
The California Red-legged Frog, *Rana aurora draytonii*, along the Arroyo Santo Domingo, northern Baja California, Mexico

PIERRE FIDENCI

735 Balboa St., # 4 San Francisco, CA 94118, USA. E-mail: pfidenci@garciaandassociates.com

HISTORICALLY, the California Red-legged Frog occurred from northern California (Shasta County) to Northern Baja California, Mexico at elevations below 2440 metres (Stebbins, 2003). In California, the species was originally found in 46 counties but now occurs in only 22 (U.S. Fish and Wildlife Service, 2002). Remaining isolated populations of California Red-legged Frogs are found in the Sierra Nevada, northern Coast, northern Transverse Ranges of California, and Northern Baja California (Stebbins, 2003). In the Central Coast of California populations are common (U.S. Fish and Wildlife Service, 2002).

In the United States, the California Red-legged Frog is listed as a federally threatened species (since 1996) through the Endangered Species Act (USFWS 1996). In the state of California, within which most of its range is contained, it is designated a California Species of Special Concern (CDFG, 2003). In Mexico, there is no special protection for this species (Grismer, 2002). However, Mexican laws protect all wildlife but the protection is rather illusive. Under its red-list of threatened species the World Conservation Union does not include the California Red-legged Frog (IUCN, 2003).

California Red-legged Frogs live in a Mediterranean climate where aquatic breeding habitats are diverse and subject to significant temporal and spatial changes (Jennings & Hayes, 1994). They use streams, pools in or next to streams, marshlands, springs, large reservoirs, natural and artificial ponds, sand and gravel pits containing water, wells, and lagoons (Storer, 1925; Wright & Wright, 1949; Stebbins, 1951, Hayes & Jennings, 1988; and Jennings, 1988). During periods of wet weather, frogs may disperse and use

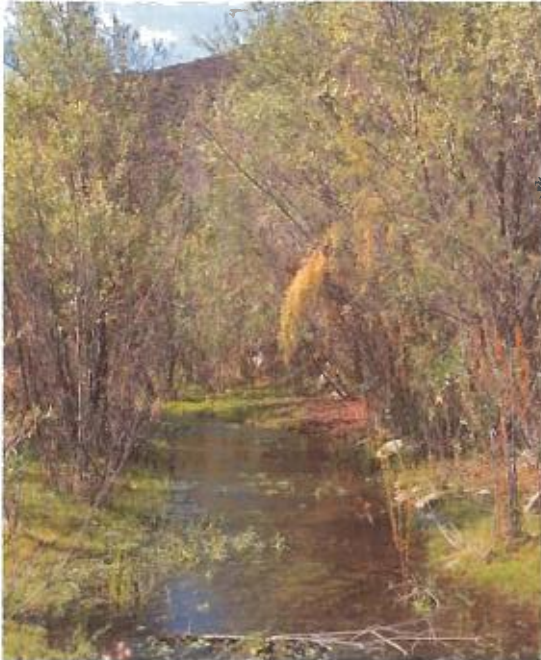
upland riparian habitat (distances up to 3 km), and use summer habitat when water is not available at their normal breeding areas (Rathbun et al., 1997). The use of seasonal habitat can be also associated with foraging activities. California Red-legged Frogs lay 2,000 to 5,000 eggs from late November to late April. Eggs hatch in 6 to 14 days and tadpoles require 11 to 20 weeks to metamorphose (Storer, 1925). Over-wintering tadpoles have been observed in the central coastal area of California (Fellers et al., 2001). Sexual maturity is reached at about 2 years for males and 3 years for females (Jennings & Hayes, 1985). The diet of California Red-legged Frogs is mainly composed of invertebrates, and for the larger adults vertebrates. However, tadpoles are phytograzers.

Environmental Setting

The Arroyo Santo Domingo is located 250 km south of the US-Mexican border within the Northern Baja California Province. It extends for a distance of approximately 80 km from the San Pedro Mártir Mountains to the Pacific Ocean. The Santo Domingo Drainage traverses the California phytogeographic region (Grismer, 1994), a region characterised by mesophytic vegetation communities dominated by Pacific coastal shrubland and foothill chaparral. The climate is cooler and wetter than in the rest of Baja California. The temperature of western Baja California is regulated by the Pacific Ocean influence, which creates a coastal advection fog keeping the air temperature cool (Grismer, 1994). Most precipitation occurs during winter storms.

METHODS

Our objective was to collect data on the distribution of the California Red-legged Frog along the Santo



Arroyo Santo Domingo; elevation 860 metres.
Photograph © Pierre Fidenci.

Domingo drainage, which represents the southernmost known location reported for this species (Welsh, 1976; Grismer, 2002). We surveyed three stretches of the Arroyo Santo Domingo during the spring of 2002 and 2003. The first stretch of approximately 1.5 km was located downstream east from Misión Santo Domingo at about 60 m elevation. We surveyed this site on May 25th, 2002 and May 20th, 2003. The second site was located north of Valledares at about 500 m elevation. We surveyed this site on May 24th, 2002. The third site, called El Potrero, was at about 860 m elevation. We surveyed this site on May 26th, 2002, and May 21st and 22nd, 2003.

Field surveys consisted of day-time and night-time surveys. Day-time surveys were conducted by visually scanning banks with binoculars between 09:30 and 16:00 hrs. Night-time surveys were conducted between 21:00 and 23:00 hrs using binoculars and a 6-volt flashlight. Both visual and auditory methods were used to detect frogs. In cases where frogs were obscured from view, the vegetation was parted where possible to uncover hidden pools.



California Red-legged Frog, *Rana aurora draytonii*, from El Arroyo Santo Domingo. Photograph © Pierre Fidenci.



California Red-legged Frog, *Rana aurora draytonii*, from El Arroyo Santo Domingo. Photograph © Pierre Fidenci.

RESULTS AND DISCUSSION

We observed California Red-legged Frogs at both our lower and higher elevation sites, and although we did not conduct surveys above 900 m, it is likely that the species is to be found at higher elevations along the Arroyo Santo Domingo. Indeed, Welsh (1976) encountered California Red-legged Frogs in the Sierra San Pedro Martír at 2200 m. We did not observe any signs of the species at 500 m elevation, and local farmers confirmed that they had not seen frogs in that section of the creek either. It appears that the California Red-legged Frog is not distributed continuously along El Arroyo Santo Domingo, but

could use these uninhabited stretches during dispersal (Rathbun et al., 1997). As noted by Welsh (1976), California Red-legged Frogs are present at a wide range of elevations (60-2200 m) among different microhabitat types along the Arroyo Santo Domingo.

At the lower elevation site, we observed *Rana aurora draytonii* tadpoles (about 4 weeks old) by in their hundreds with the apparent absence of adults. However, we did not find any tadpoles or egg masses at the higher elevation sites, despite the numerous adults observed. The lack of tadpoles is curious since we conducted surveys after the breeding season when tadpoles are most likely to be found (Jennings & Hayes, 1994). Additionally, the occurrence of tadpoles at the lower part of the Rio Santo Domingo confirmed that we conducted surveys in concordance with the timing of tadpole presence. The absence of tadpoles could be attributed to different causes (e.g., use of other parts of the creek for breeding where we did not conduct surveys) but remains unknown.

An average of ten adult *R. aurora draytonii* were observed at El Protero during day-time spring surveys. Frogs were found less than 20 cm from water in shady areas. No tadpoles were found. The largest frog had a snout-vent length of 83.8 cm. Frogs were mostly found outside water, near small and large pools, and used the main channel and backwater pools. Most backwater pools appeared to lack fish, and all the frogs observed were of a sufficiently large size to avoid predation from fish such as trout (*Oncorhynchus sp.*). Most pools also had submerged aquatic vegetation providing the opportunity for refuge. The largest frog was found basking in a shady area next to a boulder, where aquatic vegetation was absent. This pool was part of the main creek at the site of a small cascading waterfall, and was relatively deep (0.8 m) with a sandy bed. Frogs appeared to use the numerous small granite crevices for thermal and physical refuge, where temperatures are cooler and less subject to diel variation. Most of the frogs did not show any escape behaviour until approached within 0.2 m. At other sites in California, California Red-legged Frogs jump usually within 1 m of human presence

(pers. obs.). This geographic difference in the timing of escape responses could be explained by the low predation rate along the Rio Santo Domingo.

An average of five frogs were observed during the night-time surveys, most of them found during the early evening. Frogs seen on land during the day were usually found at the same location at night.

Potential Threats and Conservation

In general, California Red-legged Frogs along the Arroyo Santo Domingo appear to be protected from any significant impacts that could threaten their survival, at least in the short term. However, I identified two potential threats that could become important in the future due to population growth: habitat loss and alteration due to recreation, and agriculture.

Habitat loss and alteration appears to represent the most significant impact on the Arroyo Santo Domingo. It occurs primarily at the lower section where a dirt access road allows recreation activities along the creek. The creek is used actively by humans for fishing and swimming. Negative impacts include vehicles crossing and illegal garbage disposal along the creek.

Agriculture and livestock grazing also appear to have a negative impact on the Arroyo Santo Domingo. Water diversion was observed at various localities along the Arroyo Santo Domingo below 860 m. Alteration in the hydrology of free-flowing creeks caused by the construction of dams and other similar projects may be expected to have serious effects on stream-dwelling amphibians (Lind et al., 1996). Water is pumped directly from the creek, mostly in its lower sections. Some water is also diverted at El Portrero (860 m) and La Mission (600 m) where two farms are present. The amount of water used by these two farms seems negligible due to their small agriculture practices. At El Portrero, water is diverted into artificial, shallow seasonal pools. They are devoid of emergent vegetation and allow watering of fruit trees and seasonal crops. For a few days after these temporary pools are filled with water, California Red-legged Frogs can be readily observed

(Martorell pers. comm., 2002), and thus appear to be beneficial in providing additional suitable habitat. The owner of this property has also created a permanent pond at about 300 m from the Arroyo Santo Domingo, which could provide additional breeding habitat for frogs since water would be present for more than five months of the year.

As noted by Grismer (2002), illegal reptile collecting for commercial use in the United States poses an important threat to local, endemic, and insular herpetofauna of Baja California. According to local people, however, California Red-legged Frogs are not captured for food or the pet trade along the Arroyo Santo Domingo. These frogs were collected for human consumption in California until the mid 1950s, and thereafter replaced by the introduced larger Bullfrog (*Rana castebeiana*) from the East Coast of the United States (Jennings & Hayes, 1985). Fortunately, local people of Baja California do not consider this species as a food resource.

California Red-legged Frogs in the El Arroyo Santo Domingo deserve special attention since they might constitute the largest remaining population at the extent of the species' distribution. Our 2002 and 2003 field surveys can be regarded as a preliminary step in assessing its current range and population status in Mexico. The difficulty in accessing sites that have never been previously surveyed or visited by any biologists should be considered a priority in any future surveying effort, and may lead to possible extensions to its range.

ACKNOWLEDGEMENTS

I thank Angela Pasillas and Efrain Martorell for their generous hospitality in Baja California, and Renée Sittman and James Buskirk, who participated in the fieldwork. Finally, I am grateful to John Garcia of Garcia and Associates for the use of the GPS unit.

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