

Trogloxyeny in the Caucasian parsley frog (*Pelodytes caucasicus*)

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ABSTRACT - The Caucasian parsley frog (*Pelodytes caucasicus*) is a patchily distributed endemic of Turkey and the Caucasus. What is known about its habitat preferences mostly refers to the breeding sites; unlike other *Pelodytes* species it has never been reported to occur in caves. This paper presents observations showing that caves, particularly those with bat colonies, are an important habitat for this obscure species.

INTRODUCTION

The Caucasian parsley frog (*Pelodytes caucasicus* Boulenger 1896) is a little-known species with localised and fragmented distribution. It occurs in western Republic of Georgia, Krasnodar Region of Russia, and extreme northeastern Turkey, with isolated populations in the central part of Turkey's northern coast and in Georgia-Azerbaijan border area (Kaya et al., 2009). Published information about its habitat preferences mostly refers to its breeding sites, with non-breeding habitats characterised very broadly as moist forests with dense undergrowth near water (Chubinishvili et al., 1995 and bibliography therein; Tarkhnishvili & Gokhelasvili, 1999; Kuzmin, 2001; Gül, 2014). The only known wintering sites are in the layer of leaf litter on the forest floor (Kuzmin, 2001). The closely related common parsley frog (*P. punctatus*) is known to use caves as wintering sites and summer shelters (Thomas & Triolet, 1994; Salvidio et al., 2004); it is also known from Pleistocene cave deposits (Delfino, 2004; Blain et al., 2014). However, although most (possibly all) of *P. caucasicus* range lies in areas of extensive limestone karst (Adamia et al., 2011), this species has never been reported to occur in caves.

MATERIALS AND METHODS

The study was conducted in summer months (July-August) in the vicinity of Khosta, Russia (43°33-34' N, 39°49-56' E), in the area later included in Sochinsky National Park, at elevations 94-444 m a. s. l. All explored caves (N=8) were located on steep slopes covered with deciduous forests, sometimes with limestone cliffs. All caves were simple horizontal or near-horizontal shafts with no visible water and a deep layer of mud mixed with rocks of varying size on the floor. The caves ranged in length from 8 to ~500 m, and the entrances were located 2-400 m from the nearest stream. Three of the caves had colonies of horseshoe bats (*Rhinolophus* spp.).

Parsley frogs were located during daytime by flipping rocks on the floor of the caves and hand-digging through underlying soft sediment. Each cave was searched for approximately half an hour by moving from the entrance inwards and flipping rocks nearest to the path, so only a small portion of such

habitat was searched in each cave and it was unlikely that any frog would be caught twice. The cave where the largest number of frogs (N=3) was found was later visited at night for spotlighting search (its results were excluded from statistical analysis to avoid counting the same frogs twice). The length of each cave was estimated visually. The coordinates of each cave, its elevation above the sea level, and the distance from the entrance to the nearest stream were determined post-hoc from Google Earth. The same methods were used to search for frogs in the forest outside the caves, with approximately four hours spent looking under rocks during the day and more than twenty hours spent spotlighting at night.

The numbers of frogs found in each cave were tested for correlation with elevation above the sea level, length of the cave, and distance to the nearest stream using Spearman's Rank test; and for differences between caves with presence vs. absence of limestone cliffs near the entrance and with presence vs. absence of bat colonies inside using two-tailed randomization test with each cave as a single data point. In all cases, significance level was set at 0.05.

RESULTS AND DISCUSSION

No parsley frogs were ever found outside of caves; all following information refers to frogs found inside. A total of 8 parsley frogs were found in caves during daytime, and 4 more during a night-time visit. During the day, one frog was found approximately 50 m from the entrance, and others 5-20 m from the entrance. At night all frogs were found 5-15 m from the entrance (that cave was only 15 m long). All were found in places where daylight from the entrance was still visible, 5-10 cm deep in soft sediment under rocks 20-40 cm in size (very few larger rocks were flipped).

There was no significant correlation with elevation above the sea level, length of the cave, distance to the nearest stream, or presence/absence of limestone cliffs near the entrance ($P > 0.1$ in all cases), but the effect of presence of bat colonies was significant ($P = 0.0357$).

Finding parsley frogs in cave habitats is difficult, and there is no doubt that only a small fraction of them was found. It can be concluded that caves, particularly those with bat colonies, are important for this species as summer shelters. The fact

that frogs were also found there at night and the correlation of their numbers with bat presence suggests that they also use caves for foraging on invertebrates feeding on bat guano. Invertebrate numbers are known to be much higher in caves inhabited by bats (see for example Howarth, 1983). The frogs might also stay in the caves for hibernation, as the closely related common parsley frogs often do (Thomas & Triolet, 1994; Salvidio et al., 2004), and leave them only for breeding. The absence of significant correlation with other parameters of the caves is probably due to small sample size.

P. caucasicus is listed as near-threatened by the IUCN, and as Category 2 (declining) in Russia, Georgia and Azerbaijan (Kuzmin, 2001; Kaya et al., 2009). It is protected in dedicated nature reserves, and there were attempts at captive breeding (Kuzmin, 2001). If its decline reaches the stage when captive breeding and reintroduction would be necessary, knowledge of the importance of caves in its behavioural ecology will help in choosing reintroduction sites and in monitoring populations; the decline might also be slowed down by protecting caves. This finding also underlines the importance of protecting bat colonies in small caves, where they frequently experience catastrophic declines due to human disturbance. Many bat colonies in the study area have recently disappeared (Dinets & Rotshild, 1998).

Finding that a significant part of the population might be troglonec outside the mating season doesn't mean that the species' population densities have been underestimated or its conservation status needs to be re-evaluated, since all previous counts and estimates used data from breeding ponds (Chubinishvili et al., 1995; Tarkhnishvili & Gokhelashvili, 1999; Kuzmin, 2001).

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