

Tonto National Forest Threatened, Endangered and Sensitive (TES) Species 2000 Draft Abstracts

Tonto TES Plants Prepared by Debbie Lutch 7/5/00

Arizona Agave (*Agave Arizona*) – Endangered

Arizona Agave is a small, rosette-formed perennial that primarily reproduces through production of offsets; sexual reproduction occurs only once. It flowers summer through June and is pollinated primarily by hummingbirds and bees. Plants mature in 22-35 years; flower once, then dies. Seed production is thought to be low in the wild. Its distribution in Arizona is limited to the Tonto National Forest. The species occupies mesas and slopes, in isolated clusters of plants (usually clones) or as isolated plants. This species is found in Interior Chaparral, Desert Grassland and transition between grassland and pinyon-juniper zone on shallow, rocky soils derived from granite, schist, gneiss, quartzite, tuff and limestone. Elevations range from 3,000 to 6,000 feet and occurrence coincides with the range of its putative parents (*A. chrysantha*, *A. toumeyana* var. *toumeyana* and *A. toumeyana* var. *bella*).

Data Sources. Critical Habitat was not identified at the time of listing (1984). There are fewer than 100 plants that are known. While some plants are known to occur on private land, most plants are on the Tonto National Forest in the New River Mountains. One isolated individual occurs southeast of Payson and another near Parker Creek at the south end of Sierra Ancha Mountains. A Recovery Plan has not been finalized but a draft was developed in 1991, providing a summation of information known at that time. A management plan is currently underway that will provide for ongoing and future conservation and management options (1999). Guidance Criteria for evaluating the effects of livestock grazing on Arizona Agave for the Tonto National Forest was prepared by Angie Brooks, former Fish and Wildlife Service biologist (4/27/99). Arizona Agave is found on the A Cross, Bronco, Cartwright, New River and Star Valley Allotments.

Analysis of Effects. Threats identified in the final rule and reiterated in the 1989 Biological Opinion on the New River Allotment Management Plan include degradation of habitat by livestock grazing, inflorescence herbivory, illegal collection potential and possible insect damage. An additional concern identified by FWS is the placement of fences and other improvements at least a quarter mile from any clone. Management factors identified in HDMS Abstract (11-05-97) include herbivory of flower stalks (cattle, deer, rodents), snout-weevil damage which can make the plant susceptible to a fungal disease, and collection potential.

Arizona Hedgehog Cactus (*Echinocereus Triglochidiatus* var. *arizonicus*) – Endangered

This robust perennial cactus occurs on both the Apache-Sitgreaves and Tonto National Forests in Arizona. It has dark green cylindroid stems that occur as single stems, or more frequently,

clusters of stems. Flowers are bright red or crimson. It occurs within Interior Chaparral and Madrean Evergreen Woodland communities at elevations ranging from 3,300 to 5,700 feet. Preferred habitat is found on parent materials of igneous origin, primarily Schultze Granite and Apache Leap Tuff (Dacite); plants occurring on the Pinal schist and Pioneer formations are found only in proximity to the preferred parent materials and where the formations are expressed as exposed bedrock.

Data Sources. This cactus occurs on the Tonto from just east of Pinto to east of Superior, north to the Superstition Mountains and west to Rogers Trough. The plant also occurs on Apache Peak north of Globe. The taxonomic distribution and status of this taxa is under investigation at this time (1999) and data may indicate the plant is far more widely distributed and frequent in its occurrence than previously known. No critical habitat was identified for this species at the time of listing (1979). Although no recovery plan has been developed, a Conservation Assessment and Plan for the Tonto has been completed (1996). Guidance Criteria for evaluating the effects of livestock grazing on Arizona Hedgehog Cactus for the Tonto National Forest was prepared by Angie Brooks, former Fish and Wildlife Service biologist (4/27/99). Arizona Hedgehog Cactus is found on the following allotments on the Tonto: Bohme/Sleeping Beauty, Devil's Canyon, Millsite, and Pinto Creek, and Bellevue.

Analysis of Effects. Threats that have been identified for this species include habitat destruction by mining, road construction, power-line construction, water development and illegal collecting. Additional threats mentioned in the Tonto Conservation Assessment include the loss of individual plants as a result of damage from boring and sucking insects, "soft-rot of cactus", freeze loss and freeze cracking rendering the plant vulnerable to any number of pathogens, consumption by javelina and possible removal of plants by humans for hallucinogenic use. Much of the habitat for this plant is too rugged and boulder-strewn for livestock accessibility. Livestock may be a threat in accessible areas, but observed damage to hedgehog cacti was noted at approximately one specimen per 400-500 observations, and javelina damage was found to be much more common (Tonto CA 1996.)

Arizona Cliffrose (*Purshia subintegra*) – Endangered

Arizona Cliffrose is a low, straggling perennial shrub, growing from 3-6 feet tall and generally wider than tall. As a genus, cliffroses are morphologically variable and this can create identification problems when *P. subintegra* occur in proximity to *P. stansburiana* (e.g. Verde Valley area). This species is restricted to nutrient-deficient, calcareous limy-tuff soils derived from Tertiary lacustrine deposits. Crucifixion-thorn is the most common plant associate. Subpopulations at the Horseshoe Lake site occur at elevations between 2,100 and 2,700 feet

Data Sources. No critical habitat was identified or designated for this taxon at the time of listing. Listing occurred under the former genus *Cowania*. A Recovery Plan was developed for this species in 1994. Guidance Criteria for evaluating the effects of livestock grazing on Arizona Agave for the Tonto National Forest was prepared by Angie Brooks, former Fish and Wildlife Service biologist (4/27/99).

Analysis of Effects. Threats identified in the Recovery Plan (1994) included mining and mining exploration, livestock and burro grazing, offroad vehicle use, urbanization, pesticides and inundation. Plants and plant habitat were noted in the recovery plan as probably having been inundated and lost due to Horseshoe Dam on the Verde River. Livestock grazing and burro and browsing effects have been shown to be significant.

Blumer's Dock (*Rumex orthonuerus*) – Sensitive (Proposed, but withdrawn 8/9/99)

This herbaceous perennial is known to occur in Arizona, New Mexico and Mexico. It is characterized by the presence of Iris-like rhizomes, succulence of the leaves, lateral leaf veins perpendicular to the main vein, and by its fruiting capsules. Plants have a cluster of large basal leaves, which are somewhat succulent and range up to 20 inches in length and 7 inches in width. The inflorescence is a large narrow panicle occupying the upper half of the stem. Blumer's Dock is one of 15 species in this genus in Arizona. This species occurs in riparian habitats at elevations between 6,500 and 11,500 feet. Suitable habitats include moist loamy soil adjacent to springs and flowing streams in open meadows or meadows with overstories. It is also known to occur in the drier headwaters of some areas. Surrounding forested areas are characterized by mixed conifer. It typically occurs in open, sunny locations, but can occupy more shaded sites.

Data Sources. This species is currently known to occur in Arizona on the Apache-Sitgreaves, Coronado, Coconino and Tonto National Forests. Recent genetic work has clarified the distinction between *R. orthonuerus* and the closely related *R. occidentalis*. This work resulted in the classification of the White and Gila Mountain populations as *R. orthonuerus* and not *R. occidentalis*. Morphological characteristics from the Carson and Lincoln National Forests in New Mexico indicate that they are now *R. orthonuerus* and not *R. occidentalis*. The Withdrawal of the Proposed Rule to list Blumer's Dock (8/9/99) cites that "although threats to some populations of this plant still persist, these are not sufficiently widespread enough to pose a significant risk. Recent genetic work and survey efforts indicate that *R. orthonuerus* has a much larger distribution than previously thought." A Conservation Assessment for Blumer's Dock has been prepared for populations on the Tonto (Lutch and Gobar 1993).

Analysis of Effects. The primary threats to this species include direct grazing by livestock and cattle. Other impacts include trampling, habitat degradation, water developments, and recreation-related activities such as camping and hiking.

Pima Indian Mallow (*Abutilon parishii*) – Sensitive

This herbaceous perennial is presently known from 84 populations in 17 mountain ranges. Its occurrence in Arizona is primarily within the southcentral and southeastern part of the state. This species has a woody base and herbaceous branches that can grow up to 3 feet tall from a woody rootstock. One aid to identification is the presence of dead stems up to 1 meter high, with empty fruit capsules that persist throughout the winter. This species occurs in mesic situations in full sun within higher elevation Sonoran desertscrub, desert grassland, and Sonoran deciduous riparian forest. Typical localities are on rocky hillsides, cliff bases, lower side slopes and ledges of canyons among rocks and boulders. Slopes can exceed 45⁰. In riparian zones, it can occur on flat secondary terraces but typically not in canyon bottoms. It flowers spring through fall, in response to rain, at elevations from 3,000 to 4,800 feet. It flowers only when it is sunny, and

flowers open only from 3:30 to 4:30 p.m.. Plants are expected to be self-fertile and flowers do not have to open to produce seed. Seedlings seem to do best when they grow at the base of rocks in full sun and germinate along areas where water has flowed, often along trails. Population numbers appear to increase in wet years and decline in dry years, based on observations of Van Devender and Bertelson (1994). Substrates include bouldery, rocky shallow soils of rhyolite, granite, gneiss, limestone, and Pleistocene alluvium. It is usually found in canyons with southern or western exposures.

Data Sources. This species was a former C2 candidate for federal listing (FWS 1990, 1993). It is a Salvage Restricted plant in Arizona (ARS 1993). Range within Arizona includes the Superstitions, Santa Catalinas, Rincons, Silverbells, Tucson Mountains, Santa Ritas, Tumacacori, Little Shipp Wash and Cottonwood Creek near Bagdad, Sabino Canyon, and numerous mountain ranges within Pinal County. The majority of the Arizona populations are in the Santa Catalina Mountains. The only documented locality on the Tonto National Forest is the Mercury Mine occurrence in the Mazatzal Mountains. This locality is questionable. It was based on a collection by Eastwood in 1929, but there is confusion in field notes as to collection site location. This identification needs verification. It is disjunct from the Tucson area populations and is in questionable habitat. T. Van Devender searched the area in September 1991 and did not find appropriate habitat (Van Devender et. al. 1994). The primary source of information for this species was from Arizona Game and Fish Department HDMS (last abstract revision 07-28-1997).

Analysis of Effects. Threats cited for the Pima Indian mallow (AGFD 1990) include mining and related activities, recreation, and habitat degradation due to livestock trampling and overuse. Palatability is unknown, but expected to be highly desirable to cattle. Deer and rabbits appear to browse plants. This species documented as desert tortoise food plant. Trampling by bighorn sheep noted in Silverbells, but sheep do not appear to eat plant. Its preference for steep slopes minimizes the chances for heavy livestock grazing pressure. Introduction of buffelgrass in Sonoran desert is a threat. Freezing and light fires do not hurt the plant.

Tonto Basin Agave (*Agave delamateri*) - Sensitive

This is a large suckering agave with very tall, open, unfruited flower stalk and a dense rosette. The flower stalk has few later branches that are perpendicular to the main stalk. It is usually found on south and southwest facing slope edges and atop benches, occasionally on northeast facing gentle slopes. It occupies cobbly and gravelly, deep and well-drained soils at elevations from 2,300 to 5,100 feet, and is often associated with prehistoric sites. About 90 clones are known from Young, Arizona to San Carlos Reservoir, foothills of Mazatzal and Sierra Ancha mountains, the Sunflower areas, and near Oak Creek. The greatest concentration of sites occurs along the south end of Tonto Creek near the northwest end of Roosevelt Lake in Tonto Basin.

Hohokam Agave (*Agave murpheyi*) - Sensitive

This agave has a dense rosette with a short terminal spine. It has a branched flower stalk, but flowers abort and bulbils develop at the nodes. *Agave murpheyi* does not resemble any other agaves in its area. It is found in south-central Arizona in Sonoran Desert. It is found on gentle

bajada slopes, benches or terraces above major drainages with prehistoric habitations and/or agricultural sites (that suggest tending), typically between 1,300-2,400 feet. It requires well-drained soil. There are about 60 known sites in Arizona.

Data Sources. A status report for Hohokam agave (Hodgson 1994) and Tonto Basin Agave (Hodgson 1994) should be reviewed for information on this species. Major knowledgeable individuals include Wendy Hodgson and Liz Slauson from the Desert Botanical Garden. Hodgson has suggested that Tonto Basin Agaves, like Hohokam Agaves, were grown during pre-Columbian times, but were grown on benches above drainages where check dams and alignments were found for growing more drought-tolerant crops. The primary source of information for this species was from Arizona Game and Fish Department HDMS (last abstract revision 04-21-1997).

Analysis of Effects. Management factors mentioned for Tonto Basin and Hohokam Agaves include their small range and few individuals. Urban sprawl, expansion of reservoirs and associated activities, road improvements and realignments. Threats cited for the Hohokam Agave (Hodgson 1994) include housing development, expansion of reservoirs, and predation by deer, cattle and rodents. Threats to Tonto Basin Agave (Hodgson 1994) include housing development, road building, expansion of reservoirs, the indirect effects of heavy livestock utilization such as trampling of plants and soil compaction, and agave snout-weevil attacks.

Chihuahua Sedge (*Carex chihuahuensis*) – Sensitive

This grass-like perennial is one of 50 species of *Carex* known in Arizona, and is known from southeastern Arizona, New Mexico and Mexico. It blooms from April to August at elevations from 1,100 to 8,000 feet. It typically occupies north and northwest-facing slopes in wet soils in streambeds, wet meadows, cienegas, marshy areas, shallower draws in pine-oak forest and riparian woodland. It is often associated with pine oak forests and riparian woodlands.

Data Sources. This sedge is known to occur in the Chiricahuas, Huachucas, Pinalenos, Santa Catalinas, San Luis Mountains, Rincons, Atascosas, Santa Ritas, and along the Sant Cruz River and San Bernardino Valley. It has been documented along Reynolds Creek in the Sierra Ancha Mountains on the Tonto National Forest. Of note on species biology is a comment from (Hickman 1993): “Many species, especially those with rhizomes, are invasive. This is one of the most effective genera for knitting moist or wet soil”. The primary source of information for this species was from Arizona Game and Fish Department HDMS (last abstract revision 02-07-2000).

Analysis of Effects. Restricted riparian/wetland habitats

Arizona Giant Sedge (*Carex ultra*) – Sensitive

This herbaceous perennial is one of approximately 50 species of *Carex* known from Arizona. It has the appearance of a bulrush but is actually a large sedge with round, stout, erect culms (up to 3-7 feet tall). It flowers late March through September and grows at about 2,000 to 6,000 feet in elevation. It often occurs on southeast-facing, often shaded exposures in moist soil near

perennially wet springs and streams. It is typically found in wet alluvial soil, sand and gravels, associated with aquatic/riparian woodlands or oak-pinyon woodlands.

Data Sources. This species occurs in single patches in the Chiricuahuas, Dragoons, Galiuros, Santa Ritas, Atascosa Mountains, Hieroglyphic Mountains, Aravaipa Canyon, and the Huachucas (several patches). There is one documented occurrence (1992) on the Tonto National Forest on the Cave Creek Ranger District, associated with Tangle Creek. Knowledgeable individuals on this species include Peter Warren from The Nature Conservancy, Steve McLaughlin from U of A, and Gary Helbing from the Coronado National Forest. The primary source of information for this species was from Arizona Game and Fish Department HDMS (last abstract revision 02-18-2000).

Analysis of Effects. Small populations in isolated wetlands are vulnerable to local disturbance of aquatic habitat. Springs and seeps should be protected.

Arizona Bugbane (*Cimicifuga arizonica*) - Candidate

This herbaceous perennial occurs in central Arizona, and is the only species of this genus in Arizona. Plants average 3 to 6 feet in height with large, long-petioled lower leaves and small sessile upper leaves. Small white petal-less flowers clustered on flower stalks make this plant very conspicuous when in bloom. Recent taxonomic revision reclassifies this species into the genus *Actaea*. Once this is confirmed, *Cimicifuga* may be officially changed to *Actaea*. This species occurs within moist, forested areas near perennial streams, intermittent streams or seeps between 6,000 and 8,300 feet in elevation. Rich fertile soils, high in humus are typical. Surrounding vegetation is generally mixed conifer with an understory of deciduous shrubs and trees that is often dense and shady. This species is often the dominant understory species where found. It appears that a high level of humidity is typical at many of the Arizona populations.

Data Sources. The distribution of Arizona Bugbane includes Bill Williams Mountain, Oak Creek, West Fork of Oak Creek, and West Clear Creek. The only known populations on the Tonto National Forest are associated with Workman Creek and Cold Springs Canyon in the Sierra Ancha Mountains. Potential habitat exists in unsurveyed areas in the Sierra Anchas. A Conservation Strategy for Arizona Bugbane on the Tonto summarizes information to date (Lutch 1999). A Range-wide Conservation Agreement is currently in draft form.

Analysis of Effects. Due to the species' limited range and the fact that populations are limited in aerial extent and number of plants, populations are vulnerable to habitat loss or deterioration of any type. Obvious threats include livestock grazing (to some extent wildlife grazing), timber harvest, recreation and natural events such as wildfire and flooding. Indirect actions that would change the humidity, water quality, stream flow, or canopy cover in and around populations could severely affect the potential for the site to sustain its viability.

Mogollon Thistle (*Cirsium parryi* spp. *Mogollonicum*) – Sensitive

This short-lived perennial is one of thirteen species of *Cirsium* in Arizona. Aids to identification include white fresh corollas, margins nearly entire in mature leaves, and spinulose ciliate

margins in leaves below head-bearing branches. It can reach a height of 40 inches, has poorly developed spines and flowers that occur singly or several in a cluster. The stem branches only near the apex. It blooms from July – September and is pollinated by insects. Habitats include moist to very moist soils in the riparian understory of perennial streams at approximately 7,200 feet elevation. Coniferous forest surrounds the only known population in Arizona,

Data Sources. The only locality known for this species is in Dane Spring Canyon near the Mogollon Rim on the Coconino National Forest. Barb Phillips, a botanist knowledgeable about this species, suspects it on the face of the Mogollon Rim on the Tonto National Forest. The primary source of information for this species was from Arizona Game and Fish Department HDMS (last abstract revision 10-22-1997).

Analysis of Effects. Its range in Arizona is restricted to less than one square mile in Dane Spring Canyon. Very little is known about this species, which was first discovered in 1987. Management factors noted in the HDMS abstract state, “This poorly armed thistle seems subject to browsing by cattle and elk, evidence of browsing in 1989 collection by Knight.” Suggested projects include protection of high altitude perennial streams and further surveys.

Mogollon Fleabane (*Erigeron anchana*) - Sensitive

This herbaceous perennial, also known as Sierra Ancha fleabane, occurs in central Arizona at elevations between 3,500 and 7,000 feet. This species forms a thick taproot with several crowded, thick caudex branches, with a total plant height of less than 15 cm. *Erigeron anchana* is the largest of the *Erigeron pringlei* complex. This plant blooms May – July (also noted through November) and inhabits rock crevices and ledges on boulders and vertical rock faces usually in canyons. It occurs at various exposures on igneous and metamorphic granites, in chaparral, pinyon-juniper and pine-oak forests.

Data Sources. Its total range includes the Sierra Ancha, Mazatzal and Mescal Mountains, and Pine Creek in northern Gila County. Occurrence records include Tonto Creek and Houston Creek on the Payson district, Pine Creek on Tonto Natural Bridge State Park, and Parker Creek, First Water Canyon, Devil’s Chasm, Workman Creek, and one population at the south end of Sierra Ancha Experimental Forest all in the Sierra Ancha Mountains. Major knowledgeable individuals include Barb Phillips, Coconino, Kaibab and Prescott National Forest, and Steve McLughlin, U of A. The primary source of information for this species was from Arizona Game and Fish Department HDMS (last abstract revision 07-28-1997).

Analysis of Effects. Due to its occupation of relatively inaccessible rocky outcrops and cliffs, threats to this species are minor. Potential impacts include trails and recreation.

Fish Creek Fleabane (*Erigeron piscatus*) – Sensitive

This annual fleabane occurs in central Arizona and is one of at least 29 species of *Erigeron* occurring in Arizona. Aids to identification include the lack of lobed leaves and the presence of only sparse hairs on the upper stem. It flowers from spring through fall and occurs between

2,250 to 3,500 feet in elevation. This plant typically occupies sandy alluvium substrates in canyon bottoms associated with riparian habitats near perennial streams.

Data Sources. There are only four collections for this species in Arizona: two from Turkey Creek and Aravaipa Creek in Graham County and two from Fish Creek in the Superstition Mountains (Mesa Ranger District of the Tonto National Forest). A survey at all of these sites in 1990 did not locate any plants (Gori et. al. 1990), but because it is an annual it may not even emerge in some years. The last time this species was seen and collected was in 1979 by Peter Warren. Major knowledgeable individuals include Jim Malusa and Peter Warren, The Nature Conservancy. The primary source of information for this species was from Arizona Game and Fish Department HDMS (last abstract revision 03-28-1994).

Analysis of Effects. The small range of this species makes it susceptible to natural and man-caused disturbance including flooding and recreation (such as camping sites near plants). The populations in the Superstitions are within a designated wilderness area. The Turkey and Aravaipa sites are on the Aravaipa Canyon Preserve, The Nature Conservancy. Management factors cited in the HDMS abstract include camping impacts at the Turkey Creek site, poor watershed condition, hiking impacts, flooding. Light grazing does not seem to affect plants.

Ripley Wild Buckwheat (*Eriogonum ripleyi*) - Sensitive

This woody perennial is known from central to northwestern Arizona. It is a mat-forming subshrub that grows 2-8 inches tall with numerous branches. It can be distinguished from other species in this genus in that it is low, heavily branched with short linear leaves. It flowers April through June and occurs at elevations from 2,000 to 6,000 feet in elevation. This species inhabits heavily calcareous soils in Sonoran desertscrub and pinyon-juniper woodland.

Data Sources. Known localities include Maricopa, Yavapai, Coconino and Mojave Counties. Locations on the Tonto include populations near Horseshoe Lake and Chalk Mountain. The Horseshoe Lake and Cottonwood populations each have thousands of plants. Major knowledgeable individuals include Barb Phillips, Coconino, Prescott and Kaibab Forest Botanist, and Clair Button, BLM. The primary source of information for this species was from Arizona Game and Fish Department HDMS (last abstract revision 04-08-1997).

Analysis of Effects. This species has a small range and a very specific substrate. Degradation of habitat in these areas can be of concern, due to historic livestock grazing, trampling by livestock, construction of reservoirs, off-road vehicle traffic and mining. Soil maps prepared by Phillips (1991) as part of a status survey identify large areas of potential habitat that needs to be surveyed.

Eastwood Alum Root (*Heuchera eastwoodiae*) – Sensitive

This is a distinctive perennial herb in the Saxifragaceae family, with a rosette of rounded leaves with heart-shaped bases growing from a woody root crown. It is found only in central Arizona from 5,000 up to about 8,000 feet elevation, occupying moist slopes in ponderosa pine forests

and canyons. It blooms from May to August. Plants reach heights of 20 inches; small flowers are yellowish green, often without petals. Leaves are dark green, roundish, finely haired and scalloped. Basal leaves occur on long leaf stalks. It is one of seven species of *Heuchera* in Arizona.

Data sources. Collection records include Oak Creek, West Fork of Oak Creek, Chevelon Creek and Hunter Creek in the Bradshaw Mountains and the Verde Valley. On the Tonto National Forest, this plant has been observed along Christopher Creek, Hunter Creek and Barnhardt Pass on the Payson district, along Reynolds Creek on the Pleasant Valley district, and on Lime Creek and at the north end of the New River Mountains on the Cave Creek district. Sources of information for this species include Plants of Arizona (Epple 1995), Arizona Game and Fish Department HDMS (04-17-00) and Kearney and Peebles (1951).

Analysis of Effects. “The ecology of this endemic is poorly known. The effects of livestock grazing and fires should be evaluated.” (Arizona Natural Heritage Program Abstract 1981).

Arizona Alum Root (*Heuchera glomerulata*) - Sensitive

This herbaceous perennial occurs in southeastern Arizona and New Mexico. It flowers from May to August at 4,000 to 9,000 feet in elevation. It is found on north-facing shaded rocky slopes, near seeps, springs and riparian areas, often in humus soil. It is typically associated with oak and pine woodlands, ponderosa pine, and mixed conifer vegetative communities.

Data Sources. Arizona Alum Root is known to occur in one locality on the Tonto National Forest, in the Pinal Mountains south of Globe, Arizona. Other records in the state include the Pinaleno and Galiuro Mountains, and southern Apache, Greenlee and Navajo counties. The most knowledgeable individual on this species (Elvander 1992) notes that this “is a very difficult genus, highly variable at many levels and needing much additional research. It forms intermediate with *H. novomexicana* occasionally in Greenlee, southern Apache, and southern Navajo counties and may be of hybrid origin.” The primary source of information for this species was from Arizona Game and Fish Department HDMS (last abstract revision 02-03-2000).

Analysis of Effects. Restricted to mid to high elevation riparian habitats, on shaded, rocky north-facing slopes often near water.

Alamos Deer Vetch (*Lotus alamosanus*) - Sensitive

This herbaceous perennial occurs primarily in Southern Arizona and Mexico. It is a semi-aquatic plant that forms mats, clumps or carpets along streams. Stems are slender and numerous, somewhat sprawling and can be up to a foot high. This wetland obligate blooms in April and May at elevations between 3,500 to 5,500 feet and is restricted to stream banks in canyons. It is known to occur under both open canopies and partial shade and exists in mud, damp to wet soil or sand, in springs, seeps or streams.

Data Sources. Occurrences in Arizona include the Nogales Ranger District of the Coronado National Forest in Santa Cruz County and the Superstition Mountains on the Mesa Ranger District of the Tonto National Forest. The primary source of information for this species was from Arizona Game and Fish Department HDMS (last abstract revision 11-17-1999).

Analysis of Effects. Restricted to perennial systems and aquatic habitats.

Maple leaf False Snapdragon (*Mabrya acerifolia*) - Sensitive

This herbaceous perennial vine/forb is in the snapdragon family (Scrophulariaceae) and has white to greenish-white 5-lobed tubular flowers. Leaves are dark green, downy, sticky and heart- or kidney-shaped. This plant grows prostrate, up to 10 inches in length. It inhabits shaded cliffs and rock ledges at about 2,000 feet elevation. It is a mat-forming plant with brittle stems. Stems often hang down from moist rock ledges.

Data Sources. This species was formerly considered *Maurandya acerifolia* and earlier references are to this genus. This plant is known only from south-central Arizona. The type locality is from Fish Creek Canyon and most occurrence records are from side canyons of the Salt River. Wayne Elisens, a researcher on this species noted that it was fairly common given the right habitat conditions, but would classify it as a rare plant because of its very limited distribution (Letter to Dr. VanDevender 1980). Locations in the Arizona Game and Fish Department HDMS (04-17-00) include occurrences along the Horse Mesa Dam road (Salt River), Fish Creek Hill, Goldfield Mountains, Canyon Lake, and numerous localities in the Superstition Mountains including Hewitt Ridge Canyon, Fish Creek Canyon, La Barge Canyon, Bluff Spring Canyon, Peralta Canyon, and Tortilla Creek. All of these localities are on the Mesa Ranger District of the Tonto National Forest. Other sources of information include Kearney and Peebles (1951) and Plants of Arizona (Epple 1995).

Analysis of Effects. Due to its growth habitats, it is probably not very susceptible to human disturbance. Projects that may need to be carefully evaluated in the Salt River Canyon and in the Superstitions may include certain types of trail construction and dam construction.

Sweet Cicely (*Osmorhiza brachypoda*) - Sensitive

This erect perennial herb has large compound leaves divided into numerous leaflets and small whitish or purplish flowers. Plants of this genus have thick roots that are licorice-scented and a compound umbel inflorescence. It flowers March – May and is found in moist canyons of conifer forests from 4,000 to 7,500 feet elevation. The only known occurrences for this species are from central Arizona and southern California.

Data Sources. The only known occurrence in Arizona (according to Arizona Game and Fish HDMS 04-17-00) is in Devil's Chasm in the Sierra Ancha Mountains. A summary of the status of this plant (Arizona Natural Heritage Program 1981) mentioned occurrences in the Mazatzal Mountains and the Sierra Ancha on the Tonto National Forest. Sources of information for this species include Arizona Game and Fish

Department HDMS (04-17-00), Kearney and Peebles (1951), Flora of Southern California (Munz 1974) and Higher Plants of California (Hickman 1993).

Analysis of Effects. Threats unknown at this time.

Flagstaff Penstemon or Beardtongue (*Penstemon nudiflorus*) - Sensitive

This herbaceous perennial is known only from north-central Arizona. The type specimen is from Flagstaff (1884). It is found in dry ponderosa pine forests in mountainous regions south of the Grand Canyon at 4,500 to 7,000 feet in elevation. It blooms in the summer and is generally uncommon. It may be expected on dry neutral soils. Many of the species in this genus are browsed. It is known to be associated with cinder hill type soils around Sunset Crater and Wild Bill Hill on the Coconino.

Data Sources. The species occurs in Coconino, Gila, Mohave and Yavapai counties. There is one occurrence for this species from the Tonto National Forest. It was collected in 1938 on Buckhead Mesa on the Payson Ranger District. Other occurrences are known from the Coconino and Prescott Forests, with two locations southwest of Show Low. Information on this species came from Arizona Game and Fish Department HDMS (04-17-00), Kearney and Peebles (1951), The Nature Conservancy web page, USDA Natural Resources Conservation Service web page, and McDougall (1973).

Analysis of Effects. According to Barb Phillips (Coconino, Kaibab and Prescott National Forest Biologist, pers. comm. 9/2/99), these species are adapted to fire and generally grow in open habitats.

Gila Rock Daisy (*Perityle gilensis* var. *salensis*) - Sensitive

This small perennial grows near seeps on cliff faces, ledges and rock outcrops at 3,000 to 4,000 feet elevation. Plants typically reach heights of 30-70 cm and have a sprawling growth form. It has dark green leaves and yellow flowers are born on rather stout stems. It flowers in the spring and fall. This is a variety of the more common *Perityle gilensis* var. *gilensis*, and can be distinguished by its long, extremely narrow leaves. It is also geographically separated from the typical variety. The type locality is on sandstone with a north-facing aspect.

Data Sources. This plant is known only from the type locality on the San Carlos Indian Reservation on the Salt River between Show Low and Globe, but it is expected to occur in the Salt River Canyon down river on the Tonto National Forest. Sources of information on this species include Reggie Fletcher, Regional Ecologist and Arizona Game and Fish Department HDMS (04-17-2000). A status report (Phillips, et. al. 1980) also contains a summary of information on the species.

Analysis of Effects. Threats to this species are considered minimal due to its affinity for steep cliff faces and rocky bluffs. It is unlikely that it is susceptible to human disturbance. This species was proposed for federal listing in 1976, but a 1979 status report recommended removal from any candidate lists because no threats were apparent to this plant. There is no evidence of herbivory and due to their inaccessibility and strong

resinous odor, this is an unlikely threat. Dam building on the Salt River drainage is the only type of activity mentioned in the literature as a potential threat.

Gila Rock Daisy (*Perityle gilensis* var. *gilensis*) – Sensitive

Like *P. gilensis* var. *salensis*, this is a small perennial that grows on cliff faces, ledges and rock outcrops. Based on information available to date, it is similar in appearance and growth form to *P. gilensis* var. *salensis* and is as described above.

Data Sources. Information about this variety (as compared to var. *salensis*) is lacking. One study (Powell 1973) hypothesized that geographical and morphological evidence indicates that var. *gilensis* originated from var. *salensis* via migration down the Salt River Canyon and through the establishment of autopolyploidy. It also noted distributional evidence and leaf morphology suggest that *P. saxicola* evolved from *P. gilensis* var. *salensis* as probably did *P. gilensis* var. *gilensis*. However, the only locality in Arizona in the Arizona Game and Fish HDMS database (04-17-00) showed a location on the Coconino National Forest near the face of the Mogollon Rim. More information is necessary to determine the status of this species on the Tonto National Forest.

Analysis of Effects. It is restricted to steep and generally inaccessible cliff faces, so threats are few.

Fish Creek Rock Daisy (*Perityle saxicola*) - Sensitive

This herbaceous perennial occurs in central Arizona at elevations between 2,000 and 3,500 feet. It is woody at the base, has herbaceous branches and can reach a height of 16 inches. It produces yellow flowers and sets seed from May to June. This plant grows from cracks and crevices on cliff faces, large boulders and rocky outcrops in canyons and on buttes composed of Barnes conglomerate and Mescal limestone. Habitats are very xeric and plants are often associated with east and northeast exposures in Arizona Upland Division of Sonoran desertscrub. Many of the species of *Perityle* are edaphically restricted and are local endemics.

Data Sources. This plant is known from Gila and Maricopa counties in Arizona. It is considered “locally common” at the Tonto National Monument, occurs on the Tonto National Forest near Roosevelt Lake Dam, and in the Sierra Ancha Mountains above Horse Camp Creek. It is suspected throughout the Superstition Mountains. Major knowledgeable individuals include Barb Phillips, Coconino, Kaibab and Prescott Forest Biologist and Reggie Fletcher, Regional Ecologist. The primary source of information for this species was from Arizona Game and Fish Department HDMS (last abstract revision 10-19-1994).

Analysis of Effects. Because this is an endemic with very specific habitat requirements, potential threats are minimized. Threats may include blasting for major activities such as road and trail construction, dam construction. Analysis of soil survey maps may aid in the identification of potential habitat.

Arizona Phlox (*Phlox amabilis*) - Sensitive

This is a perennial low-growing plant with a taproot and thick, oblong leaves in the Polemoniaceae family. It has conspicuous pink, wedge-shaped petal lobes with rounded tips (or slightly notched tips.). It flowers annually from March – May. Growth habits noted for this species include woody subshrub, woody shrub, and herbaceous forb/herb. The locality on the Tonto is in an opening in a ponderosa pine forest.

Data Sources. This plant is endemic to central Arizona, and is known to occur in near Prescott and Payson, Arizona. It was collected in the vicinity of Christopher Creek on the Payson district of the Tonto National Forest, and at several locations on the Prescott National Forest. The primary sources of information for this species came from Arizona Game and Fish Department HDMS (revised 4/17/00), Kearney and Peebles (1951 revised 1960), USDA Natural Resources Conservation Service web site, and McDougall (1973).

Analysis of Effects. Unknown at this time.

Aravaipa Sage (*Salvia amissa*) - Sensitive

This herbaceous perennial occurs in south-central Arizona at elevations of 1,500 to 5,000 feet. Its leaf shape, leaf hairs and elevation distinguish *S. amissa* from the other 14 *Salvia* species in Arizona. It flowers from July to October and occupies shady canyon bottoms near streams. It typically occurs on the floodplain in alluvium, is associated with oak woodland, deciduous riparian woodlands, and is commonly found where sycamore, ashes and willows grow.

Data Sources. The primary range for the species is in southern Arizona including Aravaipa Creek, Santa Catalinas, Galiuros and Winchester Mountains. It was documented in the early 1990's on the Tonto National Forest in Devil's Chasm and PB Creek in the Sierra Anchas. Major knowledgeable individuals on this species include Dave Gori and Jim Malusa from The Nature Conservancy. The primary source of information for this species was from Arizona Game and Fish Department HDMS (last abstract revision 10-24-1997).

Analysis of Effects. Riparian canyon bottom habitat is potentially vulnerable to numerous impacts: grazing, camping, off-road vehicles, etc. Threats include heavy cattle grazing (light grazing is acceptable); possibly recreation/hiking; also poor watershed conditions. Accept intermediate amount of disturbance. Needs some light but also fair amount of shade. It is abundant where found, but needs additional surveys for occurrence of new populations.

Tonto TES Invertebrates: Butterflies

Prepared by Debbie Lutch 6/26/00

Evansi Brigadier (*Agathymus evansi*) – Sensitive

This butterfly, also known as the Huachuca Giant-Skipper, inhabits open woodlands and arid canyonlands in Southeastern Arizona. It has a wingspan of 1 ¾ to 2 3/8 inches with an upperside that is very dark black-brown with orange at the wing bases. There is a band of spots on each wing that is narrow and yellow (yellow-orange in females) with black veins separating the spots. The underside of the hindwing is mottled gray and brown with pale overscales, and has an indistinct pale band. Like the Neumogen's Giant Skipper, males perch near host plants in the early morning to noon to wait for receptive females. Eggs are laid singly on the host and fall to the base of the plant. The host plant is Parry's agave (*Agave parryi*). A young caterpillar crawls to the leaf tip and burrows inside where it eats pulp and then hibernates. In the spring, the caterpillar makes a neat burrow in a leaf base where it feeds on sap until becoming inactive for the summer. Before pupating, the caterpillar enlarges the opening of its burrow and makes a silk trap door from which the adult can emerge. Adult females do not feed and males take moisture from mud. Adults fly from September through October.

Data Sources. This species has been documented in east Santa Cruz and Cochise Counties in the Huachuca mountains of Southeastern Arizona. There are no known occurrences on the Tonto National Forest and it is unclear whether this species could occur in other parts of the state, besides southeastern Arizona. Because its host plant occurs on the Tonto it is considered a potential species for the Forest. The primary source of information for this abstract came from the USGS Northern Prairie Wildlife Research Center website, A Field Guide to Western Butterflies (Tilden and Smith 1986), and Butterflies of Southeastern Arizona (Bailowitz and Brock 1991).

Analysis of Effects. This species is Globally ranked as a G1, meaning that it is critically imperiled globally because of extreme rarity or because some factor of its biology makes it especially vulnerable to extinction. Management needs noted include preserving habitat and discouraging overgrazing.

Neumogen's Giant Skipper (*Agathymus neumogeni*) – Sensitive

This butterfly, also known as the Orange Giant Skipper, inhabits shrub-grassland, open woodland, mesas and mountains from 7,100-9,150 feet elevation. Adults have a wingspan of 1 ¾ to 2 3/8 inches with an upperside of orange/yellow with black borders and black patches. The underside of the hindwing is dark gray with a faint pink band. Like the Evansi Brigadier, males perch near host plants to wait for receptive females. Eggs are laid singly on the host and fall to the base of the plant. The host plant is Parry's agave (*Agave parryi*). A young caterpillar crawls to the leaf tip and burrows inside where it eats pulp and then hibernates. In the spring, the caterpillar makes a neat burrow in a leaf base where it feeds on sap until becoming inactive for the summer. Before pupating, the caterpillar enlarges the opening of its burrow and makes a silk trap door from which

the adult can emerge. Adult females do not feed and males take moisture at mud or manure. Adults fly from September through October.

Data Sources. This species ranges from central Arizona to west-central New Mexico, and southern New Mexico to west Texas. It has been documented in eight counties in Arizona including Gila, Pinal, and Coconino counties. The primary source of information for this abstract came from the USGS Northern Prairie Wildlife Research Center website and A Field Guide to Western Butterflies (Tilden and Smith 1986).

Analysis of Effects. No management needs have been reported for this species.

Comstock's Hairstreak (*Callophrys comstocki*) – Sensitive

This butterfly, also known as the Desert Green Hairstreak, favors dry rocky areas and pinyon-juniper woodland of foothills and canyons of the upper Sonoran mountain plateaus at 5,000-6,000 feet elevation. Adults have a wingspan of less than 1 inch with a gray upperside and a gray-green underside with a sinuous row of white dots on hindwing. Males perch to watch females in depressions or gulch bottoms. Females lay eggs singly on host plant leaves. Caterpillars eat leaves, although some prefer flowers and young fruits. Chrysalids hibernate. Caterpillar hosts are usually various buckwheats (*Eriogonum* species), especially Wright's buckwheat and racemose buckwheat. Adults feed on flower nectar. They brood only once with adults present March-May.

Data Sources. This species ranges from the Great Basin and arid inter-mountain West from northern Nevada and eastern California east to southern Utah and western Colorado. It has been documented in Mohave and Navajo counties in Arizona. Potential for occurrence on the Tonto National Forest is unknown, but the Forest is within the elevational range and has the appropriate habitats. The primary source of information for this abstract came from the USGS Northern Prairie Wildlife Research Center website and A Field Guide to Western Butterflies (Tilden and Smith 1986).

Analysis of Effects. It has been noted that some habitats for this species are being invaded by cheatgrass. No management needs have been reported.

Obsolete Viceroy Butterfly (*Limenitis archippus obsoleta*) – Sensitive

This species is widespread and is tied to cottonwood-willow riparian areas and desert arroyos, in desert grassland and desertscrub habitats. The primary caterpillar host includes trees in the Willow family, including willows (*Salix*), poplars, and cottonwoods, but larvae have been known to feed on others in the families Fagaceae and Rosaceae. Adults are livid brown in color with the median line of the hindwing edged with white. The Viceroy flies with, and mimics the Queen butterfly and can only be differentiated when at rest, not during flight. It also is similar in appearance to the Monarch. When perched, it has open wings and the Queen (the milkweed butterfly) keeps wings closed. There are at least two broods with adults flying from May through August. During most of the day, males perch on vegetation or patrol around host plants to find females.

Females lay eggs at the tip of host plant leaves, depositing two or three eggs on a plant before moving to another. Caterpillars eat their eggshells after they hatch, then at night feed on catkins and leaves. Young caterpillars make a ball of leaf bits, dung, and silk which hangs off the leaf on which they are feeding; the dangling mass may distract predators. Third-stage caterpillars make a shelter from a rolled leaf tip in which to spend the winter.

Data Sources. Its total range includes southeastern Utah, Nevada, western California, Arizona, New Mexico and western Texas. This species has been documented on the Mesa Ranger District of the Tonto National Forest at the confluence of Sycamore Creek and Mesquite Wash. Other known occurrences in Arizona include the Virgin River, Grand Canyon, Sonoita Creek, and O'Donnell Canyon. Cave Creek Wash and New River Wash have also been documented, but it is unclear if these occur within USFS administered lands. The major knowledgeable individual on this species is Kim Wismann from the Hayden Library at ASU. The primary source of information for this abstract came from the USGS Northern Prairie Wildlife Research Center website, the Arizona Game and Fish Department Heritage Data Management System (HDMS) database (last update 1997-03-02), and A Field Guide to Western Butterflies (Tilden and Smith 1986).

Analysis of Effects. This subspecies has lost much of its habitat due to development, water impoundment, and the exotic aggressive saltcedar. Management needs that have been noted for the species include restoration of riparian habitats and the conservation of extant habitats.

Arizona Copper (*Lycaena ferrisi*) – Sensitive

This butterfly, also known as the Ferris' Copper, is very similar to the Ruddy Copper in appearance and habits. It inhabits open meadows in the eastern part of the state. Adults feed on flower nectar, including that of yellow composites and the caterpillar host is Dock (presumably in the genus *Rumex*). There is one flight, typically in late July and August.

Data Sources. This butterfly has only been documented in the White Mountains of Arizona and it is unknown whether it occurs on the Tonto National Forest. The primary source of information for this abstract came from the USGS Northern Prairie Wildlife Research Center website.

Analysis of Effects. There are only a few populations known. This species is Globally ranked as a G1, G2 meaning that it is critically imperiled globally because of extreme rarity or because some factor of its biology makes it especially vulnerable to extinction, or it is imperiled due to rarity or because of other factors demonstrably making it very vulnerable to extinction throughout its range.

Spotted Skipperling (*Piruna polingii*) – Sensitive

This species inhabits moist woodland openings with lush vegetation, streamsides, ravines, and meadows. Found in low to mid-elevations, from Central New Mexico and central Arizona south to Mexico. It takes nectar along cool, deep canyons and along forested road margins. The species has been seen congregating in numbers on moist cliffsides. Adults have a wingspan of about 1 inch, with a glossy dark brown upperside with small transparent white spots on the forewing and 2-3 spots on the hindwing. Underside is reddish brown with forewing spots and 3 silver median spots on hindwing. Adults rest with wings closed, but bask with hindwings open wide and forewings open at about 45 degrees. Males patrol to find receptive females. Caterpillars live and feed within nests of webbed leaves. Fully-grown caterpillars hibernate. There is a single rainy season brood, mostly in July north of the Gila River and slightly later south of it.

Data Sources. This butterfly has been documented in 8 counties in Arizona, including Gila, Yavapai, Coconino, Pinal and Cochise counties. Occurrences have been recorded along the Mogollon Rim. The primary sources of information on this species include Butterflies of Southeastern Arizona (Bailowitz and Brock 1991), the USGS Northern Prairie Wildlife Research Center website, and the Arizona Game and Fish Department Heritage Data Management System database.

Analysis of Effects. No threats reported at this time, but presumably the maintenance and restoration of riparian habitats would benefit this species.

ADDITIONAL COMMENTS:

Mountain Silverspot Butterfly (*Speyeria Nokomis nitocris*) – Sensitive

According to Rich Bailowitz (02-14-00) this subspecies occurs above and below the Mogollon Rim, at least from Kehl Springs, Coconino County, eastward to the higher White Mountains and probably into western New Mexico. Habitats occupied by this subspecies are typical of the species, occurring in and around wet meadows and along streamsides in proximity to violets and abundant nectar sources. There are records from Greenlee, Apache, Graham, Gila, Navajo and Coconino Counties. This species may occur on the Tonto and should be reconsidered for including on the Forest list during the next revision (D. Lutch 06-26-00).

Tonto TES Invertebrates: Tiger Beetles, Dragonflies, Flies

Prepared by Don Pollock 6/00

Arizona snaketail (*Ophiogomphus arizonicus*) – Sensitive

This dragonfly is a member of the large family Gomphidae (clubtails), and as such has the characteristic swollen terminal abdominal segments. Coloration is generally a green to blue-green head and thorax with green to yellow abdomen with lateral black stripes on the abdominal segments. Coloration can vary by sex and season. This species, like most clubtails, is more closely associated with stream habitats than ponds or lakes (Borror and White, 1970). Perennial water is necessary since the fully aquatic naiads require more

than one season to mature. Naiads burrow into debris in the bottom of streams. Both naiads and adults are predaceous upon other insects.

Data Sources. Current information on this species is somewhat limited. In the United States, the species has only been recorded from Arizona (Coconino, Apache, Gila, Cochise, and Greenlee Counties) and New Mexico (Grant and Catron Counties) (Nunnallee & Paulson, 1998). It has not been recorded in Mexico, but it is likely.

Analysis of Effects. Since the naiads of this species are fully aquatic, and the adults are totally riparian dependant, actions that would detrimentally affect aquatic and riparian habitats are considered a threat to this dragonfly. Water quality is important not only for the survival of this species, but also of many of its prey species, particularly the larval pray. Activities which could detrimentally alter habitats for this dragonfly include water diversions and impoundments, overuse and trampling by livestock, fires of sufficient intensity to promote the movement of soil and ash, and any other actions that would directly impact aquatic and riparian resources.

Hoary Skimmer (*Libelula nodisticta*) – Sensitive

This dragonfly is a member of the large family Libellulidae (skimmers). They are named for their habit of “skimming” the surface of still water, and as such are usually associated with ponds, marshes, or still water segments of streams, however naiads are more closely associated with streams (Borror & White, 1970). Emergent vegetation in the still water habitats is usually present. Adults are usually blue to blue-gray. There are two pairs of transverse yellow marks on the thorax sides, and yellow lateral marks on each abdominal segment. The coloration is generally more pronounced in the female. Coloration can vary by sex and season. Both naiads and adults are predaceous upon other insects.

Data Sources. This is a widely distributed species, occurring from Oregon south into Mexico and from California east to at least Oklahoma (Nunnallee & Paulson, 1998). It is known from Navajo, Apache and Cochise Counties in Arizona, and Catron, Grant, Socorro, Lincoln and Guadalupe Counties in New Mexico. It is not considered particularly rare, but its habitat is limited.

Analysis of Effects. Since the naiads of this species are fully aquatic, and the adults are totally riparian dependant, actions that would detrimentally affect aquatic and riparian habitats are considered a threat to this dragonfly. Water quality is important not only for the survival of this species, but also of many of its prey species, particularly the larval pray. Activities which could detrimentally alter habitats for this dragonfly include water diversions, overuse and trampling by livestock, fires of sufficient intensity to promote the movement of soil and ash, and any other actions that would directly impact aquatic and riparian resources.

Maricopa Tiger Beetle (*Cicindela oregona maricopa*) - Sensitive

Like all tiger beetles, this species has prominent eyes that, together with the head, are wider than the thorax. Long filamentous antennae are attached below each eye. The Maricopa tiger beetle has dark purple elytra and the head and pronotum of the thorax are metallic greenish to greenish-blue dorsally. Total body length is between 11 and 12 mm (sometimes larger). As with all tiger beetle species, the markings on the elytra are distinctive. *Cicindela oregona* has yellowish-whitish markings as follows: three spots, a middle band that has a nearly right angle bend in it and that is concave anteriorly, and a terminal spot on the posterior tip of each elytron. There is no white margin on the elytra. It is most commonly found on sandy streambanks, and less frequently on lake or pond beaches (McKown, 1987). It has also been found in non-typical places such as open areas provided by dirt roads and around leaky faucets. Adults are not shade tolerant and are rarely active unless there is full sun. Larval tiger beetles lay in wait for prey in a burrow in the sand. The burrows of tiger beetles are very characteristic. The entrance to the burrow is flush with the surface of the ground, and is clean and smooth. There is no “cone” of soil particles.

Data Sources. The species *C. oregona* is widely distributed throughout the western United States. The subspecies *maricopa* is limited to riparian and wetland habitats in Arizona and New Mexico, most frequently in the Central Highlands between approximately 900 and 3,000 feet in elevation, although there are reported observations at higher elevations. A Habitat Conservation Assessment for the Maricopa tiger beetle was completed for Region 3 on Nov. 13, 1995 (Pearson and Wisman, 1995). It is thought that substrates used by the larval stage are limiting factors (sandy shores and undisturbed silt deposits). This beetle is known to occur along the Verde, Gila, and Salt Rivers and their tributaries. Locations on the Tonto include Tonto Creek and the Verde River.

Analysis of Effects. Primary threats identified by Pearson and Wisman (1995) include long-term desiccation of streams by lowering the water table and the construction of permanent dams that contribute to desiccation of streambeds. Indirect effects of damming include infrequent but major water releases from reservoirs that results in scouring of vegetation and interrupted sand and silt deposition. The use of All-Terrain Vehicle driving over sandbars could be threats to localized areas (Schultz, 1988). Trampling by livestock also has the potential to impact individuals

A Tiger Beetle (*Cicindela purpurea cimarrona*) – Sensitive (aka Cow Path Tiger Beetle)

Like all tiger beetles, this species has prominent eyes that, together with the head, are wider than the thorax. Long filamentous antennae are attached below each eye. Total body length is from 13.5 to 16 mm. As with all tiger beetle species, the markings on the elytra are distinctive. *Cicindela purpurea* has a lack of shoulder markings and uniquely transverse (with a soft curve or bend) middle bands on the elytra (other species' middle bands are sharply bent posteriorly). There is usually another spot posterior of the middle

band. Also, as with all tiger beetles, both the adults and larvae are highly predaceous on other arthropods. Adults are generally present from June to August on bare soil (Bertholf, 1983). The species *purpurea* is known to occur in upland sites; generally in openings of vegetation (such as cow paths) where soil is bare. Throughout its range, it is typically associated with agricultural areas. The subspecies *cimarrona* is best known to be associated with the dry soils of upper beaches of lakes and playas (Milne, 1980).

Data Sources. The species *C. purpurea* is widely distributed throughout the United States from coast to coast. The subspecies *cimarrona* is known from Coconino (Pearson, pers. comm. to Coc. N.F.) and Graham (Bertholf, 1983) Counties in Arizona. It is also expected to occur in portions of New Mexico (Bertholf, 1983).

Analysis of Effects. Primary threats include All-Terrain Vehicle driving or other heavy recreational use over occupied habitat areas. Trampling by livestock could also have the potential to impact individuals.

Hairy-Necked Tiger Beetle (*Cicindela hirticollis corpuscula*) – Sensitive

Like all tiger beetles, this species has prominent eyes that, together with the head, are wider than the thorax. Long filamentous antennae are attached below each eye. Total body length is between 13 and 14 mm. As with all tiger beetle species, the markings on the elytra are distinctive. *Cicindela hirticollis* has very unique markings, including a middle band which turns sharply posteriorly, then curves again inward, shorter bands both anterior and posterior of the middle band, a shoulder patch, and a complete light margin. Also, as with all tiger beetles, both the adults and larvae are highly predaceous on other arthropods. Rangelwide, the species occupies tidal flats, coastal beaches and the sandy shores of freshwater rivers or lakes. In the southwest, this species occurrence likely overlaps that of the Maricopa tiger Beetle (*C. oregona Maricopa*), although the species is also known to occur in sandy habitats far from water (such as sand dunes and sand pits). Adults are not shade tolerant and are rarely active unless there is full sun. Larval tiger beetles lay in wait for prey in a burrow in the sand. The burrows of tiger beetles are very characteristic. The entrance to the burrow is flush with the surface of the ground, and is clean and smooth. There is no “cone” of soil particles.

Data Sources. The species *C. hirticollis* is widely distributed throughout the United States from coast to coast, with the exception of the Appalachian Mountains and the Great Basin. In Arizona the subspecies *corpuscula* it is known from Coconino, Graham, Greenlee, Maricopa, Navajo, Pinal, and Yuma Counties (Bertholf, 1983). It has not been collected in New Mexico. Like the Maricopa Tiger Beetle, it is felt that substrates used by the larval stage are limiting factors (sandy shores and undisturbed silt deposits).

Analysis of Effects. Like the Maricopa tiger beetle, primary threats include long-term desiccation of streams by lowering the water table and the construction of permanent dams that contribute to desiccation of streambeds. Indirect effects of damming include infrequent but major water releases from reservoirs that result in

scouring of vegetation and interrupted sand and silt deposition. The use of All-Terrain Vehicle driving over sandbars could be threats to localized areas (Shultz, 1988). Trampling by livestock also has the potential to impact individuals.

Tiger Beetle (*Cicindela praetextata pallidofemora*) – Sensitive

Like all tiger beetles, this species has prominent eyes that, together with the head, are wider than the thorax. Long filamentous antennae are attached below each eye. As with all tiger beetle species, the markings on the elytra are distinctive. *C. praetextata* has the elytra heavily bordered, with a single middle back-angled band and a spot anteriorly. Also, as with all tiger beetles, both the adults and larvae are highly predaceous on other arthropods. Adults are generally present from June to August in sandy areas (Bertholf, 1983). The species is known to occur mainly on dry soils of upper beaches and playas. It is primarily a lakeshore species (Milne, 1980).

Data Sources. The species *C. praetextata* is distributed only in the southwestern portion of the United States; mainly in Arizona. Information is scant on the subspecies *pallidofemora*. In Arizona it is known from “central Arizona” (Bertholf, 1983). Its preferred habitat would indicate that may overlap with *C. purpurea cimarrona*.

Analysis of Effects. Primary threats include All-Terrain Vehicle driving or other heavy recreational use over occupied habitat areas. Trampling by livestock could also have the potential to impact individuals.

Netwing Midge (*Agathon arizonicus*) - Sensitive

This medium sized, sturdily built, well sclerotized midge appears mosquito-like in size with long legs. They resemble crane flies but do not have a V-shaped suture on the mesonotum. The wings sometimes have a network of fine lines between the veins (hence the common name). They occur exclusively along swift-moving streams in which the larvae live and tend to rest on wetted, overhanging rock faces (Courtney, 2000). The larvae are typically associated with waterfall habitats. Adults do not leave the riparian corridor. Multiple species of midges may occur at the same location.

Data Sources. This species ranges through the Cascades of central Oregon, south in the Sierra Nevada and Transverse Ranges of southern California, then reoccurring disjunctly in the highlands of central and southeastern Arizona (Hogue, 1987). Although it likely occurs in suitable habitat elsewhere on FS lands, it has only been documented in Workman Creek on the Tonto National Forest.

Analysis of Effects. Because the species is so closely tied to perennial, fast moving streams, activities that would alter the integrity of such habitats would be expected to be detrimental. Primary threats would include long-term desiccation of streams by lowering the water table and the construction of permanent dams or diversions.

Parker's Cylloepus Riffle Beetle (*Cylloepus parkeri*) – Sensitive

This is a small, black (sometimes with two large reddish spots on each elytron), non-swimming beetle living on rocks, sand and gravel in stream riffles. They are from 2.15 to 2.75 mm. long, cylindrical, with long legs (with large claws), and moderately long antennae. Eggs are deposited on the underside of rocks. Both adults and larvae feed on periphyton. Water with very high oxygen content is required.

Data Sources. The species is distributed only in central Arizona, and is only known from Roundtree Canyon (and possibly Tangle Creek) on the Tonto National Forest (Johnson, 1992) and (Warrick, 1986).

Analysis of Effects. This species is highly localized on the Tonto National Forest. It requires water very high in oxygen content, therefore activities that would reduce water quality would be expected to detrimentally impact the species. Activities such as mining, channelization, and heavy grazing would almost certainly be detrimental to this species.

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Tonto TES Invertebrates: Springsnails

Prepared by Jerome Stefferud 6/00

FOSSIL SPRINGSNAIL (*Pyrgulopsis simplex*)

USFWS: Species of concern; USFS R3: Sensitive.

Description.--A moderate-size species in the family Hydrobiidae with an ovate-conic shell. Shell height is 2.0 to 2.5 mm, with 3.5 to 4.25 unshouldered and moderately convex whorls. The operculum is amber in color.

Distribution.--This species is restricted to a number of springs, including Fossil Springs, that form the perennial portion of Fossil Creek, Gila and Yavapai counties, which flows into the Verde River south of Childs, Arizona. In these springs, the species has population densities varying from 2/cm² to less than 1/cm². It is typically found only in the headspring and upper sections of the outflow. Several other species of springsnails occur in and near the Verde Valley, including the Montezuma Well, Page, Verde Rim, and Brown springsnails, indicating a high degree of endemism in the area.

Habitat.--Little is known regarding habitat requirements of the species, or even the genus, as most work on these animals has been focused on taxonomic descriptions and systematic relationships. In general, springsnails of the genus *Pyrgulopsis* typically occur on rock or aquatic macrophytes in moderate current.

Management Implications.--Prosobranch snails of the family Hydrobiidae comprise a diverse component of the inland aquatic fauna of the American Southwest, with numerous locally endemic taxa found in isolated springs, spring complexes, or drainage systems. In part due to difficulties of collecting and studying these minute snails, they remain poorly known. Many species are threatened or endangered or have disappeared completely, as a result of deterioration or disappearance of natural aquatic habitats. Fossil springsnail has experienced no apparent reduction in range or abundance as a result of activities in the Fossil Creek watershed during the past two decades. Fossil Springs was recently designated a Botanical Area by the Coconino National Forest, an action designed to provide increased protection and restoration of the area. Public access to Fossil Springs is limited to foot travel, however, other springs in the watershed containing Fossil springsnail are provided no special protection.

The ecosystem of the Fossil springsnail, and hydrobiids in general, is typically the headsprings and upper sections of outflows that range in size from small seeps to large limnocrenes such as Montezuma Well. Because springsnails are minuscule in size, and have only a partial operculum, they cannot withstand any desiccation, and occur only in water that is perennially flowing. In addition, there is evidently some chemical requirement that causes them to occur only in the very headwaters of a spring.

Sources.--

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Tonto TES Fish
Prepared by Jerome Stefferud 6/00

LONGFIN DACE (*Agosia chrysogaster*)

USFWS: Species of concern; Tonto NF: Sensitive.

Description.--The longfin dace is a small, silvery minnow (Cyprinidae) that seldom exceeds 4 inches in length. Its mouth is slightly subterminal, and there is a minute barbel present on each side of the upper lip. Coloration is usually dark gray above and white below. Sides are sometimes silvery or with a dark, lateral band terminating in a black spot at the base of the caudal fin. Breeding males develop nuptial tubercles on head and fins, and may have some yellowing of lower parts and bases of paired fins.

Distribution.--The longfin dace occurs naturally in the Yaqui, Magdalena, Sonoyta, Gila, and Bill Williams drainages, and has been introduced into the Virgin and Mimbres rivers. It ranges from low, hot, sandy-bottomed desert streams to clear, cooler brooks in the lower reaches of the conifer zones. It is rarely abundant in larger streams, or at elevations above 5,000 feet.

On Tonto NF, it is common in most small to moderate sized streams below about 5,000 feet.

Habitat.--It is usually found in waters less than 0.6 feet deep, with moderate velocities over pebble/gravel/sand substrate. Water flow is typically smooth and laminar. It has a tendency to remain in open, shallow areas throughout much of the day.

The fish is highly opportunistic, moving rapidly into flowing water during periods of high precipitation and runoff to travel amazing distances in relatively short periods of time. During desiccating conditions, longfin dace persist beneath moist debris and algal mats throughout the day, then become active at night when meager flow returns. Adults tend to congregate in shaded, deep areas when water temperatures exceed 75° F. Thermal mortalities of longfin dace have rarely been observed.

Food.--Longfin dace is an opportunistic omnivore, consuming primarily insects when the preferred taxon (baetid mayflies) is abundant, but consuming primarily algae when mayfly abundance is low. Other foods include detritus and zooplankton.

Reproduction and Growth.--Most individuals become sexually mature within the first year. Spawning occurs from December through July, and perhaps to September. Saucer-shaped depressions in sandy bottom streams are used as nests, and are located along shorelines and on sandbars at depths of less than 0.6 feet. Nests sometimes are concentrated, with as many as 20 per square yard. Incubation requires about 4 days at temperatures higher than 75° F. The life span is rarely longer than three years.

Management Implications.--Longfin dace is perhaps the only native fish species in Arizona that has been helped by the massive erosion that occurred during the past century. Since their preferred habitat is sandy-bottomed, shallow streams, excessive sedimentation has increased the abundance of this habitat type. However, they have disappeared from many areas because of lowered water tables and reservoir construction.

SONORA SUCKER (*Catostomus insignis*)

USFWS Status: Species of concern; Tonto NF: Sensitive.

Description.--The Sonora sucker, also known as the Gila sucker, is a large, robust member of the sucker family (Catostomidae), commonly reaching lengths between 12 and 24 inches. Its mouth is ventral with large fleshy lips. The body is sharply bi-colored, brownish dorsally, yellow beneath. During breeding season, males develop large nuptial tubercles on their anal and caudal fins, and on the lower, posterior part of the body.

Distribution.--Sonora sucker is widely distributed and common between 1,000 and 6,500 feet elevation in the Gila, Verde, Bill Williams, and San Francisco river basins of Arizona and New Mexico. It is uncommon in the upper Santa Cruz River in Arizona. Except in Aravaipa Creek, it has been extirpated from the San Pedro River in southern Arizona and northern Sonora, Mexico. The species is intolerant of reservoir conditions. Dams and diversions of free-flowing streams, water pollution, and sedimentation of streams have diminished its range, and the status of the species is uncertain.

On Tonto NF, it is found in the Salt and Verde rivers and larger tributaries below about 6,500 feet.

Habitat.--Sonora sucker is characteristic of gravelly or rocky pools of creeks and rivers. It can be found in a variety of habitats from warm water rivers to trout streams. Adults tend to remain near cover in daylight, but move to runs and deeper riffles at night. Young Sonora sucker typically live in runs and quiet eddies. Individuals are sedentary, exhibiting little seasonal movement and resisting downstream displacement during floods.

In Aravaipa Creek, it commonly inhabits pools >1 foot deep with slow current, and with sand/gravel substrate. Information on temperature tolerances, or other habitat preferences has not been obtained.

Food.--Foods appear to vary with availability. In Aravaipa Creek it is almost exclusively a carnivore, feeding upon the abundant aquatic insect larvae (primarily mayflies) of that stream. In other places, especially where large populations are concentrated in pools in summer, intestines are filled with plant debris, mud, or algae. Seeds of cottonwood trees are taken seasonally. Young feed along the margins of streams upon tiny crustaceans, protozoans, and other animal and plant groups.

Reproduction and Growth.--Spawning begins in February and extends till July. Eggs are deposited in riffles, and fall into the interstices between gravel particles where they incubate. Larval fish appear within a few days. Areas where suckers have been spawning may often be identified as elongated patches of "cleaned" gravel on riffles, marking the places where algae-covered bottom materials have been shifted about. Spawning does not appear correlated with any specific pattern of stream flow or temperature. Information on age and growth has not been developed.

Management Implications.--Sonora sucker was used extensively as food by primitive humans along the streams of the Gila basin, and provides sport for bow-and-arrow and snagging enthusiasts. It also will take a baited hook, especially in winter, and gives a slow, determined struggle when taken on light tackle.

Alteration of historic flow regimes and construction of reservoirs have diminished available habitat for Sonora sucker. General watershed erosion causing excessive sand deposition in streams has eliminated pool habitat, and Sonora sucker, in many streams. Surveys and monitoring are needed to track the status and trends of the species.

SPECKLED DACE (*Rhinichthys osculus*)

USFWS: Species of concern; Tonto NF: Sensitive.

Description.--A small minnow (Cyprinidae), the speckled dace seldom achieves 3 inches in length. Its body is chunky and somewhat flattened ventrally. Its mouth is slightly subterminal, with barbels present at the sides of the upper lips.

Coloration is highly variable, drab olivaceous with patterns ranging from large black blotches on the body, through a single or double lateral band, to almost unicolored (darker above, lighter below). Breeding males with brilliant red on bases of paired fins and on body near those fins, on and near anal fin base, the lower caudal lobe, the mouth, and near the upper part of gill cleft.

Distribution.--The species is the most ubiquitous freshwater fish in the western United States, naturally occurring in all seven major drainages. In Arizona, it exists in at least two major body forms, a small, highly-speckled or blotched, chubby-bodied kind in the southern part of the Gila River system, and a larger, banded or unicolored, more streamlined kind in larger rivers and creeks to the north of the Mogollon Rim. It has been extirpated from the San Pedro River in southern Arizona and northern Sonora, Mexico, but still exists in Aravaipa Creek. It has a proclivity for small, headwater streams, often occurring in spring streams and other waters isolated by many miles of dry streambed from larger streams. This species is presently rare below about 5,000 feet elevation, but once occurred in the larger streams below that level.

On Tonto NF, it is common in large to small streams between about 5,000 and 9,000 feet, and was once far more abundant in streams below 5,000 feet. It was recently rediscovered in Cave Creek after an apparent absence of 25 years following stream renovation in the early 1970's.

Habitat.--Speckled dace is a bottom dwelling species that inhabits shallow, rocky, headwater streams with relatively swift flow, sometimes in areas with considerable aquatic vegetation. It is found in riffles that are about 0.5 feet deep, with water velocities of about 1.3 feet/second over pebble/cobble substrate.

Adult speckled dace appear quite capable of maintaining position in streams during flash flooding, but young are carried downstream, often to their deaths in pools that later desiccate. Individuals can persist, however, for amazing periods of time in intermittent pools, although greatly crowded, diseased, and starving. Rapid, overall responses to high runoff have been recorded, in which the fish was essentially extinct during years of low discharge, but when conditions improved enjoyed high reproductive success and became abundant.

Although it can acclimate to temperatures as high as 98° F, the species has a relatively low tolerance for elevated temperatures and reduced oxygen, which accounts for its peak abundance in relatively swift, moderately sized, pool-and-riffle creeks between 5,000 and 10,000 feet elevation. Preferred water temperature appears to be around 60° F.

Breeding adults seem to prefer swifter water, particularly the males, and in the late winter and early spring both sexes sometimes are numerous in swirling waters behind stones or other obstructions in the swiftest riffles.

Food.--It feeds principally on benthic insects, but also takes algae, other aquatic

invertebrates, and detritus. Speckled dace feed primarily between 9:00 P.M. and 1:00 A.M.

Reproduction and Growth.--Spawning occurs in spring and again in late summer. Reproductive period is regulated by photoperiod. A single late summer flood will induce spawning whereas the same event in early summer does not.

Breeding fish seek swift water where the males build the nests by cleaning the gravel clear of bottom debris and algae. One female is attended by numerous males. Territoriality is exhibited with the male defending the nest. The eggs are demersal and adhesive, hatching time is six days at 65° F, and the larvae remain in the gravel interstices for about seven to eight days

Management Implications.--Alteration of historic flow regimes and construction of reservoirs have diminished available habitat for speckled dace. General watershed erosion causing excessive sand deposition has eliminated pool habitat and filled in riffles needed for spawning and food production in many streams.

Surveys and monitoring are needed to track the status and trends of the species. Land management practices that can increase erosion need to be evaluated as to their effects on the species and its habitat. Awareness of the presence of the species in isolated habitats is needed for proper management of the ecosystem.

GILA CHUB (*Gila intermedia*)

USFWS: Candidate; Arizona: Special Concern; New Mexico: Endangered; USFS R3: Sensitive; Mexico: Endangered; AFS: Special Concern; Tonto NF: Sensitive.

Description--Gila chub is a member of the minnow family (Cyprinidae) that can achieve lengths up to 10 inches. Its body is chunky with large scales. Overall coloration is dark, sometimes lighter on the belly. Breeding males have red or orange on the lower cheeks, posterior parts of the lips, paired fin bases, and on the lower sides of the body. Breeding colors of the males seem more intense than in other Arizona chubs, culminating in the entire ventro-lateral surface becoming fire-red, and the eye becoming yellow to yellow-orange.

Distribution--In Arizona, Gila chub was widely distributed in isolated habitats, occurring in the headwaters of essentially all the major tributaries to the Gila River, including the Verde, Agua Fria, Aravaipa, San Pedro, and Santa Cruz drainages. It has recently been rediscovered in the San Pedro drainage in Sonora, Mexico, where it had not been collected since 1857.

On Tonto NF, it occurs in Fish and Mineral creeks; it was extirpated from Cave Creek and Seven Springs Wash during fish renovation efforts in the early 1970's.

Habitat--Gila chub typically occupies pools in small streams, marshes, cienegas, and other quiet waters, although it may have occurred in larger, more complex habitats. It is highly secretive, remaining in deeper waters near cover.

Food--Foods include both terrestrial and aquatic invertebrates, small fishes, algae, and organic debris.

Reproduction and Growth--Breeding in streams seems to be sporadic throughout the spring and summer, while in constant temperature springs breeding lasts through late winter, spring and summer months, and perhaps into early autumn. Breeding occurs over

beds of aquatic plants. Females achieve lengths of 10 inches; males rarely grow longer than 6 inches.

Management Implications--Gila chub is becoming rare, especially where land use practices such as overgrazing lead to incision of floodplains and lowering of water tables, which, in turn, drain marshlands and other stream-associated habitats. Efforts to maintain and restore cienega type habitats are needed to ensure the survival of the species.

Populations of Gila chub have been quickly eliminated following stocking of largemouth bass into their habitat. The spread of nonnative fish in waters in Arizona continues to be disastrous for the native fish fauna of the state.

Reintroduction of Gila chub into suitable habitats is an appropriate management action.

DESERT SUCKER (*Catostomus (Pantosteus) clarki*)

USFWS: Species of concern; Tonto NF: Sensitive.

Description.--The desert sucker, also known as the Gila mountain-sucker, is a moderate-sized member of the sucker family (Catostomidae), reaching lengths of up to 12 inches. Its mouth is ventral with large lips, and has well-developed cartilaginous scraping edges on the jaws. The coloration is silvery tan to dark greenish above, silvery to yellowish below. During spawning, both sexes may display an orange red lateral stripe.

Distribution.--Desert sucker occur in the Bill Williams, Salt, Gila, San Francisco, and Verde river drainages in Arizona and New Mexico. They are characteristic of small to moderately large streams, at elevations of about 1,000 to 6,000 feet. They do not occur in reservoirs, and dams and diversions of free-flowing streams have diminished its range somewhat. The species is generally common throughout its range, however continuing threats of water development make its future uncertain.

It is widespread in most streams throughout Tonto NF.

Habitat.--Desert sucker is found in rapids and flowing pools of streams, primarily over bottoms of gravel-rubble with sandy silt in the interstices. Adults live in pools, moving at night to swift riffles and runs, where they feed on encrusting algae scraped from stones. Young inhabit riffles throughout the day, feeding on midge larvae. Individuals exhibit little seasonal movement, and resist downstream displacement during floods.

Desert sucker is highly adaptive to a wide range of temperatures, tolerating water temperatures as high as 90° F. Desert sucker may be able to tolerate lower oxygen levels than other native stream fishes.

Food.--Chironomid larvae (midges) are the primary food of juveniles. As an adult, desert sucker is primarily herbivorous, scraping filamentous algae from stones as well as ingesting plant detritus, aquatic insect larvae, and other invertebrates. Individuals often turn completely upside-down as they glean food off surfaces of stones.

Reproduction and Growth.--Desert sucker spawns in late winter or early spring on riffles, where adults congregate in large numbers. Spawning is typically of one larger female and two or more smaller males. A depression in the bottom is formed by lateral movements of the female's body, and adhesive eggs are buried in loose gravels. Eggs hatch in a few days, and larvae gather in quiet pools near the bank, moving to swifter waters as they mature. Juveniles are mature by the second year of life at a length of 4 to

5 inches.

Management Implications.--Alteration of historic flow regimes and construction of reservoirs have diminished available habitat for the desert sucker. In addition, nonnative fish that can compete or hybridize with the desert sucker, or prey on them, have found ideal living conditions in the altered landscapes.

Persistent demand for domestic water and continued importing of nonnative fish may reduce the range of the desert sucker. Surveys and monitoring need to be done to track the status and trends of the species.

ROUNDTAIL CHUB (*Gila robusta*)

USFWS: Species of concern; Arizona: Special Concern; Mexico: Rare; Tonto NF: Sensitive.

Description.--A moderately streamlined member of the minnow family (Cyprinidae), the roundtail chub has a slender caudal peduncle and a deeply forked, relatively large caudal fin. Coloration of adults is silvery shading dorsally to dusky yellow or light green. Both sexes have orange-red coloration of the ventrolateral surface and on all fins except the dorsal. Both males and females possess breeding tubercles to a highly variable degree.

Distribution.--Roundtail chub is widespread in moderate to large rivers of the Colorado River basin. In Arizona, it still occurs in the mainstem and tributaries to the Verde and Salt rivers, although populations have declined considerably during the past few decades.

On Tonto NF, it occurs in the Verde and Salt rivers and many of their larger tributaries.

Habitat.--Roundtail chub occupy cool to warmwater, mid-elevation streams and rivers where typical adult microhabitat consists of pools to eight feet deep adjacent to swifter riffles and runs. Cover is usually present and consists of large boulders, tree rootwads, submerged large trees and branches, undercut cliff walls, or deep water. Smaller chubs generally occupy shallower, low velocity water adjacent to overhead bank cover. Roundtail chub appear to be very selective in their choice of pools, as they are commonly found to congregate in certain pools, and are not found in similar, nearby pools. Spawning takes place over gravel substrate. Tolerated water temperatures range up to 80° F.

Food.--Young chubs feed on small insects, crustaceans and algal films, while older chubs move into moderate velocity pools and runs to feed on both terrestrial and aquatic insects along with filamentous algae. Large roundtail chubs take small fish, and even terrestrial animals such as lizards that fall into the water.

Reproduction and Growth.--Roundtail chub breed in early summer, often near beds of submergent vegetation or other kinds of cover such as fallen trees and brush, as spring runoff is subsiding. Fertilized eggs are randomly scattered over gravel substrate with no parental care. Individuals up to 20 inches in length and weighing 2 pounds may occur, but typically maximum size is between 10 and 16 inches.

Management Implications.--The type of habitat seemingly preferred by adult roundtail chub is rapidly disappearing from southwestern streams as the very large and old riparian trees are not being replaced. Maintenance of natural flow regimes and occasional flooding are apparently important to continued survival of local populations. Predation

by flathead catfish and smallmouth bass has been implicated in elimination of populations.

In certain areas, roundtail chubs constitute a significant game fish. Large adults readily take artificial and natural baits, and provide considerable sport on appropriately light fishing tackle.

SPIKEDACE (*Meda fulgida*)

USFWS: Threatened (1986), critical habitat (1999); Arizona: Special Concern; New Mexico: Endangered; USFS R3: Sensitive; AFS: Threatened; Tonto NF: Sensitive.

Description.--The spikedace is a sleek, stream-dwelling member of the minnow family (Cyprinidae), that seldom exceeds 3 inches in length. Its body is slender, almost spindle-shaped, and slightly compressed laterally. Scales are present only as small plates deeply embedded in the skin. There are two spinous rays at the leading edge of the dorsal fin, the first being obviously the strongest, sharp-pointed, and nearly as long as the second. The eyes and mouth are both large, the mouth is terminal and barbels are absent. There are seven rays in the dorsal fin, and usually nine in the anal fin. The caudal fin is deeply forked.

Coloration is bright silvery on the sides of the body, with vertically-elongated, black specks. The back is olive-gray to brownish, and usually is mottled with darker pigment. The underside is white. Males in breeding condition become brightly golden or brassy, especially on the head and at the fin bases.

Distribution.--The spikedace was common and locally abundant throughout the upper Gila River basin of Arizona and New Mexico. Its distribution was widespread in large and moderate-sized rivers and streams in Arizona, including the Gila, Salt, and Verde rivers and their major tributaries upstream of present day Phoenix, and the Agua Fria, San Pedro, and San Francisco river systems.

Spikedace now is restricted to less than six percent of the historic range. In Arizona it occurs in Aravaipa and Eagle creeks, and the Verde River upstream of Tapco.

It does not presently occur on Tonto NF, although Salt and Verde rivers and Tonto Creek are historical collection sites.

Habitat.--Adult spikedace occupy midwater habitats of runs, pools, and swirling eddies that are typically less than one foot deep with velocities of 1 to 2 feet per second. Adults often aggregate in shear zones along gravel-sand bars, quiet eddies on the downstream edge of riffles, and broad, shallow areas above gravel-sand bars. Larval spikedace most commonly occupy slow-velocity waters near stream margins over sand-dominated substrates.

In winter, spikedace appear to seek out protected areas, either cobble streambanks or slow-velocity areas in the lee of gravel bars. Spawning occurs in shallow sand and gravel-bottomed riffles. Physical cover in the form of instream or overhead objects does not appear to be a factor in the habitat requirements of the species.

Food.--The diet of spikedace is composed almost exclusively of aquatic insects, primarily mayfly nymphs and adults. Production of aquatic insects consumed by spikedace occurs mainly in riffle habitats, where the insects are dependent upon clean and

relatively stable conditions. Spikedace feed by picking off food items entrained in the stream drift.

Reproduction and Growth.--Breeding of spikedace is apparently initiated in April-June in response to a combination of declining stream discharge and increasing water temperatures. Gametes are presumably expelled into the water column. Ova are adhesive and demersal, and likely adhere to the substrate. Fecundity of individual females ranges from 90 to 150 ova of about 1/16-inch diameter. Younger females will spawn once and older females will spawn twice each year. No specific information on incubation times or size at hatching is available.

Spikedace average 1.6 inches in length at the end of the first year, and 2.5 inches at the end of the second year. Longevity typically is one to two years, although a few fish reach three or even four years. Maximum size is three inches.

Management Implications.--Distribution and abundance of spikedace has been severely reduced by habitat destruction due to damming, channel alteration and downcutting, riparian degradation, water diversion and groundwater pumping. Introduction and spread of exotic predatory and competitive fishes also contributed to its decline. Resource activities that affect water quality, such as removal of riparian vegetation, sedimentation, or control of water levels, can affect spikedace habitat quality, and should be avoided or corrected.

On Tonto National Forest, critical habitat includes 51 miles of stream in Verde River, Fossil, Tonto, Rye, and Greenback creeks.

RAZORBACK SUCKER (*Xyrauchen texanus*)

USFWS: Endangered (1991), critical habitat (1996); Arizona: Special Concern; USFWS R3: Sensitive; Mexico: Endangered; AFS: Endangered; Tonto NF: Sensitive.

Description.--Razorback sucker is one of the larger members of the sucker family (Catostomidae), reaching lengths to 24 inches and weights over 6 pounds. Adult fish are relatively robust. Its most noticeable feature is a sharp-edged keel that develops behind the head in adults. Coloration is dark olivaceous on the back and keel, fading to yellowish white on the abdomen. Males become dark brown to black on the back and develop a russet- to orange-colored lateral band and yellow belly. Coarse, sharp tubercles, whose function is hold the female during the spawning act, develop on the anal, caudal, and pelvic fins, and on the caudal peduncle. Females that have spawned repeatedly may be scarred and abraded from contacts with males and with rocky bottoms.

Distribution.--The razorback sucker was once abundant throughout the Colorado River basin, primarily in the mainstem and major tributaries in the southwestern United States and northwestern Mexico. A significant commercial fishery for it existed in Saguaro Lake in 1949, but it has not appeared in collections since about that time. It disappeared from Roosevelt Lake just before the 1930's, but persisted in the Verde River basin, in Peck's Lake near Clarkdale, at least until 1954.

At present, the largest remaining population exists in Lake Mohave, and smaller populations exist in the Green River and the upper Colorado River subbasin. No significant recruitment to any population has been documented in recent years.

On Tonto NF, razorback sucker have been stocked into the Verde and Salt rivers, and several of their larger tributaries.

Habitat.--Information on habitat of razorback sucker is limited. Except for spawning migrations, razorback suckers are fairly sedentary, moving relatively few miles over several months. They tend to occupy strong, uniform currents over sandy bottoms, eddies and backwaters lateral to the river channels, and sometimes concentrating in deep places near cut banks or fallen trees. During spawning season, razorback suckers are found in runs with coarse sand, gravel, and cobble substrate, flooded bottomlands, gravel pits, and large eddies formed by flooded mouths of tributary streams and drainage ditches. In the Green River during non-breeding season, the fish are found in depths of 2 to 11 feet over sand or silt substrates, with water velocities of 0.3 to 2.0 feet per second. During summer months use shifts to relatively shallow waters off mid-channel sandbars.

Habitat needs of young and juvenile razorback suckers in the wild are largely unknown because they are rarely encountered by researchers. Larval razorback suckers in Lake Mohave remain near shore after hatching but either disappear or migrate to depths in excess of 50 feet within a few weeks. Juveniles are most often collected from irrigation canals in Arizona and California. Substantial numbers of razorback suckers were reared through the juvenile and adult stages in hatcheries and in isolated ponds.

Food.--Diet of razorback sucker consists of midge larvae, planktonic crustaceans, diatoms, filamentous algae, and detritus. Razorbacks feed mostly from the bottom, but have elongated, "fuzzy" gillrakers and subterminal mouth both characteristic of planktonic or detrital feeding habits.

Reproduction and Growth.--Both sexes mature as early as Age-4. Spawning occurs from late winter to early summer along shorelines or in bays at water depths of 1 to 20 feet and water temperatures of 52 to 68° F over sand and gravel substrates.

No nest is built nor is parental care given. Each female produces about 75,000 to 144,000 eggs, which drift to the bottom and hatch there. Larvae and juveniles suffer very high mortality from predation, particularly from introduced species.

After their seventh year of life, annual growth is less than 0.4 inches per year. Longevity is upwards of 50 years.

A remnant population of large adults in Lake Mohave spawns from late January through April over gravelly bottoms in relatively shallow water. Despite successful reproduction, there has been no evidence for successful recruitment of young fish into the population for more than two decades. Most individuals in the Lake Mohave population are over 40 years old.

Management Implications.--Since 1910, 15 dams have been constructed on the lower Colorado River and its major tributaries, the Gila, Verde, and Salt rivers. These dams dewatered, cooled, or impounded most of the lower basin system so that little natural riverine habitat exists today. Thus, the few remaining unaltered rivers (e.g., upper Verde and Salt rivers and their tributaries) are vital to the continued existence of razorback sucker.

About 40 non-native species are established in the Colorado River, and more will probably be introduced in the future. Alteration of historic flow regimes and construction of reservoirs has created favorable conditions for these fishes, many of which are major predators on razorback sucker.

Many millions of hatchery-produced larval razorback suckers were stocked into the mainstem and tributaries of the Salt, Verde, Gila and lower Colorado rivers during the past decade. Recaptures from these stocking efforts were scarce, and current stocking is of larger individuals. Monitoring is difficult given the large reintroduction area and its geography. There are indications that populations are being established in isolated habitats and in the uppermost reservoirs of the drainages being stocked. Individuals to 18 inches have been captured in the Verde River and Horseshoe Reservoir, and in Fossil Creek.

Razorback suckers have successfully reproduced in isolated backwaters where predators were not present; growth to 8 inches was recorded before predators invaded the site. It appears that survival of razorback sucker is largely dependent on its reestablishment in areas where predators are absent and individuals can grow to adult size.

On Tonto National Forest, critical habitat includes all of the Verde River north of Horseshoe Dam.

LOACH MINNOW (*Tiaroga cobitus*)

USFWS: Threatened (1986), critical habitat (1999); Arizona: Special Concern; New Mexico: Endangered; USFS R3: Sensitive; Mexico: Endangered; AFS: Threatened; Tonto NF: Sensitive.

Description.--Loach minnow is a stream-dwelling member of the minnow family (Cyprinidae). Its body is elongated, little compressed, and flattened ventrally, and seldom exceeds three inches in length. The mouth is small, terminal, and highly oblique; there are no barbels. The eyes are markedly upward directed. Coloration of the body is an olivaceous background, highly blotched with darker pigment. Whitish spots are present at the origin and insertion of the dorsal fin, and dorsal and ventral portions of the caudal fin base. Breeding males have bright red-orange coloration at the bases of the paired fins and on the adjacent body, on the base of the caudal lobe, about the mouth, near the upper portion of the gill openings, and often on the abdomen. Females in breeding become yellowish on the fins and lower body.

Distribution.--Loach minnow was once locally common throughout much of the Gila River system, including mainstem and tributaries of the Verde, Salt, San Pedro, San Francisco and Gila rivers, and the East, Middle and West forks of the upper Gila River up to about 7,200 feet elevation. Its present range of occurrence represents about 15% of the former range, and includes the upper Gila River and its three forks, the San Francisco River and Aravaipa Creek.

Loach minnow does not currently occur on Tonto NF, and there are no historical records of occurrence.

Habitat.--Loach minnow inhabit turbulent, rocky riffles of mainstream rivers and tributaries up to about 7,200 feet elevation. It is restricted almost exclusively to a bottom-dwelling habit, swimming above the substrate for only brief moments as it darts from place to place. Adult loach minnow are typically found in water flowing 2 to 2.5 feet per second and 6 to 7 inches deep where they occupy the interstices of cobble-size substrate (these habitats occasionally have dense growths of filamentous algae). Larval and juvenile loach minnow are usually found in shallower, slower water over sand substrate.

Food.--Loach minnow are opportunistic, benthic insectivores, largely deriving their food supplies from among riffle-dwelling, larval mayflies, blackflies and midges. Loach minnow appear to actively seek their food among bottom substrates, rather than pursuing animals entrained in the stream drift.

Reproduction and Growth.--Spawning of loach minnow occurs in spring (March to June) when maximum daily water temperatures exceed 60° F. Adhesive eggs are deposited on the underside of flattened cobble-size rocks in the same riffles occupied by adults during the remainder of the year. The nest is guarded by the male, and possibly the female as well. Fecundity of individual females is 150 to 250 mature ova about 1/16-inch in diameter. Eggs incubate for five to six days. At hatching, larval loach minnow are less than 1/4-inch long. At one year, loach minnow are about 2.5 inches, and attain a maximum length of about three inches at two years. Longevity of most individuals is 15 to 24 months, although some may survive 36 months.

Management Implications.--Activities that affect water quality, such as removal of riparian cover, sedimentation, or control of water levels, can affect loach minnow habitat quality. Dams and reservoirs appear to eliminate loach minnow for many miles upstream and downstream. Spread of exotic predators, especially flathead catfish and channel catfish, can also directly reduce loach minnow populations. On Tonto National Forest, critical habitat includes 65 miles of stream in Verde River, and Fossil, Tonto, Rye, and Greenback creeks.

COLORADO PIKEMINNOW (*Ptychocheilus lucius*)

USFWS: Endangered (1967), critical habitat (1994); Arizona: Special Concern; New Mexico: Endangered; USFS R3: Sensitive; Mexico: Endangered; AFS: Endangered; Tonto NF: Sensitive

Description.--Colorado pikeminnow is one of the largest members of the minnow family (Cyprinidae), and was probably the top carnivore in the Colorado River system. Individuals approached a maximum length of 6 feet and a weight of 100 pounds. Its body is pike-like and somewhat compressed dorso-ventrally. The head is flattened and elongated, with a large, nearly horizontal mouth. The skin is leathery in texture.

Distribution.--At one time Colorado pikeminnow were common throughout the Colorado River basin, and were an important source of food for the native Americans who lived along the lower Colorado and Gila rivers. Until about 1911, the species was so abundant that hundreds of pikeminnow were pitchforked out of irrigation ditches onto the banks for use as fertilizer. Commercial fishermen operated in the lower Salt River until about 1910, catching pikeminnow to sell in adjacent towns. The last pikeminnow taken in the Gila River system was captured at Roosevelt in 1937.

It is now found in small numbers only in limited portions of the upper Colorado basin in Colorado, Utah, and New Mexico. It now occupies only about 25 percent of its former range.

On Tonto NF, it has been extensively stocked into the Salt and Verde rivers.

Habitat.--Colorado pikeminnow is characterized as a "big river" generalist species, occurring in turbid, deep, and strongly flowing water. However, small individuals occupy shallow backwater areas with little or no current and silt/sand substrates. During

flood periods, adults move out of the river channels and occupy flooded bottom lands where they may feed on terrestrial animals.

Food.--Juveniles feed primarily on insects and crustaceans, while individuals over 8 inches feed principally on fish.

Reproduction and Growth.--Spawning occurs from early July through about mid-August, and coincides with rising water temperature and decreasing flow. Eggs are broadcast over gravel and cobble substrates in riffles or rapids. Survival and percentage hatch is highest at 68°F. After hatching, the larvae drift downstream, until they reach a size where they can move into shoreline areas consisting of embayments, backwaters and isolated backwater pools.

Management Implications.--The near extinction of this species is due to a combination of factors, the most significant being those associated with water development projects that have altered stream morphology, flow patterns, temperatures, water chemistry, and silt loads of most major streams throughout the Colorado basin. Access to many spawning areas is prevented by barrier dams.

Since 1985, extensive reintroductions of hatchery-raised Colorado pikeminnow have been made into the Salt and Verde river systems. Reintroduction sites on Tonto and Prescott NF's include the Salt River from Roosevelt Dam to Hiway 60 bridge, and from Horseshoe Reservoir to Perkinsville on the Verde River. Pikeminnow populations in these areas are designated "experimental-nonessential".

GILA TROUT (*Oncorhynchus gilae*)

USFWS: Endangered (1967); Arizona: Special Concern; New Mexico: Endangered; USFS R3: Sensitive; AFS: Threatened; Tonto NF: Sensitive.

Description.--Gila trout are distinguishable from other trouts by the presence of mustard- to watery-yellow slash marks on either side of the lower jaw. Their general body coloration is deep golden-yellow below the lateral line, to silvery-yellow or with a golden sheen and blue reflections dorsally. Parr marks are apparent on all but the largest individuals. The dorsal, anal, and pelvic fins are white-tipped. body spotting is mostly above the lateral line, and is extremely fine and profuse, extending onto the dorsal, adipose, and caudal fins.

Distribution.--Gila trout are native to the tributaries and main stem of the upper Gila River and a portion of the San Francisco river in New Mexico, and tributaries to the Verde River in Arizona. Their present distribution is restricted to relict and reestablished populations in the Gila, San Francisco, and Mimbres river drainages in New Mexico, and Dude Creek in the Verde River drainage in Arizona.

Habitat.--Gila trout occur in small headwater streams where water temperatures seldom exceed 70° F. Stream gradients are often 2% or greater, and stream morphology is a consequence of valley topography. Pools are usually formed by boulders, rootwads, or large, down trees. Riffles are gravel-dominated and generally free from sand or finer particles. Stream banks are stable and usually vegetated with a diverse array of riparian grasses, shrubs and trees. Hiding and resting cover for Gila trout is provided by boulders, deep pools, and large rootwads and trees.

Food.--Like many salmonids, Gila trout are opportunistic carnivores, consuming a large

variety of aquatic and terrestrial insects entrained in the stream drift. Gila trout feed during the day, with peak feeding occurring before noon.

Reproduction and Growth.--Spawning occurs in the spring when water temperature exceeds about 45° F, and stream flow recedes. Spawning begins in early April at the lowest elevations, and continues through June at the highest elevations. Fish select spawning sites (redds) based on substrate and depth of water. Redds are constructed in 3 to 6" deep water in substrates of small pebbles (1.5") or finer material, and range in size from 2.5 to 4.5 ft². Fecundity of females ranges from 75 to 150 eggs of about 3/16" diameter. Fry emerge from the redds about 8 to 10 weeks later at length of 0.6 to 0.8".

At the end of their first year, Gila trout are 3 to 4" in length, and at the end of the second year may approach 6". Growth is strongly influenced by abundance or density of fish in the stream, and there is considerable variation in growth rates between streams and even between years. Maximum size of Gila trout in currently occupied habitat is 10 to 11", although individuals over 13" have been found.

Management Implications.--Gila trout were replaced in most of their native range by introduction of nonnative predatory and competitive fishes, specifically brown rainbow trouts. Management activities that affect riparian conditions have also contributed to their decline. Current distribution of Gila trout in tiny headwater streams makes them highly vulnerable to catastrophic events, such as wildfire or floods that can eliminate entire populations.

Recovery efforts for Gila trout include monitoring of native and reintroduced populations, reestablishment in selected streams, and hatchery propagation.

Recovery Status.--Gila trout will be recommended for downlisting to Threatened status when all of the native lineages are considered secure, and all are replicated within the native range.

GILA TOPMINNOW (*Poeciliopsis occidentalis occidentalis*)

USFWS: Endangered (1967); Arizona: Special Concern; USFS R3: Sensitive; Mexico: Threatened; AFS: Special Concern; Tonto NF: Sensitive.

Description.--Gila topminnow is a small member of the livebearer family, Poeciliidae. Males seldom exceed one inch in length and females two inches. Coloration is tan to olive on the body and usually white on the belly. Scales on the dorsum are darkly outlined, and the fin rays are outlined with melanophores, although lacking in dark spots. Breeding males are impressively blackened. Gonopodium of male reaches past snout when in copulatory position. Gila topminnow is similar in appearance to western mosquitofish (*Gambusia affinis*).

Distribution.--Gila topminnow was historically widespread and abundant in the Gila River drainage. It was described as "one of the commonest fish in the southern part of the Colorado River drainage..." in the early 1940's, and was found throughout the Gila River system up to about 4,500 feet elevation. Today Gila topminnow is eliminated from all riverine habitats and remains in only eight natural sites (two on public lands) and in a varying number of transplanted sites. Gila topminnow were reported from the Salt River at Roosevelt, and in Tonto Creek in 1904.

It currently exists at seven sites on Tonto NF (Table 1).

Habitat.--Habitat requirements of Gila topminnow are fairly broad; it prefers shallow, warm and fairly quiet waters, but can adjust to a rather wide range, living in quiet to moderate currents, depths to three feet, and water temperatures from constant 80° F springs to streams fluctuating from 43-99° F. The species lives in a wide variety of water types; springs, cienegas, marshes, permanent or interrupted streams, and formerly along the edges of large rivers. Preferred habitat contains dense mats of algae and debris, usually along stream margins or below riffles, with sandy substrates sometimes covered with organic mud and debris.

Gila topminnow also live in a fairly wide range of water chemistries, with recorded pH's from 6.6 to 8.9, dissolved oxygen readings from 2.2 to 11 ppm, and salinities from tap water to sea water.

Food.--Gila topminnow food habits are generalized and include bottom debris, vegetative materials, amphipod crustaceans and insect larvae, including mosquitoes.

Reproduction and Growth.--The mode of reproduction in Gila topminnow is internal fertilization of the eggs with internal development of the young. The young are born alive. Onset of breeding and brood size are affected by water temperature, photoperiod, food availability, and predation. In constant warm temperature springs, breeding takes place year-round, whereas in fluctuating habitats, breeding occurs from April to August. Brood size varies from 1 to 20 young, and two broods are carried simultaneously by the female, one much further developed than the other. Gestation period is 24 to 28 days. Topminnow life span is approximately one year.

Reasons for Decline.--Along with much of the native southwestern fish fauna, range and abundance of Gila topminnow have been declining since the late 1800's. Damming and diversion of streams, channelization and arroyo-cutting, and groundwater pumping have altered the natural aquatic ecosystem to such an extent that little habitat is left for the species. The Gila River system now contains only a small fraction of its pre-1860 aquatic habitat. Large streams that used to be stable and had extensive lagoons, marshes and backwaters, and springs and cienegas on the smaller tributaries, are now intermittent, deeply cut, broad sandy washes subject to severe flooding. The loss of aquatic habitats due to human activity dramatically reduced the amount of habitat available for Gila topminnow, however it persisted and was abundant through the 1930's.

Since the introduction of common carp in 1878, more than 60 nonnative fishes have been imported into Arizona for various purposes. Most of these nonnatives inhabited the faster, deeper mainstream waters and newly constructed reservoirs, and had little effect on Gila topminnow. But in 1926, western mosquitofish was introduced into Arizona from the southeastern United States, and has since spread rapidly throughout the southwest. Western mosquitofish occupies the same habitat as Gila topminnow, thus it came into direct contact with Gila topminnow, and its aggressive, predatory nature led to sudden declines in the populations of Gila topminnow.

Western mosquitofish directly prey on juvenile Gila topminnow, and harass and bite the fins of the adults, which often results in infection and death of the individual. Because both species are livebearers, there is no competition for spawning sites. Food habits of the two species are different with Gila topminnow mainly browsing on detritus and vegetation, and the mosquitofish feeding mainly on invertebrates and small fish.

The role of western mosquitofish in the decline of Gila topminnow has been well-

documented, which in many cases has been very rapid. Several flourishing populations of Gila topminnow were completely eliminated within two years after introduction of western mosquitofish. In general, the two species do not coexist, particularly in habitats that are not subject to flooding, or where habitat complexity is low.

When the habitat is sufficiently large and complex, the two species can apparently maintain some segregation and coexistence can occur, in some instances, over a long period of time. The mechanism by which the balance between them is maintained in these particular instances is poorly understood, but appears related to periodic flooding, habitat complexity, the presence of springhead refuges, and perhaps water chemistry. In Sonoita Creek and upper Santa Cruz River, coexisting topminnow and mosquitofish tended to segregate, with mosquitofish in quieter water and topminnow occupying moderate currents associated with shore, logs, or debris.

Management Implications.--The threat to survival of Gila topminnow from habitat destruction and nonnative fish continues. Much of the original range of the Gila topminnow was irretrievably lost due to damming and diversion of water, and other habitat losses. The spread of western mosquitofish has continued unchecked since introduction of the species to Arizona in 1926. What little suitable habitat remains today is usually occupied by western mosquitofish, which precludes survival of Gila topminnow.

Protection of native populations is paramount in preventing extinction of Gila topminnow. Management activities that affected water quality, quantity, or riparian conditions caused local disappearance of populations. Resource uses, such as grazing, mining, irrigation, timber, recreation, roads and public access can be hazardous to the existence of Gila topminnow populations and their habitats. Conflicting opinions by resource managers on the effects of such uses on aquatic habitats often hinder protection of the species. Full consideration of the effects of land uses on the habitat at occupied sites is necessary to ensure continued vitality of the populations. In addition, all efforts must be made to protect natural sites from invasion by western mosquitofish.

A secondary effort involves expanding the number of occupied sites in order to buffer the effects of continuing loss of populations. Transplants of Gila topminnow were done in 1964 and 1975 in attempts to establish new populations of this depleted native fish. Fifty-six sites, including four on Tonto NF, were stocked during this period. In 1981, the Forest Service, Arizona Game and Fish Department (AGFD), and U. S. Fish and Wildlife Service entered into a Memorandum of Understanding (MOU) for the purpose of enhancing the recovery of Gila topminnow by reintroducing it into ponds, springs, and streams within the historic range. The agencies agreed that downlisting of the species would be initiated when 20 populations had survived over at least a three-year period, and delisting could be initiated when 30 populations had survived for at least five years. Since 1982, 136 sites on State, private and Federal lands in southern Arizona have been stocked with Gila topminnow, with the majority of stockings occurring in 1982.

Potential reintroduction sites were chosen based on a habitat capability profile developed for Gila topminnow. Parameters of the profile included cover, food availability, and water depth, temperature, quality, and velocity. Ponds and stock tanks, spring streams, and perennial and intermittent streams were considered the most viable sites for reintroduction. In 1982, Gila topminnow were stocked into 40 sites on Tonto

NF, and in 1983, an additional 15 sites were stocked. Other than two sites on private land inholdings stocked in 1985, no other reintroductions have since been made on the Forest.

The fate of the reintroduced populations has been modest (Table 2). Most sites disappeared due to desiccation, but flooding, invasion by western mosquitofish, dredging of the site, or vandalism also caused loss of populations. Although the criteria for downlisting of the species was briefly met during 1987 and 1989, the number of sites persisting longer than three years dwindled to 19 by 1991, including 11 on the Tonto NF. During 1992, an additional three populations on the Tonto NF failed. To date, populations at seven sites on the Tonto NF remain extant. The long-term persistence of populations at these sites justifies extraordinary efforts to ensure their continued survival, particularly at sites that are dependent upon constructed improvements.

In spite of the poor reintroduction record, efforts to establish Gila topminnow in additional sites, or reestablish in sites that failed for correctable reasons, need to be renewed. Monitoring by AGFD during the past decade has provided valuable information and considerable insight into the suitability of sites for supporting Gila topminnow. Site selection during the 1980's emphasized constructed improvements, such as stock tanks or drinkers, for reintroduction. A decade of experience has shown that these types of waters typically cannot be depended upon to sustain perennial water. In addition, the presence of an endangered species has conflicted with maintenance requirements at some sites and has required exceptional efforts by resource managers and permittees.

Future efforts need to concentrate on sites that have natural sources of water (e.g., springs or streams), and sites that will not require continual maintenance or management attention. Several waters on Tonto NF have been identified or suggested as having potential for reintroduction of Gila topminnow. Analysis of these sites, and others, needs to be done to determine their potential for sustaining a population of Gila topminnow. Activities that will be permitted at each site need to be agreed upon by the agencies prior to stocking.

Table 1. Location of sites on Tonto National Forest stocked with Gila topminnow and year of stocking.

Site Name	Twn	Rng	Sec	Year Stocked
Artesian Well #3	6N	11E	8	1982
Artesian Well #4	6N	11E	8	1982
Blue Mountain Spring	6N	6E	19	1982
Bronco Canyon Spring Tank	7N	5E	28	1983
Buckhorn Spring	4N	11E	27	1982
Camp Creek	7N	5E	35	1964
Campaign Creek	2N	12E	12	1983
Cave Creek	7N	5E	5	1964
Chalky Butte Well Tank	3N	16E	35	1982

Site Name	Twn	Rng	Sec	Year Stocked
Charlesbois Spring ¹	1N	10E	5	1983
Cherry Creek @ Ellison Ranch	5N	15E	5	1985
Corner Artesian	6N	11E	20	1982
Cottonwood Artesian	5N	13E	34	1982
Cottonwood Spring	3N	12E	5	1982
Dutchman Grave Spring ¹	9N	7E	16	1983
Fig Spring	7N	7E	28	1982
Fish Creek	2N	10E	10	1964
Frog Spring	9N	6E	7	1982
Grapevine Spring	3N	15E	12	1982
Happy Camp Spring	1S	12E	28	1982
Hidden Water Spring ¹	3N	9E	21	1976 ²
Horse Creek	8N	6E	1	1982
Indian Spring	3N	10E	24	1982
Kayler Spring ¹	7N	10E	14	1982
Lime Canyon Spring	8N	5E	23	1982
Little Nob Well	3N	16E	35	1982
McCann Spring Tank	5N	7E	26	1982
Mesquite Flat Trough	6N	10E	34	1982
Mesquite Spring Tank	5N	8E	31	1982
Mesquite Tank #1	1N	11E	26	1983
Mesquite Tank #2	2N	9E	1	1982
Mud Spring Tank	9.5N	5E	20	1983
Mud Springs ¹	5N	8E	26	1982
Packard Spring	6N	10E	17	1982
Pilot Tank	1S	11E	36	1983
Red Creek	9.5N	5E	24	1983
Reed Spring	8N	10E	34	1982
Rock Creek, 3-Bar "C"	4N	11E		1976
Rock Spring #1	5N	7E	23	1982
Rock Springs #2	3N	16E	12	1983
Rock Tank Spring	7N	4E	35	1983
Salt River @ Horseshoe Bend	3N	15E	2	1985
Seven Springs	7N	5E	9	1964 ²
Shute Spring	3N	15E	19	1976

Site Name	Twn	Rng	Sec	Year Stocked
Springfed tank #078	5N	13E	31	1982
Sycamore Creek	9N	7E	29	1975
Sycamore Creek	9N	6E	25	1976
Sycamore Spring	3N	15E	24	1982
Thicket Spring	10N	5E	35	1983
TT Spring	9.5N	5E	25	1982
Tucker Box	5N	13E	20	1982
Two Mile Spring	9N	6E	28	1983
Unnamed (TT) Spring	9.5N	5E	24	1982
Unnamed drainage #68 ¹	2N	9E	1	1982
Unnamed spring #0	6N	9E	21	1982
Unnamed spring #1	6N	9E	21	1982
Unnamed spring #3	4N	11E	2	1982
Unnamed spring #4	5N	7E	24	1982
Unnamed spring #5	9.5N	5E	32	1983
Unnamed spring #6	10N	5E	34	1982
Unnamed spring #7	7N	10E	4	1983
Unnamed spring tank #498	5N	10E	2	1982
Unnamed springfed tank	6N	9E	21	1982
Upper Horrell Spring	2N	12E	12	1983
Walnut Spring ¹	6N	8E	3	1982
White Rock Spring	9N	5E	12	1982
Zigzag Spring	9.5N	5E	25	1976

¹Population still present in 1999.

²Multiple stockings.

Table 2. Synopsis of all reintroductions of Gila topminnow on Tonto National Forest through 1997.

Introductions	Year	# Sites	Number of sites persisting through:						
			1983	1985	1987	1989	1991	1992	1997
	1964	4	2	2	2	2	2	1	0
	1976	5	1	1	1	1	1	1	1

1982	40	24	17	12	9	6	4	4
1983	15		5	5	5	2	2	2
1985	2			0	0	0	0	0
Total	66	27	25	20	17	11	8	7

DESERT PUFFISH (*Cyprinodon macularius*)

USFWS: Endangered with critical habitat (1996); Arizona: Special Concern; USFS R3: Sensitive; Mexico: Endangered; AFS: Endangered; Tonto NF: Sensitive.

Description.--Desert pupfish is a member of the Cyprinodontidae family, a group that also includes killifish. Life span in the wild varies from one to three years. Long-lived individuals may reach a length of three inches, but most do not exceed two inches. Mature males in breeding condition are brightly colored; the body is iridescent light-to-sky blue, and the tail fin yellow or orange. Females and juveniles are silvery with narrow, vertical dark bars.

Distribution.--Desert pupfish once was widespread and abundant in southern Arizona, southeastern California, northern Baja California, and Sonora. Its habitat in the lower Gila and Colorado river drainages comprised a wide diversity of waters that consisted of the margins of the larger lakes and rivers, desert springs, marshes, and tributary streams including the Salt, San Pedro, and Santa Cruz rivers. Currently no natural populations of desert pupfish occur in Arizona (Quitobaquito pupfish (*C. eremus*, formerly *C. m. eremus*) occurs on Organ Pipe Cactus National Monument). In California, several populations persist in tributaries to the Salton Sea, and in Mexico pupfish exist along the Colorado river delta and in other nearby wetlands. Several transplanted populations are on private and public lands in Arizona and California, including one at Boyce Thompson Arboretum near Superior.

It does not currently occur on Tonto NF.

Habitat.--Desert pupfish occupied a diversity of habitats ranging from cienegas and springs to small streams and margins of larger bodies of water. Most habitats were shallow and had soft substrates and clear water. Abundance of aquatic vegetation and invertebrates probably varied seasonally, with lowest levels associated with harshest conditions. Pupfish can survive in water temperatures to 112° F, dissolved oxygen concentrations as low as 0.1 milligrams per liter, and salinities twice that of sea water. Pupfish typically occupy water shallower than that inhabited by adults of most other species.

Food.--Wild fish consume whatever variety of algae, plants, suitably-sized invertebrates, and detritus is available. Adult foods include ostracods, copepods, and other crustaceans and insects, pile worms, molluscs, and bits of aquatic macrophytes torn from available tissues. They have been reported to eat their own eggs and young. Pupfish will actively excavate pits in soft substrates in search of food, and will defend these pits when occupied. Foraging is typically a daytime activity, and fish may move in response to daily warming from shallower water during morning to feed in deeper places later in the day.

Reproduction and Growth.--Desert pupfish may become sexually mature as early as

six weeks old and 0.6 inches in length, however, most do not breed until their second summer. Male pupfish are highly aggressive and pugnacious during the breeding season when they establish, actively patrol, and defend individual territories. Breeding territories are usually in water less than three feet deep and associated with a small structure or incongruity on the substrate. Territories are typically one to two square yards of bottom, depending on their individual size, density of other male pupfish, and water temperature. Adult females swim in loose schools and forage inconspicuously until ready to spawn, when she is attracted by a territorial male and leaves the school. Females may lay 50 to 800 eggs during a season, which are randomly deposited within the male territory. There is no direct parental care. Eggs hatch in about 10 days at 68° F.

Growth rate is dependent upon age, habitat and environmental conditions, and population density. Lengths of two inches are attained by the end of the first growing season. Maximum length of three inches may be attained by the second summer. Life span in the wild appears highly variable, from less than a year for some populations and up to two years for others. Predation by aquatic insects, piscivorous birds, and mammals is a source of mortality. Nonnative predacious fishes introduced into pupfish habitats have severely reduced, and in some cases, eliminated populations of pupfish.

Reasons for Decline.--Habitat loss due to water diversion and damming, domestic livestock grazing, mining, road construction, pollution, and interactions with nonnative species has resulted in almost complete extirpation of the species from its historic range. The Colorado and Gila river systems now contain only a small fraction of their pre-1860 aquatic habitat. Large streams that use to be stable and had extensive lagoons, marshes and backwaters, and springs and cienegas on the smaller tributaries, are now intermittent, deeply cut, broad sandy washes subject to severe flooding. Pupfish do not fare well in the presence of non-native fishes and incursions by exotics have typically resulted in decline or extirpation of pupfish. Non-native fishes that occupy habitats also used by pupfish (e.g., western mosquitofish, sailfin molly, largemouth bass, and juvenile cichlids) have proven most destructive to populations of native species. Primary mechanisms of replacement include predation and aggression, and behavioral activities that interfere with reproduction.

Management Implications.--Nearly all of the original range of desert pupfish has been irretrievably lost due to channelizing, damming, and diversion of water. The ecosystem that once supported innumerable numbers of pupfish no longer exists, save for a few isolated streams, springs, and wetlands. The continued existence of desert pupfish in the wild will depend on the efforts of humans to sustain them in habitats that meet their ecological needs. Artificial transplantation into suitable habitats, and continued maintenance of those habitats will be required. Even then, the fragmentation of a species that once was interconnected across many hundreds of stream miles may result in genetic drift and loss of viability of the population.

WOUNDFIN (*Plagopterus argentissimus*)

USFWS: Endangered (1970); Arizona: Special Concern; USFS R3: Sensitive; AFS: Endangered; Tonto NF: Sensitive.

Description.—The woundfin is a streamlined silvery minnow with a flat head and a conspicuous, sharp dorsal spine, from which the common name is derived. A well-

developed barbel hangs from the upper lip. Characteristic of many fishes inhabiting swift, shallow, sand-bottomed streams, it has expansive sickle-shaped fins, barbels on the lips, reduced eyes, and extensive sensory buds on the lower part of the head and along the leading pectoral fin-rays. It is essentially scaleless.

Distribution.—Woundfin likely occurred in larger streams throughout the lower Colorado River basin. Specimens were taken from near the confluence of the Salt and Verde rivers, to the mouth of the Gila at Yuma, and thence upstream into the Virgin River. It is entirely probable that the species occurred further upstream on the Verde, Salt, and Gila rivers.

Currently it is restricted to the Virgin River in Arizona, Nevada, and Utah. Attempts to increase its range have included transplanting into the Hassayampa, Pariah, and Salt rivers, and Sycamore Creek in the Agua Fria drainage. None have been successful.

It does not currently occur on Tonto NF.

Habitat.—Woundfin are a riverine species most often found adjacent to riffles in runs and quiet waters over sand or sand/gravel substrates; they cannot tolerate reservoir conditions. They apparently prefer areas of shifting sand substrates that are mobilized by almost laminar currents. Preferred depths range from 2 to 14 inches, but disturbed fish move rapidly to deeper areas. They apparently are mainstream dwellers, seldom ascending creeks much beyond the floodplain of the larger river. They tolerate higher salinities than most fishes in their native habitat.

Food.—Woundfin are omnivorous and opportunistic. They feed on aquatic insect larvae, filamentous algae and to a lesser extent, terrestrial insects and amphipods.

Reproduction and Growth.—Most spawning occurs during April-May when water temperatures are between 58 and 86°F. Females congregate in pools, then move into flowing water where males wait to spawn. Areas used for spawning may be less than 2 feet wide and no more than an inch deep. Eggs are strewn randomly, and no care is provided eggs or young.

Woundfin rarely achieve lengths greater than 3.5 inches, and few individuals live longer than two years. Young reach about 2 inches in August.

Reasons for Decline.—This species is in jeopardy due to extreme stress caused by alterations in its ecosystem. Nonnative fishes have brought disease and parasites, and they compete for food and space and prey on young of woundfin. Extremes of water flow and degraded quality contributed to loss of range. Dams and diverting of water from streambeds, and groundwater pumping have caused many areas formerly capable of supporting the species to desiccate. Other land uses that result in a decrease in the amount of surface water have also contributed to their decline.

Management Implications.—All of the habitat formerly available in the mainstem Colorado, Gila, Salt, and Verde rivers is now unavailable for woundfin. A few tributary streams that retain relatively natural hydrographs and habitats that possess or are capable of recovery of functional riparian conditions may provide suitable sites for transplants. Habitat in Tonto Creek has been identified as suitable for woundfin. Any population established there would be considered as “experimental-nonessential” under the Endangered Species Act.

BONYTAIL (*Gila elegans*)

USFWS: Endangered (1980), critical habitat (1994); Arizona: Special Concern; USFS R3: Sensitive; Mexico: Endangered; AFS: Endangered; Tonto NF: Sensitive.

Description.—The long and slender caudal peduncle (area between anal and tail fins) of adults is the most distinctive feature of bonytail. The body is very streamlined, the skull is concave. The adult has a predorsal hump and is partially scaled. The mouth is terminal.

Distribution.—Originally found in the main stem of the Colorado River and some of its tributaries as far north as Wyoming, bonytail now persists in unknown numbers in some mainstem reservoirs (Mohave and Havasu) of the Colorado River, and maintains an apparently declining population in the Colorado River upstream from the Grand Canyon. Locally, the species was collected from the Gila River near San Carlos, and in the Salt River at Tempe and at the confluence of the Verde River. This species is extinct in the Gila River system.

It does not currently occur on Tonto NF.

Habitat.—Bonytail are considered a main stem river fish, but live much of their time in backwaters and eddies rather than fight the strong current. They are able to survive in lakes and ponds, including lakes Mohave and Havasu. They apparently prefer waters with high levels of total dissolved solids (TDS), avoiding less than 560 and more than 6,600 ppm TDS.

Food.—Individuals over 8 inches long feed on terrestrial and aquatic insects, plant debris, filamentous algae, and plankton. They also eat small fishes. Smaller individuals feed on midge and mayfly nymphs.

Reproduction and Growth.—Bonytail generally grow to 10 to 15 inches total length, and rarely achieve lengths up to 24 inches. Maximum age is not known, but specimens 7 years old have been recorded. They spawn in the spring at water temperatures between 64 and 70°F, over gravel bars. The fertilized eggs are strewn at random and adhere to rocks or settle in crevices; nor care is given eggs or young. Maturity is at 2 or 3 years. Bonytail are readily cultured where they may also spawn in ponds.

Reasons for Decline.—Loss or severe degradation of riverine habitat are primary reasons bonytail have declined. As with other big river fishes, their highly specialized adaptation to the harsh and unusual habitats of southwestern rivers is best demonstrated by the fact that when that environment changed, they decreased from being a common species to one of the rarest. **Management Implications.**—Loss of habitat, combined with introduction of a host of nonnative predacious fishes, has made much of their original range uninhabitable today. It is unlikely that bonytail will survive in the wild indefinitely. Establishment of refuges consisting of ponds free of nonnative species is probably their best hope for continued existence.

HEADWATER CHUB (*Gila nigra*)

Tonto NF: Sensitive

Description.—Formerly recognized as a subspecies (*G. r. grahami*) of roundtail chub, it was recently raised to specific status, and renamed the headwater chub. It differs from roundtail chub in the number of rays in the dorsal and anal fins, and number of scales in

the lateral line. Its coloration is dark, as opposed to the silvery color of roundtail chub.

Distribution.—Headwater chub is restricted to the Gila River basin, in middle to headwater reaches of middle-sized streams.

Locally it is in Tonto Creek and tributaries, East Verde River, Fossil Creek, and other tributaries to the Verde River.

Habitat.—It prefers pools associated with cover such as deep places near obstructions, large pools, or undercut banks in middle-size streams.

Food.—Principle food items of chubs in Fossil Creek consisted of larval insects, Ostracods and plant material. Based on the seasonal variation in macroinvertebrate species consumed, headwater chubs are apparently opportunistic feeders on whatever insects are available in the water column. Fry feed on diatoms and filamentous algae.

Reproduction and Growth.—Spawning occurs in the spring, late March to April. Fertilized eggs are broadcast over sandy-rocky substrates in pool-riffle areas, no parental care is provided either eggs or larvae. After hatching, fry inhabit water along the streambanks and shallow backwaters where they use macrophytes for protection. Headwater chubs can grow to 8.5 inches total length by their 3rd year, and older individuals can achieve lengths of 13 inches or more.

Reasons for Decline.—Habitat degradation and introduction of nonnative predacious fishes have reduced certainly abundance and perhaps range of the species.

Management Implications.—Efforts to restore functional conditions in riparian and aquatic areas and reduce or eliminate nonnative fishes in occupied habitats should be encouraged. Restoration of native fisheries in these relatively small streams is an achievable goal.

FLANNELMOUTH SUCKER (*Catostomus latipinnis*)

Tonto NF: Sensitive.

Description.—The common name is derived from the very large, fleshy lobes on the lower lips. Coloration of adults on the back and upper sides is greenish or bluish-grey, and deep yellow to orange-red on the sides. The dorsal fin is large and sickle-shaped.

Distribution.—Historically, flannelmouth suckers occurred in the Colorado River and larger, strongly-flowing tributaries from Wyoming south to Mexico. In the upper basin, their range much the same as historically. Locally they were taken in the Gila River at Tempe and upstream, the Salt River above Roosevelt Reservoir, and in the Gila River near San Carlos. Today their numbers are much reduced or absent in the lower basin and are considered rare in central Arizona. It is considered extirpated from the Gila River system.

It does not currently occur on Tonto NF.

Habitat.—They do poorly in reservoirs, but have apparently adapted to the changed habitat in today's upper Colorado River basin. They are most at home in medium to large, strongly flowing rivers, easily navigating the swift waters of the Colorado River. Young are found in shallow riffles and eddies while adults abound in deep riffles and runs. Pools inhabited may be 6 to 150 feet wide with little or no vegetation and are generally murky; depths are 3 to 20 feet. The bottom is gravel, rocks, sand, or mud.

Food.—Flannelmouth suckers feed extensively on algae and other plants, and on bottom invertebrates. Adults do not appear to be especially selective of food items.

Reproduction and Growth.—Like many suckers, they run upstream a short distance in the spring to spawn. Spawning takes place when water temperatures reach about 50° F. Spawning occurs over gravel bars where the adhesive, demersal eggs are fertilized and sink to the bottom, where they adhere to substrate, or drift between crevices. No care is given eggs or young. Maturity is at age 4 or 5 years. Individuals reach lengths of 21 inches (occasionally over 30 inches), and live an average of 10 years.

Reasons for Decline.—Although flannelmouth sucker have not suffered as severe adversity from environmental changes in southwestern rivers as have other large river fishes, they have been impacted. Larvae and young are preyed upon heavily by predators, and spawning, rearing, and feeding sites have been adversely impacted by habitat degradation and water manipulations.

Management Implications.—Changes that have occurred to the historic habitat in the lower basin are essentially irreversible (dams, water diversion, water temperature regimes, nonnative species, etc.), thus habitat recovery for the species on a local basis is probably precluded.

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Tonto TES Reptiles and Amphibians

Prepared by Cheryl Carrothers 6/19/00

Chiricahua Leopard Frog

Rana chiricahuensis

Proposed

This frog inhabits streams with deep, rock-bound pools, but may also occur in springs and stock tanks that support aquatic or herbaceous vegetation. A variety of available stream depths, with shoreline vegetation and steep or undercut banks are optimal. Aquatic habitat for this species may be found among oak and pine forests, grasslands, and deserts of central and southeastern Arizona. Leopard frogs require relatively permanent water for reproduction.

Data sources: The Arizona Game and Fish Department, Nongame Branch has surveyed the majority of potential habitats for this and other species on the Tonto National Forest, beginning in 1991. Although many areas within the Forest are considered within the historic range for this species, Chiricahua leopard frogs have been documented from only the Payson and Pleasant Valley Ranger Districts. This species was proposed for listing as a Threatened Species by the USFWS on June 14, 2000.

Analysis of Effects: There is currently much concern over the population status of native ranid frogs in the southwest. Clarkson and Rorabaugh (1989) made the first systematic investigation of the status of southwestern leopard frogs when they surveyed for four species of native leopard frogs at historical sites from 1983-1987. They concluded that all leopard frog populations examined were declining. Bullfrogs, crayfish, tiger salamanders, and exotic fishes all contribute to major negative effects on native populations of leopard frogs. Additional threats include population fragmentation and habitat destruction.

Lowland Leopard Frog

Rana yavapaiensis

Found in desert scrub, grassland, and pine/oak woodland habitat types of central and extreme northwestern Arizona. Based on records in the AGFD database, this species occurs between 480 and 5960 feet in elevation. In general, *R. chiricahuensis* occurs above 3500 feet and *R. yavapaiensis* occurs below 3500 feet on the Tonto. This frog is generally restricted to permanent waters with aquatic and herbaceous vegetation.

Data sources: Sredl et al. have conducted Forest wide amphibian and aquatic reptile species annually since 1991. Sredl (1997) commented that the lowland leopard frog is the most stable native ranid in Arizona, and its status in central Arizona seems good. Tonto National Forest personnel and other AGFD personnel have conducted additional, site-specific surveys. Surveys were conducted according to accepted protocols for potential species. Locations have been documented from Bloody Basin, Cave Creek, the Verde River, Sycamore Creek west of Sugarloaf Mountain, Mazatzal Mountain creeks, tributaries from the Sierra Anchas, and many more.

Analysis of Effects: There is currently much concern over the population status of native ranid frogs in the southwest. Clarkson and Rorabaugh (1989) made the first systematic investigation of the status of southwestern leopard frogs when they surveyed for four species of native leopard frogs at historical sites from 1983-1987. They concluded that all leopard frog populations examined were declining. Bullfrogs, crayfish, tiger salamanders, and exotic fishes all contribute to major negative effects on native populations of leopard frogs. Populations of lowland leopard frogs may be especially susceptible to events such as sever floods and droughts. The events may destroy or alter habitats so that recolonization may take several years.

Arizona Southwestern Toad *Bufo microscaphus microscaphus*

Occurs from eastern to west central Arizona in association with permanent pools, rocky streams and canyons, appearing to select for shallow water flowing over sandy or rocky bottoms. Found in close proximity to unaltered, late seral riparian areas within desert grasslands, pinyon-juniper, pine-oak and ponderosa pine communities south of the Mogollon Rim (2,000-6,000 feet elevation). Does not depend upon spring or summer rains to stimulate reproduction (maybe a function of preference for perennial waters).

Data sources: The Nongame branch of the Arizona Game and Fish Department has conducted surveys for herp species on the Tonto since 1991. This species has been documented as occurring on the Globe, Payson, and Pleasant Valley Ranger Districts and is expected to occur on the Cave Creek District as well.

Analysis of Effects: Observations of Southwestern toads have been documented from Pinto Creek, Cave Creek, within and south of Cherry Creek, from within Spring Creek, from one unnamed tank within the vicinity of Crouch Creek, Webber Creek, Tonto Creek, and from the East Verde River NE of Payson.

Sonoran Desert Tortoise *Gopherus agassizii*

A completely terrestrial desert species, requiring firm, but not hard ground for construction of burrows; adequate ground moisture, and herbs, grass or cacti for food. This species occurs across much of southwestern Arizona's Sonoran desert, principally in rocky foothills and less often on lower bajadas and in semi desert grassland. Creosote bush is often present in its habitat.

Data sources: Significant survey effort has been expended in the search for individuals and sign across the Forest. Many locations have been documented below 4,000 feet elevation.

Analysis of Effects: Populations in the Phoenix and Tucson areas are declining. Major threats are habitat degradation, habitat fragmentation from urban development, and genetic contamination by escaped captives. There is no evidence of declines of non-urban Sonoran desert populations.

Arizona Night Lizard

Xantusia vigilis arizonae

The Arizona night lizard occurs locally along the southern edge of the Colorado Plateau. This metapopulation is found on granite boulders and is morphologically adapted to surviving within the available crevice habitats. They have longer, broader heads, relatively long limbs and toes and a bold color pattern (Bezy 1988).

Data sources: Bureau of Land Management personnel conducted herp surveys on the edge of known ranges for various species. A range extension for this species was documented by the BLM during this time, extending known locations from Hualapai Mountains southeast to the vicinity of Superior and Globe/Miami.

Analysis of Effects: Sedentary, slow growing, with a diet of plant and insect matter, variable activity periods, leaving cover of boulders primarily at night, and bear live young. Activities, which may alter or isolate rocky outcrops, would likely affect this species.

Maricopa Leafnose Snake

Phyllorhynchus browni lucidus

This snake inhabits upland rocky or sandy desert dominated desertscrub grown to mesquite, saltbush, creosote bush, paloverde and saguaro. Tonto National Forest lands between Phoenix to Superior at elevations between 1,000 and 3,000 feet, represent the northern known range of this species.

Data sources: BISON and HDMS provided most current locality information. One occurrence at Bush Highway at the Salt River from 1973. Usually found only by patrolling desert roads at night. They are most active after summer rains begin, especially on humid nights.

Analysis of Effects: This species is a nocturnal burrower using relatively coarse, rocky soils, as well as in sand, reported to prey primarily on lizards and their eggs.

Mexican Garter Snake

Thamnophis eques megalops

This aquatic snake is associated with permanent streams, marshes, rich springs, and headwaters at low to intermediate elevations (3,000 to up to 6,200 feet). Shallow, slow-moving, and at least partially vegetated bodies of water generally characterize stream situations frequented by this species. Habitat associations of riparian locations in which this species has been found include: pine and oak woodlands, mesquite grasslands, with occurrences of cottonwood and willow species. Known to occur from central and southeast Arizona with locations documented in the Verde and upper Gila River drainages.

Data sources: The Nongame branch of the Arizona Game and Fish Department has conducted surveys for herp species on the Tonto since 1991. Tonto National Forest personnel and other AGFD personnel have conducted additional, site-specific surveys. Surveys were conducted according to accepted protocols for potential species. Locations from Verde River near Horseshoe Lake, and more north near Houston Creek confluence, Sycamore Creek west of Sugarloaf

Mountain and near Juniper Spring in the Sierra Anchas, primarily the Cave Creek and Tonto Basin Ranger Districts, with potential on the Mesa Ranger District.

Analysis of Effects: Specific habitat impacts that have occurred to threaten this species are dewatering, over-grazing, modification of stream morphology, and increased siltation. The introduction of exotic species such as the bullfrog and crayfish, has probably adversely affected the Mexican garter snake through increased competition for food and predation on the young. Prey items for the Mexican garter snake have been known to include leopard frogs, toads, tadpoles, and various native fishes.

Narrow-headed Garter Snake *Thamnophis rufipunctatus*
rufipunctatus

This is a highly aquatic species of garter snake, and it is restricted to montane and immediately adjacent regions at intermediate elevations (3,000-8,000 feet), from central Arizona into New Mexico and Mexico. This snake typically inhabits clear, cool, rocky streams, frequently basking along the shore. When disturbed, it tends to slide into the water and dives to the bottom to hide. The narrow-headed garter snake is rather habitat specific, generally occurring, in Arizona, only in the shallow, swift-flowing, rocky rivers and streams with headwaters along the Mogollon Rim.

Data sources: The Nongame branch of the Arizona Game and Fish Department has conducted regular herp surveys on the Tonto since 1991. Observations have been documented from the Salt and East Verde Rivers, Tonto, Haigler, Christopher and Canyon Creeks within the Globe, Payson and Pleasant Valley Ranger Districts.

Analysis of Effects: Specific habitat impacts that have occurred to threaten this species are grazing and overall stream degradation. The introduction of exotic species such as non-native fish, bullfrogs and crayfish, has probably adversely affected the narrow-headed garter snake through increased competition for food and predation on the young.

Gila Monster *Heloderma suspectum*

These large lizards are found primarily in Sonoran Desert and extreme western edge of Mohave Desert, less frequently in desert-grassland and rarely in oak woodland to about 4,100 feet elevation. They are most common in wetter, rocky paloverde-saguaro desert scrub foothills, bajadas and canyons than in the drier, sandier creosote bush-burr sage association locales, seeming to avoid open flats and agricultural areas. This species is diurnal, but typically resides below ground, preying primarily on small mammals and the eggs of birds and reptiles. They rarely need to actively search for food above ground due to their low metabolic rates, their ability to eat large meals at one setting, and their capacity to store fat within their tail and throughout their bodies.

Data sources: BISON and HDMS provided most current locality information. Rare observations of Gila monsters above 5,000 feet, one near Fishermen's Point

access along the Chamberlain Trail and another within Town of Payson limits, near the south end of town.

Analysis of Effects: Physical damage to Gila monster habitat has become common and widespread in Arizona. This habitat degradation is believed to be associated with reptile collecting for commercial trade.

Info:

Crayfish *Oronectes virilis*

Bullfrog *Rana catesbeiana*

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Tonto TES Birds

Prepared by Debbie Lutch, 6/26/00

Bald Eagle (*Haliaeetus leucocephalus*) - Endangered

Bald eagles occur in Arizona as either breeding populations or winter migrants. Arizona bald eagles occur at elevations between 460 and 7,390 feet. Nests occur in tall trees, cliff faces, ledges, and pinnacles near open water for foraging. Perches for shelter, roosting, foraging and guarding are important habitat components. Their diet is comprised mainly of fish, with small mammals, carrion, birds and reptiles eaten to a lesser extent (AGFD 1997). Known to occur in the central and northern portion of the state. Resident nesting occurs along Tonto Creek, the Salt River and the Verde Rivers on the Tonto National Forest.

Data Sources. As of 1996, there were a total of 17 breeding areas on the Tonto National Forest. The Volunteer "Nestwatch" program was initiated on the Forest in 1978 to monitor eagle-nesting activity and has continued annually ever since. Data collected by Nestwatchers and other surveys are compiled and published annually by the Arizona Game and Fish Department. The Fish and Wildlife Service is currently considering delisting the Bald Eagle (6/26/00).

Analysis of Effects. Threats to the bald eagle include ingestion of lead-poisoned waterfowl, timber harvest, degradation of winter roosts, shooting, disturbance at nests, loss of perches (especially snags), and loss of riparian aquatic habitats essential to foraging and nesting (AGFD 1988). On the Tonto, threats have been primarily a loss of trees (mature cottonwoods) and the lack of long-term replacement of these trees due to scouring floods and livestock grazing; and disturbance and interaction with humans (Tonto National Forest Biological Assessment 1996)

Southwestern Willow Flycatcher (*Empidonax traillii extimus*) - Endangered

The southwestern willow flycatcher is a small *Empidonax* flycatcher and can only be positively identified in the field by its unique song. It is a Neotropical migrant that breeds in the southwestern United States and winters in Mexico, and Central America. It is an insectivore, feeding within and above dense riparian vegetation. It is found in riparian habitats along perennial drainages where dense growth of willows, tamarisk, and other shrubs and medium-sized trees are present with a scattered overstory of cottonwoods. Foraging occurs throughout this habitat. The flycatcher nests in thickets of trees and shrubs approximately 12-24 feet tall, with a high percentage of canopy cover and large volume of foliage. This species is known to occur in the central and southern portions of Arizona.

Data Sources. Critical habitat has been designated on the Tonto National Forest on the Verde River upstream from Horseshoe Reservoir. Occupied habitat occurs on Tonto Creek and the Salt River near Roosevelt Lake in the central portion of Forest. Flycatchers have been confirmed at Ister Flat on the Verde River near

Horseshoe Reservoir, but breeding has not yet been confirmed at this location. Sources of information to use for determining habitat potential and suitability for the flycatcher include *Procedure for Identification and Designation of Southwestern Willow Flycatcher Habitat on the Tonto National Forest* (Lutch and Ross 2000) and *Southwestern Willow Flycatcher Habitat Fluvial Characteristics* (Loomis, et. al. 2000), both of which are based on the *Region 3 Guidance Criteria for Determining Effects of Issuing Term Grazing Permits on Threatened, Endangered or Species Proposed for Listing* (8/25/99) and a similar one for the BLM (2/9/99). A Recovery Team is working on a Recovery Plan for the species.

Analysis of Effects. Southwestern willow flycatchers are hosts for brown-headed cowbird (*Molothrus ater*) parasitism throughout their range. Parasitism rates range from 10-50% and parasitism is documented to be a major threat to the species; however, extensive loss and destruction of riparian habitat is considered the primary threat.

Mexican Spotted Owl (*Strix occidentalis lucida*) - Threatened

Mexican spotted owls nest and roost primarily in closed-canopy forests or rocky canyons. Forests used for roosting and nesting often contain mature or old growth stands with complex structure. These forests are typically uneven-aged, multistoried, and have high canopy closure. Mexican spotted owls do not build nests, but use naturally occurring sites, often in large diameter trees, cliff cavities and abandoned hawk or raven nests. Spotted owl prey mainly on small mammals, particularly arboreal or semi arboreal species, although birds, insects, reptiles and other types of small mammals are taken as well. Prey species composition varies with cover type. Spotted owls are known to occur along the Mogollon Rim and the sky-island mountains of the Tonto.

Data Sources. Spotted Owls are known to occur in Arizona, New Mexico, southern Utah, and portions of Colorado and in Mexico. Approximately 70 Protected Activity Centers (PACs) occur on the Tonto National Forest, with most occurrences along the face of the Mogollon Rim and in sky island mountain ranges like the Pinals and the Sierra Anchas. A Recovery Plan was published in December 1995. Six Recovery Units were identified in the Plan to allow for specific recovery strategies for each area. Two Recovery Units overlap the Tonto, including Upper Gila Mountain and Basin and Range West. The Mexican Spotted Owl is also included in *Region 3 Guidance Criteria for Determining Effects of Issuing Term Grazing Permits on Threatened, Endangered or Species Proposed for Listing* (8/25/99).

Analysis of Effects. The primary threats cited for the owl in most Recovery Units include large-scale catastrophic wildfire and timber harvest. Potential threats also include recreation, overgrazing, fuelwood harvest, road development and mining.

Cactus Ferruginous Pygmy Owl (*Glaucidium brasilianum cactorum*) - Endangered

The pygmy owl nests in cavities in trees or large columnar cacti. Cavities may be naturally formed or excavated by woodpeckers. In central and southern Arizona, the

pygmy owl's primary habitats historically were riparian cottonwood forests, mesquite-cottonwood woodlands and mesquite bosques. The riparian habitats provide the large trees and large cacti for nests and roosts. Riparian areas are also known for their high density and diversity of animal species that constitute the pygmy owl's prey base. Currently, the pygmy owl is most frequently found in Sonoran desertscrub associations that are comprised of paloverde, ironwood, mesquite, acacia, bursage and columnar cacti (saguaro or organpipe).

Data Sources. Historical records indicate that the pygmy owl was once common throughout much of the southern half of Arizona. The species was generally associated with the Gila, Salt, Verde, San Pedro, and Santa Cruz rivers and their tributaries. The northernmost record was from New River, Arizona, approximately 34 miles north of Phoenix. The pygmy owl has declined throughout Arizona to the degree that it is virtually extirpated from the State. Surveys conducted in 1992 and 1993 found only three single pygmy owls each year. All were in extreme southern Arizona in the general vicinity of Tucson. Critical Habitat has been designated for the pygmy owl, a portion of which overlaps the Tonto National Forest on the Mesa Ranger District. There is as yet no Recovery Plan for the species. Primary sources of information on this species include *Region 3 Guidance Criteria for Determining Effects of Issuing Term Grazing Permits on Threatened, Endangered or Species Proposed for Listing* (8/25/99), *Survey on the Tonto National Forest for the Cactus Ferruginous Pygmy Owl* (Johnson and Haight 1998) and *Cactus Ferruginous Pygmy Owl Survey Protocol* (revised 1/00). Major knowledgeable individuals on this species include Dave Kreuper from the BLM, Tom Skinner from the Coronado National Forest and Bill Burger from Region VI of the Arizona Game and Fish Department.

Analysis of Effects. The cactus ferruginous pygmy owl is threatened primarily by past, present, and potential future destruction and modification of its habitat, throughout a significant portion of its range in the U.S. This is because their known distribution in southern Arizona is in areas which have suffered considerable degradation, destruction and modification attributed to urban and agricultural encroachment, wood cutting, water diversion, channelization, livestock overgrazing, groundwater pumping, and hydrological changes resulting from various land-use practices. Initially, cutting of mesquite for fuelwood probably resulted in the greatest impact to habitat. Later, changes in the hydrologic regime that resulted from urban and agricultural water uses, likely became the major impact to suitable habitat. Improper livestock grazing practices have likely been a continuing contributing factor in habitat degradation (USDA 1998).

Yuma Clapper Rail (*Rallus longirostris yumanensis*) - Endangered

The clapper rail breeds in freshwater marshes in the United States as well as brackish marshes of Mexico. It probably winters in salt or brackish waters in Mexico. Preferred habitat is mature cattail-bulrush stands in shallow water near high ground. A mat of dead vegetation is an important habitat component. Relatively large areas of emergent

vegetation are used more frequently than smaller areas. They arrive on their breeding grounds in early to mid April. Clapper Rails have been described as selective, opportunistic or limited in their diet depending upon habitat type. Their main food along the Colorado River appears to be crayfish. Other foods include small fish, clams, insects and small seeds.

Data Sources. The Yuma clapper rail was listed as Endangered in 1967 and the Recovery Plan was approved in 1983. No critical habitat has been designated. The historical range of the Yuma Clapper Rail included the marshes of the lower Colorado River and its tributaries in Mexico and the United States. It is possible that the rails may not have originally occupied the Colorado, but expanded their range northward with the creation of suitable marsh habitat associated with dam development on the Colorado system. The current range in Arizona is along the Colorado River from Topock Marsh to the Mexican border. It has also been found on the Gila and Salt Rivers, upstream to the area of the Verde confluence and at Picacho Reservoir. Populations exist on the Colorado River delta in Mexico and the Salton Sea in California. The only portion of the current or historical range on the Tonto is located on the Salt River below Stuart Mountain Dam, at Granite Reef Campground. There is also an unconfirmed sighting from 1991 on the Verde River, northeast of Box Bar, near Rio Verde. The majority of clapper rails, estimated in 1976 at more than 1700 breeding birds, are distributed from the Colorado River Delta in Mexico north to Topock Marsh, Arizona, west to marshes along the Salton Sea, California, and east along the Gila River to Tacna, Arizona. The primary source of information for this abstract came from the *Biological Assessment for the Tonto National Forest Land Management Plan* (3/96).

Analysis of Effects. The primary threat to the species is habitat destruction, primarily due to stream channelization and drying and flooding of marshes.

Peregrine Falcon (*Falco peregrinus anatum*) – Sensitive (previously an Endangered Species, recently delisted)

In the southwest region, peregrines persist mainly on mountain cliffs and river gorges. Eyries exist on dominant cliffs that generally exceed 200 feet in height; nests are usually situated on open ledges. Peregrines formerly nested in nearly all of the region's plant communities. Prey abundance and diversity provided by these situations is probably a major factor in eyrie selection. Nest sites are often adjacent to water courses and impoundments because of the abundance of avian prey. Peregrines may travel up to 17 miles from nesting cliffs to hunting areas. Preferred hunting habitats include cropland, meadows, river bottoms, marshes, and lakes. Prey species may include, but are not limited to, blackbirds, jays, doves, shorebirds, and smaller songbirds. As of 1993, breeding was documented at more than 180 sites in Arizona.

Data Sources. Extensive surveys have been conducted by the Arizona Game and Fish Department on the Tonto National Forest over the last 10-15 years. In particular, habitats associated with the Sierra Ancha Mountains were determined

to have prime habitat for peregrines. Confirmed locations for the peregrine on the Tonto include sites along the Mogollon Rim, in the Sierra Ancha Mountains, and the Mazatzal Mountains. A Recovery Plan was approved in 1984. In a Draft Addendum to the Recovery Plan, the Fish and Wildlife Service recommended delisting of the southwestern regional population because the recovery goals outlined in the 1984 Plan have been met.

Analysis of Effects. Previous peregrine population declines coincided with the increasing use of DDT, but other limiting factors included availability of cliffs and prey that can limit distribution or numbers of breeding falcons, competition for nesting cliffs with other raptors, and possible predation to eggs and young.

Common Black Hawk (*Buteogallus anthracinus*) – Sensitive

The black hawk is associated with aquatic systems throughout its range. Year-round nesting and foraging habitat occurs in association with perennial systems characterized by mature riparian gallery forests, with cottonwoods and willows and/or sycamores dominating the overstory. Black-hawks typically forage within riparian drainages for reptiles, amphibians and small mammals associated with that forest cover type. They nest in large cottonwoods and sycamores and are known to occur in the major drainages (Gila, Salt, and Verde) in the central and southern part of the state.

Data Sources. Documented nests sites occur throughout the Tonto along perennial streams and occurrences are tracked in the Arizona Game and Fish HDMS. The Common Black hawk Conservation Assessment (Boal and Mannan 1996) was reviewed for current information on this species.

Analysis of Effects. The primary threat to the black hawk is the degradation and loss of riparian habitat which could occur as a result of livestock grazing, mineral extraction, water diversions, dams, agriculture, ground water pumping, and the invasion of exotic species such as salt cedar and water cress. Other possible threats include habitat changes and the use of pesticides in their winter range, declines in prey species populations, and disturbance to nesting black-hawks by recreationists (Boal and Mannan 1996). As stated in the Conservation Assessment for the species, the "common black- hawk is a riparian obligate species occupying the highest trophic level in many riparian areas. Management favoring common black-hawks should therefore improve overall riparian conditions.... special attention should be directed at tree regeneration and stream characteristics". Livestock grazing is mentioned specifically in the Assessment and recommendations include removal of livestock or the building of livestock enclosures to protect areas where tree regeneration is occurring naturally.

Northern Goshawk (*Accipiter gentilis*) – Sensitive

The goshawk is the largest North American member of the genus *Accipiter*, which includes both the sharp-shinned hawk and Cooper's hawk. The goshawk is a forest habitat generalist that uses a variety of forest types, forest ages, structural conditions and successional stages. It primarily occupies ponderosa pine, mixed-species, and spruce-fir

habitats in the southwest and prefers mature conifer stands with dense canopies for nesting. The goshawk preys on small- to medium-sized birds and mammals which it captures on the ground, in trees, or in the air. Foraging area preference is apparently determined by prey availability and opportunity.

Data Sources. Goshawk surveys have been conducted over much of the potential nesting habitat on the Forest. Eight confirmed territories have been documented on the Payson and Pleasant Valley Ranger Districts of the Tonto. Others have been suspected in the Pinals, Mt. Ord and other portions of the Sierra Anchas. There are specific Standards and Guidelines pertaining to the Goshawk in an amendment (1996) to the Tonto Land Management Plan, that are based on the *Management Recommendations for the Northern Goshawk in the Southwestern United States* (RM-217; Reynolds et. al. 1992).

Analysis of Effects. There is a concern that populations and reproduction of the goshawk are declining in the western United States. These declines may be associated with forest changes caused by timber harvesting, but fire suppression, livestock grazing, drought and toxic chemicals may also be involved (Reynolds et. al 1992).

Northern Gray Hawk (*Asturina nitida maxima*) - Sensitive

The Gray hawk is a small long-tailed, accipiter-like buteo. Their relatively short wings and long tail allow them to maneuver in dense cover in pursuit of prey. Prey species are mainly lizards, snakes, beetles, grasshoppers, rabbits, squirrels, mice, quail, doves, and fish. Gray hawks inhabit riparian areas in southern Arizona, typically where there is permanent running water. Primary riparian habitats consist of cottonwood, willow and sycamore groves in the San Pedro and Santa Cruz river drainages. They are known to inhabit mature woodlands of river valleys and nearby semiarid mesquite and scrub grasslands. They build a relatively small nest 20 to 40 feet high in a cottonwood, hackberry, or mesquite along a stream or river. The Arizona population is migratory, leaving by October and returning in late March or early April.

Data Sources. Northern gray hawks have recently been found on the Tonto National Forest on Cherry Creek and nesting on Pinal Creek (T. Corman, pers. com. 2/17/00). The Arizona Game and Fish Department Heritage Data Management System (HDMS) tracks this species and has an unconfirmed record of a nesting pair of gray hawks in Seven Springs Wash on the Cave Creek Ranger District in 1963. The primary sources of information for this abstract include *Forest and Rangeland Birds of the United States* (DeGraaf et. al. 1991), *A Peterson Field Guide to Hawks* (Clark 1987) and The Arizona Game and Fish Department Heritage Data Management System (last update 1995-01-19).

Analysis of Effects. Threats were not cited in the above-mentioned references, but it is likely that degradation of riparian habitats has been a cause for concern with this species.

Western Snowy Plover (*Charadrius alexandrinus nivosus*) - Sensitive

Snowy plovers breed along the Pacific Coast from southern Washington to Baja California and locally from southern Oregon, western Nevada, southwestern Montana, central Kansas, north-central Oklahoma, and north-central Texas; also along the Gulf Coast from Florida west to Texas. It forages on wet sands of beaches, at the surf line, or along muddy or alkaline shores of ponds and lakes inland. It prefers open habitats and avoids thick vegetation and narrow beaches backed by bluffs where it might get trapped by high water. Food is mostly small crustaceans, marine worms, other minute marine animals, beetles, flies and other insects.

Data Sources. The western subspecies is a confirmed migrant in Arizona (T. Corman pers. com 2/17/00), presumably at man-made reservoirs and possibly along large rivers. This species is not tracked in the Arizona Game and Fish Department Heritage Data Management System (HDMS) database. The primary sources of information for this abstract include *Forest and Rangeland Birds of the United States* (DeGraaf et. al. 1991) and *Peterson Field Guide to Hawks* (Clark 1987). The Fish and Wildlife Service's website was also checked for information.

Analysis of Effects. It is unclear to what extent management actions in non-coastal state may have on wintering populations of this species. The primary cause for this species' decline is a disturbance of nesting habitat, although a decline in wintering populations has been noted on the coast of California. Most analysis of effects for this species is centered on coastal populations.

Eared Trogon (*Euptilotis neoxenus*) - Sensitive

Trogans are short-billed long-tailed tropical species that occur mainly in extreme southern Arizona. They inhabit oak and pine-oak forests in mountain canyons and in sycamore, walnut, and cottonwood riparian habitats along streams. They build nests inside cavities of sycamores or cottonwoods, typically 12 – 40 feet above the ground. Cavities used for nest sites are either naturally formed or are excavated by woodpeckers. Trogans primarily feed on insects and fruit. Not to be confused with the more recognized elegant trogon, the eared trogon has a very different vocalization than the elegant and has a slate-colored bill, has no eye ring, does not have a white breast band, and their wide tail has a bluish cast. The eared trogon typically prefers the pine habitat of higher elevations and is less commonly seen than the elegant trogon in southeastern Arizona. The primary range of the eared trogon is the highlands of Chihuahua, Mexico, but it has been sited in the Huachucas and Chiricahua Mountains of Southern Arizona. Adults have also been documented in central Arizona in the Pinal Mountains, Chevelon Canyon on the Apache-Sitgreaves Forest, and at Christopher Creek on the Payson Ranger District of the Tonto. The only confirmed nesting attempt in Arizona is in Ramsey Canyon in southern Arizona.

Data Sources. Eared trogons have recently been documented on the Tonto National Forest as either singles or pairs. There have been confirmed records on the Tonto in the Pinal Mountains on the Globe Ranger District and in the Sierra Anchas at Parker Creek. A memo to Larry Widner from Carolyn Cox dated

February 6, 1996 details the reports at that time. All sightings at that time were of a single female at the confluence of Haunted Canyon and Pinto Creek. The bird was feeding on juniper berries and was inhabiting sycamore, juniper and alder. It is unlikely that the Pinals are being used for breeding by eared trogons (memo 2/6/96). A Birding Southeastern Arizona website (Gates 2000) was also checked for recent information on this species, as was the Arizona Game and Fish Department Heritage Data Management System (HDMS).

Analysis of Effects. Maintenance and restoration of riparian habitats should address some of the issues associated with habitat needs for this species.

Arizona Bell's Vireo (*Vireo bellii*) - Sensitive

This neotropical migrant breeds from southern California, southern Nevada, Arizona, New Mexico, north to the Midwest to North Dakota and east to Illinois and south to Tennessee, Arkansas, Louisiana, Texas and Mexico. It winters from Mexico south to Central America. The Bell's vireo is dependent on riparian habitats and occupies watercourses and marshes where mesquite is mixed with cottonwoods, willows, saltcedar, elderberry and desert hackberry. It nests in dense riparian shrubs, usually near water. Nests consist of a small, basketlike cup attached to a forked branch of mesquite, hackberry, catclaw, oak, willow, ash, cottonwood or low shrub, seldom more than 5 feet off the ground. Insects and spiders are the primary food source and are gleaned from leaves and branches. Berries are occasionally eaten. Bell's vireos are common cowbird hosts.

Data Sources. Arizona Partners in Flight Bird Conservation Plan (1999) was reviewed for current information on this species. Bell's vireos are not tracked by AGFD HDMS. This species is currently a management indicator species listed in the Tonto Plan (1985), as an indicator of a well-developed understory in low elevation (1500 - 3500 feet) riparian habitats (Tonto Plan, page 249). Some surveys were conducted in the late 1980's, primarily on the Cave Creek and Mesa Ranger Districts. Another source of information used for this abstract was *Forest and Rangeland Birds of the United States* (DeGraaf et. al. 1991).

Analysis of Effects. The primary threat to the Bell's vireo is assumed to be degradation and loss of riparian habitat which could occur as a result of livestock grazing, mineral extraction, water diversions, dams, agriculture, ground water pumping, and the invasion of exotic species such as salt cedar and water cress.

Western Yellow-billed Cuckoo (*Coccyzus americanus occidentalis*) - Sensitive

Currently, cuckoos breed in disjunct riparian habitats in the west. They winter in South America to Peru, Bolivia and Argentina. In Arizona, it is uncommon to fairly common breeder in riparian habitats, below the Mogollon Rim in the Colorado and Gila River drainages. These cuckoos feed entirely on large insects including grasshoppers, cicadas, katydids, and caterpillars. Occasionally berries and fruit may be taken. They typically nest on a horizontal branch 6-25 feet off the ground, mostly in willow or other

dense deciduous vegetation close to water. Yellow-billed cuckoos are not parasitic. They require a minimum of 25 acres of broadleaf forest at least 100 m wide (Gaines 1974) and at least 2.5 acres of dense nesting habitat per pair (Laymon and Halterman 1989). In Arizona, pairs are usually distributed every 0.5 miles in large blocks of contiguous habitat.

Data Sources. The Fish and Wildlife Service has been petitioned to list the Yellow-billed Cuckoo and has determined so far that listing may be warranted (2/7/00). They have initiated a status review of the species, with a deadline for comments on April 17, 2000. The Arizona Partners in Flight Bird Conservation Plan (1999) was also reviewed for current information on this species. Yellow-billed Cuckoos have been documented along the Verde River south of Bartlett reservoir, Verde River near Horseshoe reservoir, near Roosevelt Lake, Pinto Creek, Tonto Creek on the Tonto Basin Ranger District, and the Salt River near Blue Point on the Mesa Ranger District.

Analysis of Effects. There has been a drastic reduction in the breeding range of Western yellow-billed cuckoos within the past 60 years due to riparian habitat alteration or destruction (Laymon and Halterman 1987). Habitat loss is the primary reason for declines of this species, including land clearing for agriculture, overgrazing, fire, urbanization and flood control. Pesticide use, primarily on wintering grounds is suspected of causing thin eggshells.

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Prepared by Genevieve Masters 4/00

Allen's Big-eared Bat (*Idionycteris phyllotis*) - High Priority species; "at high risk of imperilment" (Western Bat Species Regional Priority Matrix (1998).

Life History

Idionycteris phyllotis are found in the mountainous regions of the southwestern United States through central Mexico, where they primarily dwell in caves and abandoned mine shafts within mountainous pine and oak forests. Its historic range includes Arizona, California, Colorado, New Mexico, Nevada, Utah and Mexico (Federal Register, 1994). It is an insectivorous bat, which feeds mostly by gleaning moths and stationary insects from surfaces. The availability of water holes is a significant factor in habitat selection due to their high rate of evaporative water loss. Males and females live in colonies of 5 to 28 individuals during the non-summer months. Males are solitary and females form maternity colonies during the summer months.

Idionycteris phyllotis generally occur at elevations ranging from 2,600 - 9,800 feet, but most specimens are at altitudes between 3,500 - 7,500 feet. Most *I. phyllotis* are observed two to three hours after sunset near water. Their flight is characterized by swift, direct movements during open flight and slow, highly maneuverable movements in close quarters. They are also capable of hovering. Nearly all capture sites have been in the vicinity of rocks, such as cliffs or large boulders, which are their most probable roosting sites. Its defining characters are its large ears (34 to 43 mm) which possess lappets projecting from the base of the ears and extending over the forehead.

Conservation History

1983: *Idionycteris phyllotis* was listed under the Natural Heritage Global Rank "G5" (G5 = Demonstrably Secure).

1994: *Idionycteris phyllotis* was listed in the Federal Register, November 15, 1994, as a Category 2 species for consideration to be listed as a threatened or endangered species.

1995: *Idionycteris phyllotis* was listed under the Natural Heritage Arizona State Rank "S2" ("S2"="Rare").

1996: The United States Fish and Wildlife Service changed listing status of "Federal Candidate" species. This classification formerly included three sub-classifications: Federal Candidate: Category 1, Category 2, and Category 3. There are no longer "Category" designations. This species was listed as a Federal Candidate Category 2 species. Species formerly designated Category 2 and 3 are no longer considered federal candidate species, and so no longer kept any Federal protection under the "Candidate" listing. However, such species may retain other federal or state designated protections (Federal Reg., Feb. 28, 1996).

1996: Former C2 species were reclassified as Federal "Species of Concern".

1996: *Idionycteris phyllotis* was listed by a New Mexico Natural Heritage Program list as “Tracked”; data were being actively accumulated and entered into computerized and manual files by the Heritage Program.

1997: *Idionycteris phyllotis* was listed under the Natural New Mexico State Rank “S2” (“S2”=“Imperiled”).

Data Sources

Records of capture exist across most of Arizona, but are not known from the southwestern deserts of Arizona. Most Arizona specimens have been taken from the southern Colorado Plateau, the Mogollon Rim and adjacent mountain ranges within ponderosa pine, pinyon-juniper, Mexican woodland and riparian areas of sycamores, cottonwoods and willows.

In 1992, a bat colony containing *Idionycteris phyllotis* was reported in the Sierra Anchas on the Tonto Basin Ranger District. This bat colony was still present in 1997. In 1993, one individual was netted in the Sierra Anchas on the Pleasant Valley Ranger District.

Threats/Analysis of Effects

Roost disturbance is the greatest threat to *I. Phyllotis*. Mining activities have caused the relocation or extermination of several bat roosts. Reproduction is shown to decrease after relocation, threatening the survival of the roost. Deforestation removes the feeding environment for the bats, as well as that of their insect prey.

References

4/11/00. The University of Michigan – Museum of Zoology – Animal Diversity Website, [http://animaldiversity.ummz.umich.edu/accounts/idionycteris/i._phyllotis\\$%narrative.html](http://animaldiversity.ummz.umich.edu/accounts/idionycteris/i._phyllotis$%narrative.html)

4/25/00. New Mexico Game and Fish – Biota Information System Of New Mexico (BISON), Allen’s Big-eared Bat (*Idionycteris phyllotis*) Species Account, version 1/2000.

Arizona Game and Fish Department. 1997. (*Idionycteris phyllotis*). Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, AZ. 3 pp.

D. F. Hoffmeister, Mammals of Arizona, University of Arizona Press, 1986.

California Leaf-nosed Bat (*Macrotus californicus*) – Wildlife of Special Concern in Arizona (AZ Game and Fish Dept. Draft 3/16/96), High Priority species; “at high risk of imperilment” (Western Bat Species Regional Priority Matrix (1998)).

Life History

California leaf-nosed bats range through southern California, southern Nevada, southwestern Arizona, and southward to the southern tip of Baja California (Mexico), northern Sinaloa (Mexico), and southwestern Chihuahua (Mexico). They tend to live in the same area year after year, and do not migrate. Its historic range does not include areas within New Mexico; however, this species is “accidental” in New Mexico. The California leaf-nosed bat is a year-round resident in desert scrub habitats of southern and western Arizona.

The California leaf-nosed bat is a rather large bat, with big ears and a “leaf” on the end of its nose. It is brown in color and its tail extends beyond the tail membrane. When captured and handled, this bat is reluctant to bite and does not make any sound that humans can hear.

The California leaf-nosed bat lives predominantly in Sonoran and Mohave Desert scrub habitats, but is occasionally found in the Chihuahuan and Great Basin deserts. During the day, this species roosts primarily in mines and caves. At night it may rest in open buildings, cellars, bridges, porches, and mines that offer overhead protection but which are open for adequate flight approach.

California leaf-nosed bats do not hibernate like many bats, nor do they migrate. Although they may move from one roost to another, they tend to live in the same area year after year and remain active year-round.

Mating takes place in the fall. During the winter, the embryo develops very slowly until March, then proceeds at normal rates. Females congregate in maternity colonies to give birth to one young during May and June. The young can fly and forage on their own after one month. The maximum life expectancy for this species is 15 years or more.

California leaf-nosed bats are most active shortly after sunset and about two hours before sunrise. They primarily eat insects, including grasshoppers, cicadas, beetles, dragonflies, sphinx moths, butterflies, and caterpillars. They tend to “glean” or take insects off the ground or from the vegetation instead of catching insects in flight. They can hover well and are very agile in flight, but cannot move on the ground well or crawl like many bats. It has been suggested that this species occasionally also eats cactus fruit.

Conservation History

1991: The species’ population trend was Unknown. Additional survey work would be required to determine the species current trends.

1991: *Macrotus californicus* was placed by November 21, 1991 Federal Register, in Category 2.

1994: *Macrotus californicus* was listed in the Federal Register, November 15, 1994, as a Category 2 species for consideration to be listed as a threatened or endangered species.

1995: *Macrotus californicus* was listed as a United States Forest Service Sensitive Species.

1995: *Macrotus californicus* was listed under the Natural Heritage Global Rank “G4” (“G4” = Apparently Secure”).

1995: *Macrotus californicus* occurred in Arizona, and was a State Candidate.

1995: *Macrotus californicus* was being “Tracked”; data were being actively accumulated and entered into computerized and manual files by the Heritage Program.

1995: *Macrotus californicus* was listed under the Natural Heritage Arizona State Rank “S3” (“S3”=“Uncommon or Restricted”).

1996: The United States Fish and Wildlife Service changed listing status of “Federal Candidate” species. This classification formerly included three sub-classifications: Federal Candidate: Category 1, Category 2, and Category 3. There are no longer “Category” designations. This species was listed as a Federal Candidate Category 2 species. Species formerly designated Category 2 and 3 are no longer considered federal candidate species, and so no longer kept any Federal protection under the “Candidate” listing. However, such species may retain other federal or state designated protections (Federal Reg., Feb. 28, 1996).

1996: Former C2 species were reclassified as Federal “Species of Concern”.

1996: *Macrotus californicus* was listed as an Arizona Species of Special Concern.

Data Sources

In 1916, a bat colony containing *Macrotus californicus* was reported within the Mazatzal Mountains on the Tonto Basin Ranger District. In 1960, two additional mines containing *Macrotus californicus* were reported within the Mazatzal Mountains on the Tonto Basin Ranger District. A bat colony containing *Macrotus californicus* was reported near Seven mile Wash on the Globe Ranger District. This bat colony was still present in 1986.

Threats/Analysis of Effects

Sustained exposure to ambient temperatures of less than 78 degrees may cause death. California leaf-nosed bats are quite susceptible to human disturbance, which can hinder reproduction or force individuals from a roost into the extreme daytime temperatures, especially during summer months. Loss of habitat due to sealing off of mine shafts and caves is also detrimental. The cause of concern for *Macrotus californicus* is apparently due to habitat loss, degradation, and/or fragmentation.

References

4/11/00. New Mexico Game and Fish – Biota Information System Of New Mexico (BISON), California Leaf-nosed Bat (*Macrotus californicus*) Species Account, version 1/2000.

Arizona Game and Fish Department. 1993. Arizona Wildlife Views, Bats of Arizona, Special Heritage Edition, p 6.

Desert Bighorn Sheep (*Ovis canadensis*) – Sensitive (on Regional Forester’s Sensitive Species List (7/21/99))

Life History

The lack of historic records makes it difficult to accurately assess the number of desert bighorn (*Ovis Canadensis mexicana* and *O. c. nelsoni*) that occurred in Arizona prior to European settlement. Certainly, this genus was at one time more widespread than it is today, both on a continental and statewide (Arizona) basis. It has been suggested that bighorn once occupied most of the mountain ranges in the West including such areas as North and South Dakota, Nebraska, and parts of Texas where they have been extirpated. In Arizona, bighorn sheep could be found in many mountain ranges and canyons of Arizona including the San Francisco Peaks, Verde Valley, Grand Canyon, and most desert ranges below the Mogollon Rim.

Desert bighorn prefer the precipitous, rocky desert ranges in Arizona. The mountains they occupy are of broken rock, scarred with numerous gullies. Vegetation is rarely thick or tall. Bighorn often use the highest ridges on such mountains as lookouts. In Arizona, the best habitat can be found between 3,000 and 4,000 feet elevation in the jojoba communities where the dominant grass between shrubs is galleta. Other suitable habitats are along washes or creek beds or near natural tanks. Desert bighorn prefer the leaves and fruits of mesquite, ironwood, palo verde, cat-claw, coffeeberry, bushmuhly, jojoba, brittlebush, and calliandra. They also feed on the dry leaves of three-awn, filaree, galleta, fluff grass, and others, and frequently scratch the ground to get at roots.

Data Sources

Transplanted populations exist north and south of Apache Lake, and within the Superstition Mountains on the Mesa Ranger District. There was a transplanted population near Lion Mountain on the Cave Creek Ranger District in the 1980’s that was unsuccessful due to predation (pers. comm. Don Pollock).

Threats/Analysis of Effects

Desert bighorn sheep numbers in Arizona declined during the early part of this century, reaching an estimated low of 2,500 in the 1950’s. Domestic cattle and sheep, along with wild horses and burros, competed with bighorns. Domestic stock also introduced diseases to bighorn populations. Although populations have increased as a result of intensive wildlife management efforts, many herds live in isolation, their habitat fragmented by highways, agricultural fields, mines, and other aspects of human encroachment. Isolation can negatively affect these herds by denying them access to important areas and inhibiting genetic exchange.

Activities that influence bighorn sheep numbers include disturbance from a wide variety of sources. These sources include but are not limited to: hunting and other recreational

use of habitat, poaching, habitat fragmentation and encroachment caused by roads, fences, mining, military based activities, industrial, agricultural, and residential development.

References

Arizona Game and Fish Department. 1999. Bighorn Sheep/Mountain Lion Research Project:

Management Protocols to Investigate the Cause of Declining Desert Bighorn Populations in the Goat Mountain-Stewart Mountain Complex. 13 pp.

Arizona Game and Fish Department. 1999. Arizona Wildlife Views, p. 6.

United States Fish and Wildlife Service. 2000. Desert Bighorn Sheep of Cabeza Prieta NWR website.

<http://ifw2irm2.irm1.r2.fws.gov/refuges/arizona/cabighrn.html>.

D. F. Hoffmeister, Mammals of Arizona, University of Arizona Press, 1986.

Southwestern River Otter (*Lutra Canadensis sonora*) – Sensitive (on Regional Forester’s Sensitive Species List (7/21/99), Wildlife of Special Concern in Arizona (AZ Game and Fish Dept. Draft 3/16/96)

Life History

Lutra canadensis is one of two North American species in this genus, and is the only species found in Arizona. Its total range consists of southwest and south-central Colorado, northern and central New Mexico, Arizona, southern Utah and Nevada and California along the Colorado River. Historically, it could be found in all of the major river systems within Arizona e.g., Gila, Salt, Verde, and Colorado. Suitable habitat includes all rivers and streams with adequate prey; prey includes fish, amphibians and arthropods.

River otters associate with permanent water sources, and are therefore known to use riparian habitat in New Mexico. Otter require permanent flowing water or ponds, overhanging bank vegetation, and haul-out sites suitable for leaving and entering water. These habitat traverse a variety of ecosystems ranging from semi-desert shrubland to sub-alpine forest. The species requires high quality water with low sediment loads with an abundant food base of fish or crustaceans. Minimum estimated water flows are 10 cubic feet per second. Other habitat features that may be important include the presence of ice-free reaches of stream in winter, water depth, stream width, and suitable access to shoreline.

Otters do not build their own den but may utilize or enlarge cavities in rock piles, vegetation, natural cavities, abandoned dens of other animals especially beaver. Dens may be up to one half mile from water. Beaver bank dens are particularly favored sites. Logjams, dense riparian vegetation, and snow and ice caves are also used. Less frequent

use was made of brush piles, talus, muskrat dens, undercut banks, and beaver lodges. Otters may move considerable distances over land when mating. The essential aspect of river otter habitat is the presence of wetlands. Wetlands and the fish (especially the native species) that inhabit them have been recognized as the most endangered components of the Southwest. About 17 different semi-aquatic situations have been cited as being used by otters in the Southwest. The bodies of water inhabited by otters range from man-made structures e.g., stock and hatchery ponds, reservoirs, spillways, and borrow ditches to permanent and intermittent bodies of water that are either lotic (flowing) or lentic (pooled). Rivers and streams are most often mentioned by authors as being river otter habitat. River otters use salt-water as well as fresh-water and brackish marshes in the Southwest. Beaver ponds are commonly used wetlands.

All studies to date, show that most movement of otters is along riparian corridors. Some movement has been documented between drainage systems even at high elevation. Terrestrial habitat adjacent to water is even more variable than mesic habitat. Most often it is the riparian zone or community that lies along rivers and streams that provides the necessary cover for otters to den, to rest, and to capture food. Plant cover can range in height from grasses, shrubs, desert succulents, and trees. In broad terms, swamps (in eastern Texas and southeastern Oklahoma), forests, shrublands, grasslands, and even deserts constitute types of terrestrial habitat adjacent to waters used by otters. Since the Southwestern Region is characterized by having a high amount of incident solar radiation and sporadic torrential rains, important features of the plants is in shading the nearby waters and to protect the soil from erosion. Specific plant species that occur at sites that otters visit include: native trees such as willow (*Salix* spp.), cottonwood (*Populus* spp.) alder (*Alnus* spp.), maples (*Acer* spp.), dogwood (*Cornus* spp.); wetland herbaceous plants such as bulrush (*Scirpus* spp.), cattail (*Typha* spp.), and grasses (*Gramineae*). Upland plant species that occur adjacent to wetlands visited by otters are quite variable. Sub-alpine fir (*Abies lasiocarpa*), sagebrush (*Artemisia* spp.), catclaw (*Acacia greggii*), golden rabbitbrush (*Chrysothamnus nauseosus*), and grasses are just a few species that may be found in these situations in the Southwest. In the Sonoran Desert, even barrel cacti (*Ferocactus acanthodes*) and Saguaro cacti (*Cereus giganteus*) are found in well-drained sites above riparian zones.

Data Sources

Evidence suggests that a few populations persisted at least into the 1960's and likely to the present. Unconfirmed reports continued to be received from several localities, but extensive surveys conducted in the late 1980's in several key areas had been unproductive. A Louisiana subspecies (*L. c. lataxina*) was successfully introduced into central Arizona during 1981-1983 and may eventually cause genetic swamping of the native form, if any still exist.

In 1971, a specimen was collected from Cherry Creek, 15 miles north of the confluence with the Salt River on the Pleasant Valley Ranger District.

Threats/Analysis of Effects

Although apparently never abundant, populations have declined in historic times to very rare at present. Riparian alteration would affect existing populations and dispersion from nearby occupied locations. Channelization, bank-armoring, marshland draining and other kinds of habitat destruction were major factors in the population declines.

Overhanging riparian vegetation is important to otter habitat. Low pH in polluted waters has been noted to preclude otter habitation. Otters have demonstrated an inability to live near humans due to associated environmental disturbances.

Historically, river otters inhabited aquatic ecosystems throughout the United States and Canada, but they have been extirpated or reduced in many areas due to human encroachment, habitat destruction, and over-harvest.

Surface mining, and oil and gas development may seriously impact otter populations through effects on water quality, habitat suitability, and prey availability. Disturbance and pollution from a large number of boats and people can have negative influences on establishment of river otter populations.

References

4/25/00. New Mexico Game and Fish – Biota Information System Of New Mexico (BISON), Southwestern River Otter (*Lutra canadensis sonora*) Species Account, version 1/2000.

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Spotted Bat (*Euderma maculatum*) - Wildlife of Special Concern in Arizona (AZ Game and Fish Dept. Draft 3/16/96), High Priority species; “at high risk of imperilment” (Western Bat Species Regional Priority Matrix (1998).

Life History

Historic records suggest that the spotted bat was widely distributed but quite rare over its range, although it may have been locally abundant at certain sites. The historic range of the spotted bat includes Arizona, California, Colorado, Idaho, Montana, New Mexico, Nevada, Oregon, Utah, Wyoming, Texas, Canada and Mexico.

Roost site characteristics are poorly known for this species, but limited observations suggest that spotted bats roost singly in crevices, with rocky cliffs and surface water characteristic of localities where they occur. Its diet consists of moths, June bugs, and grasshoppers as well as other insects.

Reproduction is poorly understood. It appears that the spotted bat breeds in the early spring (late February to April). Limited observations indicate one young is born per female per year. Observations outside Arizona suggest young are born from late May to early July.

Conservation History

1988: The spotted bat was listed as a Federal Notice of Review species to be considered for potential listing as a threatened or endangered species.

1988: New Mexico Status: Endangered (G2).

1990: The spotted bat was listed as a United States Forest Service Sensitive Species.

1991: This species was listed in the November 21, 1991 Federal Register, as a Notice of Review Candidate, Category 2.

1994: *Euderma maculatum* was listed in the Federal Register, November 15, 1994, as a Category 2 species for consideration to be listed as a threatened or endangered species.

1994: *Euderma maculatum* was listed under the Navajo Endangered Species List “G4” (“Candidate” - Any species or subspecies for which the Navajo Fish and Wildlife Department (NFWD) does not currently have sufficient information to support their listing as G2 or G3 but has reason to consider them”. The NFWD is actively seeking information to determine if they warrant inclusion in a different group or removal from the list. They are not protected under Tribal Code but should be considered in project planning.

1995: *Euderma maculatum* was listed under the Natural Heritage Global Rank “G4” (“G4”=“Apparently Secure”).

1995: *Euderma maculatum* was being “Tracked”; data were being actively accumulated and entered into computerized and manual files by the Arizona Heritage Program.

1995: *Euderma maculatum* was listed under the Natural Heritage Arizona State Rank “S2” (“S2”=“Rare”).

1995: *Euderma maculatum* was listed “Rare” in Mexico.

1996: The spotted bat was listed as an Arizona Species of Special Concern.

1996: The spotted bat was listed as state threatened within Texas.

1996: The United States Fish and Wildlife Service changed listing status of “Federal Candidate” species. This classification formerly included three sub-classifications: Federal Candidate: Category 1, Category 2, and Category 3. There are no longer “Category” designations. This species was listed as a Federal Candidate Category 2

species. Species formerly designated Category 2 and 3 are no longer considered federal candidate species, and so no longer kept any Federal protection under the “Candidate” listing. However, such species may retain other federal or state designated protections (Federal Reg., Feb. 28, 1996).

1996: The Natural Heritage Global Rank for the species *Euderma maculatum* was listed “G4” (“G4”=Apparently secure globally).

1996: Former C2 species were reclassified as Federal: “Species of Concern”.

1997: *Euderma maculatum* was considered G4 on the (NESL) Navajo Endangered Species List) in 1994; however, this status was removed from the NESL in 1997 -- effective May 1, 1997. Change in status explanation: “Although this is not a species typically found in abundance, it appears to be widespread on the Navajo Nation; typically inhabits a variety of habitat types: no known threats”.

1997: *Euderma maculatum* was listed under the Natural Heritage NM State Rank “S3” (“S3”=“Rare or Uncommon”).

Data Sources

From 1891 to 1965, only 35 spotted bat specimens were known from its entire range. Surveys in New Mexico and elsewhere in 1983 documented population declines at several historic sites. Additional surveys conducted in the mid-to-late 1980’s, that were based on echolocation calls, revealed very few of these bats in areas where the species was previously more-or-less regular in occurrence.

As of 1986, very few specimens were known from Arizona. Sites varied from southeastern, south-central, to northeastern parts of the state. *Euderma maculatum* is rarely and unpredictably encountered in various habitats in scattered localities throughout Arizona, but especially in the extreme northwestern corner. It has been found from low desert areas in southwestern Arizona to high desert and riparian habitat in the northwestern part of the state. It has also been found in conifer forests in northern Arizona and other western states. Although initially thought to be extremely rare, the spotted bat is now known to occupy a wider range than originally believed. Increasing numbers of field workers focusing on this species are slowly improving our understanding, although population abundance and densities are still poorly known.

Threats/Analysis of Effects

Very little is known about the distribution of the population of this bat. The lack of natural history data places it in class 2, requiring more information. Because the Spotted Bat seems to forage in various habitats, conservation of diurnal roosts, rocky cliffs that have snug cracks for roosting, seem to be the best way to protect this species. However large open foraging sights, where their echolocation is most effective, are important to the conservation of this species, as well as the availability of large moths as prey.

The cause of concern for *Euderma maculatum* is due to habitat loss, degradation, and/or fragmentation. This species could be adversely affected by pesticides ingested through contaminated insects. Riparian habitats seem important, and those in northwestern Arizona along the Virgin River are extremely threatened. Excessive taking for scientific purposes is also a threat.

There is a need for greater assurance that roosts will remain undisturbed and future (potential) roost sites left when managing for bats in pinyon-juniper habitat. There is a need also for cultivation of a diverse food base, as well as adequate numbers and dispersion of sources of water. Ideally management should aim to sustain adequate food, water and roost sites in close proximity to one another.

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Townsend's Big-eared Bat (*Plecotus townsendii*) - High Priority species; “at high risk of imperilment” (Western Bat Species Regional Priority Matrix (1998).

Life History

This species has a large geographic range. It is found in western North America from Washington and Wyoming east to the Black Hills of South Dakota, southward to Texas, California, Arizona and through the Mexican upland in southern Mexico. Isolated populations also exist in the Ozark Mountains of Oklahoma, Missouri, Arkansas, Kentucky, Virginia, and West Virginia. It occupies a variety of habitats ranging from coniferous forests and woodlands, deciduous riparian woodlands, semi-desert and montane shrublands.

In Arizona, this species occurs throughout the state, although it is only infrequently found in the Desert Mountains. During the winter, it is found mostly south of the Mogollon Plateau and northwest of Mohave County. The distribution of this bat tends to be geomorphically determined, and is strongly correlated with the availability of caves or cave-like roosting habitat e.g., old mines. Population concentrations occur in areas with substantial surface exposures of cavity forming rock, and in old mining districts. *Plecotus townsendii* has been found from 1,200 to 5,600 feet. Most records; however, seem to come from above 3,000 feet.

Townsend's big-eared bats hang from open ceilings of mines and caves during the day. They do not use cracks or crevices, and may use open abandoned buildings as a night roost. In Arizona, they hibernate during the winter in cold caves, lava tubes, and mines mostly in uplands and mountains from the vicinity of the Grand Canyon to the southeastern part of the state, south of the Mogollon Rim.

P.townsendii are Lepidopteran specialists with a diet consisting of greater than 90% moths. They forage in darkness, and are rarely seen at dusk. Following a late night peak of foraging activity, they usually rest in a night roost. They may also feed again shortly before dawn.

Mating occurs in October but delayed fertilization postpones the birth of one young until June. The females congregate in maternity colonies of 12 to several hundred individuals in the spring and summer, whereas the males tend to be more solitary. The young can fly at one month of age, but are not weaned until they are two months old.

Conservation History

1990: The full species *Plecotus townsendii* was listed under the natural Heritage Global Rank "G4" ("G4"="Apparently Secure Globally").

1991: The full species *Plecotus townsendii* was listed under the Natural Heritage NM State Rank "S3" ("S3"="Rare or Uncommon").

1993: The Western Big-eared bat was listed as a State Species of Special Concern 2 in Oklahoma.

1994: The Pale Townsend's (=western) big-eared bat (*Plecotus townsendii pallescens*) was listed in the Federal Register as a Category 2 species for consideration to be listed as a threatened or endangered species.

1995: The two western subspecies, *P.t.townsendii* and *C.t.pallescens*, were concurrently recognized as Category 2 Federal Candidates. The two eastern subspecies, *P.t.ingnes* and *P.t.virginianus*, were listed as endangered under the Federal Endangered Species Act.

1995: The United States Forest Service considered *P.townsendii* a sensitive species, and the BLM considered it a Species of Special Concern.

1995: *Plecotus townsendii pallescens* was listed under the Natural Heritage Arizona State Rank "S3" ("S3"="Uncommon or Restricted").

1995: The subspecies, *Plecotus townsendii*, was being "Tracked"; data were being actively accumulated and entered into computerized and manual files by the Arizona Heritage Program.

1995: *P.townsendii* was still an unprotected mammal in Nevada and New Mexico where state regulation changes were lagging behind federal listing changes.

1995: *P.townsendii* was listed as an S2 species (a species of special concern because of limited distribution and habitat) by the Utah Division of Wildlife Resources.

1995: *P.townsendii* was listed as a species of “Undetermined Status” by Colorado Division of Wildlife.

1996: The United States Fish and Wildlife Service changed listing status of “Federal Candidate” species. This classification formerly included three sub-classifications: Federal Candidate: Category 1, Category 2, and Category 3. There are no longer “Category” designations. This species was listed as a Federal Candidate Category 2 species. Species formerly designated Category 2 and 3 are no longer considered federal candidate species, and so no longer kept any Federal protection under the “Candidate” listing. However, such species may retain other federal or state designated protections (Federal Reg., Feb. 28, 1996).

1996: Former C2 species were classified as Federal: “Species of Concern”.

1996: The complete Natural Heritage Global Rank for the subspecies *Plecotus townsendii pallescens*, was G4T4.

1996: The subspecies *Plecotus townsendii pallescens* was listed under the Natural Heritage New Mexico State Rank “S?” (“S?”=“Unknown”).

1996: *Plecotus townsendii pallescens* was listed by a New Mexico Natural Heritage Program list as “Tracked”; data were being actively accumulated and entered into computerized and manual files by the heritage Program.

1996: *Plecotus townsendii* was listed Wildlife of Special concern in Arizona.

1997: *Plecotus townsendii* was listed as a state Species of Special Concern in Utah due to declining populations and limited distribution.

Data Sources

During the winter, these bats occur south of the Mogollon Plateau but northwest to near Ashfork and Hackberry. Nursery colonies have been found at Crystal Cave, Chiricahua Mountains, and in a cave in Sycamore Canyon, Baboquivari Mountains. Another is known from near Union Pass, Mohave County. Yet another is known at Hereford, Cochise County.

In 1916, a bat colony containing *Plecotus townsendii* was reported within the Mazatzal Mountains on the Tonto Basin Ranger District. This bat colony was still present in 1997. Another bat colony containing *Plecotus townsendii* was reported near Seven mile Wash on the Globe Ranger District in 1960. This bat colony was still present in 1986.

Townsend's big-eared bats were sited in mines in the Tonto National Forest, Arizona, in September of 1992. A bat colony containing *Plecotus townsendii* was also reported in 1992 in the Sierra Anchas on the Tonto Basin Ranger District. Two maternity sites were also recorded at two mine sites in the Bill Williams River area in 1995. Townsend's big-eared bats have also been observed roosting under some bridges surveyed in Arizona. In 1995, a bat colony containing *Plecotus townsendii* was reported in the Sierra Anchas on the Pleasant Valley Ranger District. This bat colony was still present in 1997. In 1995, a bat colony containing *Plecotus townsendii* was reported in the Mazatzal Mountains on the Payson Ranger District. This bat colony was still present in 1997. In 1992, a possible maternity roost was identified in the Sierra Anchas on the Tonto Basin Ranger District.

A Conservation Strategy has been drafted by the Idaho State Conservation Effort.

Threats/Analysis of Effects

The Townsend's big-eared bat was listed as a species that required special federal protection in 1992 because of its extreme sensitivity to human disturbance, vandalism of roost caves by recreationists, and its low reproductive rate. Populations of this species are threatened by habitat loss, vandalism, and disturbance by cave explorers at maternity and hibernation roosts. Human disturbance can cause permanent abandonment of roost sites; therefore, minimization of human disturbance is essential for *Plecotus townsendii* to remain in existence. Arousal from winter hibernation can lead to the expenditure of roughly 10 to 30 days supply of fat reserves. This can lead to starvation before the arrival of spring when food supplies again become abundant. Low reproductive potential, high longevity and high roost fidelity make *P.townsendii* populations highly sensitive to roost threats. Besides humans, predators of this species, including feral house cats, bobcats, screech owls, and snakes, have led to the decline of this animal.

The presence of suitable shelters seems to be one of the important limiting factors for this species. The loss of caves and mines to natural erosion has been suggested as a possible threat to *P.townsendii* populations; however, these losses appear to happen over a span of decades and or centuries rather than months or years and likely provide adequate time for populations to adjust.

The impacts of timber harvest may range from temporary displacement to elimination of potential roost sites. Additional losses of old growth timber may result in losses of *P.townsendii* populations in those areas where alternative roost sites do not exist.

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Western Red Bat (*Lasiurus borealis*) - Wildlife of Special Concern in Arizona (AZ Game and Fish Dept. Draft 3/16/96), High Priority species; "at high risk of imperilment" (Western Bat Species Regional Priority Matrix (1998)).

Life History

Red bats have the broadest distribution of any American bat, ranging from extreme southern Canada through the United States east and west of the Great Plains, and south to Panama and South America. In Arizona, the red bat is thought to be a summer resident only. It occurs statewide, except in desert areas, but primarily along riparian corridors among oaks, sycamores and cottonwoods and along other waterways in the central and southeastern parts of the state. The red bat has been poorly studied in Arizona. Most of what is known has been gathered from a closely related eastern species of red bat. Red bats are generally known to occur at elevations ranging from 2,400 - 7,200 feet.

While red bats occasionally roost in saguaro boots and other cavities, they are more typically found roosting in dense clumps of foliage in riparian or other wooded areas. Roost sites are shaded above and tend to be open below, permitting the bats to drop into flight. When roosting, the red bat often wraps itself in its furred tail membrane and hangs from a branch by one or both feet.

Red bats emerge to forage one to two hours after dark and may forage well into the morning. They feed mainly upon flying insects; they feed to a much lesser extent on ground-dwelling insects, such as crickets.

Red bats are generally solitary, although they sometimes migrate in groups and may forage in close association with others. Copulation occurs in August and October and may be initiated in flight. The female stores the sperm until the following spring when fertilization occurs. Red bats have from one to five young per litter. With an average litter of 2.3, this is more than any other bat.

Data Sources

Within Arizona, records of capture exist where bats were found over ponds or along waterways among oaks, sycamores, and walnuts in the Huachucas and Grahams, cottonwoods along Bright Angel Creek not far from the Colorado River, and the pine-fir forest of the Sierra Anchas. As of 1992, records indicated a total of 61 red bats had been found at locations scattered throughout the state from May 30 to September 30.

In 1962, a male western red bat was collected in the Sierra Anchas on the Pleasant Valley Ranger District.

Threats/Analysis of Effects

The chief threats to the red bat in Arizona are its apparently low numbers and the loss of riparian and other broad-leafed deciduous forests and woodlands. Humans and human construction is also a threat to the red bat. There have been documented cases of these bats being impaled by barbed wire, entrapped on road surface oil, flying into buildings, and radiator grills of automobiles.

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