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Arizona Ecological Services Office
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FILE COPY

In Reply Refer to: AESO/SE
02EAAZ00-2016-F-0447

November 9, 2016

Kenneth Born, District Ranger
Coronado National Forest
5700 North Sabino Canyon Road
Tucson, Arizona 85750

RE: Final biological opinion for ongoing operations of the Sabino Canyon shuttle, Pima County, Arizona

Dear Mr. Born:

Thank you for your request for formal consultation with the U.S. Fish and Wildlife Service (USFWS) under section 7 of the Endangered Species Act of 1973 (16 U.S.C. 1531-1544), as amended (Act). Your request was dated July 27, 2016, and received by us on July 27, 2016. At issue are impacts that may result from the ongoing operation of the Sabino Canyon shuttle located on the Coronado National Forest, Pima County, Arizona. In your letter and biological assessment, you concluded that the proposed project may affect, and is likely to adversely affect the endangered Gila chub (*Gila intermedia*) with designated critical habitat and the endangered Gila topminnow (*Poeciliopsis o. occidentalis*). In your letter, you requested concurrence with your determination that the proposed action may affect, but is not likely to adversely affect the Western yellow-billed cuckoo (*Coccyzus americanus*). The basis for our concurrence is found in Appendix A.

This biological opinion is based on information provided in your request, the biological assessment (BA) for the project (USFS 2015), the Coronado National Forest Plan as amended (USFS 1986), our 2009 biological opinion on the reestablishment of Gila topminnow (USFWS 2009, 22410-2009-F-0143), telephone conversations, and other sources of information. References cited in this opinion are not a complete bibliography of all references available on the species of concern, vehicles and their effects, or on other subjects considered in this opinion. A complete administrative record of this consultation is on file at this office.

Consultation History

August 12, 2009 — We sent you the biological opinion on Repatriation of Gila Topminnow into Sabino Creek (22410-2009-F-0143). This biological opinion

	addressed and covered recreation in the Sabino Canyon Recreation Area (SCRA) as part of the proposed action.
August 23, 2013	We discussed the scope of project with you.
September 3, 2013	We discussed the scope of project with you.
May 18, 2015	We discussed the scope of project with you.
October 22, 2015	We received your initial request for consultation and the BA for the project.
July 7, 2016	Our staffs discussed a potential change in the proposed action, changing the consultation time-frame to 20 years, and changing the initiation date of consultation.
July 27, 2016	We received your second request for consultation, and an updated proposed action.
September 29, 2016	We provided you with a draft biological opinion.
November 4, 2016	We received your comments on the draft biological opinion.

BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

Shuttle Operation

Sabino Canyon Tours LLC currently runs the shuttle service in Sabino and Bear Canyons. The 1970s era fleet includes both single vehicle shuttles with a capacity of 48 passengers on two axles and combination shuttles with trailers that carry 67 passengers on four axles. Generally, two combination shuttles at a time make the run in upper Sabino and one single shuttle makes the Bear Canyon tour. Service hours are from 9 am to 5 pm seven days per week. Shuttles may operate only five days a week; but seven days a week is allowed. The concessionaire adjusts the number and type of shuttles depending on demand. On summer weekends shuttles run every half hour on the Sabino Canyon route and every hour on the Bear Canyon route. During summer weekdays shuttles run every hour on both routes. The busiest time is from fall to spring, and the service runs every half hour on the Sabino Canyon route and every hour on the Bear Canyon route.

The Sabino Canyon route travels 3.7 miles up the canyon, crossing the creek nine times. The Bear Canyon route is 1.9 miles with a single creek crossing in lower Sabino Canyon. The Sabino Canyon route uses nine regularly scheduled stops whereas the Bear Canyon route uses three stops along its route. Shuttle drivers provide a narration over a loudspeaker system along

the route that focuses on the natural beauty of the canyon. The drivers are also equipped with two way radios for safety.

For safety during high stream flows after a storm or spring run-off event, the shuttle often shifts service to areas that do not require stream crossings. These changes in service are known as "white-water" tours. There is no definitive flow measurement at which shuttle operations shift to white-water tours. The decision is made by the concessionaire based on his professional judgment and experience after inspection of the crossings.

During the peak season (mid-December through June) the Sabino Canyon route operates seven days per week, every 30 minutes starting at 9:00 am, with the final shuttle departing at 4:30 pm. During the off-peak season (July to mid-December) the Sabino Canyon route operates Monday through Friday, every hour starting at 9:00 am, with the final shuttle departing at 4:00 pm; and on weekends and holidays departs every 30 minutes starting at 9:00 am, with the final shuttle leaving at 4:30 pm. Shuttles do not run on Christmas and New Year's Day. The Bear Canyon route operates year round, seven days per week, every hour starting at 9:00 am, with the final shuttle departing at 4:00 pm. The shuttle system currently accommodates about 150,000 people per year (USFS 2015). The concessionaire reports that it has served an average of 134,839 passengers annually between 2007 and 2012. Variation in service ranged from 97,253 passengers in 2007 to 143,578 passengers in 2010.

During the peak season, the shuttle service runs a minimum of 16 round trips per day on the Sabino Canyon route, while during the off-peak season a minimum of eight round trips per day are made. The shorter Bear Canyon route makes a total of eight round trips per day all year. This results in about 4,500 round trips in Sabino Canyon each year and about 3,000 round trips in Bear Canyon each year. Additional operations may include evening rides during the months of April, May, June, September, October, and November, three times per month; and on a limited basis, group and charter rides for special events. Evening rides are limited to 18 per year, and group events may not exceed one per month. Round trips vary in that the company adds or subtracts shuttles to accommodate the number of riders seeking the service on any given day.

One shuttle traverses the vented low-water crossings on the Sabino Canyon route 18 times per round trip. During the peak season, there are 16 round trips per day, traversing the vented low-water crossings 288 times per day. During the off-peak season, there are eight round trips per day, traversing the vented low-water crossings 144 times per day. This results in about 81,000 trips over the vented low-water crossings per year, for the Sabino Canyon route. One shuttle traverses the single vented low-water crossing on the Bear Canyon route two times per round trip, year round. There are eight round trips per day, making 16 trips over the vented low-water crossings per day. This results in about 6,000 trips across the vented low-water crossings per year, for the Bear Canyon route. In total, this equates to about 87,000 trips across the vented low-waters crossings per year for both routes, for the current operations of the shuttle. Thus, the number of axles (and wheels) crossing the creek is an estimate.

Shuttle operations include infrastructure such as a fee booth at the Sabino Visitor's Center, a repair shop, office, storage, and yard facility located well away from Sabino Creek. The shuttle also includes two service vehicles (a standard ¾ ton pickup truck and a multi-passenger van).

These service vehicles cross the creek periodically. However, we cannot reliably estimate how many times they cross the creek. The operation includes a staff mechanic who repairs shuttles, but the existing permit has no requirements for vehicle inspections or a maintenance schedule, or reporting of needed repairs. Additionally, shuttle personnel engage in crossing maintenance after high flow events by shoveling sediment off the bridges and depositing it either up or downstream of the bridge in or next to the ordinary high water mark of the stream.

Conservation Measures

The following conservation measures are included as part of the proposed action to reduce potential effects to federally listed species. The conservation measures change some of the proposed actions.

Shuttle Fleet

- Shuttle vehicles must fully comply with the Federal Motor Vehicle Safety Standards for the vehicle type classification and gross vehicle weight rating of the particular vehicle used. This requirement applies to the entire vehicle including any stage in the production of vehicles originally manufactured as 'incomplete vehicles.'

Exhaust Emissions

- If a fuel-burning vehicle is used, shuttle equipment will meet all Arizona Department of Environmental Quality (ADEQ) street-legal motor vehicle emissions standards for the model year and vehicle type classification, gross vehicle weight, or other classification applicable to ADEQ. Shuttle vehicles shall be considered to be operating in the Emissions Control Area of Pima County.
- Proof of vehicles' inspections and emissions compliance with ADEQ standards will be provided annually.
- If a fuel-burning non-diesel powered vehicle is used, shuttle vehicle must be of model year 1994 or more recent and must also be equipped and operate with a functional three-way catalytic vehicle exhaust after-treatment system in the original location of such a device when supplied by the original vehicle manufacturer.
- If a fuel-burning diesel powered vehicle is used, shuttle vehicles will be of model year 2004 or more recent, and must also be equipped and operate with a functional diesel oxidation catalyst system for exhaust after-treatment in the original location of such a device when supplied by the original vehicle manufacturer. These vehicles must be fueled only with on-highway ultra-low Sulphur diesel fuel. These shuttle vehicles will be allowed to operate with a functional diesel oxidation catalyst system, provided the retrofit meets all prerequisites and requirements of the California Air Resources Board.
- Drawn, non-powered shuttle vehicles (i.e., trailers) will be of model year 2015 or newer. Trailers shall be equipped with hydraulically applied wheel brakes, with reaction brake systems acceptable. Trailers shall be equipped with automatically operating front and rear-axle steering, or otherwise be able to negotiate the curves and width restrictions in the SCRA, without touching any constructed roadside or low-water crossing features.

Safety

- Shuttle vehicles and equipment must meet the minimum safety performance requirements for motor vehicles or items of motor vehicle equipment per National Highway Traffic Safety Association for the model year of manufacture of that vehicle or equipment, as evidenced by equipment manufacturer applied original vehicle equipment certification label(s).
- Shuttle speed will not exceed 15 miles per hour in the SCRA.
- Shuttle vehicles and equipment shall be maintained to remain in compliance with the above requirements at all times, or such individual pieces of the fleet shall be immediately removed from service until compliant.

Noise

- An interpretive message may be provided after approval by the Forest Service, but not heard outside of the shuttle.
- Overall in-motion shuttle vehicle noise, measured from a distance of 50 feet from any direction and any portion of the vehicle, shall be limited to a maximum of 65 dBA. Overall idling shuttle vehicle noise, measured from a distance of 50 feet from any direction and any portion of the vehicle, shall be limited to a maximum of 56 dBA.

Water Quality

- Shuttles will be visually inspected daily for oil, gas, and other fluid leaks. Inspection results will be maintained in a log, available for Forest Service review. Leaking vehicles and vehicles with internal fluid drops visibly present will be removed from service until fully repaired.
- The shuttle will not operate when water depth is greater than the bottom of the frame or oil/transmission pan, at the first historic vented low-water crossing (just past Stop #2).
- Sediment removed from vented low-water crossings will not be placed in the stream channel and will be removed from site to a specified location provided by the Forest Service. Heavy equipment may be used, but vehicles must stay within the clearing limits of the road and fit within the entire historic vented low-water crossing. Removal shall be in compliance with Section 404, of the Clean Water Act of 1970.

Wildlife

- Shuttle drivers will yield to wildlife crossing the paved road of the route.

We believe these conservation measures are reasonably certain to be implemented, as they are expected to be part of the proposed action under a National Environmental Policy Act decision by the U.S. Forest Service.

Action Area

The action area is defined as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02). In delineating the

action area, we evaluated the farthest reaching physical, chemical, and biotic effects of the action on the environment.

Sabino Creek flows through Sabino Canyon in the Santa Catalina Mountains, draining 25.5 square miles (91.9 km^2) before emptying into the Tucson basin (Desilets et al. 2008). The stream is perennial, but during low-flow it can be reduced to isolated pools. At the northern end of Sabino Canyon, Sabino Creek flows through the upper slopes of Mount Lemmon through the Marshall Gulch Picnic Area into the Pusch Ridge Wilderness. Below the Pusch Ridge Wilderness, Sabino Creek enters the SCRA. A paved road follows Sabino Creek for about 3.8 miles within the SCRA, intersecting the creek nine times. Stone bridges (1.5 to 2.5 m high) span the creek at these intersections and act as barriers (waterfalls) to upstream movement by fish (U.S. Forest Service 2009). Sabino Dam is located below bridge one and also acts as a barrier to fish movement.

Below Sabino Dam, Sabino Creek flows off Coronado National Forest (CNF) lands, joins Bear Creek, and flows into Tanque Verde Creek. For this project, we define the action area as the Sabino Canyon and Bear Canyon watersheds and the ephemeral portion of Sabino Creek below the Sabino Dam to the confluence with Tanque Verde Creek (Figure 1).

ANALYTICAL FRAMEWORK FOR THE JEOPARDY AND ADVERSE MODIFICATION DETERMINATIONS

Jeopardy Determination

Under our policy and regulation, the jeopardy analysis in this Biological Opinion relies on four components: (1) the Status of the Species, which evaluates the Gila topminnow and Gila chub range-wide condition, the factors responsible for that condition, and its survival and recovery needs; (2) the Environmental Baseline, which evaluates the condition of the Gila topminnow and Gila chub in the action area, the factors responsible for that condition, and the relationship of the action area to the survival and recovery of the Gila topminnow and Gila chub; (3) the Effects of the Action, which determines the direct and indirect impacts of the proposed Federal action and the effects of any interrelated or interdependent activities on the species; and (4) Cumulative Effects, which evaluates the effects of future, non-Federal activities in the action area on the species.

Following our policy and regulation, the jeopardy determination is made by evaluating the effects of the proposed Federal action in the context of the species' current status, taking into account any cumulative effects, to determine if implementation of the proposed action is likely to cause an appreciable reduction in the likelihood of both the survival and recovery of the species in the wild. The jeopardy analysis in this Biological Opinion considers the range-wide survival and recovery needs of the species and the role of the action area in its survival and recovery as the context for evaluating the significance of the effects of the proposed Federal action, taken together with cumulative effects, for purposes of making the jeopardy determination.

Adverse Modification Determination

This Biological Opinion relies on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 CFR 402.02. In accordance with policy and regulation, the adverse modification analysis in this Biological Opinion relies on four components: 1) the Status of Critical Habitat, which evaluates the range-wide condition of designated critical habitat for the Gila chub in terms of physical and biological features , the factors responsible for that condition, and the intended value of the critical habitat for conservation of the species; 2) the Environmental Baseline, which evaluates the condition of the critical habitat in the action area, the factors responsible for that condition, and the value of the critical habitat for conservation of the species in the action area; 3) the Effects of the Action, which determines the direct and indirect impacts of the proposed Federal action and the effects of any interrelated or interdependent activities on the physical and biological features and how that will influence the value of affected critical habitat units for conservation of the species; and 4) the Cumulative Effects, which evaluates the effects of future, non-Federal activities in the action area on the physical and biological features and how that will influence the value of affected critical habitat units for conservation of the species.

For purposes of the adverse modification determination, the effects of the proposed Federal action on the species' critical habitat are evaluated in the context of the range-wide condition of the critical habitat, taking into account any cumulative effects, to determine if the critical habitat range-wide would remain functional (or would not preclude or significantly delay the current ability for the physical and biological features to be functionally established in areas of currently unsuitable but capable habitat) such that the value of critical habitat for the conservation of the species is not appreciably diminished.

STATUS OF THE SPECIES AND CRITICAL HABITAT

Gila topminnow

The Gila topminnow was listed as endangered in 1967 without critical habitat (32 FR 4001, USDOI 1967). Only Gila topminnow populations in the United States, and not in Mexico, are presently listed under the ESA. The reasons for decline of this fish include past dewatering of rivers, springs and marshlands, impoundment, channelization, diversion, regulation of flow, land management practices that promote erosion and arroyo formation, and the introduction of predacious and competing nonnative fishes (Miller 1961, Minckley 1985). Other listed fish suffer from the same impacts (Moyle and Williams 1990). Life history information can be found in the 1984 recovery plan (USFWS 1984), the draft revised Gila topminnow recovery plan (Weedman 1999), and references cited in the plans, and this information is incorporated herein by reference.

Gila topminnow are highly vulnerable to adverse effects from nonnative aquatic species (Johnson and Hubbs 1989). Predation and competition from nonnative fishes have been a major factor in their decline and continue to be a major threat to the remaining populations (Meffe et al. 1983, Brooks 1986, Stefferud and Stefferud 1994, Minckley and Marsh 2009). The native fish fauna of the Gila basin and of the Colorado basin overall, was naturally depauperate and

contained few fish that were predatory on or competitive with Gila topminnow (Carlson and Muth 1989). In the riverine backwater and side-channel habitats that formed the bulk of Gila topminnow natural habitat, predation and competition from other fishes was essentially absent. Thus Gila topminnow did not evolve mechanisms for protection against predation or competition and is predator- and competitor-naive. Due to the introduction of many predatory and competitive nonnative fish, frogs, crayfish, and other species, Gila topminnow could no longer survive in many of their former habitats, or the small pieces of those habitats that had not been lost to human alteration. Both large (Bestgen and Propst 1989) and small (Meffe et al. 1983) nonnative fish cause problems for Gila topminnow, as can nonnative crayfish (Fernandez and Rosen 1996) and bullfrogs.

Multiple Federal actions affect this species every year that require formal section 7 consultation. There have been more than 100 biological opinions that have included the Gila topminnow. All formal consultations affecting this species can be found here: https://www.fws.gov/southwest/es/arizona/Biological.htm. Survey work and recovery projects also occur periodically, and are summarized in the most recent Rosemont biological opinion (22410-2009-F-0389) and multiple reports (Duncan and Clarkson 2013, Robinson and Crowder 2015).

Gila chub

The Gila chub was listed as endangered with critical habitat in 2005 (70 FR 66664; USFWS 2005). Primary threats to Gila chub, such as predation by and competition with nonnative organisms, and secondary threats identified as habitat alteration, destruction, and fragmentation are all factors identified in the final rule that contribute to the consideration that the Gila chub is endangered or likely to become extinct throughout all or a significant portion of its range (USFWS 2005).

Gila chub generally spawn in late spring and summer; however, in some habitats, it may extend from late winter through early autumn (Minckley 1973). Schultz and Bonar (2006) data from Bonita and Cienega creeks suggested that multiple spawning attempts per year per individual were likely, with a major spawn in late February to early March followed by a secondary spawn in autumn after monsoon rains. These dates overlap with the peak shuttle season. Bestgen (1985) concluded that temperature was the most significant environmental factor triggering spawning.

The Gila chub is considered a habitat generalist (Schultz and Bonar 2006), and commonly inhabits pools in smaller streams, cienegas, and artificial impoundments throughout its range in the Gila River basin at elevations between 609 and 1,676 meters (2,000 to 5,500 feet)(Miller 1946, Minckley 1973, Rinne 1975, Weedman et al. 1996).

Historically, the Gila chub was recorded from nearly 50 rivers, streams and spring-fed tributaries throughout the Gila River basin in southwestern New Mexico, central and southeastern Arizona, and northern Sonora, Mexico (Miller and Lowe 1967, Minckley 1973). The Gila chub now occupies an estimated 10 to 15 percent of its historical range, and is limited to about 25 small,

isolated, and fragmented populations throughout the Gila River basin in Arizona and New Mexico (Weedman et al. 1996, USFWS 2005, USFWS 2015).

Critical Habitat

Critical habitat for the Gila chub is designated for about 160.3 miles of stream reaches in Arizona and New Mexico that includes cienegas, headwaters, spring-fed streams, perennial streams, and spring-fed ponds. Critical habitat includes the area of bankfull width plus 300 feet on either side of the banks (70 FR 66664; USFWS 2005). The bankfull width is the width of the stream or river at bankfull discharge (i.e., the flow at which water begins to leave the channel and move into the floodplain) (Rosgen 1996). Critical habitat is organized into seven areas or river units:

Area 1 - Upper Gila River, Grant County, New Mexico, and Greenlee County, Arizona, includes Turkey Creek (New Mexico), Eagle Creek, Harden Cienega Creek, and Dix Creek;

Area 2 - Middle Gila River, Gila and Pinal Counties Arizona, consists of Mineral Creek;

Area 3 - Babocomari River, Santa Cruz County, Arizona includes O'Donnell Canyon and Turkey Creek;

Area 4 - Lower San Pedro River, Cochise and Graham counties, Arizona, includes Bass Canyon, Hot Springs Canyon, and Redfield Canyon;

Area 5 - Lower Santa Cruz River, Pima County, Arizona, includes Cienega Creek, Mattie Canyon, Empire Gulch, and **Sabino Canyon (6.9 mi)**;

Area 6 - Upper Verde River, Yavapai County, Arizona, includes Walker Creek, Red Tank Draw, Spring Creek, and Williamson Valley Wash; and

Area 7 - Agua Fria River, Yavapai County, Arizona, includes Little Sycamore Creek, Sycamore Creek, Indian Creek, Silver Creek, Lousy Canyon, and Larry Creek.

There are seven primary constituent elements of critical habitat, which include those habitat features required for the physiological, behavioral, and ecological needs of the species:

1) Perennial pools, areas of higher velocity between pools, and areas of shallow water among plants or eddies all found in headwaters, springs, and cienegas, generally of smaller tributaries;

2) Water temperatures for spawning ranging from 63°F to 75 °F, and seasonally appropriate temperatures for all life stages (varying from about 50°F to 86 °F);

3) Water quality with reduced levels of contaminants, including excessive levels of sediments adverse to Gila chub health, and adequate levels of pH (e.g., ranging from 6.5 to 9.5),

dissolved oxygen (i.e., ranging from 3.0 ppm to 10.0 ppm) and conductivity (i.e., 100 mmhos to 1,000 mmhos);

4) Prey base consisting of invertebrates (i.e., aquatic and terrestrial insects) and aquatic plants (i.e., diatoms and filamentous green algae);

5) Sufficient cover consisting of downed logs in the water channel, submerged aquatic vegetation, submerged large tree root wads, undercut banks with sufficient overhanging vegetation, large rocks and boulders with overhangs, a high degree of stream bank stability, and a healthy, intact riparian vegetation community;

6) Habitat devoid of non-native aquatic species detrimental to Gila chub or habitat in which detrimental nonnative species are kept at a level that allows Gila chub to continue to survive and reproduce; and

7) Streams that maintain a natural flow pattern including periodic flooding.

Multiple Federal actions affect this species every year that require formal section 7 consultation. There have been 42 biological opinions that have included the Gila chub. A complete list of all consultations affecting this species can be found here: https://www.fws.gov/southwest/es/arizona/Biological.htm. Survey work and recovery projects also occur periodically, and are summarized in the recent draft recovery plan (USFWS 2015).

ENVIRONMENTAL BASELINE

The environmental baseline includes past and present impacts of all Federal, State, or private actions in the action area, the anticipated impacts of all proposed Federal actions in the action area that have undergone formal or early section 7 consultation, and the impact of State and private actions which are contemporaneous with the consultation process. The environmental baseline defines the current status of the species and its habitat in the action area to provide a platform to assess the effects of the action now under consultation.

Europeans have influenced Southern Arizona for hundreds of years, and Native Americans have done so for much longer (Hastings and Turner 1965, Bahre and Hutchinson 1985, Bahre 1991, Tellman et al. 1997). Often-cited human impacts in the area include vegetation type conversion, dewatering surface waters and aquifers, erosion and channel down cutting, loss or reduction of native species, introduction and spread of nonnative species, and habitat loss. As with many of the river basins in the southwest, aquatic habitats (and fish communities) in the Gila basin have changed from historical conditions (Miller 1961, de la Torre 1970, Naiman and Soltz 1981, Miller et al. 1989, Minckley and Deacon 1991, Minckley and Marsh 2009). Aquatic habitats have been fragmented and reduced in quantity and quality due to diversion, groundwater mining, and natural and human-caused changes in the watershed and hydrologic regime (de la Torre 1970, Davis 1982, Tellman et al. 1997).

After Europeans arrived, major alterations began in the Gila River basin (Rea 1983). Beaver, which were a major influence on the structure of the Gila basin aquatic ecosystem, were locally

extirpated. Beavers were reestablished in the San Pedro Riparian National Conservation Area in 1999. The introduction of livestock began very early and resulted in substantial alteration of the watershed and its soil and vegetation (York and Dick Peddie 1969, Humphrey 1987, Bahre 1991). Croplands increased, often along river terraces, resulting in destabilization and erosion of floodplains (Leopold 1946, Rea 1983). Roads and trails caused extensive erosion and substantial destruction of river channels (Leopold 1921, Dobyns 1981, Rutman 1997).

Diversion of water, which was already practiced by Native Americans in some areas, increased in those areas and was initiated in others (Tellman et al. 1997). As diversion and irrigation increased, the demand for water storage increased, resulting in a variety of large and small dams and impoundments (Haddock 1980). Improper grazing, mining, timber harvest, hay harvesting, fire suppression, and other activities in the nineteenth century led to widespread erosion and channel entrenchment in southeastern Arizona streams and cienegas when above-average precipitation and flooding occurred in the late 1800s and early 1900s after a drought (Bryan 1925, Martin 1975, Sheridan 1986, Webb and Betancourt 1992, Turner et al. 2003). By the mid 1900's, large stretches of river in the Gila basin no longer had perennial flow, and the remaining areas were separated by long dry stretches, dams, and impounded water (Brown et al. 1977, Rea 1983, Hendrickson and Minckley 1984, Tellman et al. 1997).

As a result of these changes, the riverine habitats of the Gila basin, including the San Pedro River (BLM 1998, Tellman et al. 1997), became fragmented, and connectivity was substantially reduced. Populations of fish or other aquatic species extirpated were not replaced by colonization (Minckley 1999, Hedrick et al. 2001). Habitat fragmentation contributes to the genetic isolation of populations (Parker et al. 1999). Population fragmentation can reduce genetic variation and viability (Minckley 1999). This, in turn, can increase the risk of extirpation and extinction by reducing survival, reproduction, and dispersal. Isolation also precludes re-colonization should one or more populations be eliminated. When an inhospitable environment that imposes a high degree of threat on the remnant habitat surrounds isolated populations, these risks are compounded. This fragmentation has been a major factor in the decline of almost all of Arizona's native aquatic fauna, where native aquatic species, particularly rarer ones, tend to be isolated in small headwater areas scattered across the tributaries of the basin (Hendrickson and Minckley 1984, Minckley 1985, Minckley and Marsh 2009).

Human disturbances of the watershed, floodplain, and stream channel change many of the factors determining channel configuration. Increased sediment off the watershed is a common result of human actions, and sediment is a major determinant of channel shape (Leopold 1997). When the dynamic equilibrium has been disrupted, the channel begins a process of adjustment as it attempts to restore a dimension, pattern, and profile that are consistent with controlling hydraulic variables (Rosgen 1996). These adjustments may lead to dramatic changes in the stream channel width, depth, and geometry that encroach on human activities. As human activities are affected, additional flood control and channelization may occur, which exacerbate the problems in adjacent areas, and the channel will continue to become increasingly unstable.

Drought and Climate change

The information on how climate change might impact southeastern Arizona is less certain than current drought predictions. However, virtually all climate change scenarios predict that the American southwest will get warmer during the 21st century (IPCC 2001, 2007; Overpeck et al. 2012, Garfin et al. 2013). Precipitation predictions show a greater range of possibilities, depending on the model and emissions scenario, though precipitation is likely to be less (USGCRP 2001, Seager et al. 2007). To maintain the present water balance with warmer temperatures and all other biotic and abiotic factors constant, precipitation will need to increase to keep pace with the increased evaporation and transpiration caused by warmer temperatures.

That southeastern Arizona and much of the American southwest have experienced serious drought recently is well known (Garfin et al. 2013, CLIMAS 2013). Almost 68 percent of Arizona was experiencing drought conditions during December 2013 (CLIMAS 2013). What is known with far less certainty is how long droughts last. State-of-the-art climate science does not yet support multi-year or decadal drought predictions. However, instrumental and paleoclimate records from the Southwest indicate that the region has a history of multi-year and decadal drought (Hereford et al. 2002, Sheppard et al. 2002, Jacobs et al. 2005). Multi-decade drought in the Southwest is controlled primarily by persistent Pacific Ocean-atmosphere interactions, which have a strong effect on winter precipitation (Brown and Comrie 2004, Schneider and Cornuelle 2005); persistent Atlantic Ocean circulation is theorized to have a role in multi-decadal drought in the Southwest, particularly with respect to summer precipitation (Gray et al. 2003, McCabe et al. 2004, Wang et al. 2013). Given these multi-decade regimes of ocean circulation, and the severity and persistence of the present multi-year drought, there is a fair likelihood that the current drought will persist for many more years (Stine 1994, Seager et al. 2007), albeit with periods of high year-to-year precipitation variability characteristic of Southwest climate. There is high confidence the Southwest will experience exceptional droughts that are more frequent, more intense, and longer lasting, and they will be hotter than historical droughts (Overpeck et al. 2012, Garfin et al. 2013).

Many of the predictions about the impacts of climate change are based on modeling, but many modeled predictions have already occurred (Udall 2013). In addition, many models have underestimated the increase in greenhouse gasses. The tree die-offs and fires that have occurred in the southwest early in this century show the impacts of the current drought. In addition, the basin's rivers, streams, and springs continue to be degraded (Overpeck et al. 2012), or lost entirely. Climate change trends are highly likely to continue (Overpeck et al. 2012), and the impacts on species will likely be complicated by interactions with other factors (e.g., interactions with nonnative species and other habitat-disturbing activities). Drought and climate change will also impact watersheds and subsequently the water bodies in those watersheds. Drought and especially long-term climate change will affect how ecosystems and watersheds function. These changes will cause a cascade of ecosystem changes, which may be hard to predict and are likely to occur non-linearly (Seager et al. 2007).

Studies have shown that since 1950, the snowmelt season in some watersheds of the western U.S. has advanced by about 10 days (Dettinger and Cayan 1995, Dettinger and Diaz 2000, Stewart et al. 2004). Such changes in the timing and amount of snowmelt are thought to be

signals of climate-related change in high elevations (Smith et al. 2000, Reiners et al. 2003). The impact of climate change is the intensification of natural drought cycles and the ensuing stress placed upon high-elevation montane habitats (Cook et al. 2004, Breshears et al. 2005, Mueller et al. 2005, IPCC 2007). The increased stress put on these habitats is likely to result in long-term changes to vegetation, invertebrate, and vertebrate populations within coniferous forests and canyon habitats that affect ecosystem function and processes (Fleishman et al. 2013).

The Assessment of Climate Change in the Southwest United States (Garfin et al. 2013) looked at 16 Global Climate Models (GCMs) and nine dynamical downscaled regional simulations (Mearns et al. 2009, as cited in Garfin et al. 2013) to assess temperature projections in the southwest. All of the GCMs and regional simulations showed progressive warming in the southwest through 2100. Average range of temperature increase from 15 GCM models by the end of the century is 2 to 6o F for the low emissions scenario (B1) and 5 to 9o F for the high emissions scenario (A2)(Nakicenovic and Swart 2000; Mearns et al. 2009, as cited in Garfin et al. 2013). The largest temperature increases are in the summer, though there is great variability among the GCMs (Garfin et al. 2013). Additionally, the freeze-free season is modeled to increase in southeastern Arizona by 17 to 24 days in the period 2041 to 2070 (Mearns et al. 2009, as cited in Garfin et al. 2013).

The discussion of precipitation change in the southwest U.S. in Garfin et al. (2013) reveals the large uncertainty regarding if and how regional precipitation may change. However, there is general agreement among the models that spring precipitation will decrease (Cayan et al. 2013). In addition, there is presently no model consensus on how the summer monsoon regime in the Southwestern U.S. will change. This is of particular importance for the Action Area, as it receives the majority of its annual precipitation from the summer monsoon, although recharge is thought to be greater in the winter (Serrat-Capdevila et al. 2007, Cayan et al. 2013).

Increased occurrence of extreme events

Extreme events such as drought, fires, heat waves, storms, and floods are predicted to occur more frequently and be more intense because of climate change (IPCC 2007, Overpeck et al. 2012, Gershunov et al. 2013). It is anticipated that an increase in extreme events will most likely affect populations living at the edge of their physiological tolerances. The predicted increases in extreme temperature and precipitation events may lead to dramatic changes in the distribution of species or to their extirpation or extinction (Parmesan and Matthews 2006).

Decreased streamflow

Kundzewicz et al. (2007) state that of all ecosystems, freshwater ecosystems will have the highest proportion of species threatened with extinction due to climate change. Species with narrow temperature tolerances will likely experience the greatest effects from climate change and it is anticipated that populations located at the margins of species hydrologic and geographic distributions will be affected first (Meisner 1990). Current models suggest a decrease in precipitation in the Southwest (Kundzewicz et al. 2007, Seager et al. 2007) which would lead to reduced streamflows. Streamflow is predicted to decrease in the Southwest even if precipitation were to increase moderately (Nash and Gleick 1993, State of New Mexico 2005, Hoerling and

Eischeid 2007). Winter and spring warming causes an increased fraction of precipitation to fall as rain, resulting in a reduced snow pack, an earlier snowmelt, and decreased summer base flow (Christensen et al. 2004, Stewart et al. 2004, Regonda et al. 2005, Stewart et al. 2005). Earlier snowmelt and warmer air temperatures can lead to a longer dry season. Warmer air temperatures lead to increased evaporation, increased evapotranspiration, and decreased soil moisture. These three factors would lead to decreased streamflow even if precipitation increased moderately (Garfin 2005, Seager et al. 2007). The effect of decreased streamflow is that streams become smaller, intermittent or dry, and thereby reduce the amount of habitat available for water-dependent species.

An example of using downscaled analysis from global climate models to regions was the analysis of annual average precipitation projections from 17 global climate models to estimate recharge in the San Pedro Basin (Serrat-Capdevila et al. 2007). While the models used in this analysis were older versions evaluated in the IPCC Third Assessment (2001), their results were similar to those generated by the next generation of models in the IPCC Fourth Assessment (2007): 12 of 17 models predicted drier conditions for the San Pedro Basin, whereas five predicted slightly wetter conditions. The study estimated that recharge in the San Pedro Basin would decrease 4 to 6 percent by 2020, 6 to 8 percent by 2030, and 17 to 30 percent by the end of the 21st century (based upon the range of IPCC GHG emission scenarios considered).

Desilets et al. (2008) hypothesize that runoff in Sabino Creek is particularly sensitive to increases in the intensity and duration of large-scale weather patterns and that these storms are lasting longer or becoming more frequent. Another event similar to the July 2006 flood would likely wash Gila topminnow downstream into an area that does not support Gila topminnow, resulting in the loss of the population. Refer to our December 31, 2008, BO on Aquatic Species Conservation for a discussion on impacts of drought and climate change in southeastern Arizona (file number 22410-2008-F-0103). We incorporate by reference that discussion (U.S. Fish and Wildlife Service 2008).

Change in the hydrograph

In a warmer world an enhanced hydrologic cycle is expected; flood extremes could be more common (Das et al. 2011 in Gershunov et al. 2013); and droughts may be more intense, frequent, and longer-lasting (Seager et al. 2007). Stewart et al. (2005) show that timing of spring streamflow in the western U.S. during the last five decades has shifted; the major peak now arrives 1 to 4 weeks earlier, resulting in less flow in spring and summer. They conclude that almost everywhere in North America, a 10 to 50 percent decrease in spring-summer streamflow will accentuate the seasonal summer dry period with important consequences for warm-season water supplies, ecosystems, and wildfire risks (Stewart et al. 2005). Rauscher et al. (2008) suggest that with air temperature increasing from 37 to 41° F, snowmelt driven runoff in the western U.S. could occur as much as two months earlier.

Fire

Since the mid-1980s, wildfire frequency in western forests has nearly quadrupled compared to the average of the period 1970 to 1986 (Westerling et al. 2006). The total area burned is more

than six and a half times the previous level (Westerling et al. 2006). In addition, the average length of the fire season during 1987 to 2003 was 78 days longer compared to 1970 to 1986 and the average time between fire discovery and control increased from about 8 to 37 days for the same time (Westerling et al. 2006). McKenzie et al. (2004) suggest, based on models, that the length of the fire season will likely increase and fires in the western U.S. will be more frequent and severe. In particular, they found that fire in New Mexico appears to be acutely sensitive to summer climate and temperature changes and may respond dramatically to climate warming (McKenzie et al. 2004). The summer temperatures in the southwest are predicted to increase more than any other season (Garfin et al. 2013).

Furthermore, drought and climate change will cause changes in fire regimes in all southeastern Arizona vegetation communities (Kitzberger et al. 2006). The timing, frequency, extent, and destructiveness of wildfires are likely to increase (Westerling et al. 2006) and may facilitate the invasion and increase of nonindigenous plants. These changed fire regimes will change vegetation communities, the hydrological cycle, and nutrient cycling in affected watersheds (Brown et al. 2004). Some regional analyses conservatively predict that acreage burned annually will double with climate change (MacKenzie et al. 2004). Such watershed impacts could cause enhanced scouring and sediment deposition, more extreme flooding (quicker and higher peak flows), and changes to water quality due to increases in ash and sediment within stream channels. Severe watershed impacts such as these, when added to reductions in extant aquatic habitats, may restrict sites available for the conservation of aquatic species and make management of extant sites more difficult.

Severe wildfires capable of decimating large areas are relatively recent phenomena and result from the cumulative effects of historical or ongoing grazing, which removes the fine fuels needed to carry fire, and fire suppression (Madany and West 1983, Savage and Swetnam 1990, Touchan et al. 1995, Swetnam and Baisan 1996, Belsky and Blumenthal 1997). Historical wildfires in the southwest were primarily cool- burning understory fires with return intervals of 3 to 7 years in ponderosa pine (Swetnam and Dieterich 1985). Cooper (1960) concluded that before the 1950s; crown fires were extremely rare or nonexistent in the region. Effects of fire may be direct and immediate or indirect and sustained over time (Gresswell 1999).

Description of the Action Area

The "action area" means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action. Indirect effects are those that are caused by the proposed action and are later in time, but are still reasonably certain to occur. An interrelated activity is an activity that is part of the proposed action and depends on the proposed action for its justification. An interdependent activity is an activity that has no independent utility apart from the action under consultation (50 CFR 402.02).

The Sabino Canyon Recreation Area encompasses 1,400 acres of the Santa Catalina Ranger District of the Coronado National Forest. Elevations range from 2,800 ft near the visitor's center to just over 3,800 ft at the northwest end of the recreation area. The canyon is steep-sided and narrow with many cliff and rock formations at the higher elevations along the ridges that roughly form the boundary of the area. The average annual precipitation is about 13 inches as measured

at a weather station on the Forest Service Administrative Site. Rainfall comes in two seasons of the year; summer "North American monsoons" and winter precipitation (USFS 2015).

The recreation area is located in Sonoran Desertscrub (Brown 1994). A palo verde-mixed cactus association is the typical expression of this biotic community within the Sabino Canyon Recreation Area. Dominant plant species at the site include velvet mesquite (*Prosopis velutina*), palo verde (*Cercidium* spp.), creosote (*Larrea tridentata*), and jojoba (*Simmondsia chinensis*). Cacti in this association include prickly pears (*Opuntia* spp.), saguaro (*Carnegia gigantea*), barrel cactus (*Ferrocactus wislezenii*), staghorn cholla (*Opuntia versicolor*). Many other species are present and include Limber-bush (*Jatropha cuneata*), white bursage (*Ambrosia dumosa*), hedgehog cactus (*Echinocereus engelmannii*), fishhook cactus (*Mammillaria microcarpa*), and desert hackberry (*Celtis pallida*)(USFS 2015).

Sabino Creek itself supports Interior Deciduous Riparian Woodland along the drainage. Typical species in this habitat include Arizona sycamore (*Platanus wrightii*), Fremont's cottonwood (*Populus fremontii*), New Mexican alder (*Alnus oblongifolia*), and Scouler willow (*Salix scouleri*). Areas above the low water crossings have come to support well developed, mature stands of these riparian tree species. These stands of trees provide shade for the creek and help regulate water temperature. The riparian strand is also of extreme importance to the large variety of wildlife that use the canyon, since the majority of species are dependent upon riparian areas for all or a portion of their lifecycle (USFS 2015).

Sabino Creek has a 31,689 acre watershed of the Santa Catalina Mountains. Its sources are springs and seeps at the highest elevations of the mountain. Rainfall and snowfall at these higher elevations feed Sabino Creek and average rainfall at the top of the Santa Catalina Mountains is more than twice that of the Sabino Canyon Recreation Area. The drainage is steep and portions are perennial, but the majority of the stream is considered intermittent. The steep nature of the drainage ensures that the stream is flashy in response to rainfall events. When snowfall accumulates on the mountain, the creek will swell with the spring thaw, but in most years snowfall accumulation is lacking (USFS 2015).

Within the recreation area, the stream is characterized by pools, runs, and riffle habitat. The dynamic nature of steep gradient streams in the southwest ensures that run and riffle habitat moves from year to year, but pools may be more predictable, except when large pulses of sediment enter and move through the system (USFS 2015).

Sabino Canyon Road runs from the Visitor Center at the base of Sabino Canyon up the canyon 3.7 miles, crossing Sabino Creek via vented low water crossings nine times. Sabino Creek regularly overtops the road crossings as the discharge from the creek exceeds the maximum discharge capacity of the vents (USFS 2015).

The vented low water crossings were constructed of stone and reinforced concrete in the mid 1930's. The road surfaces through the crossings are paved, and are five to twelve feet above the bottom of the stream channel. The vents are within a foot of the top of the crossings so that the crossings act as dams. The upstream areas of all crossings are currently filled with sediment,

which causes the upstream stream level to be within a couple of feet of the road surface (USFS 2015).

Under more natural conditions without the obstruction of the crossings, sediment would move through the system with peak flow events and be deposited along the way. Eventually sediment would reach the lower portions of Sabino Creek and move into the larger Tanque Verde Wash where the flood plain is broader and velocities less. The bridges however, hold this sediment in the steeper portion of the system and result in a great deal of deep alluvium in the reaches upstream of each crossing. Each year after the fore-summer drought, this alluvium must become saturated before water will be available to flow in the stream. As a result of this sedimentation and the changes in rainfall patterns, the stream begins to flow later in the year than it might have in the years before the crossings were installed (USFS 2015).

There is a USGS stream gauge on Sabino Creek downstream of the crossings with records beginning in water year 1988. Sabino Creek flows are highest during the winter months and during the monsoon season, often exceeding 20 cfs and infrequently reaching more than 1000 cfs. Flows are lowest in the early summer and autumn months. The creek is often dry during these times (USFS 2015).

In 2015, Forest Service Hydrologist Richard Cissel gathered data and modeled stream flows over the vented low-water crossings (Cissel 2015). The following table depicts the model results of the mean number of days that maximum discharge capacity is exceeded for each creek crossing based on average annual discharge for the period of 1988 through 2012 and the amount of blockage in the discharge vents (USFS 2015).

Table 1. Modeled maximum discharge capacity and mean number of days the stream flow exceeded capacity and overtopped the road over the analysis period (water year 1988-2012) for each crossing in the unblocked condition and the observed blockage condition, Sabino Canyon, Arizona (USFS 2015).

	Unblocked Condition		Observed Blockage Condition	
	Maximum Discharge Capacity, Qmax (cfs)	Mean Days Over Qmax (days/yr)	Maximum Discharge Capacity, Qmax (cfs)	Mean Days Over Qmax (days/yr)
Crossing 1, lowest	59	27	35	47
Crossing 2	60	26	25	60
Crossing 3	84	18	67	24
Crossing 4	61	26	31	52
Crossing 5	42	40	35	47
Crossing 6	80	19	66	24
Crossing 7	116	12	100	15
Crossing 8	170	6	82	18
Crossing 9, highest	89	17	32	51
Mean	84	22	53	37
Median	76	20	35	47

The frequency with which maximum discharge is exceeded varies annually due to precipitation amounts, duration, and location in the Sabino Creek watershed. Crossing number 2 has the lowest capacity and crossing 7 has the highest capacity. Thus, crossing 2 is the first to be overtopped and crossing 7 is the last to be overtopped during flows. When crossing number 7 is overtopped, all crossings are overtopped. This occurs on average 15 days per year. Conversely, when flows are above 25 cfs, at least crossing 2 is inundated. This occurs on average 60 days per year (USFS 2015).

Under current conditions, at least one crossing will overtop on 16 percent of days (58) over the course of a year and about half of the crossings on the Sabino Canyon route will overtop on 13 percent of days (47) in any given year (Cissel 2015). These crossings retain sediment as it moves through the creek during high flow events. To avoid buildup of sediment that impacts operations, shuttle personnel remove the sediment by shovel from the vented low-water crossings and deposit it either up or down stream of the crossing in or next to the ordinary high water mark of the creek (USFS 2015).

A. Status of the species and critical habitat within the action area

Gila Chub

Gila chub currently occur in Sabino Creek within the SCRA. Most Gila chub are above bridge 4, but there are fish in plunge pools just below bridges 1, 2, and 3 (U.S. Forest Service 2009, Josh Taiz, SCRD, personal communication). Annual surveys conducted by AGFD since 2004 suggest that Gila chub are recolonizing the lower stretch of Sabino Creek within and just above the SCRA, all of which is designated critical habitat for the species. Surveys in 2012 found 287 Gila chub (196 adults, 91 juveniles). Many of the chub were found near stop 8 (Timmons and Upton 2013). On May 4, 2016, Bonar et al. (2016) captured 56 Gila chub (juveniles and adults) in Sabino Creek immediately upstream of the bridge below the dam, and also found chub in Bear Canyon below the Forest boundary. While sampling for Gila topminnow in June 2016, AGFD recorded 1,480 Gila chub (Mosher 2016a).

In 2005, Gila chub were released into upper Bear Canyon, just below Sycamore Reservoir (Ehret 2008). Gila chub were found downstream from there in 2006 (n=9), 2008 (23), but not in 2009 in the Seven Falls reach (Ehret 2008, 2009).

The population is unstable-threatened according to Weedman's status categories for the species, but is moving towards the stable-threatened category (70 FR 66669, Weedman 1999). The draft Gila chub Recovery Plan delineated the threats to Gila chub in Sabino as drought, roads, wildfire, and fire suppression (USFWS 2015).

Predation by and competition with aquatic nonindigenous organisms, including green sunfish (*Lepomis cyanellus*), western mosquitofish (*Gambusia affinis*), and crayfish species (*Orconectes virilis* and possibly others), has likely been the primary cause for past declines of the Gila chub in Sabino Creek. Dudley and Matter (2000) correlated green sunfish presence with Gila chub declines in Sabino Creek, including predation by small green sunfish on young-of-the-year Gila

chub. In 1999, CNF and AGFD removed most of the green sunfish from Sabino Creek, which subsequently increased viability of the Gila chub population. Western mosquitofish occupied Sabino Creek from at least 1982 through 1993 and were likely introduced to control mosquitoes. In the winter of 1992, a record flood probably displaced mosquitofish downstream and they have not been detected in Sabino Creek since. Gila chub moved downstream into habitat previously occupied only by Western mosquitofish after this flood (Dudley and Matter 1999). Mosquitofish are known to prey on eggs, larvae, and juveniles of the Gila chub. Crayfish may have also preyed on Gila chub in Sabino Creek historically; however, no crayfish have been detected in Sabino Creek since 2006.

Currently on the Coronado National Forest, the only localities for this species are Sabino Creek and nearby Bear and Romero creeks, although the species is found downstream elsewhere or occurs within private inholdings. Also, there are plans to re-establish the species in a number of localities on- and off-Forest. The Gila chub occurred historically in Sabino Creek (1938, 1943, 1949; and nearby creeks and tributaries) but was threatened by the non-native green sunfish. In 1999, a successful stream renovation eradicated the sunfish and boosted the viability of the Sabino Creek population of Gila chub. A population of green sunfish remained in the lower stretches of the stream below the treatment reach. However, in 2003, the Aspen Fire burned much of the Sabino watershed. Fearing that subsequent rains would fill pools with ash and sediment, the Arizona Game and Fish Department (AGFD) and the Coronado National Forest salvaged about 900 chub. The subsequent monsoonal rains scoured Sabino Canyon and brought ash and debris, eradicating all remaining fish, both chub and non-native. The salvaged Gila chub were bred in captivity, and their progeny were released into Sabino Creek, Bear Creek, and Romero Creek in 2005. The fish in Sabino Creek did well, reaching an estimated population of 2,000 individuals. The AGFD periodically monitors the population in Sabino Creek. The last survey was completed in August of 2016 (Mosher et al. 2016).

In addition to green sunfish, Sabino Creek supported an infestation of crayfish. This population was unaffected by the stream renovation project and remained even after the ash flows from the Aspen Fire. Interestingly, in the years since the reintroduction of the Gila chub, this non-native arthropod has disappeared from the system. While no studies were conducted to test the hypothesis, it is suspected that the chub themselves eradicated this crayfish. The eradication most likely occurred during the drought periods when the fish and crayfish were forced together in small pools. Young crayfish and crayfish that are shedding their exoskeleton would be vulnerable to predation and the chub are known to be voracious predators.

Designated critical habitat for Gila chub within the action area includes 6.9 miles of Sabino Creek extending from the southern boundary of the CNF upstream to the confluence with the West Fork of Sabino Canyon in the CNF. This is 4.2 percent of all designated critical habitat for Gila chub.

The following are the primary constituent elements (PCEs) for Gila chub, and their status in this critical habitat unit.

1) Perennial pools, areas of higher velocity between pools, and areas of shallow water among plants or eddies all found in headwaters, springs, and cienegas, generally of smaller tributaries;

   Sabino Canyon is perennial, though during May and June, there is virtually no flow, water being restricted to pools. Shallow water is always present, though can be limited, because this is a canyon-bound reach.

2) Water temperatures for spawning ranging from 63°F to 75°F, and seasonally appropriate temperatures for all life stages (varying from about 50°F to 86°F;

   Water temperatures are likely conducive to spawning at appropriate times of the year (spring and autumn)(Schultz and Bonar 2006) in Sabino Creek. Temperatures probably do not get near critical thermal maxima (Carveth et al. 2006), but may in the future.

3) Water quality with reduced levels of contaminants, including excessive levels of sediments adverse to Gila chub health, and adequate levels of pH (e.g. ranging from 6.5 to 9.5), dissolved oxygen (i.e., ranging from 3.0 ppm to 10.0 ppm) and conductivity (i.e., 100 mmhos to 1,000 mmhos);

   Water quality taken at the Gila topminnow stocking in August 2015 had a water temperature of 24.7°C, pH 7.3, conductivity of 108 mmhos, and dissolved oxygen of 9.6 ppm (Mosher et al. 2016).

4) Prey base consisting of invertebrates (i.e., aquatic and terrestrial insects) and aquatic plants (i.e., diatoms and filamentous green algae);

   We have no evidence that the prey base will be limited. The addition of Gila topminnow to the ichthyofauna of Sabino Creek has added a historical prey item for Gila chub.

5) Sufficient cover consisting of downed logs in the water channel, submerged aquatic vegetation, submerged large tree root wads, undercut banks with sufficient overhanging vegetation, large rocks and boulders with overhangs, a high degree of stream bank stability, and a healthy, intact riparian vegetation community;

   Sufficient cover is not an issue in this system, as there is plenty of large woody debris, bedrock, boulders, and other cover (Ehret and Christ 2008, Ehret and Dickens 2009).

6) Habitat devoid of non-native aquatic species detrimental to Gila chub or habitat in which detrimental nonnative species are kept at a level that allows Gila chub to continue to survive and reproduce; and

   The green sunfish that were in Sabino Creek were extirpated in SCRA after the stream renovation in 1999, and the debris and sediment flows following the Aspen Fire. Crayfish are also extirpated, probably due to the synergistic effects of predation by Gila chub and impacts from the Aspen Fire.

7) Streams that maintain a natural flow pattern including periodic flooding.

Sabino Creek has a natural flood regime and will maintain a natural flood regime, as most of the watershed is protected by the national forest and Pusch Ridge Wilderness.

Gila Topminnow

Collection records indicate the presence of Gila topminnow within Sabino Creek as early as 1894 by W. W. Price (Weedman 1999). In June 1982, AGFD released 2000 Gila topminnow into Sabino Creek, but only two individuals were observed in the creek six months later (Weedman 1999). Flooding, recreational impacts, cold water temperatures and the presence of green sunfish may have caused this release effort to fail (Voeltz and Bettaso 2003). Sabino Creek was recommended for stocking in the draft revised Recovery Plan (Weedman 1999) and in August of 2015, 510 fish were released into the canyon above the last creek crossing (Mosher et al. 2016). An additional 985 Gila topminnow were stocked into Sabino Creek on August 30, 2016 (Mosher 2016b)

Surveys by AGFD in June 2016 recorded 72 Gila topminnow. No Gila topminnow were found in the stocking location, but they were found downstream of there to near tram stop 8 (Mosher 2016a). After reports of Gila topminnow in Bear Canyon on April, 2016, fish surveys found them there in May (Bonar et al. 2016), and June (Mosher 2016a).

B. Factors affecting species environment and critical habitat within the action area

In 2003, the Aspen Fire burned 84,750 acres in the upper elevations of the Santa Catalina Mountains, including most of the Sabino Canyon watershed. Occupied Gila chub habitat was not burned. Following the fire, the CNF and AGFD salvaged 900 Gila chub from Sabino Creek before subsequent rains brought ash and debris downstream into designated critical habitat and scoured Sabino Canyon. Primary constituent elements of critical habitat, including perennial pools, water quality, and invertebrate food base, were negatively affected by the ash and sediment flows. Sediment and ash reduced the amount of pool habitat and limited the depth of ordinary surface flows, limiting PCEs 1 and 3. Few, if any, Gila chub or nonindigenous fish remained in the creek in the fall of 2003. Salvaged Gila chub were successfully bred in captivity and their progeny were released into Sabino Creek and nearby Bear and Romero creeks in 2005. The Sabino Creek Gila chub population has grown from 350 individuals released in 2005 to over 2000 fish in 2009 (Suzy Ehret, AGFD, personal communication).

Within Sabino Creek, past recreational activities, such as wading, swimming, and walking up and down the creek, may have displaced Gila chub and affected critical habitat. Recreationists have also likely contributed to past introductions of aquatic nonindigenous organisms to Sabino Creek. Green sunfish were stocked into the small lake created by Sabino Dam soon after the dam's completion in 1938 (Lazaroff 1993, *in* Dudley and Matter 2000). However, this species was not present upstream of any bridges until about 1982 (Dudley and Matter 2000). The public likely transported green sunfish upstream of these bridges. Recent monitoring of the Gila chub population in Sabino Creek shows that the population is able to persist with current levels of

recreation (U.S. Forest Service 2009, Timmons and Upton 2013). Effects of recreation on the Gila chub and Gila topminnow were addressed in the 2009 consultation (22410-2009-F-0143) on the release of Gila topminnow.

Heavy rainfall over the Santa Catalina Mountains in July 2006 led to record flooding and triggered a historically unprecedented number of debris flows in the Sabino Creek watershed. At least 18 debris flows damaged roads, bridges, and other structures in the SCRA (Macgirl et al. 2007). Effects to Gila chub from the Mt. Lemmon Emergency Flood Stabilization project to repair and rehabilitate areas damaged by these floods will be considered under consultation (22410-2006-IE-0608). Likely effects included a temporary decrease in water quality and food availability due to increased sedimentation from soil disturbance during construction. The CNF implemented conservation measures for that project to minimize these effects.

Because the watershed above the SCRA is virtually all on the Coronado National Forest, almost any action may be subject to section 7 consultation. However, since much of the Sabino Creek watershed is in the Pusch Ridge Wilderness, few actions have occurred that would require consultation. Formal consultations in the area have involved highway improvements and the LRMP. Consultations before 2005 did not consider aquatic species in Sabino Creek, as the Gila chub was not listed yet. Areas outside of the wilderness area but in the Sabino watershed near Palisades and Summerhaven are far removed from SCRA. Several emergency consultations on fires and floods have been initiated, but some are not completed:

- 22410-2006-IE-0608 Mt. Lemmon Emergency Flood Stabilization,
- 22410-2008-IE-0169 Mt. Lemmon February 2008 Storm Damage,
- 22410-2002-I-0039 Mt. Lemmon Emergency Landslide,
- 22410-2000-I-0100 Lemmon Rock Fuels Reduction,
- 2003 Aspen fire

EFFECTS OF THE ACTION

Effects of the action refer to the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action. Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration. Indirect effects are those that are caused by the proposed action and are later in time, but are still reasonably certain to occur.

Potential direct effects from operation of the shuttle may come in the form of impacts to individuals, fry, or eggs from the wheels of vehicles at crossings that are inundated during higher flow events. Direct effects to fish, fry, young, and eggs from shuttle crossing can only possibly occur when the crossings are inundated. Table 1 summarizes the average number of days that each crossing may be inundated based on 24 years of streamflow data. Based on measurement

of the vents, maximum flows through the crossings were calculated. When flows exceed that maximum, water will be across the tread of the crossing and shuttles will drive through the live stream. The data indicate that about half of the crossings will be inundated on 13 percent of the days in an average year in their current, partially blocked state.

The number of wet creek crossings by the shuttle is difficult to determine based on the data gathered and the variable and seasonal nature of rainfall. However, we can estimate the numbers of wet creek crossings with the caveat that the timing and duration of rainfall effects stream flow. The maximum number of days that all bridges are inundated is 15. Based on an average number of 288 crossings during peak season per day the shuttle would make up to an estimated average number of 4,320 wet crossings per year through occupied Gila chub and Gila topminnow habitat if those 15 days occurred during peak shuttle season.

At least one crossing is inundated on average 60 days per year. Without consideration of seasonal variation in shuttle service, the shuttle makes an average of 12 round trips per day. Multiplying by 60 days that at least one crossing is inundated by 12 round trips (i.e. 24 crossings) gives an estimate of 1,440 wet creek crossings as an approximate minimum number of wet crossings per year if only crossing 2 was inundated.

So, based on the data that we have it is estimated that the shuttle will make a minimum of 1440 wet crossings to a maximum of 4,320 wet crossings. These estimates are necessarily limited by the accuracy of the data and must be understood to reasonably represent the situation in Sabino Canyon. In good rainfall years there could be significantly more wet crossings and in bad years significantly less. It is recognized that shuttle operations cease to cross the stream when flows are too high to be safe, but there are no data on how many times and for what period such changes in shuttle traffic occur, so the estimates in the previous paragraph may be looked at as potential maximum numbers of crossings.

The time-frame of the proposed action is 20 years. Therefore, the number of crossings enumerated above are expected to happen every year for 20 years. That equates to 86,400 crossings, 172,800 axles, and 345,600 tires making wet crossings over the 20-year time frame of the action. Because the proposed action covers 20 years and Gila topminnow and Gila chub distribution and populations can vary widely over that length of time, we consider all of Sabino Creek at the road crossings to be occupied.

The hydrodynamics of a rolling rubber tire moving through water combined with the mobility of an adult fish makes the possibility of a vehicle running over an adult fish very remote. There are no documented occurrences of fish being run over in Sabino Canyon. However, during higher flows when the crossings are wet, hatchling chub (and to a limited extent, adults) could be vulnerable to vehicles traveling through the live stream. Because the estimated maximum of 4,320 wet crossings annually for 20 years, the likelihood increases greatly. Because Gila chub are demersal spawners (eggs are deposited on substrate), eggs moving across the crossings should be rare. Gila topminnow are weak swimmers, and have been observed congregating in the slack water at the margins of road crossings. Gila topminnow are also live-bearers, young fish seek shallow, slack water, increasing the likelihood they may congregate at creek crossings

As stated earlier, high flows result in sediment being deposited on the low-water crossings. These sediment mounds have been cleared by shuttle personnel using shovels after the water has receded and the sediments are relatively dry. Sediment that is cleared will be removed off site.

Potential indirect effects may also derive from spills of vehicle fuel, lubricants, coolant, or hydraulic fluid that enter the creek directly from the vehicles themselves or as polluted storm water runoff from spills that saturate portions of the paved road. The conservation measures requiring newer vehicles, regular inspections, and not using vehicles that do not meet certain criteria will definitely make this potential impact unlikely, and of little consequence to the species or critical habitat.

Shuttle operations are a part of the overall recreational experience on the Coronado National Forest. Recreational use in the canyon is complex in terms of demographics, concentration, and purpose. Private citizens visiting public lands is a federal action as are the programs and infrastructure needed to manage and facilitate the large number of visitors that Sabino Canyon receives. The potential effects of visitors on Gila chub and Gila topminnow are discussed in the environmental baseline, as recreation has been covered under a previous formal section 7 consultation.

Potential Effects of the Action on Gila Chub Critical Habitat

In our analysis of the effects of the action on critical habitat, we consider whether or not a proposed action will result in the destruction or adverse modification of critical habitat. In doing so, we must determine if the proposed action will result in effects that appreciably diminish the value of critical habitat for the recovery of a listed species. To determine this, we analyze whether the proposed action will adversely modify any of the PCEs that were the basis for determining the habitat to be critical. To determine if an action results in adverse modification of critical habitat, we must also evaluate the current condition of all designated critical habitat PCEs, and the PCEs of those units, to determine the overall ability of all designated critical habitat to support recovery. Further, the functional role of each of the critical habitat PCEs in recovery must also be considered because, collectively, they represent the best available scientific information as to the recovery needs of the species.

Gila chub critical habitat was designated when the species was listed as Endangered (USFWS 2005, 70 FR 66716). The portion of Sabino Canyon that was designated as critical habitat is "Sabino Canyon: 11.1 km (6.9 mi) of creek extending from the southern boundary of the Coronado National Forest in T13S, R15E, sec. 9 SE1/4 upstream to its confluence with the West Fork of Sabino Canyon [Creek] in T12S, R15E, sec. 22 NE 1/3, Land ownership: Coronado National Forest" (USFWS 2005). This includes all of the proposed action area, except Shuttle Stop 9. USFWS (2005) also states that "critical habitat includes the stream channels within the identified stream reaches and areas within these reaches potentially inundated during high water flow events. Critical habitat includes the area of bank-full width plus 300 feet on either side of the banks." The habitat features, or "primary constituent elements" (PCE) necessary for survival and recovery of the Gila chub include:

- Perennial pools, areas of higher velocity between pool areas, and areas of shallow water among plants or eddies all found in small segments of headwaters, springs, or cienegas of smaller tributaries;
- Water temperatures for spawning ranging from 17 to 24° C with sufficient dissolved oxygen, nutrients, and any other water related characteristics needed, and seasonally appropriate temperatures for a life stages;
- Water quality with reduced levels of contaminants or any other water quality characteristics, including excessive levels of sediments, adverse to Gila chub health;
- Food base consisting of invertebrates and aquatic plants;
- Sufficient cover consisting of downed logs in the water channel, submerged aquatic vegetation, submerged large tree root wads, undercut banks with sufficient overhanging vegetation, large rocks and boulders with overhangs, and a high degree of streambank stability and healthy, intact riparian vegetative community;
- Habitat devoid of nonnative aquatic species detrimental to Gila chub or habitat in which detrimental nonnatives are kept at a level which allows Gila chub to continue to survive and reproduce;
- Streams that maintain a natural flow pattern including periodic flooding. An example is Sabino Canyon that has experienced major floods. If flows are modified, then the stream should retain a natural flow pattern that demonstrates an ability to support Gila chub; and
- 300-foot riparian zone adjacent to each side of the stream.

The on-going shuttle activities have no potential to impact any of the PCEs except for water quality.

The three components of the project are addressed below separately.

1. Shuttle Crossings. Shuttle crossings have very little visible effect on water quality since most of the wet crossings are accomplished when flows are rather moderate. Sediment tends to wash over the concrete crossings so the movement of the shuttle is not stirring up fine sediments except when there are sand bars that have recently been deposited. But, as stated above these sediment deposits are only there after peak flow events and personnel clear them off generally before the shuttle can cross. The potential for sediment being displaced by shuttles crossing through the water is minimal, since it should only rarely occur.

2. Shuttle Related Spills. Spills of vehicle lubricants and fluids could be the greatest potential for potential impacts to water quality. Evidence of fluid leaks is left in numerous places along the road. It is predictable therefore that the fluids would enter the creeks either directly from leaks, or washed off of vehicle components when crossing water, or lifted off the road surface during storm events that place contaminated water into the creek. No testing of the creek has been done looking for such contaminants and there are no maintenance records to access to determine how often leaks are a problem. Proposed conservation measures should make spills rare and minimal.

3. The conservation measure requiring that sediment be removed from the stream channel will minimize or eliminate impacts to the stream and critical habitat.

Cumulative Effects

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

In 1991, the American Fisheries Society adopted a position Statement regarding cumulative effects of small modifications to fish habitat (Burns 1991). Though the American Fisheries Society use of the term cumulative differs from the definition in the ESA, the statement concludes that accumulation of, and interaction between, localized or small impacts, often from unrelated human actions, pose a serious threat to fishes.

Flooding that occurred in 2003 after the Aspen Fire appears to have eradicated nonindigenous fish from Sabino Creek downstream of CNF lands. However, the potential still exists for introduction of nonindigenous aquatic organisms into Sabino Creek by the public from private lands downstream of the CNF. Nonindigenous sunfish currently exist in artificial lotic developments adjacent to Tanque Verde Creek, but are below a fish barrier at the confluence of Sabino Creek and Tanque Verde Creek. It is highly unlikely that these sunfish or other nonindigenous aquatic organisms could move above the fish barrier on their own. However, it is possible that the public could release nonindigenous aquatic organisms above this fish barrier. Sabino Creek flows intermittently above this fish barrier, but could allow for movement of nonindigenous aquatic organisms upstream during periods of continuous flow.

In the months immediately following the 1999 renovation of Sabino Creek, it was observed anecdotally by the USFS that non-native green sunfish were found to move above impassable fish barriers such as the 12ft-high Sabino Dam (USFS 2015). It was assumed that these fish were moved up-stream of the barrier by the public. Since the time when sunfish were eradicated by the post fire flows of the Aspen fire, it is also likely that curious and inquisitive visitors from time to time similarly capture and move Gila chub, contrary to state and federal law. The USFS has on one occasion found a small aquarium dip net lying on the road near the creek (USFS 2015). While these types of effects are likely to occur, it is not known at what level they normally occur.

In general, Arizona's human population is expected to continue increasing as it has historically. Based on data provided on the City of Tucson Website (https://www.tucsonaz.gov/hcd/tucson-update-population) Pima County's population was 531,433 in 1980 and grew to 1,205,341 by 2015. That means that the population has more than doubled in 35 years. Based on previous growth, it is likely that an additional 100,000 people will be added to the county population by the time the Sabino Shuttle temporary permit expires in 2017.

Conclusion

After reviewing the current status of the Gila topminnow, Gila chub, and critical habitat for Gila chub, the environmental baseline for the action area, the effects of the proposed action with its accompanying conservation measures, and the cumulative effects, it is the USFWS's biological

opinion that the action, as proposed, is not likely to jeopardize the continued existence of the Gila chub and Gila topminnow, and is not likely to destroy or adversely modify designated critical habitat for Gila chub for the following reasons:

- The conservation measures proposed by the CNF will minimize the adverse effects of tram operation to the species, their habitat, and designated critical chub habitat;
- The Gila chub population persists with the current operation of the Sabino Canyon tram;
- The recently released Gila topminnow appear to be establishing a population, and will likely coexist with the proposed operation of the Sabino Canyon tram;
- Critical habitat for the Gila chub will remain functional under the proposed action.

The adverse effects that do occur in the action area do not reach the scale where recovery of the Gila chub and Gila topminnow would be delayed or precluded. Adverse effects are anticipated to be of a similar small scale, and are unlikely to destroy or adversely modify Gila chub critical habitat in the action area to the extent that recovery would be delayed or precluded for many of the reasons found in the conclusion and discussion above.

The draft Gila chub Recovery Plan (FWS 2015) has criteria that are useful for determining jeopardy. Before considering Gila chub for down- or de-listing, all available remnant populations within each recovery unit are maintained in a protected stream (including Sabino Creek), and trends of recruitment and population size indices are considered stable or positive over the most recent rolling 10-year period. In addition, the draft recovery plan defines a stable (viable) population as one containing at least 5000 reproductive adults. Sabino Creek may not currently support 5,000 reproductive adults but if Sabino Creek were precluded from supporting the number of breeding Gila chub already there, it would seriously hamper recovery of the species. Since the impacts of the proposed action affect only one natural Gila chub population and the action area is very small compared to the range of the species, and Gila chub are expected to still be present and little affected in Sabino Creek during the time frame of the proposed action, it is unlikely that a tipping point away from recovery would be reached. While the action area does include an important population of the species, the effects of the action will not cause the loss of the population, and it will similarly not be a tipping point away from recovery.

Similarly, the draft Gila topminnow Recovery Plan (Weedman 1999) has criteria that are useful for determining jeopardy. Down- and de-listing criteria require the creation of many additional populations in wild sites. The draft recovery plan defines a stable (viable) population as one containing at least 500 over-wintering adults. Sabino Creek may not currently support 500 over-wintering adults, but it could. Since the impacts of the proposed action affect only one reestablished Gila topminnow population and the action area is very small compared to the range of the species, and Sabino Creek is a reestablished population, the loss of the population would not be a serious setback to conservation of the species. Since Gila topminnow were only recently released into Sabino Creek, the success of the release and their ultimate disposition is

unknown. The effects of the action will definitely not cause the loss of the population, and it will similarly not be a tipping point away from recovery.

Based on the above analyses and summary, it is the FWS's biological opinion that the proposed action will not alter the ability of Gila chub critical habitat to retain its PCEs and to function properly. As such, Gila chub designated critical habitat will remain functional to serve its intended conservation role for the species. Therefore, we conclude that the proposed action is not likely to either destroy or adversely modify Gila chub designated critical habitat nor affect its role in recovery of the species.

The conclusions of this biological opinion are based on full implementation of the project as described in the Description of the Proposed Action section of this document, including any Conservation Measures that were incorporated into the project design.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulations pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Harm" is defined (50 CFR § 17.3) to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. "Harass" is defined (50 CFR § 17.3) as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. "Incidental take" is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by the CNF so that they become binding conditions of any grant or permit issued to the applicant, as appropriate, for the exemption in section 7(o)(2) to apply. The CNF has a continuing duty to regulate the activity covered by this incidental take statement. If the CNF (1) fails to assume and implement the terms and conditions or (2) fails to require the applicant to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. To monitor the impact of incidental take, the CNF must report the progress of the action and its impact on the species to the USFWS as specified in the incidental take statement [50 CFR § 402.14(i)(3)].

Amount of Extent of Take

Gila Topminnow and Gila Chub

The USFWS anticipates that the proposed action may result in incidental take of Gila topminnow and Gila chub. Incidental take will be difficult to detect for the following reasons: dead animals

are difficult to find, cause of death may be difficult to determine, and losses may be masked by seasonal fluctuations in numbers or other causes (e.g., oxygen depletion). The incidental take is expected to be in the form of harassment and kill from:

- Tram and support vehicles driving over the crossings when they are inundated with water.

We consider incidental take for Gila chub to have been exceeded if more than three injured or dead Gila chub are observed during creek crossings by the tram and support vehicles annually, or there are 30 dead or injured chub for the life of the project.

We consider incidental take for Gila topminnow to have been exceeded if more than five injured or dead Gila topminnow are observed during creek crossings by the tram and support vehicles annually, or there are 50 dead or injured topminnow for the life of the project.

Effect of Take

In this biological opinion, the USFWS determines that this level of anticipated take is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat for Gila chub for the reasons stated in the Conclusions section.

Reasonable and Prudent Measures

The following reasonable and prudent measures are necessary and appropriate to minimize take Gila topminnow and Gila chub:

1. The CNF shall implement measures to identify potential take from the proposed action in Sabino Creek;

2. The CNF shall monitor implementation of the proposed action and any resulting incidental take and report to the USFWS and AGFD the findings of that monitoring.

Terms and Conditions

To be exempt from the prohibitions of section 9 of the Act, the CNF must comply with the following terms and conditions, which implement the reasonable and prudent measures and outline required reporting and monitoring requirements. These terms and conditions are non-discretionary.

The following term and condition implement reasonable and prudent measure #1:

1.1. The CNF shall include as a condition of any contract or agreement, tram operators should observe during water crossings and must report as soon as possible any fish seen that may have been injured or killed by the tram passing through water and report that occurrence to the CNF;

1.2. If CNF staff see a fish that may have been injured or killed by the tram passing through water, they shall report the observation as soon as possible;

1.3 When the CNF receives a report from the tram operator or CNF staff of a potential fish injury or death from tram operation, CNF staff who can identify fish or photo-document the occurrence shall look for the fish and document potential cause of death (as determinable), time, date, species, crossing, photograph, and other pertinent information.

The following term and condition implement reasonable and prudent measure #2:

2.1 A brief written report shall be prepared by CNF summarizing project implementation and potential and actual observed take. This report shall be submitted annually to the USFWS. The report shall also make recommendations, as needed, for modifying or refining these terms and conditions to enhance protection of the Gila topminnow and Gila chub or more efficiently use the limited monitoring resources of the CNF.

2.2 Reporting shall be included in the CNFs annual ESA report.

Reporting Requirements/Disposition of Dead or Injured Listed Animals

Review requirement: The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize incidental take that might otherwise result from the proposed action. If, during the course of the action, the level of incidental take is exceeded, such incidental take would represent new information requiring review of the reasonable and prudent measures provided. The CNF must immediately provide an explanation of the causes of the taking and review with the USFWS the need for possible modification of the reasonable and prudent measures.

Upon locating a dead, injured, or sick listed species initial notification must be made to the USFWS's Law Enforcement Office, 4901 Paseo del Norte NE, Suite D, Albuquerque, New Mexico, 87113, telephone 595-248-7889 within three working days of its finding. Written notification must be made within five calendar days and include the date, time, and location of the animal, a photograph if possible, and any other pertinent information. The notification shall be sent to the Law Enforcement Office with a copy to this office. Care must be taken in handling sick or injured animals to ensure effective treatment and care and in handling dead specimens to preserve the biological material in the best possible state.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. We recommend you implement the following conservation recommendations for the Gila chub and Gila topminnow:

1) Continue to assist USFWS and AGFD in conserving and recovering the Gila chub and Gila topminnow;

2) Assist the USFWS in implementing recovery plans for both species; and

3) The CNF should consider and review other sites on the Forest that may be suitable for the release of Gila chub and Gila topminnow.

For the USFWS to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, the USFWS requests notification of the implementation of any conservation recommendations.

REINITIATION AND CLOSING STATEMENT

This concludes formal consultation on the actions outlined in the request. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

In keeping with our trust responsibilities to American Indian Tribes, we encourage you to coordinate with the Bureau of Indian Affairs in the implementation of this consultation and, by copy of this biological opinion, are notifying the Tohono O'odham Nation of its completion. We also encourage you to coordinate the review of this project with the Arizona Game and Fish Department.

The USFWS appreciates the Coronado National Forest's efforts to conserve and recover the Gila topminnow and Gila chub. For further information please contact Doug Duncan (520) 670-6150 (x262) or Scott Richardson (520) 670-6150 (x242). Please refer to consultation number, 02EAAZ00-2016-F-0447, in future correspondence concerning this project.

Sincerely,

Douglas K Duncan
for
Steven L. Spangle
Field Supervisor

cc (hard copy):
Field Supervisor, Fish and Wildlife Service, Phoenix, Arizona (2 copies)
Assistant Field Supervisor, Fish and Wildlife Service, Tucson, Arizona

cc (electronic copy):
Tohono O'odham Nation, Sells, Arizona (c/o Holly Barton)
Chief, Habitat Branch, Arizona Game and Fish Department, Phoenix, Arizona (pep@azgfd.gov)
Raul Vega, Regional Supervisor, Arizona Game and Fish Department, Tucson, Arizona

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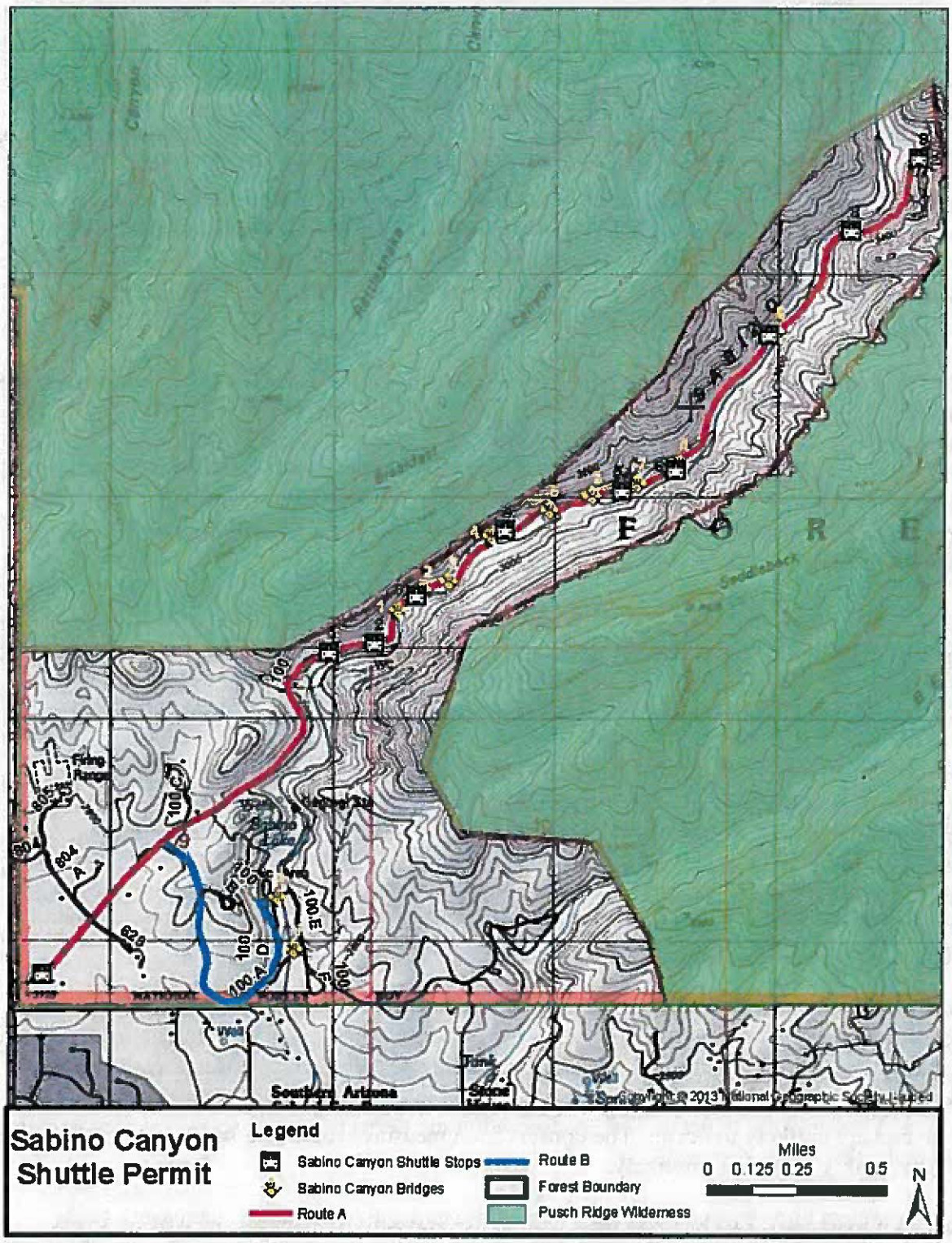
Figure 1. Action area in Sabino Creek, Pima County, Arizona.



APPENDIX – CONCURRENCE

Western yellow-billed cuckoo

The yellow-billed cuckoo usually nests in structurally complex, large patches of riparian habitat throughout Arizona (79 FR 5991, USFWS 2014). Surveys conducted by the Arizona Breeding Bird Atlas reported 68 percent of the yellow-billed cuckoo observations were in lowland riparian woodlands, often containing a variable combination of Fremont cottonwood, willow, velvet ash (*Fraxinus arizonica*), Arizona walnut (*Juglans major*), mesquite, and tamarisk (*Tamarix* spp.)(Corman and Wise-Gervais 2005). Narrow bands of riparian woodland can contribute to the overall extent of suitable habitat. Large patches of contiguous riparian habitat do not occur in the action area. Thus, it is likely that the yellow-billed cuckoo occurs on occasion as a transient, but nesting now or in the future is unlikely.

Data specific to the Santa Catalina RD from 2015 indicates that the western yellow-billed cuckoo was found during the breeding season in Peppersauce and Geesaman Canyons. The species was not found during Audubon surveys in Sabino Canyon in 2015. The eBird website (http://ebird.org/content/ebird/) does show several observations of cuckoo in the Santa Catalina Mountains including Sabino Canyon (USFS 2015). The 2015 survey results, along with ebird's anecdotal accounts, suggest that cuckoos use parts of the Santa Catalina Mountains not considered typical riparian woodlands.

It is important to note that the species is found in canyons similar to Sabino in other, less visited canyons in the Santa Catalina Ranger District such as Romero Canyon, Paige Creek, Geesaman, and Peppersauce. The habitat in the Sabino Canyon area appears to be suitable for Western yellow-billed cuckoo although recent survey efforts failed to detect the species.

Potential effects to the western yellow-billed cuckoo from the proposed tram could be from disturbance during the breeding season from the noise and activity of the shuttle. Since the permitted activities include over 7,500 trips per year from both routes traveling through potentially suitable habitat, there is potential for noise disturbance to this species. Though the species has not been documented by formal surveys in SCRA, the data represent one year and there is still potential for them to occur in this canyon that supports potentially suitable habitat. Therefore, there is a slight potential for disturbance from shuttle operations.

Indirect effects could arise from the species food source (insects) being contaminated by spilled lubricants and fluids. The species is insectivorous often eating species that emerge from aquatic environments for some portions of their complex life cycle. These types of indirect effects are not documented and there are no programs to monitor insects for potential contamination in the canyon, and are unlikely to occur. The conservation measures regarding spills and contaminants should make this effect very unlikely.

Noise can impact birds by changing their habitat use and activity patterns, increasing stress responses, decreasing foraging efficiency and success, reducing reproductive success, increasing predation risk, diminishing intraspecific communication, and causing hearing damage (NoiseQuest 2012; Pater et al. 2009). These responses can vary, depending on the nature of the

sound, including sound level, rate of onset, duration, number of events, spectral distribution of sound energy, and level of background noise (Pater et al. 2009). The sound limits specified in the conservation measures will minimize impacts from noise to the few yellow billed cuckoos that may occur in the action area. Proposed critical habitat does not occur in the action area and will not be affected.

Conclusion

We concur that the proposed action is not likely to adversely affect the western yellow-billed cuckoo for the following reasons:

- There are no known breeding records and few occurrence records for western yellow-billed cuckoo in the action area;
- The riparian woodland habitat in the action area is not suitable nesting habitat due to the small blocks of riparian trees, and lack of adjacent foraging habitat;
- Conservation measures will limit spills and leakage of contaminants that may impact invertebrate species that cuckoos forage on; and
- Conservation measures and design features will limit noise disturbance of western yellow-billed cuckoo by reducing allowable decibel levels and requiring that the narration not be audible outside of the shuttle vehicle.

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FINAL BIOLOGICAL OPINION SUMMARY

Date of Opinion:	November 9, 2016
Action Agency:	U.S. Forest Service
Project:	Ongoing operations of the Sabino Canyon shuttle, Pima County, Arizona
Location:	Sabino Canyon Recreation Area, Pima County, Arizona

Listed species affected: Gila chub with designated critical habitat, Gila topminnow

Draft Biological Opinion: Non-jeopardy and non-adverse modification

Incidental Take Statement: Yes

Level of Incidental Take Anticipated: If more than 3 injured or dead Gila chub are observed during creek crossings by the tram and support vehicles annually, or there are 30 dead or injured chub for the life of the project.

If more than 5 injured or dead Gila topminnow are observed during creek crossings by the tram and support vehicles annually, or there are 50 dead or injured topminnow for the life of the project.

REASONABLE AND PRUDENT MEASURES:

1. The CNF shall implement measures to identify potential take from the proposed action in Sabino Creek;

2. The CNF shall monitor implementation of the proposed action and any resulting incidental take and report to the USFWS and AGFD the findings of that monitoring.

TERMS AND CONDITIONS:

1.1. The CNF shall include as a condition of any contract or agreement, tram operators should observe during water crossings and must report as soon as possible any fish seen that may have been injured or killed by the tram passing through water and report that occurrence to the CNF;

1.2. If CNF staff see a fish that may have been injured or killed by the tram passing through water, they shall report the observation as soon as possible;

1.3 When the CNF receives a report from the tram operator or CNF staff of a potential fish injury or death from tram operation, CNF staff who can identify fish or photo-document

the occurrence shall look for the fish and document potential cause of death (as determinable), time, date, species, crossing, photograph, and other pertinent information.

2.1 A brief written report shall be prepared by CNF summarizing project implementation and potential and actual observed take. This report shall be submitted annually to the USFWS. The report shall also make recommendations, as needed, for modifying or refining these terms and conditions to enhance protection of the Gila topminnow and Gila chub or more efficiently use the limited monitoring resources of the CNF.

2.2 Reporting shall be included in the CNFs annual ESA report.
Conservation Recommendations:

FWS recommends the following conservation activities:

1) Continue to assist USFWS and AGFD in conserving and recovering the Gila chub and Gila topminnow;

2) Assist the USFWS in implementing recovery plans for both species; and

3) The CNF should consider and review other sites on the Forest that may be suitable for the release of Gila chub and Gila topminnow.

Coordination with species leads: Completed. Info from the species leads incorporated.

Field Supervisor Comments: