

Sex-based Variation in Red-backed Salamander (*Plethodon cinereus*) Movement Behavior



Heather Nelson, David Steinberg, Mark Troiani, Michael Simmons, Jennifer Purrenhage
University of New Hampshire, College of Life Sciences and Agriculture



Background Information

- The eastern red-backed salamander (*Plethodon cinereus*) is a small woodland salamander common throughout eastern forests¹
- Red-backed salamanders play a key role in the ecosystem by controlling invertebrate populations and providing food for larger predators²
- They are also an important indicator species for monitoring forest health^{1, 2}
- Understanding differences in movement between sexes can help predict effects of anthropogenic changes to native habitat³



Figure 1: Eastern red-backed salamander adults

Research Question

How does sex in *Plethodon cinereus* impact movement behavior?

Hypothesis

Male salamanders will exhibit greater movement than female salamanders as they must travel to find mates.

Experimental Design

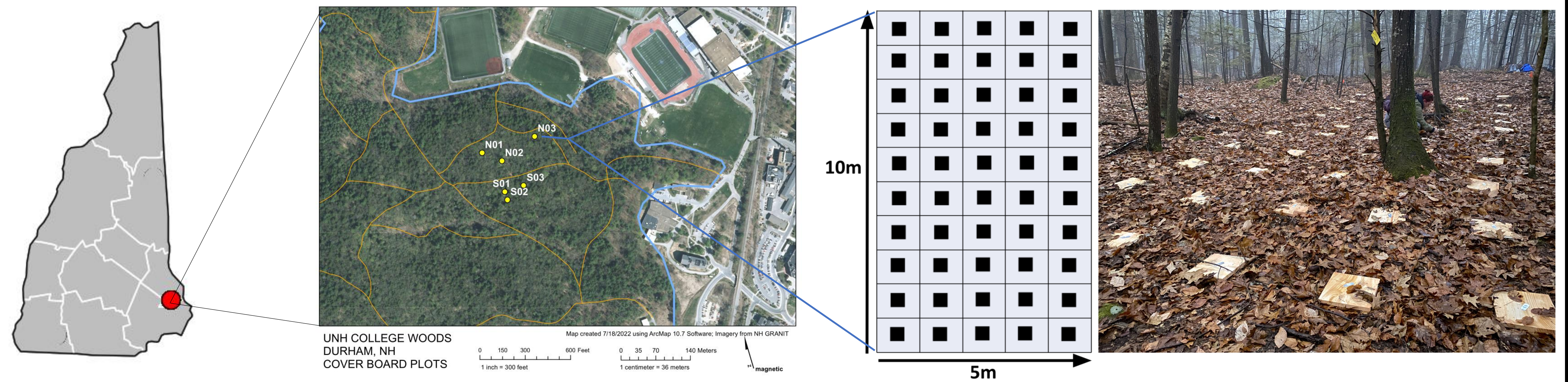


Figure 2: The location and arrangement of each plot

- Six permanent coverboard plots were established in College Woods, with 50 1x1m coverboards arranged in grid (Fig. 2)
- Each plot was surveyed biweekly from May to December 2022
- Individuals were captured, measured, sexed, and uniquely marked with visible implant elastomer if newly captured (Fig. 3)
- Three movement parameters were calculated for each recaptured individual (total distance moved, maximum distance between recaptures, distance between furthest captures)

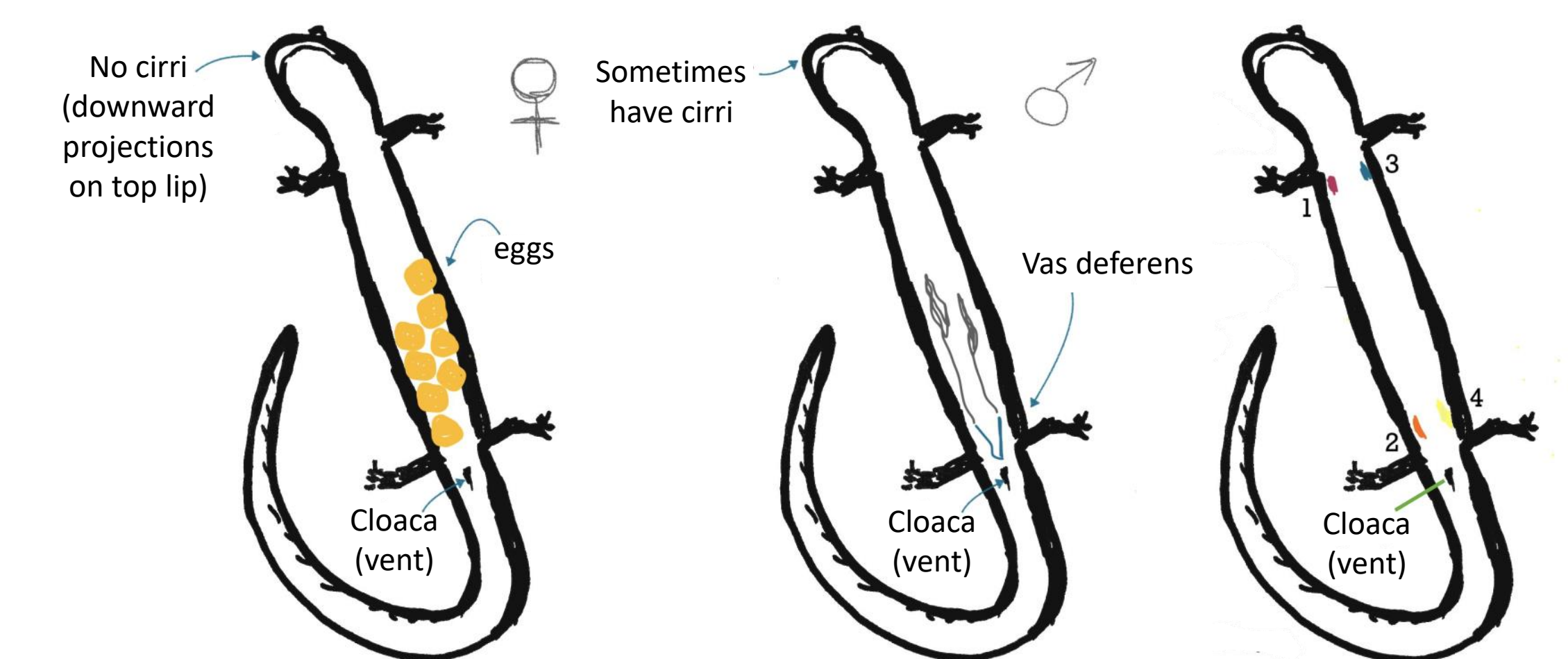


Figure 3: A brief overview of how salamanders were sexed (female on the left, male in the center) and a diagram of where elastomers were placed (right)

Results

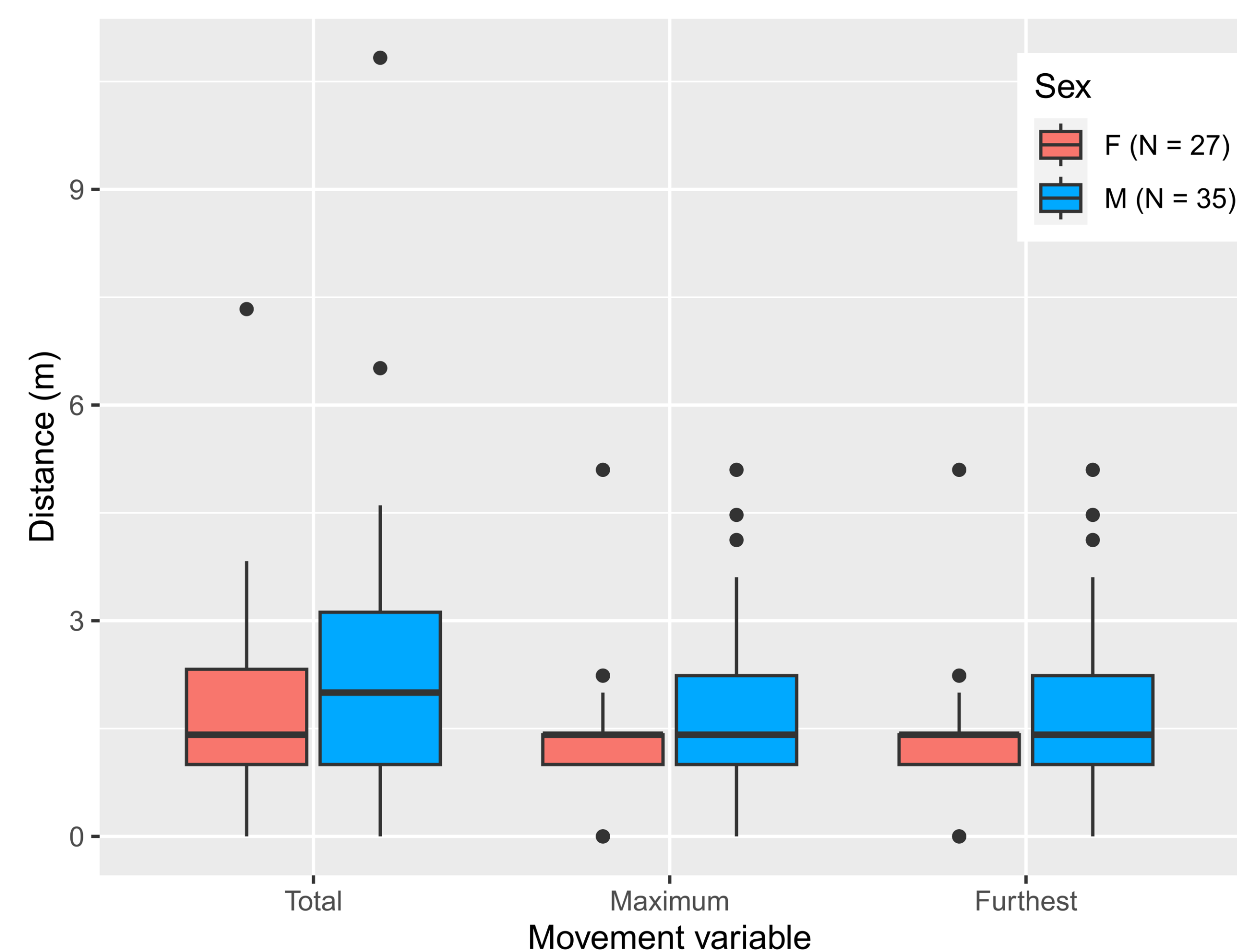


Figure 4: None of the three statistical tests measured showed a significant difference ($P < 0.05$) between the movement of males and females. Total distance moved (abbreviated as "Total") had a p-value of 0.13 and a t-stat of -1.13. Maximum distance between recaptures (abbreviated as "Maximum") had a p-value of 0.15 and a t-stat of -1.03. Distance between furthest captures (abbreviated as "Furthest") had a p-value of 0.13 and a t-stat of -1.12.

Future Directions



Figure 5: An illustration of color and pattern variation in red-backed salamanders in College Woods that could be useful in identifying individuals with pattern recognition software

- Sex-based variation in movement behavior could shape population genetics and inform future management practices
- Improved sexing of individuals during the non-breeding season will be crucial for an accurate estimate of any sex-based differences in behavior
- Visible implantable elastomers occasionally migrated, making ID sometimes ambiguous
- Free pattern recognition software may offer a free and non-invasive alternative to tracking of individuals across time⁴
- Development of low-cost, effective, and minimally-invasive marking methods could be applied to a wide variety of taxa

References

- Gordon, A., B. A. Wintle, S. A. Bekessy, J. L. Pearce, L. A. Venier, and J. N. Wilson. 2012. The use of dynamic landscape metapopulation models for forest management: a case study of the red-backed salamander. *Canadian Journal of Forest Research* 42:1091–1106.
- Hocking, D. J., and K. J. Babbitt. 2014. Effects of Red-Backed Salamanders on Ecosystem Functions. *PLOS ONE* 9:e86854.
- Grayson, K. L., and H. M. Wilbur. 2009. Sex- and context-dependent migration in a pond-breeding amphibian. *Ecology* 90:306–312.
- Bendik, N. F., T. A. Morrison, A. G. Gluesenkamp, M. S. Sanders, and L. J. O'Donnell. 2013. Computer-Assisted Photo Identification Outperforms Visible Implant Elastomers in an Endangered Salamander, *Eurycea tonkawae*. *PLOS ONE* 8.

Acknowledgements

This research was made possible by the support of Steve Eisenhaure and the UNH Office of Woodlands and Natural Areas, the Salamander Population & Adaptation Research Collaboration Network, the University of New Hampshire's Institutional Animal Care and Use Committee, and New Hampshire Fish and Game Department.



Figure 6: A red-backed salamander adult