



United States Department of the Interior

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June 30, 1999

Cons. # 2-22-99-F-016

Eleanor S. Towns, Regional Forester
U.S. Forest Service, Southwest Region
517 Gold Avenue SW, Room 6428
Albuquerque, New Mexico 87102-0084

Dear Ms. Towns:

This is in response to your October 1, 1998, request for formal consultation with the U.S. Fish and Wildlife Service (Service) pursuant to section 7 of the Endangered Species Act of 1973, as amended (Act), for the reauthorization of livestock grazing permits for a period of ten years for 7 allotments in the Apache-Sitgreaves National Forest, Coronado National Forest, Gila National Forest, and the Tonto National Forest. The Forest Service has determined that the proposed action may affect, is likely to adversely affect the endangered lesser long-nosed bat (*Leptonycteris curasoae yerbabuenae*), threatened loach minnow (*Rhinichthys [= Tiaroga] cobitis*), threatened spikedace (*Meda fulgida*), and endangered Sonora tiger salamander (*Ambystoma tigrinum stebbinsi*). The determinations of effects were made in compliance with the July 2, 1998, guidance criteria with which the Service concurred on September 18, 1998. The Forest Service has made the finding of may affect, is not likely to adversely affect the endangered Arizona hedgehog cactus (*Echinocereus triglochidiatus* var. *arizonicus*) and the threatened Zuni fleabane (*Erigeron rhizomatus*).

Concurrences

On September 18, 1998, the Service concurred with the *Guidance Criteria for Determining the Effects of Issuing Term Grazing Permits on Threatened, Endangered, or Species Proposed for Listing* (Guidance Criteria) dated August 25, 1998, that was prepared by the U. S. Forest Service. The Service's concurrence on this document meant that project-level grazing activities that met criteria for no effect or may affect, is not likely to adversely affect for a species would meet the informal section 7 consultation requirements of 50 CFR §§ 402.13 and 402.14(b). The Service concurred with the August 25, 1998, grazing criteria with the following understanding:

1. Determinations of not likely to adversely affect using these criteria will only be made when the grazing activity in question is found to have beneficial,

discountable, or insignificant effects on the species. "Beneficial effects" have contemporaneous positive effects without any adverse effects to the species or habitat. "Discountable effects" are extremely unlikely and would not be expected to occur, "insignificant effects" relate to the size of the impact so that, based on best judgement, a person would not be able to meaningfully measure, detect, or evaluate insignificant effects.

2. The application of these criteria is mandatory unless site-specific information available on species needs, habitat conditions, and/or grazing activities indicates that the criteria are not applicable. In these cases, site-specific review and concurrence will be required to satisfy informal consultation requirements.
3. Documentation of all effects determinations of no effect and not likely to adversely affect using these criteria must include clear explanation of how the criteria are met and must be maintained in the administrative record of the Forest Service.
4. For both no effect and not likely to adversely affect determinations to remain in effect for the life of the term permit (up to 10 years), yearly confirmation throughout the lifetime of the permit must take place to ensure the criteria for those findings to continue to be met.
5. A copy of the September 18, 1998, letter from the Service to the Forest Service must be distributed to all Forest Service users of the Guidance Criteria, and must be attached to the front of all copies of that document.
6. Representatives of the Service and the Forest Service will meet within 6 months of the concurrence letter to review a sample of determinations made using these criteria and identify and correct any problems that have been encountered in their application.

The October 1, 1998, biological assessment from the Forest Service made may effect. Is not likely to adversely affect determinations in 95 allotments for the following listed species: jaguar (*Panthera onca*), lesser long-nosed, Mexican long-nosed bat (*Leptonycteris nivalis*), bald eagle (*Haliaeetus leucocephalus*), American peregrine falcon (*Falco peregrinus anatum*), Mexican spotted owl (*Strix occidentalis lucida*), southwestern willow flycatcher (*Empidonax traillii extimus*), New Mexican ridgenosed rattlesnake (*Crotalus willardi obscurus*), loach minnow, razorback sucker (and critical habitat) (*Xyrauchen texanus*), Apache trout (*Oncorhynchus apache*), Gila trout (*Oncorhynchus gilae*), Colorado pikeminnow (=squawfish) (*Ptychocheilus lucius*), spikedace, Gila topminnow (*Poeciliopsis occidentalis*), Little Colorado spinedace (*Lepidomeda vittata*), Arizona hedgehog cactus, Kuenzler's cactus (*Echinocereus lloydii*), Sacramento prickly poppy (*Cirsium vinaceum*), and Zuni fleabane.

The Arizona hedgehog cactus and the Zuni fleabane were not treated in the Guidance Criteria. Section 7 regulations at 50 CFR § 402.14(b) provide that a Federal agency need not initiate formal consultation if the agency determines, with the written concurrence of the Service, that the proposed action may affect, is not likely to adversely affect a listed species or critical habitat. The Forest Service made the

following determinations for the Arizona hedgehog cactus, Zuni fleabane, and the proposed threatened Blumer's dock (*Rumex orthoneurus*):

Arizona hedgehog cactus

1) Apache-Sitgreaves National Forest (Dark Canyon, Granville, and Hells Hole allotments) and Tonto National Forest (Radium allotment): The Forest Service determined that the ongoing grazing activities on the Dark Canyon, Granville, and Hells Hole and Radium allotments may affect, not likely to adversely affect the Arizona hedgehog cactus. The Service concurs with this determination for the following reasons: there could be a loss of some individuals due to livestock trampling, but these numbers are anticipated to be extremely low because suitable habitat primarily is located in rugged, rocky areas, which receive little use from livestock; the implementation of Forest Plan Amendment # 6 (allowable forage use guidelines, i.e., utilization standards); increased rest for each pasture relative to historic and current use; and stocking density is within estimated capacity.

Zuni fleabane

1) Cibola National Forest (Whitehouse allotment): The Forest Service determined that the ongoing grazing activities on the Whitehouse allotment may affect, not likely to adversely affect the Zuni fleabane. The Service concurs with this determination for the following reasons: the plant is unpalatable to livestock, so it generally is not eaten by cattle and trampling generally not a problem because of the steep slopes and lack of forage; and construction of stock tanks could affect the plant, however, development will not proceed until the sites have been inventoried for the Zuni fleabane, and if plants are found, stock tanks will be moved to a distance greater than 1000' from occupied areas.

Blumer's dock

The Forest Service made a determination of may affect, not likely to jeopardize for the proposed threatened Blumer's dock for the Apache-Sitgreaves National Forest (Arab, Benton Creek, Chevelon Canyon, Colter Creek, Cow Flat, Foot Creek, Grandfather, Greer, Lake Mountain Complex, PS, Stone Creek, Table Top Complex, and Voight allotments), Coronado National Forest (Pinery Canyon), Gila National Forest (Alexander, Canyon Creek, Copper Creek, Corner Mountain, Deep Canyon, Eagle Peak, Gallo Mountain, Govina, Jordan Mesa, Luna, McCarty, Spur Lake, and XXX allotments), and the Tonto National Forest (Center Mountain allotment). The Service concurs with this determination because livestock grazing is unlikely to appreciably reduce the survival and recovery of Blumer's dock in the wild due to the widespread range of the species and its abundance.

Consultation History

In 1995, the Recision Bill (P.L. 104-19), also known as the Burns Amendment, directed the Southwestern Region of the Forest Service to develop and adhere to a schedule of National Environmental Policy Act (NEPA) compliance on all grazing allotments within 10 years. In February 1998, the Forest Service revised its direction as a result of lawsuits

filed by Forest Guardians and Southwest Center for Biological Diversity. The new direction gave highest priority to allotments where protection of threatened and endangered species and their habitats was needed most.

In order to accommodate the large number of allotment management plans that needed reissuance, the Forest Service and Service established an Interagency Allotment Management Plan (AMP) Consultation Team (Team). The Team included a Team leader, botanist, an aquatic biologist, a terrestrial biologist, two range ecologists, a data recorder and two advisors from the Service. The Team's primary role was to review the Forest Service's effect determinations for each AMP presented. Forest Service biologists explained their rationale and documentation for their determination of effects for each federally listed species found on or within close proximity to the allotment. The Team held an organizational meeting on July 2, 1998, Albuquerque, New Mexico. The Team reviewed 124 allotments during meetings held July 13-17; September 8-11; and September 21-23, 1998, in Albuquerque, New Mexico.

Species specific criteria were also developed during the informal consultation processes for this consultation. These criteria were adapted and modified from the "on-going" grazing consultation. The result was a document titled *Guidance Criteria for Determining Effects of Issuing Term Grazing Permits on Threatened, Endangered, or Species Proposed for Listing*, dated August 25, 1998. On September 18, 1998, the Service's Southwest Regional Director endorsed these criteria. The criteria, utilized during the Interagency AMP Consultation Team review meetings, established standards for the effect determinations of no effect; may affect; is not likely to adversely affect; and may affect, is likely to adversely affect.

On October 1, 1998, the Forest Service requested the following from the Service: (1) a biological opinion on seven grazing allotments for which the Forest Service has made the determination of may affect, is likely to adversely affect for the lesser long-nosed bat, Sonora tiger salamander, loach minnow, and spikedace, (2) concurrence with findings of may affect, is not likely to adversely affect on the Arizona hedgehog cactus and Zuni fleabane and (3) a formal conference on 28 allotments containing the proposed threatened Blumer's dock.

On October 30, 1998, the Service requested the following information pursuant to 50 CFR §402.14(c)(2) and (6): (1) Map(s) of all the 5th and 6th code watersheds within the action area (i.e., the Southwestern Region of the Forest Service) and, (2) a table summarizing the Forest Service's determinations and allotments by species. These materials were delivered to our office on December 9, 1998. The Forest Service informed our office that maps of 6th code watersheds were not available for every National Forest in the Southwestern Region and thus, the maps provided contained information only on 5th code watersheds.

A biological opinion on the effects of on-going grazing activities to threatened and endangered species within Arizona and New Mexico was provided to the Forest Service on February 2, 1999. The biological opinion analyzed the effects on 10 federally listed species that occurred on one or more of the 21 grazing allotments located on five National Forests. Species specific criteria were developed and agreed upon during the informal stages of the on-going grazing consultation. The information provided in the

February 2, 1999, biological opinion is included herein by reference (U.S. Fish and Wildlife Service 1999 *in litt.*).

This biological opinion is based on information provided in the October 1, 1998, biological assessment (BA); supplemental biological assessments; individual allotment environmental assessments (EA); individual allotment assessment forms provided for each allotment during review meetings conducted by the Interagency AMP Consultation Team (see above); the Guidance Criteria; the September 10, 1998, letter from the Service to the Forest Service concurring with the Guidance Criteria; and other information available to the Service.

BIOLOGICAL OPINION

It is the Service's biological opinion that the proposed reauthorization of livestock grazing permits for a period of ten years for 7 allotments in the Apache-Sitgreaves National Forest, Coronado National Forest, Gila National Forest, and the Tonto National Forest, as described in the BA, is not likely to jeopardize the continued existence of the lesser long-nosed bat, loach minnow, spikedace, or Sonora tiger salamander. No critical habitat currently is proposed or designated for these species; therefore, none will be adversely modified or destroyed.

Description of the Proposed Action

The proposed action is the reissuance of livestock grazing permits that will be valid for 10 years in the Apache-Sitgreaves National Forest (Dark Canyon, Hells Hole, and Granville allotments), Coronado National Forest (A Bar Draw, Dagoon, and Paradise allotments), Gila National Forest (Gila River allotment), Cibola National Forest (Whitehouse allotment), and the Tonto National Forest (Radium allotment).

Apache Sitgreaves National Forest

1) Dark Canyon Allotment

Administrative Unit: Clifton Ranger District

Allotment Acres: 18,266 acres (3,938 full/potential capacity range)

Sub-Basin (5th Code Basin): Eagle Creek

Projected Stocking Density: 684 animal months (5.7 acres per animal month)

Proposed Use: 57 cow/calf from January 1-December 31.

Type of Grazing System: 3 pasture rest rotation

Major Vegetation Type: pinyon/juniper/Arizona cypress

Elevation: 3400 -7400 feet (1037 - 2257 meters)

Major Drainages: Eagle Creek, Dark Canyon, and Wood Canyon

Allotment Condition: Range condition is fair over most of the allotment; soil condition is impaired over most of the allotment.

Listed Species Adversely Affected: spikedace and loach minnow

Ecological condition and or Management Action that Contributes to Effects

Determinations: Loach minnow will be affected when livestock are trailed along, through, and across Eagle Creek during pasture moves and for shipping, and when removed from the allotment.

2) Granville Allotment

Administrative Unit: Clifton Ranger District
Allotment Acres: 8,660 acres (2,293 full/potential capacity range)
Sub-Basin (5th Code Basin): lower Blue River, lower San Francisco River
Projected Stocking Density: 1,794 animal months (1.3 acres per animal month)
Proposed Use: 229 yearlings from October 1-March 31.
Type of Grazing System: Entire allotment used each winter with no rotation
Major Vegetation Type: chaparral/juniper
Elevation: 4900 -7951 feet (1994.5 - 2425.1 meters)
Major Drainages: HL Canyon; Pigeon Canyon (adjacent to allotment)
Allotment Condition: The watershed condition is mostly unsatisfactory with some satisfactory and untreatable areas. The condition of the range is fair over most of the allotment.
Listed Species Adversely Affected: loach minnow
Ecological condition and or Management Action that Contributes to Effects Determinations: The loach minnow will be affected by high stocking density and unsatisfactory condition of the watershed.

Coronado National Forest

1) A Bar Draw Allotment

Administrative Unit: Sierra Vista Ranger District
Allotment Acres: 4,803 acres (4,361 full/potential capacity range)
Sub-Basin (5th Code Basin): Upper Santa Cruz River
Projected Stocking Density: 1704 animal months (2.6 acres per animal month)
Proposed Use: 142 cow/calf from January 1-December 31
Type of Grazing System: 3 pasture deferred rotation (20 cows); 2 pasture deferred rotation (105 yearlings)
Major Vegetation Type: plains grassland, shrub, oak woodland
Elevation: 4900 -6257 feet (1494.5 - 1908.4 meters)
Major Drainages: A Bar Draw
Allotment Condition: Range condition is fair over most of the allotment; watershed condition is satisfactory over most of the allotment.
Listed Species Adversely Affected: Sonora tiger salamander
Ecological condition and or Management Action that Contributes to Effects Determinations: Adverse effects to Sonora tiger salamander may occur from livestock trampling.

2) Dragoon Allotment

Administrative Unit: Douglas Ranger District
Allotment Acres: 4,495 acres (4,274 full/potential capacity range)
Sub-Basin (5th Code Basin): Wilcox Playa
Projected Stocking Density: 900 animal months (4.7 acres per month)
Proposed Use: 75 cow/calf from January 1-December 31.
Type of Grazing System: 8 pasture deferred rotation; 5 pastures on NFS land
Major Vegetation Type: desert grassland, oak and juniper woodlands
Elevation: 4600 - 6500 feet (1403 - 1982.5 meters)
Major Drainages: Jordon Canyon and Wood Canyon

Allotment Condition: 41% of the allotment is in satisfactory soil condition; 59% of the allotment is in impaired soil condition.

Listed Species Adversely Affected: lesser long-nosed bat

Ecological condition and or Management Action that Contributes to Effects

Determinations: Lesser long-nosed bat is affected by livestock use in high density agave habitats during agave bolting period and trampling of agaves.

3) Paradise Allotment

Administrative Unit: Douglas Ranger District

Allotment Acres: 9,466 acres (7,770 full/potential capacity range)

Sub-Basin (5th Code Basin): San Simon Creek

Projected Stocking Density: 840 animal months (9.3 acres per animal month)

Proposed Use: 70 cow/calf from January 1-December 31.

Type of Grazing System: 5 pasture deferred rotation

Major Vegetation Type: Oak/juniper woodlands, ponderosa pine

Elevation: 4500 - 8500 feet (1372.5 - 2592.5 meters)

Major Drainages: East Turkey Creek, Silver Creek

Allotment Condition: 100% of the allotment is in satisfactory condition.

Listed Species Adversely Affected: lesser long-nosed bat

Ecological condition and/or Management Action that Contributes to Effects

Determinations: Lesser long-nosed bat will be affected by trampling and grazing of agaves by livestock.

Tonto National Forest

1) Radium Allotment

Administrative Unit: Globe Ranger District

Allotment Acres: 27,000 acres (19,761 full/potential capacity range)

Sub-Basin (5th Code Basin): Pinal Creek and San Carlos River

Projected Stocking Density: 1,440 - 2,868 animal months (14 to 7 acres per animal month)

Proposed Use: 239 cow/calf yearlong

Type of Grazing System: 17 pasture, deferred rotation

Major Vegetation Type: pinyon-juniper, chaparral, desertscrub

Elevation: 3200 - 5811 feet (976 - 1772.4 meters)

Major Drainages: Upper Nugget Wash, Pinal Creek, Ash Springs Wash, Negro Wash

Allotment Condition: According to the BA, half of the watershed is in satisfactory condition, with the remaining half in unsatisfactory condition; range condition is fair over most of the allotment

Listed Species Adversely Affected: lesser long-nosed bat

Ecological condition and or Management Action that Contributes to Effects

Determinations: The allotment contains potenail foraging habitat for the lesser-long nosed bat, but exact acreage and conditions of the foodplants

are unknown. The agave and saguaro densities are unknown, livestock grazing during the agave bolting period, or trampling and grazing of young saguaros, impacts the lesser long-nosed bat's food plants.

Gila National Forest

1) Gila River Allotment

Administrative Unit: Silver City Ranger District

Allotment Acres: 17,419 acres (13,486 full/potential capacity range)

Sub-Basin (5th Code Basin): Middle Gila River

Projected Stocking Density: 1,620 animal months (8.3 acres per animal month)

Proposed Use: 216 cow/calf from September 1-April 15.

Type of Grazing System: 2 pasture, winter, rest-rotation

Major Vegetation Type: pinyon-juniper, desert shrub, semi-desert grassland

Elevation: 4200 - 6370 feet (1281 - 1942.9 meters)

Major Drainages: Gila River

Allotment Condition: The majority of the allotment is in unsatisfactory watershed condition. The majority of the allotment is in fair range condition.

Listed Species Adversely Affected: Spikedace and loach minnow

Ecological condition and or Management Action that Contributes to Effects

Determinations: The spikedace and loach minnow could be affected by livestock trailing across and along a 2-mile (3.22 km) reach of the Gila River.

STATUS OF THE SPECIES

Lesser long-nosed bat

The lesser long-nosed bat was listed as endangered on September 30, 1988 (U. S. Fish and Wildlife Service 1988). No critical habitat has been designated for this species. A recovery plan for this species was approved on March 4, 1997 (U. S. Fish and Wildlife Service 1997a). The lesser long-nosed bat is a medium-sized leaf-nosed bat, body length roughly 2.7 to 3.7 inches (6.9 cm to 9.4 cm), with a long muzzle and tongue. These features are adaptations to collect nectar from the flowers of columnar cactus, such as the saguaro (*Cereus giganteus*), and paniculate agaves, such as Palmer's agave (*Agave palmeri*), desert agave (*Agave deserti*), and Pary's agave (*Agave paryi*) (Hoffmeister 1986). This nectar, pollen, and fruit eating bat migrates seasonally from Mexico to southern Arizona and southwestern New Mexico. These bats are yellowish-brown or pale gray; juveniles are gray. It is one of four members of the tropical bat family Phyllostomidae found in the United States. Previously known as *Leptonycteris sanborni*, it was formally separated from the greater long-nosed bat (*L. nivalis*) as a distinct species. The lesser long-nosed bat can be distinguished from the Mexican lesser long-nosed bat (*Choeronycteris mexicana*), with which it co-occurs in Arizona, by its larger size, less elongate snout, and tiny tail (Arroyo-Cabrales *et al.* 1987; Barbour *et al.* 1969).

The natural history and ecology of the lesser long-nosed bat has been discussed by a number of biologists (Arends *et al.* 1995; Arita and Wilson 1987; Howell and Roth 1979, 1981; Davis 1960, 1974; Easterla 1972, 1973; Gardner 1977; Hall and Dalquest 1963; Hensley and Wilkins 198; Howell 1979; Findley *et al.* 1975; Ceballos *et al.* 1997; Cockrum and Ordway 1959).

The migratory lesser long-nosed bat is found throughout its historic range from southern Arizona, through western Mexico, and south to El Salvador. It occurs in southern Arizona from the Picacho Mountains southwest to the Agua Dulce Mountains and southeast to the Chiricahua Mountains and in the extreme southwestern portion of New Mexico, south to Mexico (Cockrum and Petryszyn 1991; Hayward and Cockrum 1971; Hoyt *et al.* 1994). It is considered mostly a summer resident of Arizona and New Mexico. Historically, this bat ranged from central Arizona and southwest New Mexico to El Salvador.

Caves and mines are used as day roosts. Although factors that identify potential roost sites are not completely understood, maternity roost tend to be warm and poorly ventilated. Such roosts may reduce the energetic requirements of adult females while they are raising their young (Arends *et al.* 1995). In Mexico and Venezuela, the lesser long-nosed bat co-occurs in large numbers with up to three species of mormoopid bats which generally live in hot, dry roosts (Bonaccorso *et al.* 1992). In Arizona, it tends to be the single occupant of caves and mines.

In Arizona, roosts are occupied from late April to September (Cockrum and Petryszyn 1991; Wilson 1979). Adult females, most of which are pregnant, and their recent young are the first to arrive, and they form maternity colonies at lower elevations near concentrations of flowering columnar cacti. After the young are weaned, these colonies disband in July and August; some females and young move to higher elevations, primarily in the southeastern parts of Arizona near concentrations of blooming paniculate agaves. Adult males are known mostly from the Chiricahua Mountains but also occur with adult females and young of the year at maternity sites. There are 9 known major roosts in Arizona; 3 are maternity roosts and 6 are post-maternity roosts (U. S. Fish and Wildlife Service 1997a). According to surveys conducted in 1991 through 1994, the number of bats estimated to occupy these sites ranged from 1 to 58,000 individuals.

Many aspects of the life history of the lesser long-nosed bat are poorly known. Current information suggests that most females bear only a single young per year and that timing of mating and parturition varies geographically. It is likely that periods of birth and lactation coincide with peak flower availability. Parturition is not highly synchronous in maternity roosts of the lesser long-nosed bat. Females in different stages of pregnancy and young ranging in age from newborns to nearly volant juveniles have been found at the same time in maternity roosts (Tuttle and Stevenson 1982; U. S. Fish and Wildlife Service 1997a). This asynchrony suggests that females conceive at slightly different times, possibly in different roosts, before occupying maternity roosts.

Longevity and sources of mortality have not been studied in this species. If they survive their first few months of life, many bats, including tropical phyllostomid bats, can live for as long as 10 years (Tuttle and Stevenson 1982). Major predators include snakes in roosts, carnivores at roost entrances, and owls while bats are foraging.

There appears to be an interdependence between the lesser long-nosed bat and some of its food plants. The bats obtain food from plants that need to be pollinated. These plants depend at least in part on bats for effective pollination (Howell 1979, Fleming *et al.* 1990; Flemming and Tuttle *et al.*, 1990b). Palmer's agave exhibit many characteristics of chiropterophily, such as nocturnal flower dehiscence and nectar production, light-colored and erect flowers, strong floral odor, and high levels of pollen protein with relatively low levels of nectar sugar concentrations (Slauson 1996). Parry's agave demonstrates many, if not all, of these same morphological features (Gentry 1982). Slauson (1996) has demonstrated that nectar feeding bats are the principle pollinators defining seed set in Palmer's agave, although other pollinators also may be important. While it is true that these bats depend on the plants for food, the plants depend on bats only for cross pollination, as the plants can reproduce vegetatively by sending shoots from the bottom of the main stem. Tens of these small clones frequently surround the parent plant, and if one dies there are many remaining plants (Howell 1979, Gentry 1982).

An extremely important feature of the pollination ecology of the lesser long-nosed bat is its mobility. The bat appears to be an opportunistic forager and an efficient flier, capable of speeds up to 14 miles (22.5 km) per hour. The seasonally available food resources may account for the seasonal movement patterns of the bat. The lesser long-nosed bat is known to fly long distances from roost sites to foraging sites. This nightly mobility was first discovered during a radiotracking study of the lesser long-nosed bat at Bahia Kino, Sonora, Mexico, in 1989 and 1990 (Horner *et al.* 1998; Sahley *et al.* 1993). Bats feeding on the Mexican mainland roosted on Isla Tiburon, 25.5-18.6 miles (25-30 km) away. Tracking data indicated that these bats flew for about 6 hours each night for a total flight distance of 50-62 miles (80-100 kms). Flight speeds while commuting between day roost and feeding areas averaged 18.6-24.8 miles (30-40 km) per hour and averaged 10 miles (16 km) per hour while foraging. The cost of commuting from Isla Tiburon to the mainland was calculated to equal about 7-8 flower visits. Since the bats visited over 100 *Pachycereus pringlei* flowers per night (Sahley *et al.* 1993), these relative long commute flights require comparatively small amounts of energy. Density of forage plants may be an important factor in determining optimal or acceptable foraging distances. Since bats have been known to visit over 100 flowering plants per night (Sahley *et al.* 1993), these relatively long commute flights require comparatively small amounts of energy. Lesser long-nosed bats have been recorded visiting individual blooming Palmer's agaves in excess of 1,000 visits per night (R. Sidner, Tucson, Arizona, pers. comm. 1997), while other agaves may not be visited at all (L. Slauson, Desert Botanical Gardens, Phoenix, Arizona, pers. comm. 1997). Lesser long-nosed bats have been observed feeding at hummingbird feeders many miles from the closest potential roost sites (Y. Petryszyn, pers. comm. 1997).

Howell (1994 in U. S. Fish and Wildlife Service 1997a) radiotagged 24 *Leptonycteris* roosting in the Blue Bird Mine in southwestern Arizona. Adult bats tagged in early 1993, when cactus flower and fruit densities were relatively high, commuted an average of 8.6 miles (13.8 km) to their feeding areas; juveniles commuted an average of 4.7 miles (7.5 km). In late August, when cactus food resources were scarce, adults commuted 10.9 miles (17.5 km) from the roost to feed. In both tracking sessions, several radiotagged bats flew from the Blue Bird Mine to the Copper Mountain Mine, a distance of about 15 miles (24.2 km), to feed and roost.

The efficient flight of the lesser long-nosed bat profoundly influences its roosting strategy. Because they can fly long distances at low energy costs, the lesser long-nosed bat can afford to roost long distances from good feeding areas. Bats roosting in Pinacate Cave in Sonora, Mexico, provide an excellent example. Most of the area around this cave, which seasonally houses over 100,000 adult females and their young, is devoid of cactus and agave plants. The closest substantial densities of cactus flowers and fruits are found in Organ Pipe Cactus National Monument, about 25-31 miles (40-50 km) away. A substantial portion of the lesser long-nosed bats at Pinacate Cave are suspected to fly 25 to 31 miles (40.3 to 50 km) each night to foraging areas in Organ Pipe Cactus National Monument (U. S. Fish and Wildlife Service 1997a).

A second example comes from male lesser long-nosed bats roosting in the Chiricahua Mountains in May (U. S. Fish and Wildlife Service 1997a). Preliminary analysis of fresh fecal material collected on May 15, 1993, revealed the presence of large amounts of cactus pollen (probably saguaro) and small amounts of agave pollen. There are no flowering columnar cacti and some flowering agaves in the Chiricahuas in May. The closest locations of saguaros, either Saguaro National Monument east or north of Stafford, are 78 miles (125 km) away. While the actual flight distances of the lesser long-nosed bat require careful study, these and other observations suggest that foraging radius of *Leptonycteris* roosts may be on the order of 31-62 miles (50-100 km). If true, lesser long-nosed bats in large roosts could forage over an area of 3,033-12,130 mile² (7,855-31,416 km²), depending on the density and location of suitable food plants. From these calculations, it seems evident that *Leptonycteris* bats forage over wide areas and that large roosts require extensive stands of cacti or agaves for food. Therefore, destruction of food plants many miles from lesser long-nosed bat roosts could have negative impacts on this animal.

The loss of roost and foraging habitat, as well as direct taking of individual bats during animal control programs, particularly in Mexico, have contributed to the current status of the species. Suitable day roosts and suitable concentrations of food plants are the two resources that are critical for the lesser long-nosed bat. As indicated above, the lesser long-nosed bat consumes nectar and pollen of paniculate agave flowers and the nectar, pollen, and fruit produced by a variety of columnar cacti. Caves and mines are used as day roosts. The factors that make roost sites useable have not yet been identified. Whatever the factors are that determine selection of roost locations, the species appears to be sensitive to human disturbance. Instances are known where a single brief visit is sufficient to cause a high proportion of lesser long-nosed bats to temporarily abandon their day roost and move to another. Some of the disturbed bats return to their preferred roost in a few days. However, the sensitivity suggests that the presence of alternate roost sites may be critical when human disturbance occurs. Interspecific interactions with other bat species may also influence lesser long-nosed bat roost requirements.

As with other colonial roosting bats, lesser long-nosed bats are probably limited by the number of sites that provide the proper roosting environment especially for parturition. The availability of roost sites free from disturbance may be a significant limiting factor for the lesser long-nosed bat. Long-nosed bats are particularly sensitive to perturbation of the roost; several authors have noted that these bats are the first bats to take flight when humans intrude (Wilson 1979, 1985). These bats are frequently found near roost

entrances and take to flight very easily with the slightest noise or movement (Wilson 1985). While no known roosts of this species have been rendered unusable, in general roosting caves are becoming increasingly subject to human destruction and disturbance (Tuttle and Stevenson 1982). Vandalism and willful destruction of roosts can affect both the bats that are present at the time of the destruction and the physical conditions in the roost. A major problem for bats all over Mexico, and other tropical Latin American countries, is that frequently uninformed citizens destroy all bats in a roost, believing them to be vampire bats. An environmental education campaign is urgently needed in this respect, particularly in the areas where the common vampire bat (*Desmodus rotundus*) and lesser long-nosed bat inhabit the same roost.

Foraging habitat disruption and destruction has also been identified as a threat to the lesser long-nosed bat (Buchman and Nabhan 1996). Foraging habitat can be modified or destroyed by the harvesting of agave for mescal and pulque, the expansion of agriculture, and other land uses. Excessive harvest of agaves for the production of alcoholic beverages in Mexico and other Latin American countries may also be contributing to the decline of this species.

Because it is a major pollinator (and potential seed disperser in the case of columnar cactus) of columnar cacti and paniculate agaves, both of which are highly distinctive elements of the flora of Mexico and the southwestern United States, the lesser long-nosed bat can be viewed as a "keystone mutualist" in the sense that its impact on arid habitats is larger than would be expected solely from its abundance (Fleming *et al.* 1996; U. S. Fish and Wildlife Service, 1997a). Its migratory behavior also makes it an important "mobile link" between geographically separated habitats (e.g., desert lowlands and Sierra Madre uplands, tropical dry forest, and Sonoran desert). Therefore, its protection is important for the reproductive success of some of the dominant plants in a variety of arid and semiarid habitats in North America.

Loach minnow

The loach minnow was listed on October 28, 1986, as a threatened species under the Act based on the the reduction of its range and numbers due to habitat destruction and competition with non-native fish species (U. S. Fish and Wildlife Service 1986a). In 1991, the Loach Minnow Recovery Plan was published by the Service (U.S. Fish and Wildlife Service 1991a). The Service designated critical habitat for the species under the Act on March 8, 1994 which included portions of the San Francisco, Tularosa, and upper Gila rivers, Aravaipa Creek, and the Blue River from Campbell and Dry Blue creeks downstream to the confluence with the San Francisco River (U.S. Fish and Wildlife Service 1994). Critical habitat for the loach minnow was set aside by the New Mexico District Court (Coalition of Arizona-New Mexico Counties for Stable Economic Growth vs. U.S. Fish and Wildlife Service, No. 95-1285-M Civil D.N.M., filed 4 March 1997). Critical habitat was revoked by the Service on March 25, 1998 (U.S. Fish and Wildlife Service 1998).

The loach minnow is a small, slender, elongate fish rarely exceeding 60 mm (2.4 inches) in length (Minckley 1973). The eyes are directed upward and the mouth is terminal with no barbels. Loach minnow have an olivaceous coloration that is highly blotched with darker pigment. Whitish spots are present at the origin and insertion of the dorsal fin as

well as the dorsal and ventral portions of the caudal fin base. Breeding males develop bright red-orange coloration at the bases of the paired fins, on adjacent fins, on the base of the caudal opening, and often on the abdomen. Breeding females become yellowish in color on their fins and lower body (Minckley 1973).

The loach minnow is endemic to the Gila River basin of Arizona and New Mexico, and Sonora, Mexico. Historic range included the basins of the Verde, Salt, San Pedro, San Francisco, and Gila rivers (Minckley 1973; Sublette *et al.* 1990). The species is believed to be extirpated from Mexico.

The loach minnow is found in turbulent, rocky riffles of rivers and tributaries up to approximately 7,200 feet (2,200 m) elevation. Loach minnow are bottom-dwelling inhabitants of shallow, swift waters flowing over gravel, cobble, and rubble substrates in mainstream rivers and tributaries (Rinne 1989; Propst and Bestgen 1991). Most growth occurs during the first summer. Longevity is typically 15 months to 2 years, although loach minnow can live as long as 3 years (Britt 1982; Propst *et al.* 1988; Propst and Bestgen 1991). Loach minnow use the spaces between, and in the lee of, larger substrates for resting and spawning (Propst *et al.* 1988; Rinne 1989). The species is rare or absent from habitats where fine sediments fill the interstitial spaces (Propst and Bestgen 1991).

The first spawn generally occurs in their second year primarily during March through May (Britt 1982; Propst *et al.* 1988); however, under certain circumstances loach minnow also spawn in the autumn (Vives and Minckley 1990). A recent report (Miller 1998) indicates loach minnow males were in breeding coloration when collected from Negrito Creek on June 25, 1998. Spawning occurs in the same riffles occupied by adults during the non-spawning season. The adhesive eggs of the loach minnow are attached to the underside, downstream side of a rock that forms the roof of a small cavity in the substrate. The number of eggs per rock ranges from 5 to more than 250, with the means of 52 to 63 (Propst *et al.* 1988). Eggs incubated at 18 to 20°C hatched in 5 to 6 days. Limited data indicate that the male loach minnow may guard the nest during incubation (Propst *et al.* 1988; Vives and Minckley 1990).

Loach minnow feed exclusively on aquatic insects (Abarca 1987; Barber and Minckley 1983; Britt 1982). Loach minnow are opportunistic benthic insectivores, feeding primarily upon riffle-dwelling larval ephemeropterans, simuliid, and chironomid dipterans. They actively seek their food among bottom substrates, rather than pursuing food items in the drift.

During the last century, both the distribution and abundance of the loach minnow have been greatly reduced throughout the species' range (Propst *et al.* 1988). Competition and predation by non-native fish and habitat destruction have reduced the historic range of the loach minnow by about 85% (Miller 1961; Hendrickson and Minckley 1984; Williams *et al.* 1985; Marsh *et al.* 1989; U.S. Fish and Wildlife Service 1986a, 1994a). Present populations are geographically isolated and inhabit the upstream ends of their historic range. In Arizona, the loach minnow is generally rare to uncommon where it is found in the following areas: Aravaipa Creek (Pinal and Graham counties); limited reaches of the White River (Gila County) and the North and East forks of the White River (Navajo County); Three Forks area of the Black River; throughout the Blue River;

Campbell Blue Creek; sporadic in Eagle Creek; and in the San Francisco River between Clifton and the New Mexico border (Greenlee County) (Marsh *et al.* 1990; Velasco 1994; Bagley *et al.* 1995, 1996). Historically in Arizona, the loach minnow occupied as many as 1,400 stream miles (2,250 km), but it is now found in less than 140 miles (225 km) (Propst *et al.* 1988).

In New Mexico, the loach minnow historically occupied approximately 205 stream miles (330 km); now it is found in about 160 stream miles (258 km), although the loach minnow has become very rare in substantial portions of this remaining range. The species still occurs in the upper Gila River, including the East, Middle, and West forks, the San Francisco and Tularosa rivers, and Dry Blue Creek.

Recent biochemical work on this species indicates that there are substantial differences in genetic makeup between the remnant loach minnow populations that occupy isolated fragments of the Gila River basin (Tibbets 1992). Therefore, it is important to preserve all the isolated loach minnow populations including the ones in the proposed project area.

The natural flooding characteristic of desert streams needs to be restored in order to rejuvenate the habitat and reduce competition from non-native species (Minckley and Meffe 1987). Recovery needs also include discouraging detrimental land and water use practices, ensuring perennial flows with natural hydrographs, curtailing the introduction of non-native fishes, and identifying, acquiring, and protecting important lands and water rights (Minckley and Meffe 1987).

Spikedace

The spikedace was listed on July 1, 1986, as a threatened species under the Act based on reductions in its habitat, and non-native, predatory and competitive fish species (U.S. Fish and Wildlife Service 1986b). The Spikedace Recovery Plan was approved in 1991 (U.S. Fish and Wildlife Service 1991b). Critical habitat was subsequently designated (U.S. Fish and Wildlife Service 1994b). Critical habitat for the spikedace was set aside by the New Mexico District Court (Coalition of Arizona-New Mexico Counties for Stable Economic Growth vs. U.S. Fish and Wildlife Service, No. 95-1285-M Civil D.N.M., filed 4 March 1997). Critical habitat was revoked by the Service on March 25, 1998 (U.S. Fish and Wildlife Service 1998).

Adult spikedace length ranges from 2.48 - 2.95 inches (63 - 75 mm) (Sublette *et al.* 1990). The eyes are large, the snout fairly pointed, and the mouth is slightly subterminal with no barbels present. The species is slender, somewhat compressed anteriorly. Scales are present only as small deeply embedded plates. The first spinous ray of the dorsal fin is the strongest and most sharp-pointed. Spikedace are olive-gray to light brown above with brilliant silver sides and black specks and blotches on back and upper side. Breeding males have bright brassy yellow heads and fin bases, with yellow bellies and fins (Minckley 1973; Page and Burr 1991). Spikedace live about two years with reproduction occurring primarily in one-year old fish (Barber *et al.* 1970; Anderson 1978; Propst *et al.* 1986).

Spikedace occupy mid-water habitats usually less than one meter deep, with slow to moderate water velocities over sand, gravel, or cobble substrates (Propst *et al.* 1986; Rinne and Kroeger 1988). Adults often aggregate in shear zones along gravel-sand bars where rapid water border slower flow, quiet eddies on the downstream edges of riffles, and broad shallow areas above gravel-sand bars (Propst *et al.* 1986). The preferred habitat of the spikedace varies, shifting both seasonally and with maturation (Propst *et al.* 1986). Geographical differences in utilized microhabitat have been noted, with populations in the forks area of the Gila drainage occupying deeper, slower velocities than more downstream populations. Likewise, seasonal shifts in utilized microhabitat have been noted in the upper Gila drainage, with populations seeking shallower habitats (<6.6 in., <16.8 cm) in the winter and deeper water (6.6 - 12.6 in., 16.8 - 32.1 cm) during warmer months. In winter, the species congregates along stream margins with cobble substrates. The erratic flow patterns of southwestern streams that include periodic spates and recurrent flooding are essential to the feeding and reproduction of the spikedace by scouring the sands and keeping gravels clean (Propst *et al.* 1986). Spikedace larvae and juveniles tend to occupy shallow, peripheral portions of streams that have slow currents and sand or fine gravel substrates, but will also occupy backwater habitats. The young typically occupy stream margin habitats, where the water velocity is less than 0.16 ft/second (5 cm/second) and the depth is less than 1.96 inches (5 cm). Juveniles are also found at depths of 12.6 inches (32 cm) or less, but utilize gravel-sand substrates and a wider range of water velocity than do larvae (Propst *et al.* 1986).

Spikedace are polyandrous and sexually mature at age I (Anderson 1978). Spawning extends from mid-March into June and occurs in shallow (less than 5.9 inches, 15 cm deep) riffles with gravel and sand bottoms and moderate flow (Barber *et al.* 1970; Anderson 1978; Propst *et al.* 1986). By mid-May, most spawning has occurred, although in years of high water flows, spawning may continue into late May or early June (Propst *et al.* 1986). Younger females spawn once, and older females spawn twice each year.

Reproduction is apparently initiated in response to a combination of declining stream discharge and increasing water temperature. Males move about the spawning riffles without exhibiting intrasexual aggression, awaiting females ready to spawn (Barber *et al.* 1970). Females enter spawning sites from adjacent pools, slow-velocity areas, or downstream, and are met by two or more patrolling males and herded toward the bottom where spawning occurs. After spawning, the males return to patrol the area while the female moves downstream. Gametes are presumably expelled into the water column. The ova are adhesive and demersal and adhere to the substrate. The number of eggs produced varies from 100 to over 800, depending on the size of the individual. The young grow rapidly, attaining a standard length of 1.38 to 1.58 inches (35 to 40 mm) by November of the year spawned. Based on length-frequency analyses, the maximum longevity is about 24 months, although few survive more than 13 months (Propst *et al.* 1986).

Spikedace feed primarily on aquatic and terrestrial insects (Barber and Minckley 1983; Marsh *et al.* 1989; Propst *et al.* 1986). In addition, Barber *et al.* (1970) reports that they feed on food items in the drift including some fish fry. Diet composition is largely determined by type of habitat and time of year (Minckley 1973). Propst *et al.* (1986)

reports that spikedace from the Gila-Cliff valley feeds (based on frequency of occurrence) on mayflies (71%), true flies (34%), and caddisflies (25%). The general lack of terrestrial invertebrates in spikedace stomachs indicated that the species is very dependent upon aquatic insects for sustenance (Propst *et al.* 1986).

Although the spikedace is currently listed as threatened, the Service has found that it warrants reclassification to endangered status. However, reclassification is precluded due to work on other higher priority listing actions (U.S. Fish and Wildlife Service 1994b). The need for reclassification is based on increases in serious threats to a large portion of its habitat. The spikedace is listed as endangered by the State of New Mexico.

Since the 1800s, the spikedace has declined markedly in distribution and abundance throughout its range (Propst *et al.* 1986). By 1996, the spikedace had been eliminated from over 85% of its historic range (New Mexico Department of Game and Fish 1996) and currently persists only in the upper Verde River and Aravaipa Creek in Arizona and portions of the Gila River in New Mexico (Barber and Minckley 1966; Minckley 1973; Anderson 1978; Barrett *et al.* 1985; Bestgen 1985; Jakle 1992; Marsh *et al.* 1990; Sublette *et al.* 1990). The species is generally absent from the Gila River from the confluence of the west and east forks downstream to the mouth of Turkey Creek, and occurs irregularly downstream from the mouth of the Middle Box of the Gila River to the Arizona/New Mexico state line (Propst *et al.* 1986)..

Habitat destruction, and competition and predation from introduced non-native fish species are the primary causes of the species decline (Miller 1961; Marsh 1991). The spikedace is native to the Gila River drainage, including the San Francisco drainage, except in the extreme headwaters (Propst *et al.* 1986). In the Gila River, spikedace are regularly found only in the Cliff-Gila Valley reach of the Gila River and lowermost West Fork Gila River (Propst *et al.* 1986). Long-term monitoring studies in the Gila drainage have indicated a decline in spikedace abundance in the Cliff-Gila Valley reach of the Gila River (New Mexico Department of Game and Fish 1996).

The effects of historic and present perturbations in the Gila River basin have resulted in fragmentation of spikedace range and isolation of remnant spikedace populations. Recent taxonomic and genetic work on spikedace indicate there are substantial differences in morphology and genetic makeup among remnant spikedace populations. Anderson and Hendrickson (1994) found that spikedace from the Verde River are morphologically distinguishable from all other spikedace populations, being the most distinct from the spikedace in Aravaipa Creek, while spikedace from the upper Gila River and Eagle Creek populations have intermediate measurements. Mitochondrial DNA and allozyme analyses have revealed similar patterns of geographic variation within the species (Tibbets 1992).

The expansion of non-native fishes needs to be controlled or eliminated where detrimental to this species. Invasion of non-native fishes either from stock watering tanks upstream, or the Gila River downstream, is an additional threat. The red shiner is present in the Gila River and has been suggested as a potential competitor for native species (Rinne 1992; New Mexico Department of Game and Fish 1996).

Sonora tiger salamander

The Sonora tiger salamander was listed as endangered on January 6, 1997. Disease, predation by introduced non-native fishes and bullfrogs, and collection of salamanders for bait were cited as the most serious and immediate threats to this species (Lowe 1954; Gelbach 1967; Jones *et al.* 1995; U. S. Fish and Wildlife Service 1997b). No critical habitat was designated for this species. A recovery plan is currently in preparation by Dr. James Collins and Jon Snyder of Arizona State University.

The Sonora tiger salamander is a large salamander with a dark venter and light-colored blotches, bars, or reticulation on a dark background. Snout-vent lengths of metamorphosed terrestrial salamanders vary from approximately 2.6-4.9 inches (6.7 to 12.5 cm) (Jones *et al.* 1988, Lowe 1954). Larval salamanders are aquatic with plume-like gills and well-developed tail fins (Behler and King 1980). Larvae hatched in the spring are large enough to metamorphose into terrestrial salamanders from late July to early September, but only an estimated 17 to 40 % metamorphose annually. Remaining larvae mature into branchiataes (aquatic and larval-like, but sexually mature salamanders that remain in the breeding pond) or over-winter as larvae (Collins and Jones 1987)

The Sonora tiger salamander is known from approximately 45 breeding localities (Ziemba *et al.* 1998; Abbate 1998; U.S. Fish and Wildlife Service 1997b; Collins and Jones 1987; Collins 1981, 1996). Salamanders that may be Sonora tiger salamanders have also been found at the lower Peterson Ranch tank in Scotia Canyon, upper Garden Canyon Pond at Fort Huachuca, and at Los Fresnos in the San Rafael Valley, Sonora. Salamanders have not been found at the Scotia Canyon site for several years; this population may be extirpated. Additional reports of the salamander from one mine, one cave, and one spring-fed well have yet to be confirmed (Ziemba *et al.* 1998). All sites where Sonora tiger salamanders have been found are located in the Santa Cruz and San Pedro river drainages, including sites in the San Rafael Valley and adjacent portions of the Patagonia and Huachuca mountains in Santa Cruz and Cochise counties, Arizona. All confirmed historical and extant aquatic populations are found in cattle tanks or impounded cienegas within 19 miles (30.6 km) of Lochiel, Arizona. During intensive surveys in 1997, from one to 150 Sonora tiger salamanders were found at 25 stock tanks (Abbate 1998). Populations and habitats are dynamic, thus the number and location of extant aquatic populations change over time, as exhibited by the differences between survey results in 1985 and 1993-1997 (Ziemba *et al.* 1998, Abbatte 1998, Collins and Jones 1987, Collins 1996).

Historically, the Sonora tiger salamander probably inhabited springs, cienegas, and possibly backwater pools that were extant long enough to support breeding and metamorphosis (at least two months), but ideally were permanent or nearly permanent, allowing survival of mature branchiataes. The grassland community of the San Rafael Valley and adjacent montane slopes, where all extant populations of Sonora tiger salamander occur, may represent a relictual grassland and a refugium for grassland species. Tiger salamanders in this area became isolated and, over time, genetically distinct from ancestral *A. t. mavortium* and *A. t. nebulosum* (Jones *et al.* 1995). This subspecies has opportunistically taken advantage of available stock tank habitats as natural habitats disappeared (Hendrickson and Minckley 1984) or were invaded by non-native predators with which the Sonora tiger salamander can not coexist (U.S. Fish and

Wildlife Service 1997b).

Ambystoma tigrinum mavortium or *stebbins* x *mavortium* crosses have recently been confirmed for the first time at two stock tanks in the San Rafael Valley (Ziemba *et al.* 1998). Thus, genetic swamping of *stebbinsi* populations may be underway. With the exception of Bog Hole in the San Rafael Valley and a site on Fort Huachuca, cattle grazing occurs throughout the range of the Sonora tiger salamander. Cattle can trample salamanders and their eggs, and can degrade habitat at stock tank breeding sites. Overgrazing can cause loss of cover and erosion that can threaten the integrity of stock tanks used by the salamander. Genetic analysis suggests very little genetic variability in Sonora tiger salamanders (Collins *et al.* 1988; Jones *et al.* 1988, Jones *et al.* 1995, Ziemba *et al.* 1998). In populations with low genetic variability lethal alleles are more likely to be expressed, disease resistance may be low, and evolution and adaptation to a changing environment is relatively slow.

Primary threats to the salamander include predation by non-native fish and bullfrogs, disease, catastrophic floods and drought, illegal collecting, introduction of other subspecies of salamanders that could genetically swamp *A. t. stebbinsi* populations, and stochastic extirpations or extinction characteristic of small populations with low genetic variability. Predation by catfish, bass, mosquito fish, and sunfish can eliminate stock tank populations of Sonora tiger salamander (Collins *et al.* 1988). The salamanders can apparently coexist with bullfrogs, but bullfrogs prey on salamanders, and perhaps if they are present in sufficient densities could reduce or eliminate salamander populations. Tadpoles of wood frogs (*Rana sylvatica*), are known to feed on spotted salamander (*Ambystoma maculatum*) eggs (Petranka *et al.* 1998), but under experimental conditions bullfrog tadpoles do not feed on viable salamander eggs or hatchlings (Collins 1996). A disease, recently identified as an iridovirus, has been documented at numerous tanks in the San Rafael Valley (Jancovich *et al.* 1998). Once introduced to a stock tank, iridovirus kills most or all aquatic salamanders (Collins *et al.* 1988, Jancovich *et al.* 1998). The disease may be spread by birds, cattle, or other animals that move among tanks (Jancovich *et al.* 1998). The disease could also be spread by researchers if equipment such as waders and nets used at a salamander tank are not disinfected or allowed to thoroughly dry before use at another tank. Diseased salamanders were found at two tanks in 1997 (Abbate 1998).

ENVIRONMENTAL BASELINE

Under section 7(a)(2) of the Act, when considering the effects of the action on federally listed species, the Service is required to take into consideration the environmental baseline. Regulations implementing the Act (50 CFR § 402.02) define the environmental baseline to include past and present impacts of all Federal, State, or private actions in the action area. Also included in the environmental baseline are the anticipated impacts of all proposed Federal actions in the action area that have undergone formal or early section 7 consultation, and the impacts of State and private actions that are contemporaneous with the consultation process.

Status of the Species and Factors Affecting Species Environment Within the Action Area

Lesser long-nosed bat

Habitat or roost sites for the lesser long-nosed bat occur within the following allotments: Dragoon and Paradise allotments in the Coronado National Forest and the Radium Allotment in the Tonto National Forest. The status of the species within the action area is summarized by allotment.

Dragoon Allotment

Surveys were conducted in the Dragoon Mountains in 1994, 1995, and 1997. One migratory night roost site is known to occur on the Dragoon Allotment. There are no known maternity or migratory day roosts within the allotment. There are no known maternity roosts on the Coronado National Forest and no known migratory day roost sites with greater than 300 bats in the mountain ranges administered by the Douglas District (which includes the Chiricahua, Dragoon, and Peloncillo Mountains). The only two large migratory day roosts known in this general area are located on private lands. The closest known large roost site (i.e., greater than 1,000 bats) is approximately 30 miles (48.3 km) from the Dragoon Allotment and therefore, according to the Forest Service, is within foraging distance of the allotment. Within the Dragoon Allotment, there are approximately 51,000 acres of potential agave habitat. These include the following vegetation types: desert grasslands and interior chaparral with high agave densities, oak woodlands with moderate agave densities, and pinyon-juniper woodlands with low agave densities. The entire Dragoon Allotment is within suitable agave habitat. Within the allotment, 50% is within desert grasslands, 30% is within oak woodlands, and 20% is within pinyon-juniper woodlands. The allotment and surrounding areas contain no saguaros or other columnar cactus.

Paradise Allotment

Roost surveys have been conducted in the Chiricahua Mountains (including the Paradise Allotment) from the 1960s through 1997. There are no known migratory day roosts, night roosts, or maternity roosts within the allotment. As discussed earlier, there are no known maternity roosts on the Coronado National Forest and no known migratory day roost sites with greater than 300 bats in the mountain ranges administered by the Douglas District, which includes the Chiricahua, Dragoon, and Peloncillo Mountains. The only two large migratory day roosts known in this general area are located on private lands. There is one small roost site within 25 miles (40.25 km) of the Paradise Allotment and therefore, according to the Forest Service, is within foraging distance of the allotment. Within the Chiricahua Mountains, there are approximately 250,000 acres of potential agave habitat. These include the following vegetation types: grasslands and interior chaparral with high agave densities, oak woodlands with moderate agave densities, and pinyon-juniper and pine-oak woodlands with low agave densities. Another 25% of the allotment falls within areas of moderate or high density agaves. The allotment and surrounding areas contain no saguaros or other columnar cacti.

Radium Allotment

The Radium Allotment occurs on the periphery of the lesser long-nosed bat's range. It is unknown whether the bat actually roosts within or adjacent to this allotment. Roost surveys have not been conducted. Caves and mines could potentially provide suitable roost sites. Any potential roosts in the allotment would probably be transitory (non-maternity) roosts used by adults and/or young bats in the summer or fall. The nearest known roost is greater than 70 miles (112.7 km) from the allotment south of the Gila River. However, long nosed-bats have been recorded from scattered localities north of the Gila River. In addition, the Service is unaware of any adequate efforts to survey for lesser long-nosed bats on this allotment. Agave and saguaro food plants occur on approximately 20% (roughly 5,000 acres) of the allotment. Densities of these food plants are unknown.

Based on known distances lesser long-nosed bats have traveled from roost sites to foraging areas, potential foraging habitat may extend in a 40-mile radius from roosts. With the lack of bat survey information, the presence of potential roost sites, and the availability of suitable forage plants, the Radium Allotment is considered lesser long-nosed bat foraging habitat.

Prior to this consultation, no formal section 7 consultation has been completed on the lesser long-nosed bat within the action area. Past consultations that resulted in non-jeopardy biological opinions for the species include the following: 1) Arizona Ecological Services Field Offices's September 26, 1997, programmatic biological opinion for the Bureau of Land Management (BLM) Safford and Tucson Field Offices' livestock grazing program in southeastern Arizona anticipated that take of lesser long-nosed bats would occur in the form of habitat; 2) the Service issued a biological opinion to the BLM for the Lower Gila South Resource Management Plan and Amendment in Arizona in which anticipated take of lesser long-nosed bats would occur in the form of habitat; and 3) the Service's December 19, 1997, Biological Opinion on Eleven National Forests and National Grasslands of the Southwestern Region of the Forest Service anticipated take of lesser long-nosed bats would occur in the form of habitat.

Loach minnow and Spikedace

Both the distribution and abundance of loach minnow and spikedace have become dramatically reduced in the past century, and now each is only present in 15 per cent of its historical range. Past changes in range and population density undoubtedly occurred in response to natural spatial and temporal variations in the environment, but the current threatened status of loach minnow and spikedace is the result of direct, indirect, and cumulative effects of human activities. The Gila River and its forks are in a generally degraded condition with poor riparian habitats, incised channels, poor bank stability, and high streambed embeddedness (Propst *et al.* 1986).

Dark Canyon Allotment

Within the Upper Gila watershed in Arizona, spikedace are known only to occur within Eagle Creek, tributary to the Gila River in Graham and Greenlee counties. Spikedace were first detected in Eagle Creek in 1985 and subsequently found in 1987 to be

common in the creek within 50% of the allotment (Marsh *et al.* 1990). The species has not been found in Eagle Creek since 1987. Approximately 4 miles (6.44 km) of Eagle Creek borders the western portion of the allotment and provides potentially occupied habitat for spikedace. Two major drainages on the allotment (Dark and Whitewater Canyons) empty directly into Eagle Creek. Potential habitat within the allotment occurs within a 3 to 4-mile reach of Eagle Creek, portions of East Eagle and Dry Prong Creeks, and in Robinson Canyon. The nearest known occupied habitat is near the Sheep Wash confluence with Eagle Creek, approximately 12 miles (19.3 km) downstream.

Loach minnows are known to inhabit Eagle Creek roughly 20 miles (32.2 km) upstream of the Dark Canyon Allotment. Suitable habitat for the species occurs in roughly 4 miles (6 km) of Eagle Creek that flows within the allotment along the allotment border (Eagle Creek riparian pasture). This area was surveyed in 1996 and 1997; however the species was not detected. The absence of the species in this portion of the Eagle Creek cannot be assumed given the presence of an upstream source population and suitable habitat. The Forest Service intends to conduct fish surveys on Eagle Creek on the Dark Canyon Allotment in 1999.

Granville Allotment

Loach minnow or spikedace do not occur within the Granville Allotment, since there are no perennial streams. However, the loach minnow occurs regularly in both the Blue and San Francisco Rivers. The closest occupied loach minnow habitat occurs about 5 miles (8.05 km) downstream from the allotment in the San Francisco River. The spikedace has been extirpated from the San Francisco River and its tributaries. About 86% of the allotment drains into the San Francisco River through Sardine Canyon, Fry Canyon, and Cave Creek. Sardine Canyon was last surveyed for fish in 1995 and the San Francisco River in 1996. About 12% of the allotment drains through Pigeon Creek into the Blue River.

Gila River Allotment

Extensive fish survey data are available in or near the Gila River Allotment (Tables 1 and 2). Fish surveys have been conducted about 6 miles (9.66 km) north of the allotment at Riverside (1992-1998) and in the Gila Bird Area (1996-1998) within the allotment. Loach minnow and spikedace occupy the Gila River within this allotment. These species are also reported from upstream (Table 2) and downstream (Miller 1995). During 1995-1998, the Silver City Ranger District funded fish surveys of the Gila River by Western New Mexico University (Miller 1998).

In the Bird Area, loach minnow and spikedace were collected in all three years, but were never abundant (Table 1). The Gila Bird Area had stream restoration activities completed in 1995, and the riparian vegetation and aquatic habitats have improved significantly along this reach of the river. In 1999, loach minnow and spikedace numbers have increased noticeably in this area; and large numbers of loach minnow were also found in nearby Mangus Creek (P. Boucher, U.S. Forest Service, pers. comm.). The Bird Area may now contain the largest remaining populations of loach minnow and spikedace in the Gila River system.

Table 1. Number of fish collected at the Gila River, Gila Bird Area site from the Gila River Allotment, 1996-1998 (Miller 1998).

	1996	1997	1998	Total	% of Total (3,226)
Native Fish					
Loach minnow	9	36	16	61	1.9%
Spikedace	8	61	6	75	2.3
Longfin dace	354	36	16	406	12.6
Desert sucker	74	165	152	391	12.1
Sonoran sucker	492	842	720	2,054	63.6
Roundtail chub	<u>0</u>	<u>0</u>	<u>6</u>	<u>6</u>	<u><0.1</u>
Total	937	1,140	916	2,993	92.5
Non-native Fish					
Red Shiner	20	15	3	38	1.2%
Common Carp	29	0	20	49	1.5
Yellow bullhead	17	11	0	28	0.9
Channel catfish	5	3	6	14	<0.1
Flathead catfish	2	1	3	6	<0.1
Mosquitofish	29	46	11	86	2.7
Green sunfish	3	0	0	3	<0.1
Bluegill	0	1	0	1	<0.1
Smallmouth bass	0	2	4	6	<0.1
Fathead minnow	<u>0</u>	<u>2</u>	<u>0</u>	<u>2</u>	<u><0.1</u>
Total	105	81	47	233	6.4

The fish surveys show that this part of the Gila River is still dominated by native fishes (92.5%). Competition with non-native fishes is often cited as a major factor in the decline of loach minnow and spikedace. The red shiner, in particular, is frequently indicted in the decline of these fishes (Minckley and Deacon 1968; Minckley 1973). The red shiner is a very competitive fish species that out-competes loach minnow and spikedace for food items and habitat; and is very tolerant of many extremes found in the desert and semi-desert aquatic habitats (Matthews and Hill 1977). Red shiners were collected in low numbers in the Bird Area in all three years (Table 1); and were also found in low numbers at Riverside, except for a large increase in 1998 (Table 2). Since red shiners were only abundant at Riverside in 1998, it appears unlikely that the overall downward trend of the loach minnow and spikedace since 1992 is highly related to red shiner competition. The overall decline in the loach minnow and spikedace populations at Riverside is more likely to be related to habitat degradation caused by excessive sedimentation, poor water quality, and irregular streamflows (different from the natural hydrograph and including dewatering of streams for irrigation) than to competition and predation by non-native fishes.

Table 2. Number of fish collected at the Gila River, Riverside permanent site, 1992-1998 (U.S. Fish and Wildlife Service 1998).

	1992	1993	1994	1995	1996	1997	1998	Total	% of Total
								(2,824)	
Native Fish									
Loach minnow	103	25	24	10	0	3	29	194	6.9%
Spikedace	309	61	4	60	10	25	45	514	18.2
Longfin dace	24	36	1	66	93	0	36	256	9.1
Desert sucker	24	36	39	128	7	31	86	351	12.4
Sonoran sucker	<u>7</u>	<u>36</u>	<u>7</u>	<u>611</u>	<u>25</u>	<u>49</u>	<u>105</u>	<u>840</u>	<u>29.8</u>
Total	467	194	75	875	135	108	301	2,155	76.4
Non-native Fish									
Red Shiner	0	7	0	1	3	0	173	184	6.5%
Mosquitofish	<u>13</u>	<u>4</u>	<u>162</u>	<u>22</u>	<u>7</u>	<u>0</u>	<u>277</u>	<u>485</u>	<u>17.2</u>
Total	13	11	162	23	10	0	450	669	23.7

Sonora tiger salamander

The Sonora tiger salamander occurs on the A Bar Draw Allotment, Coronado National Forest. The status of the species within this allotment is summarized by below.

A Bar Draw Allotment

The Sonora tiger salamander has been recorded from at least three sites (stock ponds) within the A Bar Draw Allotment. All ponds are maintained for livestock. There are nine additional records on nearby Forest grazing allotments and private lands. All other stock ponds on the allotment in this elevation range may represent potential habitat, but their suitability for Sonora tiger salamanders has not been determined.

Past formal consultations on the salamander include the Arizona Ecological Services Field Office's December 19, 1997, biological opinion that addressed grazing at a plan level regarding effects to the salamander. The opinion found that grazing and other activities proposed were not likely to jeopardize the continued existence of the Sonora tiger salamander. That opinion provided a number of terms and conditions to minimize take, including detailed protocols on how to maintain or clean out stock tanks where the salamander may occur. Currently, the Arizona Ecological Services Field Office is consulting formally on the Coronado National Forest's grazing program. This Forest-wide programmatic biological opinion concerns the effects on the Sonora tiger salamander from livestock grazing on the Coronado National Forest but excludes the A Bar Draw Allotment.

EFFECTS OF THE ACTION

The Service's primary task in developing a biological opinion is to determine whether the proposed action is likely to jeopardize the continued existence of any listed species. The jeopardy/non-jeopardy determination is based on an evaluation of the following: (1) a species' status in the project area and range-wide (see above sections); (2) the effects of the proposed action on the survival and recovery of a listed species (including effects of interdependent and interrelated actions); (3) the aggregate effects of other Federal actions on a listed species (e.g., amount of take occurring as a result of Federal actions subject to previous consultations); and (4) the cumulative effects on a listed species (i.e., future non-Federal actions that are reasonably certain to occur in the action area).

The Act directs the Service to consider the direct and indirect effects from the proposed action and interdependent and interrelated actions that may affect the threatened and endangered species in the action area. Indirect effects are those that are caused by, or result from, the proposed action, and are later in time, but reasonable certain to occur. Interdependent actions are actions that have no independent utility apart from the action under consideration. Interrelated actions are actions that are part of a larger action, and are dependent on the larger action for their justification.

Service guidance for conducting section 7 consultation states, "If the nature of the effects cannot be determined, benefit of the doubt must be given to the species." (U. S. Fish and Wildlife Service and National Marine Fisheries Service 1998, pages 3-12). The Service is concerned that many of the effects on listed species resulting from this project were not adequately considered or analyzed by the Forest Service, as evidenced by the nonspecific mitigations and conservation measures for the listed species. With an indeterminate project proposal, such as this one, conservation measures should address the worst-case situations in order for determinations and conclusions to be credible to the Service.

Lesser long-nosed bat

Direct effects to lesser long-nosed bats as a result of grazing activities are not expected because these activities are unlikely to affect roosts. One migratory roost site is known to occur on the Dragoon Allotment. Roost surveys were conducted in areas that include the Paradise Allotment from 1960 through 1998; however, no known migratory day roosts, night roosts, or maternity roosts were located. However, it is possible that undetected roosts occur within the Radium Allotment where roost surveys have not been conducted.

Indirect effects to lesser long-nosed bats may occur through adverse effects to forage plants. The Dragoon, Paradise, and Radium Allotments are known to contain foraging habitat for the bat. The proposed action for the Dragoon Allotment would allow cattle grazing in suitable bat foraging habitat during the bolting period with the number of acres involved varying from year to year. A rest rotation system would be used, thus, each pasture would be rested for approximately 14 to 16 months before re-entered by livestock. The proposed action for the Paradise Allotment would allow livestock grazing in approximately 3,800 acres or 25% of suitable bat foraging habitat during the bolting period. A winter seasonal, pasture rest-rotational grazing system would be implemented

under the proposed action for the Paradise Allotment. The Radium Allotment would allow livestock grazing on approximately 2,000 acres or 40% of suitable bat foraging habitat during the bolting period. All three allotments have utilization standards of 45%. According to the Forest Service, the proposed utilization standards and pasture rotation systems decrease overgrazing and the chance of widespread trampling of agaves.

Saguaros may be affected both directly and indirectly by grazing activities. Saguaros occur on slopes, bajadas, and in valleys. Impacts due to livestock grazing activities may occur from trampling of young saguaros, grazing of nurse plants which results in reduction or removal of protective cover, or grazing of the young saguaros themselves (Abouhalder 1992). Nurse plants, which shade sensitive saguaro seedlings (Shreve 1931), may be reduced by grazing and germination sites may be adversely altered due to soil compaction, erosion, and reduced infiltration. Benson (1982) noted that seedbeds of saguaros have been locally obliterated by grazing. Neiring *et al.* (1963) found that enhanced reproduction of saguaros on slopes was correlated with reduced localized levels of grazing. Cattle also may compact soils and reduce germination and survival of the foodplants of the bat.

No long-term investigation has documented the influence of grazing on agave mortality or flowering stalk herbivory. Individual paniculate agave plants only bloom once in their life cycle (e.g., approximately 20 years). However, agave stalks as they begin to bolt are particularly palatable to domestic livestock and wild herbivores, including deer, javelina, rodents, and rabbits. Cattle probably trample young agaves, and have been known to "walk down" agave flowering stalks (T. Cordery, Arizona Ecological Services Field Office, pers. comm., 1998). Agave germination and seedling establishment may be influenced by degraded ecological conditions such as soil compaction, erosion, reduced infiltration, and altered plant species diversity and abundance. Effects to bat forage plants due to livestock grazing are expected to be more intense where livestock congregate near water sources and less intense on steep slopes or among rocks where grazing is generally relatively light. Palmer's agave typically occurs on rocky slopes, but is also scattered within the desert grassland and oak woodland communities within the elevation range of approximately 3,000 to 6,000 ft (Gentry 1982). Like Palmer's agave, Parry's agave is typically found on rocky slopes, but at somewhat higher elevations (4,900 to 8,200 ft) (Gentry 1982).

The severity of indirect adverse effects to lesser long-nosed bats resulting from reduction in forage is dependent on the importance of forage plants in a specific area to reproduction, survival, and growth of the bat. Areas with high densities of paniculate agaves and saguaros may be particularly important to the bat, especially if those high density sites are in proximity to roosts. The distribution and abundance of agaves on the Dagoon, Paradise, and Radium Allotments, relative to the distribution of livestock during the agave bolting period (April 15 - September 15), has not been evaluated.

Considerable evidence exists suggesting an interdependence of the *Leptonycteris* bat species and certain agaves and cacti. Activities that adversely affect the density and productivity of saguaros and paniculate agaves may adversely affect populations of lesser long-nosed bats (Abouhalder 1992, U.S. Fish and Wildlife Service 1997a). Livestock grazing in areas with agaves may affect the long-nosed bat, particularly under high intensity use. Intense grazing could result in trampling of young agaves and cacti,

soil compaction, erosion, alteration of the plant community species composition and abundance, and changes in the natural fire regime. Activities that directly or indirectly promote invasion or increased density of non-native grasses, particularly Lehmann lovegrass (*Eragrostis lehmanniana*), brome grass (*Bromus* species), and Mediterranean grass (*Schismus barbatus*), may result in increased fire frequency and intensity (Minnich 1994, Rogers and Steele 1980) which in turn may have related impacts to paniculate agave and columnar cacti populations. Grasses are probably the strongest competitor of agave seedlings. Livestock also feed on flower stalks, which are a primary nectar source for foraging bats.

Loach Minnow and Spikedace

Loach minnow and spikedace are the rarest of the remaining five species of native fishes inhabiting the Gila River drainage (Propst *et al.* 1986). The geographic range and population numbers of the loach minnow and spikedace have been declining for many years. The estimated current total river miles of habitat remaining for the loach minnow and spikedace is 160 miles (257 km), which is a decline of about 85% from historical range information. In the Gila River and its tributaries, a decline in numbers of loach minnow and spikedace has been revealed in fish surveys since 1992, and these data further verify the general overall decline in their numbers in the Gila River.

In addition, loach minnow and spikedace have low population numbers, short life expectancies, and low fecundity. These factors combine to make these species very sensitive to adverse environmental changes and disturbances, including grazing effects of livestock. In addition, the species are very habitat specific and only inhabit a small part of the total river habitat (primarily riffles) available, and these limited habitats are vulnerable to the adverse effects of sedimentation.

General Effects of Livestock Grazing on the Two Listed Fishes

Evaluation of livestock grazing effects using the Guidance Criteria indicated adverse effects on the Dark Canyon, Granville, and Gila River Allotments. This determination included adverse effects to the watersheds, stream channels, and aquatic habitats in Eagle Creek, San Francisco River, and Gila River. In general, livestock grazing activities in the uplands can contribute to changes in surface runoff quantity and intensity, sediment transport, soil chemistry, and infiltration and water holding capabilities of the watershed; flood flows may increase in volume while decreasing in duration, and low flows may decrease in volume and increase in duration (Brown *et al.* 1974, Gifford and Hawkins 1978, Johnson 1992). Reduced herbaceous vegetation leads to accelerated soil loss due to increased exposure of soils to downpour events and reduced sediment filtering capabilities of the vegetation (Erman *et al.* 1977, Mahoney and Erman 1992, Osborne and Kovacic 1993). Hoof action can cause loss of cryptobiotic soil crusts, soil compaction, erosion, and gullyng (Harper and Marble 1988, Marrs *et al.* 1989, Orodho *et al.* 1990, Schlesinger *et al.* 1990, Bahre 1991, Klemmedson 1956, Ellison 1960, Arndt 1966, Gifford and Hawkins 1978, Webb and Stielstra 1979, McClaran and Anable 1992). Litter is reduced by trampling and churning into the soil thus reducing cover for soil, plants, and wildlife (Schulz and Leininger 1990). Overuse of vegetation by livestock can cause changes to plant root structures, and alter plant species composition and overall biomass (Martin 1975, Menke 1988, Vallentine 1990, Popolizio *et al.* 1994).

These conditions may increase sediment delivery into the stream (Platts 1990, Meehan 1991, Johnson 1992, Wertz and Wood 1994), change the way in which flood flows interact with the stream channel, and may exacerbate flood damage to banks, channel bottoms, and riparian vegetation.

Indirect effects from modification of the watershed, stream channel, streambanks, and riparian zone result in short- and long-term adverse effects to loach minnow and spinedace. The physical damage caused by livestock to streambanks and stream channels due to trailing often results in increased channel width to depth ratios which increases riffle habitat, but may decrease the amount of "shear zones," the transitional habitat between fast and slow water favored by adult spinedace (Propst *et al.* 1986). A wider, shallower stream would have reduced velocities in riffle/run/glide habitat which would result in a decrease in the amount of loach minnow habitat. 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).

Spinedace and loach minnow are adversely affected by activities that contribute to altering the flow regime (water quality, quantity, intensity, and duration), degrading the stream channel, and modifying the floodplain and riparian vegetation structure and diversity. These impacts occur at all levels of cattle presence, regardless of season, but increase as number of livestock and length of time the cattle are present increase (Marlow and Pogacnik 1985). The way in which the effects of livestock grazing are manifested and the magnitude of the effects in the watershed, is dependant on local site conditions. Range condition, considered together with soil, watershed, and riparian condition, is assumed to be closely correlated with ecological condition and function. Watershed/ecological effects of grazing are generally expected to be more evident where stocking levels are high, soils are impaired, and/or rangelands are in fair, poor, or very poor condition.

The effects of downstream sedimentation from grazing may adversely affect loach minnow and spinedace and their habitats. Adverse effects of stream sedimentation to fish and fish habitat have been extensively documented (Barrett 1992; Deacon and Minckley 1974; Minckley and Deacon 1968; Osborne and Kovacic 1993; Rinne and Minckley 1991; Shreve 1931; Murphy *et al.* 1981, Wood *et al.* 1990, Newcombe and MacDonald 1991, Barrett 1992, Megahan *et al.* 1992, Waters 1995, Newcombe and Jensen 1996). Excessive sediment may smother invertebrates, reducing fish food production and availability. Excessive sediment buries gravel, cobble, and coarse sand substrates required by loach minnow and spinedace for cover, feeding, and spawning. Sediment deposition may eliminate the under-cobble pockets needed by loach minnow, making potential habitat unsuitable. Propst *et al.* (1988) reported that stream reaches subject to high sediment transport and deposition supported few if any loach minnows; and they were rare in riffles that were deeply embedded, or armored with cobble and rubble. Muncey *et al.* (1979) reported that substantial evidence exists that turbidity and siltation negatively affect spawning behavior; and that fish eggs were very susceptible to smothering by siltation. Loach minnow and their eggs are particularly vulnerable to substrate sedimentation that reduces available habitat and smothers eggs (Propst *et al.* 1988).

Some direct effects of high levels of suspended sediments have been identified as harmful to warmwater fishes (Newcombe and Jensen 1996). Suspended sediment concentrations of only a few hundred milligrams per liter (mg/l) have caused reduced feeding, gill abrasion, weight loss, reproductive failure, and direct mortality to some fish species (Newcombe and Jensen 1996).

The short lifespan of the loach minnow and spikedace, coupled with the comparatively low fecundity of the species and small disjunct populations renders them vulnerable to significant adverse effects from activities which may only impact their habitat for relatively short time periods, especially during the spawning season. Any situation that eliminated or greatly reduced a year-class would severely deplete recruitment to a population. For example, excessive sedimentation during the spawning season might suffocate a large portion of that year's reproductive effort. In the succeeding year, total reproductive effort would be diminished. The net effect would be a major reduction in population size of either species (Propst *et al.* 1988).

Dark Canyon Allotment

Livestock use within potential loach minnow habitat on the Dark Canyon Allotment is limited to trailing cattle along, through, and across Eagle Creek while moving cattle among pastures and for shipping. Due to the rugged topography and limited access points within the allotment, trailing of livestock along the canyon bottoms is the only practical method available to the operator.

Under the proposed action for the Dark Canyon Allotment, livestock will have direct access to Eagle Creek entering and leaving the allotment as well being moved from pasture to pasture. Livestock will be moved through the Eagle Creek riparian pasture during a two week period in May and again in October each year. The number of times and locations that livestock will cross Eagle Creek during these pasture moves is unknown at this time. The Forest Service has indicated that a fishery biologist will select the livestock crossing points out of riffles inhabited by the spikedace and loach minnow. In addition, direct access to Eagle Creek may affect loach minnows by crushing eggs, larvae or adult fish, and by causing eggs to be covered by sediments generated by livestock wading in the creek or trampling the streambank. Repeated crossing of livestock may alter aspects of stream morphology that influence suitability for the species. The accumulation of sediments in the interstitial spaces of cobbles and gravels in riffle habitats is especially detrimental to successful reproduction of loach minnow, and may reduce the aquatic invertebrate food base.

Indirect effects to spikedace and loach minnow within the Dark Canyon Allotment and its habitat in Eagle Creek may occur through the continued impacts of livestock on upland soils and vegetation. Approximately 50% of the Dark Canyon Allotment is in unsatisfactory watershed condition with roughly 70% of the soils in impaired or unsatisfactory condition. Although riparian vegetation is improving along Eagle Creek, presently about 60% is in unsatisfactory condition. Given these unsatisfactory edaphic and vegetative conditions, continued trampling and grazing by livestock are likely to generate sediments that enter Eagle Creek from the allotment impacting the loach minnow. According to the EA for the Dark Canyon Allotment, maximum allowable use in key areas will be 35%.

Granville Allotment

The intermittent drainages from the allotment flow primarily into the San Francisco River. Loach minnow are found in the river about 5 miles (8.05 km) downstream, and spikedace have been extirpated from the river. The San Francisco River is still considered potential habitat for the spikedace. The proposed action will indirectly affect the loach minnow through downstream sedimentation, since 86% of the allotment drains into occupied loach minnow habitat (i.e., the San Francisco River through Sardine Canyon, Fry Canyon, and Cave Creek). Twelve% of the allotment drains into the Blue River through HL Canyon, via Pigeon Creek. The loach minnow is much more sensitive than spikedace to adverse effects from excess sediment in the aquatic ecosystem (U.S. Fish and Wildlife Service 1999 *in litt.*). Thirty-six percent of the Granville Allotment watershed has unsatisfactory conditions with the remaining 64% in satisfactory/untreatable condition. Ninety-five% of the soils are in unsatisfactory condition with the remaining 5% in impaired condition. The proposed action increases the number of livestock from 70 to 229 cattle with and increase in projected stocking density from 1,124 to 1,794 animal months. Roughly 26% of the allotment is within full/potential capacity range and maximum allowable use 45%. Higher stocking densities may lead to increased erosion from areas not presently impacted. The above conditions are likely to result in the generation of measurable sediments that could reach occupied minnow habitats. Because of the unsatisfactory edaphic and vegetative conditions, sediments originating from the allotment may not be effectively filtered, loach minnows and/or their habitats will be effected. Degraded watersheds due to over-utilization of forage by livestock and wildlife, and active erosion of stream channels exacerbated by the presence of livestock, may contribute to altering the hydrologic regime (water quality, quantity, intensity, duration, and pattern), thereby increasing erosion and sedimentation into occupied loach minnow habitat (U.S. Fish and Wildlife Service 1999 *in litt.*).

Gila River Allotment

The Gila River divides the Gila Allotment into the West and East Pastures. Cattle, while in either pasture, do not have access to the Gila River. However, every other year when livestock leave or enter the West Pasture, the livestock will be trailed across (as well as up and down) a 2-mile reach of the Gila River occupied by loach minnow. About half of the permitted 216 head of cattle will be placed in the north end of the West Pasture and the remaining cattle will be placed in the south end. The cattle going to, and coming from the north end of the pasture will be driven across the Gila River at one crossing and will follow a stock trail to the upland pasture. The cattle going to, and coming from the south end of the West Pasture will be trailed up and down the Gila River for approximately 2 miles (3.22 km) on an existing recreational trail which crosses the Gila River four times. These crossings will occur in the fall and spring however, timing will depend on weather as well as other factors (i.e., general livestock operating logistics). In general, river crossings will occur in October, but may take place from mid-September to mid-November. The livestock crossings during the spring will be occur in March, prior to spring run-off. Livestock trailing through the river may directly harm individuals of the species by disturbing and disrupting spawning, altering habitat by disturbing substrate and introducing sediments, and by potentially chasing young into fast current which would wash them downstream into unsuitable habitat. Direct harm to individuals of the

species by trampling may also occur. However, the BA provides mitigation recommendations that state specific crossing points may be considered. These crossing points, referred to as "hardened crossing points" would be identified by a qualified fisheries biologist. This mitigation, if implemented, could minimize impacts to loach minnow and spikedace and their habitats by allowing the cattle to cross in calm water with silt or sandy substrates (i.e., outside of loach minnow and spikedace habitats).

According to the Forest Service, soil and watershed conditions within the Gila Allotment are generally in unsatisfactory conditions. Range conditions are fair, but improving according to the Forest Service. A large percentage of the allotment was reported as being in poor range condition in the 1950s during an allotment analysis. While the entire area of the allotment has not been reanalyzed, data collected in 1998 from range transects and on-the-ground inspections indicate that most areas of the allotment are now in fair range conditions. However, the proposed action does not reduce numbers of cattle (in terms of animal months) on the Gila River Allotment from the current levels. Proposed use will consist of 216 cattle (cow/calf) from September 1- April 15.

Sonora tiger salamander

The Sonora tiger salamander is found on the A-Bar Draw allotment of the Coronado National Forest. Salamander breeding occurs in livestock tanks, that require periodic maintenance to remain viable as both salamander breeding sites and as functional livestock waters. Thus, the survival of the salamander is currently intertwined with that of the Forest Service's grazing program, and depends on periodic maintenance of livestock waters. Although the salamanders require the tanks for breeding, and therefore livestock grazing activities benefit the salamander, the livestock program may also have adverse effects. These effects include: 1) trampling or ingestion of metamorphs, aquatic branchiata and larvae, and eggs; 2) trampling and browsing of vegetation at and near tanks, resulting in reduced salamander escape cover, and reduced cover and forage for invertebrate prey; 3) adverse effects to salamanders due to increased turbidity and reduction of aquatic cover and egg deposition sites at tanks due to cattle wading into the water; 4) possible increased disease transmission; 5) watershed degradation and resulting increased runoff and sedimentation, requiring more frequent maintenance of tanks; 6) construction of range improvement projects that may result in direct mortality of terrestrial salamanders or that facilitate access to tanks with subsequent increased chance of introduction of non-native predators and collection or translocation of salamanders; and 7) maintenance of stock tanks; which although is needed for stock tanks to remain as viable breeding habitats, can result in injury or mortality of salamanders. These seven effects are discussed below.

Trampling or ingestion of metamorphs, aquatic branchiata and larvae, and eggs may occur. This effect has not been documented, but may occur when cattle water at tanks. While drinking, cattle may ingest small larval salamanders that can not escape. Small larvae and eggs, which are often deposited on aquatic vegetation, branches, or on the pond substrate, could also be easily trampled by cattle that wade into a tank. Larger larvae and adult branchiate and metamorph salamanders are more mobile and would likely be occasionally trampled as well.

Trampling and browsing of vegetation at and near tanks, resulting in reduced salamander escape cover, and reduced cover and forage for invertebrates that the salamander preys on may occur. Livestock tanks are usually devoid of shoreline vegetation, and the land adjacent to the tank may be denuded for several to many meters away from the water due to trampling and browsing by cattle. This shows that salamanders can exist under these conditions, but populations may be more robust if shoreline cover was enhanced. Shoreline cover may provide some protection from predation for terrestrial salamanders, and may also harbor insects and other invertebrate prey. However, the shoreline cover could also harbor small predators, such as garter snakes (*Thamnophis* species) and bullfrogs, that could feed on salamanders, offsetting benefits of enhanced cover for the salamander.

Adverse effects to salamanders due to increased turbidity and reduction of aquatic cover and egg deposition sites at tanks due to cattle wading into the water may be occurring. Tanks where salamanders breed are almost always very turbid. Cattle wading into the tanks, combined with erosion and runoff from denuded and trampled soils immediately adjacent to the tanks, likely contribute to these high turbidity levels. The effects of high turbidity on the Sonora tiger salamander have not been determined; however, Lefcort *et al.* (1997) examined the effects of silt on growth and metamorphosis of larval mole salamanders (*Ambystoma opacum*) and tiger salamanders (*A. tigrinum tigrinum*). Salamanders in silty water grew more slowly, metamorphosed sooner, and were more susceptible to infection by a water mold (*Saprolegnia parasitica*), than salamanders in non-silty water.

Possible increased disease transmission may occur. Approximately 8% of aquatic populations experience die-offs each year in which all or almost all salamanders and larvae in the pond die (Snyder, pers. comm. 1999). *Ambystoma tigrinum* virus is thought to be primarily responsible (Jancovich *et al.* 1998). Cattle, humans, birds, invertebrates, or amphibians moving among tanks may carry mud with them, inoculating populations with the virus (Jancovich *et al.* 1998). In regard to transmission by cattle, this would be most likely among adjacent tanks within a pasture where cattle could easily move between tanks. Personnel associated with the livestock, such as ranch hands also could unknowingly carry the disease among tanks via muddy boots or equipment. Although the disease can result in large mortality events, the effect on the survival of populations or the subspecies is less clear because tanks that are devastated by disease are typically recolonized via breeding terrestrial metamorphs (Jancovich *et al.* 1998). However, at a minimum, such events will decrease the likelihood of population persistence and likely result in reduced genetic variation and subsequent reduced fitness.

Watershed degradation and resulting increased runoff and sedimentation, requiring more frequent maintenance of tanks may be occurring. The A Bar Draw Allotment is considered to have fair range condition over most of the allotment with the watershed (i.e., Upper Santa Cruz River) cited as being satisfactory. Thus, tanks within this allotment may not need frequent maintenance. In addition, as part of the proposed action, the Forest Service will be implementing a tank maintenance and management plan. The management plan for stock tank maintenance was developed by the Service as part of terms and conditions in the December 19, 1997, biological opinion to minimize

take which included detailed protocols on how to maintain or clean out stock tanks where the salamander may occur.

Threats to Sonora tiger salamander in the project area include erosion, sedimentation, and smoke or ash toxicity due to wildfire, prescribed fire, managed natural fire, and fire suppression activities; death or injury of salamanders due to off-road vehicles illegally driving through tanks; trampling of salamanders and destruction of vegetation cover by livestock at and near stock tanks; illegal collection of salamanders for bait or other purposes; and introduction of non-native fish, bullfrogs, crayfish, or other subspecies of salamanders to Sonora tiger salamander habitat that may prey upon or spread disease to Sonora tiger salamanders, and in the case of other subspecies, interbreed with and cause genetic swamping of Sonora tiger salamander populations.

CUMULATIVE EFFECTS

Cumulative effects are those effects of future non-Federal (State, local government, or private) activities that are reasonably certain to occur during the course of the Federal activity subject to consultation. 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. Cumulative effects analyses as stated here applies to section 7 of the act and should not be confused with the broader use of this term in the National Environmental Policy Act or other environmental laws.

Because of the quality of the habitats in the Apache-Sitgreaves National Forest, Tonto National Forest, Gila National Forest, and the Cibola National Forest, accumulating effects from all impacts are a serious concern. A large part of the adverse impacts to these areas come from small actions that do not individually threaten the region, but cumulatively result in deterioration. Activities within the proposed project area that meet the definition of cumulative effects and may impact the lesser long-nosed bat, loach minnow, and spokedace include streambed channelization, road and highway construction, ranchette development, and off-road vehicle use. Cumulative effects are the most difficult effects to document because they occur or originate on non-Federal lands. The nature of cumulative effects identified by the Service, however, indicate a significant and pervasive effect on the lesser long-nosed bat, spokedace, and loach minnow. In light of these cumulative effects occurring range-wide, the threshold for a jeopardy determination on agency actions is lowered.

Lesser long-nosed bat

On a landscape level, paniculate agave and saguaro populations appear to be well dispersed. However, the percentage of the agave population which successfully produces flowering stalks is unknown. Large segments of the range of the lesser long-nosed bat and its forage plants are exposed to Federal, State, and private livestock grazing management activities. The overall effects of grazing (herbivory, trampling, and ecosystem changes affecting plant reproduction, recruitment, and establishment) on bat forage plants is unknown. Lesser long-nosed bat foraging ecology and energy budget is largely unknown. This, combined with potential disturbance of roost sites and loss of habitat due to urbanization and other activities on large tracts of State and private lands within the range of the bat, contributes to negative impacts on the species. The impacts

due to mining activities in the vicinity of the Dragoon, Paradise, and Radium Allotments are unknown. Several other activities can have adverse effects on the lesser long-nosed bats including decline of native bees and other insects that, along with the lesser long-nosed bat, pollinate the forage plants, collection of saguaros for residential and commercial xeriscapes, recreational caving and rock climbing.

Loach minnow and Spikedace

Cumulative adverse effects to the stream ecosystems and watersheds come from many small actions that do not individually threaten the entire system, but taken together result in deterioration. The incremental nature of sediment deposition from many sources in the watershed is a classic case of cumulative effects, where the whole rather than one source is the primary concern (Waters 1995). In 1991, the American Fisheries Society adopted a position statement regarding cumulative effects of small modifications to fish habitats (Burns 1991). That statement concludes that accumulation of localized or small impacts, often from unrelated human actions, poses a serious threat to fisheries.

The spikedace and/or loach minnow have been found to be associated with the Eagle Creek, Lower Blue River, Lower San Francisco River, and Middle Gila River 5th code watersheds. Several past factors are likely to have negatively affected these watersheds and tributary streams including; stream channelization, roads, timber harvest, livestock grazing, fire occurrence, fire suppression, recreation, prairie dog eradication, invasion of non-native Kentucky bluegrass (*Poa pratensis*) in the wet bottoms, non-native aquatic species, elk grazing, and private inholdings. Other impacts to these stream systems include water diversions for farming and other purposes, water pollution, suburban development, and mining.

The combined effects of livestock management activities associated with the Dark, Granville, and Gila River Allotments confounded with unsatisfactory watersheds and impaired soil conditions may be impeding survival and recovery of these fish species. The management of these allotments in sum, results in alteration of the hydrologic regime and contributes to deterioration of the ecosystem. There have been recent efforts by the National Forest to ameliorate some of the erosion and sedimentation problems aggravated by ongoing livestock grazing activities on these allotments. The National Forest is developing plans for the construction of sediment traps and erosion control structures, and riparian exclusion of livestock. These actions are a proactive approach and have the potential to measurably benefit the ecosystem; but monitoring data are required to determine their effectiveness.

Although the majority of the upper Gila River watershed is managed by the Forest Service, management of private lands along the Eagle Creek and the Gila River also contributes to the degradation of loach minnow and spikedace habitat downstream. Livestock grazing on private in-holdings has severely reduced the quantity and diversity of riparian vegetation, which increases potential streambank erosion. The increase in bank erosion has serious detrimental sedimentation effects on loach minnow and spikedace habitat. Persistence of non-native fishes in Eagle Creek and the Gila River and their tributaries continues to impact loach minnow and spikedace populations. To

ensure the continued existence of these species, cumulative adverse effects of many smaller actions must be reduced.

Sonora tiger salamander

Because of the quality of habitat in which the salamander occurs, wildfires and wildfire suppression, land exchanges, and recreation are a concern. The removal of water from ponds during wildfires suppression activities has been addressed in the management plan for stock tank maintenance. Other cumulative effects that may impact salamanders include the presence of predatory exotic fish and amphibians in the Upper Santa Cruz River watershed, genetic contamination from released bait salamanders, disease, overcollecting by amateur and professional herpetologists, drought, ranchette development, and potential lowering of the water table from water use on private lands.

CONCLUSION

After reviewing the current status of the lesser long-nosed bat, spikedace, loach minnow, and Sonora tiger salamander, the environmental baseline for the action area, the effects of the proposed action, and cumulative effects, it is the Service's biological opinion that the reauthorization of livestock grazing permits for a period of ten years for 7 allotments in the Apache-Sitgreaves National Forest, Tonto National Forest, Gila National Forest, and the Coronado National Forest, as described in the BA, is not likely to jeopardize the continued existence of these species. However, the proposed action, as discussed in this biological opinion, has the potential to adversely impact these taxa and their habitats, thus, hampering recovery actions.

Our non-jeopardy conclusion for the lesser long-nosed bat is based on the following: 1) the proposed action is not expected to directly affect the bat's known roosting sites; and 2) the lesser long-nosed bat has a wide geographic range and thus, livestock grazing within the Dragoon, Paradise, and Radium Allotments will affect lesser long-nosed bat food plants within a relatively small portion of its range. While the effects of livestock grazing on lesser long-nosed bat food plants in the Dragoon, Paradise, and Radium Allotments are considered adverse, the impacts are not likely to jeopardize the continued existence of the species.

Our conclusions for the spikedace and loach minnow are based on the following: 1) spikedace and/or loach minnow occur in tributaries outside the Dark Canyon or Granville Allotments; and 2) both species occur within the Gila River Allotment, however, the effects of cattle trailing through the Gila River, while adverse, are not severe enough (temporally or spatially) to imperil the continued existence of these species.

Our conclusion of non-jeopardy for the Sonora tiger salamander is based on the following: 1) the viability of Sonora tiger salamander populations is currently dependent upon the Forest Service's grazing program because nearly all salamander breeding populations are located in stock tanks maintained by the permittees; 2) although grazing of uplands within and around the A Bar Draw Allotment could facilitate erosion and siltation of tanks, these conditions probably affect existing salamander populations minimally and can be compensated for, in part, by careful maintenance of stock tanks;

3) terms and conditions from the Service's December 19, 1997, Biological Opinion, which are part of the proposed action, minimize the likelihood of take during maintenance of stock tanks.

INCIDENTAL TAKE STATEMENT

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

The measures described below are non-discretionary, and must be undertaken by the Forest Service so that they become binding conditions of any grant or permit issued to any applicant, permittee, or contractor, as appropriate, in order 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 any applicant, permittee, or contractor 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 must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement [50 CFR § 402.14(i)(3)].

Lesser long-nosed bat

Amount or Extent of Incidental Take

The primary type of take expected to result from the ongoing grazing activities on the Dragoon, Paradise, and Radium Allotments is harm, which occurs through the effects to habitat that alter the availability of food plants, affecting the suitability of the habitat to support the lesser long-nosed bat. The Service anticipates, however, that incidental take of the lesser long-nosed bat associated with the proposed action will be difficult to detect for the following reasons: finding dead or impaired individuals is unlikely; it is difficult to detect and analyze the results of changes in bat foraging behavior and distribution, and reduced foraging efficiency. Therefore, the Service defines incidental take in terms of habitat characteristics, and is using this surrogate measure to identify

when take has been exceeded. The Service concludes that incidental take from the proposed action will be considered exceeded if any of the following conditions occur:

1. Ecological conditions do not continue to improve under the proposed livestock management. Improving conditions can be defined through improvements in watershed, soil condition, and trend and condition of rangelands (e.g., vegetative litter, plant vigor, and native species diversity) within the natural capabilities of the landscape within all pastures on the allotment with high density agave, or saguaro sites.
2. Livestock herbivory of agave flowering stalks or trampling of young saguaros contributes to limiting the abundance or distribution of lesser long-nosed bat food plants (*Agave palmeri*, *A. paryi*, *A. deserti*, and *Cereus giganteus*).
3. Required monitoring and reporting of livestock utilization levels are not completed within designated time frames.

Effects of Take

In the accompanying biological opinion, the Service determined that this level of anticipated take is not likely to result in jeopardy to the lesser long-nosed bat.

Reasonable and Prudent measures

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize take:

1. Actions will be taken to improve ecological conditions (watershed, soil, and range conditions) on the allotment in pastures with high density agave or saguaro sites.
2. Livestock grazing shall not contribute to limiting the food resources (*A. palmeri*, *A. paryi*, *A. deserti*, and *Cereus giganteus*) available to the lesser long-nosed bat by reducing the distribution or abundance of flowering agaves, or young saguaros below the natural capabilities of the landscape.
3. Monitor grazing activities resulting in incidental take. A written report containing the data and the findings shall be submitted to the Service.

Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the Endangered Species Act, the Forest Service must comply with the following Terms and Conditions, which implement the reasonable and prudent measures described above. These Terms and Conditions are nondiscretionary.

The following term and condition implements reasonable and prudent measure number 1:

- 1.1 On or before April 15, 2000, the Forest Service shall determine livestock capacity on capable areas, with consideration for wild ungulates, using a proper use level

based on existing condition. The Forest Service shall utilize production/utilization studies or other capacity determination methods. The Forest Service shall identify livestock use/non-use areas, assess proper season of use, adjust acreage of full/potential capacity range, and recalculate stocking levels, as appropriate. If ongoing monitoring does not continue to show improvement or maintenance of good or better status during the period covered by this consultation, the Forest Service shall evaluate the on-going grazing management and identify and implement changes as appropriate. The Forest Service shall provide the Service with a copy of the written report containing the data and findings upon which the livestock capacity is based on or before April 15, 2000.

The following term and condition implements reasonable and prudent measure number 2:

- 2.1 On or before April 15, 2000, the Forest Service shall provide the Service with a final written report that has evaluated the abundance and distribution of lesser long-nosed bat food plants (*A. palmeri*, *A. paryi*, *A. deserti*, and *Cereus giganteus*, and *C. thurberi*) on the Dragoon, Paradise, and Radium allotments, identified high density agave, and saguaro sites. On or before April 15, 2000, the Forest Service shall protect these sites to prevent livestock herbivory of agave flowering stalks and trampling of young saguaros. Livestock access to high density agave sites shall be precluded during the agave bolting period from April 15 through September 15.

or

- 2.1. On or before April 15, 2000, the Forest Service shall provide the Service with a written report analyzing lesser long-nosed bat food plant (*A. palmeri*, *A. paryi*, *A. deserti*, and *Cereus giganteus*) abundance and distribution, and livestock use patterns during the agave bolting period (April 15 through September 15) at a landscape level. This landscape level analysis shall be forest-wide for the Coronado and Tonto National Forests. With this information and in cooperation with the Service, the Forest Service shall reassess if/how/where livestock may be contributing to limiting the food resources available to the lesser long-nosed bat. By April 15, 2000, the Forest Service shall develop and fully implement a five-year monitoring/research plan, developed with the assistance of the Service, to adequately evaluate the relationship between livestock grazing and paniculate agave, and saguaro distribution, abundance, flowering, recruitment, and ecology.

The following Terms and Conditions implement reasonable and prudent measure number 3:

- 3.1 The Forest Service shall monitor forage utilization (or equivalent, e.g., stubble height, or clip and weigh) within each pasture on the allotment with agave or saguaro plants. Utilization shall be monitored on designated key areas before turnout, at the mid-point of livestock use, and within one week after livestock are moved from the pasture. Established and replicable methods shall be applied to measure utilization. Forage utilization monitoring shall be designed so that the effects of grazing on key areas and key species can be measured. When forage utilization levels, based on amended Forest Plan direction, are met, livestock shall

be moved from the pasture. Turnout (range readiness) criteria shall be applied prior to pasture entry. Midpoint checks shall be conducted by the Forest Service. Key areas shall include the most ecologically sensitive areas for the lesser long-nosed bat (e.g., high density agave and saguaro sites). The Forest Service shall provide a written report to the Service that contains photocopies of the field data sheets, key species monitored, locations of key areas, analysis summaries, turnout criteria, and target utilization limits no later than 60 days from the last day of the grazing season.

- 3.2 All monitoring required of the Forest Service as part of this incidental take statement, and reporting of the effectiveness of the terms and conditions shall be submitted in a written report to the New Mexico Ecological Services Field Office no later than 60 days after the last day of the grazing season. This report shall:
- 1) summarize the status of the lesser long-nosed bat and grazing on the allotments for the previous calendar year;
 - 2) discuss application and effectiveness of the Terms and Conditions;
 - 3) documentation of direct or indirect take, if any;
 - 4) summarize utilization monitoring summary and analysis;
 - 6) progress made toward completion of multi-year Terms and Conditions; and
 - 7) any suggestions for improving how Terms and Conditions are to be applied.
- If, at any time, expected monitoring results are not accomplished (e.g., utilization levels exceeded, monitoring is not completed on schedule) these findings and any corrective actions taken shall be included in the report.

Loach Minnow and Spikedace

Amount or Extent of Incidental Take

The primary type of take of loach minnow and spikedace expected to result from the permitted grazing activities for the next 10 years on the Dark Canyon, Granville, and Gila River Allotments is harm, which occurs through the effects to habitat that alter the suitability of the habitat to support these listed animals. The Service anticipates, however, that incidental take of loach minnow and spikedace associated with the proposed action cannot be directly quantified and will be difficult to detect for the following reasons: finding dead or impaired individuals is unlikely; and losses may be masked by seasonal fluctuations in environmental conditions and fish numbers. Therefore, the Service defines incidental take in terms of habitat characteristics, and is using this surrogate measure to identify when take has been exceeded. The Service concludes that incidental take of loach minnow and spikedace from the proposed action will be considered to be exceeded if any of the following conditions are met:

1. Ecological conditions do not improve under the proposed livestock management. Improving conditions can be defined through improvements in watershed, soil condition, trend and condition of rangelands (e.g., vegetative litter, plant vigor, and species diversity), riparian conditions (e.g., vegetative and geomorphologic: bank, terrace, and flood plain conditions), and stream channel conditions (e.g., channel profile, embeddedness, water temperature, and base flow) within the natural capabilities of the landscape in all pastures on the Dark Canyon, Granville, and Gila River Allotments.

2. The riparian corridors along Eagle Creek (Dark Canyon Allotment) and Gila River (Gila River Allotment) receive more than incidental impacts by livestock (riparian plant utilization or streambank alteration). The evaluation will be conducted annually using appropriate methodology, such as, the U.S. Forest Service's Thalweg Watershed Area Link (T-Walk) methodology (U.S. Forest Service 1996) or COWFISH (Lloyd, 1986).
3. Required monitoring and reporting of livestock utilization levels are not completed within the designated time frames.

Effects of Take

In the accompanying biological opinion, the Service determined that this level of anticipated take is not likely to result in jeopardy to the loach minnow and spikedace.

Reasonable and Prudent Measures

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize take:

1. The Forest Service shall undertake actions to improve ecological conditions (watershed, soil, range, riparian, and stream channel conditions) on the allotments within the Eagle Creek and Middle Gila River watersheds.
2. The Forest Service shall provide protection to stream courses, and riparian and aquatic habitats from the impacts of livestock management within the Dark Canyon, Granville, and Gila River Allotments.
3. The Forest Service shall monitor grazing activities resulting in incidental take. The Forest Service shall submit an annual report containing the data and the findings to the Service.

Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the Endangered Species Act, the Forest Service must comply with the following Terms and Conditions, which implement the reasonable and prudent measures described above. These Terms and Conditions are nondiscretionary.

The following Terms and Conditions implement reasonable and prudent measure number 1:

- 1.1 On or before April 15, 2000, the Forest Service shall determine the livestock capacity for each allotment using an agency approved method of capacity determination. Capable rangeland shall take into account slope, distance to water, existing range conditions, production of palatable forage, and accessibility by livestock. The capacity determination shall clearly address wild ungulate use and needs, and range, riparian, watershed, and soil condition. If ongoing monitoring does not continue to show improvement or maintenance of good or

better status during the period covered by this consultation, the Forest Service shall evaluate the on-going grazing management and identify and implement changes as appropriate.

- 1.2 On or before April 15, 2000, the Forest Service shall initiate a watershed analysis of the Eagle Creek and Middle Gila River watersheds to determine factors affecting stream flow (water quality, quantity, intensity, etc.). The purpose of this analysis is to better understand and disclose the effects (individual and cumulative) of ongoing human activities (including grazing) to existing resource conditions, identify information needed for future management decisions, and to identify and prioritize work activities which will assist in the recovery of the loach minnow and spikedace. The analysis shall be developed in coordination with the Service and must be completed by September 30, 2000. The watershed analysis may be attained through an interdisciplinary team review of the best available information on various uses/activities and resource conditions within the watershed, with the focus on the status and effects to the listed species. This analysis shall include an evaluation of all program areas such as, but not limited to, roads, recreation, livestock management; watershed, soil, range, and riparian condition assessment; and stream channel status and morphology in order to determine affects to the ecological condition of the Eagle Creek and Middle Gila River watersheds.

The following Terms and Conditions implement reasonable and prudent measure number 2:

- 2.1 The Forest Service shall restrict all livestock access to Eagle Creek and the Gila River to the minimum periods necessary for trailing cattle among pastures and for shipping. Trailing of the herd shall occur no more than twice a year on Eagle Creek on the Dark Canyon Allotment, and only once during May (the loach minnow and spikedace spawning period). Livestock trailing will occur every other year along the Gila River on the Gila River Allotment before April 1 to avoid the loach minnow and spikedace spawning period. Livestock may be trailed in small groups if monitoring shows this to minimize impacts.
- 2.2 Livestock crossings of Eagle Creek and the Gila River shall be evaluated by a journeyman-level Forest Service fishery biologist to ensure crossings occur in areas least likely to impact loach minnow, spikedace, or their habitats.
- 2.3 The Forest Service shall ensure that trailing of cattle along Eagle Creek and the Gila River, is conducted so that: 1) cattle are present for the shortest period of time possible in riparian/aquatic habitats; 2) livestock are not present overnight along the stream courses; 3) the shortest route across the stream is taken; 4) trailing across streams is conducted as infrequently as possible; and 5) whenever possible, trailing is conducted when bankline soil moisture is relatively low.
- 2.4 The Forest Service shall conduct adequate surveys of riparian habitats (vegetation, stream bank condition, water quality and quantity) before and after livestock pasture moves in Eagle Creek pastures to determine livestock effects. The Forest Service shall submit a written report on these findings to the Service

on or before December 31, 1999. In coordination with the Service, following the 1999 analysis of impacts, the Forest Service shall determine if continued monitoring is needed in the future.

- 2.5 As livestock rotate among pastures, the Forest Service shall check and repair, as necessary, all fences required to maintain the integrity of livestock exclosures established for protection of potential loach minnow and spokedace habitat in the Eagle Creek and the Gila River.
- 2.6 The Forest Service shall establish at least two fish monitoring sites in Eagle Creek on the Dark Canyon Allotment to determine fish species occurrence and habitat suitability within the Dark Canyon Allotment. Fish monitoring shall be conducted annually beginning in 1999 by a journey-level Forest Service fishery biologist (or equivalent) and coordinated with other fish survey/monitoring programs.
- 2.7 The fish monitoring for loach minnow and spokedace by the Forest Service shall be conducted on an annual basis in the Gila River within the Gila River Allotment.

The following Terms and Conditions implement reasonable and prudent measure number 3:

- 3.1 The Forest Service shall monitor forage utilization (or equivalent, e.g., stubble height or clip and weigh) on pastures within the Eagle Creek, Middle Gila River, Lower Blue River, and Lower San Francisco River watersheds during the grazing season and within three weeks after the livestock grazing season ends. Established and replicable methods shall be implemented by the Forest Service to measure utilization. The Forest Service shall design forage utilization monitoring so that the effects of grazing on key areas and key species can be measured. When forage utilization levels, based on amended Forest Plan direction, are met, livestock shall be moved from the pasture. Turnout (range readiness) criteria shall be applied prior to pasture entry. Key areas are to include the most ecologically sensitive areas for the loach minnow (e.g., riparian areas, tributary channels, source areas of sediment). The Forest Service shall provide high quality photocopies of the completed field data sheets, key species monitored, locations of key areas, analysis summaries, turnout criteria, and target utilization limits to the Service no later than 60 days from the last day of the grazing season.
- 3.2 All monitoring required of the Forest Service as part of this incidental take statement, and reporting of the effectiveness of the terms and conditions shall be submitted to the New Mexico Ecological Services Field Office no later than 60 days from the last day of the grazing season. This report shall summarize: 1) the status of the loach minnow and/or the spokedace, and grazing on the allotments for the previous calendar year; 2) application and effectiveness of the Terms and Conditions; 3) documentation of direct take, if any; 4) utilization monitoring summary and analysis; 5) fish monitoring data; 6) progress made toward completion of multi-year terms and conditions; and 7) any suggestions for improving how terms and conditions are to be applied. If, at any time, expected

monitoring results are not accomplished (e.g., utilization levels exceeded, monitoring is not completed on schedule) these findings and any corrective actions taken shall be reported to the Service.

Sonora tiger salamander

Amount or Extent of Incidental Take

As discussed in the effects of the proposed action, take of Sonora tiger salamander could occur in the form of harm, harassment, injury, or death resulting from a variety of aspects of the proposed action. Take attributable to the proposed action likely will be difficult to detect and often the cause of any observed mortality will be impossible to determine (i.e. dead and dying diseased salamanders may be found, but the cause of disease transmission will likely be unknown). However, the Service anticipates the following forms of take over the life of the project:

1. All Sonora tiger salamanders at any stock tank maintained by dredging, other forms of silt removal, or other maintenance that drains the tank. However, with implementation of the terms and conditions from the Service's December 19, 1997, Biological Opinion, most take will be in the form of harassment resulting from capture, holding of salamanders, and re-release back into the stock tank.
2. Mortality or injury of up to five Sonora tiger salamanders due to construction of range improvement projects.
3. Mortality of up to all aquatic Sonora tiger salamanders at one stock tank as a result of disease transmission, mortality or injury by off-road vehicles, or introduction of non-native organisms as a result of facilitating access to stock tanks via road maintenance or construction.
4. Direct mortality or injury of up to two Sonora tiger salamanders as a result of routine inspections and operations, primarily as a result of animals crushed on roads near occupied stock tank habitats.
5. Direct mortality or injury of up to all aquatic Sonora tiger salamanders at one stock tank due to disease transmission by cattle or ranch hands.
6. Loss of genetic distinctiveness at one tank due to introduction of non-native salamanders (especially *Ambystoma tigrinum mavortium*).
7. Direct or indirect mortality or injury of up to 20 Sonora tiger salamanders or eggs at each stock tank grazed by livestock as a result of cattle wading into stock tanks, removal of shoreline or aquatic cover and egg deposition sites, and increased turbidity.

Note that this opinion anticipates but does not authorize take of Sonora tiger salamander due to illegal activities such as illegal transport and release of fish or salamanders, capture of Sonora tiger salamanders, and off-road vehicle activity.

Effects of Take

The Service has determined that the level of anticipated take is not likely to result in jeopardy to the Sonora tiger salamander.

Reasonable and Prudent Measures

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize impacts of incidental take of Sonora tiger salamander:

- 1.1 The Forest Service shall continue implementation of the terms and conditions from the Service's December 19, 1997, Biological Opinion.
- 1.2 The Forest Service shall disseminate information to the permittees and others who work on the allotments of the need to implement these terms and conditions to reduce disease transmission and the likelihood of introducing non-native organisms.
- 1.3 The Forest Service shall ensure the construction areas and operational procedures are well defined to minimize effects to Sonora tiger salamanders from construction and operation of range improvement projects and other routine activities.
- 1.4 The Forest Service shall ensure measures are implemented that minimize cattle wading into stock tanks in order to reduce the loss of shoreline and aquatic cover.
- 1.5 The Forest Service shall monitor of incidental take resulting from the proposed action and provide written reports containing the data and findings on an annual basis to the Service.

Terms and Conditions

The following term and condition implements reasonable and prudent measure number 1:

- 1.1 The Forest Service shall continue to implement the terms and conditions of the Service's December 19, 1997, Biological Opinion on the Coronado National Forest.

The following terms and conditions implement reasonable and prudent measure number 2:

- 2.1 The Forest Service shall inform the permittees of the allotments under consultation for the Sonora tiger salamander in a letter delivered to them within 45 days of the date of this biological opinion of the following:
 - a. Take of Sonora tiger salamander is prohibited by the Endangered Species Act, but any take that occurs as a result of the grazing program is exempt from the section 9 prohibitions if grazing is carried out in a manner consistent with these terms and conditions.

- b. The letter shall contain a copy of these terms and conditions.
- c. The permittees are required to implement these terms and conditions on National Forest lands within their allotments.
- d. Capture, transport, and release of live salamanders, fish, or bullfrogs is prohibited by State law within the allotments.

The following terms and conditions implement reasonable and prudent measure number 3:

- 3.1 Within 1,650 feet (198 meters) of occupied stock tanks, the Forest Service shall implement the following actions during surface-disturbing activities (such as construction of range improvement projects):
 - a. To the maximum extent possible, project features shall be located in previously-disturbed areas.
 - b. Vehicle use shall be limited to existing routes to the maximum extent possible.
 - c. Blading of work areas shall be minimized to the maximum extent possible. Disturbance to shrubs shall be avoided if possible. If shrubs cannot be avoided during equipment operation or vehicle use, wherever possible they shall be crushed rather than excavated or bladed.
- 3.2 If a Sonora tiger salamander is found in any project construction area, regardless of the distance to a stock tank, the Forest Service shall ensure to the maximum extent practicable, activities are be modified to avoid injuring or harming the animal.
- 3.3 The Forest Service shall ensure that no new roads are constructed that lead to stock tanks or pass within 300 feet (91.4 meters) of stock tanks within the A Bar Draw Allotment.
- 3.4 If existing roads that lead to stock tanks or within 300 feet (91.4 meters) of stock tanks located in the A Bar Draw Allotment are graded, improved, or otherwise maintained, the Forest Service shall ensure that the stock tanks are clearly posted "No Fishing" and "No Off-Road Vehicles." The Forest Service shall inspect, adequately maintain, and replace the signs as appropriate. The most easily accessible stock tanks shall be the highest priority for signing.
- 3.5 The Forest Service shall coordinate construction of any new stock tanks with the Service to ensure the project would not facilitate invasion of non-native species or disease transmission. If the Service concurs in writing that the new stock tank would not increase the risk of disease spread or invasion of non-native predators

or competitors, or other subspecies of tiger salamanders, no further consultation is necessary. If concurrence is not obtained, the Forest Service shall, in accordance with 50 CFR § 402.14(a), evaluate potential effects of the action and reinitiate consultation if appropriate.

- 3.6 Existing stock tanks occupied by the Sonora tiger salamander shall be maintained as needed by the Forest Service to ensure their continued suitability as habitat for the salamander. Maintenance of tanks in the A Bar Draw Allotment that contain non-native organisms (fish, bullfrogs, crayfish, or other subspecies of tiger salamander) shall be coordinated with the Service and implemented in a manner that will, if possible, eliminate non-native species.
- 3.7 The Forest Service shall ensure that permittees or others authorized to work at stock tanks undertake all precautions to minimize disease transmission and translocation of aquatic organisms. All equipment (such as waders, shovels, fence posts, etc) used at a stock tank within the A Bar Draw Allotment shall be allowed to thoroughly dry or shall be rinsed in a 10% bleach solution prior to using the same equipment at another tank. The Forest Service shall ensure that no water is pumped from stock tanks occupied by the Sonora tiger salamander. The Forest Service shall ensure that all precautions are taken (such as fish screens and adding bleach) to prevent the movement of fish, bullfrogs and their tadpoles, and crayfish between stock tanks as a result of pumping water from a contaminated source and trucking it to a trough or stock tank.

The following terms and conditions implement reasonable and prudent measure number 4:

- 4.1 Beginning in August 1999, the Forest Service shall fence as many occupied stock tanks or portions of stock tanks in the A Bar Draw Allotment as possible to increase shoreline and aquatic cover and reduce potential mortality and injury to Sonora tiger salamanders due to cattle wading into stock tanks or spreading disease to populations. If stock tanks are fenced completely, cattle could be watered by providing water lines from the stock tanks to troughs or drinkers. Double tanks, where one of the tanks is fenced, and the other is not, could also be employed.
- 4.2 Beginning in August 1999, the Forest Service shall begin enhancement of aquatic cover and egg deposition sites in stock tanks grazed by cattle. Enhancement could take the form of placing logs, branches, or dead trees and shrubs into the tanks.

The following terms and conditions implement reasonable and prudent measure number 5:

- 5.1 The Forest Service shall monitor take of Sonora tiger salamanders and document any disturbance of the animals and/or their habitat. A written report summarizing the results of such monitoring/documentation, as well as a description of implementation and the effectiveness of these terms and conditions, shall be submitted to the New Mexico Ecological Services Field Office on or before

December 31 of each year beginning in 1999. The written reports shall contain precise information on the location of the stock ponds, the location of the stock ponds shall be marked on a 7.5 minute topographic map, and a 35 millimeter color slide of each of the stock ponds (landscape view) with the location of the pond (latitude and longitude), name of the photographer, and date that the photograph was taken, legibly marked in permanent black ink. These reports also shall make recommendations, as needed, for modifying or refining these terms and conditions to enhance protection of the Sonora tiger salamander or reduce needless hardship on the Coronado National Forest and the permittee of the A Bar Draw Allotment.

Reporting Requirements

If, during the course of the action, the authorized level of incidental take is exceeded, or a federally listed species is taken in a manner not described above, the Forest Service shall immediately notify the Service by telephone and in writing within twenty-four (24) hours of the incident. In addition, to notifying the Service, the Forest Service also should require the permittee to cease the activity resulting in take and reinitiate consultation immediately to avoid further potential violation of section 9 of the Act.

Disposition of Sick, Injured, or Dead Individuals

The nearest Service Law Enforcement Office must be notified within twenty-four (24) hours in writing should any listed species be found dead, injured, or sick in, adjacent to, or in the vicinity of the project area. Notification must include the date, time, and location of the carcass, cause of injury or death (if known), and any pertinent information. Care should be taken in handling sick or injured individuals and in the preservation of specimens in the best possible state for later analysis of cause of death. In conjunction with the care of sick or injured endangered species or preservation of biological materials from a dead animal, the finder has the responsibility to ensure that evidence associated with the specimen is not unnecessarily disturbed. If necessary, the Service will provide a protocol for the handling of dead or injured listed animals. In the event the Forest Service suspects that a species has been taken in violation of Federal, State, or local law, all relevant information should be reported in writing within twenty-four (24) hours to the Service's New Mexico Law Enforcement Office (505/883-7814) and the New Mexico Ecological Services Field Office (505/346-2525), or the Service's Arizona Law Enforcement Office (602/379-6443) and the Arizona Ecological Services Field Office (620/640-2720), as appropriate.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. The term "conservation recommendations" has been defined as Service suggestions regarding discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat or regarding the development of information. The recommendations provided here relate only to the proposed action and do not necessarily represent complete fulfillment of the agency's section 7(a)(1) responsibility. In order for the Service to be

kept informed of activities that either minimize or avoid adverse effects or that benefit listed species or their habitats, the Service requests notification of the implementation of the conservation recommendations below. The Service recommends the following conservation recommendations be implemented:

Lesser Long-nosed bat

1. The Forest Service should continue surveys for the lesser long-nosed bat, including the use of infrared spotting scopes in areas containing foodplants.
2. The Forest Service should implement appropriate portions of the Lesser Long-nosed Bat Recovery Plan.

Loach minnow and Spikedace

1. The Forest Service should reduce livestock utilization levels within the Dark Canyon, Granville, and Gila River Allotments to more rapidly improve watershed conditions.
2. The Forest Service should consider excluding all livestock access, including trailing and crossings, from Eagle Creek and the Gila River to provide maximum protection and recovery potential for loach minnow and spikedace.
3. The Forest Service should identify the sources of sediment input into Eagle Creek and the Gila River and develop and implement programs to mitigate those impacts.
4. The Forest Service should implement appropriate portions of the Loach Minnow Recovery Plan, and Spikedace Recovery Plan. The Forest Service should consider reintroduction of these species into historical habitats on the National Forest lands.

Sonora tiger salamander

1. The Forest Service should fund studies of the vectors of disease transmission, salamander metapopulation dynamics, distribution of the *mavortium* genome in the San Rafael Valley, the movements and habitat use by terrestrial adult Sonora tiger salamanders, and other topics that may improve our understanding of the conservation and recovery needs of the Sonora tiger salamander. Surveys for Sonora tiger salamander that involve capture or take require appropriate permits from the Service and Arizona Game and Fish Department.
2. The Forest Service should continue to actively participate in the preparation of the Sonora tiger salamander recovery plan and assist in its implementation.
3. The salamander recovery plan, scheduled for completion on February 2000, is expected to contain specific recommendations for stock tank operation and maintenance, cattle use at tanks, maintenance and enhancement of cover and egg deposition sites, and other topics related to grazing effects. After completion

of the recovery plan, the Forest Service and the Service should reevaluate the terms and conditions herein and make changes as needed to be consistent with the plan.

Other Wildlife Issues

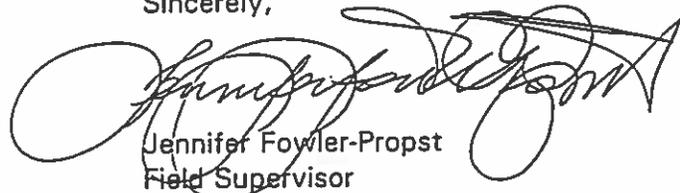
1. The Service recommends that the Forest Service conduct adequate surveys and appropriate ecological studies in the project area for the desert viceroy butterfly (*Limenitis archippus obsoleta*), New Mexico silverspot butterfly (*Speyeria nokomis nitocris*), Gila monster (*Heloderma suspectum*), and the Chiricahua leopard frog (*Rana chiricahuensis*). Activities associated with livestock grazing should avoid adverse impacts to these species, or fully mitigate any impacts.
- 2) Lastly, for future projects or actions contemplated by the Forest Service, the Service earnestly recommends that collaboration and joint impact analysis occur early in the planning process. We also recommend that collaboration by the Forest Service occur with other Federal entities now committed to the Southwest strategy in order to more efficiently and effectively address ongoing and future section 7 consultation needs.

REINITIATION - CLOSING STATEMENT

This concludes formal consultation on proposed issuance of livestock permits by the Forest Service. 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. In instances where the amount of incidental take is exceeded, any operation causing such take must cease pending reinitiation.

In future communications regarding this consultation, please refer to consultation #2-22-99-F-016. Please contact Chris Nagano, Dennis Coleman (fishes), or Charlie McDonald (plants) if you have any comments or questions at the letterhead address or at 505/346-2525.

Sincerely,



Jennifer Fowler-Propst
Field Supervisor

cc:

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