A case of caudal autotomy in a captive *Plethodon teyahalee*

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This is a note on the first recorded case of voluntary tail autotomy in a captive *Plethodon teyahalee* (Hairston, 1950). Autotomy, the process where an animal discards a single or multiple limbs, is a common feature found amongst lower vertebrates (Wake and Dresner, 1967; Romano *et al.*, 2010). It is widespread amongst salamander species where it occurs as a defence mechanism against predators and rival animals during competition over territories or mates (Jamison and Harris, 1992; Stebbins and Cohen, 1995; Marvin, 2010; Romano *et al.*, 2010). In salamanders, it is the tail which is autotomised, allowing the individual to escape predation (Stebbins and Cohen, 1995). This specialist adaptation comes with a high cost as the tail is a site of fat storage, as well as aiding in balance and locomotion (Brodie, 1997; Marvin, 2010). It is believed to have evolved from ancestral species which adopted a defensive position by using the tail to distract predators away from the head and/or body (Brodie, 1997).

Within Caudata, there is believed to be a rough grouping of three different types of tail autotomy, and this is defined by how and which part of the tail separates from the body (Wake and Dresner, 1967). Species which have tail breaks, normally towards the posterior of the tail and caused by trauma, are termed 'thick-based tail' species (Wake and Dresner, 1967). Those which are able to autotomise their tail, but only at its base at a localised specific site are the 'constricted-based tail' group, and make up the majority of species (Wake and Dresner,

1967). The final grouping, which includes species of Plethodon are classified as 'Slender-based tail' Salamanders; these species are able

Figure 1. *Plethodon teyahalee* autotomated tail.

Figure 2. *Plethodon teyahalee* autotomated tail suspended in water.

to autotomise their tails along its length (Wake and Dresner, 1967).

P. teyahalee is a large, terrestrial, lungless species of caudate which naturally occurs at lower altitudes in the southern Appalachian Mountains, United States of America (Hairston, 1950; Highton, 1995). It is a member of the *glutinosus* species complex which contains multiple species within the Eastern Plethodon grouping (Highton, 1995). Other species within the Eastern clade of Plethodon are known to frequently autotomise their tails as an anti-predator defence and display well-developed 'wound-healing' specialisations (Wake and Dresner, 1967; Highton, 1962). This feature has been widely studied in *Plethodon cinereus* (Green, 1818; Venesky and Anthony, 2007), and has also been recorded in *Plethodon jordani* (Blatchley, 1901; Brodie Jr. and Howard, 1973) and *Plethodon dorsalis* (Cope, 1889; Hucko and Cupp, 2001).

Figure 3. Site of tail autotomation.

In June 2018, a group of five *P. teyahalee* were purchased from a private German collection and brought to the UK, where the animals were placed into a quarantine enclosure. A lack of clear sexual characteristics were present due to the animals either not yet being at sexual maturity (ages unknown) or experiencing unsuitable conditions during their transport. As such, it was not feasible to identify their sex.

After standard quarantine procedure, three surviving individuals were introduced into a permanent, semi-opaque, naturalistic enclosure, which replicates the temperate moist lowland Appalachian mountains (Grover, 1998). Their lungless nature means that they spend much of their time under damp refugia such as rocks and logs (Grover, 1998; Caruso, 2016; Lyons, Shepard and Kozak, 2016). Within the enclosure there are multiple damp hides provided in the form of rotting wood, moss piles and artificial crevices. There is also a dense layer of leaves from multiple species of tree, including *Quercus rober*, *Fagus sylvatica,* and *Anacardium occidentale* providing varying degrees of humidity across

the enclosure and sites of refuge. Due to this reliance on dark and moist refugia to avoid desiccation (Caruso, 2016), overhead lighting is not provided, with natural light being present through a window.

The animals are fed weekly on a mixed diet of commercially available invertebrates; brown field crickets (*Acheta domesticus,* Linnaeus, 1758), calci worm larvae (*Hermetia illucens*, Linnaeus, 1758), waxworms (*Galleria mellonella*, Linnaeus, 1758), mealworms (*Tenebrio molitor*, Linnaeus, 1758), fruit flies (*Drosophila melanogaster*, Meigen, 1830) and silk moth larvae (*Bombyx mori*, Linnaeus, 1758). Brown field crickets and fruit flies are dusted on an *ad hoc* basis with 'Nekton MSA' supplement powder.

Prior to this feeding activity, the animals are located and checked for signs of ill health with minimal contact. This activity is carried out in low light as is the feeding, and takes place in the evening which is aimed to replicate the period of time when the species naturally emerges to hunt (Lyons, Shepard and Kozak, 2016). This activity of feeding and observing the animals is kept to a shortened period of time (<30 minutes) to minimise disturbance and occurs at a maximum frequency of once a week.

On Monday the 28th of January 2019, at 23:15pm, during feeding and health checking activity, it was found that one individual had autotomised its tail. Animals had not been fed or disturbed for a period of 10 days prior to this event. The site of skin breakage was straight with smooth edges and a folded flap of skin had depressed over the edge of the wound (Fig. 1) with no sign of predation by invertebrates or other *P. teyahalee*. The animal was located under a piece of refugia and exhibited normal signs of mobility and retreat at being discovered. The wound itself was clean and no blood was observed to be leaving the wound.

The tail was located in a different part of the enclosure (Fig. 2 & 3). Upon removal it was observed that the last 1.5cm of the tail had mobility and slowly moved left and right a single time in each direction before movement stopped. The tail also had no clear signs of predation upon it, and no other *P. teyahalee* were found within the immediate vicinity.

Figure 4. Posterior image of *Plethodon teyahalee*

The autotomised tail length measured 7.1cm upon discovery, with roughly 1.8cm of tail remaining on the animal (SVL of 6.5cm). The site of tissue breakage was at a point closer to the base of the tail than the skin breakage, causing some skin tissue to overhang. Exposed vertebrae were seen to be protruding from the wound on the animal, and at the anterior of the tail where the attachment should have been, there was apparent musculature; as such it is believed that it was autotomised. This is a hallmark of slender-based tail species of Plethodontid, which do not localise tail breakage sites only to the base, but at variable sites, and confirms *P. teyahalee's* placement within the slender-based tail group and also Plethodon (Wake and Dresner, 1967; Mueller *et al*., 2004).

The animal was then observed on the 29th of January 2019, at 18:30pm and on the 9th of February 2019, at 19:55pm and showed no

Figure 5. *Plethodon teyahalee* with autotomatised tail.

signs of ill health, displaying the normal behaviour of retreat to refugia (Fig. 4 and 5). The wound site on this occasion was dry, and on one side the skin which had been overhanging had clearly bonded, starting the process of healing. This sign of wound-healing further reinforces *P. teyahalee's* placement within slender-based tail Plethodontids (Piersol, 1910; Wake and Dresner, 1967).

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