

Correlations between vernal pool phenology and a breeding population of *Bufo americanus* in Dearborn Heights, Michigan

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Abstract:

Vernal pools are a disappearing hydrologic resource in Southeastern Michigan. As industrialization and suburbanization continue to drain and develop these important wetlands, there has been a dramatic drop in anuran and other associated wildlife populations. This research project attempted to investigate what relationships exist between various weather factors and the breeding use of a temporary wetland by the American toad, *Bufo americanus*. Only one remaining natural vernal pool associated with the Ecorse River Watershed was identified in Dearborn Heights, Michigan. Although research continues, a strong correlation between the onset of precipitation and the breeding use of this vernal pool was noted.

Introduction and Background:

Vernal pools have been an important part of Michigan's environment since glaciers retreated from the state over 10,000 years ago. As glaciers melted northward they left behind many poorly drained areas in much of Southeastern Michigan. Some of these wetland areas are permanent year round while others hold water for only some of the year meaning they typically dry up during the summer. A vernal pool is a temporary wetland lacking fish which is often used by amphibians and invertebrates (as well as a wide variety of other organisms) for feeding and breeding activities early in the spring. Today, very few vernal pools remain in Southeastern Michigan and local amphibian populations have shown a significant decline as a result. In Michigan, vernal pools receive protection only if they meet certain wetland criteria (Jarvie) which are often difficult to substantiate. Most vernal pools go unnoticed and unprotected. Site development is initiated before proper documentation and certification is able to result in protection under state and federal wetland protection acts.

The organisms that live in vernal pools must complete their life cycle during a very short time period. If the vernal pool does not fill up with water at the right time, it delays egg laying by toads. The later breeding takes place, the less time there is before the pool dries up. This could lead to insufficient time for eggs to hatch, tadpoles to metamorphose into toadlets, and for the toadlets to be of sufficient size to disperse into neighboring habitat. Climate change, with its impact on temperature and precipitation totals may play a significant role in disrupting the breeding habits of amphibians that have evolved through time.

Null Hypothesis:

There is no relationship between the onset and duration of water in a vernal pool with water temperature, air temperature, precipitation, and vernal pool temperature.

Methods:

We use portable weather instrumentation due to the insecurity of the site we investigated. Current weather conditions were obtained by using a Kestral 4500 Pocket Weather Tracker with wind vane and a Vernier LabQuest with temperature probe. Our GLOBE precipitation gauge broke during the winter when we couldn't get in over a weekend to empty the water so we used precipitation data from the U.S. weather service station located at the Detroit Metropolitan Airport just a few miles away from our investigation site.

We waited all winter and early spring to begin our research by checking daily to see if water had accumulated in the vernal pool. Unfortunately, because of a drought the previous summer and the slow infiltration of rain and snowmelt over the winter, water did not accumulate in the vernal pool until we had steady rain for three days. Even with several days of precipitation, water did not begin to appear in the vernal pool until late Saturday, April 20, 2013.

Once the pool filled up with water, we began our daily measurements on Sunday, April 21st and have been doing them daily between 3:00 P.M. and 6:00 P.M. depending on what time we are able to make it to the site. Our data collection and analysis will continue until either the vernal pool dries up or the toadlets metamorphose, whichever comes sooner.



Figure 1. Grassy portion and wood section of the Incinerator vernal pool.

Data

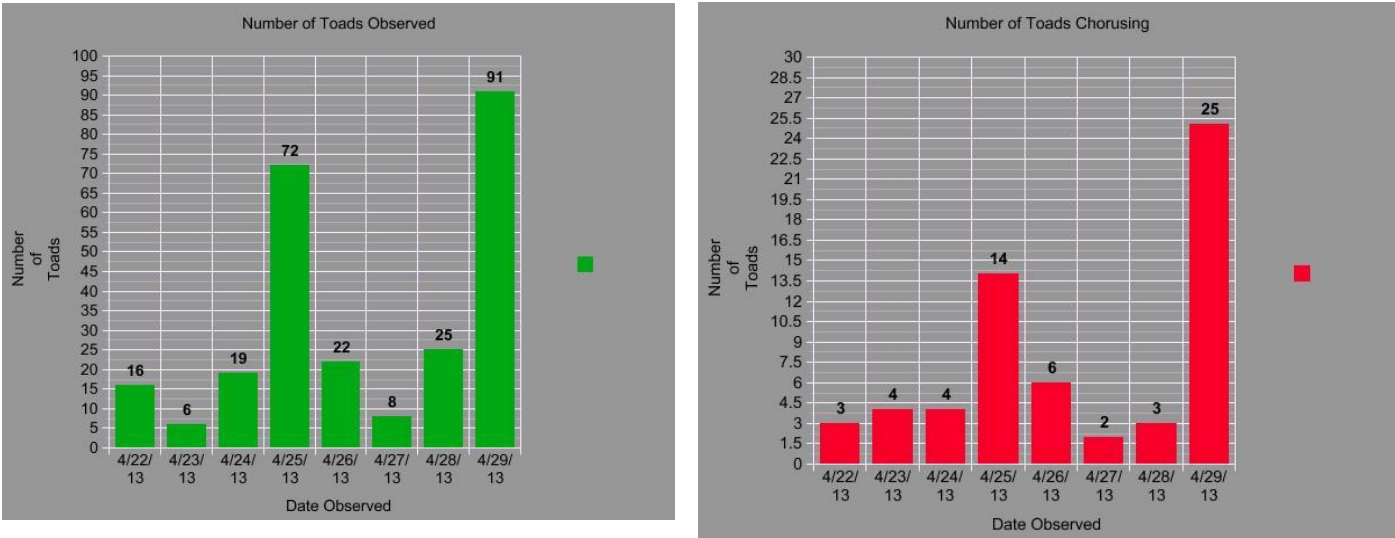
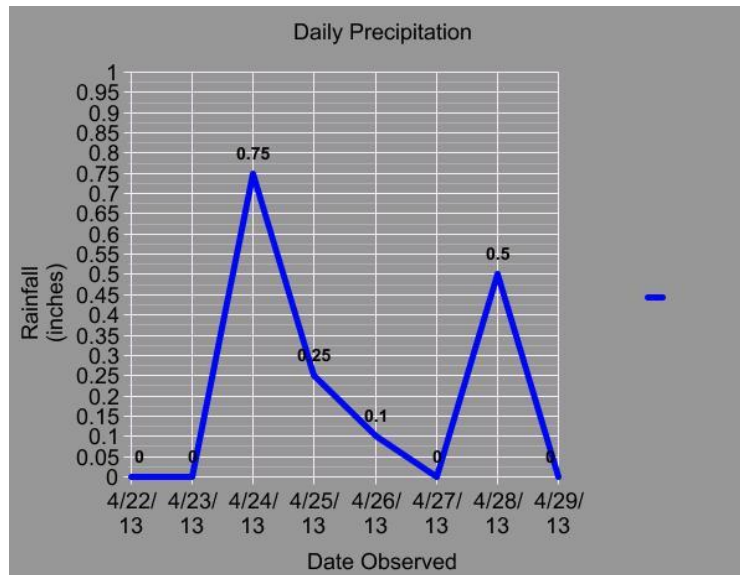


Figure 2. The graphs above show the correlation between number of toads observed, number of toads chorusing, and rainfall. The more rainfall, the greater the number of toads observed, and the greater the number of toads chorusing.



Discussion:

What role will a changing climate play in the breeding of the American toad? From just our brief study it is strongly indicated that precipitation at the right time plays a significant role in the successful breeding of *Bufo americanus*. Should climate change bring about altered precipitation amounts or patterns that don't match the phenology of the toad, breeding could be disrupted or diminished. The long term survival of small seasonal wetlands like our study site would be jeopardized if sufficient rainfall does not arrive at the right time to fill them. Species like the American toad have evolved to carry out their life cycle in a specific pattern and if this is disrupted by water too early or too late, it could throw off their entire reproductive biology. *Bufo americanus* is just one of many species that depend on the vernal pool as part of their life cycle. In a changing climate, numerous species will be affected.

Finding just one natural remaining vernal pool in all of South Dearborn Heights is disturbing. Although this vernal pool is home to an abundant number of reproducing toads. If the City of Dearborn Heights sells this property to developers, it will most likely silence forever the biological diversity now found at this site. The principal researchers of this investigation want the City of Dearborn Heights and the property owners to take the aesthetic and biological values of this wetland into consideration before approving the development of this area. Because of the millions of dollars this land is worth, we doubt our small voices will account for much.

References:

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