A preliminary analysis of salamander morphology at City Lake Natural Area

Natalie G. Troth[1], Joshua M Hall[1], Macie Skelton[1], Jacey McKinley[1], Kennedy Anderson[1], Cindy Scruggs[1], Thomas Laffoon[1], Frankie Zerr[1], Quentin Deans[1], Alex O'Neal, Logan Gaither[1], Aileen Granados[1], Grayson Hall

[1]Department of Biology, Tennessee Technological University, Cookeville, TN 38505

Introduction

- Body size metrics are often measured through snout-vent length (SVL) and used as a proxy to body mass.
- Many studies do not examine body mass relative to length when examining species-specific measurements, although broader multi-species analyses show differences of allometric relationships among amphibian families.[1]
- Mass-related allometric data can indicate important health indices such as metabolic rates, fat reserves, and reproductive output.[1, 2]
- We wanted to determine variation in body size allometry and body condition for populations of Plethodontidae at the same site, which has rarely been considered.
- Focal species included: the zig-zag salamander (*Plethodon dorsalis*), slimy salamander (*P. glutinosus*), dusky salamander (*Desmognathus fuscus*), and cave salamander (*Eurycea lucifuga*).

Research Questions

How does body size allometry vary across sympatric species of Plethodontidae? How does body condition vary seasonally for our study species?

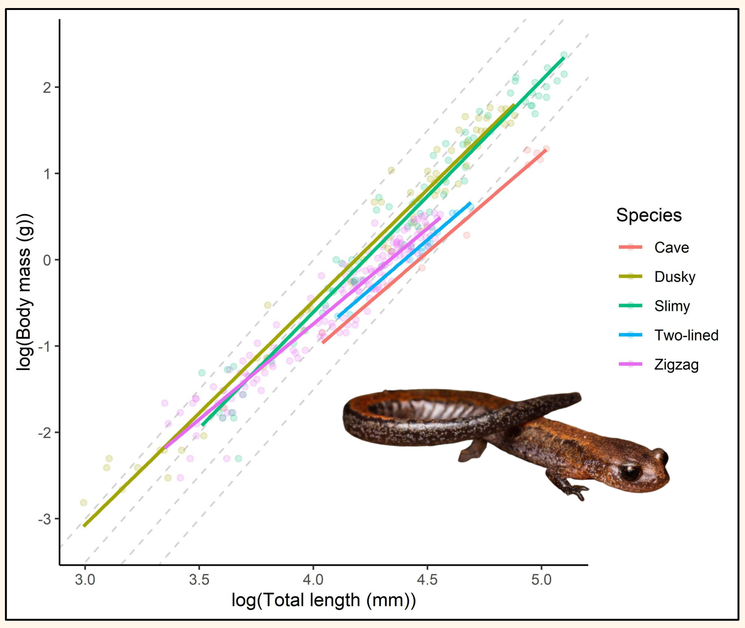

Figure 1. Log regression of body mass relative to total length shown for all salamander species. Gray dotted lines represent slopes of 3 for reference.

Methods

- We conducted monthly field samples from March 2025 to February 2026 at two transects within City Lake Natural Area.
- Salamanders were caught, massed, photographed, and released.
- Body size allometry was evaluated by performing a linear regression with log body mass as the response and log body length, species, and their interaction as fixed effects.
- For species with a large sample size, residuals were calculated from this model to estimate body condition and analyzed against months using ANOVA to consider seasonal changes.

Preliminary Results

- All species exhibit negative body size allometry (i.e. slopes < 3); and the interaction term was statistically significant ($p<0.001$; i.e. slopes and intercepts vary across species (Fig. 1)).
- *P. dorsalis* shows significant body condition changes throughout year ($p=0.01$; Fig. 2, 3), while *D. fuscus* (Fig. 4) and *P. glutinosus* ($p=0.59, 0.66$; Fig. 5) body conditions do not show substantial change across seasons.

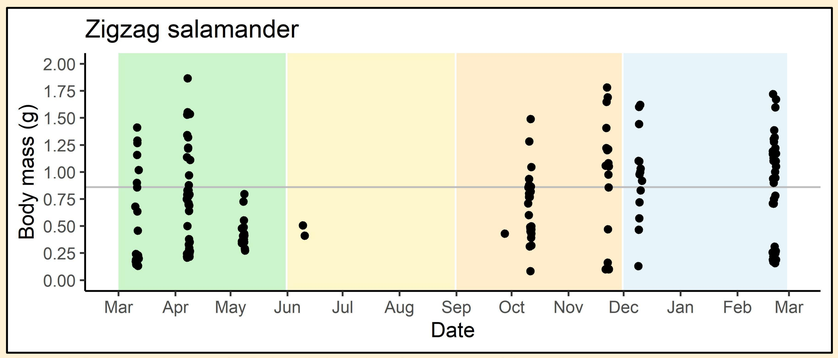

Figure 2. Body mass in grams for *P. dorsalis* throughout four seasons of data collection.

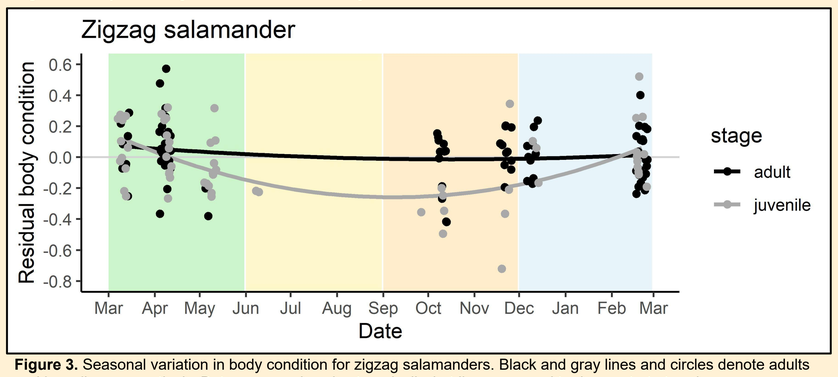

Figure 3. Seasonal variation in body condition for zigzag salamanders. Black and gray lines and circles denote adults and juveniles, respectively. Data were analyzed categorically, but lines are used to demonstrate trends.

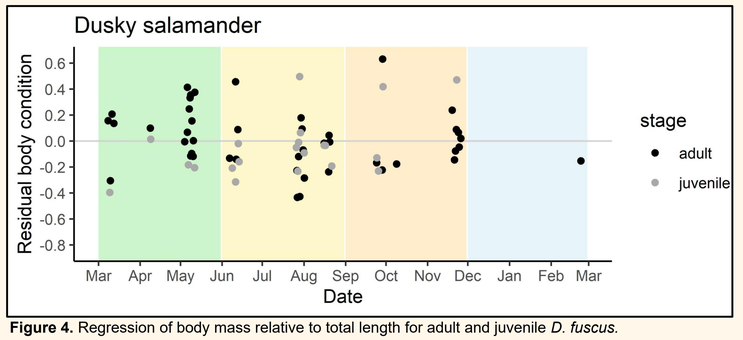

Figure 4. Regression of body mass relative to total length for adult and juvenile *D. fuscus.*

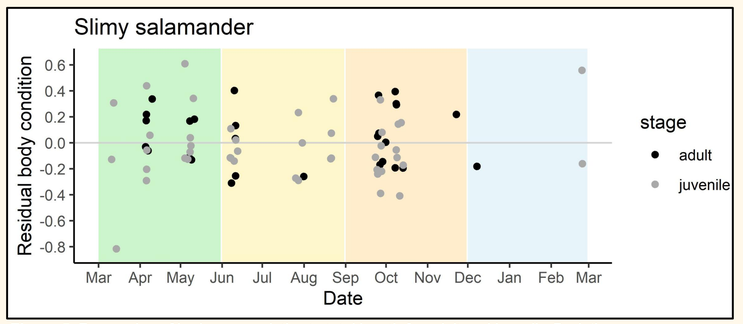

Figure 5. Regression of body mass relative to total length for adult and juvenile *P. glutinosus.*

Preliminary Conclusion

Negative body size allometry appears common in Plethodontidae[1] but more data are required to evaluate species differences (e.g. differences in allometry *per se* vs changes in condition?)

Body condition data indicate an inverse relationship between *P. dorsalis* and *P. glutinosus*, where juvenile *P. dorsalis* body condition is lower while *P. glutinosus* are most active. Future work will include more analyses and data collection to understand species-specific variation in allometry at City Lake.

Acknowledgements

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[1] SANTINI, L., BENÍTEZ-LÓPEZ, A., FICETOLA, G.F. and HUIJBREGTS, M.A.J. (2018), Length–mass allometries in amphibians. Integrative Zoology, 13: 36- 45. https://doi.org/10.1111/1749-4877.12268. [2] Gillooly JF, Brown JH, West GB, Savage VM, CharnovEL (2001). Effects of size and temperature on metabolic rate. Science 293, 2248–51.