OBSERVATIONS ON NESTING LOCATION AND BROODING BEHAVIOR OF THE COMMON FIVE-LINED SKINK (*PLESTIODON FASCIATUS***) IN MIDDLE TENNESSEE**

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Abstract.—Reproductive activities of Common Five-lined Skinks (*Plestiodon fasciatus*) have been documented throughout much of the range of the species, but information on nests or brooding behavior for populations inhabiting Tennessee is lacking. On 16 June 2019, I found a female brooding eight eggs in a nest underneath weathered cardboard on a gravel driveway in southern Cannon County, Tennessee. I photographed the brooding female and her eggs 16 times during the incubation period, which included five times after hatching commenced. The female was positioned alongside her clutch with her tail or other body part on top of or otherwise in contact with one or more of the eggs each time I examined the nest. The female invariably, but only temporarily, abandoned her nest soon after I removed the cardboard and began flash photography. Although always within the same area underneath the cardboard, the eggs were positioned differently each time I observed them. The eggs began to hatch on 6 July, and all had hatched by the morning of 7 July, at which time the female was in the nest with her hatchlings. At least three hatchlings were in the nest the morning of 8 July. This is the first record of Common Five-lined Skinks nesting in gravel, and supports reports from other regions that a brooding female (1) routinely repositions eggs, (2) has a strong bond to the nest even after repeated disturbances during a three-week period, (3) and her hatchlings might remain in the nest a day or two after all eggs have hatched.

Key Words.—clutch size, egg repositioning, hatching date, hatchlings, incubation, nest guarding behavior, reproduction.

The Common Five-lined Skink (*Plestiodon fasciatus*) typically lays eggs in decaying logs and stumps (Hecnar 1994; Trauth et al. 2004; Jensen et al. 2008; Niemiller et al. 2013) from late spring to early summer (Noble and Mason 1933). After laying, females brood their eggs (Fitch, 1954; Mitchell 1994; Trauth et al. 2004). Brooding refers to any behaviors of a parent attending to eggs and young in the nest (Peters 1964), and brooding female Common Five-lined Skinks protect eggs from predators, and help maintain proper moisture in the nest (Noble and Mason 1933; Fitch 1954; Hecnar 1994). Although well-documented in other regions, relatively little information has been

published on nesting behavior of the Common Five-lined Skink in Tennessee. Here, I report on an unusual nest site, clutch size, and brooding behavior of a female Common Fivelined Skink observed during a three-week period in middle Tennessee.

METHODS AND MATERIALS

I found a female Common Five-lined Skink brooding eggs underneath weathered cardboard while I was clearing debris from along the edge of my gravel driveway in southern Cannon County, Tennessee on 16 June 2019. I replaced the cardboard over the nest and returned with a digital camera to photograph the eggs and brooding female later that day. I also examined and photographed the brooding female on the following dates: 17, 18, 21, 24, 25, 26, 29 June, and 6, 7, 8 and 9 July. I used digital images to document the position of the female and her eggs throughout the incubation period. Fitch (1954) reports that females often desert their nest when disturbed, and he cautions that repeated disturbances might cause a female to permanently abandon her eggs; consequently, I never touched the female or her eggs, and I photographed them as quickly as possible, usually replacing the cardboard within 30 secs.

RESULTS

Although I attempted to limit the duration of my observations of the brooding female, she was noticeably disturbed each time I lifted the cardboard from her nest, and she almost always sought refuge in lawn adjacent to the driveway soon after I began flash photography; however, she invariably returned to her nest and resumed brooding activities, sometimes within 30 mins after my initial disturbance (Fig. 1). Each time I examined the nest, the female was positioned alongside the clutch with her tail or other body part on top of or otherwise in contact with one or more of her eggs, which she apparently repositioned between my visits, including those few instances when I checked on the position of the female within an hour of a previous visit (Fig. 1C, 1D). For example, two of seven eggs visible at 0448 h on 18 June (Fig. 1C) were in a different position 40 min later (Fig. 1D), and at least four of the eggs were repositioned within a four-hour interval on 24 June (Fig. 1F, 1G). Based on egg counts made during all encounters, no eggs were added, ingested, or otherwise removed from the nest throughout the duration of my observations.

The eggs began to hatch before 0525 h on 6 July (Fig. 1K, 1L), 21 days after my initial discovery of the nest. Based on later examination of shell fragments, all eggs had

hatched by 0510 h on 7 July, at which time the female and six hatchlings remained in the nest (Fig. 2). I checked the nest twice on 7 July (0510 h and 1745 h). The female was with six hatchlings in the morning, but she almost immediately abandoned her hatchlings, which made it impossible for me to obtain a focused photograph. When I rechecked the nest about 12 h later, she had returned and was positioned adjacent to the collapsed egg shells and unfortunately, hatchlings: the hatchlings quickly scampered out of the nest when I lifted the cardboard (Fig. 2B). Three hatchlings were in the nest the morning of 8 July (0711 h) (Fig. 2C), but on 9 July neither the female nor any hatchlings were in the nest, and I removed the decaying cardboard from my driveway.

DISCUSSION

A variety of nesting sites have been reported for the Common Five-lined Skink, including cavities in sawdust piles (Mount 1975), excavated cavities in soil underneath rocks (Fitch 1954), within woody debris (Trauth et al. 2004), beneath bark of standing tree stumps (Corrington 1929), and, most commonly, in cavities of decaying logs and stumps (Hecnar 1994; Trauth et al. 2004; Jensen et al. 2008; Niemiller et al. 2013). Females apparently select sites with environmental parameters, such as temperature and moisture content, that are relatively stable (Hecnar 1994). Gravel is likely not ideal for nesting because it exhibits relatively large thermal variation and lower levels of moisture compared to other substrates (Mitchell and Janzen 2019); however, the weathered cardboard under which the eggs were laid likely served to stabilize humidity in the nest and prevent the eggs from experiencing temperature fluctuations. extreme Furthermore, in addition to guarding eggs from predators (Noble and Mason 1933), brooding female Common Five-lined Skinks from other areas also monitor and regulate moisture levels of their clutch by adjusting their body position



FIG. 1. A female Five-lined Skink (*Plestiodon fasciatus*) brooding eggs underneath a cardboard box on a gravel driveway in southern Cannon County, Tennessee during June and July 2019. Eight egg were present from discovery until hatching, although one egg is sometimes obscured beneath the body of the brooding female. (A) 16 June, 1357 h. (B) 17 June 0523 (C) 18 June 0448 h. (D) 18 June 0528 h. (E) 21 June 0506 h. (F) 24 June 0945 h. (G) 24 June 1314 h. (H) 25 June 0903 h. (I) 26 June 0730. (J) 29 June 0608 h. (K) 6 July 0524 h; hatching had begun. (L) 6 July 0521h.

to maintain contact with eggs (Hecnar 1994), and routinely reposition eggs to prevent them from adhering to the substrate or to other eggs (Fitch 1954). Although I neglected to record temperature and humidity conditions of the nest, I assume the female I observed facilitated normal growth and development of the embryos by maintaining almost constant contact with her clutch and frequently repositioning the eggs.

No data exist on average clutch size for populations of Common Five-lined Skinks in Tennessee. Niemiller et al. (2013) indicate that females typically lay four to 14 eggs per clutch,

but this range of typical clutch size is estimated from reports from neighboring states (M.L. Niemiller, pers com.). Fitch (1954) indicates that females in Kansas typically lay 9, 10, or 11 eggs, with a mean of 8.82 for 34 natural nests (the mean increases to 9.5 when counts of ovarian and oviducal eggs are included). Cagle (1940) reports a mean of 9.2 for 26 nests in Illinois (min 6, max 15), and Conant (1951) a mean of 10 for five nests in Ohio (7 to 13). Groves (1982) reports on five clutches of eggs $(6, 6, 7, 11, and 8 eggs; \bar{x} = 7.6)$, including one clutch from Virginia and the other four from North Carolina. Based on the size of each of these clutches, mean clutch size of southeastern populations might be smaller than more northerly populations, as suggested by Smith (1946), but discounted by Fitch (1954). Furthermore, variation in clutch size could in part be associated with body size of the female: larger females lay more eggs than smaller females (Ruthven 1911; Fitch 1954). Regardless, I am unaware of any reports of clutch size of natural nests in Tennessee. I did document with photographs several natural nests in southern Cannon County during the early 1990s, but I found only one of these nests early in the incubation period when I am confident that no egg loss, either from predators or the brooding female, had occurred. This clutch, depicted in the species account for

the Common Five-lined Skink in Niemiller et al. (2013), also consisted of eight eggs.

Rate of development and, hence, duration of incubation, is dependent on environmental temperatures to which the eggs are exposed Consequently, incubation (Fitch 1954). periods vary widely, even in those situations in which captive females brood eggs in the laboratory, presumably with controlled and relatively stable environmental temperatures. For example, Noble and Mason (1933) report incubation periods of 27, 29, 29, 36, 41, and 47 days for six clutches of eggs from females collected from the same locality and housed in a laboratory. The eggs I found hatched 21 to 22 days after I discovered them; however, I cannot determine precisely the duration of the incubation period because I am not certain when the female laid her eggs. Fitch (1954) suggests that that newly laid eggs are white, but become soiled and darken to a mottled tan color within a day or two after being moved around in their nest cavity, which is primarily in soil underneath rocks in Kansas. Although laid in gravel and never contacting soil, the eggs I monitored never appeared bright white or clean. Based on the dull coloration of the eggs, I assume that the female had laid them at least a few days before I discovered the nest. Furthermore, the clutch consisted of eight eggs when discovered and no eggs were added,



FIG. 2. A brooding female Five-lined Skink (*Plestiodon fasciatus*) and her hatchlings underneath a decaying cardboard box on a gravel driveway in southern Cannon County, Tennessee. (A) 7 July 0510 h. (B) 7 July 1749 h. (C) 8 July0651 h.

indicating that the clutch was complete when I discovered the nest. Thus, I suspect that the eggs were laid sometime during the first or second week of June. Regardless, an incubation period of 22 to 32 days is not unreasonable for natural nests in middle Tennessee. Mitchell (1994) reports incubation period for two clutches of eggs in Virginia as 22 and 32 days, and Cagle (1940) notes that hatching occurred on 23 and 24 July in a clutch of eggs laid on 30 June (thus a 23- or 24-day incubation period). Fitch (1954) does report incubation periods of more than 40 days for several nests in Kansas, but he suggests that periods might be lower in warmer and drier years.

Although primarily discussing brooding behavior, Noble and Mason (1933) indicate that hatchlings seldom remain in the nest for more than a "few hours", but they are not certain if this is a natural response or a result of being disturbed frequently. They also state, however, that one of the seven females they observed stayed with her young for two days after they hatched, so their meaning of a few

LITERATURE CITED

- Cagle, F.R. 1940. Eggs and natural nests of *Eumeces fasciatus*. American Midland Naturalist 23:227–233.
- Conant, R. 1951. The Reptiles of Ohio. Second edition. University of Notre Dame Press, Notre Dame, Indiana, USA. 284 pp.
- Corrington, J.D. 1929. Herpetology of the Columbia, South Carolina, Region. Copeia 1929:58–83.
- Fitch, H.S. 1954. Life history and ecology of the Five-lined Skink, *Eumeces fasciatus*. University of Kansas Publications, Museum of Natural History, Lawrence, Kansas, USA. Volume 8, Number 1 pp. 1–156.
- Groves, J.D. 1982. Egg-eating behavior of brooding Five-lined Skinks, *Eumeces fasciatus*. 1981:969–971.

hours is vague. I did not observe the female facilitate hatching as suggested by Mount (1975), but she did remain with her nest until all eggs had hatched. My observations support the suggestions of others that a female will remain in her nest until all eggs have hatched and that some hatchlings linger in the nest for at least 24 h. Furthermore, my observations indicate that a female Common Five-lined Skink develops a strong bond with her eggs, and that she might not completely abandon them even after repeated disturbances during a three-week period. Fitch (1954) cautions that repeated disturbances might cause a female to permanently abandon her eggs, but more data on the amount, frequency, and intensity of disturbance is required to better understand variables involved in severing the bond between a mother and her eggs. Lastly, this is the first record of Common Five-lined Skinks nesting in gravel and highlights the dearth of published information on basic natural history for one of the more common species of lizards in Tennessee.

- Hecnar, S.J. 1994. Nest distribution, site selection, and brooding in the Five-lined Skink (*Eumeces fasciatus*). Canadian Journal of Zoology 72:1510–1516.
- Jensen, J.B., C.D. Camp, J.W. Gibbons, and M.J. Elliott. 2008. Amphibians and Reptiles of Georgia, University of Georgia Press, Athens, Georgia, USA.
- Mitchell, J.C. 1994 The Reptiles of Virginia, Smithsonian Institution Press, Washington, D.C. USA.
- Mitchell, T. S. and F.J. Janzen. 2019. Substrate influences turtle nest temperature, incubation period, and offspring sex ratio in the field. Herpetologica 75:57–62.
- Mount, R.H. 1975. The Reptiles and Amphibians of Alabama. Agriculture Experiment Station, Auburn, Alabama, USA.

- Niemiller, M.L., R.G. Reynolds, and B.T. Miller. 2013. The Reptiles of Tennessee. University of Tennessee Press, Knoxville, Tennessee, USA.
- Noble, G.K. and E.R. Mason. 1933. Experiments on the brooding habits of the lizards *Eumeces* and *Ophisaurus*. American Museum Novitates 619:1–29.
- Peters, J.A. 1964. Dictionary of Herpetology. Hafner Publishing Company, New York, New York, USA.
- Ruthven, A.G. 1911. A biological survey of the sand-dune region on the south shore of

Saginaw Bay, Michigan. Michigan Geological and Biological Survey, Publication Number 4, Biological Series 2.

- Smith, H.M. 1946. Handbook of Lizards. Comstock Publishing Company, Ithaca, New York USA.
- Trauth, S.E., H.W. Robison, and M.V. Plummer. 2004. The Amphibians and Reptiles of Arkansas, The University of Arkansas Press, Fayetteville, Arkansas, USA.