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NOTE

LATE-SUMMER AGGREGATION OF THE FOOTHILL YELLOW-LEGGED FROG
(*RANA BOYLI*) IN CENTRAL CALIFORNIA

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ABSTRACT—We report on a late-summer, above-ground aggregation of foothill yellow-legged frogs (*Rana boylei*) in the Diablo Range, Santa Clara County, California. Our observation provides the first published account of aggregation in this species.

RESUMEN—Reportamos una agregación no subterránea del sapo *Rana boylei* que ocurrió durante la última parte del verano en la sierra del Diablo, condado de Santa Clara, California. Nuestra observación provee el primer registro publicado de agregación en esta especie.

In California, the foothill yellow-legged frog (*Rana boylei*) ranges from the Oregon border southward through the northern and central California coast and interior coast ranges to the transverse ranges of Los Angeles County, and west of the crest of the southern Cascade Mountains, along the western slope and foothills of the Sierra Nevada southward to Kern County (Stebbins, 1985; California Department of Fish and Game, in litt.). Isolated populations exist in the mountains of Los Angeles County (California Department of Fish and Game, in litt.). In California, the foothill yellow-legged frog is listed as a species of special concern because populations have restricted distributions and have experienced recent and widespread declines (California Natural Diversity Database, in litt.). However, the species remains locally abundant in the Diablo Range of central California, where we recorded this observation. During late-August 2003, two of us (RAL and GAL) observed an above-ground aggregation of foothill yellow-legged frogs.

We observed the aggregation adjacent to a stream in Soda Springs Canyon (37°10.038'N, 121°30.687'W) at an elevation of 440 m, ca. 1.25 km upstream from its confluence with

Coyote Creek, Santa Clara County. We observed six adults tightly clustered on a vertical bedrock ledge 1.2 m above a small pool embedded within an otherwise dry reach of stream. Frogs were oriented such that each individual was in physical contact with at least one other frog, either side-by-side, or stacked vertically. Frogs were inactive; this allowed us to pick up and examine one frog without disturbing the other frogs.

The stream in Soda Springs Canyon is a narrow, high-gradient (>2%), mostly second-order (Strahler, 1957) stream, characterized by intermittent flows of surface water in summer. Soda Springs Canyon contains springs and seeps that maintain small, spatially isolated pools during late summer and autumn. The aggregation site was oriented in a northeastern direction and fully shaded from direct sunlight by the bedrock ledge and by a mature riparian canopy of interior live oaks (*Quercus wislizeni*), California bay laurels (*Umbellularia californica*), and big-leaf maples (*Acer macrophyllum*). Dimensions of the isolated pool adjacent to the aggregation site were 1 by 1.2 m, with a maximum depth of 15 cm. Mean depth of pool was 5 cm. Temperatures of air and water in the pool at the time of observation were 35 and 17.8°C, respectively.

The diurnal behavior we observed is unusual for the foothill yellow-legged frog. Typically, when air temperatures are warm, as in this instance, frogs are wary, and when approached or disturbed while on land, will quickly jump into the adjacent stream and seek cover under boulders, cobbles, fine sediment and detritus, or vegetation.

Foothill yellow-legged frogs within the Coyote Creek watershed appear to form aggregations under different thermal conditions. We have observed these frogs sunning or basking in loose aggregations adjacent to rocky streams. In contrast, during periods with cooler ambient air temperatures, aggregations of adults and juveniles have been observed under large boulders, bedrock ledges, and within crevices (E. Gonsolin, unpublished data).

Our observation is unusual in that the frogs were aggregated above ground in full shade, and unlike active basking frogs, demonstrated no escape behavior when approached, although air temperatures were 35°C. The one frog that we handled was not cool to the touch. Our observation suggests that foothill yellow-legged frogs may become inactive under warm air temperatures typical of late summer and autumn.

Within the upper Coyote Creek watershed, outside the breeding season, most adults migrate up tributaries, such as Soda Springs Canyon (E. Gonsolin, unpublished data). These tributaries contain more large-sized boulders and bedrock, and tend to exhibit much cooler temperatures of water and air in summer than the main stem of upper Coyote Creek. As such, tributaries may provide better refugia from predators (i.e., birds) and high flows that scour the channel in winter, as well as more favorable air and water temperatures in summer when compared to sites in the main stem of Coyote Creek.

Bradford (1984) suggested that sunning aggregations of the closely related mountain yellow-legged frog (*Rana muscosa*) in summer may reduce evaporative water loss. We also observed that several pools along the stream in

Soda Springs Canyon and Coyote Creek were being predated actively by the western aquatic garter snake (*Thamnophis couchii*) and the western terrestrial garter snake (*T. elegans*). This observation suggests that the frogs we observed may have been avoiding pools to reduce their risk of predation because garter snakes forage in pools in the immediate proximity.

Our observation may be of conservation significance because aggregation sites for foothill yellow-legged frogs appear to provide refugia for multiple individuals under appropriate environmental conditions. It also is likely that these frogs were able to select above-ground, terrestrial microhabitats on tributaries with appropriate cover and temperatures for survival. Such microhabitats, where adults migrate following the breeding season, should be considered when implementing conservation measures aimed at protecting the foothill yellow-legged frog during all phases of its life cycle.

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