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Amphibian Occupancy, Habitat Use, and Reproductive Success in a System of Restored Wetlands

Emily Stulik
Indiana University - Purdue University Fort Wayne

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Emily Stulik and Bruce Kingsbury
Department of Biology, Indiana-Purdue University Fort Wayne

Introduction

Overview

- Amphibian populations are declining at alarming rates worldwide. In the Midwest and Indiana especially, habit loss due to agriculture is a major threat to local populations.
- Wetland restoration can potentially mitigate aspects of habitat loss, but effective sampling techniques and suitable analytical approaches are needed to accurately measure the quality and functionality of the restored habitat.
- Eagle Marsh Nature Preserve in Fort Wayne is a 716 acre wetland system that began the restoration process from an agricultural field to a natural wetland in 2006.

Study Background

- This is the first study to measure occupancy and habitat use in the broader amphibian community in Eagle Marsh Nature Preserve and surrounding wetlands.
- Occupancy probability, psi (Ψ), is the probability that a site will be occupied by the species of interest. It can also be interpreted as the proportion of area occupied.
- We hypothesized that covariates such as wetland area, hydroperiod (permanent or vernal), habitat type (restored or established), depth, or amount of vegetation may influence occupancy for different species.

The Northern Leopard Frog, *Lithobates pipiens*, (left) and the Blanchard's Cricket Frog, *Acris blanchardi* (right), have declined from their native ranges in the Midwest. Both are Species of Special Concern in Indiana.

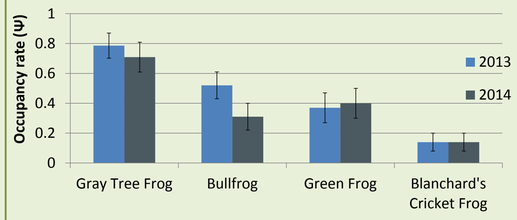
Methods

Left: Eagle Marsh Nature Preserve, with Fox Island County Park to the south. Above: Using dipnets to catch tadpoles in Eagle Marsh.

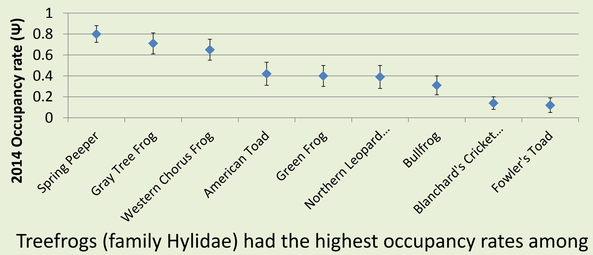
- We listened to frogs calling and caught tadpoles multiple times at 29 wetlands in Eagle Marsh Nature Preserve, Fox Island County Park, and Arrowhead Marsh Nature Preserve.
- During each survey we measured the pond perimeter, water depth, and percent vegetation in and around the wetlands in order to assess habitat use.
- We compared models that assumed constant occupancy (psi[.]) to models where occupancy was a function of measured covariates (psi[covariates]).
- We generated and ran models in program PRESENCE and ranked models using second-order correction AICc to accommodate the small sample size.

Results

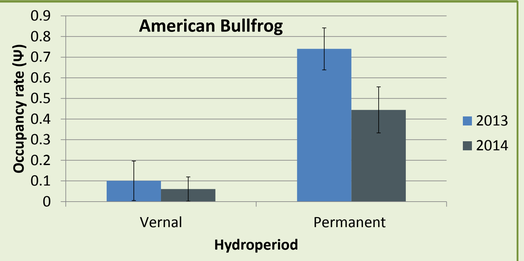
Call Surveys 2013-2014



- Occupancy estimates of calling male American Bullfrogs and Gray Tree Frogs declined in 2014.

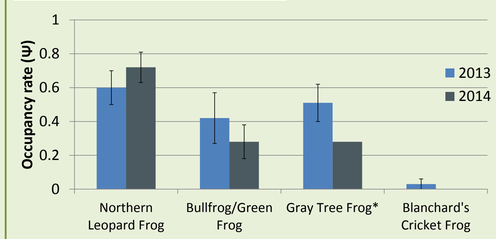


- Treefrogs (family Hylidae) had the highest occupancy rates among calling anurans in 2014. The lowest rates were seen in the Blanchard's Cricket Frog and Fowler's Toad.

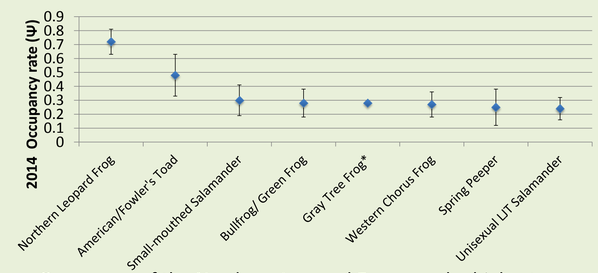


- The hydroperiod of wetlands had a strong influence on occupancy in the American Bullfrog.

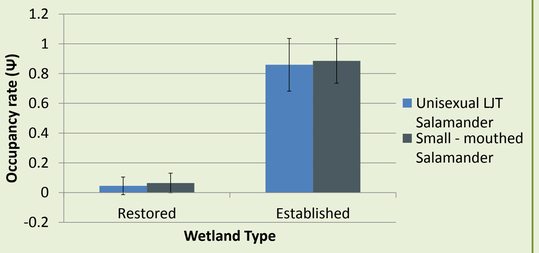
Tadpole Surveys 2013-2014



- The Northern Leopard Frog was the only species where larval occupancy increased in 2014. Blanchard's Cricket Frog tadpoles were only found at one site in 2013.



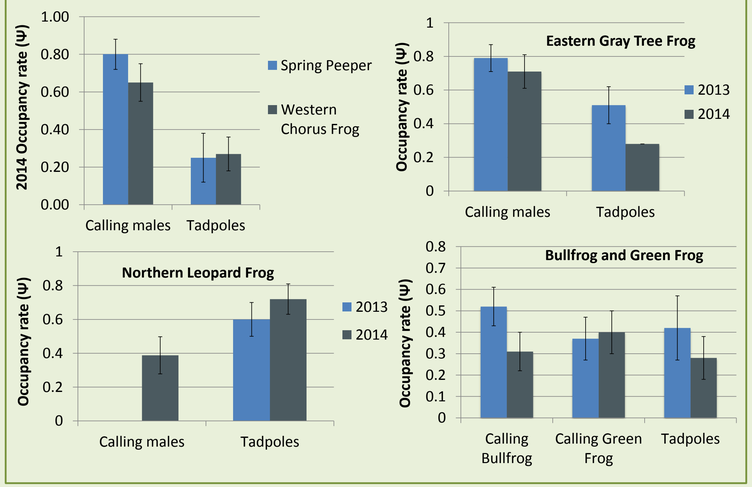
- Occupancy of the Northern Leopard Frog was the highest among larval amphibians caught in 2014.



- Salamanders at Eagle Marsh and Fox Island are more likely to use forested, established wetlands to breed rather than open, restored wetlands.

Comparing Occupancy between Survey Methods

- With the exception of the American Bullfrog, occupancy estimates of calling males did not accurately predict occupancy of successful reproduction.



Conclusions

- The two species of special concern, the Northern Leopard Frog and the Blanchard's Cricket Frog, had opposite trends in occupancy. Tadpole occupancy of leopard frogs was the highest among all species, while cricket frogs had the lowest estimates.
- Hydroperiod influenced occupancy of American Bullfrogs, both for calling males and tadpoles. Bullfrog tadpoles need two years to metamorphose, and it appears that adults are selective in choosing wetlands that retain water year round.
- Larval occupancy was strongly associated with habitat type in two salamanders, the Small-mouthed Salamander and Unisexual LJT Salamander. Salamanders are primarily woodland species, and only bred in forested, established wetlands.
- Occupancy probabilities were different among the two survey methods. This finding has important management and conservation implications. Many studies base management decisions on wetlands where species are heard calling, but it may be more suitable to focus on protecting habitat where species are breeding successfully.

Acknowledgements

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