

Cannibalism in *Bombina variegata* Linnaeus, 1758 in Wahlwiller, Limburg Province, the Netherlands

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Introduction

Cannibalism among Anurans has been documented for many species around the world, both on eggs (Tyler, 1963; Weygoldt, 1980; Zimmermann and Zimmermann, 1983; Gascon, 1992; Bonilla and La Marca, 1996; Drewes and Altig, 1996), tadpoles (Wager, 1965; Jancowski and Orchard, 2013) and post-metamorphic specimens (Inger and Marx, 1961; Werner, Wellborn and McPeck, 1995; Wells, 2007; Jancowski and Orchard, 2013). Observations in the wild of cannibalism among Bombinatoridae are rare. In the Yellow-bellied Toad (*Bombina variegata*) it is only expected to occur infrequently (Gollmann and Gollmann, 2002). Here we make note of cannibalism among *B. variegata* in the wild in Wahlwiller, Limburg province, the Netherlands.

On August 1st 2013, the population dynamics and reproduction success of *B. variegata* were studied in a number of small ponds in Wahlwiller in the province of Limburg (N45°21'–45°32", E45°21'–45°32"). This site is one of the most northern places within the distribution range of this species. One of the ponds, with a surface area of approximately 0.24 m² and a 20 cm depth, was occupied by several tadpoles, 23 individuals at the early juvenile stage and a single adult female. While observing, the female suddenly seized one of the juveniles. Her action was clearly triggered by its movement. She spit it out shortly after, although 80% of the juvenile was already inside her mouth. Then, within twenty seconds, the same happened to a second juvenile. Fifty seconds later, a third attack took place; after being in the female's grip for ten seconds, this third juvenile

was swallowed completely. Six minutes after this event, the juvenile had not been regurgitated regardless the stress the female had undergone while being weighted, measured and photographed. The event took place at 12.55 pm at 33°C air temperature. The female measured 36 mm (SVL) and weighed 4.8 g (after ingesting the juvenile). Similar juveniles measured approximately 9 mm (SVL).

Whether the adult female and juvenile(s) were related is not clear. Different females are known to have deposited eggs in this specific water, making it plausible that juveniles from different kinships were present. Therefore, it is unclear if this episode represents hetero cannibalism (consuming non-related conspecifics) or filial cannibalism (consuming related conspecifics).

Cannibalism seems to be rare in *B. variegata* and has almost never been observed, in particular in the wild. Moreover, no evidence of cannibalism could be found even in intensive comparative studies on stomach contents (e.g. Mollov, Boyadzhiev and Donev, 2006). In captivity, a 14 mm juvenile was observed to be consumed by an adult specimen (Niekisch, 1990) and Kuzmin (1999) reported larvae predated on eggs and other larvae but also adults on juveniles. Our case proves that cannibalism in *B. variegata* does occur in the wild too.

Why the first two juveniles caught were not consumed remains unclear. Toxicity seems unlikely: all juveniles measured less than 10 mm (SVL) and at this stage the toxic glands are usually not fully developed yet. In fact, the toxic glands in *B. variegata* do not function until the abdomen or belly changes in bright yellow color (Niekisch, 1990). Among our early stage juveniles, only a few had a very light yellow abdomen, suggesting that for almost all of them, toxic glands were most probably not yet developed.

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