

FINAL REPORT

Habitat selection and activity patterns in Eastern box turtles (*Terrapene carolina*)

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INTRODUCTION

Nest site selection by female turtles may provide a way to increase the chance of survival for their offspring; but, little is known about the variables that influence that choice. This project was designed to examine the microhabitat variables at nest sites of the Eastern box turtle, *Terrapene c. carolina* at a Boy Scout camp in Pana, Christian County, Illinois. The objective of this study was to determine if females chose nest sites that differed from random sites.

The Eastern box turtle, *Terrapene c. carolina*, is a small terrestrial turtle that inhabits predominantly open woodland areas, ranging from New England south to Georgia and west to Michigan, Illinois, Tennessee, and northern Alabama. It is omnivorous, eating a wide variety of plants and small animals and invertebrates, including carrion (Ernst et al. 1994). Box turtles are long-lived, sexual maturity is late (usually 7-10 years of age), and annual reproduction is low. Females usually produce only one clutch of eggs a year and, at this latitude, they usually excavate their nests in June (Dodd 2001). The exact criteria by which females choose nest sites is unknown but numerous studies have shown that female turtles travel great distances from their home ranges to nesting sites (Congdon et al. 1983, Hall et al. 1999), and often show nest site fidelity, choosing locations within a few meters of previous years' sites (Congdon et al. 1983, Stickel 1989).

This study sought to answer the following questions: 1) Do females *T. c. carolina* place their eggs at sites that differ from random sites in their microhabitat characteristics? 2) What are the microhabitat variables of nest sites that differ from random?

MATERIALS & METHODS

Study Site

The study was conducted at the Rhodes-France Boy Scout Camp (RFSC), Pana, Christian County, Illinois. The RFSC is a 200 ha area of mainly oak-hickory forest. Approximately 40 ha are used by the scouts, who have placed some permanent structures and various open areas within a disjunct forest canopy for camp sites. The area is not open to the public and rarely has human activity except for the months of June, July, and August, when summer camps are held. Sections of the camp have been periodically logged, as recent as 30 years ago. The camp is bordered on the north and west by agricultural fields (corn, soybean, alfalfa) and on the south and east by a grazed cattle pasture.

Procedures

Nesting activity of female turtles was monitored during the 2001 nesting season at Rhodes-France Boy Scout Camp (RFSC) in Pana, Christian County, Illinois. Female turtles were located through intensive searching and radiographed to determine their reproductive status. Gravid females had a radio transmitter, to allow for relocation, and a thread trailer to locate the path taken by the turtle, glued to their shell. Thus outfitted, turtles were relocated and weighed daily to determine if eggs had been laid. Nest sites were found either by following the thread trail of the animal or by direct observation of nesting behavior. Once the nest was found, a 1-m² area centered on each site was then visually estimated for the percentage of bare ground, percentage of herbaceous plants, percentage of woody plants, and percentage of leaf litter. Vegetation height (± 5 cm), light intensity (± 1 lx), and percent canopy cover were also measured. These measurements were also taken for 75 random sites

and the two data sets compared using principle components analyses (PCA) to determine if nest sites differed significantly from random sites.

This project was conducted by Beth Flitz, a graduate student in my laboratory. The funds from the current grant period were used to offset travel costs to and from the site, to pay for radiographs, and to purchase equipment necessary to measure all box turtles encountered.

RESULTS

A total of 107 turtles were observed and individually marked during the study, of which 63 were male, 35 were female, and 9 were juveniles that could not be accurately sexed. Females were generally heavier than males (Table 1), but statistical analyses did not differentiate the sexes on the basis of any of the measured characteristics.

In total, 24 nests were found and measured for microhabitat characteristics. All females chose sites either in open campsites within RFSC or in a grazed meadow bordering the camp. The PCA applied to the dependent variables resulted in 98.8 % of the variance being explained by one component. Nest sites differed from random sites in percent woody vegetation, percent bare ground, percent leaf litter, percent canopy cover, vegetation height, and light intensity (Table 2; Kolmogorov-Smirnov tests; $p < 0.05$)

DISCUSSION & RECOMMENDATIONS

The relatively large number of individual box turtles observed at RFSC, combined with the 24 nests constructed during the 2001 activity season indicates that the population at RFSC may be stable. However, the surrounding agricultural areas and their observed use by nesting females may negatively impact the population. Doroff and Keith (1990) reported mortality in *T. ornata* from farm equipment in relatively small areas of habitat (< 800 ha) that were surrounded by agricultural fields. Populations inhabiting isolated patches of suitable habitat cannot effectively disperse to nearby populations (Gilpin 1987) and may experience increased susceptibility to local extinction on account of being isolated (Goodman 1987, Sjögren 1991). I recommend that IDNR consider continued monitoring of the *T. c. carolina* population at RFSC to assess the survivorship of adults (especially females) and recruitment of new individuals to the population at this locality. Ideally, mean annual adult survivorship should equal or exceed 0.95 if the RFSC population were to remain stable (Doroff and Keith 1990).

Nest sites at RFSC differed from random sites with all females placing their nests in open camp sites or a meadow bordering the camp. Due to the importance of incubation temperature on hatchling development, I suggest that open sites were selected due to the higher incubation temperatures they provide (Wilhoft et al. 1983, Packard et al. 1987, Wilson 1998). Because the Boy Scouts of America has jurisdiction over the use of the land at RFSC, it is unlikely that human activities at open camp sites could be suspended during the peak box turtle nesting period (June). As such, I recommend that IDNR consider monitoring adult female box turtles that are initially observed distant to the camp sites – the objective being to determine if these females are either migrating to camp site areas to nest or successfully nesting in areas having different microhabitat characteristics to those reported in this study.

Because female box turtles in some areas of RFSC appear to prefer campsite areas for nesting, there is ample opportunity for scouts visiting this camp to interact with this species. As such, the state may wish to pursue a collaborative educational endeavor with the Boy Scouts of America to continue monitoring the nesting activity of *T. c. carolina* in and around the camp sites at RFSC. Doing so would not only provide additional information about the reproductive biology of this species, but also serve as an important educational tool for the scouts and their troop leaders (*sensu* Dodd and Franz 1993, Belzer and Steisslinger 1999).

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Table 1. Morphometrics of Eastern box turtles (*Terrapene c. carolina*) observed at Rhodes-France Scout Camp, Pana, Christian County, Illinois, during the 2001 activity season. Mean values for each metric are reported.

Gender or age class	Total Turtles Found	Carapace length (mm)	Plastron length (mm)	Carapace depth (mm)	Mass (g)
Males	63	139.2	128.5	65.2	469.0
Females	35	134.8	128.1	66.8	486.3
Hatchlings	9	32.0	29.9	14.1	8.4

Table 2. Habitat characteristics for nest sites ($n = 24$) chosen by female Eastern box turtles (*Terrapene c. carolina*) at Rhodes-France Scout Camp, Pana, Christian County, Illinois, during the 2001 activity season, and random sites ($n = 75$) measured at the same locality. Totals in the first four data columns do not total 100 % due to rounding values. Chi-square and p-values (resulting from Kolmogorov-Smirnov post-hoc tests) are not reported for herbaceous cover because that characteristic was not significant in principle components analyses.

	Percent bare ground	Percent leaf litter	Percent herbaceous cover	Percent woody vegetation	Light intensity (lux)	Percent canopy cover	Vegetation height (cm)
nest sites	39.2	3.3	59.5	0	656.7	25.6	8.3
random sites	15.5	26.6	47.2	10.9	138.7	71.3	37.4
Chi-square	9.60	15.50	—	21.73	31.20	19.92	18.67
p-value	0.017	0.001	—	< 0.001	< 0.001	< 0.001	< 0.001