

A.15 Foothill Yellow-Legged Frog (*RANA BOYLI*)

A.15.1 Legal and Other Status

The foothill yellow-legged frog is considered a species of concern by the U.S. Fish and Wildlife Service. It is also a California Species of Special Concern, and is listed as a Protected Amphibian under the California Code of Regulations.



A.15.2 Species Distribution and Status

A.15.2.1 Range and Status

Historically, foothill yellow-legged frogs ranged 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). An isolated population was reported in Sierra San Pedro Mártir, 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). Its known elevation range extends from near sea level to approximately 2,040 meters above sea level (Stebbins 1985).



Jennings and Hayes (1994) consider the species to be endangered in central and Southern California. It no longer occurs in the extreme southern portions of its historical range and populations on the west slope of the Sierra Nevada are limited (Drost and Fellers 1996). The species has been reported as threatened in the west slope drainages of the Sierra Nevada and southern Cascade Mountains east of the Sacramento-San Joaquin River axis (Jennings and Hayes 1994). Foothill yellow-legged frog has not been observed for nearly 20 years in 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).

A.15.2.2 Distribution and Status in the Plan Area

Jennings and Hayes note at least five extant populations in eastern Butte County based on verified museum records and 12 extinct populations in western Butte County (Jennings and Hayes 1994). Within the Plan Area, populations have been observed in Big Chico Creek along the upper reaches of Upper Bidwell Park, and in Mud Creek and Rock Creek (Maslin pers. comm.). At least one occurrence has been detected along Butte Creek (Engstrom pers. comm.) (see Figure A.15-1, *Foothill Yellow-Legged Frog Modeled Habitat and Recorded Occurrences*). In addition, California Department of Fish and Game snorkel surveys have identified juvenile, larval and breeding adults in Big Chico Creek, Butte Creek, and Feather River in almost every year of survey report from 2001 to 2006 (Garman pers. comm.). There are no California Natural Diversity Database (CNDDB) recorded occurrences of the foothill yellow-legged frog within the Plan Area, but several occurrences are known from above the Plan Area boundary in Butte County (CNDDB 2007, Shedd pers. comm.) (see Figure A.15-1).

A.15.3 Habitat Requirements and Special Considerations

The foothill yellow-legged frog is a medium-sized frog, typically reaching 1.5 to 3.2 inches (3.7 to 8.2 centimeters [cm]) (snout to vent length) (Stebbins 1985). Its color ranges from grey, brown, reddish, or olive above, either plain or mottled, often harmonizing with the prevailing color of rocks and soil. As the name indicates, the undersides of the hind legs are yellow, the color often extending onto the abdomen.

Foothill yellow-legged frogs are found in or near clear, cool rocky streams in 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 types. They can occur in a range of waterways from small intermittent creeks to large river systems.

Foothill yellow-legged frogs favor shallow, flowing water in small to moderate-sized streams with at least some cobble-sized substrate (Hayes and Jennings 1988, Jennings 1988). This habitat is believed to aid oviposition (Storer 1925, Fitch 1936, Zweifel 1955) and refuge habitat for larvae and postmetamorphs (Hayes and Jennings 1988, Jennings 1988). This species has been found in streams without cobble (Fitch 1938, Zweifel 1955), but it is not clear whether these habitats are regularly used (Hayes and Jennings 1988, Jennings and Hayes 1994).

Foothill yellow-legged frogs prefer sunny and partly shaded banks for basking. Adults are usually found near water and prefer some riffle habitat or cascade and pool areas with rocky banks. They can persist in pools in otherwise dry streams, but are more vulnerable to predation there (Moyle 1973).

Breeding sites are typically shallow, low velocity areas close to shore. Egg masses are typically attached in shallow water from 3 to 16 inches (8 to 40 centimeters) (Lind et al. 1996).

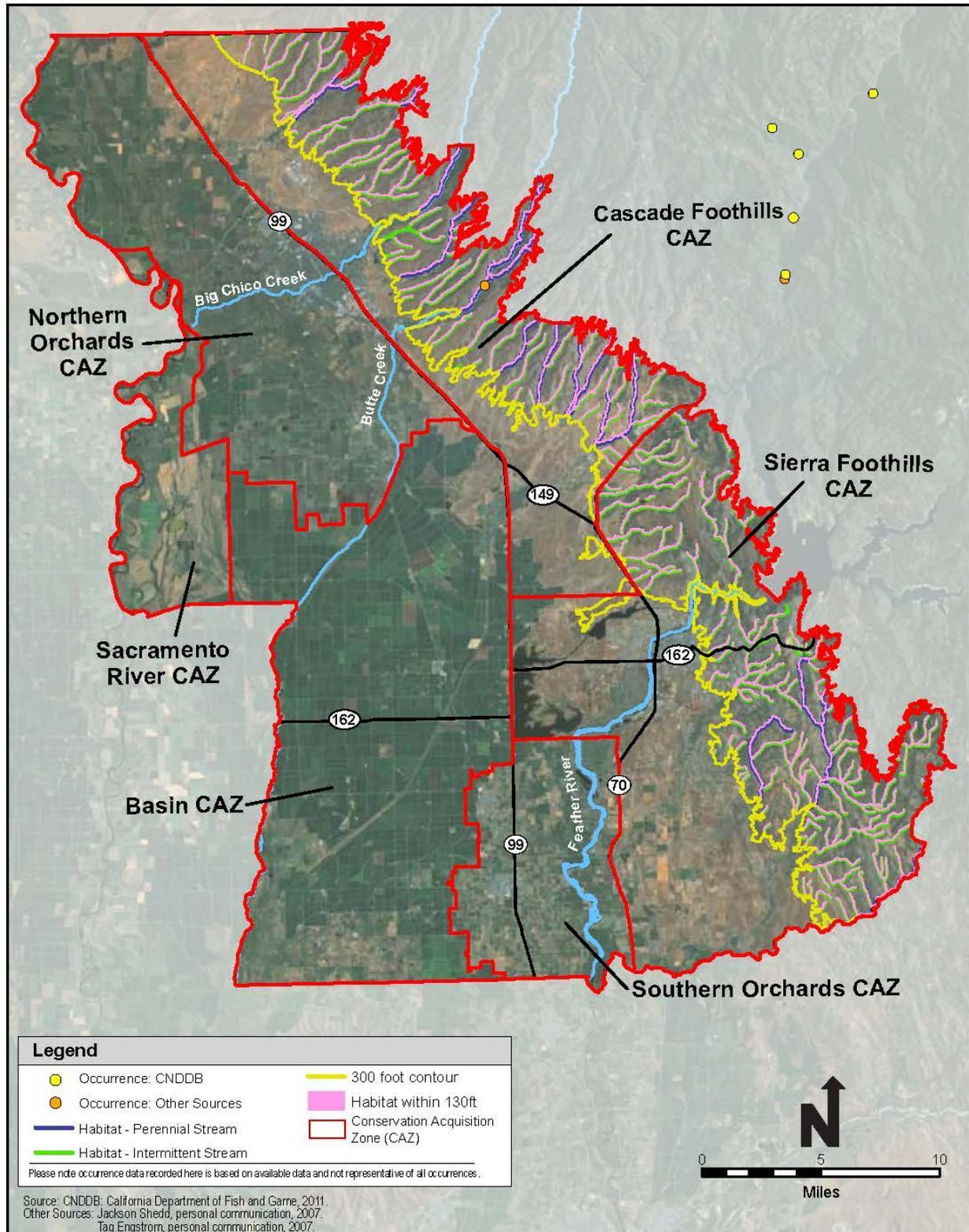


Figure A.15-1. Foothill Yellow-Legged Frog Modeled Habitat and Recorded Occurrences

Stream velocity is important because faster flows can wash away egg masses or tadpoles. Research has shown that velocity should be less than 0.66 feet per second (0.2 meters/second) (Kupferberg 1996). Egg masses have been found in water ranging from 48°F to 71°F (9°C to 21.5°C). Breeding is probably restricted to sites and to time intervals where eggs can avoid lethal temperatures (Hayes and Jennings 1986). Warm edge-water habitat is especially important for developing tadpoles. Hayes and Jennings (1988) reported that foothill yellow-legged frogs are found more frequently at stream sites with at least 20 percent, but not more than 90 percent shading.

They are also found in sites with more than 40 percent riffles, and where more than 40 percent of the substrate is at least cobble-sized (where cobbles are defined as ranging from 3 to 10 inches). Boulders that do not move under bank-full conditions are found to be important habitat (Kupferberg 1996); boulders serve as both basking sites and as escape cover (Jennings 1988). Additional geomorphologic stream characteristics typically associated with foothill yellow-legged frog habitat include low-gradient sections (less than 6.5 percent grade), areas with a high meander-to-width ratio, areas with a high width-to-depth ratio, and sites with a cross-sectional configuration that includes side channels (Kupferberg 1996, Lind et al. 1996). In addition, research indicates that occurrence of the foothill yellow-legged frog is positively correlated with sections of creeks or rivers that are near (preferably within 0.25 miles [0.4 kilometer]) confluences with tributaries (Kupferberg 1996). These frogs are likely to breed in the main stems of rivers or creeks and overwinter in tributaries, perhaps to avoid higher flows in the main stems.

Foothill yellow-legged frogs are usually absent from habitats where introduced aquatic predators such as centrarchid (sunfish-like) fishes and bullfrogs are present, probably because their aquatic developmental stages are vulnerable to such predators (Hayes and Jennings 1986, Hayes and Jennings 1988, Kupferberg 1994, Jennings and Hayes 1994).

A.15.4 Life History

The species deposits its egg masses on the downstream side of cobbles and boulders over which a relatively thin, gentle flow of water exists (Storer 1925, Fitch 1936, Zweifel 1955). The timing of oviposition typically follows the period of high flow discharge from winter rainfall and snowmelt, resulting in oviposition between late March and early June (Jennings and Hayes 1994). The embryos have a critical thermal maximum temperature of 26°C (Zweifel 1955). After oviposition, a minimum of roughly 15 weeks is needed to attain metamorphosis, which typically occurs between July and September (Storer 1925, Jennings 1988). Two years are thought to be required to reach adult size (Storer 1925), but no data are available on longevity. Postmetamorphs probably eat both aquatic and terrestrial insects, but few dietary data exist for this species (Storer 1925, Fitch 1936). Red-sided, western terrestrial, and Oregon garter snakes have been reported as feeding on the post-hatching stages (Fitch 1941, Zweifel 1955, Lind 1990), and Evenden (1948) reported rough-skinned newt predation of the eggs of foothill yellow-legged frog.

A.15.4.1 Dispersal Behavior

Adult foothill yellow-legged frogs are primarily diurnal and occupy small home ranges. Frogs can be active all year in warm localities, but become inactive or hibernate in colder areas. Significant seasonal movements from breeding areas have not been reported. These frogs probably spend most of their time in or near streams during all seasons.

Adults often bask on exposed rock surfaces near streams. When disturbed, they dive into the water and take refuge among stones, silt, or vegetation (Stebbins 1985). Although most individuals remain active year-round, some exhibit periods of inactivity, especially during cold weather. During these periods of inactivity, individuals seek cover beneath various cover types (i.e., rocks, overhanging vegetation, leaf litter) on shore within a few meters of water, or in streams partly or totally submerged (Van Wagner 1996). Nussbaum et al. (1983) found frogs underground and beneath surface objects more than 155 feet (50 meters) from water in April.

A.15.5 Threats

Habitat loss and degradation (often by livestock), introduction of exotic predators, and toxic chemicals (including pesticides) pose continued and increasing threats to the long-term viability of amphibians throughout California (Jennings and Hayes 1994). In addition, poorly timed water releases from upstream reservoirs can scour egg masses of this species from their oviposition substrates (Jennings and Hayes 1994), and decreased flows can force adult frogs to move into permanent pools, where they may be more susceptible to predation (Hayes and Jennings 1988).

According to Hayes and Jennings (1996), the primary factor in the decline of the species in the Sierra Nevada is the introduction of nonnative predators. Competition and predation by introduced bullfrogs and fish have greatly contributed to the decline of the species. Moyle (1973) also implicated the bullfrog in the observed reduction of foothill yellow-legged frog populations in the Sierra Nevada. These frogs were present at only three of the 95 localities where bullfrogs were also observed (Moyle 1973). Nonnative centrarchid (sunfish-like) fishes readily eat ranid eggs (Werschkul and Christensen 1977), and, where introduced into foothill streams, could also contribute to the elimination of the species. Stock ponds and other human-made ponds are harmful, as they promote bullfrog populations.

Habitat loss and degradation, particularly in the Sierra Nevada foothills, have also been major factors in declining foothill yellow-legged frog populations (Hayes and Jennings 1996). Habitat alterations have occurred as a result of dam and canal construction, agriculture, urbanization, mining, and grazing practices. Besides eliminating habitat, these alterations have resulted in reduced riparian habitat, decreases in suitable stream substrates, habitat fragmentation, elimination of travel corridors, and detrimental flow regimes. Low flows, in combination with loss of riparian habitat, tend to warm the water and foster nonnative predators. Prolonged droughts may have also impacted populations of these frogs.

A.15.6 Relevant Conservation Efforts

Foothill yellow-legged frog is a covered species under several HCP/NCCPs, including the San Joaquin County Multi-species Habitat Conservation Plan and Open Space Plan (SJMSCP), East Contra Costa County HCP/NCCP, Yolo Natural Heritage Program, and Placer County Conservation Plan. In addition, the Northern California Regional Land Trust (NCRLT) has acquired two conservation easements totaling approximately 7,000 acres in nearby Tehama County that serve as habitat for foothill yellow-legged frog.

A.15.7 Species Habitat Suitability Model

A.15.7.1 Breeding Habitat

Breeding habitat for the foothill yellow-legged frog includes the following land cover types and conditions that are present above 300 feet mean sea level:

- Perennial and intermittent streams; and
- All HCP/NCCP land cover types except urban and disturbed ground within 130 feet of perennial and intermittent streams.

A.15.7.2 Assumptions

Foothill yellow-legged frogs reside in or near clear, cool rocky streams in a variety of habitats. They favor shallow, flowing water in small to moderate-sized streams with at least some cobble-sized substrate (Hayes and Jennings 1988). However, they can occur in a range of waterways from small intermittent creeks to large river systems (Stebbins 1985). Breeding sites are typically shallow, low velocity areas close to shore (Lind et al. 1996).

The diel and seasonal movement ecology and behavior of adults are largely unknown, though they are thought to occupy small home ranges (Hayes and Jennings 1988). Significant seasonal movements from breeding areas have not been reported in the literature. A recent unpublished radio telemetry study found that frogs rarely ventured more than 12 meters (39 feet), and were found at a maximum distance of 40 meters (131 feet), from the wetted stream channel (Bourque pers. comm.). Maslin (pers. comm. 2007) has found foothill yellow-legged frogs ranging as much as approximately one-half mile from streams during non-breeding periods.

Foothill yellow-legged frogs are infrequent or absent in habitats where introduced aquatic predators (i.e., various fishes and bullfrogs) are present (Hayes and Jennings 1988, Kupferberg 1994). These introduced species inhabit many lower elevations, lower flow reaches of waterways in the Plan Area, though bullfrogs can expand their range upstream in lower precipitation years (Maslin pers. comm.).

Habitat for the foothill yellow-legged frog is assumed to only be present above 300 feet in elevation because at lower elevations channels are primarily located on the valley floor where

channels would likely lack cobble substrates, water temperatures would be warmer, and nonnative predators would likely be more abundant. In addition, this elevational limit approximates the range of the frog in Butte County identified by DFG (California Habitat Relationships System 1995).

A.15.8 Recovery Plan Goals

No recovery plan has been prepared for this species.

A.15.9 References

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Personal Communications

- Ryan Bourque, Wildlife Biologist. September 26, 2007 – phone with Letty Brown. Discussion about the conclusions of his Humboldt State master's thesis. This was a radio telemetry study of the movement ecology of a population of foothill yellow-legged frogs in Tehama County, California (unpublished data). Radio telemetry was conducted during the following time periods: April through June of 2004, October through December 2004, and October through December 2005.
- Tag Engstrom, Biology Professor. California State University, Chico. Comments during May 4, 2007 meeting
- Clint Garman, Fisheries Biologist. California Department of Fish and Game. May 23, 2007 – personal communication.
- Dr. Paul Maslin, Biology Professor (retired). California State University, Chico. May 15 and September 29, 2007 – personal communication by email with Letty Brown. Email correspondence regarding the movement ecology of foothill yellow-legged frogs based on Dr. Maslin's experience on the Big Chico Creek Ecological Preserve.
- Jackson Shedd, Wildlife Biologist. August 23, 2007 – personal communication.

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