STATE WILDLIFE GRANT PROGRAM
STATE OF ILLINOIS
ANNUAL REPORT: MARCH 1, 2008 THROUGH JUNE 1, 2009

PROJECT TITLE:
UTILITY OF ANURAN CALL-SURVEY DATA FOR ESTIMATING OCCUPANCY, ABUNDANCE, AND REPRODUCTIVE SUCCESS IN THE CACHE RIVER BASIN

PROJECT NUMBER: T-40-R-1

NEED:
In Illinois eight of 41 amphibian species are listed as threatened or endangered and an additional six species have been identified as conservation priorities. Three of these species, the bird-voiced treefrog (*Hyla avivoca*), the crayfish frog (*Rana areolata*) and the wood frog (*Rana sylvatica*) have been identified during frog calling-surveys conducted in the Cache River basin of southern Illinois over the past five years. However, the use of calling-survey data to infer trends in occupancy and abundance of anuran species has been questioned (Bridges and Dorcas 2000; Crouch and Paton 2002; Oseen and Wassersug 2002; Nelson and Graves 2004; Weir et al. 2005). The presence of non-calling satellite males, for example, may cause these surveys to underestimate frog populations. The absence of calling frogs may be an indicator of environmental conditions during the survey period as well as frog abundance. Both of these factors could lead to estimators of occupancy and abundance that underestimate the true parameters. The presence of calling frogs, furthermore, does not necessarily indicate successful breeding or recruitment. For example, a wetland site may have breeding adults and even reproduction (egg laying), but it may dry too quickly (i.e. have a short hydroperiod) for the larvae to complete metamorphosis or it may contain predatory fish that prey on anuran larvae and prevent all metamorphosis. From a landscape perspective, this site would be considered a population sink, drawing migrants from nearby sites, some of which may be productive as a result of longer hydroperiods or absence of fish, thus wasting all reproductive effort. This would lead to estimators of occupancy and abundance that overestimate the true parameters.

In addition, when no frogs are detected at a wetland site, it may be the result of unsuitable habitat or it may be that it is isolated from other wetlands. In the case of the latter, some temporary disturbance may have occurred, such as introduction of fish, but the distance to the nearest wetland is too great to allow re-colonization. Although frogs have traditionally been considered organisms with limited dispersal capabilities, this view has been increasingly brought into question as studies have shown that anuran populations are greatly affected by the movement of individuals between habitats (Marsh and Trenham 2000). The need exists to determine effective colonization distances for anurans.

The need exists to critically evaluate the results of calling-surveys so that any trends that are inferred from these data are accurate, as management decisions may be based on call-survey results. The evaluation of call-survey data can be accomplished by comparing the results of in-depth field surveys with the results of call-survey data. The results from such a comparison can be extrapolated to call-survey data collected throughout Illinois. The need also

exists to understand why some sites are sinks. This could result in management recommendations that would restore sinks into sources.

OBJECTIVES:

1. Analyze the existing call-survey data for ten sites in the Cache River basin and compare to differences in coarse-scale (landscape-level) habitat variables surrounding the sites where frogs have been detected versus those where they are absent.

2. Estimate occupancy, abundance, reproductive success, and measure fine-scale habitat variables at the ten sites using in-depth field surveys. Investigate which fine-scale habitat variables explain the variation in the frog population variables

3. Combine the fine-scale habitat variables and the landscape-level variables into one analysis to investigate the importance of each variable and level in determining occupancy, abundance, and reproductive success and effective colonization distances for each species and the species community in the Cache River Basin.

STUDY 1 Analyze existing frog calling survey data.

OBJECTIVE: Examine attributes of habitat preferred by frog species at the ten Cache River wetland sites where volunteers have been conducting call-surveys for the past five years.

ACCOMPLISHMENTS: Geospatial data was used to determine habitat characteristics of the ten Cache River wetland sites at buffer zones of 500m and 1000m.

STUDY 2 Estimate occupancy, abundance, reproductive success, and fine-scale habitat variables at the ten Cache River wetland sites where volunteers have been conducting call-surveys for the past five years.

JOB 2.1 Examine frog populations via field surveys.

OBJECTIVE: Examine frog populations at the ten volunteer sites via visual encounter, dip net, minnow trap, and call surveys.

ACCOMPLISHMENTS: Between March 2007 and June 2008, field sites in the Cache River State Natural Area were surveyed weekly for frog occupancy. This was done using a variety of methods, including visual, call, minnow trap, and dip net surveys. Visual surveys consisted of a 10 minute daytime sweep through each site. An observer would visually search for any evidence of frogs, including eggs, tadpoles, metamorphosed individuals, and adults, and identified any detected anurans to species. Call surveys always began shortly after sunset and ended before 2am according to the NAAMP protocol. During each call survey, an observer listened intently at a given site for 5 minutes, identifying any species of frog calling and rating the strength of the call chorus based on the calling index created by NAAMP. For each minnow trap survey, five collapsible minnow traps were set at each site overnight. The following day the contents of the trap were inspected, any frogs identified and released. The dip net survey at a site consisted of

five sweeps with a dip net through the wetland, each sweep lasting 10 seconds. At the end of each sweep the contents of the net was inspected and any captured frogs or tadpoles identified. If, during the use of any of these survey methods, an individual was captured that could not be identified in the field, especially egg or larval specimens, it was collected and raised in captivity until the individual's identity could be confirmed.

The results of these surveys are shown in Appendix I. For the purpose of this study it is assumed that the presence of metamorphs indicates survival to adulthood and successful recruitment. No evidence for reproduction was found for *Bufo americanu* or *Rana areolata* at any of the sites where they were detected with call surveys. If we assume that the presence of metamorphs in a population indicates successful survival of a species to reproductive maturity, then evidence for recruitment was found at certain sites for seven species: *Acris crepitans, Bufo fowleri, Hyla versicolor-chrysoscelis, Pseudacris crucifer, P. triseriata, Rana catesbeiana, R. clamitans,* and *R. sphenocephala.*

JOB 2.2 Measure fine-scale habitat attributes at the ten sites.

OBJECTIVE: Measure environmental factors, including cloud cover, wind speed, humidity, air temperature, soil temperature, and water temperature, and site characteristics, such as fragmentation, size, and vegetation, for use in future statistical analyses.

ACCOMPLISHMENTS: During each survey at each site these microhabitat variables were measured and recorded.

JOB 2.3 Conduct regression analyses.

OBJECTIVE: A multiple regression approach will be used to determine which fine-scale habitat variables are related to occupancy, abundance, reproductive success for each species (Rowe and Dunson 1995; Skelly 1997). We will combine the fine-scale habitat variables and the landscape-level variables into one analysis to investigate the importance of each variable and level in determining occupancy, abundance, and reproductive success for each species and the species community.

JOB 3 Conduct overall multiple regression analysis.

OBJECTIVE: Combine the fine-scale habitat variables and the landscape-level variables into one analysis to investigate the importance of each variable and level in determining occupancy, abundance, reproductive success, and colonization distances for each species and the species community.

ACCOMPLISHMENTS: Regression analysis was conducted using landscape-level variables at distance of 500m and 1000m.

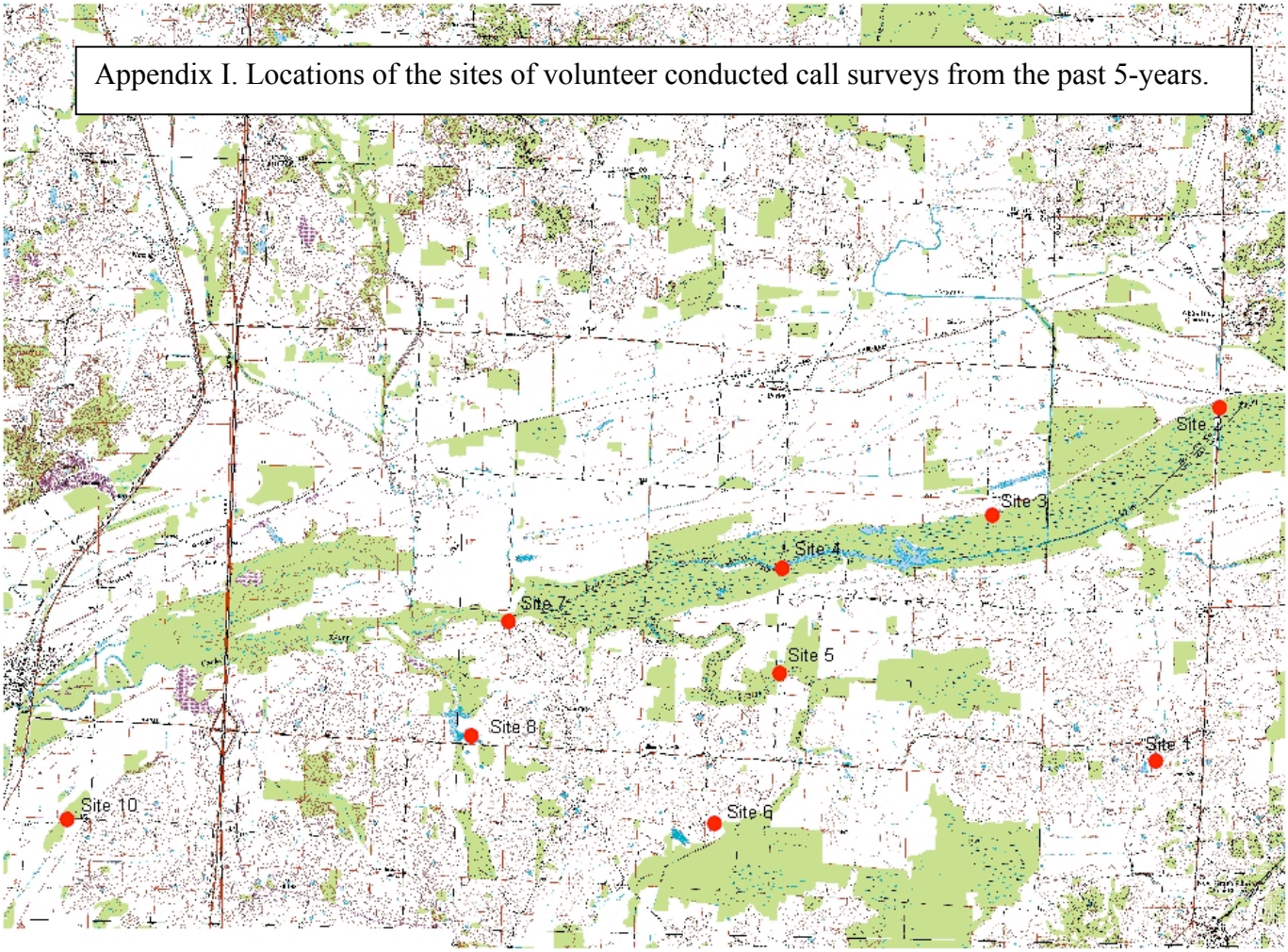
JOB 4 Prepare and submit annual performance reports.

ACCOMPLISHMENTS: The interim report was prepared and distributed to agency staff.

JOB 5 Prepare final report.

OBJECTIVE: The final report will include the observed effects of environmental factors on frog populations, suggestions for conservation and an examination of effectiveness of NAAMP call surveys with possibilities for improvement.

Appendix I. Locations of the sites of volunteer conducted call surveys from the past 5-years.



Appendix II. Total number of individuals observerd or captured in each life stage of each species for each site with the corresponding calling index (CI). The NAAMP defines calling indices as follows: 0 – no individuals heard; 1 – individuals can be counted but there is space between calls; 2 – individuals can still be distinguished but calls overlap; 3 – full chorus, calls are constant, continuous, and overlapping. The life stages of the species are defined as Eggs, Tad. = Tadpoles, Met. = Metamorphs, and Adults.

Site	Species	Maximum Calling Index	Adult	Egg Mass	Tadpole	Tad. w/ legs	Metamorph
1	*Acris crepitans*	3	0	0	0	0	0
	Bufo americanus	0	0	0	0	0	0
	Bufo fowleri	1	0	0	0	0	0
	Hyla avivoca	0	0	0	0	0	0
	Hyla cinerea	3	0	0	0	0	0
	Hyla versicolor	1	0	0	0	0	0
	Pseudacris crucifer	3	6	0	0	0	0
	Pseudacris triseriata	1	0	0	0	0	0
	Rana aureolata	0	0	0	0	0	0
	Rana catesbeiana	2	8	0	0	0	0
	Rana clamitans	0	3	0	0	0	0
	Rana sphenocephala	0	29	0	0	0	0
2a	*Acris crepitans*	3	0	0	0	0	0
	Bufo americanus	0	0	0	0	0	0
	Bufo fowleri	1	0	0	0	0	0
	Hyla avivoca	0	0	0	0	0	0
	Hyla cinerea	0	0	0	0	0	0
	Hyla versicolor	1	0	0	0	0	0
	Pseudacris crucifer	1	0	0	0	0	0
	Pseudacris triseriata	0	0	0	0	0	0
	Rana aureolata	1	0	0	0	0	0
	Rana catesbeiana	1	1	0	0	0	0
	Rana clamitans	1	4	0	0	0	0
	Rana sphenocephala	1	5	0	0	0	0
2b	*Acris crepitans*	3	3	0	0	0	0
	Bufo americanus	0	0	0	0	0	0
	Bufo fowleri	0	0	0	0	0	0
	Hyla avivoca	3	0	0	0	0	0
	Hyla cinerea	3	0	0	0	0	0
	Hyla versicolor	0	0	0	0	0	0
	Pseudacris crucifer	2	0	0	0	0	0
	Pseudacris triseriata	0	0	0	0	0	0
	Rana aureolata	0	0	0	0	0	0
	Rana catesbeiana	1	3	0	0	0	0
	Rana clamitans	1	0	0	0	0	0
	Rana sphenocephala	3	0	0	0	0	1
3	*Acris crepitans*	3	27	0	0	0	13
	Bufo americanus	0	0	0	0	0	0
	Bufo fowleri	1	0	0	0	0	0
	Hyla avivoca	2	0	0	0	0	0
	Hyla cinerea	3	0	0	0	0	0
	Hyla versicolor	1	0	0	0	5	0
	Pseudacris crucifer	3	0	0	0	0	0
	Pseudacris triseriata	0	0	0	0	0	0
	Rana aureolata	0	0	0	0	0	0
	Rana catesbeiana	1	21	0	13	0	0
	Rana clamitans	0	0	0	5	0	0
	Rana sphenocephala	2	15	0	48	6	9

4	*Acris crepitans*	3	14	0	0	0	29
	Bufo americanus	0	0	0	0	0	0
	Bufo fowleri	0	0	0	0	0	0
	Hyla avivoca	0	0	0	0	0	0
	Hyla cinerea	3	0	0	1	0	0
	Hyla versicolor	1	0	0	0	5	0
	Pseudacris crucifer	2	0	0	0	0	0
	Pseudacris triseriata	1	0	0	0	0	0
	Rana aureolata	1	0	0	0	0	0
	Rana catesbeiana	2	9	0	0	0	0
	Rana clamitans	1	0	0	0	0	0
	Rana sphenocephala	2	1	0	20	5	2
5	*Acris crepitans*	3	44	0	0	0	3
	Bufo americanus	0	0	0	0	0	0
	Bufo fowleri	2	1	0	0	0	2
	Hyla avivoca	0	0	0	0	0	0
	Hyla cinerea	3	0	0	0	0	0
	Hyla versicolor	2	0	0	0	5	0
	Pseudacris crucifer	3	0	0	0	0	0
	Pseudacris triseriata	1	0	0	0	0	0
	Rana aureolata	0	0	0	0	0	0
	Rana catesbeiana	1	4	0	0	5	2
	Rana clamitans	1	0	1	0	0	0
	Rana sphenocephala	2	13	25	166	41	0
6	*Acris crepitans*	2	1	0	0	0	0
	Bufo americanus	0	0	0	0	0	0
	Bufo fowleri	1	4	0	0	0	5
	Hyla avivoca	0	0	0	0	0	0
	Hyla cinerea	3	0	0	0	0	0
	Hyla versicolor	2	0	0	0	0	0
	Pseudacris crucifer	3	0	0	0	0	0
	Pseudacris triseriata	3	3	17	23	0	0
	Rana aureolata	0	0	0	0	0	0
	Rana catesbeiana	1	1	0	0	0	3
	Rana clamitans	0	0	0	0	0	0
	Rana sphenocephala	1	28	64	418	964	159
7	*Acris crepitans*	3	4	0	0	0	0
	Bufo americanus	1	0	0	0	0	0
	Bufo fowleri	0	1	0	0	0	0
	Hyla avivoca	0	0	0	0	0	0
	Hyla cinerea	3	0	0	0	0	0
	Hyla versicolor	3	1	28	10	0	0
	Pseudacris crucifer	3	0	0	0	6	1
	Pseudacris triseriata	3	6	25	34	19	26
	Rana aureolata	0	0	0	0	0	0
	Rana catesbeiana	2	57	0	285	11	18
	Rana clamitans	1	0	0	6	0	4
	Rana sphenocephala	2	5	3	19	8	7
8	*Acris crepitans*	3	26	0	0	0	5
	Bufo americanus	0	0	0	0	0	0
	Bufo fowleri	3	0	0	0	0	0
	Hyla avivoca	0	0	0	0	0	0
	Hyla cinerea	3	1	0	0	0	0
	Hyla versicolor	2	0	0	0	0	1
	Pseudacris crucifer	2	0	0	6	6	0
	Pseudacris triseriata	1	0	0	0	0	0
	Rana aureolata	1	0	0	0	0	0
	Rana catesbeiana	2	2	0	5	0	0

	Rana clamitans	1	0	0	0	0	0
	Rana sphenocephala	2	0	0	5	20	0
10	*Acris crepitans*	0	5	0	0	0	0
	Bufo americanus	1	0	0	0	0	0
	Bufo fowleri	0	0	0	0	0	0
	Hyla avivoca	0	0	0	0	0	0
	Hyla cinerea	2	0	0	0	0	0
	Hyla versicolor	2	0	0	0	0	0
	Pseudacris crucifer	2	0	0	0	0	0
	Pseudacris triseriata	3	0	2	0	0	0
	Rana aureolata	1	0	0	0	0	0
	Rana catesbeiana	1	4	0	0	0	0
	Rana clamitans	0	0	0	0	0	0
	Rana sphenocephala	2	2	24	2988	397	8

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