

Comparative population structure of vernal pool amphibians in a changing landscape



Jared Homola

2014 MAWS Research Stipend Recipient

Ph.D. Student

University of Maine, Orono

Introduction

Landscape genetics

- Study of how geographical and environmental features affect genetic variation
 - Gene flow
 - Blends landscape ecology and population genetics



Objectives

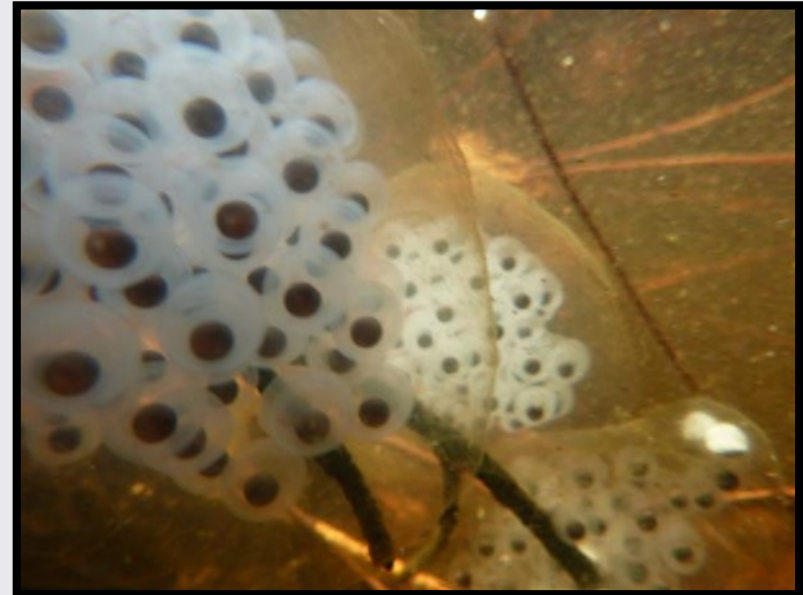
1. Quantify interpopulation structure for wood frogs and spotted salamanders
 - local (<5 km) and regional (250 km) scales
2. Identify potential gene flow barriers



Methods

Amphibian sampling

- One egg per egg mass
- ≈ 40 individuals if free-swimming

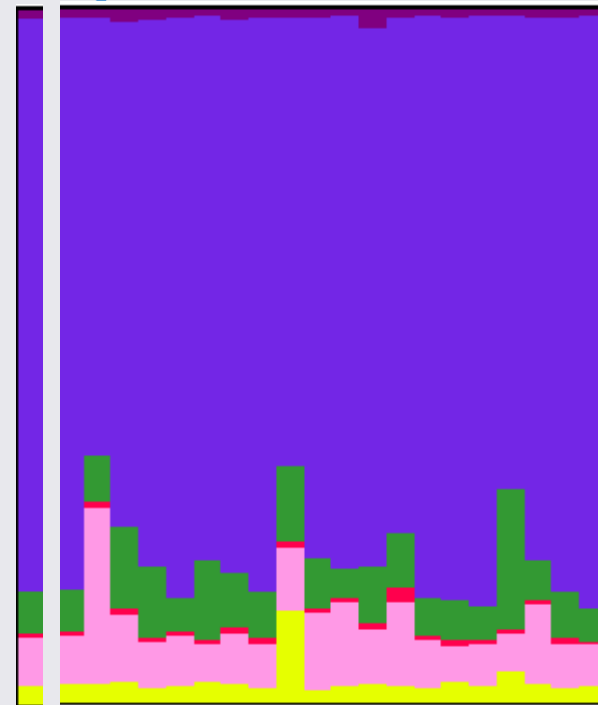


Methods

Genetic methods

Bayesian analysis to assign individuals into clusters

- Vertical band represents one individual
- Colors represent posterior probabilities of cluster assignment
- Entire blocks are for 20 individuals sampled at each site



Preliminary results

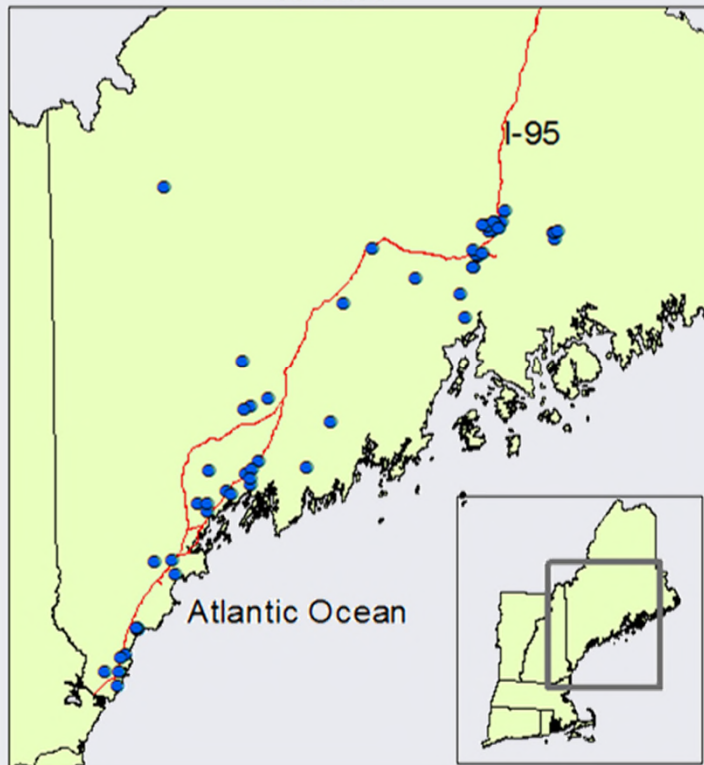
Amphibian sampling

2014 collections

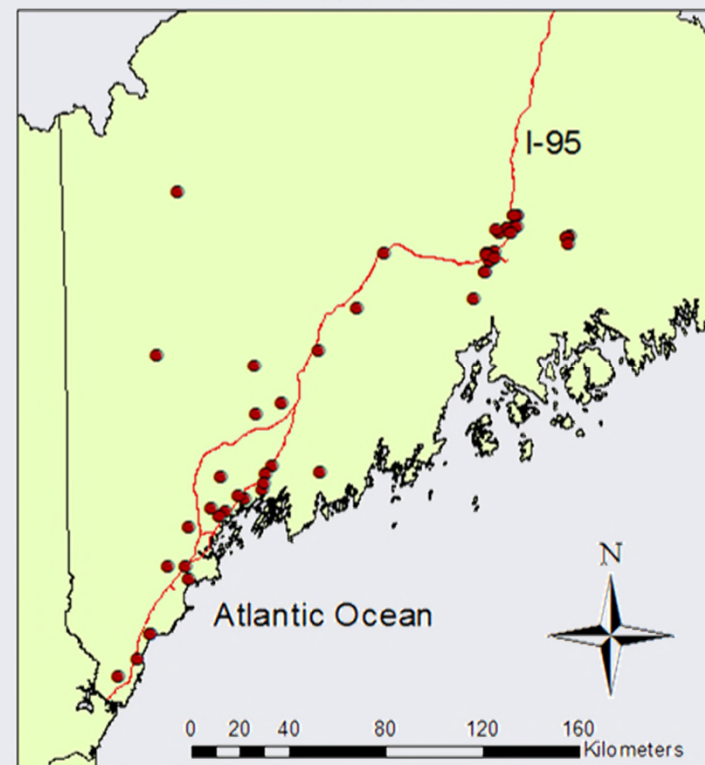
1228 spotted salamanders from 65 sites

1190 wood frogs from 60 sites

Spotted salamanders
65 sites



Wood frogs
60 sites



Preliminary results

Genetic differentiation

Wood frogs (18 pops)

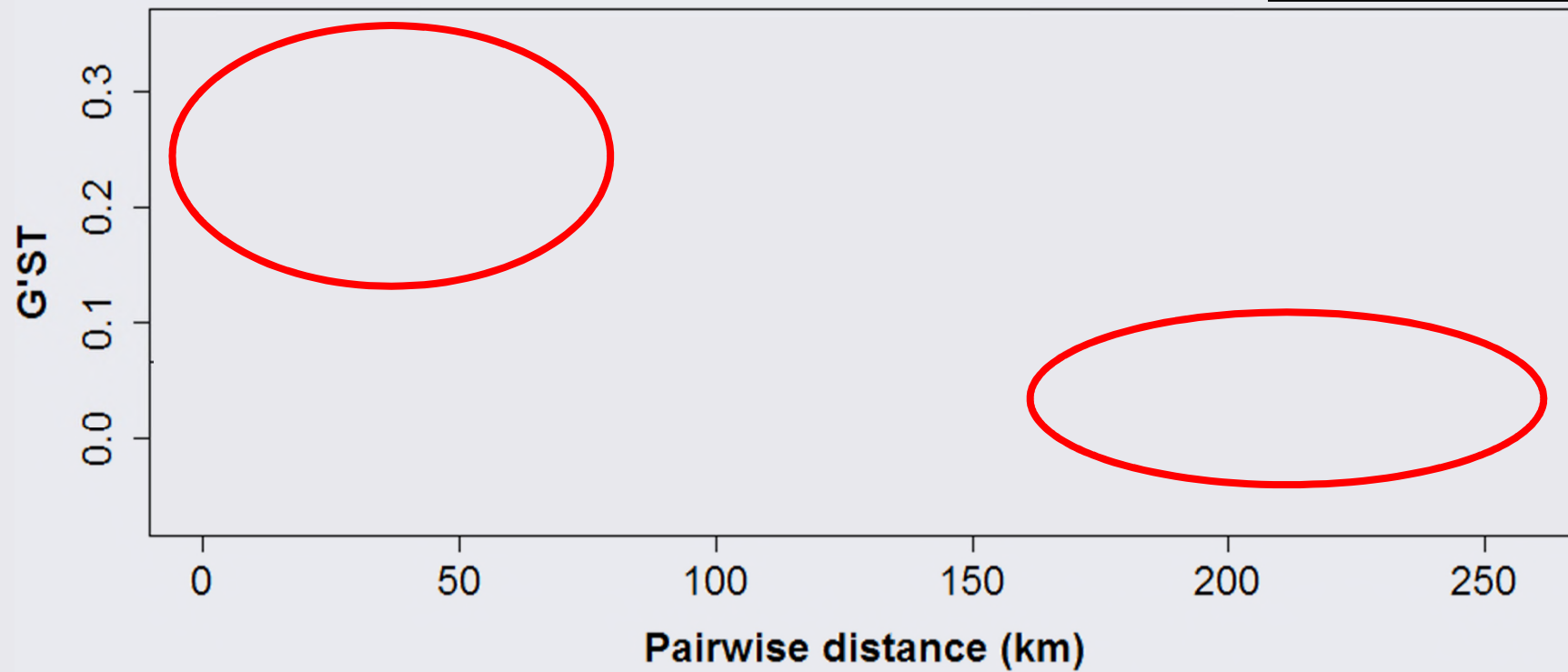
- Overall $F_{ST} = 0.03$, range 0.0 – 0.11
- 131/153 F_{ST} values significant ($p < 0.01$)

Spotted salamanders (44 pops)

- Overall $F_{ST} = 0.03$, range 0.0 – 0.11
- 617/946 F_{ST} values significant ($p < 0.01$)

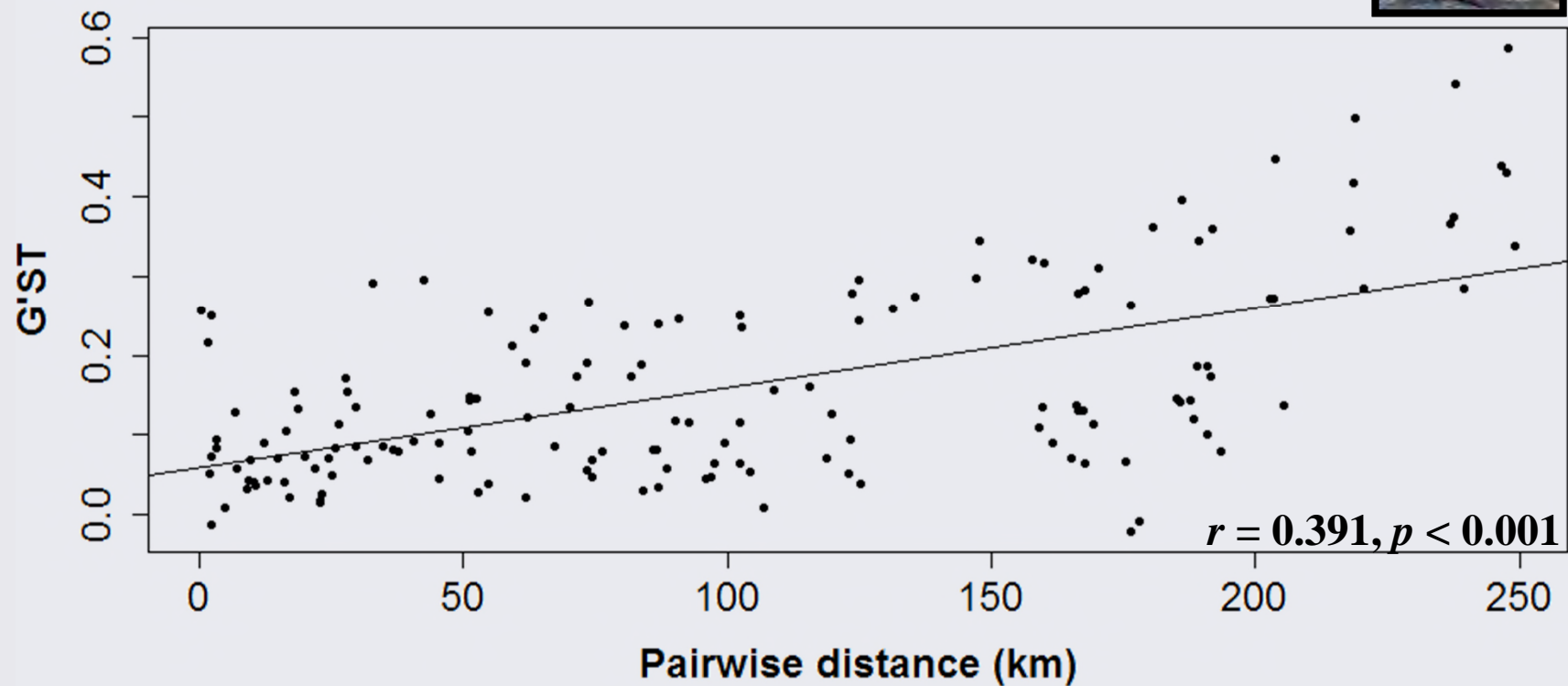
Preliminary results

Isolation-by-distance



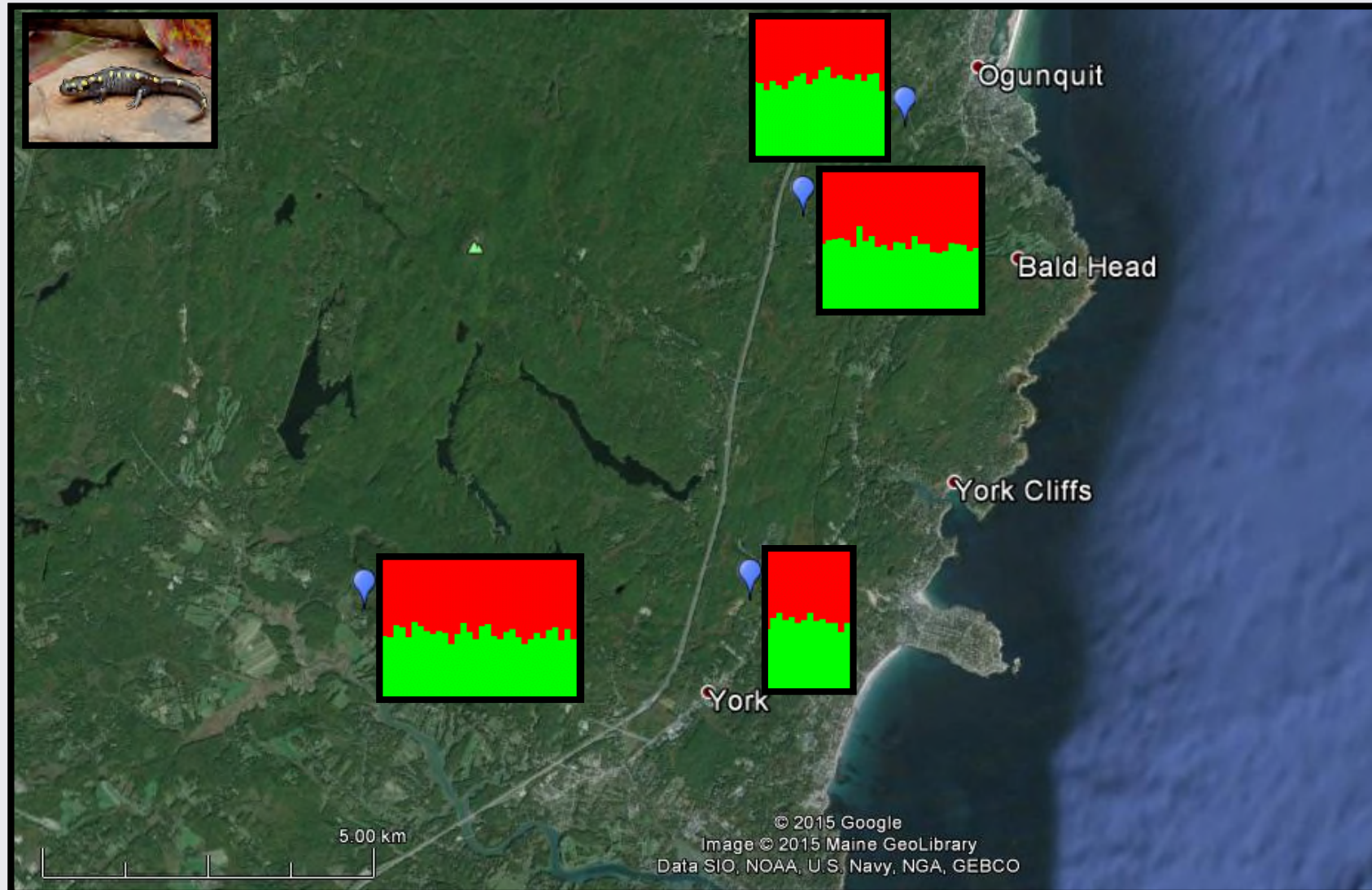
Preliminary results

Isolation-by-distance



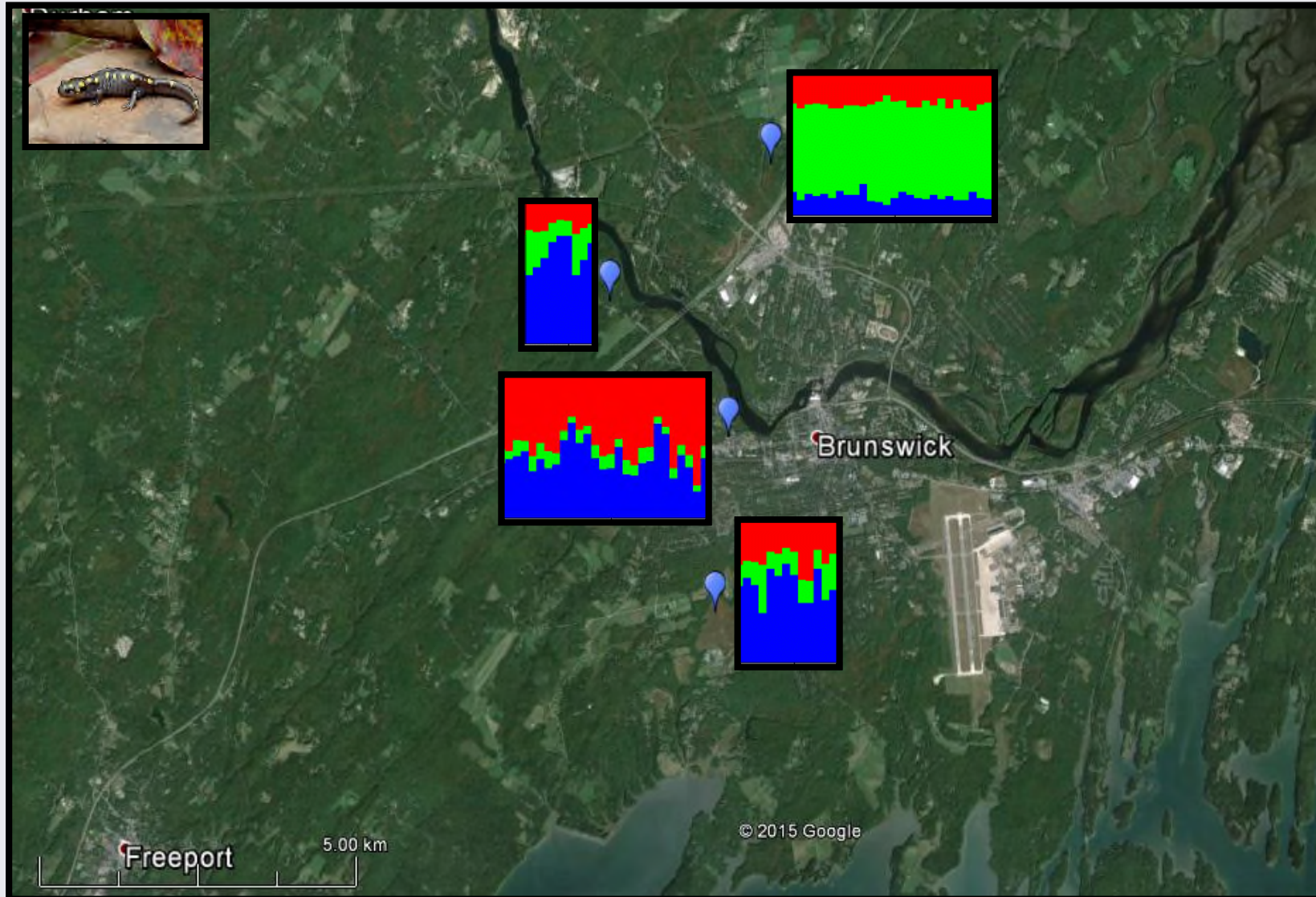
Preliminary results

Genetic structure



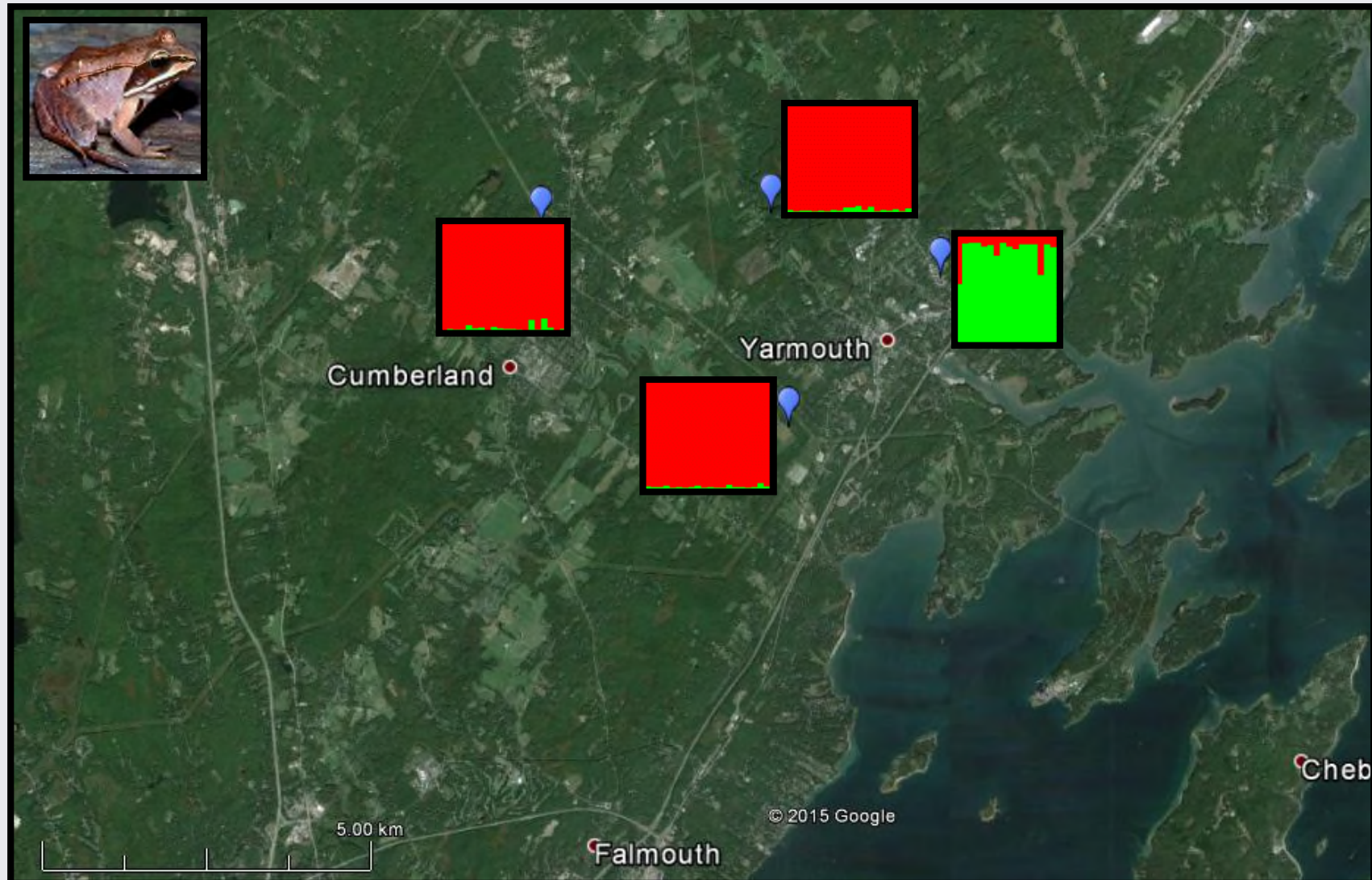
Preliminary results

Genetic structure



Preliminary results

Genetic structure



Preliminary conclusions

Genetic structure is present in both species

- Strongest for wood frogs

Structuring may coincide with anthropogenic landscape fragmentation

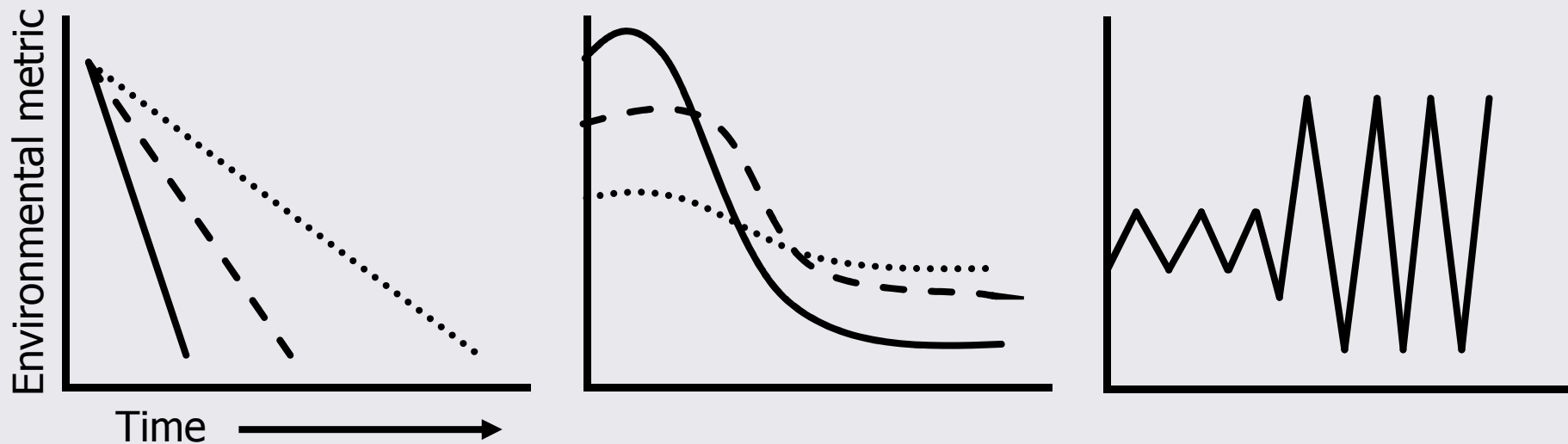


Next steps

Agent-based modeling

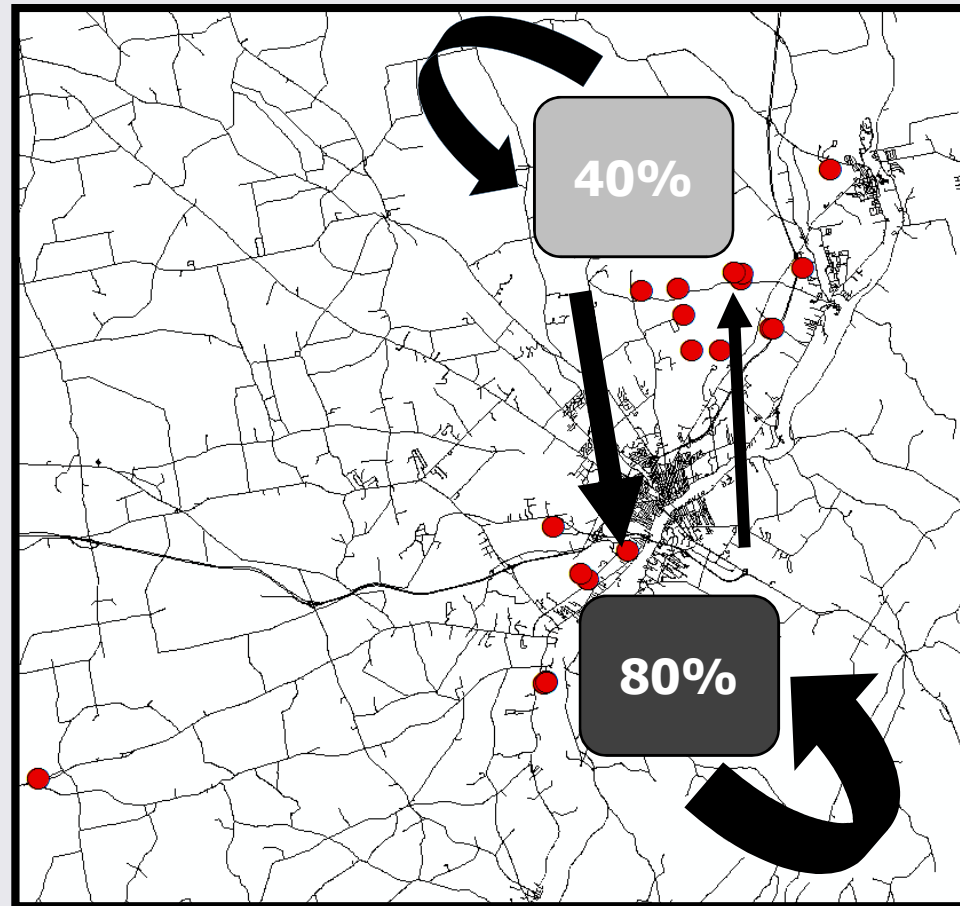
Objectives

- Evaluate ecological and evolutionary consequences of environmental change (e.g., urbanization and climate change).



Next steps

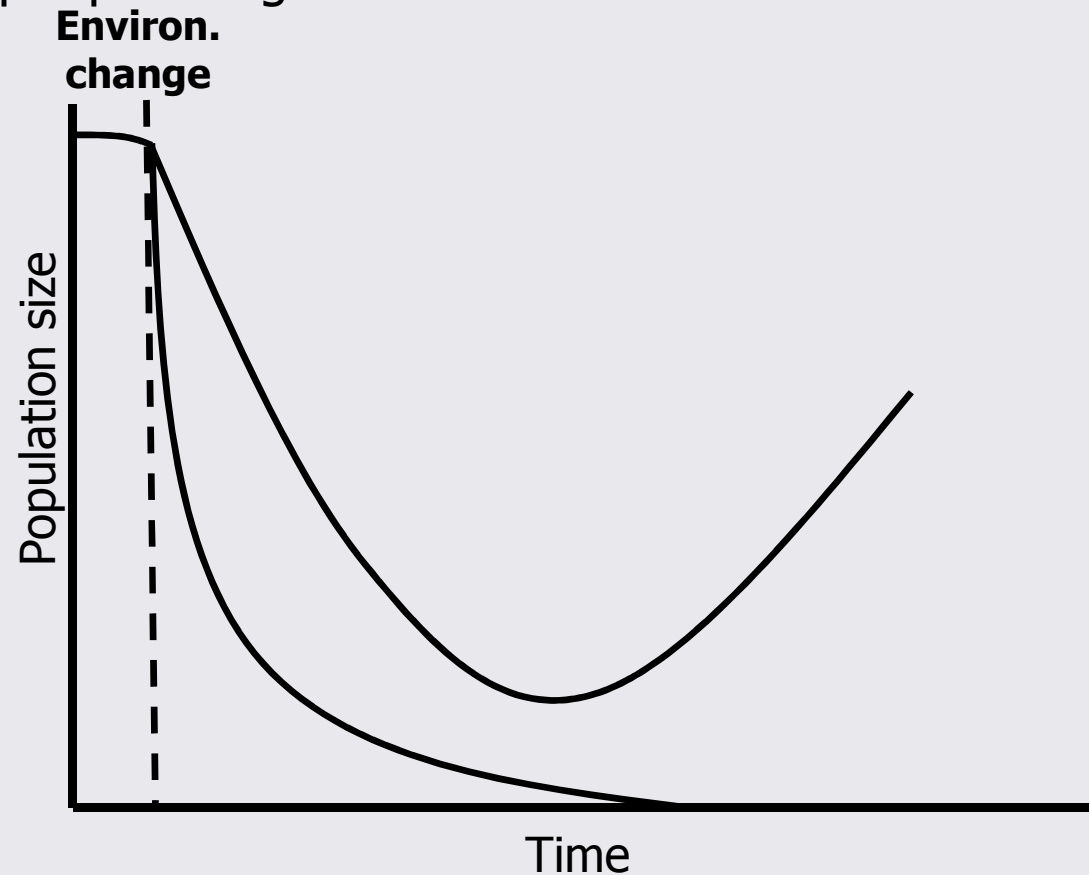
Quantifying urban/rural gene flow



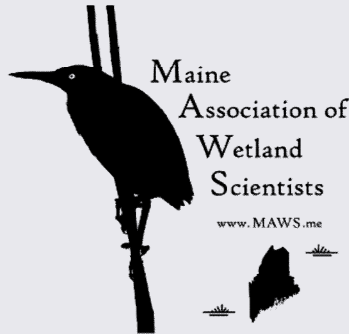
Next steps

Expected outcomes

- Better understanding of limits of adaptation
- Provide a predictive tool for conservation prioritization and landscape planning



Acknowledgements



Collaborators and assistants

Dr. Aram Calhoun
Dr. Krista Capps
Carly Eakin
Jessica Balukas

Wes Wright
Tess Howard
Laura Podzikowski
Mitchell Jones

Landowners

Central Maine Power
Town of Scarborough
Town of Sidney
Town of Yarmouth
Wells Reserve at Laudholm
Brunswick-Topsham Water District
Bayroot, LLC
Cordiner Family
Spiller Family
Collamore Family
Pattison Family
Brillant Family
Larson Family
Weaver Family
Pelletier Family
Crystal Springs Farm
Tims Family
Larson Family
Sheepscot Valley Conservation Assoc.
York Landtrust

Committee members

Dr. Mike Kinnison
Dr. Cyndy Loftin
Dr. Mac Hunter
Dr. Tim Waring
Dr. Andrew Whiteley

Questions?



Wanted: Amphibian breeding sites!

E-mail: jared.homola@maine.edu

Phone: 517-214-7039