

FAUNISTIC SURVEY OF AMPHIBIAN SPECIES PRESENT AT UNDERC

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ABSTRACT

This study was conducted on the UNDERC property located on the Wisconsin and Michigan border. It attempted to determine what amphibian species were present, where they were located, and what their breeding seasons were. In addition an attempt was made to correlate differences in size between and among species within a lake and between lakes. Reasonable explanations of these size differences were also proposed. Although it has all the problems inherent in any faunistic survey, it does give a reasonable idea of the species present and their locations. The species present include *Rana pipiens*, *R. sylvatica*, *R. septentrionalis*, *R. clamitans*, *R. palustris*, *R. catesbeiana*, *Hyla crucifer*, *H. versicolor*, *P. triseriata*, *Bufo americanus*, *B. woodhousei fowleri*, and *N. viridescens*. However, the study was not as successful in providing an accurate picture of these species breeding seasons. There were significant size differences and possible explanations include growth with age, different nutrients, and different predation.

INTRODUCTION

This study was designed to determine the Amphibian species present on the University of Notre Dame Environmental Research Center's (UNDERC) property, their relative number, their respective locations, if possible their breeding seasons, and to correlate and attempt to explain any size differences in the species found.

UNDERC is about 2833 ha. of land on the state border between Wisconsin and Michigan's Upper Peninsula. The property lies mainly in Goebic County (Michigan) with a minor portion in Vilas County (Wisconsin). The center of the UNDERC site is at 46^o 13' North by 89^o32' East(Amand, etal).

The organisms belonging to class Amphibia are salamanders(including newts), toads, and frogs; all of which might be expected to be at UNDERC. However, even if an organism is present on the UNDERC property it doesn't necessarily follow that it will be captured and included in this survey; thus, bringing up one of the problems inherent in any faunistic survey.

Although, at first it may seem easy to catch and catalog all the various amphibian species on such a relatively small property, it is in reality a complex problem without an easy solution. One problem is that a method of capture used for one type of organism (or even one species) might not work for another. For instance, the usual method of hunting for frogs with a dip net and hands is not very effective in capturing *Rana catesbeiana* which normally require more extensive methods (including nets dragged through the deeper water and fishing for them). Thus, a

standardization of capture methods is needed to prevent an organism from appearing to be more plentiful in an area just because it is more readily captured.

Another problem in a species survey is the inaccessibility of habitats. In most lakes I was limited to hunting for herps in the areas around the dock. It was near impossible to reach other areas because of thick vegetation, deep water, or other hazards.

Another problem I experienced was time constraints. To arrive at an accurate picture of the species present at UNDERC I would need to survey from at least early Spring to late Fall. Also I would need to sample at all times of the day and night. In general I was confined to sampling in June and July, and mostly during the day.

Still another problem inherent in any survey is the accuracy of identification. Since I am not an expert I can't be positive about all my identifications but I am fairly confident in them.

Taking into consideration all these limiting factors, I attempted to produce as accurate a picture of the amphibians present at UNDERC as possible. I searched along streams and lakes and under moist logs, stones, and other debris for herps. When spotted I captured the amphibians using my hands and a dip net. Upon capture I identified the organisms using a field guide(Peterson, 1975) and noted all pertinent information. From this information I expected to determine the species present at UNDERC and their location. In addition, by observing mating habits and identifying eggs and tadpoles from a handout(Taylor and

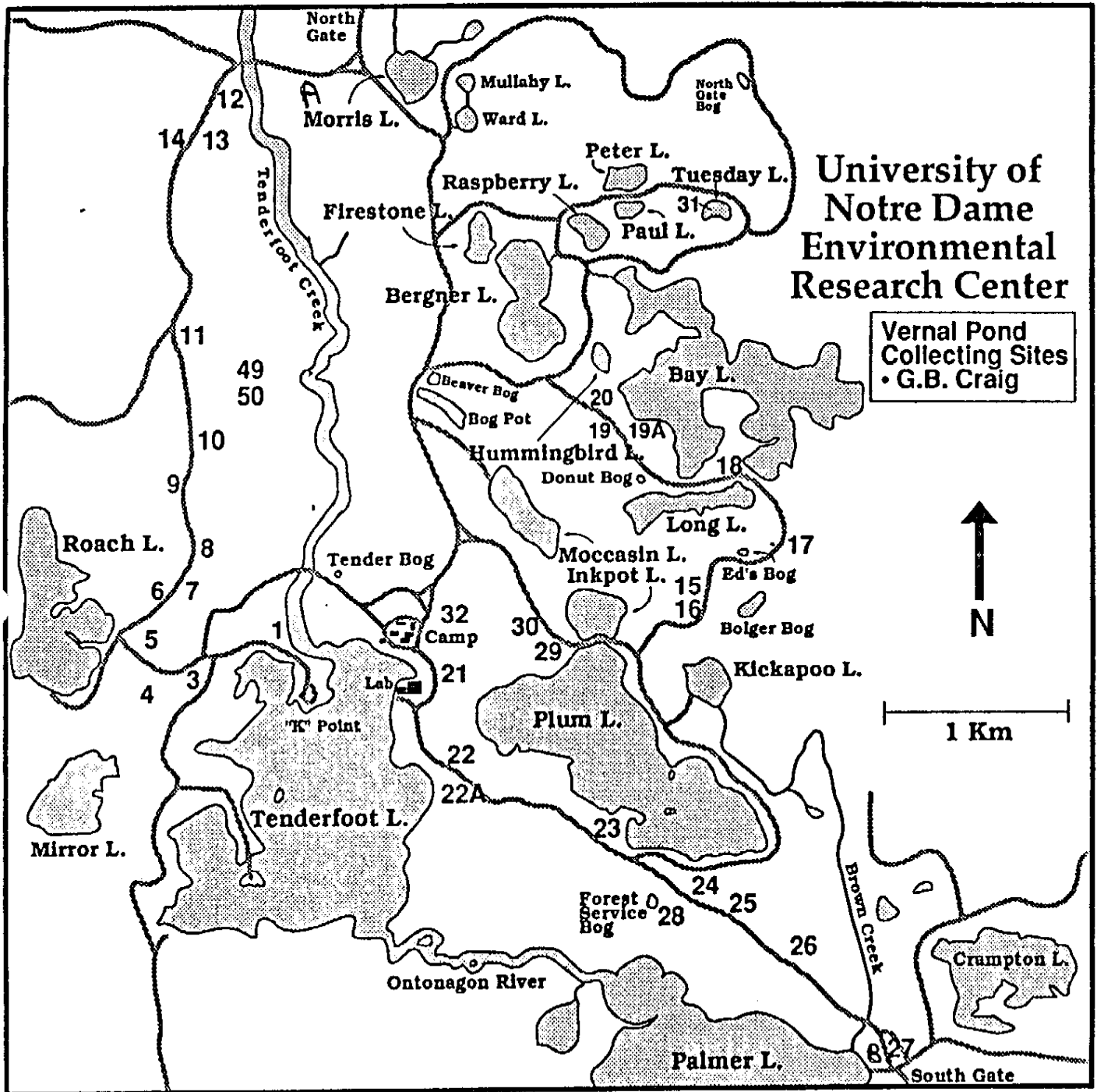


Fig. 1. Location of specific testing sites

Kollros) I hoped to determine the breeding seasons for the organisms present. Differences in size were compared by a one way ANOVA and the Fischer LSD method. Significant differences were found in several cases, and an attempt was made to identify the cause of these size differences.

I found the following species at UNDERC *Rana pipiens*, *R. septentrionalis*, *R. pipiens*, *R. sylvatica*, *R. palustris*, *R. catesbeiana*, *Hyla crucifer*, *H. versicolor*, *Bufo americanus*, *B. woodhousei fowleri*, *N. viridescens*, *P. triseriata*. However, I was unable to get enough conclusive evidence to provide a truly accurate picture of these species' breeding seasons. Size differences could be linked to several factors chief among them growth with age, and altered predation and nutrients.

MATERIALS AND METHODS

I found that the first step in a faunistic survey is to become familiar with the surroundings, organisms, and methods to be used. Learning the lakes, ponds, streams, and other important areas of UNDERC (fig. 1) was essential. This was accomplished by roaming the property in a van and taking note of the location of various landmarks.

Next, I had to learn how to capture and identify the various herps on the property. This was basically a trial and error process. I had to develop the skill for capturing amphibians. The same holds true for identification. After handling and examining several organisms I started to become confident in my identifications.

SURVEYING FOR ADULT FROGS AND TOADS

After becoming familiar with the surroundings and techniques I began my faunistic survey by capturing frog and toad adults. This was done by arriving at the chosen site. Sites were chosen at random, but they were chosen so as to get a wide range of sample sites and they were usually near a open body of water. Also several sites were visited more than once. This was to gather data on different times of the day or during different times of the summer.

After arriving at a site I noted down the location(type of habitat),water and air temperature, time, date, and weather. Then I proceeded to search the vegetation surrounding the water and the water itself for amphibians. If an amphibian was spotted I attempted to capture it using a combination of my hands and a dip net. If captured, I put the herp in a large bucket and sealed it with a lid punctured with air holes.

After I captured several organisms I would retreat to a van to make an identification, sex determination, and length measurement for each organism. I found it worked better in the van because if a herp got away during this process it was very easy to recapture it. The length was a standard head-body measurement(tip of snout to anal opening). Identifications were made through a field guide for reptiles and amphibians (Conant). Sex determination was based upon secondary sexual characteristics. This information was added to the tadpole data to derive a picture of the species present at UNDERC, their location, and their

relative numbers.

SURVEYING FOR SALAMANDERS

The method for surveying for salamanders is the same as the one for frogs and toads except in the choice of location. In picking a site to search for salamanders I looked for an area with fallen logs, stones and other debris. The area had to be moist but not wet.

SURVEYING OF TADPOLES AND EGGS AND DETERMINATION OF BREEDING SEASON

I attempted to survey and determine the breeding season of the amphibians present at UNDERC by capturing tadpoles and eggs and also by observing the mating habits of adults. I looked for tadpoles and eggs at the same sites as I looked for the adult amphibians. In addition to the methods used for capture of frogs and toads, I would sweep my net through the water under vegetation to capture tadpoles.

Once tadpoles were captured I would follow the steps for frog and toad surveying, including length measurement and identification by a field guide (Conant). When finding the relative abundance of a species tadpole numbers were included with adult numbers. In addition I would determine the stage of development of the tadpole using a handout (Taylor and Kollros). The stage of development could provide a clue as to when conception occurred (and thus when the breeding season was).

If I found eggs they were brought back to the lab and grown until the

steps for tadpoles could be followed.

The mating habits I was looking for including clasping and releasing calls. If adults were seen exhibiting these behaviours it was noted and used to help determine the breeding season.

All this information was used to help derive a picture of the amphibians breeding seasons as well as their distribution.

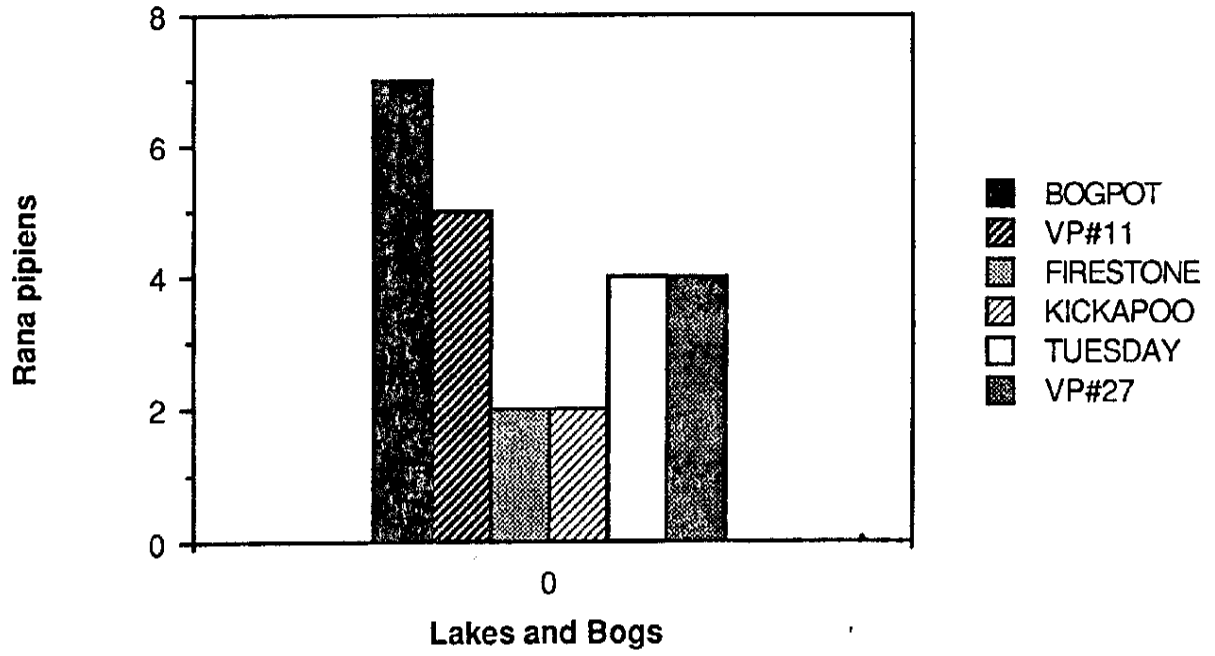
SIZE DIFFERENCES CORRELATION

After I had gathered the information on the species present at each lake, I calculated the average size (with the standard error of the mean) for a certain species present at a specific lake at a certain time. Using this information I would compare the size differences between members of the same species in different lakes on the same day. Or I would compare differences between the same species in the same lake on different days. I used several of these combinations to correlate size differences. The different groups were compared by using a one way ANOVA. A p value less than .05 indicated a significant difference. I then ran a Fischer LSD to determine exactly which groups were significantly different, I then attempted to hypothesize reasonable explanations for these size differences.

RESULTS

Fig 4.

Distribution of *Rana pipiens*



As I noted, I attempted to sample from a broad range of areas at UNDERC. Just as one would expect, some areas showed great diversity in the types and numbers of species present, while others showed little or no organisms. I will first present the data showing what organisms were present at a site (please refer to Fig.1 for the location of a specific site) and their relative number (please refer to the appendix for a complete listing of the organisms present at a specific lake).

SURVEYING OF ADULT FROGS AND TOADS

Rana were by far the most common amphibian captured on the UNDERC property. They were present in almost every lake and pond. Of the *Rana* the species *clamitans* were the most prevalent. *R. clamitans* were found in great numbers with 7 present in Bolger Bog, 22 in Bog Pot, 1 in Firestone, 1 in Kickapoo, 1 in Paul, 1 in Vernal Pond #11, 100 in Tuesday, 13 in VP#24, 19 in Vernal Pond #27, and 3 in Ward (Fig.2).

R. septentrionalis was the next most common amphibian with 5 found at Bolger, 9 at Bog Pot, 1 at kickapoo, 1 at Vernal Pond #9, 4 at Vernal Pond #11, 7 at Tuesday, 11 at Vernal Pond #27, and 3 at Ward (Fig. 3).

R. pipiens was found in several lakes. 7 were found in Bog Pot, 2 in firestone, 2 in kickapoo, 5 in Vernal Pond #11, 3 in Tuesday, and 4 in Vernal Pond #27 (fig.4).

Other amphibians were not as prevalent. *R. sylvatica* was only captured at Bolger, and Vernal Pond #27.

R. catesbeiana was found only at Firestone, Kickapoo, and Vernal Pond

#11.

R. palustris was spotted in Bog Pot.

Hyla crucifer and *versicolor* were only found in Vernal Pond #27.

Bufo americanus and *woodhousei fowleri* were spotted at Bay, Bog Pot, and Vernal Pond #27.

The temperature of the water at a capture site ranged from 19⁰ C to 25⁰ C with the average temperature at 23⁰ C.

To sum up the species present include *Rana pipiens*, *R. sylvatica*, *R. septentrionalis*, *R. clamitans*, *R. palustris*, *R. catesbeiana*, *Hyla crucifer*, *H. versicolor*, *P. triseriata*, *Bufo americanus*, *B. woodhousei fowleri*, and *N. viridescens*.

SURVEYING FOR SALAMANDERS

The sites tested for salamanders included the sites for frogs and toads plus Site B, an area across from Vernal Pond #27. The results were negative except in two cases.

Site 5 was Kickapoo Lake. The species found was *N. viridescens*.

Site 7 was Tuesday Lake. An amphibian was spotted but not captured.

SURVEYING OF TADPOLES AND EGGS AND DETERMINATION OF BREEDING SEASON

The sites for eggs and tadpoles were the same as for adult frogs and toads. So for each site tadpole and egg numbers were included with adults.

Average size (cm) of amphibians present

TABLE:1

	A	B	C	D	E	F	G
1		Tuesday	Bolger	BogPot	VP#11	VP#24	VP#27
2	clamitans, 6/8/88	3.62+/- .089					
3	clamitans, 6/21/88	3.98+/- .16				5.28+/- .8	
4	clamitans, 7/14/88	4.53+/- .24	4.63+/- .2	5.06+/- .20		4.68+/- .31	3.95+/- .22
5	septentrionalis, 6/7/88						5.33+/- .11
6	septentrionalis, 7/14/88	4.07+/- .1	4.46+/- .1.1	4.32+/- .12			5.73+/- .29
7	pipiens, 7/14/88			3.72+/- .099	5.7+/- .13		6.5+/- .37
	crucifer, 7/14/88					1.1+/- .005	

The mating habits observed were not significant.

SIZE DIFFERENCES CORRELATIONS

The average sizes and the standard error of the mean for several species grouped by lake and date are given (table 1). These groups were then examined by a one way ANOVA and a Fischer LSD. The results of these tests reveal a significant difference between the size of *R. clamitans* on 7/14/88 in Bogpot and Vernal Pond #27. There was also a significant difference between *R. clamitans* in Tuesday.

In addition there were significant differences between *septentrionalis* on 7/14/88 in Vernal Pond #27 and Tuesday, between *R. pipiens* in Vernal Pond #27 and Bog Pot, between *pipiens, septentrionalis, and clamitans* on 7/14/88 in Bog Pot, and between *clamitans, pipiens, and septentrionalis* in Vernal Pond #27 on 7/14/88.

DISCUSSION

Two of the three main objectives of this study were realized. The first was the determination of the amphibian species present at UNDERC. The species include *Rana pipiens, R. sylvatica, R. septentrionalis, R. clamitans, R. palustris, R. catesbeiana, Hyla crucifer, H. versicolor, P. triseriata, Bufo americanus, B. woodhousei fowleri,* and *N. viridescens*. By far, *R. clamitans* was the most abundant species followed by *R. septentrionalis* and *R. pipiens*. I am confident that all these species are

present at UNDERC. However, because of the limitations in my survey I think that there are several species of amphibians present which escaped capture and subsequently were not included in this study. Especially included in this category would be salamanders because the environment at UNDERC seems very well suited for them. So, although I am fairly certain that the organisms I have listed are present at UNDERC and equally certain that other organisms are present which are not listed.

The survey of Amphibians present at UNDERC leads to some interesting conjectures. For instance, the presence of *R. clamitans* in almost every lake can be a clue to its makeup. It would seem that *R. clamitans* is well suited to a variety of environments. This is borne out by the green frogs dominance in Tuesday. *R. clamitans* is almost the only frog found in Tuesday. There could be two explanations for this: one, that the environment is too harsh to support other amphibians, or two, that the green frogs cannot be displaced by other species. I think it is probable the former because in many lakes *R. clamitans* is found along with many other species, thus proving it is not dominant over them. On the opposite end of the spectrum is the *Hyla* which was only found in one place, a vernal pond. Vernal ponds, by definition not very deep. Thus they lack some of the predators such as fish and snapping turtles found in lakes. They also contain immense vegetation which affords ample hiding places for the small *Hyla*. These small frogs would be quickly gobbled up by the predators in a large lake, showing why they are found only in a vernal pond.

However, I failed in my second objective which was to determine the breeding seasons for the organisms present. Not enough quality information was gathered to enable me to make an accurate assessment of the breeding seasons of the organisms present.

As for my third objective, I am able to propose several possible theories as to the significant differences in size. The differences in size of *R. clamitans* in Tuesday on 6/8/88, 6/21/88, and 7/14/88 can probable be attributed to the obvious fact that organisms grow with time. There is an equally obvious explanation for the differences in size between *R. clamitans*, *septentrionalis*, and *pipiens* in Vernal Pond*27 on 7/14/88. These differences can probable be attributed to natural differences in size between species.

Other size differences can probable be attributed to more subtle reasons. There are significant differences in size between *R. pipiens* and *R. septentrionalis* in vernal ponds and in bigger lakes. The frogs are bigger in the ponds. These is probable due to two factors. Like the *Hyla* these other two species probable also benefit from the lack of fish and turtles in vernal ponds. The lesser predation allows more organisms to survive and grow. Also there are probable more organisms(such as insects) in a vernal pond than in a lake. Thus, the increase in nutrients could also help account for the size difference.

Hopefully the information gathered in this study will be beneficial to later researchers both in formulating and carrying out their research.

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APPENDIX

BAY LAKE

SPECIES	SEX	LENGTH(cm)	DATE	STAGE
R. pipiens spotted			6/9/88	
B. americanus		2.2	7/14/88	

Table 1. Species present at Bay Lake

BOLGERBOG

A	B	C	D	E
SPECIES	SEX	LENGTH(cm)	DATE	STAGE
R. sylvatica		3.4	6/7/88	
R. septentrionalis		5.3	6/9/88	
R. septentrionalis		5.8	6/9/88	
R. septentrionalis		6.3	7/14/88	
R. septentrionalis		4.9	7/14/88	
R. clamitans		5.8	7/14/88	
R. clamitans		4.2	7/14/88	
R. clamitans		4.6	7/14/88	
R. clamitans		4.4	7/14/88	
R. clamitans		4.3	7/14/88	
R. clamitans		4.6	7/14/88	
R. clamitans		4.5	7/14/88	

Table 3. Species present at Bolger Bog

Rana pipiens, *R. sylvatica*, *R. septentrionalis*, *R. clamitans*, *R. palustris*, *R. catesbeiana*, *Hyla crucifer*, *H. versicolor*, *P. triseriata*, *Bufo americanus*, *B. woodhousei fowleri*, and *N. viridescens*. I am confident that all these species are present at UNDERC. However, because of the limitations in my survey I think that there are several species of amphibians present which escaped capture and subsequently were not included in this study. Especially included in this category would be salamanders because the environment at UNDERC seems very well suited for them. So, although I am fairly certain that the organisms I have listed are present at UNDERC and equally certain that other organisms are present which are not listed.

After determining the species present, my second main objective was to determine the best locations for capturing a particular organism. Figures 3-7 give an adequate picture of the location and numbers to be found there for several species.

However, I failed in my third objective which was to determine the breeding seasons for the organisms present.

Hopefully the information gathered in this study will be beneficial to later researchers both in formulating and carrying out their research.

ACKNOWLEDGEMENTS

I would like to thank the "Bev", Joanna and Kathleen, and the rest of the UNDERC class for their assistance in catching herps. I would like to

BOG POT

SPECIES	SEX	LENGTH(cm)	DATE	STAGE
<i>B.woodhousei fowleri</i>		5.8	6/29/88	
<i>R. clamitans</i>		4.9	6/29/88	
<i>R. clamitans</i>		5.2	6/29/88	
<i>R. clamitans</i>		6.8	7/14/88	
<i>R. clamitans</i>		5.4	7/14/88	
<i>R. clamitans</i>		5	7/14/88	
<i>R. clamitans</i>		6.1	7/14/88	
<i>R. clamitans</i>		7	7/14/88	
<i>R. clamitans</i>		6	7/14/88	
<i>R. clamitans</i>		6	7/14/88	
<i>R. clamitans</i>		4.6	7/14/88	
<i>R. clamitans</i>		5.8	7/14/88	
<i>R. clamitans</i>		5	7/14/88	
<i>R. clamitans</i>		4.5	7/14/88	
<i>R. clamitans</i>		4.8	7/14/88	
<i>R. clamitans</i>		4.4	7/14/88	
<i>R. clamitans</i>		5	7/14/88	
<i>R. clamitans</i>		3.5	7/14/88	
<i>R. clamitans</i>		5	7/14/88	
<i>R. clamitans</i>		4.5	7/14/88	
<i>R. clamitans</i>		4.5	7/14/88	
<i>R. clamitans</i>		3.8	7/14/88	
<i>R. clamitans</i>		3.6	7/14/88	
<i>R.septentrionalis</i>		4.8	7/14/88	
<i>R.septentrionalis</i>		4	7/14/88	
<i>R.septentrionalis</i>		4	7/14/88	
<i>R.septentrionalis</i>		5	7/14/88	
<i>R.septentrionalis</i>		4.3	7/14/88	
<i>R.septentrionalis</i>		4	7/14/88	
<i>R.septentrionalis</i>		4.4	7/14/88	
<i>R.septentrionalis</i>		4.1	7/14/88	
<i>R.septentrionalis</i>		4.3	7/14/88	
<i>R. pipiens</i>		3.8	7/14/88	
<i>R. pipiens</i>		3.5	7/14/88	XXIII
<i>R. pipiens</i>		4.2	7/14/88	
<i>R. pipiens</i>		3.8	7/14/88	
<i>R. pipiens</i>		3.6	7/14/88	
<i>R. pipiens</i>		3.4	7/14/88	
<i>R. pipiens</i>		3.8	7/14/88	
<i>R.palustris spotted</i>			7/14/88	

Table 2. Species present at Bog Pot

FIRESTONE LAKE

A	B	C	D	E
SPECIES	SEX	LENGTH(cm)	DATE	STAGE
R. pipiens		5.8	6/26/88	
R. pipiens		5.6	6/26/88	
R. catesbeiana		4.1	6/26/88	
R. clamitans		4.1	6/26/88	

Table 4. Species present at Firestone

KICKAPOO LAKE

SPECIES	SEX	LENGTH(cm)	DATE	STAGE
R. pipiens		7.4	6/7/88	
R. pipiens		6.7	6/7/88	
R. septentrionalis		6.2	6/9/88	
R. clamitans		6.8	6/26/88	
nothing found	on	other shores	6/26/88	
R. catesbeiana			6/29/88	XXIII
N. viridescens		7	7/5/88	
NOTHING			7/11/88	

Table 5. Species present at Kickapoo

PAUL LAKE

SPECIES	SEX	LENGTH(cm)	DATE	STAGE
R. clamitans		5.8	6/7/88	

Table 6. Species present at Paul

VERNAL POND #9

SPECIES	SEX	LENGTH(cm)	DATE	STAGE
R. septentrionalis		5.5	6/27/88	

Table 8. Species present at VP# 9.

VERNAL POND #11

SPECIES	SEX	LENGTH(cm)	DATE	STAGE
Rana pipiens		5.9	6/9/88	
Rana pipiens		5.7	6/9/88	
Rana pipiens		5.8	6/9/88	
Rana pipiens		5.9	6/9/88	
Rana pipiens		5.2	6/9/88	
R.septentrionalis		5.7	6/9/88	
R.septentrionalis		5.8	6/9/88	
R.septentrionalis		3.8	6/9/88	XXIII
R. catesbeiana		7.6	6/9/88	
R. catesbeiana		7.8	6/9/88	
R.septentrionalis		5.5	6/27/88	
R.clamitans		6.8	6/27/88	

Table 9. Species present at VP# 11

TUESDAY LAKE

SPECIES	SEX	LENGTH(cm)	DATE	STAGE
R. clamitans		3.6	6/8/88	XXIV
R. clamitans		3.6	6/8/88	XXIV
R. clamitans		3.6	6/8/88	XXII
R. clamitans		3.6	6/8/88	XX
R. clamitans		3.5	6/8/88	XX
R. clamitans		3.4	6/8/88	XXI
R. clamitans		4.5	6/8/88	XXIV
R. clamitans		3.8	6/8/88	XXIII
R. clamitans		3.8	6/8/88	XXIV
R. clamitans		3.4	6/8/88	XXII
R. clamitans		3.4	6/8/88	XXI
R. clamitans		3.3	6/8/88	XXI
R. clamitans		3.2	6/8/88	XXI
R. clamitans		3.4	6/8/88	XXII
R. clamitans		4.6	6/8/88	XXIV
R. clamitans		3.2	6/8/88	XXII
R. clamitans		3.7	6/8/88	XXIV
R. clamitans		3.7	6/21/88	
R. clamitans		4	6/21/88	XXIV
R. pipiens spotted			6/21/88	
R. clamitans		4.3	6/21/88	XXIV
R. clamitans		3.6	6/21/88	XXIV
R. clamitans		3.7	6/21/88	XXIV
R. clamitans		5.2	6/21/88	
R. clamitans		7.1	6/21/88	
R. clamitans		3.8	6/21/88	XXIV
R. clamitans		3.7	6/21/88	
R. clamitans		3.8	6/21/88	XXIV
R. clamitans		3.9	6/21/88	XXIV
R. clamitans		6.7	6/21/88	
R. clamitans		3.1	6/21/88	
R. clamitans		3.6	6/21/88	XXIV
R. clamitans		7.1	6/21/88	
R. clamitans		3.8	6/21/88	XXIV
R. clamitans		3.8	6/21/88	XXIV
R. clamitans		3.2	6/21/88	XXIII
R. clamitans		3.8	6/21/88	XXIII
R. clamitans		3.7	6/21/88	XXIV
R. clamitans		3.1	6/21/88	XXIV
R. clamitans		3.6	6/21/88	XXIII
R. clamitans		3.7	6/21/88	XXIV
R. clamitans		3.5	6/21/88	XXIV
R. clamitans		3.6	6/21/88	XXIV
R. clamitans		3.4	6/21/88	XXIII
R. clamitans		3.4	6/21/88	XXI

Table 7. Species present at Tuesday Lake

TUESDAY LAKE

R. clamitans		3.1	6/21/88	XXI
R. clamitans		3.5	6/21/88	XXI
R. clamitans		3.2	6/21/88	XXI
R. clamitans		3.4	6/21/88	XXI
B. americanus		1	6/21/88	
R. clamitans		3.9	6/21/88	XXIV
R. clamitans		3.5	6/21/88	XXIII
R. clamitans		3.8	6/21/88	
R. clamitans		4.8	6/21/88	
R. clamitans		5.3	6/21/88	
R. clamitans		3.4	6/21/88	XXIV
R. clamitans		3.8	6/21/88	XXI
R. clamitans		3.6	6/21/88	XXI
R. pipiens		6.3	6/21/88	
R. clamitans		5.9	6/27/88	
R. clamitans		3.8	7/14/89	
R. clamitans		4.4	7/14/89	
R. clamitans		6.9	7/14/89	
R. clamitans		7.6	7/14/89	
R. clamitans		7.2	7/14/89	
R. clamitans		6.5	7/14/89	
R. clamitans		6.5	7/14/89	
R. clamitans		3.8	7/14/89	
R. clamitans		4	7/14/89	
R. clamitans		7.8	7/14/89	
R. clamitans		9	7/14/89	
R. clamitans		9	7/14/89	
R. clamitans		3.7	7/14/89	
R. clamitans		4.4	7/14/89	
R. clamitans		4.3	7/14/89	
R. clamitans		4.3	7/14/89	
R. clamitans		3.8	7/14/89	
R. clamitans		4.1	7/14/89	
R. clamitans		3.7	7/14/89	
R. clamitans		3.9	7/14/89	
R. clamitans		4.1	7/14/89	
R. clamitans		4.3	7/14/89	
R. clamitans		4	7/14/89	
R. clamitans		4.2	7/14/89	
R. clamitans		3	7/14/89	
R. clamitans		3.6	7/14/89	
R. clamitans		4	7/14/89	
R. clamitans		4	7/14/89	
R. clamitans		3.4	7/14/89	
R. clamitans		3.9	7/14/89	
R. clamitans		3.8	7/14/89	

TUESDAY LAKE

R. clamitans		3.6	7/14/89	
R. clamitans		3.2	7/14/89	
R. clamitans		3.6	7/14/89	
R. clamitans		3.9	7/14/89	
R. clamitans		3.5	7/14/89	
R. clamitans		3.7	7/14/89	
R. clamitans		4.2	7/14/89	
R. clamitans		3.8	7/14/89	
R. clamitans		3.8	7/14/89	
R. clamitans		3.6	7/14/89	
R. clamitans		3.3	7/14/89	
R. clamitans		3.9	7/14/89	
R. pipiens		4.9	7/14/89	
R. pipiens		4.5	7/14/89	
R. septentrionalis		4.5	7/14/89	
R. septentrionalis		3.9	7/14/89	XXIII
R. septentrionalis		4.3	7/14/89	
R. septentrionalis		4	7/14/89	
R. septentrionalis		4.2	7/14/89	
R. septentrionalis		3.8	7/14/89	
R. septentrionalis		3.8	7/14/89	XXIII

vernal pond #24

SPECIES	SEX	LENGTH(cm)	DATE	STAGE
EGGS & TADPOLES			6/7/88	
NONE SITED			6/8/88	
RANA CLAMITANS		9.3	6/20/88	
RANA CLAMITANS		4.6	6/20/88	
RANA CLAMITANS		4.4	6/20/88	
RANA CLAMITANS		4.5	6/20/88	
RANA CLAMITANS		4.3	6/20/88	
RANA CLAMITANS		4.6	6/20/88	
HYLA CRUCIFER		1.8	6/20/88	XXIV
HYLA CRUCIFER		1.4	6/20/88	XXIII
HYLA CRUCIFER		1.4	6/20/88	XXIV
RANA CLAMITANS		5.5	7/14/88	
RANA CLAMITANS		5.4	7/14/88	
RANA CLAMITANS		4.7	7/14/88	
RANA CLAMITANS		5.1	7/14/88	
RANA CLAMITANS		5	7/14/88	
RANA CLAMITANS		3.6	7/14/88	
RANA CLAMITANS		3.5	7/14/88	
P. TRISERIATA		1.7	7/14/88	
HYLA CRUCIFER		1.3	7/14/88	
HYLA CRUCIFER		1.3	7/14/88	
HYLA CRUCIFER		0.8	7/14/88	
HYLA CRUCIFER		1	7/14/88	
HYLA CRUCIFER		1.2	7/14/88	
HYLA CRUCIFER		1.1	7/14/88	XXIII
HYLA CRUCIFER		1.1	7/14/88	XXIII
HYLA CRUCIFER		1.1	7/14/88	XXIII
HYLA VERSICOLOR		4	7/14/88	

Table 10. Species present at VP# 24

VERNAL POND #27

SPECIES	SEX	LENGTH(cm)	DATE	STAGE
R. septentrionalis		4.9	6/7/88	
R. septentrionalis		5.6	6/7/88	
R. septentrionalis		5.4	6/7/88	
R. septentrionalis		5.2	6/7/88	
R. sylvatica		4.2	6/7/88	
R. sylvatica	male	5	6/7/88	
R. pipiens		5.4	6/7/88	
Bufo americanus		3.4	6/7/88	
R. septentrionalis		5.6	6/8/88	
R. septentrionalis		5.3	6/8/88	
R. sylvatica		4	6/8/88	
R. clamitans		3	7/14/88	
R. clamitans		7.5	7/14/88	
R. clamitans		4	7/14/88	
R. clamitans		4.2	7/14/88	
R. clamitans		4.4	7/14/88	
R. clamitans		3.5	7/14/88	
R. clamitans		3.5	7/14/88	
R. clamitans		3.8	7/14/88	
R. clamitans		2.9	7/14/88	
R. clamitans		4	7/14/88	
R. clamitans		4.5	7/14/88	
R. clamitans		3.8	7/14/88	
R. clamitans		3.7	7/14/88	
R. clamitans		4.2	7/14/88	
R. clamitans		3.3	7/14/88	
R. clamitans		3.5	7/14/88	
R. clamitans		3.7	7/14/88	
R. clamitans		3.5	7/14/88	
R. clamitans		3.3	7/14/88	
R. pipiens		5.8	7/14/88	
R. pipiens		6.9	7/14/88	
R. pipiens		6.9	7/14/88	
R. septentrionalis		5.2	7/14/88	
R. septentrionalis		5.3	7/14/88	
R. septentrionalis		6.4	7/14/88	
R. septentrionalis		6	7/14/88	

Table 11. Species present at VP #27

WARD LAKE

SPECIES	SEX	LENGTH(cm)	DATE	STAGE
R.septentrionalis		4.4	6/26/88	XXIII
R.septentrionalis		4.6	6/26/88	XXIII
R.septentrionalis		4.3	6/26/88	
R. clमितans		6	6/27/88	
R. clमितans		8.1	6/27/88	
R. clमितans		4.8	6/27/88	

Table 12. Species present at Ward