Devils Canyon and Mineral Creek Fish Surveys During 2009

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Introduction

Gila chub *Gila intermedia* was listed as federally endangered with critical habitat in 2005 (Federal Register 2005). At the time of listing 29 populations in seven watersheds in the Gila River basin were considered extant. One of the extant populations was in Mineral Creek, tributary to the Gila River in Pinal County, Arizona. The Mineral Creek population was first documented in 1993 (Andrews and King 1997), but was last documented during 2000 (Robinson 2008a) even though four surveys in upper Mineral Creek (upstream of Big Box Dam) were completed between 2002 and 2008: two during 2002, one in 2006, and one in 2008. Gila chub are likely extirpated from upper Mineral Creek (Robinson 2008a). Robinson (2008a) recommended repatriating Gila chub to upper Mineral Creek, however expressed concern about stocking another lineage of Gila chub into the system if the species still occurred elsewhere in the watershed (e.g., Devils Canyon and the portion of Mineral Creek between Big Box Dam and the ASARCO Ray Mine tunnel). Mineral Creek watershed Gila chub, if they still exist, would be the preferred lineage to repatriate into upper Mineral Creek. Robinson (2008a) recommended surveying Devils Canyon and the portion of Mineral Creek between Big Box Dam and the tunnel to be more confident that Gila chub are extirpated from the Mineral Creek watershed. Gila chub have never been documented in Devils Canyon, a tributary to Mineral Creek, but only two fish surveys are known to have been done, both restricted to the lowest reach immediately above Big Box Dam Reservoir (Robinson 2008a). Gila chub were recorded from the portion of Mineral Creek between Big Box Dam and the ASARCO Ray Mine tunnel in a 1993 survey (Andrews and King 1997).

The objective of the surveys within the Mineral Creek watershed during 2009 were to document occurrence of Gila chub and other fish species within perennial waters in Devils Canyon and the portion of Mineral Creek between Big Box Dam and the ASARCO Ray Mine tunnel.

Study Site

Mineral Creek is a tributary to the Gila River in Pinal County Arizona. Mineral Creek is impounded by Big Box Dam (constructed in 1971) just upstream of ASARCO Ray Mine. An approximately 650-m long reach of Mineral Creek exists from Big Box Dam to the tunnel entrance, after which the stream flows through the tunnel under the ASARCO Ray Mine (Figure 1). Immediately above Big Box Dam, the watershed divides into Devils Canyon to the west and Mineral Creek to the east (this portion of Mineral Creek is referred to as upper Mineral Creek). Devils Canyon is a mostly north-to-south oriented drainage and the northern upstream end crosses US Highway 60. Rawhide Canyon, a north-to-south oriented tributary, meets Devils Canyon approximately 3.1 km upstream from the confluence with Mineral Creek. Robinson (2008b) identified two perennial reaches in Devils Canyon during an aerial survey; the upper reach extended from the U.S. Highway 60 bridge downstream for approximately 2 km, and the lower reach extended from the Rancho Rio Creek confluence downstream for approximately 4 km, ending about 750 m downstream of an area known to canyoneering enthusiasts as Five Pools (five waterfalls with associated plunge pools). Robinson (2008b) also observed some water and riparian vegetation in a short portion of Rawhide Canyon from its mouth upstream approximately 500 m. We surveyed five reaches during 2009 (Figure 1): 1) Devils Canyon from the U.S. Highway 60 bridge to 2,350 m downstream on July 14, 2) Devils Canyon from Rancho Rio Creek to approximately 2,440 m downstream on April 15-16, 3) the plunge pools

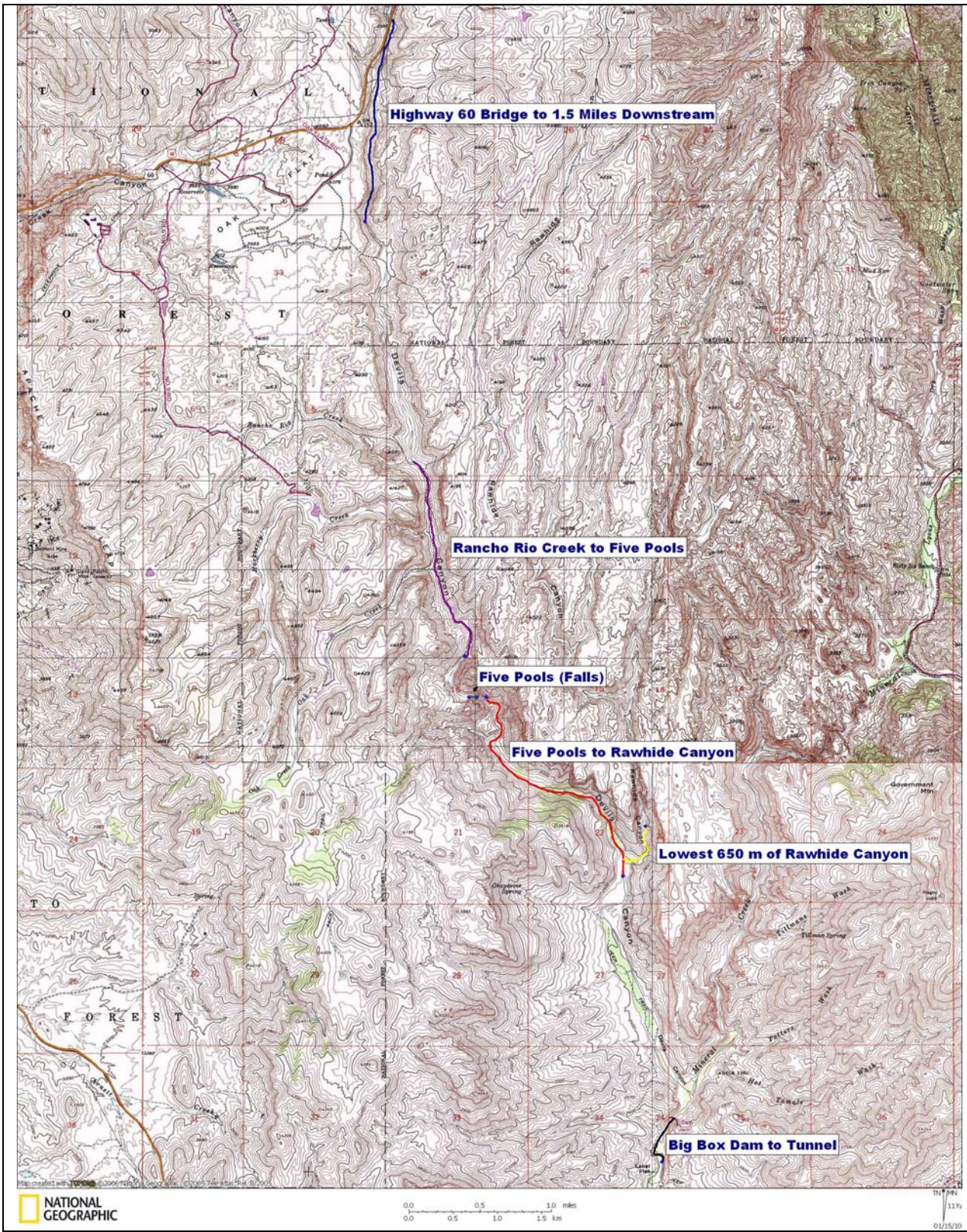

Figure 1. Map showing location of reaches sampled in Devils Canyon, Rawhide Canyon, and Mineral Creek during 2009 fish surveys.

below each of the five falls on April 16, 4) from approximately 50 m downstream of the lowest of the five falls downstream 3,070 m to about 175m past the confluence of Rawhide Canyon on August 3-4, and 5) Rawhide Canyon from its mouth upstream 650 m to a dry waterfall on August 3.

Seven fish species have been documented in Mineral Creek and its tributary Devils Canyon. Fish species reported in Devils Canyon include green sunfish *Lepomis cyanellus* and fathead minnow *Pimephales promelas* (Schwemm 2002; AGFD unpublished data). Fish species reported in Mineral Creek include native longfin dace *Agosia chrysogaster*, Gila chub *Gila intermedia*, and desert sucker *Catostomus clarki* and nonnatives fathead minnow, green sunfish, mosquitofish *Gambusia affinis*, and black bullhead *Ictalurus melas* (Andrews and King 1997).

Methods

Wadeable water within each reach was surveyed using a Smith-Root model LR24 backpack electrofisher with one probe and rattail. Stream sections were shocked during daylight hours moving in an upstream direction, and stunned fish were captured with dip nets (Duraframe Dipnet® electro intermediate hex trap net with 3 mm mesh and 5 ft long pole). Section length and duration shocked were variable, and were a result of where we stopped to process fish. Data recorded for each section included: date, GPS location, species captured and numbers, seconds electrofished, and length of section electrofished.

Deeper pools were surveyed with Promar collapsible mini-hoop nets (0.85 m long, 0.3 m diameter circular hoops, with 9 mm mesh) or Promar collapsible minnow traps (0.43 m long, 0.25 m wide, with 2 or 5 mm mesh) baited with Gravy Train® dog food. Nets were set in the afternoon and pulled the next morning when possible, or for a minimum of 2 hours during daylight. Dip nets (Duraframe Dipnet® electro intermediate hex trap net with 3 mm mesh and 5 ft long pole) were also used to survey deeper pools or areas where electrofishing or traps could not easily be used. Data recorded for each trap or dip net sweep included: date and time net was set and pulled, GPS location, species captured and numbers of individuals.

Four of the Five Pools were sampled after rappelling down to each; the second uppermost pool is small and was not sampled. In the first and third pools, an experimental monofilament gill net (green meanie 15.2 m long x 1.5 m wide, with 6 different mesh panes ranging from 19 to 46 mm) was set in the morning and pulled several hours later in the afternoon. Two mini hoop nets (Promar® collapsible 0.85 m long, 0.3 m diameter circular hoops, with 9 mm mesh) baited with Gravy Train® dog food were also set in the morning in the third pool and pulled several hours later in the afternoon. The fourth and fifth pools were surveyed by snorkeling; two people snorkeled through each for approximately 10 minutes.

Results

No Gila chub were captured in any of the five reaches surveyed. Three fish species, all of which are nonnative, were captured during the surveys: green sunfish, fathead minnow, and mosquitofish. In the section of Mineral Creek below Big Box Dam, green sunfish were by far the most abundant species, and the only other species captured was fathead minnow (Table 1). Green sunfish appeared to be more abundant in this section of Mineral Creek than in any of the Devils Canyon reaches surveyed (Tables 1 and 2). In Devils Canyon both green sunfish and

mosquitofish were captured, but mosquitofish were only captured in the upstream-most reach (Highway 60), whereas green sunfish were captured in all four reaches surveyed (Table 2). No fish were captured or observed in Rawhide Canyon. Crayfish were also captured in the Highway 60 and Rancho Rio to Five Pools reaches and two dead ones were observed in the reach between Five Pools and Rawhide Canyon (Table 2). Sonoran mud turtles *Kinosternon sornoriense* were observed all reaches except the Five Pools. A black-necked garter snake *Thamnophis cyrtopsis* was observed and captured in the Highway 60 reach of Devils Canyon.

Discussion

No Gila chub were captured or observed during our surveys, which lends evidence that they are not present in Devils Canyon and are no longer present in the section of Mineral Creek between Big Box Dam and the ASARCO Ray Mine tunnel. They were last captured in the section of Mineral Creek between Big Box Dam and the mine during 1993, but were captured just downstream of the old reservoir in Lakel Flat, which is now covered by the mine. Our survey in Mineral Creek was intensive, but within the uppermost portion immediately below Big Box Dam there was a large deep pool which could not be effectively sampled with the gear we had, so it is possible that Gila chub are present, but if so they are likely very rare, as there were many suitable looking pools downstream that were sampled but no chub were captured.

Gila chub have never been reported from Devils Canyon, but it seems likely that they could have occupied the lower reach from just downstream of Five Pools to the confluence with Mineral Creek as there are no natural waterfalls in this reach to prevent upstream movement during high flow periods, and the portion just downstream of Five Pools appears to be perennial. However, the section between Rawhide Canyon and the confluence with Mineral Creek appears to be ephemeral (Schwemm 2002, Cori Carveth, Arizona Game and Fish Department, personal communication), which may function as a fish barrier to some species. It also seems likely that Gila chub could have occupied the lowest reach of Rawhide Canyon for the same reasons. The five waterfalls that create the Five Pools however, are postulated to have been fish barriers for over ten thousand years, as we think they are basalt, and two of the falls are 15.2 vertical meters and two others 3.7 m, and one 3.0 m (Figure 2). If these five falls were fish barriers, then there should never have been any native fish captured upstream; results of our survey support this hypothesis and we only found records of one survey upstream (a vegetation survey; Jacobs and Flesch 2007) where only nonnative fish were observed. However, it seems likely that the upper portion of the stream was surveyed more times in the past given it's proximity to U.S. Highway 60 and the fact that it occurs on Forest Service and State Lands; records of any past surveys would help determine if the hypothesis is true or false. The dry waterfall in Rawhide Canyon about 650 m upstream of the confluence with Mineral Creek had a vertical drop of approximately 5-6 m and has thus also a likely been a fish barrier in at least the last few thousand or so years.

Only nonnative fishes were found during our survey of Devils Canyon and one section of Mineral Creek. Nonnative fish in the portion of Mineral Creek surveyed may have originated from the Gila River and migrated into Mineral Creek before the mine was developed, may have been purposely stocked, or may have migrated downstream from upstream stock tanks. Nonnative fish in the portion of Devils Canyon upstream of Five Pools likely originated from one of the many stock tanks in the upper portion of the Devils Canyon watershed (Robinson

2009b). Native fish were found in the 1990s within the portion of Mineral Creek that we surveyed, but are either now extirpated or are very rare.

Recommendations

Data from past surveys indicate that Gila chub are extirpated from upper Mineral Creek (upstream of Big Box Dam; Robinson 2009a), and data in this report and previous surveys indicates that they are not present in Devils Canyon. Therefore, we contend that Gila chub are extirpated from the Mineral Creek watershed upstream of Big Box Dam. They may also be extirpated from the portion of Mineral Creek downstream of Big Box Dam, as we did not capture any in the section between the dam and the ASARCO Ray Mine tunnel. It is possible, but seemingly unlikely, that they still exist, but are rare in this section of Mineral Creek, and we could conduct another survey in this section to be even more confident. Regardless, it is desirable to re-introduce Gila chub to upper Mineral Creek. Assuming they are extirpated from the entire Mineral Creek drainage, the preferable lineage to use for reintroduction would be one that is geographically close, as it would be assumed to be the most genetically similar. Based on an examination of Dowling et al. (2008), and considering genetics and geographic proximity we suggest that the three best choices of lineages to use are Redfield Canyon, Hot Springs Canyon, or Bonita Creek.

The portion of Devils Canyon from about 600 m upstream of Five Pools to the confluence of Rancho Rio Creek appears to be perennial, given the presence of mature riparian forest and presence of green sunfish. This reach had many deep pools (Figure 2) and abundant aquatic invertebrates which indicated that it would be suitable for Gila chub. Consideration should be given to renovating Devils Canyon upstream of Five Pools (including stock tanks) and repatriating native fishes including longfin dace, Gila chub, and desert sucker. Another approach that is more logistically complex and extensive would be to renovate the entire Mineral Creek watershed upstream of Big Box Dam, including Devils Canyon, Big Box Dam Lake and the lowest 1 km of upper Mineral Creek, and then stocking and managing for only native fish species upstream of the dam. Upper Mineral Creek upstream of the series of small waterfalls approximately 1450 m upstream of Big Box Dam Reservoir is free of nonnative fishes so would not need to be renovated.

Acknowledgements

These surveys were funded through and agreement with U.S. Fish and Wildlife Service as part of the Central Arizona Project (CAP) Gila River Basin Native Fishes Conservation Program. Various Arizona Game and Fish Department personnel people assisted with the fish surveys. Natalie Robb, Jeff Sorensen, Tony Robinson, Clay Crowder, and David Orabutt conducted the surveys in Devils Canyon between Rio Rancho Creek downstream to the bottom of Five Pools. Rawhide Canyon and the section of Devils Canyon between Rawhide Canyon and the Five Pools were surveyed by Clay Crowder, Antonio Lopez, Cassandra Smith, and Danny Rodriguez. The section of Devils Canyon near U.S. Highway 60 was surveyed by David Orabutt, Amberle Vasey, and Danny Rodriguez. The section of Mineral Creek between Big Box Dam and the ASARCO Ray Mine tunnel was surveyed by Tony Robinson, David Orabutt, and Clay Crowder; we were escorted by Keith Warren of ASARCO Ray Mine.

Table 1. Summary of results of the April 22, 2009 fish survey in Mineral Creek, ASARCO Ray Mine, Arizona, showing for each gear type total number of fish captured, the number of sampling efforts, mean catch-per-unit-effort and standard error of the mean catch rate. Catch rates for electrofishing are the number of individuals (Ind) captured per minute electrofished, and for minnow trapping are number of individuals captured per hour.

Gear type	Statistic	Green sunfish	Fathead minnow	Total
Electrofishing	# Individuals	596	4	600
	# Efforts	6	6	6
	Mean #Ind/min	16.88	0.15	17.03
	SE	(3.03)	(0.15)	(3.14)
Minnow Trapping	# Individuals	759	1	760
	# Efforts	21	21	21
	Mean #Ind/h	13.40	0.02	13.42
	SE	(4.17)	(0.02)	(4.17)
Table Total	# Individuals	1355	5	1360

Table 2. Summary of results of the 2009 fish survey of four reaches of Devils Canyon from the U.S. Highway 60 bridge downstream to Big Box Dam Reservoir. No fish were captured in the one reach of Rawhide Canyon (from mouth upstream 650 m) sampled.

Reach	Gear type	Statistic	Green Sunfish	Mosquitofish	Total Fish	Crayfish
Highway 60 to 1.5 miles downstream						
	Electrofisher	#Individuals	22	361	383	161
		#Efforts	8	8	8	8
		Mean #Ind/min	1.38	18.8	20.18	11.14
		SE	(1.37)	(12.71)	(12.49)	(4.52)
	Dip net	#Individuals	0	0	0	27
Rancho Rio Creek to Five Pools						
	Electrofisher	#Individuals	411		411	9
		#Efforts	9		9	9
		Mean #Ind/min	4.17		4.17	0.09
		SE	(0.67)		(0.67)	(0.05)
	Mini Hoop	#Individuals	215		215	7
		#Efforts	20		20	20
		Mean #Ind/h	0.55		0.55	0.02
		SE	(0.09)		(0.09)	(0.01)
Five Pools (falls)						
	Gill net	#Individuals	8		8	
		#Efforts	2		2	
		Mean	1.18		1.18	
		SE	(0.92)		(0.92)	
	Snorkel	#Individuals	11		11	
		#Efforts	4		4	
		Mean #Ind/min	16.18		16.18	
		SE	(16.18)		(16.18)	
	Mini hoop	#Individuals	10		10	
		#Efforts	2		2	
		Mean #Ind/h	1.52		1.52	
		SE	(1.52)		(1.52)	
Five Pools to Rawhide Canyon						
	Electrofisher	#Individuals	55		55	
		#Efforts	8		8	
		Mean #Ind/min	7.31		7.31	
		SE	(4.51)		(4.51)	

Reach	Gear type	Statistic	Green Sunfish	Mosquitofish	Total Fish	Crayfish
	Dip net	#Individuals	22		22	
		#Efforts	20		20	
		Mean #Ind/m^2	7.03		7.03	
		SE	(2.88)		(2.88)	
	Mini hoop net	#Individuals	110		110	2
		#Efforts	12		12	
		Mean #Ind/h	1.34		1.34	
		SE	(0.58)		(0.58)	





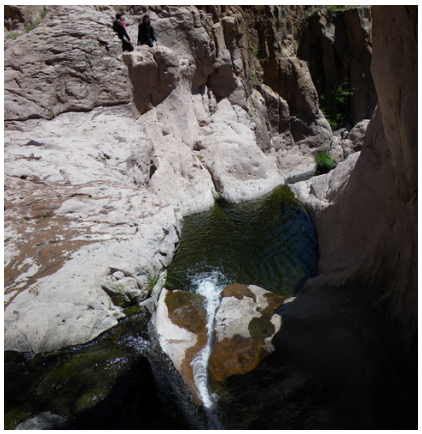
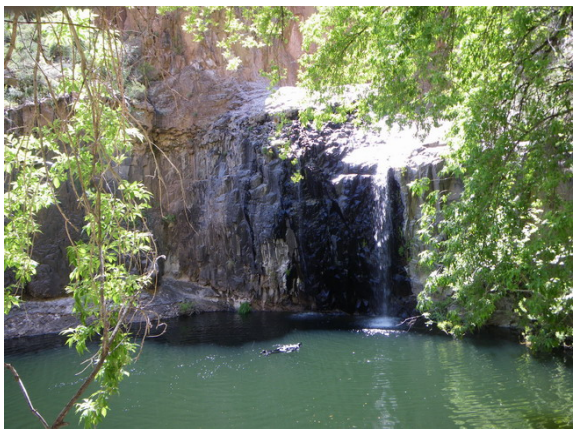

Figure 2. Photographs of Devils Canyon on April 17, 2008: *top left* shows Devils Canyon Creek near the confluence with Rio Rancho Creek. The rest of the photographs are of each of the Five Pools: *middle left* shows pool 1 (the uppermost pool), *bottom left* shows pool 2, *top right* shows pool 3, *middle right* shows pool 4, and *bottom right* shows pool 5 (lower most pool).

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Victoria Boyne

From: ResolutionProjectRecord
Subject: FW: AGFD survey reports
Attachments: Mineral Creek Drainage Native Fish Restoration Plan Outline (2).doc; Mineral Creek Fish Survey April 21-22 2008.pdf; Mineral Creek Survey 04-12-07.doc; MineralCreekandMineralCreekDrainageStockTankSurveysDuring2013_DRAFT_20141229.docx; Devils Canyon Stream Survey 2002.pdf; Mineral and Devils 2009 Surveys 20100222.pdf; Arnett-Telegraph July 23 2008 1-year post-stocking monitoring.pdf

From: Natalie Robb [mailto:NRobb@azgfd.gov]
Sent: Monday, January 22, 2018 11:58 AM
To: Eleanor Gladding <Egladding@swca.com>; Jeffery Johnson <jeffjohnson@swca.com>
Cc: Dana Warnecke <DWarnecke@azgfd.gov>
Subject: AGFD survey reports

Eleanor and Jeff,

Here are stream survey reports for Mineral Creek, Devil's Canyon, and Arnett Creek. See you on Thursday,

Thanks,
Natalie

Natalie Robb
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