The abundance of four scorpion species across the gradient of urbanization in the Phoenix Valley, Arizona

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INTRODUCTION

- Although researchers have evaluated the effects of urbanization on many species of mammals, birds, and reptiles, few studies have focused on the scorpion community (Fig 1).

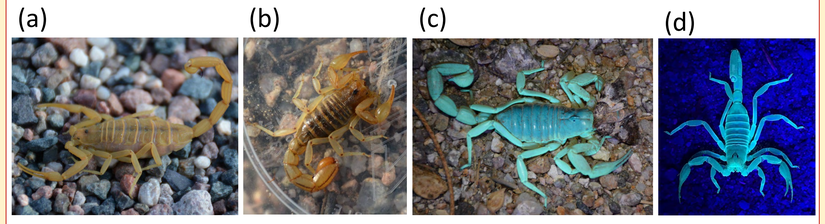

Fig 1. Scorpion species in the Phoenix Valley include (a) bark, (b) stripe-tailed, (c) giant desert hairy, and (d) yellow sand scorpion. Note the green coloration in (c) and (d) from the UV black light.

- Multiple scorpion species co-occur with humans and development in the desert southwest. However, where scorpions overlap in their distribution with humans is predicted to vary spatially depending on landscape configuration and urban intensity.

- In Arizona, previous research evaluated the distribution of humans that were stung by scorpions. However, no field studies have evaluated how each scorpion species responds to varying levels of urbanization and landscape characteristics at finer spatial scales.

- This information is important for understanding urban ecology of communities and managing potential human-wildlife conflict.

RESEARCH OBJECTIVES

The objective of this project was to evaluate how the distribution, diversity, and abundance of scorpion species varied across the Phoenix Valley. Our specific objectives were to:

1. Inventory the scorpion species present across the urban gradient.

2. Evaluate habitat relationships for four scorpion species in relation to the gradient of urbanization and other landscape factors.

It was predicted that some species would be more sensitive to urbanization (i.e., stripe-tailed and giant desert hairy), whereas other scorpions (i.e., bark) would occur across the entire gradient of urbanization and dominate the scorpion community in urban areas.

METHODS

- During the summer of 2019, we surveyed 50 sites across the urban gradient (Fig 2) using UV "black" lights by walking 560 m long transects (Fig 3) three times at one month intervals.

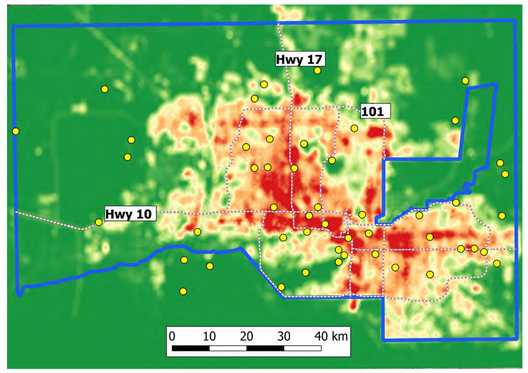

Fig 2. Study area across the Phoenix Valley. The blue outline shows the boundary for the CAP LTER. Urban intensity varies from low (green) to high (red). Yellow dots indicate CAP locations that were evaluated for scorpions.

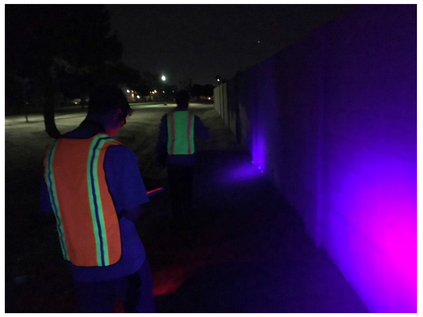

Fig 3. Night-time survey sampling for scorpions with UV black lights. In urban areas, bark scorpions were commonly found along block walls.

RESULTS

- Overall, we recorded a total of 3,289 scorpions across the gradient of urbanization during our surveys in the summer of 2019.

- **Note**: Please see the CAP poster by REU student Ryan Faust for more information about how the numbers for each scorpion species varied across varying levels of urbanization in our system.

- Consistent with our predictions, some scorpions were more sensitive to urbanization (Fig 4). Whereas, the bark scorpion occurred across the entire gradient of urbanization, including in areas of relatively high urbanization (Fig 4).

- Bark scorpions exhibited characteristics of an "urban adapter", occurring across the entire gradient, and peaking at intermediate levels of urbanization. Other scorpion species were consistent with being "urban avoiders", reaching their highest N in wildland areas.

RESULTS CONTINUED

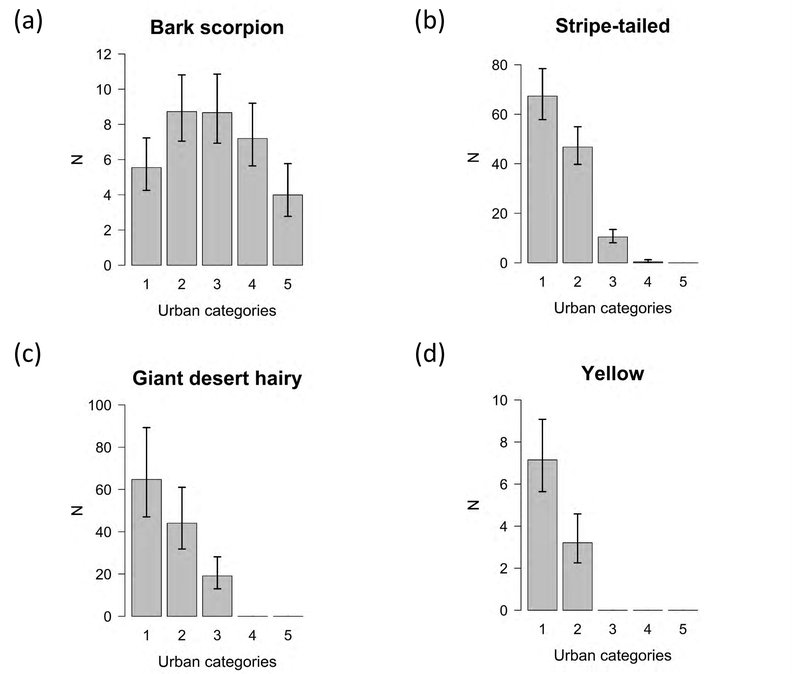

Fig 4. Population size (N) of (a) bark, (b) stripe-tailed, (c) giant desert hairy, and (d) yellow scorpions across the gradient of urbanization, ranging from wildland (category 1) to highly urban (category 5). Results are based on N-mixture models of abundance.

CONCLUSIONS

- The scorpion community changed from a diverse system in wildland areas to being dominated by a single species, the bark scorpion, in highly urbanized areas.

- Next steps will focus on quantifying how species richness of the scorpion community changes across the urban gradient.

ACKNOWLEDGEMENTS

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