# THREATENED AND ENDANGERED SPECIES

# OF NEW MEXICO

## 2008 BIENNIAL REVIEW
## DRAFT
## First Public Comment Period

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**New Mexico Department of Game and Fish**
**Conservation Services Division**

# THREATENED AND ENDANGERED SPECIES OF NEW MEXICO
## 2008 Biennial Review and Recommendations

Authority: Wildlife Conservation Act (17-2-37 through 17-2-46 NMSA 1978)

**EXECUTIVE SUMMARY:** A total of 118 species and subspecies are on the 2008 list of threatened and endangered New Mexico wildlife. The list includes 2 crustaceans, 25 mollusks, 23 fishes, 6 amphibians, 15 reptiles, 32 birds and 15 mammals (Tables 1, 2). An additional 7 species of mammals has been listed as restricted to facilitate control of traffic in federally protected species. A species is endangered if it is in jeopardy of extinction or extirpation from the state; a species is threatened if it is likely to become endangered within the foreseeable future throughout all or a significant portion of its range in New Mexico. Species or subspecies of mammals, birds, reptiles, amphibians, fishes, mollusks, and crustaceans native to New Mexico may be listed as threatened or endangered under the Wildlife Conservation Act (WCA). During the Biennial Review, species may be upgraded from threatened to endangered, or downgraded from endangered to threatened, based upon data, views, and information regarding the biological and ecological status of the species. Investigations for new listings or removals from the list (delistings) can be undertaken at any time, but require additional procedures from those for the Biennial Review.

The 2006 Biennial Review contained a recommendation for maintaining the status for 119 species and subspecies listed as threatened, endangered, or restricted under the WCA, and uplisting four species (Arizona grasshopper sparrow, Pecos bluntnose shiner, spikedace, and meadow jumping mouse ) from threatened to endangered and downlisting two species (shortneck snaggletooth and piping plover) from endangered to threatened. The 2006 Biennial Review was completed when New Mexico State Game Commission approved all of these recommendations in August 2006.

The first draft of the 2008 Biennial Review contains a recommendation regarding listing status for each of the 125 species or subspecies listed as threatened, endangered, or restricted under the WCA. Of these, 123 are recommended to retain their current listing status. Two species are recommended for changes in status. Desert bighorn sheep is recommended for downlisting from endangered to threatened and gray redhorse is currently recommended for uplisting from state threatened to endangered. Uplisting from threatened to endangered confers no regulatory authority to the New Mexico Department of Game and Fish (NMDGF) over the habitat of these species. However, NMDGF believes that a state-endangered status will emphasize the importance of, and demonstrate the ability for, state-level management to support the long-term persistence of otherwise imperiled native wildlife.

A summary of the distribution, current status, threats (existing, past or future actions that can create uncertainty of species persistence if they are not carried out in a manner that considers wildlife and habitat needs), and recommendations regarding listing status and conservation actions are presented for each species or subspecies on the state list. Species accounts contain only key references. The Department's database on these species consists of over 6000 taxa. Databases for individual species are available on the internet at: http://www.bison-m.org.

NMDGF emphasizes the need for identifying and protecting endangered wildlife in New Mexico. The State of New Mexico has lost, and continues to lose, its wildlife diversity. More than 90 different taxa have been extirpated from one or more counties, including 25 that are believed to be

extinct (i.e., no longer exist anywhere), and at least 15 others that have been extirpated from the state (but continue to exist elsewhere).

Table 1. Summary of review and recommendation for 2008 New Mexico endangered species list.

| | Number of Species or Subspecies and 2008 Recommendations | | |
|---|---|---|---|
| TAXA and 2006 STATUS | No Change | Reclassify As Endangered | Reclassify As Threatened |
| INVERTEBRATES | | | |
| Endangered | 12 | -- | 0 |
| Threatened | 15 | 0 | -- |
| FISHES | | | |
| Endangered | 12 | -- | 0 |
| Threatened | 10 | 1 | -- |
| AMPHIBIANS | | | |
| Endangered | 4 | -- | 0 |
| Threatened | 2 | 0 | -- |
| REPTILES | | | |
| Endangered | 7 | -- | 0 |
| Threatened | 8 | 0 | -- |
| BIRDS | | | |
| Endangered | 12 | -- | 0 |
| Threatened | 20 | 0 | -- |
| MAMMALS | | | |
| Endangered | 6 | -- | 1 |
| Threatened | 8 | 0 | -- |
| Restricted (CITES) | 7 | 0 | 0 |
| TOTAL | 123 | 1 | 1 |

Table 2. Taxonomic review of New Mexico threatened and endangered species. Taxa listed as subspecies under the Wildlife Conservation Act are denoted by placing subspecies name in parentheses.

**INVERTEBRATES (27)**

Endangered:

no change: (12)

- Socorro isopod, *Thermosphaeroma thermophilum*
- Noel's amphipod, *Gammarus desperatus*
- paper pondshell, *Utterbackia imbecillis*
- Texas hornshell, *Popenaias popeii*
- Koster's springsnail, *Juturnia kosteri*
- Alamosa springsnail, *Psuedotryonia alamosae*
- Chupadera springsnail, *Pyrgulopsis chupaderae*
- Socorro springsnail, *Pyrgulopsis neomexicana*
- Roswell springsnail, *Pyrgulopsis roswellensis*
- Pecos assiminea, *Assiminea pecos*
- wrinkled marshsnail, *Stagnicola caperata*
- Florida mountainsnail, *Oreohelix florida*

Threatened:

no change: (15)

- lake fingernailclam, *Musculium lacustre*
- swamp fingernailclam, *Musculium partumeium*
- long fingernailclam, *Musculium transversum*
- Lilljeborg peaclam, *Pisidium lilljeborgi*
- Sangre de Cristo peaclam, *Pisidium sanguinichristi*
- Gila springsnail, *Pyrgulopsis gilae*
- Pecos springsnail, *Pyrgulopsis pecosensis*
- New Mexico springsnail, *Pyrgulopsis thermalis*
- star gyro, *Gyraulus crista*
- shortneck snaggletooth, *Gastrocopta dalliana dalliana*
- ovate vertigo, *Vertigo ovata*
- Hacheta Grande woodlandsnail, *Ashmunella hebardi*
- Cooke's Peak woodlandsnail, *Ashmunella macromphala*
- Mineral Creek mountainsnail, *Oreohelix pilsbryi*
- Doña Ana talussnail, *Sonorella todseni*

**FISHES (23)**

Endangered:

no change: (12)

- Gila chub, *Gila intermedia*
- Chihuahua chub, *Gila nigrescens*
- roundtail chub, *Gila robusta*
- Rio Grande silvery minnow, *Hybognathus amarus*
- Arkansas River shiner, *Notropis girardi*
- southern redbelly dace, *Phoxinus erythrogaster*
- Colorado pikeminnow, *Ptychocheilus lucius*
- (Zuni) bluehead sucker, *Catostomus discobolus yarrowi*
- blue sucker, *Cycleptus elongatus*
- Pecos gambusia, *Gambusia nobilis*
- (Pecos) bluntnose shiner, *Notropis simus pecosensis*
- spikedace, *Meda fulgida*

Threatened:

no change: (10)

- Gila trout, *Oncorhynchus gilae*
- Mexican tetra, *Astyanax mexicanus*

peppered chub, *Macrhybopsis tetranema*
suckermouth minnow, *Phenacobius mirabilis*
loach minnow, *Tiaroga cobitis*
Pecos pupfish, *Cyprinodon pecosensis*
White Sands pupfish, *Cyprinodon tularosa*
Gila topminnow, *Poeciliopsis occidentalis*
greenthroat darter, *Etheostoma lepidum*
bigscale logperch, *Percina macrolepida*

Uplist to endangered: (1)
gray redhorse, *Moxostoma congestum*

**AMPHIBIANS (6)**
Endangered:
no change: (4)
Jemez Mountains salamander, *Plethodon neomexicanus*
lowland leopard frog, *Rana yavapaiensis*
mountain toad, *Bufo boreas*
Great Plains narrow-mouthed toad, *Gastrophryne olivacea*
Threatened:
no change: (2)
Sacramento mountain salamander, *Aneides hardii*
Sonoran desert toad, *Bufo alvarius*

**REPTILES (15)**
Endangered:
no change: (7)
Gila monster, *Heloderma suspectum*
sand dune lizard, *Sceloporus arenicolus*
gray-checkered whiptail, *Aspidoscelis dixoni*
gray-banded kingsnake, *Lampropeltis alterna*
Mexican gartersnake, *Thamnophis eques*
plain-bellied water snake, *Nerodia erythrogaster*
(New Mexico) ridgenosed rattlesnake, *Crotalus willardi obscurus*

Threatened:
no change: (8)
western river cooter, *Pseudemys gorzugi*
Slevin's bunchgrass lizard, *Sceloporus slevini*
canyon spotted whiptail, *Aspidoscelis burti*
mountain skink, *Eumeces callicephallus*
green ratsnake, *Senticolis triaspis*
narrow-headed gartersnake, *Thamnophis rufipunctatus*
western ribbonsnake, *Thamnophis proximus*
(mottled) rock rattlesnake, *Crotalus lepidus lepidus*

**BIRDS (32)**
Endangered:
no change: (12)
brown pelican, *Pelecanus occidentalis*
aplomado falcon, *Falco femoralis*
white-tailed ptarmigan, *Lagopus leucurus*
whooping crane, *Grus americana*
least tern, *Sterna antillarum*
common ground-dove, *Columbina passerina*

buff-collared nightjar*, Caprimulgus ridgwayi*
elegant trogon, *Trogon elegans*
northern beardless-tyrannulet, *Camptostoma imberbe*
(southwestern) willow flycatcher, *Empidonax traillii extimus*
thick-billed kingbird, *Tyrannus crassirostris*
(Arizona) grasshopper sparrow, *Ammodramus savannarum ammolegus*

Threatened:

no change: (20)

neotropic cormorant, *Phalacrocorax brasilianus*
bald eagle, *Haliaeetus leucocephalus*
common black-hawk, *Buteogallus anthracinus*
peregrine falcon, *Falco peregrinus*
(Gould's) wild turkey, *Meleagris gallopavo mexicana*
whiskered screech-owl, *Megascops trichopsis*
boreal owl, *Aegolius funereus*
broad-billed hummingbird, *Cynanthus latirostris*
white-eared hummingbird, *Hylocharis leucotis*
violet-crowned hummingbird, *Amazilia violiceps*
lucifer hummingbird, *Calothorax lucifer*
Costa's hummingbird, *Calypte costae*
Gila woodpecker, *Melanerpes uropygialis*
Bell's vireo, *Vireo bellii*
gray vireo, *Vireo vicinior*
Abert's towhee, *Pipilo aberti*
Baird's sparrow, *Ammodramus bairdii*
yellow-eyed junco, *Junco phaeonotus*
varied bunting, *Passerina versicolor*
piping plover, *Charadrius melodus*

**MAMMALS (22)**

Endangered:

no change: (6)

Arizona shrew, *Sorex arizonae*
Mexican long-nosed bat, *Leptonycteris nivalis*
(Peñasco) least chipmunk, *Neotamias minimus atristriatus*
(Arizona) montane vole, *Microtus montanus arizonensis*
gray wolf, *Canis lupis*
meadow jumping mouse, *Zapus hudsonius*

Downlist to threatened: (1)

(desert) bighorn sheep, *Ovis canadensis mexicana*

Threatened:

no change: (8)

least shrew, *Cryptotis parva*
southern long-nosed bat, *Leptonycteris curasoae*
spotted bat, *Euderma maculatum*
western yellow bat, *Lasiurus xanthius*
white-sided jackrabbit, *Lepus callotis*
(Organ Mountains) Colorado chipmunk, *Neotamias quadrivittatus australis*
southern pocket gopher, *Thomomys umbrinus*
American marten, *Martes americana*

Restricted Species (CITES):

no change: (7)

leopard, *Pathera pardus*
clouded leopard, *Neofelis nebulosa*
snow leopard, *Panthera uncia*
jaguar, *Panthera onca*
Florida panther, *Felis concolor coryi*
tiger, *Panthera tigris*
ocelot, *Felis pardalis*

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# INVERTEBRATES

## CRUSTACEA

### ENDANGERED

**Socorro isopod, *Thermosphaeroma thermophilum***

**Distribution:** The Socorro isopod is endemic to a small thermal spring located southwest of Socorro, New Mexico (Richardson 1897, Shuster 1981). A captive population exists at the Socorro Isopod Propagation Facility (SIPF) near Socorro, and a refuge population is maintained at the Albuquerque Biological Park.

**Current Status:** The Socorro isopod was listed as a state (NMDGF Reg. 563) and federal (USFWS 1982) endangered species in 1978. In August 1988, *T. thermophilum* was extirpated in the wild when diminished discharge of the native spring resulted in habitat desiccation. Spring flow was reestablished in September 1988, which likely flushed isopods from the underground plumbing system into the native spring. The native population was augmented a month later from a captive population housed at the Department of Biology, University of New Mexico. This near extinction event prompted resource agencies to build the Socorro Isopod Propagation Facility (SIPF) near the native habitat. Construction of this facility (1990) expanded the total area occupied by the Socorro isopod, and provided opportunity for captive propagation, genetic, and life history studies (Lang et al. 2006, Shuster et al. 2005). Population and habitat monitoring at the native spring and SIPF has occurred monthly since November 1994. Native and captive populations are stable with lower densities of isopods occurring under artificial habitat conditions of the SIPF compared to higher densities at the natural spring (Lang et al. 2006).

**Threats**: Primary threats include vandalism, modification of spring flows, and potential disruption of thermal ground water discharge from aquifer pumping and surface/sub-surface explosive tests on lands situated west of the Socorro and Magdelena mountains (Lang 2001). Aquatic invasive species pose a threat to all native aquatic biota and ecosystems in New Mexico (NMDGF 2008). Aquatic ecosystems and macroinvertebrates are likely to show strong responses to global climate change (Xenopoulos et al. 2005, Burgmer et al. 2007).

**Recommendations:** No change in listing status is recommended. NMDGF is actively implementing conservation activities detailed in the federal recovery plan (USFWS 1982), which identifies goals and actions to achieve recovery and delisting of the species. Conservation efforts are coordinated with the U. S. Fish and Wildlife Service, Albuquerque Biological Park, and the private land owner. Aquatic ecosystems and macroinvertebrates are likely to show strong responses to global climate change (Xenopoulos et al. 2005, Burgmer et al. 2007).

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**Noel's amphipod, *Gammarus desperatus***

**Distribution:** Historically, Noel (1954) and Cole (1981, 1985, 1988a, 1988b) reported this amphipod from three Chaves County sites near Roswell: Lander Springbrook, North Spring (type locality), and Bitter Lake National Wildlife Refuge (BLNWR). Noel's amphipod currently occurs only on BLNWR (Bitter Creek, Sago Spring, Unit 6 and 7 spring-ditch, Hunter Marsh) and on private land near Hunter Marsh (Federal Register 2005). In 2006 an isolated population of *Gammarus desperatus* was discovered on the Lower Tract ("Farm') of BLNWR from a small springhead that discharges to the Rio Hondo (Lang 2007).

**Current Status:** The Lander Springbrook population was extirpated during the period 1951-1957, whereas loss of the North Spring population occurred during the period 1978-1988 (Cole 1981, 1985, 1988a, 1988b). Extirpation at the type locality prompted the 1990 uplisting of the species from state threatened to endangered under NMDGF Regulation 682. Gammarid amphipods are apparently extirpated from North Spring (Mehlhop 1992, 1993; Lang 2005). Populations on BLNWR have been monitored routinely since 1995 (Lang 2002, 2005, 2008). NMDGF has implemented a conservation plan for four state-listed macroinvertebrate species of Chaves County, including *G. desperatus* (NMDGF 2005). The USFWS listed this species as endangered under the Endangered Species Act (Federal Register 2005). Acquisition of federal water rights for BLNWR (USDJ 1996, Balleau Groundwater, Inc. 1997) may serve to impart habitat protection for this species. Genetic studies imply the presence of cryptic species of gammarid amphipods at BLNWR (Gervasio et al. 2004, Seidel and Berg 2007). Deposition of post-fire ash, laden with polycyclic aromatic hydrocarbons resulting from the March 2000 Sandhill Fire at BLNWR, may account for the overall dramatic decline of macroinvertebrate populations observed in Bitter Creek at Dragonfly Spring; especially affected was Noel's amphipod (Lang 2005, 2008). Morphologic and genetic studies are ongoing to assess intra- and inter-specific relationships among amphipods of this species complex (Lang 2008).

**Threats:** The specific epithet, *desperatus*, refers to what Cole (1981) considered an imperiled situation for the species: the progressive loss of isolated gammarid populations in Chaves County, New Mexico, between 1951-1988 (Cole 1985, 1988a, 1988b). Cole attributed these extirpations to regional ground water depletion and habitat alterations (e.g., artesian spring source diversion, dewatering, capping). Similar factors likely affected localized gammarid populations in west Texas (Lang et al. 2003). While populations of *G. desperatus* are stable under current refuge management plans (Research Management Consultants, Inc. 1998), off-refuge land use practices within areas of the Roswell Artesian Basin (Basin) pose threats to the long-term viability of populations at BLNWR. Regional ground water pumping for agriculture, municipal water supplies, and oil and gas industry operations continue in the Basin (BLM 1994, USFWS 1997). Any increases in ground water extraction similar to aquifer drawdown levels that occurred in the Basin from the 1950's to 1970's could lead to habitat impacts on BLWNR. Oil and gas development is ongoing within areas of the Basin that Balleau Groundwater, Inc. (1996, 1999) identified as primary ground water source-zones for surface waters at BLNWR. In New Mexico, such extractive processes and industry operations can result in aquifer drawdown, alter aquitard hydraulics, and contaminate ground and surface waters (Hennighausen 1969; Jercinovic 1982, 1984; Longmire 1983; Quarles 1983; Boyer 1986; Richard 1988a, 1988b; Rail 1989; Richard and Boehm 1989a, 1989b; Balleau Groundwater, Inc. 1996; Martinez et al. 1998). Amphipod crustaceans are acutely sensitive to ground and surface water contaminants (Eisler 1987, Green and Trett 1989, Pennak 1989, Covich and Thorpe 1991). There is increased risk of degradation of ground and surface water quality posed by sewage contamination (i.e., municipal waste, septic discharge) from urban encroachment in aquifer recharge-discharge areas along the western bounds of BLNWR (Federal Register 2005). Illicit dumping of domestic contaminants (e.g., pesticides, herbicides, waste oil, etc.) in sinkholes is known to contaminate ground water resources in karst areas of the United States (White et al. 1995, Zokaites 1997) and in New Mexico (Bitner and Graves 1992, McQuillan et al. 1989). Natural stochastic events, such as fire or drought, could adversely impact extant *G. desperatus* populations at BLNWR. In the short-term, Noel's amphipod is threatened by impoverished aquatic conditions following the March 2000 Sandhill Fire which severely burned reaches of Bitter Creek formerly inhabited by *G. desperatus* (Lang 2002, 2005, 2008; Lang et al. 2003). The long-term impact of these effects,

whether beneficial or adverse, on the aquatic biota and riparian corridor of Bitter Creek remain undetermined. Prolonged drought may affect hydrologic conditions on BLNWR by reducing discharge through refuge surface waters while concomitantly increasing salinity and concentrating contaminants. Aquatic invasive species represent a threat to native wildlife and habitats at BLNWR (NMDGF 2008). Aquatic ecosystems and macroinvertebrates are likely to show strong responses to global climate change (Xenopoulos et al. 2005, Burgmer et al. 2007).

**Recommendation:** No change in listing status is recommended. In collaboration with the U. S. Fish and Wildlife Service, NMDGF should continue to monitor post-fire effects on the aquatic macroinvertebrates and riparian corridor of Bitter Creek. NMDGF and cooperators should continue implementing strategies of the state conservation plan to alleviate threats and achieve recovery of this species.

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**MOLLUSCA**

**BIVALVIA**

**ENDANGERED**

**Paper pondshell, *Utterbackia imbecillis***

**Distribution:** The paper pondshell is one of the most widely distributed freshwater mussels in North America (Taylor 1983, Williams et al. 1993, Howells et al. 1996), occurring over a wide variety of substrata (mud to gravel) in reservoirs, lakes, rivers, and streams (Gordon and Layzer 1989). The only extant population in New Mexico was documented by recent shells from Conchas Lake, San Miguel County (Taylor 1983); hundreds of miles from the nearest known occurrences in adjacent states (Howells et al. 1996) and northern México (Río Conchos; Johnson 1999). Lang and Mehlhop (1996) reported only one fresh valve of an immature paper pondshell from Ute Creek near Ute Reservoir, Harding County. While this record represents an eastward range extension in New Mexico, the species was not found in Conchas Lake.

**Current Status:** The paper pondshell was listed as state endangered (NMDGF Reg. 624) in 1983. Historic populations in the Conchas River near Variadero are apparently extirpated (Lang and Mehlhop 1996), and may represent the source for the Conchas Lake population (Taylor 1983). This mussel has many glochidial (larval) host fish, and consequently has been introduced to impounded waters throughout the United States by fish stocking and bait bucket introductions (Howells et al. 1996). In 2007 numerous live *U. imbecillis* were collected from the middle Rio Grande near Rio Rancho, Sandoval County (NMDGF files). The genus *Anodonta* is taxonomically complex with many outstanding questions regarding the phylogenetic status of putative species (Hoeh 1993). Taxonomic studies and human-mediated dispersal pose questions regarding specific identity and native status of this species in New Mexico.

**Threats:** Holocene climate change and habitat modification (stream channelization, dewatering, poor watershed management, and manipulation of natural flows) was likely responsible for loss of native riverine populations (Lang and Mehlhop 1996). Contaminants and the potential for introduction of aquatic invasive species (e.g., zebra and/or quagga mussels) represent threats to populations of paper pondshell in Canadian River mainstem impoundments (NMDGF 2008). Aquatic ecosystems and macroinvertebrates are likely to show strong responses to global climate change (Xenopoulos et al. 2005, Burgmer et al. 2007).

**Recommendations:** No change recommended in listing status. Surveys should be undertaken to document current status of the species in New Mexico. State and federal agencies should take preventative measures to prevent the introduction of zebra and/or quagga mussels and other aquatic invasive species to New Mexico's surface waters.

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**Texas hornshell, *Popenaias popeii***

**Distribution:** Texas hornshell is known from Western Gulf and Mexican Gulf coastal drainages of the Rio Grande Basin south to the northern state of Vera Cruz, México (Johnson 1999). In the United States, this mussel occurred in the Rio Grande basin from North Spring River (Roswell, Chaves County; Cockerell 1902), throughout the lower Pecos River, downstream to Brownsville, Cameron County, Texas (Metcalf 1982, Neck and Metcalf 1988, Howells et al. 1996). *Popenaias popeii* has declined notably throughout the United States, as only two geographically disjunct populations are known. In New Mexico, this species currently occupies about 12% of its historic range, where an extant population is confined to a 14 km reach of the Black River, Eddy County (Lang 2001). Howells (2004) reported live Texas hornshell in the Rio Grande near Laredo, Webb County, Texas.

**Current Status:** The sporadic occurrence of *P. popeii* in Texas led Strecker (1931) to regard this species as "scarce." The dearth of information in historic and contemporaneous collection records prompted listing of this mussel as state endangered in 1983. The American Fisheries Society regarded this species as threatened (Williams et al., 1993). Texas hornshell is considered a candidate for listing (priority 2) under the Endangered Species Act (Federal Register 2001). The NMDGF (2007) implemented a recovery plan for this species. Previous research focused on the distribution and abundance, habitat affinities, life history, salinity tolerance, and genetics of the Black River population (Lang 2001). Smith et al. (2003) described the breeding periodicity and reproductive anatomy of the species. Ongoing conservation efforts include population monitoring, habitat studies, water quality monitoring, early life history research (reproductive ecology), molecular genetic study, riparian habitat restoration (erosion control, fencing), and conservation planning through federal incentive programs (e.g., Candidate Conservation Agreement with Assurances; Federal Register 1997).

**Threats:** Human-caused modification of riverine ecosystems (e.g., construction of mainstem impoundments, diversion and redistribution of water, water pollution, introduction of exotic mollusks) responsible for the imperilment of freshwater mussels in the eastern United States (Allan and Flecker 1993, Neves 1993, Williams et al. 1993, Ricciardi and Rasmussen 1999, Vaughn and Taylor 1999) likewise accounts for significant loss of mussel populations in the Pecos River of New Mexico and Texas (Taylor 1983, Neck and Metcalf 1988, Howells et al. 1996, Howells 2003). In southeastern New Mexico, construction of impoundments (Lake MacMillan, Brantley Reservoir, Lake Avalon) is one of the many factors responsible for extirpation of *P. popeii* from the Pecos River mainstem (Taylor 1983). Low-head dams on the Black River likely prevent movement of glochidial-bearing host fishes to riverine reaches upstream of Black River Village where this mussel does not occur (Lang 2001).

Opportunities for recolonizing reaches downstream of the Carlsbad Irrigation District dam appear limited by altered physicochemical and hydrologic regimes. Ground water depletion and ground and surface water contaminants are considered principal causes of decline in unionid mussels (Metcalf 1982, Taylor 1983, NMDGF 1988, Williams et al. 1993, Neves et al. 1997, Strayer 1999). Numerous contaminants of ground and surface water can adversely impact aquatic mollusks (Havlik and Marking 1987, Green and Trett 1989, Neves et al. 1997, Augspurger et al. 2003). Regional ground water pumping for agriculture and the petroleum industry are ongoing in the Black River drainage. Such extractive processes are known to deplete ground water aquifers (Fiedler and Nye 1933, Thomas 1959, Havenor 1968) and to contaminate ground and surface waters in the Pecos and Black River valleys (Hennighausen 1969; Metcalf 1974; Jercinovic 1982, 1984; Longmire 1983; Quarles 1983, Boyer 1986; Rail 1989; Martinez et al. 1998). The Black River basin has experienced repeated problems of ground water depletion and contamination. Water levels of domestic, agricultural/range wells in the area have lowered and even dried-up. Richard (1988a, 19988b) and Richard and Boehm (1989a) documented ground water contamination of domestic and agricultural/range wells from petroleum-derived hydrocarbons and sulfides in the upper Black River valley (i.e., Washington Ranch, Ballard Wells, etc.). Richard and Bohem (1989b) reported "severe" sulfide gas contamination of Blue Spring (ca.1988) from oil and gas operations (deepwell injection for storage); the contaminant plume originated up-gradient and was likely transported ca. 20 miles down-gradient to Blue Spring, a regionally significant artesian spring that is the primary hydrologic source for the Black River (Hendrickson and Jones 1952). Such long-distance transport of ground water is common in karst evaporite rock (White et al. 1995, Martinez et al. 1998) and raises concerns for surface water quality of the Black River, especially considering the current proliferation of petroleum industry operations in the Black River drainage. Several low-water bridge crossings span the Black River. Transit of heavy trucks carrying toxic chemicals and petroleum-derived products across these areas could result in surface water contamination from traffic accidents. In July 2002, surface waters of the Black River were contaminated by tebuthiuron, an herbicide used to control woody plants. Lang (2003) reported no adverse effects of tebuthiuron on *P. popeii* of the Black River. Fish kills in the lower Pecos River (2002-2007) from Lake Brantley downstream to the Black River confluence have been attributed to toxins produced by golden algae, *Prymnesium parvum.* These toxins are highly lethal to aquatic, gill-breathing fauna such as mollusks (bivalves, snails), crustaceans, fish, and larval stages of amphibians. While there are no known instances of golden alga blooms within the occupied range of Texas hornshell, such a catastrophic event could decimate the species in New Mexico.
Over the long-term, insensitive land-use practices (e.g., excessive clearing of native vegetation, prolonged over-grazing, poor soil and water conservation practices, non-point source discharge of pollutants [toxic chemicals, hydrocarbons, sediments], etc.) within a watershed, and the accumulative impacts of such activities, may: (a) increase erosion and sedimentation; (b) exacerbate drainage entrenchment; (c) increase pulse discharge of instream flows, sediments, and pollutants into the drainage; and (d) alter stream channel morphology and substrate composition (see references in Wood and Armitage 1997). These environmental perturbations can have profound effects on the overall health of aquatic ecosystems, long-term viability of mussel populations, and habitat suitability of flow refuges colonized by unionid mussels (Williams et al. 1993, Neves et al. 1997, Strayer 1999, Lang 2001). Introduction of aquatic invasive species (e.g., , Asian clam, quagga mussel, zebra mussel, New Zealand mudsnail, non-native crayfish) threaten unionid populations throughout the United States (Williams et al. 1993, Neves et al. 1997, NMDGF 2008, http://www.esg.montana.edu/aim/mollusca/nzms/nzmsbib.html). Aquatic ecosystems and macroinvertebrates are likely to show strong responses to global climate change (Xenopoulos et al. 2005, Burgmer et al. 2007).

**Recommendation:** No change in listing status is recommended. NMDGF and cooperators should continue to implement strategies of the state conservation plan to alleviate threats and achieve recovery of Texas hornshell. Protection of habitat is critical for conservation of this mussel. Actions required to protect the species include: (a) collaborative efforts by all stakeholders to address outstanding issues of transportation routes across the Black River; (b) increased communication and coordination among state and federal agencies that regulate extractive resource use (ground water, oil and gas) in the Black River basin; (c) controlled propagation research at the Albuquerque Biological Park (holding capacity) and Dexter National Fish Hatchery and Technology Center (production, rearing capacity); (d) habitat suitability assessment of the Delaware River; (e) population/habitat monitoring; and (e) life history research.

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**GASTROPODA**

**ENDANGERED**

**Koster's springsnail, *Juturnia kosteri***

**Distribution:** Taylor (1987) described this spring snail from Sago Spring, Bitter Lake National Wildlife Refuge (BLNWR). Additional populations on BLNWR include: Lake St. Francis, Bitter Creek, Sago Spring wetland complex, western perimeter of Unit 3, spring-ditch of units 5-7, and the northwest corner of Hunter Marsh (Lang 2002, 2005; Federal Register 2005). The western limit of the species range was from North Spring, Roswell Country Club, where the population has been extirpated (Taylor 1987, Lang 2005).

**Current Status**: Hershler (2001) reassigned *Tryonia kosteri* Taylor, 1987 to the genus, *Durangonella* Morrison, 1945 on the basis of reproductive anatomy. Phylogenetic analysis of mitochondrial DNA genome led Hershler et al. (2002) to allocate *D. kosteri* to a new genus, *Juturnia* Hershler, Liu, Stockwell, comprising two other cochliopinid snails from the Desert Southwest Rio Grande region. Koster's springsnail was listed as state threatened in 1983, and uplisted to endangered based on threats posed by impoverished habitat conditions following the March 2000 Sandhill Fire in Bitter Creek (NMDGF 2000). The USFWS listed this species as endangered under the Endangered Species Act (Federal Register 2005). NMDGF has routinely monitored populations on BLNWR since 1995 (Lang 2002, 2005, 2008). Acquisition of federal water rights for BLNWR (USDJ 1996, Balleau Groundwater, Inc. 1997) may serve to impart habitat protection for this species. The NMDGF (2005) implemented a conservation plan for a suite of four state-listed invertebrates of Chaves County, including *J. kosteri.*

**Threats:** While populations of *J. kosteri* are stable under current refuge management plans (Research Management Consultants, Inc. 1998), off-refuge land use practices within areas of the Roswell Artesian Basin pose threats to their long-term viability on BLNWR. Regional ground water pumping for agriculture, municipal water supplies, and oil and gas industry operations continue in the Basin (BLM 1994, USFWS 1997). Any increases in ground water extraction similar to aquifer drawdown levels that occurred in the Basin from the 1950's to 1970's could lead to habitat impacts on BLWNR. Oil and gas development is ongoing within areas of the Basin that Balleau Groundwater, Inc. (1996, 1999) identified as primary ground water source-zones for surface waters at BLNWR. Such extractive processes and industry operations can result in aquifer drawdown, alter aquitard hydraulics, and contaminate ground and surface waters in New Mexico (Hennighausen 1969; Jercinovic 1982, 1984; Longmire 1983; Quarles 1983; Boyer 1986; Richard 1988a, 1988b; Rail 1989; Richard and Boehm 1989a, 1989b; Balleau Groundwater, Inc. 1996; Martinez et al. 1998). Aquatic mollusks are acutely sensitive to ground and surface water contaminants (Havlik and Marking 1987, Eisler 1987, Green and Trett 1989, Augspurger 2003). There is increased risk of degradation of ground and surface water quality posed by sewage contamination (i.e., municipal waste, septic discharge) from urban encroachment in aquifer recharge-discharge areas along the western bounds of BLNWR (Federal Register 2005). Illicit dumping of domestic contaminants (e.g., pesticides, herbicides, waste oil, etc.) in sinkholes is known to contaminate ground water resources in karst areas of the United States (White et al. 1995, Zokaites 1997) and in New Mexico (Bitner and Graves 1992, McQuillan et al. 1989). Natural stochastic events, such as fire or drought, could adversely impact extant *J. kosteri* populations at BLNWR. Although Lang (2001) demonstrated short-term fire effects on the physicochemical conditions in Bitter Creek following the March 20000 Sandhill Fire, the long-term impact of these effects, whether beneficial or adverse, on the aquatic biota and riparian corridor remain undetermined (Lang 2002, 2005). Prolonged drought may affect hydrologic conditions on BLNWR by reducing discharge through refuge surface waters while concomitantly affecting aquatic physicochemical conditions and concentrating potential contaminants. Aquatic invasive species represent a threat to native wildlife and habitats at BLNWR (NMDGF 2008). Aquatic ecosystems and macroinvertebrates are likely to show strong responses to global climate change (Xenopoulos et al. 2005, Burgmer et al. 2007).

**Recommendation:** No change in listing status is recommended. In collaboration with the U. S. Fish and Wildlife Service, NMDGF should continue monitoring post-fire effects on aquatic macroinvertebrates and the riparian corridor of Bitter Creek. NMDGF and cooperators should continue to implement strategies of the state conservation plan to alleviate threats and achieve recovery of this species.

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**Alamosa springsnail, *Pseudotryonia alamosae***

**Distribution:** This endemic spring snail is known only from thermal spring sources forming the perennial headwaters of Alamosa Creek above the Monticello Box, Socorro County (Taylor 1983, 1987).

**Current Status:** *Pseudotryonia alamosae* was listed as state threatened in 1983, and was uplisted to endangered based on threats posed by an open pit beryllium mine within the immediate watershed of Alamosa Creek (NMDGF 2000). The Alamosa springsnail is a federal endangered species (Federal Register 1994). Based on studies of molecular genetics (Hershler et al. 1999) and reproductive anatomy, Hershler (2001) reassigned *Tryonia alamosae* Taylor, 1987 to a new genus, *Pseudotryonia* Hershler. *Pseudotryonia alamosae* occurs in spring sources and spring-fed tributaries along the north riverbank of Alamosa Creek downstream to approximately 30 meters above the Monticello Box (Lang 2001, Lang 2003). Within this available habitat, the species is most abundant in the lowest velocity, warmest and most stenothermic microhabitats associated with thermal spring vents situated in the upper reach of this perennial spring-fed system. Private land use practices, including salt cedar removal, currently favor persistence of this species in Alamosa Creek.

**Threats:** Primary threats include local/regional ground water depletion, ground and surface water contamination, direct habitat alteration (stream diversion and impoundment), mineral mining, and poor watershed management (Taylor 1983; NMDGF 1988; Lang 2001, 2003). Introduction of aquatic invasive species can result in elimination of spring snail populations by predation or habitat degradation (e.g., non-native crayfish; Fernandez and Rosen 1996, NMDGF 2008) or by direct competition for food sources (i.e., New Zealand mudsnail; http://www.esg.montana.edu/aim/mollusca/nzms/nzmsbib.html). Aquatic ecosystems and macroinvertebrates are likely to show strong responses to global climate change (Xenopoulos et al. 2005, Burgmer et al. 2007).

**Recommendation:** No change in listing status is recommended. NMDGF is collaborating with the U. S. Fish and Wildlife Service (USFWS) and the Monticello Community Ditch Association (MCDA) for conservation activities detailed in the federal recovery plan (USFWS 1994). Resource agencies should pursue opportunities to acquire private lands, including mineral and ground water rights, where future beryllium ore exploration or mining may adversely affect ground water aquifers that supply surface waters and spring-fed wetlands of Alamosa Creek.

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**Chupadera springsnail, *Pyrgulopsis chupaderae***

**Distribution:** The Chupadera springsnail is known from two hillside seeps situated along the southern flank of the Chupadera Mountains, southeast Socorro County (Taylor 1983, 1987). This species is endemic to Willow Spring (type locality), and once occurred in an unnamed spring located about 0.25 mile north of the type locality.

**Current Status:** *Pyrgulopsis chupaderae* was listed as state threatened in 1983, and uplisted to endangered (NMDGF 1996) due to habitat overgrazing by cattle which resulted in the apparent extirpation of the species at the unnamed spring. The Chupadera springsnail is a candidate for listing (priority 2) under the Endangered Species Act (Federal Register 2002). Despite intensive long-term land use practices at Willow Spring (grazing, spring source diversion, spring run impoundment), the Chupadera springsnail has persisted at the type locality (Taylor 1983, Lang 2002). Population monitoring initiated in 1996 was pre-empted by transference of ownership of Willow Spring in August 1999. Since then annual requests to visit Willow Spring have been repeatedly denied by all owners. *Pyrgulopsis chupaderae* was last observed live in August 1999, and the status of the species has not been confirmed since that time.

**Threats:** Imminent threats include local/regional ground water depletion, diversion or impoundment of spring flow, loss of riparian vegetation, and overgrazing of the watershed during extended drought (Taylor 1983, NMDGF 1988, Lang 2002). These threats are exacerbated by subdivision development on ranch lands surrounding Willow Spring. Introduction of aquatic invasive species can result in elimination of spring snail populations by predation or habitat degradation (e.g., non-native crayfish; Fernandez and Rosen 1996, NMDGF 2008) or by direct competition for food sources (i.e., New Zealand mudsnail; http://www.esg.montana.edu/aim/mollusca/nzms/nzmsbib.html). Aquatic ecosystems and macroinvertebrates are likely to show strong responses to global climate change (Xenopoulos et al. 2005, Burgmer et al. 2007).

**Recommendation:** No change in listing status is recommended. Due to the species' restricted distribution, small population size and lack of access, controlled propagation at the Albuquerque Biological Park might be warranted. The NMDGF attempted to initiate a state recovery plan for this species but the private land owner declined participation.

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**Socorro springsnail, *Pyrgulopsis neomexicana***

**Distribution:** Although this species was evidently described by Pilsbry (1916) from one of three springs of the Socorro Thermal Area (Summers 1976), no empty shells or live specimens have ever been collected from this area, which is located three miles west of Socorro (Landye 1981; Taylor 1983, 1987). Prior to 1971, significant water development and habitat alterations likely resulted in extirpation of the species at the type locality (Landye 1981,

Taylor 1987). Taylor (1987) provided a morphological description of this species from a thermal spring located on the southeastern flank of the Magdalena Mountains, Socorro County, while noting uncertainty of taxonomic affinities of this population with those from the Socorro Thermal Area. From a 1981 collection, Taylor (1987) estimated the total population at about 5000 individuals.

**Current Status:** *Pyrgulopsis neomexicana* was listed as state endangered in 1983. This snail is considered a federal endangered species (Federal Register 1994). Lang (2001) last visited Torreon Springs in 1996, and noted that the spring source had been capped by a windmill; live *P. neomexicana* were observed in the spring outflow channel (~2.0*l* x 0.5*w* x 0.1*d* m). The private landowner has since denied site access to monitor and study *P. neomexicana*, and the current status remains unknown.

**Threats:** Regional/local ground water depletion, spring run dewatering, contamination, and riparian habitat degradation represent principal threats to the population (NMDGF 1988, Lang 2001). Natural stochastic events such as drought could adversely impact this population by reducing spring discharge. Introduction of aquatic invasive species can result in elimination of spring snail populations by predation or habitat degradation (e.g., non-native crayfish; Fernandez and Rosen 1996, NMDGF 2008) or by direct competition for food sources (i.e., New Zealand mudsnail; http://www.esg.montana.edu/aim/mollusca/nzms/nzmsbib.html). Aquatic ecosystems and macroinvertebrates are likely to show strong responses to global climate change (Xenopoulos et al. 2005, Burgmer et al. 2007).

**Recommendation:** No change in listing status is recommended. The remnant population merits resurvey to determine current status. A refuge population should be established at the Albuquerque Biological Park.

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**Roswell springsnail, *Pyrgulopsis roswellensis***

**Distribution:** Taylor (1987) reported three populations of *P. roswellensis* on Bitter Lake National Wildlife Refuge (BLNWR) and a population in North Spring, Roswell Country Club (RCC). The trend in species range reduction by extirpation of once widely distributed, but localized, populations is supported by the Pleistocene fossil record and reinventory of known site occurrences (Noel 1954, Taylor 1987, Federal Register 2005).

**Current Status:** Roswell springsnail was listed as state endangered in 1983. The USFWS listed this species as endangered under the Endangered Species Act (Federal Register 2005). Extant populations on BLNWR occur in: Bitter Creek, Sago Spring, and the Unit 7 spring-ditch. This species is apparently extirpated from North Spring (Lang 2005). The Department has routinely monitored populations on BLNWR since 1995 (Lang 2002, 2005, 2008). Acquisition of federal water rights for BLNWR (USDJ 1996, Balleau Groundwater, Inc. 1997) may serve to impart habitat protection for this species. The NMDGF (2005) implemented a conservation plan for a suite of four state-listed invertebrates of Chaves County, including *P. roswellensis*.

**Threats:** While populations of *P. roswellensis* are stable under current refuge management plans (Research Management Consultants, Inc. 1998), off-refuge land use practices within areas of the Roswell Artesian Basin pose threats to their long-term viability on BLNWR. Regional ground water pumping for agriculture, municipal water supplies, and oil and gas industry operations continue in the Basin (BLM 1994, USFWS 1997). Any increases in ground water extraction similar to aquifer drawdown levels that occurred in the Basin from the 1950's to 1970's could lead to habitat impacts on BLWNR. Oil and gas development is ongoing within areas of the Basin that Balleau Groundwater, Inc. (1996, 1999) identified as primary ground water source-zones for surface waters at BLNWR. Such extractive processes and industry operations can result in aquifer drawdown, alter aquitard hydraulics, and contaminate ground and surface waters in New Mexico (Hennighausen 1969; Jercinovic 1982, 1984; Longmire 1983; Quarles 1983; Boyer 1986; Richard 1988a, 1988b; Rail 1989; Richard and Boehm 1989a, 1989b; Balleau Groundwater, Inc. 1996; Martinez et al. 1998). Aquatic mollusks are acutely sensitive to ground and surface water contaminants (Havlik and Marking 1987, Eisler 1987, Green and Trett 1989, Augspurger 2003). There is increased risk of degradation of ground and surface water quality posed by sewage contamination (i.e., municipal waste, septic discharge) from urban encroachment in aquifer recharge-discharge areas along the western bounds of BLNWR (Federal Register 2005). Illicit dumping of domestic contaminants (e.g., pesticides, herbicides, waste oil, etc.) in sinkholes is known to contaminate ground water resources in karst areas of the United States (White et al. 1995, Zokaites 1997) and in New Mexico (Bitner and Graves 1992, McQuillan et al. 1989). Natural stochastic events, such as fire or drought, could adversely impact extant *P. roswellensis* populations at BLNWR. Although Lang (2001) demonstrated short-term fire effects on the physicochemical conditions in Bitter Creek following the March 20000 Sandhill Fire, the long-term impact of these effects, whether beneficial or adverse, on the aquatic biota and riparian corridor remain undetermined (Lang 2002, 2005). Prolonged drought may affect hydrologic conditions on BLNWR by reducing discharge through refuge surface waters while concomitantly affecting aquatic physicochemical conditions and concentrating potential contaminants. Aquatic invasive species represent a threat to native wildlife and habitats at BLNWR (NMDGF 2008). Aquatic ecosystems and macroinvertebrates are likely to show strong responses to global climate change (Xenopoulos et al. 2005, Burgmer et al. 2007).

**Recommendation:** No change in listing status is recommended. In collaboration with the U. S. Fish and Wildlife Service, NMDGF should continue monitoring post-fire effects on aquatic macroinvertebrates and the riparian corridor of Bitter Creek. NMDGF and cooperators should continue to implement strategies of the state conservation plan to alleviate threats and achieve recovery of this species.

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**Pecos assiminea, *Assiminea pecos***

**Distribution:** This amphibious snail occurred historically in isolated populations in New Mexico (Bitter Lake National Wildlife Refuge [BLNWR] and North Spring, Roswell County Club, Chaves County), Texas (Diamond Y Preserve, Pecos County), and sporadically throughout the Bolsón de Cuarto Cíenegas, Coahuila, México (Taylor 1983, 1987). The species however shows a pattern of localized extinctions throughout its historic range. Taylor (1987) reported extirpation of *A. pecos* from North Spring and at the type locality (Unit 7) on BLNWR. Extant populations on BLWNR occur in marsh habitats along Bitter Creek, Sago Spring wetland complex near Sinkhole #31, and the spring-ditch of units 7 and 15 (Federal Register 2005). An additional population was located at East Sandia Spring, Reeves County, Texas (Lang 2002).

**Current Status:** Pecos assiminea was listed as state endangered in 1983. This species is considered as endangered under the Endangered Species Act (Federal Register 2005). Populations on BLNWR have been routinely monitored since 1995 (Lang 2002). In Texas, populations of *A. pecos* occur on lands (Diamond Y Spring Preserve, East Sandia Spring) under stewardship of The Nature Conservancy (Lang 2002). Acquisition of federal water rights for BLNWR (USDJ 1996, Balleau Groundwater, Inc. 1997) may serve to impart habitat protection for this species. The NMDGF (2005) implemented a conservation plan for a suite of four state-listed invertebrates of Chaves County, including *A. pecos*. Molecular genetic and morphometric studies of the *A. pecos* species complex retained the binomial for all populations in the United States and described the Mexican population as a new species, *Assiminea cienegensis* (Hershler et al. 2007).

**Threats:** While populations of *A. pecosensis* are stable under current refuge management plans (Research Management Consultants, Inc. 1998), off-refuge land use practices within areas of the Roswell Artesian Basin pose threats to their long-term viability on BLNWR. Regional ground water pumping for agriculture, municipal water supplies, and oil and gas industry operations continue in the Basin (BLM 1994, USFWS 1997). Any increases in ground water extraction similar to aquifer drawdown that occurred in the Basin from the 1950's to 1970's could lead to habitat impacts on BLWNR. Oil and gas development is ongoing within areas of the Basin that Balleau Groundwater, Inc. (1996, 1999) identified as primary ground water source-zones for surface waters at BLNWR. Such extractive processes and industry operations can result in aquifer drawdown, alter aquitard hydraulics, and contaminate ground and surface waters in New Mexico (Hennighausen 1969; Jercinovic 1982, 1984; Longmire 1983; Quarles 1983; Boyer 1986; Richard 1988a, 1988b; Rail 1989; Richard and Boehm 1989a, 1989b; Balleau Groundwater, Inc. 1996; Martinez et al. 1998). Aquatic mollusks are acutely sensitive to ground and surface water contaminants (Havlik and Marking 1987, Eisler 1987, Green and Trett 1989, Augspurger 2003). There is increased risk of degradation of ground and surface water quality posed by sewage contamination (i.e., municipal waste, septic discharge) from urban encroachment in aquifer recharge-discharge areas along the western bounds of BLNWR (Federal Register 2005). Illicit dumping of domestic contaminants (e.g., pesticides, herbicides, waste oil, etc.) in sinkholes is known to contaminate ground water resources in karst areas of the United States (White et al. 1995,

Zokaites 1997) and in New Mexico (Bitner and Graves 1992, McQuillan et al. 1989). Natural stochastic events, such as frequent fires or drought, could adversely impact extant *A. pecos* populations at BLNWR. Contrary to Taylor (1987), it appears that *A. pecos* is tolerant of fire, and that intensity, duration and frequency of fire are principal factors that likely determine the species' ability to recover in response to variable fire regimes (Lang 2002). Prolonged drought may affect hydrologic conditions on BLNWR by reducing discharge through refuge surface waters which could result in desiccation of riparian habitats occupied by this species. Aquatic invasive species represent a threat to native wildlife and habitats at BLNWR (NMDGF 2008). Aquatic ecosystems and macroinvertebrates are likely to show strong responses to global climate change (Xenopoulos et al. 2005, Burgmer et al. 2007).

**Recommendation:** No change in listing status is recommended. In collaboration with the U. S. Fish and Wildlife Service, NMDGF should continue monitoring post-fire effects on aquatic macroinvertebrates and the riparian corridor of Bitter Creek. NMDGF and cooperators should continue to implement strategies of the state conservation plan to alleviate threats and achieve recovery of this species.

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**Wrinkled marshsnail, *Stagnicola caperata***

**Distribution:** While this widespread species is stable over much its North American range, populations are disjunct in New Mexico, Texas, and higher elevations of some western states where declines or local extinctions have been documented (Bequaert and Miller 1973; Taylor 1983a, 1983b). Extirpation of the BLNWR population between 1983-1985 was attributed to extensive wetland habitat loss, alteration, and sewage contamination from the Roswell

waste-water treatment plant (Taylor 1983a, NMDGF 1988). In New Mexico, Taylor (1983a, 1983b) also reported this species from Valles Caldera National Preserve, Jemez Mountains, Sandoval County.

**Current Status:** The wrinkled marshsnail was listed as state endangered in 1983. This species was recently documented from live specimens in: Hunter Marsh on BLNWR; vernal grassland pools in the Valle Grande, Valles Caldera National Preserve; and in high-elevation snowmelt pools near Big Costilla Peak, Taos County (Lang 2005).

**Threats:** Water contamination from sewage effluent and habitat modification due to removal of wetland vegetation (e.g., wildland fire, prescribed burning, cutting, excessive grazing pressure) represent primary threats (Taylor 1983a, NMDGF 1988). Aquatic ecosystems and macroinvertebrates are likely to show strong responses to global climate change (Xenopoulos et al. 2005, Burgmer et al. 2007).

**Recommendations:** No change in listing status is recommended. NMDGF should continue to conduct statewide surveys of high-elevation vernal pools and low-elevation ephemeral marsh habitats, and work with land managers to provide continued protection for known populations. Genetic and morphologic studies are recommended to assess taxonomic affinities of low- and high-elevation populations in New Mexico and west Texas relative to populations in the eastern United States.

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**Florida mountainsnail, *Oreohelix florida***

**Distribution:** *Oreohelix florida* is endemic to the Florida Mountains, Luna County (Metcalf and Smartt 1997). Pilsbry (1915) first reported this species as "*Oreohelix strigosa* var." from two fossil specimens. In his species description, Pilsbry (1939) considered it a subspecies of *O. metcalfei*. Metcalf (1974) elevated *florida* to full species rank based on unique shell characteristics. Additional state records from the Santa Rita and Tres Hermanas mountains, Cooke Peak, and Apache Hills are also of fossil specimens (Metcalf and Smartt 1997).

**Current Status:** The Florida mountainsnail was listed as state endangered in 1990. This species is known only from fossil shells; no live snails were found despite numerous malacological explorations during the late 1900's (Metcalf and Smartt 1997, Lang 2000). The apparent extinction of *O. florida*, and other primitive oreohelicids in southern and eastern New Mexico, might be attributed to climatic deterioration during the Holocene or natural extinction processes on small "montane islands" (MacArthur 1972, Metcalf and Smartt 1997).

**Threats:** Threats are not easily identified since an extant population has not been documented. However, land snails occupying high-elevation limestone outcrops are at risk from climate change, natural catastrophe (rock slide, wildfire), prescribed burning, and soil disturbance from mining and logging (NMDGF 1988, Sullivan 1997, Lang 2000).

**Recommendation:** Inventory of high-elevation limestone outcrops is recommended on "montane islands" along the international border of New Mexico and Mexico. In the unlikely event an extant population is discovered, then habitat protection would be paramount.

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**BIVALVIA**

**THREATENED**

**Lake fingernailclam, *Musculium lacustre***

**Distribution:** *Musculium lacustre* is known from Central and South America, Hawaii, Japan, Australasia, and Europe (Herrington 1962, Mackie 2007). Populations in North America occur most frequently in high-elevation, deep water marshes from Canada and Alaska south to the Sierra Nevada of California and in the Rock Mountains of southern Utah (Burch 1975). In New Mexico, the lake fingernailclam is reported from Upper Cieneguilla Creek, Colfax County, near Angel Fire Recreation Area (Taylor 1983).

**Current Status:** The lake fingernailclam was listed as state threatened in 1983. The sole New Mexico population occurs on private land managed for recreational uses. The current status of *M. lacustre* in New Mexico is unknown.

**Threats:** Threats include contaminants from forest fire retardants (McDonald and Hamilton 1995) and habitat modification due to land development (NMDGF 1988). Poor watershed management could increase sedimentation of the wetland complex (Taylor 1983, NMDGF1988). Aquatic invasive species pose a threat to all native aquatic biota and ecosystems in New Mexico (NMDGF 2008). Aquatic ecosystems and macroinvertebrates are likely to show strong responses to global climate change (Xenopoulos et al. 2005, Burgmer et al. 2007).

**Recommendation:** No change in listing status is recommended. NMDGF should continue aquatic surveys to determine the statewide distribution of sphaeriid clams.

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**Swamp fingernailclam, *Musculium partumeium***

**Distribution:** The swamp fingernailclam is widespread throughout southern Canada and the United States, south to Nuevo Leon, México (Herrington 1962, Burch 1975, Mackie 2007). In New Mexico, this species is known only from Road Canyon Creek, Union County (Taylor 1983, NMDGF 1988).

**Current Status:** *Musculium partumeium* was listed as state threatened in 1983. The single documented population occurs on private land. The current status of this species in New Mexico is unknown.

**Threats:** Primary threats to species persistence include poor watershed management, stream modification (channelization, diversion, dewatering), and water pollution (NMDGF 1988). Aquatic ecosystems and macroinvertebrates are likely to show strong responses to global climate change (Xenopoulos et al. 2005, Burgmer et al. 2007).

**Recommendation:** No change in listing status is recommended. NMDGF should continue aquatic surveys of to determine the statewide distribution of sphaeriid clams. Aquatic invasive species pose a threat to all native aquatic biota and ecosystems in New Mexico (NMDGF 2008).

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**Long fingernailclam, *Musculium transversum***

**Distribution:** Native range includes most of temperate and subtropical North America, from Labrador west to the Northwest Territories, south to central México (Herrington 1962, Burch 1975, Mackie 2007). New Mexico populations are known from sites within the Canadian River Basin (Conchas River, Cabra Springs, Ute Creek near Gladstone) and Dry Cimarron River Basin (Clayton Lake, Road Canyon Creek; Taylor 1983, NMDGF 1988). The largest known population in New Mexico was extirpated from the Pecos River below Carlsbad (Taylor 1983).

**Current Status:** The long fingernailclam was listed as state threatened in 1983. While the statewide status of this species is unknown, an extant population occurs in the Black River (Lang 2005). Aquatic ecosystems and macroinvertebrates are likely to show strong responses to global climate change (Xenopoulos et al. 2005, Burgmer et al. 2007).

**Threats:** Taylor (1983) attributed extirpation of the Pecos River population to irrigation water diversions. Additional threats could include stream modification (channelization, dewatering), water pollution, and poor watershed stewardship (NMDGF 1988). Aquatic invasive species pose a threat to all native aquatic biota and ecosystems in New Mexico (NMDGF 2008).

**Recommendation:** No change in listing status is recommended. NMDGF should continue aquatic surveys to determine the statewide distribution of sphaeriid clams.

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**Lilljeborg's peaclam, *Pisidium lilljeborgi***

**Distribution:** In North America, this circumboreal species occurs in lakes and rivers from the Arctic south across the northern United States (Herrington 1962, Burch 1975, Mackie 2007). *Pisidium lilljeborgi* is found in high-elevation lakes of California (Trinity Alps), Utah (Uinta Mountains), and New Mexico (Sangre de Cristo Mountains) (Taylor 1983). In New Mexico, Lilljeborg's peaclam is known only from Nambe Lake, Santa Fe County. This population represents the most southern and highest elevational occurrence in either North America or Eurasia (Taylor 1983, NMDGF 1988). Nambe Lake is a remote glacial cirque located in the Santa Fe National Forest, and is managed as a water supply reservoir for the City of Santa Fe.

**Current Status:** Lilljeborg's peaclam was listed as state threatened in 1983. The current status of this species is unknown in New Mexico.

**Threats:** Due to its restricted distribution, the Nambe Lake population is vulnerable to contaminants from fire suppressant chemicals and natural stochastic events (fire, sedimentation) (Taylor 1983, NMDGF 1988, McDonald and Hamilton 1995). Reservoir drawdown practices and drought conditions could affect the Nambe Lake population. Aquatic invasive species pose a threat to all native aquatic biota and ecosystems in New Mexico (NMDGF 2008). Aquatic ecosystems and macroinvertebrates are likely to show strong responses to global climate change (Xenopoulos et al. 2005, Burgmer et al. 2007).

**Recommendation:** No change in listing status is recommended. NMDGF should continue surveys of high-elevation, aquatic habitats to determine the statewide distribution of sphaeriid clams.

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**Sangre de Cristo peaclam, *Pisidium sanguinichristi***

**Distribution:** This narrowly distributed peaclam is endemic to a single, high-elevation (10485 ft) glacial cirque (Middle Fork Lake) at the base of Bull of the Woods Mountain, Taos County. The Sangre de Cristo peaclam colonizes muddy shallows along the lake perimeter and a short reach of the lake outflow, Middle Fork Creek (Taylor 1983, 1987; NMDGF 1988). This peaclam can be considered the most narrowly restricted of all known North American pisidia and perhaps worldwide (Lang 2002).

**Current Status:** The Sangre de Cristo peaclam was listed as state threatened in 1983. Annual population monitoring began in July 1995 under a multi-agency conservation effort initiated by the U. S. Forest Service (1996). A total of 42 sites was surveyed from 1996-1999 in the northern Sangre de Cristo Mountains to determine the species' range. Only six valves out of an abundance of *Pisidium* voucher material (i.e., exceeding ca. 750 specimens) collected from Middle Fork Lake (1995-1999) remotely resembled *P. sanguinichristi* specimens (B. Lang, NMDGF, and Dr. G. L. Mackie, University of Guelph, Canada; *pers. obs.*). No pisidia collected from any other sites during this 3-year survey were referable to *P. sanguinichristi*. Based on the absence of *P. sanguinichristi* from the type locality, and the lack of discernable differences in shell shape and hinge dentition between paratype *P. sanguinichristi* and the conchologically similar and co-occurring congener, *Pisidium milium*, the NMDGF requested taxonomic assessment of the putative *P. sanguinichristi* as a valid species (NMDGF 1996). A mitochondrial DNA study comparing the nominal species with *P. milium* yielded inconclusive results since the biochemical analysis was restricted to a comparison of DNA extracted from shell proteins (Wilson et al. 1998). The taxonomic validity of this species merits further study (Lang 2002).

**Threats:** Whereas the remoteness and ownership of Middle Fork Lake (Carson National Forest) affords some measure of protection, the site experiences intense periods of seasonal recreational use (USFS 1996). Threats

include shoreline destabilization (erosion and sedimentation due to foot and vehicular traffic), contamination from chemicals used in fish stocking and forest fire suppressants, placer mining runoff, and natural stochastic events (fire, drought) (Taylor 1983, NMDGF 1988, McDonald and Hamilton 1995, USFS 1996). Aquatic invasive species pose a threat to all native aquatic biota and ecosystems in New Mexico (NMDGF 2008). Aquatic ecosystems and macroinvertebrates are likely to show strong responses to global climate change (Xenopoulos et al. 2005, Burgmer et al. 2007).

**Recommendation:** No change in listing status is recommended. The NMDGF should continue sphaeriid clam surveys in high-elevation, wetland habitats throughout the Sangre de Cristo Mountains, and expand this effort to include the Jemez Mountains. In the event live peaclams referable to *P. sanguinichristi* are located, genetic studies comparing *P. sanguinichristi* with *P. milium* would be in order. While a study comparing shell characteristics of these congeners may help resolve outstanding taxonomic questions, considerable ecophenotypic variation in shell morphology and hinge dentition of sphaeriid clams manifested by local environmental influences could render such an effort futile (Herrington 1962, Mackie 2007).

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**GASTROPODA**

**THREATENED**

**Gila springsnail, *Pyrgulopsis gilae***

**Distribution:** The Gila springsnail is endemic to a series of thermal spring in the Gila River Basin, Gila Wilderness, Grant County (Taylor 1983, 1987). This species is known from ten isolated populations throughout the Basin: Alum Hot Spring, Gila River mainstem; an unnamed spring in the Middle Fork Gila River; three populations

from the East Fork Gila River; and five populations from headwater tributaries (i.e., Taylor Creek, 3 sites; Beaver Creek, 2 sites) of the East Fork Gila River (Taylor 1983, 1987; Mehlhop 1993; Lang 2002).

**Current Status:** This spring snail was listed as state threatened in 1985 (NMDGF Regulation 624) and is considered a candidate for listing under the Endangered Species Act (Federal Register 2002). Lang (2002) documented the persistence of this species at the type locality (unnamed spring, East Fork Gila River) and at Alum Hot Spring. Populations along the Gila River mainstem and Middle Fork Gila River occur on U. S. Forest Service (USFS) land. The East Fork Gila River sub-basin harbors eight populations: two each on private and dual stewardship (private-USFS) lands, and four populations on USFS managed land.

**Threats:** Natural stochastic events (drought, forest fire, sedimentation, flooding), wetland habitat degradation from recreational bathing, and poor watershed management (e.g., over-grazing, forest over-harvesting) represent primary threats to *P. gilae* populations on federal and private lands (Taylor 1983, 1987; NMDGF 1988; Mehlhop 1993). Fire suppression chemicals can have potentially deleterious effects on *P. gilae* populations (McDonald and Hamilton 1995). Introduction of non-native crayfish and the New Zealand mudsnail can adversely impact spring snails and aquatic habitats (Fernandez and Rosen 1996, NMDGF 2008, http://www.esg.montana.edu/aim/mollusca/nzms/nzmsbib.html). Long-term persistence of this species is contingent upon protection of spring sources, their outflows, and the riparian corridor immediately adjacent to these habitats. Aquatic ecosystems and macroinvertebrates are likely to show strong responses to global climate change (Xenopoulos et al. 2005, Burgmer et al. 2007).

**Recommendation:** No change in listing status is recommended. NMDGF should monitor extant populations and expand aquatic surveys to include unexplored reaches within the Gila River Basin. Recommend allocation of funding to assess genetic divergence of *P. gilae* among geographically isolated populations throughout the Gila River Basin. Any significant genetic divergence may warrant taxonomic reevaluation of the species, which may confer specific management recommendations particular to genetically distinct populations relative to current ownership and land-use practices.

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**Pecos springsnail, *Pyrgulopsis pecosensis***

**Distribution:** *Pyrgulopsis pecosensis* is endemic to two perennial tributaries of the Black River, Eddy County, New Mexico: Blue Spring (type locality) and Castle Spring (Taylor 1987).

**Current Status:** The Pecos springsnail was listed as state threatened in 1983. Acquisition of Blue Spring surface water rights (72-5-28 NMSA 1995) and the "...lack of oil and gas reserves in the area..." prompted reclassification of *P. pecosensis* from a candidate for listing under the Endangered Species Act to a species of concern (Federal Register 1996). The acquisition of surface water rights from Blue Spring was a temporary state lease. Contrary to this reclassification, the Black River valley has experienced repeated problems of ground water depletion and contamination. Water levels of domestic and agricultural/range wells in this watershed have lowered and even dried-up (residents of Black River Village and environs, *pers. com.*). Pecos springsnail is apparently extirpated from Castle Spring (Landye 1981, NMDGF 1988, Mehlhop 1992). Lang (2002, 2004) reported persistence of *P. pecosensis* in Blue Spring from springhead sources downstream through the middle reach of the spring run. This population has been monitored annually since 1997 and is currently stable (Lang 2008).

**Threats:** Taylor (1983) identified ground water depletion as the primary threat to extant populations of *P. pecosensis*. Extirpation of the Castle Spring population was attributed to a number of factors including flood scour, ground water depletion, and possible contamination from an upstream livestock tank (Landye 1981, NMDGF 1988, Mehlhop 1992). Regional ground water withdrawals for agriculture and oil and gas industry operations (exploration, storage, transfer and refining) are ongoing in the Black River valley and adjacent aquifers in Eddy County (BLM 1997). Such extractive processes and industry operations are known to deplete aquifers and to contaminate ground and surface waters in New Mexico (Hennighausen 1969; Jercinovic 1982, 1984; Longmire 1983; Quarles 1983; Boyer 1986; Richard 1988a, 1988b; Rail 1989; Richard and Boehm 1989a, 1989b; Balleau Groundwater, Inc. 1996; Martinez et al. 1998). Aquatic mollusks are acutely sensitive to ground and surface water contaminants (Havlik and Marking 1987, Eisler 1987, Green and Trett 1989, Augspurger et al. 2003). Richard (1988a, 1988b) and Richard and Boehm (1989a, 1989b) documented ground water contamination of domestic and agricultural/range wells in the upper Black River valley (i.e., Washington Ranch, Ballard Wells) by petroleum-derived hydrocarbons and sulfides. Richard and Boehm (1989b) reported "severe" sulfide contamination of Blue Spring, a regionally significant artesian spring that is a primary hydrologic source for the Black River (Hendrickson and Jones 1952). These authors indicated that gas contamination originating up-gradient was likely transported about 20 miles down-gradient to Blue Spring. Such long distance transport of ground water is common in karst, evaporite rock (White et al. 1995, Martinez et al. 1998). This raises long-term concerns for surface water quality of the Blue Spring wetland complex and the Black River, especially considering the proliferation of petroleum industry operations in the Black River valley. Oil and gas industry operations within the immediate watershed of Blue Spring are ongoing. Prolonged drought could reduce flow through the system, resulting in habitat loss while also increasing salinity and potentially concentrating contaminants. Introduction of non-native crayfish and the invasive New Zealand mudsnail can adversely impact spring snails and aquatic habitats (Fernandez and Rosen 1996, NMDGF 2008, http://www.esg.montana.edu/aim/mollusca/nzms/nzmsbib.html). Aquatic ecosystems and macroinvertebrates are likely to show strong responses to global climate change (Xenopoulos et al. 2005, Burgmer et al. 2007).

**Recommendation:** No change in listing status is recommended. NMDGF should develop a state recovery plan for this species. A "Candidate Conservation Agreement" (Federal Register 1997) could provide a mechanism for species and habitat conservation compatible with past and present land-use practices. Continue annual habitat and population monitoring of *P. pecosensis* in Blue Spring.

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**New Mexico springsnail, *Pyrgulopsis thermalis***

**Distribution:** *Pyrgulopsis thermalis* is restricted to a series of thermal springs along the East Fork Gila River, and an isolated thermal spring (Alum Hot Spring) on the Gila River mainstem below the confluence of the East and West forks, Grant County (Taylor 1983, 1987; NMDGF 1988; Mehlhop 1993). This species prefers thermal spring flows with temperatures from 33 to 39ºC, but occurs most abundantly within lower limits of this range (Taylor 1987).

**Current Status:** The New Mexico springsnail was listed as state threatened in 1983, and is a federal candidate for listing (Federal Register 1996). Mehlhop (1992, 1993) reported stable populations along the Gila River. Lang (2002) documented persistence of this species at the type locality (Alum Hot Spring) and at Taylor's (1987) East Fork Gila River site.

**Threats:** While the Gila Wilderness may afford some measure of protection, both populations are vulnerable to habitat degradation by natural stochastic events (forest fire, flooding, sedimentation), poor watershed management, water pollution/contaminants from recreational bathing and fire suppressant chemicals (Taylor 1983, 1987; NMDGF 1988, McDonald and Hamilton 1995; Lang 2002). Introduction of non-native crayfish and the invasive New Zealand mudsnail can adversely impact spring snails and aquatic habitats (Fernandez and Rosen 1996, NMDGF 2008, http://www.esg.montana.edu/aim/mollusca/nzms/nzmsbib.html). Aquatic ecosystems and macroinvertebrates are likely to show strong responses to global climate change (Xenopoulos et al. 2005, Burgmer et al. 2007).

**Recommendation:** No change in listing status is recommended. NMDGF should monitor extant populations and expand surveys to malacologically unexplored reaches within the Gila River Basin. Efforts to control the use of personal hygiene detergents (e.g., soap, shampoo, etc.) by bathers could protect habitat for *P. thermalis* in downstream reaches of Alum Hot Spring. Signage that prohibits use of cleansing agents would still allow for recreational use of the spring. Recommend allocation of funding to assess genetic divergence of *P. thermalis* among geographically isolated populations throughout the Gila River Basin. Any significant genetic divergence may warrant taxonomic reevaluation of the species, which may confer specific management recommendations particular to genetically distinct populations relative to current ownership and land-use practices.

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**Star gyro, *Gyraulus crista***

**Distribution:** This species is widespread throughout northern North America, ranging south into northern New Mexico, where it occurs in emergent wetlands associated with Black Lake and Coyote Creek, Colfax County (Taylor 1983, NMDGF 1988).

**Current Status:** The star gyro was listed as state threatened in 1983. The status of this species is currently unknown in New Mexico.

**Threats:** Habitat modification due to any alteration of the wetland complex, pollution, dewatering, or land development within the proximate watershed (Taylor 1983, NMDGF 1988). Aquatic invasive species pose a threat to all native aquatic biota and ecosystems in New Mexico (NMDGF 2008). Aquatic ecosystems and macroinvertebrates are likely to show strong responses to global climate change (Xenopoulos et al. 2005, Burgmer et al. 2007).

**Recommendation:** No change in listing status is recommended. NMDGF should resurvey known site occurrences and conduct statewide surveys to determine the distribution of this species.

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**Shortneck snaggletooth, *Gastrocopta dalliana dalliana***

**Distribution:** *Gastrocopta dalliana dalliana* is widespread in Arizona (central, southern, and western), and has been documented throughout northern México (Chihuahua and Sonora) south to Baja California (Bequaert and Miller 1973). In New Mexico, shortneck snaggletooth appears restricted to geographically disparate populations in the Upper Sonoran Life Zone of the Animas (Indian Creek Canyon), Big Hatchet, San Luis (Lang Canyon) and

Peloncillo mountains (Coronado National Forest lands) of Hidalgo County (Metcalf and Smartt 1997, Lang 2000). Fossil records near Santa Rosa from drift along the Pecos River are questionable (Branson et al. 1966).

**Current Status:** The shortneck snaggletooth was listed as state endangered in 1990, and was downlisted to threatened during the 2006 Biennial Review. In New Mexico, *G. d. dalliana* is more widespread than previously thought. This species occurs in a diversity of low-elevation plant communities of southwestern Hidalgo County: densely wooded, mesic habitat of Indian Creek Canyon, Animas Mountains (Lang 2000); along the riparian corridor of Guadalupe Canyon (Dr. Artie L. Metcalf, UTEP, unpub. data); and sparse juniper-oak forest (J. Nekola, unpub. data). It also occurs sporadically on exposed dry slopes in the Big Hatchet and San Luis mountains (Lang 2000). Habitat vital to *G. d. dalliana* in the Animas and San Luis mountains is under stewardship of the private landowner. The population in the Big Hatchet Mountains occurs on BLM lands.

**Threats:** Habitat modification from logging, mining, and forest fire represent primary threats to localized populations (NMDGF 1988, Lang 2000).

**Recommendation:** NMDGF should continue land snail surveys to refine the range of this species in southern New Mexico, and work with land managers to ensure that habitat management promotes persistence of the species.

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**Ovate vertigo, *Vertigo ovata***

**Distribution:** The historic range included northern North America, ranging south over most of the United States to México. The occurrence of *Vertigo ovata* in the Western Molluscan Province is sporadic, especially in the Rocky Mountain States (Bequaert and Miller 1973). Fossil specimens of *V. ovata* from spring-related Pleistocene and Holocene deposits chronicle the extirpation of localized populations throughout Arizona, New Mexico, and western Texas (Metcalf 1967, Bequaert and Miller 1973, Metcalf and Smartt 1997). In New Mexico, extant populations are known from mesic habitats of Blue Spring, Eddy County, and from the riparian corridor associated with Alamosa Creek immediately upstream of the Monticello Box, Socorro County (Lang 2001).

**Current Status:** The ovate vertigo was listed as state threatened in 1991 (NMDGF Regulation 682). Populations at Blue Spring and Alamosa Creek appear stable under current land use practices, with evidence of successful reproduction and recruitment of immature snails into the adult population (Lang 2001).

**Threats:** In the Desert Southwest, reduction in habitat suitability for this species is attributable to natural stochastic events (e.g., Holocene warming, arroyo entrenchment; Haynes, 1968) exacerbated by human-related land use activities (e.g., wetland [marsh] drainage and development, stream diversion, grazing; Metcalf and Smartt 1997). Beryllium ore exploration and mining within the immediate watershed of Alamosa Creek have posed threats to this species (NMGF 2000, 2002); currently there are no proposals or permits for such activities. Extant populations at Blue Spring are threatened by ground water extraction and oil and gas industry operations which can result in local/regional aquifer depletion (Hennighausen 1969, Quarles 1983), diminution of spring flows (NMDGF 1988), and surface and ground water contamination (Jercinovic 1982, 1984; Longmire 1983; Quarles 1983; Boyer 1986; Eisler 1987; Green and Trett 1989). Poor watershed stewardship and natural stochastic events, such as prolonged

drought, could adversely impact habitat conditions at Blue Spring by reducing hydrologic discharge through the wetland system; thereby desiccating riparian plant communities and increasing grazing pressure in these areas (Taylor 1983, NMDGF 1988, Mehlhop 1992). Aquatic ecosystems and macroinvertebrates are likely to show strong responses to global climate change (Xenopoulos et al. 2005, Burgmer et al. 2007).

**Recommendations:** No change in listing status is recommended. NMDGF should continue statewide surveys of marsh habitats while monitoring extant populations. Resource agencies should pursue opportunities to acquire private lands, including mineral and ground water rights, where future beryllium ore exploration or mining may adversely affect aquifers that supply spring-fed wetlands of Alamosa Creek upstream of the Monticello Box.

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**Hacheta Grande woodlandsnail, *Ashmunella hebardi***

**Distribution:** *Ashmunella hebardi* is narrowly restricted to dense pine cover along the south wall of Chaney Canyon (6600-7400 ft) on the west-central flank of the Big Hatchet Mountains west of Big Hatchet Peak, Hidalgo County (Metcalf and Smartt 1997, Lang 2005). The species may occur at higher elevations on vertical limestone facies immediately west-northwest of Big Hatchet Peak above 7400 ft.; sampling in this area is limited by access.

**Current Status:** *Ashmunella hebardi* was listed as state threatened in 1990, and is considered a federal species of concern (Federal Register 1994). The Hacheta Grande woodlandsnail occurs most commonly at the base of limestone outcrops beneath large rock fragments and rubble piles where litter-soil mold collects. The BLM conducted a prescribed burn in the north-central range of the Big Hatchet Mountains (Thompson Canyon northward to Zeller Peak) in 2005 that did not impact this species.

**Threats:** Any form of soil disturbance (e.g., mineral mining) or vegetation removal (e.g. logging, prescribed burn, or grazing) would likely result in adverse impacts to edaphic conditions and direct habitat loss in areas were this species occurs. Habitat modification from wildland fire, deciduous woody plant diseases, insect pests, and climate change could impact extant populations (Sullivan 1997; Lang 2001, 2005).

**Recommendation:** No change in listing status is recommended. Population monitoring should continue. NMDGF should initiate a conservation plan for this species.

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**Cooke's Peak woodlandsnail, *Ashmunella macromphala***

**Distribution:** This species was known only from the precipitous north slope of Cooke's Peak, Cooke's Range, Luna County (Vagvolgyi 1974, Metcalf and Smartt 1997). Surveys north and south of Cooke's Peak documented a single isolated population of *Ashmunella macromphala* on a north-facing igneous scree slope in OK Canyon (Lang 2001). While no live snails were observed at this site, recent shell material implies that a viable population may exist there.

**Current Status:** Cooke's peak woodlandsnail was listed as state threatened in 1990. Both populations of *A. macromphala* occur on BLM land.

**Threats:** Land snails occupying high-elevation outcrops and talus sprawls may be risk from climate change, natural catastrophe (rock slide, wildfire), prescribed burning, and soil disturbance from mining and logging (NMDGF 1988; Sullivan 1997; Lang 2001, 2004). Surveys in May 2000 documented significant sign of cattle grazing throughout the unnamed canyon leading up to the base of the type locality (Lang 2001). While cattle will likely not venture onto or across a talus slope, intense browsing of deciduous woody vegetation around the perimeter of a scree slope can potentially decrease leaf litter available as food for snails, significantly alter seral succession, and affect plant community composition. Vagvolgyi (1974) discussed the importance of deciduous leaf litter for this species.

**Recommendation:** No change in listing status is recommended. NMDGF should monitor extant populations, and expand malacological surveys for this species to include potentially suitable habitats in southwestern areas of the Cooke's Range. NMDGF should pursue development of a state recovery plan.

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**Mineral Creek mountainsnail, *Oreohelix pilsbryi***

**Distribution:** *Oreohelix pilsbryi* is endemic to the Black Range, Sierra County (Pilsbry 1939), where it has been reported from two localities near "Oliver's Mine" along Mineral Creek, about 5.5 miles west of Chloride (Metcalf and Smartt 1997). This species was previously known from a 30 m section of limestone outcrop along Mineral Creek (type locality), and from similar habitat located 50 m up-slope (NMDGF 1988, Metcalf and Smartt 1997).

**Current Status:** Mineral Creek mountainsnail was listed as state threatened in 1990. Lang (2001) found *O. pilsbryi* abundant throughout an approximate 0.3 mile reach of stream that constricts Mineral Creek to a narrow sinuous channel lined by limestone outcrops; several small shells (5-10 mm *w*) confirmed a reproducing population. No empty shells or fragments were observed downstream from this site.

**Threats:** Considering this species apparent affinity for moist soils on well-shaded north- and east-facing slopes, any form of canopy removal, whether by cutting or forest fire, would likely dry the forest floor and potentially render edaphic condition unsuitable to *O. pilsbryi.* This species is vulnerable to any form of soil disturbance or mining activity within the immediate vicinity of occupied habitat. While cattle may not graze regularly at the type locality, cows do travel the narrow stream corridor and rest along shaded canyon walls. Soil disturbance from such foot traffic and trampling could adversely affect *O. pilsbryi* if downstream grazing intensity increases so as to push cattle into marginal habitats upstream in search of forage (NMDGF 1988, Lang 2001).

**Recommendation:** No change in listing status is recommended. NMDGF should continue to monitor extant populations and survey for new populations. Fencing of the type locality would serve to protect this species' limited habitat. NMDGF should pursue development of a state recovery plan.

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**Doña Ana talussnail, *Sonorella todseni***

**Distribution:** The Doña Ana talussnail is endemic to Doña Ana Mountains, Doña Ana County (Miller 1976). *Sonorella todseni* is the most geographically restricted of all known species of *Sonorella* in New Mexico (Metcalf and Smartt 1997).

**Current Status:** *Sonorella todseni* was listed as state threatened in 1990. Lang (2001) reported live *S. todseni* in rivulet-like accumulations of dark rhyolitic talus on the north and east slope of Doña Ana Peak. Total population size appears very small, probably occupying <1.0 acre, collectively (Sullivan 1997).

**Threats:** Habitat protection is paramount for the conservation of this species, which is vulnerable due to its restricted range, fragile habitat, and easy public land access (NMDGF 1988, Lang 2001). The extant population is susceptible to any form of soil disturbance or mining activity in the general vicinity of talus slopes. Surveys revealed sign of shrub removal by digging and a plastic tag tie from a local gardening center (Lang 2001). Removal of woody vegetation not only disturbs talus slopes, but also results in loss of food and cover for snails (Vagvolgyi 1974), increases the potential for slope erosion, and effectively reduces water retention capacity of the soil. Cumulative effects of these activities can have irrevocable impacts, exacerbating habitat desiccation and increasing substrate temperatures, which can dry-out developing egg masses deposited in talus just below the ground surface. Climate change, natural perturbations (fire, rock slides), mining, and related substrate disturbance activities represent threats to this species (NMDGF 1988, Sullivan 1997, Lang 2001).

**Recommendation:** No change in listing status is recommended. NMDGF should continue efforts with the Bureau of Land Management to monitor extant populations and to secure occupied habitat through a state recovery plan.

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**VERTEBRATES**

**FISHES**

**ENDANGERED**

**Gila chub, *Gila intermedia***

**Distribution:** Gila chub was historically present in smaller streams and cienegas of the Gila River drainage of southwestern New Mexico (Sublette et al., 1990; Paroz and Propst, 2007), southeastern Arizona (Minckley, 1973; Rinne, 1976), and northern Sonora (Varela-Romero et al., 1992). This chub has an affinity for deep pools in slow-

velocity water and is almost always associated with cover, such as undercut banks, root bolls of large woody vegetation, and instream debris piles (Rinne and Minckley, 1991; Weedman et al., 1996). In New Mexico, Gila chub was known from small streams, several of which were associated with cienegas (e.g., San Simon Creek, upper Tularosa River, and Duck Creek) (Carman, 2006). The chub genus *Gila* is taxonomically complex and many questions remain to be resolved regarding the relationships of its species (Schwemm, 2006). Minckley and DeMarais (2000) proposed that in the Gila River drainage, the genus is comprised of three species, *G. intermedia, G. robusta,* and *G. nigra.* While recent work supports this classification (Schwemm, 2006) and New Mexico recognizes the species, management at a population level ensures that the entire *Gila* complex is conserved.

**Current Status:** Gila chub was state-listed as endangered in New Mexico in 1978 and was recently federally listed as endangered with critical habitat (USFWS 2005). A state recovery plan was approved in 2006 (Carman 2006). The Arizona range of Gila chub has diminished and it is rare in New Mexico, currently known only from Turkey Creek (Weedman et al., 1996; Carman, 2006). Small populations persist in Sonora (Varela-Romero et al., 1992). Wildfire and associated ash flows during 2003 greatly diminished the Turkey Creek population, but a few individuals, including age 0 chubs, were found in July 2004 (D. Propst, pers. comm.). The species may persist in canyon-bound portions of Mule Creek, a San Francisco River tributary.

**Threats:** Loss of stream and cienega habitats and nonnative fishes, such as smallmouth bass (*Micropterus dolomieui*), are probably the primary reasons for the greatly reduced range and abundance of Gila chub. Ash flows and elevated sediment loads remain a threat to the Turkey Creek population.

**Recommendation:** No change in listing status is recommended. Implementation of the recovery plan should continue (Carman, 2006). The Turkey Creek population should be periodically sampled (at least biennially) to monitor its status; monitoring is scheduled in 2008. If wildfire threatens Turkey Creek population, individuals should be evacuated and temporarily held in secure facility until ash and elevated sediment loads no longer threaten population. Replication of the Turkey Creek population in a secure habitat within historical range is necessary. Surveys should be conducted to accurately characterize its status in New Mexico. If additional populations are found, efforts should be made to protect them by precluding or removing nonnative fishes, habitat enhancement or protection, and restrictive angling regulations (if appropriate). The taxonomic relationships among the closely related *Gila* species of the Gila River drainage should be clarified.

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**Chihuahua chub, *Gila nigrescens***

**Distribution:** Chihuahua chub is native to the Mimbres, Guzmán, and Bustillos basins of southwest New Mexico and northwest Chihuahua (Smith and Miller, 1986; Miller, 2006). It generally occurs in stream and cienega habitats and almost always occurs in deep pool habitats associated with instream cover such as uprooted trees (Propst and Stefferud, 1994). In New Mexico, Chihuahua chub is limited mainly to a 15 km reach of the Mimbres River and associated spring habitats (Propst, 1999).

**Current Status:** Chihuahua chub was state listed as endangered in New Mexico in 1976 and was federally listed as threatened in 1983 (USFWS, 1983). A federal recovery plan for the species has been approved (USFWS, 1986). Chihuahua chub has declined significantly throughout its native range (Propst and Stefferud, 1994). In Chihuahua, it was found mainly in remote stream reaches where there was little or no modification of habitat by human activities and nonnative predatory fishes were absent. Ash-laden flows from the 1995 "Pigeon Fire" reduced Chihuahua chub abundance in the Mimbres River substantially. The surviving river population was probably supplemented by individuals leaving springs associated with the Mimbres River.

A spring system associated with the Mimbres River supports the largest wild population (ca. 300) of the species in the U.S., and individuals have been taken from this population to maintain a brood and refuge stock at Dexter National Fish Hatchery and Technology Center. The chubs in Mimbres River springs periodically have heavy infestations of yellow grub (*Clinostomum marginatum*) (J.J. Landye, pers. comm.), and this ectoparasite probably causes elevated mortality of spring inhabitants. Invasion of springs by largemouth bass (*Micoropterus salmoides*) necessitated several efforts to remove these nonnative predators. The Nature Conservancy (TNC) and New Mexico Department of Game and Fish have properties on the Mimbres River that are managed, in part, to provide habitat for Chihuahua chub. McKnight Creek, below the Gila trout waterfall barrier, was stocked with Chihuahua chub (1993 and 1997) to increase abundance of stream populations of the species. The Mimbres River population has been augmented in most years since 1999 with fish reared at Dexter National Fish Hatchery and Technology Center. Annual autumn monitoring of the Mimbres River population indicates its numbers have increased over the past 8 years (Propst and Paroz, 2007).

**Threats:** Modification and destruction of riverine habitats (dewatering, channelizing, and removal of woody riparian vegetation) are the greatest threats and impediments to recovery of Chihuahua chub in the Mimbres River. Nonnative fishes, such as rainbow trout (*Oncorhynchus mykiss*), usurp Chihuahua chub habitat and may prey upon them. Longfin dace (*Agosia chrysogaster*) may displace young Chihuahua chub from shoreline habitats. Escapement of nonnative fishes (e.g., largemouth bass) from Bear Canyon Reservoir is a threat to spring and riverine Chihuahua chub populations, but installation of a fish screen at outflow of the reservoir has diminished this threat. The yellow grub infestation of chubs in spring habitats presents a severe health threat to this population.

**Recommendations:** No change in listing status is recommended. Cooperative efforts with The Nature Conservancy, U.S. Fish and Wildlife Service, and U.S. Forest Service to improve status of the species should continue. The NMDGF Mimbres Property should continue to be managed for benefit of Chihuahua chub. Nonnnative salmonids should be removed from all stream reaches of the Mimbres River currently occupied by Chihuahua chub. Lands having suitable, or potential, Chihuahua chub habitat and water rights in Mimbres Valley should be obtained from willing sellers. The fish barrier at Bear Canyon Reservoir should be maintained to ensure there is no escapement of nonnative fishes, particularly centrarchids, from Bear Canyon Reservoir. The U.S. Fish and Wildlife Service should be encouraged to continue maintenance of captive population and brood stock at Dexter National Fish Hatchery and Technology Center. Regulations regarding use of bait fishes should be strictly enforced.

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**Roundtail chub, *Gila robusta***

**Distribution:** Roundtail chub formerly occupied the Colorado River and its tributaries from Wyoming south to the confluence of the Little Colorado River (Arizona), tributaries of the Colorado River downstream of the Little Colorado River, and headwaters of the Río San Pedro in northwestern Mexico (Minckley, 1973; Hendrickson et al., 1981; Tyus et al., 1982; Hendrickson, 1983; Mueller and Marsh, 2002; Miller, 2006). Throughout much of its range, the species was historically common (Minckley, 1973; Holden and Stalnaker, 1975). In New Mexico, roundtail chub occurred in the San Juan, Zuni (a Little Colorado River tributary), San Francisco, and Gila River drainages (Baird and Girard, 1853; Koster, 1957; Bestgen and Propst, 1989; Platania, 1990). In these streams, it was most common in moderate-velocity areas near vegetated shorelines and debris piles. Based upon Minckley and DeMarais' (2000) reclassification of Gila River drainage *Gila* species, roundtail chub was historically restricted to the mainstem Gila River downstream of Cliff (Schwemm 2006).

**Current Status:** Roundtail chub was state-listed as threatened in New Mexico in 1975 and uplisted to endangered in 1996. A state recovery plan for the Colorado River basin chubs, including roundtail chub, was completed in 2006 (Carman, 2006). The Navajo Nation lists roundtail chub as endangered, Group 2 (Mikesic et al., 2005). Although roundtail chub remains comparatively common in portions of the upper Colorado River drainage (Tyus et al., 1982), it has declined considerably in the lower portion of the Colorado River drainage (Bestgen and Propst, 1989; Rinne and Minckley, 1991; Mueller and Marsh, 2002). In New Mexico, the species is rare in the San Juan River (Paroz et al., 2007), extirpated from the Zuni River drainage (Propst et al., 2001), extirpated from the San Francisco River drainage (Bestgen and Propst, 1989), and likely was eliminated from in the Gila River drainage (Bestgen and Propst, 1989; Paroz et al. 2006; Paroz and Propst, 2007).

**Threats:** Habitat modification (channelization, dams, removal of woody riparian vegetation, discharge manipulation, and seasonal stream desiccation) and establishment of nonnative predators are the primary factors contributing to the imperiled status of the species.

**Recommendations:** No change in listing status is recommended. NMDGF has joined with other states (Colorado, Utah, Arizona, Nevada, and Wyoming), Native American tribes (Navajo, Jicarilla, and Southern Ute), and federal agencies (U.S. Bureau of Land Management and U.S. Forest Service) to develop a range-wide conservation plan for the species. Participation by NMDGF in this endeavor should continue. Implementation of the state recovery plan should continue, including an active program to restore roundtail chub to San Juan River. Nonnative ictalurids, cyprinids, and centrarchids should be removed from San Juan River chub habitats to improve potential for successful restoration of roundtail chub. Roundtail chub was recently restored to historical habitat in the lower Gila River in New Mexico. The taxonomic relationships among the closely related *Gila* species of the Gila River drainage should be clarified.

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**Rio Grande silvery minnow, *Hybognathus amarus***

**Distribution:** Rio Grande silvery minnow formerly occupied main-stem habitats of the Rio Grande from near its confluence with the Rio Chama in northern New Mexico downstream to the Gulf of Mexico and the Pecos River from near Santa Rosa downstream to its confluence with the Rio Grande (Bestgen and Platania, 1991). In New Mexico, the species was most common in the Rio Grande between Cochiti Pueblo and Elephant Butte Reservoir and in the Pecos River between Fort Sumner and Carlsbad (Bestgen and Platania, 1991). Within these stream reaches, it was most commonly found in main channel run habitats over sand substrates and seasonally in low velocity areas such as backwaters and embayments.

**Current Status:** Rio Grande silvery minnow was state listed as endangered in New Mexico in 1979 and federally listed as endangered in 1994 (USFWS, 1994). A recovery plan for the species was approved in 1999 (USFWS, 1999), and an approved revision is expected in 2008. The species currently occupies about 5% of its historical

range. It was extirpated from the Pecos River (Bestgen et al., 1989) and from the Rio Grande upstream of Cochiti Dam and downstream from the upper extent of Elephant Butte Reservoir (Edwards and Contreras-Balderas, 1991; Bestgen and Propst, 1996). In its current range between Algodones and Elephant Butte Reservoir, it is typically most common between San Acacia and Elephant Butte Reservoir, in part because the canal system and diversion dams at San Acacia, Isleta, and Angostura allow downstream movement but prevent upstream passage (Platania and Dudley, 2003). However, the San Acacia reach is also most susceptible to bouts of channel drying that cause extensive mortality. Between Albuquerque and Isleta, Rio Grande silvery minnow is rare, and it is uncommon between Isleta and San Acacia. Where still present, its abundance varies considerably seasonally and annually (Dudley and Platania, 2007). Since 2001, Rio Grande silvery minnows have been salvaged from drying river reaches, although relocation is now restricted to those fish most likely to survive stress of handling and transport (U.S. Fish and Wildlife Service, 2007). Stocking efforts in the Albuquerque reach since 2000 have augmented the population (Osborne et al. 2006), but genetic analyses indicate that an exceedingly low number of Rio Grande silvery minnow effectively produce offspring that survive to adults (Alò and Turner 2005; Osborne et al. 2005; Turner et al. 2006). Considerable effort has been expended on behalf of the species by the Middle Rio Grande Endangered Species Act Collaborative Program over the past 9 years. However, drought and extended seasonal drying of substantial reaches of the river have frustrated efforts of the Program, and survival of Rio Grande silvery minnow in the wild is low in most years. Population levels declined substantially from the early 1990s to 2005. During 2005, abundance of Rio Grande silvery minnow increased in response to an extended period of elevated discharge associated with snowmelt runoff, but abundance subsequently declined in 2006 (Dudley and Platania, 2007). Abundance increased somewhat in 2007 (S.P. Platania, personal communication).

**Threats:** Habitat modification (channelization, stream desiccation, modified thermal regimes, and impoundments), barriers to movement (i.e., diversion dams), and loss of natural flow regimes are the primary factors threatening the persistence of Rio Grande silvery minnow. Long-term forecasts predict decreased quantity and increasing demand on Rio Grande water (Agency Technical Workgroup 2005), exacerbated in the near term by new consumptive withdrawals by the cities of Albuquerque and Santa Fe. Nonnative fishes (predators and competitors) also negatively impact surviving Rio Grande silvery minnow populations. Interspecific competition from plains minnow *Hybognathus placitus*, introduced from the Canadian and Red rivers in Oklahoma via bait bucket transfer, likely contributed to extinction of Rio Grande silvery minnow from the Pecos River (Moyer et al. 2005).

**Recommendations:** No change in listing status is recommended. NMDGF should continue to actively participate with the U.S. Fish and Wildlife Service and other entities to implement the Rio Grande Silvery Minnow Recovery Plan (USFWS 1999). The Recovery Plan is currently being revised, and a primary focus of the revised plan will be to prevent extinction of the species. Surface flows should be maintained permanently in the Rio Grande from Angostura Diversion to Elephant Butte Reservoir. Augmentation of extant wild populations with hatchery-reared Rio Grande silvery minnow should be continued, and hatchery stocks should be managed to ensure sufficient genetic diversity to support augmentation and establishment of wild populations for recovery. USFWS intends to reintroduce Rio Grande silvery minnow to the Big Bend reach of the Rio Grande along the border of Texas and Mexico beginning in 2008, and NMDGF should support the establishment of additional populations within the species' historical range (e.g., Pecos River, Rio Grande above Cochiti Lake). Status of Rio Grande silvery minnow should be closely monitored. Regulations regarding use of bait fishes should be strictly enforced for the Rio Grande.

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**Arkansas River shiner, *Notropis girardi***

**Distribution:** The historic range of this shiner included plains streams in the Arkansas River drainage of New Mexico, Texas, Oklahoma, Kansas, and Arkansas (Cross and Collins, 1975; Gilbert, 1980; Matthews and Hill, 1980). In New Mexico, it occurred in the South Canadian River drainage from the vicinity of Sabinoso downstream to the New Mexico/Texas border (Sublette et al., 1990; Pittenger and Schiffmiller, 1997). It inhabits stream reaches characterized by extremes in discharge and is found most commonly in main channel runs over shifting sand and small gravel substrates (Cross and Moss, 1987, SWCA 2004). Spawning by Arkansas River shiner occurs from late spring through early autumn and is closely linked to increases in flow (Platania and Altenbach, 1998; Platania et al., 2005.).

**Current Status:** Arkansas River shiner was state listed as endangered in New Mexico in 1976. It was federally listed as threatened by USFWS in 1998 (USFWS, 1998). Arkansas River shiner is absent or declining in much of its historical range (Cross et al., 1983; Larson, 1988). In 2001, critical habitat was designated for the species in Kansas, Oklahoma, New Mexico, and Texas, but subsequently the Canadian River, from Ute Dam in New Mexico to Lake Meridith in Texas, was excluded from the designation (USFWS 2005). In New Mexico, Arkansis River shiner is currently found only in the South Canadian River downstream of Ute Dam and Revuelto Creek (Larson, 1988, SWCA 2004, Platania 2006). Arkansas River shiner was established in the Pecos River during the past 20 years, probably via bait bucket transfer, and it is moderately common in the river between Fort Sumner and Brantley Reservoir (Bestgen et al., 1989, Platania et al., 2005). The population of Arkansas River shiner in the Pecos River is not protected by NMDGF or by the U.S. Fish and Wildlife Service.

**Threats:** Desiccation of occupied habitat by water diversions and withdrawals and loss of flow spikes are probably the major threats to the species. Degradation of water quality also presents a threat to the species.

**Recommendation:** No change in listing status is recommended. A multi-year study to characterize status of South Canadian River drainage fishes, including Arkansas River shiner, was conducted from 2004 through 2007 (Platania 2006). Results of this study should be used to inform management actions for the species. Efforts should be made to restore Arkansas River shiner to areas of historical occupancy, particularly reaches of the South Canadian River

upstream of Ute Reservoir. Baitfish regulations should be strictly enforced in the Canadian River basin. Programs to protect flows in the South Canadian where Arkansas River shiner currently and historically occurred should be enforced (Canadian River Municipal Water Authority 2005). NMDGF should continue involvement in the USFWS recovery program.

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**Southern redbelly dace, *Phoxinus erythrogaster***

**Distribution:** Southern redbelly dace naturally occurs in the upper and middle Mississippi River drainage, Great Lakes drainages, and Ohio River drainage (Becker, 1983). Isolated native populations, likely remnants of a wider Pleistocene distribution, occur in Kansas (Cross and Collins, 1975), Oklahoma (Miller and Robison, 1973),

Arkansas (Robison and Buchanan, 1988), Colorado (Woodling, 1985), and New Mexico (Sublette et al., 1990). In New Mexico, the species occurs mainly in spring habitats associated with the upper Mora River, Coyote Creek, and tributaries to Black Lake (Sublette et al., 1990, Platania et al., 2007). The species prefers cool-water spring-fed systems and small streams with dense aquatic vegetation and clear water (Pfleiger, 1971; Boschung and Mayden 2004). Within its limited New Mexico range, it is common in suitable habitats.

**Current status:** Southern redbelly dace was listed as state endangered in New Mexico in 1975. Spring system populations within its historical New Mexico range appear to be stable, but stream (e.g., Mora River) have declined (Platania et al. 2007). Surveys completed during 2001 found the species persisting in portions of Coyote Creek, but absent from the Mora River near the Village of Mora (S.P. Platania, UNM, pers. comm.)

**Threats:** Excessive grazing probably impacted historical range of this species. Currently, modification of spring systems for water development, sedimentation, and introduction of nonnative predators, particularly brown trout (*Salmo trutta*), are the primary threats to southern redbelly dace in New Mexico.

**Recommendation:** No change in listing is recommended. Recently completed studies (Platania et al., 2007) to characterize status of fishes in the South Canadian River drainage provide an accurate and current assessment of the status of southern redbelly dace in New Mexico. In addition, a New Mexico Share with Wildlife funded study to characterize the life history of southern redbelly dace was recently completed and information from it will improve management and conservation of the species. The potential for NMDGF to purchase habitats occupied by southern redbelly dace in Mora River valley should be explored, and if available, purchased. Regulations regarding use of bait fishes should be strictly enforced in the Canadian River basin.

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**Colorado pikeminnow, *Ptychocheilus lucius***

**Distribution:** Colorado pikeminnow formerly inhabited the Colorado River system from its mouth in Baja California upstream to Wyoming (Minckley et al., 1986; Mueller and Marsh, 2002). Seasonal migrations of the species have been documented (Tyus and McAda, 1984). A large-bodied fish, growing to lengths greater than 1.5 m, it was the largest native predator in the system. Historically, it was moderately common to abundant in much of the Colorado River system (Minckley, 1973). In New Mexico, its native range included at least the San Juan River (Koster, 1960; Platania et al., 1991) and perhaps the Gila River (LaBounty and Minckley, 1972).

**Current Status:** Colorado pikeminnow was listed state-listed as endangered in New Mexico in 1975 and as endangered by U.S. Fish and Wildlife Service in 1967. The Navajo Nation lists Colorado pikeminnow as endangered, group 2 (Mikesic et al., 2005). Currently, Colorado pikeminnow persists mainly in the Green River in Utah (Holden and Stalnaker, 1975), and Yampa, Gunnison, and Colorado rivers in Colorado (Tyus and Karp, 1989; Osmundson and Kaeting, 1989). A small population of the species persists in the San Juan River in New Mexico and Utah (Platania et al., 1991). In 1996 through 1999, age-0 Colorado pikeminnow were stocked in the San Juan River; survival of individuals from these stockings for several months was documented (Trammell, 2000). After a

2 year hiatus, stocking of age-0 Colorado pikeminnow resumed in 2002, and has continued through 2007. Older fish (age-2 through age-5) have also been stocked opportunistically. Individuals from these stockings survived at least 1 year (Golden and Holden, 2005, Ryden, 2007), but it is uncertain how successfully they will recruit to the adult population. Colorado pikeminnow larvae have been irregularly collected in the San Juan River, indicating that at least a few mature adults occupy the system (Brandenburg and Farrington 2007). A recovery plan for the species has been approved (USFWS, 1991) and recovery efforts in the San Juan River are accomplished under the auspices of the San Juan River Basin Recovery Implementation Program (SJRRIP). The common name of the species was recently changed from Colorado squawfish to Colorado pikeminnow (Nelson, et al., 1998).

**Threats:** Fragmentation of range, water depletion, modification of natural flows, contaminants, competition and predation by nonnative fishes, and loss of prey base are the primary threats to Colorado pikeminnow.

**Recommendations:** No change in listing status is recommended. NMDGF should continue to work through the SJRRIP to support and implement actions to recover Colorado pikeminnow. Efforts to remove or suppress nonnative fish populations in the San Juan River drainage, focusing on those that prey upon Colorado pikeminnow, should continue. Augmentation of San Juan River Colorado pikeminnow population should continue. Because it was likely an important prey of Colorado pikeminnow, efforts to restore roundtail chub (*Gila robusta*) to San Juan River should be undertaken. Studies to determine reasons for low survivorship of stocked Colorado pikeminnow should be undertaken. Strict regulations regarding use of bait fishes should be adopted and implemented in the San Juan River basin.

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**Zuni bluehead sucker, *Catostomus discobolus yarrowi***

**Distribution:** Zuni bluehead sucker historically inhabited headwater streams of the Little Colorado River in east-central Arizona and west-central New Mexico (Smith et al., 1983; Crabtree and Buth, 1987). The species most frequently occurs in streams reaches with cobble and bedrock substrates with slow- to moderate-velocity water (Propst et al., 2001). In New Mexico, the sucker currently is limited to the headwaters of the Zuni River drainage.

**Current Status:** Zuni bluehead sucker was state listed as endangered in New Mexico in 1975. A state-sponsored recovery plan for the species was approved by New Mexico State Game Commission in December 2004 (Carman, 2004). Currently, the species is limited to a few areas in headwater tributaries and springs of the Zuni River in New Mexico (Hanson, 1980; Propst et al., 2001; Carman, 2008). Its status in Arizona is unknown (K.Young, AZGFD, pers. comm.). Genetic studies are ongoing to determine the relation of Zuni bluehead sucker to other suckers in the Little Colorado River (T.Dowling, ASU, pers. comm.). Zuni bluehead sucker is a candidate species for listing under the federal Endangered Species Act (USFWS, 2007).

**Threats:** Habitat degradation, mainly excessive siltation of streams, and loss of wetted habitat are the primary threats to the species. While efforts are ongoing to restore the Zuni River watershed, increased development in the area may exacerbate these threats. Nonnative predators, such as green sunfish (*Lepomis cyanellus*) also limit opportunities to expand the range and abundance of Zuni bluehead sucker. The presence and increasing abundance of crayfish in the basin might reduce habitat suitability for Zuni bluehead sucker.

**Recommendations:** No change in listing status is recommended. The Zuni Bluehead Sucker Recovery Plan, per guidelines of New Mexico Wildlife Conservation Act, was developed with participation of various stakeholders (e.g., Pueblo of Zuni, U.S. Forest Service, The Nature Conservancy, and private landowners) and implementation should continue (Carman, 2004; Carman, 2008). Collaborative conservation efforts should be formalized through development of a cooperative agreement. Efforts should be made to improve Zuni River watershed conditions and to provide long-term security for Zuni bluehead sucker habitats. The effects of groundwater pumping on surface flows in Zuni River drainage need elucidation. Nonnative fishes, particularly green sunfish, should be removed from historical Zuni bluehead sucker habitats. Monitoring and protection of extant populations should continue.

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**Blue sucker, *Cycleptus elongatus***

**Distribution:** Blue sucker occurs in larger rivers throughout much of the Mississippi-Missouri River and Gulf Coastal drainages (Gilbert, 1980). The historical range of the species in New Mexico was the Pecos River from north of Carlsbad downstream to the New Mexico/Texas border and the lower reaches of the Black River (Sublette et al., 1990). Archaeological evidence suggests that the species also occupied the Rio Grande in New Mexico (Gehlbach and Miller, 1961), but no specimens exist to confirm its existence there. Blue sucker is most common in rivers with moderately fast flowing water and deep pools (Moss et al., 1983).

**Current Status:** The blue sucker was state listed as endangered in New Mexico in 1976. Blue sucker has declined throughout much of its native range (Moss et al., 1983; NatureServe 2007). In recent decades in New Mexico, it was regularly found in the Pecos River only between Brantley Dam and Avalon Reservoir, a 15-km river reach, whereas it was rare in the Black River and the Pecos River downstream of Avalon Dam (Zymonas and Propst 2008). Populations of blue sucker have drastically declined since 2002 as a result of recurring outbreaks of toxic golden algae from Brantley Lake downstream. Blue sucker is likely extirpated from the Pecos River, and it is unknown if individuals in the Black River comprise a self-sustaining population. Recent research has produced evidence that the form of *Cycleptus* inhabiting the Rio Grande drainage (including Pecos River) warrants recognition as a species, although it has not been formally described (Burr and Mayden, 1999; Bessert, 2006).

**Threats:** Range fragmentation by dams, loss of high velocity habitats, contaminants, stranding in canals, and toxic conditions caused by golden algae *Prymnesium parvum* are the primary threats to the species in New Mexico. Pecos River fish kills attributed to golden algae occurred below Malaga, NM by 1988 (Rhodes and Hubbs 1992) and from Brantley Lake downstream beginning in 2002. Toxic conditions have recurred sporadically throughout this reach, and in November of 2007, a block delivery of water from Brantley Lake to Texas contained high levels of algal toxins (S. Denny, NMDGF, personal communication). Intensified oil and gas development represents an increasing threat to water quality in the Black River drainage.

**Recommendations:** No change in listing status is recommended. Permanent flows in Pecos River between Brantley Dam and Avalon reservoir should be maintained. The causes of golden algae blooms in lower Pecos River system need to be determined and efforts made to preclude such conditions from occurring in the future. The taxonomic relationship of Pecos River blue sucker with congeners needs elucidation. Following cessation of irrigation releases, blue suckers in canals of Carlsbad Irrigation District should be rescued and stocked in Black River or Pecos River between Brantley Dam and Lake Avalon. A captive propagation effort to facilitate conservation and recovery of blue sucker in New Mexico should be supported. Actions to protect the water quality of the Black River from the effects of oil and gas development should be promoted.

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**Pecos gambusia, *Gambusia nobilis***

**Distribution:** Pecos gambusia is endemic to springs and spring systems of the Pecos River valley of southeast New Mexico and Trans-Pecos Texas (Hubbs and Springer, 1957). Springs and gypsum sinkholes on Bitter Lake National Wildlife Refuge and Blue Spring and its outflow are the only documented areas of historical occurrence in New Mexico (Bednarz, 1979; Echelle and Echelle, 1980). Pecos gambusia occurs almost exclusively in springs and spring-run habitats with lithic or vegetative cover (Echelle et al., 1989).

**Current Status:** Pecos gambusia was federally listed as endangered in 1970. It was state-listed as endangered in New Mexico in 1975. A recovery plan for the species was finalized in 1983 (USFWS, 1983). The range of Pecos gambusia has diminished in Texas (Echelle and Echelle, 1980), but it still occupies its documented historical New Mexico range.

**Threats:** Groundwater mining, habitat modification by excessive grazing or spring run dredging, and nonnative predators present the greatest threats to Pecos gambusia. Hybridization with western mosquitofish *Gambusia affinis* may also be a threat (Swenton and Kodric-Brown 2007).

**Recommendations:** No change in listing status is recommended. Investigations into habitat preferences and and hybridization with western mosquitofish should continue. Potential sites for establishing additional populations should be evaluated and, if suitable, stocked with Pecos gambusia.

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**Spikedace, *Meda fulgida***

**Distribution:** Spikedace is endemic to the Gila River drainage of southwest New Mexico, southeast and central Arizona, and perhaps northern-most Sonora (Koster, 1957; Minckley, 1973; Miller and Winn, 1951; Miller, 2006). It is found in low- to moderate-gradient warmwater streams in shallow runs with moderate-velocity water over sand and small gravel substrates (Minckley, 1973; Propst et al., 1986). In preferred habitats, it is occasionally found in large aggregations.

**Current Status:** Spikedace was state-listed as a threatened species in 1975 and federally listed as threatened in 1986 (USFWS 1986). A federal recovery plan for spikedace was finalized in 1991 (USFWS 1991). Critical habitat was designated for the species in much of its occupied habitat in New Mexico (USFWS 2007). Spikedace has been eliminated from most (>90%) of its historical Arizona range and persists there only in Aravaipa Creek (Minckley, 1973; Barber and Minckley, 1966, Eby et al. 2003). No spikedace specimen has been found in Eagle Creek since

the late 1980s (Marsh et al., 1990; M. Richardson, USFWS, Phoenix, AZ. Pers. Comm.). It has not been found in the upper Verde River since 1997 ( Rinne 2005). In New Mexico, spikedace has been eliminated from the San Francisco River drainage (Anderson, 1978; Propst et al., 1986). The range of the species in the Gila River drainage in New Mexico is fragmented and declining; it is currently found mainly in the lower portions of the Cliff-Gila Valley reach of the Gila River and lower reaches of West Fork Gila River (Paroz and Propst 2007). In both the Cliff-Gila Valley reach and lower West Fork Gila River, its abundance declined from the late 1990s through 2006 (Propst et al. in press ). In 2007, spikedace abundance was higher in lower Cliff-Gila Valley reach than it was in several preceding years (NMDGF files; D. Miller, WNMU, Pers. Comm). Recent surveys failed to find it in East Fork Gila River (Paroz et al. 2006). It apparently has been eliminated from Middle Fork Gila River (last collected in 1995), likely a consequence of predation by nonnative yellow bullhead *Ameiurus natalis* and smallmouth bass *Micropterus dolomieui* and drought (Propst et al. in press). Spikedace is frequently found near the mouth of the Middle Box upstream of Redrock (Propst et al., 1986; Paroz et al., 2006; Paroz and Propst 2007). Overall, the status of spikedace in New Mexico has declined markedly, both in range and abundance, since the late 1990s.

**Threats:** Dewatering of riverine habitats by diversion or pumping, ash and sediment flows associated with wildfires, modification of occupied habitats (channelization and removal of woody debris), range fragmentation, and nonnative predators are the primary threats to the species. Range fragmentation (by artificial barriers and stream desiccation) limits the ability of the species to repopulate areas adversely modified by human activity. Drought for the past 10 years has exacerbated intensity of aforementioned human-caused threats.

**Recommendations:** No change in listing status is recommended. A natural flow regime in Gila River should be maintained and additional depletions or diversion of the Gila River within occupied or potential spikedace habitats should not occur. Removal of nonnative fishes, particularly predators, should be conducted within currently occupied and potential habitats of spikedace. Stocking of nonnative warmwater fishes should not occur in Gila River drainage. Spikedace should be restored to San Francisco River. Cooperative efforts with the Arizona Game and Fish Department, as well as several federal agencies, to conserve spikedace should continue. Recently adopted bait fish regulations should be strictly enforced by NMDGF.

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**Pecos bluntnose shiner, *Notropis simus pecosensis***

**Distribution:** Pecos bluntnose shiner formerly inhabited the Pecos River from near Santa Rosa downstream to Major Johnson Springs near Carlsbad (Hatch et al., 1985). Historical occurrence of persistent populations in the Texas portion of the Pecos River is doubtful (Platania, 1995). The species mainly occurs in pool and run mesohabitats within wide, shallow, sand-bed river reaches.

**Current Status:** Pecos bluntnose shiner was federally listed as threatened in 1987. It was state listed as threatened in New Mexico in 1976 and uplisted to endangered in 2006. The species has an approved recovery plan (USFWS 1992). Currently, Pecos bluntnose shiner is found in the Pecos River from near Old Fort State Park (near Fort Sumner) downstream to the inflow area of Brantley Reservoir near Carlsbad (Hoagstrom et al., 2008). Within this river reach, the fish tends to be most common upstream of Roswell. Systematic monitoring efforts indicated diminishing numbers beginning in 2002, associated with drought and desiccation of the Pecos River upstream of Roswell. Despite recovery efforts, abundance declined to historically low levels by 2005 (Davenport 2006). Although results of monitoring efforts have been questioned by some entities, an independent review of fish population data collected since 1992 confirmed that the precipitous decline since 2002 reported by NMDGF and USFWS was real and not an artifact of sampling vagaries (Fagan, 2005). Pecos bluntnose shiner abundance increased somewhat in 2006 and 2007 likely a consequence of maintenance of continuous flow from Sumner Dam to Brantley Lake (avoidance of intermittency) and increased rainfall in the summers of 2006 and 2007 (NMDGF and USFWS files).

**Threats:** Primary threats to Pecos bluntnose shiner include large volume, extended duration block releases from reservoirs during the summer reproductive season, seasonal dewatering, artificially depressed river flows, channelization, diminished habitat diversity, non-point pollution from agricultural sources, and range fragmentation. High volume reservoir releases during the summer spawning season displace large numbers of eggs and larvae into unsuitable habitats (Dudley and Platania, 2007; Hoagstrom et al., 2008). Forecast warmer and drier climatic conditions (Agency Technical Workgroup 2005) threaten to exacerbate stress from habitat constriction. Although the lower habitat reach (downstream of Roswell) experiences relatively better flow during dry periods, it supports an unbalanced age structure with few individuals in larger, adult size classes (Hoagstrom et al., 2008).

**Recommendations:** Based on the recent precipitous decline in abundance and anticipated increased threats to habitat due to drought and other factors (mainly river drying), no change in status is recommended. Water management options to avoid intermittency have recently been refined, but have not yet been tested in drought years. Multi-agency efforts to manage flows in the Pecos River to meet irrigation needs without imperiling surviving populations of Pecos bluntnose shiner should incorporate restoration or mimicry of natural flows. Permanent surface flows should be maintained throughout the currently occupied range of Pecos bluntnose shiner, and additional water acquisition options should be identified. Short-term, emergency actions such as rescue, salvage, and re-release of fish to the river following drying events should be considered to prevent extirpation of the species in the wild. Efforts to restore the river channel downstream of Roswell to a more natural configuration should be initiated, and NMDGF should continue to support restoration efforts in progress on the Bitter Lakes National Wildlife Refuge. The potential to restore Pecos bluntnose shiner to formerly occupied habitat in the Pecos River upstream of Sumner Reservoir should be investigated. Strict enforcement of bait fish regulations should be followed throughout the Pecos River drainage.

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**THREATENED**

**Gila trout, *Oncorhynchus gilae***

**Distribution:** Historically, Gila trout inhabited cool and coldwater reaches of the Gila (including the San Francisco River) and Verde rivers drainages in southwest New Mexico and eastern and central Arizona (Miller, 1950; Minckley, 1973, Behnke, 1992). In New Mexico, Gila trout formerly occurred in the Gila River from its confluence with Mogollon Creek upstream through its headwaters and in tributaries of the San Francisco River (Propst et al., 1992). Although Gila trout historically inhabited a variety of stream habitats, it now occurs mainly in small headwater streams (Propst et al., 1992); in such streams availability of pool habitat appears to be critical to abundance (Rinne and Medina, 1988; Propst and Stefferud, 1997).

**Current Status:** Gila trout was listed as endangered by U.S. Fish and Wildlife Service in 1967, but was downlisted to threatened in 2006 (USFWS 2006). Gila trout was listed as endangered in 1975 by New Mexico and it was downlisted to threatened in 1988. The Gila Trout Recovery Plan was recently revised (USFWS 2003) and provides detail on what must be accomplished for its delisting the species. Gila trout occupies about 9 km of its historical Arizona range and currently occurs in about 90 km of mainly small headwater habitats in New Mexico. Renovation of upper West Fork Gila River will, when completed, increase occupied habitat by about 34 stream km. Abundance in occupied habitats is variable, ranging from fewer than 100 adults in the smallest to several thousand adults in the largest (Propst and Stefferud, 1997). Contamination of extant populations by nonnative rainbow and brown trouts and elimination of populations by wildfires reduced wild populations of Gila trout substantially between 1989 and 2004. Following downlisting and adoption of an Endangered Species Act Section 4d rule that allows NMDGF to implement 'take' regulations, Black Canyon and lower Mogollon and Iron creeks were opened to special regulation angling.

**Threats:** Contamination of extant populations by nonnative rainbow and brown trouts, wildfire, and habitat degradation are the primary threats to the species.

**Recommendations:** No change in listing status is recommended. Cooperative efforts with Arizona Game and Fish Department, U.S. Fish and Wildlife Service, and U.S. Forest Service to restore species to its historical range should continue. In particular, removal of nonnative trout from upper West Fork Gila River drainage should be completed and removal of nonnative salmonids from West Fork Mogollon Creek, and Rain Creek in New Mexico, and suitable streams in Blue River drainage in Arizona should be initiated. As soon as nonnative trout are completely removed from each renovated stream, Gila trout of appropriate lineage should be repatriated. Because of limited distribution and abundance, all reasonable efforts should be undertaken to protect extant Gila trout

populations from effects of wildfire and fire-induced ash flows. Stocking of nonnative salmonids in historical range of Gila trout should cease. As additional populations are established, each should be evaluated for sport fishing potential and, if appropriate, be opened to special regulation angling.

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**Mexican tetra, *Astyanax mexicanus***

**Distribution:** The native range of Mexican tetra extends from Gulf Coastal drainages of eastern and central Mexico northward to the Nueces River of Texas (Birkhead, 1980). It occurs in the Rio Grande from its mouth upstream to the Big Bend region and in the Pecos River upstream to near Santa Rosa (Koster, 1957). Mexican tetra tends to be more common in low-velocity pool habitats in small streams and spring systems.

**Current Status:** Mexican tetra was state listed as threatened in New Mexico in 1976. It is locally common in small streams and springs along the Pecos River near Roswell and also at Blue Spring. Mexican tetra is rare in the main stem Pecos River, Black River, and Delaware River (NMDGF files; T. Frey, BLM, personal communication).

**Threats:** Loss of habitat by groundwater mining,diversion of flows from small streams, and outbreaks of toxic golden algae appear to be the main threats to the species in New Mexico.

**Recommendations:** No change in listing status is recommended. Surveys to document the current distribution and status of the species in New Mexico should be undertaken. The causes of golden algae blooms in lower Pecos River system need to be determined and efforts made to preclude such conditions from occurring in the future. Bait-fish use regulations should be strictly enforced in the entire Pecos River drainage.

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**Peppered chub (formerly Arkansas River speckled chub), *Macrhybopsis tetranema***

**Distribution:** Arkansas River speckled chub is native to the Arkansas River drainage of New Mexico, Colorado, Kansas, Oklahoma, Texas, and Arkansas (Wallace, 1980). In New Mexico, it historically occurred in the South Canadian River drainage downstream of the confluence of Ute Creek and in Ute Creek (Sublette et al., 1990; Pittenger and Schiffmiller, 1997). The species is found mainly in shallow, permanently flowing plains streams over

clean sand and gravel substrate (Miller and Robison, 1973). It is found most frequently in moderate-velocity habitats and apparently avoids areas with low to zero water velocity (Cross and Collins, 1975).

**Current Status:** In New Mexico, Arkansas River speckled chub was state listed as threatened in 1978. Arkansas River speckled chub has disappeared from about 90% of its historical range (Luttrell, et al. 1999). It no longer occurs in Colorado (Luttrell et al., 1993) or Arkansas (Robison and Buchanan, 1988) and its range in Kansas has contracted considerably (Cross et al., 1985). In Oklahoma, it is now limited mainly to the north-central portion of the state (Luttrell et al., 1993). The New Mexico range of Arkansas speckled chub is now restricted to the South Canadian River downstream of Ute Dam. Within this reach it was moderately common in the early 1990s. When reported, a recently completed multi-year survey of the South Canadian River drainage will clarify the current status of the species within its New Mexico range. The *Macrhybopsis aestivalis* complex is comprised of six nominal species. In a recent review of the systematics of the complex, Arkansas River speckled chub was elevated to species, *Macrhybopsis tetranema* (Eisenhour, 1999). The American Fisheries Society recognizes the genus as *Macrhybopsis* (Nelson et al., 2004), but Sublette et al. (1990) use *Extrarius* as the generic epithet. With its elevation to species, the common name of the Arkansas River form of *Macrhybopsis* was changed to "peppered chub" (Nelson et al., 2004).

**Threats:** Habitat loss through water diversion, groundwater pumping, and regulated reservoir releases are the primary threats to the Arkansas River speckled chub.

**Recommendations:** No change in listing status is recommended. Permanent flows in South Canadian River downstream of Ute Dam should be maintained, and these flows should minimally mimic a natural hydrograph. Efforts should be made to restore the species to its historical range upstream of Ute Reservoir. Regulations regarding use of bait fishes should be strictly enforced in the Canadian River basin.

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**Suckermouth minnow, *Phenacobius mirabilis***

**Distribution:** Suckermouth minnow occurs throughout much of the central and lower Mississippi River system, including the Missouri and Ohio rivers drainages (Becker, 1983) and rivers tributary to the Gulf of Mexico in Texas (Hubbs et al., 1991). In New Mexico, the native range of the species includes only the South Canadian and Dry Cimarron rivers (Sublette et al., 1990). It was introduced, probably via baitbucket, to the Pecos River near Fort Sumner (J.E. Brooks, USFWS, pers. comm.). Suckermouth minnow most commonly occupies shallow, moderate-velocity runs over sand and pea gravel bottoms (Minckley, 1959; Deacon, 1961; Jenkins and Burkhead 1994).

**Current Status:** Suckermouth minnow was state listed as threatened in New Mexico in 1976. Although suckermouth minnow is apparently relatively common in the central portion of its range, it has declined considerably on the periphery of its range (Cross et al., 1985; T.P. Nesler, CDOW pers. comm.). In New Mexico, it is uncommon in the South Canadian River upstream of Conchas Reservoir and may be extirpated from the Dry Cimarron River; it was not found during a recent survey of the drainage (S.P. Platania, ASIR, Pers. Comm.). It was not found during surveys of the South Canadian River downstream of Ute Dam (SWCA 2004). During 2005 surveys it was found at several locations in the South Canadian River and lower Vermejo River; it was rare to uncommon at all sites where found (Platania et al. 2006). Once assembled and synthesized, data from a recently completed multi-year inventory of the South Canadian River drainage will provide current information, on status of suckermouth minnow in New Mexico.
**Threats:** The primary threats to suckermouth minnow are probably excessive sedimentation of run habitats, habitat desiccation, and habitat fragmentation.

**Recommendations:** No change in listing status is recommended. Bait fish regulations should be strictly enforced in the South Canadian River basin.

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**Loach minnow, *Tiaroga cobitis***

**Distribution:** Loach minnow is endemic to the Gila River drainage of southwest New Mexico, southeast and east-central Arizona, and northeast Sonora (Miller and Winn, 1951; Koster, 1957; Minckley, 1973; Miller, 2006). In New Mexico, the minnow was historically found throughout warmwater reaches of the San Francisco and Gila rivers, and major tributaries of each (Koster, 1957; Propst et al., 1988; Paroz and Propst 2007). Loach minnow is found almost exclusively among cobble in riffle habitats where water velocity is rapid (Propst and Bestgen, 1991).

**Current Status:** Loach minnow was state-listed as threatened in 1975 and federally listed as threatened in 1986 (USFWS 1986). Critical habitat, including much of its currently occupied habitat in New Mexico, was designated for the species in 2007 (USFWS 2007). A federal recovery plan for the species was finalized in 1991(USFWS 1991). Loach minnow has been eliminated from Sonora and much of its historical range in Arizona (Minckley,

1973: Marsh et al., 1990; Rinne and Minckley, 1991; Olden and Poff 2005; Miller, 2006). In New Mexico, its range in the Gila and San Francisco drainages is fragmented (Propst et al., 1988; Paroz and Propst 2007). Currently, it is moderately common only in a short reach (<10 km) of the San Francisco River near Glenwood. Small populations in the Gila forks area and upper Tularosa River have declined in the past 10 years or are possibly extirpated (Propst et al. in press). Recent inventories of upper West Fork Gila River (upstream of Gila Cliff Dwellings) and East Fork Gila River failed to collect loach minnow (NMDGF files). Predation by nonnative yellow bullhead *Ameiurus natalis* and smallmouth bass *Micropterus dolomieus* as well as drought and habitat degradation, have contributed to its decline.

**Threats:** Range fragmentation, stream desiccation by diversion or pumping, loss of natural flow regime, habitat degradation (channelization and sedimentation), and nonnative fishes (e.g., channel catfish *Ictalurus punctatus*, yellow bullhead *Ameiurus natalis*, smallmouth bass *Micropterus dolomieui*, and red shiner *Cyprinella lutrensis*) are the primary threats to the species.

**Recommendations:** No change in listing status is recommended. However, apparent loss of populations from portions of Tularosa River, much of West Fork Gila River, and East and Middle forks Gila River is cause for concern. Planned and ongoing inventories of San Francisco River drainage and portions of Gila drainage should be completed. The natural flow regime of the Gila River (including San Francisco River) should be maintained; additional water depletions or diversions within occupied or historical loach minnow habitat should not be allowed. Nonnative fishes should be removed, or suppressed. Nonnative warmwater fishes should not be stocked in or near occupied habitats. Cooperative efforts with the Arizona Game and Fish Department, as well as federal agencies, to conserve loach minnow should continue. Regulations regarding use of bait fishes should be strictly enforced by NMDGF.

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**Gray redhorse, *Moxostoma* (formerly Scartomyzon) *congestum***

**Distribution:** The historical range of gray redhorse included Gulf Coastal drainages of central and west Texas and northwestern Mexico, the Pecos River and Rio Grande in southern New Mexico and Texas, and Mexican tributaries to the Rio Grande (Jenkins, 1980, Miller 2006). In New Mexico, it historically occurred in the Rio Grande

downstream of Socorro and in the Pecos River (including the Black River) from about Roswell downstream to the Texas/New Mexico border (Sublette et al., 1990). In addition to riverine habitats, gray redhorse also occupies several lower Pecos River impoundments (e.g., Six Mile and Ten Mile reservoirs). Gray redhorse is most commonly found in deep, slow-velocity water over a variety of substrates.

**Current Status:** Gray redhorse was state listed as threatened in New Mexico in 1976. Prior to 2003, gray redhorse occurred only in the Pecos River downstream of Brantley Lake and in the lower reaches of the Black River in New Mexico (Cowley and Sublette, 1987; Sublette et al.,1990). Fish kills caused by recurring outbreaks of golden algae since 2002 have drastically diminished the status of gray redhorse in the Pecos River, and it is no longer found upstream of Bataan Dam in Carlsbad (Zymonas and Propst, 2008). It remained common in the reach between Carlsbad and Six Mile Dam after 2002, but extensive mortality occurred there during golden algae outbreaks in 2007, casting doubt on long-term persistence of this population. Thus, the only viable population in New Mexico now occurs in the lower Black River from Blue Spring to the Pecos River confluence. This represents a contraction to roughly 30% of the species' occupied range within New Mexico since 2002, and to 10% of historically occupied stream length in the New Mexico portion of the Pecos River drainage. Presence of dams and golden algae blooms prevent natural recolonization of formerly-occupied reaches. The American Fisheries Society recently accepted the arguments of Harris and Mayden (2001) and resurrected *Moxostoma* as the genus nomen for gray redhorse (Nelson et al, 2004).

**Threats:** Range fragmentation by dams, modified flow regimes, contaminants, stranding in canals, and toxic conditions caused by golden algae *Prymnesium parvum* are the primary threats to the species in New Mexico. Pecos River fish kills attributed to golden algae occurred below Malaga, NM by 1988 (Rhodes and Hubbs 1992) and from Brantley Lake downstream beginning in 2002. Toxic conditions have recurred sporadically throughout this reach, and in November of 2007, a block delivery of water sent from Brantley Lake to Texas contained lethal levels of algal toxins (S. Denny, NMDGF, personal communication). Intensified oil and gas development represents an increasing threat to water quality in the Black River drainage.

**Recommendations:** Uplisting to endangered is recommended in response to possible extirpation from the Pecos River, continued recurrence of toxic outbreaks of golden algae, and increasing threats to the Black River population. Permanent flows in Pecos River between Brantley Dam and Avalon Reservoir should be maintained. Causes of golden algae blooms in lower Pecos River system should be determined, and measures to prevent, or limit, their outbreaks in future should be undertaken. Effects of water quality on recruitment and survival of gray redhorse should be determined, and if deleterious constituents found, their effects ameliorated or eliminated. Actions to protect the water quality of the Black River from the effects of oil and gas development should be promoted. A captive propagation effort by the Albuquerque BioPark to facilitate conservation and recovery of gray redhorse in New Mexico should be supported.

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**Pecos pupfish, *Cyprinodon pecosensis***

**Distribution:** Pecos pupfish formerly occupied the Pecos River, and associated floodplain habitats, from Bitter Lake National Wildlife Refuge in New Mexico downstream to the confluence of Independence Creek in Texas (Echelle and Echelle; 1978, Hoagstrom and Brooks, 1999). The species is tolerant of saline conditions and is usually associated with low- to moderate-velocity run and pool habitats (including backwaters) in streams and floodplain gypsum sinkholes (Echelle and Echelle, 1978; Hoagstrom and Brooks, 1999).

**Current Status:** Pecos pupfish was previously proposed for federal listing as endangered (USFWS, 1994). However, the proposal was withdrawn and a conservation agreement for Pecos pupfish was adopted and implemented. The species was state-listed as threatened in 1988 in New Mexico. Strict baitfish regulations were adopted by the State Game Commission in 1998 and a public information brochure on these regulations was published and disseminated in 1999. Pecos pupfish has been eliminated from all of its Texas range except Salt Creek and artificial impoundments used for commercial rearing of shrimp (Wilde and Echelle, 1992; G.P. Garrett, TPWD, pers. comm.). In New Mexico, it currently occurs in habitats on Bitter Lake National Wildlife Refuge and Bottomless Lakes State Park (Hoagstrom and Brooks, 1999). It is irregularly found in the mainstem Pecos River (C.W. Hoagstrom, pers. comm.).

**Threats:** Nonnative sheepshead minnow, which hybridizes with Pecos pupfish, is the primary threat to the species. Sheepshead minnow was probably established in the Pecos River by bait introduction. This nonnative is largely responsible for the elimination of the species from much of its Texas range (Echelle and Conner, 1989) and has become established in the Pecos River of New Mexico downstream of Six Mile Reservoir (Echelle et al., 1997; Echelle and Echelle 2007). Hybridization in New Mexico occurs in Eddy County, but the populations in Chavez County (Bitter Lake National Wildlife Refuge, Bottomless Lakes State Park, BLM Overflow Wetlands) show no evidence of hybridization (Echelle and Echelle 2007). Modification of off-channel habitats, groundwater depletion, seasonal stream dewatering, and contaminants from oil and gas extraction activities also threaten the persistence of the species.

**Recommendations:** No change in listing status is recommended. Baitfish regulations for Pecos River need to be rigorously enforced to prevent the further spread of sheepshead minnow and other nonnative fish species. Monitoring of the spread of sheepshead minnow and hybridization with Pecos pupfish should continue. Effects of groundwater pumping on sinkhole habitats of Pecos pupfish need to be determined and evaluated. Proposed oil and gas development activities in vicinity of Pecos pupfish habitat should be carefully scrutinized and modified, if necessary, to avoid introduction of contaminants to occupied or potential Pecos pupfish habitats. Neither native nor nonnative sportfishes should be stocked in habitats supporting Pecos pupfish. Pecos pupfish should be established in unoccupied, but suitable, habitats in Pecos River drainage. Active participation in the Pecos pupfish conservation agreement should continue, and a conservation/recovery plan for should be developed.

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**White Sands pupfish, *Cyprinodon tularosa***

**Distribution:** White Sands pupfish is endemic to the endorheic Tularosa Basin of south-central New Mexico (Miller and Echelle, 1975). Although it was formerly believed to have naturally occurred in Mound Spring and possibly Lost River (Miller and Echelle, 1975; Jester and Suminski, 1982), it historically occurred only in Malpais Spring (and associated playa habitats) and Salt Creek (Pittenger and Springer, 1999). Within occupied habitats, White Sands pupfish is common (Pittenger and Springer, 1996; Carman, 2004).

**Current Status:** White Sands pupfish was originally state listed, in 1975, as an endangered species in New Mexico before being downlisted to its current state status as threatened. White Sands pupfish occupies its entire, but limited, historical range in the Tularosa Basin. Additional populations were established in Mound Spring and Lost River, also in Tularosa Basin (Pittenger and Springer, 1999). A Cooperative Agreement for the Conservation of White Sands Pupfish (2006) provides for its protection and monitoring of its status. NMDGF, U.S. Fish and Wildlife Service, White Sands Missile Range, and Holloman Air Force Base, and White Sands National Monument are signatory to the agreement.

**Threats:** Habitat degradation by military activities, weapons testing, and introduction of crayfish and nonnative fishes (particularly predators) are primary threats to the species. Previously, feral horses degraded habitats of White Sands pupfish, but these have been removed from White Sands Missile Range.

**Recommendations:** No change in listing status is recommended. Managment activities under the updated Cooperative Agreement for the Conservation of White Sands Pupfish should be continued. Establishment of new White Sands pupfish populations should be carefully considered to ensure the integrity of the species within each evolutionary significant unit.

**Literature Cited:**

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**Gila topminnow, *Poeciliopsis occidentalis***

**Distribution:** Gila topminnow historically was one of the most common and widespread fishes in lower elevation streams of the Gila River drainage in Arizona (Hubbs and Miller, 1941; Minckley, 1973). The only documented historical location of Gila topminnow in New Mexico was a series of stenothermal warm springs along the San Francisco River near Pleasanton (Koster, 1957), but it is likely the species occurred elsewhere in suitable habitats in and along the Gila and San Francisco rivers. Gila topminnow typically occupied vegetated shoreline habitats of streams where water velocities were slow, springs, and spring runs (Minckley et al., 1977).

**Current Status:** Gila topminnow was federally listed as endangered in 1967. It was state-listed as a threatened species in New Mexico in 1990. Gila topminnow has been eliminated from almost all of its historical range. It currently persists as several scattered locations in Arizona, and the security of these is variable (Weedman and Young, 1997). The New Mexico San Francisco River population was eliminated by drought or floods during the 1950s. In 1989, Gila topminnow was stocked in a pond on the NMDGF Red Rock Wildlife Management Area. That

effort was not successful. Gila topminnow was again stocked in Red Rock Wildlife Management Area pond in 2005. That population persisted for nearly a year but aquatic vegetation overtook the pond in late summer 2006 and no fish have been collected since. NMDGF is planning to increase and improve wetland habitats on Red Rock Wildlife Management Area to benefit Gila topminnow. NMDGF is currently working with private landowners in the lower Gila River drainage in New Mexico to establish additional populations of Gila topminnow.

**Threats:** Habitat loss by groundwater mining, stream channelization, stream desiccation, removal of shoreline vegetation, and nonnative western mosquitofish (*Gambusia affinis*) and other nonnative predators, are the primary threats to Gila topminnow.

**Recommendations:** No change in listing status is recommended. The pond and associated wetlands on the NMDGF Red Rock Wildlife Management Area should be enlarged, enhanced, and augmented with additional topminnow, if needed. Other suitable sites for repatriation of the species should be located.

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**Greenthroat darter, *Etheostoma lepidum***

**Distribution:** Greenthroat darter occurs in two disjunct areas: the Edwards Plateau of south-central Texas and the lower Pecos River drainage of New Mexico (Echelle et al., 1984). In New Mexico, the species occurred in mainstream and tributary habitats in the Pecos River valley from Bitter Lake National Wildlife Refuge (BLNWR) downstream to the Texas/New Mexico border (Sublette et al., 1990). Greenthroat darter is found mainly in small stream and spring habitats having clear water, dense aquatic vegetation, and clean gravel and cobble substrates (Page, 1983).

**Current Status:** Greenthroat darter was state listed as threatened in New Mexico in 1975. Although the species remains relatively common in preferred habitats in Texas, its overall range there has declined (Anderson et al., 1995). In New Mexico, greenthroat darter persists primarily in three separate areas Blue Spring, Rattlesnake Spring, and some springs, spring runs, and impoundments on the middle tract of the BLNWR. The Rattlesnake Spring population was established in the late 1980s as a joint effort of the National Park Service, U.S. Fish and Wildlife Service, and NMDGF, and sampling in 2007 indicated persistence of this population. The species was captured at one of three sampled sites on the BLNWR in 2007 (USFWS, unpublished report). A project initiated in 2007 will provide documentation on present status and distribution.

**Threats:** Any pumping that lowers groundwater water levels, diversion of spring runs, and elevated sediments are the primary threats to greenthroat darter.

**Recommendations:** No change in listing status is recommended. Systematic surveys to document current status of the species in New Mexico should be completed. The life history of this species in New Mexico needs documentation.

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**Bigscale logperch, *Percina macrolepida***

**Distribution:** The historical range of bigscale logperch consisted of Texas Gulf Coastal drainages, the Red River of Texas and Oklahoma, and the Pecos River of Texas and New Mexico (Kuehne and Barbour, 1983). In New Mexico, the native range of the species was the Pecos River from the vicinity of Santa Rosa to Fort Sumner, the Pecos River near Carlsbad, and the Black River (Sublette et al., 1990). Bigscale logperch are most commonly found in fast-flowing, non-turbulent, moderately-deep water with large cobble substrata (Stevenson, 1971).

**Current status:** Bigscale logperch was state-listed as threatened in New Mexico in 1975. The species likely occupies much of its historical New Mexico range, but its abundance has apparently declined. It also inhabits Santa Rosa, Sumner, and Brantley reservoirs and has been introduced (probably via baitbucket transfer) to Ute Reservoir on the South Canadian River (the South Canadian population is not protected). In 2007, the species was collected primarily at the Black River and Pecos River sites from above Santa Rosa to below Sumner Dam; only one individual was captured from the Pecos River downstream of Ft. Sumner (USFWS and NMDGF files). A project initiated in 2007 will provide documentation on present status and distribution.

**Threats:** Reduced flows, loss of moderate- to high-velocity reaches by diversion, and reduced water quality are probably the primary threats to bigscale logperch. Toxic blooms of golden algae threaten populations from Brantley Lake downstream.

**Recommendations:** No change in listing status is recommended. Systematic surveys to document current status of the species in New Mexico should be completed. The life history of this species in New Mexico needs documentation.

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**AMPHIBIANS**

**ENDANGERED**

**Jemez Mountains Salamander, *Plethodon neomexicanus***

**Distribution and Biology:** *Plethodon neomexicanus* is endemic to north-central New Mexico where it is found only in the Jemez Mountains in Sandoval, Rio Arriba, and Los Alamos counties. It occurs from 7,200-11,256 ft elevation in mixed conifer habitat with abundant rotted logs and surface rocks. This habitat is dominated by Douglas fir, blue spruce, Engelmann spruce, ponderosa pine, and white fir with occasional aspen, Rocky Mountain maple, New Mexico locust, oceanspray, and various shrubby oaks (Degenhardt et al. 1996; Hathcock 2008; Whitford 1976; Williams 1973). *Plethodon neomexicanus* is rarely observed on the surface or encountered under surface litter or aspen logs. It is most often encountered under and inside well-rotted Douglas-fir logs or under rocks.

**Current Status:** *Plethodon neomexicanus* is listed as a Species of Concern by Region 2 USFWS (USFWS 2008). The New Mexico Endemic Salamander Team has completed the Jemez Mountains Salamander Management Plan.

This plan was approved and signed by NMDGF, USFWS, and USFS during January 2000, and was designed to provide guidance for management of the Jemez Mountains salamander on USFS lands.

**Threats:** Current threats to the already fragmented populations of Jemez Mountains Salamander are numerous. The cumulative effects of recent actions including: 1) the findings of significantly elevated microhabitat temperatures on the habitat severely burned during the Cerro Grande and Dome fires, 2) the proposed widening of NM Hwy 126 into occupied habitat, 3) the low recapture rates at historic sites, and 4) the detection of a fungal infection from specimens on the Valles Caldera (Cummer et al. 2005), have caused concern among those familiar with the habitat requirements of the Jemez Mountains Salamander.

*Wildfire*: There is a continued threat of additional negative impacts to populations of Jemez Mountains Salamanders from natural wildfire and management-ignited fire (Cummer and Painter 2007). Salamander populations are known to be susceptible to fire-related effects, including decreased forest humidity, desiccation of habitat, loss of microhabitat (such as downed logs and litter), erosion, and filling in (by runoff) of subterranean habitat utilized by salamanders. Post-fire management actions that have negatively impacted Jemez Mountains Salamanders and their habitat include the mulching and reseeding of occupied habitat with soil-binding, non-native grasses.

*Logging*: Since 1980, increases in timber harvest by the USFS have prompted concern about the effects of logging on *P. neomexicanus* (USFWS 1986, 1987). A large percentage of the range of *P. neomexicanus* occurs on National Forest lands and the close association of *P. neomexicanus* with mixed coniferous forests makes them vulnerable to many forest management practices (Ramotnik and Scott 1988). Wiltenmuth (1996) suggested that *P. neomexicanus* might not be able to withstand the additional stress of drying environmental conditions associated with activities such as logging. Historically, the effects of logging were considered to be a major threat to *P. neomexicanus*, however, the recent reduction of timber harvesting in the Jemez Mountains has somewhat diminished that threat. Silvicultural activity today in the habitat of *P. neomexicanus* is generally restricted to post-fire salvage logging and tree thinning in the urban-forest interface zones.

*Road Construction*: Roads and other development (residential, recreational, or commercial) would have negative effects on *P. neomexicanus* if constructed in their habitat, via direct take, habitat and population fragmentation and loss, and soil compaction. The current alternative chosen to widen and resurface NM Hwy 126 will cause population fragmentation and direct take of salamanders. The current alignment transects known occupied salamander habitat just north of the town of Seven Springs.

*Disease*: Disease has been implicated in the decline of many amphibians, and it is an unknown, but credible threat to *P. neomexicanus*. Cummer et al. (2005) reported the chytridiomycete fungus (*Batrachochytrium dendrobatidis*) from an individual *P. neomexicanus* from Sierra Toledo on the Valles Caldera in Sandoval County. However, Cummer (2006) tested 66 *P. neomexicanus* from the same area and all results were negative for *B. dendrobatidis*.

Because there is so much inherent variability in monitoring secretive species where only an unknown percentage is surface active at any given time, as in *P. neomexicanus*, we lack hard data that conclude whether the species is declining throughout its known range. However, antidotal evidence strongly suggests this is the case. For example *P. neomexicanus* were found at only 6 (44%) of 14 historically occupied sites surveyed during 2007. Based on numerous recent surveys, *P. neomexicanus* appear to be extinct at the type locality where numerous early investigators found the species to be very abundant. Additionally, Cummer et al. (2003, 2004) reported the absence of *P. neomexicanus* at a site on the Valles Caldera National Preserve where the species was once abundant (Whitford 1976).

**Recommendations:** *Plethodon neomexicanus* should maintain its listing as endangered. NMDGF should continue to provide support for the New Mexico Endemic Salamander Team and the implementation of the Jemez Mountains Salamander Management Plan. This Team should continue to review the effectiveness of this Plan and should consider revision as necessary. NMDGF should continue monitoring *P. neomexicanus* within areas burned by the Dome Fire and the Cerro Grande Fire. Cummer and Painter (2007) recommended that surveys are valuable for determining presence-absence, but alone are ineffective and not appropriate for monitoring or measuring populations after a disturbance. Investigations of the population on the Valles Caldera and elsewhere for the presence of the *Batrachochytrium dendrobatidis* should be continued.

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**Lowland Leopard Frog, *Lithobates yavapaiensis***

**Distribution and Biology:** In New Mexico, *L. yavapaiensis* is known from 3700-5575 ft in western Catron, Hidalgo, and Grant counties (Degenhardt et al. 1996; Sredl 2005). This is a frog of permanent to semi-permanent streams and ponds; most populations occupy small streams and rivers, springs, and associated pools at low elevations in desert scrub localities. *Lithobates yavapaiensis* reaches the extreme eastern edge of its range in southwest New Mexico (Platz 1988; Sredl 2005). The species is abundant in select tributaries of Canon Bonito in Sonora, Mexico.

**Current Status:** *Lithobates yavapaiensis* is listed as a Species of Concern by USFWS (USFWS 2008), and is listed as a species of wildlife of special concern in Arizona (AGFD 1996). Herpetologists in Arizona have documented the extinction of several populations in recent years and viable populations at all known historic localities in New Mexico no longer exist (Jennings 1987, 1995). During August 2000, a single individual was observed in the New Mexico portion of Guadalupe Canyon in extreme southwest Hidalgo County approximately 1.1 air miles upstream of the NM/AZ border. This remains the first and only specimen reported from New Mexico since April 1985 (Degenhardt et al. 1996). No reproduction of this species, i.e., egg masses or tadpoles, have been reported from New Mexico. *Lithobates yavapaiensis* is considered very rare and perhaps extirpated in New Mexico.

**Threats:** The causative agents for the decline of this species and other frogs, toads, and salamanders worldwide are largely unknown (Blaustein and Wake 1995; Blaustein et al. 1994). Several factors, including acid rain, air quality, stress-related bacterial infections, and introduced predators (i.e., bullfrogs, crawfish, and game fish) have been suggested (Rosen et al. 1995). Berger et al. (1998) identified epidermal changes caused by a chytridiomycete fungus (*Batrachochytrium dendrobatidis*) as being the agent responsible for mass frog dieoffs and significant population declines in the rainforests of Australia and Central America. This same fungal infection has been implicated in dieoffs of Lowland Leopard Frogs in southeast Arizona (Bradley et al. 2002; Sredl 2005), and is known to be present in New Mexico populations of leopard frogs (C.W. Painter and R.D. Jennings *unpubl data*). Rosen et al. (1995) reported a strong negative co-occurrence between the Lowland Leopard Frog and American Bullfrog (*Lithobates catesbeianus*). Jennings and Hayes (1994) reviewed the decline of *L. yavapaiensis* in the desert southwest.

**Recommendations:** *Lithobates yavapaiensis* should maintain its current listing as endangered. Museum specimens of this species from New Mexico should be examined for the presence of *Batrachochytrium dendrobatidis*. Landowner permission should be requested to routinely monitor the suitability of habitat at the single known site where the species was last known to occur in New Mexico.

The scientific name should be changed from *Rana yavapaiensis* to *Lithobates yavapaiensis* (Frost et al. 2006, 2008).

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**Boreal Toad, *Anaxyrus boreas***

**Distribution and Biology:** In New Mexico, *A. boreas* is known only from north-central Rio Arriba County between 9100-10,500 ft in the San Juan Mountains at Canjilon Lakes, Trout Lakes, and Lagunitas Lakes (Stuart and Painter 1994). It lives in high mountain ponds, slow-moving streams, or low wet meadows. Dominant vegetation where *A. boreas* occurs in New Mexico includes corkbark fir, Engelmann spruce, aspen, willows, and various grasses and sedges. The species reaches its southern edge of its range in northcentral New Mexico (Degenhardt et al. 1996; Muths and Nanjappa 2005).

Severe declines and extirpations of many populations have occurred in most areas where the Boreal Toad was once abundant (Muths and Nanjappa 2005).

**Current Status:** The southern Rocky Mountain form of *Anaxyrus boreas* (as *Bufo boreas*) was classified as a "warranted but precluded" candidate species for federal listing (USFWS 2001). USFWS (2005) reversed this decision and found the species "not warranted" for federal listing based on the lack of sufficient genetic evidence to designate this form as a distinct population segment. The species is currently listed as a Species of Concern by USFWS (USFWS 2008). The USFS lists the species as Sensitive (USFS 2007). *Anaxyrus boreas* is listed as endangered in Colorado (Goettl 1997; Hammerson 1999), and as a species of special concern in Utah (UDWR 1997). The distribution and abundance of *A. boreas* have declined approximately 80% (Colorado) and 94% (Wyoming) in the last 20 years (Nesler and Goettl 1994). Although not reported from New Mexico until June 1966 (Campbell and Degenhardt 1971), *A. boreas* is currently thought to be extinct in New Mexico (Carey 1993). Jones (1978) estimated a population of 327 toads occurred at Upper Lagunitas Lake during 1978 whereas Woodward and Mitchell (1985) surveyed 139 ponds in known or expected *A. boreas* habitat in Rio Arriba County and located adults or tadpoles in only two ponds. During July-August, 1993, J.P. Hubbard and J.N. Stuart (*pers. comm*.) visited known localities and were unable to confirm the continued existence of *A. boreas* in New Mexico. During September 1996 retired USFWS personnel reported an unconfirmed sighting of *A. boreas* from Bobo Lake, a site ca 7 mi. ESE of Chama. Visits to this site in 1997 and 1998 failed to locate *A. boreas*. Surveys conducted during 2002 and 2006 at historic sites in New Mexico were also negative (Christman 2006), as were surveys of potential habitat in the Cruces Basin Wilderness.

**Threats:** Several factors have contributed to the decline of *A. boreas* and other montane amphibians in western North America, including the damaging effects of increased ultraviolet (UV-B) light on embryos; acidification and heavy-metal contamination of water, habitat destruction and degradation, such as may result from water, minerals, and livestock management, road construction, timber and fire management, recreation; impact of introduced trout; infectious fungal disease; pathogen-induced mortality resulting from suppressed immune systems caused by some undetermined environmental stressors; climate change; predation, and life history characteristics (Hammerson 1999; Carey 2005). A combination of these factors is likely involved in dieoffs of the Boreal Toad. However the chytridiomycete fungus (*Batrachochytrium dendrobatidis*) has been implicated in mass dieoffs and significant population declines of the species in Colorado (Muths et al. 2003). Christman (2006) reported the presence of *B. dendrobatidis* in the Chorus Frog, (*Pseudacris maculata*) at Canjilon Lakes – a site historically occupied by *A. boreas*.

Any resource management activities that degrade alpine wetlands will negatively affect breeding habitat for Boreal Toads. Surveys for *B. dendrobatidis* should continue at historic localities and other habitats considered for translocation of the Boreal Toad.

**Recommendations:** *Anaxyrus boreas* should maintain its current listing as endangered. NMDGF should continue work with the Boreal Toad Recovery Team, Colorado Division of Wildlife, USFS, and private landowners to initiate translocation Boreal Toads into historic habitat. Monitoring of all species of amphibians occurring at historic sites of the Boreal Toad for the presence of *B. dendrobatidis* should be continued prior to translocation. Additional surveys that concentrate on locating eggs, tadpoles, and new metamorphs should be carried out.

Goebel (1996, 2005) examined mtDNA variation in toads of the *A. boreas* complex throughout western North America and found that various populations in the southern Rocky Mountain region are genetically distinctive and may warrant recognition as one or more different species. The scientific name should be changed from *Bufo boreas* to *Anaxyrus boreas* (Frost et al. 2006), the common name should be changed to Boreal Toad (Frost et al. 2008).

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**Great Plains Narrow-mouthed Toad, *Gastrophryne olivacea***

**Distribution and Biology:** In New Mexico, populations of this small, toad-like frog are known from two highly disjunct localities: 1) along NM Hwy 9 near Hermanas in southern Luna County near the U.S.-Mexican border (Degenhardt 1986; Stuart and Painter 1996), and 2) Kiowa National Grasslands just north of Clayton, Union County (Moriarty et al. 2000). All specimens known from New Mexico have been collected in low-lying, flooded roadside ditches in desert scrub habitat dominated by mesquite, creosotebush, and various arid-land grasses or in flooded grasslands. Based on locality records from Texas (Dixon 1987), *G. olivacea* may occur in Lea County in southeastern New Mexico as well. The Great Plains Narrow-mouthed Toad is active above ground only after torrential rains when it is easily detected by its distinctive call. Ants are the primary prey (Fitch 1956). During the first week of August 2006, numerous breeding adults were observed in flooded roadside ditches at the NM Hwy 9 locality near Hermanas.

**Current Status:** *Gastrophryne olivacea* is a wildlife species of special concern in Arizona (AGFD 1996). The Republic of Mexico lists this species as rare (SDS 1994). Populations in Colorado are small and geographically limited, although they appear secure (Hammerson 1999). The species was not discovered in New Mexico until June 1986 (Degenhardt 1986).

**Threats:** Overgrazing and other habitat modifications (i.e., draining or filling low-lying areas) are the primary threats to this species. Pesticide application in the adjacent agricultural regions is a potential threat, due to toxicity to eggs and larvae and impacts on adult food sources. The increased road traffic resulting from Border Patrol and County Sheriff patrol of NM Hwy 9 may result in increased incidental take through road mortality.

**Recommendations:** *Gastrophryne olivacea* should maintain its current listing as endangered. Habitat of the few known populations in New Mexico should be routinely monitored for any changes due to overgrazing or other anthropogenic modifications. Additional suitable habitat should be surveyed for the presence of this species during summer monsoon rains.

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**THREATENED**

**Sacramento Mountain Salamander, *Aneides hardii***

**Distribution and Biology:** *Aneides hardii* is endemic to south-central New Mexico where it is found only in the White, Capitan, and Sacramento mountains in Otero and Lincoln counties. It is generally associated with Douglas fir and spruce at elevations from 7850-11,700 ft where it is found under large woody debris or rocks (Degenhardt et al. 1996; Ramotnik 1997). Dominant overstory includes Douglas fir and white fir with lesser amounts of Engelmann spruce and southwestern white pine. Rocky Mountain maple, gooseberry, and oceanspray share the understory with seedling conifers and downed logs in various stages of decay. There are usually limestone rocks and boulders exposed on the surface (Scott and Ramotnik 1992). *Aneides hardii* may be locally abundant where essential microhabitat characteristics are available.

**Current Status:** The Sacramento Mountain Salamander is listed as a Species of Concern by USFWS (USFWS 2008), and as Sensitive by the USFS (USFS 2007).

**Threats:** Ramotnik and Scott (1988) suggested that intensive logging, slash removal, and burning may reduce or eliminate populations of *A. hardii*. Ramotnik (1996) reported that smaller, presumably juvenile, salamanders comprise 47% of the total salamanders collected on unlogged plots while only 30% of the total on logged plots. Reasons for this difference may include lower reproductive rates or lower survival rates of eggs, hatchlings, or juveniles on logged plots and may indicate that logged plots represent less than optimal habitat. Borg (2001) found that Sacramento Mountain salamanders were more limited by the availability of cool microhabitats in logged sites than in forested sites and that juvenile salamanders on logged sites had significantly poorer body condition than those on unlogged sites.

Logging and other disturbances that cause desiccation of the habitat remain the primary threat to *A. hardii*. These salamanders survived the historic, low-intensity fires in the Sacramento Mountains but recent fire suppression has created the inevitable possibility of "stand-replacing" fires. The intensity of these fires compared to the more frequent, historic fires makes it difficult to predict how *A. hardii* will respond (Ramotnik 2005). In a five-year study of such a fire in the Sacramento Mountains, Ramotnik (2007) found that counts of *A. hardii* declined sharply during the first year post fire and remained low for 5 years. She suggested that salamanders either moved off of the site or retreated below ground to avoid desiccation, and that recolonization of the site will be possible only after canopy cover develops, depth of litter increases, and large natural cover objects become suitable habitat. Soil pH increased sharply on the burned sites immediately after the fire but after 3 years pH has begun to decrease due to the dilution effect caused by precipitation. Organic matter content and water-holding capacity are significantly lower on burned sites than on unburned sites. These soil characteristics are important because they are associated with soil moisture and can influence the ability of salamanders to repopulate burned sites. The relative proportion of prey items (primarily ants, springtails, harvestman spiders, and dipteran flies) to non-prey items is highest on the low-burn and unburned sites. The response of arthropods to fire, however, can be expected to change seasonally and annually as a function of climatic variation, recovery rate of the vegetation and forest floor, and differences in life history patterns of individual arthropods.

The possible effects of pesticide application (Ramotnik 1997) and ORV use on populations of Sacramento Mountain Salamanders need investigation.

**Recommendations:** This species should maintain its current listing as threatened. All logging and other ground disturbing silvicultural activities within occupied or potential sites where *A. hardii* occur should be coordinated with and approved by the New Mexico Endemic Salamander Team. A Management Plan should be drafted and implemented to guide the management of this species. NMDGF should continue to provide support for the New Mexico Endemic Salamander Team.

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**Sonoran Desert Toad, *Ollotis alvaria***

**Distribution and Biology:** In New Mexico, *O. alvaria* is an uncommon species that occurs only in southwest Hidalgo County in the vicinity of Rodeo and in scattered localities in the adjacent Peloncillo Mountains at elevations of 4100-4950 ft (Degenhardt et al. 1996). It reaches the extreme eastern limit of its range in southwest New Mexico. *Ollotis alvaria* was not collected in New Mexico until the summer of 1961 (Cole 1962). Habitat includes mesquite-creosotebush lowlands, arid grasslands, rocky riparian zones with sycamore and cottonwood, and oak-walnut woodlands in mountain canyons (Fouquette et al. 2005, and citations therein). This large toad spends most of the summer months in rodent holes and generally emerges only during the summer rains to breed. Breeding usually occurs during 1 night, 2-3 days following a major rainfall event of more than 25 mm (Sullivan and Malmos 1994). Average clutch size is 7,500 – 8,000 eggs that are deposited in shallow waters of seasonal and permanent pools (Fouquette et al. 2005).

**Current Status:** *Ollotis alvaria* does not receive formal protection elsewhere. Fouquette (1970) characterized this species as one of the least known of all American toads.

**Threats:** Habitat modification and overcollecting are possible threats to this species in southwest New Mexico. Draining or filling in of cattle watering tanks poses a threat to the species, as does the diversion of roadside silt and runoff into known breeding ponds. The conversion of mesquite-creosotebush lowlands and arid grasslands to agriculture or subdivisions near Rodeo, NM eliminates habitat. Roadway mortality is often observed.

**Recommendations:** *Ollotis alvaria* should maintain its current listing as threatened. The scientific name should be changed from *Bufo alvarius* to *Ollotis alvaria* (Frost et al. 2006a, 21006b; Frost et al. 2008). Regular monitoring of the habitat known to be occupied by this toad should occur. Additionally, surveys in suitable habitat should be conducted during the summer breeding season to locate new occupied sites.

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## REPTILES

### ENDANGERED

### Gila Monster, *Heloderma suspectum*

**Distribution and Biology:** *Heloderma suspectum* is peripheral in New Mexico, reaching the eastern edge of its range in southwest New Mexico where there are only a few isolated records from Hidalgo, Grant, Luna, and perhaps Doña Ana counties at elevations of 6100-6400 ft (Degenhardt et al. 1996). It was first reported from New Mexico in 1950 (Shaw 1950) and is common only at Redrock Wildlife Area in Grant County (Beck 1994, 2005) and at Granite Gap in Hidalgo County. Records of occurrence at Kilbourne Hole in Doña County and other areas east of a line drawn from Silver City southward to Animas may represent displaced, released, or escaped captive individuals.

*Heloderma suspectum* is the largest lizard native to the United States and the only venomous one. The seasonal activity period extends from March-November although *H. suspectum* spends as much as 96% of its time in sub-surface refugia (Beck and Lowe 1994). Beck and Jennings (2003) investigated shelter use in Gila Monsters in southwest New Mexico for six years. Their results suggest that the availability of suitable refugia played an important role in habitat selection by Gila Monsters and thus influenced the pattern of local dispersal. Beck (2005) provided a through review of the species throughout its range.

**Current Status:** *Heloderma s. suspectum* is listed as threatened by the Republic of Mexico (SDS 1994). The USFS (2007) lists the Gila Monster as Sensitive. The population in New Mexico appears stable, although the species is commercially valuable and therefore susceptible to illegal collecting. The Reticulated Gila Monster, *H. s. suspectum,* occurs in New Mexico.

**Threats:** Threats to *H. suspectum* are largely from habitat loss and fragmentation, and illegal collection. Individuals are often killed by lay public who believe they are dangerous and present a hazard to the public. Highway mortality is often observed.

**Recommendations:** *Heloderma suspectum* should maintain its current listing as endangered. Habitat known to be occupied by Gila Monsters should be regularly monitored and any loss or fragmentation should be investigated to determine impacts to local populations of Gila Monster. Information on identification and legal status should be distributed to the public within the range of the Gila Monster in New Mexico. Protection from illegal collecting should be strictly enforced.

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**Sand Dune Lizard, *Sceloporus arenicolus***

**Distribution and Biology:** *Sceloporus arenicolus* is endemic to southeast New Mexico and a small area of adjacent Texas. In New Mexico, it occurs only in portions of Chaves, Eddy, Lea, and southern Roosevelt counties (Degenhardt et al. 1996). The species inhabits the second smallest range of any North American endemic lizard (Conant and Collins 1991). *Sceloporus arenicolus* is confined to areas of shinnery oak - sand dunes and their peripheries, where the uneven sandy terrain and wind-created blowouts are essential habitat requirements. Within this habitat, populations of *S. arenicolus* are localized and fragmented by areas of unsuitable habitat. Individuals show a strong preference for large, deep blowouts with intermediate sand grain coarseness (Fitzgerald et al. 1995, 1997).

**Current Status:** *Sceloporus arenicolus* is listed as a Candidate Species by the USFWS (USFWS 2008). These are species that the USFWS has on file sufficient information on biological vulnerability and threats to support proposals to list them as Endangered or Threatened. *Sceloporus arenicolus* receives no formal protection in Texas, where the distribution and abundance of populations are declining. Fitzgerald (2007) reported finding *S. arenicolus* at only 3 of 27 (11%) sites in potential habitat surveyed in Texas.

**Threats:** Primary threats to populations of this narrowly endemic lizard are habitat destruction caused by chemical brush control and oil and gas exploration and extraction activities.

The elimination and modification of shinnery oak-dune habitat resulting from chemical brush control programs on BLM, state, and private lands is a significant threat to the persistence of populations of *S. arenicolus* (Gorum 1995; Snell et al. 1993, 1994). The current BLM Roswell Resource Area Resource Management Plan states that chemical treatment of the shinnery oak-dune community is not to occur in suitable or occupied habitat of the Sand Dune Lizard, as long as the species remains state-listed. However, it is clear that sand dune blowouts are patches in a shinnery oak matrix, and the shinnery oak matrix must exist in order for blowouts to form and persist.

An additional significant threat includes oil and gas exploration and extraction. These activities have a local effect on populations of *S. arenicolus* in the vicinity of oil well pads; reducing these populations by an average of 37% when compared to control areas approximately 200 m distant from the pad (Sias and Snell 1996). Sias and Snell (1998) using data from additional studies, found a negative relationship between well density and the abundance of *S. arenicolus*.

The Sand Dune lizard receives no protection from habitat degradation as a result of oil and gas exploration and extraction on NM State Trust lands. Recently there has been extensive development on occupied habitat along the

Eddy/Lea county line just east of Loco Hills on NM State Trust lands. This population of Sand Dune lizards represents the densest population known from throughout its range in New Mexico. Currently, oil field development in this area far exceeds the NMDGF recommended maximum of 13 wells/sq. mi and additional development is planned at this site.

**Recommendations:** *Sceloporus arenicolus* should maintain its listing as Endangered. Intensive research designed to help in an understanding of habitat use, including in developed oil and gas fields should be continued. Additional research should address dispersal, establishment of corridors through the shinnery oak matrix, microhabitat use, and genetic characteristics of the population throughout its range in New Mexico and Texas. NMDGF should closely monitor activities in the range of *S. arenicolus* and recommend to all land management agencies and private consumptive industry (oil/gas development and ranchers) that the newly developed collaborative conservation strategies (New Mexico LPC/SDL Working Group 2005) for *S. arenicolus* in New Mexico are strictly adhered to.

Personnel in land management agencies who conduct surveys for Sand Dune Lizard must be thoroughly trained in field identification of the species and the standardized survey methodology. This methodology has been developed to accurately assess the presence or absence of a population within a contiguous area of suitable habitat (i.e., dune complex). Other survey methods that have been used recently have failed to provide comparable data since they do not incorporate the population approach in the standardized method.

Chan et al. (In Press) recognized three distinct groups of *S. arenicolus* corresponding to northern, central, and southern portions of the species' range. The distinctiveness of these groups was supported by mtDNA and microsatellite genetic data which corresponded to geological and ecological landscape features. Chan et al (In Review) recommended conservation efforts should focus not only on preservation of the sand dune complexes, but preservation of these complexes within each of these geographic areas.

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**Gray Checkered Whiptail*, Aspidoscelis dixoni***

**Distribution and Biology:** *Aspidoscelis dixoni* is a diploid unisexual species that normally reproduces by parthenogenetic cloning. This asexually reproducing lizard is known from only two areas; a small area in Trans-Pecos Texas and in the vicinity of Antelope Pass in Hidalgo County, New Mexico (Scudday 1973). The total range of *Aspidoscelis dixoni* in New Mexico is only 3 x 5 miles, where populations are fragmented by patches of unsuitable habitat. In New Mexico, *A. dixoni* is found on creosotebush flats with little or no shrubby undergrowth on sandy to gravelly soils. It has not been found in the sandy arroyo bottoms of Antelope Pass or in the surrounding desert grasslands. Overall, *A. dixoni* is a rare lizard, although it may be locally common at elevations of 4265-4760 ft where suitable habitat occurs (Painter 1991, 1992). From 1987-1993, NMDGF biologists conducted mark-recapture trapping for this species throughout its range at Antelope Pass. During 417,366 trap days and 8,288 lizard captures, only 409 (ca. 5%) were *A. dixoni* (Sias and Painter 2001).

**Current Status:** *Aspidoscelis dixoni* is listed as a Species of Concern by USFWS (USFWS 2008). The species receives no formal protection in Texas. Based on reproductive traits and morphometrics, Walker et al. (1994) suggested that the New Mexico population of *A. dixoni* is distinct from those in Trans-Pecos, Texas. Additionally, current studies of this species by the American Museum of Natural History also suggest the form at Antelope Pass may be genetically distinct from that in Trans-Pecos, Texas (C.J. Cole, Adjunct Curator of Herpetology, American Museum of Natural History, *pers. comm*. 2000).

**Threats:** Potential threats to this species include overgrazing, habitat alteration, chemical brush control, mining, and unregulated overcollecting. Cole et al. (2007) suggested that destabilizing hybridization and interspecific competition with the Western Whiptail, *Aspidoscelis tigris*, is causing significant population declines of *A. dixoni* at Antelope Pass.

**Recommendations:** This species should maintain its current listing as endangered. Following Reeder et al. (2002) and Crother et al. (2003) North American species in the genus *Cnemidophorus* should be re-assigned to the genus *Aspidoscelis*. Habitat of the species in Hidalgo County should be regularly monitored for fragmentation and degradation through anthropogenic causes. Further surveys should be conducted in the range of *A. dixoni* in New Mexico. Recent data and unverified observations suggest the species has declined since an extensive status review was conducted during 1987-1993 (Cole et al. 2007*;* Tomberlin *pers comm*.). Collecting of any type should be strictly controlled.

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**Gray-banded kingsnake, *Lampropeltis alterna***

**Distribution and Biology:** *Lampropeltis alterna* is a medium-sized colubrid snake found in the United States from the Balcones Escarpment of the Edward's Plateau in central Texas westward through Trans-Pecos Texas to the Hueco Mountains in El Paso County (Miller 1979; Merker and Merker 2005). In New Mexico, *L. alterna* is known only from Eddy County where it occurs in the southern end of the Guadalupe Mountains (Degenhardt et al. 1996; Hakkila 1994). Painter et al. (1992) first reported the species from New Mexico.

*Lampropeltis alterna* is a secretive and nocturnal inhabitant of the Chihuahuan Desert. It occurs on desert hills and dry mountain slopes in rocky limestone areas associated with various xeric-adapted plants including sotol, lechugulla, acacia, mesquite, ocotillo, creosotebush, and various cacti. Elevation in these areas range from 1460 – 5850 feet (Merker and Merker 2005). Small rodents and lizards are the primary prey, although small treefrogs (*Hyla arenicolor*) have also been reported in the diet. Very little is known regards reproduction in the wild; clutch size of captive females averages eight and varies from 3-13 eggs; neonates average ca. 10 inches total length.

**Current Status:** Depending upon the number of specimens taken and/or the ultimate disposition of the specimens, collection of *L. alterna* in Texas requires either a Nongame Dealer Permit or a Nongame Collection Permit (letter in NMDGF files from Wildlife Permits Coordinator, TPWD, 8 March 1999). The species is listed as threatened by the Republic of Mexico (SDS 1994). The subspecies *L. a. alterna*, the Gray-banded Kingsnake, occurs in New Mexico.

**Threats:** Due to the presumed very small population size, the primary threat to this species in New Mexico is overcollecting. It is believed that the removal of even a small number of females from a population could significantly affect the population size. Disclosure of site specific information on the area of occurrence could increase the pressure from overcollecting. Highway mortality may also contribute to population declines.

**Recommendations:** *Lampropeltis alterna* should maintain its current listing as endangered. NMDGF should monitor the effectiveness of the conservation recovery actions in the final Recovery Plan. Areas known to be occupied by *L. alterna* should be regularly patrolled for illegal collecting activities.

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**Mexican Gartersnake, *Thamnophis eques***

**Distribution and Biology:** In New Mexico, *Thamnophis eques* likely occurred at scattered sites throughout the Gila and San Francisco watersheds from 3690-5420 ft in western Grant and Hidalgo counties. Documented localities include single localities at and near Mule Creek and along the Gila River near Virden (Fitzgerald 1986). There is a single, century-old record from Duck Creek in Grant County near Cliff but populations no longer exist at that locality (Degenhardt et al. 1996). The species is known from adjacent Arizona (Cochise County at San Bernardino NWR), although populations at that site are declining with the introduction of non-native bullfrogs implicated for the decline (Rosen and Schwalbe 1988, Schwalbe and Rosen 1988). Extensive searches at these sited during The subspecies *T. e. megalops* occurs in New Mexico.

**Current Status:** *Thamnophis eques* is listed as a Species of Concern by USFWS (USFWS 2008). *Thamnophis eques* is a species of wildlife of special concern in Arizona (AGFD 1996) and is listed as threatened by the Republic of Mexico (SDS 1994). The subspecies *T. eques megalops* was petitioned for federal listing by the Center for Biological Diversity (2003), and the USFWS initiated a status review to determine if listing this species is warranted (USFWS 2006a). The basis of this petition was cited as documented population declines, decreased range, and local extinction. Despite that fact that USFWS biologists concluded that *T. eques megalops* has declined from 85-90% of its US range, USFWS (2006b) found this petitions not warranted based on a lack of information throughout the species range in Mexico. However, this finding may be brought into question by the Center for Biological Diversity who filed suit against USFWS to overturn the agency's decision.

**Threats:** Threats throughout the range of this subspecies include loss of wetlands, urbanization, habitat alteration, pollution, livestock grazing, loss of native prey species, exotic species predation (including bullfrogs and non-native predatory fishes), and possibly overcollecting.

**Recommendations:** *Thamnophis eques* should maintain its current listing as endangered, and permits for collection should be limited to research that aids in conservation of the species or wetlands where they occur. Permission to conduct surveys on private lands should be applied for and further surveys should be conducted at historic localities. Research projects designed for conservation of the species and reestablishment of wetlands within the historic range of the species should be initiated. Projects directed at the removal of non-native predators, restoration of the natural stream flow, and restoration of native riparian vegetation should be designed and implemented. Holycross et al. (2007) suggested that until these recommendations are implemented on a broad scale the general pattern of decline in the US populations will continue.

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**Plain-bellied Watersnake, *Nerodia erythrogaster***

**Distribution and Biology:** *Nerodia erythrogaster* occurs from the Atlantic Ocean to southeast New Mexico. In New Mexico, it is confined to the lower Pecos River drainage, including along the Black and Delaware rivers. It is a rare, nocturnal, and little observed species that seems to prefer permanent, shallow, flowing water with rocky retreats and foraging areas where it forages for fish and frogs. Christman and Kamees (2007) examined 41 wild caught individuals and 128 museum specimens and found only fish, tadpoles, and frogs in the diet. *Nerodia erythrogaster* reaches the extreme western extent of its range in southeast New Mexico (Degenhardt et al. 1996). Being at the western limits of its range in New Mexico, populations of *N. erythrogaster* are less dense and perhaps more likely to be fragmented through habitat loss (Christman and Kamees 2007). Despite numerous surveys along the lower Pecos River drainage since 1988, fewer than 10 individuals of this species were located (Painter 1991, 1993). However, Christman and Kamees (2007) reported finding 40 individuals (20 males, 20 females) on the Pecos and Delaware rivers in Eddy County during 1205 trap days and 45 hours of active searching. Fifteen of the 40 snake captures occurred along the Pecos River between the NM Hwy 31 crossing and 10-Mile Dam. The lack of recaptured snakes in this river reach suggests a robust population (Christman and Kamees 2007). The subspecies, the Blotched Watersnake, *N. e. transversa*, occurs in New Mexico.

**Current Status:** No protection is afforded this species in Texas. It is listed as threatened by the Republic of Mexico (SDS 1994). Populations in Mexico are rapidly declining due to alteration of aquatic habitat (Conant 1977; Scudday 1977).

**Threats:** Primary threats are from direct take and alteration of current water use practices. Populations that exist in areas of high human impact, e.g., 6-Mile Dam, 10-Mile Dam, and the acequia on the north edge of Carlsbad are particularly susceptible to take (NMDGF files). It is often killed by uninformed fishermen who believe it to be venomous and injurious to game fish populations (West 1992).

**Recommendations:** *Nerodia erythrogaster* should retain its current status as endangered. An educational program designed to provide public information, (especially to the anglers along the lower Pecos River) on the natural history, status, and distribution of this species around Carlsbad should be initiated. A research program using radio telemetry and designed to investigate population trends and habitat utilization should be initiated. The common name of this species should become Plain-bellied Watersnake (Crother 2000).

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**New Mexico Ridgenosed Rattlesnake, *Crotalus willardi obscurus***

**Distribution and Biology:** The total known range of this federally threatened subspecies of *C. willardi* includes the high elevations of the Animas Mountains (5970-8500') and Peloncillo Mountains (5600-6200') (SW Hidalgo County, New Mexico), and the northern Sierra San Luis (extreme NE Sonora and NW Chihuahua, Mexico) (Barker 1991). The species was not reported from the Peloncillo Mountains in Arizona until 1997 (Holycross and Smith 1997). Recent genetic work demonstrates that the three mountain ranges harbor isolated populations that should be regarded as Evolutionarily Significant Units (i.e., Distinct Population Segments) under the Endangered Species Act. Multiple lines of evidence suggest an exceptionally small population occurs in the Peloncillo Mountains, and the Peloncillo population tested positive for genetic bottlenecks in several statistical tests (Holycross and Douglas 2007).

This is a montane generalist, found in rocky hillsides, canyon bottoms, and talus slopes. Dominant vegetation in the habitat of *C. willardi* includes various oaks, Apache and Chihuahua pine, alligator bark juniper, manzanita, and various grasses (Degenhardt et al. 1996).

**Current Status:** *Crotalus willardi obscurus* is listed as threatened by the USFWS (USDI 1991) and as a species of special concern in Arizona. A federal recovery plan was approved in 1985 (USFWS 1985). The Animas Mountains population is protected by private land ownership and appears fairly secure (Holycross 1995), although there is the continued threat of catastrophic wildfire. In the Peloncillo Mountains a total of only 26 specimens are known to science. Eighteen of these were collected by A.T. Holycross (Arizona State Univ.) with funding provided by NMDGF, AGFD, and USFWS between 1995 and 2001 (Holycross 1999; Holycross, *pers. comm*.).

**Threats:** The most prominent threat to *Crotalus willardi obscurus* is habitat loss (i.e., type conversion of woodland habitat) and direct take resulting from wildfire or prescribed management-ignited fires. Additionally, changes in land ownership or land use practices that result in habitat modification could negatively affect populations. Prescribed fire may pose a threat to marginal and fragmented habitat for this species in the Peloncillo Mountains. Seasonal variation of the threat imposed by fire deserves additional research.

The species is commercially valuable and much sought after by private herpetoculturists. While investigating the status of *C. willardi* in the Animas Mountains, Harris and Simmons (1975) reported encountering 15 collectors from 6 states during late August 1974, and they felt that the species could not withstand such overexploitation.

**Recommendations:** *Crotalus willardi obscurus* should maintain its current listing as endangered. NMDGF should cooperate with USFWS and form an Advisory Team to redraft the Recovery Plan (USFWS 1985), which is over 20 years old and outdated. Staff biologists from NMDGF and USFS should work together to help design a program of prescribed fire. The primary goal should be to develop a fire management program which emphasizes the need for cool-season, low-intensity fires to reduce the buildup of woody fuels and thus the chance for catastrophic wildfire within the montane habitat of *C. willardi obscurus*.

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**THREATENED**

**Western River Cooter, *Pseudemys gorzugi***

**Distribution and Biology:** In New Mexico, *P. gorzugi* is confined to the Pecos River drainage, including the Pecos, Black, and Delaware rivers below Brantley Dam and in Rocky Arroyo in Eddy County (Degenhardt et al. 1996; Christman and Kamees 2007). Historic records of *P. gorzugi* from Bitter Lake NWR in Chaves County (Bundy 1951) are questionable (Painter 1991). Christman and Kamees (2007) trapped 56 individuals at 11 of 24 sites surveyed. During these surveys, *P. gorzugi* was most common in the Black River.

*Pseudemys gorzugi* is often an abundant turtle within its limited habitat, preferring river systems with deep pools and generally avoiding shallow riffles (Degenhardt et al. 1996). The species is primarily herbivorous, although it is easily trapped using sardines as bait.

**Current Status:** *Pseudemys gorzugi* is one of the least-known freshwater turtles in North America (Ernst 1995, Ernst et al. 1994). Populations of *P. gorzugi* in Texas are declining, due primarily to take for the pet trade (Mike Forstner 2001 *in. litt*. NMDGF files), and habitat loss and degradation (Scudday 1974). It is listed as Rare by the Republic of Mexico (SDS 1994).

**Threats:** The primary threat to *P. gorzugi* is from weekend recreationists who use this turtle for target practice, as numerous dried shells with obvious bullet holes have been found along the Delaware River (Painter 1991; Christman and Kamees 2007). Fishermen often take it on trotlines set for catfish or while fishing for other species with live or dead animal bait. Water-use practices in the lower Pecos River are determined by a large number of factors so that the water required for this species is likely guaranteed.

**Recommendations:** *Pseudemys gorzugi* should maintain its current listing as threatened, although NMDGF should partner with Texas and seek funding to investigate its current status throughout its known range. Attempts to obtain permission to investigate sites on private land at Willow Lake and Blue Spring should be made. A program of public awareness should be initiated and informative signs should be posted around the commonly used fishing areas in the lower Pecos River drainage.

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**Slevin's Bunchgrass lizard, *Sceloporus slevini***

**Distribution and Biology:** *Sceloporus slevini*, primarily a Mexican species, is peripheral in New Mexico, reaching the northern and eastern edge of its range in southwest New Mexico. It is known only from extreme southwest Hidalgo County in the grasslands and adjacent foothills in the southern end of the Animas Valley at elevations of 5100-5300 ft (Degenhardt et al. 1996). Dixon and Medica (1965) first reported the species from New Mexico. As the common name suggests, *S. slevini* occurs in areas of dense bunch grass, usually on hillsides within the ponderosa pine zone. The specimens from New Mexico are enigmatic because of their grassland origin, although research suggests this was once a widespread grassland species that has only recently retreated to the mountain slopes to escape the destruction of the grasslands brought about by overgrazing (Bock et al. 1990).

**Current Status:** Other than in New Mexico, *S. slevini* receives no formal protection anywhere throughout its range. Within its limited habitat in southeast Arizona, many populations are suffering significant declines because of severe overgrazing (Congdon 1994). Prior to 1994, *S. slevini* had not been collected in New Mexico since 1967 when it was know from only 6 specimens. During 1994-97 however, trapping efforts in suitable habitat in the Animas Valley have shown *S. slevini* to be more abundant and widespread than previously known.

**Threats:** The primary threat to *S. slevini* is overgrazing. Unregulated, excessive collecting may cause localized reductions in populations.

**Recommendations:** *Sceloporus slevini* should retain its status as threatened. Routine monitoring of the small New Mexico population should be implemented to ensure that grazing practices, especially in times of severe drought, do not cause declines. In addition, strict regulations regarding collecting should continue to be enforced. Based on recommendations of Smith et al. (1996) the subspecies *Sceloporus scalaris slevini* in New Mexico should be elevated to full species rank (*S. slevini*); the common name should be Slevin's Bunchgrass Lizard (Crother 2000)

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**Canyon Spotted whiptail, *Aspidoscelis burti***

**Distribution and Biology:** The range of this large lizard extends southward into Mexico to at least southern Sonora. It reaches the extreme eastern and northern edge of its range in southwest New Mexico. In New Mexico, it occurs only in Guadalupe Canyon in southwest Hidalgo County where it is common in its limited habitat at 4330-4520 ft (Degenhardt et al. 1996). Records from the Peloncillo Mountains along Geronimo Trail and from the Alamo Hueco Mountains (Hayward et al. 1977) are questionable and have not been verified. This is the largest member of the genus *Aspidoscelis* in North America. It is an active diurnal species that depends upon a mosaic of open spaces and cover where it forages for insects, its primary prey. The subspecies, the Giant Spotted Whiptail, *A. b. stictogramma*, occurs in New Mexico.

**Current Status:** *Aspidoscelis burti* receives no formal protection in Arizona or Mexico.

**Threats:** Habitat alteration and overcollecting are the only major perceived threats to this species in New Mexico. Populations of *A. burti* in Guadalupe Canyon are healthy and stable (Painter and Tomberlin 1996) although they could be impacted by uncontrolled wildfire or by overgrazing of the riparian vegetation in their limited habitat.

**Recommendations:** *Aspidoscelis burti* should be retained as threatened. NMDGF biologists should coordinate with private landowners within the habitat of *A. burti* to help design a program of prescribed fire. The primary goal should be to develop a fire management program which emphasizes the need for cool-season, low-intensity fires to reduce the buildup of woody fuels and thus the chance for catastrophic wildfire within the riparian habitat of *A. burti*. Routine monitoring of the small New Mexico population should be implemented to ensure that grazing practices, especially in times of severe drought, do not cause declines. In addition, strict regulations regarding collecting should continue to be enforced. Following Reeder et al. (2002) and Crother et al. (2003) North American species in the genus *Cnemidophorus* should be re-assigned to the genus *Aspidoscelis,* and the subspecies *stictogrammus* should become *stictogramma*.

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**Mountain Skink, *Plestiodon callicephalus***

**Distribution and Biology:** In New Mexico, *Plestiodon callicephalus* occurs only in the southern Peloncillo Mountains of southwest Hidalgo County. It is known from 4300-6400 ft in Guadalupe Canyon and along Geronimo Trail, where it is uncommon in its limited habitat (Degenhardt et al. 1996). *Plestiodon callicephalus* is peripheral in New Mexico, where it reaches the eastern and northern edges of its range. *Plestiodon callicephalus* requires abundant and well-rotted leaf litter for forage areas and sites for egg-laying. It is secretive and rarely observed, although it is easily captured using pitfall traps set in its riparian habitat.

**Current Status:** No protection is afforded *P. callicephalus* in Arizona or Mexico.

**Threats:** Habitat alteration and overcollecting are the only perceived threats to this species in New Mexico. Populations of *P. callicephalus* in Guadalupe Canyon are healthy and stable (Painter and Tomberlin 1996) although the species could be impacted by uncontrolled wildfire or by overgrazing of the riparian vegetation in its limited habitat.

**Recommendations:** This species should maintain its current listing as threatened. NMDGF should coordinate with private landowners and federal land management agencies within the habitat of *P. callicephalus* to help design a program of prescribed fire. The primary goal should be to develop a fire management program which emphasizes the need for cool-season, low-intensity fires to reduce the buildup of woody fuels and thus the chance for catastrophic wildfire within the riparian habitat of *P. callicephalus*. Routine monitoring of the small New Mexico population should be implemented to ensure that grazing practices, especially in times of severe drought, do not cause declines. In addition, strict regulations regarding collecting should continue to be enforced. Based on de Queiroz, K and T.W. Reeder (2008) populations in New Mexico should be changed from *Eumeces callicephalus* to *Plestiodon callicephalus*.

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**Green Ratsnake, *Senticolis triaspis***

**Distribution and Biology:** *Senticolis triaspis* occurs from southwest New Mexico and southern Arizona south to Costa Rica. It reaches the extreme eastern edge of its range in southwest New Mexico where it is very rare and seldom encountered. In New Mexico, it is known from only 3 museum specimens (Degenhardt et al. 1996, Garrett and Painter 1992, Painter and Tomberlin 1996). The Northern Green Ratsnake, *S. t. intermedia*, occurs in New Mexico.

**Current Status:** *Senticolis triaspis* receives no formal protection in Mexico. It is protected from unregulated take in Arizona (AGFD 1996).

**Threats:** This beautiful species is very desirable and valuable in the pet trade and is therefore threatened by overcollecting. Habitat alteration through uncontrolled wildfire or increased livestock grazing is also a threat.

**Recommendations:** *Senticolis triaspis* should maintain its current listing as threatened. NMDGF should coordinate with federal land management agencies and private landowners within the habitat of *S triaspis* to help design a program of prescribed fire. The primary goal should be to develop a fire management program which emphasizes the need for cool-season, low-intensity fires to reduce the buildup of woody fuels and thus the chance for catastrophic wildfire within the riparian habitat of *S. triaspis*. Routine monitoring of the habitat that supports the

small New Mexico population should be implemented to ensure that grazing practices, especially in times of severe drought, do not cause declines. In addition, strict regulations regarding collecting should continue to be enforced.

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**Narrow-headed Gartersnake, *Thamnophis rufipunctatus***

**Distribution and Biology:** In New Mexico, *Thamnophis rufipunctatus* is confined to Catron, Grant, and Hidalgo counties where it reaches the eastern edge of its distribution. It is a habitat specialist, occurring only in shallow, swift-flowing, rocky rivers and streams of the San Francisco and Gila River drainages (Fitzgerald 1986; Degenhardt et al. 1996). It feeds almost exclusively on fish (Fleharty 1967). Extensive surveys during 2004-05 (NMDGF; Holycross et al. 2006) suggest a disappearance of the species from the area of the San Francisco Hot Springs in Catron County near Glenwood, the site of a previously robust population.

**Current Status:** *Thamnophis rufipunctatus* is listed as a Species of Concern by USFWS (USFWS 2008). It is a species of wildlife of special concern in Arizona (AGFD 1996).

**Threats:** Major threats to this species are changes in water-use practices and heavy livestock overgrazing of streamside vegetation that results in alteration of habitat, including heavy siltation and the elimination of undercut banks. There is indirect evidence that the introduction of American Bullfrogs (*Lithobates catesbeianus*) has eliminated *T. rufipunctatus* from its native habitat in some areas, e.g., Wall Lake in Catron County (Fleharty 1967; Schwalbe and Rosen 1988). Nowak and Santana-Bendix (2002; 2003a, 2003b) reported declines of this species in central Arizona based on the presence of non-native "spiny-rayed" fishes (i.e., the sunfishes *Micropterus* and *Lepomis*, family Centrarchidae), habitat destruction and modification due to increased recreation and siltation, and localized mortality due to channel-altering flood events, direct predation by humans, and roadkills.

**Recommendations:** *Thamnophis rufipunctatus* should maintain its current listing as threatened. NMDGF should seek funding to complete a study of the current status of this species in southwest New Mexico, including participation in a range wide phylogenetic study of the species. Although the population at San Francisco Hot Springs is believed to be extirpated, efforts should continue at this and nearby sites to obtain specimens for disease testing. Microhabitat characteristics of the San Francisco Hot Springs site should be compared to those collected during earlier studies at the same site. In addition, strict regulations regarding collecting should continue to be enforced.

Pierce (2007) prepared a New Mexico State Recovery Plan for this species. In this Plan he identified three management needs: 1) the need for additional information on the declines and threats to populations of *T. rufipunctatus* in New Mexico; 2) the need for additional information on the biology and natural history of *T. rufipunctatus* in New Mexico; and 3) the need to coordinate with the USFS and BLM in efforts to repatriate the species at historic sites on federal lands.

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**Western Ribbonsnake, *Thamnophis proximus***

**Distribution and Biology:** In New Mexico, *Thamnophis proximus* occurs as isolated and disjunct populations mostly east of the Pecos River. It is uncommon where it occurs, with the possible exception of Bitter Lakes National Wildlife Refuge near Roswell. The species reaches the western limit of its range in eastern New Mexico and is one of the least-known and little-studied snakes in the state (Degenhardt et al. 1996). The subspecies, the Arid Land Ribbonsnake, *T. p. diabolicus*, occurs in New Mexico.

**Current Status:** *Thamnophis proximus* does not receive formal protection in Texas, although it is listed as threatened by the Republic of Mexico (SDS 1994). A mark-recapture study of this species initiated at Bitter Lake NWR during 1997 has shown the species to be more abundant on the refuge than previously thought (G. Warrick, Refuge Biologist data files).

**Threats:** Major threats to *T. proximus* are changes in water use practices that could result in alteration of habitat. Illegal take may be of concern in the Spring River population near metropolitan Roswell. Road-killed individuals are occasionally encountered on the tour loop roads at Bitter Lake NWR.

**Recommendations:** *Thamnophis proximus* should maintain its current listing as threatened. A public awareness program should be initiated at Bitter Lakes NWR to alert people of the presence of this species and the potential of the species to be encountered on the roadways. Additional state-wide surveys should be initiated to determine the extent and status of the population at historic sites and in additional potential habitat. In addition, strict regulations regarding collecting should continue to be enforced.

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**Mottled Rock Rattlesnake, *Crotalus lepidus lepidus***

**Distribution and Biology:** In New Mexico, this montane rattlesnake is known only from the Guadalupe Mountains in Eddy County and extreme eastern Otero County where it reaches the northern edge of its range in New Mexico (Degenhardt et al. 1966). *Crotalus l. lepidus* is a localized inhabitant of the Guadalupe Mountains, rarely found away from rocky canyons or hillsides (Swinford 1992). Two subspecies of Rock Rattlesnake, *C. l. lepidus* and *C. l. klauberi*, occur in New Mexico; only *C. l. lepidus* is protected. A zone of intergradation between these poorly diagnosed subspecies may occur in the San Andres Mountains on White Sands Missile Range in Sierra and Doña Ana counties.

**Current Status:** *Crotalus l. lepidus* does not receive formal protection in Texas, although it is a Species Subject to Special Protection in the Republic of Mexico (SDS 1994).

**Threats:** Much of the habitat for *C. l. lepidus* in New Mexico occurs in Carlsbad Caverns National Park, therefore it appears to be secure except for illegal take and road mortality within the Park. Outside of the Park, the steep, rocky habitat is generally unsuitable for livestock grazing, oil and gas exploration, or other development. Mining may have localized effects. Overcollecting, e.g., at Sitting Bull Falls, may reduce populations in areas well known to snake collectors, especially given the articles that have appeared in the popular herpetocultural literature (e.g., Swinford 1989, 1990).

**Recommendations:** *Crotalus l. lepidus* should maintain its current listing as threatened. Any evidence of overcollecting of *C. l. lepidus* should be closely monitored.

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**BIRDS**

**ENDANGERED**

**Brown Pelican, *Pelecanus occidentalis***

**Distribution**: This coastal species breeds from California and the mid-Atlantic states southward to South America (AOU 1998). Brown Pelicans are occasional visitors inland to New Mexico; they occur during all seasons, but they are most frequent summer through fall. Through 2008, there have been some 60 reports involving nearly 73 individual birds, these from 18 of New Mexico's 33 counties, with most from large lakes or along major rivers, including the San Juan, Rio Grande, Canadian, Gila, and Pecos drainages. Most Brown Pelicans that occur in New Mexico are the Pacific subspecies *P. o. californicus*, although the eastern *P. o. carolinenis* is also likely to occur.

**Current Status**: The Brown Pelican was listed as federally endangered throughout its range under the precursor of the Endangered Species Act (ESA) in 1970 (United States Code of Federal Regulations 1970). Another success story of the ESA, Brown Pelicans in coastal states along the Atlantic Coast and in Florida and Alabama were removed from the List of Endangered and Threatened Wildlife in 1985 (USFWS 1985). Brown Pelicans occurring

throughout the remainder its range in North, Central, and South America and in the Caribbean are similarly recovering and were proposed for delisting on 20 February 2008 (USFWS 2008). In New Mexico, the Brown Pelican was first listed as threatened in 1983 and then was reclassified as endangered in 1990 as the extent of its occurrence in New Mexico became better understood. Brown Pelicans were recorded annually in New Mexico during the eight-year period 2001-2008, averaging 3 individuals per year and with reports from 12 counties.

**Threats**: An important factor in the decline of the species was pesticide contamination of its prey base (fish), leading to impaired reproduction and direct mortality (USFWS 1985, Johnsgard 1993, Shields 2002). Other threats include loss of breeding areas (e.g., due to oil spills), illegal killing, and competition with commercial fisheries.

**Recommendation**: No change in status is recommended. Strict enforcement of laws against harming and disturbing all Brown Pelicans is essential in protecting those few individuals that occur in New Mexico. NMDGF should continue to track Brown Pelican numbers in the state to determine long-term persistence of the species in New Mexico.

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**Aplomado Falcon, *Falco femoralis***

**Distribution**: This grassland raptor occurs from the southwestern United States to southern South America (AOU 1998, Keddy-Hector 2000). The historic range in New Mexico included desert grasslands across the southern one-third of the state and across the central region north Socorro County (Hector 1987, Keddy-Hector 2000, Meyer and Williams 2005). The species requires extensive, contiguous desert grasslands characterized by relatively tall, dense grass cover and scattered yucca (*Yucca* spp.) and mesquite (*Prosopis glandulosa*) (Montoya et al. 1997, Young et al. 2002).

**Current Status**: The northern subspecies, *F. f. septentrionalis*, is federally-listed as endangered (USFWS 1986) with a nonessential experimental population designation for all populations in New Mexico and Arizona (USFWS 2006). The subspecies was listed by New Mexico as endangered in 1990. Following a documented nesting in southern New Mexico in 1952 (Ligon 1961), the subspecies was very rarely reported in the state from the 1960s through the 1980s (Meyer and Williams 2005). However, coincident with the 1992 discovery of thriving populations in nearby Chihuahua, Mexico (Montoya et al. 1997), an increased presence of Aplomados in New Mexico became apparent by the early 1990s, which raised hopes that natural recolonization of the historic range was underway (Williams 1997). Overall, the decade 1990-1999 produced 24 credible reports involving 26-31 falcons in southern New Mexico, with 36 observations occurring per year by the latter part of the decade (Meyer and Williams 2005). That trend has continued into 2006, with multiple reports from throughout the historic New Mexico range, including observations of pairs. One pair occupied a territory for at least two years and fledged young, which was the first successful nesting by native Aplomado Falcons in the United States in half a century (Meyer and Williams 2005). Extensive surveys and studies in adjacent Chihuahua, Mexico better clarified the extent of the distribution there, and indicated that falcons in northern Chihuahua and southern New Mexico should be considered a single interacting population (Young et al. 2004). Starting in 2006, the native population of Northern Aplomado Falcons in New Mexico is being supplemented by releases of captive-bred Aplomados of tropical southern Mexico origin: 11

captive-bred birds were released in 2006 and 39 birds were released in 2007. Up to 1500 birds are slated for release over the next decade. At least one pair of captive-bred birds successfully nested and fledged young near their release site in 2007, while a greater number have dispersed away from where they were released to areas largely unknown (the birds are not fitted with transmitters).

**Threats**: The primary causes for decline of the Northern Aplomado Falcon are loss and degradation (e.g., shrub encroachment and loss of grass cover) of required grassland habitat from excessive grazing, control of range fires, and conversion of grasslands to agricultural lands (USFWS 1986, 1990; Hector 1987). There is also evidence of continued contamination of Aplomado Falcons' prey by organochlorine pesticides and toxic heavy metals such as mercury and lead (Keddy-Hector 2000).

**Recommendation**: No change in status is recommended. All agencies and organizations should continue to work cooperatively to protect native Aplomados, and should encourage continued natural recolonization by maintaining and improving grassland habitat. This cooperative effort will be particularly important given the US Fish and Wildlife Service's designation of the entire state of New Mexico as a nonessential experimental population area for the Aplomado Falcon, and the resulting removal of requirements for Aplomado habitat conservation measures that had resulted from previous Biological Opinions. Monitoring should be conducted to quantify: 1) natural recolonization of New Mexico grasslands by native stock from Chihuahua; 2) establishment of captive-bred birds of tropical southern Mexico origin in New Mexico; 3) availability of prey and its relationship to grassland condition and climate; and 4) factors that influence nesting success and site fidelity of native Aplomados along the New Mexico-Mexico border. A conservation strategy not currently under consideration, but having merit, involves revising the outdated 1990 recovery plan to reflect new information, which could lead to revised strategies and recovery goals based upon current circumstances.

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**White-tailed Ptarmigan, *Lagopus leucurus***

**Distribution**: This alpine tundra-inhabiting grouse occurs from Alaska and the Yukon south through the Rocky Mountains, reaching its southernmost limits in the Sangre de Cristo Mountains of New Mexico (Braun et al. 1993,

AOU 1998). In New Mexico, the species occurred historically on all the ridges and peaks of the Sangres above timberline, from the vicinities of Santa Fe Baldy and Pecos Baldy northward to the Colorado line (Bailey 1928, Ligon 1961).

**Current Status**: The species was listed as endangered by New Mexico in 1975. By the early 1900s, the species had become extremely rare throughout its New Mexico range (Bailey 1928) and, by the mid-1900s, it was extirpated from the southern peaks and restricted to only a few peaks in the northernmost reaches of its former habitat (Ligon 1961). A 1981 transplant of Colorado birds into the southern portion of the range was successful and there have been records in and near the transplant area in most years from 1990 to 2007, including observations of nests and young. In addition, reports have increased from the northern peaks (Latir, Wheeler) in recent years, providing evidence of persistence of native stock in far northern New Mexico.

**Threats**: Initial declines were attributed to habitat degradation from intensive grazing, particularly by domestic sheep, combined with unrestricted killing (Bailey 1928, Ligon 1961, Lee 1967, Hubbard 1970). Threats to the states' remnant ptarmigan population include use of New Mexico's limited alpine tundra habitat by livestock, growing numbers of elk and bighorn sheep, and humans (including wilderness hiking, ski area development, construction of snow catchment fences, and microwave relay stations) (Braun et al. 1993).

**Recommendation**: No change in status is recommended. NMDGF should work with land managers to protect alpine and timberline habitats for this species. NMDGF should conduct a coordinated survey of all suitable habitats in the Sangre de Cristo Mountains to document current distribution and abundance. In addition, as White-tailed Ptarmigans are highly adapted to living in alpine habitat, being intolerant to heat stress and dependent on alpine vegetation, studies that investigate the effects of climate change on the species should be undertaken.

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**Whooping Crane, *Grus americana***

**Distribution**: Formerly widespread in North America, the species had declined to a single flock of about 16 individuals by 1941, which migrated between Canada and coastal Texas (Lewis 1995). Natural occurrence of the species in New Mexico is unproven; unverified sightings from the Hatch and Portales areas in the 1850s and 1930s, respectively, might have been of this species (Allen 1952). Up to 2002, members of an experimental population produced in Idaho since 1975 – which used Sandhill Cranes (*G. canadensis*) as foster parents for young Whooping Cranes – were infrequently reported wintering in the middle Rio Grande Valley of New Mexico. More recent records were unconfirmed sightings of 2 Whooping Cranes in December 2004 and 5 adult Whooping Cranes in October 2006 at the Grulla National Wildlife Refuge, Roosevelt County (Williams 2005, 2007). These unconfirmed reports suggest that, as the wild flock that migrates between Canada and Texas continues to recover, migrants might be expected to reoccur in the part of the state (Williams 2007).

**Current Status**: The Whooping Crane was federally listed as endangered under the precursor of the Endangered Species Act in 1967. In New Mexico, it was first listed as threatened in 1975 and then reclassified as endangered in 1990. After being on the brink of extinction, the species is now an enduring symbol of national and international efforts to recover endangered species as recovery efforts appear to be achieving some success rangewide. According to the United States Fish and Wildlife Service and Patuxent Wildlife Research Center, by January 2006, the world population of Whooping Cranes was up to 476 individuals, including 218 in the wild flock that migrates between

Canada and Texas, 64 in an experimental flock that migrates between Wisconsin and Florida, 59 in an experimental, non-migratory flock in Florida, and 135 in several captive breeding facilities. However, because of high mortality rates and lack of pairing and reproduction, all efforts to establish a viable Rocky Mountain flock have been terminated in the west, with the remaining birds in the wild being reclassified as "experimental, nonessential" and all critical habitat designations within New Mexico being removed (USFWS 1997). Two captive-bred Whooping Cranes did winter in New Mexico in 2000-01. However, only one, an 18-year old individual, survived to winter here in 2001-02 and, after migrating north from New Mexico in spring 2002, it was never seen again and presumably died, thereby signaling the end of the experimental population.

**Threats**: Overall declines in the species is attributed to anthropogenic habitat loss and degradation from fencing and plowing in tall- and mixed- grass prairie, and from draining of freshwater wetlands. Once reduced in numbers, populations were more vulnerable to losses from killing, disease, and collision with manmade objects (Lewis 1995).

**Recommendation**: The continued lack of proof of natural occurrence of the species in the state has complicated NMDGF considerations of whether the species should be removed from New Mexico's list of threatened and endangered species. Verifiable evidence of naturally occurring Whooping Cranes in Roosevelt County is critical to understanding this species' future in the state. In addition, strict enforcement of laws against harming and disturbing all Whooping Cranes remains essential in protecting those few individuals that might occur in New Mexico.

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**Piping Plover, *Charadrius melodus***

**Distribution**: This small, migratory shorebird breeds in the northern Great Plains, Great Lakes region, and Atlantic coastal areas (Haig 1992). It occurs as a very rare migrant in New Mexico, where it has been reported at wetlands in Colfax, Guadalupe, Socorro, Chaves, and Eddy Counties.

**Current Status**: The species is federally listed as endangered in the inland United States and as threatened in the remainder of its range along the Atlantic coast (USFWS 1985). In New Mexico, Piping Plover was first listed as threatened in 1988, reclassified as endangered in 1990, and then downlisted back to threatened in 2006. It is also listed as threatened by Colorado. Although Piping Plovers nest in southeastern Colorado (Kingery 1998), not far north of New Mexico, the species has been reported in New Mexico on only 7 occasions, most recently in April 2001 (Williams 2001). Piping Plover breeding populations have dynamic demographics in recent years. The Northern Great Plains Piping Plover population, which extends south to the Arkansas River of southeastern Colorado, is geographically the closest to New Mexico and displays the highest fluctuations in population numbers. During the 1991, 1996, and 2001 international Piping Plover breeding censuses, clear increases in the Atlantic Coast and smaller Great Lake plover populations were detected, while numbers of Piping Plovers observed in the Northern Great Plains were more variable, at 2032, 1599, and 1981 adults, respectively (Ferland and Haig 2002). Annual variation in population numbers appears to depend upon availability of mudflat and sandbar habitats, water levels, and violent storm systems. Despite a period of at least 40 years of no known Piping Plover breeding in Colorado beginning in 1949, surveys by the United States Army Corps of Engineers on southeast Colorado reservoirs recorded as many as 24 breeding pairs in 2003. Because the occurrence of Piping Plovers within the state is dependent upon status and conditions of breeding populations elsewhere, higher Piping Plover numbers in Colorado will surely increase the number of Piping Plovers migrating through New Mexico.

**Threats**: The major threats to this species are loss and degradation of nesting and wintering habitats from urbanization, vehicular traffic, human disturbance, and water impoundments and regulation (USFWS 1985, Ryan et al. 1993).

**Recommendation**: No change in status is recommended. Protection of mudflat and sandbar habitats at New Mexico wetlands will benefit this and other shorebird species that migrate through the state. The species will also benefit from recommended recovery actions put forth in the Piping Plover Atlantic Coast Population Revised Recovery Plan (ACPPRT 1996)

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**Least Tern, *Sterna antillarum***

**Distribution**: The Least Tern breeds from California, the Dakotas, and Maine south to southern Mexico and the Caribbean, with interior populations (a separate subspecies, Interior Least Tern, *S. a. athalassos*) breeding primarily in the Mississippi River Basin (Sidle et al. 1988, AOU 1998). In New Mexico, this summer resident is an occasional visitor to wetlands in at least 18 New Mexico counties, but it is only known to breed at Bitter Lake National Wildlife Refuge (NWR), Chaves County and farther south in the Pecos Valley at Brantley Lake, Eddy County. For many years, the only known nesting site in the state was Bitter Lake NWR (Hubbard 1978), but Least Terns were found summering at Brantley Lake in 2002 and 2003, and were documented nesting there in 2004 – the first New Mexico breeding away from Bitter Lake.

**Current Status**: The Interior Least Tern was federally listed as endangered in 1985 (USFWS 1985). In New Mexico, this subspecies was listed as endangered in 1976. The state's breeding population has been quite small throughout much of the past 50 years, rarely exceeding 8 breeding pairs at Bitter Lake National Wildlife Refuge, and reproductive success typically has been poor. During the 10-year period from 1990 to 1999, the breeding population averaged only about 5-6 pairs each year, with continued poor productivity. In the six-year period 2000-2005, however, the population at Bitter Lake increased steadily, to 14 pairs by 2005, and remarkably high productivity was achieved, averaging 1.24 young fledged per pair during that period. The population has again declined in recent years: only 1 bird was successfully produced from nesting attempts in 2006 and, while numbers of nesting birds were up from the previous year, few nests successfully fledged young in 2007. At Brantley Lake, up to 7 pairs summered in 2004 and at least 6 chicks fledged. Up to 9 pairs were there early in 2005, but numbers declined to 3-4 pairs during the season, and no successful nesting was documented. The subspecies again attempted to nest at Brantley Lake in 2006, but nesting attempts were unsuccessful as nesting areas were inundated from rising lake levels. No nesting attempts were detected at Brantley Lake in 2007 (USBOR 2007).

**Threats**: The Interior Least Tern has been threatened by human disturbance at nesting beaches and flats, chemical contamination of the prey base, and loss and degradation of riverine habitats from altered flow regimes and channelization (USFWS 1990, Thompson et al. 1997). The Bitter Lake National Wildlife Refuge population might be jeopardized by oil and gas development, lowered water tables, contamination, and predation (e.g., by coyotes).

The struggling Brantley Lake population is threatened by ill-timed water level fluctuations and by human disturbance to limited sand flat habitat.

**Recommendation**: No change in status is recommended. NMDGF should continue to cooperate with the United States Fish and Wildlife and the United States Bureau of Reclamation, as well as with other agencies, to monitor the known nesting populations and to continue to identify, protect, and manage habitat to benefit this species. Flexible water management in Brantley Lake should be considered where possible to minimize likelihood of inundating nests and to increase the potential that appropriate habitats (such as created or managed habitats) are utilized by the species.

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**Common Ground-Dove, *Columbina passerina***

**Distribution**: This small dove occurs from the southernmost United States, including southern New Mexico, south into Latin America (AOU 1998, Bowman 2002). Within New Mexico, it occurs primarily across the southern counties that border Mexico. This low elevation species prefers brushy, well-watered valleys, and frequents riparian woodlands and shrublands, especially mesquite thickets along streams and canyon bottoms.

**Current Status**: This species was listed by New Mexico as endangered in 1983. It was formerly resident year-round in southern New Mexico (Ligon 1961), but it was only a rare visitor there by the 1980s. During the 10-year period from 1990 to 1999, less than 5 birds per year, on average, were reported in New Mexico, with no documented nesting. Documented occurrences increased from 2000 to 2007, averaging up to 12 birds per year, with birds reported in eight counties but primarily in the southwestern counties of Hidalgo, Grant, Luna, and Doña Ana. The species recently has been found summering annually at several Hidalgo County locales (breeding is suspected but not confirmed).

**Threats**: Declines in this species are likely in response to loss and degradation of native shrublands in lowland riparian areas, through clearing, burning, excessive grazing, and land conversion.

**Recommendation**: No change in listing status is recommended. Protection and enhancement of shrubby riparian habitats and provision of surface water in such habitats should be encouraged. NMDGF should support investigations of demography, breeding behavior, breeding habitat requirements, and the ecological and physiological limitations influencing the species' distribution in New Mexico.

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**Buff-collared Nightjar, *Caprimulgus ridgwayi***

**Distribution**: This nocturnal species occurs primarily from western and southern Mexico south into Nicaragua. It reaches its northernmost geographic limits in southeastern Arizona and southwestern New Mexico (AOU 1998), where it summers in low-elevation desert canyons characterized by thickets of mesquite, acacia, hackberry, and other brush, with scattered junipers on adjacent slopes. Most New Mexico reports are from Guadalupe Canyon, Hidalgo County, with single reports from Doña Ana and Grant Counties.

**Current Status**: This species was listed by New Mexico as endangered in 1975. It was first discovered in the United States in Guadalupe Canyon, Hidalgo County (Johnson and Hardy 1959), but it has not been reported there since 1985; NMDGF surveys for listed species there failed to detect this species from 1987 to 2004. There has been only a single report of the species in the state since 1985: an unconfirmed occurrence of one heard at Redrock, Grant County on 30 May 1999 (Williams 1999). The species is rare but regular in occurrence in southern Arizona (Bowers and Dunning 1997, Corman and Wise-Gervais 2005).

**Threats**: Loss of native habitat in brushy desert canyons, through vegetation clearing, burning, overgrazing, or water table reduction threatens this species at the northern fringe of its range. Human disturbance, including by bird watchers, could likewise jeopardize small populations by disrupting breeding activity.

**Recommendation**: No change in listing status is recommended. NMDGF should continue to work with public and private land managers to conduct annual monitoring of the known breeding population and surveys for additional populations. NMDGF should also work with public and private land managers to protect and enhance Guadalupe Canyon and similar habitats for native species such as this nightjar.

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**Elegant Trogon, *Trogon elegans***

**Distribution**: This primarily Mexican species reaches the northern limit of its range in southeastern Arizona and southwestern New Mexico (AOU 1998, Kunzmann et al. 1998), where it is a rare summer resident of riparian habitats in montane canyons (Hall and Karubian 1996). In New Mexico, it is found annually in the Peloncillo Mountains in Hidalgo County. Non-breeding vagrants rarely occur elsewhere in other mountain ranges of southern Hidalgo County (most recently in 2004), and in Catron, Grant, Sierra, and Otero Counties.

**Current Status**: The species is listed by the United States Fish and Wildlife Service as a species of special concern (USFWS 2002) and it was listed as endangered by New Mexico in 1975. It became one of the first non-game birds in the United States to receive special protection when it was protected from all forms of collecting by Arizona in about 1940. Up until 2006, the Elegant Trogon was only known to breed in New Mexico in a single canyon in the Peloncillo Mountains, where NMDGF and cooperators have documented one to two pairs annually since 1991. In

July 2006, a second breeding site in another canyon of the Peloncillo Mountains was discovered. The pair again nested in the newly-discovered breeding site in 2007.

**Threats**: The species is threatened by loss of limited breeding habitat (including large trees with suitable nesting cavities) and foraging habitat (including fruiting shrubs) from fire, wood-cutting, excessive grazing, lowering of water tables, and road construction or other development. Disturbance of nesting birds by humans (including photographers and bird watchers using recorded vocalizations to attract birds) is also a threat.

**Recommendation**: No change in status is recommended. Preservation and enhancement of mid-elevation montane riparian habitats in the Peloncillo Mountains and similar ranges is necessary, including maintaining water tables in canyons sufficient to support sycamores. Protection of breeding territories and nesting birds from human disturbance is also a priority. NMDGF should continue to work with public and private land managers to conduct annual monitoring of the known breeding population and surveys for additional populations. NMDGF should support studies investigating basic life history traits of the species.

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**Northern Beardless-Tyrannulet, *Camptostoma imberbe***

**Distribution**: This Neotropical flycatcher occurs from Costa Rica north through Mexico, reaching its northernmost geographic limits in southern Texas, southeastern Arizona, and southwestern New Mexico (Tenney 2000). In New Mexico, it summers regularly only in Guadalupe Canyon, Hidalgo County (AOU 1998). This is a low-elevation riparian species that prefers dense thickets of mesquite, acacia, hackberry, and similar vegetation, typically along stream courses (Phillips et al. 1964, Oberholser 1974).

**Current Status**: The species was listed as endangered by New Mexico in 1975. It is listed by Texas as threatened, by the United States Fish and Wildlife Service as a species of conservation concern, and by New Mexico Partners in Flight as a priority species. This small flycatcher was detected on NMDGF surveys of New Mexico's Guadalupe Canyon each year from 1987 to 2004, with nesting documented in both 2002 and 2003. The number of detected territories in the canyon averaged 3.2 territories annually from 1987 to 1996, indicating that the species might have benefited from the exclusion of livestock and improved habitat conditions there since the late 1980s. However, numbers dropped following human-caused fire there in the mid-1990s and the onset of drought in the late 1990s. The local population has yet to recover, with an annual average of only 1.4 territories from 1997 to 2004. To date, the species is only an extremely rare vagrant elsewhere in southwestern New Mexico.

**Threats**: The very small and localized New Mexico population is vulnerable to loss of required habitat from burning, clearing, lowering of water tables, and excessive grazing.

**Recommendation**: No change in status is recommended. The preservation and enhancement of native riparian and associated habitats in Guadalupe Canyon and elsewhere in southwestern New Mexico are essential for maintaining this species in the state. Human disturbance at nest and roost sites needs to be minimized. NMDGF should continue to work with public and private land managers to conduct annual monitoring of the known breeding population and surveys for additional populations. NMDGF should support investigations of demography, breeding behavior, breeding habitat requirements, and all other aspects of its life history.

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**(Southwestern) Willow Flycatcher, *Empidonax traillii extimus***

**Distribution**: The species breeds from southern Canada to the southern United States, and winters from southern Mexico to Panama (AOU 1998). The southwestern subspecies *extimus* (Phillips 1948) breeds primarily in New Mexico, Arizona, and southern California, where it is restricted to remnants of dense streamside vegetation and where breeding populations have suffered declines (Phillips et al. 1964, Unitt 1987, Hubbard 1987, Rosenberg et al. 1991, USFWS 1995). Within New Mexico, significant populations occur along the Rio Grande and Gila drainages, with much smaller populations at isolated locales in the San Juan, upper Canadian, Zuni, San Francisco, and Mimbres drainages.

**Current Status**: The southwestern subspecies was federally listed as endangered in 1995 (USFWS 1995). The subspecies was first listed by New Mexico as threatened in 1988 and then was reclassified as endangered in 1996. The subspecies is also state listed in neighboring states: it is endangered in California and Utah, and it is a wildlife species of special concern in Arizona. Cooperative surveys conducted statewide from 1993 to 2007 found an annual average of 333 summering territories in about 41 localities, primarily from the Rio Grande Valley westward. The majority of sites (n = 31) are small, averaging only 1-5 territories each, while 8 sites averaged 6-20 territories each and only 2 sites averaged more than 20 territories each. The two largest sites are significantly larger than all other sites, supporting greater than 100 territories each. The Cliff-Gila Valley (once the largest site that accounted for some 70% of the state's population), declined during 2000-2007, losing nearly 32% of its population (declining from a high of 209 territories in 1999 to 144 in 2007). During the same period, however, the site along the Rio Grande above Elephant Butte Reservoir increased more than eight-fold to 199 territories in 2007. Also during the 2000-2007 period, the population on federally-managed lands in the vicinity of the Lower Gila Box has likewise shown significant increases; territories (summed across three sites) increased from 17 in 2000 to 102 in 2007.

**Threats**: A number of threats have been identified as contributing to the endangered status of the Southwestern Willow Flycatcher. These threats are often interrelated and include: habitat alteration, fragmentation, and/or loss; fire; water manipulation (diversion, impoundment, pumping, flood control); excessive livestock grazing; brood parasitism by cowbirds; occurrence of remaining birds as small and isolated populations; low productivity; predation; recreation; and research activities. Efforts, especially in the middle Rio Grande Valley, to eradicate exotic plants, such as tamarisk, that do not involve concurrent restoration of native vegetation also jeopardize this flycatcher, which commonly uses tamarisk for nesting.

**Recommendation**: No change in listing status is recommended. NMDGF has been an active member of the Southwestern Willow Flycatcher Recovery Team, which was formed in 1998. The Recovery Team submitted a draft recovery plan to the United States Fish and Wildlife Service in 2000, which was finalized in 2002 (USFWS 2002). The plan identifies goals and actions to achieve recovery and delisting of the subspecies, and NMDGF should work to prepare the state recovery plan by adapting the federal plan. Meanwhile, all concerned parties must continue to work together to identify, protect, and enhance this flycatcher's riparian habitats.

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**Thick-billed Kingbird, *Tyrannus crassirostris***

**Distribution**: This Neotropical flycatcher of western Mexico and Guatemala reaches its northern geographic limits in southeastern Arizona, southwestern New Mexico, and the Big Bend region of western Texas (AOU 1998). In New Mexico, it summers regularly only in Guadalupe Canyon, Hidalgo County. It was first discovered in Guadalupe Canyon in 1958 (Levy 1959) and nesting was documented in New Mexico in 1959 (Zimmerman 1960). In New Mexico, the species requires native broadleaf riparian habitats characterized by mature cottonwoods and sycamores; to date, all New Mexico nests have been located in tall sycamores.

**Current Status**: The species was listed by New Mexico as threatened in 1975 and then was reclassified as endangered in 1990. The species is listed by Texas as threatened. NMDGF surveys along a two-mile transect in Guadalupe Canyon documented an annual average of 2.4 territories from 1987 to 2001. However, only one territory was found in both 2002 and 2003, and none was found in 2004 and 2006. Only a single bird was reported in both 2005 and 2007. Vagrants were occasionally found in summer elsewhere in Hidalgo County through 2001, but there have been no reports away from Guadalupe Canyon since 2001.

**Threats**: The small and localized New Mexico population is threatened primarily by loss of mature broadleaf riparian woodlands, especially large cottonwoods and sycamores, from fire (prescribed or otherwise), cutting, lowering of water tables, and excessive grazing.

**Recommendation**: No change in status is recommended. NMDGF should continue to monitor the small breeding population. In addition, NMDGF should encourage public and private land managers to protect and enhance native broadleaf riparian habitats in Guadalupe Canyon and elsewhere in southwestern New Mexico. In particular, fires in riparian areas that kill large trees should be discouraged, as should activities that result in lowered water tables.

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**(Arizona) Grasshopper Sparrow, *Ammodramus savannarum ammolegus***

**Distribution**: This unique, local subspecies of the widespread Grasshopper Sparrow is restricted to grasslands in southeastern Arizona, extreme southwestern New Mexico, and immediately adjacent areas of northern Sonora and Chihuahua, Mexico. The known range in New Mexico is limited to two populations in southern Hidalgo County, one in the Animas Valley and one in the Playas Valley (Williams 1991, 2006, 2007). This sparrow requires extensive, well developed desert grasslands characterized by grama and other bunchgrasses and generally lacking woody vegetation; abundant thatch and dry grasses are needed for cover.

**Current Status**: The subspecies was listed as threatened by New Mexico in 1990 and then uplisted to endangered in 2006. NMDGF breeding bird surveys were initiated in June 1987 in the Animas Valley specifically for this sparrow. In June 1992, the Animas Valley transect was expanded and a new transect was established in the Playas Valley. Data were consistently gathered along both transects for 15 years (1992-2006); no data were collected in 2007. In 1992, 109 sparrows were detected on the Animas transect and 41 were detected on the Playas transect. Since 1992, numbers recorded on each transect have shown year-to-year variation (Williams 1997), which might be in response

to precipitation, local fire events, or grazing practices. However, both transects have shown persistent, statistically significant long-term declines over the 15-year survey period. By 2004, the Animas transect had declined 88% (to 21 sparrows), while the Playas transect declined 100% (to 0 sparrows). In 2005, both transects yielded slight increases from 2004 – the Animas route up from 21 to 26 birds and the Playas route up from 0 to 2 birds (Williams 2006). Similarly, the Animas Valley transect showed continued improvement in 2006, with 47 sparrows detected (Williams 2007). However, the Playas transect showed no improvement in 2006, as no sparrows were detected (Williams 2007). These survey results indicate that the Playas population is at or near extirpation.

**Threats**: The main threat to this subspecies' continued survival in southern Hidalgo County is loss, degradation, and fragmentation of its native grassland habitat, primarily from excessive grazing that leads to reduced grass cover and increased brush encroachment. Ill-timed fires (especially those occurring during late spring-early summer) can severely depress recruitment.

**Recommendation**: No change in status is recommended. NMDGF should encourage grazing management practices and burning programs that perpetuate suitable grasslands for this unique subspecies. In particular, consideration should be given to grass banking or other means of reducing stocking rates in times of drought. NMDGF should continue to monitor the two populations each June, and should continue to survey for possible additional populations in that vicinity.

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**THREATENED**

**Neotropic Cormorant, *Phalacrocorax brasilianus***

**Distribution**: This widespread waterbird of Central and South America reaches its northernmost geographic limits in New Mexico (AOU 1998), where it nests only in the middle Rio Grande Valley. Non-breeders wander north to Bernalillo County, west to Hidalgo County and the Gila Valley in Grant County, and east to the Tularosa Basin and middle and lower Pecos Valley, and northeast to Colfax and Union Counties. Nesting cormorants require stands of trees or shrubs in or near water that are free from human disturbance.

**Current Status**: The species was listed by New Mexico as threatened in 1975. The species occurs in varying but typically small numbers primarily at Elephant Butte and Caballo Reservoirs and at the Bosque del Apache National Wildlife Refuge (NWR), where it is outnumbered by (and often confused with) the larger Double-crested Cormorant (*P. auritus*). Although the species has been reported in New Mexico annually by bird watchers, documentation of nesting has been less consistent. The species was first documented nesting in New Mexico at Elephant Butte Reservoir in 1972 (Hundertmark 1974) and, since then, no more than 50 nests have been found in any season and no nesting was documented anywhere in New Mexico from 1998 to 2006. The 8 years with no reported nesting and few documented individuals suggested that the species had largely vanished from the state, but then some encouraging evidence for the persistence of the species came in summer 2007, when a NMDGF-contracted waterbird study in the middle and lower Rio Grande of New Mexico resulted in the discovery of 5 Neotropic Cormorant nests in Quates March (near San Marcial, Socorro County) (Stahlecker 2007). This number is comparable to that found in 1975; Hundertmark (1975) found at least six pairs nesting in the upper Elephant Butte Reservoir. However, the lack of consistent, long-term data for this species has impeded attempts to assess population trends. Nevertheless, there is evidence that the species is in decline: numbers increased north to Bosque del Apache NWR area in the mid-1990s, but numbers of individuals reported in most key areas since 2000 have been considerably below historic levels.

**Threats**: Loss and degradation of limited breeding sites, disturbance of breeding colonies, fluctuations in food supply, contamination, and persecution are among the main threats to this fish-eating species (Telfair and Morrison 1995).

**Recommendation**: No change in status is recommended. A monitoring program is needed for this and other nesting colonial waterbirds to determine population trends and to assess the effects of natural and man-caused habitat alterations.

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**Bald Eagle, *Haliaeetus leucocephalus***

**Distribution**: The species is widespread in North America, occurring from Alaska and Newfoundland south to northern Mexico and the Gulf Coast. It migrates and winters in suitable habitat throughout New Mexico (Hubbard 1978). Beginning in the late 1980s, Bald Eagles were found nesting at four sites in two counties: three sites in Colfax and one in Sierra (Williams 2000). A pair attempted to nest at a new site in Catron County in 2005, and another pair nested in a new site in Rio Arriba County in 2006 and 2007. In 2007, only two territories were occupied, one in Colfax County and one in Rio Arriba County, but a third possible territory was reported in a new site in Colfax County. In New Mexico, nests are placed in large cottonwoods or ponderosa pines, typically in the vicinity of water and often also in close proximity to concentrations of small mammals such as prairie dogs (Williams 2000).

**Current Status**: An ongoing conservation success story, breeding pairs throughout the lower 48 states have been steadily increasing (increasing from 417 in 1963 to 5,750 in 1998) since the species was listed on the precursor of the Endangered Species Act in 1967. Recovery of the species first led to the federal reclassification of the Bald Eagle from endangered to threatened in 1995 (USFWS 1995) and then to the removal of the species from the List of Endangered and Threatened Wildlife in 2007 (USFWS 2007). However, there have been on-going efforts in Arizona to list the Sonoran Desert Population of Bald Eagles ("Desert Bald Eagle") as federally endangered; on 5 February 2008, the Center for Biological Diversity (CBD) challenged the United States Fish and Wildlife Service's 30 August 2006 finding denying CDB's petition to define the Desert Bald Eagle population as a distinct population segment and to list the Desert Bald Eagle as federally endangered. NMDGF supported the federal delisting of the species (Maracchini 1999), although the species was listed as threatened by New Mexico in 1975 and remains in need of conservation action in the state. Each winter, the state is visited by Bald Eagles that breed at more northerly latitudes and winter surveys conducted annually by NMDGF has showed that the number of Bald Eagles wintering in New Mexico steadily increased from an annual average of 220 birds in the late 1970s to 450 by the mid-1990s. The small nesting population, however, was reduced to 2-3 active territories in 2007.

**Threats**: The principal threats to Bald Eagles in New Mexico are human disturbance (especially to nesting pairs but also to wintering birds), loss and degradation of breeding and wintering habitats (including declines in prey and in nest and roost site availability), environmental contamination, electrocution, and illegal killing (including both shooting and poisoning).

**Recommendation**: No change in status is recommended. NMDGF should continue to monitor the known breeding population, encourage (through protection) new breeding pairs, and work with land managers to maintain and enhance the riparian/wetland areas and prey base where eagles occur.

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**Common Black-Hawk, *Buteogallus anthracinus***

**Distribution**: This Neotropical raptor reaches its northern geographic limits in the southwestern United States, where it is an uncommon but regular summer resident in New Mexico. It historically was largely restricted to the San Francisco, Gila, and Mimbres drainages, but, though rare, it is increasing east to the middle Rio Grande Valley, the Hondo Valley, and the middle and lower Pecos Valley. In 2003, it nested for the first time north to the Canadian River. Breeding birds require mature, well-developed riparian forest stands (e.g., cottonwood bosques) that are located near permanent streams where the principal prey of fish, amphibians, and reptiles is available (Schnell 1994).

**Current Status**: The species, which declined in abundance as its riparian habitat was reduced, was listed by New Mexico as threatened in 1975. It is also state listed by Texas and Arizona. In 1994 and 1995, R. W. Skaggs (1996) intensively surveyed the San Francisco, Gila, and Mimbres basins, and estimated a population of up to 80 pairs. Recent reports from the Gila Valley suggest that the population remains healthy in that area. With recent gains in eastern New Mexico, the statewide population might now number about 100 pairs.

**Threats**: Loss of southwestern riparian habitat, particularly cottonwood bosques and free-flowing streams, is the principal threat to this riparian-obligate species (Hubbard 1965, Oberholser 1974, Schnell 1994). Other threats include disturbance to nesting birds and illegal shooting.

**Recommendation**: No change in status is recommended. NMDGF should expand survey work for this riparian species to include the development of a monitoring program to measure status and trends, and should continue to encourage the preservation and enhancement of riparian habitats.

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**Peregrine Falcon, *Falco peregrinus***

**Distribution**: The species occurs almost worldwide (Brown and Amadon 1968). New Mexico supports both breeding populations of Peregrines and migrating Peregrines that breed outside the state. Breeding Peregrines are of the American subspecies *F. p. anatum* and breed locally in mountains and river canyons (Skaggs et al. 1988). *En route* migrants are either the American subspecies, which can be found essentially statewide, or the more rare tundra subspecies *F. p. tundrius*.

**Current Status**: The *anatum* subspecies was federally delisted in 1999 (USFWS 1999); based on available data, NMDGF argued that federal downlisting from endangered to threatened was warranted but that delisting was not (Maracchini 1998). The subspecies was first listed by New Mexico in 1975 and then, in response to encouraging observations of gradually increasing occupancy of breeding sites after 1980, it was downlisted from endangered to threatened in 1996. However, occupancy has changed little since 1997 and has not yet achieved the level of a healthy, self-sustaining population, which generally is recognized as 85% occupancy of known sites (USFWS 1984, Ratcliffe 1993, Johnson and Williams 2005). In New Mexico, occupancy rates averaged 83% by any Peregrine during the five-year period 2001-2006, and 80% by territorial pairs (Johnson and Williams 2006). Of even greater concern, however, has been a long-term decline in productivity by the species in New Mexico and elsewhere in the southwestern United States. New Mexico data demonstrate that although productivity recovered from historic lows by the early 1980s, it began trending lower after 1984 and has yet to stabilize. Through 2006, productivity remained 37% below its 1960-1964 average, and 23% below its 1984-1988 average (Johnson and Williams 2006).

**Threats**: Chemical contamination of the environment remains a threat, as old compounds continue to be used in parts of the species' range and especially as new compounds are developed and applied to the land (Ratcliffe 1993, Williams and Johnson 2005). In New Mexico, disturbance to nesting pairs and illegal taking are also threats (Johnson 1984, Johnson and Williams 2005).

**Recommendation**: No change in status is recommended. NMDGF should continue to work cooperatively with other agencies to systematically monitor the breeding population for occupancy and productivity, and should continue to work with land management agencies to identify and protect suitable breeding habitat; such cooperation is currently stipulated under a Master Interagency Agreement among the NMDGF, the United States Fish and Wildlife (USFWS), and the United States Forest Service. In particular, NMDGF should work closely with USFWS to implement its post-delisting monitoring plan (USFWS 2003). Take for falconry should continue to be closely monitored for its effects on occupancy and productivity rates (Maracchini 1999).

**Literature Cited**:

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**(Gould's) Wild Turkey, *Meleagris gallopavo mexicana***

**Distribution**: The species occurs wildly in North America. However, the subspecies *mexicana*, of Mexico's Sierra Madre, occurs naturally in the United States only in the Animas and Peloncillo ranges and the intervening Animas Valley in southern Hidalgo County, New Mexico (Ridgway and Friedmann 1946). It occurs in all major canyons

and adjacent foothills in that area, but primarily occurs: 1) in the Peloncillo Mountains, from Guadalupe Canyon north to the Skeleton Canyon area; 2) in the Animas Mountains from Deer Creek north to Indian and Double Adobe Creeks; and 3) along the Animas Creek in the middle Animas Valley. Where found, this subspecies concentrates in pine-oak forested canyons and adjacent slopes, and in riparian areas dominated by cottonwood and sycamore trees; Brown (1982) characterized Gould's habitat as Madrean Evergreen Woodland, primarily piñon pine, piñon-ricegrass (and/or beargrass) habitat. Important habitat components include water, tall trees for roosting, and beargrass for nesting.

**Current Status:** This unique subspecies was listed as threatened by New Mexico in 1975. The subspecies has also experienced reductions in its range in Mexico (Leopold 1959). Gould's Turkeys were studied intensively in New Mexico under NMDGF contracts from 1982 to 1996, and estimates for the Peloncillo Mountains population during that period fluctuated from fewer than 20 up to approximately 75 birds, with no consistent trend (Schemnitz and Potter 1984, Willging 1987, Figert 1989, York 1991). Recent (2005-2007) spring surveys of gobbling activity on public land in the Peloncillo Mountains managed by the Forest Service (considered the 'core area' for Gould's distribution in New Mexico) detected 35-50 birds annually. The Animas Mountains population had been estimated at some 30 adults (Schemnitz and Willging 1986) and there have been reports of flocks of up to 17 in recent years. Based on historic and recent evidence, it seems likely that the subspecies has always been local and relatively rare in New Mexico, but that its populations in both the Peloncillo and Animas Mountains are maintaining themselves.

**Threats**: Threats to this subspecies in Hidalgo County include habitat loss from removal of vegetation, fire, competition with livestock (both cattle and hogs), lack of water sources, hybridization with non-native turkeys, and human killing and disturbance.

**Recommendation**: No change in status is recommended. The NMDGF should resume standardized surveys for this subspecies throughout its New Mexico range and should develop a monitoring program to identify population trends. Although the population has been and continues to be small, it seems to be well-adapted to local conditions; hence, augmentation with stock from elsewhere (e.g., Mexico) is not recommended.

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Ridgway, R., and H. Friedmann. 1946. Birds of North and Middle America, vol. 10. United States National Museum Bull. 50:455-457.

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**Whiskered Screech-Owl, *Megascops trichopsis***

**Distribution**: This primarily Mexican and Central American species occurs from the southwestern United States south to Nicaragua. In New Mexico, it occurs only in Hidalgo County, where it is found regularly in several canyons (e.g., Skeleton, Whitmire, Cottonwood, Clanton) in the Peloncillo Mountains and, occasionally, in the Animas Mountains (Indian Creek Canyon vicinity). As in Arizona, the species requires dense pine-oak woodlands and oak woodlands just below the pine-oak zone in New Mexico, especially favoring oak riparian areas in mountain canyons and dense woodlands on adjacent north facing slopes (Marshall 1957).

**Current Status**: The species was listed as threatened by New Mexico in 1990, as the status of the small resident population in the Peloncillo Mountains became better understood. First detected in the state in 1974 (Ligon and Brenowitz 1976), it was found to be resident in small numbers in early 1990 (Williams and Hubbard 1990). Subsequent NMDGF surveys through the 1990s documented the extent of the Peloncillo Mountains population and 15 occupied territories were located in four canyons in that range in 2000 (Williams 2000). Individuals have been also reported from three sites in the Animas Mountains, most recently in May 2006 (Williams 2006). Owls abandoned one Peloncillo Mountain canyon in 2 years subsequent to a prescribed fire in 1997, as none were located there in 1998 or 1999, but they reoccupied the canyon in 2000. Nine territories were located in Skeleton Canyon in the Peloncillo Mountains in 2006 (Williams 2006).

**Threats**: Loss of pine-oak and oak woodlands in the Peloncillo and Animas Mountains, especially in canyon bottoms, through vegetation removal or fire (natural or prescribed) is the principal threat to this species. Cavity trees (snags, etc.) are especially vulnerable to fire and woodcutting. Human disturbance, particularly excessive playback of its vocalizations by bird watchers, could negatively impact New Mexico's small populations.

**Recommendation**: No change in status is recommended. NMDGF should continue to monitor the limited New Mexico populations and should encourage public and private land managers to protect pine-oak and oak woodlands in Hidalgo County, especially riparian canyons.

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**Boreal Owl, *Aegolius funereus***

**Distribution**: This northern species occurs in boreal forests of the Old and New Worlds. In North America, it reaches its southernmost geographic limits in the mountains of northern New Mexico, where it was first detected in 1987 (Stahlecker and Rawinski 1990). In New Mexico, NMDGF-assisted surveys found the species to be resident in undisturbed spruce-fir and similar forests in the San Juan, Sangre de Cristo, and Jemez Mountains (Stahlecker and Duncan 1996).

**Current Status**: The species was listed as threatened in New Mexico in 1990. Intensive surveys in the state found that the species occurred in very small numbers at 10 specific sites in eight general areas in the Carson and Santa Fe National Forests (Stahlecker and Duncan 1996). The most recent record of a Boreal Owl was of one heard in pre-dawn darkness in Rio Arriba County on 20 August 2007 (Williams 2008).

**Threats**: New Mexico's small and highly fragmented Boreal Owl populations are vulnerable and would be negatively impacted by losses of their specialized and limited subalpine habitats. In particular, timber harvest in such habitats would eliminate nesting cavities, reduce prey populations, and remove forest structure necessary for nesting, foraging, and roosting; the slowness of forest succession in high elevation stands implies disturbed habitats would remain unsuitable for one-two centuries (Hayward and Hayward 1993, Hayward and Verner 1994, Hayward 1997).

**Recommendation**: No change in status is recommended. Conservation of the Boreal Owl in New Mexico depends on protection of its specialized habitat – high elevation stands of mature and older spruce-fir forests in the San Juan, Sangre de Cristo, and Jemez Mountains. Protective measures should include the identification and setting aside of areas of occupancy. Forest management should focus on maintaining the distribution and abundance of spruce-fir forests, whether occupied by Boreal Owls or not, with emphasis on retaining these vegetation types in their natural states. Even-aged timber management on a broad scale should be eliminated in high elevation areas, while management based on simple snag retention in clearcut areas should be recognized as having little ecological value. NMDGF should resurvey potential Boreal Owl habitats in the state to determine current numbers.

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**Broad-billed Hummingbird, *Cynanthus latirostris***

**Distribution**: This widespread Mexican species reaches its northern geographic limits in the borderlands region of the southwestern United States (AOU 1998), where it is a species of low to mid-elevation riparian woodlands. In New Mexico, the species is a regular summer resident in Guadalupe Canyon, Hidalgo County, where it tends to nest in hackberry thickets and similar vegetation (Baltosser 1986, 1989). In 1998, breeding was confirmed in Skeleton Canyon in the central Peloncillo Mountains, the first recorded breeding away from Guadalupe Canyon (Williams 1998), and the species has occurred essentially annually there and farther north in Post Office Canyon since 1998. In addition, there have been reports from several additional New Mexico counties, including confirmed records for Grant, Doña Ana, Eddy, Valencia, and Bernalillo Counties, but there have been no documented breeding in any county other than Hidalgo.

**Current Status**: The species was listed as threatened in New Mexico in 1975. The small population in Guadalupe Canyon and immediately adjacent side canyons is currently estimated at about 12-20 individuals and appears to have been relatively stable in recent years. NMDGF surveys and cooperator reports indicate another 10-15 individuals might summer regularly in three additional canyons farther north in the Peloncillo Mountains. In addition, recent records from Carlsbad, Eddy County indicate that a few birds occasionally overwinter in the state (Williams 2006).

**Threats**: The principal threat is loss of riparian woodlands in Guadalupe Canyon and similar canyons in the Peloncillo Mountains from clearing (brush removal, tree cutting), burning, excessive grazing, and lowering of water tables.

**Recommendation**: No change in status is recommended. The protection and enhancement of riparian woodlands and adjacent xeric habitats in Guadalupe Canyon and similar canyons in southwestern New Mexico should be encouraged. NMDGF should continue to monitor the status of the breeding populations in Guadalupe Canyon and other canyons in the Peloncillo Mountains, and to search for additional populations.

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**White-eared Hummingbird, *Hylocharis leucotis***

**Distribution**: This species of Mexican and Central American highlands reaches its northernmost geographic limits in the mountains of southeastern Arizona and southwestern New Mexico (AOU 1998). This hummingbird prefers relatively moist montane forests and forested canyons, and is found most commonly in the pine and pine-oak zones (Howell and Webb 1995). White-eared Hummingbirds were first found summering in New Mexico in the Animas Mountains in the mid-1970s (Hubbard 1978) and have continued to be documented there, most recently in 2001 and 2003. There are additional reports from elsewhere in southwestern New Mexico: the species has been reported in the Peloncillo Mountains (most recently in 1992), the Pinos Altos Mountains (in 1993 and 1994), and the Mogollon Mountains (in 2000 and 2005). Vagrants also have strayed farther north and east to the Manzanita Mountains in 1994 and 1995, to two sites in the Sangre de Cristo Mountains in 1993, and to the Sacramento Mountains in 2005.

**Current Status**: The species was listed as threatened in New Mexico in 1978. Only small numbers were detected in Hidalgo, Grant, and Catron Counties from 2000 to 2005.

**Threats**: This species is restricted to moist mountain canyons and adjacent forested slopes, and is vulnerable to loss of its required habitats from fire, mining, lumbering, road-building, and excessive grazing. Acid rain from regional smelters likewise might impact these high mountain forests.

**Recommendation**: No change in status is recommended. To clarify its breeding status in the state, NMDGF should encourage intensive surveys for the species in areas of reported occurrence.

**Literature Cited**:

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**Violet-crowned Hummingbird, *Amazilla violiceps***

**Distribution**: This hummingbird of the Mexican highlands reaches its northernmost geographic limits in southeastern Arizona and southwestern New Mexico. In New Mexico, it summers regularly only in broadleaf riparian woodlands of sycamore, cottonwood, hackberry, and oak in Guadalupe Canyon, Hidalgo County, where it nests exclusively in sycamores (Zimmerman and Levy 1960; Baltosser 1986, 1989; Williams 2002). The species also has been found in the summer months in Clanton, Skeleton, and Post Office Canyons in the Peloncillo Mountains and along the Double Adobe Creek in the Animas Mountains. Single individuals documented in Anthony from November 2001 to February 2002 and in Las Cruces in February 2002 (both in Doña Ana County) were the first known to winter in New Mexico. Single vagrants have strayed east to Luna County in 2002 and north to Socorro County in 1981, Santa Fe County in 1999, and Los Alamos County in 2005.

**Current Status**: The species was listed as threatened in New Mexico in 1975. New Mexico's population is small but does not show a detectable trend: it has rarely numbered more than about 12 individuals since the mid-1980s, these distributed among 2 to 5, rarely 7, locations within the New Mexico portion of Guadalupe Canyon (Williams 2002). Occurrences since the late 1990s of individuals in two additional canyons of the Peloncillo Mountains and one canyon in the Animas Mountains might signal pioneering of new range, but, to date, no breeding or even consistent summering has been documented away from Guadalupe Canyon.

**Threats**: This hummingbird is threatened by loss of low elevation broadleaf riparian and adjacent xeric habitats in Guadalupe Canyon and similar canyons in southwestern New Mexico, resulting from fire, clearing, excessive grazing, and lowering of water tables. Fire poses a significant threat if riparian areas supporting mature trees are burned or if nectar source plants such as agaves are destroyed by fire. Grazing in canyon bottoms might remove necessary dense understory vegetation and impede regeneration of riparian trees.

**Recommendation**: No change in status is recommended. NMDGF should continue to monitor the small breeding population and its habitat, and should encourage public and private land managers to preserve low-elevation broadleaf riparian woodlands in Guadalupe Canyon and elsewhere in southwestern New Mexico.

**Literature Cited**:

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**Lucifer Hummingbird, *Calothorax lucifer***

**Distribution**: This primarily Mexican highland species reaches the United States only in southeastern Arizona, southwestern New Mexico, and Trans-Pecos Texas (Scott 1994). New Mexico's breeding population of this migratory species is found primarily in the Peloncillo Mountains in Hidalgo County, where it occurs regularly in several mid-elevation canyons (most regularly in Post Office, Skeleton, Cottonwood, and Clanton Canyons) and occasionally occurs in Guadalupe Canyon. Away from the Peloncillo Mountains, single vagrants have strayed north and east to Grant, Sierra, Luna, and Eddy Counties. Where found, this species concentrates in rugged canyons, along slopes in dry mountain ranges (especially along rocky hillsides and talus slopes), and in dry washes vegetated with desert scrub, such as shrubby trees (juniper, piñon, oak), cactus, yucca, ocotillo, and agave.

**Current Status**: This hummingbird was listed as threatened in New Mexico in 1985. The Peloncillo Mountains population is small; surveys from 1990 through 2006 have detected about 20 breeding females annually. Fire has deterred breeding in areas in the central Peloncillo Mountains where birds were confirmed nesting in 1995 and 1996.

**Threats**: Loss of native dry canyon/hillside habitats, including loss of native food plants from burning or excessive grazing, is the principal threat to the small New Mexico breeding population.

**Recommendation**: No change in status is recommended. NMDGF should continue to survey for and monitor this species, and should work with land managers in protecting its preferred dry canyon/hillside habitat. NMDGF should support studies investigating the effects of fire (prescribed or otherwise) on nectar resources, particularly on plants such as agaves**.**

**Literature Cited**:

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**Costa's Hummingbird, *Calypte costae***

**Distribution:** The distribution of this arid-land species is centered on the Sonoran Desert region of the southwestern United States and northwestern Mexico. Within New Mexico, it occurs primarily in the southwest, where it is a warm season migrant and occasional breeder (Baltosser 1989, Baltosser and Scott 1996). All documented or suspected breeding has been in Hidalgo, Grant, and Doña Ana Counties; the species is most regular in Guadalupe Canyon in Hidalgo County where breeding has been documented, less regular along the lower Gila River in Grant and Hidalgo Counties, and occasional east to the San Andres and Organ Mountains in Doña Ana County. Migrants have been additionally recorded at several sites in Hidalgo, Grant, and Doña Ana Counties, and at single sites in Sandoval, McKinley, and Sierra Counties.

**Current Status**: The species was listed by New Mexico as threatened in 1983. In recent years, the species has been irregular in occurrence in the state. In 1993, up to 7 individuals occupied Guadalupe Canyon from late-March to mid-June, and breeding was suspected (Williams 1993). The species staged an impressive invasion in 1995, with reports from 4 sites in 3 counties (Williams 1995), including reports of 2 males in the San Andres Mountains (Weisenberger and Howe 1996). Since that year, displaying males were observed at 2 sites near Redrock in 1997, an individual bird was observed near Virden in 1998, and individual birds were observed in Silver City and in the Peloncillo Mountains in 1999. One to five birds were reported annually in southwestern New Mexico 2000-2007, but there was no evidence of breeding (Williams 2006; 2007a, b; 2008). The first individual to be found wintering in New Mexico was documented in Placitas, Sandoval County from January to February 2002 (Williams 2002). More recently, an overwintering adult male was seen in Las Cruces, Dona Ana County 29 November 2005 – 2 January 2006 (Williams 2006).

**Threats**: The long-term persistence of the species in the state is threatened by loss (from fire, excessive grazing, or clearing) of native xeric hillside vegetation and adjacent riparian vegetation in the Peloncillo Mountains, the lower Gila Valley, and elsewhere in southwestern New Mexico.

**Recommendation**: No change in status is recommended. NMDGF should continue to work with public and private land managers to identify, preserve, and restore riparian areas and associated xeric hillside vegetation in southwestern New Mexico, including in Guadalupe Canyon and other canyons in the Peloncillo Mountains, and in the lower Gila Valley, particularly in the Middle Box and Lower Box.

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Williams, S. O., III. 2008 (*in press*). New Mexico, summer season 2007. North American Bird.

**Gila Woodpecker, *Melanerpes uropygialis***

**Distribution**: This species of the southwestern United States and western Mexico is found only in southwestern New Mexico, where it is a permanent resident in southern Hidalgo County and in the lower Gila Valley in Hidalgo and Grant Counties. Within the state, Gila Woodpeckers require well-developed broadleaf riparian woodlands characterized by extensive groves of mature cottonwoods and/or sycamores.

**Current Status**: The species was listed as threatened by New Mexico in 1975. The species is listed as endangered by California, where loss of native riparian habitats in the lower Colorado River Valley has reduced populations (Rosenberg et al. 1991). NMDGF surveys conducted 1987-2004 annually found 5-8 pairs in Guadalupe Canyon in Hidalgo County, and reports from additional southern Hidalgo County sites (including nesting in the Animas Valley) have been encouraging. Recent (1996-2005) observations on the east side of the Animas Mountains represent the first for the species from east of the Continental Divide. Based on available information, however, numbers have declined in the Gila Valley since the 1970s and have remained depressed.

**Threats**: The principal threat to the species in the state is habitat destruction, especially the cutting or other destructive clearing (burning, inundation) of cottonwood and sycamore stands. Habitat fragmentation also threatens the species, as mature but isolated cottonwood groves smaller than 20 ha (50 acres) tend to be avoided by Gila Woodpeckers (Rosenberg et al. 1991).

**Recommendation**: No change in status is recommended. NMDGF should continue to monitor known populations and to survey for additional populations. In addition, NMDGF should continue to encourage land managers, including public and private water managers, to preserve and restore extensive riparian woodlands, particularly mature groves of cottonwoods and sycamores. Prescribed fires that can kill large trees should be avoided in riparian areas.

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**Bell's Vireo, *Vireo bellii***

**Distribution**: This small, insectivorous Neotropical migrant breeds in the central and southwestern United States and northern Mexico (Brown 1993). Within New Mexico, it occurs in the southernmost portion of the state, where small numbers summer primarily in the Gila Valley, Guadalupe Canyon, and the lower Rio Grande and Pecos Valleys and associated drainages (Hubbard 1978). The species prefers dense, typically low, shrubby vegetation (e.g., hackberry, mesquite, tamarisk) in riparian areas (Brown 1993, Parody and Parker 2002).

**Current Status**: The species has suffered significant declines in portions of the southwestern United States (Brown 1993), most notably in the lower Colorado River Valley (Rosenberg et al. 1991) and in central and coastal California (Franzreb 1987), where the California subspecies is federally listed as endangered (USFWS 1986). Similar declines have been noted in Arizona (Phillips et al. 1964) and New Mexico (Hubbard 1978), and the species was listed by New Mexico as threatened in 1975. New Mexico surveys and reports through 2007 indicate overall numbers remain very low and reproductive failure, often caused by cowbird brood parasitism, is high. The state's largest documented population is in the Lower Gila Box in Grant and Hidalgo Counties, where up to 44 territories were located in 1998. A significant population in the vicinity of Rattlesnake Springs, Eddy County numbers about 20 pairs annually, but cowbird brood parasitism there typically exceeds 60% of vireo nests. The number of territories detected on a transect survey in Guadalupe Canyon declined from an annual average 4.8 in 1987-1992 to 3.8 in 1993-1998 and to 1.8 in 1999-2004.

**Threats**: The species is primarily threatened by loss and fragmentation of dense shrubby/woody riparian habitats from urbanization, land conversion to agriculture, excessive grazing, burning, brush removal, firewood cutting, flood control, and reservoir construction. High brood parasitism by cowbirds also reduces New Mexico's breeding populations (Franzreb 1987, Brown 1993).

**Recommendation**: No change in status is recommended. NMDGF should continue to survey and monitoring efforts to detect population distribution and trends. NMDGF should continue to encourage land managers to preserve and restore riparian and adjacent shrubby habitats along lowland streams. Restoration projects elsewhere that have employed local information have proved successful in increasing Bell's Vireo populations (Kus 1998). Cowbird control can be useful in very localized areas, but it is only successful when completed in conjunction with other conservation measures (Goldwasser et al. 1980, Franzreb 1989).

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**Gray Vireo, *Vireo vicinior***

**Distribution**: This little-studied but widespread Neotropical migrant breeds in the Four Corners states, southern California, and western Texas, and winters in northwestern Mexico (AOU 1998). In New Mexico, it is most often found in arid juniper woodlands on foothills and mesas, these sometimes associated with oaks or piñons and often in areas with a well-developed grass component. Within the state, the species has been found summering/breeding in most counties west of the Great Plains.

**Current Status**: The species was listed by New Mexico as threatened in 1983. Based on degree of threat (including restricted range and small overall population sizes) and observed declining population trends rangewide, this species is listed by Partners in Flight as a North American priority species and by United States Fish and Wildlife Service as a national species of conservation concern (USFWS 2002). In the state, breeding populations have disappeared from some historic habitats, but have persisted at others. In addition, recent surveys have found the species in new areas and in unexpected numbers. Since the mid-1990s, surveys by NMDGF and other agencies and organizations (e.g., Bureau of Land Management, National Park Service, United States Fish and Wildlife Service, Hawks Aloft, New Mexico Natural Heritage Program, Kirtland Air Force Base) have documented territories at a number of sites, including in: Bernalillo County (the Manzanito Mountains); Doña Ana County (San Andres and Organ Mountains); Eddy County (Guadalupe Mountains); Otero County (McGregor Range and Sacramento Mountains); Rio Arriba County; San Juan County; Santa Fe County (the Caja del Rio area); and Socorro County (at multiple sites, including in the Los Pinos and Oscura Mountains). A summary of this species' distribution, abundance, habitat associations, and breeding success throughout New Mexico was completed by NMDGF in 2006 (DeLong and Williams 2006).

**Threats**: Threats include loss and degradation of quality juniper-grassland habitat from burning, clearing, excessive grazing, and oil and gas development. High brood parasitism by cowbirds also reduces New Mexico's breeding populations.

**Recommendation**: No change in status is recommended. A state recovery plan has been developed for the Gray Vireo (Pierce 2007), and NMDGF should work with other agencies and organizations to accomplish management strategies outlined in the plan. In particular, development of standardized survey protocol and recommended guidelines for habitat management practices is required to effectively quantify population trends and to coordinate management of the Gray Vireo with juniper thinning projects. Identifying and maintaining quality juniper savannah and other occupied habitats is also a priority and land managers should consider the needs of this species when undertaking activities in quality Gray Vireo habitats, such as clearing or burning of juniper woodland for fuel reduction, grazing enhancement, and bighorn sheep habitat improvement.

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**Abert's Towhee, *Pipilo aberti***

**Distribution**: This is primarily a species of the lowlands of central and southwest Arizona and adjacent areas, where it is a permanent resident along desert rivers and streams (Tweit and Finch 1994). It is found in New Mexico only in Grant and Hidalgo Counties in the Gila Valley and at San Simon Cienega, where it inhabits riparian thickets and similar native habitats.

**Current Status**: The species was listed by New Mexico in 1983. In the Gila Valley, incidental observations in recent years suggest that numbers are reduced from 25 years ago. For example, at Redrock, where 50 birds were counted in 1969 and 55 were counted in 1981, only 14 were found in 1994 (Williams 1994) and even fewer were found there through 2005. A small population persists upstream, in the Cliff-Gila Valley, where 11 nests were documented in 2000, but only 5 pairs were reported in 2003. Smaller numbers (up to 12) inhabit San Simon Cienega (Williams 1993).

**Threats**: The species is threatened by loss and degradation of native riparian habitats, particularly due to excessive grazing, within its restricted New Mexico range. Rea (1983) observed that extensive loss of cottonwood-willow and brushy mesquite habitat along the Gila River in Arizona reduced this species' density. Alternatively, after removal of livestock from the San Pedro Riparian National Conservation Area in Arizona, Abert's Towhee densities in cottonwood-willow habitat more than doubled over five years (Krueper et al. 2003).

**Recommendation**: No change in status is recommended. NMDGF should continue to work with land and water managers to protect and restore native riparian habitats there and at San Simon Cienega. NMDGF has contracted a study investigating historical and current distribution and abundances of Abert's Towhee in the Gila Watershed. NMDGF should support additional studies on which factors limit Abert's Towhee populations.

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**Baird's Sparrow, *Ammodramus bairdii***

**Distribution**: This grassland sparrow breeds in the northern Great Plains from the Canadian prairie provinces south to Montana, the Dakotas, and western Minnesota (AOU 1998, Green et al. 2002). It winters in southeastern Arizona and southwestern Texas south into north-central Mexico (AOU 1998, Green et al. 2002). Birds in New Mexico are primarily migrants moving through the eastern plains and southern lowlands, but wintering birds do occur locally in southern grasslands, particularly in Otero, Luna, and Hidalgo Counties.

**Current Status**: The status of this migratory species is of international concern, including in Canada (Gossen et al. 1993) and in the United States where it is listed by Partners in Flight as a North American priority species and by the United States Fish and Wildlife Service as a species of conservation concern (USFWS 2002). It was listed by New Mexico as threatened in 1975. The species formerly was relatively numerous and widespread in New Mexico (Hubbard 1978), but is very rarely reported in recent years. Surveys by NMDGF cooperators from 2000 to 2005 identified Otero Mesa grasslands as especially important to migrating Baird's Sparrows.

**Threats**: The decline throughout the species' range is attributed to loss of native grassland habitat owing to unsustainable range management practices, conversion to cropland, exotic plant invasion, and shrub encroachment (Phillips et al. 1964, Oberholser 1974, Gossen et al. 1993, Green et al. 2002). In New Mexico, loss, degradation, and fragmentation of grasslands from excessive grazing and oil and gas development are of particular concern.

**Recommendation**: No change in status is recommended. NMDGF should work with public and private land managers to identify, describe, and protect migration and overwintering habitats, and should develop a monitoring program for migrant and wintering populations.

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**Yellow-eyed Junco, *Junco phaeonotus***

**Distribution**: This sparrow of the higher mountains of Mexico and Guatemala reaches its northern geographic limits in the sky island mountain ranges of southeastern Arizona and southwestern New Mexico (AOU 1998, Sullivan 1999). In New Mexico, it was historically only known to occur in the Animas Mountains, Hidalgo County, where it was largely confined, at least in the nesting season, to coniferous forest. A second population was discovered in the Big Burro Mountains, Grant County in 2003 (Williams 2004) and nesting was documented there in 2004 and 2005 (DeLong 2004, 2005a). The resident species undertakes altitudinal migration in Arizona (Moore 1972, Horvath and Sullivan 1988) and presumably does so in New Mexico as well, which might explain the occasional winter sightings in the Peloncillo and Big Hatchet Mountains.

**Current Status**: The species was listed by New Mexico as threatened in 1983. It was reported as "common" in the Animas Mountains in early years (Bailey 1928), but precise data are lacking. Surveys of suitable habitat in the Animas Mountains in 1992, 1995, 1996, and 1997 found fewer that 30 adults each year. However, informal surveys found only 2 birds there in 2000, none in 2001, 5 singing males in 2002, and none in 2003. In 2005, NMDGF surveys of available habitat in the Animas Mountains documented only 9 territories, with successful reproduction in at least 2 territories (DeLong 2005b). In the newly-discovered population in the Big Burro Mountains, 4-6 territories were detected in 2004 (DeLong 2004), 7 territories were documented in 2005 (DeLong 2005a), at least 5 temerities were documented in 2006 (Williams 2007a, b), and at least 4 territories were documented in 2007 (Williams 2007c) with nesting confirmed in most years. Due to limited access, little information exists regarding the impacts of the Adobe Fire (a lightening-ignited fire that burned an estimated 23,500 to 26,460 acres in the Animas Mountains over a two-week period in late May 2006) on the Animas Yellow-eyed Junco population. No birds were reported seen in the Animas Mountains in May 2006 (Williams 2007c), but a nest was found in 2007.

**Threats**: The very small and restricted New Mexico populations are vulnerable to loss and degradation of their limited coniferous forest habitat from burning, cutting, and excessive grazing. Grazing pressure has been shown to be especially detrimental to this ground nesting species in Arizona, where cattle grazing was responsible for a dramatic 75% reduction in nest success (Walsberg 2005). In addition, productivity can suffer in years when dry conditions suppress breeding.

**Recommendation**: No change in status is recommended. A monitoring program is recommended for this species in the Animas and Big Burro Mountains. Private and public land managers are encouraged to protect this junco's limited New Mexico habitat.

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**Varied Bunting, *Passerina versicolor***

**Distribution**: This is primarily a Mexican species that enters the United States only along the Mexican border in Arizona, New Mexico, and Texas (AOU 1998, Groschuph and Thompson 1998). In New Mexico, this Neotropical migrant summers regularly in small numbers in Hidalgo, Doña Ana, and Eddy Counties, where it prefers dense, shrubby vegetation associated with relatively arid canyons.

**Current Status**: The species was listed as threatened in New Mexico in 1975. Surveys and reports by NMDGF personnel and cooperators from 1987 to 2007 indicate that this species persists as a summer resident in local areas of Hidalgo, Doña Ana, and Eddy Counties. In addition, there are also reports of vagrants in Grant, Luna, Socorro, Sierra, and Otero Counties. New Mexico's populations remain small, however, with the 2-5 occupied territories found annually in Guadalupe Canyon, Hidalgo County since 1990 representing the state's largest 'concentration.' However, surveys in the vicinity of Carlsbad Caverns National Park in 2003 detected this species in five canyons (Williams 2004), suggesting larger numbers in Eddy County than previously known.

**Threats**: This species is threatened primarily by habitat loss, particularly of dense shrubby riparian habitat required by this species, resulting from burning, clearing, excessive grazing, and lowering of water tables. Cowbird parasitism, documented in Guadalupe Canyon in 1993 (Williams 1994), might also threaten New Mexico's small breeding populations.

**Recommendation**: No change in status is recommended. NMDGF should continue to monitor known populations and survey for and document new populations. NMDGF also should encourage land managers to preserve and restore dense shrubby (e.g., mesquite) habitat in areas where this species occurs.

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**MAMMALS**

**ENDANGERED**

**Arizona shrew, *Sorex arizonae***

**Distribution:** Arizona shrew is known from the Huachuca, Santa Rita, and Chiricahua Mountains of southeastern Arizona (Diersing and Hoffmeister, 1977; Hoffmeister, 1986), and portions of Chihuahua, Mexico (Caire et al., 1978). In New Mexico, it is known only from the Animas Mountains (Conway and Schmitt, 1978; Cook, 1986) where it has been verified at four sites (Simons and Maldonado, 2007). In the Animas Mountains, Arizona shrew occupies mesic woodlands dominated by Douglas fir (*Pseudotsuga menziesii*), quaking aspen *(Populus tremuloides*), and netleaf oak (*Quercus reticulata*), often near springs. In Arizona, it is associated with silver-leaf oak (*Q. hypoleucoides*), Arizona white oak (*Q. arizonica*), Arizona madrone (*Arbutus arizonica*), Chihuahua pine (*Pinus leiophylla* var. *chihuahuana*), and Arizona sycamore (*Platanus wrightii*) (Simons and Van Pelt, 1999). The known elevation range is from approximately 5170 to 8500 ft. Mature forest with ground cover, including live understory vegetation and woody debris, are important habitat features for this species (Simons and Van Pelt, 1999; Simons and Hoffmeister, 2003).

This is a terrestrial shrew that does not hibernate and forages for invertebrates in and under forest litter during alternating periods of activity during the day and night. The reproductive biology of this species is largely unknown; breeding occurs at least from late July through October (Simons and Hoffmeister, 2003).

**Current Status:** The New Mexico State Game Commission approved the listing of Arizona shrew as endangered in 1978 (Jones and Schmitt, 1997). Although limited, information on New Mexico populations suggests that the Arizona shrew is a very rare and extremely localized species. Surveys in 2001 documented the presence of Arizona shrew at two new locations in the Animas Mountains (Simons and Maldonado, 2007). The species appears to be reasonably abundant at several sites in southern Arizona (Simons and Van Pelt, 1999).

**Threats:** The apparent rarity, extremely limited distribution, and small population size in New Mexico make this species highly vulnerable to any adverse habitat alterations. Destruction of mature riparian forest communities and associated under story vegetation and woody debris, such as by wildfire, is the primary threat to the Arizona shrew in New Mexico. The Adobe Fire in the Animas Mountains during May-June 2006 burned through at least one known location for this species. Surveys are needed to assess the impact of this fire on habitat for Arizona shrew.

**Recommendation:** No change in the listing status of Arizona shrew is recommended. Periodic surveys of distribution and population status in the Animas Mountains should be continued. A field study of the impact of the Adobe Fire on at least one known population should be initiated. Other possibly suitable habitats in the Peloncillo Mountains should be surveyed for presence. Assessment of the relationships between New Mexico and other populations (Ortega et al., 2005) should be continued.

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**Mexican long-nosed bat, *Leptonycteris nivalis***

**Distribution:** Mexican long-nosed bats are known to occur at higher elevations (1550 to 9300 ft) in at least 15 states in Mexico (Arita and Humphrey, 1988). In the United States, the species is only found in southwest Texas (Borell and Bryant, 1942; Easterla, 1972; Mollhagen, 1973) and southwestern New Mexico (Arita and Humphrey, 1988; Hensley and Wilkins, 1988; Hoyt et al., 1994). Two bats collected in 1963 and 1967 in Hidalgo County, New Mexico and identified as lesser long-nosed bats (*L. yerbabuenae*) were later identified as *L. nivalis* (Arita and Humphrey, 1988), and the presence of this species in southern Hidalgo County was re-confirmed in 1992 (Hoyt et al., 1994) and during 2003-2005 (Bogan et al., 2006a, 2006b). Primary areas of occurrence in New Mexico are the Animas, Peloncillo, and Big Hatchet mountain ranges and the valleys between these ranges (Bogan et al., 2006a, 2006b). The species apparently uses many of the same areas and resources (e.g., roost sites and food sources) in New Mexico as the similar lesser long-nosed bat, a state threatened species.

Mexican long-nosed bats inhabiting southwest New Mexico represent summer migrants from Mexico (Hoyt et al., 1994), and they are present only from mid-July to mid-September (Bogan et al., 2006a, 2006b). In New Mexico, Mexican long-nosed bats inhabit upper desert scrub and pine-oak woodlands in or near mountainous areas. Characteristic vegetation in these areas includes agave (*Agave* spp.), juniper (*Juniperus* spp.), oak (*Quercus* spp.), and Mexican piñon (*Pinus cembroides*). Roosting habitats of this species in New Mexico have been recently studied, and all known day roosts are in caves and rock fissures, and an abandoned building near the Animas Mountains is used as a night roost between feeding forays (Bogan et al., 2006a, 2006b; Cryan, 2007; Goodbar, 2007). They roost in caves, mines, hollow trees, and man-made structures in other portions of their range (Hall and Dalquest, 1963; Novick, 1963; Hensley and Wilkins, 1988).
Information on the reproductive biology of this species is very limited. Easterla (1973) speculated that young are born in Mexico before their arrival to Big Bend National Park. Mexican long-nosed bats are active at night, when they leave day roost sites to search for night-blooming food plants, principally on agaves and various cacti (Hall and Dalquest, 1963; Easterla, 1972; 1973; Gardner, 1977; Hensley and Wilkins, 1988). These bats primarily feed upon nectar and pollen, but may also eat some soft fruits and insects associated with flowering plants. Individuals forage long distances, often across valleys separating mountain ranges, between their day roosts and areas where food plants are available.

**Current Status:** The Mexican long-nosed bat is listed as endangered by the U. S. Fish and Wildlife Service, and federal recovery plan has been prepared (USFWS, 1994). A 5-year review of the recovery plan is scheduled for approximately 2010. The New Mexico State Game Commission approved listing the species as endangered in 1990; it was also listed during 1975-1978, apparently based on the nomenclature in use at the time for long-nosed bats (Jones and Schmitt, 1997). Population sizes, migratory habits and distribution in New Mexico are not fully understood. Hoyt et al. (1994) conservatively estimated that they netted 150 to 200 individuals of *Leptonycteris* in the proportion of two lesser long-nosed bats for every one Mexican long-nosed bat in the Animas Mountains. A recent study by Bogan et al. (2006) identified night roost sites in the Animas, Peloncillo, and Big Hatchet mountains; numbers of long-nosed bats (both species) at these roosts ranged from 4 to a few thousand individuals and varied during the summer.

**Threats:** The species was federally listed as a result of identified population declines and the lack of formal protection for the species' habitat, particularly food plants such as agave. Disturbance of roost sites, including maternal colonies, has also been identified as a potential threat for this species.

**Recommendation:** No change in the current listing status of Mexican long-nosed bat is recommended. Identification and protection of roost sites and maintenance of viable populations of food plants (particularly agave) are necessary to conserve this species in New Mexico. The recently completed studies of long-nosed bat species in southern Hidalgo County (Bogan et al., 2006a-b; Cryan 2007; Goodbar, 2007) will provide a more thorough understanding of this bat's population status, movements, and habitat use in New Mexico. Pending completion of the 5-year review of this species by the U.S. Fish and Wildlife Service, the NMDGF should have a primary role in any revision of the existing federal recovery plan with a goal of adopting the revised document for use as a state recovery plan.

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**(Peñasco) least chipmunk, *Neotamias minimus atristriatus***

**Distribution:** The least chipmunk (*Neotamias minimus*) occurs from central Yukon to western Quebec, south to California and New Mexico, and northeast to Wisconsin (Hall, 1981). In New Mexico, least chipmunks inhabit the northern mountain ranges (Chuska, San Juan, Jemez, Sangre de Cristo, and Sandia). In addition, disjunct and isolated populations assigned to the subspecies *N. minimus atristriatus* (Peñasco least chipmunk) occur in portions of the Sacramento and White mountains in southcentral New Mexico, including James Canyon, Peñasco Canyon, and Sierra Blanca Peak (Findley et al., 1975; Sullivan and Petersen, 1988).

Historically, Peñasco least chipmunks in the Sacramento and White mountains occupied two distinctly different habitats. Habitat in James and Peñasco canyons was characterized by mesic meadows and herbaceous riparian communities adjacent to agricultural fields, ponderosa pine (*Pinus ponderosa*) forest, and juniper *(Juniperus monosperma*) woodlands. In contrast, habitat at Sierra Blanca is more typical for least chipmunks from other localities, and includes high elevation talus slopes and glacial cirques surrounded by Englemann spruce (*Picea engelmanni*), quaking aspen (*Populus tremuloides*), corkbark fir (*Abies lasiocarpa*), and Douglas fir (*Pseudotsuga menziesii*) (Conley, 1970; Sullivan, 1985; Sullivan and Petersen, 1988; Frey and Boykin, 2007).

Foods of the Peñasco least chipmunk include a variety of nuts, seeds, and fruits such as those from sunflowers (*Helianthus* spp.), gooseberry (*Ribes* sp.), wild strawberry (*Fragaria ovalis*), piñon (*Pinus edulis*), and Gambel's oak (*Quercus gambelii*), as well as a variety of flowers, leaves, and insects (Bailey, 1932). Young are born mid-summer, and juveniles have been observed in early September (Bailey, 1932).

**Current Status:** The Peñasco least chipmunk was proposed as a federal candidate species, but was not added to the U. S. Fish and Wildlife Service's candidate list. The subspecies was approved for listing as threatened by the New Mexico State Game Commission in 1983 (Jones and Schmitt, 1997). This chipmunk has not been confirmed in James Canyon or Peñasco Canyon since 1969 (Conley, 1970) despite intensive capture efforts in 1981-1982 (Yates, 1982). Given habitat changes in these areas, it is likely that the James Canyon and Peñasco Canyon populations have been extirpated. The remaining known populations of Peñasco least chipmunk are restricted to high elevation talus slopes and the Sierra Blanca area. A survey conducted on Sierra Blanca in 1981-1982 estimated a population of only 15-20 individuals. A reported specimen of least chipmunk captured in Sixteen Springs Canyon in 1996 was subsequently identified as a gray-footed chipmunk (*Neotamias canipes*), a very similar species. Surveys by Hope and Frey (2000) found Peñasco least chipmunks in high elevation talus slopes in the northern Sacramento Mountains and verified its presence on Buck Peak as reported by Ortiz et al. (1998).

**Threats:** Historic Peñasco least chipmunk habitat in James and Peñasco canyons has been significantly altered by grazing and agricultural activities. These areas appear to no longer support populations of Peñasco least chipmunk. Known populations are restricted to small patches of high elevation talus habitat, and the species is sensitive to any natural or human-induced changes to these habitats. Additionally, the species is possibly threatened by competition from the closely related gray-footed chipmunk, which appears to have replaced Peñasco least chipmunk in several areas of former occurrence (J. K. Frey, personal communication, 2004). It is unknown if this replacement is due to direct competition, habitat changes that have favored one species over the other, or a combination of both.

**Recommendations:** No change in the current listing status of Peñasco least chipmunk is recommended. Protection of known habitats in the Sacramento and White mountains (including the Sierra Blanca Peak vicinity) and additional survey work to better define current distribution, population size, and habitat requirements are recommended. Forest management actions that encourage the development of open ponderosa pine stands interspersed with areas of shrubs, forbs, and bunchgrasses to provide food sources would benefit this species (Frey and Boykin, 2007). Actions to benefit this chipmunk should be carried out as a cooperative effort among several resource management agencies, including Lincoln National Forest, Mescalero Apache Indian Reservation, NMDGF, and U.S. Fish and Wildlife Service (Sullivan and Nagorsen, 1998; Frey and Boykin, 2007). Use of the genus *Neotamias* for all species of chipmunk in New Mexico conforms with Frey (2004); however, other authorities (e.g., Thorington and Hoffmann, 2005) assign all these species to the genus *Tamias*. Because this taxonomic issue is unresolved, we recommend continued use of *Neotamias*.

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**(Arizona) montane vole, *Microtus montanus arizonensis***

**Distribution:** The montane vole (*Microtus montanus*) occurs from British Columbia south to east-central California, Arizona, and New Mexico (Hall, 1981; Sera and Early, 2003). The Arizona subspecies, *Microtus montanus arizonensis,* is restricted to the White Mountains of eastern Arizona (Hoffmeister, 1986) and adjacent portions of the Gila National Forest in New Mexico and is the southernmost and most geographically isolated of montane vole subspecies (Hubbard et al., 1983; Frey et al., 1995; Frey, 2005). In New Mexico, Arizona montane voles are known only from Catron County where they have been documented at Centerfire Bog, Jenkins Creek, Flanagan Spring, Romero Creek, SA Creek, and the upper San Francisco River (Hubbard et al., 1983; Frey et al., 1995; Frey, 2005).

Arizona montane vole habitat in New Mexico consists of mesic sedge and grass meadows bordering small creeks and marshes at elevations around 6800 ft. Sedge and grass cover used by this vole is typically 9 or more inches in height (Frey, 2005). The sympatric Mexican vole (*M. mexicanus*) also occurs in these areas, but generally prefers drier habitats. Arizona montane voles construct distinct runways and build houses among grasses and matted sedges. Their diet consists primarily of grasses and sedges.

**Current Status:** The New Mexico State Game Commission approved listing the Arizona montane vole as endangered in 1979 (Jones and Schmitt, 1997). NMDGF is presently (2008) developing a state recovery plan for both Arizona montane vole and meadow jumping mouse. Current information suggests that the New Mexico populations are small and isolated; however vole populations are known to fluctuate dramatically in response to habitat changes (Findley et al., 1975). Surveys conducted along Jenkins Creek by the Department in 1998 and 2000 reconfirmed the presence of this species in this locality. Surveys in 2004 found Arizona montane vole still persists at the Jenkins Creek locality and documented four new localities on the Gila National Forest, all within the San Francisco River drainage system (Frey, 2005).

**Threats:** The combination of small, isolated populations and limited habitat increase the vulnerability of the Arizona montane vole to any adverse habitat alterations due to natural climatic changes and human activities such as livestock grazing, water diversion, and wetland conversion. Although much of the known habitat occurs on the Gila National Forest, other historic sites that may persist are on private land.

**Recommendations:** No change in the current listing status of Arizona montane vole is recommended at this time. Recommendations for actions to protect the habitat and improve our understanding of the biology of this species are currently being developed for inclusion in a state recovery plan, scheduled for completion in 2008. Efforts should be made to protect sensitive mesic meadow habitat on both public and private lands in the drainages of known occurrence and other high-elevation riparian areas in west-central New Mexico. Maintenance of cattle enclosures and addition of new enclosures to protect areas of occurrence would benefit this vole. Cooperative projects between NMDGF and the U.S. Forest Service to enhance stream and riparian habitat and restore cienegas on the Gila National Forest would benefit this subspecies. Funding and implementation for such projects is needed to improve the habitat and population status for this species.

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**Gray wolf, *Canis lupus***

**Distribution:** The historic distribution of the gray wolf included much of North America extending from northern tundra regions southward to Durango, Mexico (Hall, 1981). In the north-central portion of the United States, gray wolves occur in Michigan, Wisconsin, and Minnesota, while in the Northern Rocky Mountain region, gray wolves are presently found in Wyoming, Idaho, and parts of southern Montana. Presently, there are approximately 1,000 wild, free-ranging gray wolves in the Northern Rockies. Understanding the distribution of Mexican wolves requires a review of the taxonomy of gray wolves in the Southwest. Work on the taxonomy of gray wolves by Young and Goldman (1944) and Hall (1981) revealed 24 subspecies of gray wolves in North America, five of which occurred in the Southwest and Mexico: *C. l. baileyi*, *C. l. mogollonensis*, *C. l. monstrabilis*, *C. l. nubulis*, and *C. l. youngi*. Taxonomic revisions of Mexican wolves by Bogan and Mehlhop (1983) lumped *C. l. mogollonensis* and *C. l. monstrabilis* into *C. l. baileyi.* More recently, Nowak (1995) proposed reducing the original 24 subspecies of North American gray wolves into five, of which *C. l. baileyi* is one. Taxonomic classifications by Young and Goldman (1944), Hall (1981), Bogan and Mehlhop (1983), and Nowak (1995) were based on comparisons of morphological characteristics, relying heavily on skull measurements. They concluded that *C. l. baileyi* is a morphologically distinct subspecies of the gray wolf. More recently, molecular genetic (DNA) analyses have identified distinct genetic attributes in Mexican wolves (García-Moreno et al., 1996; Hedrick, 1995; Wayne, et al., 1992).

The U. S. Fish and Wildlife Service concluded that a realistic delineation of the original range of the Mexican wolf should include the restricted range of *C. l. baileyi* as described by Young and Goldman (1944), Hall (1981), and Nowak (1995); much of the expanded range resulted from consolidation of subspecies by Bogan and Mehlhop

(1983); expansion of *C. l. baileyi* into ranges of exterminated subspecies of wolves described by Nowak (1995). This estimated range is consistent with the dispersal capability of gray wolves (Fritts, 1983). The range of the Mexican wolf for purposes of reintroduction includes portions of central and north Mexico, west Texas, south New Mexico, and central and southwest Arizona (Parsons, 1996). Information on territory size of Mexican wolves does not exist; however, territories of wolves in other regions of North America range from 25 to over 5,000 square miles (Mech, 1970; Fuller et al, 1992).
The natural history of the Mexican wolf is based largely on anecdotal observations of northern wolf populations. Mexican wolves were virtually eliminated before in-depth studies of their biology could be undertaken. Most Mexican wolves were taken in pine-oak woodlands, pinyon-juniper woodlands, and grasslands interspersed between these areas, generally above 4500 ft. (Brown, 1983). The combination of prey availability, cover, and water found in montane woodlands appear to have been preferred by Mexican wolves. Diets of Mexican wolves were poorly documented; however, they probably preyed on larger mammals such as mule deer (*Odocoileus hemionus*), white-tailed deer (*O. virginianus*) , elk (*Cervus elaphus*), collared peccaries (*Tayassu tajacu*), beavers (*Castor canadensis*), cottontails (*Sylvilagus* spp.), and jackrabbits (*Lepus* spp.) (Bailey, 1932; Leopold, 1959; Parsons, 1996). For Mexican wolves released in Arizona since 1998, approximately 80% of wild prey has been identified as elk with lesser numbers of mule deer and white-tailed deer also confirmed as wolf kills (USFWS, unpublished data). Wolves generally capture their prey by chasing, often in groups pursuing prey for long distances. Family groups (packs) form the basic social unit of wolves that typically consist of a breeding pair and yearling offspring (Mech, 1970).

Control activities aimed at elimination of wolves undoubtedly affected the structure of these social animals (Parsons, 1996). Precise data on pack sizes and social structure were not documented before these animals were extirpated. Most information gathered on wild Mexican wolves comes from trappers, who generally targeted lone animals. Most information on the productivity of wild Mexican wolves has been obtained by persons engaged in digging in wolf dens to kill the young (Brown, 1983). A sample of eight dens from Mexico had litter sizes of 4 to 8 pups (McBride, 1980). A sample of 86 litters of captive Mexican wolves ranged from one to nine, with a mean of 4.6 (Siminski, 1996). Captive females come into estrous between mid-February and mid-March, gestation periods average 63 days, and parturition occurs in April and May (Parsons, 1996).

**Current Status:** The gray wolf within the southwestern United States and Mexico is federally-listed as endangered by the U. S. Fish and Wildlife Service. The New Mexico State Game Commission approved a state listing of wolves as endangered in 1975 (Jones and Schmitt, 1997). In 1978, McBride (1980) estimated that fewer than 50 wolves existed in the Mexican States of Chihuahua and Durango. The current status of wolves in Mexico is unknown, but current numbers are believed to be considerably lower than McBride's estimates. Recent surveys in Mexico have failed to detect any wolves in the wild (Carrera, 1994), and it appears very unlikely that there are any wild wolves remaining in Mexico. Intensive investigation of reports of wolves along the U. S./Mexico border areas of New Mexico and Arizona failed to provide any clear evidence of Mexican wolves in any of these areas (Wolock, 1994; Whitaker et al., 1995). There is a federal recovery plan for the Mexican wolf (USFWS, 1982). The goal of the recovery plan is to re-establish at least 100 wolves in 5,000 $mi^2$ of the subspecies historic range (USFWS, 1982). Background information concerning the reintroduction of Mexican wolves has been thoroughly reviewed and made available to the public (USFWS, 1996).

In March 1997, the Secretary of the Department of the Interior authorized the reintroduction of Mexican wolves to the Southwest. This decision included selection of the preferred alternative as described in the Final Environmental Impact Statement (USFWS, 1996). Beginning in March 1998, captive-reared Mexican wolves were released into the Blue Range Wolf Recovery Area in the Apache National Forest in eastern Arizona. Initial releases occurred at 6 different locations within Arizona. The Final Rule for the experimental population of Mexican wolves allowed for the translocation of wolves throughout the recovery zone, and for wolves from the initial releases to naturally disperse onto public lands in Arizona and adjacent New Mexico on the Gila National Forest.

In November 2007, the U.S. Fish and Wildlife Service began a NEPA scoping process to gather input on potential modifications to its 1998 rule that established a reintroduction program for the Mexican gray wolf. It held 12 public scoping meetings in Arizona and New Mexico at the end of 2007 which drew more than 1,200 attendees, who submitted 324 written comments. Altogether they received more than 13,000 written comments. They are now in the process of analyzing these comments to identify all the individual issues mentioned. The issues will be used to frame the range of alternatives to be developed and analyzed in the Environmental Impact Statement for the revision of the Mexican Wolf Reintroduction Project.

Mexican gray wolves have been present continuously in New Mexico since about 2000. Wolves naturally dispersed to New Mexico after being released in Arizona, and other wolves were translocated to remote sites in the Gila Wilderness. The 2007 end of year count yielded a minimum of 52 free-ranging Mexican wolves associated with known groups within the recovery area, with two pups killed by vehicles in Arizona shortly after the count. Of these wolves, 6 packs, as well as a few single animals, were in New Mexico. One of these NM packs was confirmed as a successful breeding pair in 2007.

**Threats**: The principal cause of the decline and apparent extirpation of the wolf in New Mexico was a highly-efficient and persistent predator control program, the goal of which was to eradicate the species. Causes of death for reintroduced wolves released since 1998 have been primarily management actions, shooting, and collisions with vehicles, but have also included mountain lions, rattlesnake bites, and diseases.

**Recommendations:** No change in the listing status of the Mexican wolf is recommended. NMDGF should continue to actively participate in on-going recovery activities of the U. S. Fish and Wildlife Service and other cooperators. The goal is to monitor the status of the reintroduced Mexican wolves and their habitats, and to work with local interests to ensure that and promote adaptive Mexican wolf reintroduction is successful and consistent with ongoing land uses.

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**(Desert) bighorn sheep, *Ovis canadensis mexicana***

**Distribution:** Bighorn sheep historically ranged from southwest Canada to northwest Mexico, with the desert subspecies *O. c. mexicana* occurring in New Mexico, Arizona, Texas, Sonora, Chihuahua, and Coahuila (Hall, 1981). Historically, desert bighorn sheep probably occurred in many arid mountain ranges in south and central New Mexico (NMDGF, 2003). There is evidence of their occurrence as far northwest as the Zuni Mountains and the Malpais area south of Grants; as far northeast as the Capitan and Jicarilla Mountains; as far south east as the Sacramento and Guadalupe Mountains. However, it is believed that their core distribution included the Magdalena, Mogollon, San Andres, Organ, West Potrillo, Burro, Big Hatchet, Little Hatchet, San Luis, Peloncillo, and Alamo Hueco Mountain ranges as well as the San Francisco River drainage (Bailey, 1932; Buechner, 1960; Sands, 1967).

Currently, free-ranging desert bighorn sheep are found in the following mountain ranges in New Mexico: Big Hatchet, Little Hatchet Mountains, Peloncillo,, San Andres, Fra Cristobal, Caballo, and Ladron. In addition, a captive population currently lives within the Red Rock breeding facility in Grant County.

Desert bighorn sheep inhabit arid, open habitats. Their habitat is characterized by steep, rocky, and broken terrain that confers high visibility. Although primarily grazers feeding upon grasses and forbs, desert bighorn sheep diets in New Mexico include large amounts of shrubs and browse (Sandoval, 1979; Watts, 1979; Bavin, 1980; Elenowitz, 1983). Sandoval (1979) found 45 species of plants in the diet of the desert bighorn in New Mexico, with mountain mahogany (*Cercocarpus montanus*), globemallow (*Sphaeralcea* spp.), bladderpod (*Lesquerella purpurea*), and grasses as the main items. Bighorn sheep obtain minerals from natural salt-licks (Shackleton, 1985); however, little is known about mineral requirements of desert bighorn sheep. Watts (1979) noted them crossing 4 km (2.5 miles) of open lands between the Big Hatchet Mountains and the Cairn Hills to utilize mineral licks. Summer activities of desert bighorn are often concentrated within two miles of water sources (Leslie and Douglas, 1979; Cunningham and Ohmart, 1986). In the San Andres Mountains, bighorn sheep were usually found within one mile of surface water.

Males generally remain separate from female and juvenile sheep except during the breeding season. In the San Andres Mountains, the rut occurs mainly from July into December; however, some breeding does occur in other seasons (Sandoval, 1979). Lambs are generally born between January and April, but have been documented during every month. Mountain lion predation is the primary cause of desert bighorn sheep mortality in New Mexico, though mortality resulting from disease, competition with livestock, human conflicts, and accidents also occurs (McCarty and Bailey, 1994; NMDGF, 2003).

**Current Status:** While it is difficult to accurately determine when the populations of desert bighorn sheep in New Mexico were locally extirpated, it is generally believed to have occurred as follows: prior to 1800 in the Zuni and Magdalena Mountains; between 1850-1900 in the San Francisco River and Turkey Creek drainages and Burro

Mountains; early 1900s in the Alamo Hueco, Animas, Peloncillo, and West Potrillo Mountains; 1940s to 1950s in the Guadalupe and Sacramento Mountains and El Malpais area (NMDGF, 2003).

Efforts to resotore bighorn sheep began with the establishment of the San Andres National Wildlife Refuge in 1941, and the captive breeding facility at Red Rock in 1972. The New Mexico State Game Commission approved a listing of the *O. c. mexicana* subspecies as endangered in 1980, excluding the Peloncillo Mountains and Red Rock Wildlife Area populations in 1988 (Jones and Schmitt, 1997). This subspecies also has special protection in Mexico (Secretaría de Desarrollo Social, 1994). Desert bighorn sheep populations in New Mexico have declined precipitously, despite multiple transplants out of Red Rock into the wild, and they now occur in a handful of the mountain ranges that they historically inhabited.

The statewide population number has been increasing steadily since it reached a low of less than 170 bighorn in the wild populations in 2001. The increase has been due to a combination of transplants out of Red Rock into the wild, and mountain lion removal in desert bighorn sheep ranges. Currently, there are six wild desert bighorn sheep populations in New Mexico, and an additional captive population at Red Rock. All of the populations were established or re-established through transplant efforts, with the exception of the Caballos which is a self-starting herd presumably from the Fra Cristobals. The total free ranging population of desert bighorn sheep in New Mexico as of autumn 2007 is estimated at approximately 375-430 individuals, with an additional 60 sheep at the Red Rock captive facility (NMDGF, unpublished data). Based on aerial and ground surveys, individual desert bighorn sheep population estimates are: Peloncillos (n=80-85); Hatchets (n=100-115); San Andres (n=80-90); Fra Cristobal (n=80-85); Caballos (n=10-20); and Ladrones (n=25-35).

A plan to guide recovery of desert bighorn sheep in New Mexico was completed in 2003 (NMDGF, 2003). This plan identifies the criteria for downlisting from endangered to threatened as ≥250 free-ranging desert bighorn distributed among at least 2 distinct populations or metapopulations, each containing ≥100 individuals

**Threats:** The principal factors currently threatening desert bighorn sheep populations in New Mexico include mountain lion predation and habitat modification from extensive livestock grazing and fire suppression. (NMDGF, 2003). From 1993-2003, approximately 85% of all known-cause mortalities of radiocollared desert bighorn sheep have been due to mountain lion predation. Domestic sheep represent a serious threat to desert bighorn sheep because of the potential for the transmission of fatal diseases, especially pneumonia which can decimate bighorn populations (McCarty and Bailey, 1994). Low genetic diversity exists in the Red Rock herd, and hence the wild herds, although the impact of this on herd health is not well understood (Caughley 1994). In small wild populations, impacts of demographic stochasticity may be greater than genetics in regulating population declines (Lande 1988).

A population and habitat viability analysis (PVHA) was conducted for New Mexico desert bighorn sheep in July 1999. The PVHA results suggested that without regular and substantial supplementation, all existing populations of desert bighorn in New Mexico were at significant risk of extinction within 65 years (Fisher et al., 1999). High mortality rates, particularly from mountain lion predation, appeared to be the proximate factor placing these populations at risk (Fisher et al., 1999). The persistence of a male-biased sex ratio among lambs born at the Red Rock facility also impacts New Mexico's augmentation and reintroduction programs.

**Recommendation:** The Department recommends downlisting desert bighorn sheep to threatened. The statewide population estimate has increased every year since reaching a minimum of 250 in 2004, and in 2007 was estimated at 375-435. The Bootheel metapopulation (the Peloncillos and Hatchet populations) has increased every year since reaching a minimum of 100 bighorn in 2003, and now contains 180-200, The San Andres population consisted of a minimum of 100 bighorn in 2005, but a small dieoff in this herd decreased the population to less than 100 in 2006, with an estimated 80-90 by 2007. The Fra Cristobal and Caballo metapopulation reached a minimum of 100 animals in 2007, with a population estimate of 100-110. NMDGF should continue to monitor herds and study limiting factors within both extant populations and unoccupied historic ranges, with recovery strategies considering results and recommendations of the PVHA and Recovery Plan.

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**Meadow jumping mouse, *Zapus hudsonius***

**Distribution:** The meadow jumping mouse (*Zapus hudsonius)* occurs from Alaska, southward through British Columbia to the southwest United States, and southeastward to Georgia (Hafner et al., 1981; Hall, 1981). The subspecies *Z. h. luteus* (New Mexico meadow jumping mouse) is endemic to New Mexico, southern Colorado, and Arizona (Hafner et al., 1981). Hafner et al. (1981) reported this subspecies at 14 localities in New Mexico in the San Juan, Sangre de Cristo, Jemez, and Sacramento Mountains, and in the Rio Grande Valley between Española and Bosque del Apache National Wildlife Refuge. Morrison (1992) subsequently verified the presence of meadow jumping mouse in most localities reported by Hafner et al. (1981), and located new populations in the Jemez Mountains (8 localities in the upper Guadalupe River drainage), the Rio Grande Valley (2 new localities near Española and Isleta), the Rio Chama (1 new locality), and in the Sacramento Mountains (13 different sites along tributaries of the Rio Peñasco). One historic locality in the Sangre de Cristo Mountains was not reconfirmed in 2006; however, the species was found at two new sites at Sugarite Canyon State Park and on Coyote Creek (J. K. Frey, personal communication, 2006). A closely-related species, the western jumping mouse (*Zapus princeps*), also occurs in the Sangre de Cristo range; the two species have been confused by previous researchers and are difficult to tell apart (Frey, 2005a).

In the Sacramento Mountains, soil moisture, vegetative cover characteristics and composition, and proximity of permanent water were similar to other meadow jumping mouse habitat in New Mexico (Morrison, 1990). Typical plant species associated with meadow jumping mouse habitat include spikerush (*Eleocharis macrostachya*), sedges

(*Carex* spp.), rushes (*Juncus* spp.), and numerous species of grasses (e.g., *Agrostis*, *Poa*, *Agropyron*, and *Bromus*), forbs, and willows.

The extremely short activity season of this rodent is generally limited to the months of July through September in montane areas, and possibly longer at lower-elevation sites. Surveys must therefore be conducted during mid to late summer, otherwise the species is not detected during small mammal trapping efforts. The diet is comprised primarily of grass seeds, with fungi, plants, and invertebrates also consumed. Due to the short activity season, only a single litter is produced each year.

**Current Status:** The meadow jumping mouse was listed as threatened by the New Mexico Department of Game and Fish in 1983 (Jones and Schmitt, 1997) and was uplisted to endangered in 2006. In addition, the U.S. Fish and Wildlife Service recently designated the New Mexico meadow jumping mouse (*Z. h. luteus*, which includes all New Mexico populations) a Candidate for federal listing under the U.S. Endangered Species Act. NMDGF is presently (2008) developing a state recovery plan for both meadow jumping mouse and Arizona montane vole.

Zwank et al. (1997) captured meadow jumping mice in all habitats that they surveyed at Bosque del Apache National Wildlife Refuge. Other extant populations in the Rio Grande and Rio Chama valleys were surveyed in the late 1980s (Morrison, 1992) and the species was found at four of seven historical localities. These localities appear to represent relicts of a formerly more extensive range in this valley. Meadow jumping mice may use the vegetated margins of irrigation ditches adjacent to agricultural areas in the Rio Grande Valley, which suggests that habitat disturbance may not be a limiting factor under some conditions, provided that soil moisture and herbaceous plant cover and composition are sufficient to replicate natural habitat (Morrison, 1990).

Surveys for this species were conducted in the Jemez and Sacramento Mountains during 2005 (Frey, 2005b) and the results indicated a significant decline in presence and suitable habitat for these montane populations than was reported by Morrison (1992) based on her surveys in the late 1980s. Frey (2005b) found that the species and its habitat were found at only 2 of 12 historic sites in the Jemez Mountains and 2 of 11 historic sites in the Sacramento Mountains. Frey (2005b) found that herbaceous vegetation, particularly sedges, with a vertical height of at least 24 inches was a significant predictor of meadow jumping mouse presence at survey sites in the Sacramento and Jemez Mountains. In all cases where meadow jumping mice were found, livestock were currently being excluded (Frey, 2005b). Drought conditions and loss of dense herbaceous vegetation and moist soil conditions along streams due to excessive grazing pressure were identified as the primary reasons for the significant loss of habitat in these two ranges. Subsequently, surveys in 2006 in the Sangre de Cristo Mountains found this species at 2 of 3 historic localities, and persisting at two other previously unknown locations within that range (J. K. Frey, personal communication, 2006). The species was absent at the only known historic site in the San Juan Mountains.

Many of the montane sites where the species persists are very small, only a few acres in size, and are widely separated from other occupied sites. The presence of beaver dams and/or human-made impoundments and the exclusion of livestock from riparian areas were identified as the most important factors for the presence of suitable habitat for this species in montane parts of its range.

**Threats:** As a result of the species' reliance on mesic and densely-grassed habitats in proximity to water, primary threats to the meadow jumping mouse in New Mexico include habitat degradation due to development, conversion of mesic areas to agricultural crop production, excessive grazing pressure from livestock, removal of beavers and their dams, downcutting of streams, drought, and water diversions. The drastic reduction in herbaceous vegetation along streams in many areas of historic occurrence due to drought and excessive grazing poses the most immediate threat to this species. The highly fragmented nature of its distribution in the state is also a major contributor to the vulnerability of this species and increases the likelihood of very small, isolated populations being extirpated. Even if suitable habitat exists (or is restored) in some locations, the likelihood of recolonization from other populations is extremely limited.

**Recommendation:** No change in the current listing status of the meadow jumping mouse is recommended. The species was uplisted from threatened to endangered during the 2006 biennial review. The uplisting was based on the results of surveys in the Jemez, Sacramento, and Sangre de Cristo mountain ranges in 2005-2006 and the substantial evidence for significant habitat loss in these mountain ranges since the late 1980s and early 1990s when the last intensive survey effort was done (Frey 2005b; J.K. Frey, personal communication, 2006).

A state recovery plan for this species is presently being developed which will outline recommendations and actions for conservation. Immediate efforts to protect and, where appropriate, enhance herbaceous moist-soil habitat for this species in montane areas of its range should be implemented, through construction of new cattle enclosures or improvement of existing enclosures to create a series of refugial habitat areas, particularly in the Sacramento and Jemez mountains. Longer-term habitat improvement efforts that are needed to maintain this species in montane areas include: 1) implementation of grazing management practices that enhance and maintain herbaceous riparian wetlands with required habitat components, including adequate vertical cover as provided by sedges, grasses, and forbs; 2) restoration of suitable habitat in montane riparian areas where the species has been extirpated, such as by willow planting, check-dam construction, and erosion protection features; and 3) re-establishment of beaver in montane streams where channel downcutting and loss of riparian and wet meadow vegetation has occurred. NMDGF should implement a regular monitoring program of all known populations and locations where habitat restoration has been achieved, possibly once per every 2-3 years, and should continue surveys to document other potential extant populations. Additional research on specimens of *Zapus* historically collected in New Mexico is also needed, especially collections from the Sangre de Cristo Mountains, given the extreme similarity between this species and the closely-related western jumping mouse found in northern New Mexico (Frey, 2005a). Additional monitoring of known lower-elevation populations in the Rio Grande (e.g., Bosque del Apache National Wildlife Refuge) and Rio Chama valleys is also warranted as these populations have not been adequately surveyed since prior to the drought period that began in the mid-1990s.

The recent addition of New Mexico meadow jumping mouse (*Z. h. luteus*) to the federal Candidate list likely will provide opportunities for NMDGF to collaborate with the U.S. Fish and Wildlife Service in the implementation of the above-referenced actions.

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**THREATENED**

**North American least shrew, *Cryptotis parva***

**Distribution:** The North American least shrew is the northernmost of several species of least shrew, a primarily tropical group of mammals. The species occurs from extreme southeastern Canada south to the Gulf Coast, westward into Colorado and New Mexico, and southward into Mexico (Hall, 1981; Fitzgerald et al., 1994; Hutterer, 2005). Eastern New Mexico represents the westernmost extent of the species' distribution. The least shrew was first discovered in the state at Tucumcari in 1981 (Hoditschek et al., 1985). This species is known from three general

localities in eastern New Mexico: 1) the Tucumcari area, including Tucumcari Lake (Quay County), 2) Salt Lake on Grulla National Wildlife Refuge near Portales (Roosevelt County), and 3) Bitter Lake National Wildlife Refuge and vicinity in the Pecos River Valley, including Bottomless Lakes State Park and the BLM Overflow Wetlands (Chaves County) (Hoditschek et al., 1985; Owen and Hamilton, 1986; Frey 2005). Efforts to trap shrews in other suitable habitats in eastern New Mexico (areas near Santa Rosa, Carlsbad, and Conchas Lake) have failed to find this species (Shuster, 1987).

As presently understood, the North American least shrew in New Mexico may consist of two subspecies, *C. p. parva* on the eastern plains and *C. p. berlandieri* in the Pecos River Valley (Hafner and Shuster, 1996). The populations in the Pecos River Valley are likely relicts of a more widespread distribution that have become isolated since the Pleistocene by climatic changes, whereas those from the vicinities of Tucumcari and Portales may be the result of more recent westward expansion of populations in western Texas.

The North American least shrew occupies a variety of habitats within the western portion of its range. The species inhabits riparian woodlands in southeastern Colorado (Choate and Reed, 1988) and short grass prairie and mesic meadows in northeastern Colorado (Fitzgerald et al., 1994). Mesic areas with dense grass cover appear to represent primary habitat for this species in New Mexico. They occupy mesic meadows with willows (*Salix gooddingii*) and cattails (*Typha angustifolia*) along the edge of Tucumcari Lake (Cully, 1983; Hoditschek et al., 1985). At Grulla National Wildlife Refuge, they were found in communities of alkali sacaton (*Sporobolus airoides*), grama (*Bouteloua* sp.), and various forbs (Owen and Hamilton, 1986). Frey (2005) found this species associated with saltgrass (*Distichlis stricta*) meadows and cattail/bulrush (*Scirpus* spp.) marshes, but also in mesic areas dominated by non-native grasses.

Food habits of the North American least shrew are similar to other shrew species, and include insects, arthropods, and earthworms (Fitzgerald et al., 1994). Gestation takes 21 to 23 days, young are born blind and hairless, and weaning occurs about 21-23 days after birth (Fitzgerald et al., 1994).

**Current Status:** The North American least shrew was approved for listing as threatened by the New Mexico State Game Commission in 1985 (Jones and Schmitt, 1997). Known distribution in New Mexico is limited to three general areas of occurrence in the eastern third of the state. Recent surveys by Frey (2005) found that the species persists at all historic sites in New Mexico and occurs elsewhere in the Tucumcari area and the Pecos River Valley near Bitter Lake National Wildlife Refuge and Bottomless Lakes State Park. Thus,the North American least shrew appears to be more common and widespread in these areas than previously known (Frey, 2005). It eventually may be found in other areas of eastern New Mexico (such as eastern Union County) with similar habitat.

**Threats:** Because of its reliance on mesic grasslands and wetlands, this species is vulnerable to habitat loss and degradation resulting from climatic variation (i.e., drought) and human activities (e.g., water diversion, agriculture, and excessive grazing).

**Recommendation:** No change in the current listing status of this species is recommended, although we propose to change the common name from least shrew to North American least shrew to conform with Hutterer (2005). Additional surveys in the vicinity of known localities and in other parts of eastern New Mexico with suitable habitat should be conducted to better ascertain the species distribution and population status in the state. Conservation projects that maintain suitable mesic habitat and continuity between these habitats in eastern New Mexico would benefit this species. Additional genetic studies of the relationship between the Pecos River Valley and eastern plains populations in New Mexico would provide valuable information for management purposes. Successful implementation of measures to protect and enhance habitat for the North American least shrew could lead to future delisting under the WCA.

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**Lesser long-nosed bat, *Leptonycteris yerbabuenae***

**Distribution:** The lesser long-nosed bat occurs from South America north through Mexico to southern Arizona and southwestern New Mexico; populations in the United States represent the northern extent of the species' range (Findley et al., 1975; Hall, 1981; Hoffmeister, 1986; Simmons, 2005). In New Mexico, this bat is known from the Animas, Peloncillo, and Big Hatchet mountains and adjacent valleys in southern Hidalgo County (Findley et al., 1975; Baltosser, 1980; Hoyt et al., 1994; Bogan et al., 2006a, 2006b). Similar to the Mexican long-nosed bat (*L. nivalis*), the lesser long-nosed bat is a migratory species that is found in the United States only during summer months (Hayward and Cockrum, 1971; Findley et al., 1975; Wilson, 1985). Bogan et al. (2006a, 2006b) reported occurrence in New Mexico from mid-July to mid-September. Habitats utilized by the southern long-nosed bat include forested canyons and adjacent desert grassland and shrub lands (Findley et al., 1975; Hoffmeister, 1986). The diet consists of nectar, pollen, and soft fruits of agaves (*Agave* spp.) and various cacti, with insects being taken incidentally. In Arizona, migrant females are pregnant when they arrive from Mexico and subsequently give birth and rear their young in maternal colonies (Hoffmeister, 1986). Caves and rock fissures are the only known day roost sites in New Mexico (Bogan et al., 2006a, 2006b), but the species is also known to roost in trees, mines, culverts, and buildings elsewhere in its range. An abandoned building near the Animas Mountains is a known night roost for long-nosed bats between feeding forays (Bogan et al., 2006a, 2006b).

**Current Status:** The lesser long-nosed bat is listed as endangered (as the subspecies *L. curasoae yerbabuenae*) by the U. S. Fish and Wildlife Service, and a federal recovery plan is available (USFWS, 1995) but in need of updating. A federal 5-year review of the species was recently completed (USFWS, 2007). The New Mexico State Game Commission approved the addition of this species to the threatened list in 1975 (Jones and Schmitt, 1997). Until recently, few studies have been conducted on this bat in New Mexico, and its ecology and population size and trends are not fully understood. Hoyt et al. (1994) conservatively estimated that they netted 150 to 200 individuals of *Leptonycteris* in the proportion of two lesser long-nosed bats for every one Mexican long-nosed bat in the Animas Mountains. Recent studies by Bogan et al. (2006a, 2006b), Cryan (2007), and Goodbar (2007) identified and characterized roost sites in the Animas, Peloncillo, and Big Hatchet mountains; numbers of long-nosed bats (both species) at day roosts ranged from 4 to a few thousand individuals and varied during the summer.

The taxonomy of *Leptonycteris* bats has been a subject of debate, and various scientific and common names have been applied to populations of long-nosed bats that occur in the United States. Simmons (2005) and Cole and Wilson (2006) considered the subspecies *L. curasoae yerbabuenae* (lesser long-nosed bat), the form found in the southwestern U.S. and Mexico, to be specifically distinct from *L. curasoae* of South America. United States populations were formerly placed in the species *L. sanborni*.

**Threats:** Current threats are thought to include a lack of formal protection for the species' habitat, disturbance of both day and night roost sites and maternity colonies, and degradation of food resources (agave and cacti) within its limited range in New Mexico.

**Recommendation:** No change in the current listing status of this species is recommended, although we propose changing the scientific name to *L. yerbabuenae* and the common name from southern long-nosed bat to lesser long-nosed bat to conform with Simmons (2005) and Cole and Wilson (2006). Identification and protection of roost sites and maintenance of viable populations of food plants (particularly agave) are necessary to conserve this species in New Mexico. The recently completed studies of both long-nosed bat species and their habitats in southern Hidalgo County (Bogan et al., 2006a, 2006b; Cryan, 2007; Goodbar, 2007) provided a more thorough understanding of this bat's population status, movements, and habitat use in New Mexico. The USFWS (2007) has recommended actions that are concordant with those needed in New Mexico including additional research on the biology, taxonomic status, habitat requirements, and the effects of human activities on the species in the borderlands region. The USFWS (2007) also recommends updating and revising the federal recovery plan. NMDGF should have a primary role in any recovery plan revision with a goal of adopting the revised plan for use in the state.

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**Spotted bat, *Euderma maculatum***

**Distribution:** The spotted bat is widely distributed across western North America, occurring locally from central California and southern British Columbia, and southward through the Big Bend region of Texas to central Mexico (Hall, 1981; Fenton et al., 1983, 1987). Nowhere within this range is the species considered to be abundant. In New Mexico, spotted bats are known from numerous localities including Albuquerque (Bernalillo Co.), the Jemez Mountains (Sandoval Co.), the Mogollon Mountains (Catron Co.), the San Mateo Mountains (Socorro Co.), the Sacramento Mountains (Otero Co.), Mesilla Park (Doña Ana Co.), Lake Roberts (Grant Co.), Ghost Ranch (Rio Arriba Co.), and Aztec (San Juan Co.). Perry et al. (1995) reported spotted bats from the Sacramento Mountains, indicating a more extensive range in New Mexico than previously suspected.

This species has been recorded in a wide variety of habitats, including riparian communities, pinyon-juniper woodlands, and ponderosa pine and spruce-fir forests (Findley et al., 1975), and in burned areas of pondersosa pine forest (Ellison et al., 2005). In New Mexico, the spotted bat occurs in forested areas between 3900 and 10600 ft elevation. Spotted bats may summer in forested areas and migrate through lower elevations during other seasons (Hoffmeister, 1986). Most New Mexico records of spotted bats are from warmer months (April - September), but Sherwin and Gannon (2005) documented winter roosting in Albuquerque buildings. Ruffner et al. (1979) captured several specimens in Utah in January and February. Moths represent the principal food source of the spotted bat (Ross, 1967; Easterla, 1973). Young may be born in early summer based on captures of lactating females in late June to mid-July (Findley et al., 1975). Spotted bats utilize cliff faces and rock crevices for roosting, and such rocky areas are an essential habitat component for this species (Easterla, 1973).

**Current Status:** Spotted bats were approved for listing as threatened by the New Mexico State Game Commission in 1988 (Jones and Schmitt, 1997). Surveys in New Mexico and other states documented population declines throughout the species' historic range in 1983. Recent spotted bat surveys in New Mexico have relied upon both listening for audible echolocation sounds as well as the use of Anabat detectors. The current status of the spotted bat in New Mexico is not fully understood.

**Threats:** Threats and limiting factors are largely unknown, but the species is likely adversely affected by pesticides, disturbance of foraging habitats, and disturbance to roosting sites. This bat is relatively rare throughout its range, thus its scarcity in New Mexico may be a function of its biology rather than due to any impacts.

**Recommendations:** No change in the current listing status of the spotted bat is recommended. NMDGF should continue to encourage land management agencies to protect known foraging and roosting habitats. Surveys, particularly those based on standardized acoustic methods and direct observations, are needed to better identify the species' distribution, population trends, and potential threats in New Mexico.

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**Western yellow bat, *Lasiurus xanthinus***

**Distribution :** The western yellow bat occurs from southern California eastward through Arizona and southwestern New Mexico and south into Baja California and western and central Mexico (Simmons, 2005). It was recently reported from Big Bend National Park, Texas (Higginbotham et al., 1999). In New Mexico, the species is known only from Guadalupe Canyon and the Animas Mountains in southern Hidalgo County (Mumford and Zimmerman, 1963; Findley et al., 1975; Baltosser, 1980; Cook, 1981, 1986).

This species is associated with riparian woodlands, and is most frequently captured over water (Findley et al., 1975; Baltosser, 1980; Cook, 1981, 1986). In Guadalupe Canyon, western yellow bat habitat includes riparian woodlands with cottonwoods (*Populus fremontii*), Arizona sycamores (*Plantanus wrightii*), and Arizona white oaks (*Quercus arizonica*). Similar to the closely related southern yellow bat, western yellow bats probably roost in trees and other large vegetation; elsewhere in its range, it has been reported to use the dead fronds of palms and yucca as roost sites. The species has been recorded in New Mexico only in summer months (May-September), and likely migrates southward for the winter. The diet includes arthropods, particularly flying insects. Pregnant females have been taken in May and June and lactating females in August (Mumford and Zimmerman, 1963; Cook, 1981, 1986), suggesting that young are born in mid-summer. Pregnant specimens of this species examined from New Mexico contained two embryos (Barbour and Davis, 1969).

**Current Status:** This species was approved for listing as threatened by the New Mexico State Game Commission in 1975 (Jones and Schmitt, 1997). The New Mexico populations are peripheral and believed to be of low density. Formerly considered to be a subspecies of the southern yellow bat (*Lasiurus ega*), genetic studies resulted in the designation of *L. xanthinus* as a distinct species (Baker, et al., 1988; Morales and Bickham, 1995)

**Threats:** Loss or alteration of riparian broadleaf forest habitats in southwestern New Mexico is the major threat to this peripheral species.

**Recommendation:** No change in the current listing status of western yellow bat is recommended. Protection and enhancement of riparian broadleaf woodlands in southwestern New Mexico should be encouraged and would benefit this species. Population surveys and ecological studies of the species should be encouraged although, due to the rarity of this bat, such studies would probably best be done as part of a multi-species survey effort for bats in southwestern New Mexico. The recent discovery of the species in Chihuahuan Desert habitat in westernTexas suggests additional surveys in this habitat in southern New Mexico may be warranted.

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**White-sided jackrabbit, *Lepus callotis***

**Distribution:** The white-sided jackrabbit (*Lepus callotis)* is a species almost entirely confined to Mexico, which represents the core distribution for this species. The subspecies *L. c. gaillardi* occurs throughout the Mexican Plateau, from Jalisco north to southwestern New Mexico (Findley et al., 1975; Hall, 1981). In New Mexico, it is known only from the Animas Valley and very limited parts of the Playas Valley in southern Hidalgo County; these two valleys constitute the entire range in the United States (Findley et al., 1975; Bednarz, 1977; Bednarz and Cook, 1984).

This elusive hare was reported only a few times after its discovery along the U.S.-Mexico border in 1892 (Mearns, 1896). Two were collected in the Playas Valley in 1931 (Anderson and Gaunt, 1962). Bogan and Jones (1975) obtained a single specimen in 1974. Systematic surveys for this species in New Mexico were initiated in the 1980s, and spotlighting from a vehicle at night was found to be an effective survey method.

White-sided jackrabbits tend to form male-female pairs, which is most evident during the breeding season (at least mid-April to mid-August) but may persist year-round. Pregnant females have been found March through October. Males with mates defend territories from intruder males. This species rests in shelter forms in dense grass and rarely uses underground burrows (Best, 1999)

Studies by Bednarz and Cook (1984), Conway (1975), and Conley and Brown (1977) confirmed that the white-sided jackrabbit is a desert grassland specialist. Plants species associated with white-sided jackrabbit habitat in the Animas and Playa Valleys include blue grama *(Bouteloua gracilis)*, black grama (*B. eriopoda*), tobosa (*Hilaria mutica*), buffalograss *(Buchloe dactyloides*), wolftail (*Lycurus pheloides*), flatsedge (*Cyperus* spp.), snakeweed (*Gutierrizia sarothrae*), soaptree yucca (*Yucca elata*), and honey mesquite (*Prosopis glandulosa*). Traphagen (2002) found that presence of buffalograss is an important indicator of white-sided jackrabbit presence, whereas shrub cover was negatively correlated with presence. Most observations (97%) of this species have been recorded in pure grasslands, with the remaining 3% recorded in grasslands with very limited forb and shrub components (Bednarz and Cook, 1984).

**Current Status:** This species was approved for listing as threatened by the New Mexico State Game Commission in 1975 (Jones and Schmitt, 1997). Spotlight censuses conducted in the Animas Valley between May and August 1976 revealed a mean of 15 individuals (range: 5-25) per census, and resulted in a population estimate of 250 to 300 individuals (Bednarz 1977). During eight censuses conducted in 1981, Cook counted a mean of 7.5 individuals per census (Cook, 1981a; 1981b). Cook also noted that numbers of black-tailed jackrabbits (*L. californicus*) increased 22 times and desert cottontail (*Sylvilagus auduboni*) increased approximately four times; while white-sided jackrabbit sightings decreased by 50% compared to the findings of Bednarz (1977). Bednarz and Cook (1984)

postulated that the decrease of white-sided jackrabbit and increase of black-tailed jackrabbit and desert cottontail was associated with a decrease in the density and vigor of grasses and concomitant increase in forb and shrub cover.

During five surveys in the Animas Valley during 1990, only 3.2 individuals were observed per census (Mehlhop, 1995). During 1994 and 1995, seven surveys conducted in the same general areas surveyed by Bednarz and Cook revealed a mean of 1.1 individuals per census and a total of eight individuals (Mehlhop 1995). While different sampling efforts by Mehlhop (1995) and Bednarz and Cook preclude statistical comparison, these data strongly suggest a significant decrease in the population from 1976 to 1995. Whether these surveys accurately reflected the overall New Mexico population of white-sided jackrabbit is unknown.

Data from NMDGF surveys conducted between 1997 and 2002 indicated more individuals detected per survey than was reported by Mehlhop (1995). Variation in survey methodology may have influenced results conducted by different biologist over this time period. No observations of this species have been made in the Playas Valley during recent surveys, and the status of white-sided jackrabbit in this area remains uncertain, although increased shrub growth in the valley may have eliminated suitable habitat. While the overall status of the species remains unclear, the Animas Valley population appears to be more secure than the Playas Valley population. The species remains present in the Janos area of Chihuahua, Mexico (south of the New Mexico border) as of 2008 (M. Watson, pers. comm.).

**Threats:** Loss and degradation of grassland habitats in the Animas Valley through drought, shrub encroachment, and changes in grass species composition represent the primary threats to the white-sided jackrabbit in New Mexico. In Zacatecas, Mexico, overgrazing and shrub encroachment are thought to have encouraged expansion of the range of black-tailed jackrabbit and the exclusion of white-sided jackrabbit (Matson and Baker, 1986); similar patterns of habitat use between these two hares have been observed in Chihuahua, Mexico (Desmond, 2004). Baker (1977) noted that excessive grazing might be one of the factors contributing to the decline of white-sided jackrabbit and apparent replacement by black-tailed jackrabbit. Although such mortality probably does not represent a significant threat to this species, vehicles sometimes kill white-sided jackrabbits (N. Moore-Craig, personal communication, 1992). Increased illegal activity and traffic along the U.S.-Mexico border may be affecting this species, and plans to develop improved fencing on the border may have adverse effects to the habitat of this hare in the southern Animas Valley. Indiscriminate shooting of white-sided jackrabbits could threaten this species; however, Bednarz (1977) found no evidence of shooting during his study.

**Recommendation:** No change in the current listing status for white-sided jackrabbit is recommended. NMDGF should re-initiate surveys to assess population status and trends using the protocol proposed by Mehlhop (1995). Private landowners are encouraged to employ non-detrimental livestock grazing practices within white-sided jackrabbit habitat and to employ shrub control where appropriate to maintain the grassland habitat needed by this species. A Habitat Conservation Plan (HCP) for range management on private lands in the Animas Valley, among other areas, is nearing completion and includes consideration of this species in New Mexico. NMDGF supports management efforts proposed in the HCP that are expected to improve grassland conditions in the southern Animas Valley and thereby benefit this species. Coordination with U.S. Department of Homeland Security, particularly in relation to border fence development, is also needed to address concerns related to this and other wildlife species. The relationship between U.S. and Mexican populations of the species and population status in other portions of its range should be investigated.

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**(Organ Mountains) Colorado chipmunk, *Neotamias quadrivittatus australis* (including Oscura Mountains population)**

**Distribution:** The Colorado chipmunk (*Neotamias quadrivittatus*) is widely distributed across five western states, including southern Colorado, eastern Utah, northeastern Arizona, the extreme western portion of the Oklahoma Panhandle, and northern and central New Mexico (Durrant, 1952; Findley et al., 1975; Hall, 1981; Hoffmeister, 1986; Caire et al., 1989; Fitzgerald et al., 1994). In New Mexico, the Colorado chipmunk is known to inhabit the Chuska, Zuni, San Mateo, Jemez, Gallinas, Sangre de Cristo, Sandia, and Manzano mountain ranges. The species also occurs in piñon -juniper woodlands from Johnson Mesa to the Canadian River Canyon (Findley et al., 1975). Southern populations in New Mexico (Organ and Oscura mountains) are isolated from populations in the northern half of the state, and from each other, and are currently recognized as two distinct subspecies: Organ Mountains chipmunk (*N. q. australis*) and Oscura Mountains chipmunk (*N. q. oscuraensis*).

Chipmunks were discovered in the Organ Mountains in 1903 by O. B. Metcalf (Bailey, 1932), and were initially regarded as a subspecies of gray-collared chipmunk, *Neotamias cinereicollis cinereus* by Howell (1929) and Bailey (1932). Findley et al. (1975) regarded chipmunks from the Organ Mountains to be gray-collared chipmunks (*N. cinereicollis*). A morphological study indicated a close phyletic relationship between the Organ Mountains chipminks and northern populations of *N. q. quadrivittatus* (Patterson, 1980). As a result of this work, the Organ Mountains chipmunk was described as the subspecies *N. q. australis* (Patterson, 1980). Chipmunks were discovered in the Oscura Mountains in 1977 (Patterson, 1980) and, although considered a form of Colorado chipmunk, were not formally described as a new subspecies for almost 20 years (Sullivan, 1996).

The distribution of the Organ Mountains chipmunk is limited to the Organ Mountains in southern New Mexico (Patterson, 1980). Most habitat for this subspecies is found on the north-facing slopes in the vicinity of Aguirre Springs, and is characterized by ponderosa pine (*Pinus ponderosa*), oaks (*Quercus* spp.), junipers (*Juniperus* spp.), Apache plume (*Fallugia paradoxa*), and sumac (*Rhus* spp.) at elevations between 6000 and 7300 ft (Patterson 1980). The distribution of the Oscura Mountains chipmunk is limited to the Oscura Mountains at the northern end of the Tularosa Basin on White Sands Missile Range in south-central New Mexico (Sullivan, 1996). Habitat for this species is restricted to northwest-facing limestone cliff edges in pinyon-juniper-oak communities, which is characterized by pinyon (*Pinus edulis*), one-seed juniper (*J. monosperma*), mountain mahogany (*Cercocarpus montanus*), antelope brush (*Pursia tridentata*), four-wing salt bush (*Atriplex canescens*), and oaks (*Quercus* spp.). Open areas are variously covered with side-oats grama (*Bouteloua curtipendula*), black grama (*B. eriopoda*), blue grama (*B. gracilis*), Chihuahuan love-grass (*Eragrostis erosa*), and soaptree yucca (*Yucca elata*) (Sullivan, 1996).

Colorado chipmunks from more northerly locales generally breed in late spring (Bailey, 1932; Patterson, 1980); however, Oscura Mountains chipmunks appear to breed in early spring (Sullivan, 1996). Lactating females and juvenile animals were observed in mid-September, and females with embryos were collected in early April. The Oscura Mountains chipmunk appears to have a reproductive pattern intermediate between the Colorado chipmunk in northern New Mexico and the Organ Mountains chipmunk (Patterson, 1980; Sullivan, 1996). The early spring conception pattern of the Oscura Mountains chipmunk (Sullivan, 1996) is similar to that reported for the Organ Mountains chipmunk (Patterson, 1980) and appears to coincide with periods of reduced water stress and increased food production.

Both subspecies, similar to other chipmunks, are adept tree climbers but spend much of their time in and on brushy vegetation, limestone ledges, cliffs, woody debris, and rockpiles. They tend to be most active in early morning and late afternoon.

**Current Status:** The Organ Mountains chipmunk was approved for listing as threatened by the New Mexico State Game Commission in 1983 (Jones and Schmitt, 1997). In 1987, NMDGF proposed the addition of the Oscura Mountains population of Colorado chipmunks based on a study by Sullivan and Yates (1987) that indicated the Oscura Mountains chipmunks were most closely related to chipmunks in the Organ Mountains. The Oscura Mountains population was included within the listing of the Organ Mountains subspecies in 1988 (Jones and Schmitt, 1997) as an undescribed subspecies under the Organ Mountains chipmunk. The Oscura Mountains population was later described as a new subspecies, *T. q. oscuraensis,* by Sullivan (1996). The Organ Mountains population of chipmunks was estimated at 1,000 to 2,000 by Patterson (1980). No estimates have been attempted for the Oscura Mountains population, but surveys conducted in 2004-2005 suggest a small population (T. Griffin, personal communication, 2005). The most recent surveys of both populations were conducted by Rivieccio et al. (2003) using auditory detection; live-trapping proved to be largely ineffective.

**Threats:** These small, isolated chipmunk populations are extremely vulnerable to habitat loss or alteration. Excessive scientific collecting and disease (i.e., sylvatic plague) may also pose threats to these populations. The mosaic of piñon-juniper-oak woodland habitats of the Oscura Mountains chipmunk and the broken topography with limestone cliffs and ledges has a patchy distribution and is restricted to the west and northwest cliffs in the Oscura Mountains (Sullivan, 1996). Because of the localized and patchy distribution of this habitat, the most immediate threat to this species is destruction of natural habitat by human activities and wildfire.

**Recommendations:** No change in the listing status of the Organ Mountains Colorado chipmunk (considered to include the Oscura Mountains population) is recommended. Coordination with White Sands Missile Range in monitoring of the Oscura Mountains chipmunk should be continued. The use of predictive habitat models and auditory detection methods (following Rivieccio et al., 2003) in monitoring of the two populations is recommended. To clarify the current taxonomy and protected status of these two populations, it is also recommended that provisions under the WCA be initiated in the near future to list the Oscura Mountains chipmunk, *T. q. oscuraensis,* as a threatened subspecies rather than continuing to list it as an undescribed form under the Organ Mountains subspecies of Colorado chipmunk. Use of the genus *Neotamias* for all species of chipmunk in New Mexico conforms with Frey (2004); however, other authorities (e.g., Thorington and Hoffmann, 2005) assign all these species to the genus *Tamias*. Because this taxonomic issue is unresolved, we recommend continued use of *Neotamias*.

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**Southern pocket gopher, *Thomomys umbrinus***

**Distribution:** The known distribution of the southern pocket gopher is restricted to a few mountain ranges in southeastern Arizona and the Animas Mountains in New Mexico (Findley et al., 1975; Hinesley and Thaeler, 1977; Cook, 1982, 1986; Hoffmeister, 1986). In New Mexico, the species has been found mostly at elevations above 7200 ft in the Animas Mountains as well as at lower elevations along creeks in that area (Hinesley and Thaeler, 1977; Cook, 1982, 1986). The Animas Mountains population has been recognized as a distinct subspecies (*T. u. emotus*). A recent survey for this species or other pocket gophers in the Big Hatchet Mountains, east of the Animas Mountains, was unsuccessful in detecting southern pocket gopher (Geluso, 2006)

Pocket gophers are fossorial (i.e., live primarily underground) and eat roots of various plant species that are encountered as they dig their burrow systems. The presence of pocket gophers is typically evidenced by mounds of fresh soil which are pushed out of their burrows. They are generally not social, and the only time that individuals coexist in the same burrow system occurs when females are caring for their young. They are polygamous and breeding may occur more than two times in a year (Hall, 1981). Cook (1982, 1986) found pregnant females between mid-March and early April, with 2-3 embryos in each specimen.

**Current Status:** The New Mexico State Game Commission approved the listing of the southern pocket gopher as endangered in 1975 (Jones and Schmitt, 1997). The primary reasons for listing the species were endemism and its very restricted distribution in New Mexico. The species is difficult to survey because of its fossorial nature, the relative inaccessibility of its habitat, and its co-occurrence with a closely-related species (Botta's pocket gopher,

*Thomomys bottae*) in parts of its range. Part of its range in the Animas Mountains was affected by the Adobe Fire in May-June 2006, although active burrow mounds in partially burned areas and in post-fire debris flows were noted in October 2006 (J. Stuart, pers. observ.). There are no population estimates for this species in New Mexico.

**Threats:** The species is restricted to a remote area of private land and is not threatened by habitat development or other human activities. Wildfire likely poses the greatest threat to persistence in the Animas Mountains, although the species is likely resilient in this regard. At present, the area of occurrence in New Mexico appears to be secure.

**Recommendation:** No change in the current listing status of the southern pocket gopher is recommended. Periodic surveys (every 5-10 years) should be conducted in the Animas Mountains to determine distribution and population status. Additional surveys in the Peloncillo and Big Hatchet mountains may be warranted to determine if the species is more widespread than known.

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**American marten, *Martes americana***

**Distribution:** The American marten, also known as pine marten, is widely distributed across North America, and occurs from Alaska to New Brunswick, southward to California and New Mexico and eastward to New York (Hall, 1981). In New Mexico, the species is known only from the north-central mountains including the San Juan and Sangre de Cristo ranges (Findley et al. 1975). Reports of marten in the Jemez Mountains have not been substantiated. Habitat in New Mexico includes mature, high elevation spruce-fir (*Picea-Abies*) forests (Bailey, 1932; Findley et al., 1975). Mature/old-growth spruce-fir forests with greater than 30% canopy cover and abundant coarse woody debris (i.e., snags, down fall, etc.) have been identified as preferred marten habitat throughout the range of the species (Clark and Stromberg, 1987). Martens may avoid large clearings such as clear cuts or burned areas (Koehler and Hornocker, 1977; Soutiere, 1979).

The summer diet of marten is varied and includes mammals, birds, eggs, fish, insects, and carrion (Buskirk and Ruggiero, 1994). Soft mast and berries are eaten in the fall, and small mammals, including red-backed voles (*Clethrionomys gapperi*), voles (*Microtus* spp.), golden-mantled ground squirrels (*Spermophilus lateralis*), and red squirrels (*Tamiasciurus hudsonicus*) comprise the majority of their winter diet (Buskirk and Ruggiero, 1994). Female marten reach sexual maturity at 15 months and produce a single litter of 3-4 in spring (Clark and Stromberg, 1987). The gestation period of 8-9 months is long due to delayed implantation.

**Current Status:** The American marten was approved for listing as threatened by the New Mexico State Game Commission in 1975 (Jones and Schmitt, 1997). Martens reach the southern limit of their geographic distribution in New Mexico, where they are considered to be an uncommon resident species. The presence of this species in the

Sangre de Cristo Range in Taos County and San Juan Mountains in Rio Arriba County was reconfirmed in the 1990s through the collection of road-killed specimens; the species was also reported from the Taos Ski Valley during 1997-1999 (NMDGF, unpublished data). Recent surveys conducted by a Department contractor found marten in the Sangre de Cristo Range in the vicinity of Taos and Pecos, and in the San Juan Mountains near Chama. In 2003, Department personnel captured and radiocollared several marten in the vicinity of Taos Ski Valley (Long, 2003). Results from monitoring efforts suggest that there is a small resident population in this area, but it remains unclear as to whether this population is isolated from other populations in the Sangre de Cristos. In this study, radiocollared marten used mature spruce-fir forest and talus slopes at elevations between 10,000 and 11,500 ft in elevation.

**Threats:** American marten in New Mexico are vulnerable to habitat degradation or fragmentation through timber harvesting in mature/old-growth forests, removal of downed timber as part of fuels reduction projects or as firewood, wildfire, and destruction of talus slopes within the species' range. Catastrophic wildfire likely poses the greatest threat under present conditions in the state. Marten are also very susceptible to trapping, although there is currently no open season in New Mexico. Illegal take of marten may pose a minor threat in some areas.

**Recommendation:** No change in the current listing status of the American marten is recommended. Studies to better determine distribution, habitat use, population status, and population isolation in New Mexico are needed to inform forest management practices beneficial to the species.

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