

A case of tail bifurcation in *Notophthalmus viridescens*: a rare condition or an increasing phenomenon in Urodeles?

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On 28 July 2019, I captured an adult female *Notophthalmus viridescens viridescens* (red-spotted newt) with tail bifurcation (Figure 1) in a vernal pond in Norwich, Vermont, USA (43.7486°N, 72.3394°O). The individual weighed 3.552 g. Its snout-vent length was 51 mm, with a 47-mm-long primary tail, and a

15-mm-long supernumerary tail branching as a lateral bifurcation from the left side of the primary tail, 27 mm from the cloaca (Figure 1). Besides tail bifurcation, the newt had a normal appearance (Figure 1). Immediately after taking biometrics and photos, I released the individual in the pond where I had found it.



Figure 1. Adult female red spotted newt (*Notophthalmus viridescens viridescens*) with a bifurcated tail sampled in a natural, unpolluted pond in Norwich (Vermont, USA) in July 2019.

With only a handful of cases reported in the last centuries (reviewed in Henle *et al.*, 2012), bifurcations or duplications of tails are often considered among the least prevalent of morphological abnormalities in urodeles (Henle *et al.*, 2012; Smirnov, 2014; Zamora-Camacho, 2020). However, in the last decade, tail bifurcation has been reported in Plethodontids: *Bolitoglossa heiroreias* (Medina-Florez & Townsend, 2014), *Desmognathus fuscus* (Hartzell, 2017), and *Plethodon cinereus* (Liebgold, 2019), as well as in Salamandrids: *Triturus dobrogicus*, *T. carnifex* (Henle *et al.*, 2012), *Calotriton arnoldi* (Martínez-Silvestre *et al.*, 2014), *Calotriton asper* (Gosá *et al.*, 2019), *Lissotriton vulgaris* (Smirnov, 2014), *Salamandrina perspicillata* (Romano *et al.*, 2017), *Pleurodeles waltl* (Zamora-Camacho, 2020), and *N. v. viridiscens* (this study).

This growing number of recent cases reported calls into question the alleged low prevalence of this phenomenon. This tendency could result from a greater awareness of researchers regarding amphibian abnormalities (Peltzer *et al.*, 2011; Lunde & Johnson, 2012). As an alternative, but non-mutually exclusive explanation, some of the stressors that trigger these anomalies, such as pollution, ultraviolet radiation, and abnormal temperatures (Reeves *et al.*, 2010), are increasingly pervasive in the context of global environmental change (Vitousek, 1994), which could bolster tail bifurcation prevalence in urodeles.

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