Predation on *Allobates femoralis* (Boulenger 1884; Anura: Aromobatidae) by the colubrid snake *Xenopholis scalaris* (Wucherer 1861)

Max Ringler¹*, Eva Ursprung¹, Walter Hödl¹

Subsumed under the vernacular name “poison frogs”, the superfamly Dendrobatodea contains the “non-poisonous poison frogs” in the family Aromobatidae and the “true poison frogs” in the family Dendrobatidae (Grant et al., 2006). While the latter regularly feature bright, aposematic colouration and potent skin toxins, members of the Aromobatidae are usually cryptically coloured and rely on camouflage and rapid escape behaviour as anti-predator measures (Cooper, Caldwell and Vitt, 2009). Despite intensive research on various aspects of dendrobatid biology, little information is available on natural predators of this taxon (cf. Darst and Cummings, 2006; Saporito et al., 2007; Cooper, Caldwell and Vitt, 2009; Noonan and Comeault, 2009). *Allobates femoralis* is a semi-cryptic pan-Amazonian aromobatid frog (Amézquita et al., 2009) and possesses, at the most, only traces of skin toxins of the potent alkaloid classes known from dendrobatids (Daly, Myers and Whittaker, 1987). However, the species was found to be a Batesian mimic of poisonous species of the dendrobatid genus *Epipedobates* (Darst and Cummings, 2006), including *E. hahneli*, which is syntopic with *A. femoralis* at the observation site in French Guiana (Lescure and Marty, 2000; Born and Gaucher, 2001). Additionally, the skin

¹ Department of Evolutionary Biology, University of Vienna Althanstraße, 14, A-1090 Vienna, Austria; email: max.ringler@univie.ac.at
* corresponding author.

---

Figure 1. Adult *Allobates femoralis* with attached HDF reflector.
excretions of *A. femoralis* are likely to make the frog unpalatable to some predators due to their bitter taste (pers. obs).

The focus individual, a male *A. femoralis* with a snout-urostyle length of 27.05 mm and a weight of 1.7 g, was used in field experiments to test the suitability of the harmonic-direction-finding (HDF) telemetry-technique (Pellet et al., 2006) to study male tadpole transport and female mating commutation in this highly territorial (Ringler, Ursprung and Hödl, 2009) species. The trials took place in tropical lowland rainforest near the research station “Saut Pararé” in the nature reserve “Les Nouragues”, French Guiana (4.04° N, 52.68° W, WGS84). After some other individuals had been observed in captivity in order to optimise reflector attachment, on 28 February 2008 three individuals, including the focal male, were released inside their respective territories with attached reflectors to investigate their behaviour under natural conditions. The reflectors consisted of a Schottky diode that was soldered between two antennas made of 40 µm steel-strands forming a 6 cm by 12 cm T-shaped dipole with the braze points covered in shrinkable tubing. To attach the reflectors to the frogs we used waistbands (Fig. 1), made from latex-free condoms to prevent skin irritation (Gutleb et al., 2001). Together with the waistband, the reflectors had a total mass of less than 0.05 g, which is

Figure 2. Adult *Xenopholis scalaris* coiled under leaves.

Figure 3. Partly digested *Allobates femoralis* recovered from partly skeletonised *Xenopholis scalaris*.
less than 5\% of the body mass of adult *A. femoralis*.

The focal male was recovered with a RECCO HDF several times from 28 - 29 February and showed apparently normal behaviour during that time, including constant advertisement calls and regular movement and escape behaviour. On 1 March, with the first detection on that day at 1100 hours, we unambiguously retrieved the reflector’s signal from an adult (aprox. 300 mm in total length) *Xenopholis scalaris*, which we discovered typically coiled in its protective position (Zug, Vitt and Caldwell, 2007) under some leaves (Fig. 2), still inside the territory of the focal male. To observe the further behaviour of the snake, we took it into captivity in a netted cage. During the night the snake died and was already partly skeletonised by ants when we discovered it the next morning. We opened the body cavity of the snake and recovered the partly digested frog, which apparently had been swallowed head first and whose ventral pattern was still recognizable for individual identification (Fig. 3). No apparent internal injuries from the reflector were visible and its antennae were folded smoothly in the intestinal tract of the snake. Hence we cannot be certain whether the death of the snake was caused by toxic skin excretions from the frog, direct effects of the swallowed reflector, or if it was attacked and killed by the ants that covered the corpse in the morning.

*Xenopholis scalaris* is a small (300-350 mm in total length) leaf-litter snake with an equally pan-Amazonian distribution as *A. femoralis* where it inhabits primary and old secondary rainforest in humid zones. It features a brick-red brown body with a dark longitudinal central line running along the body which is accompanied by perpendicular running, dark triangular shaped patterns (Fig. 2). The species is known to feed on frogs, and given its nocturnal activity (Starace, 1998), it is highly likely that the prey frog was taken during the night when *A. femoralis*, like almost all dendrobatoids, is not active. Snake predation on telemetered amphibians has been reported previously by Spieler and Linsenmair (1998) and Jehle and Arntzen (2000). However, as we did not witness the actual predation event, we can only speculate whether the attached reflector rendered the frog more conspicuous and made it more susceptible to fall prey to the snake, or if the reflector hindered the frog in escaping its predator.

**Acknowledgements.** Fieldwork was supported by the Austrian Science Fund grant FWF-18811 (PI Walter Hödl). We are especially grateful to Nicolas Perrin from the Department of Ecology and Evolution at the UNIL, Lausanne, Switzerland for the loan of the RECCO HDF. Permissions were provided by the CNRS and fieldwork was conducted in compliance with current French and EU law.

**References**


