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POPULATION STATUS OF THE
ILLINOIS CHORUS FROG (*PSEUDACRIS STRECKERI ILLINOENSIS*) IN
MADISON COUNTY, ILLINOIS, WITH EMPHASIS ON
THE NEW POAG ROAD/FAP 413 INTERCHANGE AND
FAP 413 WETLAND MITIGATION SITE

IDOT CONTRACT 1-5-90179

REPORT ON 1993 RESULTS

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DISCLAIMER

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

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EXECUTIVE SUMMARY

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 two choruses. The small number of choruses and the small number of frogs at each is thought to indicate a reduction in the numbers of frogs when compared to previously reported results. One chorus near the junction of Old Poag Road and Wanda road consisted of one calling male. The other chorus which is located near the junction of Sand Road and Hartzell Road consisted of 2 to 6 (mean = 4.25) frogs calling per night. Surveys of tadpoles at these two sites and two others previously reported as breeding sites yielded *P. s. illinoensis* tadpoles at one site. 714 transforming froglets were caught using drift fences at this site. Habitat requirements for breeding success in this frog include sandy soils without sod development and permanent or ephemeral bodies of water that are free of predatory fishes. Ephemeral bodies of water must persist from early march which coincides with the beginning of the breeding season to middle June by which time tadpoles have transformed to froglets. Sod free areas of sandy soil types are a requirement for postbreeding habitat of this frog. All burrows of this fossorial frog were found in areas of no or sparse vegetation.

A proposed wetland mitigation site was also surveyed for suitability as Illinois chorus frog habitat. This site was judged unsuitable because it was not located in an area of sandy soils. Previous reports of chorus of the Illinois chorus frog at the site are considered suspect because frogs were identified by call alone without close examination of the frogs or site.

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INTRODUCTION

The fossorial Illinois chorus frog (*Pseudacris streckeri illinoensis*), a taxon threatened in Illinois (Kenney, 1978; Morris and Smith, 1981) and a federal Category 2 candidate (may qualify as a federally endangered or threatened species) (Dodd, et al., 1985), is distributed in Illinois mainly along the central part of the Illinois River (Smith, 1951, 1961, 1966; Morris and Smith, 1981; Taubert, et al., 1982; Brown and Rose, 1988; Morris, 1990). Populations are, however, scattered along the Mississippi River floodplain from Madison to Alexander Counties, IL (Holman, et al., 1964; Brown and Brown, 1973; Axtell and Haskell, 1977; Morris and Smith, 1981; Taubert, et al., 1982; Gilbert, 1986; Brown and Rose, 1988; Morris, 1990). A proposed highway interchange for FAP 413 at New Poag Road, just NW of Poag, Madison Co., IL, will impact a site where *P. s. illinoensis* has been heard calling (R. W. Axtell, through G. Rose, pers. comm. to M. Morris).

The contract for which this report was prepared was let to survey the FAP 413 interchange site and nearby areas to delineate the current status of *P. s. illinoensis*. Work began on the project in April 1993 with the expectation of continuation until the biotic factors necessary to understand the possible impact of FAP 413 on the frog can be determined. To reach this understanding a series of objectives were proposed and accepted as the minimum knowledge base needed to assess impact. This report outlines the progress made in 1993 in determining these biotic factors.

The report is organized based on the objectives laid out before the work began. The report consists of 6 sections along with a conclusion. Each section of the report is devoted to an objective. A separate methods, results, and discussion subsection is included within the section for each objective where appropriate. The stated objectives for the project are:

1. Determine the distribution of *P. s. illinoensis* choruses in the vicinity of the impact area.
2. Determine the approximate number of breeding individuals visiting choruses

that are located in the vicinity of the impact area.

3. Determine what factors at breeding sites are important for successful transformation and consequent maintenance of frog population numbers.
4. Determine post-breeding habitat and map locations in the vicinity of the impact area.
5. Evaluate suitability of the proposed wetlands mitigation site as potential habitat for *P. s. illinoensis*.
6. Survey the proposed mitigation site for existing populations of *P. s. illinoensis* and other sympatric amphibians and reptiles.

OBJECTIVE 1: DISTRIBUTION OF *PSEUDACRIS STRECKERI ILLINOENSIS*

METHODS: Roads into the study area were patrolled at night in automobiles when frogs were expected to be calling and/or possibly crossing roads.

Periodically, stops were made to listen for chorusing frogs. At each stop a data sheet (Figure 1) was filled out recording the species of anurans heard and environmental conditions at the time the observations were made. When *P. s. illinoensis* was heard at a stop, identification was considered tentative if the frog or frogs could not be caught and confirmed if frogs were captured. Road surveying began April 19 and ended May 8, 1993.

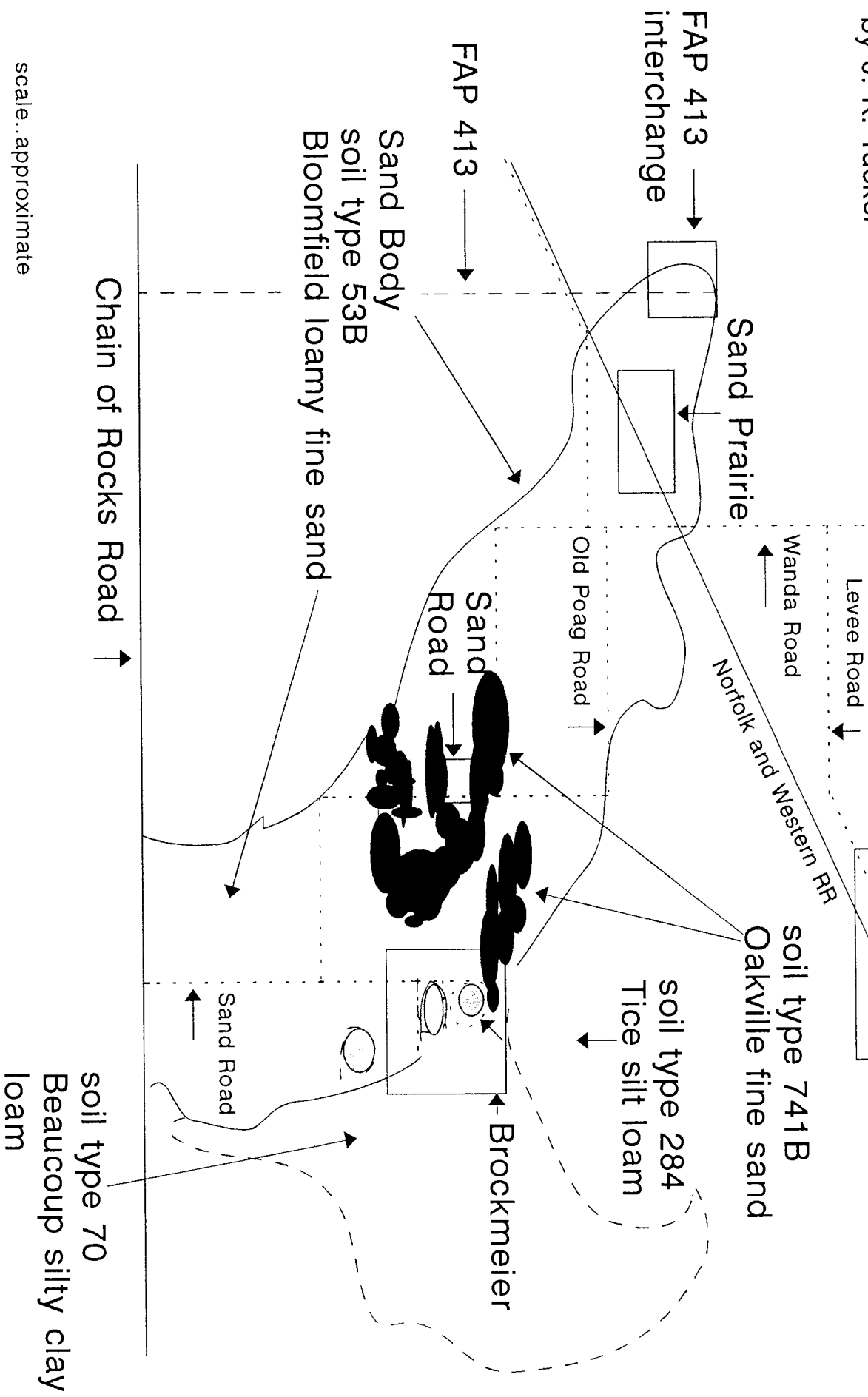
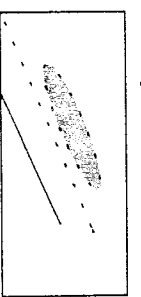
The area investigated by road surveys is contained in the polygon defined by Interstate 270 to the south, Ill. route 157 to the east, Ill. route 3 to the west and Ill route 143 to the north. This area was selected because it contains all of the historical published and verbally reported (to George Rose or Michael Morris) chorus locations in the vicinity of the route of FAP 413.

RESULTS: Choruses of *P. s. illinoensis* were found at two locations during road surveys (Figure 2). One of these localities (Brockmeier site) was previously reported by Taubert *et al.* (1982). The other (sand prairie site) has not been reported previously. No *P. s. illinoensis* were encountered on roads. Localities and dates of visits for each stop along with lists of anurans heard calling and conditions at the time of the stop are summarized in Table 1.

Figure 2. Map of sand body showing location of FAP 413 interchange location and projected path of FAP 413; location of proposed mitigation site; and locations of three sites (Sand Prairie, Sand Road, and Brockmeier) where attempts to located tadpoles of *Pseudacris streckeri illinoensis* were made. One or more frogs were heard calling at the Sand Prairie and Brockmeier sites in 1993.

North

Proposed mitigation site



scale.. approximate
0.8 km

Table 1. Locations where stops were made during road survey

Location	Date	Time	Conditions	Anurans heard
Canal Rd X Il rt 3	4/19	19:44	Cold/windy/rain	<i>Bufo americanus</i> <i>Rana sphenoccephala</i> <i>Pseudacris triseriata</i>
Canal Rd X Il rt 111	4/19	19:51		<i>Bufo americanus</i> <i>Pseudacris triseriata</i>
New Poag Rd X Cemetary Rd	4/19	20:00		<i>Bufo americanus</i> <i>Pseudacris triseriata</i>
Wanda Rd X Cahokia Diversion Canal	4/19	20:15		<i>Pseudacris triseriata</i>
Mitigation area	4/19	20:25		<i>Hyla versicolor</i> <i>H. crucifer</i> <i>Rana sphenoccephala</i> <i>Bufo americanus</i> <i>Pseudacris triseriata</i>
Chain of Rocks Rd KXEM Radio Towers	4/20	21:05	Cold/drizzle	<i>Pseudacris triseriata</i>
Sand Road site	4/20	21:40		<i>Bufo americanus</i> <i>Rana sphenoccephala</i> <i>Pseudacris triseriata</i>
Brockmeier site	4/20	22:02		<i>Hyla crucifer</i> <i>Rana sphenoccephala</i> <i>Bufo americanus</i> <i>Pseudacris streckeri</i> <i>illinoensis</i>
Mitigation area	4/22	19:40	cold/windy	<i>Hyla versicolor</i> <i>H. crucifer</i> <i>Rana sphenoccephala</i> <i>Bufo americanus</i> <i>Pseudacris triseriata</i>
New Poag Road near future location FAP 413	4/22	21:00		<i>Pseudacris triseriata</i>
Wagon Wheel Rd X Wanda Rd	4/22	21:54		<i>Bufo americanus</i> <i>Pseudacris triseriata</i> <i>Hyla crucifer</i>
Wanda Rd south of Roxana	4/22	22:12		<i>Pseudacris triseriata</i>
Brockmeier site	4/22	23:00		<i>Hyla crucifer</i> <i>Rana sphenoccephala</i> <i>Bufo americanus</i> <i>Pseudacris streckeri</i> <i>illinoensis</i> <i>P. triseriata</i>
Mitigation area	4/24	20:15	balmy with rain	<i>Hyla versicolor</i>

				<i>H. crucifer</i> <i>Rana sphenoccephala</i> <i>R. blairi</i> <i>Bufo americanus</i> <i>Acris crepitans</i> <i>Pseudacris triseriata</i>
St Thomas outskirts Thorngate Rd	4/26	21:13 balmy clear		<i>Bufo americanus</i> <i>Rana sphenoccephala</i>
Chain of Rocks near X with Old Alton Rd	4/26	22:00		<i>Bufo americanus</i> <i>Rana sphenoccephala</i> <i>Pseudacris triseriata</i> <i>Hyla crucifer</i>
Chain of Rocks Rd X X Il rt 111	4/26	22:23		<i>Bufo americanus</i> <i>Rana sphenoccephala</i> <i>Pseudacris triseriata</i> <i>Hyla crucifer</i>
Bluff Rd X Chain of Rocks Rd	4/27	23:00 [not recorded]		<i>Bufo americanus</i> <i>Pseudacris triseriata</i>
Bluff Rd X SIU Athletic Fields	4/27	23:22		<i>Bufo americanus</i> <i>Pseudacris triseriata</i> <i>Rana sphenoccephala</i> <i>R. blairi</i> <i>Hyla crucifer</i>
Bluff Rd X New Poag Rd	4/27	23:48		<i>Bufo americanus</i> <i>Pseudacris triseriata</i> <i>Rana sphenoccephala</i> <i>R. blairi</i> <i>Hyla crucifer</i>
Brockmeier site	4/29	21:27 Fog and rain		<i>Hyla crucifer</i> <i>Rana sphenoccephala</i> <i>Bufo americanus</i> <i>Bufo woodhousei</i> <i> fowleri</i> <i>Bufo hybrids</i> <i>Pseudacris streckeri</i> <i> illinoensis</i> <i>P. triseriata</i>
Sand Prairie	5/3	23:14 balmy		<i>Bufo americanus</i> <i>Bufo woodhousei</i> <i> fowleri</i> <i>Pseudacris streckeri</i> <i> illinoensis</i> <i>P. triseriata</i>
Brockmeier site	5/3	00:29		<i>Hyla crucifer</i> <i>Rana sphenoccephala</i> <i>Bufo americanus</i> <i>Bufo woodhousei</i> <i> fowleri</i> <i>Bufo hybrids</i> <i>Pseudacris triseriata</i>
Sand Prairie	5/6	23:29 cold		<i>Bufo americanus</i>

			<i>Bufo woodhousei</i> <i>fowleri</i> <i>Pseudacris triseriata</i>
Brockmeier site	5/6	23:59	<i>Hyla crucifer</i> <i>Rana sphenocephala</i> <i>Bufo americanus</i> <i>Bufo woodhousei</i> <i>fowleri</i> <i>Bufo hybrids</i> <i>Pseudacris triseriata</i>
Sand Prairie	5/8	21:00 cold	<i>Bufo americanus</i> <i>Bufo woodhousei</i> <i>fowleri</i> <i>Pseudacris triseriata</i>
Brockmeier site	5/8	22:25	<i>Hyla crucifer</i> <i>Rana sphenocephala</i> <i>Bufo americanus</i> <i>Bufo woodhousei</i> <i>fowleri</i> <i>Bufo hybrids</i> <i>Pseudacris triseriata</i>

DISCUSSION: *P. s. illinoensis* were not found during several stops at locations where chorusing frogs have been previously reported. This could indicate that frogs are less numerous now than in the early 1980's when Taubert et al. (1982) and Axtell (pers. comm. through Rose) made their surveys. At two of the three locations where Morris (1992, unpublished) heard significant sized choruses, no frogs were heard. However, the current survey was initiated late in the calling season which normally begins in early or middle March (Smith, 1961; Brown and Rose, 1988) and ends in late April or early May (Brown and Rose, 1988). Therefore, it is possible that choruses were present at historical sites but that the frogs had stopped calling before the road survey was initiated. However, at all of the previously reported sites of choruses of *P. s. illinoensis* significant numbers of calling frogs were reported in the time period during which we heard none.

To determine whether frogs are less numerous now than in the 1980's, it will be necessary to repeat the road surveys in 1994 commencing in early March. In any case, it is suspected that pending confirmation by a 1994 road survey, the Illinois chorus frog is significantly less abundant now than it was a decade ago. It is also concluded that only two sites can be confirmed as certain calling sites for *P. s. illinoensis* in Madison County, whereas choruses have been previously reported from five locations within the county.

OBJECTIVE 2: CHORUS SIZE

METHODS: Attempts were made to locate and capture frogs at the two localities where calling anurans suspected to be *P. s. illinoensis* based on the mating call were heard. All such attempts were made at night with flashlights as a light source. Prior to each such attempt 25 minutes were spent listening to the frogs to get a subjective estimate of the number of males calling. All frogs captured were marked by toe clipping which was restricted to the hind feet so that the frog's normal forward manner of burrowing would not be hindered.

RESULTS: At the Brockmeier site, which was visited 3 times between April 19 and April 29, the estimates of the number of *P. s. illinoensis* present and calling ranged from 2 to 6 with a mean of 4.25 frogs calling (n = 3 visits). At this site frogs were very easy to disturb and only a single male was caught and marked during the three visits. *P. s. illinoensis* were not heard on three visits made after April 29. At the sand prairie site, a single individual was heard calling on May 3. It likewise was impossible to catch. No *P. s. illinoensis* were heard during two visits over the next five days (May 6 and 8).

DISCUSSION: The fact that a maximum of 6 frogs were heard at a location where Morris (1992, unpublished) estimated 30 to 50 frogs were heard on visits between March 21 and April 5, 1991 may be interpreted as either evidence for significant reduction in frog numbers at this site or an indication that breeding was nearly over at the time (April 20, 1993) the first visit was made. Data presented below on the numbers of transforming froglets suggests that as few as seven clutches could account for the number of froglets estimated to have transformed at the site in 1993. Small chorus size at the only chorus found in 1993 also suggests that frog numbers in Madison County are reduced from earlier studies a decade ago and from one made just two years previous.

Brown and Rose (1988) also reported small numbers (less than 7 males) from many of the choruses they studied along the lower Illinois River. Of 36

total choruses 18 were estimated to have 10 or fewer males at them during the 1984 calling season (22 March to 23 April). This may indicate that small choruses are the natural state for the species, or more likely, that this frog is also significantly reduced in numbers in the main part of its range in Illinois as well. Brown and Rose (1988) reviewed the many impacts that human activities were thought to be having on the frog.

OBJECTIVE 3: REQUIREMENTS FOR BREEDING SUCCESS

METHODS: Known sites of choruses (Brockmeier and sand prairie) and suspected sites (mitigation area and Sand Road) were surveyed for tadpoles of *P. s. illinoensis* by seining and dip netting bodies of water at each location. All tadpoles collected were transported live to the laboratory and identified with keys in Wright and Wright (1949). Suspected *P. s. illinoensis* tadpoles were further compared to previously published illustrations (Smith, 1961, Johnson, 1987). Because tadpoles of *P. s. illinoensis* and *P. triseriata*, a sympatric congener, are similar in morphology, all *Pseudacris* tadpoles were kept in aquaria to allow transformation and positive identification. Aquaria were aerated and contained 8.2 l of water transported from the collecting site. Tadpoles were fed commercial (Tetra-Min) flake fish food.

Fish collected during the tadpole surveys were preserved in 10 percent formalin and identified to species. All were measured for total length following preservation. Identifications and nomenclature for fishes follows Smith (1979).

If froglets of *P. s. illinoensis* appeared among the transforming tadpoles in the laboratory, then drift fences were erected at that site to confirm that froglets of *P. s. illinoensis* were also transforming at the collecting site. The Brockmeier site was the only site that so qualified. Drift fences were constructed from aluminum flashing. Each fence consisted of one 15.24 m section of aluminum flashing that was 0.254 m tall. The bottoms of all fences were buried ca. 2 cm in the substratum to prevent frogs from escaping under them. At least four can traps were placed with each fence with two (one each at opposite ends of the fence) on each side of the fence. In two cases, one additional trap was also located in the center of the fence on each side yielding a total of 6 traps. Can traps consisted of plastic gallon (3.79 l) jars with the bottoms removed to form a sleeving for the hole. The hole was dug ca. 0.4 m deep and maintained at each visit by removing any loose sand that had fallen into them. One fence was equipped with screened enclosures allowing the traps to be shaded; all others were unshaded. The first drift

fence was placed May 24 and all 10 fences were in operation by May 26. Drift fences were removed June 12. Figure 3 shows the placement of the fences at the Brockmeier site. Traps were checked at least twice daily. All anurans captured were marked by toe clipping, identified to species, measured (snout to vent length) and then released unharmed. The length in mm of any remaining tail stub was recorded for any *P. s. illinoensis* that had one. All measurements were made with a millimeter rule to the nearest mm. To track fence induced mortality, any dead anurans located along the fence or within cans was identified to species and recorded on data sheets (Figure 1). Each of the sites surveyed are listed in Table 1 which contains location and anurans heard calling. Brief descriptions of the microhabitats of four of these sites that were surveyed for tadpoles is provided here.

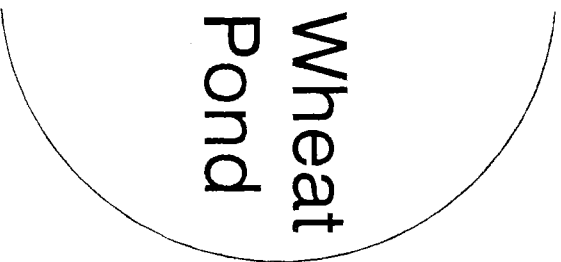
At the Brockmeier site four bodies of water were surveyed. These included a pond located in an old field setting (called dug pond), one in a wheat field (called wheat pond), a flooded area (called swamp) that drains through a ditch into the dug pond and separates the dug pond from Cahokia Creek (called creek). None of these areas supported submersed aquatic vegetation during the period of investigation. Only the creek had significant emergent aquatic vegetation consisting of cattail (*Typha* sp.) and arrowhead (*Sagittaria latifolia*). Some smartweed (*Polygonum* spp.) and curly dock (*Rumex* sp.) were present among the stunted wheat plants in the swamp. Of these four

Figure 3. Detail of Brockmeier site where drift fences were employed. Double headed arrows represent drift fences. Line between the arrowheads is nearly to scale so the amount of coverage of the Dug pond is shown. Except for fence 5, all fences were oriented parallel to the shore of the Dug pond. Thin dashed lines outline areas of heavy sod associated with the Grassy Road and the road into the site. An area of heavy sod is also located at the south border of the site and is not shown on this map.

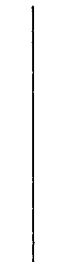
North

Brockmeier Location

South



1

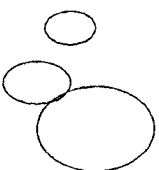


5

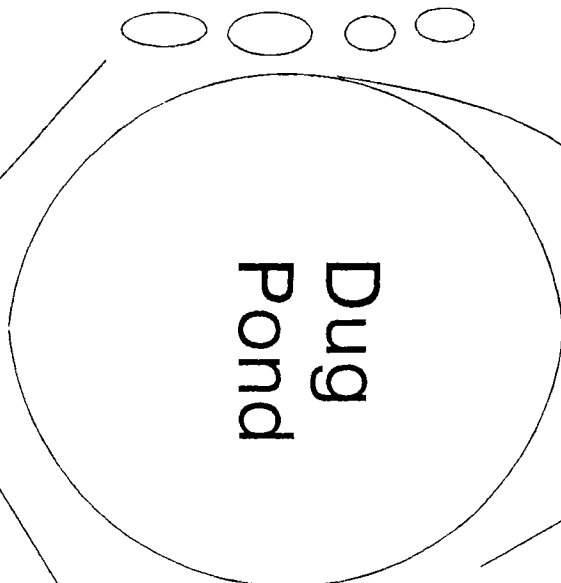
3

Grassy Road

4



6



10

8

9

7



water bodies, the wheat and dug ponds had sand bottoms while the creek and swamp had silty clay bottoms. Soil types for the dug and wheat ponds are Bloomfield loamy fine sand and Oakville fine sand (Goddard and Sabata, 1986), respectively. Beaucoup silty clay loam and Tice silt loam are found in the creek and swamp, respectively. The dug pond and swamp are ephemeral and dry or are drained most years (pers. comm. K. Brockmeier); the creek and wheat pond are permanent. At the Brockmeier site, the dug pond and wheat pond were seined and dip netted while the creek and swamp were dip netted only.

At the sand prairie site two bodies of water were sampled. One included a ditch (called ditch) along the railroad that parallels Poag Road. The ditch crosses under Poag Road through a culvert and continues in a southerly direction. This ditch has a silty clay bottom (Darwin silty clay, Goddard and Sabata, 1986) and supports *Typha* sp. along with *Polygonum* spp. The other, located south of Poag Road and east of the ditch and not obviously connected to the ditch, is a curved trench (called trench) dug in sand (Oakville fine sand, Goddard and Sabata, 1986). The trench is ca. 7 m wide at its widest and ca. 60 m long. It did not support submersed or emergent aquatic vegetation.

Two bodies of water were sampled at the mitigation area. One of these is Cahokia Creek (called creek) and the other is an old borrow pit (called pit). At this site Cahokia Creek has steep high banks and appears to have been channelized. It did not support emergent or submersed vegetation. The pit which dries in drought years (L. Primas pers. comm.), has some emergent vegetation mostly *Typha* sp. Flooded terrestrial vegetation (possibly *Ambrosia* sp. and *Salix* sp.) occurs within the pit, suggesting that drying may be a more common event than suggested by Primas. Both of these bodies of water were sampled by dip netting. The creek has an indurated sand bottom and sides. The banks are hard packed sand with 2 to 6 cm of silty clay on the surface. The pit has a silty clay bottom. The soil type surrounding the pit is Birds silt loam (Goddard and Sabata, 1986).

No standing water was found at the Sand Road site where anurans had been heard calling during the road survey portion of the study. Consequently,

samples could not be made. Soil types at this site are Oakville fine sand and Bloomfield loamy fine sand (Goddard and Sabata, 1986).

RESULTS: Tadpoles identified as *Pseudacris* sp. were recovered from the Brockmeier site (dug pond and swamp), the sand prairie site (ditch), and the mitigation area (pit). Of these tadpoles only those from the Brockmeier (dug pond) proved to be *P. s. illinoensis*. All tadpoles from the other sites upon transformation were identified as *P. triseriata*. Voucher specimens from each of these sites are deposited in the Illinois Natural History Survey collections (INHS 10938-39; 10946-56 for *P. s. illinoensis* taken under Illinois Department of Conservation permit number 93-8s) and INHS uncataloged for the *P. triseriata*.

At the other sites either no tadpoles were caught (Brockmeier-creek; Sand Road; mitigation-creek) or species of other anuran genera but not *Pseudacris* were taken (Brockmeier-wheat pond and sand prairie-trench where only *Bufo* spp. tadpoles were found).

Since only the Brockmeier site produced confirmed *P. s. illinoensis* froglets in the laboratory, drift fences were placed at this site only. A total of 714 froglets of *P. s. illinoensis* were caught, measured, marked, and released at the drift fences. A total of 144 frogs were recaptured at the fences. Table 2 contains the numbers of captures and recaptures at each drift fence by side along with mean snout to vent and tail stub lengths for frogs

Table 2. Means for measurements at initial capture for froglets of *Pseudacris streckeri illinoensis* caught along drift fences. Abbreviations: SVL = snout to vent length; Tail = tail stub length; n = number caught excluding recaptures; nr = number of recaptures; pond = side of fence closest to Dug pond; sand = side of fence farthest from Dug pond; * = mean on one side of fence are significantly ($p < 0.05$) from the mean on other side of same fence.

WHEAT FIELD FENCES						
Fence number	side	SVL (mm)	n	nr	Tail (mm)	n
1	pond	21.08	87	20		none
	sand	21.60	5	11		none
2	pond	21.16	63	10	2.00	3
	sand	21.73	11	5		none
3	pond	21.09	110	21	3.14	7
	sand	21.46	26	23	3.00	3
5	west	21.89	27	4		none
	east	21.38	22	10		none
DUG POND FENCES						
Fence number	side	SVL (mm)	n	nr	Tail (mm)	n
4	pond	19.25 *	52	0	9.38 *	47
	sand	20.40	25	1	8.44	9
6	pond	18.83	6	0	8.20	5
	sand	19.28	25	1	10.00	20
7	pond	19.57 *	44	19	9.64 *	33
	sand	20.89	54	6	4.83	6
8	pond	19.84 *	64	4	13.10 *	31
	sand	20.58	38	5	7.17	6
9	pond	20.11	9	1	12.60 *	5
	sand	20.86	7	1	3.50	2
10	pond	19.20 *	35	1	11.91	33
	sand	21.25	4	1		none

caught along each fence side. Based on the rate of captures at the fences bordering the dug pond and the extent of coverage of the border of the pond (Fig. 3), it is estimated that about 2500 froglets emerged from the pond during the time that drift fences were employed which covered essentially the entire period during which froglets were likely to have emerged. If tadpole mortality is low, then as few as 7 or 8 females depositing eggs into this pond could account for the estimated number of froglets because Smith (1961) reported a clutch size of 400 eggs.

Of the sites surveyed fish were collected at two of them. Specimens of the common carp (*Cyprinus carpio*) were collected at the sand prairie-ditch site. All of these were less than 40 mm long and caught with dip nets. At Brockmeier-wheat pond common carp, yellow bullhead (*Ictalurus natalis*), and bluegill (*Lepomis macrochirus*) were collected. Carp ranged from 30 to 140 mm in length; bullheads from 40 to 100 mm and bluegills from 30 to 90 mm.

DISCUSSION: At present little is known concerning the habitat requirements for breeding success in *P. s. illinoensis*. However, the two sites (Brockmeier wheat and sand ponds and sand prairie trench) where *P. s. illinoensis* were found calling share certain similarities. First, the bodies of water where males were calling were located within sandy soil types. Second, submersed and emergent aquatic vegetation was absent. Third, the terrestrial vegetation surrounding the ponds was of various grasses consisting of either wheat or mixed native and exotic grass species rather than forested or more herbaceous cover. Fourth, both are located on the same sand deposit (Figure 2).

The mitigation site and the part of the Brockmeier (creek and swamp) site where frogs were not heard are on silt clay soils. They also are completely or partially forested rather than prairie-like. Pending further confirmation it appears that breeding sites attractive to the frogs include small bodies of water, ephemeral or permanent, located within or very near areas of sandy soils and with prairie-like vegetation but without significant aquatic vegetation.

Brown and Rose (1988) reported similar features for 36 calling sites that

they analyzed. Of 36 choruses they studied, 19 were on soils characterized as either sand or sandy loam. Of the remaining choruses located on silt/clay soil types, all but 7 were within 200 m of a sand soil type. They also reported that 27 of 36 choruses were in "flooded depressions in fields" (Brown and Rose, 1988, p. 6). All sites were lentic in character and only 2 of 36 appeared to them to be "permanent". They reported finding no choruses at lotic environments such as ditches with moving water, creeks, or rivers.

Even if a potential breeding site attractive to the frog is present, reproductive success by the frogs using the site is not guaranteed. Two other requirements may also be important. These are how many frogs can get to the site and if eggs are laid will froglets emerge.

Except for the Brockmeier site and the Sand Road site, historical records of choruses suggest that the numbers of males heard in the past at these sites were always small, fewer than 10. This includes the chorus located by Axtell just north of the sand prairie site reported for the first time herein. No frogs were heard at the Axtell location and only one at the sand prairie site. No tadpoles of *P. s. illinoensis* were recovered at this calling site though large numbers of *Bufo* sp. and *Rana* sp. tadpoles were found. Either eggs were not laid here or too few tadpoles were present to make it likely that they would be caught. However, at this site, the trench is relatively narrow and the seine used reached from bank to bank so it seems unlikely that the any *P. s. illinoensis* present would be missed. It is concluded that though a male was heard at the sand prairie site no eggs were laid. It is concluded that no reproduction of *P. s. illinoensis* occurred at this site in 1993.

At the Sand Road and Brockmeier sites, historical records suggest that as many as 50 or more frogs have been at the sites at the same time (Taubert et al., 1982; Morris, 1992). It is therefore likely that reproduction occurred in the past at both sites and that the sites are critical for maintenance of the frog in Madison County. At the Sand Road site water was present during the breeding season of the frog even though no *P. s. illinoensis* were heard calling during the current survey. During the time that *P. s. illinoensis*

tadpoles were beginning to transform at the Brockmeier site, the Sand Road site had already dried and no froglets were found. Consequently, if the frogs did use the Sand Road site, then likely none survived to transform due to drying of the breeding site. For a breeding site to produce froglets, it is concluded that it must persist from early March when males establish choruses to mid-June by which time the bulk of the tadpoles produced have transformed.

The current study produced preliminary data supporting the hypothesis that breeding success of *P. s. illinoensis*, defined as producing transformed froglets, is adversely impacted by populations of predatory fishes. At the Brockmeier site frogs were heard in chorus at both the dug pond (current study and G. Rose) and the wheat pond (G. Rose). Presumably breeding occurred at both locations. However, only the dug pond produced transforming froglets. The hypothesis that only the dug pond produced transforming froglets is supported by the observation that all of the froglets retaining a long tail stub, an indication of recent transformation, were caught on the dug pond side of drift fences that were located between the dug and wheat ponds (Figure 3). Furthermore, no *P. s. illinoensis* tadpoles were seined from the wheat pond whereas several were seined from the dug pond. Also, nocturnal surveys of the dug pond edges produced 4 to 8 froglets per visit during the heaviest period of transformation, whereas no froglet was ever found along the banks of the wheat pond during the same nights. It is strongly suspected that predatory fishes present in the wheat pond and in particular the numerous (over 100 specimens in eight seine passes) yellow bullheads found tadpoles of *P. s. illinoensis* palatable and destroyed whatever breeding effort was expended in this pond. Fish are excluded from the dug pond due to complete drying that occurs during the late summer of most years. It is therefore concluded that *P. s. illinoensis* reproduction and presence of predatory fishes are incompatible.

It should be noted that the habitat of the wheat pond is quite different from that of the dug pond in that the former is within an agricultural field while the latter is not. It could also be that the lack of froglets may be

due to some agricultural practice. However, the wheat pond contained numerous tadpoles of *Bufo* spp. (both *B. americanus* and *B. woodhousei fowleri* and hybrids between the two) and thousands of these transformed successfully during the current study from the wheat pond (and the dug pond). Toad tadpoles are toxic and few creatures consume them (Smith, 1961). They were likely protected from the predatory fishes in the wheat pond. If agricultural practices impacted the chorus frogs it had little apparent impact on the toads and this is thought to be an unlikely explanation for the observations herein reported.

In summary for successful reproduction to occur the following conditions seem to be necessary. First, the breeding site should be prairie-like and not forested. Second, there must be sufficient frogs near to the site to find it and to find mating partners. Third, the site must be within a sand area. Fourth, the breeding site must retain water from early March to at least mid-June to allow completion of the tadpole phase of the life cycle. Fifth, predatory fishes must not be present at the site.

OBJECTIVE 4: POST-BREEDING HABITAT

DISCUSSION: At present this important aspect of the biology of *P. s. illinoensis* has not been investigated for the Madison County study areas. Work is expected to begin in the next annual cycle of the project as adults moving to the chorus are located.

What can be said is that from previous reports (reviewed by Brown and Rose, 1988) areas of sand are required as habitat for the frog. The impact of sod formation on the suitability of sand areas should be investigated because Brown *et al.* (1972) found that in the laboratory that *Pseudacris streckeri* could not penetrate sod. Consequently, it is suspected that sod formation makes burrowing impossible for free ranging frogs as well. During the current study, one adult male was dug from a burrow at the Brockmeier site. This burrow was 45 cm long and 11 cm below the soil surface at its terminus. The sand was damp but not water saturated at the terminus of the burrow. The frog was well hydrated and active and was found in a slightly enlarged chamber at the terminus of the burrow. The burrow was located in an area of unvegetated sand. Other burrows suspected to have been made by frogs were also all located in areas of open sand but were empty when excavated. No suspected frog burrows among 38 excavated were within 5 cm of plants. Furthermore, 42 burrows containing newly transformed froglets were excavated between the wheat and dug ponds. All of these were likewise located in areas of bare sand but 19 were within 0.5 cm of wheat plants. Most of these burrows were less than 2 cm long but the longest was 10 cm long. Numerous empty burrows were also excavated. No burrows were found on the "Grassy Road" (Figure 3) which is a sod covered berm that separated the dug and wheat ponds. Frogs crossing the berm were found hopping amongst the vegetation and none were found in burrows, yet it was unusual to find frogs exposed in the neighboring wheat field. The observations support the hypothesis that sod is incompatible with the frogs burrowing life history (see Brown, 1978, on the subterranean feeding habits of the frog) and that areas of sod are avoided by free ranging frogs. If so, not only must habitats be sandy but they must be fairly sparsely vegetated.

The implications for management of habitat to promote survival of *P. s. illinoensis* are that habitats selected for management must be maintained in a prairie-like state through burning and that vegetation should not be allowed to thicken and form sod.

OBJECTIVES 5 AND 6: MITIGATION SITE

DISCUSSION: The proposed location of a mitigation site for the wetlands that will be destroyed during construction of FAP 413 is marked in Figure 2. Although this site may be replaced by the selection of another more suitable site (Simon and Perino, pers. comm.), the following is a brief review of findings that support the conclusion that the proposed site is not suitable.

The site, which is located on silt clay soil types (see above for details) is incompatible with known requirements of *P. s. illinoensis* for sand soil types (Brown and Rose, 1988, and contained citations). Furthermore, the site is basically a wooded one with the exception of cleared agricultural fields, contrary to the apparent need for prairie-like habitats for the frog. The site is suitable in that the pit does not support fish populations due to periodic drying yet contains water for a sufficient period for tadpoles to develop into frogs. It is at least 1.8 km from the nearest sizable sand area making it unlikely that these small frogs could reach the site for breeding. During the current survey no *P. s. illinoensis* were heard at the site though Rose (pers. comm.) believes that he heard them at the site prior to initiation of the study. His observation remains to be confirmed by identification of actual specimens from the site.

It is our conclusion that the mitigation site is not suitable as habitat for the Illinois chorus frog and that populations of the frog cannot now be confirmed to be present at the site.

CONCLUDING REMARKS

At this point the following conclusions are offered, some of which require further investigation for confirmation but all of which are supported by existing data.

1. The Illinois chorus frog has become less numerous than it was ten years ago and possibly even less numerous than it was two years ago.
2. The Brockmeier site and the sand prairie site are the only two remaining sites where this frog could be found attempting to breed in the vicinity of FAP 413. The latter site is close to the proposed path of the road and care will have to be taken to avoid, wherever possible, unnecessary disturbances during FAP construction related activities.
3. The proposed mitigation site is not suitable habitat for the frog and that no populations can be confirmed at the site.
4. Should it be desired to incorporate habitat suitable for the Illinois chorus frog within a mitigation site, the site must have the following characteristics. It must be prairie-like rather than wooded. Prairie must be present or restored to the site though old field type habitats are also apparently acceptable. The site must be sandy and the sand unconsolidated so that frogs may burrow into it. It is probably necessary that the site be sparsely vegetated as the frogs cannot penetrate sod. The site must have a potential breeding site in fairly close approximation. The breeding site appears to be most attractive if it is within the sand area rather than in another soil type. Fishes must not be present. Water must persist from early March to mid-June at the breeding site.

Although much was accomplished during this field season some important issues remain to be settled. The most important of these are:

1. Are the frogs as uncommon relative to their former abundance as it now seems they are?
2. To what extent are frogs utilizing the immediate area of the FAP 413 interchange?
3. What measures should be undertaken to lessen the impact of actual

construction activities on the frogs?

4. Can areas where the road will pass through sand areas be made more compatible with the life history requirements of the frog without greatly increasing the costs of construction?

5. What is the fate of the 700 or so frogs that were marked this season?

6. Do other old sand terraces located south of Interstate 270 along Ill. route 159 also contain populations of the frog?

Arriving at conclusions for these points will help provide the information needed to safeguard the existence of this frog in Madison County and other areas where the frog is present in the Illinois Sand Prairies.

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FIGURE CAPTIONS