ARIZONA GAME AND FISH DEPARTMENT
HERITAGE DATA MANAGEMENT SYSTEM

Animal Abstract **Element Code:** AAABH01080
Data Sensitivity: No

CLASSIFICATION, NOMENCLATURE, DESCRIPTION, RANGE

NAME: *Lithobates chiricahuensis* (Platz and Mecham, 1979)
COMMON NAME: Chiricahua Leopard Frog
SYNONYMS: *Rana chiricahuensis* Platz and Mecham, 1979
FAMILY: Anura: Ranidae

AUTHOR, PLACE OF PUBLICATION: Platz and Mecham. 1979. Copeia 1979:383-390.

TYPE LOCALITY: "Herb Martyr Lake (elev. 1768 m), 6 km W of Portal, Coronado National Forest, Cochise County, Arizona," USA.

TYPE SPECIMEN: HT: AMNH 100372. J.E. Platz, 10 September 1971.

TAXONOMIC UNIQUENESS: *Lithobates* is a large genus; the name of the genus was recently changed from "*Rana*" to "*Lithobates*". Once thought to be a single species, the *Pantherana* clade (informally termed as *Rana pipiens* complex) contains 30 species within Middle and North America and 7 species within Arizona (6 native and 1 introduced), (Hills 1988; Hillis and Wilcox 2005). The Mogollon Rim form of the Chiricahua leopard frog in central and east-central Arizona and west-central New Mexico, are disjunct from those in southeastern Arizona, and southwestern New Mexico and Mexico. In 2004, genetic analysis (mtDNA sequences) was used by Goldberg et al. to investigate the phylogenetic relationship of *Rana subaquavocalis* and *Lithobates chiricahuensis* from localities throughout their Arizona range. Hillis and Wilcox (2005), suggests that the Mogollon Rim populations may be referable to *R. fisheri* (a species described from southern Nevada, and considered extinct by many authors). They go on to state that "*Rana fisheri* appears to have been closely related to the Mogollon Rim populations of "*R. chiricahuensis*" based on morphological similarity, and the name *R. fisheri* may be applicable to these Mogollon Rim leopard frogs." If this is the case, then these disjunct populations would be separated by about 250 miles, which brings into question the genetic history of the other ranids found in between.

The *Rana subaquavocalis* samples from the Goldberg et al. (2004) study were on a short branch within the southern Arizona clade of *Lithobates chiricahuensis*. The results are consistent with the hypothesis that *chiricahuensis* and *subaquavocalis* are conspecific. (NatureServe 2006).

DESCRIPTION: A medium to large, stocky frog with adult lengths snout to vent from 5.0-13.5 cm (2.0-5.4 in); US Fish and Wildlife (USFWS) report 54 to 120 mm (2.1 to 4.7 in). A distinctive pattern on the rear of the thigh consists of small, raised, cream-colored spots or

tubercules on a dark background; the dorsal spots are generally smaller and more numerous than in other leopard frogs. The upper lip stripe is faint or absent in front of the eye, and the head and back are often green in coloration. Dorsolateral folds are broken toward the rear of the body, deflected medially (angling inward); skin is relatively rough on the back and the sides. The eyes are higher on the head and more upturned than other Arizona leopard frogs. The hind feet are webbed, and males have a swollen and darkened thumb base. The venter is a dull whitish or yellowish color, while gray mottling usually occurs on the throat and sometimes on the chest. The groin and lower abdomen are often yellow. (USFWS 2008). Platz (1988) notes that the "posterior surfaces of thighs have numerous small papilla, each surrounded by cream colored skin...adults have mottled venter and males along southern Arizona border have vestigial oviducts."

AIDS TO IDENTIFICATION: *Lithobates chiricahuensis* is similar to the northern leopard frog (*R. pipiens*), but stockier, with a more rounded head, shorter limbs, and slightly upturned eyes (Stebbins 1985). The call is a "snore" of unusually high pulse rate (about 34 pulse/sec at 22^{o} C). The call is often a single note lasting 1-3 seconds (depending on temperature), which is intermittently repeated and terminated by a "tail" produced by slight change in pitch (Frost and Platz 1983; Platz and Mecham 1984; USFWS accessed 2011)).

Lithobates chiricahuensis is sympatric with three members of the *R. pipiens* complex including the northern (*R. pipiens*), lowland (*R. yavapaiensis*), and plains (*R. blairi*) leopard frogs. Mecham (1968c, cited by Sredl *in* Lannoo 2005) found that in east-central Arizona, northern leopard frogs predominate in meadow-like habitats and Chiricahua leopard frogs predominate in rocky streams. In the Sulphur Springs Valley of southeastern Arizona, Frost and Bagnara (1977, cited by Sredl *in* Lannoo 2005) found plains leopard frogs to predominate in non-permanent and most semi-permanent tanks and sloughs, while Chiricahua leopard frogs predominate in permanent tanks and streams. Physically, *Rana pipiens* has a complete supralabial stripe and complete uninterrupted and undeflected dorsolateral folds, and adults have green pigment in the groin region, while males possess vestigial oviducts. Male *Lithobates chiricahuensis*, unlike *R. yavapaiensis*, possess prominent vestigial oviducts (Platz 1988).

ILLUSTRATIONS:

Color drawing (Stebbins 1985: plate 15)
Color photo (Degenhardt et al. 1996: plate 24)
Color photos (Brennan and Holycross 2006: p. 46)
Color photo (J. Rorabaugh, USFWS 2005: p. 41)
Color photos of frog and egg mass (William Leonard 2003, *in* AmphibiaWeb at http://amphibiaweb.org/cgi-bin/amphib_query?)
Color photo of egg mass (William Leonard 2003, *in* http://calphotos.berkeley.edu/cgi/img_query?)
Color photo (Suzanne L. Collins 2001, *in* CNAH 1994-2006 at http://www.naherpetology.org/detail.asp?id=1160)

Color photos of northern and southern forms (Tom Brennan, *in* J. Rorabaugh at AZ PARC 2006 http://www.reptilesofaz.com/Turtle-Amphibs-Subpages/h-r-chiricahuensis.html)
Color photos (Erik F. Enderson at http://www.arts.arizona.edu/herp/RACH.html)
Color photos (Brad Moon 1990 and 2003, at http://calphotos.berkeley.edu/cgi/img_query?)
Color photo of tadpole (Ronn Altig 1998 at http://calphotos.berkeley.edu/cgi/img_query?)

TOTAL RANGE: **Current:** The species current range is similar to its historical range, but is not well represented in many areas now, and has disappeared from some drainages and mountains ranges. At the time of listing (2002), the frog was likely extant at an estimated 87 and 31-41 localities in Arizona and New Mexico respectively. In 2008, it was estimated that the frog was extant at 49 and 30-35 localities in Arizona and New Mexico, respectively. This represents extirpation from 82-84 percent of its historical localities in the U.S. The status of the 34 collections in Mexico is poorly known. (USFWS 2008).

Historical: A total of 298 and 182 localities historically known for the species in Arizona and New Mexico, respectively. An additional 34 localities are known from Sonora and Chihuahua, Mexico. (USFWS 2008).

Mountain regions of central and southeastern Arizona, southwestern New Mexico, south into the Sierra Madre Occidental to Western Jalisco, Mexico from 1066-2408 m (3500-7900 ft), (Platz and Mecham 1979; Sredl et al. 1997).

RANGE WITHIN ARIZONA: Arizona range is divided into two areas, the northern population (Mogollon Rim population), which extends from montane areas in central Arizona, east and south along the Mogollon Rim to montane parts of west-southwestern New Mexico. The second population is located in the mountains and valleys south of the Gila River in southeastern Arizona and southwestern New Mexico, and extends into Mexico (adjacent Sonora) along the eastern slopes of the Sierra Madre Occidental.

SPECIES BIOLOGY AND POPULATION TRENDS

BIOLOGY: *Lithobates chiricahuensis* is a highly aquatic habitat generalist. Adults become active in February (Jennings 1988, 1990), and eggs are laid in spring and sporadically through the summer and fall. Males usually call above water, but may also advertise below water (Degenhardt et al. 1996). Their call consists of a 1-3 second long, low-pitched, hollow snore (Brennan and Holycross 2006). Home ranges for males (dry season mean = 161.0 m^2; wet season mean = 375.7 m^2) tend to be larger than those for females (dry season mean = 57.1 m^2; wet season mean = 92.2 m^2). Post-metamorphic Chiricahua leopard frogs are generally inactive from November through February; however, a detailed study of wintertime activity or habitat use has not been done. Although microsites for these hibernacula have not been studied, they likely over-winter near breeding sites. (Sredl, *in* Lannoo 2005). Life span and age at first reproduction are unknown, although preliminarily, skeletochronology of

Chiricahua leopard frogs indicate that they can live =/< 6 years (Durkin 1996, cited by Sredl *in* Lannoo 2005).

In 1998, chytrid fungus (see Additional Information) was first identified in amphibian populations in Arizona. Chytridiomycosis was documented in *Lithobates chiricahuensis* as early as 1992. As of 2000 (Sredl 2000, in Lannoo, 2005), "one salamander species, Sonoran tiger salamanders (*A. tigrinum stebbinsi*), seven species of ranid frogs (Rio Grande leopard frogs [*R. berlandieri*], plains leopard frogs, American bullfrogs, Chiricahua leopard frogs, Ramsey Canyon leopard frogs (now considered Chiricahua), Tarahumara frogs, and lowland leopard frogs), and one treefrog (Canyon treefrog), have been affected by this fungus. All outbreaks have been a cool season phenomena, and the pathogen is well distributed in central and southeastern Arizona (Sredl et al., 2000)." (Sredl *in* Lannoo 2005). The fungus may be responsible for some of the declines seen in their populations in Arizona and New Mexico.

Common predators of adults and juveniles include the non-native American bullfrog (*R. catesbeiana*), native and non-native fishes, garter snakes (*Thamnophis* sp.), great blue herons (*Ardea herodias*), and mammals including rats, coyotes, gray foxes, raccoons, ringtail cats, coatis, black bears, badgers, skunks, bobcats, and mountain lions. Tadpoles are likely preyed upon by aquatic insects, crayfish, native and non-native fishes, garter snakes, great blue herons, and other birds. (Sredl, *in* Lannoo 2005). Anti-predator mechanisms of adult and juvenile Chiricahua leopard frogs include hopping into water (Frost and Bagnara 1977, cited by Sredl *in* Lannoo 2005), and the unusual ability to profoundly darken their ventral skin under conditions of low albedo (reflectance) and low temperature (Fernandez and Bagnara 1991 and Fernandez and Bagnara 1993, cited by Sredl *in* Lannoo 2005). This trait is thought to aid in escape from predators by reducing the amount of attention that bright flashes of white ventral skin would bring in the clear, swift moving streams they inhabit (low albedo environments). Vegetation, undercut banks, root masses, and other cover sites would probably be important retreats from predators.

REPRODUCTION: At high elevation, *Lithobates chiricahuensis* breeds in late May through August (Zweifel 1968; Frost and Platz 1983). At lower, warmer localities, breeding occurs from mid-February through June and sporadically until September (Frost and Bagnara 1977; Frost and Platz 1983) and October. Scott and Jennings (1985) did not note a difference in the time of breeding and different elevations, but did find a relationship between the time of breeding and water temperatures at sites in New Mexico (Jennings 1988, 1990). Proximate cues that stimulate mating are not well studied, but oviposition has been correlated with rainstorms (Fernandez 1996) and changes in water temperature (Platz 1993).

Egg masses have been reported in all months, but reports of oviposition in June are uncommon (Sredl *in* Lannoo 2005). This may be due to lower water levels and higher temperatures before the summer rainy season begins. Females deposit 300-1485 eggs in spherical masses attached to submerged vegetation, suspended within 5 cm of the surface (Jennings and Scott 1991). Zweifel (1968b cited by Sredl *in* Lannoo 2005) noted the water temperature range for *Lithobates chiricahuensis* embryos was 12.0-31.5 ºC, while in New

Mexico R.D.J. (personal observations, cited by Sredl *in* Lannoo 2005) noted water temperatures ranged from 12.6 ºC at a stock tank to 29.5 ºC recorded at a warm spring. Eggs take approximately 14 days to hatch (Platz 1993), and larvae metamorphose in 3-9 months (Jennings 1988, 1990). Tadpoles are known to over-winter (Frost and Platz 1983).

An observation by Field and Groebner (2005) also documents that breeding can occur at higher elevations in ponds fed by warm springs. On February 21, 2002, they discovered two egg masses in a 0.2 ha spring fed pond at 2546 m (8350 feet) near Three Forks in Apache County. The masses were situated near a spring vent and the water temperature was 18° C. Temperatures 6 m away were 14°. Air temperature was 15° C with snow still on the ground and thin ice was present along the edges of the pond.

FOOD HABITS: Adults eat arthropods and other invertebrates (Stebbins 1985; Degenhardt et al. 1996). Larvae are herbivorous and likely eat available food items including algae, organic debris, plant tissue, and minute organisms in the water (Marti and Fisher 1998). Stomach analyses of other members of the leopard frog complex from the western United States show a wide variety of prey items, including many types of aquatic and terrestrial invertebrates (e.g., snails, spiders, and insects) and vertebrates (e.g., fish, other anurans [including conspecifics], small birds; Stebbins 1951). Field et al (2003) report observing an adult frog capturing and apparently consuming a hummingbird.

HABITAT: Historically: An inhabitant of cienegas, pools, livestock tanks, lakes, reservoirs, streams, and rivers at elevations of 1,000 – 2,710 m (3,281-8,890 ft) in central, east-central, and southeastern Arizona; west-central and southwestern New Mexico; and in Mexico, northwestern Sonora and the Sierra Occidental of northwestern Chihuahua.

Currently: They are often restricted to springs, livestock tanks, and streams in the upper portions of watersheds where non-native predators either have yet to invade or habitats are marginal. Distribution and habitat use in Mexico are poorly unknown.

ELEVATION: Elevations range from 1,000-2,710 m (3,281-8,890 ft) (Platz and Mecham, 1979; Sredl et al., 1997; USFWS 2008).

PLANT COMMUNITY: Wide variety of permanent and semi-permanent aquatic systems in oak, mixed oak and pine woodlands, but also chaparral, grassland, and desert habitats (Mecham 1968; Zweifel 1968; Frost and Bagnara 1977; Scott and Jennings 1985; Stebbins 1985; Sredl and Saylor 1998). Vegetation associated with egg masses includes: *Potamogeton* sp., *Rorippa* sp., *Echinochloa* sp., and *Leersia* sp. (Sredl *in* Lannoo 2005).

POPULATION TRENDS: Statewide decline. Local abundance appears to fluctuate greatly. Historically it occurred at 298 sites in Arizona, 182 in New Mexico, and an additional 34 in Mexico (USFWS 2008), which includes both northern and southern populations. Where present, populations are few, small, and widely scattered. The most serious threats to this species include predation by non-native organisms, especially bullfrogs, fishes, and crayfish;

and an introduced fungal skin disease (chytridomycosis or "Bd") that is killing frogs and toads around the globe (USFWS 2008). Possibly some disappearances from historical sites represent natural fluctuations rather than long-term declines caused by human impacts, but in most areas disappearances appear to reflect real, on-going declines. (USFWS 2000).

According to the 2004 Assessment (Santos-Barrera et al.) in 2006 IUCN Red List, "Listed as Vulnerable because of an observed population decline, estimated to be more than 30% over the last three generations, inferred from a shrinkage in distribution due to habitat destruction and degradation, and the effects of exotic species, disease, and unknown factors. The generation length is estimated to be five years."

SPECIES PROTECTION AND CONSERVATION

ENDANGERED SPECIES ACT STATUS:
LT under genus *Lithobates* with Critical Habitat (USDI, FWS 2012)
[PT under genus Lithobates with proposed Critical Habitat (USDI, FWS 2011)]
[LT under genus *Rana* (USDI, FWS 2002)]
[PT USDI, FWS 2000]
[C USDI, FWS 1996]
[C1 USDI, FWS 1994]
[C2 USDI, FWS 1991]

STATE STATUS:
1A (AGFD SWAP 2012)
WSC (AGFD, WSCA in prep)
[State Candidate AGFD, TNW 1988]

OTHER STATUS:
Not Forest Service Sensitive (USDA FS Region 3 2007)
[Forest Service Sensitive USDA, FS Region 3 1988, 1999]
Determined Threatened (Secretaría de Medio Ambiente 2000, 2010)
[Listed Threatened, Secretaría de Desarrollo Social 1994]
VU (Santos-Barrera in et al. IUCN Red List 2006)

MANAGEMENT FACTORS: Most serious threats to this species include an introduced fungal skin disease (Chytridomycosis (chytrid)), predation by non-native species, especially bullfrogs, fishes (e.g. sport fish) and crayfish. Other threats include drought, floods, wildfires, degradation and destruction of habitat, water diversions and groundwater pumping, disruption of metapopulation dynamics (relationships among populations of frogs), an increased chance of extirpation resulting from small numbers of populations and individuals, and environmental contamination. (USFWS 2008). The chytrid fungus has also infected 8 other

amphibians including six other ranid frogs, causing mass die-offs and local extirpations (Sredl et al. 2000).

PROTECTIVE MEASURES TAKEN: Chiricahua leopard frogs are a closed season species. Collection of leopard frogs requires a specific or similar permit (Arizona Game and Fish Department 2001). *Lithobates chiricahuensis* has been listed as threatened under the Endangered Species Act of 1973 (USDI, FWS 2002), with a Draft Recovery Plan released in April 2006 (USFWS 2005).

U.S. Fish and Wildlife designated Critical Habitat throughout much of their range in Arizona and New Mexico, while re-confirming the Threatened status under the new taxonomy *Lithobates* (USFWS, 2012).

SUGGESTED PROJECTS: Priority research topics include identification of the importance of disease, pesticides and other contaminants, climate change, UV radiation, fire management, and possibly other threats to the status and recovery potential of the Chiricahua leopard frog.

Life history studies needed include those on breeding migrations; proximate cues that stimulate mating; hatching time of egg masses; age and size at reproductive maturity (which are poorly known); juvenile habitat preference and use; and comprehensive studies on the feeding behavior or diet of Chiricahua leopard frog larvae or adults.

Additional studies are need on the mechanisms by which Chiricahua leopard frogs survive the loss of surface water; relationship between Chiricahua leopard frogs and non-native predators; wintertime activity or habitat use - these frogs likely over-winter near breeding sites, although microsites for these hibernacula have not been studied; and additional behavioral and morphological work to accompany the genetic work that has been done to separate the northern population to its own specific (species) level.

LAND MANAGEMENT/OWNERSHIP: BLM – Tucson Field Office; USFS - Apache-Sitgreaves, Coconino, Coronado, and Tonto National Forests; USFWS – Buenos Aires and San Bernardino National Wildlife Refuges; State Land Department; AGFD - Cunningham Tracts and Sipe White Mountain Wildlife Area; TNC – Canelo Hills Cienega and Muleshoe Ranch Preserves; Audubon Research Ranch; Private.

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MAJOR KNOWLEDGEABLE INDIVIDUALS:

J.E. Platz - Creighton University, Omaha, Nebraska.
Phil Rosen - University of Arizona, Tucson, Arizona.
Mike Sredl - Arizona Game and Fish Department, Phoenix, Arizona.
Richard, Zweifel - Portal, Arizona.

ADDITIONAL INFORMATION:

Lithobates is from Greek and is composed of two words, 'litho' meaning 'stone', and bates 'to walk'. The species name *chiricahuensis* New Latin (NL) and references the type locality, the Chiricahua Mountains, Arizona. The former genus name *Rana* (true frog) is Latin, and probably mimics how the Romans heard their call. (Beltz, 2006).

"Chytridiomycosis is a recently recognized cutaneous infection of both wild frogs and toads (Berger et al., 1998; Bosch et al., 2000) and captive frogs (Pessier et al., 1999) caused by the fungal agent *Batrachochytrium dendrobatidis*. … Clinical signs include lethargy, abnormal posture, loss of the righting reflex, and death (Daszak et al., 1999). The infection results in a severe diffuse dermatitis characterized by epidermal hyperplasia, hyperkeratosis, and variable degrees of cutaneous ulceration and hyperemia." (Bradley et al., 2002).

Recovery Criteria (USFWS 2005): The Chiricahua leopard frog will be considered for delisting when the following quantitative criteria are met in each Recovery Unit (RU):

1. At least two metapopulations located in different drainages (defined here as USGS 10-digit Hydrologic Units) plus at least one isolated and robust population in each RU exhibit long-term persistence and stability as demonstrated by a scientifically acceptable population monitoring program.
2. Aquatic breeding habitats, including suitable, restored, and created habitats necessary for persistence of metapopulations and isolated populations identified in criterion 1, are protected and managed in accordance with the recommendations in this plan.
3. The additional habitat needed for population connectivity, recolonization, and dispersal is protected and managed for Chiricahua leopard frogs, in accordance with the recommendations of this plan.
4. Threats and causes of decline have been reduced or eliminated, and commitments of long-term management are in place in each RU such that the Chiricahua leopard frog is unlikely to need protection under the ESA in the foreseeable future.

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