas Confluence	SJ 180.6	669
PNM Fish Passage	SJ 166.6	2599
Shiprock Bridge	SJ 147.9	1011
Berg Park	AN 1.0	766
Animas River Park	AN 5.0	1018

Water Quality and Vegetation

Water quality was evaluated on a daily basis. Low dissolved oxygen levels were observed beginning in mid-July and continuing through early August. East Avocet consistently had the lowest dissolved oxygen levels with early morning measurements of 3-4 mg/L. Low DO levels were also observed in Hidden Pond and West Avocet with morning observations of <5 mg/L. All ponds were

flushed when DO dropped below 5 mg/L, but this activity was not enough to counteract the low morning dissolved oxygen levels. Based on the heavy vegetation load, the low dissolved oxygen levels were likely a direct result of respiration of decaying plant material.

East and West Avocet had the greatest vegetation load with 80-90% coverage of the pond substrate. Two species were observed in all ponds: Sago Pondweed (*Potamogeton pectinatus*) and American pondweed (*Potamogeton nodosus*). Vegetation control was accomplished via manual removal, but was unsuccessful in controlling these species to a manageable level.

Disease

Chronic mortality was observed East and West Avocet beginning on June 24th, 2013. Several fish were observed swimming at the surface of the pond and seemed to be lethargic. Manuel Ulibarri at SNARC was contacted immediately and three fish showing symptoms were shipped to the Fish Health Lab for diagnostics. Upon observing symptoms, feeding was ceased and all sample counts were postponed to reduce stress on the fish. The lab report indicated that the bacterium *Flavobacterium columnare* had colonized the gills (Bacterial Gill Disease) of the sampled fish and it was recommended that we begin a cycle of Oxytetracycline feed. Medicated feed was fed at 1.5% body weight for 10 days as recommended by the manufacturer. Unfortunately, medicated feed was not readily available which delayed treatment of the disease for approximately eight days. After the first cycle of medicated feed, mortalities were still occurring and it was decided to start a second 10-day cycle. Following the second cycle of medicated feed mortalities ceased and no symptoms were observed. Hidden Pond had the most mortalities with a total of 537. East and West Avocet had fewer observed mortalities with 261 and 100, respectively. The total number of mortalities observed in all ponds was 889.

P.I.T. Tag Retention

All fish were PIT tagged prior to arriving at the NAPI ponds from SNARC. This has greatly increased the efficiency of harvest and likely reduces handling stress on the fish, as well as reducing

handling time. Tagging fish prior to arriving at the facility also allows for evaluation of tag retention. All ponds had relatively low proportions of tag loss. East and West Avocet both had a tag loss percentage of 4%. Hidden ponds tag retention was the best of the three ponds with tag retention of 1.2%. The retention rates observed during the 2013 season are within the expected rates of tag loss.

DISCUSSION

Return rates in 2013 were lower than those in 2012 and 2011 (Morel 2012; Cheek 2013). The reduced return rates were most likely due to the first occurrence of bacterial gill disease in the ponds. As is usually the case with fish disease, the occurrence of bacterial gill disease in the NAPI ponds was likely due to stress caused by environmental conditions. The heavy vegetation load and resulting decreased dissolved oxygen levels likely stressed the fish to the point of suppressing their immune system allowing them to be colonized with bacteria.

To manage disease outbreaks in the future it is important that we prevent the environmental stress and prepare for disease. To prevent disease outbreaks in 2014, we will focus on control and management of vegetation with the ultimate goal of increasing water quality. To control vegetation we will be using a combination of herbicide, benthic barriers, and manual removal. Only one pond will be spot treated with a dichlobenil herbicide to determine if this strategy should be implemented in all ponds. Benthic barriers will also be used for vegetation control. Benthic barriers are mobile platforms that prevent vegetation from growing by blocking light to the soil. Platforms can also be moved to areas of heavy growth and will kill the underlying vegetation. If successful, benthic barriers could provide an alternative to chemical herbicides. New strategies of manual removal will also be explored to make the strategy more effective. To directly address low dissolved oxygen levels we will also be increasing the aeration in all ponds.

Considering the deficiencies and successes in 2013, there are several aspects which the Navajo Nation will improve upon and consider under SJRRIP direction and consultation for 2014 and future management;

- 1) Manage vegetation with multiple methods including herbicide and benthic barriers
- 2) Have medicated feed on station in case of disease outbreak
- 3) Increase aeration in all ponds
- 4) Use “soft release” during passive harvest
- 5) Investigate multiple new stocking locations will be considered under SJRIP guidance.

LITERATURE CITED

- Brooks, J.E., Buntjer, M.J., and Smith, J.R., 2000. Non-native species interactions: Management implications to aid in the recovery of the Colorado pikeminnow *Ptychocheilus lucius* and Razorback sucker *Xyrauchen texanus* in the San Juan River, CO-NM-UT. San Juan River Basin Recovery Implementation Program, USFWS, Albuquerque, NM.
- Furr, W. D., 2009. San Juan River Razorback Sucker Augmentation 2009 Annual Report. San Juan River Basin Recovery Implementation Program, USFWS, Albuquerque, NM
- Holden, P.B., 2000. Program evaluation report for the 7-year research period (1991-1997). San Juan River Basin Recovery Implementation Program, USFWS, Albuquerque, NM.
- Lamarra, V. A. 2005. Razorback Sucker Growout Ponds Operation Manual: Navajo Indian Irrigation Project. San Juan River Recovery Implementation Project, U.S. Fish and Wildlife Service, Albuquerque, NM. 26 pp
- Platania, S. P. 1990. Biological summary of the 1987-1989 New Mexico-Utah ichthyofaunal study of the San Juan River. Report to the New Mexico Dept. of Game and Fish, Santa Fe, NM, and the U.S. Bureau of Reclamation, Salt Lake City, UT. 143 pp.
- Ryden, D. W. 2003. An augmentation plan for razorback sucker in the San Juan River: An addendum to the five-year augmentation plan for razorback sucker in the San Juan River (Ryden 1997). U.S. Fish and Wildlife Service, Grand Junction, CO. 32 pp.
- San Juan River Basin Recovery Implementation Program. 2010a. Long-range plan. San Juan River Basin Recovery Implementation Program, U.S. Fish and Wildlife Service,

Albuquerque, New Mexico.

San Juan River Basin Recovery Implementation Program. 2010b. Program Document. San Juan River Basin Recovery Implementation Program, U.S. Fish and Wildlife Service, Albuquerque, New Mexico.

San Juan River Basin Recovery Implementation Program, 2006. Final program Document. San Juan River Basin Recovery Implementation Program, USFWS, Albuquerque, NM

U.S. Fish and Wildlife Service. 1991. Endangered and threatened wildlife and plants: the razorback sucker (*Xyrauchen texanus*) determined to be an endangered species. Dept. of the Interior, U.S. Fish and Wildlife Service, Federal Register, 23 October 1991, 56:54957-54967.