Insights on the *Triturus marmoratus* predation upon adult newts

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Resumen: *Triturus marmoratus* es una de las especies de tritón más grandes dentro de su género, estando su dieta constituida por invertebrados y huevos y larvas de anfibios. A pesar de ello, de manera anecdótica se ha registrado también el consumo de ejemplares adultos de otras especies de tritones. En esta nota presentamos un nuevo caso de consumo de un ejemplar adulto de tritón (*Lissotriton boscai*) por *T. marmoratus* y planteamos la hipótesis de que este consumo sea más frecuente de lo que las evidencias publicadas sugieren.

The marbled newt *Triturus marmoratus* (Latreille, 1800) is one of the largest newts in its genus, with females reaching 16 cm total length (Ferrand de Almeida *et al.*, 2001). This species occurs from western France to north western Portugal (Themudo & Arntzen, 2010), and its life-history differs between populations (Jakob *et al.*, 2002). In highland populations of northern Portugal, *T. marmoratus* hibernates in the winter and aestivates in the summer, moving to water between these periods, exclusively for breeding. In lowlands breeding occurs in late winter and early spring, and individuals remain terrestrial during the rest of the year (Caetano, 1988).

T. marmoratus diet changes throughout life stage and as adult, it varies according to phase (terrestrial *versus* aquatic) (Montori, 2010) and between populations (Villero *et al.*, 2006). Overall, individuals are known to feed on invertebrates such as insect larvae, earthworms, copepods, slugs, snails (Caetano, 1988), and amphibian eggs and larvae (Villero *et al.*, 2006; Diego-Rasilla, 2003). Only three reports exist about *T. marmoratus* preying on adult newts in the Iberian Peninsula: one on alpine newt *Ichthyosaura alpestris* (Orizaola & Rodríguez del Valle, 2000), one on palmate newt *Lissotriton helveticus* (Crespo-Diaz & Sanz-Azkue, 2009), and one on Bosca's newt *Lissotriton boscai* (Ayres, 2007). Similar behaviours are reported for other caudate species (Hagström, 1979; Steward, 1969 in Crespo-Diaz & Sanz-Azkue, 2009).

On 24 May 2013, while monitoring the amphibian community for disease screening at Serra da Estrela Natural Park, Portugal (Rosa *et al.*, 2013), several individuals were captured in a forestry tank (Tanque de Folgosinho, 40°29'37.09"N / 7°31'47.61"W; 1079 masl) using dip-nets. During the handling of an adult female *T. marmoratus*, it regurgitated an adult *L. boscai* (Figure 1).The female measured 67 mm SVL, and the preyed *L. boscai*, 24 mm SVL (Figure 1c).

All records of adult newts' consumption by *T. marmoratus* are reported in aquatic environment. These events may be related to: i) food availability in the water body (Griffiths, 1996; Villero *et al.*, 2006; Gosá & Sarasola, 2010); ii) voracious

Figure 1: a-b. Adult female *T. marmoratus* regurgitating an adult *L. boscai* at Serra da Estrela, Portugal; c. *L. boscai* regurgitated.
Figura 1: a-b. Hembra adulta de *T. marmoratus* regurgitando un adulto de *L. Boscai* en la Serra da Estrela, Portugal; c. *L. boscai* regurgitado.

feeding in water, recovering of a fasting period during hibernation (Caetano, 1988); iii) high energy requirements for the reproductive season – gonads maturation and maintenance (Bell, 1977), crest development (Green, 1991b) and courtship display (Green, 1991a); and iv) energy expenditure related to the aquatic life – higher metabolic rates in aquatic environment (Kristín & Gvoždík, 2014), high energy demands for air-breathing (Halliday & Sweatman, 1976; Šamajová & Gvoždík, 2009).

It has been suggested that energetic demands for reproduction leading to adult newts' predation may be significant enough to influence females' breeding site choice (Gosá & Sarasola, 2010). It is interesting to note that all known records of adult newts' intake report on females. This might be related to energy costs of egg production (Denoel *et al.*, 2005) and egg-laying (Meier & Schnieper, 1986 in Caetano, 1988).

T. marmoratus are opportunistic (Caetano, 1988) and highly euriphagic predators (Montori, 2010), especially females, whose diet is richer in amphibian items (Villero *et al.*, 2006). However, Villero *et al.* (2006) found no relation between the sizes of *T. marmoratus* and those of their preys. In fact, they relate the females' higher euriphagy not to their larger size, but to the males' territoriality (Zuiderwijk & Sparreboom, 1986) limiting their hunting possibilities, contrasting with the females' mobility which allows them to catch a higher variety of preys. More exhaustive observations would help to clarify if adult newts' consumption is actually exclusive of females, and why.

T. marmoratus usually feeds on prey ranging from less than 0.5 mm to over 45 mm (Villero *et al.*, 2006). However, this species is able to hunt larger prey first, which provide more energy and are easier to detect (Caetano, 1988). Predation upon adult newts is always presented as exceptional (Orizaola & Rodríguez del Valle, 2000; Ayres, 2007; Crespo-Diaz & Sanz-Azkue, 2009). However, despite the scarcity of observations, this behaviour may actually occur more frequently than thought.

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Unken reflex in *Mesotriton alpestris*

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Resumen: Describimos la exhibición de un comportamiento defensivo estereotipado, el "unken reflex", en el tritón alpino, *Mesotriton alpestris*. Al notar nuestra presencia en el caso terrestre, y al ser manipulado en el caso acuático, los ejemplares frecuentemente mostraron una postura rígida arqueando el cuerpo entero, elevando la cola y la cabeza, extendiendo las extremidades y mostrando la coloración ventral naranja.