



Delayed Emergence of Hatchling Eastern Box Turtles (*Terrapene carolina carolina*) in Northeastern Tennessee, USA

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The Eastern Box Turtle (*Terrapene carolina carolina*) is distributed throughout the eastern United States from the Mississippi River to the East Coast and from southern Georgia to southern Maine (Dodd 2001; Rhodin 2021). The species is listed as Vulnerable on the IUCN Red List (van Dijk 2011). Although commonly encountered in many parts of its range, noticeable declines in recent decades are attributed to anthropogenic factors (Altobelli et al. 2021; Brown et al. 2021). *Terrapene carolina* has been the subject of a number of natural history studies across its range (e.g., Dodd 2001; Burke and Capitano 2011b). However, hatchling emergence data are largely lacking for the species (Burke and Capitano 2011a; Duncan 2013), and hatchling emergence, movement, and survivorship data are essential for making informed conservation and management decisions (Altobelli et al. 2021).

We herein report a case of delayed hatchling emergence of Eastern Box Turtles (*T. c. carolina*) from Steele Creek Park in Sullivan County, northeastern Tennessee. At 1545 h on 26 February 2024, the authors encountered a hatch-

ling on its back next to a nest hole (Fig. 1). Upon further investigation, another hatchling was seen moving inside the hole along with pieces of eggshells (Fig. 1). Both hatchlings had prominent umbilical scars and their eyes were closed. The nest hole was about 7–8 cm deep and was located on a dirt hiking trail composed of semi-hardpacked sandy clay in an exposed area along an elevated powerline clearing (36.57785, -82.22120; elev. 629 m asl). This encounter was suggestive of delayed emergence (overwintering in the nest) due to the presence of two hatchlings (one still in the nest), both with prominent umbilical scars, and eggshells. No evidence indicated that the nest had been excavated by an animal. The immediate area and the majority of Steele Creek Park is mixed hardwood forest with steep knobs and ravines (Jessee et al. 2022). No precipitation had fallen on the day of the observation and the high temperature was 20.6 °C. However, the previous five days (22–26 February) had received a total of 3.89 cm of precipitation and temperature averaged 8.8 °C (NOWdata 2024).



Figure 1. A hatchling Eastern Box Turtle (*Terrapene carolina carolina*) as found (left) and a second hatchling in the nest hole with pieces of eggshell visible at the bottom of the photograph (right). Photographs by Rachel F. Herrmann.

Delayed emergence of turtle hatchlings was reviewed by Gibbons (2013), an update of Gibbons and Nelson (1978). For a temperate terrestrial turtle, such as *T. carolina*, Gibbons (2013) defined delayed emergence as remaining in the nest until spring, as opposed to early emergence, when hatchlings leave the nest and enter adult terrestrial habitat in late summer or fall. Four records of confirmed or suspected delayed emergence were reported for *T. carolina* in Gibbons (2013), two in Kansas (*T. c. triunguis* or *T. triunguis*) (Legler 1960; Ernst and Barbour 1972) and two in New York (*T. c. carolina*) (Madden 1975; Burke and Capitano 2011a). However, in Gibbons and Nelson (1978), Legler (1960) was cited for a record of delayed emergence for the Ornate Box Turtle (*T. ornata*). We were unable to find mention of a case of delayed emergence for *T. carolina* in Legler (1960), but Legler (1960) stated emergence of hatchlings could be delayed until spring for *T. ornata*, although few reported cases of delayed emergence exist for *T. ornata* (Gibbons 2013; Murray 2013). Since Burke and Capitano (2011a) stated that overwintering in the nest was not observed, the nests and hatchlings they observed did not appear to be cases of delayed emergence according to the definition cited above and why they are included in Gibbons (2013) is unclear. All hatchlings emerged by mid-September, moved between 1.5 and 10 m from the nest, and buried themselves in the soil between late October and December (Burke and Capitano 2011a). Delayed emergence in *T. carolina* appears to be facultative as both fall emergence of hatchlings and overwintering of hatchlings in the nest have been observed (Madden 1975; Burke and Capitano 2011a). To the best of our knowledge, our observation is the first reported occurrence of delayed emergence of hatchlings of *T. carolina* in Tennessee.

Although more common and widespread than originally thought (Lovich et al. 2014), many questions remain regarding delayed emergence of hatchling turtles (Gibbons 2013), even for a species like *T. carolina* whose reproductive and nesting ecology have been relatively well studied (Burke and Capitano 2011a, 2011b). Much of the literature concerning delayed emergence of turtle hatchlings focuses on species that are primarily aquatic (e.g., Gibbons and Nelson 1978; Lovich et al. 2014). Gibbons (2013) suggested that delayed emergence should be considered a default strategy among many species of turtles that experience high environmental variability upon hatching. Presumably this would allow them to enter the habitat at a more suitable time for initial growth, whereas early emergence would have them entering a more environmentally high-risk situation. However, the majority of reports of delayed emergence of turtle hatchlings are anecdotal (Gibbons 2013; Lovich et al. 2014). Long-term field studies are necessary to provide the data needed to better answer the many questions concerning the temporal aspect of hatchling emergence (Gibbons 2013; Lovich et al. 2014). From a con-

servation standpoint, the temporal aspect of hatchling emergence, a critical stage with high mortality rates in the life of a turtle (Altobelli et al. 2021), is of great importance because delayed emergence increases the risk of inadvertent nest disturbance or destruction by humans as well as the risk of nest predation (Gibbons 2013; Butterfield et al. 2022).

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