

## 1 **A.15 Foothill Yellow-Legged Frog** 2 **(*RANA BOYLI*)**

### 3 **A.15.1 Legal and Other Status**

4 The foothill yellow-legged frog is considered a species of  
5 concern by the USFWS. It is also a California Species of  
6 Special Concern, and is listed as a Protected Amphibian  
7 under the California Code of Regulations.

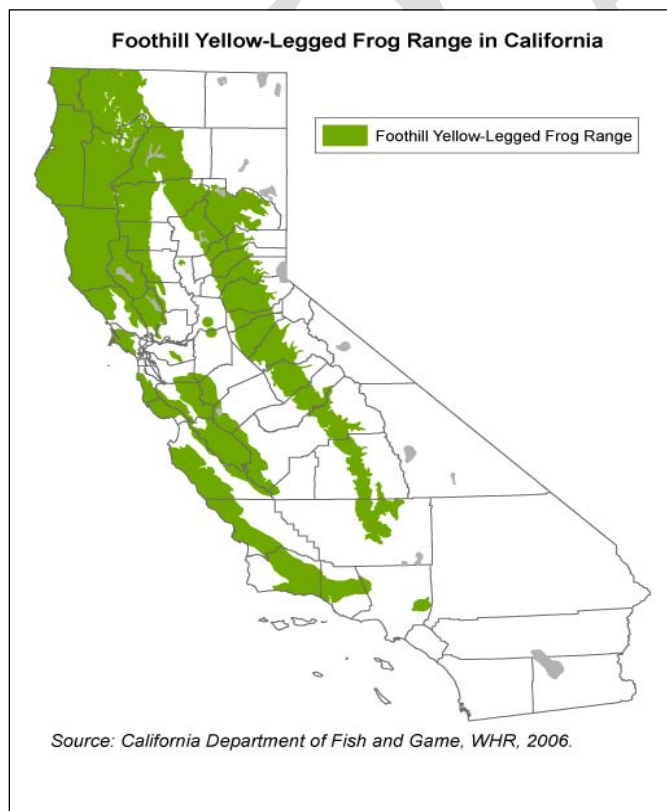


photo courtesy Galen Rathbun, USGS

### 8 **A.15.2 Species Distribution and Status**

#### 9 **A.15.2.1 Range and Status**

10 Historically, foothill yellow-legged frogs ranged from west of the crest of the Cascade  
11 Mountains in Oregon south to the Transverse Ranges in Los Angeles County, and in the Sierra  
12 Nevada foothills south to Kern County (Zweifel 1955, Stebbins 1985). An isolated population  
13 was reported in Sierra San Pedro Martir, Baja Mexico (Loomis 1965). The current range  
14 excludes coastal areas south of northern San Luis Obispo County and foothill areas south of  
15 Fresno County where the species is apparently extirpated (Jennings and Hayes 1994). Its known  
16 elevation range extends from near sea level to approximately 2,040 meters above sea level  
17 (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

1 widely scattered (Jennings and Hayes 1994).

## 2 **A.15.2.2 Distribution and Status in the Plan Area**

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

## 14 **A.15.3 Habitat Requirements and Special Considerations**

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

20 Foothill yellow-legged frogs are found in or near clear, cool rocky streams in a variety of habitats,  
21 including valley-foothill hardwood, valley-foothill hardwood-conifer, valley-foothill riparian,  
22 ponderosa pine, mixed conifer, coastal scrub, mixed chaparral, and wet meadow types. They can  
23 occur in a range of waterways from small intermittent creeks to large river systems.

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

30 Foothill yellow-legged frogs prefer sunny and partly shaded banks for basking. Adults are usually  
31 found near water and prefer some riffle habitat or cascade and pool areas with rocky banks. They  
32 can persist in pools in otherwise dry streams, but are more vulnerable to predation there (Moyle  
33 1973).

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

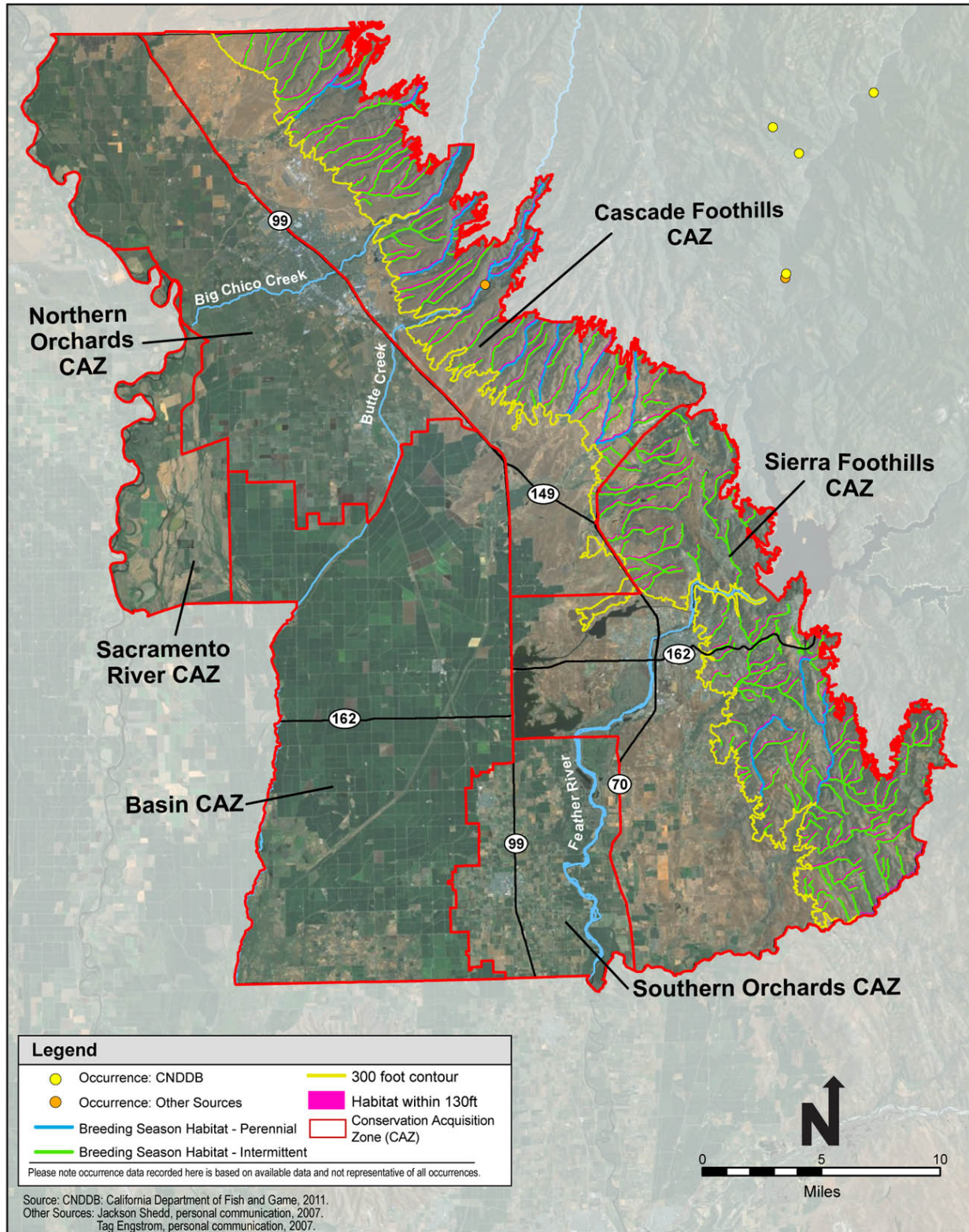


Figure A-15. Foothill Yellow-Legged Frog Modeled Habitat and Recorded Occurrences

Stream velocity is important because faster flows can wash away eggs 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, 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 (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 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, when 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 (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

[[To be prepared as additional information gathered during the Butte Regional HCP/NCCP development process.]]

## 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.) has found foothill yellow-legged frogs ranging as much as approximately one half mile from streams during non-breeding periods (Maslin pers. comm. 2007b).

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. 2007a).

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 References

### Literature Cited

- California Habitat Relationships System. 1995. Web-based foothill yellow-legged frog range map located at:  
<http://nrm.dfg.ca.gov/taxaquery/documentlist.aspx?AssociatedItemID=58&STitle=Rana+boylii%2c+Baird%2c+1854&PTitle=Foothill+Yellow-legged+Frog>.
- CNDDDB (California Natural Diversity Database). 2006. Natural Heritage Division. California Department of Fish and Game, State of California. RareFind, October.
- Drost, C. A. and G. M. Fellers. 1996. Collapse of a regional frog fauna in the Yosemite area of the California Sierra Nevada. 10:414-425.
- Evenden Jr, F. G. 1948. Food Habits of *Triturus Granulosus* in Western Oregon, JSTOR. 1948:219-220.
- Fitch, H. S. 1936. Amphibians and reptiles of the rogue river basin, Oregon. *American Midland Naturalist* 17(3):634–652.
- Fitch, H. S. 1938. *Rana boylii* in Oregon. *Copeia* 1938(3):148.
- Fitch, H. S. 1941. The feeding habits of California garter snakes. *California Fish and Game* 27(2):1-32.
- Hayes, M. P. and M. R. Jennings. 1986. Decline of ranid frog species in western North America: Are bullfrogs (*Rana catesbeiana*) responsible? *Journal of Herpetology* 20(4):490–509.
- Hayes, M. P. and M. R. Jennings. 1988. Habitat correlates of distribution of the California red-legged frog (*Rana aurora draytonii*) and the foothill yellow-legged frog (*Ranaboylii*): Implications for management. Pp. 144–158 in Natural history and decline of native ranids in California, edited by R. C. Szaro, K. E. Jennings, M. R. 1988. Pp. 61–72 in H. F. DeLisle, P. R. Brown, B. Kaufman, and B. M. McGurty (editors), Proceedings of the conference on California herpetology. Southwestern Herpetologists Society, Special Publication (4).
- Hayes, M. P. and M. R. Jennings. 1996. Status of Amphibians. In Sierra Nevada Preservation Project, Final report to Congress. Vol. 2, Assessments for Management Options. Davis: University of California, Centers for Water and Wildland Resources.

- Jennings, M. R. and M. P. Hayes. 1994. Amphibian and Reptile Species of Special Concern in California. Final report submitted to the California Department of Fish and Game, Rancho Cordova, CA. Contract 8023.
- Kupferberg, S. J. 1994. Exotic larval bullfrogs (*Rana catesbeiana*) as prey for native garter snakes: Functional and conservation implications. *Herpetological Review* 25(3):95–97.
- Kupferberg, S. J. 1996. Hydrologic and Geomorphic Factors Affecting Conservation of a River-Breeding Frog (*Rana boylei*), *JSTOR*. 6:1332-1344.
- Lind, A. J. 1990. Ontogenetic changes in the foraging behavior, habitat use and food habits of the western aquatic garter snakes, *Thamnophis couchii*, at Hurdygurdy Creek, Del Norte County, California. Master's thesis, Humboldt State University, Arcata, CA.
- Lind, A. J., H. H. Welsh, and R. A. Wilson. 1996. The effects of a dam on breeding habitat and egg survival of the foothill yellow-legged frog (*Rana boylei*) in Northwestern California. *Herpetological Review* 27(2):62-67.
- Loomis, R. B. 1965. The yellow-legged frog, *Rana boylei*, from the Sierra San Pedro Martir, Baja California Norte, Mexico. *Herpetologica* 2(1):78–80.
- Moyle, P. B. 1973. Effects of introduced bullfrogs, *Rana catesbeiana*, on the native frogs of the San Joaquin Valley. *Copeia* 1:18-22.
- Nussbaum, R. A., E. D. Brodie, Jr., and R. M. Storm. 1983. Amphibians and Reptiles of the Pacific Northwest. University Press of Idaho.
- Stebbins, R. C. 1985. A Field Guide to Western Reptiles and Amphibians. Boston: Houghton Mifflin.
- Storer, T. 1923. Coastal range of yellow-legged frog in California. *Copeia* (114):8.
- Storer, T. 1925. A synopsis of the amphibia of California. *University of California Publications in Zoology* 27:1–342.
- Van Wagner, T. J. 1996. Selected life-history and ecological aspects of a population of foothill yellow-legged frogs (*Rana boylei*) from Clear Creek, Nevada County, California. Master's thesis, California State University, Chico, CA.
- Werschkul, D. F., and M. T. Christensen. 1977. Differential predation by *Lepomis macrochirus* on the eggs and tadpoles of *Rana*. *Herpetologica* 33:237-241.
- Zweifel, R. G. 1955. Ecology, distribution, and systematics of frogs of the *Rana boylei* group. *University of California Publications in Zoology* 54(4):207–292.

## **Personal Communications**

- Bourque, Ryan. 2007. Personal communication by phone with Letty Brown on September 26.  
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.
- Garman, Clint. 2007. California Department of Fish and Game, personal communication, May 23.
- Maslin, Dr. Paul. 2007. Personal communication, May 15.
- Masline, Dr. Paul. 2007. Personal communication by email with Letty Brown, on September 29.  
Email correspondence regarding the movement ecology of foothill yellow-legged frogs based on Dr. Maslin's experience on the Big Chico Creek Ecological Preserve.
- Shedd, Jackson. 2007. Personal communication, August 23.

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