

Patterns and potential mechanisms of phenotypic changes in urban small mammals

Leslie Lopez, Bri Casement, and Nicholas Green

Department of Ecology, Evolution, and Organismal Biology

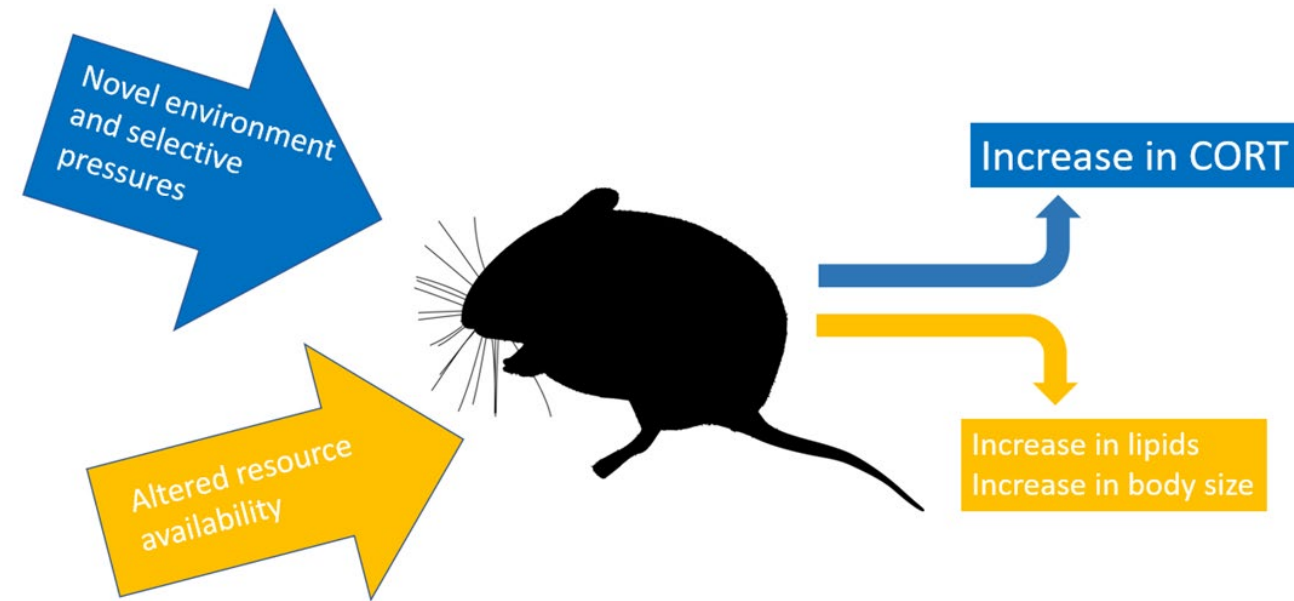
Kennesaw State University

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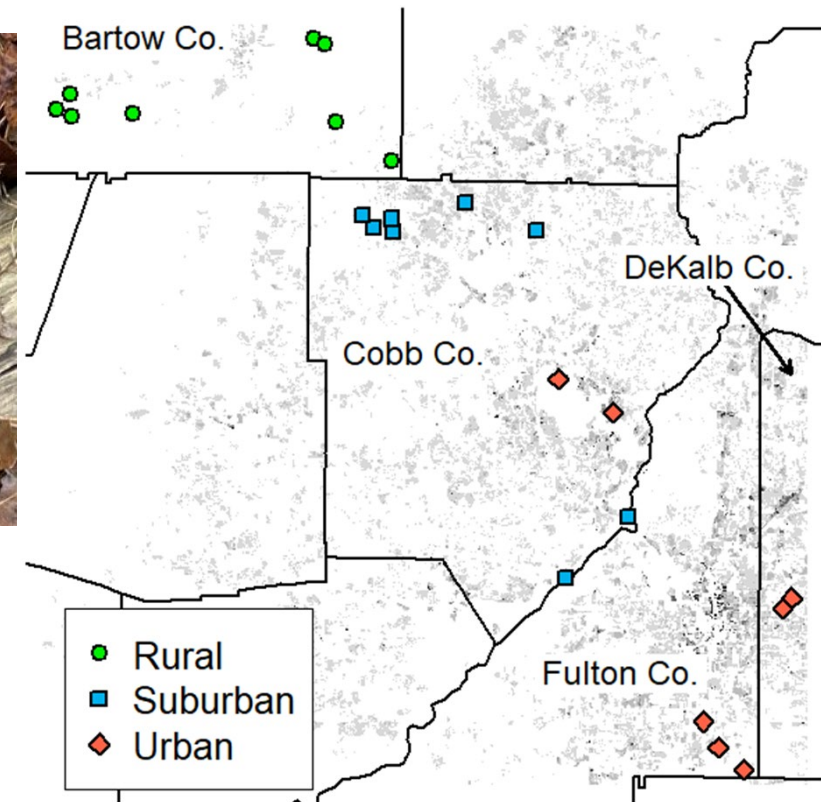
Background

- We investigated how urbanization affects small mammal morphology and physiology.
- Novel environments may present novel challenges and opportunities.
- Investigated how urbanization might affect 3 endpoints:
 1. Morphology (mass, length)
 2. Serum lipid concentrations
 3. Stress hormone (cortisol) levels



Methods: Overview

- Trapped small mammals along urban-rural gradient centered on Atlanta, Georgia, USA.
 - Sampled 23 sites from May-August 2023
 - 14,720 trap-nights, 1,135 captures of 13 species
- Recorded species, sex, reproductive status, body mass, body length from each individual, and took a blood sample.



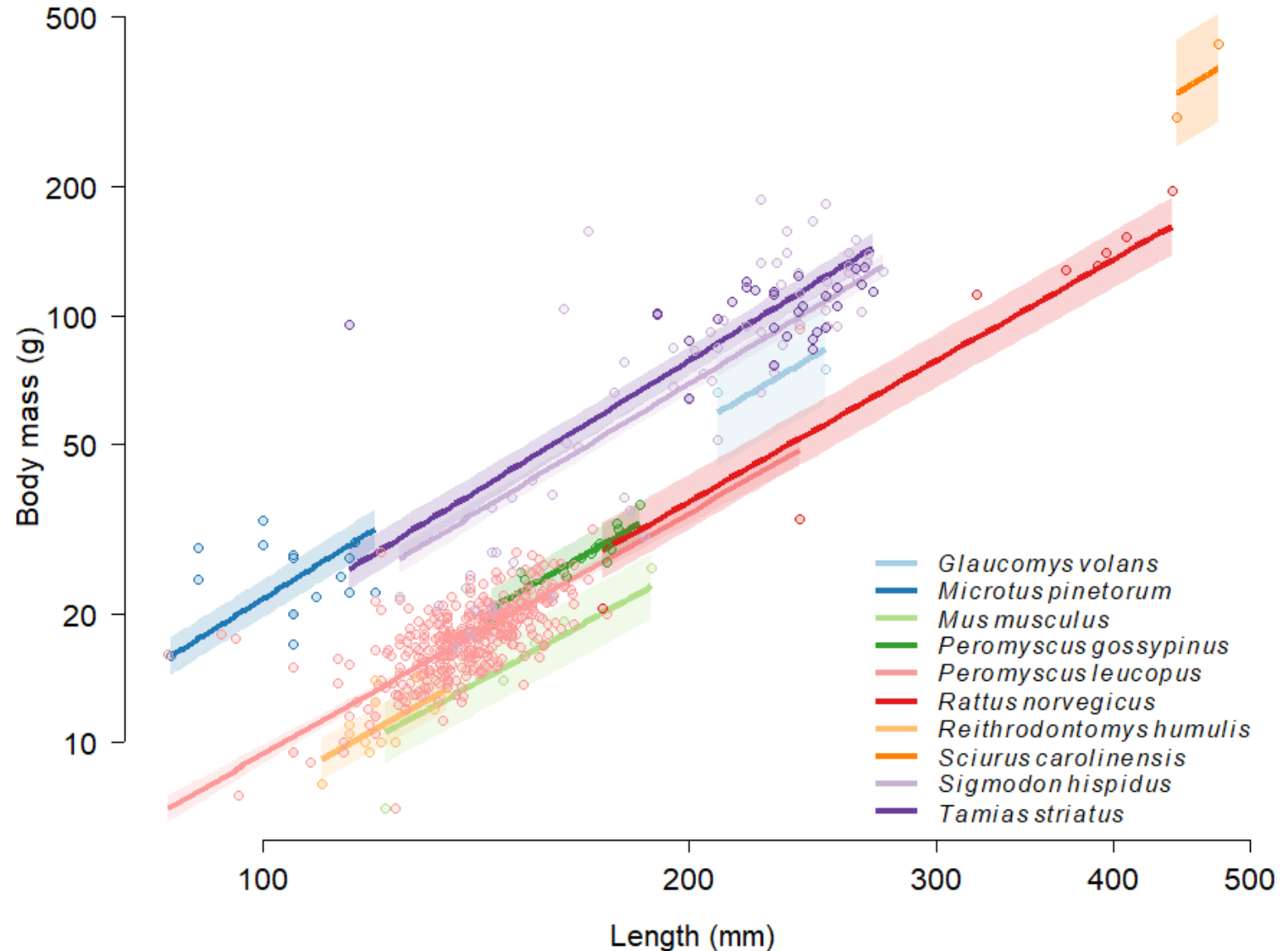
Methods: Physiological sampling

- Drew blood from submandibular vein
 - Measured TRIG, CHOL using CardioChek Plus in field
 - Took blood sample for later CORT analysis
- Pregnant and juvenile animals excluded from blood sampling
- Total: 118 lipid panels, 89 serum samples



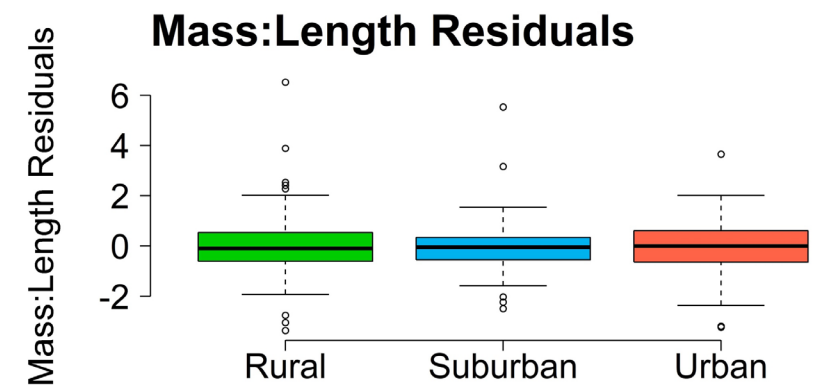
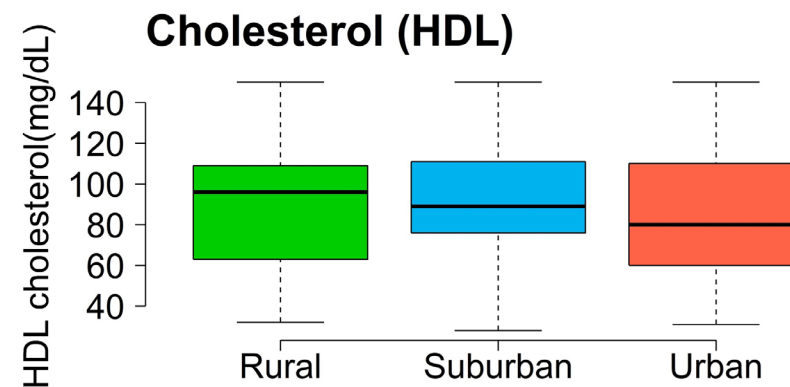
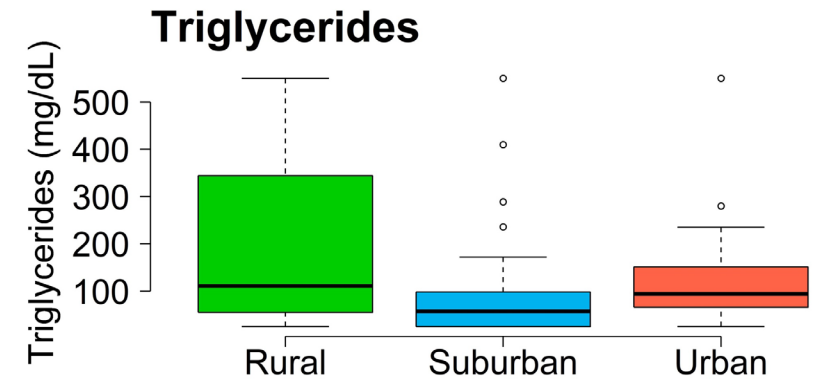
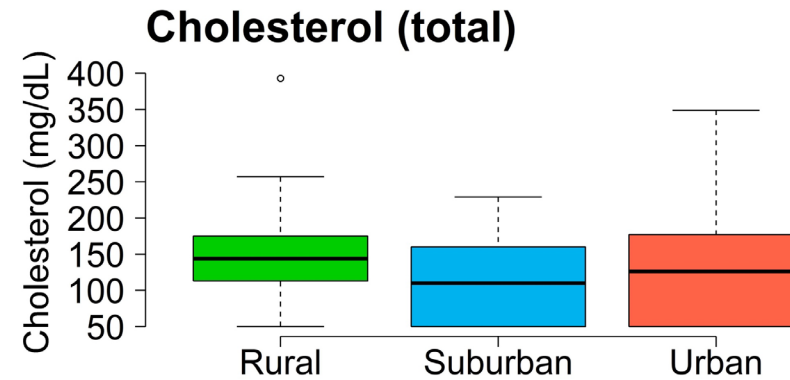
Results: Mass:Length Allometry by Species

- Fit power law of mass vs. length, with species-specific slopes
 - Model $R^2 = 0.91$ (omnibus $F_{10,557} = 575.60$, $P < 0.01$).
- Then, compared residuals of this relationship to site characteristics (incl. urbanization)



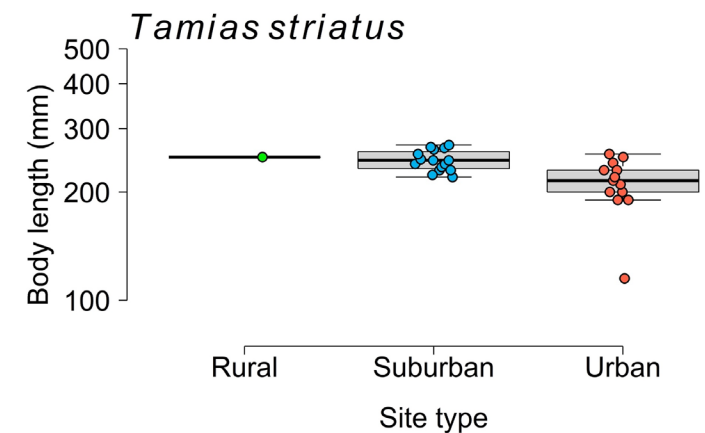
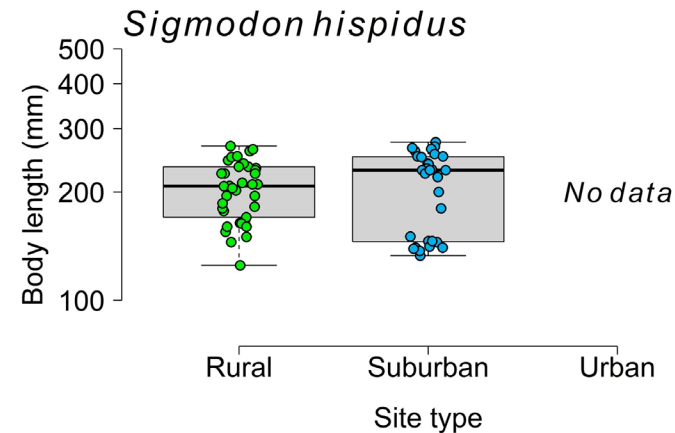
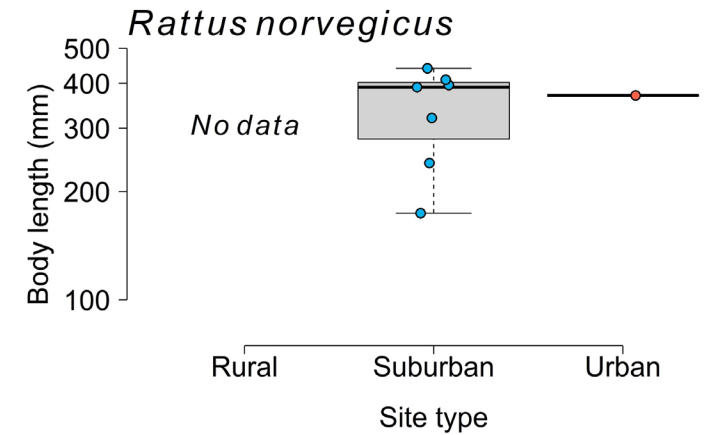
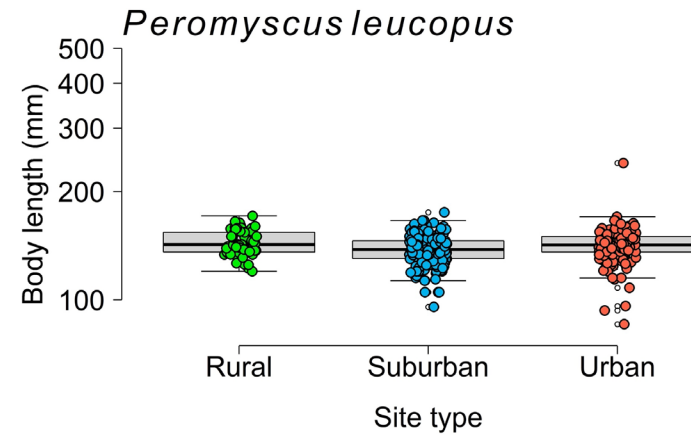
Results: Urbanization affected TRIG but not CHOL

- Only TRIG varied with site type
 - TRIG lowest in suburban animals (Kruskal-Wallis $\chi^2 = 11.8$, 2 d.f., $P < 0.01$)
- CHOL unaffected by site type
- Mass:Length residuals unaffected by site type



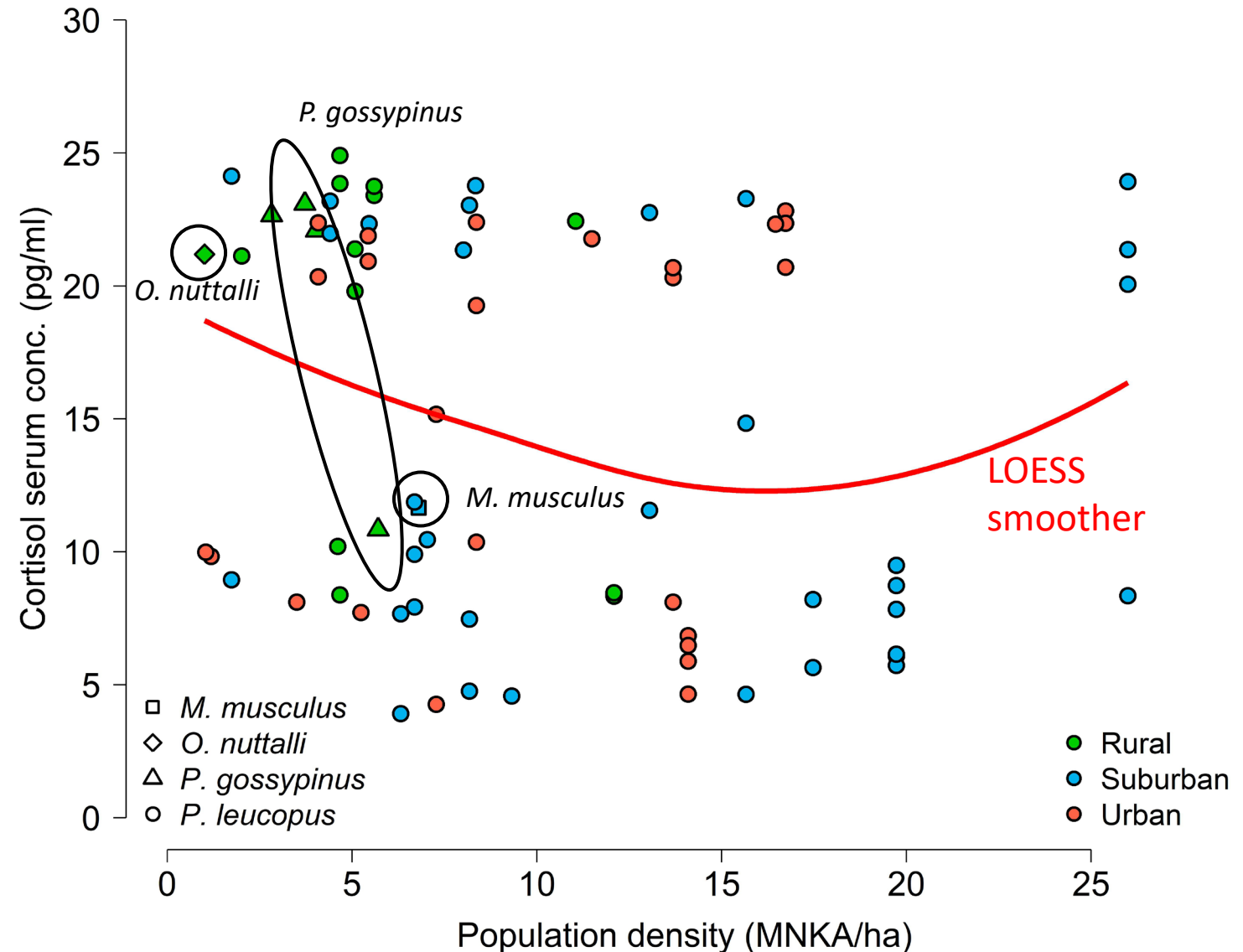
Results: Urbanization affected total length

- White-footed mice (*P. leucopus*) were significantly shorter at suburban sites
 - Kruskal-Wallis $\chi^2 = 14.55$, $P < 0.01$
- Chipmunks (*T. striatus*) were significantly shorter at urban sites.
 - Kruskal-Wallis $\chi^2 = 9.21$, $P < 0.01$
- Brown rat (*R. norvegicus*) and cotton rat (*S. hispidus*) not affected by site type, although *Rattus* sample size small



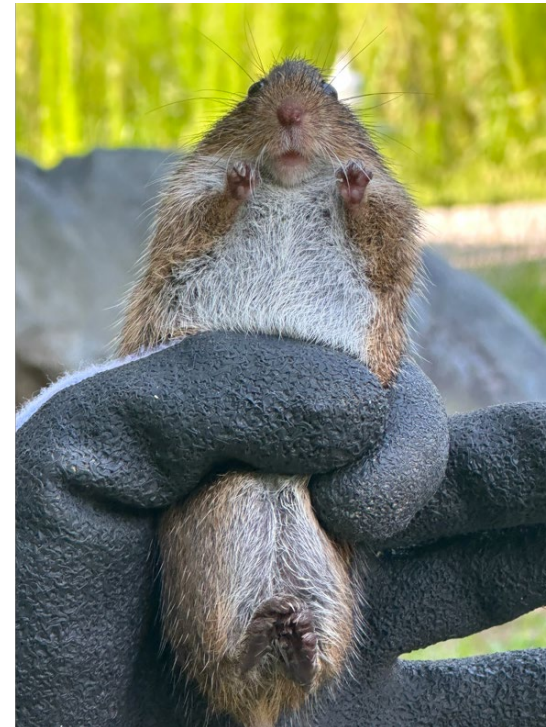
Results: CORT

- CORT concentration may have varied by site type (Kruskal-Wallis $\chi^2 = 6.09$, $P = 0.047$), but effect smaller than inter-assay variation.
- CORT weakly negatively correlated with conspecific population density (Spearman's $\rho = -0.276$, $S = 97060$, $P < 0.05$)
- CORT data dominated by *P. leucopus*



Preliminary conclusions

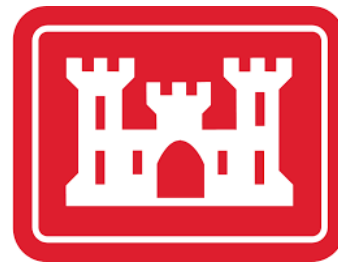
- The hypothesized caloric surplus expected in urban sites was not evident in morphological or serological data.
 - Suburban sites had lowest TRIG, shortest PELE; Urban sites had shortest TAST
 - Sites did not appear to offer different resources, or at least not in a way relevant to small mammals like we hypothesized.
 - Will re-analyze using censored regression models to account for range of CardioChek device
- Little redundancy (i.e., correlation) between morphological and physiological indicators of nutritional status.
 - Important for future studies of small mammal ecophysiology
- Results show no relationship between urbanization and individual stress



Acknowledgements

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- USACE
- Cobb County Parks Department
- Georgia Power at Plant Bowen
- Frazer Forest
- Fernbank Museum of Natural History
- Atlanta Expo Center
- The Conservation Fund



Georgia Power



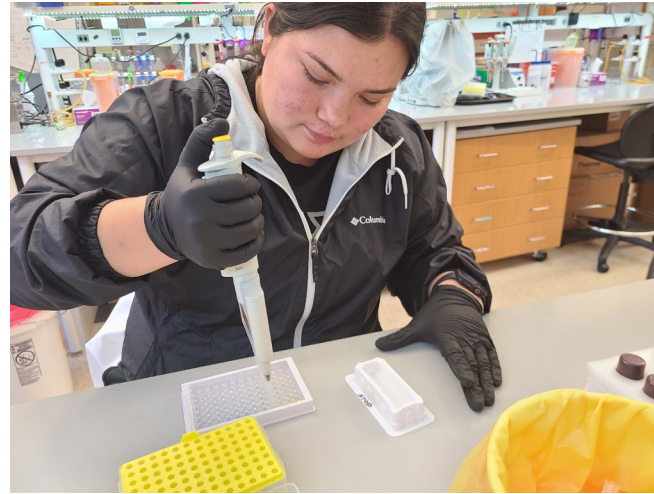
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Thank you!

