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Nesting Ecology of the Striped Mud Turtle (*Kinosternon baurii*) in Central Florida. Linnaeus Fund Research Report

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Much of our knowledge of the nesting ecology of freshwater turtles is either anecdotal or has been obtained from research on a few, widely dispersed genera (i.e., *Apalone*, *Trachemys*, *Chelydra*, and *Chrysemys*). The family Kinosternidae is composed of over 23 species of small aquatic turtles, however, relatively little is known about species in this family (Ernst et al., 1994). Because the members of the family Kinosternidae have small bodies relative to members of other families of freshwater turtles, they may exhibit behavioral and/or physiological differences in their nesting process compared to larger-bodied species. Previous research on this species has shown that females nest throughout the year (Mushinsky and Wilson, 1992) and that fall- and winter-laid embryos express embryonic diapause, a form of developmental arrest (Ewert and Wilson, 1996).

I studied the nesting behavior of the striped mud turtle (*Kinosternon baurii*) on a sandhill in central Florida. A portion of the results of this research have been published (Ewert and Wilson, 1996) or accepted for publication (Wilson, in press).

Methods. — I conducted research at the Ecological Research Area of the University of South Florida, Tampa, Florida, from September 1991 to August 1994. Details of the vegetation of this 200 ha reserve can be found in Wilson (1996). Gravid females were captured as they traveled between a wetland habitat and their upland nesting habitat by the use of a 1490 m long drift fence. Females were tracked to their nesting sites using thread trailing devices attached to the rear of the carapace (Wilson, 1994). I measured seasonal patterns of nesting, clutch frequency, movements, and predation rates on nests. To determine if microhabitat characteristics of nest sites directly influence offspring survival, I tested two null hypotheses: (1) nest site microhabitats are selected randomly, and (2) embryo survival does not depend upon nest site selection.

Results. — During the four years of this study, I captured 515 individual female striped mud turtles several times, for a total of 1557 captures. Females nested in all months of the year, however, the peak nesting season occurred during the months of September and October (Fig. 1).

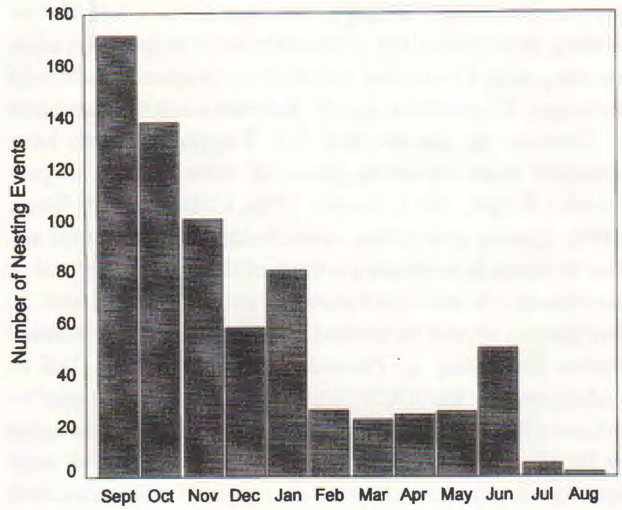

Figure 1. Number of female striped mud turtles nesting each month from September 1991 to August 1994.

Clutch frequency averaged 1.6 clutches per female per year, with a range of 1–3 clutches. Female movements to and from their nest sites were significantly positively correlated with the amount of rainfall. Most movements from the wetland to the nest site ranged between 60 and 180 m, however, some females traveled over 240 m to the nest site. After oviposition, females prolonged their stay on the upland by moving an average of 4 m from the nest site and burying themselves below soil and/or litter from 1 to 35 days before returning to the wetland. Using captures along the drift fence as a measure of nest-area fidelity, I found that females were captured near the same part of the fence during successive nesting forays (mean distance between captures at the fence = 65.7 m).

With the aid of thread trailers, I located 62 nest sites. Microhabitat characteristics at nest sites were not randomly selected (Wilson, in press). Specifically, nest sites differed from random sites in distance from closest vegetation and

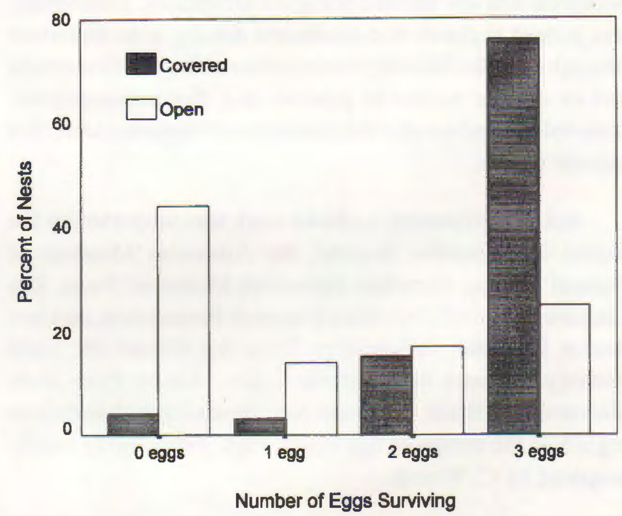

Figure 2. Survivorship of striped mud turtle embryos in nests located at two experimental sites. Covered sites = nests located 1–5 cm from vegetation; Open sites = nests located 30–50 cm from closest vegetation. Figure modified from Wilson (in press).

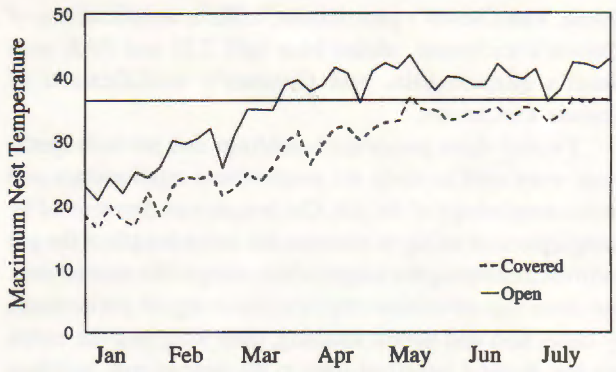

Figure 3. Maximum soil temperatures (°C) for nests located at Covered (dashed line) and Open (solid line) sites from January through July. The horizontal line at 36°C represents a potential thermal extreme; embryos of some turtle species have been shown to withstand only brief periods at or above this temperature (Ewert, 1979). Figure modified from Wilson (in press).

the amount of bare ground present. Females apparently selected sites close to vegetation and avoided sites far from vegetation. Experimentally manipulating nest sites, I found that embryo survivorship was significantly higher at sites close to vegetation (covered sites) than at sites far from vegetation (open sites; Fig. 2). Maximum soil temperatures within the nests at open sites averaged 6.6°C higher than those at covered sites (Fig. 3). During the incubation month of July, when soil temperatures were the highest, sites close to vegetation were at or above 36°C an average of 1 hr/day, whereas soil temperatures at sites far from vegetation were at or above 36°C an average of 4 hrs/day.

Discussion. — Female striped mud turtles mature at a relatively small body size compared to many other freshwater turtle species, and as a consequence of small body size, they lay relatively small clutches (usually 2 or 3 eggs). Producing multiple clutches over an extended nesting season may spread the risk of predation and ensure that some clutches produce viable hatchlings. Also, the occurrence of embryonic diapause in eggs oviposited in fall and winter may enable females to extend their nesting season over a longer period of time (Ewert and Wilson, 1996).

Although many species of aquatic turtles have been shown to return to the wetland shortly after nest completion, female striped mud turtles prolonged their stay on land after constructing their nests. This same pattern of prolonged nesting forays has been documented in other species of *Kinosternon* such as *K. subrubrum* (Burke et al., 1994) and *K. flavescens* (Iverson, 1990). Females may bury underground and move with the next rainfall to disguise their scent trails from predators (Burke et al., 1994), or may bury directly above the nest to deter predators from the eggs (Iverson, 1990). I suggest that additional explanations for the prolonged nesting forays may involve physiological limitations such as energy expenditure and/or evaporative water loss (Wilson, in prep.).

In contrast to most turtle species studied, female striped mud turtles in central Florida routinely place their nests close to clumps of grass or other vegetation and avoid open sunny sites. This difference in nest placement between striped mud turtles and other species may be attributed to the fact that most research on nest-site selection by turtles has been carried out on medium- to large-bodied turtles. The majority of turtle species dig their nest with their hind legs and the length of the hind legs usually determines the depth of the nest; therefore, large turtle species have the ability to dig relatively deeper nests than do smaller turtle species. Larger-bodied turtles should, therefore, place their relatively deep nests in microhabitats that have little surrounding vegetative cover so that the eggs can reach the appropriate incubation temperature for complete embryonic development. On the other hand, smaller-bodied turtles should place their relatively shallow nests near vegetative cover to protect the embryos from environmental extremes. Although other factors may be involved in embryo survival at this site (Wilson, in press), I believe the observed difference in survivorship between nests located near vegetation and those located in open sunny sites was a direct result of the maximum temperatures imposed on the developing embryos inside the nest cavity.

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