

**THE AMPHIBIAN COMMUNITY OF THE SARATOGA BATTLEFIELD - SPRING, 2001
SIENA COLLEGE BIOLOGY AND ENVIRONMENTAL STUDIES SEMINAR GROUP^{1,2}**

For the past decade, scientists have been concerned over losses of populations and species of amphibians all over the world. This apparent global decline makes it important to document existing patterns of species distribution and abundance, and to collect long-term records capable of detecting changes in those patterns. In addition, our desire to conserve amphibian species richness is hampered by a relatively poor understanding of patterns of habitat usage by these organisms. Successful conservation efforts will require preservation of complex landscapes that include all features needed to support local populations. To do this we must first understand seasonal and ontogenetic changes in habitat use.

These issues were addressed on the Saratoga National Historical Park (aka Battlefield). The Park includes about 2500 acres of relatively natural habitat stretching from the Hudson River (elevation approximately 90 ft.) upslope into the hills to the west to an elevation of about 350 ft. The site includes a range of habitat features including the River's floodplains, the Old Champlain Canal, and a variety of upland wetlands ranging from streams to wooded vernal pools to permanent ponds. In addition to their mission to interpret the historical significance of the Battlefield, the staff of the Park recognize their role in maintaining and understanding the biological community that inhabits the site. They support biological research, including herpetological inventories that were conducted this year in conjunction with Wildlife Conservation Society (WCS).

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² A list of project participants is included as Appendix A.

In an attempt to contribute to these efforts, we conducted a variety of activities at the Park in the spring of 2001. Because of the constraints of the academic calendar, we restricted our efforts to studying the spring-breeding frog community, along with those salamanders (family Ambystomatidae) that have life histories similar to frogs. Our measurements were designed, in conjunction with data collected by WCS, to address three primary questions:

- What species are present on the site?
- What are their population densities?
- What is their distribution in time and space?

The first two questions addressed the hypothesis that the amphibian community at the site is stable through time, or alternately, the hypothesis that species richness and/or population densities are decreasing as part of the global pattern of decline. If sufficient historical data existed for comparison to those we collected, it might have been possible to reach conclusions about community status at the end of this study. We reviewed the historical data with park staff to see if this hypothesis could be immediately tested, but concluded that existing data were not sufficient to establish past community composition or population densities. We hope the data collected this year will allow for future determination of population and community trends.

The third question addressed both spatial and temporal aspects of amphibian conservation. One spatial pattern of interest is seasonal movements between spring breeding sites and summer home ranges. Any successful preserve must clearly include both. However, if we are able to add a multi-year perspective to these studies, we are

particularly interested in testing the hypothesis that frog populations on this landscape function as metapopulations. We imagine that the floodplains along the Hudson River must represent a stable breeding habitat resource, while the temporary wetlands upslope might be more subject to periodic drying. Thus the upslope populations might be viewed as “sinks”, more likely to undergo local extinction in dry years, which would then require repopulation by immigrants from the “source” population in the floodplains. Such metapopulation dynamics would have additional implications for amphibian conservation on this and other sites.

Methods.

The following measurements were taken during the 2001 spring breeding season. Some were designed to augment measurements being taken by WCS, while others were independent. There was not a one-to-one correspondence between methods and research questions. Most methods addressed more than one question, and all questions required multiple methods. However, we believe that this combination of activities maximized the collection of useful information while minimizing duplication of effort between WCS and Siena.

Several standard pieces of information were collected as a routine part of all calling surveys, time-constrained searches, and road transects. These were date, location, weather conditions, wind speed (0 = <1mph, smoke rises vertically; 1 = 1-3mph, smoke drifts; 2 = 4-7mph, wind felt on face; 3 = 8-12mph, wind extends small flag; 4 = 13-18mph, strong wind raises dust and paper), wet and dry bulb temperatures on a sling psychrometer, and time. In addition, sound pressure level was recorded with a realistic SPL meter for calling surveys and time constrained searches; and condition of the road

surface (wet/dry) was recorded for road transects. A table showing which methods were conducted in which ponds is located in Appendix B.

Pond calling surveys. These surveys supplemented but did not replicate the surveys described in the WCS workplan. We followed the NAAMP protocol (U.S. Geological Survey, North American Amphibian Monitoring Program). Summarized briefly, calling survey teams arrived at the observation point, allowed exactly one minute for the chorus to recover from the disturbance of their arrival, and then listened to the chorus for three minutes. If the observers judged that the chorus was interrupted (for example by traffic noise) during the three-minute sampling period, they had the option of listening for up to an additional two minutes. During the observation period, all species heard calling were assigned a calling index value of 1 (individuals could be counted; there was space between calls), 2 (individuals could be distinguished but there was overlap between calls), or 3 (full chorus, with calls continuous and overlapping). This data set gave us information on what species were present and breeding at what ponds. These surveys were not performed in ponds studied by WCS during weeks that WCS staff were on site.

Densities at breeding sites were estimated using two different methods. For *Rana sylvatica* (woodfrogs), and *Ambystoma maculatum* (spotted salamander), *egg clutch counts* were taken in the daylight during the week following breeding activity. These counts estimated the number of females that were breeding at each pond. Since our study was time constrained to April and early May, these were the only species whose entire breeding period was included in our sampling period. In some cases woodfrog egg clutches were located in inaccessible places in the pond. In order to estimate total

clutches under these conditions, we counted the number of egg masses on the surface of the water, and then multiplied by two. This multiplier was determined by counting surface and total egg clutches at other ponds where all egg masses were accessible.

For other species, we conducted *time constrained pond searches*. This method replicated that described in the WCS workplan. The pond was visually searched for 30 minutes with the search path chosen to maximize encounters, and the number of individuals of all species seen was noted

Night-driving transect. This method took advantage of the tour road that traverses much of the Park in order to identify main travel corridors of amphibian migration. The entire tour road was driven slowly (~ 10 mph) at the beginning of the evening on every night that the road surface was wet. Whenever an amphibian was seen in the road, the observers stopped the car, identified the amphibian to species, and recorded the direction it was moving and its exact location along the road. Directions were taken with a compass. Locations were marked with flagging tape that was retrieved during the daylight. We initially attempted night-driving transects on Routes 4 and 32, but discontinued them because of excessive traffic.

In total, data were collected for 30 days during the months of April and May, 2001. Calling counts were performed on 20 of those nights, pond time constrained searches on 10 nights, night driving occurred on 6 nights. Egg clutch counts were taken during 3 daylight searches.

Results.

The following species were found on the Saratoga National Historical Park during spring 2001: *Pseudacris crucifer* (Spring peeper), *Rana sylvatica* (Wood frog), *Rana*

pipiens (Leopard frog), *Rana catesbeiana* (Bullfrog), *Rana clamitans* (Green frog), *Hyla versicolor* (Gray treefrog), *Bufo americanus* (American toad), *Ambystoma maculatum* (spotted salamander), *Notophthalmus viridescens* (Red-spotted newt). By combining data from calling counts, time-constrained searches, and clutch counts, we generated an overview of which species used which ponds (Table 1).

Pseudacris crucifer had the most wide-spread breeding range, being found in all ponds studied. *Notophthalmus viridescens*, with its fully aquatic adults, was observed in only two ponds. Most ponds on the site had a diverse range of inhabitants. There were no readily apparent subsets of species that tended to be found together or to avoid other species.

A question of interest was what determines when breeding activity starts at a given pond. The simplest hypothesis is that certain areas of the landscape thaw out first in the spring, and that each species has some combination of temperature and rainfall cues that triggers its breeding migration at some point after that. In that case, we might expect to see a consistent order in which ponds get used by the different species. We tested that idea using the four species that bred early enough to be sure we observed their arrival at all sites they were going to use, *Pseudacris crucifer*, *Rana sylvatica*, *Rana pipiens*, and *Bufo americanus*. *Pseudacris crucifer* and *Rana sylvatica* were the first species that began calling on April 9th, followed by *Rana pipiens* on April 12, and then *Bufo americanus* on April 18 (Fig. 1). *Rana sylvatica* and *Pseudacris crucifer* did appear to follow a similar pattern of pond order, generally the order in which the ponds began to melt. However, the later species did not follow this same pattern. Perhaps the melting

snow triggers the breeding behavior of the early species, but the later breeding species use some other cue.

Four major areas of movement were detected from data taken driving the tour road (Fig. 2). These four areas correspond most closely to the stop 1 pond, the service road pond, beaver pond, and the stop 8 area. These data are relatively few, probably because of the dry spring and the paucity of wet nights. Although we did observe movement of all species, we did not consider the data set sufficient to draw conclusions.

The egg clutch counts that were taken for *Rana sylvatica* and *Ambystoma maculatum* gave us an estimate of the number of females of those species breeding at each pond. A total of 530 *R. sylvatica* and 56 *A. maculatum* clutches were observed. The ponds and vernal pools of the stop 8 area had the largest number of clutches for both species, although most ponds on the site had some clutches (Table 2).

Time-constrained searches provided information on the relative densities of the other species of frogs on the site. The maximum number of individuals of each species recorded at each pond is given in Table 3. By way of contrast, the highest level of calling index recorded for each species in each pond is also shown in Table 3. It was obvious from the sound levels that the time-constrained searches frequently included only a very small proportion of the individuals that were present in the pond.

Discussion.

The Saratoga National Historical Park appears to have a good complement of native amphibians on site. Although we do not have historical records capable of establishing a known baseline, all species that we would have expected to see in this area were seen. There were no obvious omissions from the spring-breeding amphibian

community of the upper Hudson Valley, so it does not seem likely that extinctions have occurred in this community.

We are less confident in drawing conclusions about patterns in population density. We collected good density information only for *Rana sylvatica* and *Ambystoma maculatum*, those species that both breed early and leave readily quantifiable egg clutches. For these, we are confident that our results accurately reflect the number of females that bred in the study ponds this spring. However, we are concerned that this number might not be a good representation of the total population in this particular year because of the extreme dryness during the month of April. Typically April features several wet nights when major breeding migrations occur. This year our driving transects did not include such a night. Therefore we do not know whether all the females eventually moved to the ponds and our data reflect the entire populations, or whether some portion of the females in the populations did not breed this year. Only additional years' worth of data will reveal whether this year was anomalous.

We are less confident that our density estimates on the other species are meaningful. The time-constrained searches did not seem to yield visual encounters that obviously correlated to the sound intensity of the surrounding chorus. We are interested in exploring the possibility that other methods, such as sound pressure level or auditory transects, would yield more useful estimates.

Our results on the temporal use of ponds by different species revealed that a single pattern does not explain the arrival of all species. It seems likely that this results either from the use of different cues for migration, or differential dispersal and habitat use relative to the breeding ponds. It is also possible that the abnormally dry weather

discussed above simply interfered with normal timing of migration. This topic will require further study. Likewise, our data on spatial distribution and migration routes of various species were hurt by the weather patterns and are inconclusive.

This study was conceived as the first year of a long-term study. We hope that the data taken this year on species presence, population densities, and distribution in time and space will serve as the basis for future study that will allow a more complete understanding of the biology of the amphibian community at the Saratoga National Historical Park.

Siena College
Saratoga Battlefield
Species found at every pond

Spring 2001

	Species								
	<i>Pseudacris crucifer</i>	<i>Rana sylvatica</i>	<i>Rana pipiens</i>	<i>Rana catesbeiana</i>	<i>Rana clamitans</i>	<i>Hyla versicolor</i>	<i>Bufo americanus</i>	<i>Ambystoma maculatum</i>	<i>Notophthalmus viridescens</i>
Pond									
Stop 1	X	X	X	X	X	X	X	X	X
Service road	X	X		X	X	X	X	X	
Beaver	X	X	X	X	X		X	X	X
Stop 2	X	X	X	X	X				
Stop 8 East	X	X		X	X	X		X	
Stop 8 west	X	X		X	X		X		
Stop 8 Woods	X	X			X	X		X	
Stop 8 Roadside	X	X		X				X	
Stop 8 Fern Field	X	X		X	X	X	X	X	
Davidson	X		X		X		X		
Burdyl	X	X		X	X	X	X		
River Road	X	X	X	X	X	X	X		
Canal Below Stop 10	X	X	X		X	X	X		
Vly	X	X	X			X	X		
Canal South of Entrance	X		X				X		

Table 1: This table lists what species were using what ponds on the site. These data are based on the calling counts, pond time constrained searches, and egg clutch counts. No single pond had an occurrence of every species.

Siena College
Saratoga Battlefield
Egg clutch counts

Spring 2001

	<u>Species</u>	
Pond	<i>Rana</i>	<i>Ambystoma</i>
	<i>sylvatica</i>	<i>maculatum</i>
Stop 1	119	2
Service road	174*	0
Beaver	2	12
Stop 2	0	0
Stop 8 East	60	12
Stop 8 west	67*	6
Stop 8 Woods	126	15
Stop 8 Roadside	89	3
Stop 8 Fern Field	129	4
Davidson	0	0
Burdyi	2	2
River Road	2	0
Canal Below Stop 10	0	0
Vly	1	0
Canal South of Entrance	0	0
total for each species	530	56

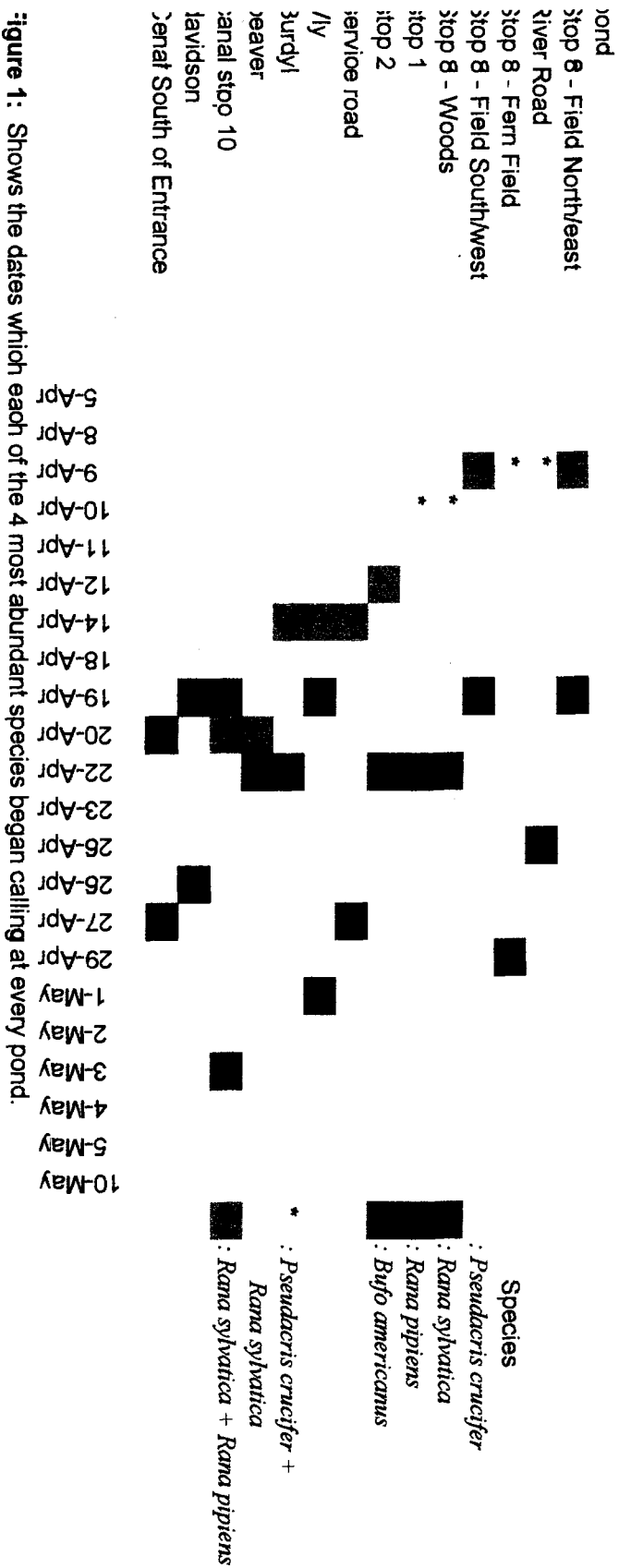
*= Estimation

Table 2: This table lists the egg clutch counts taken on the site. The largest clutches, which signifies the most breeding, were found in the stop 8 area. Each clutch represents one female frog at that pond, and gives us an over all estimation of the number of females at that pond

Pond	Species		<i>Rana</i> <i>pipiens</i>	<i>Rana</i> <i>caesabellana</i>	<i>Rana</i> <i>clamitans</i>	<i>Hyla</i> <i>versicolor</i>	<i>Bufo</i> <i>americanus</i>	<i>Ambystoma</i> <i>maculatum</i>	<i>Notophthalmus</i> <i>viridescens</i>
	<i>Pseudacris</i> <i>crucifer</i>	<i>Rana</i> <i>sylvatica</i>							
Stop 1	17 (3)	10 (3)	0 (1)	2	0 (1)	0 (3)	0 (1)	1	1
Service road	31* (3)	0 (3)	0	4	3 (1)	0 (3)	0 (1)	1	
Beaver	0 (3)	0 (2)	17 (1)	1 (1)	2 (1)	0	11 (2)	5	9
Stop 2	0 (3)	0 (2)	0 (1)	0 (1)	0	0	0		
Stop 8 East	3 (3)	0 (3)	0	1	0 (1)	0 (1)	0	1	
Stop 8 west	7 (3)	3 (3)	0	1	1 (1)	0	0 (1)		
Stop 8 Woods	9 (3)	0 (3)	0	0	0 (1)	0 (1)	1 (1)		
Stop 8 Roadside	26	7	0	1	0	0	0	2	
Stop 8 Fern Field	20 (3)	7 (3)	0	1	14 (2)	0 (1)	3 (1)		
Davidson	0 (3)	0	0 (2)	0 (1)	1	0	0 (1)		
Burdyl	1 (3)	0 (1)	0	6 (1)	4 (1)	0 (1)	0 (2)		
River Road	1 (3)	0 (2)	0 (3)	1 (1)	0 (2)	0 (2)	0 (2)		
Vly	0 (3)	0 (3)	0 (2)	0	0	0 (1)	0 (3)		

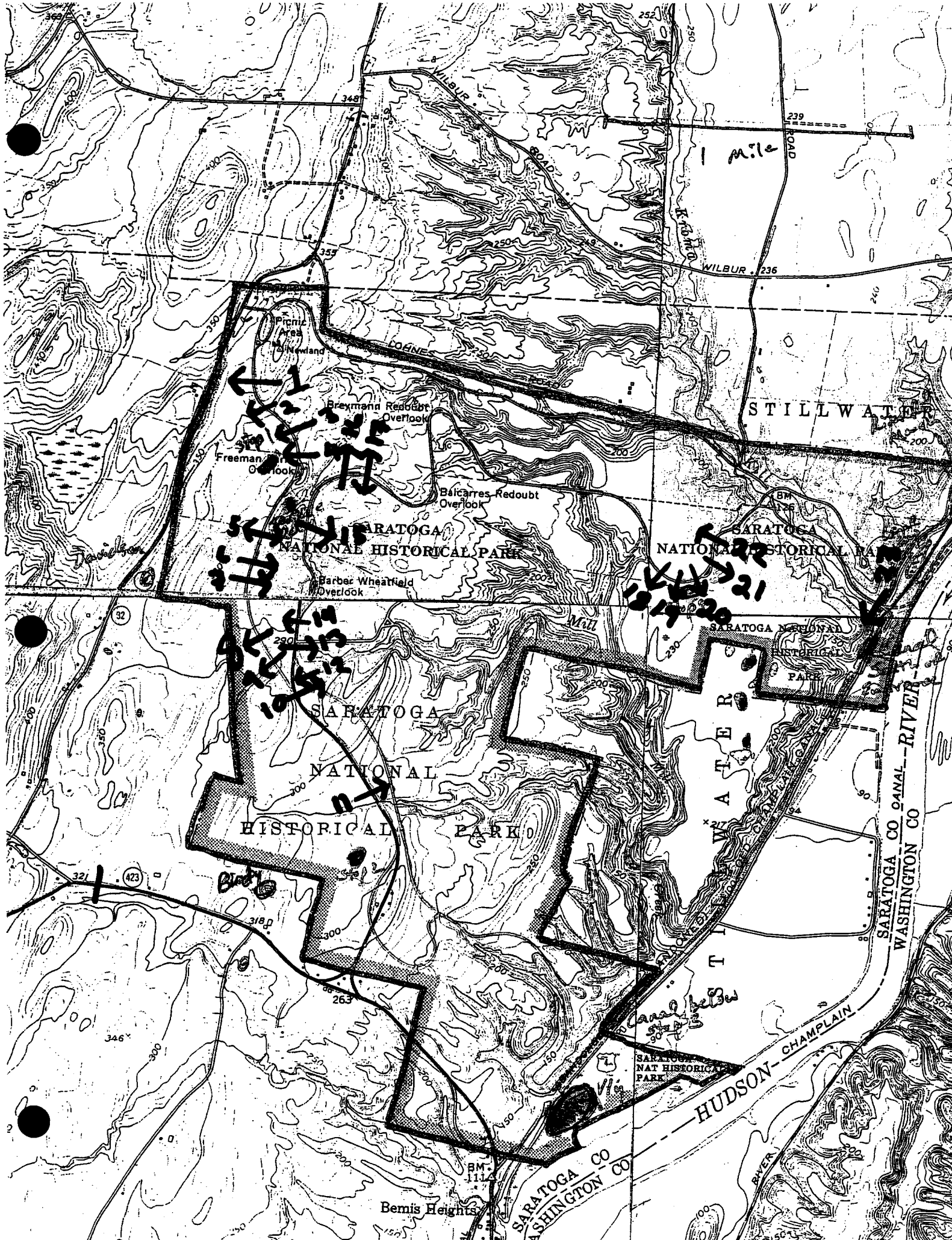
* 5 emplexed pairs

Table 3: This table shows the maximum number of individual frogs of each species observed during time constrained searches. This provides density information for the other species that egg clutch were unable to be taken on. The numbers in parenthesis is the maximum calling index for that species in that particular pond.



<u>Arrow Number</u>	<u>Species observed</u>
1	1 male and 1 female <i>Pseudacris crucifer</i>
2	1 male <i>Pseudacris crucifer</i>
3	2 male <i>Rana sylvatica</i>
4	1 male and 1 female <i>Pseudacris crucifer</i> 1 male <i>Rana sylvatica</i>
5	2 female <i>Rana sylvatica</i>
6	1 male <i>Rana sylvatica</i>
7	1 male <i>Pseudacris crucifer</i>
8	1 female <i>Rana catesbeiana</i>
9	1 male <i>Bufo americanus</i>
10	2 male <i>Pseudacris crucifer</i>
11	1 male and 1 female <i>Rana sylvatica</i>
12	1 male <i>Rana catesbeiana</i>
13	1 female <i>Rana catesbeiana</i>
14	1 <i>Rana clamitans</i>
15	2 male <i>Hyla versicolor</i>
16	1 male <i>Rana sylvatica</i> 1 male and 1 female <i>Pseudacris crucifer</i>
17	1 female <i>Pseudacris crucifer</i> 4 female <i>Rana sylvatica</i>
18	2 female <i>Rana clamitans</i> 1 female <i>Rana catesbeiana</i>
19	1 male <i>Hyla versicolor</i>
20	2 female <i>Bufo americanus</i>
21	1 male <i>Pseudacris crucifer</i>
22	1 male <i>Bufo americanus</i>
23	1 female <i>Rana pipiens</i>

Figure 2: This shows the species migration patterns throughout the Battlefield. Major areas of movement were observed around stop 1, beaver pond, and the stop 8 area.



Appendix A. Siena students who participated in this project, Spring term 2001

Justin Britcher

Matt Calacone

Katrina Howie

Jared Lendrum

John Loz

Sean Mahar

Ryan Miller

Laurie Reagan

Melissa Riehl

Matt Sauer

Dana Strang

Appendix B

Siena College
Saratoga Battlefield
Methods Used

Spring 2001

<u>Pond</u>	<u>Methods Used</u>		
	<u>Call</u> <u>Count</u>	<u>Time Constrained</u> <u>Searches</u>	<u>Egg clutch</u> <u>Counts</u>
Stop 1	x	x	x
Service road	x	x	x
Beaver	x	x	x
Stop 2	x	x	x
Stop 8 East	x	x	x
Stop 8 west	x	x	x
Stop 8 Woods	x	x	x
Stop 8 Roadside		x	x
Stop 8 Fern Field	x	x	x
Davidson	x	x	x
Burdyl	x	x	x
River Road	x	x	x
Canal Below Stop 10	x		
Vly	x	x	
Canal South of Entrance	x		

Appendix B

**Siena College
Saratoga Battlefield
Methods Used**

Spring 2001

Methods Used

<u>Pond</u>	<u>Call</u>	<u>Time Constrained</u>	<u>Egg clutch</u>
	<u>Count</u>	<u>Searches</u>	<u>Counts</u>
Stop 1	x	x	x
Service road	x	x	x
Beaver	x	x	x
Stop 2	x	x	x
Stop 8 East	x	x	x
Stop 8 west	x	x	x
Stop 8 Woods	x	x	x
Stop 8 Roadside		x	x
Stop 8 Fern Field	x	x	x
Davidson	x	x	x
Burdyl	x	x	x
River Road	x	x	x
Canal Below Stop 10	x		
Vly	x	x	
Canal South of Entrance	x		

Siena College
Saratoga Battlefield
Amphibian Calling Counts

Spring 2001

Pcnd : Davidson

Date	Temperature		Weather	Wind	Time	Species									
	Wet/Dry					<i>Pseudacris crucifer</i>	<i>Rana sylvatica</i>	<i>Rana pipiens</i>	<i>Rana catesbeiana</i>	<i>Rana clamitans</i>	<i>Hyla versicolor</i>	<i>Bufo americanus</i>			
5-Apr			Clear												
8-Apr	45/46		cloudy	2	10:30										
9-Apr	46/47		shower	3											
10-Apr	43/47		Partly cloudy	2	7:42										
11-Apr	45/53		cloudy	2	11:00										
12-Apr	49/52		cloudy	1	8:16										
14-Apr	43/54		Partly cloudy	3	10:12										
18-Apr	32/36		Clear	8.5	10:05	1									
19-Apr			Clear		9:36	2		1							
20-Apr	48/58		Partly cloudy	2	8:36	3									
22-Apr	66/68		Clear	4	8:14	3		2	*					*	
26-Apr	44/54		Clear	1	8:13	3		1							
27-Apr	53/61		Clear	1	9:40	1		1							1
29-Apr	45/56		Clear	3	8:58	1		1							
1-May	62/77		Clear	0	7:50										
2-May	64/78		Clear	0	10:55	2		1				1			
8-May	65/80		Clear	1	9:57	3		1							
4-May	65/78		Partly cloudy	2	8:30	2									1
5-May	48/55		Clear	8.5	9:55	3									
10-May	57/71		Partly cloudy	1	9:57	3									

Pcnd : Stop 1

Date	Temperature		Weather	Wind	Time	Species							
	Wet/Dry					<i>Pseudacris crucifer</i>	<i>Rana sylvatica</i>	<i>Rana pipiens</i>	<i>Rana catesbeiana</i>	<i>Rana clamitans</i>	<i>Hyla versicolor</i>	<i>Bufo americanus</i>	
5-Apr			Clear										
8-Apr	45/46		cloudy	2	8:17								
9-Apr	46/47		shower	3	8:15								
10-Apr	43/47		Partly cloudy	2	8:15	2	1						
11-Apr	45/53		cloudy	2	8:12	2							
12-Apr	49/52		cloudy	1	10:41	3	3						
14-Apr	43/54		Partly cloudy	3	8:15	3	3						
16-Apr	30/46		Cloudy	3	9:00	2	3						
19-Apr			Clear		8:05	3							
20-Apr	48/58		Partly cloudy	2	8:88	3	3						

Date	Temperature Wet/Dry	Weather	Wind	Time	Species <i>Pseudacris crucifer</i>	<i>Rana sylvatica</i>	<i>Rana Pipiens</i>	<i>Rana catesbeiana</i>	<i>Rana clamitans</i>	<i>Hyla versicolor</i>	<i>Bufo Americanus</i>
22-Apr	68/69	Clear	4	8:21	3	2	1		1		
26-Apr	62/76	Partly cloudy	2	8:80	3	1					
27-Apr	56/61	Clear	1	8:08	2						
29-Apr	45/56	Clear	3	9:21	3						
1-May	62/77	Clear	0	8:10	3						
2-May	84/79	Clear	0	7:57	3						
6-May	85/80	Clear	1	8:05	3					2	
4-May	85/79	Partly cloudy	2	8:45	2						
5-May	46/55	Clear	3.5	8:00	3				1		
10-May	57/71	Partly cloudy	1	8:27	3					3	

Pond : Service Road

Date	Temperature Wet/Dry	Weather	Wind	Time	Species <i>Pseudacris crucifer</i>	<i>Rana sylvatica</i>	<i>Rana Pipiens</i>	<i>Rana catesbeiana</i>	<i>Rana clamitans</i>	<i>Hyla versicolor</i>	<i>Bufo Americanus</i>
5-Apr		Clear									
8-Apr	45/46	cloudy	2	8:27							
9-Apr	46/47	shower	3	8:26							
10-Apr	48/47	Partly cloudy	2	3:21							
11-Apr	45/53	cloudy	2	3:20							
12-Apr	49/52	cloudy	1	10:37	1						
14-Apr	48/54	Partly cloudy	3	8:21	3	3					
16-Apr	38/46	Cloudy	3	9:00	2	1					
19-Apr		Clear		8:09	3						
20-Apr	43/58	Partly cloudy	2	8:37	2						
22-Apr	66/68	Clear	4	8:28	3	3					
23-Apr	62/74	Partly cloudy	4	9:15	3	1					
27-Apr	56/61	Clear	1	8:07	2						1
29-Apr	45/56	Clear	3	9:24	2						
1-May	62/77	Clear	0	8:14	3						
2-May	84/78	Clear	0	8:05	3						
3-May	65/30	Clear	1	8:10	3					1	
4-May	65/78	Partly cloudy	2	8:50	2					2	
5-May	48/55	Clear	3.5	8:05	3						
10-May	57/71	Partly cloudy	1	8:34	3				1	3	

Pond: Beaver

Date	Temperature Wet/Dry	Weather	Wind	Time	Species <i>Pseudacris crucifer</i>	<i>Rana sylvatica</i>	<i>Rana Pipiens</i>	<i>Rana catesbeiana</i>	<i>Rana clamitans</i>	<i>Hyla versicolor</i>	<i>Bufo Americanus</i>
5-Apr		Clear									
8-Apr	45/46	cloudy	2	8:36							
9-Apr	46/47	shower	3	8:45	*						

Date	Temperature	Wet/Dry	Weather	Wind	Time	Species	<i>Pseudacris</i>	<i>Rana</i>	<i>Rana</i>	<i>Rana</i>	<i>Rana</i>	<i>Hyla</i>	<i>Bufo</i>
10-Apr	43/47		Partly cloudy	2	8:27	1							
11-Apr	45/58		cloudy	2	8:30	1							
12-Apr	49/52		cloudy	1	10:30	1							
14-Apr	43/54		Partly cloudy	3	8:26	2							1
19-Apr			Clear		8:14	3							
20-Apr	48/53		Partly cloudy	2	8:43	3		*					
22-Apr	66/68		Clear	4	8:38	3		1		1			1
28-Apr	60/72		Partly cloudy	4	9:45	2		1					2
27-Apr	53/61		Clear	1	8:11								
29-Apr	45/56		Clear	3	9:27	1			1				
1-May	62/77		Clear	0	8:19	3							
2-May	64/78		Clear	0	8:20	3							
3-May	65/80		Clear	1	8:13	3							1
4-May	65/78		Partly cloudy	2	8:56	2							
5-May	46/55		Clear	3.5	8:10	2							
10-May	57/71		Partly cloudy	1	8:43	3							

Pond: Stop 2

Date	Temperature	Wet/Dry	Weather	Wind	Time	Species	<i>Pseudacris</i>	<i>Rana</i>	<i>Rana</i>	<i>Rana</i>	<i>Rana</i>	<i>Hyla</i>	<i>Bufo</i>
5-Apr			Clear										
3-Apr	46/43		cloudy	2	8:50								
9-Apr	46/47		shower	3	9:05								
10-Apr	43/47		Partly cloudy	2	8:40								
11-Apr	45/58		cloudy	2	8:45	1							
12-Apr	49/52		cloudy	1	10:24	3		1					
14-Apr	48/54		Partly cloudy	3	8:31	3		2					
19-Apr			Clear		8:24	3							
20-Apr	48/58		Partly cloudy	2	3:49	2		2					
22-Apr	66/68		Clear	4	8:38	3		1					
27-Apr	58/61		Clear	1	8:17	2							
29-Apr	45/56		Clear	3	9:32	1							
1-May	62/77		Clear	0	-					1			
2-May	64/78		Clear	0	-								
3-May	35/80		Clear	1	8:24	3							
4-May	35/78		Partly cloudy	2	9:03	2							
5-May	48/55		Clear	3.5	8:17								
10-May	57/71		Partly cloudy	1	8:50	3							

Pond: Stop 4

Temperature	Species	<i>Pseudacris</i>	<i>Rana</i>	<i>Rana</i>	<i>Rana</i>	<i>Hyla</i>	<i>Bufo</i>
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Date	Wet/Dry	Weather	Wind	Time	crucifer	<i>sylvatica</i>	<i>Pipiens</i>	<i>catesbeiana</i>	<i>clamitans</i>	<i>versicolor</i>	<i>Americanus</i>
5-Apr		Clear									
8-Apr	45/46	cloudy	2	9:05							
9-Apr	46/47	shower	3	9:38	1						
10-Apr	48/47	Partly cloudy	2	9:00	3*						
11-Apr	45/53	cloudy	2	9:02	3*						
12-Apr	49/52	cloudy	1	10:16	3*						
14-Apr	48/54	Partly cloudy	8	8:48	3*	2*					
19-Apr		Clear		8:38	3*						
20-Apr	48/58	Partly cloudy	2	8:57	3	1					
22-Apr	66/68	Clear	4	8:58	3	1	1				
27-Apr	58/81	Clear	1	8:25	2						1
29-Apr	45/56	Clear	3	9:48	1		1				
1-May	62/77	Clear	0	-							
2-May	64/78	Clear	0	-							
3-May	65/80	Clear	1	8:30	3						1
4-May	65/78	Partly cloudy	2	9:10	2						1
5-May	48/56	Clear	8.5	8:27	3						
10-May	57/71	Partly cloudy	1	8:57							

Pood: Stop 8 - Fern Field

Date	Temperature	Wet/Dry	Weather	Wind	Time	Species					
						<i>Pseudacris</i>	<i>Rana</i>	<i>Rana</i>	<i>Rana</i>	<i>Hyla</i>	<i>Bufo</i>
5-Apr			Clear								
8-Apr	45/46	cloudy	2	9:15							
9-Apr	45/47	shower	3	10:10	2		8				
10-Apr	48/47	Partly cloudy	2	9:17	3		8				
11-Apr	45/53	cloudy	2	9:23	3		8				
12-Apr	49/52	cloudy	1	9:55	3		8				
14-Apr	48/54	Partly cloudy	8	9:00	3		8				
19-Apr		Clear		8:40	3		1				
20-Apr	48/58	Partly cloudy	2	9:04	3		2				
22-Apr	66/63	Clear	4	9:08	8*		1		2		
27-Apr	53/61	Clear	1	8:38	2						
29-Apr	45/56	Clear	3	9:48	2						1
1-May	62/77	Clear	0	8:28	3						
2-May	64/78	Clear	0	8:55	3						
3-May	65/80	Clear	1	5:42	3						1*
4-May	66/78	Partly cloudy	2	9:17	2					1	
5-May	48/56	Clear	8.5	5:50	3						
10-May	57/71	Partly cloudy	1	9:08	1						

Pond: Stop 8 - Woods

Date	Temperature		Weather	Wind	Time	Species						
	Wet/Dry					<i>Pseudacris crucifer</i>	<i>Rana sylvatica</i>	<i>Rana clamitans</i>	<i>Rana catesbeiana</i>	<i>Rana versicolor</i>	<i>Bufo Americanus</i>	
5-Apr			Clear									
8-Apr	45/46		cloudy	2	9:19							
9-Apr	45/47		shower	3	10:31							
10-Apr	48/47		Partly cloudy	2	9:28	1	3*					
11-Apr	45/53		cloudy	3	9:39	1	3					
12-Apr	49/52		cloudy	3	9:48	3	3					
14-Apr	48/54		Partly cloudy	3	9:12	3						
19-Apr			Clear		8:44	3	2					
20-Apr	48/58		Partly cloudy	2	9:11	3	1					
22-Apr	86/68		Clear	4	9:07	3	2	1				
27-Apr	58/61		Clear	1	8:37	2						1
29-Apr	45/56		Clear	3	9:54	1						
1-May	82/77		Clear	0	8:32	3						1
2-May	84/78		Clear	0	9:10	3				1		1
3-May	85/80		Clear	2	8:49	3		1				1
4-May	85/78		Partly cloudy	2	9:25	2				1		
5-May	45/55		Clear	3.5	8:55	3*						
10-May	57/71		Partly cloudy	1	9:06	1						

Pond: Stop 8 - Field South/west

Date	Temperature		Weather	Wind	Time	Species						
	Wet/Dry					<i>Pseudacris crucifer</i>	<i>Rana sylvatica</i>	<i>Rana clamitans</i>	<i>Rana catesbeiana</i>	<i>Hyla versicolor</i>	<i>Bufo Americanus</i>	
5-Apr			Clear									
6-Apr	45/48		cloudy	2	9:34							
9-Apr	46/47		shower	3	10:50		2					
10-Apr	48/47		Partly cloudy	2	9:46	2	3					
11-Apr	45/53		cloudy	3	10:00	3	3					
12-Apr	49/52		cloudy	3	9:26	3	3					
14-Apr	48/54		Partly cloudy	3	9:21	3	3					
19-Apr			Clear		8:55	3	1				1	
20-Apr	48/58		Partly cloudy	2	9:23	8						
22-Apr	88/68		Clear	4	9:25	3	2					1
25-Apr	42/48		Clear	2	8:45	3						
27-Apr	58/61		Clear	1	8:45	2						
29-Apr	45/58		Clear	3	10:11				1			
1-May	82/77		Clear	0	8:45	3						
2-May	84/78		Clear	0	9:37	3						
3-May	85/80		Clear	2	8:58	3						

Date	Temperature		Weather	Wind	Time	Species					
	Wet/Dry					<i>Pseudacris crucifer</i>	<i>Rana sylvatica</i>	<i>Rana pipiens</i>	<i>Rana catesbeiana</i>	<i>Rana clamitans</i>	<i>Hyla versicolor</i>
4-May	65/78	Partly cloudy	2	9:35	2						
5-May	46/55	Clear	3.5	9:00	2						
10-May	57/71	Partly cloudy	1	9:16							
Pond: Stop 8 - Field North/east											
5-Apr		Clear									
8-Apr	45/46	cloudy	2	9:34			2				
9-Apr	46/47	shower	3	10:31							
10-Apr	43/47	Partly cloudy	2	9:43							
11-Apr	45/53	cloudy	3	10:00	1		3				
12-Apr	49/52	cloudy	3	9:30			2				
14-Apr	43/54	Partly cloudy	3	9:21	3		3				
19-Apr		Clear		8:50	3						
20-Apr	48/58	Partly cloudy	2	9:10	3		3				
22-Apr	66/68	Clear	4	9:20	3		2		1		
25-Apr	36/39	Clear	2	9:30	3						
27-Apr	53/61	Clear	1	8:48	2				1		
29-Apr	45/56	Clear	3	10:06							
1-May	62/77	Clear	0	8:46	3		1				
2-May	64/78	Clear	0	9:30	3						
3-May	66/80	Clear	2	8:58	3						
4-May	65/78	Partly cloudy	2	9:32	2						1
5-May	46/55	Clear	3.5	9:00	3						
10-May	57/71	Partly cloudy	1	9:16	2						

Pond: River Road

Date	Temperature		Weather	Wind	Time	Species					
	Wet/Dry					<i>Pseudacris crucifer</i>	<i>Rana sylvatica</i>	<i>Rana pipiens</i>	<i>Rana catesbeiana</i>	<i>Rana clamitans</i>	<i>Hyla versicolor</i>
6-Apr		Clear									
8-Apr	45/46	cloudy	2	9:55							
9-Apr	46/47	shower	3	11:17	1		1				
10-Apr	43/47	Partly cloudy	2	10:12							
11-Apr	45/53	cloudy	3	10:20	1						
12-Apr	49/52	cloudy	3	8:56	2						
14-Apr	43/54	Partly cloudy	3	9:34	3						
19-Apr	69/49	Clear	3	7:40	3		1	1	1		
19-Apr		Clear		9:08	3			1			
20-Apr	48/58	Partly cloudy	2	9:19							
22-Apr	66/68	Clear	4	9:30	3		2	3		1	

Date	Temperature Wet/Dry	Weather	Wind	Time	Species <i>Pseudacris crucifer</i>	<i>Rana sylvatica</i>	<i>Rana pipiens</i>	<i>Rana catesbeiana</i>	<i>Rana clamitans</i>	<i>Hyla versicolor</i>	<i>Bufo americanus</i>
25-Apr	39/40	Clear	1	10:15	3		1				1
27-Apr	53/61	Clear	1	9:00	2		1				
29-Apr	45/56	Clear	3	10:17	2						1
1-May	62/77	Clear	0	9:03	3						2
2-May	64/70	Clear	0	10:00	3		1		1	1	2
3-May	65/80	Clear	2	9:26	3		1		1	2	2
4-May	65/73	Partly cloudy	2	9:44	2				1	1	
5-May	46/55	Clear	3.5	9:15	3		1		1		
10-May	57/71	Partly cloudy	1	9:32	3				2	2	

Pond: canal stop 10

Date	Temperature Wet/Dry	Weather	Wind	Time	Species <i>Pseudacris crucifer</i>	<i>Rana sylvatica</i>	<i>Rana pipiens</i>	<i>Rana catesbeiana</i>	<i>Rana clamitans</i>	<i>Hyla versicolor</i>	<i>Bufo americanus</i>
5-Apr		Clear									
6-Apr	45/46	cloudy	2	10:00							
9-Apr	46/47	shower	3								
10-Apr	43/47	Partly cloudy	2	10:20	*	*					
11-Apr	45/53	cloudy	3	10:25	3*						
12-Apr	49/52	cloudy	2	9:04	3*						
14-Apr	43/54	Partly cloudy	3	9:41	3						
19-Apr		Clear		9:12	3*						
20-Apr	48/53	Partly cloudy	2	9:11	3	1	2				
22-Apr	66/63	Clear	4	9:36	3	1	2				
27-Apr	53/61	Clear	1	9:04	2			2			
29-Apr	45/56	Clear	3	10:25	2						
1-May	62/77	Clear	0	-							
2-May	64/73	Clear	0	-							
3-May	65/30	Clear	2	9:31	3		1		1	2	2
4-May	65/78	Partly cloudy	2	9:50	2					2	
5-May	46/55	Clear	3.5	9:20	3						
10-May	57/71	Partly cloudy	1	9:35	3		1		1	2	1

Pond: Canal South of Entrance

Date	Temperature Wet/Dry	Weather	Wind	Time	Species <i>Pseudacris crucifer</i>	<i>Rana sylvatica</i>	<i>Rana pipiens</i>	<i>Rana catesbeiana</i>	<i>Rana clamitans</i>	<i>Hyla versicolor</i>	<i>Bufo americanus</i>
5-Apr		Clear									
8-Apr	45/46	cloudy	2	10:05							
9-Apr	45/47	shower	3								
10-Apr	43/47	Partly cloudy	2	10:26							
11-Apr	45/53	cloudy	3	10:32							
12-Apr	49/52	cloudy	2	8:50							

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Pond Time Constrained soarinos

Spring 2001

Pond : Stop 1

Temperature		Weather		Wind		H2O		Time		Pseudacris		Rana		Rana		Rana		Rana		Hyla		Bufo		Ambystoma		Notophthalmus	
Date	Wet/Dry					Temp		Begin	End	crucifer		sylvatica		pipiens		catesbeiana		clamitans		versicolor		americanus		maculatum		viridescens	
16-Apr	39/46		Cloudy		3	61		8:20	9:00	5		9												1			
23-Apr	62/76		Partly Cloudy		4	69		8:30	9:00	12		1		2		3										1	

Pond : Service Road

Temperature		Weather		Wind		H2O		Time		Pseudacris		Rana		Rana		Rana		Rana		Hyla		Bufo		Ambystoma		Notophthalmus	
Date	Wet/Dry					Temp		Begin	End	crucifer		sylvatica		pipiens		catesbeiana		clamitans		versicolor		americanus		maculatum		viridescens	
16-Apr	38/46		Partly Cloudy		3	52		9:00	9:30	8		3				1		1						1			
23-Apr	52/74		Partly Cloudy		4	68		9:15	9:45	23*		2				3		2									

* 5 amplexed pairs

Pond : Beaver

Temperature		Weather		Wind		H2O		Time		Pseudacris		Rana		Rana		Rana		Rana		Hyla		Bufo		Ambystoma		Notophthalmus	
Date	Wet/Dry					Temp		Begin	End	crucifer		sylvatica		pipiens		catesbeiana		clamitans		versicolor		americanus		maculatum		viridescens	
16-Apr	38/44		Partly Cloudy		3	50		9:45	10:20					3										4		6	
23-Apr	60/72		Partly Cloudy		4	65		9:45	10:15					14*		1		2				11		1		3	

Pond : Stop 8 East

Temperature		Weather		Wind		H2O		Time		Pseudacris		Rana		Rana		Rana		Rana		Hyla		Bufo		Ambystoma		Notophthalmus	
Date	Wet/Dry					Temp		Begin	End	crucifer		sylvatica		pipiens		catesbeiana		clamitans		versicolor		americanus		maculatum		viridescens	
17-Apr	38/45		Partly Cloudy		3	60		10:25	10:55															1 (1 dead)			
25-Apr	36/39		Clear		2	55		9:30	10:00							1											

Pond : Stop 8 west

Temperature		Weather		Wind		H2O		Time		Pseudacris		Rana		Rana		Rana		Rana		Hyla		Bufo		Ambystoma		Notophthalmus	
Date	Wet/Dry					Temp		Begin	End	crucifer		sylvatica		pipiens		catesbeiana		clamitans		versicolor		americanus		maculatum		viridescens	
17-Apr	38/46		Partly Cloudy		3	51		11:01	11:27	2m 1f																	
25-Apr	42/48		Clear		2	57		8:46	9:15	4m		1 dead				1											

Pond : Stop 8 Woods

Date	Temperature Wet/Dry	Weather	Wind	H2O Temp	Time Begin	Time End	Species		Rana sylvatica	Rana pipiens	Rana catesbeiana	Rana clamitans	Hyla versicolor	Bufo americanus	Ambystoma maculatum
							Pseudacris crucifer	8m 1f							
4-Apr	45/58	Cloudy	2	-	9:20	9:48									1m

pond : Stop 8 Roadside

Date	Temperature Wet/Dry	Weather	Wind	H2O Temp	Time Begin	Time End	Species		Rana sylvatica	Rana pipiens	Rana catesbeiana	Rana clamitans	Hyla versicolor	Bufo americanus	Ambystoma maculatum
							Pseudacris crucifer	10							
7-Apr	36/46	Partly Cloudy	8	50	7:05	7:55			4m 3f						2
14-Apr	45/53	Cloudy	2	-	8:45	9:13					1m				

pond : Stop 8 Fern Field

Date	Temperature Wet/Dry	Weather	Wind	H2O Temp	Time Begin	Time End	Species		Rana sylvatica	Rana pipiens	Rana catesbeiana	Rana clamitans	Hyla versicolor	Bufo americanus	Ambystoma maculatum
							Pseudacris crucifer	12m 4f							
17-Apr	38/48	Partly Cloudy	3	51	8:50	9:20			5m 2f			7m 8f			
24-Apr	45/58	Partly Cloudy	4	-	8:10	8:37					1	1			8

pond : Davidson

Date	Temperature Wet/Dry	Weather	Wind	H2C Temp	Time Begin	Time End	Species		Rana sylvatica	Rana pipiens	Rana catesbeiana	Rana clamitans	Hyla versicolor	Bufo americanus	Ambystoma maculatum
							Pseudacris crucifer	1f							
28-Apr	44/54	Clear	1	81	8:18	8:48									

pond : Burdyl

Date	Temperature Wet/Dry	Weather	Wind	H2C Temp	Time Begin	Time End	Species		Rana sylvatica	Rana pipiens	Rana catesbeiana	Rana clamitans	Hyla versicolor	Bufo americanus	Ambystoma maculatum
							Pseudacris crucifer	1							
28-Apr	45/54	Clear	0	63	9:18	9:48					6	4			

pond : River Road

Date	Temperature Wet/Dry	Weather	Wind	H2O Temp	Time Begin	Time End	Species		Rana sylvatica	Rana pipiens	Rana catesbeiana	Rana clamitans	Hyla versicolor	Bufo americanus	Ambystoma maculatum
							Pseudacris crucifer	1m							
25-Apr	39/40	Clear	1	55	10:15	10:45					1				

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Date	Temperature Wet/Dry	Weather	Wind	Time Begin	Time End	Arrow Number
9-Apr	46/47	Shower	3	8:10	11:57	
<u>Species</u>	<u>sex</u>	<u>(location) Ft</u>		<u>Direction of Movement</u>		
<i>Pseudacris crucifer</i>	f	(1) 620.2		West		1
<i>Rana sylvatica</i>	m	(1) 43.4		West		4
<i>Rana sylvatica</i>	f	(2) 692.8		West		5
<i>Rana sylvatica</i>	m	(2) 1274.9		East		6
<i>Pseudacris crucifer</i>	m	(2) 1855.4		East		7
<i>Pseudacris crucifer</i>	m	(3) 62.9		East		10
<i>Rana sylvatica</i>	m and f	(4) 1269.4		East		11
<i>Rana sylvatica</i>	m and f	NA		South		
<i>Rana sylvatica</i>	m and f	(6) 689.5		North and West		16
<i>Pseudacris crucifer</i>	f	(6) 1101.7		North		17
<i>Rana sylvatica</i>	2 f	(6) 1291.0		South		17
<i>Rana sylvatica</i>	2 f	(6) 1493.3		South		17
*		(7) 739.2		West		18

* = Breeding *Rana sylvatica*; *Psuedacris crucifer*; Spotty on rd

Date	Temperature Wet/Dry	Weather	Wind	Time Begin	Time End	Arrow Number
12-Apr	49/52	Cloudy	1			
<u>Species</u>	<u>sex</u>	<u>(location) Ft</u>		<u>Direction of Movement</u>		
<i>Pseudacris crucifer</i>	m	(1) 712.7		South West		1
<i>Pseudacris crucifer</i>	m	(1) 483.8		South West		2
<i>Rana sylvatica</i>	2m	(1) 229.8		South West		3
<i>Pseudacris crucifer</i>	m and f	(1) 229.8		South West		3
<i>Rana sylvatica</i>	f	(2) 655.3		South East		5
<i>Rana Pipiens</i>	f	na		West		
<i>Rana sylvatica</i>	m	(6) 531.3		North West		16

Date	Temperature Wet/Dry	Weather	Wind	Time Begin	Time End	Arrow Number
3-May	65/85	clear	1	9:15		
<u>Species</u>	<u>sex</u>	<u>(location) Ft</u>		<u>Direction of Movement</u>		
<i>Rana Pipiens</i>	f	Just before route 4		South West		23

Date	Temperature Wet/Dry	Weather	Wind	Time Begin	Time End	Arrow Number
12-May	53/56	Cloudy	3	8:20		
<u>Species</u>	<u>sex</u>	<u>(location) Ft</u>		<u>Direction of Movement</u>		
<i>Bufo americanus</i>	m	Beaver			West	9
<i>Rana clamitans</i>	f	Stop 8 near road side ponds			West	18

Date	Temperature	Weather	Wind	Time	Time	
22-May	Wet/Dry	60 dry	shower	1	Begin	End
Species	sex	(location) Ft		8:30		Arrow
				<u>Direction of Movement</u>		Number
<i>Rana catesbeiana</i>	f	before beaver			West	8
<i>Pseudacris crucifer</i>	m	after beaver			East	10
<i>Hyla versicolor</i>	m	just before service rd			East	15
<i>Hyla versicolor</i>	m	just before service rd			East	15
<i>Rana clamitans</i>	f	stop 8 by big tree			West	18
<i>Rana catesbeiana</i>	f	stop 8 by big tree			West	18
<i>Hyla versicolor</i>	m	stop 8 by entrance to woods			North East	19
<i>Bufo americanus</i>	f	stop 8 by entrance to parking area			South South West	20
<i>Bufo americanus</i>	f	stop 8 by entrance to parking area			South South West	20
<i>Psuedacris crucifer</i>	m	Just after parking area at stop 8			East North East	21
<i>Bufo americanus</i>	m	Down hill after stop 8			North West	22

Date	Temperature	Weather	Wind	Time	Time	
23-May	Wet/Dry	57/57	drizzle	2	Begin	End
Species	sex	(location) Ft		8:20		9:45 Arrow
				<u>Direction of Movement</u>		Number
<i>Rana catesbeiana</i>	m	after stop 4			South West	12
<i>Rana catesbeiana</i>	f	after stop 4			East	13
<i>Rana clamitans</i>	m?	Monument comemrating battle (Acland)			West North West	14

Straw was thrown on either side of the road from beginning of tour road to stop 2

1-From stop 1 measured from edge of parking area closest to front gate.

North End of stop 1 lot heading north.

2- Measured from south end of the service road heading south.

3- From headstone on right near rock pile heading south.

4- measured north from end of tour stop 2

5- Measured from north at tour stop 5 toward north

6- Measured from north of service road heading North

7- As going around loop, measured from opening of fern field