

**SAN JUAN RIVER
RAZORBACK SUCKER (*Xyrauchen texanus*)
POPULATION AUGMENTATION: 2012
Annual Report**



Photo by USFWS

Submitted By:

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To:

The San Juan River Basin Recovery Implementation Program

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EXECUTIVE SUMMARY

- **15,824** razorback sucker were stocked during 2012 augmentation efforts
 - 4,424 fish stocked above the annual target of 11,400 fish
 - Several stocking sites between RM 166.6 (PNM Weir) – RM 196.1 (Verde del Rio Park) were used in 2012
 - Soft releases conducted for hatchery stocked fish
 - Fourth year of 8 year augmentation plan
 - 71,557 fish stocked to date under 8 year augmentation effort
 - 78.5% of the 8 year augmentation target (91,200) have been stocked from 2009 to 2012

- **815** fish opportunistically stocked from the Southwestern Native Aquatic Resources and Recovery Center (SNARRC, previously Dexter National Fish Hatchery & Technology Center) in the San Juan River Basin
 - Soft released at RM 166.6 on March 29, 2012
 - Mean total length (TL)= 368 mm, Range 250-478 mm
 - 2008 & 2009 Year Class (YC); Age-3 & 4 fish

- **10,670** fish stocked from Uvalde NFH in the San Juan River Basin
 - Oct. 17- 1,745 fish soft released at Verde del Rio Park (RM 196.1)
 - Fish health issues noted with this stocking
 - Mean TL= 362 mm, Range 265-485 mm
 - 2009 YC; Age-3 fish
 - Oct. 23- 2,269 fish soft released at PNM Sluiceway (RM 166.6)
 - Mean TL= 365 mm, Range 302-454 mm
 - 2009 YC; Age-3 fish
 - Oct. 30- 2,682 fish soft released at PNM Sluiceway (RM 166.6)
 - Mean TL= 392 mm, Range 284-576 mm
 - 2006 & 2009 YC; Age-6 & 3 fish
 - Nov. 6- 1,679 fish hard released at Animas Confluence (A-RM 0.1)

- Mean TL= 408 mm, Range 318-535 mm
 - 2009 YC; Age-3 fish
 - Nov. 14- 2,295 fish soft released at PNM Sluiceway
 - High level of mortality documented with this stocking
 - Mean TL= 405 mm, Range 318-535 mm
 - 2009 YC; Age-3 fish
 - 93.6% of annual augmentation request fulfilled by Uvalde NFH
 - 99.7% of Uvalde NFH fish were ≥ 300 mm TL
- **4,339** fish stocked from two Navajo Agricultural Products Industry (NAPI) ponds in the San Juan River Basin
 - 6,298 stocked into the two ponds by SNARRC in the Spring of 2012
 - 64.8% return rate
 - Mean TL= 336 mm, Range 102-496 mm
 - 2008 & 2009 YC, Age-4 & 3 fish
 - 259 Young-of-Year (YOY) fish produced through spawning in Hidden Pond
 - Mean TL= 130 mm, Range 102-176 mm
 - 2012 YC & age-0 fish
 - 2 YOY fish stocked without PIT tags during Passive harvest
 - Fish stocked at multiple stocking locations (RM 166.6 – 196.1, & A-RM 0.1)
- All razorback sucker stocked in 2012 were implanted with a PIT tag and had TL measurements recorded; all SNARRC & Uvalde NFH fish also had weight (WT) measurements recorded
- Adaptive management 2013 through 2016
 - Hatchery sources of razorback sucker for use in 2013-2016 augmentation efforts under review by the San Juan River Basin Recovery Implementation Program
 - Continue to investigate potential stocking sites throughout the San Juan River Basin

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INTRODUCTION

Razorback sucker (*Xyrauchen texanus*), is one of three San Juan River native fish species, along with Colorado pikeminnow (*Ptychocheilus lucius*) and roundtail chub (*Gila robusta*), that have declined 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 in 1991 (U.S. Fish and Wildlife Service, {USFWS}, 1991). In addition to federal protection, razorback sucker is currently a protected species in Arizona, California, Colorado, Nevada, New Mexico, Utah, and the Navajo Nation.

One goal of the San Juan River Basin Recovery Implementation Program (SJRIP) is to establish self-sustaining populations of the two endangered fishes ultimately leading to recovery and downlisting of the two species (SJRIP 1995). Due to the paucity of historic collections of razorback sucker, 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; 1994-1996 (Ryden and Pfeifer 1994a). Experimental stocking was implemented to provide insight about recovery potential and habitat suitability for the razorback sucker in the San Juan River between river mile (RM) 158.6 Hogback Diversion, NM and Lake Powell, UT RM 0 (Maddux et al. 1993). Data from these stockings indicated that razorback sucker could persist in the San Juan River and this information led to the implementation of a full-scale augmentation program for razorback sucker in 1997 (Ryden 2003b). Additionally, based on these and other studies, critical habitat for razorback sucker in the San Juan River was designated from RM 158.6 downstream to Neskahi Canyon in the San Juan arm of Lake Powell (USFWS 1994).

In 1997 a *Five-year augmentation plan for razorback sucker in the San Juan River* was completed (Ryden 1997). This plan identified the establishment of 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).

To meet this goal, it was estimated that 73,482 razorback sucker would have to be stocked between 1997 and 2001. From September 1997 to November 2001, a total of 5,896 razorback sucker were stocked into the San Juan River. The shortfalls in stocking numbers were a result of insufficient numbers of razorback sucker available to the SJRIP augmentation program. From 1997 to 2001, the SJRIP acquired for use, or constructed, several ponds on Navajo Agricultural Products Industry (NAPI) lands for the purpose of rearing razorback sucker for stocking into the San Juan River. These ponds were the primary source of razorback sucker for the SJRIP's augmentation program. Ponds were stocked with young razorback sucker each Spring, of which appropriately sized individuals (≥ 300 mm TL) were passively harvested (fyke nets) and stocked into the San Juan River each Fall. Fish that failed to meet the minimum size requirement were left in the ponds for continued grow-out. This strategy led to the presence of multiple cohorts in the ponds creating unpredictability during Fall harvest efforts.

Despite the augmentation shortfalls, useful recapture data were collected. First, razorback sucker were recaptured during every spring and fall fish community monitoring trips from 1997-2001 (Ryden 2001). Second, aggregations of spawning adults were encountered 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, with over 1,000 larvae being collected in each of the last three years; 2010-2012 (Farrington et al. 2013). Although larval razorback sucker have been collected for the last 15 years, documented recruitment to juvenile life stages is limited (Ryden 2008).

Based on these observations, the SJRIP-BC extended the augmentation effort for razorback sucker and approved *An augmentation plan for razorback sucker in the San Juan River: Addendum to the five-year augmentation plan for razorback sucker in the San Juan River (Ryden 1997)* in February 2003 (Ryden 2003b). This addendum outlined an additional eight-year augmentation period for razorback sucker. The 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 being stocked over two years, 2006 and 2007. The large number of fish stocked in those years was attributable to the harvest of all razorback sucker from the NAPI ponds in preparation for a shift from a multiple cohort to a single cohort rearing strategy in East and West Avocet ponds, and Hidden Pond. Many of the fish stocked were under the target size of ≥ 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 Passive Integrated Transponder (PIT) tags. Although large numbers of fish were stocked in 2006 and 2007, recapture rates, three years post stocking, were similar to those from smaller stockings (n = <5,000) (Steve Ross, personal communication).

In response to changes in the augmentation strategy, the timeline for beginning the eight-year augmentation effort was delayed, with full implementation beginning in 2009. This report provides an overview of the fourth year (2012) of the eight-year effort (2009-2016) for razorback sucker augmentation in the San Juan River Basin. Details summarizing the grow-out of razorback sucker at the NAPI ponds during 2012 will be covered in a separate report by the Navajo Nation Department of Fish and Wildlife (NNDFW).

Relationship To The Recovery Program

The main objective for augmentation is to facilitate the establishment of a self-sustaining population of razorback sucker, with the eventual goal of recovering (i.e. delisting) this species in the San Juan River Basin (Ryden 1997, SJRIP 2012). 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 contribute to the persistence of a spawning adult population.

The SJRIP Long-Range Plan (LRP, SJRIP 2012) identifies the need to assess the feasibility and implementation of razorback sucker augmentation. The revised augmentation plan (Ryden 2003b), along with the stocking plan and protocols for the NAPI ponds (Furr and Davis 2009b), provide the necessary guidance for those efforts to fulfill the goals, actions, and tasks defined in the 2012 LRP. The requirements of the augmentation program for the San Juan River's razorback sucker population are specified in the 2012 LRP under the following goals, actions, and tasks:

- **Goal 1.1 - Establish a Genetically and Demographically Viable, Self-Sustaining CPM and RBS Populations.**
 - **Action 1.1.1** Develop plans for rearing and stocking CPM and RBS.
 - **Task 1.1.1.2** Review and update augmentation plan for RBS and adjust stocking goals as needed.
 - **Action 1.1.3** Produce, rear, and stock sufficient numbers of RBS to meet stocking goals of augmentation plan.
 - **Task 1.1.3.1** Produce and rear RBS at Dexter NFH [now SNARRC] for stocking to grow-out facilities.
 - **Task 1.1.3.2** Rear and stock hatchery-reared RBS from three NAPI grow-out ponds (3,000-3,500 fish per pond, > 200 mm TL).
 - **Task 1.1.3.3** Produce 12,000 RBS per year (>300 mm TL) at Uvalde NFH.
 - **Task 1.1.3.4** Stock at least 91,200 RBS (> 300 mm TL) during eight year stocking period or 11,400 per year.
 - **Task 1.1.3.5** Opportunistically stock available RBS in excess of the 11,400 described above.

- **Goal 1.2 - Evaluate RBS and CPM Augmentation Program and Genetic Integrity**
 - **Action 1.2.2** Evaluate methods to improve RBS and CPM stocking successes.
 - **Task 1.2.2.1** Identify, describe, and implement strategies for improving survival and retention of stocked razorback sucker and Colorado pikeminnow, including acclimation prior to stocking, size of fish stocked, time and location of stocking, physiological conditioning, and predator avoidance

- **Goal 1.3 - Support Operations and Maintenance of Facilities to Support RBS and CPM Stocking Programs.**
 - **Action 1.3.1. Support Production and Grow-out Facilities.**
 - **Task 1.3.1.1** Support operation and maintenance of hatchery facilities (Dexter and Uvalde NFH) for RBS production.
 - **Task 1.3.1.2** Operate and maintain NAPI grow-out ponds.
 - **Task 1.3.1.3** Support construction, operation, and maintenance of Horse Thief Canyon Fish Rearing Ponds.

In February 2007, the SJRIP-BC approved a shift 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 Basin 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. NMFWCO is the pertinent field office for processing of SJRIP stocking requests.

Objectives for RZB Augmentation Fiscal Year 2012

- 1) Obtain, rear, harvest, and stock razorback sucker to fulfill the tasks and objectives outlined in the current versions of the razorback sucker augmentation plan addendum (Ryden 2003b) and the SJRIP Long-range plan.
- 2) Conduct soft releases for all hatchery stocked razorback sucker using release locations at, or upstream of, the PNM Weir (RM 166.6). Soft releases consist of holding and monitoring fish within an enclosure with low/zero velocity for up to 72 hours allowing fish to recuperate from handling and hauling stressors, and acclimatize to water chemistry parameters, *in situ*, at specific locations.

STOCKINGS

SNARRC Opportunistic Stocking

On March 29, 2012 personnel from SNARRC and NMFWCO soft released 815 razorback sucker at the PNM Sluiceway (RM 166.6) (Table 1). The PNM Sluiceway soft release site consists of a concrete channel (approximately 80 meters (m) x 10 m) with accumulated silt/sand sediments and a cobble/boulder lined stilling pool (approximately 25 m x 12 m) with accumulated silt/sand sediments, and benthic algae, which connects the sluiceway to its confluence with the mainstem of the San Juan River. Depth ranges from 0.6-0.8 m throughout most of the sluiceway site, but can vary depending on flows in the San Juan River. Velocity within the sluiceway is controlled by head gates, which are kept closed during soft releases, effectively maintaining near zero velocity. There is some seepage around the gates, along with some pump intake overflow returns, that create water exchange throughout the sluiceway; but their effect on creating noticeable velocity is negligible. The razorback sucker stocked from Dexter were opportunistically obtained fish originally produced for the Lower Colorado River Multi Species Conservation Program. Mean TL was 368 mm (Range= 250-478 mm); mean WT was 536 grams (g) (Range= 204-1111 g). Fish were tempered on site in the hauling tank for at least one hour and to within 1° Celsius (°C) of the measured river temperature prior to release into the enclosure. All fish were implanted with a PIT tag and had TL and WT measurements recorded prior to delivery. Fish were held for approximately 18 hours, after which time the block net was removed allowing fish to access the San Juan River mainstem.

Uvalde NFH 2012 Annual Commitment Stockings

In an effort to increase survival and retention of Uvalde NFH razorback sucker, changes in handling and hauling protocols were implemented by the hatchery in 2011. Under these protocols five stocking events were required to deliver Uvalde NFH's 2012 augmentation commitment. In addition, new stocking protocols were implemented by NMFWCO that included soft releasing, similar to methods used for soft releases of Colorado pikeminnow (Furr and Davis 2009a), all razorback sucker

from Uvalde NFH. All fish were implanted with a PIT tag and had TL and WT measurements recorded prior to delivery. A summary of the five stockings from Uvalde NFH and the opportunistic Dexter NFH&TC stocking are presented in Table 1.

Table 1- Summary of Dexter NFH&TC and Uvalde NFH razorback sucker stockings into the San Juan River, 2012.

Date	Site, River Mile	# of fish	Year Class	Mean TL (mm)	Range TL (mm)	Mean WT (g)
March 29	PNM Sluiceway RM 166.6	815	2008/2009	368	250-478	622
Oct. 17*	Verde del Rio Park RM 196.1	1,745	2009	362	265-485	456
Oct. 23	PNM Sluiceway RM 166.6	2,269	2009	405	290-581	700
Oct. 30	PNM Sluiceway RM 166.6	2,682	2006/2009	392	284-576	595
Nov. 6	Animas River Confluence A-RM 0.1	1,679	2009	408	295-558	698
Nov. 14**	PNM Sluiceway RM 166.6	2,295	2009	405	318-535	686
Total Stocked from Hatcheries		11,485				

*fish health issue noted with the October 17 stocking ** high mortality was documented with the November 14 stocking

The five releases from Uvalde NFH resulted in 10,670 razorback sucker being stocked at two locations in the San Juan River and one location in the Animas River. Due to changes in the access to the PNM Sluiceway, no pre-release site sampling was conducted at that site in 2012. Furthermore, no pre-release site sampling occurred for the October 17th stocking at Verde del Rio Park because the fish appeared stressed and it was decided to get fish stocked as soon as they were tempered. The soft release site at Verde del Rio Park consists of the downstream confluence zone of a secondary side channel with the primary channel of the San Juan River (approximately 35 m x 8 m).

Predominant substrate was embedded gravel and cobble covered with benthic algae, with silt/sand along near-shore areas. Near-shore velocities downstream of the side channel's return were low, with the area best described as embayed. The upper end of the enclosure consisted of a riffle/run habitat as the side channel rejoined the mainstem at the downstream end of a large island. Depths range from zero at the shoreline to 0.6 m along the block net forming the enclosure. No enclosure could be erected for the November 6th stocking at the Animas River Confluence site so fish were

hard released after tempering in the hauling tanks. This site consists of a side channel (approximately 100 m x 20 m) formed by a large mid-channel cobble bar/island. Substrate was embedded cobble with benthic algae. Depth throughout most of the side channel was 0.5-0.7. The Animas River Confluence was the only site where an enclosure could not be erected and a standard hard release had to be used; all other releases utilized soft release methodologies. Holding times for the soft releases ranged between 20-24 hours.

Summary Results from NAPI Ponds

A total of 4,377 razorback sucker were stocked using standard hard release protocols from the NAPI ponds into the San Juan River in 2012. Thirty-eight razorback sucker had errors in their recorded data and were removed from the SJRIP Access database and are not presented in Table 2. These fish are, however, counted when calculating the 2012 annual augmentation totals (Appendix B). There was a 64.8% return rate from the original 6,298 fish stocked into the ponds by SNARRC. Ninety-three razorback sucker not needed for a PIT tag retention study conducted by NNDFW were tagged and stocked from Hidden Pond on April 12 (n=25) and May 15 (n=68), 2012. Passive harvests began on August 8 and ran through September 13, 2012. Passively harvested fish were stocked at four locations: Verde del Rio/River Walk Park (RM 196.1), Animas Confluence (RM 180.1), PNM/Nenahnezad Fish Ladder (RM 166.6), and Animas River Confluence (A-RM 0.1). Active harvest for Hidden Pond occurred on October 15, fish were stocked at the PNM/Nenahnezad Fish Ladder (RM 166.6). East Avocet was actively harvested on October 16, fish stocked at Animas River Confluence (A-RM 0.1).

Table 2- Summary of 2012 NAPI pond harvest results as recorded in the SJRIP Access Database.

Pond	Harvest Type	Number Recorded	Mean TL (mm)	Range TL (mm)	Mean WT (g)
East Avocet	Passive	729	346	240-475	386
	Active	1,256	362	225-495	441*
Hidden Pond	Passive	721	336	190-460	362
	Active	1,281	347	205-496	430*
	In-Pond Spawned 2012 YC	259	130	102-190	29*
	Tagging Study Excess Fish	93	377	320-448	492
Total		4,339			

*indicates mean WT's were calculated from a subset of fish harvested. Numbers presented here may differ from actual numbers stocked due to duplicate or other PIT tag recording errors.

DISCUSSION

The SJRIP Augmentation Program accomplished *Actions* and *Tasks* set forth in SJRIP-LRP *Goal 1.1*, except for Task 1.1.3.3, with 93.6% of the requested 11,400 razorback sucker from Uvalde NFH delivered. Actions are being taken to address *Goal 1.2* and evaluations are currently ongoing. A total of 15,824 razorback sucker were stocked in 2012. This represents an exceedance of the annual stocking target of 11,400 razorback sucker by 4,424 fish (138.8% of augmentation target fulfilled). During the first four years of the 8-year augmentation effort 71,557 razorback sucker have been stocked. This represents 78.5% of the entire 8-year augmentation target of 91,200 fish. The SJRIP is currently modifying hatchery commitments in providing razorback sucker for augmentation in the San Juan River Basin. During the transition period there should not be any reduction in the overall number of fish available to the SJRIP from various hatcheries and NAPI ponds. Therefore, the potential still exists to routinely stock over 15,000 adult and sub-adult razorback sucker each year. Since future augmentation efforts are expected to meet or exceed the annual augmentation target, it is expected that the SJRIP augmentation program will fully satisfy Task 1.1.3.4 by the end of the 8-year augmentation effort in 2016.

In 2011 Uvalde NFH personnel began to haul fish in a smaller distribution truck and at lighter hauling densities. The Uvalde NFH truck has two 500 gallon tanks that would haul approximately 1,700 razorback sucker per load (1.7 fish/gallon); thereby requiring seven loads to haul the $\geq 11,400$ fish in 2011 to meet their annual commitment. This increase in effort was deemed necessary in order to expand the access to various, and smaller, stocking locations, while effectively halving the hauling densities in an effort to reduce hauling stress and associated mortalities. Additionally, by hauling fish in multiple loads the chance of losing all, or a significant portion, of the numbers requested from a catastrophic event was avoided. In 2012, Uvalde NFH personnel were also able to transport fish in a goose-neck trailer mounted hauling tank towed by a pick-up truck. This allowed for more fish to be transported on trips when the hauling trailer, and extra personnel to drive the truck, were available. This extra capacity maintained low hauling densities, but was able to reduce the number of trips required to fulfill the 2012 augmentation request from seven to five.

During soft releases NMFWCO personnel were able to document fish health issues and mortalities associated with stockings that occurred on October 17 and November 14, 2012. A proportion of the razorback sucker released at Verde del Rio Park (RM 196.1) on October 17 had experienced a bacterial and *Ichthyophthirius multifiliis* (Ich) outbreak during grow out at Uvalde NFH. Fish were treated with medicated feed, malachite green, and formalin to control the Ich and bacterial infection (Karin Eldridge, personal communication). However, many of those fish had become weakened and emaciated, and were unable to be restored to a healthier condition prior to delivery. It was estimated that up to a third of the fish released were in less than ideal condition at the time of stocking.

Although the eventual fate of these fish was not determined, it is assumed that many of these fish suffered from delayed mortality due to their poor health. The stocking at the PNM Sluiceway on November 14 experienced high mortality 18 hours post-stocking (Ernest Teller, personal communication). It was noted by all personnel present at time of stocking that fish were “acting unusually” once off-loaded and could be visually inspected while swimming freely within the enclosure. The fish appeared disoriented, with many fish beaching themselves along the shorelines. Furthermore, fish were witnessed repeatedly ‘gulping’ at the surface. Approximately one hour post-stocking, fish exhibited normal behavior (i.e. no more beaching and a reduction in the frequency of ‘gulping’ at the surface) and personnel vacated the PNM site. The following morning staff from NMFWCO returned to the PNM Sluiceway to remove the block net and documented numerous mortalities. NMFWCO staff did observe live razorback sucker within the enclosure indicating that

the stocking did not experience 100% mortality. However, considering that an estimated >90% of fish did not survive, for purposes of the SJRIP database, the entire stocking of 2,295 razorback sucker is being considered unsuccessful.

The March 29, 2012 soft release of 815 razorback sucker from SNARRC resulted in 94 individuals recaptured during sampling from the Hogback Diversion to Shiprock Bridge (RM 158.6-147.9, n=17) and from PNM Weir to Hogback Diversion reach (RM 166.6-159, n=77) in July 2012 (NMFWCO data). Although the duration between time of stocking and recapture was relatively short (103-112 days), it nonetheless provides some insight into the limited longitudinal dispersal for razorback sucker stocked prior to increased flows associated with Spring run-off. Overall, there were a total of 175 individual fish (21.5%) recaptured from this stocking across all sampling efforts in 2012 (SJRIP database). Recapture data like this are useful in informing future augmentation decisions, especially when it comes to the stocking of opportunistically acquired fish that typically fall outside the planned annual augmentation timeframe.

In 2012, all razorback sucker stocked were released at, or upstream, of the PNM Weir/Sluiceway (RM 166.6). It is intended that using upstream areas of the San Juan River for soft releases will facilitate upstream range expansion and retention for this species. Annual stockings of razorback sucker will continue to be scheduled in autumn, preferably after the end of irrigation and field sampling seasons, in an attempt to lessen entrainment and post-stocking sampling disturbance.

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, including the conducting of soft releases for razorback sucker, will 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 from hatcheries into the San Juan River 2012.

<u>Date</u>	<u>Species</u>	<u>Year Class</u>	<u># of Fish</u>	<u>Mean TL mm</u>	<u>Tag type</u>	<u>Stocking Location</u>	<u>Release Type</u>	<u>Source/Age</u>
Mar. 29	Xyr tex	2008/2009	815	368	PIT	RM 166.6	Soft	Dexter age-3 & 4
Oct. 17	Xyr tex	2009	1,745	362	PIT	RM 196.1	Soft	Uvalde age-3
Oct. 23	Xyr tex	2009	2,269	405	PIT	RM 166.6	Soft	Uvalde age-3
Oct. 30	Xyr tex	2006/2009	279	425	PIT	RM 166.6	Soft	Uvalde age-3 & 6
Oct. 30	Xyr tex	2009	2,403	388	PIT	RM 166.6	Soft	Uvalde age-3
Nov. 6	Xyr tex	2009	1,679	408	PIT	A-RM 0.1	Hard	Uvalde age-3
Nov. 14	Xyr tex	2009	2,295	405	PIT	RM 166.6	Soft	Uvalde age-3

2012 Hatchery RBS Stocking Total = 11,485

Appendix B. Yearly summary of razorback sucker stocked into the San Juan River, 1994-2012

Year	Total number of razorback sucker stocked (Sizes of fish stocked)
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)

Appendix B. - continued

Year	Total number of razorback sucker stocked (Sizes of fish stocked)
Eight-year Augmentation Effort: 2009-2016 (n= 71,557 fish stocked to date)	
2009	8,418* (Mean TL = 412 mm; Range = 136-560 mm TL)
2010	28,485 (Mean TL = 417 mm; Range = 222-575 mm TL)
2011	18,830 (Mean TL = 363 mm; Range = 208-540 mm TL)
2012	15,824 (Mean TL = 378 mm; Range = 102-581mm TL)
TOTAL: 1994-2012	130,473
* 4,021 razorback sucker stocked in Feb. 2010 are part of the 2009 stocking effort but are tallied in the 2010 stocking totals.	