ILLINOIS
UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

PRODUCTION NOTE

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Population status of the Illinois chorus frog

(Pseudacris streckeri illinoensis)

in Madison County, Illinois: Results of 1998 surveys

IDOT CONTRACT 1-5-90868

FINAL REPORT ON 1998 RESULTS

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The findings, conclusions, and views expressed herein are those of the researchers and should not be considered as the official position of the Illinois Department of Transportation.

ACKNOWLEDGMENT OF SUPPORT

This research (contract number 1-5-90179) was funded by the Illinois Department of Transportation.
A study of the biology of the Illinois chorus frog, *Pseudacris streckeri illinoensis*, is reported. Surveys of Madison County for choruses of the frogs located eight choruses in 1998. All of these choruses were located at the same sites that choruses were found in 1997. No frogs were found at historical sites near Granite City, South Roxana, or New Poag Road similar to results in 1994-1997. The bulk of the study was conducted using drift fences at the recently purchase wetland mitigation area adjacent to Sand Road in Sec. 19, T4N, R8W. The primary purpose of the 1998 study was to examine spacial variation in use of the mitigation area by the Illinois chorus frog and to estimate population size and density at the mitigation area. I estimated population size using recaptures of frogs previously marked. Lincoln-Petersen index estimate of population size based on recaptures of previously marked frogs was about 108 frogs for both sexes. This estimate is about one-quarter of the 1997 estimate possibly due to unfavorable rainfall in 1997. The apparent reduction in frog numbers was not due to activities associated with wetland restoration because those activities did not begin until November of 1998. However, had the wetland project been completed in the fall of 1997 frog populations may have been maintained by the slower drying of the wetland area. I found the first evidence of surface activity among adult frogs outside of the breeding season. A single frog was collected in September of 1998 suggesting that monitoring of drift fences year-round is important.
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I thank G. B. Rose, M. M. Tucker, and D. Warner for field assistance. L. E. Brown provided many useful suggestions concerning the biology of the frog and helped with literature needs. G. E. Kruse provided permits necessary for this project.
INTRODUCTION

The Illinois chorus frog, *Pseudacris streckeri illinoensis*, is restricted to the floodplains of the Mississippi and Illinois rivers in Arkansas, Illinois, and Missouri (Conant and Collins, 1991). The frog is listed as a threatened species in Illinois (Herkert, 1992), as a rare species in Missouri (Anonymous, 1992), as a species of special concern in Arkansas (R. Roberg, pers. comm.), and as federal C-2 species (Dodd et al., 1985).


Several previous publications and unpublished reports provide details on the life history of *P. s. illinoensis* including information on underground feeding behavior (Brown, 1978), burrowing behavior (Axtell and Haskell, 1977; Brown et al., 1972; Tucker et al., 1995; Tucker, 1995), chorus sites (Brown and Rose, 1988; Tucker, 1998), fecundity (Butterfield et al., 1989; Tucker and Philipp, 1995; Tucker, 1997a), post-metamorphic growth (Tucker, 1995; Tucker and Philipp, 1995), morphology of newly transformed froglets (Tucker, 1997b), good habits (Tucker, 1997c), thermobiology (Packard et al., 1998), and morphological adaptations to fossorial existence (Brown and Means, 1984;
This year's activities carried forward objectives from previous years and expanded these to include a detailed analysis of the herpetology of the wetland mitigation area (Table 1). Our initial objectives were:

1. Monitor the distribution of *P. s. illinoensis* choruses in appropriate habitat in the impact area.
2. Estimate the approximate number of *P. s. illinoensis* located on the wetland mitigation area.
3. Examine growth rate and survivorship of frogs at the site to establish baseline data for later comparisons to survivorship following wetland mitigation.
4. Examine the spatial distribution of *P. s. illinoensis* at the wetland mitigation site.
5. Test the hypothesis that adult frogs are only at the surface during the short breeding season.

**STATISTICAL METHODS**

Associations among environmental variables and anuran activity were determined with Spearman's rank correlation (*Rho*). Comparison of means was made using the Kruskal-Wallis test, analysis of variance (ANOVA), or analysis of covariance (ANCOVA), as appropriate, using SAS (SAS Institute, 1988). The sequential Bonferroni method was used to determine minimum values of *P* needed to reduce the probability of type I errors.
Monitoring of chorus locations in the Sand Road study area (Fig. 1) began on February 20, 1998. The methods used and sites visited were reviewed in previous reports (i.e., Tucker and Philipp, 1993, 1994, 1995, 1996, 1997).

RESULTS AND DISCUSSION
In 1998, a total of eight choruses were located (Fig. 1). All of these locations were sites of choruses in previous years. No new chorus sites were found in 1998.

Generally, chorus sites have been stable in the general study area from 1994-1997 with no indication of recolonization of distant sites where this species is thought to have been extirpated (Tucker and Philipp, 1995; Tucker, 1998). The failure to recolonize former chorus sites is likely due to the inability of frogs to reach those sites from the refugia that they now occupy (Tucker, 1998).

POPULATION SIZE ESTIMATES

Population size estimate was made using the Petersen method as modified by Bailey (1951) for estimates of population size when number of recaptures were small (Donnelly and Guyer, 1994). Standard error was not calculated due to the small number of captures in 1998.

RESULTS AND DISCUSSION
Petersen estimate of population size was 108 total frogs based on 14 recaptures of 217 previously marked frogs and 7 captures of unmarked frogs. The 1998 estimate was only one-quarter of the estimate made in
Figure 1. Sand Road study area showing the location of the wetland mitigation area and known choruses of the Illinois chorus frog (*Pseudacris streckeri illinoensis*) in Madison County, Illinois.
1997 of about 455 adults. Apparently, unfavorable rainfall in the
summer and fall of 1998 reduced recruitment in this species. As a
consequence population size apparently decreased by more than 75% in a
single year.

Reduction in population size can be further supported by the
capture rates in 1998 compared to 1996 and 1997 at the mitigation area
by using the number of frogs caught during the season per meter of drift
fence as an estimate of population. In 1996 and 1997, I caught 0.25 and
0.32 frogs/m of drift fence, respectively. In contrast, I caught only
0.04 frogs/m of drift fence in 1998 consistent with Petersen estimates.
Thus, population size of these frogs was reduced by 84 to 88% in a
single year using this method. Successful recruitment from year to year
is apparently very important in maintaining populations sizes (Tucker,
1995; 1998). Thus monitoring the mitigation site and documenting
recruitment rates are critical to management of these frogs.

GROWTH AND SURVIVORSHIP

MATERIALS AND METHODS

This portion of the study is based on 722 froglets initially marked by
toe clipping (Tucker and Philipp, 1993). Because only toes on the hind
feet could be used, frogs were not given individually unique toe clips.
Instead, they were marked in year cohorts with frogs newly collected
each year given a different clip pattern.

Recaptures of frogs marked as froglets in 1993 were made in 1994,
1995, 1997, and 1998 at chorus sites and along drift fences placed at
sites bordering Sand Road in Madison County, Illinois (Tucker, 1998).
Recaptured frogs were measured from snout to vent (= SVL) to the nearest
1 mm, had their sex determined, and were then released immediately.
Unmarked frogs collected in each year were given appropriate toe clip patterns. Sex and reproductive status were determined using the method of Tucker (1998).

I used SAS (SAS Institute, 1988) for statistical comparisons. Because sample sizes were small, I used nonparametric statistics including the Wilcoxon rank sum test (Z) to compare means.

Voucher specimens include 13 froglets collected in 1993 and 23 road-killed adult frogs collected in 1994 (INHS 10938-39; 10946-56 and INHS 12329-12351, respectively). The froglets were preserved under Illinois Department of Natural Resources (IDNR) permit number 93-8s. The road-killed frogs were preserved under IDNR permit A-93.0207.

RESULTS AND DISCUSSION

Recaptures of sexually mature frogs marked as froglets in 1993 were made in 1994, 1995, and 1997. No recaptures of 1993 froglets were made in 1996 and 1998. For all years, 41 frogs were recaptured from the 722 froglets marked (Table 1).

The largest cohort of transforming froglets collected in 1993 averaged 21.2 mm in SVL (Tucker, 1995). Frogs from this 1993 cohort grew rapidly as indicated by those recaptured in 1994. Males on average increased their SVL by 15.6 mm, whereas females increased their SVL by 18.1 mm. Females recaptured in 1994 were larger than males recaptured in 1994 (Z = 2.45, 1 df, P = 0.0142) suggesting that they initially grew faster than males (Fig. 2). However, recaptured males and females did not differ significantly in size in either of the other two years (Z > 1.41, 1 df, P > 0.10). Sample sizes are, however, small for all year cohorts (Fig. 2).

<table>
<thead>
<tr>
<th></th>
<th>1994</th>
<th>1995</th>
<th>1997</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sex</td>
<td>N</td>
<td>mean(SD)/range</td>
</tr>
<tr>
<td></td>
<td>females</td>
<td>7</td>
<td>39.3(2.0)/37-43</td>
</tr>
<tr>
<td></td>
<td>males</td>
<td>13</td>
<td>36.8(2.0)/32-40</td>
</tr>
</tbody>
</table>
Figure 2. Growth of the Illinois chorus frog (Pseudacris streckeri illinoensis) from recently transformed froglets (1993) to adult males and females (other years). Horizontal bar represents the mean, the vertical bar represents the mean ± 1 standard deviation. Numbers above (females) and below (males and froglets) the vertical bars represent sample sizes.
Excluding growth between 1993 and 1994, the frogs grew at slow rates between 1995 and 1997 (Fig. 2). During these three years, females added 2 mm to mean 1994 SVL, and males added 3.3 mm (Table 1). If the rates are reasonable approximations of post-sexual maturity growth rates, then adult growth rates were slow averaging 0.67 mm per year for females and 1.1 mm per year for males.

Tucker (1995) noted the relatively large size at transformation for Pseudacris streckeri illinoensis in Madison County. Most toads (Bufo species) and hylids (e.g., Acris, Pseudacris, and Hyla) transform at smaller sizes of 10 to 17 mm (Turner, 1960 for a review). Moreover, P. s. illinoensis grows rapidly its first growth season following transformation. Females reach 90% of their maximum observed size (41.3 mm for 1997) in their first season of growth (i.e., 39.3 mm for 1994, see Table 1). Males, however, attain 78% of maximum growth in their first season of growth.

Some other anurans may grow as quickly as does Pseudacris streckeri illinoensis. For instance, Bayless (1969) found that the cricket fly (Acris crepitans) in Texas could reach sexual maturity and potentially breed in the same season that they transformed. Other small anurans grow at slower rates. The narrow-mouthed toad (Gastrophryne carolinensis) may take four years to reach maximal sizes (Anderson, 1954) and becomes sexually mature in their second year compared to the first year observed by me for P. s. illinoensis.

The observation that growth may be faster for females than males is not unique. Females of Fowler's toad (Bufo woodhousi fowleri) also grow faster than males (Clarke, 1974; Breden, 1988). Shirose and Brooks
(1995a) note that female green frogs (*Rana clamitans*) and female mink frogs (*Rana septentrionalis*) from Ontario grew at faster rates than did males of either species.


Adult survivorship estimated at 26% stands in contrast to the 2.8% estimated juvenile survivorship (Tucker, 1998). The large difference between adult and juvenile survivorship estimates suggests that future population size will be strongly influenced by the number of transforming froglets. Conservation plans for *Pseudacris streckeri illinoensis* should include efforts to increase the likelihood that tadpoles will successfully transform along with habitat protection programs.

**SPATIAL DISTRIBUTION**

**MATERIALS AND METHODS**

The distribution of frogs on the sand portion of the study area was studied using drift fences randomly placed on the site. Drift fences were constructed with aluminum flashing. Pitfall traps (5 gal. buckets buried next to the fence) were position along each side of the drift fences at 15 m intervals. Each frog captured was measured, marked, and released at the time of capture. The fence and pit number was also recorded for all frogs. Frogs found along the drift fence were assigned
the nearest pit number. The time interval includes the first and last
Figure 3

A

South
Pit
Road
Fence 2
Fence 8
Fence 7
Fence 4

1997

B

South
Pit
Road
Fence 2
Fence 8
Fence 7
Fence 4

1998
Figure 3. Number of Illinois chorus frogs (*Pseudacris streckeri illinoensis*) caught on eight drift fences at the wetland mitigation area in 1997 (A) and 1998 (B).
capture of specimens of *Pseudacris streckeri illinoensis* for both the 1997 and 1998 seasons.

**RESULTS AND DISCUSSION**

*Pseudacris s. illinoensis* were most commonly caught on fences 2 and 8 in 1997 (Fig. 3A). In contrast, frogs were most commonly caught on fence 6 in 1998 but few frogs were caught on any of the fences consistent with the drop in population size noted above.

The relatively high number of captures on fence 6 differs from 1997 results. In that year few individuals were caught on fence 6. The reason for this disparity is not clear but could be due to the small number of frogs apparently available for capture in 1998.

**TEMPORAL DISTRIBUTION**

**MATERIALS AND METHODS**

For this portion of the study, drift fences were monitored during most months of 1997 and 1998. Because it was anticipated that any post-breeding activity by *P. s. illinoensis* might be at a low level, fence coverage was kept the 1997 level of 545 m. (Fig. 4). Fences were monitored daily with few exceptions.

**RESULTS AND DISCUSSION**

All captures made on all fences for all reptiles and amphibians are listed in Table 2. I caught one individual *P. s. illinoensis* in September 1998 (Table 3). This is the first adult-sized individual of this species found at the surface during the non-breeding season. This result is not consistent with the hypothesis that adult *P. s. illinoensis* are only active at the soil surface during the breeding season. Nevertheless, our study confirms that surveys for this frog can
capture of specimens of *Pseudacris streckeri illinoensis* for both the 1997 and 1998 seasons.

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only be profitably conducted in early spring and that summer surveys of possible sites would be unlikely to discover frogs. However, fall activity may be more important than previously realized and continued surveys are indicated.
Figure 4. Fences during 1997 and 1998 used to examine summer and fall activity of the Illinois chorus frog (*Pseudacris streckeri illinoensis*).
Table 2. All reptiles and amphibians collected from 1996 to 1998.

<table>
<thead>
<tr>
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<td>Lampropeltis calligaster</td>
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<td>3/0</td>
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<tr>
<td>Coluber constrictor</td>
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<td>Heterodon platyrhinos</td>
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<td>Chrysemys picta</td>
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<td>7/2</td>
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<td>Trachemys scripta</td>
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<td><strong>Amphibians</strong></td>
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<td>106/25</td>
<td>21/1</td>
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<td>1/1</td>
<td>26/0</td>
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<td>Bufo americanus</td>
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<td>19/3</td>
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<td>304/147</td>
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Table 3. Number of reptiles and amphibians caught in each month of 1997 and 1998.

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<td>Species/Month</td>
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<tr>
<td>Heterodon platyrhinos</td>
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<td>Coluber constrictor</td>
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<tr>
<td>Lampropeltis calligaster</td>
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<tr>
<td>Cnemidophorus sexlineatus</td>
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</tr>
<tr>
<td>Chrysemys picta</td>
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<td>0</td>
</tr>
<tr>
<td>Trachemys scripta elegans</td>
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<tr>
<td>Cheilodrya serpentina</td>
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<td>Acris crepitans</td>
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<tr>
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<td>1</td>
</tr>
<tr>
<td>Species</td>
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</tr>
<tr>
<td>-------------------------------</td>
<td>----</td>
<td>----</td>
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<td><em>Rana catesbiana</em></td>
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<td><em>Rana sphenoecephala</em></td>
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<td><em>Bufo americanus</em></td>
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<td><em>Bufo w. fowleri</em></td>
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<td><em>Hyla versicolor</em></td>
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<td><em>Pseudacris triseriata</em></td>
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<td><em>P. s. illinoensis</em></td>
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<tr>
<td><em>P. crucifer</em></td>
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<tr>
<td><em>Ambystoma tigrinum</em></td>
<td>0</td>
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</tr>
</tbody>
</table>

No animals were caught in January and December of 1997; sampling was not conducted in June, November, and December of 1998.
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