**INTRODUCTION**

Since 2002, we have used mapping of chin-mottling patterns to identify individual foothill-yellow legged frogs (Rana boylii) by visually matching digital photographs from three separate field studies in California (Figure 1). Over 1,950 individuals have been identified to date from chin photographs collected of adult and subadult frogs from Hardypilly Creek (Hamboldt Co., 2002-2004), the North Fork Feather River (NFR, Butte Co., 2006-2012), and Little and Big Carson Creeks (Marin Co., 2008-2012). The pilot study at Hardypilly Creek began in 2004 to evaluate this method for identification of individuals. On the NFR, chin-photograph were collected from 2004 to 2012 during a twelve-year breeding study (GARCIA et al. 2006) and during annual R. boylii monitoring surveys for Pacific Gas & Electric Company. On Little and Big Carson Creeks, chin photographs have been collected since 2006 using R. boylii monitoring surveys for Marlin Municipal Water District (MMWD). PIT tags were inserted into a subset of 316 individuals between two of these studies, and 84 recaptured PIT-tagged individuals verified that no two individuals had identical markings and that there was no change in their mottling patterns with age.

As with PIT-tagging, pattern recognition of individuals can be used to estimate longevity when used on long-term studies such as in this. Longevity estimates based on length frequency histograms and von Bertalanffy growth model analyses for this species indicate that female R. boylii can live at least 12 years. During 2012, a female first captured in 2004 and recaptured and photographed over the course of nine years substantially increased estimate for female R. boylii.

**METHODS**

On all studies, adult and subadult frogs were captured, weighed, measured, and the chin patterns photographed following methods described by MARLOW et al. (2012), in press. Each year on the NFR and MMWD projects, animals were picked in black and white and labeled with photo number, survey data, and information on breeding site. Individual identification was determined by matching patterned skin samples and estimating growth through photographs by external observations of each study group. In addition, to check if any of the all frogs captured on Hardypilly Creek were PIT-tagged (Wheeler et al. 2007) and 48 individuals were PIT-tagged in 2007 on the NFR (in order to further verify that individuals retained unique marks that no two frogs had identical patterns. PIT tagged frogs were released at 30 cm and 60 cm. Frogs captured on the MMWD project were not PIT-tagged but identified only through use of this photographic method.

**RESULTS**

A total of 2,050 individual PIT-tagged were identified using this method at Hardypilly Creek, the NFR, and Big and Little Carson Creek study sites. Of 2,140 individuals, 421 (19.9%) were recaptured over two or more years. A full analysis of longevity data is included. Additionally, a photographic study began in 2004 on the NFR has been recaptured in six consecutive years from 2004 to 2012. Female F72 was captured a total of eight times over the course of the entire breeding season (Figure 2).

**REFERENCES**


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**DISCUSSION**

This method continues to be a reliable non-invasive method to conduct mark-recapture studies on R. boylii and has proven beneficial for determining estimates of longevity as well as movements and breeding patterns from multiple years. Future imagery data analysis and a mating behavioral analysis of this subadult female in 2013 substantiates that female R. boylii can live at least 12 years and her longevity estimate (84.3) did suggest that she may live up to perhaps 15 years.

Based on these results, this method of pattern recognition holds promise for studies on other salamander species such as newts & salamanders & salamanders & newts, and even amphibians, for monitoring and gaining more information about small populations of R. boylii and possibly for other Western North American newts.

**Figure 1. Location of Hardypilly Creek study in Butte County, California (2002-2012).**

**Figure 2. Chin photographs of R. boylii.**

**Figure 3. Estimated Growth Curves from "RGT" from 2004-2006 capture data and size estimate for Female F72 captured over the years.**