Amphibian and Reptile Richness and Abundance in the Halifax Backlands

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INTRODUCTION

The Halifax Backlands:

- ❖ Diverse urban wilderness with water systems
- ❖ A perfect home for amphibians and reptiles.

❖ **Threats to amphibians and reptiles: habitat loss and degradation (Urbina-Cardona et al. 2024).**

- ❖ Pollutants ➡ freshwater acidification (Schindler 2001).
- ❖ Road salts ➡ freshwater salinization (Dodd 2010).

❖ **Salinization and acidification harm:**

- ❖ Immune system functioning (Messina et al. 2023),
- ❖ Amphibian growth and development (Dodd 2010),
- ❖ Loss of mass and death in reptiles (Agha et al. 2018),
- ❖ Osmoregulatory functions (Cañedo-Argüelles et al. 2019)

Knowledge gap:

❖ No research on amphibians and reptiles in the Halifax Backlands

Objectives:

❖Document richness and abundance of amphibian and reptile species

❖Determine significant differences in abundance and richness when people were sighted versus when they were not sighted.

❖Assess correlations between water quality (pH, temperature, conductivity) and abundance and richness.

METHODS

- ❖ 6 permanent sites with 9 additional surveyed once
- ❖ Surveys to record:
  - ❖ Amphibian and reptile richness and abundance
  - ❖ If people were sighted
  - ❖ Water conductivity, temperature and pH

Figure 1. Map of study sites in the Backlands

RESULTS

❖ Amphibian and Reptile Richness and Abundance in The Backlands

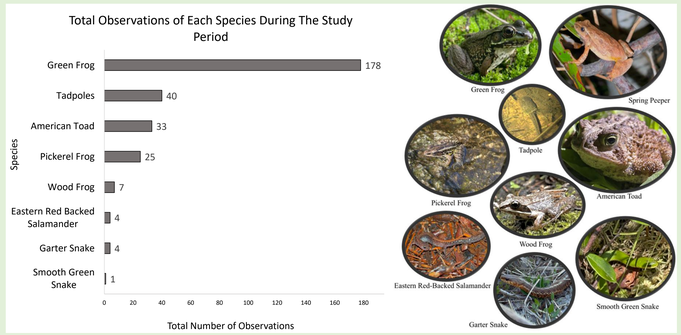

Figure 2. Species composition . Total count of observations for each species seen during the study period (between 12th of May until the 31st of July 2025).

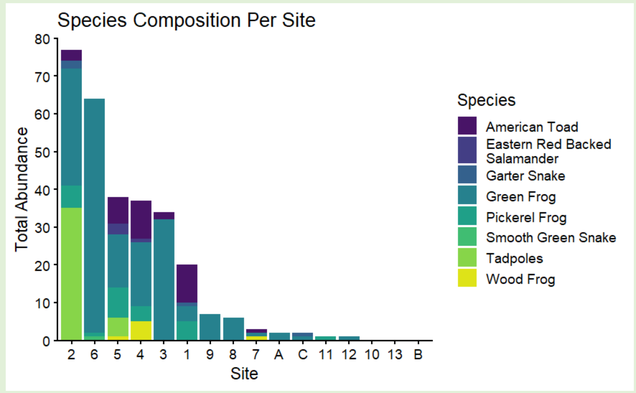

Figure 3. Species composition for all sites

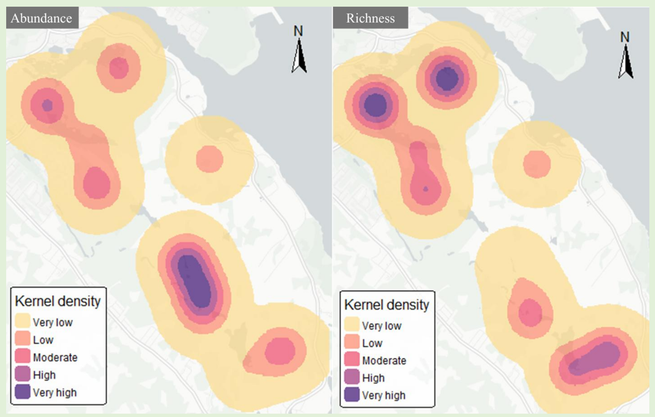

Figure 4. Kernel density map of average abundance per survey and species richness for all sites

❖ Effects of Human Presence on Richness and Abundance

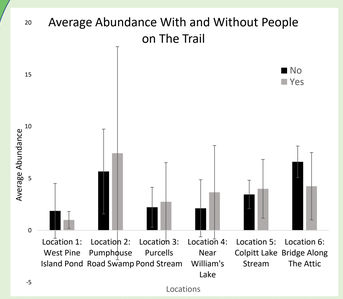

Figure 5. Average abundance of amphibians and reptiles for each sites with and without people present on the trail

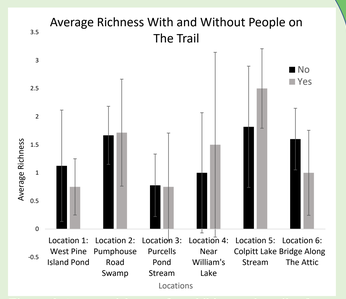

Figure 6. Average richness of amphibians and reptiles for each sites with and without people present on the trail

Table 1. Results of the Wilcoxen rank-sum test for the average abundance and average richness with and without people present on the trail during the time of the study.

Site	p-Value for Average Richness	p-Value for Average Abundance
Location 1: West Pine Island Pond	0.7901	0.6329
Location 2: Pumphouse Road Swamp	0.3491	0.9371
Location 3: Purcells Pond Stream	0.9371	0.8578
Location 4: William's Lake	0.5506	0.6847
Location 5: Colpitt Lake Stream	0.763	0.3442
Location 6: Bridge Along The Attic	0.2581	0.1762

❖ Effects of Water Quality on Richness and Abundance

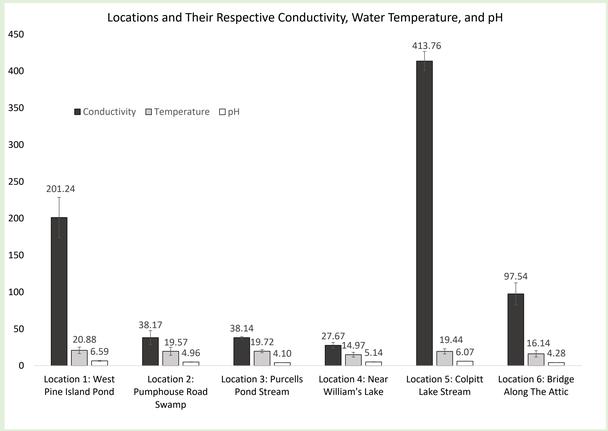

Figure 7. Average conductivity, temperature and pH for all survey sites

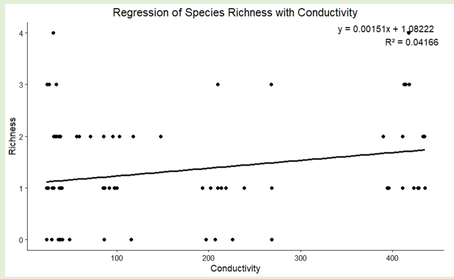

Figure . Regression analysis of species richness with conductivity for all sites. Adjusted R^2 displayed

DISCUSSION

Richness and Abundance of Amphibians and Reptiles:

- ❖ Frogs seen are expected, no Leopard, Bull- or Mink frogs
- ❖ No turtles
- ❖ Few salamanders – they are nocturnal (Wise et al. 2022
- ❖ Few Garter snakes only in southern sites

Abundance and Richness With and Without People:

- ❖ Intensity of human disturbance may be important

Abundance and Richness and Water Quality

- ❖ Increased conductivity not always toxic – ion identity determines toxicity (Mount et al. 1997).
- ❖ Increased conductivity can mean more insects (Godoy et al. 2017)

Limitations:

❖ Minimal data over a short period ➡ more studies needed!

References

Agha M, Ennen JR, Bower DS, Nowakowski AJ, Sweat SC, Todd BD. 2018. Salinity tolerances and use of saline environments by freshwater turtles: implications of sea level rise. Biol Rev. 93(3):1634–1648. doi:https://doi.org/10.1111/brv.12410

Cañedo-Argüelles M, Kefford B, Schäfer R. 2019. Salt in freshwaters: causes, effects and prospects - introduction to the theme issue. Philos Trans R Soc Lond B Biol Sci. 374(1764):20180002. https://doi.org/10.1098/rstb.2018.0002

Dodd CK. 2010. Amphibian ecology and conservation: a handbook of techniques. Oxford (UK): Oxford University Press.

Gibbons JW, Buhlmann KA. 2001. Wildlife of Southern Forests: Habitat and Management. Dickson JG, editor. Blaine (WA): Hancock House Publishers.

Godoy BS, Queiroz LL, Lodi S, Oliveira LG. 2017. Environment and Spatial Influences on Aquatic Insect Communities in Cerrado Streams: the Relative Importance of Conductivity, Altitude and Conservation Areas. Neotrop Entomol. 46(2):151–158. https://doi.org/10.1007/s13744-016-0452-4

Messina S, Costantini D, Eens M. 2023. Impacts of rising temperatures and water acidification on the oxidative status and immune system of aquatic ectothermic vertebrates: A meta-analysis. Science of The Total Environment. 868:161580. https://doi.org/10.1016/j.scitotenv.2023.161580

Mount DR, Gulley DD, Russel Hockett J, Garrison TD, Evans JM. 1997. Statistical models to predict the toxicity of major ions to Ceriodaphnia dubia, Daphnia magna and Pimephales promelas (fathead minnows). Environmental Toxicology and Chemistry. 16(10):2009–2019. https://doi.org/10.1002/etc.5620161005

Schindler DW. 2001. The cumulative effects of climate warming and other human stresses on Canadian freshwaters in the new millennium. Can J Fish Aquat Sci. 58(1):18–29. https://doi.org/10.1139/f00-179

Sullivan K, Nordberg EJ, Smith K, Bower DS. 2025. Water quality preferences of an Australian freshwater turtle. Aquat Conserv: Mar Freshw Ecosyst. 35(3):e70097. https://doi.org/10.1002/aqc.70097

The Backlands Coalition. [date unknown] [accessed 2025 Oct 20]. https://backlandscoalition.ca/?page_id=21

Urbina-Cardona N, Angulo A, Turner A, Cogălniceanu D, Wickramasinghe D, Suazo-Ortuño I, Watling J, Dary Acevedo L, Hernandez-Ordoñez O, Doherty-Bone T, et al. 2024. Amphibian conservation action plan : a status review and roadmap for global amphibian conservation. Gland (Switzerland): IUCN. 115–147. https://doi.org/10.2305/QWVH2717

Waddle JH. 2006. Use of amphibians as ecosystem indicator species [graduate dissertation]. Gainesville (FL): University of Florida. 110 p.

Wise SE, Rohacek A, Scanlon AE, Cabrera T, Buchanan BW. 2022. The Effects of Artificial Night Lighting on Tail Regeneration and Prey Consumption in a Nocturnal Salamander (Plethodon cinereus) and on the Behavior of Fruit Fly Prey (Drosophila virilis). Animals. 12(16):2105. https://doi.org/10.3390/ani12162105

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