ARIZONA GAME AND FISH DEPARTMENT
HERITAGE DATA MANAGEMENT SYSTEM

Animal Abstract **Element Code:** AAABH01250
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CLASSIFICATION, NOMENCLATURE, DESCRIPTION, RANGE

NAME: *Rana yavapaiensis* Platz and Frost, 1984
COMMON NAME: Lowland Leopard Frog, Yavapai Leopard Frog, San Felipe Leopard Frog
SYNONYMS: *Lithobates yavapaiensis* (Platz and Frost, 1984), *Rana pipiens* complex (lowland form)
FAMILY: Anura: Ranidae

AUTHOR, PLACE OF PUBLICATION: Platz and Frost, 1984. Copeia, 1984: 940-948.

TYPE LOCALITY: "Tule Creek (elev. 670 m), 34º 00', 112º 16', Yavapai County, Arizona", USA.

TYPE SPECIMEN: HT: AMNH 117632. J.E. Platz, 25 August 1971.

TAXONOMIC UNIQUENESS: *Rana* is a large genus, including Old and New World species (Stebbins 1985). The *Rana pipiens* complex was separated and contains nearly 30 species in North America and 7 species within Arizona (6 native and 1 introduced) (Hillis 1988). Distinguishing these 7 leopard frogs in Arizona has been problematic, mainly because they are similar in appearance and can inhabit the same locality (Platz and Platz 1973; Platz and Frost 1984; Jennings 1988; Jaeger et al. 2001). *R. yavapaiensis* is very similar to *R. onca* (Relict leopard frog); although Rorabaugh (2006) suggested the two may be the same species, Oláh-Hemmings et al (2010) found no admixing of *R. onca* and *R. yavapaiensis* haplotypes from sites in Nevada, Arizona, and northern 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.

DESCRIPTION: A leopard frog of relatively small size, ranging from 1.8-3.4 in (4.6-8.6 cm) SVL; males are smaller than females with maximum lengths of about 2.8 in (7.2 cm) SVL. This is typically a brown frog, although some are green, particularly on the head. Usually there are no spots on the snout. There is often a yellowish wash to the groin area that many times extends onto the posterior venter and underside of the legs. The rear of the thigh has a dark brown and tight reticulate pattern. Adult males lack prominent vocal sacs, and a darkened thumb base. Dorsolateral folds are present, prominent, and lighter in color than the dorsum, broken and inset toward the rear. The upper-lip stripe is incomplete or vague (diffuse anterior to the eye), and the skin is tuberculate. The call is a series of high-pitched chuckles (*tuck-tuck-tuck*) that are not very loud and are similar to that of the Plains (*R. blairi.*) and Relict (*R. onca*) leopard frogs. (Platz 1988; Rorabaugh 2006; Stebbins 2003). The pulse rate is almost as low as that of *R. blairi*, but the repetition rate is faster, 10-16 pulses per second rather than 4-7. They also exhibit short guttural grunting sounds suggestive of rubbing an inflated rubber balloon. (Stebbins 2003).

AIDS TO IDENTIFICATION: *Rana yavapaiensis* is similar to *R. chiricahuensis* (Chiricahua leopard frog), but is biochemically distinct. The dorsolateral folds, tuberculate skin, and usually vague upper-lip strip is as in *R. chiricahuensis*, however, *R. chiricahuensis* has a more prominent vocal sac and dark thighs with a scattering of light spots rather than a dark network. (Stebbins 2003). *R. yavapaiensis* is most similar genetically to *R. onca* (Jaeger et al. 2001), and adult *R. onca* have "incomplete, indistinct, dorsolateral folds extending 1/2 to 3/4 of the way down the dorsum, ... shortened legs, an incomplete supralabial stripe, and upper surfaces of the thighs usually spotted rather than barred" (Jennings 1988).

Rana yavapaiensis can be distinguished from the 6 other species of leopard frogs within its range. "*Rana blairi* has a complete supralabial stripe extending anteriorly to the tip of the snout. *Rana pipiens* has a complete supralabial stripe, complete dorsolateral folds uninterrupted and undeflected in the sacral region. Adult *R. pipiens* may have green pigment in the groin region and males possess vestigial oviducts. The posterior surfaces of the thighs in *R. chiricahuensis* have numerous small papilla, each surrounded by cream-colored skin. Adult *R. chiricahuensis* have a mottled venter, and males along the southern Arizona border have vestigial oviducts. *R. berlandieri* is native to New Mexico and was unintentionally introduced in recent years to southwestern Arizona. Males, unlike *R. yavapaiensis,* possess prominent vestigial oviducts" (Platz 1988).

ILLUSTRATIONS:

Color drawing (Stebbins 1985: plate 15)
Color drawing (Stebbins 2003: plate 17)
Black and white photo (Platz and Frost 1984; p. 941)
Color photo (Tom Brennan, Randy Babb, and Jim Rorabaugh *in* Online field guide to the reptiles and amphibians of Arizona https://live-reptilesofaz.pantheonsite.io/turtle-amphibs-subpages/h-l-yavapaiensis/)
Color photos (Brennan and Holycross 2006: p. 456)
Color photos (Holycross et al. 2022a: p. 49)

Color photos (Murphy 2018: p. 55)

TOTAL RANGE: Currently found in central and southeastern Arizona below the Mogollon Rim, southwest New Mexico (Gila River and Rio San Francisco), and probably northern Sonora and northwestern Chihuahua, Mexico. (Stebbins 2003; Sredl 2005).

Historically, *R. yavapaiensis* ranged from northwestern Arizona through central and southeastern Arizona, southwestern New Mexico, and northern Sonora, Mexico. Populations were also known from southwestern Arizona and southeastern California along the lower Colorado River and in the Coachella Valley (Platz and Frost, 1984; Platz 1988; Jennings 1995; cited by Sredl 2005). Because of the problem with identifying leopard frogs in southwestern Utah, southeastern Nevada, and extreme northwestern Arizona, this account follows the taxonomy of Jaeger et al. (2000) and considers frogs of the Virgin River downstream into the Black Canyon of the Colorado River below Hoover Dam in Nevada to be relict leopard frogs (*R. onca*). (Sredl 2005). "Vitt and Ohmart (1978) surveyed numerous localities along the lower Colorado River and concluded that populations of leopard frogs, which would now be considered lowland leopard frogs, in that area may be extinct. All post-1980 records from the lower Colorado River and in the vicinity of the Salton Sea have turned out to be Rio Grande leopard Frogs (*R. berlandieri*), which have established themselves in the lower Colorado River and Gila River to Phoenix, Arizona (Plat et al. 1990; Jennings and Hayes 1994a; Rorabaugh et al. 2004)" (Sredl 2005).

RANGE WITHIN ARIZONA: Found in central and southeastern part of state, with close to 60 % of all localities occurring in Gila, Maricopa and Yavapai counties (central Arizona below the Mogollon Rim). They are now absent from the lower Colorado River, and have declined significantly in southeastern Arizona. (Rorabaugh 2006).

SPECIES BIOLOGY AND POPULATION TRENDS

BIOLOGY: Where their range overlaps with the Chiricahua Leopard Frog (*R. chiricahuensis*), hybridization may occur. The two frogs hybridize in California Gulch and Big Casa Blanca Canyon, Santa Rita Mountains, Santa Cruz County. (Stebbins 2003).

Size at metamorphosis for *R. yavapaiensis* ranges from 25-29 mm (0.9-1.2 in) SVL (Platz 1988). The smallest males to exhibit secondary sexual characteristics from study sites in Graham and Yavapai counties, Arizona were 53.5 mm (2.1 in) and 56.2 mm (2.2 in) SVL, respectively (Sredl unpublished data). Size at which females reach sexual maturity is not known. Females have a mean asymptotic SVL of 76.4 mm (3.0 in), while that of males is 63.1 mm (2.5 in) (Sredl et al. 1997a).

Preliminarily, skeletochronology of *R. yavapaiensis* indicate that they can live as long as 3 years (Sredl and Fernandez unpublished data). Estimates of survivorship of the adult and juvenile stages appear to follow a seasonal pattern (Sredl et al. 1997a; Sredl 2005), high in the spring and summer and lower in the fall and winter. Within any given year, survivorships

were always lowest in the winter. In 3 of 4 years for which there were estimates for all four intervals, wintertime survivorship was by far the lowest; this pattern held for both adults and juveniles. In populations examined, sex ratios generally do not differ from 1:1 (Sredl et al. 1997a).

REPRODUCTION: Reproduction is aquatic. Breeding migrations have not been noted in *R. yavapaiensis* as have been described for some amphibians. In Arizona, frogs breed primarily from January to May, with additional breeding occurring in some populations in summer and early fall after the onset of the summer rains. (Sredl unpublished data; Rorabaugh 2006). Male lowland leopard frogs attract a potential mate by emitting an airborne call consisting of a series of low pulses lasting 3-8 seconds (Platz and Frost 1984). Proximate cues that stimulate mating in *R. yavapaiensis* are not well studied, although rainfall and water temperature have been mentioned as cues for other leopard frog species in the Southwest. Egg masses have been observed from January through late April and October (Ruibal 1959; Collins and Lewis 1979; Frost and Platz 1983). Females deposit spherical masses attached to submerged vegetation, bedrock, or gravel. Eggs usually are deposited near the surface of the water (Sartorius and Rosen 2000). Clutch size has not been studied in *R. yavapaiensis*. Egg masses have been observed to hatch in the wild in 15-18 days (Sartorius and Rosen 2000). Larvae metamorphose in as little as 3-4 mo or as long as 9 mo, and can overwinter (Collins and Lewis 1979; Sredl unpublished data); size at metamorphosis ranges from 25-29 mm SUL (Platz 1988). Altig et al. (1998) describes the tadpoles of *R. yavapaiensis*.

FOOD HABITS: Adults eat arthropods and other invertebrates (Stebbins 1985; Degenhardt et al. 1996). Larvae are herbivorous and likely eat algae, organic debris, plant tissue, and minute organisms in 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], and small birds) (Stebbins 1951).

HABITAT: *Rana yavapaiensis* inhabit aquatic systems in desert grasslands to pinyon-juniper (Platz and Frost 1984). They are habitat generalists and breed in a variety of natural and man-made aquatic systems. Natural systems include rivers, permanent streams, permanent pools in intermittent streams, beaver ponds, cienegas (=wetlands), and springs, while man-made systems include earthen cattle tanks, livestock drinkers, canals, irrigation sloughs, wells, mine adits, abandoned swimming pools, and ornamental backyard ponds (Platz and Frost 1984; Scott and Jennings 1985; Sredl and Saylor 1998). Most historical localities are small to medium-sized streams and rivers (Jennings 1987; Sredl and Saylor 1998). In lotic habitats, they are concentrated at springs, near debris piles, at heads of pools, and near deep pools associated with root masses (Jennings 1987; Sredl unpublished data).

The role of habitat heterogeneity within the aquatic and terrestrial environment is unknown, but likely important. Shallow water with emergent and perimeter vegetation provides basking habitat and deep water, root masses, undercut banks, and debris piles provide refuge from

predators and potential hibernacula (Jennings 1987; Platz 1988; Jennings and Hayes 1994a; Sredl unpublished data). In semi-permanent aquatic systems, *R. yavapaiensis* may survive the loss of surface water by retreating into deep mud cracks, mammal burrows, or rock fissures (Howland et al. 1997). In southeast Arizona, frogs were more likely to inhabit canyons that provided more perennial water during dry summer months and plunge pools that provided more bank heterogeneity (Wallace et al. 2010). Seim and Sredl (1994) studied the association between juveniles and adult stages and pool size and found juveniles were more frequently associated with small pools and marshy areas while adults were more frequently associated with large pools.

ELEVATION: In Arizona elevation ranges from 480 – 6,200 ft (146 – 2,499 m), generally <6,200 ft (1,951 m) (unpublished records, AZGFD, HDMS accessed 2006). Range wide, they are found from sea level to 1,817 m (5,960 ft) (Jennings and Hayes 1994b); or sea level to 5,577 ft (1,700 m) as reported by Stebbins (2003).

PLANT COMMUNITY: Lower and Upper Sonoran Desert, grassland, oak and oak-pine woodland (Stebbins 1985). Common overstory at six lowland leopard rd frog sites, observed by Sredl et al. (1997a, in Sredl 2005), "Consisted of Fremont cottonwoods (*Populus fremonti*), willows (*Salix* sp.), seepwillows (*Baccharis glutinosa*), mesquite (*Prosopis* sp.), and introduced salt cedars (*Tamarix chinensis*). Common ground cover in moist areas included yerba-mansa (*Anemopsis californica*), canyon ragweeds (*Ambrosia ambrosioides*), and arrow-weeds (*Tessaria sericea*). Three-square rushes (Scirpus *americanus*), spike rushes (*Eleocharis* sp.), and introduced Bermuda grass (*Cynodon dactylon*) lined the banks or perimeter of ponds and slackwater pools. The largest, deepest pools had stands of narrow-leafed cattails (*Typha angustifolia*); large ponds in addition to having cattails, had pondweeds (*Potomageton* sp.)."

POPULATION TRENDS: Adequate data is needed to determine status of *Lithobates yavapaiensis* in central Arizona, but populations are thought to be stable (Sredl et al. 1997a). According to NatureServe (2006), "Large numbers of occurrences still exist in central Arizona (the largest portion of United States range) but, apparently extirpated from other portions of range in the southwestern United States; information is not available for Mexico." The species is declining in southeast Arizona and is extirpated from southwestern Arizona (USDI, FWS 1991; Sredl et al. 1997b).

SPECIES PROTECTION AND CONSERVATION

ENDANGERED SPECIES ACT STATUS: SC (USDI, FWS 1996)
[C2 (USDI, FWS 1989, 1991, 1994)]
[C3A as *Rana* sp. (San Felipe leopard frog) (USDI, FWS 1982, 1989)]

STATE STATUS: 1 (AZGFD, AWCS 2022)
[1A (AGFD, SWAP 2012)]

OTHER STATUS:

[WSC (AGFD, WSCA 1996 in prep)]
[Candidate (AGFD, TNW 1988)]
Bureau of Land Management Sensitive as *Lithobates* (USDI, BLM AZ 2010, 2017)
[Bureau of Land Management Sensitive (USDI, BLM AZ 2008)]
Forest Service Sensitive as *Lithobates* (USDA, FS Region 3 2013)
[Forest Service Sensitive (USDA, FS Region 3 1988, 1999, 2007)]
Determined Subject to Special Protection (Secretaría de Medio Ambiente 2000, 2010)
[Listed Rare, Secretaría de Desarrollo Social 1994]
LC (IUCN, IUCN SSC Amphibian Specialist Group 2022)

MANAGEMENT FACTORS: The greatest threats to *R. yavapaiensis* are habitat alteration and fragmentation, accentuated by the introduction of non-native predatory and competitive fishes, crayfishes, and frogs (mainly bullfrogs). (NatureServe 2006). Damming, draining, and the diversion of water have fragmented formerly contiguous aquatic habitats. A chytrid fungus (see Additional Information section) has infected populations of *L. yavapaiensis* as well as six other ranid frogs and two other amphibians causing mass die-offs and local extirpations (Sredl et al. 2000). Habitat fragmentation and water manipulation can lead to local extirpation by disrupting the metapopulation dynamics of lowland leopard frogs in arid landscapes (Jennings and Scott 1991). Other prominent factors are water pollution and heavy grazing.

PROTECTIVE MEASURES TAKEN: *Rana yavapaiensis* is a closed season species. Collections of this species are illegal statewide without a scientific collecting or similar permit (Arizona Game and Fish Department 2001).

SUGGESTED PROJECTS: Studies on disease, population and metapopulations, dispersal abilities, habitat reservations, and effectiveness of translocations are needed.

LAND MANAGEMENT/OWNERSHIP: BIA – Fort McDowell and San Carlos Reservations, and Indian Allotments; BLM – Havasu, Kingman, Phoenix, Safford and Tucson Field Offices; NPS – Saguaro National Park; USFWS – Bill Williams and San Bernardino National Wildlife Refuges; USFS - Apache-Sitgreaves, Coconino, Coronado, Prescott, and Tonto National Forests; State Land Department; Alamo Lake State Park; Pima County - Cienega Creek Natural Preserve; Private; TNC – Aravaipa Canyon, Bingham Cienega, Buehman Canyon, Hassayampa River, Muleshoe Ranch, and San Pedro River Preserves, Cascabel Community

Management Area, and Lower San Pedro Program; Boyce Thompson Southwestern Arboretum.

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ADDITIONAL INFORMATION:

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).

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