

**SAN JUAN RIVER  
RAZORBACK SUCKER  
POPULATION AUGMENTATION  
2009  
Annual Report**



Submitted By:

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To:

The San Juan River Basin Recovery Implementation Program

# EXECUTIVE SUMMARY

- 71,355 (includes winter 2010 stockings) razorback sucker stocked into the San Juan River from 1994-early 2010
  - 41,629 (58.3%) of these stocked in 2006 and 2007 as part of NAPI restructuring
  
- 2009 stockings surpassed annual augmentation target
  - 12,439 razorback sucker stocked to date as part of 2009 augmentation effort
    - 11,400 annual target, currently over target by 1,039 fish (9.1%)
  - approximately 3,500 more fish to be delivered as part of seasonal stocking study
    - 2009 expected to result in exceeding annual target by 4,500 fish (39.5%)
  
- 8,418 were stocked in calendar year 2009 (12,439 including winter 2010 stockings\*)
  - 4,421 fish harvested from NAPI ponds; 9,233 stocked, 47.9% return
    - 1,630 fish harvested from East Avocet; 3,000 stocked, 54.3% return
      - Mean TL 344 mm, Range 222-435 mm
    - 935 fish harvested from West Avocet; 3,000 stocked, 31.2% return
      - Mean TL 371, Range 245-498 mm
    - 1,856 fish harvested from Hidden Pond; 3,233 stocked, 57.4% return
      - Mean TL 312 mm, Range 136-415 mm
  - Uvalde NFH stocked 3,997 2006 Year Class razorback sucker on October 27th & 30th, 2009
    - 2,000 stocked below Hogback Diversion
      - Mean TL= 417 mm, Range 325-511 mm
    - 1,997 stocked below Animas confluence
      - Mean TL= 420 mm, Range 300-510 mm

Executive Summary-continued.

- Uvalde NFH stocked 4,021 2006 Year Class razorback sucker on February 9th & 12th, 2010\*
  - 2,000 stocked below Shiprock Bridge (Hogback site was inaccessible),
    - Mean TL= 455 mm, Range 333-560 mm
  - 2,021 stocked below Animas confluence,
    - Mean TL= 438 mm, Range 318-545 mm
- 2010 schedule
  - Uvalde NFH to stock remaining 2006 YC razorback sucker as part of the seasonal stocking effort (will finalize 2009 stocking commitment)
  - Dexter NFH&TC to stock 10,500  $\geq 200$  mm razorback sucker in NAPI ponds
    - Occurred April 8, 2010
    - Passive and Active harvests will occur in Fall
  - Uvalde to stock 11,400  $\geq 300$  mm razorback sucker in late Fall
  - Eight year augmentation effort fully underway
    - Annual augmentation target of  $\geq 11,400$  razorback sucker with TL  $\geq 300$  mm expected to be met or exceeded each year from 2009-2016

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# INTRODUCTION

Razorback sucker (*Xyrauchen texanus*), is one of three San Juan River native fish species, along with the Colorado pikeminnow (*Ptychocheilus lucius*) and the roundtail chub (*Gila robusta*), that have become greatly reduced in numbers and range since the mid 1900's (Minckley 1973, Bestgen 1990). Physical alterations of riverine habitats, water impoundment in the form of Navajo Reservoir and Lake Powell and their associated effects on flow and thermal regimes, introduction of non-native fish species, and contaminants may have contributed to the decline of these native species (Platania 1990, Brooks et al. 1993, Ryden and Pfeifer 1994a). Razorback sucker was listed as endangered under the Endangered Species Act on November 22, 1991 due to diminished numbers and lack of recruitment of this species in the wild (U.S. Fish and Wildlife Service {USFWS} 1991). The razorback sucker is currently protected by state laws in Arizona, California, Colorado, Nevada, New Mexico, Utah, and by the Navajo Nation.

One of the two goals of the San Juan River Recovery Implementation Program (SJRIP) is to protect and recover endangered fishes in the San Juan River Basin with the ultimate goal of establishing self-sustaining populations of razorback sucker and Colorado pikeminnow (SJRIP 1995). Due to the paucity of historic collections of this species, including the failure to collect any wild razorback sucker during three years (1991-1993) of intensive studies on all life stages of the San Juan River fish community (Buntjer et al. 1993, 1994, Lashmett 1993, 1994, Ryden and Pfeifer 1993, 1994b, Gido and Propst 1994) the SJRIP Biology Committee initiated an experimental stocking program for razorback sucker in the San Juan River (Ryden and Pfeifer 1994a). Experimental stocking was implemented to provide needed insight about recovery potential and habitat suitability for the razorback sucker in the San Juan River between river mile (RM) 158.6 at the Hogback Diversion structure, NM and Lake Powell, UT RM 0 (Maddux et al. 1993). This is the area designated as Critical Habitat for razorback sucker (USFWS 1994).

Between March 1994 and October 1996, 942 razorback sucker were stocked into the San Juan River at four stocking sites (RM 158.6, 136.6, 117.5, and 79.6). Data gathered on these fish identified habitat types being used year-round by razorback sucker in the San Juan River, and

provided information on movements, survival, and growth rates. Based on the successes of the experimental stocking study, a full-scale augmentation effort for razorback sucker in the San Juan River was initiated by the SJRIP in 1997 (Ryden 2003b).

In 1997 a *Five-Year Augmentation Plan For Razorback Sucker In The San Juan River* was completed (Ryden 1997). This plan identified a target population of 15,900 razorback sucker in the San Juan River between Hogback Diversion (RM 158.6) and Lake Powell (RM 0.0). In order to meet this target population, it was estimated that 73,482 razorback sucker would have to be stocked between 1997 and 2001. To meet that objective stocking of razorback sucker began in September 1997. Between September 1997 and November 2001, a total of 5,890 razorback sucker were stocked into the San Juan River, with all stockings taking place at RM 158.6. This represented a 92.0% shortfall ( $n = 67,592$  fish) compared to the target stocking numbers specified in the 1997 augmentation plan.

Despite this stocking shortfall, useful recapture data were collected. First, razorback sucker were recaptured during every spring and fall fish community monitoring trip from 1997-2001 (Ryden 2001). Second, aggregations of spawning adults were collected in the spring of 1997, 1999, and 2001 at RM 100.2 (McElmo Creek) just downstream of Aneth, UT (Ryden 2001, 2003a). Lastly, larval razorback sucker have been collected every year since 1998 (Brandenburg and Farrington 2010). Although larval razorback sucker have been collected for the last 12 years, documented recruitment to juvenile life stages has been limited (Ryden 2008).

Based on these observations, the SJRIP-BC extended the augmentation effort for razorback sucker. *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* was completed in February 2003 (Ryden 2003b). This addendum outlines an additional eight-year augmentation period for razorback sucker. This eight-year augmentation period was scheduled to begin in 2004 and continue through 2011. Between 2002 and 2008, 52,084 razorback sucker were stocked with 41,629 (79.9%) of those stocked in 2006 and 2007. The large number of fish stocked in those years was attributable to the harvest of all razorback sucker from the Navajo Agricultural Products Industry (NAPI) ponds in preparation for the ponds referred to as the “Six-

Pack ponds” being taken out of production and for the institution of a single cohort strategy in East Avocet, West Avocet, and Hidden Pond. Many of the fish were under the target size of  $\geq 300$  mm (2006 mean TL = 265 mm (range of 68-537 mm), 2007 mean TL = 268 mm (range of 110-573 mm) and due to complicating factors during harvesting roughly 25% of those fish were stocked without PIT tags.

In response to challenges and changes in the augmentation strategy the timeline for beginning the eight-year augmentation effort has not been clearly defined (Ryden 2005). In lieu of this ambiguity, the razorback sucker stocking and augmentation efforts that occurred 2002-2008 are considered interim, and 2009 is the starting point of the eight-year augmentation effort. This report provides an overview of year 1 (2009) of the eight-year effort (2009-2016) for razorback sucker augmentation in the San Juan River.

### **Relationship To The Recovery Program**

The main objective for augmentation was to restore a wild population of razorback sucker to appropriate historic habitat, with the eventual goal of recovering this species in the San Juan River (Ryden 1997, SJRIP 2008). Augmentation is intended to increase overall population numbers, provide opportunities for research (i.e., movement studies, habitat and spawning site preferences), add genetic diversity to the existing gene pool, and continue the persistence of a spawning adult population. Subsequent data collection may identify factors limiting successful recruitment of this species in the San Juan River.

The San Juan River Long Range Plan (SJRIP 2008) identifies the need to assess the feasibility and implementation of razorback sucker augmentation. The revised augmentation plan (Ryden 2003b) and stocking plan and protocols for the NAPI ponds (Furr and Davis 2009) provides the necessary guidance for those efforts to fulfill Action 2.2.2 of the Long Range Plan. The requirements to artificially augment the San Juan River's razorback sucker population are specified in tasks 2.2.2.1-7 of the Long Range Plan (SJRIP 2008).

In February 2007, the SJRIP-BC mandated a switch in rearing strategies and management at the NAPI grow-out ponds, contracted Uvalde National Fish Hatchery (Uvalde NFH) to meet the

yearly stocking requests of the SJRIP, and charged the USFWS's New Mexico Fish & Wildlife Conservation Office (NMFWCO) with San Juan River augmentation oversight.

Stocking of fish reared at USFWS hatcheries in the Southwest Region are subject to Regional Policy No. 03-06, "Stocking of fish and other aquatic species". This policy applies to production, transport, and stocking for USFWS hatchery production and incorporates guidance and requirements from USFWS Fish Health Policy (713 FWM 1-5), Policy for Controlled Propagation of Species Listed under the Endangered Species Act (Federal Register 65:183), and goals and objectives of the USFWS's Strategic Plan for the Fisheries Program. The USFWS's Fish and Wildlife Conservation Offices are the primary conduit for satisfaction of policy requirements and ensure compliance with needs relative to fish health, stocking requests and priorities, deviation from approved stocking requests, pre-stocking treatments (e.g. nonnative fish removal from stocking sites), and applicable environmental regulation. New Mexico FWCO is the pertinent field office for processing of SJRIP stocking requests.

#### **Objectives for Augmentation Fiscal Year 2009**

- 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 (*Ryden 2003b final*).
- 2) Conduct three seasonal stockings with 2006 year class (YC) razorback sucker from the Uvalde National Fish Hatchery to quantify temporal differences among stocking seasons.

# METHODS AND PROTOCOLS

## **NAPI Ponds**

Once water is available, the NAPI ponds (East Avocet, West Avocet, and Hidden Pond) are filled to capacity and, when possible, allowed 2 weeks to establish phytoplankton productivity. Water quality is monitored by personnel from Navajo Nation Department of Fish and Wildlife (NNDFW) and NMFWCO. Aerators are run 24 hours/day to minimize dissolved oxygen concentration fluctuations. Fish are stocked from Dexter NFH&TC in early April at a density of 3,500 fish/pond (10,500 fish in total). Fish typically range between 125-200 mm TL when stocked. Monthly sampling is conducted to calculate growth. Four to five fyke nets are set perpendicular to shorelines to capture a sample set of 50 razorback sucker from each pond. Water quality and temperature data along with growth measurements are analyzed to adjust feeding rates as follows:

- water temp  $\geq$  70 F feed 3% Body Weight per day, Mon thru Fri
- water temp 60-69 F feed 2% Body Weight per day, Mon thru Fri
- water temp < 60 F feed 1.5% Body Weight per day, Mon thru Fri

Fish are currently fed Silver Cup Razorback grower 0301. Fish are not fed this supplemental diet for up to two weeks prior to active harvesting.

Once monthly sampling results indicate that fish have acquired a mean TL of  $\geq$ 300 mm, passive harvest is conducted to collect, process, and stock as many fish as possible prior to the final draw down and active harvest. Fish are collected by fyke nets, placed in live wells, and transported to shore for processing. All fish are measured for TL, standard length (SL), and weight (WT), and implanted with a 134.2 kHz Passive Integrated Transponder (PIT) tag. Fish are transported in live hauling tanks provided by NNDFW and stocked in the San Juan River. Passively harvested fish are stocked at one of four sites in geomorphic reaches 5 and 6: Animas Confluence (RM 180), PNM weir and Nenahnezad Fish Passage (RM 166.6), Hogback Diversion (RM 158.6), or Shiprock Bridge (RM 147.9). Passive harvest is conducted for as long as capture rates justified the effort involved.

A second type of harvest is used to remove all remaining fish from ponds and is referred to as active harvest. During active harvest ponds are drained using existing siphons until the only remaining water is in the kettle area. Further draw down of the kettle areas is accomplished by use of a gas powered pumps. Razorback sucker are then collected by seine or dip net and transported via water-filled buckets to 600-1,000 gallon portable holding tanks oxygenated by airstones and compressed oxygen. Due to the usually high numbers of fish collected SL, and WT are recorded for as many fish as time allows. However, all fish are implanted with a 134.2 kHz PIT tag and measured for TL. After processing fish are transported in live hauling tanks provided by NNDFW, and stocked in the San Juan River. Actively harvested fish are stocked at one of four sites in geomorphic reaches 5 and 6: Animas Confluence (RM 180), PNM weir and Nenahnezad Fish Passage (RM 166.6), Hogback Diversion (RM 158.6), or Shiprock Bridge (RM 147.9). Passive and active harvests activities are a concerted effort between NNDFW and the USFWS-NMFWCO.

## **Uvalde Stockings**

Annual stockings of  $\geq 11,400$  razorback sucker from Uvalde National Fish Hatchery (Uvalde NFH) are scheduled to occur in autumn after the end of irrigation and field sampling seasons. However, in 2009 it was the recommendation of the SJRIP Biology Committee to investigate seasonal effects on stocking efficacy by utilizing 2006 YC razorback sucker held on station at Uvalde NFH. The plan is to stock approximately 4,000 razorback sucker at two sites (2,000 fish per site) during Fall (2009), Winter (2010), and Spring (2010). Two sites were identified based upon their upstream location or their proximity to historically recognized spawning bars. One site is just below the Animas River confluence (Animas site, RM 180) and the second is downstream of the Hogback Diversion (Hogback site, RM 158.4). Fish are stocked employing normal 'hard' release methodologies in which fish are acclimated to temperature prior to release into the channel. Seasonal effects on short and long-term retention post stocking will be evaluated through recapture data.

# RESULTS

## NAPI Ponds

Sampling conducted on May 12<sup>th</sup>, June 18<sup>th</sup>, July 23<sup>rd</sup>, and August 12<sup>th</sup> to determine growth indicated that razorback sucker in the Avocet ponds had acquired the mean target TL of  $\geq 300$  mm by the end of July and that fish in Hidden Pond were close to acquiring the target TL by mid-August (Table 1).

**Table 1 Growth monitoring sampling results.**

Pond	Date	# Sampled	Mean TL mm	Mean SL mm	Mean WT g
East Avocet	12May2009	50	208	172	119
West Avocet	12May2009	24	241	197	155
Hidden Pond	12May2009	50	246	202	145
East Avocet	18Jun2009	50	290	241	309
West Avocet	18Jun2009	16	275	229	271
Hidden Pond	18Jun2009	50	270	240	213
East Avocet	23Jul2009	50	321	274	364
West Avocet	23Jul2009	50	347	292	461
Hidden Pond	23Jul2009	50	289	241	233
East Avocet	12Aug2009	50	319	270	380
West Avocet	12Aug2009	50	344	294	491
Hidden Pond	12Aug2009	33	286	239	244

Passive harvest began September 16 and ended October 23, 2009. Overall capture rates with fyke nets were relatively low with only 757 razorback sucker collected from all three ponds (Table 2). All fish passively harvested received a PIT tag and were measured for TL, SL, and WT. Mean TL of all fish passively harvested fish was 342 mm (range 222-444 mm) and mean WT was 423 g (range 110-930g).

**Table 2 2009 Passive harvest results; dates sampled, number collected, mean and range TL, and mean WT by pond.**

Pond	Dates	# Passively Harvested	Mean TL	Range of TL	Mean WT
East Avocet	Sept. 30-Oct. 2 Oct. 6-9	331	345 mm	222-435 mm	412 g
West Avocet	Sept. 16-18 Oct. 1-2, 6-9	373	365 mm	255-444 mm	552 g
Hidden Pond	Oct. 20-23	53	316 mm	234-364 mm	304 g
<b>Total</b>		<b>757</b>	<b>342 mm</b>	<b>222-444 mm</b>	<b>423 g</b>

Active harvests occurred on November 3<sup>rd</sup>, 6<sup>th</sup>, and 10<sup>th</sup> for East Avocet, West Avocet, and Hidden Pond respectively. A total of 3,664 razorback sucker were actively harvested from the three ponds (Table 3). All fish actively harvested received a PIT tag and were measured for TL. Overall mean TL for actively harvest fish was 344 mm (range 136-498 mm). Subsets of each pond's actively harvested fish were also measured for SL and WT (Table 4).

**Table 3 2009 Active harvest results; mean and range for TL by pond, and percent return from each pond.**

Pond	Date	# Actively Harvested	Mean TL in mm	Range TL in mm	Passively and Actively Harvested	# Stocked into pond	% Return
East Avocet	Nov. 3	1,299	344	227-435	1,630	3,000	54.3%
West Avocet	Nov. 6	562	377	245-498	935	3,000	31.1%
Hidden Pond	Nov. 10	1,803	312	136-415	1,856	3,233	57.4%
<b>Total</b>		<b>3,664</b>	<b>344</b>	<b>136-498</b>	<b>4,421</b>	<b>9,233</b>	<b>47.9%</b>

**Table 4 Active and passive harvests percent of total fish measured for TL, SL, and WT with mean and range for SL and WT.**

Pond	% of fish measured	Mean SL in mm	Range SL in mm	Mean WT in g	Range WT in g
East Avocet	64.5%	288	200-395	419	100-800
West Avocet	50.2%	306	205-465	564	160-970
Hidden Pond	27.2%	259	173-330	317	115-560
<b>Total</b>	<b>47.3%</b>	<b>284</b>	<b>173-465</b>	<b>433</b>	<b>100-970</b>

A total of 4,421 razorback sucker were stocked from the NAPI ponds into the San Juan River in 2009. This represents a 47.9% return from the original 9,233 fish stocked into the ponds by Dexter NFH&TC. Mean TL for all fish stocked from NAPI ponds was 345 mm and mean WT (extrapolated from the percentage of fish measured for WT) was 433 g. As indicated by the Dexter NFH&TC fish delivery record, fish were stocked into the ponds on April 8, 2009 with an estimated TL range of 125-200 mm (mean TL 163) and mean weight of 114 g. Active harvests occurred after approximately 6 months of grow-out in the NAPI ponds. Mean TL increased 182 mm and mean WT increased 319 g across all ponds during grow-out. This equates to a 212% increase in TL and a 378% increase in WT and a growth-rate of roughly 1mm TL/day and 1.8 g WT/day (average growth/180 days).

### **Uvalde Stockings**

Uvalde NFH and NMFWCO personnel conducted the Fall stocking of the 2006 YC razorback sucker in late October 2009. On Oct. 27<sup>th</sup> 2,000 razorback sucker were stocked at the Hogback site (RM 158.4) with a mean TL of 417 mm (range 325-511 mm) and mean WT of 766 g. The second load of 1,997 fish was stocked Oct. 30<sup>th</sup> at the Animas site (RM 180) with a mean TL of 420 mm (range 300-510 mm) and mean WT of 770 g (Table 5). All fish were implanted with a 134.2 kHz PIT tag and measured for TL and WT.

**Table 5 Seasonal Stocking information.**

Date	Site, River Mile	# of fish	Mean TL	Range TL	Mean WT
Oct. 27, 2009	Hogback, RM 158.4	2,000	417 mm	325-511 mm	766 g
Oct. 30, 2009	Animas, RM 180	1,997	420 mm	300-510 mm	770 g
Feb. 9, 2010	Shiprock Bridge, RM 147.9	2,000	455 mm	333-560 mm	1099 g
Feb. 12, 2010	Animas, RM 180	2,021	438 mm	318-545 mm	945 g
	Total	8,018	433 mm	300-560 mm	895 g

The Winter stocking was conducted by Uvalde NFH and NMFWCO personnel on February 9<sup>th</sup> and 12<sup>th</sup>, 2009. On Feb. 9<sup>th</sup> 2,000 razorback sucker (2006 YC) with a mean TL of 455 mm (range 333-560 mm) and mean WT of 1099 g were stocked just downstream of the Shiprock Bridge (RM 147.9). The stocking site at Shiprock Bridge had to be used due to inclement weather making access for the Regional Distribution Unit truck into the Hogback site impractical. The second load of 2,021 fish was stocked Feb. 12<sup>th</sup> at the Animas site and had a mean TL of 438 mm (range 318-545 mm) and mean WT of 945 g (Table 5). All fish were implanted with a 134.2 kHz PIT tag and measured for TL and WT.

Although some of the 2006 YC razorback sucker from Uvalde NFH were stocked within calendar year 2010 they count toward the 2009 augmentation request. Consequently, a total of 12,439 razorback sucker have been stocked under the 2009 augmentation effort to date. This surpasses the annual stocking target of 11,400 razorback sucker by 1,039 fish (9.1% over target). Furthermore, there is still another seasonal stocking of 2006 YC razorback sucker from Uvalde NFH that is to be scheduled, which will finalize the 2009 augmentation request. With the addition of this final stocking of approximately 3,500 fish (Grant Webber personal communication) it is likely that the 2009 Uvalde NFH augmentation request will be exceeded by over 4,500 fish (39.5%).

## DISCUSSION

Razorback sucker augmentation in the San Juan River for 2009 exceeded the annual stocking target of 11,400  $\geq$ 300 mm TL razorback sucker. This marks the third time that the SJRIP was able to surpass the 11,400 fish stocking target; and the first time since the anomalous years of 2006 and 2007 when 9 NAPI ponds were completely emptied of fish. A final seasonal stocking is still to occur adding to the number of fish stocked under the 2009 effort. Augmentation efforts for 2010-2016 are similarly expected to meet or exceed the annual augmentation target. With Uvalde NFH committed to provide 11,400  $\geq$ 300 mm TL razorback sucker each Fall to meet the augmentation target, and all fish harvested out of NAPI ponds supplementing target numbers, the likelihood that the annual augmentation target will be met in any given year is greatly improved. As a result of this consistency 2009 is designated as the beginning of an eight-year augmentation effort which will carry through the year 2016.

Protocols used for the operation and management of the NAPI ponds were defined in *A stocking plan and production protocol for razorback sucker (Xyrauchen texanus) reared at NAPI ponds* (Furr and Davis 2009). Upon further consultation with NNDFW any changes or amendments required to the management protocols will be made under the adaptive management approach.

Passively harvesting fish reduces the overall number of fish that will have to be handled and processed during active harvest. This creates more manageable numbers of fish processed during the single day of active harvest and alleviates some of the fish stress by reducing time between collection, holding, processing, and stocking into the river. Future passive harvests will begin once fish acquire a mean TL of  $\geq$ 300 mm. Passive harvests will be conducted for as long as numbers collected justify the amount of effort involved. Alternative capture methods (i.e. alternative net configurations, styles, and designs, baiting, electro-fishing, etc.) should be investigated in order to increase the percentage of fish passively harvested prior to active harvest.

Razorback sucker exhibit some degree of site fidelity (Davis and Furr 2007, 2008). Except for spawning associated movement, adult razorback sucker tend to be predominantly sedentary (Tyus 1987; Tyus and Karp 1990). Previous augmentation efforts routinely stocked fish at RM

158.6 (Hogback Diversion), the upper-most boundary of critical habitat. Data indicate that a majority of razorback sucker recaptures have occurred  $\pm 10$  miles of RM 158.6 (Davis and Furr 2007, 2008). Over eight years of augmentation, 2009-2016, continuing to only stock at Hogback Diversion (RM 158.6) would result in over 91,200 razorback sucker  $\geq 300$  mm stocked at a single location. Therefore it has been suggested by the SJRIP-Biology Committee that multiple stocking locations continue to be utilized to reduce overcrowding and intraspecific competition within specific geomorphic reaches of the San Juan River. As additional spawning sites are identified, stocking in proximity to those sites may be advantageous in promoting increases in reproductive effort.

Two seasonal stockings occurred in Fall 2009 and Winter 2010. The final stocking was originally scheduled for late April, 2010. However, it was discovered in March that the 2006 YC razorback sucker at Uvalde NFH were in spawning condition. Attempting to handle and process (measure, weigh, and tag) gravid females could place compounding stresses on the fish leading to an increase in mortality. Therefore, the final stocking will be delayed until Fall 2010.

Although this modification to the stocking timeline removes Spring as a season for comparison, the issue of gravid females had not been originally considered when determining seasons for analysis. With the probability of gravid fish reoccurring and complicating Spring handling and stocking, this season is not considered an ideal time for stocking mature individuals of this species.

As the effects of augmentation on the razorback sucker population, and on the San Juan River fish community as a whole, are better understood, management decisions will invariably be reconfigured to address these new data. Due to the stochastic nature of the San Juan River, an adaptive management approach can best respond to the myriad of issues that may arise during augmentation efforts. Stocking protocols will continue to be evaluated annually and changes made to subsequent stockings and production protocols in order to expedite recovery.

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**Appendix A. Razorback sucker stocked into the San Juan River as part of the 2009 augmentation effort.**

<u>Date</u>	<u>Species</u>	<u>Year Class</u>	<u># of Fish</u>	<u>Mean TL mm</u>	<u># Tagged</u>	<u>Tag type</u>	<u>Stocking Location</u>	<u>Release Type</u>	<u>Source/Age</u>
9/16-10/23 2009	Xyr tex	2007	757	345	702	PIT	166.6/147.9	Hard	NAPI all age-2+
10/27/2009	Xyr tex	2006	2,000	416	2,000	PIT	158.4	Hard	Uvalde age-3+
10/30/2009	Xyr tex	2006	1,997	420	1,997	PIT	180	Hard	Uvalde age-2+
11/3/2009	Xyr tex	2007	1,299	343	1,299	PIT	166.6	Hard	NAPI E.Av age-2+
11/6/2009	Xyr tex	2007	562	376	562	PIT	166.6	Hard	NAPI W.Av. age-2+
11/10/2009	Xyr tex	2007	1,803	312	1,803	PIT	166.6	Hard	NAPI H.p. age-2+
2/9/2010	Xyr tex	2006	2,000	447	2,000	PIT	147.9	Hard	Uvalde age 3+
2/12/2010	Xyr tex	2006	2,021	447	2,021	PIT	180	Hard	Uvalde age 3+

2009 RBS Totals = 12,439 stocked

**Appendix B. Yearly summary of razorback sucker stocked into the San Juan River, 1994-2009**

<b>Year</b>	<b>Total number of razorback sucker stocked (Sizes of fish stocked)</b>
Experimental Stocking Study: 1994-1996 (n= 942 fish stocked)	
1994	688 (Mean TL =251 mm; Range = 100-446 mm TL)
1995	16 (Mean TL = 424 mm; Range = 397-482 mm TL)
1996	238 (Mean TL = 336 mm; Range = 204-434 mm TL)
Five-Year Augmentation Effort: 1997-2001 (n=5,890 fish stocked)	
1997	2,883 (Mean TL = 192 mm; Range = 104-412 mm TL)
1998	1,275 (Mean TL = 250 mm; Range = 185-470 mm TL)
1999	0 N/A
2000	1,044 (Mean TL = 214 mm; Range = 111-523 mm TL)
2001	688 (Mean TL = 410 mm; Range = 288-560 mm TL)
Interim Stocking Years: 2002-2008 (n=52,084 fish stocked)	
2002	140 (Mean TL = 319 mm; Range = 110-470 mm TL)
2003	887 (Mean TL = 327 mm; Range = 100-495 mm TL)
2004	2,988 (Mean TL = 353 mm; Range = 225-559 mm TL)
2005	1,996 (Mean TL = 355 mm; Range = 223-534 mm TL)
2006	18,793 (Mean TL = 265 mm; Range = 68-537 mm TL)
2007	22,836 (Mean TL = 268 mm; Range = 110-573 mm TL)
2008	4,444 (Mean TL = 307 mm; Range = 225-390 mm TL)
Eight-year Augmentation Effort: 2009-2016 (n=12,384 fish currently stocked)	
2009	12,439 (Mean TL = 412 mm; Range = 136-560 mm TL)
<b>TOTAL: 1994-2009*</b>	<b>71,355</b>