Thermal Ecology of Reintroduced Texas Horned Lizards

Patrick Ryan, Padraic Elliott, & Dean Williams
Department of Biology, Texas Christian University

INTRODUCTION

- Reintroductions have been used for decades by wildlife managers to save threatened or endangered species.[1]
- For reintroductions to be successful, organisms must be reintroduced into quality habitat. For ectotherms like Texas horned lizards, this includes high quality thermal habitat. [2,3]
- Texas horned lizards are a threatened species in Texas and are the subject of many reintroduction efforts with little success.[4]
- The Texas horned lizard has a high optimal body temperature of 34.2 - 38.5 ºC and a high upper critical temperature of 45.9 - 48.1 ºC. This makes them well adapted to remaining in direct sun for extended periods of time eating ants. [5]
- Our objectives were to measure the thermal habitat quality and thermal ecology of reintroduced lizards at a reintroduction site and compare it to a nearby ranch with a natural population of horned lizards (Fig. 1).

Texas horned lizard.

METHODS

Figure 1. Map of the two study sites in Mason, Texas.

- We used radio-telemetry to relocate 18 lizards to get gps points for home ranges, ground temperature selection data, and body temperature data on the lizards (Fig. 2).
- We analyzed thermal habitat selection by comparing ground temperatures at the lizard to a random point 10 meters away.
- Thermal dataloggers in 3D printed lizards were used to assess microhabitat quality at the two study sites (Fig. 3).
- We calculated a quality score (de) that indicates how close habitat temperatures are to the horned lizards' optimal temperature range.

Figure 2. Female Texas horned lizard affixed with radio-transmitter.

Figure 3. (Top) 3D model lizards with thermal dataloggers in them. (Bottom) Model lizard in field ready to record temperature data.

RESULTS

Were there differences in home range sizes between the two sites?

NO

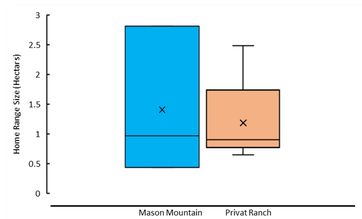

Figure 4. Box plot showing difference in home range areas between MM and WR.

- We recorded no significant difference in home range size between the reintroduction site (MM, N= 3) and the private ranch (WR, N = 5) (P = 0.76) (Fig. 4).

What factors influenced lizard location?

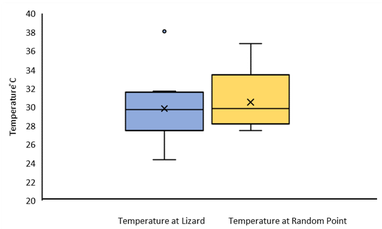

Figure 5: Boxplot of morning ground temperatures at the lizard and the random point.

- We found that lizards were found on plots with lower temperatures than random only in the morning (Fig. 5, p = 0.002).

Was there a difference between sites in microhabitat selection?

NO

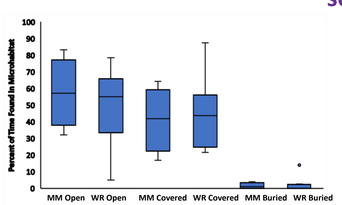

Figure 6. Boxplot of percent of observations lizards were in various microhabitats.

- We observed no difference in microhabitat selection between sites. Lizards used open and covered habitats the same and more than buried (Fig. 6).

Did the number of observations of lizards being in the optimal or critical temperature range in different microhabitats vary between sites?

NO

- There was no difference between sites, but there was a difference for microhabitats overall, with covered ones being in the optimal range significantly more than the critical range (Fig. 7, N = 12, p = 0.007).

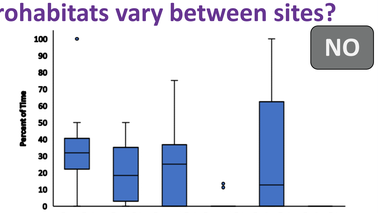

Figure 7. Percent of time microhabitats that lizards were found in were in the optimal (opt) or critical range (crt).

RESULTS

Was there a difference between sites in terms of microhabitat quality?

NO

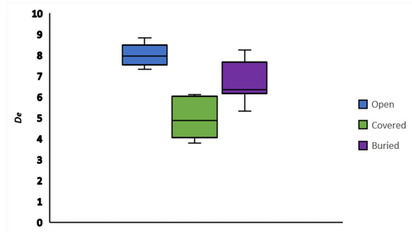

Figure 8. Boxplot of thermal habitat quality scores (*De*) in different microhabitats (lower scores are higher quality).

- Thermal quality did not differ between sites, but covered microhabitats have better thermal quality than other microhabitats (Fig. 8, N= 12, p = 0.0004).

Were temperatures in different microhabitats different between sites?

Yes

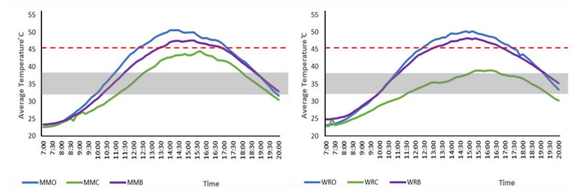

Figure 9. Average temperature from dataloggers in different microhabitats across different times of the day. A) Average temperatures over time at MM. B) Average temperatures over time at WR. Open microhabitats are MMO and WRO, covered microhabitats are MMC and WRC, and buried microhabitats are MMB and WRB. Red line is the critical temperature and grey box is the optimal temperature range.

- We found a significant difference in the temperatures of covered habitats in the afternoon between MM and WR (Fig 9. p = 0.00005).

DISCUSSION

- Our results suggest that there is no difference in thermal habitat quality between sites. Our sites have lower thermal quality however, than found in a recent study in south Texas.
- The thermal ecology of the lizards is similar between the two sites.
- We further confirmed the important role that vegetative cover plays in thermal habitat quality, especially during the middle of the day.
- Future work needs to look at the impacts of microhabitat configuration in the landscape on overall habitat quality and the use of cover by Texas horned lizards to inform habitat management strategies.

ACKNOWLEDGEMENTS

This project was funded in part by a TCU SERC grant and the Andrews Institute of Mathematics & Science Education. Additional thanks to MR Tucker, Rachel Alenius, the TPW staff at Mason Mountain WMA, and Brian Wright for their assistance with this project and to Tammy Pfrang for 3D printing the models.

[1] Santos, T., Pérez-Tris, J., Carbonell, R., Tellería, J. L., & Díaz, J. A. (2009). Monitoring the performance of wild-born and introduced lizards in a fragmented landscape: Implications for ex situ conservation programmes. *Biological Conservation*, *142*(12). **[2]** Mccoy, E. D., Osman, N., Hauch, B., Emerick, A., & Mushinsky, H. R. (2014). Increasing the chance of successful translocation of a threatened lizard. *Animal Conservation*, *17*(S1). **[3]** Taylor, E. N., Diele-Viegas, L. M., Gangloff, E. J., Hall, J. M., Halpern, B., Massey, M. D., Rödder, D., Rollinson, N., Spears, S., Sun, B. jun, & Telemeco, R. S. (2021). The thermal ecology and physiology of reptiles and amphibians: A user's guide. In *Journal of Experimental Zoology Part A: Ecological and Integrative Physiology* (Vol. 335, Issue 1). **[4]** Donaldson W., A.H Price, & J. Morse. 1994. The current status and future prospects of the Texas horned lizard (*Phrynosoma cornutum)* in Texas. *Texas Journal of Science* 46(2): 97-113. **[5]** Pianka, E. R., & Parker, W. S. (1975). Ecology of Horned Lizards: A Review with Special Reference to Phrynosoma platyrhinos. Copeia. https://doi.org/10.2307/1442418