

Cannibalism observed in a tadpole
of the Western Spadefoot Toad
Pelobates cultripipes (CUVIER, 1829)

Cannibalism is a strategy with complex trade-offs. Cannibals show faster growth, larger size and/or higher survival rate than non-cannibal conspecifics (POLIS 1981; MICHIMAE & WAKAHARA 2001). Conspecifics are assumed to provide better nutritional input than heterospecific prey (POLIS 1981; MEFFE & CRUMP 1987). Moreover, cannibalism has ecological implications, such as a reduced intraspecific competition (DENOËL et al. 2006). However, cannibalism also implies fitness costs (ELGAR & CRESPI 1992), such as killing relatives (WALDMAN 1988), the risk of transferring pathogens from conspecifics (PFENNIG et al. 1998) and the likelihood of injury inflicted by conspecifics (POLIS 1981; MICHIMAE & WAKAHARA 2001). Moreover, because omnivores usually aggregate with conspecifics while carnivores are solitary (BAZAZI et al. 2012), cannibals may be more exposed to predators as they do not benefit from the protective effects of groups.

In amphibians, cannibal larvae have been observed in anurans as well as urodels. Cannibalism in amphibian larvae is environmentally induced (MICHIMAE & WAKAHARA



Fig. 1: The cannibal tadpole of *Pelobates cultripes* (CUVIER, 1829). Note the prominent jaw sheath.

2001) but also influenced by kinship environment (PFENNIG & COLLINS 1993). Some anuran species can be opportunistic cannibals, such as *Hyla arborea* (LINNAEUS, 1758) and *Epidalea calamita* (LAURENTI, 1768) (HEUSSER 1971), while cannibal morphs were not described for these species. However, cannibal morphs have been described in the Mexican Spadefoot *Spea multiplicata* (COPE, 1863) (PFENNIG 1990; BANBURY & MAGLIA 2006), a genus phylogenetically related to *Pelobates* (GARCÍA-PARÍS et al. 2003).

There are several studies on the diet of the Western Spadefoot tadpoles *Pelobates cultripes* (CUVIER, 1829) (e.g., DÍAZ-PANIAGUA 1985) but cannibalism was reported only when tadpoles congregated in high densities (GARCÍA-PARÍS et al. 2004). It was unknown if this behavior also occurs at low densities.

Within a long-term study of anuran larval ecology (ESCORIZA & BEN HASSINE 2014), *Pelobates cultripes* tadpoles were sampled in Maials, Lleida (northeast Spain at 41.5°N and 0.6°E, 200 m a.s.l.), located within semi-arid climate (BSk steppe climate; PEEL et al. 2007). In February 2009, the tadpoles were found in a temporary pond (hydroperiod of five months), with a surface area of 945 m², and an average depth of 0.81 m. The water was very turbid (300 NTU [Nephelometric Turbidity Units]), with 5 % of the surface covered by emergent vegetation. No anuran species other than *P. cultripes* were found in the pond. The catch per unit effort (CPUE = 0.56 specimens per dipnet haul) may serve as a measure of larval abundance in the pond.

Two tadpoles of 55 mm and 53 mm in total length, respectively, were collected and placed in an aquarium of 100 cm x 30 cm x 40 cm (water depth 38 cm) provided with *ad libitum* food access (Marine pellet and *Spirulina* tabs - Ocean Nutrition®, San Diego). When the larger tadpole began to attack the smaller one, more food was added to the aquarium (pellets for both omnivorous and herbivorous fishes in the same proportion).

After one day, the larger tadpole (which showed a prominent jaw sheath and a wider head - Fig. 1) had killed and consumed the smaller one. Cannibal strategies in amphibian larvae developed to promote faster development and metamorphosis before pond desiccation (LANNOO & BACHMANN 1984) and for this reason this type of behavior is frequently observed under extreme conditions, such as temporary ponds under semi-arid and climates or ephemeral tropical pools (DEGANI 1993; DAYTON & WAPO 2002; HAWLEY 2009). It also may appear as a consequence of carnivorous morphs evolving in order to feed on large prey (HOFFMAN & PFENNIG 1999), especially when there is low prey availability. Nevertheless, cannibalism increases with conspecific density (HOFFMAN & PFENNIG 1999; MICHIMAE & WAKAHARA 2001) and depends on the body-size structure of the population (POLIS 1981).

Because the pond studied was not running dry, the observed cannibalism cannot easily be attributed to environmentally induced stress, as reported in, e.g., the Southern Spadefoot, *S. multiplicata* (PFENNIG 1992), the more so, as the aquarium and the low holding density did not simulate a drying habitat. The fact that the pond showed high turbidity and, consequently, low primary productivity, low algal food availability could have favored the emergence of opportunistic cannibalism in this population. However, more observations are needed, before sound conclusions can be drawn about the environmental triggers that may promote cannibalism in this species.

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