Predation Release of Texas Horned Lizards (*Phrynosoma cornutum*) Living in Small Towns

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INTRODUCTION

- Texas horned lizards are a threatened species in Texas and the subject of many conservation organizations working on reintroduction efforts.[1]
- Populations of these lizards still persist in some small Texas towns and can be found at much higher densities (~50 lizards/ha) than in surrounding natural areas (3-10 lizards/ha).[2,3]
- Texas horned lizards have a number of natural predators including: raptors, canids, felids, and snakes and predation is often implicated in the low survival rates of reintroduced lizards.
- Studies have found that some prey species can reach high densities in urban environments either because predators are taking advantage of leftover human resources or predators are less common in urban areas (Fig. 1).[4]
- We used model lizards to test the hypothesis that predation levels are lower in town than in surrounding natural areas.
- Our two objectives were to:
  1. Measure predation levels in town and compare them with a nearby natural ranch.
  2. Measure predation levels on babies, juveniles, and adults.

Texas horned lizard.

Snakes are common predators of horned lizards.

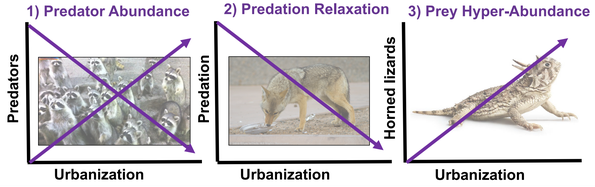


Figure 1. Increased presence of meso-predators subsidized by humans or decreased presence of predators leading to lower predation and higher prey densities.

METHODS

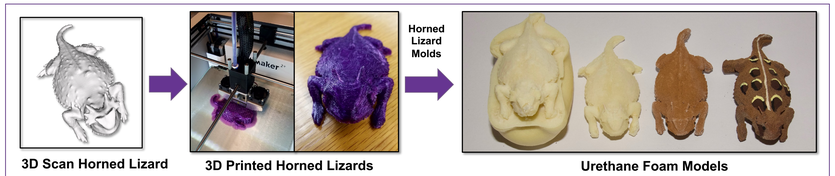


Figure 2. The manufacturing process for making model Texas horned lizards used in this study.

- We 3D printed Texas horned lizard models to create molds which allowed us to make foam model lizards of three different size classes (Fig. 2, 4).
- We placed models (N=504) and controls (N=84) in 3 locations. Kenedy and Karnes City were our urban field sites and a ranch in Dimmit County acted as our natural environment (Fig. 3, 4).
- We performed our predation experiment once in June and later in August to account for differences in weather events and migrating predators.
- We left models in the field for 9 days in the urban environment and then 9 days on the ranch.
- During the first round, all models were painted gray to color match the lizards and substrates of Kenedy and Karnes City, and during the second round all models were painted red to color match the lizards and substrates found on the ranch (Fig. 4).
- Models with signs of predation were categorized as: Avian (pecks & decapitations), Bites (rodent), Bites (other), or Unknown (Fig. 6)

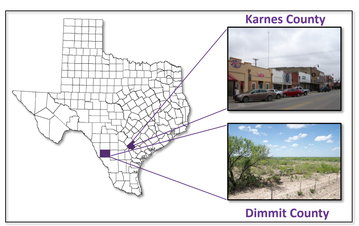


Figure 3. Map of our field sites in Karnes and Dimmit Counties.

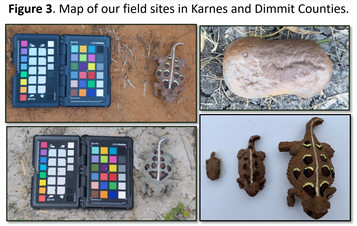
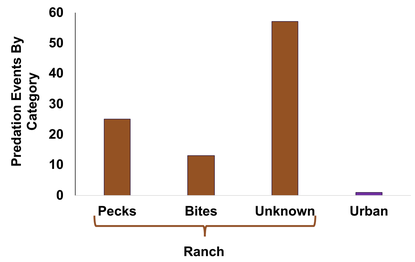


Figure 4. Models and controls that were used in our predation experiment.

RESULTS

Were there differences in predation rates between towns and natural areas?

YES



- We recorded significantly more predation events on the ranch (N = 60) than in town (N = 1) (P = 1.12E-18) (Fig. 5).

Figure 5. Predation events on Texas horned lizard models on the ranch (by category) and the towns .

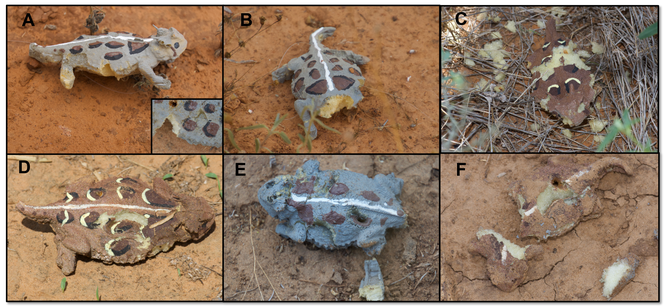
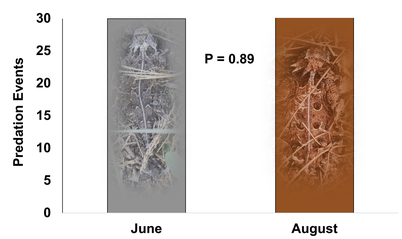


Figure 6. Predation events were categorized as Avian: Pecks(A) & Decapitations(B), Bites: Rodent(C) & Other(D&E), and Unknown (F) .

Were there differences in predation between June and August?

NO



- We observed no difference in the amount of predation events occurring in June (N=30) and in August (N=31) (Fig. 7).

Figure 7. Number of predation events between our two sampling rounds.

Does background color matching influence predation?

YES

- When models were not painted to background color match on the ranch in June we observed significantly more avian predation (Fig. 8).
- This supports a long held hypothesis that background color matching in horned lizards is their primary defensive adaptation for visually oriented predators like birds.[5]

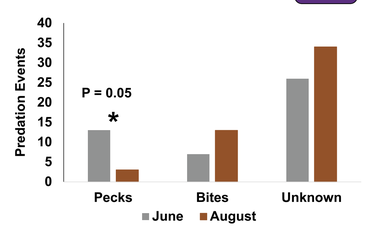
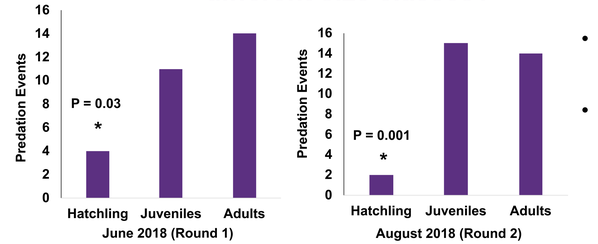


Figure 8. Predation events by category in June and August.

RESULTS

Were there differences in predation rates between different size classes?

YES



- We saw significantly less predation events on hatchling models (Fig. 9).
- Hatchling Texas horned lizards may have higher survivorship than previously thought.

Figure 9. Predation events on hatchling, juvenile, and adult sized models in June and August.

Are using controls important?

YES

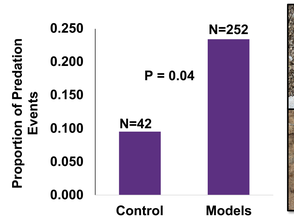


Figure 10. Proportion of predation events on models and controls from the ranch .

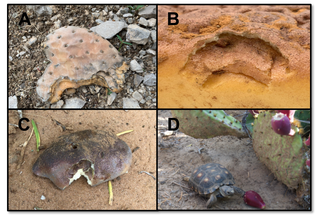


Figure 11. A) Prickly pear pad with bite marks. B&C) Controls with bite marks potentially from Texas tortoises (D) which were a common sight on the ranch.

- Models were attacked by predators significantly more often than controls allowing us to be confident in the interpretation of our results (Fig. 10).
- 4 controls, all from the ranch had evidence of predation possibly from Texas tortoises that mistook our controls for cactus pads and fruits (Fig. 11).

DISCUSSION

- Our results supported our prediction that predation on Texas horned lizards in town would be significantly lower than in the natural ranch setting.
- Evidence exists for an altered predator community in Kenedy and Karnes City including an observed lack of many natural Texas horned lizard predators like: greater road runners, raptors, shrikes, snakes, and bobcats.
- Low levels of predation may be the reason Texas horned lizards exist in high densities in town.
- Texas horned lizards in natural environments (i.e. the ranch) are under heavy predation pressure from a wide variety of natural predators, especially birds.
- Models may be used as conservation tools to measure predation levels in areas deemed suitable for potential Texas horned lizard reintroductions.

ACKNOWLEDGEMENTS

This project was funded in part by a TCU RCAF grant. Additional thanks to Alan Griffin, Nick Bontrager, Rachel Alenius, and Dusty Rhoads for their assistance with this project.

[1] 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. **[2]** Ackel, A. 2015. The devil in the details: population estimation for conservation management of Texas horned lizards (*Phyrnosoma cornutum*). Masters of Science Thesis, Texas Christian University. **[3]** Whiting, M.J., J.R. Dixon, and R.C. Murray. 1993. Spatial distribution of a population of Texas horned lizards *(Phrynosoma cornutum*: Phrynosomatidae) relative to habitat and prey. *The Southwestern Naturalist* 38: 150-154. **[4]** Fischer, J.D., S.H. Cleeton, T.P. Lyons, and J.R. Miller. 2012. Urbanization and the predation paradox: the role of trophic dynamics in structuring vertebrate communities. *Bioscience* 62: 809-818 **[5]** Norris, K.S., and C.H. Lowe. 1964. An analysis of background color-matching in amphibians and reptiles. *Ecology* 45(3): 565-580.