# 2007-2008 FISH SURVEY
# RESOLUTION BASELINE BIOLOGICAL SURVEYS
# PINAL COUNTY, ARIZONA

*Prepared for:*

Resolution Copper Mining

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## 1. OBJECTIVES AND ASSUMPTIONS

Fish surveys were conducted in order to determine the presence or absence of the Gila chub (*Gila intermedia*), as well as other native fishes within portions of Devils Canyon and upper Mineral Creek, and within two stock tanks in the vicinity of the Project (the Survey Area; Figure 1). The Gila chub is listed by US Fish and Wildlife Service (FWS) as endangered with critical habitat under the Endangered Species Act (70 FR 66663). Critical habitat for this fish includes a 9-mile (14.4 km) reach of Mineral Creek, extending "*from the confluence with Devils Canyon in T. 3S, R. 13E, Section 35 NW1/4 continuing upstream to its headwaters in T.2 S, R.14 E., Section 15 NE1/4"* (70 FR 66663; Figures 1 and 2).

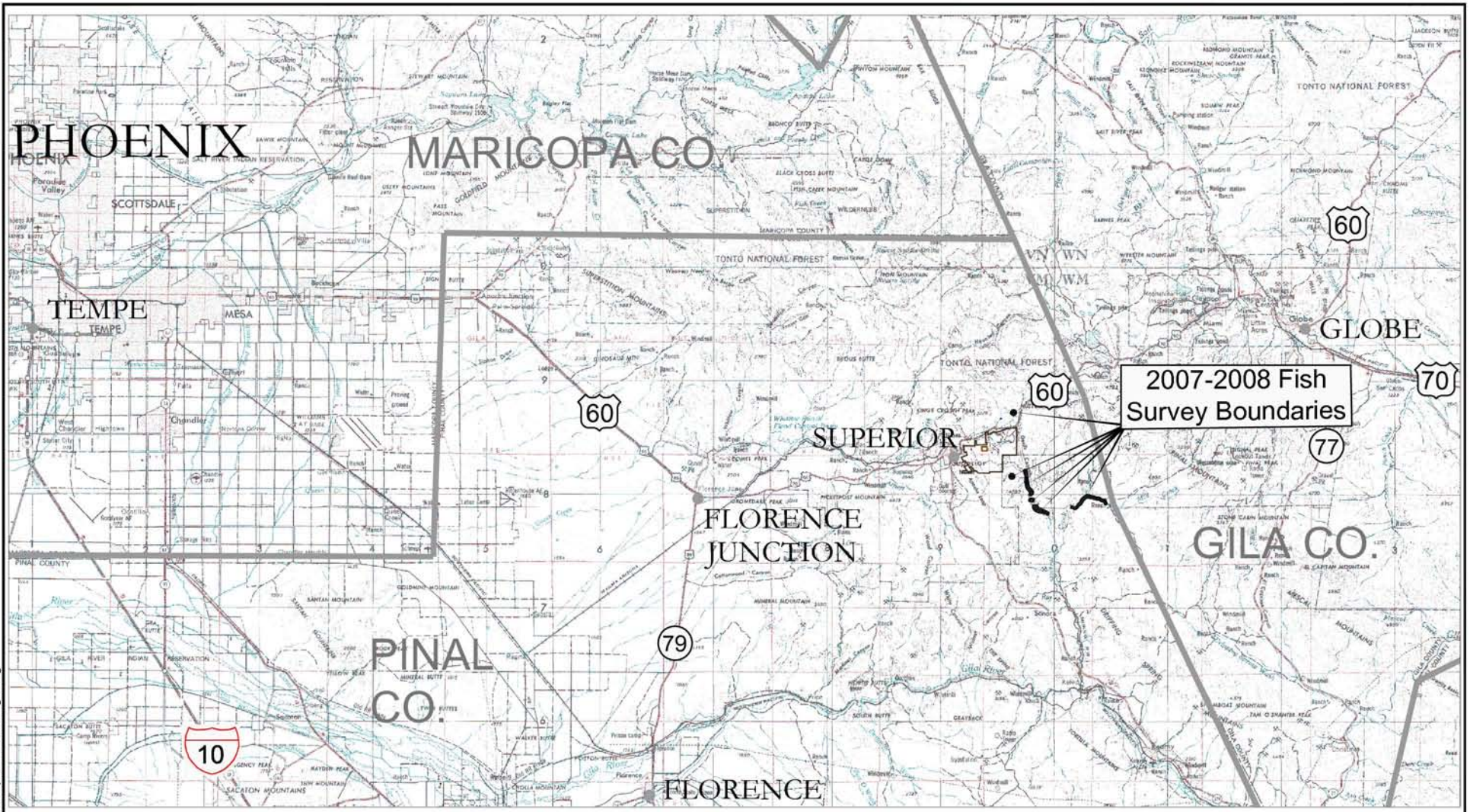
The Survey Area included portions of Devils Canyon and upper Mineral Creek, Hackberry Tank, and an unnamed stock tank located northeast of Oat Flat Campground and north of US Highway 60 (Figure 2).

## 2. BACKGROUND

Devils Canyon includes perennial, intermittent, and ephemeral stream flow segments. Flows within upper Devils Canyon are primarily derived from stormwater runoff during the winter and summer rainy seasons. For an indeterminate period following winter and summer storm events, portions of the creek in the upper and lower canyon support interrupted and intermittent flow, while most of the canyon watercourse ceases to flow. Other segments of the stream, primarily below its confluence with Rio Rancho Creek, flow year-round and are maintained by a fairly constant, low-velocity base flow. Mineral Creek also contains reaches of ephemeral, intermittent, and perennial flow within the Survey Area.

On April 14, 2000, six biologists from Arizona Game and Fish Department (AGFD) sampled the fish in Mineral Creek with backpack electro-fishers and dip nets. They found three species of fish: longfin dace (*Agosia chrysogaster*), Gila chub, and green sunfish (*Lepomis cyanellus*) (Weedman 2000). The AGFD biologists collected and preserved specimens for each of the three species; these specimens are deposited in the fish collection at Arizona State University. Gila chub were found along with green sunfish from about ½ mile above Big Box Dam (which is located on Mineral Creek just downstream from its confluence with Devils Canyon) upstream approximately 1½ miles to Tillmans Wash. Longfin dace were present throughout the entire sampled reach, from Big Box Dam upstream to the confluence of Tillmans Wash with Mineral Creek.

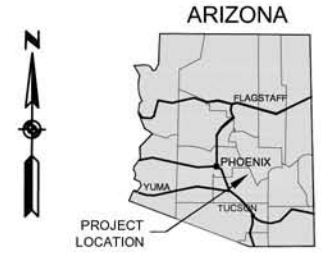
WestLand biologists surveyed portions of Mineral Creek and Devils Canyon (Figure 2) in 2007 and 2008, as described in this report. Two species of fish, the longfin dace and green sunfish, were identified by WestLand within the Survey Area. The following sections provide brief species accounts for Gila chub, longfin dace, and green sunfish.




Pinal County, Arizona
Mesa 1:250,000 USGS Map

0 4 8 miles

Approx. Scale 1 inch = 8 miles

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VICINITY MAP
Figure 1

DWG FullPath: M:\projects\807.16\Fish Survey 2007-2008\Fig1.dwg

Un-named Tank

Hackberry Tank

DC 1
DC 2
DC 3
DC 4
DC 5
DC 6

Upper Crater Tank

MC 1
MC 2

Designated Critical Habitat continues 2.6 miles up Mineral Creek

Big Box Dam

Pinal County, Arizona
Base Maps: Superior, Pinal Ranch, Teapot Mountain, & Hot Tamale Peak USGS 7.5 Minute Quadrangles

N
W E
S

1500' 0' 1500'

SCALE: 1" = 1500'

LEGEND

- 2007-2008 Visual Fish Survey Boundaries
- Resolution Parcel
- Designated Critical Habitat for Gila Chub (USFWS 2005)
- DC 1 Pools Surveyed by Snorkeling

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# 2007-2008 FISH SURVEY

Figure 2



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## 2.1. GILA CHUB (*GILA INTERMEDIA*)

This species is generally dark in color and sometimes lighter on its belly. Females can reach 25 cm (approximately 10 in) in length and males seldom reach 15 cm (approximately 6 in) in length. The Gila chub was listed as endangered by the FWS on November 2, 2005 (70 FR 66663). Critical Habitat was designated at the time of listing and is designated in part along a 9-mile (14.4 km) reach of Mineral Creek, extending "*from the confluence with Devils Canyon in T. 3S, R. 13E, Section 35 NW1/4 continuing upstream to its headwaters in T.2 S, R.14 E., Section 15 NE1/4"* (70 FR 66663; Figure 2). This fish is classified as a Forest Sensitive by the Tonto National Forest (TNF).

Historically found in headwater streams of the Gila River drainage in Arizona, this species is currently known from the following drainages in Arizona: Santa Cruz River (Cienega Creek, Sabino Creek, and Sheehy Spring), Middle Gila River (Eagle, Bonito, and Harden Cienega Creeks and San Carlos and Blue Rivers), San Pedro River (Bass, O'Donnell and Redfield Canyons, Babocomari River and Turkey Creek), Agua Fria River (Silver and Sycamore Creeks), Salt River (Fish and Cave Creeks), and Verde River (Spring and Walker Creeks) (AGFD 2002). As stated above, a previously unknown population of this fish was discovered in Mineral Creek in April 2000. A subsequent survey conducted by the AGFD in September of 2002 found that Mineral Creek appeared to be "totally devoid of fish" (Weedman 2002). It is unknown to AGFD or WestLand what caused the extirpation of the fish community in Mineral Creek between 2000 and 2002. At this time, it is believed that Gila chubs may be extirpated from the system (Dave Weedman [AZGFD] personal communication to Mike Cross [WestLand], August 4, 2008).

Utilizing diverse habitat types based on season and age, Gila chubs are normally found in small headwater streams, cienegas, and marshes of the Gila River Basin. Adults typically use deeper pools while juveniles frequent riffles, pools, and undercut banks (AGFD 2002).

This species is highly secretive and is typically found in association with Gila topminnows, desert and Sonora suckers, and longfin dace. Spawning occurs over beds of submerged vegetation, usually in the late spring or summer. They are omnivores, preferring both aquatic and terrestrial insects. Larger specimens are pisciverous (fish-eating). [USFWS 2005].

## 2.2. GILA LONGFIN DACE (AGOSIA CHRYSOGASTER CHRYSOGASTER)

Gila longfin dace adults rarely exceed 2.6 in (56 mm) in length. This species' back and upper sides are silvery gray to olive, sides sometimes have gold flecks, lower sides and abdomen are whitish, and heads are thick and blunt. The longfin dace is considered a Species of Concern by FWS[1] and is classified as a Forest Sensitive by the TNF.

[1] Species of Concern are species for which FWS and NOAA's National Marine Fisheries Service (NMFS) have some concerns regarding status and threats, but for which there is insufficient information available to list under the ESA.

This species is native to the Gila and Bill Williams River drainages in Arizona and the Magdalena and Sonoyta River drainages in Sonora, Mexico. Surveys conducted in Mineral Creek in 2000 found longfin dace to be abundant in this stream (Weedman 2000); however, as described above, the fish community in Mineral Creek was apparently extirpated sometime between 2000 and September 2002. In August and October of 2006, AGFD stocked 150 and 140 longfin dace, respectively, into Mineral Creek. This stocking was successful and longfin dace are currently extant in Mineral Creek (Dave Weedman [AZGFD] personal communication to Mike Cross [WestLand], August 4, 2008).

Longfin dace occupy a wide range of habitats from intermittent hot low desert streams up to clear cool brooks at higher elevations. They tend to occupy small to medium sized streams with sand or gravel bottoms, eddies, pools with overhanging banks or other cover (AGFD 2006).

This flood-adapted species will move to the margins of currents during high flows, returning to the main channel as floodwaters subside. During drought, they are known to persist within sodden algal mats or under logs and stones. It has a remarkable ability to quickly disperse into new habitats. Spawning has been recorded year round but primarily occurs from December through July. They are omnivorous and feed primarily upon detritus. This species is highly susceptible to predation (AGFD 2006).

## 2.3. GREEN SUNFISH (*LEPOMIS CYANELLUS*)

The green sunfish was the earliest of the smaller sunfishes to be introduced to Arizona waters and was first collected in 1926 (Minkley 1973). It is characterized by a relatively large mouth and blue-green striations on its cheeks. The opercle (gill plate) flap is black with a reddish or orange border. The basic coloration is olive green with dark vertical bars on its side. Adults are 3 to 12 inches in length and 3 ounces to nearly 2 pounds in weight (USBR 2007).

This species is native to the Great Lakes, Hudson Bay, and Mississippi River Basins from New York and Ontario to Minnesota and South Dakota in the north southward to the Gulf of Mexico. It is also native to Gulf Slope drainages from Florida westward to the Rio Grande and northern Mexico (Page and Burr 1991). This fish has been widely introduced throughout the US and can now be found in most warm water lakes and streams in Arizona (USBR 2007). This species has been recorded within Mineral Creek (Weedman 2000). Observations by WestLand indicate that this fish is also present and abundant in Devils Canyon.

The green sunfish is the most piscivorous (fish-eating) member of its genus (Dudley and Matter 2000). They will eat anything that they can swallow, including insects, crawfish, fish, and amphibians. This fish is highly adaptable and achieves its highest densities in rocky habitats within lakes or streams where other sunfishes are absent or uncommon. Under these conditions, stunted populations often develop, creating management problems within lakes and streams when they compete with young fishes for food or prey upon them.

These fish have been implicated in the reduction and/or eradication of a number of native fishes (Moyle and Nichols 1973, 1974; Lemly 1985; Dudley and Matter 2000). Dudley and Matter studied the impacts of green sunfish upon Gila chub recruitment in Sabino Creek, Arizona. Young Gila chubs were abundant in upstream reaches of Sabino Creek devoid of green sunfish. Conversely, young Gila chubs were absent in downstream reaches containing green sunfish. Green sunfish were observed to be highly predacious upon the young Gila chubs and the authors concluded that young Gila chubs did not persist in stream reaches occupied by this exotic fish.

## 3. METHODS

On November 13, 2007, three WestLand biologists with experience in fish identification accessed upper Mineral Creek via Dripping Springs Road and Hagen Ranch (as identified on the Pinal Ranch 7.5'-minute series USGS map), with the owner's permission to cross the property. The biologists drove west from Hagen Ranch for 1.5 miles and parked approximately 0.25 mile downstream from Lyons Fork. The biologists hiked downstream until perennial surface water was reached. WestLand visually surveyed the perennial reaches of the creek from shore using both the unaided eye and binoculars. Snorkeling surveys were also conducted in order to closely observe the fish and make positive identification. When snorkeling, the observer (with snorkel and face mask) quietly entered the pool from the downstream side and carefully viewed the water column to his right, left, and center. The pools were shallow (3 to 5 ft [1 to 1.5 m] depth), so leaves and other sediment in the pool were disturbed while snorkeling. The sediment suspended in the water column reduced visibility; however, by entering the pool downstream, swimming and crawling slowly in the pool, remaining motionless while making observations, sediment disturbance trailed the observer and the observer was able to observe the fish at close range in clear water.

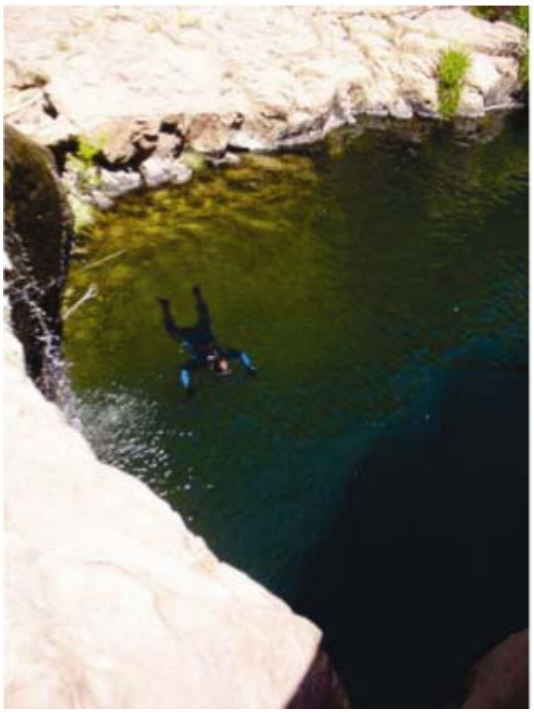

**Photo 1. WestLand biologist conducting snorkeling survey within Upper Crater Tank on May 8, 2008.**

On November 14, 2007, two WestLand biologists visited portions of Devils Canyon. The canyon was accessed at the confluence of Rancho Rio Creek. The creek in Devils Canyon was inspected for fish from near the confluence of Rancho Rio Creek downstream approximately 1.5 river miles downstream to a point just upstream of the Crater Tanks. Detailed observations were also made at five points along the survey reach that contained substantial pools (Figure 2). The methods employed were identical to those described for Mineral Creek above.

On May 8 and 9, 2008, WestLand biologists returned to Devils Canyon to conduct fish investigations within the uppermost of several deep pools known as the Crater Tanks (Upper Crater Tank, Figure 2). Visual surveys were

conducted in the same manner described above. The large and deep (approximately 25 ft [8 m] in depth) pool was surveyed by snorkeling around the perimeter of the pool at the surface (Photo 1), as well as free diving to explore the water column and the bottom of the pool for the presence of fishes not visible from the surface. Special attention was paid to areas of undercut banks, boulders, and the slack water behind the waterfall flowing into the pool. In addition, WestLand biologists surveyed the pools via angling with hook and line in an attempt to capture any introduced catfish.

On May 29 and 30, 2008, WestLand biologists conducted visual, angling, and dip net surveys of Hackberry Tank and a stock pond located on the north side of US Highway 60 just west of Devils Canyon.

The UTM coordinates for the areas included in the fish surveys are provided in Table 1. The polygons for the fish surveys in Figure 2 are the reaches where the WestLand biologists visually inspected the water for fish. The UTM coordinates for the upstream and downstream ends of each of the three polygons in Devils Canyon and the single polygon in Mineral Creek are also provided in Table 1. For Devils Canyon and Mineral Creek, the red points (Figure 2, Table 1) refer to those pools where a WestLand biologist snorkeled as part of the fish survey. The UTM center points for Hackberry Creek stock tank and the un-named stock tank in Figure 2 are also provided in Table 1. Locations of these surveyed features are mapped in Figure 2.

**Table 1. UTM coordinates (NAD 27) for each surveyed stream segment, stock tank, and pool**

| AREA/LOCATION | EASTING | NORTHING |
|---|---|---|
| **STOCK TANKS** | | |
| UN-NAMED STOCK TANK | 496380 | 3687197 |
| HACKBERRY CREEK STOCK TANK | 496191 | 3681644 |
| **DEVILS CANYON SURVEYED AREAS** | | |
| NORTH AREA | | |
| NORTH END | 497340 | 3682296 |
| SOUTH END | 497772 | 3679925 |
| MIDDLE AREA | | |
| WEST END | 497678 | 3679663 |
| EAST END | 498192 | 3679465 |
| SOUTH AREA | | |
| NORTH END | 498262 | 3679172 |
| SOUTH END | 499464 | 3678242 |
| POOLS SURVEYED BY SNORKLING | | |
| DC 1 | 497544 | 3680995 |
| DC2 | 497599 | 3680781 |
| DC3 | 497797 | 3680619 |
| DC4 | 497836 | 3680401 |
| DC5 | 497866 | 3680006 |
| DC6/UPPER CRATER TANK | 498006 | 3679551 |
| **MINERAL CREEK SURVEYED AREAS** | | |
| EAST END | 504595 | 3679209 |

**Table 1. UTM coordinates (NAD 27) for each surveyed stream segment, stock tank, and pool**

| AREA/LOCATION | EASTING | NORTHING |
|---|---|---|
| WEST END | 501345 | 3678932 |
| POOLS SURVEYED BY SNORKLING | | |
| MC 1 | 502041 | 3679217 |
| MC 2 | 502703 | 3679815 |

# 4. RESULTS

## 4.1. MINERAL CREEK FINDINGS

At the time of the survey, surface flow in Mineral Creek began approximately 300 ft (100 m) upstream from the confluence with Lyons Fork (Figure 2). The uppermost area surveyed consisted of approximately 900 ft (300 m) of slow surface flow with a few small riffles and one pool. Surface flow was interrupted approximately 600 ft (200 m) downstream of Lyons Fork. Approximately 3,000 ft (1,000 m) downstream, surface flow re-emerged and was observed to be continuous for the remainder of the Survey Area along Mineral Creek, and presumably all the way downstream to Mineral Creek's confluence with Devils Canyon. The stream flow morphology exhibited a classic run-riffle-pool complex. Water clarity was ideal for observations and visibility was generally clear to the bottom. The riffles and runs were generally less than 6 inches deep and the pools were generally less than 3 ft (1 m) deep. Substrate was variable and included sands, silts, gravels, boulders and bedrock.

WestLand observed numerous longfin dace throughout all flowing portions of Mineral Creek. WestLand did not observe any green sunfish, Gila chubs, or other fishes during this portion of the survey. Lowland leopard frogs (*Lithobates yavapaiensis*) were also observed in abundance throughout this reach.

## 4.2. DEVILS CANYON FINDINGS

At the time of the survey, surface flows in Devils Canyon began in the vicinity of the mouth of Rancho Rio Creek and continued downstream through the Survey Area. The stream morphology differed from that of Mineral Creek in that riffles and runs were largely absent and the substrate consisted predominantly of boulders. Aquatic habitat consisted of mostly boulder-strewn pools generally less than 3 ft (1 m) deep, with the exception of the upper Crater Tank, which was approximately 25 ft (8 m) deep at the time of the survey. Due to leaves and tannins in the stream, water clarity was reduced as compared to that observed in Mineral Creek. However, there was visibility to the bottom in most places.

Snorkeling and free diving within the upper Crater Tank allowed observation of the character of this relatively deep aquatic habitat. A waterfall approximately 10-ft (3-m) tall spills into the pool, which is bounded on both sides by bedrock cliffs. On the west side of the pool (river right) the bank is undercut approximately 10 ft (3 m). The bottom substrate was level and consisted of light-colored coarse gravel. Fishing line and tackle were found snagged on the bedrock walls of the pool.

Green sunfish were observed in abundance throughout the entire flowing reach of Devils Canyon. Fish sampling via angling in the upper Crater Tank resulted in the collection of approximately 10 green sunfish (Photo 2). A few large green sunfish were captured in the upper Crater Tank but most observed green sunfish were small and stunted (Photo 3). Crayfish (*Orcontectes virilis* and/or *Procambaus clarkii*) were also noted in Devils Canyon. No leopard frogs were observed within the Survey Area in Devils Canyon, and canyon tree frogs and their tadpoles were only present in isolated pools lacking green sunfish. No Gila chubs, longfin dace, or any other fish besides green sunfish were observed within the upper Crater Tank or anywhere else in Devils Canyon.

**Photo 2. Green sunfish caught with hook and line at Upper Crater Tank in Devils Canyon on May 8, 2008.**

**Photo 3. Green sunfish caught in Upper Crater Tank on May 8, 2008. This fish appears stunted in growth.**

### 4.3. STOCK TANK FINDINGS

No fishes of any kind were observed within Hackberry Tank or the unnamed tank northeast of Oak Flat Campground and north of US Highway 60 (Figure 2). Numerous introduced tiger salamanders (*Ambystoma* spp.) were observed within these tanks. This strongly indicates that fish are absent from these ponds as studies indicate that tiger salamanders almost always disappear when fish are present (FWS 2002).

## 5. DISCUSSION

One native fish species, the longfin dace, was found to be extant within mineral creek on November 13, 2007. Within this same surveyed area, WestLand biologists did not detect Gila chub. WestLand biologists did not detect longfin dace or Gila chub in the surveyed area of devils canyon. Because the surveyed area in devils canyon included all of the larger perennial pools, our findings indicate that Gila chub and longfin dace are absent from Devils Canyon. WestLand believes that the presence of green sunfish throughout this stream reach precludes the occurrence of Gila chubs, longfin dace, and any other native fish. Also, there are no known headwater pools within Devils Canyon that are free of green sunfish, precluding the possibility of recurrent colonization of downstream pools by native fish surviving in headwater pools. Dudley and Matter (2000) experimentally demonstrated that the presence of even small-size green sunfish in pools effectively reduces the chance of survival of first-year juvenile Gila chub to zero. Adult Gila chub can co-exist with green sunfish. It is their first-year offspring that are not likely to survive predation by green sunfish. In Sabino Creek, near Tucson, Arizona (Dudley and Matter's study area), adult Gila chub persisted in the same pools with green sunfish because the upper-most perennial pools contained spawning adult Gila chub and had not yet been colonized by green sunfish. Our observations in Mineral

Creek indicate that the headwaters are free of green sunfish. It is likely that the continued presence of longfin dace within Mineral Creek is due to recent (2006) stocking by the AGFD and the availability of a headwater refugium that is free of green sunfish.

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