United States Department of the Interior
U.S. Fish and Wildlife Service
2321 West Royal Palm Road, Suite 103
Phoenix, Arizona 85021
Telephone: (602) 242-0210 FAX: (602) 242-2513

AESO/SE
2-21-99-F-022 December 19, 2000

Mr. Delvin Lopez
District Ranger
Tonto National Forest
Cave Creek Ranger District
40202 N. Cave Creek Road
Scottsdale, Arizona 85262

Dear Mr. Lopez:

This document transmits the Fish and Wildlife Service's (Service) biological opinion based on our review of the proposed Red Creek Allotment grazing strategy and associated improvements located on the Cave Creek Ranger District of the Tonto National Forest, Arizona, and its effects on southwestern willow flycatcher (*Empidonax traillii extimus*), cactus ferruginous pygmy-owl (*Glaucidium brasilianum cactorum*), Gila topminnow (*Poeciliopsis occidentalis occidentalis*), and loach minnow (*Rhinichthys cobitis*) in accordance with section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.). Your April 21, 2000, request for formal consultation was received on April 24, 2000.

This biological opinion is based on information provided in the April 2000 biological assessment and evaluation (BAE), the April 21, 2000, Biological Assessment for Issuing Term Grazing Permits, the October 1999 Environmental Assessment (EA), the December 1999 biological assessment and evaluation for fish within the allotment (fish BAE), the Forest Plan, the Tonto National Forest Land Management Plan, and the August 25, 1998 Grazing Criteria, and other sources of information. A complete administrative record of this consultation is on file at this office.

CONSULTATION HISTORY

Prior to 1989, the Red Creek Allotment was managed jointly with the Skeleton Ridge Allotment. A joint management plan was approved for the two allotments on August 22, 1985. The plan was amended on November 27, 1985, to allow for construction of a gap fence and corral, and again on May 23, 1988, for construction of additional fencing. The Red Creek and Skeleton Ridge allotments are now managed separately. A separate BAE was prepared on the management plan for both the Skeleton Ridge and Ike's Backbone allotments on September 8,

1989. The BAE was amended on July 3, 1996.

On October 23, 1997, the Southwest Center for Biological Diversity and Forest Guardians filed a Complaint for Declaratory and Injunctive Relief, challenging the legality of livestock grazing on allotments on the Apache-Sitgreaves, Coconino, Coronado, Gila, Prescott, and Tonto National Forests. The complaint contended that the Forest had violated the Act by failing to formally consult with the Service on the effects of authorizing grazing on specific grazing allotments. In response, the Forest Service established a team composed of a leader, representative biologists and rangeland specialists from the Forest Service, and advisors from the Service. To facilitate the work of the team, the Forest Service developed guidance criteria for reauthorizing livestock term grazing permits (USFS 1998a).

Based on the guidance criteria, the Forest Service made adverse effects determinations to Gila topminnow (topminnow) and southwestern willow flycatcher (flycatchers) within the BAE for the Red Creek Allotment. The Forest Service then modified the Annual Operating Plans to avoid these adverse effects, and the Cave Creek Ranger District made a "no effect" determination after committing to deferring grazing on the Red Creek drainage or in the Red Hills Pasture until after formal consultation had been completed.

The Forest Service determined that the action as proposed is not likely to adversely affect bald eagle (*Haliaeetus leucocephalus*), Mexican spotted owl (*Strix occidentalis lucida*), lesser long-nosed bat (*Leptonycteris curasoae yerbabuenae)*, razorback sucker (*Xyrauchen texanus*), Colorado pikeminnow (*Ptychochelius lucius*), or spikedace (*Meda fulgida*). Concurrence from the Service was granted through the Grazing Team for the Forest Service's determination. These species are not considered or evaluated further within this biological opinion. At the recommendation of the team, formal consultation was subsequently requested by the Forest Service for loach minnow, topminnow, flycatcher, and cactus ferruginous pygmy-owl (pygmy-owl). Since this project was first evaluated by the Grazing Team, an official date for initiating consultation was not determined. The Service agreed to submit a final biological opinion by December 15, 2000.

BIOLOGICAL OPINION

I. DESCRIPTION OF THE PROPOSED ACTION

As described in the BAE, the Forest Service designed the proposed action to develop and implement a grazing strategy, including the construction of any improvements necessary to implement that strategy, that is consistent with the Tonto National Forest Land Management Plan (LMP) (USFS 1985). The BAE indicates that the proposed action is needed to address management concerns as they relate to the Forest's LMP, including: 1) whether or not the impact of current grazing activities is consistent with the Forest Plan's direction for management of threatened or endangered species, and/or designated critical habitat; and 2) whether the impact of current grazing activities is consistent with the Forest Plan's direction for management of

riparian and/or upland species. The BAE is intended to analyze the effects of the proposed Red Creek Allotment Management plan on endangered or threatened species and critical, suitable, and potential habitat for these species.

The proposed action is to develop a new grazing strategy for the Red Creek Allotment that will meet Forest Plan objectives, standards, and guidelines. Initially, an EA was prepared and used to evaluate six alternatives for management (USFS 1999). The Forest Service determined that Alternative E is the preferred alternative, and requested formal consultation on that alternative. Under Alternative E, the Red Creek Allotment would be used as a yearlong cow/calf operation, with yearling carryover from January 1 to May 31 each year. Alternative E is the proposed action under consultation within this biological opinion.

The proposed action would decrease the number of cattle permitted on the allotment from 519 adult cattle year-round and 339 yearlings (natural increase) from January 1 to May 31 to 380 adult cattle year-round and their natural increase from January 1 to May 31. Additionally, yearling cattle could be removed in the event of a drought period. The Forest Service proposes utilization levels of 40 percent or less in riparian areas and 35 percent or less in upland areas, according to the BAE. Additional changes would be made to pasture combinations and season of use. The season of use for the Red Creek Pasture would change from its current use of 3.5 months every other spring to four months of use every other winter. The size of the overall area being grazed as the Red Creek Pasture would be reduced, as it was previously used with the Soda Springs and Yellowjacket pastures in one large pasture encompassing 18,733 acres, and is now being used as a pasture on its own that encompasses only 7,226 acres. Additionally, one trick tank would be built in the Red Creek pasture. The Forest Service also proposes a fence at Thicket Spring tank that would discourage concentration of cattle in Red Creek.

No grazing would occur along the Verde River, as the Red Hills Pasture would no longer be used. The Tangle Creek and Red Creek pastures would be used as winter pastures, with use alternating every other year between the two pastures. For each pasture, four months of use (November through February) would occur, followed by 1.75 years of rest while the alternating pasture is used from November through February.

The Roundtree/Cedar/Tangle Creek Pasture was previously used for 3.5 months every other year under a modified Santa Rita grazing system. Under the proposed action, the Tangle Creek Pasture would be used in rotation with the Red Creek Pasture, receiving four months of use between November and February. The Tangle Creek Pasture, when combined with the Roundtree and Cedar Pastures, encompassed 15,087 acres, and will now incorporate 6,643 acres.

The Soda Springs and Yellowjacket pastures (previously combined with the Red Creek Pasture) and the Roundtree and Cedar pastures (previously combined with the Tangle Creek Pasture) would be used in conjunction with the Mustang Pasture, as four pasture units. The Soda Springs/Yellowjacket/Red Creek Pasture totaled 18,733 acres. Managed separately, Soda Springs would encompass 8,019 acres, while the Yellowjacket Pasture would encompass 3,488

acres. The Roundtree and Cedar pastures, when combined with the Tangle Creek Pasture, encompassed 15,087 acres. As proposed, the Roundtree/Cedar Pasture would include 8,444 acres. Each of the four pastures (Mustang, Yellow Jacket, Lower Soda/Upper Soda, and Cedar/Roundtree) would receive use in various parts of the year for 2.5 to 3 months at a time, as follows: first year, spring and early summer; second year, mid-summer; third year, late summer and fall; and fourth year, complete rest.

The Cedar Push Pasture, encompassing 1,437 acres, would be used as a gathering/shipping pasture in April and May of each year, as opposed to its current use for three days prior to shipping at the end of May. The Yellowjacket Holding Pasture and corrals are currently used between summer pasture moves in July. There is no proposed use for this pasture under the proposed action. Similarly, the Palo Verde Pasture will no longer be used.

According to the fish BAE, the proposed changes in pasture combinations, the decrease in total acres available for grazing (due to removal of the Red Hills Pasture), and the decrease in the number of allowed cattle will result in an increased stocking rate from 8.9 equivalent acres/animal month to 6.0 equivalent acres/animal month.

The Forest Service proposes making the following improvements in order to utilize the above schedule:

1. Construct two trick tanks in the Tangle Pasture and one in the Red Creek pasture to try to improve livestock distribution and draw livestock away from riparian areas.

2. Develop horizontal wells to replace water sources in the Tangle Pasture lost when a portion of Red Creek was fenced to exclude cattle. The wells may also help to draw livestock out of the riparian area in Tangle Creek.

3. Reconstruct a portion of fencing at Thicket Spring Tank to allow for a Gila topminnow exclosure. Portions of the tank would be accessible to livestock for water from both the Mustang and Red Creek pastures. Again, fence reconstruction may encourage livestock to feed in the uplands and reduce concentrations in Red Creek.

4. Construct 4 to 5 miles of pasture boundary fences between Tangle and Red Hills pastures to tie together existing fencing and natural barriers. Additionally, construct a short gap fence between Red Hills and Red Creek pastures. These measures would ensure that pasture boundaries are secure, and that the Red Hills Pasture would no longer be grazed.

5. Construct approximately 0.5 miles of pasture boundary fences between the Tangle and Cedar/Peso pastures at the upper and lower boundary to ensure that livestock cannot access Tangle Creek during the growing season.

6. Adjust the allotment's southern boundary fence to incorporate Dutchman Grave Spring into the Red Creek Allotment. Adjustment of the allotment's boundary fence would remove the Dutchman Grave Spring from the Sears Club/Chalk Allotment and place it in the Red Hills Pasture on the Red Creek Allotment where grazing will be discontinued.

The Forest Service also plans to conduct prescribed burns to reduce chaparral species and increase forage species for livestock and wildlife. The Forest Service believes that prescribed burning may reduce the likelihood of catastrophic wildfire, as well as encourage livestock to use upland areas by improving upland forage. Their goal would be to improve soil conditions in the uplands and to subsequently reduce the flooding potential. Additional section 7 and NEPA review would be conducted for prescribed burns at a later date. The effects of prescribed burning, including the potential for take of listed species, is not covered by this biological opinion.

Initially, the proposed action included closure of FR 18, which enters Red Creek from the Tangle Creek pasture, and continues for four miles downstream to its confluence with the Verde River. The EA notes that FR 18 will be closed, as does the fish BAE. However, the BAE does not address this issue, and verbal clarification from the Forest Service determined that there are currently no plans to close this road.

Description of the Project Area

The Red Creek Allotment (allotment) is located on the Cave Creek Ranger District of the Tonto National Forest in central Arizona. The allotment includes 19 miles of perennial streams and 64 miles of intermittent streams. The Verde River flows north to south through approximately 14 miles of the Red Hills Pasture of the Red Creek Allotment, while Red and Tangle creeks flow through additional portions of the allotment. The topography of the allotment varies from gently rolling basins to steep mountainous terrain and ranges from 2,000 to 6,600 feet in elevation (Figure 1).

Several plant communities occur on the allotment, including desertscrub (9,990 acres), Juniper and associated grasslands mixed with desertscrub (20,171 acres), juniper and associated grasslands, (44,408 acres), pinyon/juniper/oak woodlands (29,840 acres), and riparian vegetation communities (2,378 acres). Barren areas with rock and no vegetation are also present (583 acres). The lowest elevations in the allotment support Sonoran desertscrub, which is characterized by paloverde (*Cercidium microphyllum*), saguaro (*Cereus giganteus*), velvet mesquite (*Prosopis velutina*), jojoba (*Simmondsia chinensis*), prickly pear cactus (*Opuntia phaeacantha*), catclaw acacia (*Acacia greggii*), and desert broom (*Baccharis sarothroides*). The majority of this vegetation community is found on slopes exceeding 40 percent. Within this community, perennial grasses occur only in flatter areas.

The juniper and associated grassland community occurs between the semi-desert grasslands and pinyon-juniper woodlands. It is the dominant vegetation community on the allotment, occurring on approximately 44,408 acres. This community consists primarily of redberry juniper (*Juniperus erythrocarpa*) with small amounts of pinyon pine (*Pinus monophylla*) in northern portions of the allotment. Grass species include curly mesquite (*Hilaria belangeri*), hairy grama (*Bouteloua hirsuta*), black grama (*B. eriopoda*), Rothrock grama (*B. rothrockii*), sand dropseed (*Sporobolus cryptandrus*), cane beardgrass (*Andropogon barbinodis*), and three-awn species (*Aristida* spp.). Due to grazing pressure and the lack of natural fire disturbance, snakeweed (*Gutierrezia sarothrae*), catclaw acacia, mimosa (*Mimosa biuncifera*), and prickly pear are now also found in this community.

The pinyon/juniper/oak woodland community occurs at elevations the same as or slightly higher than juniper woodlands. Turbinella oak (*Quercus turbinella*), buckbrush (*Ceanothus greggii*), and mountain mahogany (*Cercocarpus montanus*) dominate this community. Grasses within this community include sideoats grama (*B. curtipendula*) or hairy grama (*B. hirsuta*).

Riparian communities occur along the major streams within the allotment. The allotment includes 19 miles of perennial streams and 64 miles of intermittent streams, with over 30 miles of major riparian areas occurring along them. Along the Verde River, riparian vegetation consists of Goodding willow (*Salix gooddingii*), Fremont cottonwood (*Populus fremontii*), occasional Arizona sycamore (*Platanus wrightii*), velvet ash (*Fraxinus velutina*), seep willow (*Baccharis salicifolia*), velvet mesquite (*Prosopis velutina*), salt cedar (*Tamarix chinensis*), bulrush (*Scirpus* spp.), cattail (*Typha* spp.), and a sparse understory of grasses and forbs.

Figure 1. Boundaries and pastures for the Red Creek Allotment, Cave Creek Ranger District, Tonto National Forest (USFS 1998b).

Within the allotment, Red Creek is intermittent with some areas of perennial flow. Vegetation along Red Creek includes Goodding willow, Bonpland willow (*S. bonplandiana*), Fremont cottonwood, Arizona sycamore, velvet ash, seep willow, burrobrush (*Hymenoclea monogyra*), velvet mesquite, and a sparse understory of grasses and forbs including deer grass (*Muhlenbergia rigens*). Tangle Creek is also an intermittent stream with some reaches of perennial flow. Vegetation along Tangle Creek is similar to that occurring along Red Creek.

Approximately one-half of the Red Creek Allotment occurs within either the Mazatzal or the Pine Mountain Wilderness areas. The Forest Plan calls for management of the Mazatzal Wilderness (Management Area 1B) and the Pine Mountain Wilderness (Management Area 1A) for wilderness values while providing livestock grazing and recreation opportunities that are compatible with maintaining wilderness values and protecting resources (USFS 1985).

The remainder of the Allotment falls within Management Areas 1C and 1F. Management Area 1C contains that portion of the Verde River Corridor that runs through the Cave Creek District.

Within this area, the Forest Plan dictates that management should emphasize preservation of the naturally-occurring flora, fauna, river-oriented recreation, aesthetic quality, and ecological processes, while providing for a high quality experience. The Forest Plan also dictates that management within Area 1F should focus on managing for a variety of renewable natural resources with emphasis on wildlife habitat improvement, livestock forage production, and dispersed recreation (USFS 1985).

II. STATUS OF THE SPECIES (Range-wide)

Loach Minnow

The Service listed the loach minnow as a threatened species on October 28, 1986 (USFWS 1986). The historic range of loach minnow included the basins of the Verde, Salt, San Pedro, San Francisco and Gila rivers (Minckley 1973, Sublette *et al*. 1990). Habitat destruction as well as competition and predation by nonnative species reduced the range of the species by approximately 85 percent (Miller 1961,Williams *et al*. 1985,Marsh *et al*. 1989). Loach minnow remains in limited portions of the upper Gila, San Francisco, Blue, Black, Tularosa, and White rivers and Aravaipa, Turkey, Deer, Eagle, Campbell Blue, Dry Blue, Pace, Frieborn, Negrito, Whitewater, and Coyote creeks in Arizona and New Mexico (Barber and Minckley 1966,Silvey and Thompson 1978,Propst *et al*. 1985,Propst *et al*. 1988,Marsh *et al*. 1990,Bagley *et al*. 1995,USBLM 1995,Bagley *et al*. 1996,Miller 1998).

Loach minnow are small, slender, elongate fish with markedly upwardly-directed eyes (Minckley 1973). Loach minnow are bottom-dwelling inhabitants of shallow, swift water over gravel, cobble, and rubble substrates (Rinne 1989, Propst and Bestgen 1991). Loach minnow use the spaces between, and in the lee of, larger substrate for resting and spawning (Propst *et al*. 1988, Rinne 1989). They are rare or absent from habitats were fine sediments fill the interstitial spaces (Propst and Bestgen 1991). Some studies have indicated that the presence of filamentous algae may be an important component of loach minnow habitat (Barber and Minckley 1966). The life span of loach minnow is about two years (Britt 1982,Propst and Bestgen 1991). Loach minnow feed exclusively on aquatic insects (Schreiber 1978,Abarca 1987). Spawning occurs in March through May (Britt 1982,Propst *et al*. 1988); however, under certain circumstances loach minnow also spawn in the autumn (Vives and Minckley 1990). The eggs of loach minnow are attached to the underside of a rock that forms the roof of a small cavity in the substrate on the downstream side. Limited data indicate that the male loach minnow may guard the nest during incubation (Propst *et al*. 1988,Vives and Minckley 1990).

Recent biochemical genetic work on loach minnow indicate there are substantial differences in genetic makeup between remnant loach minnow populations (Tibbets 1993). Remnant populations occupy isolated fragments of the Gila River basin and are isolated from each other. Based upon her work, Tibbets (1992, 1993) recommended that the generally distinctive units of loach minnow should be managed as separate units to preserve the existing genetic variation.

The status of loach minnow is declining rangewide. Although it is currently listed as threatened, the Service has found that a petition to uplist the species to endangered status is warranted. A reclassification proposal is pending, however, work on reclassification is precluded due to work on other higher priority listing actions (USFWS 1994).

Critical habitat was redesignated for loach minnow on April 25, 2000 (USFWS 2000). Critical habitat includes portions of the Verde, Black, middle Gila, San Pedro, San Francisco, Tularosa, Blue, and upper Gila rivers and Eagle, Bonita, Tonto, and Aravaipa creeks and several tributaries of those streams. The final critical habitat designation includes 106 miles of the Verde River beginning at the confluence of the Verde River and Fossil Creek and extending upstream to Sullivan Dam, excluding those lands belonging to the Yavapai Apache Tribe (USFWS 2000).

Gila Topminnow

Topminnow are live-bearing fishes of the family Poeciliidae. Males are smaller than females and rarely greater than one inch in length, while females reach two inches. Body coloration is tan to olivaceous, darker above, lighter below, and often with white on the belly. Breeding males are usually darkly blackened with some golden coloration of the midline, and with orange or yellow at the base of the dorsal fin.

Topminnow are highly fecund and broods mature rapidly. Fertilization is internal and sperm packets, which may fertilize subsequent broods, are stored. The brood development time is 24 to 28 days. Two to three broods in different stages develop simultaneously in a process known as superfetation. Topminnow give birth to 1 - 31 young per brood (Schoenherr 1974), with larger females producing more offspring (Minckley 1973). Topminnow mature a few weeks to many months after birth depending on when they are born and water temperature. They breed primarily from March to August, but some pregnant females occur throughout the year (Schoenherr 1974), and some young are produced in the winter months.

The Topminnow was listed as an endangered species on March 11, 1967, without critical habitat (USFWS 1967). The topminnow is found in the Gila, Sonora, and de la Concepcion river basins in Arizona, New Mexico, and Sonora, Mexico (Minckley 1973, Vrijenhoek *et al*. 1985), but is listed only in the United States. The topminnow was listed in 1967 as *Poeciliopsis occidentalis*. Species nomenclature was later revised to include two subspecies designations of *P.o. occidentalis* and *P.o. sonoriensis* (Minckley 1969, Minckley 1973). *P.o. occidentalis* is known as the topminnow, while *P.o. sonoriensis* is known as the Yaqui topminnow. *Poeciliopsis occidentalis*, including both subspecies, is collectively known as the Sonoran topminnow. Both subspecies are protected under the Act.

Topminnow are good colonizers in part because one gravid female can start a population, and in part because of their tolerance of a wide variety of physical and chemical conditions (Meffe and Snelson 1989). Minckley (1969, 1973) described their habitat as edges of shallow aquatic habitats, especially where abundant aquatic vegetation exists. Topminnow are known to occur in

streams fluctuating from 43° to 97° Fahrenheit, with a pH from 6.6 to 8.9, dissolved oxygen levels of 2.2 to 11 milligrams/liter, and salinities approaching those of sea-water (Meffe *et al*. 1983). Topminnow can burrow under mud or aquatic vegetation when water levels decline (Deacon and Minckley 1974, Meffe *et al*. 1983). Sonoran topminnows regularly inhabit springheads with high loads of dissolved carbonates and low pH (Minckley *et al*. 1977, Meffe and Snelson 1989). This factor has helped protect small populations of topminnows from mosquitofish (*Gambusia affinis*) which are usually rare or absent under these conditions.

Minckley (1973) and Constantz (1980) reported that topminnow are opportunistic feeders that eat bottom debris, vegetation, amphipods, and insect larvae when available. Minckley (1969, 1973) described their habitat as edges of shallow aquatic habitats, especially where abundant aquatic vegetation exists. They occupy pool, glide, and backwater habits with low to moderate velocities. Although they may occupy shallow to deep water, they are normally found in the upper one-third of the water column (Forrest 1992, Simms and Simms 1992).

Habitat losses and interactions with nonnative fish have caused the extirpation of topminnow throughout most of its range. Water diversions, stream downcutting, backwater draining, vegetation clearing, channelization, water impoundment, livestock grazing, and other human uses of natural resources have damaged or destroyed necessary habitat (Miller 1961, Minckley 1985). In addition, competition with and predation by nonnative fish species, most notably mosquitofish, have also adversely affected this species (Meffe *et al*. 1983, USFWS 1984). Topminnow are highly vulnerable to the adverse effects from nonnative species (Johnson and Hubbs 1989). Predation by and competition from nonnative fishes have been major factors in their decline, and continue to be major threats to remaining populations (Meffe *et al*. 1983, Meffe 1985, Brooks 1986, Marsh *et al*. 1990, Stefferud and Stefferud 1994, Weedman and Young 1997). The native fish fauna of the Gila and Colorado basins was naturally depauperate and contained few fishes that were predatory on or competitive with topminnow (Carlson and Muth 1989). In the riverine backwater and side-channel habitats that formed the bulk of topminnow natural habitat, predation and competition from other fishes was essentially absent. Topminnow therefore did not evolve mechanisms for protection against predation or competition. With the introduction of large numbers of predatory and competitive nonnative fish, frogs, crayfish, and other species, topminnow could no longer survive in many of their former habitats.

The topminnow was once abundant in the Gila River Basin and was one of the more common fishes of the Colorado River Basin, particularly in the Santa Cruz system (Hubbs and Miller 1941). However, the range of the topminnow has been reduced to 30 localities, 12 of these natural (Appendix A, Table 1) and the remaining 18 stocked. Of the 12 recent, natural topminnow populations still considered extant, only three populations (Cienega Creek, Monkey Spring, and Cottonwood Spring) have no nonnative fish present and can therefore be considered secure from nonnative fish threats. The 18 stocked sites are the only sites out of 175 wild sites stocked with topminnow where the topminnow persists. Of these 18 localities, one is outside of historic topminnow range, and four now contain nonnative fish (Weedman and Young 1997, Weedman 1998).

The status of the topminnow is poor and declining, with many populations being small and highly threatened. The theory of island biogeography applies to these isolated habitat remnants, as they function similarly (Meffe *et al.* 1983). Moyle and Williams (1990) note that fish in trouble tend to be endemic, restricted to a small area, part of native fish communities with fewer than five species, and found in isolated springs or streams. All of these criteria apply to the present status of topminnow.

Minckley (1999) speculates that topminnow population size and geographic range were highly variable in the past. Minckley (1999) indicates that the original, widespread distribution of topminnow in the Gila River basin was likely dependent on dispersal from secure refugia whenever abundant surface water, maximal habitat connectedness, and moderate winter temperatures coincided. Expanded populations were destroyed with drought or sudden drops in winter temperatures, resulting in isolated, remnant populations. Minckley (1999) concludes that the former connectedness of systems which allowed expansion of topminnow populations no longer exists, so that topminnow are no longer able to re-colonize their former habitat without some form of human intervention.

Southwestern Willow Flycatcher

The flycatcher is a small grayish-green passerine bird (Family Tyrannidae) measuring approximately 5.75 inches. It has a grayish-green back and wings, whitish throat, light gray-olive breast, and pale yellowish belly. Two white wingbars are visible (juveniles have buffy wingbars). The eye ring is faint or absent. The upper mandible is dark, and the lower is light yellow grading to black at the tip. The song is a sneezy fitz-bew or a fit-a-bew, and the call is a repeated whitt.

The flycatcher is one of four currently recognized willow flycatcher subspecies (Phillips 1948, Unitt 1987, Browning 1993). It is a neotropical migrant that breeds in the southwestern U.S. and migrates to Mexico, Central America, and possibly northern South America during the non-breeding season (Phillips 1948, Stiles and Skutch 1989, Peterson 1990, Ridgely and Tudor 1994, Howell and Webb 1995). The historic breeding range of the flycatcher included southern California, Arizona, New Mexico, western Texas, southwestern Colorado, southern Utah, extreme southern Nevada, and extreme northwestern Mexico (Sonora and Baja) (Unitt 1987).

The Service listed flycatcher as endangered, without critical habitat on February 27, 1995 (USFWS 1995). The Service designated critical habitat on July 22, 1997 (USFWS 1997b), and published a correction notice on August 20, 1997 to clarify the lateral extent of the designation (USFWS 1997c). Critical habitat designation included eighteen critical habitat units totaling 599 river miles in Arizona, California, and New Mexico. The Service did not include areas in CO, NV, TX, and UT that are considered important because of the limited range of the bird in those states.

In Arizona, critical habitat includes portions of the San Pedro River (100 miles), Verde River (90 miles) including Tavasci Marsh and Ister Flat, Wet Beaver Creek (20 miles), West Clear Creek (9 miles), Colorado River in the Grand Canyon (32 miles), and Little Colorado River and the West, East, and South Forks of the Little Colorado River (30 miles).

Declining flycatcher numbers have been attributed to loss, modification, and fragmentation of riparian breeding habitat, loss of wintering habitat, and brood parasitism by the brown-headed cowbird (Sogge *et al.* 1997, McCarthey *et al.* 1998). Urban, recreational, agricultural development, water diversion, and groundwater pumping, channelization, dams, and livestock grazing have caused habitat loss and degradation. Fire is an increasing threat to willow flycatcher habitat (Paxton *et al.* 1996), especially near monotypic saltcedar vegetation (DeLoach 1991) and where water diversions and/or groundwater pumping desiccates riparian vegetation (Sogge *et al.* 1997). Brown-headed cowbirds (*Molothrus ater*) parasitize flycatcher nests by laying their eggs in the flycatcher's nest. Livestock and range improvements such as waters and corrals, agriculture, urban areas, golf courses, bird feeders, and trash areas enhance feeding sites for cowbirds. When in close proximity to flycatcher breeding habitat, and especially when coupled with habitat fragmentation, these feeding areas facilitate cowbird parasitism of flycatcher nests (Hanna 1928, Mayfield 1977a, Mayfield 1977b, Tibbitts *et al.* 1994).

Habitat

The flycatcher breeds in dense riparian habitats from sea level in California to around 8000 feet in Arizona and southwestern Colorado. Historic egg/nest collections and species' descriptions throughout its range describe the flycatcher's widespread use of willow for nesting (Phillips 1948, Phillips *et al.* 1964, Hubbard 1987, Unitt 1987, T. Huels *in litt.* 1993, San Diego Natural History Museum 1995). Currently, flycatchers primarily use Geyer willow, Goodding's willow, boxelder (*Acer negundo*), saltcedar, Russian olive (*Elaeagnus angustifolio*) and live oak (*Quercus agrifolia*) for nesting. Other plant species less commonly used for nesting include buttonbush (*Cephalanthus* sp.), black twinberry (*Lonicera involucrata*), cottonwood (*Populus* spp.), white alder (*Alnus rhombifolia*), blackberry (*Rubus ursinus*), and stinging nettle (*Urtica* spp.). Based on the diversity of plant species composition and complexity of habitat structure, the four basic habitat types that can be described for the flycatcher are monotypic willow, monotypic exotic, native broadleaf dominated, and mixed native/exotic (Sogge *et al.*1997).

Open water, cienegas, marshy seeps, or saturated soil are typically in the vicinity of flycatcher territories and nests. Flycatchers sometimes nest in areas where nesting substrates were in standing water (Maynard 1995, Sferra *et al.* 1995, Sferra *et al*. 1997). However, hydrological conditions at a particular site can vary remarkably in the arid Southwest within a season and between years. At some locations, particularly during drier years, water or saturated soil is only present early in the breeding season (i.e., May and part of June). The total absence of water or visibly saturated soil has been documented at several other sites where the river channel has been

modified (e.g. creation of pilot channels), where modification of subsurface flows has occurred (e.g. agricultural runoff), or as a result of changes in river channel configuration after flood events (Spencer *et al.* 1996).

Diet

The flycatcher is an insectivore, foraging in dense shrub and tree vegetation along rivers, streams, and other wetlands. The bird typically perches on a branch and makes short direct flights, or sallies, to capture flying insects. Drost *et al.* (1998) found that the major prey items of the flycatcher (in Arizona and Colorado), consisted of true flies (Diptera); ants, bees, and wasps (Hymenoptera); and true bugs (Hemiptera). Other insect prey taxa included leafhoppers (Homoptera: Cicadellidae); dragonflies and damselflies (Odonata); and caterpillars (Lepidoptera larvae). Non-insect prey included spiders (Araneae), sowbugs (Isopoda), and fragments of plant material.

Breeding Biology

Throughout its range the flycatcher arrives on breeding grounds in late April and May (Sogge and Tibbitts 1992, Sogge *et al.* 1993, Muiznieks *et al.* 1994, Sogge and Tibbitts 1994, Maynard 1995, Sferra *et al.* 1995, Sferra *et al*. 1997). Nesting begins in late May and early June and young fledge from late June through mid-August (Willard 1912, Ligon 1961, Brown 1988a, Brown 1988b, Whitfield 1990, Sogge and Tibbitts 1992, Sogge *et al.* 1993, Muiznieks *et al.* 1994, Whitfield 1994, Maynard 1995). Southwestern willow flycatchers typically lay three to four eggs per clutch (range = 2 to 5). Eggs are laid at one-day intervals and are incubated by the female for approximately 12 days (Bent 1960, Walkinshaw 1966, McCabe 1991). Young fledge approximately 12 to 13 days after hatching (King 1955, Harrison 1979). Typically one brood is raised per year, but birds have been documented raising two broods during one season and renesting after a failure (Whitfield 1990, Sogge and Tibbitts 1992, Sogge *et al.* 1993, Muiznieks *et al.* 1994, Sogge and Tibbitts 1994, Whitfield 1994, Whitfield and Strong 1995). The entire breeding cycle, from egg laying to fledging, is approximately 28 days.

Southwestern willow flycatcher nests are fairly small (3.2 inches tall and 3.2 inches wide) and placement in shrubs or trees is highly variable (2.0 to 59.1 feet off the ground). Nests are open cup structures, and are typically placed in the fork of a branch. Nests have been found against the trunk of a shrub or tree (in monotypic saltcedar and mixed native broadleaf/saltcedar habitats) and on limbs as far away from the trunk as 10.8 feet (Spencer *et al.* 1996). Flycatchers using predominantly native cottonwood/willow riparian habitats nest low to the ground (5.9 to 6.9 feet on average), whereas birds using mixed native/exotic and monotypic exotic riparian habitats nest higher (14.1 to 24.3 feet on average). Birds nesting in habitat dominated by box elder nest the highest (to almost 60 feet).

Brown-headed cowbird parasitism of flycatcher broods has been documented throughout its range (Brown 1988a, Brown 1988b, Whitfield 1990, Muiznieks *et al.* 1994, Whitfield 1994, Hull

and Parker 1995, Maynard 1995, Sferra *et al.* 1995, Sogge 1995b). Where studied, high rates of cowbird parasitism coincided with flycatcher population declines (Whitfield 1994, Sogge 1995a, Sogge 1995c, Whitfield and Strong 1995) or, at a minimum, resulted in reduced or complete nesting failure at a site for a particular year (Muiznieks *et al.* 1994, Whitfield 1994, Maynard 1995, Sferra *et al.* 1995, Sogge 1995a, Sogge 1995c, Whitfield and Strong 1995). Cowbird eggs hatch earlier than those of many passerine hosts, thus giving cowbird nestlings a competitive advantage (Bent 1960, McGeen 1972, Mayfield 1977a, Mayfield 1977b, Brittingham and Temple 1983). Flycatchers can attempt to renest, but it often results in reduced clutch sizes, delayed fledging, and reduced nest success (Whitfield 1994). Whitfield and Strong (1995) found that flycatcher nestlings fledged after July 20th had a significantly lower return rate and cowbird parasitism was often the cause of delayed fledging.

Territory Size

Southwestern willow flycatcher territory size likely fluctuates with population density, habitat quality, and nesting stage. Estimated territory sizes are 0.59 to 3.21 acres for monogamous males and 2.72 to 5.68 acres for polygynous males at the Kern River (Whitfield and Enos 1996), 0.15 to 0.49 acres for birds in a 1.48 to 2.22 acre patch on the Colorado River (Sogge 1995c), and 0.49 to 1.24 acres in a 3.71 acre patch on the Verde River (Sogge 1995a). Territories are established within a larger patch of appropriate habitat sufficient to contain several nesting pairs of flycatchers. These birds appear to be semi-colonial nesters.

Rangewide Distribution and Abundance

Unitt (1987) documented the loss of more than 70 flycatcher breeding locations rangewide (peripheral and core drainage within its range) estimating the rangewide population at 500 to 1000 pairs. There are currently 95 known flycatcher breeding sites (in CA, NV, AZ, UT, NM, and CO) holding approximately 686 territories (Appendix A, Table 2). Sampling errors may bias population estimates positively or negatively (e.g., incomplete survey effort, double-counting males/females, composite tabulation methodology, natural population fluctuation, and random events) and it is likely that the total breeding population of flycatchers fluctuates. Unpublished information indicates that after the 1999 breeding season, just over 900 territories are known throughout the bird's range (G. Beatty, Service, pers. comm.).

The distribution of breeding groups is highly fragmented, with groups often separated by considerable distances (e.g. in Arizona, approximately 55 miles straight-line distance between breeding flycatchers at Roosevelt Lake, Gila County, and the next closest breeding groups known on either the San Pedro River, Pinal County, or Verde River, Yavapai County). To date, survey results reveal a consistent pattern rangewide in which the flycatcher population is comprised of extremely small, widely-separated breeding groups including unmated individuals.

Arizona Distribution and Abundance

As reported by Paradzick *et al.* (2000), the greatest concentrations of willow flycatchers in Arizona in 1999 were near the confluence of the Gila and San Pedro rivers (236 flycatchers, 134 territories); at the inflows of Roosevelt Lake (140 flycatchers, 76 territories); between Fort Thomas and Solomon on the middle Gila River (9 flycatchers, 6 territories); at Topock Marsh on the Lower Colorado River (30 flycatchers, 16 territories); along the Verde River at Camp Verde (7 flycatchers, 5 territories); near Alpine/Greer on the San Francisco River/Little Colorado River (11 flycatchers, 8 territories); at Alamo Lake on the Bill Williams River (includes Santa Maria and Big Sandy river sites) (43 flycatchers, 23 territories); and in the Lower Grand Canyon on the Colorado River (21 flycatchers, 11 territories).

Unitt (1987) concluded that "...probably the steepest decline in the population level of *E.t. extimus* has occurred in Arizona..." Historic records for Arizona indicate the former range of the flycatcher included portions of all major river systems (Colorado, Salt, Verde, Gila, Santa Cruz, and San Pedro) and major tributaries, such as the Little Colorado River and headwaters, and White River. As of 1999, 289 territories were known from 47 sites along 12 drainage statewide (Appendix A, Table 2). The lowest elevation where territorial pairs were detected was 197 feet at Adobe Lake on the Lower Colorado River; the highest elevation was at the Greer town site (8300 feet). The majority of breeding groups in Arizona are extremely small. Of the 47 sites where flycatchers have been documented, 70 percent (n=33) contain five or fewer territorial flycatchers.

To date, survey results reveal a consistent pattern rangewide in that the flycatcher population, as a whole, is comprised of extremely small, widely-separated breeding groups including unmated individuals (Appendix A, Table 2). Seventy percent (33/47) of the Arizona sites where flycatchers have been found are comprised of five or fewer territories. The current distribution of breeding groups is highly fragmented, with groups often separated by considerable distances. This reduces meta-population stability and increases the risks of local extirpation due to stochastic events, predation, cowbird parasitism, and other factors.

Because of the bird's low numbers, the effects of management and research activities are a concern. Survey and nest monitoring activities, and handling and banding procedures are regulated by Federal and State permitting processes to remove and reduce effects to the bird. Trapping, handling, banding, determining the nest's status, and removing cowbird eggs can, even with the most careful biologist, result in injury or death to a bird. Specific training in standardized survey and monitoring procedures (Sogge *et al.* 1997) are required throughout its range.

Cactus Ferruginous Pygmy-owl

A detailed description of the life history and ecology of the pygmy-owl may be found in the Birds of North America (Proudfoot and Johnson 2000), Ecology and Conservation of the Cactus Ferruginous Pygmy-owl in Arizona (Cartron and Finch 2000a), and other information available at the Arizona Ecological Services Field Office. Information specific to the pygmy-owl in Arizona is limited. Research in Texas has provided useful insights into the ecology of the subspecies, and in some instances represents the best available information; however, habitat and environmental conditions are somewhat different in Arizona and conclusions based on Texas information is tentative.

The Service listed the Arizona population of the pygmy-owl as a distinct population segment on March 10, 1997, effective April 9, 1997 (USFWS 1997a). The past and present destruction, modification, or curtailment of habitat is the primary reason for the decrease in population levels of the pygmy-owl. On July 12, 1999 the Service designated approximately 731,712 acres of critical habitat supporting riverine, riparian, and upland vegetation in seven critical habitat units located in Pima, Cochise, Pinal, and Maricopa counties in Arizona (USFWS 1999a). Only lands containing, or likely to develop, those habitat components essential for the primary biological needs of the owl and requiring special management are considered critical habitat. By definition, all areas above 4,000 feet, areas not containing or capable of developing constituent elements (e.g., saguaro, large diameter trees, etc.), areas with existing features and structures (e.g., roads, buildings, etc.), areas not requiring special management, or other areas such as National Parks or Tribal lands were excluded from the critical habitat designation. The actual area meeting this definition is substantially less than the total area within the exterior boundaries of the area designated.

Areas designated as critical habitat included: 1) sites with recent owl locations; 2) sites considered important for genetic and demographic interchange within the geographical area occupied by the species, and; 3) sites that are essential to the conservation of the species and that require special management considerations. These units either contain the primary constituent elements or the capacity to develop these elements and are essential for the primary biological needs of this species which include foraging, nesting, rearing of young, roosting, sheltering, and dispersal. Actions that may destroy or adversely modify critical habitat are actions that destroy or alter the primary constituent elements to the extent that the value of critical habitat for both survival and recovery of the species is appreciably diminished. These activities include, but are not limited to vegetation removal, water diversions or impoundments, ground water pumping, and recreational activities that appreciably degrade habitat.

Species Description and Life History

Pygmy-owls are small birds, averaging 6.75 inches in length. Pygmy-owls are reddish-brown overall, with a cream-colored belly streaked with reddish-brown. Pygmy-owls are crepuscular/diurnal, with a peak activity period for foraging and other activities at dawn and

dusk. During the breeding season, they can often be heard calling throughout the day, but most activity is reported between one hour before sunrise to two hours after sunrise, and late afternoon/early evening from two hours before sunset to one hour after sunset (Collins and Corman 1995).

A variety of vegetation communities are used by pygmy-owls, including riparian woodlands, mesquite bosques, Sonoran desertscrub, and semidesert grassland communities, as well as nonnative vegetation within these communities. While plant species composition differs among these communities, there are certain unifying characteristics such as the presence of vegetation in a fairly dense thicket or woodland, the presence of trees or saguaros large enough to support cavity nesting, and elevations of less than 4,000 feet. Historically, pygmy-owls were associated with riparian woodlands in central and southern Arizona. Plants present in these riparian communities include cottonwood, willow and hackberry (*Celtis* spp.). Cottonwood trees are suitable for cavity nesting, while the density of mid- and lower-story vegetation provides necessary protection from predators and an abundance of prey items for pygmy-owls.

Over the past several decades, pygmy-owls have been primarily found in the Arizona Upland Subdivision of the Sonoran Desert, particularly Sonoran desertscrub (Brown 1994). This community in southern Arizona consists of paloverde, ironwood, mesquite, acacia, bursage (*Ambrosia* spp.), and columnar cacti (Phillips *et al*. 1964, Monson and Phillips 1981, Davis and Russell 1984, Johnson and Haight 1985, Johnsgard 1988). However, over the past several years, pygmy-owls have also been found in riparian and xeroriparian habitats and semidesert grasslands as classified by Brown (1994). Desertscrub communities are characterized by an abundance of saguaros or large trees, and a diversity of plant species and vegetation strata. Xeroriparian habitats contain a rich diversity of plants that support a wide array of prey species and provide cover. Habitat occupied by pygmy-owls in semidesert grasslands includes mesquite trees in uplands and linear woodlands of various tree species along bottoms and washes.

The density of trees and the amount of canopy cover preferred by pygmy-owls in Arizona is unclear. However, preliminary results from a habitat selection study indicate that nest sites tend to have a higher degree of canopy cover than random sites (Wilcox *et al*. 2000). For areas outside Arizona, pygmy-owls are most commonly characterized by semi-open or open woodlands, often in proximity to forests or patches of forests. Where they are found in forested areas, they are typically observed along edges or in openings, rather than deep in the forest itself (Binford 1989, Sick 1993), although this may be a bias of increased visibility. Overall, vegetation density may not be as important as patches of dense vegetation with a developed canopy layer interspersed with open areas. The physical settings and vegetation composition varies across *G. brasilianum's* range and, while vegetation structure may be more important than composition (Wilcox *et al*. 1999, Cartron *et al*. 2000a), higher vegetation diversity is found more often at nest sites than at random sites (Wilcox *et al*. 2000).

Pygmy-owls typically hunt from perches in trees with dense foliage using a perch-and-wait strategy; therefore, sufficient cover must be present within their home range for them to

successfully hunt and survive. Their diverse diet includes birds, lizards, insects, and small mammals (Bendire 1888, Sutton 1951, Sprunt 1955, Earhart and Johnson 1970, Oberholser 1974) and frogs (Proudfoot *et al*. 1994). The density of annuals and grasses, as well as shrubs, may be important to the pygmy-owl's prey base. Shrubs and large trees also provide protection against aerial predation for juvenile and adult pygmy-owls and cover from which they may capture prey (Wilcox *et al*. 2000).

Pygmy-owls begin nesting activities in late winter to early spring. In Arizona differences between nest sites may vary by as much as two months (Abbate *et al*. 1996, S. Richardson, Arizona Game and Fish Department (AGFD) unpubl. data). As with other avian species, this may be the result of a second brood or a second nesting attempt following an initial nest failure (Abbate *et al*. 1996).

Pygmy-owls are considered non-migratory throughout their range by most authors, and have been reported during the winter months in several locations, including Organ Pipe Cactus National Monument (OPCNM) (R. Johnson unpubl. data, T. Tibbitts, OPCNM unpubl. data). Within their range, juveniles disperse over varying distances. In Texas, juveniles remained within approximately 165 feet of adults until dispersal. Straight-line dispersal distances of 20 juveniles monitored from their natal sites to nest sites the following year ranged from 0.75 to 19 miles, and averaged five miles (G. Proudfoot unpubl. data). Telemetry studies in Arizona during 1999 resulted in generally greater dispersal distances, ranging from 1.4 to 12.9 miles straight-line distance, with a mean of 6.2 miles (n=6) (S. Richardson, AGFD unpubl. data). On-going studies in the fall of 2000 indicate that juvenile dispersal distances may be even greater than previously documented (S. Richardson, AGFD pers. comm.). Juveniles typically dispersed from natal areas in July and did not reappear to defend a territory until September. They may move up to one mile in a night; however, they typically fly from tree to tree instead of long single flights (S. Richardson, AGFD unpubl. data). Subsequent surveys during the spring have found that locations of male pygmy-owls are in the same general location as last observed the preceding fall.

In Texas, Proudfoot (1996) noted that pygmy-owls used between three and 57 acres during the incubation period, and defended areas up to 279 acres in the winter. Therefore, a 280 acre home range is considered necessary for pygmy-owls. Proudfoot and Johnson (2000) indicate males defend areas with radii from 1,100 - 2,000 feet. Initial results from ongoing studies in Texas indicate that the home range of pygmy-owls may also expand substantially during dry years (G. Proudfoot unpubl. data).

Rangewide Distribution and Abundance

The pygmy-owl is one of four subspecies of ferruginous pygmy-owl. Pygmy-owls are known to occur from lowland central Arizona south through western Mexico to the States of Colima and Michoacan, and from southern Texas south through the Mexican States of Tamaulipas and Nuevo Leon. It is unclear at this time if the ranges of the eastern and western populations of the ferruginous pygmy-owl merge in southern Mexico. However, genetic information indicates that

eastern and western populations of the pygmy-owl may be genetically dissimilar (G. Proudfoot, R. Zink, R. Blackwell, A. Fry, C. Tchida, P. Heidrich, and M. Wink unpubl. data). Genetic research is currently being funded by Pima County to determine whether there is any genetic variation within tissue samples collected in Arizona compared to samples from Mexico and Texas. Preliminary results remain consistent with earlier studies, indicating an approximate one percent difference between Arizona and Texas samples (G. Proudfoot unpubl. data).

The Service is currently funding habitat studies and surveys in Sonora, Mexico to determine the distribution and relative abundance of pygmy-owls there. Based on the lack of sightings, they may be absent, rare, or uncommon in northern Sonora, Mexico (Hunter 1988, USFWS 1997a). Further studies are needed to determine their distribution in Mexico.

The range of the Arizona distinct population segment of the pygmy-owl extends from the International Border with Mexico north to central Arizona. The northernmost historic record for the pygmy-owl is from New River, Arizona, about 35 miles north of Phoenix, where Fisher (1893) reported the pygmy-owl to be "quite common" in thickets of intermixed mesquite and saguaro cactus. According to early surveys referenced in the literature, the pygmy-owl, prior to the mid-1900s, was "not uncommon," "of common occurrence," and a "fairly numerous" resident of lowland central and southern Arizona in cottonwood forests, mesquite-cottonwood woodlands, and mesquite bosques along the Gila, Salt, Verde, San Pedro, and Santa Cruz rivers and various tributaries (Breninger 1898, Gilman 1909, Swarth 1914). Additionally, pygmy-owls were detected at Dudleyville on the San Pedro River as recently as 1985 and 1986 (AGFD unpubl. data, Hunter 1988). Records from the eastern portion of the pygmy-owl's range include a 1876 record from Camp Goodwin (near current day Geronimo) on the Gila River, and a 1978 record from Gillard Hot Springs, also on the Gila River. Records from the western portion of the pygmy-owls range include a 1955 record from the Cabeza Prieta Tanks (Monson 1998).

Hunter (1988) found fewer than 20 verified records of pygmy-owls in Arizona for the period of 1971 to 1988. Formal surveys for pygmy-owls on OPCNM began in 1990, with one located that year. Beginning in 1992, survey efforts conducted in cooperation with the AGFD located three single pygmy-owls on OPCNM (USFWS and OPCNM unpubl. data). In 1993, surveys were conducted at locations where pygmy-owls had been sighted since 1970, and only one pygmy-owl was detected in northwest Tucson (Felley and Corman 1993). In 1994, two pygmy-owls were located in northwest Tucson during informal survey work by AGFD (Abbate *et al*. 1996). In 1996, AGFD focused their survey efforts in northwest Tucson and Marana. A total of 16 pygmy-owls were detected, including one pair and two fledglings. Three additional pygmy-owls were detected at OPCNM in 1996. There were also three additional, but unconfirmed, reports of pygmy-owls from OPCNM.

In 1997, survey efforts of AGFD located a total of ten pygmy-owls in the Tucson Basin study area (the area bounded to the north by the Picacho Mountains, to the east by the Santa Catalina and Rincon Mountains, to the south by the Santa Rita and Sierrita Mountains, and to the west by

the Tucson Mountains). Of the eight pygmy-owls documented from this area, one pair successfully fledged four young. Two adult males were also located at OPCNM, with one reported from a previously unoccupied area (T. Tibbitts, OPCNM pers. comm.).

In 1998, survey efforts in Arizona increased substantially and, as a result, more pygmy-owls were documented, which may at least in part account for a larger number of known owls. In 1998, a total of 35 pygmy-owls were confirmed (S. Richardson, AGFD unpubl. data, U.S. Fish and Wildlife Service unpubl. data, T. Tibbitts, OPCNM unpubl. data, D. Bieber, Coronado National Forest unpubl. data).

In 1999, a total of 41 adult pygmy-owls were found in Arizona at 28 sites. AGFD and the Service confirmed nesting at 10 of these sites. Pygmy-owls were found in three distinct regions of the state, including the Tucson Basin, Altar Valley, and OPCNM. Overall, mortality was documented for a number of fledglings due to natural (e.g., predation) or unknown causes. Of the 33 young found, only 16 were documented as surviving until their dispersal as juveniles from their natal area. It is unclear what the survival rate for pygmy-owls is; however, as with other owls and raptors, a high mortality (50 percent or more) of young is typical during the first year of life.

Surveys conducted in 2000 resulted in 24 confirmed pygmy-owl sites (i.e. nests and resident pygmy-owl sites) and several other unconfirmed sites (S. Richardson, AGFD unpubl. data, T. Tibbitts, OPCNM unpubl. data, U.S. Fish and Wildlife Service unpubl. data). A total of 34 adult pygmy-owls were confirmed. Nesting was documented at seven sites and 23 fledglings were confirmed; however, as in 1999, over a 50 percent fledgling mortality was documented (S. Richardson, AGFD unpubl. data). A total of nine juveniles successfully dispersed from their natal areas in 2000. Successful dispersal was not confirmed at two nests with four fledglings. The status of the remaining fledglings is unknown; however, they are presumed dead. Data for 2000 is presented in Appendix A, Table 3.

One factor affecting the known distribution of pygmy-owls in Arizona is where early naturalists spent most of their time and where recent surveys have taken place. For example, a majority of surveys in the recent past (since 1993) have taken place in OPCNM and in the Tucson Basin, and these areas are where most owl locations have been recorded. However, over the past three years, large, previously unsurveyed areas have been inventoried for owls, resulting in the detection of birds over a much wider distribution than previously thought. As a result, our knowledge is changing as to pygmy-owl distribution and habitat needs as new information is collected. For example, before 1998, very few surveys had been completed in the Altar Valley in southern Pima County. Prior to 1999, the highest known concentration of pygmy-owls in the state was in northwest Tucson. However, in 1999, after extensive surveys in Altar Valley, more owls were found there (18 adults) than in northwest Tucson (11 adults), although there are still fewer nest sites in Altar Valley than in the Tucson Basin (S. Richardson, AGFD unpubl. data).

Range-wide Trend

Loss and fragmentation of habitat is one of most urgent threats to pygmy-owls in Arizona (USFWS 1997a, Abbate *et al*. 1999). The complete removal of vegetation and natural features associated with construction of many large scale and high-density housing developments directly and indirectly impacts pygmy-owl survival and recovery (Abbate *et al*. 1999). Habitat loss, degradation, and fragmentation are widely accepted causes contributing to raptor population declines worldwide (Snyder and Snyder 1975, Newton 1979, LeFranc and Millsap 1984). Habitat fragmentation is the process by which a large and continuous block of natural habitat is transformed into much smaller and isolated patches by human activity (Noss and Csuti 1994). Fragmentation has two components: 1) reduction of the total amount of habitat type, and; 2) apportionment of remaining habitat into smaller, more isolated patches (Harris 1984, Wilcove *et al*. 1986, Saunders *et al*. 1991).

Nesting in small natural patches may have additional risks. For example, Haug (1985) found burrowing owl home range size increases with the percentage of vegetation disturbance. In fragmented landscapes, burrowing owls may forage greater distances and spend more time away from the nest, making them more vulnerable to predators, and therefore, less efficient at reproduction (Warnock and James 1997). As fragmentation increases, competition for fewer productive pygmy-owl territories may occur (Abbate *et al*. 1999). Unlike other larger birds that can fly long distances over unsuitable or dangerous areas to establish new territories, pygmy-owls, because of their small size and their short style of flight, are exposed to greater risks from predation and other threats (Abbate *et al*. 1999).

Site tenacity in birds is one factor that may create time lags in response to fragmentation and other disturbances. Individuals may remain in sites where they bred successfully in the past, long after the habitat has been altered (Wiens 1985). Because of the lack of data, it is unclear whether site tenacity in pygmy-owls in increasingly fragmented landscapes like those in the action area is a factor in this species' decline. For example, researchers have been closely monitoring an established pygmy-owl site (documented each year since 1996) in which the male died in 1999, apparently from a collision with a fence (S. Richardson, AGFD unpubl. data.). This site was not known to be occupied in 2000. This site has the highest amount of development (33 percent) within its estimated home range of any other known nest site (S. Richardson, AGFD unpubl. data.). The site will continued to be monitored to determine if new owls reestablish a nest site.

Currently, all known nesting pygmy-owls within northwest Tucson are located in areas containing no development or low-density housing developments that are adjacent to undeveloped tracts of land with varying amounts of noise disturbance. Individual pygmy-owls may react differently to noise disturbances, with some individuals exhibiting less tolerance than others. Noise can affect animals by disturbing them to the point that detectable changes in behavior may occur. Dangerous or unfamiliar noises are more likely to arouse wildlife than harmless and familiar noises. Habituation is the crucial determinant of success in the presence of noisy disturbances. Exposures of some experienced birds may produce no or minimal losses

(Black *et al*. 1984). The habituation process can occur slowly, so it may not be detected in the short-term. Robert and Ralph (1975), Schreiber *et al*. (1979), Cooke (1980), Parsons and Burger (1982), Ainley *et al*. (1983), and McNicholl (1983) found that adult birds, and chicks to some extent, habituated to the presence of humans, and their responses to people seemed to be less than those of undisturbed birds. Burger and Gochfeld (1981) and Knight *et al*. (1987) studied responses to noise disturbances and habituation and found that nesting birds became more tenacious and less responsive in the presence of human disturbance if they were not deliberately harassed. It is unknown if noise habituation occurs in some pygmy-owls as it does with other bird species.

Raptors in frequent contact with human activities tend to be less sensitive to additional noise disturbances than raptors nesting in remote areas. However, Newton (1979) found that exposure to direct human harassment may make raptors more sensitive to noise disturbances. Where prey is abundant, raptors may even occupy areas of high human activity, such as cities and airports (Newton 1979, Ratcliffe 1980, White *et al*. 1988). The timing, frequency, and predictability of the noise disturbance may also be factors. Raptors become less sensitive to human disturbance as their nesting cycle progresses (Newton 1979). Studies have suggested that human activities within breeding and nesting territories could affect raptors by changing home range movements (Anderson *et al*. 1990) and causing nest abandonment (Porter *et al*. 1973, Postovit and Postovit 1987).

Other factors contributing to the decline of pygmy-owl habitat include the destruction of riparian bottomland forests and bosques. It is estimated that 85 to 90 percent of low-elevation riparian habitats in the southwestern U.S. have been modified or lost. These alterations and losses are attributed to woodcutting, urban and agricultural encroachment, water diversion and impoundment, channelization, groundwater pumping, livestock overgrazing, and hydrologic changes resulting from various land-use practices (e.g., Phillips *et al*. 1964, Carothers 1977, Kusler 1985, Jahrsdoerfer and Leslie 1988, USFWS 1988, USGAO1988, Szaro 1989, Dahl 1990, State of Arizona 1990, Bahre 1991). Cutting of trees for domestic and industrial fuel wood was so extensive throughout southern Arizona that, by the late 19th century, riparian forests within tens of miles of towns and mines had been decimated (Bahre 1991).

Regardless of past distribution in riparian areas, it is clear that the pygmy-owl has declined throughout Arizona to the degree that it is now extremely limited in distribution in the state (Johnson *et al*. 1979, Monson and Phillips 1981, Davis and Russell 1984, Johnson-Duncan *et al*. 1988, Millsap and Johnson 1988, Monson 1998). A very low number of pygmy-owls in riparian areas in recent years may reflect the loss of habitat connectivity rather than the lack of suitability (Cartron *et al*. 2000b). In recent decades, the pygmy-owl's riparian habitat has continued to be modified and destroyed by agricultural development, woodcutting, urban expansion, and general watershed degradation (Phillips *et al*. 1964, Brown *et al*. 1977, State of Arizona 1990, Bahre 1991, Stromberg *et al*. 1992, Stromberg 1993a, Stromberg 1993b). Sonoran desertscrub has been affected to varying degrees by urban and agricultural development, woodcutting, and livestock grazing (Bahre 1991). Pumping of groundwater and the diversion and channelization of natural

watercourses are also likely to have reduced pygmy-owl habitat. Diversion and pumping result in diminished surface flows, and consequent reductions in riparian vegetation are likely (Brown *et al*. 1977, Stromberg *et al*. 1992, Stromberg 1993a, Stromberg1993b). Channelization often alters stream banks and fluvial dynamics necessary to maintain native riparian vegetation. The series of dams along most major southwestern rivers (e.g., Colorado, Gila, Salt, and Verde rivers) have altered riparian habitat downstream of dams through hydrological and vegetational changes, and have inundated former habitat upstream.

In the United States, pygmy-owls are rare and highly sought by bird watchers, who concentrate at a few of the remaining known locations. Limited, conservative bird watching is probably not harmful; however, excessive attention and playing of tape-recorded calls may at times constitute harassment and affect the occurrence and behavior of the pygmy-owl (Oberholser 1974, Tewes 1993). Pygmy-owl harassment by birders has been reported in both Arizona and Texas (Oberholser 1974, Tewes 1993, American Birding Association 1993, S. Richardson, AGFD pers. comm. 1999, Tropical Birds of the Border 1999).

Human activities near nests at critical periods of the nesting cycle may cause pygmy-owls to abandon their nest sites. In Texas, three of 102 pygmy-owl nests monitored from 1994-1999 were abandoned during the early stage of egg laying. Although unknown factors may have contributed to this abandonment, researchers in Texas associated nest abandonment with nest monitoring (G. Proudfoot pers. comm.). Some outdoor recreational activities such as off-road vehicle and motor bike use/racing, firearm target practicing, and jeep tours may disturb pygmy-owls during their breeding season, particularly from February through July (G. Proudfoot pers. comm. 1999 and S. Richardson, AGFD pers. comm. 1999). Wildlife may respond to noise disturbances during the breeding season by abandoning their nests or young (Knight and Cole 1995). While noise disturbance during the breeding season may affect productivity, disturbance outside of this period may affect an organism's energy balance and, therefore survival. It has become apparent that disturbance outside of a species' breeding season may also have severe effects (Skagen *et al*. 1991).

Application of pesticides and herbicides in Arizona occurs year-round, and these chemicals pose a potential threat to the pygmy-owl. The presence of pygmy-owls in proximity to residences, golf courses, agricultural fields, and plant nurseries may cause direct exposure to pesticides and herbicides. Furthermore, ingestion of affected prey items may cause death or reproductive failure (Abbate *et al*. 1999). Illegal dumping of waste also occurs in areas occupied by pygmy-owls and may be a threat to pygmy-owls and their prey. In one case, drums of toxic solvents were found within one mile of a known pygmy-owl location (Abbate *et al*. 1999).

Little is known about the rate or causes of mortality in pygmy-owls; however, they are susceptible to predation from a wide variety of species. Pygmy-owls are particularly vulnerable to predation and other threats during and shortly after fledging (Abbate *et al*. 1999). Therefore, cover near nest sites may be important for young to fledge successfully (Wilcox *et al*. 1999,

Wilcox *et al*. 2000). Although nest depredation has not been recorded in Arizona, only a few nests have been monitored (n = 21 from 1996-1999). Additional research is needed to determine the effects of predation, including nest depredation, on pygmy-owls in Arizona and elsewhere.

Another factor that may affect pygmy-owls is interspecific competition/predation. In Texas, depredation of two adult female pygmy-owls nesting close to screech-owls was recorded. These incidences were recorded as "depredation by screech-owl" after examination of the pygmy-owl corpses and assessment of circumstances (i.e., one pygmy-owl attempted to nest in a box that was previously used as screech-owl roost site, the other established a nest in a box within 16 feet of screech-owl nest site). Conversely, pygmy-owls and screech-owls were also recorded successfully nesting within seven feet of each other in the same tree without interspecific conflict. The relationship between pygmy-owl and other similar small owl species needs further study.

Direct and indirect human-caused mortalities can include collisions with cars, glass windows, fences, and power lines, as well as predation by domestic cats (*Felis domesticus).* While likely uncommon, these incidents are often underestimated, and probably increase as human interactions with owls increase (Banks 1979, Klem 1979, Churcher and Lawton 1987). This may be particularly important in the Tucson area where many pygmy-owls are located within human development areas.

The fact that pygmy-owls have been observed moving around the perimeter of golf courses while avoiding non-vegetated areas may indicate that roads and other openings act as barriers to their movements (Abbate *et al*. 1999, S. Richardson, AGFD unpubl. data). On one occasion, a radio-tagged dispersing juvenile stopped within 0.7 mile of Interstate 10 where there were large openings and few trees or shrubs, and reversed its direction (Abbate *et al*. 1999). However, radio-tagged, juvenile pygmy-owls have been observed on several occasions crossing two-lane roads with light to moderately heavy vehicular traffic, where trees and large shrubs were present on either side (Abbate *et al*. 1999).

Fire can affect pygmy-owls by altering their habitat (Abbate *et al*. 1999). A recent fire altered habitat near an active pygmy-owl nest site (Flesch 1999) and although four mature saguaros in the area survived (at least in the short-term), post-fire mortality of saguaros has been recorded (Steenberg and Lowe 1977, McLaughlin and Bowers 1982, Steenberg and Lowe 1983). Flesch (1999) also noted that approximately 20 to 30 percent of the mesquite woodland within 164 feet of the nest was fire- or top-killed, and ground cover was also eliminated until plant regeneration following the summer monsoons. Careful use of prescribed fires in areas potentially suitable for pygmy-owls is necessary so that habitat is not lost or degraded (Flesch 1999).

Low genetic variability can lead to a reduction in reproductive success and environmental adaptability. Caughley and Gunn (1996) further note that small populations can become extinct entirely by chance even when their members are healthy and the environment favorable. The pairing of siblings or parents with their offspring is rare, particularly in raptors, and has been

documented in only 18 cases, representing seven species (Carlson *et al*. 1998). Four of these species were barn owls, burrowing owls (*Athene cunicularia*), screech-owls, and spotted owls (*Strix occidentalis*).

Soule (1986) notes that very small populations are in extreme jeopardy due to their susceptibility to a variety of factors, including demographic stochasticity, where chance variations in birth and death rates can result in extinction. A series of environmental changes such as habitat reduction reduce populations to a state in which demographic stochasticity takes hold. In small populations like pygmy-owls, each individual is important for its contributions to genetic variability of that population. As discussed above, low genetic variability can lead to a lowering in reproductive success and environmental adaptability, affecting recovery of this species.

III. ENVIRONMENTAL BASELINE

The environmental baseline includes past and present impacts of all Federal, State, and private actions in the action area, the anticipated impacts of all proposed Federal actions in the action area that have undergone formal or early section 7 consultation, and the impact of State and private actions which are contemporaneous with the consultation process on the individual species of concern. 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.

Factors Affecting the Species Within the Action Area

The portion of the Verde River within the project area is within the Horseshoe Reservoir watershed and Verde River sub-basin. These lower portions of the Verde River are influenced by activities taking place upstream as well as those within the immediate area. Land uses in the watershed that have had effects to the Verde River include mining (including sand and gravel), recreation, roads, livestock grazing, irrigated agriculture, and urban development. Uses within the project vicinity (i.e., between East Fossil Creek and Horseshoe Reservoir) include recreational uses such as off-highway vehicles, particularly along Red Creek and at Sheep Bridge Crossing, and grazing (Sullivan and Richardson 1993). It can be expected that some land uses alter the characteristics of the watershed through changes in vegetation cover and community components, compaction of soils, and the resultant changes to runoff and retention patterns for rainfall or snowmelt events. Changes to sediment loads coming off the watershed are also to be expected from these uses. Once these altered flows reach the river, changes to the hydrograph occur, especially in regard to flood events and low flows. Increased runoff over a set period translates to higher flow velocities that affect patterns of erosion and deposition of substrate materials, movements of the active channel, and establishment of riparian vegetation along the banks and terraces. Activities in the riparian area, such as livestock grazing, reduce the vigor of riparian plant species, contribute to bank instability, and increase the risk of damage from a high flow event.

Decreased runoff curing low flow periods, along with decreased bank storage due to erosion and riparian vegetation loss, reduce habitat for aquatic species and contribute to changes in stream channel morphology (Gifford and Hawkins 1978, Platts 1990, Belsky *et al*. 1999).

Development of irrigated agriculture and municipal/industrial water supplies from the river flows have significant effects on the historic hydrograph as well. Creation of diversion dams and water storage reservoirs alter aquatic habitats both upstream and downstream of the structure. During some high water use periods, virtually the entire flow of the Verde River is diverted above the action area (Sullivan and Richardson 1993). Irrigation return flows, spring and aquifer inflows, and tributary sources replenish the flows to some extent, but the resultant pattern may not be comparable to the historic hydrograph. Changes in flood flows from changes to the watershed also influence flows at certain times of the year.

It is difficult to quantify the changes to the Verde River that have resulted from past and ongoing activities on the watershed and in the river itself. Sufficient information for a pre-effect analysis is lacking. The large size of the watershed area also means that there are many on-the-ground actions taking place, and while the effects of one may not appear to be significant, the combined effects often are. Segregating out one effect, in one area, from the background of combined effects is not possible within the scope of this biological opinion. That should not be construed to say that the effects of any individual action are not important, merely that it is difficult to isolate the specific effects. However, it is known that 56 percent of the fish species native to the Verde River basin have been extirpated. Four of these fishes have been repatriated, but with limited degrees of success (S. Stefferud, USFWS, pers. comm. 2000).

The Verde River watershed is dominated by federally-owned lands, particularly Forest Service lands. There are also several Federal programs that are not land based that have been implemented in the watershed. An example is the Federal Emergency Management Agency and Natural Resources Conservation Service flood control and damage repair programs. All activities on Federal lands or implemented through Federal programs require consultation under the Act to assess the effects of the action on listed species. Consultation on the land management plan for the Tonto National Forest addressed, in a general sense, the effects of multiple-use management on listed species. For livestock grazing, biological opinions have been prepared for some allotments, especially those bordering the Verde River, and concurrences with findings of may affect, not likely to adversely affect have been provided on others where appropriate. Other consultations have addressed bank stabilization in the Cottonwood/Camp Verde area, highway and bridge construction and improvement or repair, low water crossings, utility and pipeline construction, recreational activities, and new water diversions or exchanges.

Range and Watershed Condition

Cattle currently graze the allotment under a modified Santa Rita rest-rotation system. This grazing strategy, also called deferred rotation, involves grazing one pasture early and a second pasture late. The sequence is then rotated the following year (Platts 1990). This system

provides two consecutive years of spring/summer rest out of every three years for each spring/summer pasture. The permit currently allows for grazing of 519 adult cattle yearlong and their natural increase from January 1 to May 31 annually.

The allotment currently contains four management units. Grazing within the Roundtree/Cedar/ Tangle Pasture occurs during the spring or summer only, with grazing occurring for 3.5 months in the spring of the first year and 3.5 months of the summer during the second year. The pasture is rested the third year. Grazing within the Red Creek/Soda Springs/Yellowjacket Pasture follows the same usage pattern, and is used in rotation with the Roundtree/Cedar/Tangle Pasture.

Grazing last occurred in the Red Creek Pasture during the summer of 1997. This pasture was rested in 1998. Cattle were trailed through the northern portion of the Red Creek Pasture in April 1999. Fencing constructed in 1999 near the junction of Forest Road (FR) 16 and Red Creek prevents livestock from accessing the upper portion of Red Creek. Natural barriers on the east side of Red Creek within the pasture prevent the majority of livestock from accessing Red Creek, however, cattle gain some access in the lower one mile of Red Creek due to a lack of natural barriers and fencing. The Pasture contains several water developments, corrals, and small holding pastures.

The Mustang/Lower Soda Pasture is also a spring/summer-only pasture, used for 3.5 months at a time for the first two years and rested the third year. This pasture is the farthest from the Verde River, and contains only intermittent portions of Tangle Creek. The Mustang/Lower Soda Pasture contains several corrals, spring developments, and stock ponds.

The Red Hills Pasture has not been grazed since 1998. Prior to that time, grazing occurred within the pasture on a winter-use-only basis, from November 1 through March 31. The Verde River flows through the entire length of the pasture, and the pasture includes portions of Red Creek and Wet Bottom Creek as well. The majority of the pasture is within the Mazatzal Wilderness. Developments within the pasture include a few springs and one holding pasture at Palo Verde Cabin.

Current management calls for the use of salting, gathering facilities, and holding and shipping pastures. Managers use salt, drift fences, and spring developments to attempt to draw cattle into steeper areas to improve livestock distribution and forage use. Gathering facilities include the Palo Verde Holding pasture located south of the Verde River/Red Creek confluence in the Red Hills Pasture, private land at TT Spring, a horse pasture behind the private property, the Yellowjacket Holding Pasture, and the Cedar Push Shipping Pasture and corrals. The Yellowjacket Holding Pasture and Corrals, located in the Red Creek/Soda Spring/Yellowjacket Pasture, are 4.0 miles west of the Verde River, and are used between summer pasture moves in July. The Roundtree/Cedar/Tangle Pasture include shipping corrals less than 0.25 miles north of FR 16 from the FR 269 junction. This corral is used in conjunction with the Cedar Push Holding Pasture.

The private land and base property consist of approximately 40 acres located on a spring that flows into Red Creek in the Red Creek/Soda Spring/Yellowjacket Pasture. Landowners use this property for 10-12 horses, a milk cow, and several cattle (at times).

The EA notes watershed condition is mostly satisfactory, with approximately 20 percent of the watershed in unsatisfactory condition. The BAE classifies most of the soils on the Red Creek Allotment as being in satisfactory condition, noting that there are numerous areas in impaired or unsatisfactory soil condition. The allotment contains 36,804 acres (47 percent) in satisfactory condition, 11,116 acres (14 percent) in a combination of satisfactory and impaired conditions, 17,855 acres (23 percent) in impaired condition, 5,773 acres (7 percent) in unsatisfactory condition, and 6,199 acres (8 percent) that are unsuitable for grazing. Areas in unsatisfactory condition are along the Verde River or near ranch headquarters, on slopes of less than 15 percent, and at elevations less than 3,200 feet. Soils in these areas are compacted, have sparse ground cover, reduced water infiltration rates with excessive runoff, and poor watershed conditions. The BAE indicates that the unsatisfactory soil conditions appear to have been caused by long-term grazing impacts in the past, but that current management practices may also be slowing or preventing recovery.

Vegetation communities have also been altered by grazing. Within the Sonoran desertscrub community, the BAE notes that perennial grasses are generally found in the flatter areas, but that heavy livestock concentrations have removed much of the grass component within this community. The juniper and associated grassland community occurs between the semi-desert grasslands and pinyon-juniper woodlands, and is the dominant vegetation community on the allotment. According to the BAE, past heavy grazing pressure and the lack of natural fire disturbance have encouraged the encroachment of snakeweed (*Gutierrezia sarothrae*), catclaw acacia, mimosa (*Mimosa biuncifera*), and prickly pear within this community.

Aquatic and Riparian Condition

The Verde River flows for approximately 14.7 miles north to south through the allotment. Red and Tangle creeks are tributaries of the Verde River and drain the western portion of the allotment. The eastern portion of the allotment is relatively dry with no perennial streams. A U.S. Geological Survey gage on the Verde River below Tangle Creek has recorded flows ranging between 61 and 110,000 cubic feet per second (cfs), with mean annual flows between 189 and 2,229 cfs. According to the fish BAE, aquatic habitat within the Verde River in the project area is comprised of glides and runs, with short, steep riffles. The substrate of the river is predominantly sand and gravel. The fish BAE describes the Verde River within the allotment as impaired. The active channel is widening as mid-channel and sidebars force flows to migrate and erode channel banks. The fish BAE notes that there is evidence of cattle trailing and mass wasting, and that stream banks are unstable. The BAE notes that the Verde River is a perennial river classified as a C type channel using Rosgen's stream classification system. C type channels can be described as a low gradient, alluvial channel with point-bars, riffle/pool complexes, and broad, well-defined floodplains (Rosgen 1996).

Red Creek is intermittent within the allotment, with some areas of perennial flow. Red Creek is small, with base flows of only a few cfs. It is perennial from near the Red Creek Ranch to approximately one mile above its confluence with the Verde River. Those portions of Red Creek above and below the perennial reach are temporally intermittent and flow only during, and for a while after, precipitation and runoff events. According to the fish BAE, aquatic habitat within Red Creek is shallow runs and glides over shifting sand substrates. Those portions of the channel in canyon-bound reaches have bedrock and boulders which form pools and riffles. The fish BAE notes that pools within the channel are shallow and filled with sand. FR 18, which is a four-wheel-drive track, crosses Red Creek repeatedly in the lower four miles and, according to the fish BAE, 57 percent of the total length of the channel is directly affected by the road bed.

The BAE classifies most of Red Creek as a Rosgen type F4. F4 channels generally has a slope of less than two percent, and gravel as the primary channel material. There is moderate sinuosity, and the channel is considered entrenched with high bank erosion rates. There is a high sediment supply from streambanks, which have high erosion rates due to side slope rejuvenation and mass-wasting processes (Rosgen 1996). The BAE has characterized Red Creek as being in nonfunctioning condition. Under the Proper Functioning Condition (PFC) Criteria (USBLM 1993), a nonfunctional classification is defined as:

> "Riparian-wetland areas that clearly are not providing adequate vegetation, landform, or large woody debris to dissipate stream energy associated with high flows and thus are not reducing erosion, improving water quality, etc.... The absence of certain physical attributes such as a floodplain where one should be are indicators of nonfunctioning conditions."

Those portions of Red Creek within the first 3/4 miles upstream of the Verde River confluence are classified as a C4 type channel. C4 channels can be described as a slightly entrenched, meandering, gravel-dominated riffle/pool channel with a well-developed floodplain. C4 stream channels generally have a gradient of less than two percent, and is slightly sinuous. Streambanks are composed of unconsolidated, heterogenous, non-cohesive, alluvial materials that are finer than the gravel-dominated bed materials. As a result, the stream is susceptible to accelerated bank erosion. Sediment supply is moderate to high. C4 channels are susceptible to shifts in lateral and vertical stability caused by direct channel disturbance and changes in the flow and sediment regimes of the contributing watershed (Rosgen 1996).

Red Creek is additionally affected by vehicular use of FR 18. FR 18 enters Red Creek from the Tangle Creek, approximately four miles above the Verde River/Red Creek confluence. The fish BAE notes that the first reach within this four miles (approximately 0.7 miles) is perennial, and confined to a valley bottom, leaving no room for the road to avoid impacting the stream. The road crosses Red Creek fequently in this portion, often traversing long lengths of the channel. The fish BAE concludes that, as a result of the road and cattle grazing, the streambanks are indistinct. The next 1.8 mile reach also has perennial flows. In this portion, the road is able to make use of terraces due to a wider valley bottom. Approaches of the road to the stream channel

are at a straight-across angle, and are steep. Overland runoff from the uplands crosses the road, funneling fine sediment from the roadbed into the stream. For the remaining 1.5 miles of Red Creek, the valley is broader, and the road continues along the stream channel. The fish BAE notes that vehicular use destabilizes the road surface, likely contributing to erosion and sediment movement during flood events. At the Verde River confluence, there is a large area of bare ground and disturbed soil and vegetation due to continual impact of vehicle use.

Tangle Creek is also intermittent within the allotment, but has some reaches of perennial flow. Tangle Creek consists of base flows of a few cfs, and contains shallow runs and glides over shifting sand substrates. The BAE notes that the Tangle Creek is stream type F3. F3 channels are cobble dominated, entrenched, meandering channel which is deeply incised in gentle terrain. F3 channels generally have a slope of less than two percent, and have riffle/pool features. Sands are often imbedded within the larger cobble sizes. Sediment supply to F3 streams is moderate to high, and there is a high sediment supply from streambanks (Rosgen 1996). The BAE classifies Tangle Creek as a nonfunctional stream. The BAE further notes that the streambanks and vegetation along Tangle Creek are highly impacted by cattle, but that there is a high potential for recovery in some reaches.

In addition to riverine habitat, the allotment contains springs. Zig Zag Spring is a tributary to Red Creek, and consists of approximately one mile of perennial-interrupted and ephemeral water. Zig Zag Spring originates on the Red Creek ranch private property, and flows northwesterly for one mile to enter Red Creek. A dam is used to divert water from the springhead to an irrigated pasture. The fish BAE indicates that habitat for approximately 0.25 miles below the dam is shallow pools and runs scoured to bedrock. Aquatic habitat conditions are considered good.

Dutchman Grave Spring is a 0.3 mile wetted reach in a tributary to Sycamore Creek within the Mazatzal Wilderness. The fish BAE notes that Dutchman Grave Spring is not used by cattle as rugged terrain prevents access.

Thicket Spring is an earthen stock tank built on top of a natural spring. Cattle within the Mustang and Red Creek pastures access the spring for water, and it is considered essential part of pasture operations. Cattle grazing curtails cattail growth within the tank, which is relatively shallow and would likely otherwise be overgrown.

The fish BAE notes that riparian conditions on the allotment are generally unsatisfactory. Red and Tangle creeks are described as being in very poor condition due to grazing management. The fish BAE indicates that a recent field trip to the Verde River found that utilization levels and streambank impacts exceed the Forest Service's riparian area management guidance.

The fish BAE notes that waters on the allotment either currently possess the necessary constituent elements for listed fish species, or could provide them under improved conditions. The fish BAE indicates that disturbances from natural events still occur in occupied and unoccupied habitats and keep those habitats rejuvenated and suitable for topminnow.

However, livestock grazing is identified within the fish BAE as an extra impact that "...swiftly can make the habitat unsuitable." The fish BAE notes that the general use of riparian areas for gathering, trailing, shipping, holding, and working cattle may keep potential habitats from developing suitable conditions.

Table 4 (Appendix A) summarizes stream courses on the allotment by pasture that include occupied, suitable unoccupied, or potential habitat for fishes.

Previous Consultations

Numerous consultations have been completed with Federal agencies for actions taken within on the Tonto National Forest and/or the Verde River. A list of these consultations is provided in Table 5 (Appendix A).

Status of the Loach Minnow (within the Action Area)

Historically, loach minnow were found in the Verde River, however, they were last found there in the late 1930s (Minckley 1993). The Verde River and Red Creek are currently considered suitable but unoccupied habitat. Additionally, portions of the Verde River upstream of the allotment are critical habitat for loach minnow. There is no designated critical habitat for loach minnow within the proposed project area. Those portions of the Verde River within the allotment offer substantial value for loach minnow recovery, and portions of the Verde River within the allotment may be considered as critical habitat in future, potential revisions of the existing critical habitat designation (USFWS 2000).

The fish BAE concludes that spawning habitat within the allotment on the Verde River does not appear to be limiting, and that other elements of loach minnow habitat do exist along the Verde River within the allotment. However, due to downcutting and disconnection with the floodplain, the habitat in the river has become simplified and may not supply adequate larval and juvenile habitat for loach minnow. Additionally, riparian condition on the allotment is described as being in very poor condition in Allotment Summary Sheets prepared by Forest Service personnel in 1998. The summary sheets note that severe bank trampling and riparian vegetation over-utilization has occurred, and that high concentrations of cattle feces were present. There is a high sediment supply from streambank erosion, which can increase imbeddedness within the streams. Additionally, the Forest Service classified Red Creek and Tangle Creek as nonfunctional under PFC criteria (USBLM 1993).

Status of the Gila Topminnow (within the Action Area)

Topminnow are native to the Verde River. Additionally, on September 4, 1981, the Service, Forest Service, and AGFD entered into a Memorandum of Understanding (MOU) to reintroduce the topminnow into waters on National Forest administered lands in Arizona within the species' historic range. Reintroductions carried out under the MOU underwent section 7 consultation.

The resulting biological opinion, and three subsequent amendments to it, identified specific reintroduction sites and found that existing uses of the sites and normal maintenance activities involved with those uses could result in adverse effects to topminnow up to and including loss of any or all of the reintroduced populations without jeopardizing the continued existence of the species. Additional uses or changes in use or management of these areas were not covered by this biological opinion. Topminnow were ultimately reestablished in several springs on Red Creek Ranch in 1982 and 1983. Table 6 (Appendix A) summarizes the reestablishment sites and their current status.

An "extirpated" designation, as provided in the above mentioned table, means that a particular spring no longer sustains topminnow and has been judged to be inadequate for stocking (USFWS 1999b). A variety of factors have led to the determination of extirpation. Site evaluations have determined that Unnamed Spring #6, Unnamed (TT) Spring, and White Rock Spring, have periodically been dry. Low water levels are a problem for TT Spring and Unnamed Spring #5 as well. Site evaluations have determined that Thicket Spring needs to be deepened and *Typha* sp. controlled before the site would be considered suitable for further reintroduction efforts (Weedman *et al.* 1997).

Until the Service has made a determination of "extirpated" for a site, the Service does not consider the site extirpated. The Service considers those sites currently categorized as "failed, recommended for restocking" as currently occupied, for the purpose of this and other section 7 consultations. The Service considers Red Creek, Thicket Springs, and Zig Zag Spring as currently occupied and/or likely to be restocked by topminnow. Surveys of Red Creek in 1987 and 1989 located topminnow, although no formal stocking of Red Creek had taken place. Subsequent surveys have not located topminnow within Red Creek, however, both the Service and the Forest Service agree that the site is considered failed, not extirpated, and should be considered for restocking, as noted in the fish BAE. Similar conditions apply at Zig Zag and Thicket springs. Minckley (1999) notes that topminnow experience highly variable population sizes and geographic ranges. Additionally, topminnow are a short-lived, highly fecund species. These factors make it extremely difficult to reach a conclusive determination of extirpated for a given geographic area.

The fish BAE notes that nonnative predators are present within the Verde River in the allotment. The fish BAE also notes that, in its current condition, Red Creek is not particularly conducive for survival of topminnow due to a lack of floodplain development that lead to the creation of meanders and backwaters that are needed by topminnow for year-long occupancy. However, the fish BAE notes that Red Creek, from FR 18 crossing downstream to the Verde River has the potential to provide this type of habitat relatively rapidly if riparian conditions improve to a properly functioning condition, and notes that topminnow has a wide tolerance to habitat types.

Zig Zag Spring originates on the Red Creek ranch private property, and flows northwesterly for approximately one mile to enter Red Creek. A dam near the springhead diverts water to an irrigated pasture. Habitat for approximately 0.25 miles below the dam consists of shallow pools

and runs. The fish BAE notes that the 0.5 mile reach of the stream channel that is on public lands has potential for topminnow, and that riparian and aquatic conditions are in relatively good condition with deep cienega-type pools present. This reach has only been lightly used by cattle recently. The landowner notes that it does occasionally dry up during drought periods.

Dutchman Grave Spring, stocked in 1985, continues to support topminnow. Dutchman Grave Spring is a 0.3 mile wetted reach of an otherwise dry tributary to Sycamore Creek within the Mazatzal Wilderness. The spring is surrounded by a mature, riparian forest with abundant water in many large pools.

Status of the Southwestern Willow Flycatcher (within the Action Area)

Surveys for flycatchers have occurred along the Verde River since 1993 to the present. Survey results indicate a total of seven migrant flycatchers between 1997 and 1999 at Ister Flat, which is 4.25 river miles south of the allotment boundary (Paradzick *et al*. 2000). Additionally, there was one response during a tape playback survey at OK Flat during a May 1999 survey, approximately 3.2 river miles south of the Verde River/Red Creek confluence and within the allotment boundary. A June 1999 survey yielded no response, and it was determined that the May response was that of a migrant flycatcher. The nearest record of a nesting flycatcher to the action area is from the Camp Verde area, approximately 38.5 river miles north of the allotment boundary. Southwestern willow flycatchers, either migrant or nesting, are therefore known to occur on the Verde River both north and south of the allotment. It is likely that the Verde River is used as a migration corridor by flycatchers.

Unoccupied, suitable habitat exists within the allotment boundary at the confluence of Red Creek and the Verde River, and at OK Flat. Other portions of the Verde River have been classified as potential. The BAE notes that certain portions of the Verde River within the allotment are not currently considered suitable habitat because they lack the multi-layer, dense riparian habitat development used by flycatchers. Similarly, the BAE concludes that Red and Tangle creeks have not been surveyed because they lack the riparian overstory and dense understory required by flycatchers. The BAE notes that range analysis information as well as videography were used to determine potential and suitable habitat patches for flycatchers. These areas were then ground-truthed. Site visits to evaluate Red and Tangle creeks were conducted on September 10 - 11, 1998, by Forest Service and Fish and Wildlife Service biologists. The field trip resulted in the designation of potential habitat for a portion of Red Creek and Tangle Creek.

The Service designated approximately 90 miles of the Verde River from Sob Canyon to Horseshoe Reservoir as critical habitat for flycatcher. Tavasci Marsh and Ister Flat are also considered critical habitat. The critical habitat designation includes all portions of the Verde River within the allotment. The lateral extent of designated critical habitat includes those areas within 100 meters of the edge of areas with surface water during the May to September breeding season.

This encompasses thickets of riparian trees and shrubs that occur, or that may become established as a result of natural floodplain processes or rehabilitation (USFWS 1997b, USFWS 1997c).

Since the flycatcher's listing in 1995, at least 46 Federal agency actions have undergone or are currently undergoing formal section 7 consultation throughout the bird's range. Six actions have resulted in jeopardy decisions. Many activities continue to adversely affect the distribution and extent of occupied and potential breeding habitat throughout its range, including development, grazing, recreation, and dam operations. Stochastic events also continue to adversely affect the distribution and extent of occupied and potential breeding habitat. A catastrophic fire in June of 1996 destroyed approximately 0.62 miles of occupied habitat on the San Pedro River in Pinal County, and resulted in the forced dispersal or loss of up to eight pairs of flycatchers (Paxton *et al.* 1996).

Loss of flycatcher habitat due to Federal projects such as the modification of Roosevelt Dam and the operation of Hoover Dam has resulted in biological opinions that led to acquisition of otherwise unprotected property specifically for the flycatcher. Portions of the lower San Pedro River have been acquired by the Bureau of Reclamation and are now currently under the management of The Nature Conservancy. In the future, unprotected habitat will be purchased or rehabilitated to compensate for loss of flycatcher habitat along the Lower Colorado River, Tonto Creek, and Salt River in Arizona, and Lake Isabella in California.

Status of the Cactus Ferruginous Pygmy-owl (within the Action Area)

With the exception of historical occurrences on the Verde and New rivers, there are no records of pygmy-owls occurring on the Cave Creek Ranger District. Historic records indicate that pygmy-owls occupied areas as far north as New River, 35 miles north of Phoenix. Additionally, pygmy-owls were located at the confluence of the Salt and Verde rivers. The Forest Service completed surveys on the Tonto National Forest in 1997 and 1998 in desertscrub communities from the Salt River south to Highway 60, and along the Verde River north of the Fort McDowell Reservation upstream to Horseshoe Dam. No owls were detected. The allotment is approximately 38 miles from critical habitat in the Sonoran Desert, and over 100 miles from the closest known nest, located in southern Pinal County.

Riparian vegetation along the Verde River is suitable habitat for pygmy-owls. This riparian area will no longer be grazed under the proposed action, due to the closure of the Red Hills Pasture. However, portions of Red and Tangle creeks may offer potential habitat for the pygmy-owl, where grazing will continue. Additionally, lower elevational portions of the allotment are classified as Sonoran desertscrub, which is also a suitable habitat type for the pygmy-owl.

IV. EFFECTS OF THE ACTION

It is extremely doubtful that any grazing scheme will improve a local hydrologic circumstance over that found under ungrazed conditions (Platts 1990, Belsky *et al*. 1999). Platts (1990) indicates that the two primary reasons why grazing strategies of any type have not protected riverine-riparian systems in the past is because streamside areas are generally incorporated into the larger pastures and not identified as distinct areas needing specialized management, and because the range is generally overstocked.

Aquatic and Riparian Habitats

The effects of livestock grazing on riparian and aquatic habitats have been well documented and discussed in recent years (Platts 1990, Fleischner 1994, Belsky *et al*. 1999). Potential effects can be categorized into upland/watershed effects, streambank effects, streamflow and channel effects, water column effects, and effects to riparian vegetation. Changes in the upland or watershed can include removal of vegetation, alteration of species composition of vegetation communities, decreased soil stability and porosity, decreased water infiltration, and increased soil erosion and compaction. Grazing can reduce the roughness coefficient of watersheds, which in turn results in more surface runoff, soil erosion, and flooding, which have effects on the water column, as discussed below. Resulting changes to watercourses can include changes in the hydrograph such as decreased base flows, increased flood flows, and increased sediment (Gifford and Hawkins 1978, Kauffman and Krueger 1984, Chaney *et al*. 1990, Platts 1990, Fleischner 1994).

The potential effects of grazing on streambanks include the shearing or sloughing of streambank soils by either hoof or head action; elimination of streambank vegetation; erosion of streambanks following exposure to water, ice, or wind due to loss of vegetative cover, and; an increased streambank angle which increases water width and decreases stream depth. Damage begins to occur almost immediately upon entry of the cattle onto the streambanks and use of riparian zones may be highest immediately following entry of cattle into a pasture (Platts and Nelson 1985, Goodman *et al*. 1989). Vegetation and streambank recovery from long rest periods may be lost within a short period following grazing reentry (Duff 1979). Bank configuration, soil type, and soil moisture content influence the amount of damage with moist soil being more vulnerable to damage (Marlow and Pogacnik 1985, Platts 1990).

Following streambank alteration, potential effects to the channel itself can include changes in channel morphology and altered sediment transport processes (Platts 1990). Within the stream itself, there can be changes to pools, riffles, runs, and the distribution of backwater areas, a reduction in cover for fishes, elevated water temperatures, changes in nutrient levels, and increased sedimentation (Platts 1990, Belsky *et al*. 1999).

Effects to riparian vegetation can include changes in plant species composition, such as a transition from brush to grass to forbs; a reduction of floodplain and streambank vegetation,

including vegetation which overhangs banks or is found within the water column; decreases in plant vigor; alteration of plant growth form, such as lateral branching; changes in the timing and amount of organic energy leaving the riparian zone, and; elimination of riparian plant communities, which may occur as a result of lowering of the water table so that xeric plants replace riparian plants (Platts 1990, Fleischner 1994). Vegetation along small streams exercise important controls over physical conditions in the stream environment by acting as a roughness element that reduces velocity and erosive energy, by producing the bulk of the detritus that provides much of the organic matter necessary to support stream communities, by stabilizing streambanks, and by determining the quality of the stream habitat for aquatic species (Kauffman and Krueger 1984). Vegetation in riparian areas is usually grazed more heavily than the adjacent uplands (Platts and Nelson 1985).

Livestock can directly alter streamside vegetation by trampling, rubbing, and grazing on herbaceous plants and browsing on shrubs (Kauffman and Krueger 1984, Platts and Nelson 1985, Platts 1990). Impacts to vegetation can be classified as utilization of herbaceous vegetation, and utilization of woody vegetation. Use and removal of herbaceous vegetation leads to changes in species composition, species diversity, and biomass while use and removal of woody vegetation can lead to changes in foliage cover, structural height diversity, and stand reproduction. Livestock can also have indirect effects on riparian vegetation by compacting the soils and causing increased runoff and decreased water availability to plants, and by increasing soil temperatures which can lead to increased evaporation due to the removal of vegetation (Kauffman and Krueger 1984).

Changes to the water column within the stream itself can be many and varied. Water column alterations can be caused by withdrawals of streamflow to irrigate grazing lands; drainage of wet meadows or lowering of the groundwater table to facilitate grazing access; changes in the magnitude and timing of organic and inorganic energy inputs to the stream; increases in fecal contamination; changes in water temperatures due to removal of vegetation; changes in water column morphology, including increases in stream width and decreases in stream depth, as well as reduction of stream shore water depth; changes in timing and magnitude of streamflow events from changes in watershed vegetative cover, and; increases in stream temperature (Platts 1990, Fleischner 1994).

The effects of grazing on aquatic habitat are varied, and can include alteration of streambanks, the reduction of shade, a decrease in cover, and subsequent changes to stream temperatures. Because streams in improperly grazed areas contain more fine sediment, streambanks become more unstable, banks are less undercut so that potential fish habitat is eliminated, channels widen, water becomes more shallow, and channel substrates are altered by accrual of eroded sediment which causes embeddedness. The alteration of streambanks is particularly harmful as fish often adapt their survival to this habitat edge as the overhanging banks provide cover, control water velocities, and supply incoming terrestrial foods (Platts 1990).

The effects of the continued use of FR 18 within the allotment on the stream channel are direct and indirect. Vehicular use of the road at crossings of the active channel precludes the recruitment or encroachment of herbaceous vegetation. The location of the road on terraces adjacent to the stream results in acceleration of erosion and transport of sediment to the stream during overland flow events. Indirect effects of road use on fisheries habitat include a reduction in the amount of pool and riffle habitat due to increased sedimentation and embeddedness which may result in a reduction of macroinvertebrate production, increased diurnal water temperature patterns due to an increased exposure of surface water, a decrease in feeding success due to higher turbidity, and a decrease in water quality due to dust and pollutants washed from the underside of vehicles in the active stream channel. Direct effects from road use can include displacement and crushing of individual fish (primarily eggs and larvae) by vehicles in the stream.

The Red Hills pasture, including the Verde River, the lower 2.9 miles of Red Creek, and Dutchman Grave Spring would not be grazed as fencing would exclude livestock grazing from 2.2 miles of Red Creek from Thicket Spring downstream to Zig Zag Creek in Red Creek pasture, 0.5 miles of Zig Zag Creek, and 0.5 miles of Red Creek in the Tangle Creek pasture. Winter grazing would occur every other year on approximately 2.1 miles of Red Creek in the Red Creek Pasture. Tangle Creek would be winter grazed every other year in rotation with the Red Creek Pasture. Thicket Spring would be partially protected, and grazed between 2.5 to 3 or 6.5 to 7 months, depending on the year.

The fish BAE notes that those areas excluded from grazing (the Verde River, Zig Zag Spring, and Dutchman Grave Spring) can be expected to experience aquatic habitat recovery, hampered somewhat by upland conditions. Similarly, the upper and lower reaches of Red Creek that would be excluded from grazing should experience recovery of aquatic habitats, but slowed by the recovery of upland soils conditions and the effects of grazing in the middle reach. The fish BAE anticipates that aquatic habitat recovery in Tangle Creek is unlikely due to direct impacts from grazing in riparian areas coupled with indirect effects from upland conditions.

Desertscrub Habitat

The United States General Accounting Office (USGAO 1991) determined that domestic livestock grazing on hot desert allotments managed by the Bureau of Land Management "...continues to impose the risk of long-term environmental damage to a highly fragile resource." The USGAO states that historic grazing practices reduced the vigor of the hot desert ecosystems, and believes that evidence suggests that grazing practices continue to reduce productivity and vigor, noting that recovery could take decades in some areas, and that damage may be irreversible in others. Among the effects of grazing noted by the USGAO (1991) are trampling of vegetation, removal of vegetation, trampling of habitat for endangered species, elimination of vegetation components, and grazing too heavily on key species. The USGAO (1991) indicates that "Furthermore, changes in the amount and composition of vegetation caused by overgrazing

can be detrimental to native wildlife that are unable to adapt to the alterations." The USGAO (1991) further notes that, should grazing be discontinued, less soil erosion would occur, water infiltration would increase, soils would generally improve, vegetation would gain in health and vigor, cover would increase and would benefit both soil and wildlife.

Grazing can cause changes in the structure and composition of desertscrub habitat. Most studies on the effects of grazing in desertscrub have been based in the Mohave and Chihuahua deserts. However, similar effects from grazing would be expected in the Sonoran desert. These effects include a decrease in grasses and an increase in reduced shrub cover (Webb and Stielstra 1979), and reduced desirable shrubs (Orodho *et al*. 1990). In a study conducted in Sonoran desertscrub, Abouhalder (1992) found that grazing leads to browsing of shrubs and young trees, and trampling or browsing of saguaros and their nurse plants.

Effects to Loach Minnow

The fish BAE notes that loach minnow habitat in the Verde River should improve, although with continued sedimentation from upland sources that may cause increased embeddedness in riffle habitats required by loach minnow. Because of their benthic habit, loach minnow and their eggs are particularly vulnerable to substrate sedimentation that reduces habitat and smothers eggs (Propst *et al*. 1988). Additionally, the fish BAE determined that the potential for suitable loach minnow habitat to develop in Red Creek may be delayed or prevented from occurring due to the proposed action.

Regional guidance criteria (USFWS 1998) state that, in order to avoid adverse effects, complete exclusion of livestock from habitat occupied by listed fishes, or exclusion during spring from unoccupied suitable and potential habitat, is necessary unless site-specific information dictates otherwise. The fish BAE concludes that the action, as proposed, does not meet the "no effect" criteria" for loach minnow, and that the action, as proposed, is likely to adversely affect loach minnow because: 1) livestock are not excluded from accessing a portion of Red Creek that has potential but unoccupied habitat; 2) the watershed is not in satisfactory condition, soil condition will probably remain unsatisfactory or with slow improvement on slopes less than 15 percent, and increased stocking rates will slow recovery of soil condition; and 3) site inspections have indicated that middle Red Creek streambank morphology and vegetation are likely to be degraded by livestock grazing with measurable on-going effects on the recovery of habitat for loach minnow.

Effects to Gila Topminnow

The seriously impaired status of topminnow, together with the degraded environmental baseline for the Tonto National Forest, makes even small adverse effects to the species and their habitat of serious concern.

As the draft revision of the topminnow recovery plan points out, the status of the species is such, and past habitat losses so severe, that recovery (downlisting) is only a long-term vision, and the short-term goal is simply to prevent the extinction of the species within the Gila basin (Weedman 1998).

For topminnow, occupied habitat is present at Dutchman Grave Spring, suitable habitat is present in Red Creek, Zig Zag Spring, and Thicket Spring, and potential habitat is present in Tangle Creek. Changing of the allotment boundary to incorporate Dutchman Grave Spring into the Red Hills Pasture will, in the long term, have a beneficial effect on topminnow by removing the spring from the grazing pressures it currently experiences as part of the Sears Club/Chalk allotment. However, it is possible that relocation and construction of the existing boundary fence to incorporate Dutchman Grave Spring may have short-term, adverse effects on topminnow within the spring. Additionally, continued grazing within the watershed will likely slow or prevent complete recovery of habitat within Dutchman Grave Spring.

It is also possible that the reconstruction of a fence at Thicket Spring tank, which would create an exclosure for topminnow, may in the long-term have a beneficial effect on topminnow. As noted in the Provisional Extirpation Report (Weedman *et al*. 1997), management, but not elimination, of *Typha* spp. is likely needed to provide habitat at this Spring. The Forest Service's proposal would attempt to manage Thicket Spring tank for topminnow. As previously noted, the Service considers Thicket Spring tank occupied. It is therefore possible that construction of a partial exclosure could result in short-term, adverse effects to topminnow within the tank during the actual construction of the exclosure.

As previously noted, the Service considers Red Creek as occupied by topminnow. Continued grazing along 2.1 miles of Red Creek can expect to result in adverse, direct effects of mortality due to trampling of stream channels by livestock, and incidental consumption of small topminnow during livestock watering. Additionally, the effects of the continued use of FR 18 are noted above, and can include a reduction in the amount of pool and riffle habitat due to increased sedimentation and embeddedness, reduced macroinvertebrate production, increased diurnal water temperature patterns, decreased feeding success, decreased water quality, and increased mortality due to crushing of individual fish.

According to the fish BAE, continued grazing along Tangle Creek will preclude the restoration of this area to habitat suitable for topminnow. Effects from this portion of the proposed action would be adverse to topminnow, in that they preclude the progression of habitat for the species from potential to suitable.

Currently, regional guidance criteria (USFWS 1998) state that a no effect determination can not be made for topminnow because grazing occurs within the watershed on an allotment which supports occupied, suitable, and potential unoccupied habitat for topminnow, and grazing activities within the watershed on the allotment could limit the recovery of the species. The fish BAE concludes that the action, as proposed, may affect, and is likely to adversely affect

topminnow because: 1) livestock are not excluded from accessing 2.1 miles of Red Creek in the Red Creek Pasture, or from Tangle Creek in the Tangle Creek Pasture; 2) the subwatershed is not in satisfactory condition, and soils will probably remain unsatisfactory or recover slowly on slopes less than 15 percent due to increased stocking rates; and 3) 1998 site inspections indicate that, while exclusion of livestock from Red Creek and Zig Zag Spring would allow recovery of topminnow habitat in these areas, streambank alteration and over utilization of riparian vegetation in Tangle Creek and the middle 2.1 miles of Red Creek would likely continue to restrict riparian and aquatic habitat recovery.

Effects to Southwestern Willow Flycatcher

For the recovery of the flycatcher, dense riparian habitat (preferably native plants) must be restored, riparian ecosystems rehabilitated, and watersheds improved. Therefore, it is not only important to describe effects that might occur directly on the lands that are being grazed, but how grazing would impact the entire watershed. Grazing is presently one of the most significant stressors on rehabilitation and maintenance of flycatcher habitat in the action area. Currently, no willow flycatchers nest along streamside vegetation on the Tonto National Forest (Paradzick *et al*. 2000). Increases in flycatcher populations have been observed where grazing has been reduced, modified, or eliminated from riparian areas. As noted in the guidance criteria (USFS 1998a), Harris *et al*. (1987) observed flycatchers to increase by 61 percent over a five-year period after grazing was reduced.

Tonto Creek, the Verde River, and the Salt River are the largest drainage on the Tonto National Forest. These drainage, along with some of their larger tributaries (i.e., Pinto Creek, Cave Creek, Sycamore Creek, Red Creek, and Tangle Creek), provide the best opportunity to develop suitable flycatcher nesting habitat. Large portions of each stream and their watersheds are under the management of the Tonto National Forest. The only flycatchers nesting on the Tonto National Forest exist in dense tamarisk along the Salt River/Tonto Creek inflows to Roosevelt Lake. This nesting habitat developed due to the lake and will eventually be inundated. It is imperative to develop habitat as quickly as possible and to maintain this habitat through management of rivers, creeks, tributaries, and uplands to ensure the continued existence for this critically endangered species.

The Service believes the most likely location for flycatchers to nest on the Tonto National Forest are along Tonto Creek, and the Salt and Verde rivers. These low-gradient, open river bottoms have the greatest potential to re-develop cottonwood/willow communities. It is these lower gradient streams which flycatchers seem to presently prefer. However, the historical distribution of the flycatcher is not well known, and the population is currently at very low numbers and sparsely distributed. As a result, we are unsure of all the locations where flycatchers can nest.

The Service believes that tributaries offer potential nesting habitat and play a crucial role in controlling unnatural flooding on larger streams. While Red and Tangle creeks do have gradients of up to two percent, the BAE notes that some reaches do have low gradient portions. These

portions can develop dense riparian habitat, suitable for nesting flycatchers. The upland range and riparian habitat along these tributaries also play a crucial role in reducing the energy of water flowing to the mainstem Verde River. As a result, these tributaries are important in providing potential nesting habitat and in protecting riparian habitat on larger streams from unnatural flooding. Additionally, off-river locations with adequate stands of riparian habitat along the San Pedro River (Cook's Seep, Dudleyville, and Indian Hills) have been used for nesting while the mainstem recovered from flooding and other disturbances (G. Beatty, Fish and Wildlife Service, pers.comm. 2000). Tributaries like Red and Tangle creeks may play the same role along the Verde River.

The fundamental approach to recovering an endangered species is to remove the threats to its existence. In the case of the flycatcher, the evidence and field examples in the literature indicate that, with respect to livestock grazing, recovery would be most assured, and in the shortest time, with total exclusion of livestock from those areas that are described as providing potential habitat and where grazing is a significant stressor. The proposed grazing strategy will delay improvement of the environmental baseline. As a result, the proposed strategy of continuing to graze in potential habitat and degraded uplands will continue to adversely affect the flycatcher. Although the Verde River would be excluded from grazing, damage to riparian areas along Red and Tangle creeks would likely contribute to damage of the Verde River riparian corridor as well as Red and Tangle creeks because both creeks are tributaries of the Verde River.

As discussed above, effects from the proposed continued livestock grazing include watershed alteration, physical damage and changes to streambanks, stream channels, and water column in Red and Tangle creeks, and alteration of the riparian vegetative community along both creeks, as well as along the Verde River. Cows would graze approximately 2.1 miles of Red Creek and portions of Tangle Creek during the dormant season by 380 adult cattle in a deferred rotation system. Winter use of riparian areas can reduce, but not eliminate, the impacts of grazing. The strategy is for cattle to graze plentiful herbaceous perennial grasses when cottonwood and willow trees are dormant. Additionally, cold air circulating through river drainages may discourage cattle from congregating in riparian areas. However, grazing during the winter time can still cause severe damage to riparian areas if precautions are not taken (Elmore and Kauffman 1994).

The Forest Service determined that the utilization rate for woody riparian vegetation would be 40 percent of the apical meristems. The BAE notes that this utilization rate was chosen because it was established through section 7 consultation for the Skeleton Ridge/Ike's Backbone Allotment, which is located upstream of the Red Creek Allotment. It should be noted that this utilization level was not successful in minimizing damage to riparian vegetation. During the winter of 1999/2000, cattle caused significant damage by foraging and trampling cottonwood and willow within the riparian areas of the Skeleton Ridge and Cedar Bench allotments due to reduced herbaceous winter time forage and mild temperatures (M. Ross, Tonto National Forest, pers. comm.).

The effects of grazing in the uplands on riparian systems has been addressed above. The Service stresses that to generate and maintain riparian habitat, a healthy watershed (uplands, tributaries, ranges, etc.) is a key component (Elmore and Kauffman 1994, Briggs 1996). Elmore and Kauffman (1994) note that "simply excluding the riparian area (from grazing) does not address the needs of upland vegetation or the overall condition of the watershed. Unless a landscape-level approach is taken, important ecological linkages between the uplands and aquatic systems can not be restored and riparian recovery will be limited." Continuing to graze in upland where the soil conditions and riparian habitat in upland tributaries are unsatisfactory will continue to delay recovery and result in unnatural flooding. Unnatural flooding subsequently topples existing trees, and shallow rooted saplings and poles, and continues to erode rivers, as evidenced by current conditions along the Salt and Verde Rivers, Tonto Creek, and their tributaries.

As noted in the Guidance Criteria (USFS 1998a), a no effect determination can not be reached because:
1) cattle are permitted on the allotment, and; 2) livestock are permitted on the allotment and the allotment contains potential habitat. A determination of may affect, not likely to adversely affect is also not appropriate. The following excerpts of the criteria primarily address the effects of grazing on the flycatcher, and development and/or maintenance of its habitat:

1. Livestock are permitted on the allotment.
2. Livestock grazing reduces habitat suitability.
3. Grazing in potential habitat slows the progression of habitat to suitable, because regeneration or maintenance of woody vegetation is impaired by trampling, bedding, and feeding.
4. Soil conditions in upland areas with livestock are classified, at least in part, as unsatisfactory in watersheds that contain occupied, unoccupied suitable, or potential habitat.
5. Livestock use occurs in riparian areas upstream from occupied, potential, or suitable unoccupied, suitable habitat where it results in the reduction of the quality of the riparian habitat.

The status of the species and the effects of the proposed grazing action can be summarized in the following points:

1. The flycatcher is extremely endangered, and loss of riparian habitat is the primary cause;
2. Potential habitat exists within the action area, on portions of Red and Tangle creeks. The proposed action would permit cattle to graze within potential habitat;
3. The environmental baseline throughout the action area is degraded, with grazing being a significant contributor to poor riparian conditions;
4. Riparian habitat is unsatisfactory within the action area;
5. Upland range conditions are, at least in part, in unsatisfactory condition;

6. Poor range conditions can lead to larger, unnatural flooding, which in turn leads to erosion of streambanks and loss of riparian habitat.

While the history of grazing on the Tonto National Forest and current conditions on the allotment are poor in some areas, the jeopardy standard for this proposed action has not been met. The Service recognizes the importance of tributaries as potential flycatcher habitat, but finds there is still some uncertainty as to the extent to which Red and Tangle creeks may be used by flycatchers. Therefore, the extent to which grazing in the riparian areas has been eliminated, the relatively short distances of waterways along which grazing will occur, and the uncertainty of flycatcher use of Red and Tangle creeks lead us to conclude that the project will not jeopardize the continued existence of the flycatcher.

Portions of the Verde River have been designated as critical habitat for flycatcher. While grazing would occur along tributaries of the Verde River (i.e., Red and Tangle creeks), as well as in upland areas adjacent to the Verde River, the Service does not believe they will result in adverse modification of critical habitat. As noted previously, the proposed action would exclude from grazing all portions of the Verde River within the Red Creek Allotment. The exclusion of the Verde River from grazing activities, as well as the change in use for grazing of riparian areas on tributaries of the Verde River within the allotment, lead the Service to conclude that critical habitat will not be adversely modified.

No flycatchers are known to exist on those streams within the allotment that will be grazed. Only one record of a migratory flycatcher is known to occur on the Verde River within the allotment boundaries, and the Verde River has been removed from grazing within the allotment. The allotment contains portions of critical habitat for the species, as well as potential habitat.

Effects to Cactus Ferruginous Pygmy-owl

As noted within the BAE, there are no known pygmy-owls currently on the Tonto National Forest, and the nearest critical habitat area is approximately 38 miles away on the lower Salt River. The nearest historical record of a pygmy-owl is from New River, approximately 22 miles from the southeastern boundary of the allotment, and is dated in the late 1800s. No pygmy-owl surveys have been completed on the allotment.

The closure of the Red Hills Pasture will provide habitat protection from the direct, adverse effects of grazing for riparian areas along the Verde River that may be suitable for pygmy-owl occupancy. Reduced numbers of cows will be somewhat beneficial, but will be offset by the reduced total acreage that will be grazed within the allotment following closure of the Red Hills Pasture and the subsequently higher stocking rate. Riparian habitat along Red Creek and Tangle Creek will continue to be grazed in a deferred-rotation pattern, with winter use only. While this change in season of use should be generally beneficial to riparian vegetation, grazing will occur at forty percent utilization on woody species.

In addition to riparian habitat, the allotment contains approximately 24,675 acres of desertscrub habitat. Closure of the Red Hills Pasture will eliminate grazing in 18,944 acres, or 77 percent, of the desertscrub acreage within the allotment. Additional portions of the remaining 5,731 acres may be unsuitable for pygmy-owl occupancy as they occur on slopes greater than 40 percent, or at elevations higher than 4,000 feet. The BAE describes the desertscrub areas at higher elevations as being in high to moderately high ecological condition, but notes that perennial grasses within the desertscrub community have experienced heavy concentrations of livestock grazing in the past, and are slow to recover.

No information was presented identifying acres by pasture of desertscrub habitat, but information was presented showing acres of desertscrub/grassland habitat. Pygmy-owls are known to occur in semi-desert grassland where xeroriparian areas are present. Desertscrub/grassland habitat that will be grazed is found in 1,025 acres of the Cedar Pasture, 148 acres of the Lower Soda Pasture, 63 acres of the Upper Soda Pasture, 2,000 acres in the Mustang Pasture, 3,771 acres of the Red Creek Pasture, 323 acres of the Roundtree Pasture, and 2,446 acres of the Tangle Creek Pasture. Portions of the Cedar, Roundtree, and Mustang pastures are above 4,000 feet in elevation, and are therefore unlikely to support pygmy-owls.

The BAE characterizes desertscrub habitat on the allotment as being unsuitable for pygmy-owls due to insufficient vegetation density, insufficient diversity of species, and an insufficient number of large tree and cacti, and with only a limited number of trees larger than six inches in diameter. No information on the presence of xeroriparian areas is presented within the BAE. The Service would require additional, qualitative and/or quantitative information to determine that the approximately 5,731 acres of desertscrub habitat are, in their entirety, unsuitable for pygmy-owl occupation.

Currently, regional guidance criteria (USFS 1998a) state that a no effect determination can not be made for cactus ferruginous pygmy-owls for the proposed action because grazing will occur within suitable cactus ferruginous pygmy-owl habitat within the allotment, and because no surveys have been conducted in the action area to determine that pygmy-owls are or are not present. The guidance criteria recommend grazing at 30 percent utilization in desertscrub and xeroriparian areas, and at 30 percent utilization of apical stems of seedling/sapling woody riparian species. Under the guidance criteria, a may affect, not likely to adversely affect determination can therefore not be reached because livestock grazing will be conducted at higher utilization levels (35 percent in desertscrub and 40 percent in riparian areas) that would be expected to lead to degeneration of composition and vigor of understory vegetation, and that would preclude regeneration of vegetation strata.

The Service believes that utilization levels would adversely affect potential and/or suitable habitat for pygmy-owls, both through the direct effects associated with high utilization levels, and through the indirect effects that grazing in the uplands can have on riparian habitat, including that along the Verde River.

V. CUMULATIVE EFFECTS

Cumulative effects are those effects of future non-Federal (State, local government, or private) activities that are reasonably expected 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.

According to the BAE and other sources, urban and suburban development, water damming, water diversions, agricultural uses and the introduction of non-native fishes have caused significant changes in the Verde River. It is anticipated that these actions, as well as similar, future actions will continue to impact the Verde River.

VI. CONCLUSION

After reviewing the current status of the species, the effects of the proposed implementation of the Red Creek Allotment grazing strategy, the cumulative effects, and the environmental baseline, it is the Service's biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of loach minnow, topminnow, flycatchers, or pygmy-owls. No critical habitat has been designated for topminnow. No critical habitat has been designated within the allotment for pygmy-owls. Critical habitat has been designated on the Verde River for loach minnow, however, the proposed action does not affect areas within that designation. Critical habitat has also been designated on the Verde River within the allotment boundaries for flycatcher. No destruction or adverse modification of critical habitat is anticipated as a result of implementation of the proposed action for flycatchers.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation 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, captureo r collect, or to attempt to engage in any such conduct. Harm is further defined by FWS 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 by FWS as intentional or negligent actions that create the likelihoodof 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 purpsoe of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking t6hat is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by the Forest Service so that they become binding conditions of any grant or permit issued to the allottees, as

appropriate, for the exemption in section 7(o)(2) to apply. The Forest Service has a continuing duty to regulate the activity covered by this incidental take statement. If the Forest Service (1) fails to assume and implement the terms and conditions or (2) fails to require the allottees to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Forest Service or allottees must report the progress of the action and its impacts on the species to the Service as specified in the incidental take statement. [50 CFR §402.14(i)(3)].

AMOUNT OR EXTENT OF TAKE

Loach Minnow

The Service does not anticipate that the proposed action will incidentally take any loach minnow. The Service reached this conclusion based on conditions specific to this proposed action and the action area. Although loach minnow historically occurred in the Verde River, no loach minnow are known to exist in the Verde River, either upstream or downstream of the action area.

Gila Topminnow

The Service anticipates that livestock grazing and management under the proposed action would result in incidental take of topminnow through habitat alteration. It is anticipated that take will occur as a result of direct mortality of individual topminnow and as indirect losses resulting from habitat modification of Red and Tangle creeks, as well as Zig Zag and Thicket springs. Direct mortality may occur during reconstruction of allotment boundary fences at Dutchman Grave's Spring and construction of the enclosure at Thicket Spring. Direct mortality may also result from grazing along 2.1 miles of the middle portion of Red Creek, during which time trampling of the stream channel and incidental consumption of small topminnow by livestock may occur. Harm, or indirect take, may occur through habitat alteration and loss due to grazing in suitable, occupied topminnow habitat along Red Creek; grazing along the Verde River within the Red Hills Pasture when fences are periodically washed out, cut, or damaged; reduction in surface flows due to watershed degradation; alterations in the hydrograph that result in flashier streamflows; and watershed conditions that result in unstable stream channels in Red Creek, and the Verde River.

The anticipated level of take can not be quantified as numbers of individual fish for all portions of the proposed action. Topminnow are short-lived, highly fecund species whose natural cycle includes large, rapid fluctuations that make population estimates difficult to obtain and that mask changes due to take from human actions. In addition, dead fish are seldom found due to their small size and rapid consumption by scavengers. Therefore, the level of take will be quantified differently depending upon the action; i.e., 1) for construction and development actions; 2) for road use of FR 18); and 3) for general ongoing livestock grazing and allotment management.

1. For reconstruction of the allotment boundary fence and construction of the enclosure at Thicket Spring, the Service anticipates that direct take of topminnow will occur at a level that will result in no more than 10 dead or dying fish of any species being observable near the activity, or within 500 yards downstream of the activity, during implementation or within three hours following completion. If this level of mortality is observed, then the Service recommends that work should be halted and consultation reinitiated.

2. For continued use of FR18, the Service anticipates that direct take will be considered to have been exceeded if any one of the following conditions occur:

a. Vehicular use of the road not necessary for Forest Service or grazing management purposes continues;
b. Vehicular use, associated with grazing management, occurs outside of the season of use for the Tangle Creek Pasture.

3. For general ongoing livestock grazing and allotment management, take will be considered to have been exceeded if any one of the following conditions occur:

a. Any portion of the pasture fence for the Red Hills Pasture is down or open for more than two weeks while permitted cattle are in the Tangle Creek Pasture, or for more than two months total during any given year;

b. Livestock grazing occurs within the Red Hills pasture at a level resulting in more than five percent utilization of woody riparian species (measured as percentage of apical meristems within 6 feet of the ground grazed) and trampling, chiseling, or other physical impact by livestock on more than 10 percent of the alterable streambanks by length;

c. The proposed grazing management does not result in improved conditions of those portions of the Horseshoe Reservoir Watershed found with the Red Creek Allotment within five years, unless the failure to achieve static or upward trends is due to causes unrelated to, and not cumulative to, livestock grazing and its management, and changes in the grazing and its management would not reverse or ameliorate the downward trend;

d. The proposed 40 percent utilization levels for riparian areas and 35 percent utilization levels for upland areas are exceeded by more than five percent at any time or streambank alteration exceeds 20 percent by length due to trampling, chiseling, or other physical impacts by livestock.

If during the course of the action, the amount or extent of the incidental take anticipated is exceeded, such incidental take represents new information requiring reinitiation of consultation

and review of the reasonable and prudent measures provided. The Forest Service must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measures.

Southwestern Willow Flycatcher

The Service does not anticipate that the proposed action will incidentally take any flycatchers. The Service reached this conclusion based on conditions specific to the proposed action and the lack of breeding birds in the action area.

Cactus Ferruginous Pygmy-Owl

The Service does not anticipate that the proposed action will incidentally take any pygmy-owls. The Service reached this conclusion based on conditions specific to this proposed action and the action area. Although pygmy-owls historically occurred in riparian habitats in close proximity to the action area, and on the Verde River itself, no pygmy-owls have been known to exist within the action area.

EFFECT OF THE TAKE

No take is anticipated to occur for loach minnow, flycatchers, or cactus ferruginous pygmy-owls. In this biological opinion, the Service finds the anticipated level of incidental take is not likely to result in jeopardy to topminnow.

REASONABLE AND PRUDENT MEASURES

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize the incidental take authorized by this biological opinion.

1. Conduct all proposed actions in a way that will minimize direct mortality of topminnow.

2. Conduct all proposed actions in a way that will minimize loss and alteration of topminnow habitat.

3. Monitor the allotment to document allotment conditions in such a way as to ensure that take, as defined above for topminnow, will not be exceeded, and take additional measures to ensure improvement of conditions, as described below.

4. Maintain a complete and accurate record of actions which may result in take of topminnow and their habitat.

5. Ensure that any actions taken as part of the proposed action will not preclude the restocking of topminnow in the future.

TERMS AND CONDITIONS

In order to be exempt from the prohibitions of section 9 of the Act, the Forest Service is responsible for compliance with the following terms and conditions, which implement the reasonable and prudent measures described above. Implementation of terms and conditions is nondiscretionary.

1. The following terms and conditions will implement reasonable and prudent measure 1.

a. No heavy equipment shall be used within Dutchman Grave Spring when relocating the allotment fence;
b. The use of heavy equipment in Thicket Spring Tank to create the fencing or enclosure shall be minimized, and;
c. Riparian vegetation damaged or destroyed during construction activities at either Dutchman Grave Spring or Thicket Spring tank shall be minimized to the maximum extent possible.
d. A gate shall be installed by the Forest Service on FR 18 to prevent off-road vehicle and recreational traffic to ensure that no direct mortality of topminnow occurs as a result of vehicles in the active channel of Red Creek.
e. Allottees of FR 18 shall be notified of permitted use of the road (i.e., for grazing management during use of the Tangle Creek Pasture).

2. The following terms and conditions will implement reasonable and prudent measures 2, 3, and 5.

a. The Forest Service shall inspect and maintain all topminnow site exclosures (Red Hills Pasture, Thicket Springs Tank, Dutchman Grave Spring) a minimum of three times per year. One of the inspections must be within one month of livestock being put into pastures next to the exclosures. Inspection reports from the permittees may be used to accomplish this term and condition. The permittees shall report their inspection and maintenance work to the District annually. Livestock shall be removed from any exclosure within 24 hours upon learning that they have intruded into the exclosure. Notification shall be provided to the Service of any exclosure fence damage and any livestock intrusion into the exclosures in the annual report required by this biological opinion (Recovery Plan Task 1.4, Weedman 1998).

b. The Forest Service shall apply established and replicable methods to measure utilization on the Red Creek Allotment. Monitoring and measurements shall include, at a minimum: establishment of key areas; identification of species to

monitor; development of closed reference areas; evaluation of the current season's forage production before cattle are placed on pastures to establish stocking rates; and examination of pastures during and after use to establish level of use, condition of land, and the need to move cattle.

1. Stocking rates shall be based on the results from determining the available current forage production each year.
2. Annuals shall be excluded from the forage base because reliance on annuals indicates overuse of perennial grasses and grass-like plants and woody vegetation.
3. Monitoring during use of a pasture shall be completed, at a minimum, at the midpoint of that pasture's use. If utilization is already exceeded, cattle shall be removed from the pasture. If utilization is within 10 percent of the utilization maximum, plans for early removal of cattle shall be developed. These plans shall include:

a. Determination of a monitoring schedule for the remainder of that pastures usage that will be followed to ensure that utilization is not exceeded, and

b. Determination of the location to where the cattle will be relocated.

1. The Forest Service shall monitor streambank alteration during pasture use for those pastures with access to Red Creek. If alteration has already exceeded 20 percent, cattle shall be removed from the pasture. If utilization is within 5 percent of the utilization maximum, plans for early removal of cattle shall be developed. These plans shall include:

a. Determination of a monitoring schedule for the remainder of that pasture's usage that will be followed to ensure that utilization is not exceeded, and;

b. Determination of the location to where the cattle will be relocated.

c. In the annual report described in the general terms and conditions in this biological opinion, the Forest Service shall briefly summarize for the previous calendar year: 1) implementation and effectiveness of the terms and conditions; 2) documentation of take, if any, and; 3) actual livestock use (head, animal months, dates of pasture use, utilization measurements, etc.) with a description of any variations from the proposed action. If other monitoring or research is completed concerning topminnow or conditions of rangeland, riparian areas, or soils, a copy of the relevant reports shall be included (Recovery Plan Tasks 1.4, 1.5, 2.4, 3, Weedman 1998).

d. The Forest Service shall implement closure of FR 18, as described above.

e. The Forest Service shall complete within one year of permit issuance those actions itemized within the BAE designed to draw livestock out of riparian areas including trick tanks, horizontal wells, fence construction or reconstruction, and redesign of the allotment boundary.

f. The Forest Service shall ensure that the Service has copies of all NEPA documentation and section 7 reports done for projects on the Red Creek Allotment (Recovery Plan Tasks 1.4, 1.5, 2.4, 3, Weedman 1998).

3. The following term and condition will implement reasonable and prudent measure 4.

The Forest Service shall ensure that records of exclosure and gap fence monitoring and maintenance are maintained. Exclosure maintenance, repair, livestock intrusion, and other relevant information shall be furnished to the Service as part of the annual report for this biological opinion (Recovery Plan Task 1.4, Weedman 1998).

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act direct Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of listed species. Conservation recommendations are discretionary agency activities to minimize or avoid effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information on listed species.

Loach Minnow

1. Discourage the use of nonindigenous aquatic species on the Forest, and where possible, remove them.

2. Consider implementing the allowable use guidelines for livestock grazing in the Forest Plan on all allotments on the Forest to provide for quicker recovery of watershed and riparian areas.

3. Consider exclusion of cattle from all occupied native fish habitat, as outlined in regional grazing criteria (USFWS 1998).

Gila Topminnow

From the draft, revised Recovery Plan for topminnow (Weedman 1998):

1. Discourage the use of nonindigenous aquatic species on the Forest, and where possible, remove them (Recovery Plan Tasks 1.5, 1.6, 2.4, 2.5).

2. Consider implementing the allowable use guidelines for livestock grazing in the Forest Plan on all allotments on the Forest to provide for quicker recovery of watersheds and riparian areas (Recovery Plan Task 1.4).

3. Consider excluding cattle from all occupied native fish habitat, as outlined in regional grazing criteria (USFWS 1998).

4. Reestablish topminnow in suitable habitats on the Red Creek allotment. In cooperation with the Arizona Game and Fish Department, the Service, and other appropriate parties augment populations of topminnow in Red Creek, Zig Zag Creek, and Thicket Spring through supplemental stockings with fish from biologically appropriate sources. Continue periodic restockings as needed for the term of the permit (Recovery Plan Task 2).

Southwestern Willow Flycatcher

1. Continue survey efforts along the Verde River and along the lower portions of its tributaries within the Tonto National Forest.

2. Implement the allowable use guidelines for livestock grazing in the Forest Plan on all allotments on the Forest to provide for quicker recovery of watershed and riparian areas.

3. Consider the removal of cattle from additional areas of potential habitat for the flycatcher along the Verde River to accelerate the recovery of riparian habitat for this species in order to offset anticipated habitat losses elsewhere on the Tonto National Forest.

Cactus Ferruginous Pygmy-Owl

1. Continue survey efforts along the Verde River and on other portions of riparian and desertscrub habitat within the Tonto National Forest.

2. Implement the allowable use guidelines for livestock grazing in the Forest Plan on all allotments on the Forest to provide for quicker recovery of watershed and riparian areas, or implement the grazing utilization criteria established within the Guidance Criteria (USFS 1998a).

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

REINITIATION NOTICE

This concludes formal consultation on the actions outlined in April 21, 2000, request for consultation on livestock grazing on the Red Creek Allotment. As required by 50 CFR 402.16, reinitiation of formal consultation is required if: (1) the amount or extent of incidental take is

exceeded; 2) new information reveals effects of the agency action that may impact listed species or critical habitat in a manner or to an extent not considered in this opinion; 3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this opinion; or 4) a new species is listed or critical habitat designated that may be affected by the action.

We appreciate your assistance in this consultation. If we can be of further assistance, please contact Mary Richardson (x 242) or Debra Bills (x 239). Please refer to number 2-21-99-F-022 in further communication on this consultation.

Sincerely,

/s/ David L. Harlow
Field Supervisor

cc: Regional Director, U.S. Fish and Wildlife Service, Albuquerque, NM (ARD-ES)
Field Supervisor, U.S. Fish and Wildlife Service, Albuquerque, NM
Regional Forester, U.S. Forest Service, Albuquerque, NM
District Ranger, U.S. Forest Service, Cave Creek, AZ

Director, Arizona Game and Fish Department, Phoenix, AZ

W:\Mary Richardson\section7\redcreek:cgg

LITERATURE CITED

Abarca, F.J. 1987. Seasonal and diet patterns of feeding in loach minnow (Tiaroga cobitis) Girard. Proceedings of the Desert Fishes Council 20:20.

Abbate, D., A. Ditty, S. Richardson, and R. Olding. 1996. Cactus ferruginous pygmy-owl surveys and nest monitoring in the Tucson Basin area, Arizona. Final Report to the Arizona Game and Fish Dept. Internal Enhancement No. U95503, Phoenix, Arizona. 25 pp.

Abbate, D., S. Richardson, R. Wilcox, M. Terrio, and S. Belhumeur. 1999. Cactus ferruginous pygmy-owl investigations in Pima and Pinal counties. Arizona Game and Fish Department Region 5 Wildlife Program. Phoenix, Arizona. 83 pp.

Abouhalder, F. 1992. Influence of livestock grazing on saguaro seeding establishment. Pages 57-61 in C.P. Stone and E.S. Bellantoni (eds.), Proceedings of the Symposium on Research in Saguaro National Monument, Tucson, Arizona.

Ainley, D.G., R.E. LeResche, and W.J.L. Sladen. 1983. Breeding biology of the Adelie penguin. University of California Press, Berkeley, California.

American Birding Association. 1993. Good birds from the hotline. April 1993. Winging it 5(5):3.

Anderson, D.E., O.J. Rongstad, and W.R. Mytton. 1990. Home range changes in post-breeding raptors exposed to increased human activity levels in southeastern Colorado. Wildlife Society Bulletin. 18:134-142.

Bagley, B., G.W. Knowles, and T.C. Inman. 1995. Fisheries survey of the Apache-Sitgreaves National Forests, trip reports 1 - 9. May 1994 to September 1995. Arizona State University, Tempe, Arizona. 50 pp.

Bagley, B.E., G.H. Schiffmiller, P.A. Sowka, and P.C. Marsh. 1996. A new locality for loach minnow, Tiaroga cobitis. Proceedings of the Desert Fishes Council 28:8.

Bahre, C.J. 1991. A legacy of change. Historic human impact on vegetation in the Arizona borderlands. University of Arizona Press, Tucson, Arizona.

Banks, R.C. 1979. Human-related mortality of birds in the United States. U.S. Department of the Interior, Fish and Wildlife Service, Special Scientific Report on Wildlife No. 215.

Barber, W.E. and W.L. Minckley. 1966. Fishes of Aravaipa Creek, Graham and Pinal Counties, Arizona. The Southwestern Naturalist 11(3):313-324.

Belsky, A.J., A. Matzke, and S. Usselman. 1999. Survey of livestock influences on stream and riparian ecosystems in the western United States. Journal of Soil and Water Conservation First Quarter 1999:419-431.

Bendire, C.E. 1888. Notes on the habits, nests and eggs of the genus *Glaucidium boie*. The Auk 5:366-372.

Bent, A.C. 1960. Life histories of North American flycatchers, larks, swallows and their allies. Dover Press, New York, New York. 555 pp.

Binford, L.C. 1989. A distributional survey of the birds of the Mexican state of Oaxaca. Ornithological Monographs No. 443. American Ornithologists' Union, Washington, D.C. 418 pp.

Black, B.B., M.W. Collopy, H.F. Percival, A.A. Tiller, and P.G. Bohall. 1984. Effects of low-level military training flights on wading bird colonies in Florida. Report by Florida Coop. Fisheries and Wildlife Resources Unit. Technical Report No. 7. University of Florida, Gainesville. 190 pp.

Breninger, G.F. 1898. The ferruginous pygmy-owl. Osprey 2(10):128 (*in* Bent 1938).

Briggs, M. 1996. Riparian Ecosystem Recovery in Arid Lands: Strategies and References. University of Arizona Press, Tucson, Arizona.

Britt, K.D. 1982. The reproductive biology and aspects of the life history of Tiaroga cobitis in southwestern New Mexico. New Mexico State University, Las Cruces, New Mexico. 56 pp.

Brittingham, M.C. and S.A. Temple. 1983. Have cowbirds caused forest songbirds to decline? BioScience 33:31-35.

Brooks, J.E. 1986. Status of natural and introduced Sonoran topminnow (*Poeciliopsis o. occidentalis*) populations in Arizona through 1985. U.S. Fish and Wildlife Service, Albuquerque, New Mexico. 19+pp.

Brown, B.T. 1988a. Breeding Ecology of a Willow Flycatcher Population in Grand Canyon, Arizona. Western Birds 19:25-33.

_____. 1988b. Monitoring bird population densities along the Colorado River in Grand Canyon: 1987 breeding season. Final Report to the Glen Canyon Environmental Studies. Bureau of Reclamation, Salt Lake City, Utah. 26 pp.

Brown, D.E. 1994. Biotic communities: Southern United States and Northwestern Mexico. University of Utah Press, Salt Lake City, Utah. 342 pp.

_____, C.H. Lowe, and J.F. Hausler. 1977. Southwestern riparian communities: their biotic importance and management in Arizona *in* R.R. Johnson and D.A. Jones (eds.), Importance, preservation, and management of riparian habitats: a symposium. Gen. Tech. Rep. Rm-43. U.S. Department of Agriculture, Forest Service, Denver, Colorado.

Browning, M.R. 1993. Comments on the taxonomy of *Empidonax traillii* (willow flycatcher). Western Birds 24:241-257.

Burger, J. and M. Gochfeld. 1981. Discrimination of the threat of direct versus tangential approach to the nest by incubating herring an great black-backed gulls. Journal of comparative and physiological psychology (Series A) 95: 676-684.

Camp Pendleton Marine Corps Base. 1994. Biological Assessment: Riparian and Estuarine Habitat.

Carlson, C.A. and R. Muth. 1989. The Colorado River: lifeline of the American southwest. Pages 220 - 239 in D.P. Dodge (ed.) Proceedings of the International Large River Symposium. Canadian Special Publication of Fisheries and Aquatic Sciences 106.

Carlson, P.C., W.S. Lahaye, and A.B. Franklin. 1998. Incestuous behavior in spotted owls. Wilson Bulletin 110 (4): 562-564.

Carothers, S.W. 1977. Importance, preservation, and management of riparian habitats: an overview *in* R.R. Johnson and D.A. Jones (eds.), Importance, preservation, and management of riparian habitats: a symposium. General Technical Report RM-43. U.S. Department of Agriculture Forest Service, Denver, Colorado.

Cartron, J.E. and D.M. Finch (eds.). 2000a. Ecology and conservation of the cactus ferruginous pygmy-owl in Arizona. General Technical Report RMRS-GTR-43. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Ogden, Utah.

_____, W.S. Richardson, and G.A. Proudfoot. 2000b. The cactus ferruginous pygmy-owl taxonomy, distribution, and Natural History. Pp. 5-15 *in* J.E. Cartron and D.M. Finch (eds.), Ecology and conservation of the cactus ferruginous pygmy-owl in Arizona. Geneneral Technical Report RMRS-GTR-43. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Ogden, Utah.

_____, S.H. Soleson, S. Russell, G.A. Proudfoot, and W.S. Richardson. 2000b. The ferruginous pygmy-owl in the tropics and at the northern end of its range: habitat relationships and requirements. Pp. 47-53 *in* J.E. Cartron and D.M. Finch (eds.), Ecology and conservation of the cactus ferruginous pygmy-owl in Arizona. General Technical Report RMRS-GTR-43. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Ogden, Utah.

Caughley, G. and A. Gunn. 1996. Conservation biology in theory and practice. Blackwell Science Inc. United States. 459 pp.

Chaney, E., W. Elmore, and W.S. Platts. 1990. Livestock grazing on western riparian areas. Produced for the U.S. Environmental Protection Agency by the Northwest Resource Information Center, Eagle, Idaho. 45 pp.

Churcher, P.B. and J.H. Lawton. 1987. Predation by domestic cats in an English village. Journal of Zoology, London 212: 439-455.

Collins, M.D. and T.E. Corman. 1995. Cactus ferruginous pygmy-owl Surveys in Arizona: 1993-1994 season. Nongame and Endangered Wildlife Program Technical Report No. 37. Arizona Game and Fish Department, Phoenix, Arizona.

Constantz, G.D. 1980. Energetics of viviparity in the Gila topminnow (Pisces: Poeciliidae). Copeia 1980:676-678.

Cooke, A.S. 1980. Observations on how close certain passerine species will tolerate an approaching human in rural and suburban areas. Biological Conservation 18:85-88.

Cooper, C. A. 1996. Summary of 1995 Surveys for Willow Flycatchers in New Mexico. New Mexico Department of Game and Fish, Santa Fe, New Mexico. 27 pp.

_____. 1997. Statewide summary of 1996 Surveys for Willow Flycatchers in New Mexico. Contract #96-516.81. New Mexico Department of Game and Fish, Santa Fe, New Mexico. 30 pp.

Dahl, T.E. 1990. Wetland losses in the United States, 1780s to 1980s. U.S. Department of the Interior, Fish and Wildlife Service, Washington, D.C. 13 pp.

Davis, W.A. and S.M. Russell. 1984. Birds in southeastern Arizona. Tucson Audubon Society, Tucson, Arizona. 169 pp.

Deacon, J.E. and W.L. Minckley. 1974. Desert fishes in G.W. Brown, Jr. (ed.), Desert Biology, Volume 2. Academic Press, New York, New York.

DeLoach, C.J. 1991. Saltcedar, an exotic weed of western North American riparian areas: a review of its taxonomy, biology, harmful and beneficial values, and its potential for biological control. Report to the Bureau of Reclamation, Boulder City, NV, Contract No. 7-AG-30-04930.

Drost, C.A., M.K. Sogge, and E. Paxton. 1998. Preliminary Diet Study of the Endangered Southwestern Willow Flycatcher. Report to U.S. Bureau of Reclamation. U.S. Geological

Survey, Biological Resources Division/Colorado Plateau Research Station, Northern Arizona University, Flagstaff, Arizona. 26 pp.

Duff, D.A. 1979. Riparian habitat recovery on Big Creek, Rich County, Utah. A method for analyzing livestock impacts on stream and riparian habitat in O.B. Cope (ed.) Forum -- Grazing and riparian/stream ecosystems. Trout Unlimited, Denver, Colorado.

Earhart, C.M. and N.K. Johnson. 1970. Size dimorphism and food habits of North American owls. Condor 72(3):251-264.

Elmore, W. and B. Kauffman. 1994. Riparian and watershed systems: degradation and restoration. Pages 212 - 231 in M. Vavra, W.A. Laycock, and R.D. Pieper (eds.) Ecological implications of livestock herbivory in the West. Society for Range Management, Denver, Colorado.

Felley, D.L. and T.E. Corman. 1993. Spring 1993 cactus ferruginous pygmy-owl surveys in Arizona. Nongame and Endangered Wildlife Program Technical Report. Arizona Game and Fish Department, Phoenix, Arizona. 16 pp.

Fisher, A.K. 1893. The hawks and owls of the United States in their relation to agriculture. U.S. Department of Agriculture, Division of Ornitholology and Mammalogy Bulletin 3:1-210.

Fleischner, T.L. 1994. Ecological costs of livestock grazing in westem North America. Conservation Biology 8(3):629-644.

Flesch, A.D. 1999. Cactus ferruginous pygmy-owl surveys and nest monitoring on and around the Buenos Aires National Wildlife Refuge, Altar Valley, Arizona. A report to the U.S. Department of the Interior, Fish and Wildlife Service, Fish and Wildlife Service Cooperative Agreement No. 1448-00002-99-G943. 21 pp.

Forrest, R.E. 1992. Habitat use and preference of Gila topminnow. M.S. Thesis, University of Arizona, Tucson, Arizona. 84 pp.

Gifford, G.F. and R.H. Hawkins. 1978. Hydrologic impact of grazing on infiltration: a critical review. Water Resources Research 14(2):305-313.

Gilman, M.F. 1909. Some owls along the Gila River in Arizona. Condor 11:145-150.

Goodman, T., G.B. Donart, H.E. Kiesling, J.L. Holechek, J.P. Neel, D. Manzanares, and K.E. Severson. 1989. Cattle behavior with emphasis on time and activity allocations between upland and riparian habitats. Pages 95 - 102 in R.E. Gresswell, B.A. Barton, and J.L. Kershner (eds.) Practical approaches to riparian resource management, an educational

workshop. U.S. Bureau of Land Management, Billings, Montana.

Griffith, J.T and J.C. Griffith. 1995. Brown-headed cowbird trapping and least Bell's vireo recovery on Marine Corps base camp Pendleton, 1983-1993. Abstracts of the North American Research Workshop on the Ecology and Management of Cowbirds. The Nature Conservancy of Texas, Austin, Texas. 88 pp.

_____ and _____. 1996. Brown-headed cowbird trapping and the endangered least Bell's vireo: a management success story. 33 pp.

Hanna, W.C. 1928. Notes on the dwarf cowbird in southern California. Condor 30:161-162.

Harris, J.H., S.D. Sanders, and M.A. Flett. 1987. Willow flycatcher surveys in the Sierra Nevada. Western Birds 18:27-36.

Harris, M.P. 1984. The puffin. T. and A.D. Poyser, Calton, Staffordshire, England. (81).

Harrison, H.H. 1979. A field guide to western birds' nests of 520 species found breeding in the United States west of the Mississippi River. Houghton Mifflin Company, Boston, Massachusetts. 279 pp.

Haug, E.A. 1985. Observations on breeding ecology of burrowing owls in Saskatchewan. M.S. Thesis. University of Saskatchewan.

Hedrick, P.W. and K. Parker. 1999. Genetic characterization of Sonoran topminnow populations. Arizona State University, Tempe, Arizona. 12 pp.

Holmgren, M.A. and P.W. Collins. 1995. Interim report on the distribution, breeding status, and habitat associations of seven federal special-status bird species and Brown-headed Cowbirds at Vandenberg Air Force Base, Santa Barbara County, California. Museum of Systematics and Ecology, Department of Ecology, Evolution, and Marine Biology, University of California: Santa Barbara, California. Environmental Report No. 3.

Howell, S.N.G. and S. Webb. 1995. A guide to the birds of Mexico and northern Central America. Oxford University Press, New York, New York. 851 pp.

Hubbard, J.P. 1987. The Status of the Willow Flycatcher in New Mexico. Endangered Species Program, New Mexico Department of Game and Fish, Sante Fe, New Mexico. 29 pp.

Hubbs, C.L. and R.R. Miller. 1941. Studies of fishes of the order Cyprinodontes. XVII - genera and species of the Colorado River system. Occasional Papers of the Museum of Zoology, University of Michigan 433:1-9.

Huels, T. 1993. Unpublished data, Vertebrate Museum, University of Arizona, Tucson, Arizona.

Hull, T. and D. Parker. 1995. The Gila Valley revisited: 1995 survey results of willow flycatchers found along the Gila River near Gila and Cliff, Grant County, New Mexico. Prepared by Applied Ecosystem Management, Inc. for the Phelps Dodge Corporation. 25 pp.

Hunter, M.L., Jr. 1996. Fundamentals of conservation biology. Rand McNally, Taunton, Massachusetts. 482 pp.

Hunter, W.C. 1988. Status of the cactus ferruginous pygmy-owl (*Glaucidium brasilianum cactorum*) in the United States and Northern Mexico. U.S. Department of the Interior, Fish and Wildlife Service, Phoenix, Arizona. 13 pp.

Jahrsdoerfer, S.E. and D.M. Leslie, Jr. 1988. Tamaulipan brushland of the Lower Rio Grande Valley of South Texas: description, human impacts, and management options. U.S. Department of the Interior, Fish and Wildlife Service, Biological Report. 88(36). 63 pp.

Johnsgard, P.A. 1988. North American owls. Smithsonian Institution Press, Washington, D.C. 295 pp.

Johnson, J.E. and C. Hubbs. 1989. Status and conservation of poeciliid fishes. Pages 301 - 331 in G.K. Meffe and F.F. Snelson (eds.) Ecology and evolution of livebearing fishes (Poeciliidae). Prentice Hall, Englewood Cliffs, New Jersey. 453 pp.

Johnson, R.R. and L.T. Haight. 1985. Status of the ferruginous pygmy-owl in the southwestern United States. Abstracts, 103rd Stated Meeting of the American Ornithologists' Union, Arizona State University, Tempe, Arizona.

_____, _____, and J.M. Simpson. 1979. Owl populations and species status in the southwestern United States. Pp. 40-59 *in* P. Schaffer and S.M. Ehler (eds.), Owls of the west: their ecology and conservation. Proceedings of the National Audubon Society, George Whittel Education Center, Tiburon, California.

Johnson-Duncan, E.E., D.K. Duncan, and R.R. Johnson. 1988. Small nesting raptors as indicators of change in the southwest desert. Pp. 232-236 *in* R.L. Glinski *et al*. (eds.), Proceedings of the Southwest Raptor Management Symposium and Workshop. National Wildlife Federation, Washington, D.C. 395 pp.

Kauffman, J.B. and W.C. Krueger. 1984. Livestock impacts on riparian ecosystems and streamside management implications...a review. Journal of Range Management 37(5):430 - 438.

King, J.R. 1955. Notes on the life history of Traill's Flycatcher (*Empidonax traillii*) in southeastern Washington. The Auk 72:148-173.

Klem, D.A. 1979. Biology of collisions between birds and windows. Ph.D. Thesis. Southern Illinois University.

Knight, R.L., D.L. Grout, and S.A. Temple. 1987. Nest behavior of the American crow in urban and rural areas. Condor 89:175-177.

_____ and D.N. Cole. 1995. Wildlife responses to recreationists. Pp. 51-62 *in* R.L. Knight and K.J. Gutzwiller (eds.), Wildlife and recreationists coexistence through management and research. Island Press, Washington D.C.

Kus, J. 1995. The status of the least Bell's vireo and southwestern willow flycatcher at Camp Pendleton, California, in 1995. Department of Biology, San Diego State University, San Diego, California.

Kusler, J.A. 1985. A call for action: protection of riparian habitat in the arid and semi-arid West *in* R.R. Johnson *et al*. (eds.), Riparian ecosystems and their management: reconciling conflicting uses: First North American Riparian Conference. General Technical Report RM-120. USDA Forest Service, Fort Collins, Colorado.

Leberg, P.L. and R.C. Vrijenhoek. 1994. Variation among topminnows in their susceptibility to attack by exotic parasites. Conservation Biology 8(2):419-424.

LeFranc, M.M. Jr. and B.A. Millsap. 1984. A summary of state and federal agency raptor management programs. Wildlife Society Bulletin 12:274-282.

Ligon, J.S. 1961. New Mexico Birds and where to find them. The University of New Mexico Press, Albuquerque, New Mexico. 360 pp.

Marlow, C.B. and T.M. Pogacnik. 1985. Time of grazing and cattle-induced damage to streambanks. Pages 279-284 in R.R. Johnson, C.D. Zeibell, D.R. Patton, P.F. Ffolliot, and R.H. Hamre (Technical Coordinators) Riparian ecosystems and their management: reconciling conflicting uses. GTR RM-120, USDA Forest Service, Rocky Mountain Forest and Range Experimental Station, Fort Collins, Colorado. 523 pp.

Marsh, P.C., F.J. Abarca, M.E. Douglas, and W.L. Minckley. 1989. Spikedace (Meda fulgida) and loach minnow (Tiaroga cobitis) relative to introduced red shiner (Cyprinella lutrensis). Arizona Game and Fish Department, Phoenix, Arizona. 116 pp.

_____, J.E. Brooks, D.A. Hendrickson, and W.L. Minckley. 1990. Fishes of Eagle Creek, Arizona, with records for threatened spikedace and loach minnow (Cyprinidae). Journal of the Arizona-Nevada Academy of Science 23(2):107-116.

Mayfield, H.F. 1977a. Brown-headed cowbird: agent of extermination? American Birds 31:107-113.

_____. 1977b. Brood parasitism: reducing interactions between Kirtland's warblers and brown-headed cowbirds. Chapter 11 *in* Endangered birds: management techniques for preserving threatened species (S.A. Temple, ed.). University of Wisconsin Press, Madison, Wisconsin.

Maynard, W.R. 1995. Summary of 1994 survey efforts in New Mexico for southwestern willow flycatcher (*Empidonax traillii extimus*). Contract # 94-516-69. New Mexico Department of Game and Fish, Sante Fe, New Mexico. 48 pp.

McCabe, R.A. 1991. The little green bird: ecology of the willow flycatcher. Palmer publications, Inc., Amherst, Wisconsin. 171 pp.

McCarthey T.D., C.E. Paradzick, J.W. Rourke, M.W. Sumner, and R.F. Davidson. 1998. Arizona Partners In Flight southwestern willow flycatcher survey: 1997 Survey and Nest Monitoring Report. Arizona Game and Fish Department Technical Report XX, Phoenix, Arizona.

McDonald, K.P., L.C. Peterson, and M. St. Germain. 1997. Results of 1996 Surveys for southwestern willow flycatchers in the Upper Virgin River drainage and southern Utah. Publication No. 97-3, Utah Division of Wildlife Resources, Cedar City, Utah. 29 pp.

_____, J. Snider, L.C. Peterson, M. St. Germain, and S. Staats. 1995. Results of 1995 southwestern willow flycatcher surveys in the Virgin River drainage and southern Utah. Publication No. 95-17, Utah Division of Wildlife Resources, Cedar City, Utah. 28 pp.

McGeen, D.S. 1972. Cowbird-host relationships. The Auk 89:360-380.

McKernan, R. 1997. Status of the southwestern willow flycatcher along the lower Colorado River: Year 1, 1996. Report to the Bureau of Reclamation, Boulder City, Nevada, and the U.S. Fish and Wildlife Service, Carlsbad, California. 55 pp.

_____ and G. Braden. 1998. Status of the southwestern willow flycatcher along the lower Colorado River: Year 2, 1997. Report to the Bureau of Reclamation, Boulder City, Nevada, and the U.S. Fish and Wildlife Service, Carlsbad, California. 64 pp.

McLaughlin, S.P. and J.E. Bowers. 1982. Effects of wildlife on the Sonoran desert plant community. Ecology 61:246-248.

McNicholl, M.K. 1983. Reactions of male blue grouse to intrusions by an observer. Journal of Field Ornithology 54:77-83.

Meffe, G.K. 1985. Predation and species replacement in American Southwestern stream fishes: a case study. Southwest Naturalist 30:173-187.

_____, D.A. Hendrickson, and W.L. Minckley. 1983. Factors resulting in decline of the endangered Sonoran topminnow *Poeciliopsis occidentalis* (Atheriniformes: Poeciliidae) in the United States. Biological Conservation 25:135-159.

_____ and F.F. Snelson, Jr. 1989. An ecological overview of poeciliid fishes. Pp. 13 - 31 in Meffe, G.K. and F.F. Snelson, Jr. (eds.). Ecology and evolution of livebearing fishes. Prentice Hall, Englewood Cliffs, New Jersey.

Miller, D. 1998. Fishery survey report. Negrito Creek within the Gila National Forest, New Mexico. 29 and 30 June 1998. Gila National Forest, Silver City, New Mexico. July 14, 1998. 7 pp.

Miller, R.R. 1961. Man and the changing fish fauna of the American southwest. Papers of the Michigan Academy of Science, Arts, and Letters XLVI:365-404.

Millsap, B.A. and R.R. Johnson. 1988. Ferruginous pygmy-owl. Pp. 137-139 *in* R.L. Glinski *et al*. (eds.), Proceedings of the Southwest Raptor Management Symposium and Workshop. National Wildlife Federation, Washington, D.C. 395 pp.

Minckley, W.L. 1969. Native Arizona fishes, part I - livebearers. Arizona Wildlife Views 16:6-8.

_____. 1973. Fishes of Arizona. Arizona Game and Fish Department, Phoenix, Arizona. 293 pp.

_____. 1985. Native fishes and natural aquatic habitats in U.S. Fish and Wildlife Region II west of the Continental Divide. Report to the U.S. Fish and Wildlife Service, Albuquerque, New Mexico. Department of Zoology, Arizona State University, Tempe, Arizona. 158 pp.

_____. 1993. A review of fishes of the Coconino National Forest. U.S. Forest Service, Flagstaff, Arizona. 43 pp.

_____. 1999. Ecological review and management recommendations for recovery of the

endangered Gila topminnow. Great Basin Naturalist 59(3):230-244.

_____, J.N. Rinne, and J.E. Johnson. 1977. Status of the Gila topminnow and its co-occurrence with mosquitofish. U.S. Forest Service Research Paper. RM-198:1-8 Rocky Mountain Forest and Range Experimental Station, Fort Collins, Colorado.

Monson, G. 1998. Ferruginous pygmy-owl. Pp. 159 - 161 *in* R.L. Glinski (ed.), The raptors of Arizona. University of Arizona Press, Tucson, Arizona.

_____. and A.R. Phillips. 1981. Annotated checklist of the birds of Arizona. The University of Arizona Press, Tucson, Arizona. 240 pp.

Moyle, P.B. and J.E. Williams. 1990. Biodiversity loss in the temperate zone: Decline of the native fish fauna of California. Conservation Biology 4(3):275-284.

Muiznieks, B.D., S.J. Sferra, T.E. Corman, M.K. Sogge, and T.J. Tibbitts. 1994. Arizona Partners In Flight southwestern willow flycatcher survey, 1993. Draft report: Nongame and Endangered Wildlife Program, Arizona Game and Fish Department, Phoenix, Arizona. Draft of April 1994. 28 pp.

Newton, I. 1979. Population ecology of raptors. Poyser Ltd., Hertfordshire, England. 399 pp.

Noss, R.F. and B. Csuti. 1994. Habitat fragmentation. Pp. 237-264 *in* G.K. Meffe and C.R. Caroll (eds.), Principles of conservation biology. Sinauer Assoc., Sunderland, Massachusetts.

Oberholser, H.C. 1974. The bird life of Texas. Univ. of Texas Press, Austin, Texas. 1,069 pp.

O'Neil, A.W. 1990. Letter, Appendix B *in* Tewes, M.E. 1993. Status of the ferruginous pygmy-owl in south Texas and northeast Mexico. Draft Project Report No. 2, Job 25, Texas Parks and Wildlife Department. Texas A & I University, Kingsville, Texas. 42 pp.

Orodho, A.B., M.J. Trlica, and C.D. Bonham. 1990. Long-term heavy-grazing effects on soil and vegetation in the four corners region. The Southwestern Naturalist 35(1):9-15.

Paradzick C.E., R.F. Davidson, J.W. Rourke, M.W. Sumner, A.M. Wartell, and T.D. McCarthey. 2000. Southwestern willow flycatcher 1999 survey and nest monitoring report. Nongame and Endangered Wildlife Program Technical Report #151. Arizona Game and Fish Department, Phoenix, Arizona.

Parker, D. 1997. The Gila Valley Revisited: 1997 Survey Results of Willow Flycatchers Found Along the Gila River Near Gila and Cliff, Grant County, New Mexico. Unpublished report to Phelps Dodge Corporation. 11 pp.

Parker, K.M., R.J. Sheffer, and P.W. Hedrick. 1999. Molecular variation and evolutionarily significant units in the endangered Gila topminnow. Conservation Biology 13(1):108-116.

Parsons, K.C. and J. Burger. 1982. Human disturbance and nestling behavior in black-crowned night herons. Condor 84:184-187.

Paxton, E., S.M. Langridge, and M.K. Sogge. 1997. Banding and Population Genetics of Southwestern willow flycatchers in Arizona-1997 Summary Report. Colorado Plateau Research Station. U.S. Geological Survey Biological Resources Division. Northern Arizona University, Flagstaff, Arizona. 63 pp.

_____, J. Owen, and M.K. Sogge. 1996. Southwestern willow flycatcher response to catastrophic habitat loss. Colorado Plateau Research Station. U.S. Geological Survey Biological Resources Division. Northern Arizona University, Flagstaff, Arizona. 12 pp.

Peterson, R.T. 1990. A field guide to western birds. Third edition. Houghton Mifflin Company, Boston, Massachusetts. 432 pp.

Phillips, A.R. 1948. Geographic variation in *Empidonax traillii.* The Auk 65:507-514.

_____, J. Marshall, and G. Monson. 1964. The Birds of Arizona. University of Arizona Press, Tucson, Arizona. 212 pp.

Platts, W.S. 1990. Managing fisheries and wildlife on rangelands grazed by livestock. A guidance and reference document for biologists. Nevada Department of Wildlife.

_____ and R.L. Nelson. 1985. Stream habitat and fisheries response to livestock grazing and instream improvement structures, Big Creek, Utah. Journal of Soil and Water Conservation 49(4):374-379.

Porter, R.D., C.M. White, and R.J. Erwin. 1973. The peregrine falcon in Utah, emphasizing ecology and competition with the prairie falcon. Brigham Young University, Bulletin of Biological Science. 18:1-74.

Postovit, H.R. and B.C. Postovit. 1987. Impacts and mitigation techniques. Pp. 183-213 *in* G.B. Pendleton, B.A. Mildsap, K.W. Cline, and D.M. Bird (eds.), Raptor management techniques manual. National Wildlife Federation, Washington, D.C. Scientific Technical Series 10.

Propst, D.L. and K.R. Bestgen. 1991. Habitat and biology of the loach minnow, Tiaroga cobitis, in New Mexico. Copeia 1991(1):29-38.

_____, _____, and C.W. Painter. 1988. Distribution, status, biology, and conservation of the loach minnow (Tiaroga cobitis) Girard in New Mexico. U.S. Fish and

Wildlife Service Endangered Species Report 17, Albuquerque, New Mexico. 75 pp.

_____, P.C. Marsh, and W.L. Minckley. 1985. Arizona survey for spikedace (Meda fulgida) and loach minnow (Tiaroga cobitis): Fort Apache and San Carlos Apache Indian Reservations and Eagle Creek, 1985. U.S. Fish and Wildlife Service, Albuquerque, New Mexico. 8 pp. and maps.

Proudfoot, G.A. 1996. Natural history of the cactus ferruginous pygmy-owl. M.S. Thesis, Texas A & M University, Kingsville, Texas.

_____, S.L. Beasom, D. Graul, and T. Urban. 1994. Food habits of the cactus ferruginous pygmy owl. Pp. 19 *in* the Annual Report to the Caesar Kleberg Foundation for Wildlife Conservation from the Caesar Kleberg Wildlife Research Institute, College of Agriculture and Human Sciences, Kingsville, Texas.

_____ and R.R. Johnson. 2000. Ferruginous pygmy-owl (Glaucidium brasilianum). *in* A. Poole and F. Gill (eds), The Birds of North America, No. 498, 2000.

Ratcliffe, D.A. 1980. The peregrine falcon. Poyser Ltd., Hertfordshire, England. 416 pp.

Ridgely, R.S. and G. Tudor. 1994. The Birds of South America: Suboscine Passerines. University of Texas Press, Austin, Texas.

Rinne, J.N. 1989. Physical habitat use by loach minnow, Tiaroga cobitis (Pisces: Cyprinidae), in southwestern desert streams. The Southwestern Naturalist 34(1):109-117.

Robert, H.C. and C.J. Ralph. 1975. Effects of human disturbance on the breeding success of gulls. Condor 77:495-499.

Rosgen, D.L. 1996. Applied river morphology. Printed Media Companies, Minneapolis, Minneapolis.

San Diego Natural History Museum. 1995. *Empidonax traillii extimus* in California. The willow flycatcher workshop. 17 November 1995. 66 pp.

Saunders, D.A., R.J. Hobbs, and C.R. Margules. 1991. Biological consequences of ecosystem fragmentation: a review. Conservation Biology 5: 18-32.

Schoenherr, A.A. 1974. Life history of the topminnow *Poeciliopsis occidentalis* (Baird and Girard) in Arizona and an analysis of its interaction with the mosquitofish *Gambusia affinis* (Baird and Girard). Ph.D. Dissertation, Arizona State University, Tempe, Arizona.

Schreiber, D.C. 1978. Feeding interrelationships of fishes of Aravaipa Creek, Arizona. Arizona

State University, Tempe, Arizona. 312 pp.

Schreiber, E.A, R.W. Schreiber, and J.J. Dinsmore. 1979. Breeding biology of laughing gulls in Florida. Part 1: Nesting, egg, and incubation parameters. Bird Banding 50:304-321.

Sferra, S.J., T.E. Corman, C.E. Paradzick, J.W. Rourke, J.A. Spencer, and M.W. Sumner. 1997. Arizona Partners In Flight southwestern willow flycatcher survey: 1993-1996 summary report. Arizona Game and Fish Department Technical Report 113. 104 pp.

_____, R.A. Meyer, and T.E. Corman. 1995. Arizona Partners In Flight 1994 southwestern willow flycatcher survey. Final Technical Report 69. Arizona Game and Fish Department, Nongame and Endangered Wildlife Program, Phoenix, Arizona. 46 pp.

Sheffer, R.J., P.W. Hedrick, W.L. Minckley, and A.L. Velasco. 1997. Fitness in the endangered Gila topminnow. Conservation Biology 11(1):162-171.

Sick, H. 1993. Birds in Brazil: a natural history. Princeton University Press, Princeton, New Jersey.

Silvey, W. and M.S. Thompson. 1978. The distribution of fishes in selected streams on the Apache-Sitgreaves National Forest. Completion report to U.S. Department of Agriculture Forest Service. Arizona Game and Fish Department, Phoenix, Arizona. 49 pp.

Simms, J.R. and K.M. Simms. 1992. What constitutes high quality habitat for Gila topminnow (*Poeciliopsis occidentalis occidentalis*)? An overview of habitat parameters supporting a robust population at Cienega Creek, Pima County, Arizona. Proceedings of the Desert Fishes Council 24:22 - 23.

Skagen, S.K., R.L. Knight, and G.H. Orians. 1991. Human disturbance of an avian scavenging guild. Ecological Applications 1(2):215-225.

Skaggs, R.W. 1996. Population size, breeding biology, and habitat of willow flycatchers in the Cliff-Gila Valley, New Mexico. New Mexico Department of Game and Fish, Sante Fe, New Mexico. 38 pp.

Snyder, N.F. and H.A. Snyder. 1975. Raptors in range habitat. Pp. 190-209 *in* D.R. Smith. ed. Proc. symposium on management of food and range habitat for nongame birds. U.S. Department of Agriculture, Forest Service General Technical reference W0-1.

Sogge, M.K. 1995*a*. Southwestern willow flycatcher (*Empidonax traillii extimus*) monitoring at Tuzigoot National Monument. 1995 progress report to the Natl. Park Serv. National Biological Service, Colorado Plateau Research Station, Northern Arizona University, Flagstaff, Arizona. 20 pp.

_____. 1995*b*. Southwestern willow flycatcher surveys along the San Juan River, 1994 - 1995. Final report to Bureau of Land Management, San Juan Resource Area. National Biological Service, Colorado Plateau Research Station, Northern Arizona University, Flagstaff, Arizona. 27 pp.

_____. 1995*c*. Southwestern willow flycatchers in the Grand Canyon. Pages 89-91 *in* E. T. LaRoe, G. S. Farris, C. E. Puckett, P. D. Doran, and M. J. Mac eds., Our Living Resources: a Report to the Nation on the Distribution, Abundance, and Health of U.S. Plants, Animals, and Ecosystems. U.S. Department of the Interior, National Biological Service, Washington, DC.

_____ and T.J. Tibbitts. 1992. Southwestern willow flycatcher (*Empidonax traillii extimus*) surveys along the Colorado River in Grand Canyon National Park and Glen Canyon National Recreation Area. National Park Service Park Studies Unit, Northern Arizona University, Flagstaff, Arizona. 43 pp.

_____ and _____. 1994. Distribution and status of the southwestern willow flycatcher along the Colorado river in the Grand Canyon - 1994. Summary Report. National Biological Service, Colorado Plateau Research Station, Northern Arizona University, Flagstaff, Arizona. 37 pp.

_____, _____, and S.J. Sferra. 1993. Status of the southwestern willow flycatcher along the Colorado River between Glen Canyon Dam and Lake Mead - 1993. Summary Report. National Park Service Cooperative Park Studies Unit, Northern Arizona University, U.S. Fish and Wildlife Service, and Arizona Game and Fish Department., Flagstaff, Arizona. 69 pp.

_____, R.M. Marshall, S.J. Sferra, and T.J. Tibbitts. 1997. A southwestern willow flycatcher survey protocol and breeding ecology summary. National Park Service, Colorado Plateau Research Station, Northern Arizona University, Technical Report, NRTR-97/12. 37 pp.

Soule, M.E. 1986. Conservation biology. The science of scarcity and diversity. Sinauer Assoc., Inc. Sunderland, Massachusetts. 584 pp.

Spencer, J.A., S.J. Sferra, T.E. Corman, J.W. Rourke, and M.W. Sumner. 1996. Arizona Partners In Flight 1995 southwestern willow flycatcher survey. Technical Report 97, March 1996. Arizona Game and Fish Department, Phoenix, Arizona. 69 pp.

Sprunt, A. 1955. North American birds of prey. National Audubon Society. Harper and Brothers, New York, New York. 227 pp.

State of Arizona. 1990. Final report and recommendations of the Governor's riparian habitat

task force. Executive Order 89-16. Streams and riparian resources. October 1990. Phoenix, Arizona. 28 pp.

Steenberg, W.F. and C.H. Lowe. 1977. Ecology of the saguaro: II, reproduction, germination, establishment, growth, and survival of the young plant. National Park Service Scientific Monograph Series No. 8. U.S. Government Printing Office, Washington D.C.

_____ and _____. 1983. Ecology of the saguaro: III, growth and demography. National Park Service Scientific Monograph Series No. 17. U.S. Government Printing Office, Washington D.C.

Stefferud, J.A. and S.E. Stefferud. 1994. Status of the Gila topminnow and results of monitoring of the fish community in Redrock Canyon, Coronado National Forest, Santa Cruz County, Arizona, 1979-1993. Pages 361-369 in L.F. DeBano, P.F. Ffolliott, A. Ortega-Rubio, G.J. Gottfried, R.H. Hamre, and C.B. Edminister (technical coordinators) Biodiversity and Management of the Madrean Archipelago: The Sky Islands of Southwestern United States and Mexico. U.S. Department of Agriculture Forest Service, General Technical Report RM-GTR-264, Rocky Mountain Forest and Range Experimental Station, Fort Collins, Colorado. 669 pp.

Stiles, F.G. and A.F. Skutch. 1989. A guide to the birds of Costa Rica. Comstock, Ithaca, New York. 364 pp.

Stransky, K. 1995. 1995 field survey by the Colorado Division of Wildlife, southwestern willow flycatcher. Colorado Division of Wildlife, Grand Junction, Colorado. 21 pp.

Stromberg, J.C. 1993a. Fremont cottonwood-Goodding willow riparian forests: a review of their ecology, threats, and recovery potential. Journal of the Arizona-Nevada Academy of Science 26(3):97-110.

_____. 1993b. Riparian mesquite forests: A review of their ecology, threats, and recovery potential. Journal of the Arizona-Nevada Academy of Science 27(1):111-124.

_____, J.A. Tress, J.D. Wilkins, and S.D. Clark. 1992. Response of velvet mesquite to groundwater decline. Journal of Arid Environments 23:45-58.

Sublette, J.E., M.D. Hatch, and M. Sublette. 1990. The fishes of New Mexico. University of New Mexico Press, Albuquerque, New Mexico. 393 pp.

Sullivan, M.E. and M.E. Richardson. 1993. Functions and values of the Verde River riparian ecosystem and an assessment of adverse impacts to these resources. Prepared for the U.S. Environmental Protection Agency, Region 9, San Francisco, California. 364 pp.

Sutton, G.M. 1951. Mexican birds: first impressions based upon an ornithological expedition to Tamaulipas, Nuevo Leon and Coahuila. University of Oklahoma Press, Norman, Oklahoma. 282 pp.

Swarth, H.S. 1905. Summer birds of the Papago Indian Reservation and of the Santa Rita Mountains, Arizona. Condor 7:22-28.

_____. 1914. A distributional list of the birds of Arizona. Cooper Ornithological Club, Hollywood, California.

Szaro, R.C. 1989. Riparian forest and scrubland community types of Arizona and New Mexico. Desert Plants 9:70-138.

Tewes, M.E. 1993. Status of the ferruginous pygmy-owl in south Texas and northeast Mexico. Draft Project Report #2, Job 25, Texas Parks and Wildlife Department. Texas A & I University, Kingsville, Texas. 42 pp.

Tibbets, C.A. 1992. Allozyme variation in populations of the spikedace Meda fulgida and the loach minnow Tiaroga cobitis. Proceedings of the Desert Fishes Council 24:37.

_____. 1993. Patterns of genetic variation in three cyprinid fishes native to the American southwest. MS Thesis. Arizona State University, Tempe, Arizona. 127 pp.

Tibbitts, T.J., M.K. Sogge, and S.J. Sferra. 1994. A survey protocol for the southwestern willow flycatcher (*Empidonax traillii extimus*). Technical Report NPS/NAUCPRS/NRTR-94-04. National Park Service, Colorado Plateau Research Station at Northern Arizona University, Flagstaff. 24 pp.

Tomlinson, C. 1997. Summary of surveys in 1997 for southwestern willow flycatchers in southern Nevada.

Tropical Birds of the Border. 1999. Sixth Annual Rio Grande Valley Birding Festival. Harlingen, Texas.

U.S. Bureau of Land Management (USBLM). 1993. Riparian area management. Process for assessing proper functioning condition. Technical Report TR 1737-9 1993.

_____. 1995. File report on fishery inventory of Oak Grove Canyon, Graham County and Deer Creek, Pinal County. July 1995. U.S. Bureau of Land Management, Tucson, AZ. 19 pp.

U.S. Department of Agriculture, Forest Service (USFS). 1985. Tonto National Forest Plan. Southwestern Region, Albuquerque, New Mexico. 257 pp.

_____. 1998a. Guidance criteria for determining the effects of issuing term grazing permits on threatened, endangered, or species proposed for listing. Region 3, Wildlife, Fisheries, and Rare Plants, Albuquerque, New Mexico. 55 pp.

_____. 1998b. August 31, 1998, letter from District Ranger Delvin R. Lopez to the U.S. Fish and Wildlife Service re: Red Creek Allotment - Proposed Action.

_____. 1999. Environmental assessment analyzing grazing strategy and associated improvements for the Red Creek Allotment Analysis Area. Tonto National Forest, Cave Creek Ranger District, Scottsdale, Arizona.

U.S. Fish and Wildlife Service (USFWS). 1967. Endangered and threatened wildlife and plants. Federal Register 32(48):4001.

_____. 1984. Sonoran topminnow recovery plan. U.S. Fish and Wildlife Service, Albuquerque, New Mexico. 56 pp.

_____. 1986. Endangered and threatened wildlife and plants; determination of threatened status for the loach minnow. Federal Register 51(208):39468-39478. October 28, 1986.

_____. 1988. Riparian Habitat: An Unrecognized Resource. Pamphlet.

_____. 1994. Notice of 90-day and 12-month findings on a petition to reclassify spikedace (Meda fulgida) and loach minnow (Tiaroga cobitis) from threatened to endangered. Federal Register 59(131):35303-35304. July 11, 1994.

_____. 1995. Final rule determining endangered status for the southwestern willow flycatcher. Federal Register 60:10694-10715.

_____. 1997a. Endangered and threatened wildlife and plants; determination of endangered status for the cactus ferruginous pygmy-owl in Arizona. Federal Register 62:10730-10747.

_____. 1997b. Final determination of critical habitat for the southwestern willow flycatcher. Federal Register 62(140):39129-39146.

_____. 1997c. Correction; final determination of critical habitat for the southwestern willow flycatcher. Federal Register 62 (161): 44228.

_____. 1998. Memo Region 2/ES-SE of September 18, from Regional Director to Eleanor S. Towns, U.S. Forest Service re: Guidance Criteria for determining the effects of issuing term permits on threatened, endangered, or species proposed for listing. U.S. Fish and Wildlife Service, Albuquerque, New Mexico.

_____. 1999a. Endangered and threatened wildlife and plants; designation of critical habitat for the cactus ferruginous pygmy-owl (*Glaucidium brasilianum cactorum)*. Federal Register 64:37419-37440.

_____. 1999b. January 15, 1999 letter from David L. Harlow to Interested Party, regarding final determination of extirpation.

_____. 2000. Endangered and threatened wildlife and plants; final designation of critical habitat for the spikedace and loach minnow. Federal Register 65(80):24328-24372.

U.S. General Accounting Office (USGAO). 1988. Public rangelands: Some riparian areas restored but widespread improvement will be slow. Report to Congressional Requesters, U.S. General Accounting Office, Washington D.C.

_____. 1991. Rangeland management. BLM's hot desert grazing program merits reconsideration. Report to the Chairman, Subcommittee on National Parks and Public Lands, Committee on Interior and Insular Affairs, House of Representatives. Report GAO/RCED-92-12, Washington, D.C.

Unitt, P. 1987. *Empidonax traillii extimus*: An endangered subspecies. Western Birds 18:137-162.

Vives, S.P. and W.L. Minckley. 1990. Autumn spawning and other reproductive notes on loach minnow, a threatened cyprinid fish of the American southwest. The Southwestern Naturalist 35(4):451-454.

Vrijenhoek, R.C., M.E. Douglas, and G.K. Meffee. 1985. Conservation genetics of endangered fish populations in Arizona. Science 229:400-402.

Walkinshaw, L.H. 1966. Summer biology of Traill's Flycatcher. Wilson Bulletin 78:31-46.

Warnock, R.G. and P.C. James. 1997. Habitat fragmentation and burrowing owls (*Speotyto cunicularia*) in Saskatchewan. Pp.477-484 *in* J.R. Duncan, D.H. Johnson, and T.H. Nicholls (eds.), Biology and conservation of owls of the northern hemisphere. USDA Forest Service, North Central Forest Experimental Station, General Technical Report NC-190. Winnipeg, Manitoba. February 5-9, 1997.

Webb, R.H. and S.S. Stielstra. 1979. Sheep grazing effects on Mohave desert vegetation and soils. Environmental Management 3:517-529.

Weedman, D.A. 1998. Gila topminnow, *Poeciliopsis occidentalis occidentalis*, Revised recovery plan. Draft. U.S. Fish and Wildlife Service. Albuquerque, New Mexico. 86 pp.

_____, A.L. Girmendonk, and K.L. Young. 1997. Gila topminnow sites in Arizona: Provisional extirpation report 1996 - 97 field season. Nongame and Endangered Wildlife Program Technical Report 116. Arizona Game and Fish Department, Phoenix, Arizona.

_____, and K.L. Young. 1997. Status of the Gila topminnow and desert pupfish in Arizona. Arizona Game and Fish Department, Nongame and Endangered Wildlife Program Technical Report 118, Phoenix, Arizona. 141 pp.

White, C.M., W.B. Emison, and W.M. Bren. 1988. Atypical nesting habitat of the peregrine falcon (*Falco peregrinus*) in Victoria, Australia. Journal of Raptor Research 22:37-43.

Whitfield, M.J. 1990. Willow flycatcher reproductive response to brown-headed cowbird parasitism. M.S. Thesis, California State University, Chico, California. 25 pp.

_____. 1994. A brown-headed cowbird control program and monitoring for the southwestern willow flycatcher, South Fork Kern River, California, 1994. Prepared for the California Department of Fish and Game. Kern River Research Center, Weldon, California. 12 pp.

_____, and K.M. Enos. 1996. A Brown-headed Cowbird control program and monitoring for the Southwestern Willow Flycatcher, South Fork Kern River, California, 1996. Final report to the U.S. Army Corps of Engineers, Contract DACW05-96-P-0900. Weldon, California: Kern River Research Center. 16 pp.

_____, and C.M. Strong. 1995. A brown-headed cowbird control program and monitoring for the southwestern willow flycatcher, South Fork Kern River, California. Calif. Dept. Fish and Game, Bird and Mammal Cons. Program Report 95-4, Sacramento, California. 17 pp.

Wiens, J.A. 1985. Vertebrate responses to environmental patchiness in arid and semiarid ecosystems. Pp. 169-193 *in* S.T.A. Pickett, and P.A. White (eds.), The ecology of natural disturbance and patch dynamics. Academic Press, New York, New York.

Wilcove, D.S., C.H. McLellan, and A.P. Dobson. 1986. Habitat fragmentation in the temperate zone. Pp. 237-256 *in* M.E. Soule (ed.), Conservation biology: the science of scarcity and diversity. Sinauer Assoc., Sutherland, Massachusetts.

Wilcox, R.L., S. Richardson, and D. Abbate. 1999. Habitat characteristics of occupied cactus ferruginous pygmy-owl (*Glaucidium brasilianum cactorum*) sites at the suburban/rural interface of north Tucson, Arizona. Report to Arizona Game and Fish Department, Phoenix, Arizona.

_____, _____, and _____. 2000. Habitat selection by cactus ferruginous pygmy-owls in southern Arizona - preliminary results. Arizona Game and Fish Department, Tucson, Arizona. 13 pp.

Willard, F.C. 1912. A week afield in southern Arizona. The Condor 14:53-63.

Willard, F.C. 1912. A week afield in southern Arizona. The Condor 14:53-63.

Williams, J.E., D.B. Bowman, J.E. Brooks, A.A. Echelle, R.J. Edwards, D.A. Hendrickson, and J.J. Landye. 1985. Endangered aquatic ecosystems in North American deserts with a list of vanishing fishes of the region. Journal of the Arizona-Nevada Academy of Science 20(1):1-62.

Williams III, S.O. 1997. Summary of the Willow Flycatcher Surveys Conducted in New Mexico: 1994-1996, New Mexico Department of Game and Fish, Santa Fe, New Mexico.

APPENDIX A - TABLES

Table 1. Status of natural Gila topminnow populations.

Site	Ownership	Extant?[1]	Nonnatives?	Mosquitofish?	Habitat Size[2]	Threats[3]
Bylas Spring[5]	San Carlos	YES	YES	YES	S D	M, N G
Cienega Creek	BLM	YES	NO	NO	L	M, R N
Cocio Wash	BLM	NO 2000	NO	NO	S	H, M
Cottonwood Spring	Private	YES	NO	NO	S	M, N
Fresno Canyon	State Parks	YES	YES	NO[4]	M	H, N G U
Middle Spring[5]	San Carlos	YES	YES	YES	S	H, N G
Monkey Spring	Private	YES	NO	NO	S	L, W U
Redrock Canyon	USFS	YES	YES	YES	M D	H, R G N
Sabino Canyon	USFS	NO 1943	YES[5]	NO	M	H, R N
Salt Creek[5]	San Carlos	YES	NO[4]	NO[4]	S	M, N G
San Pedro River	Private	NO 1976	YES	YES	--	H, W N G R
Santa Cruz River San Rafael Tumacacori Tucson	Private	 YES[6] YES NO 1943	 YES YES YES	 YES YES	L D	H, W N R G C U
Sharp Spring	Private	YES	YES	YES	M	H, N G U
Sheehy Spring	Private	NO 1987	YES	YES	S	H, N G U
Sonoita Creek	Private, TNC, State Parks	YES	YES	YES	L D	H, W N G
Tonto Creek	Private	NO 1941	YES	YES	L	H, N R G W

[1]if no, last year recorded
[2]L = large M = medium S = small D = disjunct
[3]Immediacy H = high M = moderate L = low
Type W = water withdrawal C = contaminants R = recreation N = nonnatives G = grazing
M = mining U = urbanization
[4]none recently, they have been recorded
[5]recently renovated
[6]in Mexico, US in 1993

Table 2. Rangewide population status for the southwestern willow flycatcher. Based on 1996 survey data for New Mexico and California, 1997 survey data for Colorado, Nevada, and Utah, and 1999 survey data for Arizona.[1]

State	Number of sites with resident WIFLs	Number of drainages with resident WIFLs	Number of territories within site			
			≤5	6-20	>20	Total number of territories
Arizona	47	12	33	11	3	289
California	11	8	7	2	2	91
Colorado	7	6	2	4	1	69
New Mexico	19	6	16	2	1	209
Nevada	5	3	4	1	0	20
Utah	5	4	5	0	0	8
Texas	?	?	?	?	?	?
Total	95	39	70	18	7	686[2]

[1]Based on surveys conducted at >800 historic and new sites in AZ (Sogge and Tibbitts 1992, Sogge *et al.* 1993, Muiznieks *et al.* 1994, Sogge and Tibbitts 1994, Sferra *et al.* 1995, 1997, Sogge 1995a, Sogge *et al.* 1995, Spencer *et al.* 1996, McKernan 1997, McKernan and Braden 1998., Paradzick *et al.* 2000); CA (Camp Pendleton 1994, Whitfield 1994, Griffith and Griffith 1995, Holmgren and Collins 1995, Kus 1995, San Diego Natural History Museum 1995, Whitfield and Strong 1995, Griffith and Griffith 1996); CO (T. Ireland 1994 *in litt.*, Stransky 1995); NM (Maynard 1995, Cooper 1996, 1997, Parker 1997, Skaggs 1996, Williams 1997); NV (C. Tomlinson 1995 *in litt.*, 1997); UT (McDonald *et al.* 1995, 1997, Sogge 1995b). Systematic surveys have not been conducted in Texas.

[2] Personal communication from states outside of Arizona indicate that the current number of territories rangewide is just over 900 as of the end of the 1999 breeding season.

Table 3. Survey information for Pygmy-owls in Arizona during 2000.

Site Name	Number of Sites	Number of Adults	Number of Fledglings	Number of Juveniles Successfully Dispersed
Tucson Basin	10	14	5	2
Altar Valley	6	7	4	4
OPCNM	6	unknown	unknown	unknown
Other	2	4	4	unknown

Table 4. Miles of streamcourse by pasture that include occupied, suitable unoccupied, or potential habitat for fishes.

Streamcourse	Pasture				
	Red Hills	Red Creek	Tangle Creek	Mustang	Roundtree
Verde River	14.7				
Red Creek	2.9	4.3	0.5		
Tangle Creek			1.0		
Roundtree Creek					0.4
Zig Zag Spring	0.4				
Dutchman Grave Spring	0.3				
Thicket Spring		X		X	

Table 5. Section 7 Consultations in the Action Area.

Project	Date of Opinion or Concurrence	Species	Finding
FORMAL CONSULTATIONS			
Reintroduction of Gila Topminnow	May 1982, amended July 1982, January 1983, and May 1983	Gila topminnow	Non-jeopardy
Tonto National Forest Plan	July 1985	bald eagle, Gila topminnow, spikedace, loach minnow	Non-jeopardy
Prescott National Forest Plan	March 1986	spikedace (proposed), bald eagle	Not likely to jeopardize Non-jeopardy
Coconino National Forest Plan	April 1986	spikedace (proposed) bald eagle	Not likely to jeopardize Non-jeopardy
Sycamore Spring Habitat Renovation	October 1989	Gila topminnow	Non-jeopardy
Reintroduction of Gila topminnow at Eight Sites	November 1990	Gila topminnow	Non-jeopardy
CAP, Upper Verde Water Exchange	May 1990	Spikedace	Jeopardy
Bar V Bar and Campaign Allotment Management Plan	August 1991	Gila topminnow, Arizona agave, lesser long-nosed bat	Non-jeopardy
Quien Sabe Prescribed Burn	October 1991	Gila topminnow, Arizona agave	Non-jeopardy
Verde Valley Ranch Development	November 1992	Razorback, bald eagle	Non-jeopardy
George Yard Property, Verde River Emergency	December 1993	spikedace, razorback, bald eagle	Non-jeopardy
Rio Verde Circle Emergency Watershed Protection	March 1994	razorback, bald eagle, southwestern willow flycatcher	Non-jeopardy
Verde Valley Ranch Development	April 1994	razorback bald eagle southwestern willow flycatcher	Non-jeopardy Non-jeopardy Jeopardy
Dos S Unit Allotment Management Plan	February 1994	Gila topminnow	Non-jeopardy
Campaign Creek Road Repair	August 1994	Gila topminnow	Non-jeopardy

Table 5. Section 7 Consultations in the Action Area - Continued.

6-Bar Allotment Management Plan	June 1994	Arizona agave, American peregrine falcon	Non-jeopardy
Cross F Allotment Grazing Permit	April 1995	Gila topminnow	Non-jeopardy
Tuzigoot Bridge Repair	September 1995	razorback, southwestern willow flycatcher	Non-jeopardy
11 Forest Plans	December 1997	33 plant, fish, amphibian, reptile, bird, and mammal species	Non-jeopardy
Skeleton Ridge/Ike's Backbone Grazing Allotments	June 1997	razorback, southwestern willow flycatcher	Non-jeopardy
Windmill Grazing Allotment	October 1997	razorback	Non-jeopardy
Verde Valley Ranch, Stormwater Permit	October 1997	razorback, bald eagle, southwestern willow flycatcher	Non-jeopardy
CAP Water Transfer, Cottonwood/ Camp Verde	March 1998	razorback, bald eagle, southwestern willow flycatcher	Non-jeopardy
State Route 260 Widening and Bridge Construction in Verde Valley	May 1999	razorback sucker, spikedace	Non-jeopardy
INFORMAL CONSULTATIONS			
Apache Maid Grazing Allotment	June 1990	razorback	Concurrence
Cottonwood Artesian Habitat Creation	February 1991	Gila topminnow	Beneficial Concurrence
Kayler Springs Exclosure	August 1994	Gila topminnow	Beneficial Concurrence
Programmatic on Forest Service Ongoing Grazing	May 1995	loach minnow, spikedace, Gila topminnow, razorback sucker, Colorado squawfish, southwestern willow flycatcher, bald eagle	Concurrence
Brown Springs Grazing Allotment	November 1995	razorback sucker	Concurrence

Table 5. Section 7 Consultations in the Action Area - Continued.

Windmill Grazing Allotment	October 1997	spikedace, loach minnow, southwestern willow flycatcher	Concurrence
11 Forest Plans	December 1997	Multiple	Concurrence
State Route 260 Widening and Bridge Construction, Verde Valley	October 1998	loach minnow	Concurrence
Programmatic consultation on on-going grazing actions - Antelope Hills, Chino Dam, Perkinsville, Sand Flat, West Bear Canyon, Bald Hill, Brown Springs, Cienega, Copper Canyon, Jerome, Squaw Peak, Verde, Young, Red Creek, Sears Club/Chalk Mountain	1999 (Service programmatic concurrence of March 1998 or February 1998 criteria)	loach minnow, spikedace, Gila topminnow, razorback sucker southwestern willow flycatcher, bald eagle	Concurrence
Programmatic on U.S. Forest Service grazing term permits for Antelope Hills, Chino Dam, Muldoon, Perkinsville, and Sand Flat allotments	2000 (Service programmatic concurrence of September 1998 on August 1998 criteria)	loach minnow, Gila topminnow, razorback sucker, spikedace, southwestern willow flycatcher, bald eagle	Concurrence
Programmatic on U.S. Forest Service grazing term permits for the Red Creek Allotment	2000 (Service Programmatic concurrence of September 1998 on August 1998 criteria)	razorback sucker, spikedace, Mexican spotted owl, bald eagle	Concurrence

Table 6. Reestablishment sites of Gila topminnow on the Red Creek Allotment and their current status (USFWS 1999b).

SITE NAME	STOCKED	FAILED	STATUS AND MANAGEMENT RECOMMENDATION
Dutchman Grave Spring	1983	N/A	Occupied
Red Creek	1982/1983	1991	Failed, recommended for restocking
Thicket Spring	1983	1987	Failed, recommended for restocking
Zig Zag Spring (Creek)	Prior to 1983	1983	Failed, recommended for restocking
Frog Spring	1982	1986	Extirpated
TT Spring	1982	1986	Extirpated
Unnamed Spring #5	1983	1984/1985	Extirpated
Unnamed Spring #6	1982	1984	Extirpated
Unnamed (TT) Spring	1982	1986	Extirpated
White Rock Spring	1982	1983	Extirpated