



Utilization of Cattle Dung as Cover by a Northern Watersnake (*Nerodia sipedon sipedon*) at a High-elevation Site in Northeastern Tennessee, USA

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The use of cover objects as refuges is a common behavior among reptiles, which can spend long periods in a refuge and are known to frequent the same refuge sites between movements (Whitaker and Shine 2003; Webb et al. 2004). Cover-object selection can differ depending on physiological or ecological parameters (Cox et al. 2009). Cover objects, which can be any appropriate natural or artificial surface object in the habitat (Cox et al. 2009), can be used for predator-avoidance, thermoregulation, water-loss mitigation, and can serve as hibernacula (Cox et al. 2009; Faraone et al. 2023).

At 1210 h on 27 April 2024, during a search for coprophagous insects at Hampton Creek Cove State Natural Area (HCCSNA) (elev. 939 m asl) in Carter County, Tennessee, the lead author overturned a desiccated patty of domestic cattle (*Bos taurus*) dung (“cowpie” hereafter) and found a juvenile Northern Watersnake, (*Nerodia sipedon sipedon*) (Fig. 1) beneath it. The nearest source of water (Left Prong Hampton Creek) was approximately 30 m away. The cowpie was completely dry and coherent along its dorsal surface but maintained humidity underneath. Live grasses (*Poaceae*) under the cowpie had begun to turn yellow due to lack of sunlight.

HCCSNA exists near the elevational limit (1,067 m asl) of *Nerodia sipedon* in southern Appalachia. Although typically not found at higher elevations, *N. sipedon* is known to ascend streams to an elevation of 1,463 m where forests have been cleared (Gibbons and Dorcas 2004). Gregory and Tuttle (2016) correlated ontogeny with the practice of cover utilization by noting that young individuals were more likely to seek cover than mature individuals. They suggested that the selective pressure to avoid predation was higher in juveniles than the need for thermoregulation in adults. Regardless, in this case, due to the size of the cowpies, adult *N. sipedon* are not likely to use them.

In addition to dung as a means of predator-avoidance, its use offers some additional intriguing possibilities. Decomposing compost provides warmth (Agnew and Leonard 2003), and another natricid snake (*Natrix natrix*) is known to use agricultural manure heaps for incubation of eggs (Zuiderwijk et al. 1993; Reading and Jofré 2009; Löwenborg et al. 2012). Young watersnakes might also be consuming coprophagous invertebrates attracted to the dung. Whereas adults feed primarily on aquatic organisms such as fish and amphibians (Gibbons and Dorcas 2004), invertebrates are readily eaten by juveniles (Gibbons 2017). Although, to the best of our knowledge, this is the first report of any ophidian using megaherbivore dung as a cover source not associated with reproduction, cowpie exploitation is likely common in snakes sympatric with large mammals that produce pie-like dung.



Figure 1. A juvenile Northern Watersnake (*Nerodia sipedon sipedon*) found under cow dung at Hampton Creek Cove State Natural Area in northeastern Tennessee, USA. The yellowed grass indicates the coverage area of the cowpie. Photograph by Jeremy B. Stout.

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