



Determining Stability of Texas Horned Lizards (*Phrynosoma cornutum*) and Harvester Ants (*Pogonomyrmex spp.*) in Small Texas Towns Using GIS

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Introduction

- Texas horned lizards have experienced large declines throughout their range, especially in urban areas.^{1,2}
- Urbanization negatively impacts horned lizards through:
 - o Habitat modification, destruction, and fragmentation
 - o Increased mortality from human activity
 - o Reduced arthropod prey availability from pesticide use and invasive fire ants (*Solenopsis invicta*)



Figure 1. *Pogonomyrmex barbatus*

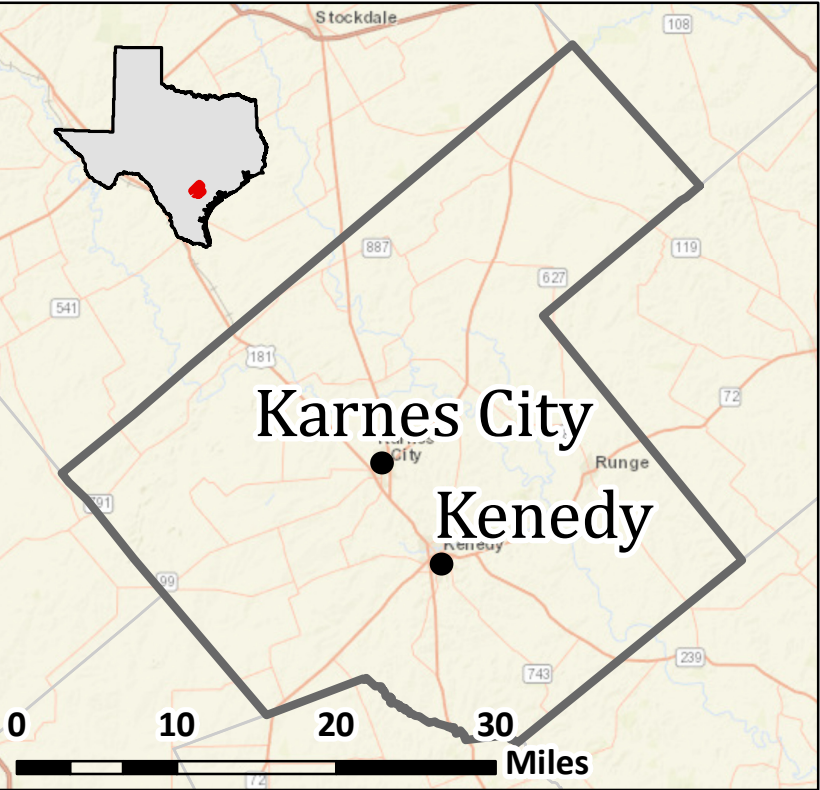


Figure 2. Location of Kenedy and Karnes City, Karnes County is shown in red.

- Food availability, particularly of harvester ants (*Pogonomyrmex spp.*) (Fig.1), is believed to determine the stability and size of horned lizard populations.^{1,3,4}
- Dr. Dean Williams (TCU Dept. of Biology) has been studying urban populations occurring in Kenedy and Karnes City (TX) (Fig. 2) since 2013.

Objective: to determine stability of horned lizard populations in Kenedy and Karnes City.

Methods

SAMPLE COLLECTION:

- o We collected GPS coordinates of harvester ant mounds (Fig. 3) and horned lizards from 10-15 sites (Fig. 4) during the summers of 2013, 2014, 2015, and 2016.
- o The number of times each site was searched varied between years (2013 & 2014: N<6, 2015: N=11, 2016: N=8).



Figure 3. Harvester ant mound

DATA ANALYSIS:

- o After consolidating data from 2013-2016, I determined the number of unique lizards captured each year.
- o I used ArcGIS software to determine the number of lizards and harvester ants occurring at each site during each year, then calculated density by dividing by the area of each site (in hectares).
- o I determined the stability of populations by testing for significant differences in average number and density of horned lizards and harvester ants between sites and years.

- o To determine if food availability influences the size and stability these populations, I tested for correlation between average number and density of horned lizards and harvester ants at each site, and compared these values to those reported by Whiting et al. 1993.

Figure 4. Study sites in a) Kenedy and b) Karnes City. Dark Blue sites have been utilized since 2013 (N=10). Light blue (N=3) and grey (N=2) sites added in 2014 and 2015, respectively.

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. Pianka, E.R. and W.S. Parker. 1975. Ecology of Horned Lizards: a review with special reference to *Phrynosoma platyrhinos*. *Copeia* 1975(1): 144-162. 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(2):150-154. 4. Whitford, W.G. and M. Bryant. 1979. Behavior of a predator and its prey: the horned lizard (*Phrynosoma cornutum*) and harvester ants (*Pogonomyrmex spp.*). *Ecology* 60(4):686-694.

Results

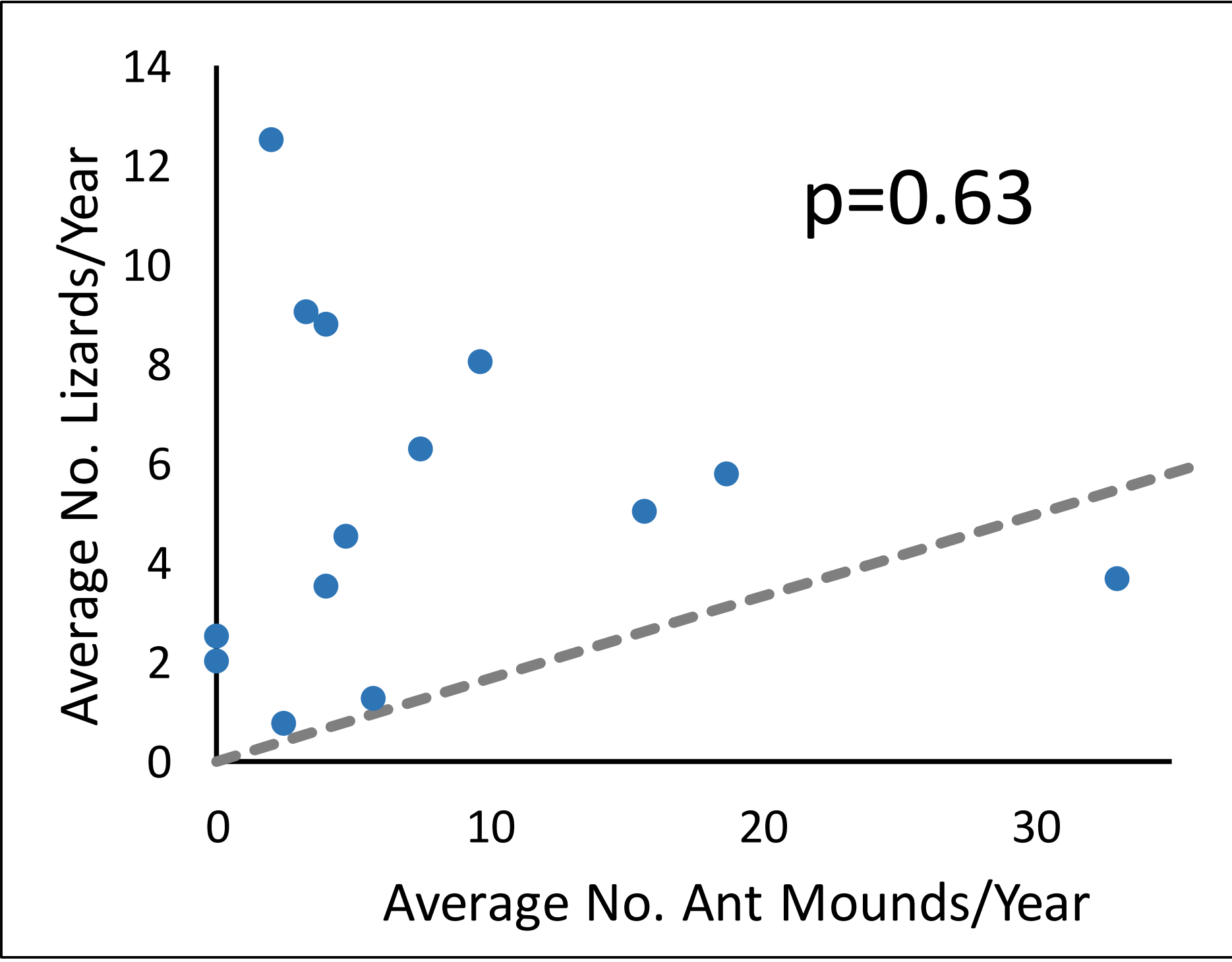


Figure 5. No significant relationship between average no. of harvester ant mounds and lizards per year at each site. The number of horned lizards at each site (blue points) is generally higher than predicted by Whiting et al. 1993 (grey line)³. School 1 is not shown.



Figure 6. Horned lizard found in Karnes City.

o The average number of horned lizards per year was statistically different between sites (One-Way ANOVA, $F_{14,38} = 34.74$, $p < 0.000001$). Tukey-Kramer post-hoc tests revealed School 1 has statistically higher average number of lizards (57.3 ± 3.8 lizards/year) than all other sites ($p < 0.000001$), while none of the remaining sites were statistically different from one another ($p > 0.079$).

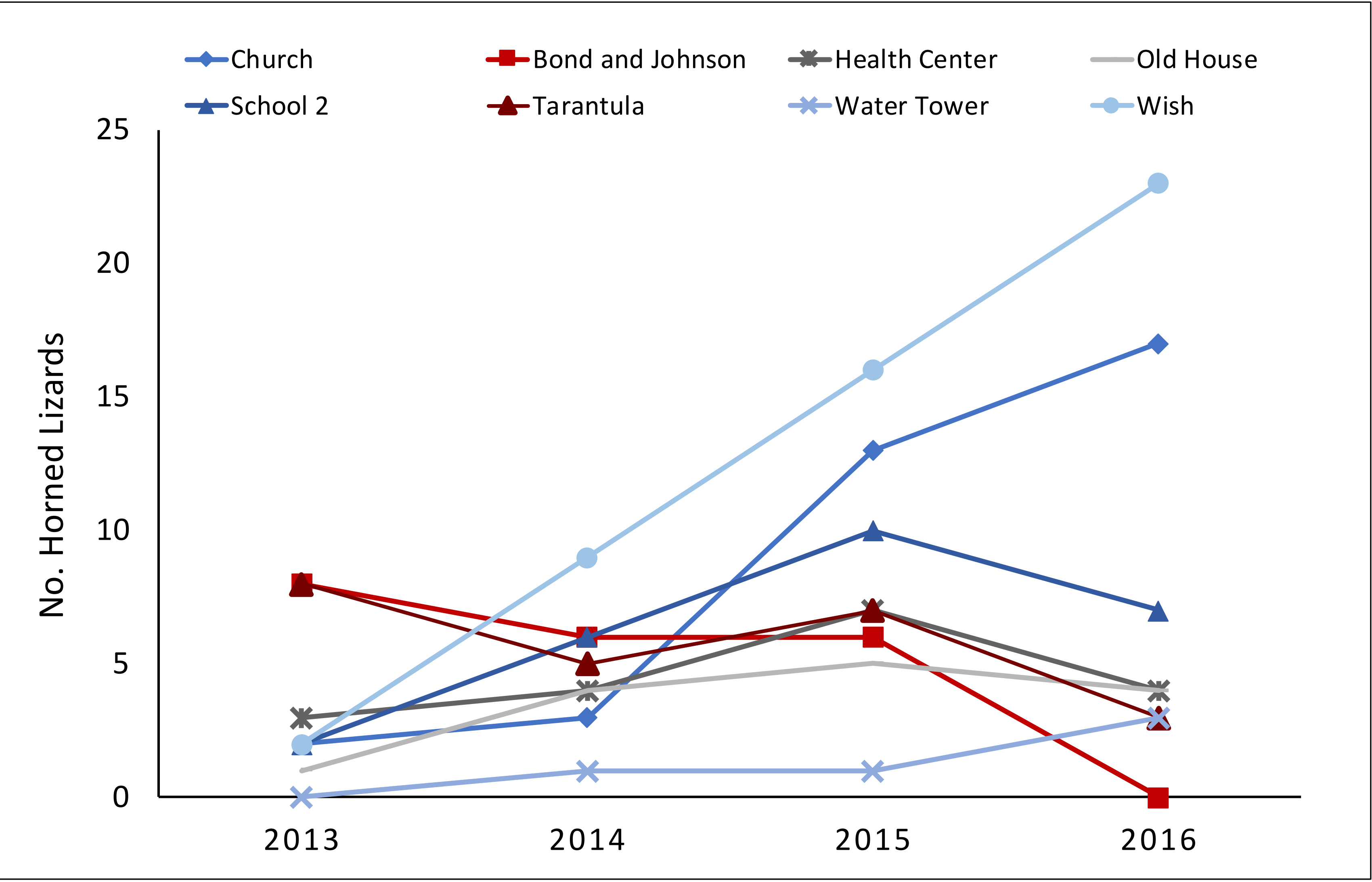


Figure 7. Trends in number of individual lizards captured yearly at 8 study sites. Most sites experienced a net increase (blue) or no change (grey) in the no. of individual lizards captured each year. Red lines indicate sites which have declined substantially. Increases in lizard captures per year may be a reflection of increased search effort in 2015 and 2016.

o The sudden disappearance of lizards from Bond & Johnson in 2016 may be a result of inbreeding depression. Previous studies found lizards at this site were genetically isolated from the rest of Karnes City, suggesting US Highway 181 provides a significant barrier to gene flow (Fig. 4b).

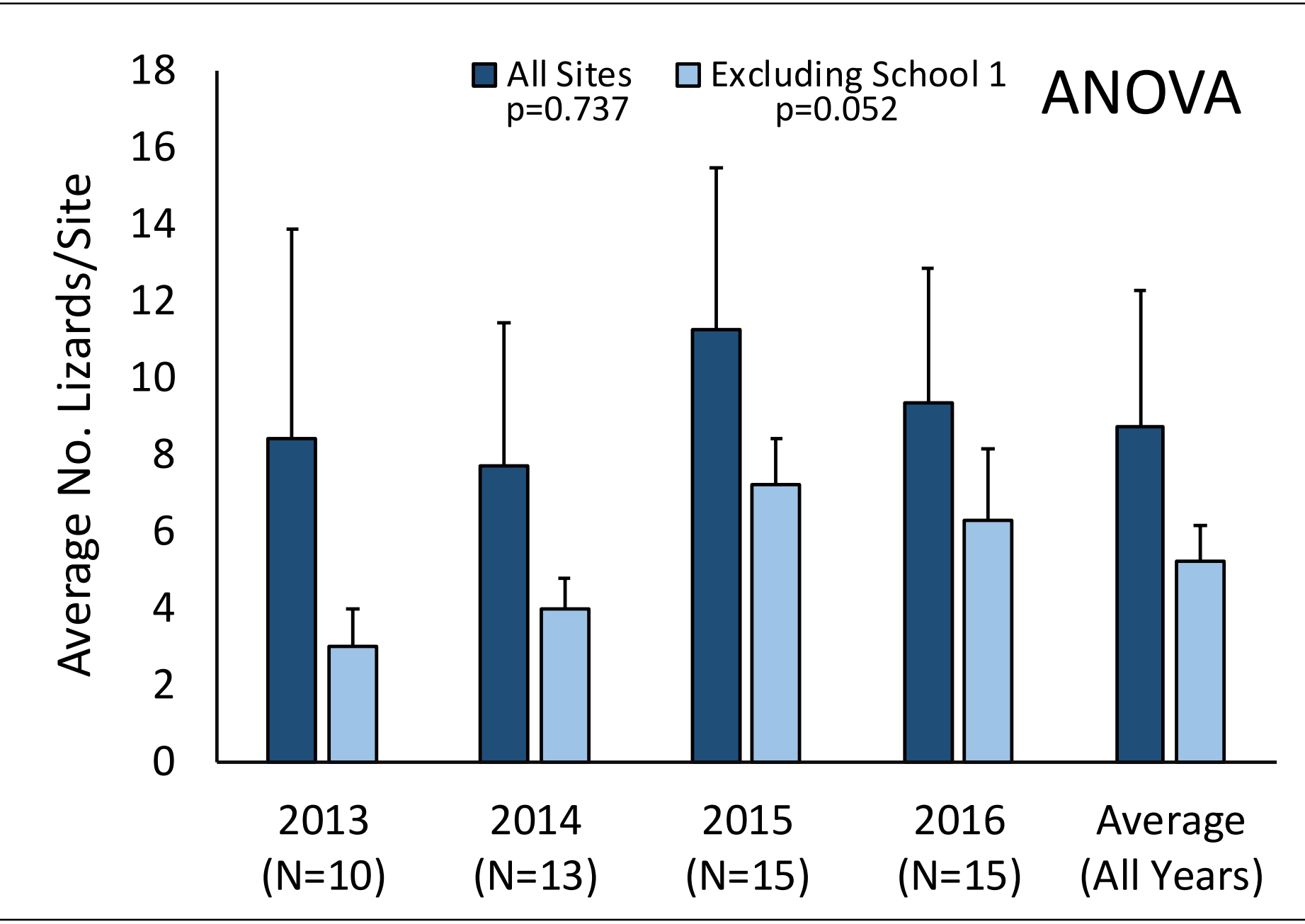


Figure 8. There is no statistical difference between average number of lizards captured per site from 2013-2016, suggesting populations are stable. Values were calculated including (dark blue) and excluding (light blue) School 1. Error bars represent +1 SEM.

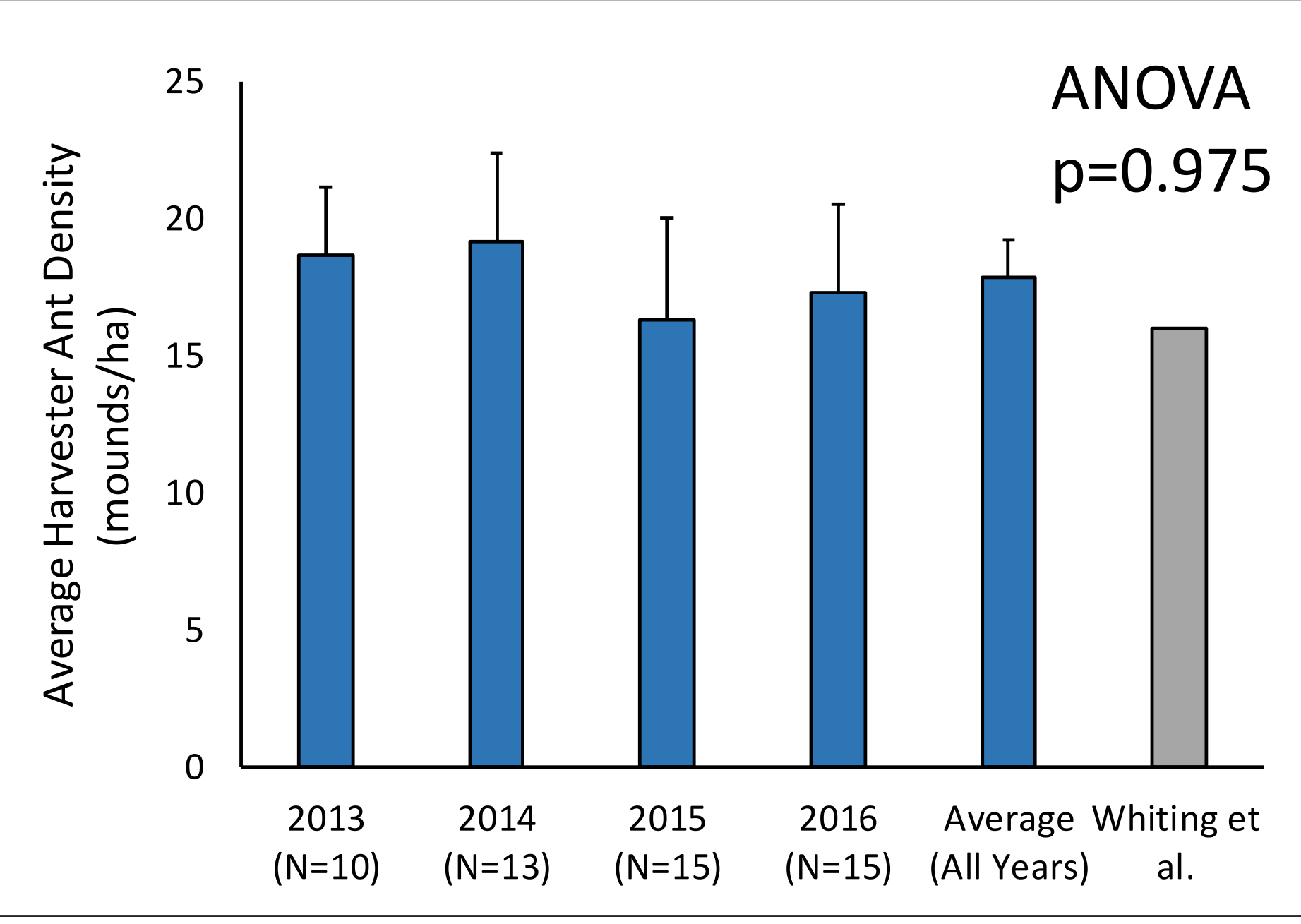


Figure 9. Average density of harvester ants is not statistically different between years or from natural habitats (15.9 mounds/hectare)³. Error bars represent +1 SEM.

Conclusions

- o Texas horned lizard populations appear to be stable in Kenedy and Karnes City, despite pressure from human development.
- o Populations of horned lizard occurring in Kenedy and Karnes City do not appear to be dependent on harvester ant availability. This is consistent with results of dietary studies, which have found that harvester ants typically account for <10% of the diets of these lizards.
- o We have not been able to explain the excessively high numbers of horned lizards occurring at School 1.
- o The disappearance of the population at Bond and Johnson suggests habitat fragmentation and reduced gene flow may pose a serious risk to horned lizards in urban areas.

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