ARIZONA GAME AND FISH DEPARTMENT
HERITAGE DATA MANAGEMENT SYSTEM

Animal Abstract **Element Code:** AAABH01080
Data Sensitivity: Yes

CLASSIFICATION, NOMENCLATURE, DESCRIPTION, RANGE

NAME: *Rana chiricahuensis* (Platz and Mecham, 1979)
COMMON NAME: Chiricahua Leopard Frog; Wright's Leopard Frog; Ramsey Canyon Leopard Frog
SYNONYMS: *Lithobates chiricahuensis* Platz and Mecham, 1979; *Lithobates subaquavocalis* (Platz, 1993); *Rana subaquavocalis* Platz, 1993
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: *Rana* is a large genus. 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), (Hillis 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.

Frost et al. (2006) recognized *Lithobates* (Anura: Ranidae) for all species of North American "*Rana*" not placed in *Rana* sensu stricto. The Raninae revision by Che et al. (2007) also placed this species in *Lithobates*. Although Crother (2008) accepted this change, others expressed a reluctance to accept this taxonomy (Hillis 2007, Wiens et al. 2009). Hillis and Wilcox (2005) provided a phylogenetic taxonomy that retained the species now under *Lithobates* within *Rana*. The nomenclature of North American ranids continued to be debated (Dubois 2007, Pauly et al. 2009, Frost et al. 2009), without resolution. Fouquette and Dubois (2014) suggested *Lithobates* be considered a subgenus of *Rana*, and Yuan et al (2016) suggested returning *Lithobates* to *Rana*. Crother (2017) suggested the best course of action was to hold this taxonomic change in abeyance and retained the use of *Lithobates*, as does Frost (2021). Holycross et al. (2022a, 2022b) and Arizona Game and Fish Department (2022) follow Yuan et al. (2016), using *Rana*, so HDMS uses *Rana* for the genus.

R. subaquavocalis, here included in *R. chiricahuensis*, formerly was regarded as a distinct species. Goldberg et al. (2004) used mtDNA sequences to investigate the phylogenetic relationship of *subaquavocalis* and *chiricahuensis*, based on 39 samples of *subaquavocalis*

and 53 samples of *chiricahuensis* from localities throughout their Arizona range. They found two distinct lineages of *chiricahuensis*, one on the Mogollon Rim of central Arizona and one in southern Arizona. *R. subaquavocalis* samples were on a short branch within the southern Arizona clade of *chiricahuensis*. The results are consistent with the hypothesis that *chiricahuensis* and *subaquavocalis* are conspecific (NatureServe 2006). Based on this evidence, Crother (2008) and Frost (2009) regarded *subaquavocalis* as a synonym of *chiricahuensis*.

Hillis and Wilcox (2005), suggested 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. Based on analyses of mtDNA and a single nuclear gene, Hekkala et al. (2011) suggested the probable conspecificity of *R. fisheri* (Vegas Valley Leopard Frog) and *R. chiricahuensis* (Chiricahua Leopard Frog). Holycross et al. (2022b) felt that the balance of the evidence supports conspecifity, although other interpretations are possible, and used *R. fisheri*. Some biologists remain unconvinced of the conspecificity of *R. fisheri* and *R. chiricahuensis* and continue to use *R. chiricahuensis*. U.S. Fish and Wildlife Service (2012) noted that the phylogenetic tree in Hekkala et al. (2011) is a subset of a larger phylogenetic tree that is still under construction and recommended making no changes until the more comprehensive phylogeny is available. As a subset, the resolution of the data is not sufficient to support recognizing individual populations of *L. chiricahuensis* as *L. fisheri*. Therefore, the species continues to be listed under the ESA as *chiricahuensis* (USFWS 2012), and HDMS continues to use *R. chiricahuensis*.

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. 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: *R. 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° 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)).

R. 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 (1968) 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) 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 *R. 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. 45)
Color photos (Holycross et al. 2022a: p. 49)
Color photo (J. Rorabaugh, USFWS 2005: p. 41)
Color photos (Murphy 2018: pp. 48-49)

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 mountain ranges. At the time of listing (USDI, FWS 2002), the frog was likely extant at an estimated 87 and 31-41 localities in Arizona and New Mexico respectively. Based on 2010 data, the species still occurs in most major drainages in Arizona and New Mexico where it occurred historically with the exception of the Little Colorado River drainage in Arizona (USDI, FWS 2012). In Arizona and New Mexico, the species likely occurs at about 14 and 16 to 19 percent of its historical localities, respectively (USDI, FWS 2007) The distribution of the species in Mexico is unclear due to limited survey work and the presence of closely related taxa in the southern part of the range of the Chiricahua leopard frog (USDI, FWS 2012).

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. Mountain regions of central and southeastern Arizona, southwestern New Mexico, south into the Sierra Madre Occidental to Western Jalisco, Mexico from 1,066 – 2,408 m (3,500 – 7,900 ft), (Platz and Mecham 1979; Sredl et al. 1997).

RANGE WITHIN ARIZONA: Arizona range is divided into two areas including the northern-montane populations and the southern group of populations (i.e. the majority of the species' range) (USDI, FWS 2007). The northern population (Mogollon Rim population), which extends from montane areas in central Arizona, east and south along the Mogollon. The second population is located in the mountains and valleys south of the Gila River in southeastern Arizona (USDI, FWS 2007). The counties the Chiricahua leopard frog has been found in include: Maricopa, Pima, Santa Cruz, Cochise, Graham, Greenlee, Apache, Gila, Navajo, Coconino, and Yavapai.

SPECIES BIOLOGY AND POPULATION TRENDS

BIOLOGY: *R. 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 and Jennings 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 1995, cited by Sredl and Jennings 2005).

Chytrid fungus (see Additional Information) was first identified in amphibian populations in Arizona in 1998 (Milius 1998). Chytridiomycosis was documented in *Rana chiricahuensis* as early as 1992. As of 2000, species affected ty this fungus are Sonoran tiger salamanders (*Ambystoma 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 Canyon treefrog (Sredl and Jennings 2005). All outbreaks have been a cool season phenomena, and the pathogen is well distributed in central and southeastern Arizona (Sredl et al. 2000, cited by Sredl and Jennings 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 and Jennings 2005). Anti-predator mechanisms of adult and juvenile Chiricahua leopard frogs include hopping into water (Frost and Bagnara 1977), 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 and Jennings 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, *R. 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 and Jennings 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. Zweifel (1968) 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 and Jennings 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 2,546 m (8,350 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:

Historical: 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.

Current: 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).

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 and Jennings 2005).

POPULATION TRENDS: In the 5-year review (USDI, FWS 2011b), the USFWS suggests that the status of the Chiricahua leopard frog is at least stable and probably improving in Arizona, declining in New Mexico, and unknown in Mexico However, local abundance appears to fluctuate. If increasing trends are real, they may represent population response to temporarily favorable environmental conditions, such as adequate summer rains that allow dispersal, rather than an intrinsic improvement that will improve over time (USDI, FWS 2011b). In their 2022 assessment, the IUCN considered population trends to be decreasing (IUCN SSC Amphibian Specialist Group 2022). However, significant progress has been made in securing existing populations and establishing new populations. If the range-wide status of the species declines in the future, endangered status should be considered (USDI, FWS 2011b).

Historically it occurred at 298 sites in Arizona, 182 in New Mexico, and an additional 34 in Mexico, 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 2007). 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. (USDI, FWS 2000). Precisely how the Chiricahua leopard frog will be affected by climate change is unclear, in part because of interrelated and indirect effects revolving around the response of non-native predators and disease to climate change, the frog’s two most significant threats at this time (USDI, FWS 2011b).

In the Chiricahua Mountains of southeastern Arizona, there has been an expansion of nonnative predatory vertebrates and a decline of Chiricahua leopard frogs over the previous two decades. Chiricahua leopard frogs were primarily limited to habitats subject to drying or near drying, such as stock tanks. Although these habitats are not favored by non-native predatory fishes and American bullfrogs, they are still unstable aquatic habitats and therefore marginal for leopard frogs (USDI, FWS 2007).

SPECIES PROTECTION AND CONSERVATION

ENDANGERED SPECIES ACT STATUS:
LT with Critical Habitat, as *Lithobates* (USDI, FWS 2012)
[PT with proposed Critical Habitat, as *Lithobates* (USDI, FWS 2011a)]
[LT (USDI, FWS 2002)]
[PT USDI, FWS 2000]
[C* (USDI, FWS 1999)]
[C (USDI, FWS 1996, 1997)]
[C2 (USDI, FWS 1991, 1994)]

STATE STATUS:
1 (AZGFD, AWCS 2022)
[1A (AGFD SWAP 2012)]
[WSC (AGFD, WSCA 1996 in prep)]
[State Candidate AGFD, TNW 1988]

OTHER STATUS:
Not Forest Service Sensitive (USDA, FS Region 3 2013)
[Forest Service Sensitive (USDA FS Region 3 2007)] *Rana subaquavocalis*
[Forest Service Sensitive (USDA, FS Region 3 1999)] *R. chiricahuensis* and *R. subaquavocalis*
[Forest Service Sensitive (USDA, FS Region 3 1988)]
Bureau of Land Management Sensitive, as *Lithobates* (USDI, BLM AZ 2017)
Determined Threatened (Secretaría de Medio Ambiente 2000, 2010)
[Listed Threatened, Secretaría de Desarrollo Social 1994]
VU (IUCN, IUCN SSC Amphibian Specialist Group 2022)

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. (USDI, FWS 2007). In Arizona, chytridiomycosis has been reported from four populations of Chiricahua leopard frogs (USDI, FWS 2007). 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). *R. 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 (USDI, FWS 2005). The Ramsey Canyon leopard frog conservation agreement and strategy is an example of collaborative efforts to recover what are considered to be Chiricahua leopard frogs. Efforts by USFWS, AZGFD, the Coronado National Forest, Fort Huachuca, The Nature Conservancy, The Phoenix Zoo, private interest (e.g. Beattys, Rutherfords, Ann Craven, Sarah Barchas), and other partners have likely prevented this species from going extinct (USDI, FWS 2007).

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* (USDI, FWS 2012) with *subaquavocalis* synonymized with *chiricahuensis*. Although a formal taxonomic revision has not been published in the Federal Register, USFWS uses *Rana chiricahuensis* in the most recent announcement initiating a 5-year status review (USDI, FWS 2022) and in the Environmental Conservation Online System (ECOS).

Three Safe Harbor Agreements (SHAs) are in place for the Chiricahua leopard frog. The three SHAs are: Malapai Borderlands Group (i.e. two ranches participating at 26,390 acres total) – extreme Southeast Arizona and Southwest New Mexico (USDI, FWS 2004), Leslie Canyon Watershed (Bar Boot Ranch/99 Bar Ranch) (USDI, FWS 2008), and Arizona Game and Fish Department (AZGFD) (six properties participating at 32,654 acres total) – statewide SHA covering the entire range of the frog in AZ (AZGFD and FWS 2006).

Re-introduction efforts for *R. chiricahuensis* have included the release of captively-reared frogs in the Upper East Verde River Management Area (UEVRMA), Arizona, and Black River Management Area (BRMA), Arizona-New Mexico. Re-introductions were highly successful at UEVRMA but failed at BRMA (Srdel et al. 2011). In an attempt to reverse population declines at Pajarita Wilderness and the Alamo-Pena Blañca-Peck Canyon Management Areas, Arizona, USA and Mexico, efforts to eradicate *R. catesbeiana* were initiated in 2008 with post-removal monitoring indicating confirming eradication by 2010. After eradication of *R. catesbeiana*, *R. chiricahuensis* populations expanded into sites previously unsuitable due to the presence of *R. catesbeiana* (Sredl et al. 2011).

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 (USDI, FWS 2007). The research project "Efficacy of using a Bacterial Microbe as a Strategy for Resisting *Batrachochytrium dendrobatidis* infection in the Chiricahua leopard frog (*Rana chiricahuensis*) was funded in 2009. It is hoped that this 'probiotics' study may lead to a treatment for chytridiomycosis that would be effective for wild populations of frogs (USDI, FWS 2011b).

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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ADDITIONAL INFORMATION:

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

Chytridiomycosis is a recognized cutaneous infection of frogs and toads caused by the fungal agent *Batrachochytrium dendrobatidis* (Berger et al. 1998; Bosch et al. 2000, Bradley et al. 2002). 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 (USDI, FWS 2005; USDI, FWS 2007; USDI, FWS 2011b): 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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