Assessing Bat Biodiversity in Increasingly Urban Landscapes

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Introduction

- Urbanization has been linked to a decrease in overall biodiversity, and expansion of urban areas can shift species composition on a landscape.
- Urban road infrastructure, anthropogenic noise and light levels, and ability to roost and find prey can all affect bat survival in urban areas.
- Bats provide valuable ecosystem services as insectivores and pollinators, valued at >$470B USD annually.
- Little bat sampling has been done in and around Atlanta, Georgia to investigate how land cover and socioeconomic factors might affect bat biodiversity.
- We investigated the hypotheses that (1) bats are negatively affected by urbanization, and that (2) bat responses to urbanization are species-specific.

Methods

Fig 1. Setting up a bat detector at a suburban site in Kennesaw, Cobb County, Georgia.

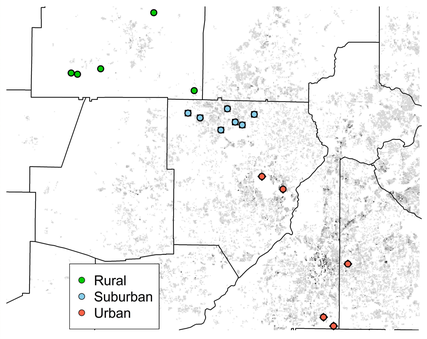

Fig 2. Map of bat detector locations along an urban-rural gradient extending from Atlanta Metro to Bartow Co., GA. Grey shading indicates human population density.

- Recorded ultrasonic bat calls using Wildlife Acoustics SM4-BAT recorders at 21 sites along urban-rural gradient.
- Used geographic information systems (GIS) to relate spatial variables (e.g., human population or tree canopy cover) to bat detector locations.
- Use R to analyze bat species' relative abundance in relation to spatial variables and urbanization.

Results

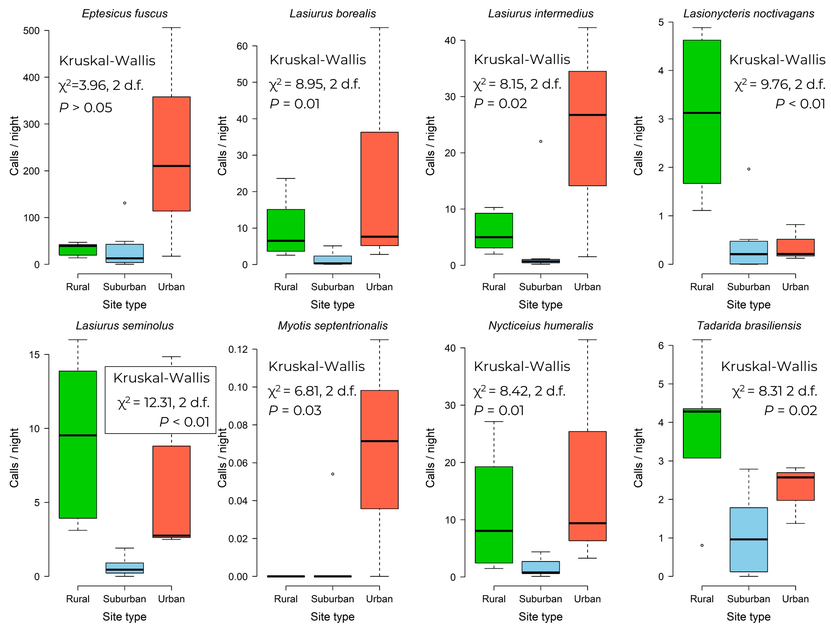

Fig. 3. Seven out of thirteen species of bat differed significantly in their relative call abundance between rural, suburban, and urban sites. Neither species richness nor Simpson index varied with degree of urbanness.

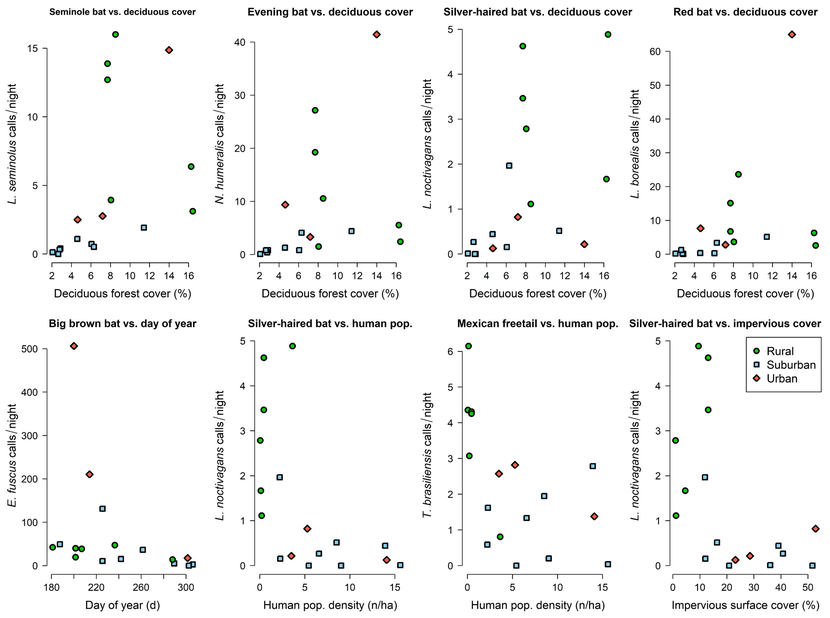

Fig. 4. Bat call relative abundance (calls/night) was positively correlated with deciduous forest cover for most species (top row). Relative abundance of the most common species, big brown bat (*Eptesicus fuscus*), was strongly negatively correlated with day of year. Call abundances of several species were negatively correlated with human population density and impervious surface cover, two indicators of urban development.

Conclusion

- Call activity differed significantly across the urban-rural gradient for seven species of bats.
- Bat activity was not necessarily lower in urban areas; instead, responses to urbanization were species-specific.
- Species-specific responses may be related to species' call characteristics, foraging traits, body size, flight style, roosting preferences, and other traits.
- Our hypothesis that bats are negatively affected by urbanization ***was not supported***.
- Our hypothesis that bat responses to urbanization are species-specific ***was supported***.
- Further analysis of this dataset using species traits, temporal patterns, and geographic variables at different scales may help explain the patterns we found.

Fig. 5
Silver-haired bat, *Lasionycteris noctivagans*
Michael Durham/Minden Pictures

Fig. 6
Eastern red bat, *Lasiurus borealis*.
Merlin D. Tuttle/Bat Conservation International

Acknowledgments

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