Effects of Anthropogenic Noise on Frog Breeding Populations in Geneseo

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Background: Frogs typically observed in western New York include Spring Peepers (*Pseudacris crucifer*),Green Frogs (*Rana clamitans*), Bullfrogs (*Lithobates catesbeianus*), and Gray Treefrogs (*Dryophytes versicolor*). Frogs in NY reproduce between early March until late August. Male frogs' sexual behavior involves producing calls directed to female frogs. During this multiple month period, groups of males will occupy the breeding pond, calling, and waiting to mate with females.

Expanding transportation infrastructure has resulted in traffic noise as an added factor in the soundscape these animals share (Andrews, 2008). The intruding sounds may be a potential barrier to the ability of animals to communicate during the breeding season. With this first preliminary survey we sought to understand: What species of frogs use these pond sites? Do frog choruses differ by site? Is there evidence roads or road noise may explain any differences we see?

Methods

-Recordings taken in May of 2020, in Geneseo, New York

-Three Audiomoth recorders placed near ponds

- At a pond alongside the thruway of I-390, just North of the Geneseo Exit 8
- At a pond at the Indian Fort Preserve, located near where Route 63 crosses I-390
- At the Paul Frame Pond 1, which is 0.36km from Rt 39, north of the Village of Geneseo

-Documented the sounds of the ponds for the first ten minutes of every hour for twenty-four hours across twenty-one days

-Analyzed the recordings from May 5th to May 19th 2020, from the hours of 8pm-12am EST, expecting the most frog callings at these times

-ID-ed species calling, and documented the chorus levels based on the Wisconsin Frog and Toad Survey (Table 1)

-Used the Raven Lite program to create spectrograms of each ten minute recordings, citing each frog call, traffic noise and other distinguishing sounds that were heard (Figure 1)

Results

Chorus Level	Description
1	Individuals could be counted with space between calls
2	Individuals could be distinguished but there is some overlap in calls
3	Calls are constant, continuous and overlapping; individuals cannot be distinguished

Table 1: Chorus levels of frog vocalizations as per the Wisconsin Frog and Toad Survey, 2006

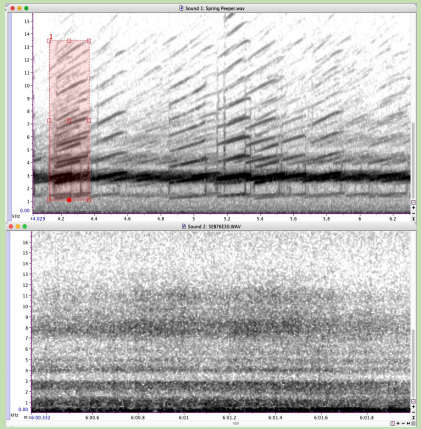

Figure 1: Spring Peeper vocalizations (top) and traffic noise (bottom) recorded near I-390

- Traffic noise within frequency range of frogs
- Traffic noise is busy in comparison to the frog vocalizations and could confuse, alter, or disrupt frog communication

Results

Site Name	Species Present	Maximum Chorus Level
Paul Frame Pond	Spring Peeper	3
	Bullfrog	1
	Gray Tree Frog	1
	Wood Frog	1
I-390	Spring Peeper	3
	Bullfrogs	3
Indian Fort	Spring Peeper	2
	Gray Tree Frog	1
	Green Frog	1

Table 2: Frog activity at Paul Frame Pond, I-390 Site, and Indian Fort

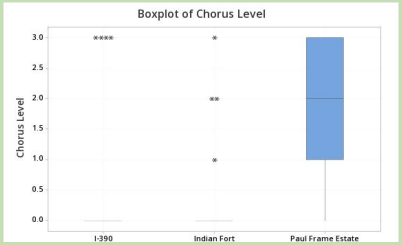

Figure 2: Spring Peeper chorus levels at Paul Frame Pond 1 had higher average chorus levels than any other site (Kruskal-Wallis; $p<0.05$)

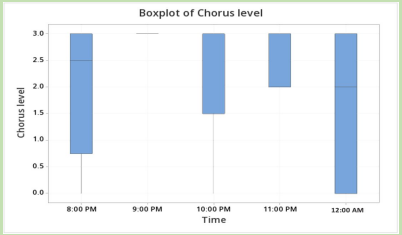

Figure 3: Time of day and of Spring Peeper vocalizations present at Paul Frame Pond 1

Conclusions and Future Recommendations: We heard the following species at our ponds: Spring Peepers (*Pseudacris crucifer*), Northern Gray Treefrog (*Dryophytes versicolor),* Bullfrog (*Lithobates catesbeianus*), Wood Frog (*Lithobates sylvaticus*), and Green Frog (*Hylarana erythraea*). Spring Peepers followed by Bullfrogs, had the most abundant calls within the recordings. There was no indication of a peak calling time across sites in our preliminary analysis. Traffic was an important factor in two of these soundscapes, i.e. I-390 and Indian Fort Preserve, which had few to no calls in comparison to the Paul Frame pond.

In the future, the analysis of frog calls should be extended to include the entire breeding season, multiple hours throughout the day, and multiple sites. We could also examine the impact of variation in traffic patterns by testing if there is a negative relationship between the number of frog calls and traffic level. Finally, we could also study how the frogs alter their calls in response to background noise. Do they wait for pauses, or try to increase/decrease their frequencies or amplitude to overcome this intrusion? Aside from bioacoustics, future research could consider other environmental factors affecting the frogs' use of roadside ponds. How does the use of road salt affect water quality? Do frogs abandon poor quality sites, or does the saline content affect the breeding success or offspring maturation?

Literature Cited and Acknowledgements

Andrews, Kimberly (2000), Ecological Effects of Roads on Amphibians and Reptiles: A Literature Review, *The Society for the Study of Amphibians and Reptiles,* 221

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