

# Background Color Matching in Texas Horned Lizards



Stephen Mirkin- M.S. Biology, Department of Biology  
Faculty Advisor : Tamie Morgan, Geological Sciences

## Introduction

- Background color matching has been hypothesized to be the primary defensive adaptation in horned lizards against visually oriented predators like birds. (1)
- Texas horned lizards are a threatened species in the state of Texas and the subject of many conservation organizations including TCU. (2)
- Current conservation strategies include reintroducing lizards in areas where they no longer occur.
  - o To date these reintroduction efforts have been unsuccessful.
  - o High predation is often blamed for the low survival rates of reintroduced lizards.
  - o Background color matching is currently not factored into reintroduction strategies.
- Biologists in Dean Williams' lab at TCU are the first researchers to test the extent of back ground color matching in Texas horned lizards.



Figure 1. Examples of two distinct color variations of Texas horned lizards. Note the high degree of background color matching.

## Methods

- We used a GIS analysis with a Munsell soils map of Texas and over a 1000 Texas horned lizard pictures from iNaturalist ® to compare average Color Overlapping Index (COI) scores calculated from a lizards background coloration to see how well it matched the soil color from where it was found.
- Lizard coloration was also qualitatively scored as gray, tan, or red and compared to the soil coloration from which it was found.
- We focused our preliminary analysis to 30 lizards from 3 counties in Texas: Karnes, Brewster, and Freer that have had COI scores calculated.



## Results

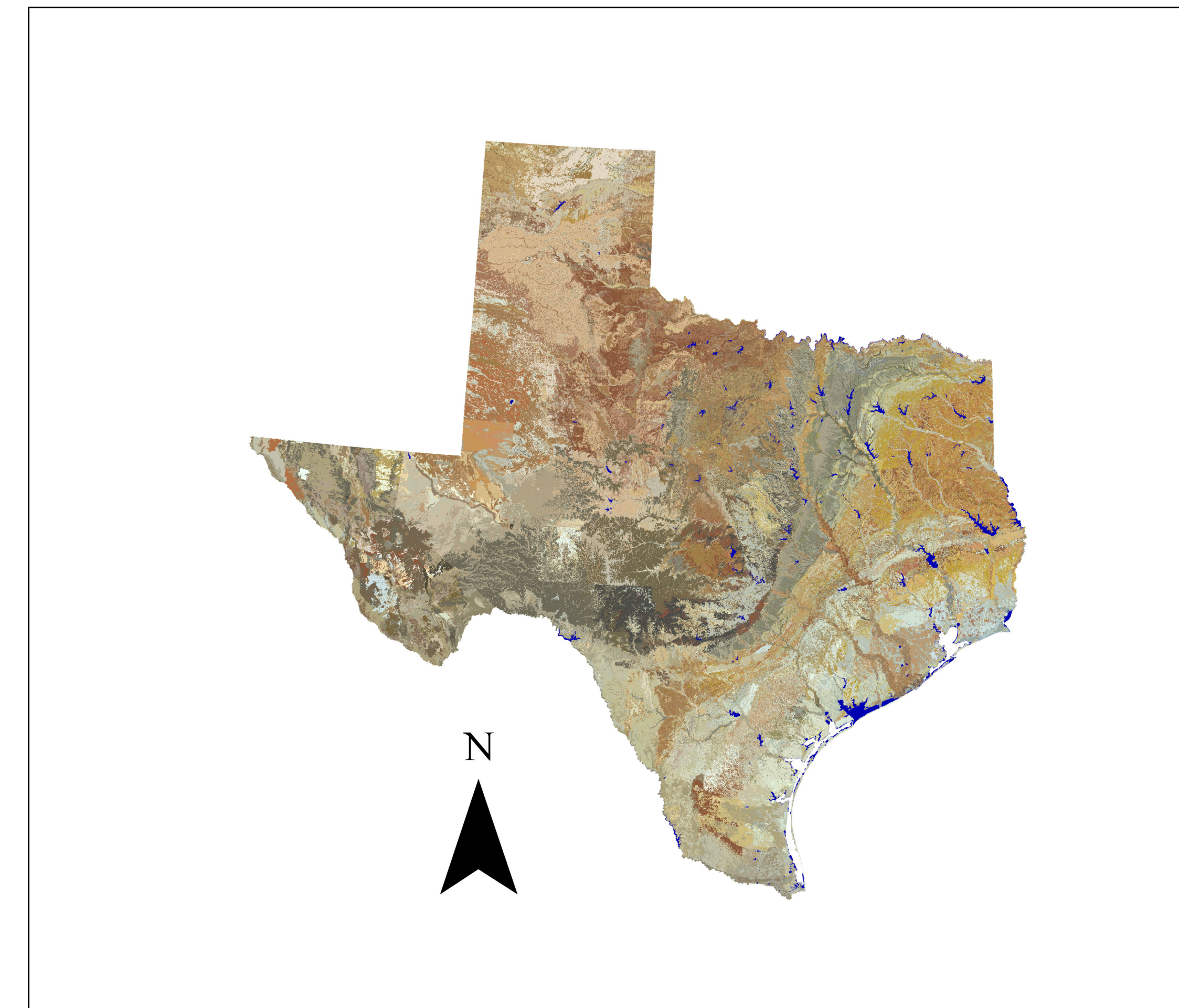


Figure 2. Map of Texas soils showing true colors derived from the Munsell soil color chart.

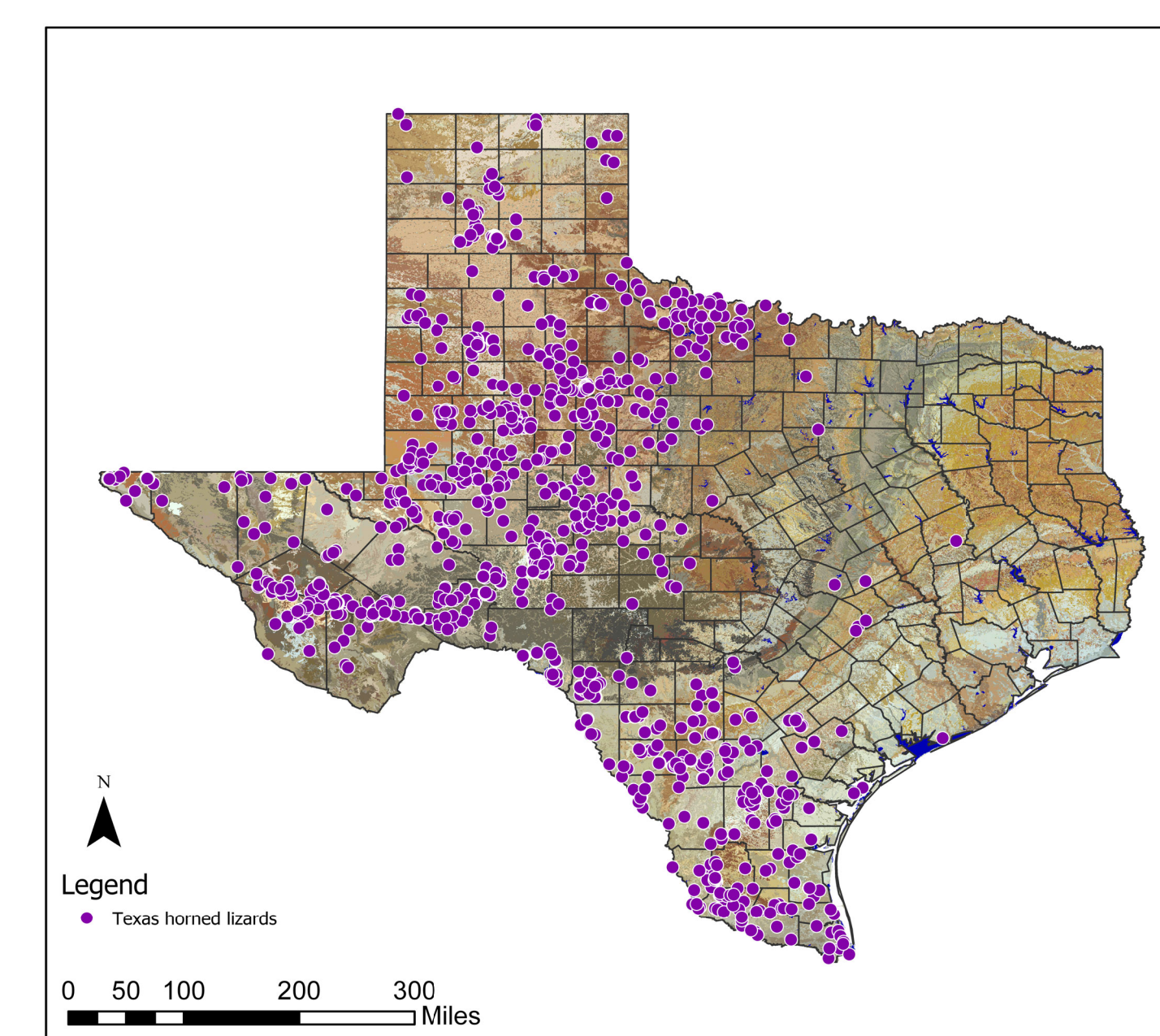


Figure 3. Map showing Texas horned lizard observations from iNaturalist.

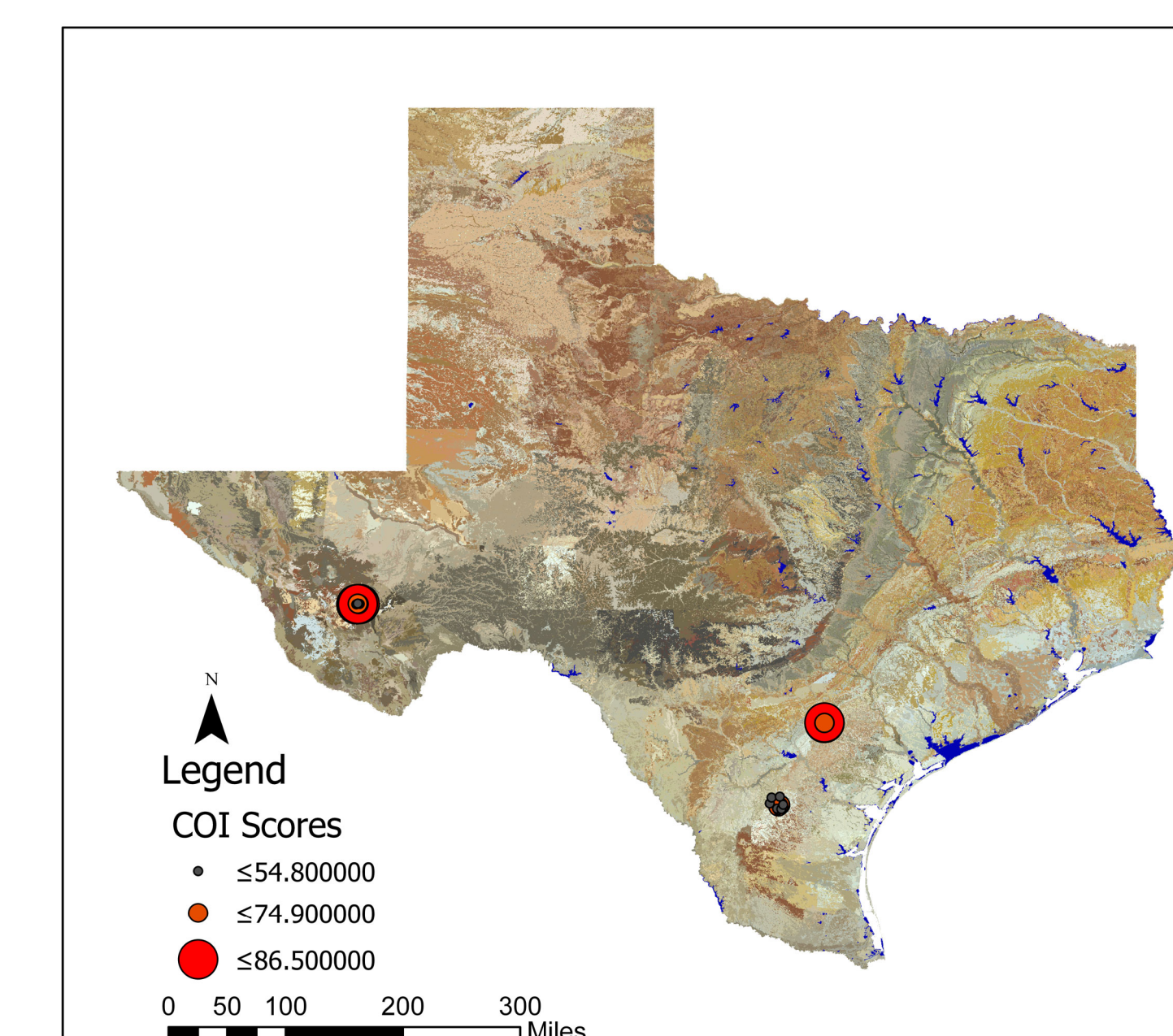


Figure 4. COI scores of lizards from Brewster, Karnes, and Freer counties showing how well individual lizards color match with their surroundings.

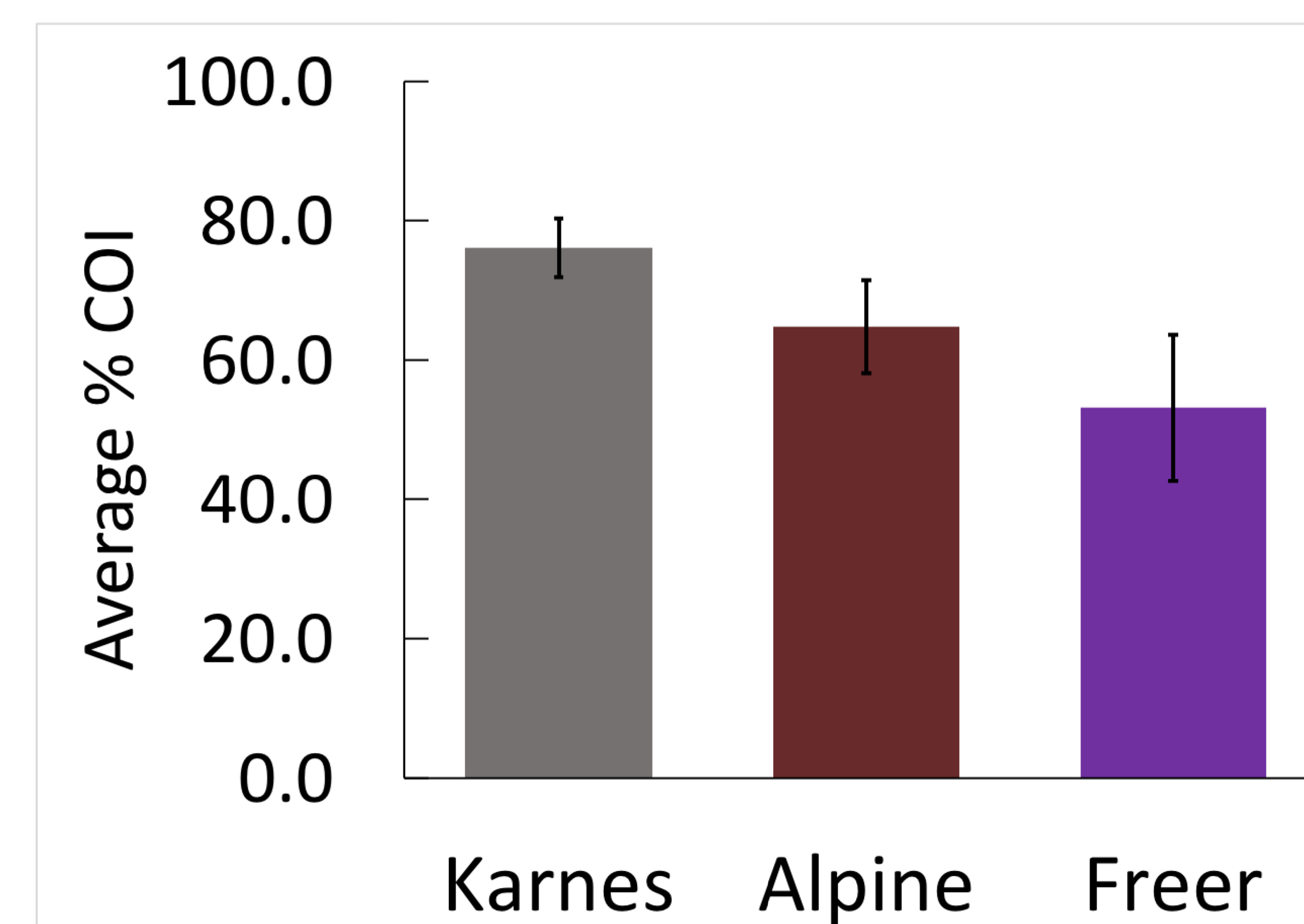


Figure 5. Average COI scores of Texas horned lizards from Karnes, Brewster, and Freer Counties.

## Discussion

- Preliminary results look like Texas horned lizards match the surrounding substrates better than substrates from other areas.
- Supports the hypothesis that background color-matching is their primary defensive adaptation.
- We found significant differences in color matching between populations of lizards found in different areas.
- This leads to more questions for future study:
  - o Why do some lizard populations match their surroundings better than others?
  - o How can we use this information to inform conservation decisions in the future?



## Acknowledgements

I would like to thank Tamie Morgan, Dusty Rhoads, Dean Williams, and Mary Rachel Tucker for their help with this project.

## References

1. Donaldson W., A.H. Price, and 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. Norris, K.S., and C.H. Lowe. 1964. An analysis of background color-matching in amphibians and reptiles. *Ecology* 45(3): 565-580.