Short and Long Distance Translocations: Movement and Survival in Eastern Box Turtles (*Terrapene carolina carolina*)

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Nature Precedings : doi:10.1038/npre.2009.3978.1 : Posted 22 Aug 2009

Introduction

The movement of animals out of harms way from areas under human development is increasing (1). These translocations often involve moving animals long distances, well outside of the animal's home range. This increases risk of disease introduction and changes in genetic structure of the population at the release site (2). Studies on reptiles have also shown that translocated animals have increased movements, homing behavior, and increased mortality (3,4). These patterns have been reported in studies of long distance translocation of eastern box turtles (5). When suitable habitat is available adjacent to the area being developed, one option is to use short distance translocations. This should minimize the problems with long distance translocations, but has not been tested thoroughly. As part of the mitigation plan for a highway construction project in Maryland, box turtles were translocated out of the construction zone. We compared the movements and mortalities of animals that were moved long distance, moved a short distance, and native (unmoved) turtles.

Methods

Study Area -- The Inter-County Connector (ICC) is an 30km highway construction project located in central Maryland just north of Washington D.C. Part of the LOD passes through North Branch Stream Valley Park (Fig. 1). Turtles found on the limit of disturbance (LOD) were translocated either long distance (~5km) or short distance (200-500m) and released into the park.

Telemetry -- Translocated turtles (31 long distance and 29 short distance) and 34 native turtles were marked and affixed with ATS radio transmitters. Animals were located every 1-2 weeks from May through November of 2008. Positions were recorded using a Garmin handheld GPS unit.

Statistics -- All analyses were run using JMP 7 for Windows. Only animals that were tracked the entire season were used for analysis of movement. Movement data were log transformed to meet assumptions of ANCOVA.

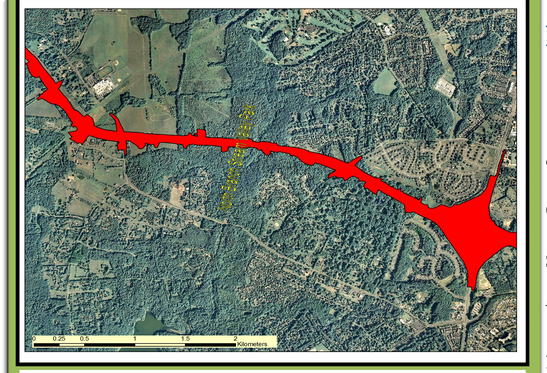

Fig.1 Aerial view of study area. Red area indicates LOD of ICC project. Turtles were released in North Branch Stream Valley Park (running north to south in center of image)

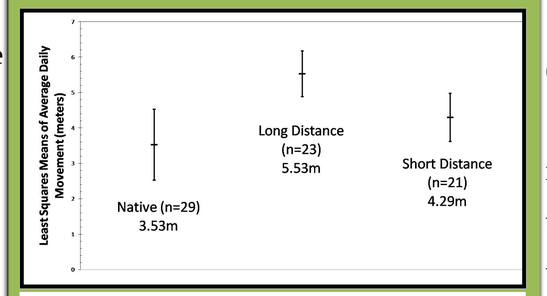

Fig.2 Least squares means of average daily movement (in meters). Error bars represent ±2 SE.

Fig.3 Picture on left is a short distance transbcated animal crawling through a hole (probably created by small mammal) in the exclusion fencing back onto the LOD. Picture on the right is an animal that had gone back onto the LOD and was killed by construction machinery.

Acknowledgements

- Funding was provided by a grant from Maryland State Highway Authority
- Joel Snodgrass and Gerald Robinson provided invaluable input on the project
- Teal Richards helped with field work and review of this poster

Results and Conclusions

Movement -- There was a significant correlation ($p=0.0031$, $N=73$) between average daily movement and carapace length so we used an ANCOVA with carapace length as the covariate. The resulting corrected means (Fig. 2) were significantly different ($p=0.0002$). The native group moved the shortest distance and the long distance group moved the longest. Tukey's HSD was equivocal however for the short distance group, with distances falling between the other groups.

Mortality -- Through July 2009 there have been a total of 14 confirmed mortalities. Mortality rates for long distance, short distance, and native groups were 12.9%, 13.7%, and 17.6% respectively. Contingency analysis was not significant ($p=0.573$).

Effectiveness of Short Distance Translocations -- Similar to results seen in rattlesnakes (6) short distance translocated turtles will try to move back onto the area that they were removed from. Four mortalities were animals that moved back onto the construction site and died from construction activity (Fig. 3). Additionally, 11 other individuals (all native or short distance) were repeatedly located on the LOD and moved back off. Without our intervention these animals likely would have died and mortality rates would have been much higher. Therefore, regardless of other factors, without effective means of excluding translocated animals from moving back onto a construction site, short distance translocations will not be an effective mitigation strategy.

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