ARIZONA GAME AND FISH DEPARTMENT
HERITAGE DATA MANAGEMENT SYSTEM

Animal Abstract **Element Code:** AAABH01210
Data Sensitivity: No

CLASSIFICATION, NOMENCLATURE, DESCRIPTION, RANGE

NAME: *Rana tarahumarae*
COMMON NAME: Tarahumara Frog, Mexican Frog
SYNONYMS: *Lithobates tarahumarae*
FAMILY: Anura: Ranidae

AUTHOR, PLACE OF PUBLICATION: Boulenger, Ann. & Mag. Nat. Hist. (ser. 8) 20(120): 413-418. 1917.

TYPE LOCALITY: "Ioquiro [=? Yoquivo] and Barranca del Cobre, Sierra Tarahumaré, [Chihuahua,] N.W. Mexico"; restricted to "Yoquivo, Chihuahua", Mexico, by Smith and Taylor, 1950, Univ. Kansas Sci. Bull., 33: 327. Type locality modified to "Sierra Tarahumare, Sonora", Mexico, by Schmidt, 1953, Check List N. Am. Amph. Rept., Ed. 6: 81.

TYPE SPECIMEN: Syntypes: British Museum Nat. Hist. 1947, 2.28.76-79 (formerly 1911.12.1236-39) from Ioquiro and 1947.2.1.63-64 (formerly 1914.1.28.148-149 from Barranca del Cobre).

TAXONOMIC UNIQUENESS: Monotypic species in the *Rana tarahumarae* group (Webb 1978; Hale and May 1983). Zweifel (1968) suggested that *R. tarahumarae* was part of the poorly understood *R. boylii* group, with *R. pustulosa* being the closest relative, however further evaluation of specimens revealed that it was not a part of the *R. boylii* group.

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 medium-sized frog ranging in sizes from 5.8-11.4 cm (2.3-4.5 in) snout-vent (females are larger than males), is usually brown in color, but may have an olive green

wash or tinges of yellow-orange. The back has small dark spots that are often obscure and dark crossbars on the hind legs. The ventral surface is white, yet the throat and chest may have gray melanophores arranged in no definite pattern; yellow coloration may be present in the groin. No mask or jaw strip are present. The skin is pustulose, and the hind feet are extensively webbed; males have a swollen and darkened thumb base. The dorsolateral fold, characteristic of related leopard frogs and other ranid species, is absent or faint, and the tympanum is indistinct. (Wright and Wright 1949; Stebbins 1951, 2003; Zweifel 1968; Hale and May 1983).

Later stage larvae are greenish-yellow with small dark spots over the dorsum and larger spots on the tail. Larvae may grow as large as 9.7 cm (3.8 in) before metamorphosis. Adult and juvenile frogs of both sexes have calls that are not very loud and consist of short snores, a whining noise, and occasional "*eeeps*". (Wright and Wright 1949; Stebbins 1951; Zweifel 1968; Hale and May 1983).

AIDS TO IDENTIFICATION: *R. tarahumarae* is most easily confused with *R. catesbeiana* (American Bullfrog), which grows to a much larger size, has a chin that is white with gray mottling, smoother skin, and a conspicuous tympanum (Rorabaugh 2023). In addition, *R. tarahumarae* has dark banding on the hind legs and indistinct dorsolateral folds (Zweifel 1968; Stebbins 1985).

ILLUSTRATIONS:

Black and white photos (Wright and Wright 1949: plate CXXII)
Color photo (Behler and King 1979: plate 193)
Black and white drawing (Stebbins 1985: plate 13)
Color drawing (Stebbins 2003: plate 18)
Color photos (by Jim Rorabaugh, Tom Brennan, and Randy Babb, *in* Online field guide to the reptiles and amphibians of Arizona , 2023 at https://live-reptilesofaz.pantheonsite.io/turtle-amphibs-subpages/h-l-tarahumarae/)
Color photo (Brennan and Holycross 2006: p 47)
Color photo (Murphy 2018, p. 54)
Color photo (Holycross et al. 2022a; p. 51)

TOTAL RANGE: Historically from extreme southern Arizona in the United States, south to northern Sinaloa and southwestern Chihuahua, Mexico. The current range is similar to its historical range, but the species is no longer extant at some northern localities. It was recently reestablished (2004) in a canyon of the Santa Rita Mountains in Arizona.

RANGE WITHIN ARIZONA: Before its extirpation from the state in the early 1980s, *R. tarahumarae* was found in three drainages in the Santa Rita Mountains and three drainages in the Pajarito-Atascosa-Tumacacori mountains complex in Santa Cruz County. From June-October 2004, an experimental population of 56 adults, 229 juveniles, and 327 larval frogs was reestablished into one of three historic canyons in the Santa Rita Mountains; source of

frogs from northern Sonora, Mexico. Additional sites including a drainage in the Pajarito Mountains are being considered for additional reestablishments.

SPECIES BIOLOGY AND POPULATION TRENDS

BIOLOGY: Adults spend most of their time around permanent sources of water and plunge pools. "Despite an absence of vocal sacs, Tarahumara frogs manage a variety of sounds, including a gentle snore, a whine, an *eep*, a short squawk, and a release or distress call composed of a series of short snores" (Rorabaugh 2023). In the cool, dry winter months, frogs retreat to hibernacula where they can remain moist and protected from predators and freezing temperatures. They emerge in spring when water temperatures reach about 10º C (50º F) (Hale and May 1983). Most movement occurs during the summer monsoon and is linear along streams with little overland dispersal (Zweifel 1955, Hale and May 1983). Males and juveniles have been reported to move up to 1,885 m (6,184 ft) and females up to 651 m (2,136 ft) (Hale and May 1983). The oldest frogs had been estimated to be at least 6 years post-metamorphosis, in a canyon in the Santa Rita Mountains (Hale and May 1983). When disturbed, anti-predator mechanisms typically include hopping into water where they take refuge under leaf litter, rocks, or other decries. Additionally, Tarahumara frogs have skin secretions that can cause mild skin irritation and may be noxious tasting. (Rorabaugh and Hale 2005).

REPRODUCTION: Breeding occurs primarily toward the end of the dry season in April and May (Rorabaugh and Hale 2005), but breeding has been observed in Arizona as late as July and August during summer rains. The mean number of eggs observed in egg masses from Arizona frogs was 1084 (standard error = 161, n = 7), with larvae in the wild taking up to two years to metamorphose (Hale and May 1983). Tadpoles reared in semi-wild conditions in Arizona metamorphosed in as little as 86 days, but most took longer than 10 months (J.C.R. Personal observations, in Rorabaugh and Hale 2005). Tarahumara frog larvae are large at all stages of development when compared to other ranids, growing as large as 106 mm. At metamorphosis, frogs are as small as 21 mm SVL, but most are 35-40 mm. Reproduction probably begins in the second spring following metamorphosis (Hale and May 1983).

FOOD HABITS: Tarahumara frogs are general predators and will eat almost any animal that can be swallowed. Both diurnal and nocturnal feeding is evident based on the array of food in observed in their stomachs. Prey items include juvenile Sonoran mud turtles (*Kinosternon sonoriense*), Sonora chub (*Gila ditaenia*), black head snakes (*Tantilla atriceps*), beetles (Tenebionidae and Scarabaeidae), water bugs (Belostomatidae), sphinx moths (Sphingidae), scorpions (Scorpionida), centipedes (Chilopoda), grasshoppers (Agrididae), mantids (Mantidae), wasps (Hymenoptera), spiders (Lycosidae), crickets (Gryllidae), caddisflies (Tricoptera), and katydids (Tettigoniidae) (Zweifel 1955; Hale and May 1983). NatureServe (2006) reports that adults are mainly invertivorous and larvae eat algae, organic debris, plant tissue, and minute organisms in the water.

HABITAT: Throughout its range, *R. tarahumarae* is typically associated with canyons and deep drought resistant "plunge pools" formed amidst boulders or in bedrock. Stream flows average less than 1.4 cubic meters (370 gallons) per second. Plunge pools in canyons with low mean flows and relatively steep gradients (>60 m per km of stream) provide the best breeding sites. Permanent water is probably necessary for metamorphosis. Habitats are located within oak, pine-oak woodlands, or the Pacific coast tropical area (Sinaloan thornscrub and tropical deciduous forest) (NatureServe 2006). Large streams may be avoided because of their propensity to flood and their variable flow rates (Hay and May 1983).

ELEVATION: Elevations of localities range from 460 m (1,500 ft) to over 1,860 m (6,100 ft) (Stebbins 1985). Localities in Arizona range from 1,068 – 1,891 m (3,500 – 6,200 ft).

PLANT COMMUNITY: In Arizona, *R. tarahumarae* occupied habitats in semidesert grassland and Madrean evergreen woodland plant communities (Zweifel 1955; Hale and May 1983).

POPULATION TRENDS: Declining globally. Frogs in the northern ranges seem more susceptible to the chytrid fungus (chytridiomycosis) when stressed by winter cold. This is the likely cause of extirpation of the Tarahumara in Arizona. (Hale et al. 2005). No naturally occurring Tarahumara frogs, larvae, or eggs have been seen in Arizona since May 1983 (Hale and May 1983; Hale and Jarchow 1988; Hale 1992; Sredl et al. 1997; Arizona Game and Fish Department unpublished data). In northern Sonora, at least four of nine populations have been extirpated (Hale and Jarchow 1988; Hale et al. 1998). In 2004 *R. tarahumarae* was reestablished into one drainage of the Santa Rita Mountains, in Arizona. The reestablished population is persisting and reproducing. Nine egg masses were found in May 2005; and the population survived a dramatic flood in August 2005 following the Florida Fire. In May 2006, a total of 12 adults, 10 juveniles, 22 large tadpoles, 650 tadpoles, and 1 egg mass were observed at the lower and middle reach sites.

SPECIES PROTECTION AND CONSERVATION

ENDANGERED SPECIES ACT STATUS: SC (USDI, FWS 1996)
[C2 (USDI, FWS 1994)]
[C1 (USDI, FWS 1985, 1989, 1991)]
[C2 (USDI, FWS 1982)]

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

OTHER STATUS: Forest Service Sensitive, (USDA FS Region 3, 2013, 2007)

[Not Forest Service Sensitive. USDA, FS Region 3 1999]
[Forest Service Sensitive USDA, FS Region 3 1988]
VU (IUCN SSC Amphibian Specialist Group 2022)
[VU (IUCN 2006)]

MANAGEMENT FACTORS: The causes of extirpation in Arizona are not clear, but may be related to one or more of the following factors: winter cold, habitat loss, exposure to heavy metals, disease, and competition with and predation by nonnative fish and bullfrogs. Airborne pollutants from copper smelters and/or mildly acidic rain that mobilize naturally-occurring metals near streams may have resulted in toxic levels of cadmium in the frog's habitats. A fungal disease, chytridiomycosis (see Additional Information section), implicated in global declines of frogs and toads, has been found in populations in Sonora, and was identified in specimens collected in Arizona in 1974. The disease likely contributed to observed declines and extirpations. Stressors, such as winter cold and heavy metal contamination, likely make frogs more susceptible to the effects of chytridiomycosis. (Hale and Jarchow 1988, Hale et al. 2005, NatureServe 2006).

PROTECTIVE MEASURES TAKEN: Arizona Game and Fish Commission Order 41 prohibits the collection of *R. tarahumarae* from the wild in Arizona. Specifically, it is against Arizona State law to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect this animal or to attempt to engage in any such conduct. Globally, no occurrences are appropriately protected and managed (NatureServe 2006).

SUGGESTED PROJECTS: Survival, reproduction, and movements of translocated populations should be studied. Causes of the original extirpation are important to reveal. These studies could include factors such as disease and toxins.

LAND MANAGEMENT/OWNERSHIP: USFS - Coronado National Forest.

SOURCES OF FURTHER INFORMATION

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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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