

## **Foothill Yellow-Legged Frog** (*Rana boylei*)

### **Legal Status**

*Federal:* None.

*State:* Species of Special Concern.



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*CNDDB Rank:* G3S2S3: Global Rank, G3 = Restricted range, rare, about 21 to 100 viable element occurrences (OCCs) or 3,000 to 10,000 individuals, or 10,000 to 50,000 acres of occupied habitat globally; State rank, S2S3 = somewhere between an S2 indicating imperiled in the state because of rarity due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the state. and an S3 which indicates vulnerable in the state due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation.

*Recovery Plan:* None.

### **Species Description and Life History**

Foothill yellow-legged frogs are moderately sized (37.2–82.0 mm snout to urostyle (urostyle: frog homologue to pelvic bone) length) and vary in coloration (Jennings and Hayes 1994). Typical coloration includes dark to light gray, brown, green, or yellow and can be plain or mottled with brick or reddish pigments in appearance (Zweifel 1955). The snout is triangular in shape with a buff-colored patch that usually occurs from its tip to a line connecting to the eyelids (Stebbins 1985). The underside of the rear legs and lower abdomen are yellow or orangish-yellow in larger individuals (Jennings and Hayes 1994). The rest of the underside is whitish with dark spots on throat and chest (Stebbins 1985). Irises are silvery gray with a horizontal, black counter-shading stripe (Jennings and Hayes 1994).

Breeding occurs from late March to early June, following streams high water stage when less sediment is being transported (Storer 1925, Grinnell et al. 1930, Wright and Wright 1949, Jennings and Hayes 1994). Males probably defend areas around themselves during the breeding season (Martof 1953, Emlen 1968). Clusters of 300-1,200 eggs are deposited on the downstream side of submerged rocks over which a relatively thin, gentle flow of water exists (Storer 1925, Fitch 1936, Zweifel 1955). Stream velocity in suitable ovipositor sites should be less than 0.66 feet per second (0.2 m/s) (Kupferberg 1996). Embryos have a critical thermal maximum temperature of 26°C (Zweifel 1955). A minimum of 15 weeks are required to attain metamorphosis, which typically occurs

between July and September (Storer 1925, Jennings 1988). Adult size is attained in 2 years (Storer 1925), but no data are available on longevity (Jennings and Hayes 1994).

Foothill yellow-legged frogs, unlike other ranid frog species in California, are rarely encountered far from permanent water sources (Morey 2000). Normal home range widths are probably less than 10 meters (Morey 2000). Occasional long distance movements up to 50 meters (165 ft) may occur during periods of high water conditions (Morey 2000). However, this species probably spend most of their time in or near streams during all seasons (Morey 2000).

### **Habitat Requirements and Ecology**

Foothill yellow-legged frogs occupy a variety of habitats, including valley-foothill hardwood, valley-foothill hardwood-conifer, valley-foothill riparian, ponderosa pine, mixed conifer, coastal scrub, mixed chaparral, and wet meadow, where clear, cool rocky streams are present (Morey 2000). Shallow, small to moderate-sized streams with flowing water and at least some cobbled-sized substrate are preferred (Hayes and Jennings 1988). The species has been found in streams lacking cobble or larger-sized substrate grain (Fitch 1938, Zweifel 1955), but it is unclear whether such habitats are regularly used (Hayes and Jennings 1988). Both adult and juvenile foothill yellow-legged frogs have also been found in lentic habitats such as seeps and ponds (CNDDDB 2008), however, these observations likely represent temporary refugia during dispersal. Though non-breeding dispersal patterns are largely unknown, frogs have been found belowground and beneath surface objects as far as 50 m from water (Nussbaum et al. 1983). It occurs at elevations from sea level to approximately 2,040 meters (6,700 ft) (Stebbins 1985). The species usually absent from habitats where introduced aquatic predators, such as various fishes and bullfrogs, are present (Hayes and Jennings 1986, 1988, Kupferberg 1994).

Garter snakes (*Thamnophis* spp.) prey heavily on foothill yellow-legged frogs and tadpoles (Fitch 1941). Red-sided, western terrestrial, and Oregon garter snakes have been reported as feeding on the post-hatching stages (Fitch 1941, Zweifel 1955, Lind 1990). Rough-skinned newts have been reported as feeding on the eggs of foothill yellow-legged frogs (Evdenden 1948). Additionally, fish, mammal (e.g., raccoons), and bird species are likely to prey on one or more stages of foothill yellow-legged frogs (Zweifel 1955). Non-native predators, such as bullfrogs (*Rana catesbeiana*) and Centrarchid fishes, are also known to prey on stages of foothill yellow-legged frogs (Moyle 1973, Werschkul and Christensen 1977).

Aquatic and terrestrial arthropods, particularly insects, comprise the prey taken by adult and postmetamorph foothill yellow-legged frogs. Insects found in the stomachs of collected individuals include grasshoppers, hornets, carpenter ants, water striders, small beetles, and dipterans (mosquitoes and others) (Stebbins 1951, Storer 1925). Tadpoles probably graze on algae and diatoms along rocky stream bottoms (Morey 2000).

Foothill yellow-legged frogs are diurnal and active year round in warmer climates but may become inactive or hibernate in cooler areas (Morey 2000). They often dive into water to take refuge under rocks or sediment when disturbed (Stebbins 1954, Storer 1925). The seasonal ecology and behavior of adult foothill yellow-legged frogs is essentially unknown (Jennings and Hayes 1994).

Although foothill yellow-legged frogs may co-occur with California red-legged frogs (*Rana boylei*) and the Cascades frog (*Rana cascadae*), differences in microhabitat preferences limit competition (Zeiner *et al.* 1988). However, bullfrogs and Centrarchid fishes may contribute to the reduction of populations (Moyle 1973, Werschkul and Christensen 1977).

## **Species Distribution and Population Trends**

### *Distribution*

Historically, the foothill yellow-legged frog occurred from west of the crest of the Cascade Mountains in Oregon south to the Transverse Ranges in Los Angeles County, and in the Sierra Nevada foothills south to Kern County (Zweifel 1955, Stebbins 1985). Populations are not known from desert slopes, but an isolated population was reported in Sierra San Pedro Martir, Baja Mexico (Loomis 1965). The current range excludes coastal areas south of northern San Luis Obispo County and foothill areas south of Fresno County where the species is apparently extirpated (Jennings and Hayes 1994).

Queries of the online databases of the California Academy of Sciences (2008) and Museum of Vertebrate Zoology (2008) yielded five recorded occurrences of foothill yellow-legged frog in Yolo County. Three of these records (also represented as an historical locality by Jennings and Hayes [2004]) represent 1997 observations in northwestern Yolo County on Davis Creek both upstream and downstream of Davis Creek Reservoir. The remaining two records represent 1925 observations within Putah Creek, eight miles west of Winters in southern Yolo County, which Jennings and Hayes (1994) presume to be extinct. A query of the California Natural Diversity Database (CNDDDB 2008) yielded two additional records observed in 1999 in two ponds in the central stretch of the Blue Ridge Mountains.

### *Population Trends*

Jennings and Hayes (1994) reported this species as endangered in central and southern California south of the Salinas River, Monterey County. The species has not been observed in or south of the Transverse Ranges since before 1978 (Jennings and Hayes 1994). High water conditions estimated to be of 500-year frequency, which occurred over much of southern California during the spring of 1969, are believed to be largely responsible for the apparent extirpation of this taxon in that region (Sweet 1983).

In the west slope drainages of the Sierra Nevada and southern Cascade Mountains east of the Sacramento-San Joaquin River axis the species has been reported as threatened

(Jennings and Hayes 1994). The species has not been observed for nearly 20 years at least 19 historical localities on the west slope of the southern Sierra Nevada, and localities at which this species is extant on the western slope of the northern Sierra Nevada and the extreme southern Cascades appear widely scattered (Jennings and Hayes 1994).

Foothill yellow-legged frogs still occur in many localities in coastal drainages north of the Salinas River system in California, some of which harbor significant numbers of frogs (Jennings and Hayes 1994). However, a number of risk factors, including exotic predators, threaten the species in this area and Jennings and Hayes (1994) consider populations in the area of special concern.

Though prevalent within the foothills of Yolo County west of Capay Valley and within adjacent Lake County, the paucity of recorded occurrences at lower elevations suggests that the foothill yellow-legged frog may never have been a common species throughout much of Yolo County.

The principal factors contributing to the decline of the foothill yellow-legged frog are thought to include past habitat destruction related to activities such as logging, mining, and habitat conversions for water development, irrigated agriculture, and commercial development and non-native predators and competitors such as introduced trout and bullfrogs (USFS 2008). Other environmental factors that may adversely affect mountain yellow-legged frogs include pesticides, certain pathogens, ultraviolet-B (beyond the visible spectrum) radiation, or a combination of these factors (67 Federal Register 44382).

### **Threats to the Species and Other Conservation Issues**

Habitat loss and degradation, non-native predators, and toxic chemicals threaten the long-term survival of the foothill yellow-legged frogs. Additionally, poorly timed water releases from upstream reservoirs can scour eggs from oviposition substrates (Jennings and Hayes 1994) and decreased waterflows can force adults into permanent pools where they may be more susceptible to predation (Hayes and Jennings 1988).

Suitable breeding habitat for the foothill yellow-legged frog should be identified in part by the presence of oviposition habitat having riffle areas with a substrate of cobble-sized or larger rocks. To provide this habitat, particular attention should be paid to maintaining a flow regime that facilitates differential sorting of loose substrate. Though specific tolerances remain unknown, management should avoid water releases that create excess flow and shear conditions during while egg masses and the larval stages are present. Though egg masses of foothill yellow-legged frogs are known to accumulate suspended particulates (Storer 1925), increased silt loads generated by activities such as vegetation removal, logging and livestock grazing should be monitored until tolerance to silt deposition is better understood.

Non-native predators pose a significant threat to foothill yellow-legged frog populations. Exotic predatory fish and bullfrogs prey on all life stages. Jennings (1996) found that the primary factor for decline in the Sierra Nevada is the introduction of non-native predators. Centrarchid fishes have been found to readily eat eggs and may also contribute to the decline of the species (Werschkul and Christensen 1977).

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