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Local Ecology Research Papers

Presence and Absence Survey of Wetland Anurans in St. Olaf College Natural Lands

Cindy Fifield

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Cindy Fifield St. Olaf College 1500 St. Olaf Ave Northfield, MN 55057 Spring 2016

Introduction

Anuran populations are experiencing a global population decline resulting in dramatic losses in biodiversity. Low population numbers indicate habitats have declined in quantity and quality. Currently over one third of amphibian populations are threatened globally (Hamer & Mcdonnell, 2008). In addition to global declines in amphibians, many midwestern populations show signs of stress. During the 1990's, a significant proportion of midwestern frogs presented large numbers of limb abnormalities consistent with mutations found in vertebrates exposed to exogenous retinoids during development (Gardiner & Hoppe 1999). Researchers also suspected parasitism and UV radiation as potential influences, however no survey reached a clear conclusion (Reister et. al 1998). Given the elusiveness of the cause and the frequency of malformation, there is growing concern for the status of Midwestern anurans populations. Besides these developmental disturbances, anuran populations also face disturbance through habitat loss from urbanization and agriculture. This is problematic not only because anurans are important in maintaining biodiversity, but also because they are an indicator of environmental integrity. Anuran surveys are often used as indicators of ecosystem disturbance because they are a sensitive species (Hager 1998). If their populations are suffering, than the entire ecosystem is possibly under duress.

The St. Olaf Natural Lands have undergone numerous transformations to reach their present mixture of restored wetlands, prairie and woodlands. The effects of these ecological transformations are likely complex. St. Olaf College restored the wetlands in 1994 through the U.S. Fish and Wildlife Service Wetland Restoration program (Shea, personal communication). Since anurans are a known indicator species (Hager 1998), surveying for the presence of different species will be helpful in determining the current success of the restoration. Although frogs serve as excellent indicators of ecosystem conditions, there is very little baseline data across the globe with which to compare recent changes in populations (Houlahan et al 2000). Inspired by citizen science, this project was aimed at building community awareness of amphibians in wetlands and prairie systems. Citizen science is universal approach that seeks

volunteers to generate large scale data unattainable by a single researcher . This type of data is extremely useful in tracking the conservation status of many organisms. Besides creating large scale data sets, citizen science seeks to educate the volunteers in the science projects they are working on (Kobori et al 2016). Following the citizen science model, much of the visual surveying was done by the lab members of Principles in Ecology, and the 5th grade students from elementary schools in Northfield during their annual Wetlands visit. The Wetlands visit is an experiential environmental field trip designed for elementary students to get involved and understand the importance of Minnesotan habitats. Within this visit, students participated in an amphibian station with activities designed to aid students in using visual and auditory senses to practice research methods. Students learned the calls and visual appearance of anurans native to Minnesota, and then participated in a visual survey in the St. Olaf College Natural Lands. In this manner, students were participating in citizen science by learning more about their local wetland while also providing data for this study.

The most recent amphibian survey in the St. Olaf Natural Lands occurred 12 years ago in 2004, 10 years after wetland restoration (Shea, personal communication). The purpose of this paper is to provide an updated account of the amphibian species in the St. Olaf Natural Lands and to gather information about current populations. The species we expected to find are based off a number of more recent studies in the area, both at Carleton College and on the St. Olaf Natural Lands. Since the two colleges are in close proximately, we expected the habitats to be relatively similar and thus the species. In the St. Olaf Natural Lands, we expect to hear the western chorus frogs (*Pseudacris triseriata)* and the wood frog (*Rana sylvatica)* start calling in late March. The leopard frog (*Rana pipiens)* and the spring peeper (*Pseudacris crucifer)* begin calling in early April. The eastern or American toad and the gray treefrog begin calling in May. (McMurty 2009). All of these frogs and toads can be found in open wetlands, shallow water ponds, ditches and damp areas. Due to the time constraints of the survey, the summer frogs may not be present and accounted for in this survey.

Methods

Auditory sampling

Sampling began mid march, twice a week until mid May. An initial survey of pond areas was taken during snow melt to gain an understanding of habitats to sample. Five Habitat sampling areas were selected to evenly represent the diversity of habitats in the Natural Lands During the sampling process, there were two minutes of silence upon entering the sample site. After the settling period, 0:30 seconds- 2 minutes of calls were recorded within 50 meters of the sampling site. Samples were collected in species of frog chorusing, and number. The scale was as follows

0 No individuals calling

1 Individuals can be distinguished and calls are not overlapping

2 Calls of <15 and some overlapping

3 > 15 calls with much overlapping

Auditory sampling protocol was based on Carleton College Arboretum sampling techniques (McMurty 2009).

Visual Sampling

Auditory sampling often misses individuals, so a visual survey was also conducted during audio sampling. The aim of the visual survey was to provide photographic evidence and species information for the website. After the initial audio minutes of sampling, a visual survey of catch and release was conducted. Although individuals were present during audio samples, it was difficult to catch all species that were calling. Some visual sampling occurred outside of specific sampling zones, as the samplers happened upon specimens around the St. Olaf Campus. Samples were recorded as "0" if no individuals were present, and "present" if an individual was seen or caught.

Habitat Description

Habitat sampling occurred in five representative areas in the St. Olaf College Natural lands. Each color circle corresponds to a different sampling site (Fig 1).

Results

According to the Minnesota DNR, frogs were expected to begin calling in Spring 2016 on March 17. These predictions are made every year based on spring climate patterns and previous surveys. In the St. Olaf Natural Lands, individual chorus frogs began calling on March 11 in sampling site Wooded 1. Chorus frogs continued to dominate the audio survey in all sampling sites until mid-April, receiving a highest rating of 3 on the audio sampling scale. The American toad began calling at the Baseball Pond in Mid-April but populations were small enough that individual callers were distinguishable. Later in May, the American toad was observed in all sample areas. Cope's gray treefrogs began calling outside of sample areas at the beginning of May. Leopard frogs , wood frogs and gray treefrogs were not present during audio samples (Table 1).

The visual survey first observed tree frog specimens in early April. However gray treefrogs and Cope's gray tree frog can only be recognized by call since they are so similar in appearance. During late April no frogs were sighted, but early during early May, there were American toad and leopard frog sightings at Baseball Pond 1 and Soccer Pond 1(Table 2). Not all visual samples were taken at specified sampling sites. Often specimens occurred outside of sample sites, but were still documented for in the survey.

Conclusions

Although I expected to hear or see 7 species given previous amphibian surveys done in 1991 and 2006, however only 5 out of the 7 were present. Each individual species emerged roughly the same time as the Minnesota DNR prediction dates, and results were relatively consistent with the most recent DNR frog calling surveys (MN DNR). Wood frogs and gray treefrogs were not present in audio surveying, which may be due to the timing of the survey. It is notable that wood frogs were present in previous surveys but did not make a visual or audio appearance in 2016. This is surprising since they should be calling in Minnesota at this time (McGurty 2009). All other frog and toad species were present in either the visual survey, the audio survey or both.

Additionally, Carleton College Arboretum, which is also within the confines of Northfield records the presence of spring peepers (*Pseudacris crucife),* but these frogs have not been documented on St. Olaf's Natural Lands (Fletcher et. al 1991). This may be due to differences in habitat between the St. Olaf Natural Lands and the Arboretum, however it may also be due to differences in restoration practices and original habitat. The Arboretum has the Cannon River in addition to more deciduous forest (McGurty 2009). St. Olaf's restoration project began in 1994 (Shea), whereas Carleton's wetland restoration began in 1998, but contained more deciduous areas originally (McGurty 2009). It is unlikely that 5 years would make a significant difference in population, however that data is not available. Spring peepers typically inhabit more wooded areas, like the Carleton Arboretum, which may explain why they are not present at St. Olaf since Carleton has more intact forest to begin with. In several years when the restored hardwood has grown up, we may see the presence of peepers (Shea, personal communication).

Since all species have a unique structure and specific habitat requirements, it is not unreasonable to expect species to respond to habitat restoration with varying rates of success. A study in Indiana noted that leopard frogs responded quickly to the restoration of wetlands (Stulik 2015). This is interesting to note, since this year leopard frogs were in low abundance in the St. Olaf Natural Lands. Previous population surveys documented leopard frogs more frequently, however differences may be due to climate patterns and the nature of spring this year. Unfortunately the survey in Indiana did not give explicit detail on the years since restoration, therefore it is difficult to draw exact conclusions in relation to the St. Olaf Natural Lands. It is possible that the 22 years since restoration is perhaps not enough time for some populations to regenerate. In order to fully understand anuran populations, a complete survey would continue into the fall. Bullfrogs and wood frogs often begin calling later in May and many frogs chorus through August in Minnesota (McGurty 2009). Due to the time constraints of the survey, this long term study was not an option.

It is important that this survey be continued in future years in order to create a longitudinal study. In order to document anuran populations, at least 10-15 years of study is necessary (Genet 2004). Ecological research is often longitudinal because changes happen

slowly over time. In order to document the full extent of change, multiple studies must occur over time (Turner et al 2003). It was difficult to quantify the true response of anurans to restoration due to lack of survey data, however this problem is not unique to St. Olaf. There is a global lack of anuran population surveys (Houlahan et al 2000), and if anything is to be done about the conservation status of anurans, consistent surveying is an promising start.

Since anurans are indicator species of ecosystem resilience and condition, maintaining up to date survey information is important for ecosystem tracking. Anuran surveys can be used to understand how climate change and anthropogenic influence is changing a particular ecosystem, which is important in the context of ecological studies as a whole.

Appendix

Color	Site Name	Habitat Description
Red	Forest 1	Restored forest hardwood surrounding a sheltered swamy area with cattails
Orange	Big Pond 2	West end of Big Pond in restored hardwood forest
Green	Big Pond 1	East end of Big Pond in open grassy area
Blue	Prairie 1	Open prairie with ephemeral puddles
Yellow	Soccer Pond 1	Drainage ditch with limited shelter from hardwood trees

Black	Baseball Pond 1	Sheltered hardwood forest and cattail pond

Fig.1. Natural Lands Map and Habitat Descriptions. Map depicts randomly selected sampling sites that correspond to color coded habitat description. Red refers to Forest 1, Orange refers to Big Pond 2, Green refers to Big Pond 1, Blue refers to Prairie 1, Yellow refers to Soccer Pond 1, Black refers to the Baseball Pond

Table 1. Audio survey showing presence or absence based on call representation. The W. Chorus Frog population is thriving as calls were continuous(3). American Toads are also present in high numbers but individuals were overlapping in calls (2). Copes Gray Treefrog and the leopard frog are small in presence, as only a few individuals were present(1). The wood Frog and the Gray Treefrog were not present in the audio samples(0).

		March 1-15	March 15-31	April 1-15	April 15-30	May 1-15
leopard frog	*(Rana pipiens)*	0	0	0	0	1
wood frog	*(Rana sylvatica)*	0	0	0	0	0
Copes' gray treefrog	*(Hyla chrysoscelis)*	0	0	0	0	1
gray Treefrog	*(Hyla versicolor)*	0	0	0	0	0
chorus frog	*(Pseudacris triseriata)*	2	3	3	3	3
American toad	*(Bufo americanus)*	0	0	0	2	2
spring peeper	*(Pseudacris crucife)*	0	0	0	0	0

Table 2. Visual Survey showing presence absence or absence of adults. 0 represents no individuals seen and "present" represents that some individuals were caught and released.

		March 1-15	March 15-31	April 1-15	April 15-30	May 1-15
leopard frog	*(Rana pipiens)*	0	0	0	0	Present
wood frog	(*Rana sylvatica)*	0	0	0	0	0
Copes' gray treefrog	*(Hyla chrysoscelis)*	0	0	Present	0	Present
gray treefrog	*(Hyla versicolor)*	0	0	Present	0	Present

chorus frog	*(Pseudacris triseriata)*	0	0	0	0	0
spring peeper	*(Pseudacris crucife)*	0	0	0	0	0
American toad	*(Bufo americanus)*	0	0	0	0	Present

Fig 2a and 2b. Eastern Toad. Two Eastern toad specimens caught at sampling site Baseball Pond 1.

Fig 3. Gray Tree Frog: Specimen found by sampling site Basebal Pond 1.

Contributors

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