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Herpetofaunal Diversity at Yankee hill State Lake and Wildlife Management Area, Lancaster County, Nebraska

Shelby Klima
University of Nebraska-Lincoln

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by

Shelby Klima

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Shelby Klima, B.S

Advisor: Dan Fogell

University of Nebraska

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ABSTRACT

A survey for amphibians and reptiles was conducted in March through October 2011 at Yankee Hill Wildlife Management Area in Lancaster County, Nebraska. The survey was conducted using several different techniques including: visual and auditory encounters, artificial and natural cover objects, aquatic trappings and road surveys. A total of 145 individuals representing 12 species were identified including seven reptiles and five amphibians. A total of 48% of the species that may potentially occur on the site were encountered, all of which are common, widely distributed generalist species. Neither Graham's Crayfish Snake nor the Massasauga, both target species for this survey, was found. Based on the mediocre species assemblage, low diversity, and disturbed conditions of the site in part due to recent lake renovations, Yankee Hill State Lake and WMA likely holds little importance for amphibian and reptile conservation in its present condition.

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INTRODUCTION

State wildlife management areas (WMA) are often managed for game species such as Whitetail Deer (*Odocoileus virginianus*) and Ringnecked Pheasants (*Phasianus colhicus*) and state lakes are often stocked with "fishable" species of fish. In many instances however, wildlife management areas that are close to or within the limits of large urban or suburban areas often serve as refugia for nongame species and even rare species that may have disappeared from much of the region. Since WMA's are not usually managed for nongame species, often only limited or reported knowledge of their biodiversity is available. More specifically, amphibians and reptiles (herpetofauna) are often overlooked when making management decisions because their diversity in a region is usually not known (Gibbons 1997). There is a general consensus among ecologists that high biodiversity contributes to improved ecosystem function and stability (Duffy 2009). Thus, knowledge of an area's herpetofaunal diversity would be a crucial contribution to the overall understanding of ecological dynamics of an area and will also improve its overall management success. The goal for this project was to complete a herpetofaunal survey at Yankee Hill State Lake and Wildlife Management Area in order to increase the knowledge of the area's biodiversity.

Yankee Hill WMA is a 938 acre tract of native and restored grasslands with a lake, located southwest of Lincoln in Lancaster County, Nebraska (Lat. 40 43' 50",Long. 96 46' 59.16")(Figure 1). Lake construction was completed in 1965 by the United States Army Corps of Engineers with the primary purpose being flood control. The Nebraska Game and Parks Commission (NGPC) manages Yankee Hill for fishing as well as upland game hunting as a secondary use (NDEQ 2002).

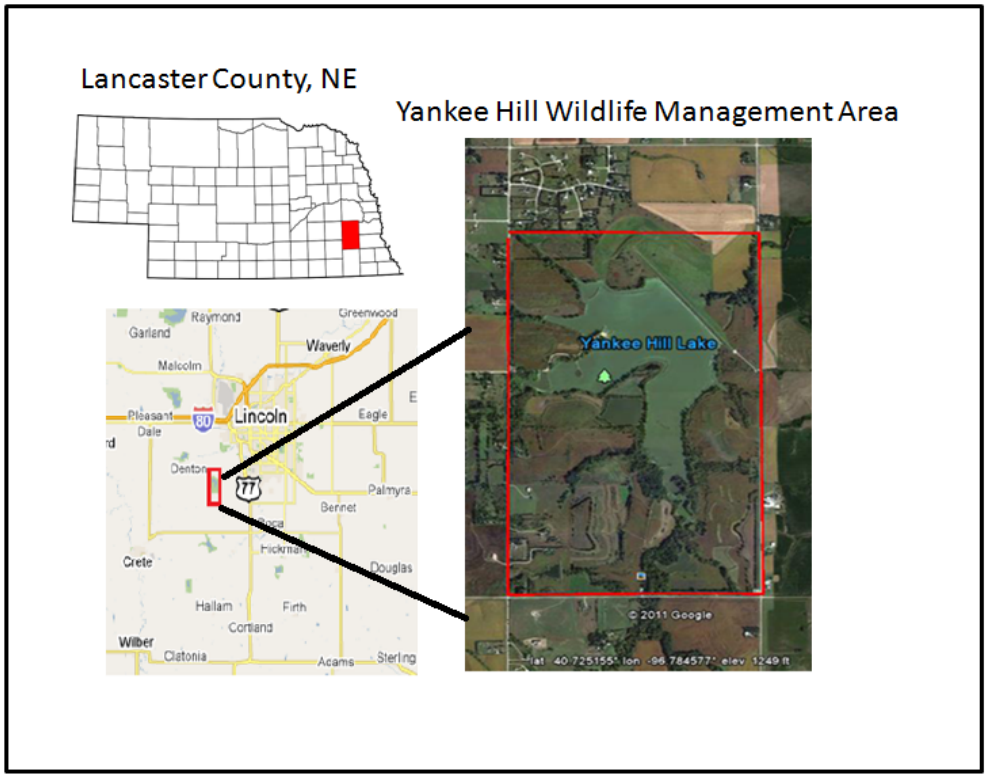

Figure1. Yankee Hill Wildlife Management Area located southwest of Lincoln in Lancaster County, Nebraska (Lat. 40 43' 50",Long. 96 46' 59.16").

Yankee Hill WMA was chosen for this survey due to the limited knowledge of amphibians and reptiles in the area as well as its close proximity to Lincoln. There are potentially 25 species of herpetofauna to be found at this site including two rare species – Graham's Crayfish Snake (*Regina grahamii*) and the Massasauga (*Sistrurus catenatus*) (Fogell 2010) (Table 1). Anecdotal reports of Massasaugas from Yankee Hill WMA exist as recently as 2004 (Dan Fogell, personal communication). Because the Massasauga is a threatened species in the state of Nebraska, improving the knowledge of its distribution would aid in conservation efforts.

Table 1. Species of potential occurrence at Yankee Hill State Lake and WMA

Amphibian Species	**Common Name**
Anaxyrus cognatus	Great Plains Toad
Anaxyrus woodhousii	Woodhouse's Toad
Acris blanchardi	Blanchard's Cricket Frog
Hyla chrysoscelis	Cope's Gray Treefrog
Pseudacris maculata	Boreal Chorus Frog
Lithobates blairi	Plains Leopard Frog
Lithobates catesbeianus	Bullfrog
Ambystoma mavortium	Barred Tiger Salamander
Reptile Species	
Chelydra serpentina	Common Snapping Turtle
Chrysemys picta	Northern Painted Turtle
Apalone spinifera	Spiny Softshell Turtle
Plestiodon septentrionalis	Northern Prairie Skink
Coluber constrictor	Eastern Racer
Lampropeltis calligaster	Prairie Kingsnake
Lampropeltis triangulum	Milk Snake
Mintonius vulpinus	Western Fox Snake
Pituophis catenifer	Bullsnake
Diadophis punctatus	Ringneck Snake
Nerodia sipedon	Northern Water Snake
Regina grahamii	Graham's Crayfish Snake
Storeria dekayi	Brown Snake
Thamnophis radix	Plains Garter Snake
Thamnophis sirtalis	Common Garter Snake
Tropidoclonion lineatum	Lined Snake
Sistrurus catenatus	Massasauga
Total number of potential species = 25	

MATERIALS AND METHODS

Survey activities were conducted at Yankee Hill WMA between March and October 2011. Several techniques were used to help identify of as many potential species as possible. The following methods and associated materials were employed throughout the survey period. Because Yankee Hill Wildlife Management Area is public property, all materials were clearly marked as study sites to avoid being tampered with by the public during the course of the study.

Visual and Auditory Encounter Surveys

Visual and auditory encounters simply involved walking around the lake and random transects on the property and recording any species of amphibian or reptile encountered. Frog and toad call surveys were completed during the spring months during their breeding season.

Natural and Artificial Cover Objects

Artificial cover has been shown to be highly effective for attracting reptiles and fossorial amphibians when natural cover objects are rare or absent (Fellers and Drost 1994, Parmelee and Fitch 1995). A total of 16 artificial cover sheets were set out in various locations during late April 2011 (Figure 2). A combination of wood and corrugated metal sheets were placed in areas expected to be high in herpetofauna activity and movement. These areas included patches of land between water sources and roadways as well as areas near small mammal burrows (Fellers and Drost 1994). Seven 1 x 1 m sheets were placed in a transect approximately 25 m apart from each other in a grassland stretch located between the lake and the roadway on east side of the property. Three 1 x 2.5 m sheets spaced 25 m apart were placed in grassland habitat on the northeast corner of the property. Four 1 x 2.5 m sheets spaced 75 m apart were placed in grassland habitat adjacent to the lake on the west side of the property. Two 1 x 1 m cover sheets spaced 25 m apart were placed in a grassy wetland area adjacent to the west finger of the lake. Artificial cover sheets were checked on each visit throughout the duration of the survey, typically between 1000 and 1400 hours. Natural cover objects including rocks, logs, tree bark, and mats of standing dead grass or brush were also checked on random occasions when encountered.

Figure 2. Artificial cover array placements.

Aquatic Trapping

The use of minnow traps has been shown to be an effective method for sampling aquatic habitat for all life stages of amphibians (Enge 1997) as well as for semi-aquatic snakes (Dan Fogell, personal communication). Minnow trapping for frogs, toads and salamanders was conducted in April during their breading season. Five minnow traps (42x20 cm, steel mesh, two 2.54 cm openings) were placed in the southwest finger of the lake where anuran amphibian calls were frequently heard. Traps were not baited and were left out for five consecutive nights on two separate events.

Turtle trapping was conducted in September. One turtle hoop trap (3 x 1 m with 2.54cm nylon mesh and one 25 cm opening) was placed on the west side of the lake where basking turtles were

observed. The trap was baited with dead sardines in oil and left out for four consecutive nights on two separate events.

Road Surveys

Road surveys or "road cruising" involved driving roads on the property as well as those bordering the WMA and recording any species encountered. Road surveying was primarily conducted between the hours of 0800-1200 and 1600-2000 on days optimal for herpetofauna activity. Such days include warm, sunny days as well as rain events (Langen et al. 2009).

Parameters Recorded

The following field parameters were recorded with every encounter: species, animal behavior, latitude and longitude using a Garmin Oregon 450 and Magellan Meridian Gold GPS receivers, general weather conditions such as temperature and precipitation using the National Weather Service (NWS) and date/time. Photographs were also taken as vouchers for all individual species encountered.

Data Analysis

Diversity and evenness were calculated using the Shannon Diversity Index. Relative abundance for amphibians and reptiles was calculated separately by taking the total number of individuals of a given species divided by the total number of all species.

RESULTS

Search efforts resulted in a total of 18 visits over the eight month period with a total of 54 search hours. The artificial cover sheets were checked 192 times. There was a total of 10 minnow trap nights and eight turtle trap nights. Approximately 126 miles were covered while road surveying. The majority of amphibians and all turtles were found by visual and auditory encounters and almost all reptiles were found via road surveys (Figure 3).

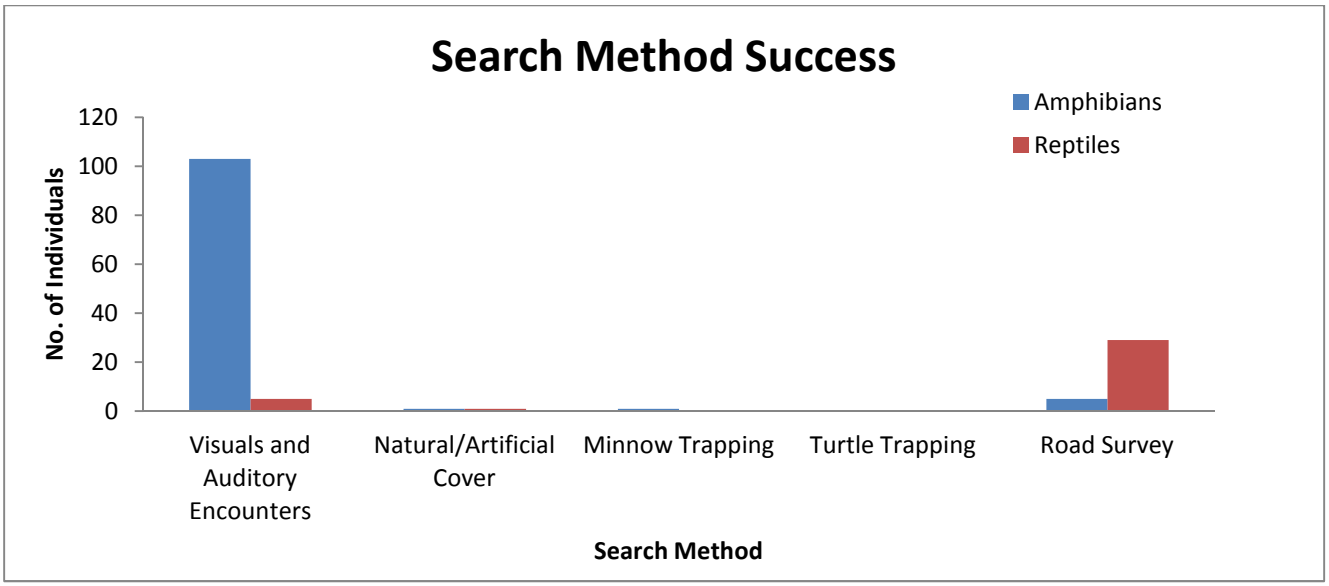

Figure 3 . The number of individuals sighted or caught with the various search methods used.

A total of 145 individuals representing 12 species (five amphibians and seven reptiles) were encountered for an encounter rate of 48% (Table 2). Amphibian species were most often encountered in March through June while reptile encounters occurred primarily in the month of October (Figure 4). Monthly temperatures for the spring months were normal at an average of 56.83^{o}F while precipitation was slightly higher than normal at 3.62 in compared to 3.21 in. Temperatures for the months of July and August were above normal by 2.0^{o}F and they also had above normal rainfall by 0.77 in. The month of September was cooler than normal by 4.5^{o}F with slightly less rainfall than normal. The average monthly temperature for the month of October was 55.6 ^{o}F which is 2.4 degrees higher than normal and precipitation was approximately 1 in less than normal for the month (NWS 2011).

Table 2. Species identified and number of individuals encountered.

Amphibian Species	**Common Name**	**Number of Individuals**
Acris blanchardi	Blanchard's Cricket Frog	66
Pseudacris maculata	Boreal Chorus Frog	1
Anaxyrus woodhousii	Woodhouse's Toad	6
Lithobates catesbeianus	Bullfrog	38
Lithobates blairi	Plains Leopard Frog	1
Reptile Species	**Common Name**	
Coluber constrictor	Eastern Racer	9
Pituophis catenifer	Bullsnake	8
Nerodia sipedon	Northern Water Snake	1
Storeria dekayi	Brown Snake	2
Thamnophis radix	Plains Garter Snake	3
Thamnophis sirtalis	Common Garter Snake	5
Chrysemys picta	Northern Painted Turtle	5
	Total	**145**

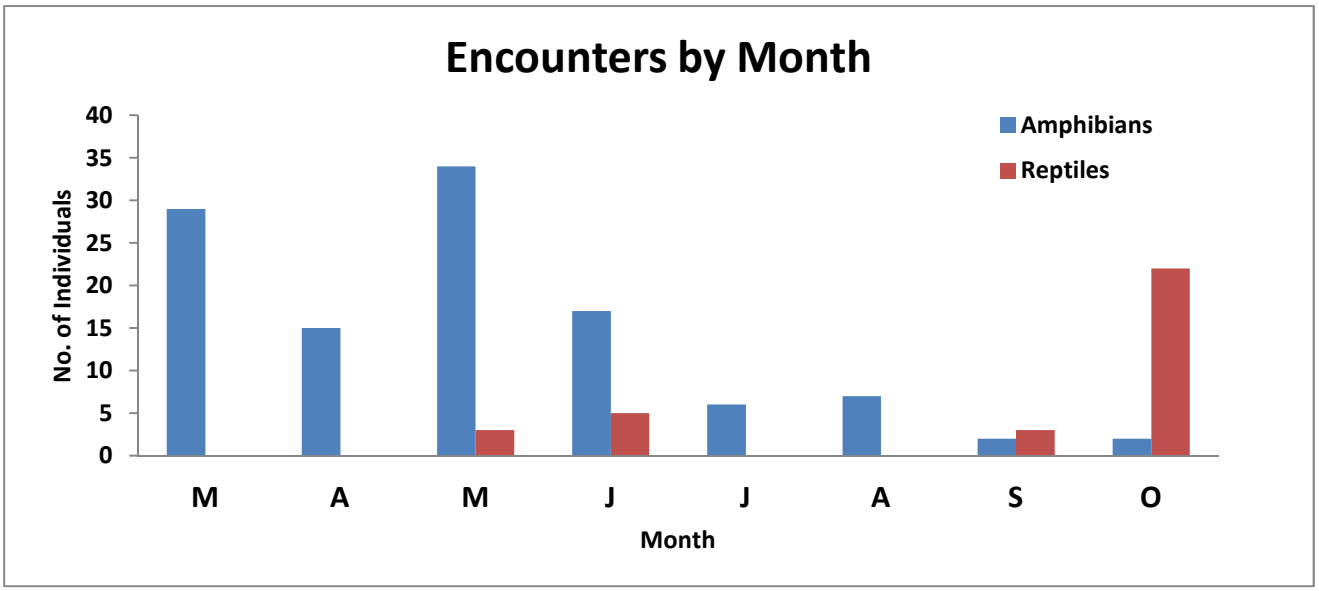

Figure 4. Number of individuals encountered by month.

The amphibian assemblage was dominated by Blanchard's Cricket Frogs (*Acris blanchardi*) and Bullfrogs (*Lithobates catesbeianus*). Together these species made up 93% of the amphibian assemblage (Figure 5). Eastern Racers (*Coluber constrictor*), Bullsnakes (*Pituophis catenifer*), and Garter Snakes (*Thamnophis sp*.) primarily composed the reptile assemblage with a combined total of 76% (Figure 6). The Shannon Diversity Index values calculated for diversity and evenness were 1.64 and 0.66, respectively.

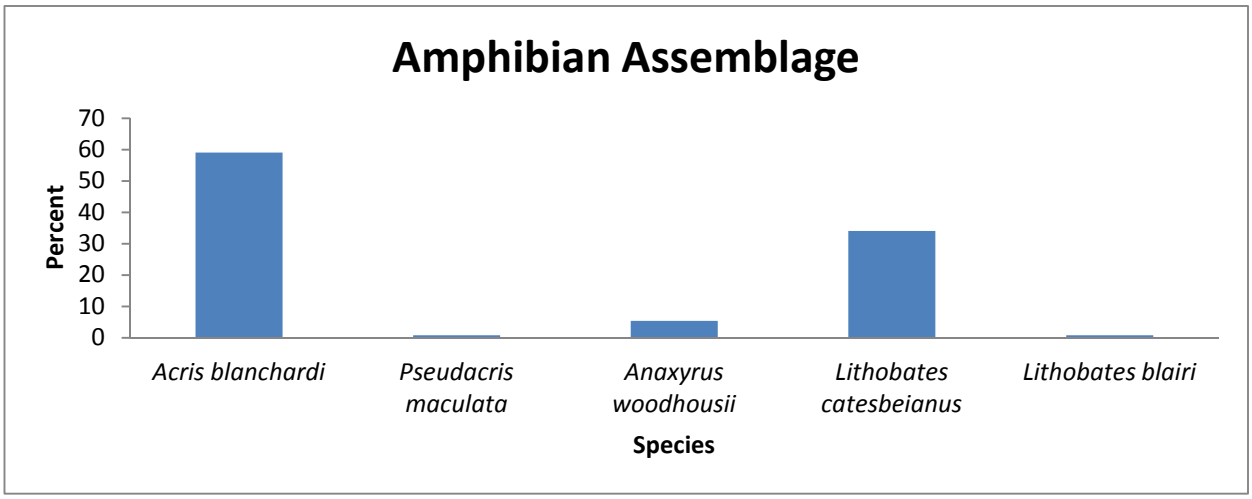

Figure 5. Percent relative abundance of amphibian species, number of individual of a given species per total number of individuals (n=112).

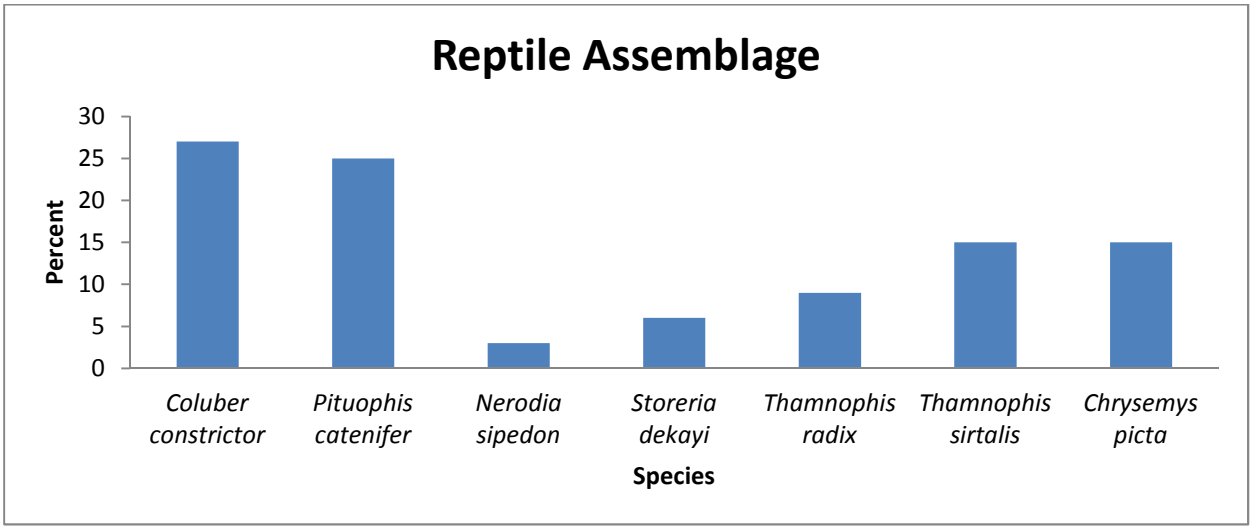

Figure 6. Percent relative abundance of reptile species, number of individuals of a given species per total number of individuals (n=33).

DISCUSSION

The data obtained indicates that 48% (12 out of 25) of the potential species were encountered during this survey. While a success rate of 100% was not expected, more species were predicted to be found. The methods employed for this survey were standard herpetofaunal survey methods however there are several other methods that could have been used as well. By increasing the number of search hours and using more targeted surveying techniques, more species might have been found. For example, the use of drift fences with funnel traps and/or pitfall traps might have resulted in the capture of small, fossorial snakes such as the Lined Snake (*Tropidoclonion lineatum*) and Ringneck Snake (*Diadophis punctatus*) or the only expected lizard species, the Northern Prairie Skink (*Plestiodon septentrionalis*). This method has been shown to be quite effective for identifying small, inconspicuous species (Todd 2007, Enge 1997, Greenburg 1994). Drift fences are labor-intensive to set up, and traps must be checked at least daily during hot weather to ensure captured animals do not perish. Therefore their use was not practical given the time constraints and funding available for this survey. The artificial cover arrays placed on the site may be more effective if given time to weather based on the findings of Parmelee and Fitch (1995). A single season is usually not enough time to allow reptiles and amphibians to "discover" the presence of artificial cover. Automated recording devices (aka "Frog Loggers") could also have been used to help detect the presence of other anuran species (Scott and Woodward 1994), but again these devices are expensive and were not cost effective for the purposes of this study. Placing minnow traps and turtle traps out for longer durations may also have increased success, especially for Common Snapping Turtles (*Chelydra serpentina*) and amphibian larvae (Shaffer et al. 1994). However, given the high traffic Yankee Hill WMA receives by fishermen, hunters, and other visitors there was a high risk that traps would be stolen. Future studies could include the use of these additional techniques as well as additional search hours.

The 48% success rate is most likely the result of a remnant herpetofaunal community persisting in a highly disturbed piece of habitat. The dominant species of herpetofauna encountered during this survey are indicative of an area that has a relatively homogeneous set of habitat features. Eastern Racers (*Coluber constrictor*), Bullsnakes (*Pituophis catenifer*), Garter Snakes (*Thamnophis* sp.) and Woodhouse's Toads (*Anaxyrus woodhousii*) can all be found statewide and occur in a wide variety of habitat types, from optimal natural areas to agricultural fields and even suburban backyards. Blanchard's Cricket Frogs (*Acris blanchardi*) and Bullfrogs (*Lithobates catesbeianus*) are two amphibian species that thrive in fish stocked ponds while other amphibian species tend to fail in similar wetland types (Fogell 2010). These particular species are habitat generalists, meaning they will utilize virtually any habitat type in their range and are more capable of adapting to disturbed habitats compared to other species (Richmond 2005). Disturbances at this site are a result of recent lake renovations, in addition to much of the terrestrial component of Yankee Hill WMA being composed of restored prairie that had previously been in agricultural production (Kirk Hansen, personal communication). The highly modified landscape at Yankee Hill also explains the relatively low diversity index (Shannon Index = 1.64), and the moderate evenness index (0.66) is explained by the dominating presence of the seven species described above.

In 1997, the Nebraska Game and Parks Commission implemented the Aquatic Habitat Program which was designed to improve the fishing quality at multi-purpose reservoirs across the state of Nebraska. Yankee Hill State Lake was included in this program in 2002 (Porath 2011). The Total Maximum Daily Loads (TMDL) report in 1998 for Yankee Hill Lake by the Nebraska Department of Environmental Equality (NDEQ) listed the lake as being impaired due to excessive amounts of sediment and nutrients being delivered into the lake, thus preventing it from being of beneficial use (2002).

In 2003, Yankee Hill State Lake was drained and dredged to meet the requirements of Section 303(d) of the Clean Water Act and Title 40 CFR Part 130 water quality standards set by the NDEQ, as well

as to improve the fish habitat as part of the Aquatic Habitat Program created by NGPC. A chemical fish kill off was also conducted at this time in order for the lake to be restocked with fishable species. After renovations were completed in 2004, the reservoir did not refill until 2007 due statewide drought (Kirk Hansen, personal communication).

Chemical fish kills combined with draining the lake likely resulted in the loss of all amphibian life utilizing the lake, either killing amphibians directly (larvae) or causing them to migrate to surrounding areas with more suitable habitat. During the drought period, the lack of water would also have altered amphibian as well as some reptile populations at this site, again forcing them to utilize more suitable surrounding areas. Given these assumptions, the herpetofaunal species assemblage encountered at Yankee Hill Lake and WMA is most likely in the process of becoming re-established. Therefore the low diversity index and poor encounter success rate may not be as bad as was initially thought.

CONCLUSION

No previous herpetofaunal surveys have been performed at Yankee Hill WMA, therefore it is difficult to accurately assess the conditions of this site prior to and after the lake renovations. No known surveys of other taxa (i.e. birds, insects, mammals, etc.) have been conducted to allow for a comparison with these current data. Due to the poor conditions of the lake, indicated from the TMDL report by the NDEQ, it is quite possible there were few species of herpetofauna located at this site for many years prior to the renovations. Currently, there are enough surrounding natural areas in close proximity to Yankee Hill that amphibians and reptiles may still migrate into and out of the WMA. However housing developments have started forming adjacent to this site and it is likely that trend will continue. Based on these survey results, Yankee Hill Wildlife management area holds little importance for amphibian and reptile conservation in its present condition. If in the future one or both of the rare species of snakes is discovered using Yankee Hill, a management plan would need to be devised that supports both the

survival and potential expansion of either of the species. Otherwise, it is recommended that intermittent herpetofaunal surveys continue and that the present survey results be used as a baseline to look for trends that might indicate habitat improvement or degradation in the future.

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