

United States Department of the Interior

U.S. Fish and Wildlife Service

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In Reply Refer To:

AESO/SE

22410-2008-F-0394

July 29, 2010

Mr. Alan Quan, Forest Supervisor
Prescott National Forest
344 South Cortez
Prescott, Arizona 86303

Dear Mr. Quan:

Thank you for your request to initiate formal consultation with the U.S. Fish and Wildlife Service (FWS) pursuant to section 7 of the Endangered Species Act of 1973 (16 U.S.C. 1531-1544), as amended (Act), for the Sycamore Livestock Grazing Project on the Verde Ranger District of the Prescott National Forest (PNF) in Yavapai County, Arizona. Your request was dated February 12, 2010, and received by us on February 17, 2010. At issue are effects that may result from the proposed grazing program. The proposed action may affect the endangered Gila chub (*Gila intermedia*) and its critical habitat.

This biological opinion (BO) is based on information provided in your February 12, 2010, letter and biological assessment (BA); October 2007 and March 13, 2008 site visits with your staff and the Sycamore Allotment permittees; and other sources of information. Literature cited in this draft biological opinion is not a complete bibliography of all literature available on the species of concern or on other subjects considered in this opinion. A complete administrative record of this consultation is on file at this office.

CONSULTATION HISTORY

The following details the history of the consultation:

December 12, 2006: We received a project initiation letter from the Verde District Ranger, Dee Hines.

October 29, 2007: We conducted a site visit to the allotment with your staff and the Sycamore Allotment permittees to discuss grazing options.

March 13, 2008: We conducted a site visit to the allotment with your staff and the Sycamore Allotment permittees to assess the functioning condition of Sycamore Creek.

- June 23, 2008: We received a public scoping letter and project information requesting comments on the modified Proposed Sycamore Livestock Grazing Project.
- July 15, 2008: We sent you comments regarding the modified Proposed Sycamore Livestock Grazing Project.
- February 17, 2010: We received your letter and BA requesting formal consultation for the Sycamore Livestock Grazing project.
- June 10, 2010: We provided you a copy of the draft BO for your review.
- July 20, 2010: We received your comments on the draft BO.
- July 22, 2010: We received comments on the draft BO from the permittee.
- July 27, 2010: We participated in a conference call with your staff to discuss the comments on the draft BO.

BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

The PNF proposes to reauthorize grazing on approximately 28,118 acres on the Verde Ranger District within the northern reaches of the Agua Fria Grasslands. A term grazing permit will be issued for up to 10 years. The proposed action consists of five components: authorization, monitoring, adaptive management, range structural improvements, and resource protection measures (conservation measures).

Authorization

The Verde District Ranger proposes to continue to authorize yearlong livestock grazing on the Sycamore Allotment under the following terms:

- Grazing will be permitted year-round on the allotment, but may be less in some years depending upon available forage with a proposed permitted use of up to 450 cow/calf and seven horses yearlong (5,484 head months).
- Grazing will occur through a rotational system (deferred/rest-rotation) that will emphasize grazing management to meet the needs of the plants' physiological requirements.
- Annual authorized livestock numbers will be based on existing conditions, available water and forage, and predicted forage production for the year. Adjustments to the annual authorized livestock numbers (increase or decrease) may occur during the grazing year, based on conditions and/or range inspections.

- The Sycamore allotment's grazing rotation system will continue to emphasize a 4-pasture 1-herd system which will realize one pasture rested fully, 1 year out of 4, and will realize summer growing season deferment or partial deferment in each pasture, 3 years out of 4. This grazing rotation will allow a staggered entry into pastures at different seasons each year. The grazing rotation will target a 4 month grazing window per pasture, but the actual schedule will vary according to adaptive management principles.
- Flexibility in the timing of entry and pasture moves will be determined by available forage and management standards and objectives specified in the allotment management plan (AMP) and annual operating instructions (AOI).
- Livestock grazing during the summer (warm-season, typically July -September), will be managed at conservative (31-40 percent) use intensity based on key herbaceous species identified within key areas on the allotment.
- Livestock grazing prescribed use levels outside of the summer forage growing seasons will be managed at a moderate (41-50 percent) use intensity based on selected key herbaceous species within key areas on the allotment.
- Livestock grazing prescribed use levels will be managed at moderate (41-50 percent) use intensity based on selected upland key browse species current leader growth at any given time during the year.
- Relative use of current year's production will be managed at 20 percent based on selected key riparian woody species (willow, cottonwood, ash and alder). Livestock grazing on selected key riparian herbaceous species within critical monitoring areas will be managed at a 50 percent relative use. These use prescriptions will apply at any time of the year that livestock are in the riparian area.

Monitoring

In order to evaluate continued progress toward meeting range management objectives, grazing monitoring will be conducted. Additionally, in order to ensure the proposed action will not exceed agreed to parameters for the Gila chub, populations and critical habitat will be monitored and a yearly report outlining monitoring results will be provided to our office and the permittee.

Two types of grazing monitoring will be conducted:

1. Implementation monitoring will be conducted by the Forest Service and/or permittee and may include, but is not limited to the following: livestock actual use data, grazing intensity evaluations during the grazing season (within key and critical areas), utilization at the end of the growing season (within key areas), and visual observation of vegetation and ground cover.
2. Effectiveness monitoring will be conducted to evaluate the success of management in achieving the desired objectives and will occur within key areas on permanent transects at an interval of ten years or less. Effectiveness monitoring may also be conducted if data and observations from implementation monitoring (annual monitoring) indicate a need.

Both qualitative and quantitative monitoring methods will be used in accordance with publications cited in the BA. The following is a description of monitoring that will occur:

Uplands Monitoring

Annual monitoring will be conducted within designated key areas of all pastures, which may include, but is not limited to, evaluation of grazing intensity during the season and utilization at the end of the growing season in order to practice adaptive management and make necessary management adjustments needed for plant development and recovery.

Riparian/Stream Monitoring

In the Sycamore Creek critical areas, manage grazing use of 20% relative use of current year's production on riparian woody species (willow, cottonwood, ash and alder) and 50% relative use on key herbaceous species (sedges, rushes, grasses). The monitoring locations will be established collaboratively by members of an interdisciplinary team (IDT) (i.e., Forest Service Rangeland Management Specialist and Fish Biologist, and the Sycamore Allotment permittee) prior to the implementation of the project.

Proper Functioning Condition (PFC) creek assessment will continue with an IDT. The three reaches will be assessed every three to five years to determine conditions and trend. The standard PFC checklist will be filled out and a summary determination made and updated as to the stream's condition (i.e., properly functioning, functioning at risk, not functioning, or unknown). A trend assessment should be made and updated as needed. This monitoring will be done after the cattle have left the pasture.

Gila Chub Population Monitoring

The Loball Pasture on the allotment contains a reach of Sycamore Creek that is occupied by the Gila chub. Population monitoring will be conducted every year to determine status and trends.

Gila Chub Critical Habitat Monitoring

The three reaches of aquatic habitat along Sycamore Creek will be monitored for livestock impacts to critical habitat (Map 2 - Appendix A of the BA). The following characteristics of critical habitat will be monitored:

- Pool habitat monitoring will be conducted annually in reaches 1-3 of Sycamore Creek to determine that pool quality or frequency is not being impacted by livestock actions. The amount and quality of pool habitat will be surveyed during base flow conditions (i.e. outside of high flow events or drought periods). A standard protocol, such as the Forest Service Region 3 Stream Inventory Methodology (Version 3.1, USDA 2005) will be used.
- Streambank alteration monitoring will be conducted annually in reaches 1-3 of Sycamore Creek to determine that no more than 20% of the banks in riparian areas have been impacted by livestock actions. Streambank critical area locations will be collaboratively selected to be used as indicators of livestock impacts to the streambank and as a management tool for the permittee that triggers his management actions if significant streambank alteration becomes apparent.

Adaptive Management

The proposed action recognizes the need to be adaptive in order to respond to changing resource conditions. Therefore, this part of the proposed action incorporates management flexibility by providing for a range of allowable livestock numbers that reflects variations in resource conditions and management objectives over time. Stocking will be adjusted within this range of numbers. Specific numbers of livestock will be determined by resource conditions and authorized in the AOI.

The following adaptive management strategies may be implemented:

- Timing of livestock movements on the Sycamore Allotment will be determined by utilization levels, forage conditions, and water availability, and will be specified in the AOI.
- The timing, intensity, and/or duration of grazing in any pasture of the Sycamore Allotment will be adjusted to lower levels as needed to achieve resource objectives. Vegetation will be allowed to regrow before any re-entry into a pasture.
- Gila chub monitoring measures employed for Sycamore Creek (Gila chub population, pool habitat, and PFC) will be managed to the previously described grazing use and streambank standards (“Gila Chub Critical Habitat Monitoring” and “Riparian/Stream Monitoring” sections above). Upon these standards being met, the permittee will immediately move livestock away from Sycamore Creek into another portion of the pasture or into the next available pasture.
- Gila chub monitoring measures will need to show stable or upward trends or consultation with our office will be re-initiated.

Adaptive management will also allow for the optional construction of rangeland improvements if they have been identified and are determined, through monitoring, to be necessary for achieving resource objectives. An example of a situation that could call for adaptive management adjustments is drought conditions.

Range Structural Improvements

The Tule corral will be expanded by constructing approximately 1/3-mile of fence. The Tule corral is the northern corral shown on Map 3 (Appendix A of the BA). The Double T Holding Pasture will be expanded by constructing approximately 3/4-mile of fence. Additionally, one cattleguard will be relocated, and a new cattleguard installed to allow for more cattle to be held overnight in the corral when it is used for rotating pastures. The Double T corral is the southern corral to the east of the Double T Ranch shown on Map 3 of the BA. No new roads will be constructed in association with these range structural improvements.

A water development will be installed in Loball Pasture to provide additional water for livestock in the uplands and reduce their reliance on Sycamore Creek. Development of the water upslope of Sycamore Creek will serve to better distribute livestock across the pasture, lessen livestock

use of the riparian area, lessen livestock access to Gila chub habitat, and help to insure that pasture rotation is not unduly impacted because of prematurely meeting utilization levels for riparian and/or Gila chub habitat monitoring standards. No new roads will be constructed in association with these water developments. The following three water source options are described below:

Source Option 1: The first option as the source for this water will be a new well drilled on private property owned by the range permittee. The private parcel is located T11N, R4E, Sec.15 &16 (Map 4-Appendix A of the BA). The well would be located on the south side of Sycamore Creek. This option includes authorizing an access route for equipment to drill a well. In order to drill the well, the permittee would access the private property via a temporary road, using an old existing travel way for alignment. This existing travel way served as the access to this private property, but is no longer used. It may be necessary to remove juniper trees in, or adjacent to the travel way prior to use. Use of this temporary road would only be authorized as needed for construction of the well. Any other use will not be authorized. The temporary road would be closed after well installation. Any future maintenance would need to be reauthorized. Water would be piped above ground from the source well to the water trough area (SE ¼ Sec. 15 and NE ¼ Sec. 22). If the well produces enough water, water would also be piped from the private parcel above ground to the T-anchor corrals located in the Loball Pasture (SW ¼ Sec. 14) and to Hiball Pasture (SW ¼ Sec. 10). Solar-powered pumps would be used to pull water from the canyon bottom to the upland stock tanks.

If monitoring shows that livestock reliance on Sycamore Creek still needs to be reduced with Source Option 1 well, a trick tank (i.e., guzzler) could be installed along with a storage tank and water trough as shown on Map 4 of the BA. If the trick tank is installed, it will provide an opportunity for additional water in the Hiball Pasture. Water would be piped above ground to the troughs as shown on Map 4 of the BA.

Source Option 2: In the event that funding for this well (Source Option 1) cannot be secured, or other reasons prevent drilling of this well on private land, the secondary source option (Map 5-Appendix A of the BA) for this water development will be a new well drilled near the water trough site on National Forest System Land (NE ¼ Sec. 22). This source option would not include water to the corrals in Loball or Hiball Pastures.

If monitoring shows that livestock reliance on Sycamore Creek still needs to be reduced with Source Option 2 well, a trick tank (i.e., guzzler) could be installed along with storage tank and water trough as shown on Map 5 of the BA. If the trick tank is installed, it will provide an opportunity for additional water in the Hiball Pasture. Water would be piped above ground to the troughs as shown on Map 5 of the BA.

Source Option 3: In the event that the primary and secondary water source wells do not produce water, the source for this water development will be an existing well located on the adjacent Long Gulch Allotment (22 Mesa Well) (Map 6-Appendix A of the BA). Water would be piped above ground from the 22 Mesa Well to the water trough area. Agreements would be made with the Long Gulch permittee as to how the maintenance for the well would be shared with the Sycamore permittee. An understanding would be developed for how the water would be shared when both permittees are in need of water at the same time.

If monitoring shows that livestock reliance on Sycamore Creek still needs to be reduced with Source Option 3 well, a trick tank (i.e., guzzler) could be installed along with storage tank and water trough as shown on Map 6 of the BA. If the trick tank is installed, it will provide an opportunity for additional water in the Hiball Pasture. Water would be piped above ground to the troughs as shown on Map 6 of the BA.

Range Improvements are cost shared with the permittee. Often the Forest Service provides the materials and the permittee provides the labor.

Conservation Measures

Resource Protective Measures

Resource protective measures are included under Alternative 2 and are designed to avoid or reduce potential resource conflicts, respond to issues, or improve implementation effectiveness. These resource protective measures were developed by the IDT after a careful review of the proposed action, and will be applied in a site-specific manner to the general implementation to avoid or minimize potential resource impacts.

Well Development – Option 1

A piezometer with a pressure transducer to measure stream level will be installed in Reach 1. The piezometer will be installed before the well under Option 1 is drilled to identify baseline groundwater conditions. Following installation of the well, a pump test will be conducted. The forest hydrologist will work with the permittee to establish a maximum drawdown rate to ensure adequate ground water is moving through the system in order to minimize impacts on downstream Gila chub critical habitat. A data logger may be installed in the well to record water levels over time.

Soil and Water Resources

Based on additional field review in the Holding Pasture, an area with gully formation was found in the southeast corner of the pasture (see “erosion structures” on Maps 4, 5 and 6 of the BA). In response to these conditions, the following resource protective measures will be applied under the proposed action:

1. A physical retention structure designed to retain sediment will be placed in the erosive gully (shown as “erosion structures” on maps). This designed feature will include placement in the gully itself, and additional structures adjacent to the gully including mechanical contouring.
2. Year-round grazing in the Holding Pasture will now be managed at conservative (31-40 percent) use intensity on key herbaceous species identified within key areas during the growing season. Moderate (41-50 percent) use intensity on key herbaceous species identified within key areas in the Holding Pasture will occur outside the summer forage growing season. Current use in the Holding Pasture has resulted in high utilization (greater than 50 percent use) year round and these new proposed utilization rates will avoid the local impacts that have been occurring.

3. Monitoring will be conducted specific to conditions in the Holding Pasture for grazing and soil. Implementation monitoring may include grazing intensity evaluations during the growing and dormant seasons, utilization at the end on the growing season, and visual observations of vegetation and ground cover. A key area will be established in this portion of the Holding Pasture. Specific soils effectiveness monitoring will be conducted on the gully's physical control structure. In addition, soil conditions will be interpolated through standard rangeland health assessments to determine trend. In the event that soil trend is determined to be downward, additional grazing management changes will be implemented. These management changes may include modifications to timing, intensity, or duration in the Holding Pasture. Modifications to these grazing management parameters (timing, intensity, duration) will not exceed the limits authorized as part of the proposed action, but may be administratively adjusted as needed to achieve an upward soil trend.

The use of applicable Best Management Practices (see Appendices B and C of the BA) is also intended to minimize impacts to these resources.

Gila Chub Specific Measures

As part of the 2005 regional programmatic consultation for the Continued Implementation of the Land and Resource Management Plans for the Eleven National Forests and Grasslands of the Southwestern Region (LRMP BO), three Reasonable and Prudent Measures with Terms and Conditions were developed to protect the Gila chub and its critical habitat. The PNF is incorporating those Reasonable and Prudent Measures with Terms and Conditions as conservation measures for their proposed action. See Appendix B of the BA for a complete list of these measures.

Action Area

For this consultation and explained in the Effects of the Action section below, the action area encompasses the entire Sycamore Grazing allotment and approximately 1.5 miles of Sycamore Creek downstream of the allotment.

STATUS OF THE SPECIES

Gila chub

The Gila chub was listed as endangered with critical habitat on November 2, 2005 (USFWS 2005). Historically, Gila chub have been recorded in approximately 43 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, Rinne and Minckley 1970, Minckley 1973, Rinne 1976, DeMarais 1986, Weedman *et al.* 1996, USFWS 2005). Only about 30 of these populations are currently occupied, and all of these are small, isolated, and face one or more threats (Weedman *et al.* 1996, USFWS 2005). These populations occur in tributaries of the Agua Fria, Babocamari, Gila, San Francisco, San Pedro, Santa Cruz, and upper Verde rivers in Cochise, Coconino, Gila, Graham, Greenlee, Pima, Pinal, Santa Cruz, and Yavapai counties in Arizona, and in Grant County, New Mexico (Weedman *et al.* 1996, USFWS 2005).

For additional information about the Gila chub see Desert Fishes Team (2003), Minckley and DeMaris (2000), Propst (1999), Rinne and Minckley (1991), DeMaris (1986), and Minckley (1973, 1985), the Arizona Department of Game and Fish (AGFD) status review (Weedman *et al.* 1996), the U.S. Fish and Wildlife Service (FWS) proposed rule and final rules listing the species (USFWS 2002, 2005), the New Mexico recovery plan for the species (Carman 2006), and references cited therein.

Taxonomy

Baird and Girard (1854) published a description of the Gila chub, as *Gila gibbosa*, based on the type specimen collected in 1851 from the Santa Cruz River. For nomenclature reasons, the name was changed by Girard to *Tigoma intermedia* in 1856, working with specimens from the San Pedro River. Despite that and other name changes, the Gila chub has been recognized as a distinct species since the 1850's, with the exception of a short period in the mid-1900's when it was placed as a subspecies of the roundtail chub *Gila robusta* (Miller 1946). For the past 30 years, *Gila intermedia* has been recognized as a full monotypic species, separate from the polytypic species *Gila robusta*, both currently accepted as valid (Robbins *et al.* 1991, Mayden *et al.* 1992, Nelson *et al.* 2004). Problematic populations nonetheless exist, variously assigned to one or the other taxa and leading to continued confusion. Further complicating matters, Minckley and DeMaris (2000) described a new subspecies within the Gila River Basin, *Gila nigra*, the headwater chub. It is of hybrid origin derived from *Gila robusta* and *Gila intermedia*. Its range is similar to that of *Gila intermedia* and is another headwater type chub, whereas, *Gila robusta* is found in the mainstem of the major rivers within the Gila River Basin. Dowling *et al.* (2008) reported on the genetics of many of the extant populations of these three Gila River chubs and recommended management units based on this information.

Life History

The Gila chub is a member of the minnow family Cyprinidae. The Gila chub is small-finned, deep-bodied, chubby (chunky), and darkly colored (sometimes lighter on belly; diffuse lateral band(s) are rarely present). Adult males average about 6 inches (150 mm) in total length; females can exceed 10 inches (250 mm) (Rinne and Minckley 1991). Scales are coarse, large, thick, and broadly overlapped, and radiate out from the base. Lateral-line scales usually number greater than 61 and less than 80. There are usually eight (rarely seven or nine) dorsal and anal fin-rays; pelvic fin-rays typically number eight, but sometimes nine (Minckley 1973, Rinne 1976, Weedman *et al.* 1996, Minckley and DeMaris 2000).

Gila chub commonly inhabit pools in smaller streams, springs, and cienegas, and can survive in small artificial impoundments (Miller 1946, Minckley 1973, Rinne 1975, Weedman *et al.* 1996). Gila chub are highly secretive, preferring quiet, deeper waters, especially pools, or remaining near cover like terrestrial vegetation, boulders, and fallen logs (Rinne and Minckley 1991). Undercut banks created by overhanging terrestrial vegetation with dense roots growing into pool edges provide ideal cover (Nelson 1993). Gila chub can survive in larger stream habitat such as the San Carlos River, and artificial habitats, like the Buckeye Canal (Stout *et al.* 1970, Rinne 1976). Gila chub are also easily cultured in a hatchery setting (Schultz and Bonar 2007).

Gila chub interact with spring and small stream fishes regularly (Meffe 1985), but are usually restricted to deeper waters (Minckley 1973). Adults are often found in deep pools and eddies

below areas with swift currents. Young-of-the-year inhabit shallow water among plants or eddies, while older juveniles use higher velocity stream areas (Minckley 1973, Minckley and Deacon 1991). Gila chub feed on both plants and animals. Adults appear to be principally carnivorous, feeding on large and small terrestrial and aquatic insects and sometimes other small fishes. Smaller individuals often feed on organic debris and aquatic plants, especially filamentous (threadlike) algae, and less intensely on diatoms (unicellular or colonial algae) (Griffith and Tiersch 1989, Rinne and Minckley 1991).

Spawning typically occurs from late spring into summer (Minckley 1973; Griffith and Tiersch 1989; Nelson 1993). Breeding males display deep red or orange coloration on ventral surfaces and paired fin bases (Minckley 1973, Rinne 1976). Spawning is likely sporadic over a long reproductive season (Rinne and Minckley 1991), and in constant warm water temperature settings such as springs, Gila chubs can spawn throughout the year (Minckley 1973, 1985, Griffith and Tiersch 1989). Spawning likely occurs over beds of submerged aquatic vegetation or root wads, with large females being followed by several smaller males (Minckley 1973). Males and females reach sexual maturity in one to three years at lengths of 90 to 95 mm (3.6-3.8 in) (Griffith and Tiersch 1989). Gila chub spawn at water temperatures warmer than 17° C (62° F), with optimal water temperatures of 20° to 24° C (68 to 75° F) (Nelson 1993), and optimal temperatures for growth of 24° to 28° C (75° F to 82° F) (Schultz and Bonar 2007). Gila chub likely live up to four years or more (Griffith and Tiersch 1989).

Threats

Decline of Gila chub is primarily due to habitat loss from various land use practices and predation and competition from nonnative fish species, and the highly fragmented and disconnected nature of the remaining Gila chub populations increases their vulnerability to these threats (USFWS 2005). Land uses that have caused past habitat loss and continue to threaten Gila chub habitat include hydrologic modification of rivers, springs, and cienegas for human uses (groundwater pumping, dewatering, diversion of water channels, impoundments, and flow regulation), poorly managed livestock grazing, logging and fuel wood cutting, road construction and use, recreation, mining, and urban and agricultural development (USFWS 2005). All of these activities have promoted erosion and arroyo formation and the introduction of predacious and competing nonnative fish species (Miller 1961, Minckley 1985), and at least one or some combination of these activities is occurring in all of the remaining populations. Wildfires and wildfire suppression activities also pose a threat to the remaining populations by causing water temperature and quality changes that can kill fish, (Rinne 2004, USFWS 2005), negatively altering food base for fishes (Earl and Blinn 2003), and resulting in stream and riparian vegetation alteration that negatively affects fish habitat (USFWS 2005).

Perhaps the most serious threat to Gila chub is predation by and competition with nonnative organisms, including numerous nonnative fish species, bullfrogs (*Rana catesbeiana*), and virile crayfish (*Orconectes virilis*). The impacts of nonnative fish species on native fish including Gila chub have been well documented (Hubbs 1955, Miller 1961, Minckley and Deacon 1968, Minckley 1973, Meffe 1985, Minckley 1985, Moyle *et al.* 1986, Williams and Sada 1985, Minckley and Deacon 1991, Ruppert *et al.* 1993, Clarkson *et al.* 2005). Dudley and Matter (2000) correlated green sunfish presence with Gila chub decline, documented green sunfish predation on Gila chub, and found that even small green sunfish readily consume young-of-year Gila chub. Dudley (1995) found that green sunfish appeared to displace both subadult and adult

Gila chub from preferred habitats; found that Gila chub utilized similar habitat types to green sunfish, indicating competition for food and space was likely occurring; and concluded that predation by and/or competition with green sunfish virtually eliminated small chub from where the two species co-occurred, indicating recruitment failure. Unmack *et al.* (2003) similarly found that green sunfish presence was correlated with the absence of young-of-year Gila chub in Silver Creek. Nonnative fish parasites, such as Asian tapeworm (*Bothriocephalus acheilognathi*), also may be a threat to Gila chub (USFWS 2005).

An important new threat to all native aquatic life in the southwestern United States is global climate change. There is evidence from climate models that global climate change could result in significant reductions in streamflow in the southwest due to warmer average temperatures, further straining threats to Gila chub and its habitat (Seager *et al.* 2007, U.S. Climate Change Science Program 2008). The U.S. Census Bureau predicts that Arizona will be the second fastest growing state in the country through 2030, adding an additional 5.6 million people (U.S. Census 2005). If these predictions hold true, already severe threats to Gila chub and its habitat will worsen, primarily due to increased human demand for surface and ground water and decreased supply. The climate change-driven effects will also result in warmer water temperatures in southwestern streams, which are more likely to favor nonnative fishes. Rahel and Olden (2008) examined climate change models, nonnative species biology, and ecological observations, and concluded that climate change could foster the expansion of nonnative aquatic species into new areas, magnify the effects of existing aquatic nonnative species where they currently occur, increase nonnative predation rates, and heighten the virulence of disease and parasite outbreaks. Drying of stream channels will also create less habitat and greater competition due to limited space and habitat. Thus climate change can eliminate Gila chub habitat through at least two mechanisms: directly, by drying up aquatic habitats due to decreases in runoff and stable or increasing human demand for water resources; and indirectly by improving conditions for nonnative species, increasing their proliferation, and thereby increasing the threat from nonnative fish predation and competition.

For a more detailed discussion of how these threats affect Gila chub, its critical habitat, and the closely related headwater chub and roundtail chub, see USFWS (2005, 2006, 2009).

Status and Distribution

Historically, Gila chub were recorded in approximately 43 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, Rinne and Minckley 1970, Minckley 1973, Rinne 1976, DeMarais 1986, Weedman *et al.* 1996). Only about 30 of these populations are currently occupied, and all of these are small, isolated, and face one or more threats (Weedman *et al.* 1996, USFWS 2005). Historically, the range of the Gila chub was more widespread throughout the southeast quadrant of Arizona, and currently occupied sites were likely much more expansive. The Gila chub now occupies an estimated 10 to 15 percent of its historical range (Weedman *et al.* 1996, USFWS 2005), and is limited to about 30 small, isolated, and fragmented populations throughout the Gila River basin in Arizona and New Mexico (USFWS 2005). Of these populations, ten are estimated to be stable-threatened, meaning Gila chub are considered common, but face threats from nonnative species and/or habitat-altering land uses, or a lack of recruitment was detected in the population. The remaining known extant populations are considered unstable-threatened, indicating that Gila chub are rare,

have a limited distribution, predatory or competitive nonnative species are present, or the habitat is modified or threatened habitat-altering land uses occur (Weedman *et al.* 1996, USFWS 2005).

In the Verde River basin, the Walker Creek, Red Tank Draw, and Spring Creek populations (Yavapai County) are considered stable-threatened, but the status of the Williamson Valley Wash population is unknown. The Santa Cruz River has three tributaries with extant populations of Gila chub: Sabino Canyon (Pima County) and Sheehy Spring (Santa Cruz County) have unstable-threatened populations, and Cienega Creek (Pima and Santa Cruz Counties) has the only known naturally-occurring stable-secure population of Gila chub. The San Pedro River basin has three extant, stable-threatened populations in Redfield Canyon (Graham and Pima Counties), O'Donnell Creek (Santa Cruz County), and Bass Canyon (Graham and Cochise Counties). Gila chub still occupy T4 Spring in the Babocomari River basin (Santa Cruz and Cochise counties), but it is very rare in this spring. The San Carlos River and the Blue River, (Gila and Graham counties), tributaries of the Gila River located on the San Carlos Apache Indian Reservation, are believed to have extant populations of Gila chub, but tribal survey information is confidential and proprietary (USFWS 2005).

The San Francisco River has two tributaries with extant stable-threatened populations, Harden Cienega Creek and Dix Creek (Greenlee County). The Agua Fria River has four tributaries with stable-threatened populations, Larry, Lousy, Silver and Sycamore Creeks (Yavapai County), as well as two unstable-threatened populations in Little Sycamore Creek and Indian Creek (Yavapai County). Two tributaries of the Gila River in Arizona have extant populations of Gila chub: Eagle Creek (Graham and Greenlee Counties) has an unstable threatened population, and Bonita Creek (Graham County) has a stable-threatened population. The Bonita Creek population is now somewhat protected by placement of a fish barrier and chemical renovation of the stream in 2008, although green sunfish and Gila topminnow have since reinvaded and additional renovation is planned (USFWS 2005, U.S. Bureau of Reclamation and Bureau of Land Management 2010, Marsh and Associates 2009).

In Mexico as recently as 1992, Gila chub occurred in two small spring areas, Cienega los Fresnos and Cienega la Cienegita, adjacent to the Arroyo los Fresnos (tributary to the San Pedro River), within 2 km (1 mi) of the Arizona-Mexico border, but are now thought to be extirpated (Varela-Romero *et al.* 1992, D. Duncan, FWS, pers. comm., 2009). No Gila chub remain in the Mexican portion of the Santa Cruz River (Weedman *et al.* 1996).

Reestablishment of Gila chub has been attempted in at least six Arizona sites. Lousy Canyon and Larry Creek, stocked with 200 Gila chub from Silver Creek in July 1995, are extant. Gardner Canyon (Cochise County) was stocked from Turkey Creek (Santa Cruz County) with 150 Gila chub in July 1988. In May 1995, no Gila chub or any other fish were captured during surveys. Turkey Creek, a tributary to the Babocomari River, was stocked with a small number of Gila chub in 2005, but is now thought to be extirpated (C. Crowder, AGFD, pers. comm., 2010). In 2005, Bear and Romero canyons in the Santa Rita Mountains were stocked with Gila chub from Sabino Canyon. Gila chub now appear extirpated from Bear Canyon (D. Mitchell, AGFD, pers. comm., 2009), but are doing well in Romero Canyon, where they can be considered stable-threatened (Ehret and Dickens 2009). Up to 200 Gila chub from the Agua Fria drainage (e.g., Indian Creek, Sycamore Creek, Little Sycamore Creek, or Silver Creek) are anticipated to be stocked into Grapevine Canyon in Yavapai County in 2010, but no date has been set at the time of this BO.

Gila Chub Critical Habitat

Critical habitat for Gila chub is designated for approximately 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. 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, USFWS 2005). 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 (Arizona);

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;

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 (USFWS 2005).

There are seven primary constituent elements (PCEs) 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 17°C to 24 °C (63°F to 75°F), and seasonally appropriate temperatures for all life stages (varying from about 10°C to 30°C [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 parts per million [ppm] to 10.0 ppm) and conductivity (i.e., 100 milliohms [mohms] to 1,000 mohms);
- 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 nonnative 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.

The FWS is currently in the process of forming a recovery team for Gila chub to develop and implement a recovery plan for the species. Until the recovery plan is completed, there is limited information with which to evaluate the ability of critical habitat to meet the recovery needs of the species, or determine how an action may alter the ability of critical habitat to meet recovery needs. In lieu of a recovery plan, assessing the functionality of each of the PCEs in a given reach of critical habitat and how an action might affect the PCEs of that reach can provide some insight into the effect of an action on the functionality of critical habitat in terms of recovery.

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 that 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.

A. Status of Gila Chub and Critical Habitat in the Action Area

Gila chub occur in Sycamore Creek, Little Sycamore Creek, and Indian Creek in the Agua Fria River drainage on the PNF (USFS 2010; USFWS 2005; Weedman *et al.* 1996). The Sycamore Creek population is classified as unstable-threatened based on threats from fire, grazing, and nonnative species (USFWS 2005). The Little Sycamore Creek population is classified as stable-threatened and Indian Creek as unstable-threatened. All three populations have been adversely affected by the Cave Creek Complex Fire in 2005. The majority of the Sycamore Allotment (23,257 acres) falls within the Sycamore Creek 6th code sub-watershed. There are 1,219 acres of the allotment within the Little Sycamore Creek 6th code sub-watershed. Only 92 acres of the project area are in the Indian Creek 6th code sub-watershed. There is no occupied or critical habitat for these two latter sub-watersheds within the Sycamore Allotment. The Little Sycamore and Indian Creek populations occur in small spring sites that are excluded by fencing from livestock grazing.

Gila chub distribution in Sycamore Creek is limited to a three mile reach between the Double T Waterfall downstream to the Rock Bottom Box in the Loball Pasture (Reach 2-Appendix A of the BA). The Rock Bottom Box site serves as an effective fish barrier to upstream movement of nonnative fish from lower Sycamore Creek (Reach 1). In addition, there is a 2.5-mile stretch of

dry channel between Reaches 1 and 2. Double T Waterfall is a barrier to fish migration from Reach 2 to Reach 3.

Land ownership of Reach 2 is Prescott NF. This reach is perennial-interrupted with chub occupying three main pool habitat areas (Figures 1-3 of the BA). Livestock grazing is limited in this reach of the creek due to the canyons and general inaccessibility to the stream. Gila chub and rainbow trout occur within this reach as well as nonnative crayfish (USFS 2010). The Gila chub population at the uppermost pool site at Double T Waterfall is considered healthy based on the presence of multiple size classes of chub. Occupancy at the Middle Box and Rock Bottom Box pool areas has been reduced due to filling in of the pools by sediment from the Cave Creek Fire that reduced pool volume. Occupancy at these two lower pool areas is expected to expand and contract based on annual stream flows and remnant pool volume. In October 2008, the Middle Box site was almost dry and only a small number of chub were observed in the pool (USFS 2010). This is more than likely a result of sedimentation from the Cave Creek Complex Fire. Also because of the fire-associated sedimentation, the Rock Bottom Box pool is typically dry and seldom holds Gila chub during base flow periods (June through October), but may be occupied during high flows.

A total of 19.5-miles of critical habitat occurs in Sycamore Creek, Little Sycamore Creek, and Indian Creek in the Agua Fria River drainage on the PNF. Critical habitat is not designated for Little Sycamore and Indian Creeks within the Sycamore Allotment; however, it does occur within both of these drainages downstream of the Sycamore Allotment. Critical habitat includes 11.4 miles of Sycamore Creek extending from its confluence with Little Sycamore Creek upstream to Nelson Place Spring near the Pine Mountain Wilderness (USFWS 2005). Approximately 10 miles of critical habitat occurs along Sycamore Creek in the project area. Land ownership is primarily PNF with four parcels of private land distributed along this critical habitat segment. Reach 1 is unoccupied critical habitat within the Loball Pasture and contains nonnative fish species that appear to limit the survival of Gila chub. Occupied critical habitat occurs along the three miles of Reach 2 in the Loball Pasture. Because of the Double T Waterfall, Reach 3 is unoccupied critical habitat within the Tule and Pine pastures and is currently only occupied by rainbow trout.

According to the final rule to list the Gila chub and designate critical habitat (USFWS 2005), the seven reaches designated as critical habitat play a vital role in the overall health of the aquatic ecosystem and, therefore, the integrity of upstream and downstream Gila chub habitat. Specifically, the final rule states that the critical habitat reach within the action area of this project (Area 7) represents part of the upper northwest area of the historical range of the Gila chub, and current Gila chub populations in the six drainages of this river area are healthy. There have been no reports of any diseases associated with the Gila chub in this area. Survey results indicate a good representation of all age classes. The final rule further states that critical habitat Area 7 is important in that conserving these Gila chub populations will help maintain representation of the species throughout its historical range. Approximately 19.5 miles of critical habitat out of 160.3 total designated miles (12 percent) occur within the action area and are important in conserving the species.

B. Factors Affecting Gila Chub and Critical Habitat Within the Action Area

Grazing has been ongoing in the Sycamore allotment since 1909, including within occupied critical habitat since it was designated in 2005. In 2005, the Cave Creek Complex Fire and associated suppression actions directly affected both the Gila chub and its critical habitat. Both the wildfire itself and burnout operations to stop the fire reached Sycamore Creek within Reaches 1 and 2. During the last five years, sedimentation associated with the loss of ground cover on burned slopes within the Sycamore Creek watershed has caused several pools to fill in and become shallower than they were before the fire. As described above, nonnative rainbow trout were stocked into the upper reaches of Sycamore Creek, occur with Gila chub in Reach 3, and have been carried down to Reach 2 by high flows. Nonnative green sunfish and fathead minnows have been documented below Rock Bottom Box in Reach 1. Nonnative crayfish also occur throughout Reaches 1 and 2.

EFFECTS OF THE PROPOSED 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 and interdependent with that action that will be added to the environmental baseline. 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.

We note that this biological opinion does not rely on the regulatory definition of “destruction or adverse modification” of critical habitat at 50 CFR 402.02. Instead, we have relied upon the statute and the August 6, 2004, Ninth Circuit Court of Appeals decision in *Gifford Pinchot Task Force v. U.S. Fish and Wildlife Service* (No. 03-35279) to complete the following analysis with respect to critical habitat.

Gila Chub

Gila chub occur only in Reach 2 of Sycamore Creek within the allotment, so effects to the Gila chub will only occur within this reach of Sycamore Creek within the action area. During high stream flow periods (winter and spring, typically December-May), chub can be found throughout Reach 2 in various pools; however, they are concentrated in three main pools (Double T Waterfall, Middle Box, and Rock Bottom Box pools). During the low stream flow periods (summer and fall, typically June-November), chub are restricted to the Double T Waterfall pool and, when conditions allow, Middle Box pool; however, because of sedimentation associated with the Cave Creek Complex Fire, the Middle Box Pool is not always occupied.

During the high-flow periods, access by livestock to all occupied pool sites is restricted by areas of bedrock that are only open to livestock at the lower ends of the pools. In addition to rough terrain that excludes livestock from most of Reach 2 during the high stream flow period, the depth of the pools in high stream flow periods will also likely exclude livestock from accessing occupied habitat during those months. The Double T Waterfall Pool is excluded from livestock access year round due to both the rough terrain features surrounding the lower end of the pool and the steep sides of this deep pool. Livestock grazing will not directly affect chub in this pool.

Livestock may access the lower two main pool sites during the low flow period; however, only the Middle Box pool holds enough water for chub during this period. The lower pool site (Rock Bottom Box) is typically dry during the low flow period as a result of sedimentation from the Cave Creek Complex Fire and, therefore, is not typically occupied by Gila chub during those months. No direct effects to chub will occur from livestock grazing during the low stream flow period at this pool.

Direct effects associated with cattle wading into occupied habitat within Reach 2 will likely be limited to the occupied Middle Box Pool during the summer-fall low stream flow period. The lower (downstream) end of this pool is accessible to livestock during the low stream flow period. Because of this pool's accessibility, direct injury to Gila chub as a result of trampling could occur. Eggs are typically laid in deep water and stick to submerged vegetation or the vertical walls of the pool and are not expected to be affected by livestock. After hatching, Gila chub young-of-the-year (fry) inhabit shallow water among plants or eddies, while older juveniles use higher velocity stream areas if they are available (Minckley 1973, Minckley and Deacon 1991). As the Gila chub move into the shallow waters of the Middle Box Pool during the low stream flow period, livestock could trample them.

Livestock access to the occupied habitat in Reach 2 of Sycamore Creek will occur during four months of the year for three out of four years with a full year of rest. Access to these pools will not always occur during the breeding season for the Gila chub, limiting the exposure of fry to livestock. The well development and additional waters in the upland pastures of the Loball Pasture are intended to reduce livestock reliance on watering from Sycamore Creek and, therefore, reduce the effects to chub, including trampling of fry. Although the well development, additional waters, and deferred rotation system are intended to reduce the effects of livestock grazing on Gila chub, adverse effects will not be completely eliminated.

Effects to Gila chub from the proposed action will mainly be indirect effects associated with habitat disturbance. Gila chub habitat downstream of the allotment is limited to a small perennial quarter mile stretch in Little Sycamore Creek, 0.5 mile from the allotment as well as approximately 0.6 miles of perennial water in Sycamore Creek in Reach 1 and downstream from its confluence. With a long dry stream channel between the allotment and a limited stretch of perennial stream habitat downstream, any sedimentation resulting from the proposed action would be insignificant. Although Gila chub are occasionally washed downstream of the allotment during flood events, they are unlikely to survive because of the overall ephemeral nature of the creek and competition and predation by nonnative fish in perennial stretches of the creek.

Indirect effects to Gila chub in Reach 2 will result from impacts to stream habitat from livestock grazing on riparian herbaceous and woody species along the stream, trailing and crossing the stream, and depositing waste products along occupied habitat. These actions could result in breakdown of stream banks and/or sedimentation and nutrient enrichment impacting habitat and water quality for the chub. Effects of stream bank erosion and sedimentation in chub habitat would be very low because the limited livestock access due to rough terrain, and also because of high stream bank stability due to predominately cobble/boulder substrates, rootwads of riparian trees that line the creek, and areas of non-erodible bedrock. In addition, management of livestock within the riparian area, including utilization limits on vegetation, is intended to avoid levels of use that could result in damage to the stream bank and loss of riparian vegetation. The

PNF will monitor this management to ensure that the riparian area remains in proper functioning condition.

In addition to the indirect effects that will occur to Gila chub as a result of livestock grazing within occupied Reach 2, indirect effects to the fish will occur within this reach from grazing activities in the uplands above Reaches 2 and 3 as well as grazing within parts of Reach 3 (unoccupied). The impact of livestock trampling on soil compaction bulk density and subsequent effects on forage growth has been documented. In Kaufman and Krueger (1984), data indicate that compaction increased linearly with increases in grazing intensity. Alderfer and Robinson (1949) (in Kaufman and Krueger 1984) found grazing and trampling Kentucky bluegrass upland pastures to a one-inch (2.5 cm) stubble height reduced vegetation cover, lowered yields, decreased noncapillary porosity, and increased the volume weight of the 0-1 inch (0-2.5 cm) layer of soil. The PNF will incorporate a management program of deferred/rest-rotation of pastures, limit the utilization rates and conduct associated monitoring, and construct water improvements on the uplands. This management is expected to minimize these effects in all four pastures, especially upstream of Reach 2 and in the uplands above both Reach 2 and Reach 3 and, therefore, reduce the indirect effects to the Gila chub and its habitat.

Reach 3 is approximately 1.6 miles long with a one mile stretch of perennial water and 0.6 miles of dry channel. Livestock are excluded from the one mile perennial stretch of Reach 3 by fencing, except for one water lane. Because of the one mile enclosure, cattle will not directly affect the perennial stretch of Reach 3 and, therefore, will not have significant effects to the creek above chub-occupied Reach 2. Although short-term vegetation removal and soil compaction and disturbance are likely to occur from grazing within the uplands above Reaches 2 and 3, vegetation utilization limits in the uplands and the proposed deferred rotation grazing system will improve conditions in the watershed and minimize the amount of erosion due to grazing. The deferred/rest-rotation plan and associated utilization rates will also ensure that adequate food sources (invertebrates and aquatic plants) are available throughout occupied Reach 2. Specifically, this management program will ensure that sufficient cover is left for the terrestrial and aquatic invertebrates that chub eat, thereby maintaining that prey base.

The installation of the gully structures in the Holding pasture may result in short-term disturbance to surrounding soils and vegetation during construction and installation; however these structures are anticipated to contribute towards the long-term improvement of the watershed and soil conditions, as well as reduce excess sedimentation into Reach 1 of Sycamore Creek. Expanding the Tule and Double T corrals and installing the cattleguard as described in the proposed action may result in some amount of soil disturbance; however the effects of these range improvements are anticipated to be insignificant and discountable due to their small area of surface disturbance and because no new roads will be constructed in association with these range improvements.

Under the current livestock grazing management, Sycamore Creek is a significant and important water source for cattle. Installation of any of the water feature options will reduce cattle use of Sycamore Creek for watering and, therefore, reduce the effects of this livestock use to chub and habitat in the creek. Options 2 and 3 occur outside of Sycamore Creek and will not have direct or indirect effects to Gila chub if one of those options is implemented. Option 1 is the preferred option and includes drilling a well on private property in a dry section of Sycamore Creek, on a bench just south of the main channel between Reaches 1 and 2 and is approximately 1.25 miles

downstream of occupied habitat. Gila chub are occasionally washed downstream during flood events; however these downstream sections of Sycamore Creek typically either dry out quickly or contain nonnative fish that prey upon and out-compete chub. Potential effects to Gila chub resulting from installation of the water features include reduction of subsurface flows that could reduce pool habitat downstream as well as reduce riparian vegetation that provides both streambank stability and cover for the fish. The potential reduction in stream flow from the well is estimated by comparing groundwater withdrawal rates to stream flow (Table 7 of the BA). The two to four gallon per minute (gpm) estimate for well pumping was obtained from PNF range staff and is more likely to be closer to two gpm because of pumping uphill. The stream flow numbers in Table 7 of the BA are those given as the median stream flows for Sycamore Creek from 2001 – 2008 in the application for in-stream water rights (USFS 2010). The greatest impact to stream flow would be during base flows conditions (June – November), where the percent change in flow will range from approximately 12 percent (two gpm) to 25 percent (4 gpm) at its peak. The PNF will install a piezometer with a pressure transducer to measure stream level and will work with the permittee to establish a maximum drawdown rate to ensure adequate ground water is moving through the system in order to minimize the effects to stream flow and downstream Gila chub habitat. A data logger will be installed in the well to record water levels over time. If monitoring shows more than expected stream drawdown due to this well, then the installation of the trick tank in the Loball Pasture, as described in the proposed action section above, will occur to minimize the effects and allow for more natural flow patterns in Reach 1. The greatest effects to stream flow below the well will occur during base flow period of June to September, which is when Sycamore Creek downstream of the allotment (within the action area) is typically dry and Gila chub do not occur there. Effects to Gila chub that get washed downstream are expected to be insignificant and discountable, especially when compared to the effects of the natural flooding/drying cycle of the creek below Reach 2 within the action area.

Critical Habitat

Only a small parcel of Indian Creek watershed (approximately 92 acres) occurs along a ridge-top within the allotment, above Indian Creek. Critical habitat in Indian Creek occurs approximately one mile downstream of the allotment; however, the small size of the watershed included in the Sycamore Allotment (92 acres of upland) and the distance to the nearest critical habitat makes any effects to that critical habitat insignificant and discountable. Therefore, critical habitat within Indian Creek downstream of the allotment will not be subjected to any effects associated with this proposed action.

Little Sycamore Creek does not occur within the allotment. Approximately three miles of critical habitat occurs along Little Sycamore Creek downstream of the allotment. Most of the three miles of Little Sycamore Creek is dry and is a mix of private and PNF land. Little Sycamore Creek is perennial for about a mile upstream from its confluence with Sycamore Creek. Gila chub occupy critical habitat in Little Sycamore Creek in a quarter-mile stretch of perennial habitat associated with Canyon Water Spring, which is bounded on both sides by long stretches of dry channel. Little Sycamore Creek is part of the PNF's Willow Allotment and effects to Gila chub critical habitat were previously consulted on in 2007 (22410-22410-2007-I-0545). Approximately 1,200 acres of the Little Sycamore Creek watershed occur on the uplands that drain into Willow Spring Gulch, a tributary to Little Sycamore Creek. The Sycamore Allotment boundaries are approximately 0.5 mile from the critical habitat. We believe that at this distance and with the proposed livestock management, any contribution of livestock grazing

to sedimentation in Little Sycamore Creek will be undetectable. Additionally, the effects of the proposed action for the Sycamore Allotment are not expected to be beyond what was consulted on for the Willow Allotment. Therefore, effects to critical habitat downstream of the Sycamore Allotment will not be considered further in this BO.

Within the Sycamore Creek watershed, critical habitat for Gila chub occurs mostly within the Sycamore Grazing Allotment. Of 11.4 miles of critical habitat along Sycamore Creek, approximately 1.5 miles of unoccupied critical habitat occurs downstream of the allotment.

As described in the Status of the Species above, there are seven PCEs of critical habitat, which include those habitat features required for the physiological, behavioral, and ecological needs of the species. In this BO, we will analyze the effects of the proposed action (livestock grazing and range improvements) within the action area as it pertains to each PCE. Livestock grazing will occur within critical habitat for the Gila chub in three of the pastures (Tule, Pine, and Lowball) three out of four years. The fourth pasture does not contain critical habitat. Each portion of critical habitat within the three pastures will be exposed to grazing for up to four months followed by a full year of rest. During the high stream flow period (December-May), livestock will have limited access to critical habitat along Sycamore Creek due to the terrain features previously described. Livestock access to critical habitat along Sycamore Creek will have the most effects during the low stream flow period and we will focus our effects within the action area for that time period.

Range improvements will not occur within critical habitat and, therefore, will not adversely affect any of the PCEs of critical habitat for the Gila chub. Of the three options proposed for development of a water feature in the uplands (including drilling new wells), two of them (Options 2 and 3) will be on the uplands outside of Sycamore Creek and Little Sycamore Creek and, therefore, outside of critical habitat. The Option 1 well will be placed within a typically dry section of Sycamore Creek on private land. Installation of well Option 1 will not affect critical habitat upstream in Reaches 2 and 3.

Perennial Pools, Areas of Higher Velocity Between Pools, and Areas of Shallow Water Among Plants or Eddies

Livestock grazing on riparian herbaceous and woody species along the stream, trailing, and crossing the stream may result in some breakdown of the stream banks and/or sedimentation in the perennial pools that Gila chub occupy. Livestock access to the three main perennial pools is limited, however, due to rough terrain (primarily the occupied critical habitat in Reach 2) and the one mile stream enclosure in Reach 3. Sycamore Creek has high stream bank stability due to predominately cobble/boulder substrates, rootwads or riparian trees lining the creek, and large areas of exposed bedrock (USFS 2010). The current high stream bank stability will ensure that perennial pool habitat will be maintained in the presence of livestock grazing. Because of these features, livestock grazing is not expected to have a significant effect on the PCE of perennial pools within the action area.

The installation of Well Option 1 is not anticipated to significantly affect the PCE of perennial pools, high velocity flows between pools, and areas of shallow water downstream of the well site within the action area. Most of this area is typically dry and the stream only flows during seasonal rain events or after winter snowmelt. Any drawdown of the subsurface flow would be discountable since most of this part of the action area is typically dry. We do not anticipate the

proposed action to impede the ability of this PCE to contribute to the conservation and recovery of the chub, nor do we expect it to affect the function and conservation role of this critical habitat area (Area 7).

The conservative and moderate utilization levels for riparian vegetation in all reaches, along with the other proposed management practices will aid in minimizing the effects to this PCE. The proposed well developments will also aid in discouraging livestock from lingering in Sycamore Creek within the critical habitat, further minimizing the effects to this PCE.

Water Temperatures for Spawning and Seasonally Appropriate Temperatures for All Life Stages
Because of the management practices of deferred/rest-rotation, utilization rates and monitoring, and water improvements in the uplands, livestock grazing is not expected to adversely affect the PCE associated with water temperature. The 20 percent limit on utilization of current year's production on selected key riparian woody species (willow, cottonwood, ash and alder) and the 50 percent use limit on selected key riparian herbaceous species will allow for sufficient stream shading to maintain water temperatures needed for spawning and the current seasonal range of temperatures that is supporting all life stages. Additionally, the one year of rest that will occur for each pasture will further ensure that riparian vegetation has the ability to maintain its productivity and vigor, further ensuring that adequate temperatures are maintained for all life stages of the Gila chub.

The area where Well Option 1 will be placed is typically dry and has mostly subsurface flows during the base flow period. Downstream of where Well Option 1 will be placed is also mostly dry, with the exception of the previously described limited perennial stretch in Reach 1. Well Option 1 will not result in a reduction of the associated riparian vegetation along Sycamore Creek, nor will it lead to any pools shrinking and, therefore alter water temperatures within the action area downstream of the well site. Because of this, the PCE of water temperature will not be affected by placement of Well Option 1 on private land between Reach 1 and Reach 2. We do not anticipate the proposed action to impede the ability of this PCE to contribute to the conservation and recovery of the chub, nor do we expect it to affect the function and conservation role of this critical habitat area (Area 7).

Water Quality with Reduced Levels of Contaminants, Including Excessive Levels of Sediments Adverse to Gila Chub Health, and Adequate Levels of pH, Dissolved Oxygen and Conductivity
The PCE of water quality is, perhaps, the most likely to be adversely affected by livestock grazing. The effects to water quality from grazing on riparian vegetation, trailing, and livestock crossings would be similar to the effects to the perennial pools described above and, similarly, should be minimal due to the proposed conservation measures and management practices that keep cattle from lingering in the riparian area and the rocky nature of the stream bed. Short-term effects to water quality are expected from livestock waste products being introduced directly into the aquatic habitat as livestock graze. The current livestock grazing program has maintained water quality ratings as "Attaining" according to Arizona Department of Environmental Quality (ADEQ) standards, indicating that livestock use along the creek or in the uplands is not contributing to long-term adverse effects to water quality (USFS 2010). The proposed management of livestock grazing in the uplands, along with the proposed conservation measures, will further ensure that soil conditions are either maintained or improved and will not, therefore, contribute sediments above levels associated with natural conditions. Rooted streamside plants retard streambank erosion and filter sediments out of the water (Belsky *et al.* 1999). The

conservative and moderate utilization rates described in the proposed action will further ensure that rooted streamside plants are maintained. We expect long-term effects to water quality will be minimal. We do not anticipate the proposed action to impede the ability of this PCE to contribute to the conservation and recovery of the chub, nor do we expect it to affect the function and conservation role of this critical habitat area (Area 7).

The effects of Well Option 1 on this PCE are anticipated to be similar to those effects associated with the PCE of water temperature above and will also not affect this PCE. Additionally, installation of the gully structure in the Holding Pasture will reduce sedimentation flow into Sycamore Creek, which will have an overall benefit to the water quality downstream of this structure in the action area, when high stream flows occur. We expect long-term effects to water quality will be minimal. We do not anticipate the proposed action to impede the ability of this PCE to contribute to the conservation and recovery of the chub, nor do we expect it to affect the function and conservation role of this critical habitat area (Area 7).

Prey Base Consisting of Invertebrates and Aquatic Plants

The utilization rates for riparian vegetation along with the utilization rates for upland vegetation as well as the pasture rotations/rest will also ensure that the food base for the Gila chub is not altered. The prey base for Gila chub can be affected by changes in water quality, water quantity, water temperature, and vegetative structure. The first three factors in the presence of prey base are also PCEs of critical habitat for the chub. The proposed action will not affect these PCEs significantly enough to diminish this PCE. Currently, livestock management with utilization rates of greater than 50 percent has resulted in increased sedimentation in various areas of the allotment; however, this can be difficult to discern from the increased sedimentation resulting from the Cave Creek Complex Wildfire. The vegetative structure will be maintained through the established utilization rates, which are less than the current rates. The reduction in utilization rates, along with the other management practices are intended to improve the overall range conditions and should, therefore, promote the food base by reducing sedimentation into the creek.

Similar to the effects to water quality, installation of the gully structure in the Holding Pasture will reduce sedimentation flow into Sycamore Creek, which will have an overall benefit to the PCE of food base downstream of this structure in the action area. Because much of the area is dry and not regularly occupied downstream of the proposed well structure, installation of Well Option 1 is not expected to affect the PCE of prey base. We do not anticipate the proposed action to impede the ability of this PCE to contribute to the conservation and recovery of the chub, nor do we expect it to affect the function and conservation role of this critical habitat area (Area 7).

Sufficient In-Stream Cover, a High Degree of Stream Bank Stability, and a Healthy, Intact Riparian Vegetation Community

The effects of the proposed grazing program on the PCE of stream cover/stream bank stability/riparian health are anticipated to be similar to those described above for the effects to the perennial pools. While short-term depletion in riparian vegetation will likely occur, the proposed grazing management and conservation measures will ensure that the effects are minimized and that the existing riparian vegetation will be maintained or enhanced. The proposed monitoring of the utilization rates will also aid in minimizing effects of grazing. Once the set utilization rates are reached in the riparian areas, livestock will be removed from

Sycamore Creek to another part of the pasture. This monitoring program and removal of livestock from the creek when standards are met will further ensure that long-term adverse effects to Gila critical habitat are minimized. Given that the proposed grazing management is more conservative in its utilization rates and conservation measures to protect the Gila chub and its critical habitat, it is unlikely that the proposed management will have long-term effects to this PCE. We do not anticipate the proposed action to impede the ability of this PCE to contribute to the conservation and recovery of the chub, nor do we expect it to affect the function and conservation role of this critical habitat area (Area 7).

Habitat Devoid of Nonnative aquatic Species Detrimental to Gila Chub

Nonnative fish species such as green sunfish and fathead minnows (present in Reach 1) are both predators of and competitors with Gila chub. Nonnative crayfish also compete for food sources as well as degrade the overall habitat quality in the aquatic ecosystems they inhabit. It is important that Gila chub habitat either be devoid of these nonnative species or that these detrimental nonnative species are kept at a level that allow Gila chub to continue to survive and reproduce. Livestock grazing is not anticipated to increase the numbers of nonnative aquatic species in Sycamore Creek, or alter habitat to favor nonnative species. We do not anticipate the proposed action to impede the ability of this PCE to contribute to the conservation and recovery of the chub, nor do we expect it to affect the function and conservation role of this critical habitat area (Area 7).

Streams That Maintain a Natural Flow Pattern Including Periodic Flooding

Livestock grazing within the critical habitat is also not expected to affect the natural flow patterns. The banks are stable under the current grazing management program and the natural flow pattern has remained intact, including periodic flooding. The grazing program under the proposed action is more conservative and is expected to significantly improve the overall conditions of both the creek and the uplands.

The main effect to this PCE will be from installation of Well Option 1. Because Sycamore Creek is a spring-dominated system, potential reductions in stream flow and, therefore, effects to the PCE of natural flow pattern are expected to be localized to the disturbance footprint of where the well is installed and downstream of the well in Reach 1. The greatest impact to stream flow would be during base flows conditions (June – September), where the percent change in flow will range from approximately 12 percent (at two gallons gpm of pumping) to 25 percent (at 4 gpm of pumping). The PNF will install a piezometer with a pressure transducer to measure stream level and will work with the permittee to establish a maximum drawdown rate to ensure adequate ground water is moving through the system in order to minimize the effects of downstream Gila chub critical habitat PCEs (perennial pools and natural flow patterns). A data logger would be installed in the well to record water levels over time. If monitoring shows more than expected stream drawdown due to this well, then the installation of the trick tank in the Loball Pasture, as described in the proposed action section above, will occur to minimize the effects and allow for more natural flow patterns in Reach 1.

While the installation of the water feature associated with Option 1 will result in a drawdown of water flowing in Sycamore Creek, it will also reduce the time cattle spend in Sycamore Creek watering. Water consumption on Sycamore Creek will still occur but at lower numbers of cattle. Rather than having up to 450 cows within critical habitat for four months, the two additional upland waters in the Loball Pasture are expected to provide water to about 100 cattle each based

on trough locations, forage availability, and livestock distribution. The conservation measures and management practices that are part of the proposed action will allow for a naturally flowing system, including allowing for the importance of periodic flooding. The combination of additional waters and monitoring the well associated with Option 1, along with the proposed management and conservation measures are anticipated to reduce the long-term effects to the PCEs of critical habitat from the proposed action and likely provide an overall benefit to the PCEs and chub in the creek. We do not anticipate the proposed action to impede the ability of this PCE to contribute to the conservation and recovery of the chub, nor do we expect it to affect the function and conservation role of this critical habitat area (Area 7).

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. Since the land within the action area is almost exclusively managed by the Forest Service, most activities that could potentially affect listed species are Federal activities and subject to additional section 7 consultations.

Future non-Federal actions within the project area that may be reasonably certain to occur include the potential development and/or modification of private property in-holdings and unregulated recreation. This part of the PNF is popular for recreational activities such as hiking, birding, off-highway vehicle riding, and hunting. These activities may result in increased overland flow and/or sedimentation into aquatic species habitat and the potential for nonnative aquatic species introductions. We anticipate that cumulative effects could occur from all of these activities.

CONCLUSION

After reviewing the anticipated effects of the proposed action for the Sycamore Livestock Grazing Project, the environmental baseline for the action area, the current status of the Gila chub and its critical habitat, and the cumulative effects, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the Gila chub and will not adversely modify its critical habitat. We base this conclusion on the following:

1. Livestock access to occupied pool habitat is limited due to rough terrain, steep walls on most of the pools, and exposed bedrock surrounding most pools. These terrain features will minimize the impacts to pool habitat, maintain suitable habitat conditions, and limit direct impacts to Gila chub.
2. The ecological condition of the area should be maintained or improved during the 10-year life of the grazing program. This will lessen the overall impacts to the uplands from livestock grazing, aiding in improved hydrologic conditions within the watershed.
3. The proposed water features that will be constructed on the uplands will aid in reducing the amount of time livestock spend in Sycamore Creek. Reducing the

amount of time livestock linger in the creek will further ensure that the PCEs of critical habitat are not subjected to long-term adverse effects and that their functionality is maintained and, in some cases enhanced. The short-term effects will be minimized by the rotation schedule previously described.

4. The proposed livestock management program is more conservative than what is currently allowed and will allow for the long-term survival of Gila chub and maintenance of its critical habitat along Sycamore Creek. Under the proposed management program, the conservation role and function of critical habitat will be maintained.
5. The proposed corral expansions and cattleguards will occur outside of occupied habitat and critical habitat and will, therefore, have no effect on either the Gila chub or its critical habitat. The gully structure proposed for the Holding Pasture will reduce the current sediment load from the uplands running into unoccupied critical habitat in Reach 1 as well as downstream of the allotment. This feature will improve the overall Gila chub habitat quality in Reach 1 as well as improving the PCEs of critical habitat in that reach, thus maintaining or improving the functionality of critical habitat in Reach 1 and downstream of the allotment.

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 further 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.

AMOUNT OR EXTENT OF TAKE ANTICIPATED

Using available information as summarized within this document, we have identified conditions of possible incidental take for the Gila chub associated with the proposed action within the Sycamore Creek. Based on the best available information concerning the Gila chub, habitat needs of the species, the project description, and information furnished by the PNF, take is anticipated for the Gila chub in the form of harm, harassment, and direct mortality as a result of livestock grazing and watering in the shallow waters of Sycamore Creek, including occupied pools.

We anticipate that the take of individual Gila chub will be difficult to detect because finding a dead or impaired specimen is unlikely. Therefore, it is not possible to provide the specific numbers of Gila chub that will be harassed, harmed, or killed as a result of the proposed action. In such instances where take is difficult to detect and/or quantify, take may be quantified in terms of the species habitat that may be diminished or removed by the action. Consistent with the 2005 Forest Service Southwest Region Land Resource Management Plan (LRMP) BO (consultation number 2-22-03-F-366), we are quantifying take to include habitat characteristics important to Gila chub (e.g., pool habitat), and using this habitat surrogate measure to help identify when take has been exceeded. We reviewed the prescriptions for take outlined on page 398 of the LRMP BO to identify when take has been exceeded. As provided for in the LRMP BO, the authorized level of incidental take of Gila chub from the proposed action will be exceeded if currently occupied pool habitat throughout Reach 2 is diminished at either the reach scale (i.e. number of pools reduced) or the scale of an individual pool (i.e. quality of pools degraded). The amount of pool habitat as measured during field surveys at base flow conditions (outside of extreme drought) must be maintained for chub. Standard protocol, such as the Forest Service Region 3 Stream Inventory Methodology (Version 3.1, 2005), can be used to document the amount and quality of pool habitat.

The FWS will not refer the incidental take of any migratory bird or bald eagle for prosecution under the Migratory Bird Treaty Act of 1918, as amended (16 U.S.C. §§ 703-712), or the Bald and Golden Eagle Protection Act of 1940, as amended (16 U.S.C. §§ 668-668d), if such take is in compliance with the terms and conditions (including amount and/or number) specified herein.

EFFECT OF THE TAKE

In this biological opinion, we have determined that this level of anticipated take is not likely to result in jeopardy to this species nor will it adversely modify its critical habitat.

REASONABLE AND PRUDENT MEASURES WITH TERMS AND CONDITIONS

The following reasonable and prudent measure is necessary and appropriate to minimize take of Gila chub:

1. PNF shall provide us a report documenting the results of their monitoring efforts, including pool habitat and fish populations throughout Sycamore Creek.

TERMS AND CONDITIONS

In order to be exempt from the prohibitions of section 9 of the Act, PNF must comply with the following terms and conditions, which implements the reasonable and prudent measure described above, and outlines reporting/monitoring requirements. These terms and conditions are non-discretionary.

- 1.1 A monitoring report containing a habitat assessment and management recommendations will be submitted to our office upon completion of monitoring the Middle Box Pool. Additionally, monitoring of all pool habitat throughout all three

reaches was proposed by PNF as part of the proposed action. The results of that monitoring should be included in the same report and provided to our office by December 15 of each year.

Additionally, the reasonable and prudent measure with terms and conditions are carried forward from the 2005 LRMP BO and can be found in that document (pages 399-400).

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 measure provided. The PNF must immediately provide an explanation of the causes of the taking and review with the AESO the need for possible modification of the reasonable and prudent measure.

Disposition of Dead or Injured Listed Species

Upon locating a dead, injured, or sick listed species initial notification must be made to the FWS's Law Enforcement Office, 2450 West Broadway Road #113, Mesa, Arizona [telephone: (480) 967-7900] 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 injured animals to ensure effective treatment and care, and in handling dead specimens to preserve biological material in the best possible condition. If feasible, the remains of intact specimens of listed animal species shall be submitted to educational or research institutions holding appropriate State and Federal permits. If such institutions are not available, the information noted above shall be obtained and the carcass left in place.

Arrangements regarding proper disposition of potential museum specimens shall be made with the institution prior to implementation of the action. Injured animals should be transported to a qualified veterinarian by a qualified biologist. Should any treated listed animal survive, the Service should be contacted regarding the final disposition of the animal.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to use 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.

1. We recommend that you pursue opportunities to restore Gila chub habitat that has been adversely affected by sedimentation as result of the Cave Creek Complex Wildfire.
2. We recommend that you assist us with the development of a recovery team for the Gila chub and an associated recovery plan.

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

REINITIATION NOTICE

This concludes initiation of formal consultation on your proposal to rehabilitate the suppression action areas associated with the August Fire south of Prescott, Arizona. 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 a 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. If conservation measures or other aspects of the proposed action are not implemented as anticipated herein, including schedules for implementation, reinitiation may be warranted pursuant to 50 CFR 402.16(b).

The FWS appreciates the PNF's efforts and consultation to identify and minimize effects to listed species from the project. We encourage you to coordinate the review of this project with the Arizona Game and Fish Department.

Any questions or comments should be directed to Brian Wooldridge (928) 226-0614 (x105) or Brenda Smith (x101) of our Flagstaff Sub-office.

Sincerely,

/s/Brenda Smith for

Steven L. Spangle
Field Supervisor

cc (Electronic):

District Ranger, Verde Ranger District, Prescott National Forest, Camp Verde, AZ
Fisheries Biologist, Verde Ranger District, Prescott National Forest, Camp Verde, AZ (Attn: Albert Sillas)
Assistant Field Supervisor, Fish and Wildlife Service, Phoenix, AZ (Attn: Ryan Gordon)
Chief, Habitat Branch, Arizona Game and Fish Department, Phoenix, AZ
Regional Supervisor, Arizona Game and Fish Department, Mesa, AZ (Attn: Trevor Buhr)
Permittee, Bar K Bar Ranch, Morristown, AZ (Attn: Edward Knipp)
Assistant Field Supervisor, Fish and Wildlife Service, Flagstaff, AZ (Attn: John Nystedt)

cc (hard copy):

Director, Hopi Cultural Preservation Office, Kykotsmovi, AZ

Supervisor, Cultural Preservation Program, Cultural Resources Department, Salt River Pima-Maricopa Indian Community, Scottsdale, AZ

Director, Apache Cultural Program, Yavapai-Apache Nation, Camp Verde, AZ

Director, Yavapai Cultural Program, Yavapai-Apache Nation, Camp Verde, AZ

Director, Cultural Research Program, Yavapai-Prescott Indian Tribe, Prescott, AZ

Environmental Specialist, Environmental Services, Western Regional Office, Bureau of Indian Affairs, Phoenix, AZ

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