

Novel Use of Upland Microhabitat by *Rana boylei* Baird 1854, in a Perennial River Drainage in the Foothills of the Sierra Nevada, Central California, USA

Jeff A. Alvarez, The Wildlife Project, P.O. Box 188888, Sacramento, CA; jeff@thewildlifeproject.com

Marina L. Olson, Westervelt Ecological Services, 3636 American River Drive, Suite 120, Sacramento, CA

Jeffery T. Wilcox, Sonoma Mountain Ranch Preservation Foundation, 3150 Sonoma Mountain Road, Petaluma, CA

The Foothill Yellow-legged Frog (*Rana boylei*) is a species for which much has been reported on the habitat use, with the majority of work specifying that the species is a lotic habitat obligate (Storer 1925, Zweifel 1955, Kupferberg 1996, Bourque 2008). More recently Alvarez and Wilcox (2021) added lentic habitat as used by this species for both refuge and breeding. There remains a paucity of reporting on the upland habitat use by this species, whether associated with lotic or lentic habitats. Bourque (2008) tracked *R. boylei* using radio telemetry and noted that males and females were found in upland areas 38% and 66% of observations, respectively. The maximum distance found from water was tracked over a season and appeared to increase from spring to fall, 7 m to 40 m. Work by Bourque (2008) indicates that uplands appear critical for seasonal use of habitat for this species, yet it is seldom studied or reported (Thomson et al. 2015). We report on observations of upland habitat use by *R. boylei*, and specifically, novel use of a microhabitat that has not been previously reported.

We conducted visual encounter surveys for *R. boylei* along an 800 m section of the north fork of the American River, Nevada County, California, at an elevation of 400 m. The river system in this area is made up of approximately 50% exposed bedrock, with approximately 50% cobble and boulder habitat within the perennial river channel. The adjacent banks were typically dominated by weathered exposed bedrock with small portions (<10-20%) comprised of cobble and other portions (10-20%) covered by vegetation or bare ground. Our surveys were conducted by walking

the margin of the river both upstream and downstream of our original starting positions, at the Mineral Bar Campground.

Initially *R. boylei* were only detected within the river channel, where they were basking on partially exposed cobble in still and flowing portions of the river. A portion of our surveys included adjacent upland habitat to ascertain use of this habitat type and to detect individuals that may be using uplands for refuge, foraging, or other aspects of their natural history. We searched cracks and small eroded niches within the bedrock that bordered the river, that were within 5-10 m of the wet edge of the river.

In a single eroded niche, we found an adult *R. boylei* that was resting in a 20 cm deep niche that was approximately 10 cm × 20 cm. The frog was briefly removed, sexed, photographed, and replaced. Approximately 20 m upstream we found a second adult *R. boylei* in a second niche that was 10 cm × 30 cm, × 30 cm deep. Both locations were approximately 2 m above the water surface and also 2 m from the water's edge (Figs. 1 and 2). Additionally, both locations were in niches that were located on the upper



Fig. 1. Location of weathered niche in which *Rana boylei* were found in the uplands adjacent to the north fork of the American River in Nevada County, California, August 2022.

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Fig. 2. Adult Foothill Yellow-legged Frog (*Rana boylei*) in a small (10 cm × 20 cm × 10 cm deep) niche in exposed bedrock along the north fork of the American River in Nevada County, California, August 2022.

face of exposed bedrock that had a relatively flat face of 86 degrees. Two days following the initial observation we found the first individual in the same location (identified using Marlow et al. 2016). An additional *R. boylei* was located in a small, eroded area of rock 3 m from water and approximately 2 m above the waters surface. This eroded chamber was 0.5 m tall and 1 m deep, with the frog in the back of the space.

Wilcox and Alvarez (2019) described behaviors of *R. boylei* at lentic habitat that included climbing a 90-degree concrete wall with actively spilling water over the surface. We contend that the climbing ability of this species is putative. Nevertheless, these individual frogs were located in remote, isolated niches in a rock face 2 m above the water during a time when deep pools within the river channel were abundant. How this species located this type of microhabitat remains unclear.

Upland habitat, and specifically upland microhabitat use, is seldom reported for this declining ranid species. Use of this habitat and how it contributes to survivorship of the species is critical. We contend that use of bedrock niches likely aids in a reduction of predation, particularly since the rock walls we noted were not likely easily negotiated by snakes or other predators. We would also add that if the species were uncommon in an area, and this microhabitat was not searched, the species may be determined to be absent during survey efforts, which can confound management and recovery of this species in California.

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Literature Cited

- Alvarez, J.A., and J.T. Wilcox. 2021. Observations of atypical habitat use by foothill yellow-legged frogs (*Rana boylei*) in the Coast Range of California. *Western North American Naturalist* 81:293-299.
- Bourque, R. 2008. Spatial ecology of an inland population of the Foothill Yellow-legged Frog (*Rana boylei*) in Tehama County, California. Master's thesis, Humboldt State University.
- Kupferberg, S.J. 1996. Hydrologic and geomorphic factors affecting conservation of a river-breeding frog (*Rana boylei*). *Ecological Applications* 6:1332-1344.
- Marlow, K.R., K.D. Wiseman, C.A. Wheeler, J.E. Drennan, and R.E. Jackman. 2016. Identification of individual foothill yellow-legged frogs (*Rana boylei*) using chin pattern photographs: a non-invasive and effective method for small population studies. *Herpetological Review* 47:193-198.
- Storer, T.I. 1925. A synopsis of the amphibia of California. *University of California Publications in Zoology* 27:1-342.
- Thomson, R.C., Wright, A.N., Shaffer, H.B. 2016. *California Amphibian and Reptile Species of Special Concern*. University of California Press, Berkeley.
- Wilcox, J.T., and J.A. Alvarez. 2019. Wrestling for real estate: male-male interactions in breeding foothill yellow-legged frogs (*Rana boylei*). *Western Wildlife* 6:14-17.
- Zweifel, R.G. 1955. Ecology, distribution, and systematics of frogs of the *Rana boylei* group. *University of California Publications in Zoology* 54:207-292.