

**THE DISTRIBUTION AND BREEDING HABITAT
OF THE BARKING TREEFROG, *HYLA GRATIOSA* LECONTE,
IN SOUTH-CENTRAL KENTUCKY AND NORTH-CENTRAL TENNESSEE**

DANIEL E. VANNORMAN AND A. FLOYD SCOTT

*Austin Peay State University
Clarksville, Tennessee 37044*

ABSTRACT

The distribution and breeding habitat of a disjunct population of the barking treefrog (*Hyla gratiosa*) were studied in the Pennyroyal Plain region of Kentucky and Tennessee from 1 May through 31 August, 1983 and 1984. Twenty breeding sites and 16 road collections were recorded from six Kentucky and two Tennessee counties. Most breeding took place in flooded sinks of grain fields. Averages for air temperature, water temperature, dissolved oxygen, and pH recorded at breeding sites on nights when males were calling were 24.2 C (+ or - 3.3 SD), 27.0 C (+ or - 1.5 SD), 8 ppm (+ or - 2.5 SD), and 7.3 (+ or - 1.3 SD), respectively. During 1983, the species was first observed on 20 May and last seen on 26 July; during 1984, 18 May and 28 August were the earliest and latest dates it was recorded. Calling was first heard on 8 June in 1983 and on 18 May in 1984; it was last recorded on 26 July in 1983 and on 15 July in 1984. Juvenile individuals were encountered during late June and most of August. An average of 3.3 males were heard calling at each site. They were routinely observed in an inflated condition at the surface of shallow water (2-120 cm deep), usually among grain stubble within 5 m of water's edge. Only one female was discovered at the breeding sites; three were encountered on roads, all near sites occupied by males and where they had been calling. Averages for snout-vent length and tibia length of all specimens examined (34) were 47.6 mm (+ or - 13.15 SD) and 21.2 mm (+ or - 4.80 SD), respectively.

INTRODUCTION

The barking treefrog, *Hyla gratiosa* LeConte, occurs on the Atlantic and Gulf coastal plains from southeastern Louisiana to southern Florida and north to southeastern Virginia. It is also found locally in northern Alabama, eastern Georgia, Tennessee and Kentucky (Conant 1975). An introduced population once persisted in New Jersey, but may now be extinct (Caldwell 1982).

In south-central Kentucky and north-central Tennessee, *H. gratiosa* exists as a disjunct, apparently relict population (Monroe and Giannini 1977). The first reports of the species from this region were from Montgomery County, Tennessee (Scott and Harker 1968). Subsequently, additional records were obtained from other sites in Montgomery County (Henderson 1978, Scott, *et al.* 1980) and from the following Kentucky counties: Todd (Monroe and Taylor 1972), Caldwell (Monroe and Giannini 1977, Giannini 1983), Lyon and Trigg (Giannini 1983).

In Kentucky, *H. gratiosa* is considered an endangered species by the Endangered Species Committee of the Kentucky Academy of Science and by the Kentucky Nature Preserves Commission (Branson *et al.* 1981). In Tennessee, the Tennessee Wildlife Resources Agency designates this species' protection status as "deemed in need of management" and the Tennessee Heritage Program considers it an animal of "special concern" (Eager and Hatcher 1980).

Except for the limited information presented by Henderson (1978) on four small breeding populations in Montgomery County, Tennessee, and Giannini (1983) on breeding populations in Caldwell County, Kentucky, little is known about the disjunct Kentucky-Tennessee population. The main purpose of this study was to determine the limits of the distribution of this little-studied population and to characterize the breeding habitats it utilizes. The

number of individuals at each breeding site, spatial positioning of breeding pond occupants, duration of the daily calling period, and duration of the breeding season were also investigated.

DESCRIPTION OF STUDY AREA

The study was confined to the Pennyroyal Plain Subsection, Highland Rim Section, Interior Low Plateaus Physiographic Province which has been defined and amply described geologically and vegetationally by Quarterman and Powell (1978). A map of this region showing its location in Kentucky and Tennessee, plus county boundaries and major cities within, appears in Figure 1.

Soils of the Pennyroyal Plain are generally red and brown in color and well-drained, although darker, poorly drained soils do occur, especially in the southern part of the area. In the Kentucky portion, Pembroke, Cumberland and Crider soils predominate (University of Kentucky 1970); in Tennessee, the main soil series are Pembroke-Crider, Baxter-Bewleyville-Pembroke and Dickson-Mountview-Guthrie (Springer and Elder 1980).

A humid, mesothermal climate with little or no water deficiency throughout the year prevails in the Pennyroyal Plain (Thorntwaite 1948). The average annual precipitation is 47.9 inches (121.7 cm) with the driest month being October and the wettest month being March (Saur 1927). The mean annual temperature (based on data for all of western Kentucky) is approximately 59°F (15°C) with average monthly summer temperatures ranging from 72°F (22°C) to 80°F (27°C) and average monthly temperatures varying from 33°F (0.5°C) to 39°F (4°C) (Kendall 1933).

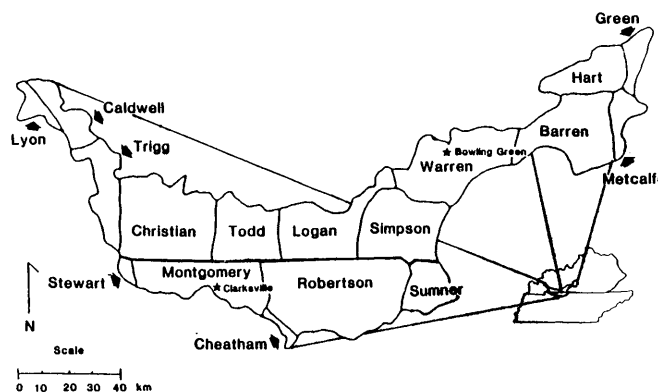


Figure 1. Pennyroyal Plain region of Kentucky and Tennessee showing locations of major cities and county boundaries.

METHODS AND MATERIALS

Distribution data were obtained from surveys of the literature and museum collections at Austin Peay State University (APSU) and University of Louisville (ULM) and from field work aimed predominately at locating new breeding sites. Searches for new breeding sites were conducted at night from 1 May to 31 August, 1983 and 1984, when males were calling and all individuals were more apt to be active. Roads traversing promising terrain (rolling

karst topography with numerous small ponds) were driven, especially following periods of rainfall. Overall, 117 night trips (61 in 1983; 56 in 1984), averaging 3.5 hours each, were logged. Total miles driven was approximately 10,400.

Attempts were made to collect a small sample (one individual of each sex and age class if possible) from each breeding site. Sex was determined by whether the individual was calling or not, by the presence or absence of vocal sacs, and by the presence (males) or absence (females) of a green throat band. Age was estimated from snout-vent length using the criteria of Wright (1932), who concluded that individuals begin breeding three years from transformation. Therefore, in this study, one- to two-year-old individuals were considered juveniles. Road records were also documented with specimens if no known breeding site was near. Sex, snout-vent length (SVL) and tibia length were recorded for all individuals captured. Measurements were taken to the nearest millimeter using vernier calipers.

The origin (natural or man-made), current human usage, and hydroperiod of breeding sites were determined either by personal observation or by owner interviews.

Hydrogen ion (pH), and dissolved oxygen (DO) concentrations plus temperature of air and water at breeding sites were measured just offshore on each visit if males were calling. Instruments used included a Fisher Accumet Mini pH meter, Model 640, a Chemetrics, Inc. dissolved oxygen test kit, Model O-12, and a mercury thermometer.

Other vertebrates present at breeding sites were determined from specimens taken by hand and seining or via recognition of their breeding calls. Dominant aquatic and emergent vegetation was usually identified in the field, but collections for laboratory identification were made when necessary.

The number of individual *H. gratiosa* at each breeding site was determined by the direct count method. Spot-lighting was employed to locate members of both sexes; males were also detected audibly when calling.

Spatial positioning of breeding pond occupants was characterized by each individual's distance from shore and height above water if found on emergent vegetation. Measurements were taken with a standard meter stick and a telescoping fishing pole marked in centimeters. Distances were determined to the nearest 0.5 m and depth to the nearest 0.5 cm.

All specimens collected were processed using standard museum procedures and deposited in the Austin Peay State University Museum of Zoology (APSU 3592 and 3642).

RESULTS

Twenty-five museum specimens and 16 literature records of *H. gratiosa* from Caldwell, Logan, Lyon, Todd, and Trigg counties in Kentucky, and from Montgomery County, Tennessee were located. Twenty breeding sites and 16 individuals on roads were found in Caldwell, Christian, Logan, Lyon, Todd, and Trigg counties in Kentucky and Montgomery and Robertson counties in Tennessee (Figure 2). Seven breeding sites were permanent ponds (mostly cattle ponds) and 13 were semi-permanently flooded sinks in barley, corn, or wheat fields.

The temporary sink ponds generally had mud bottoms and, when visited, most had grain stubble floating on and emerging from shallow water and present around the shoreline. The permanent ponds also had mud bottoms with fescue dominating the herbaceous vegetation along the shore.

Generally, aquatic and emergent vegetation was sparse at breeding sites. However, of that observed, green algae (Phylum Chlorophyta) appeared to be the most dominant offshore plant, and black willow (*Salix nigra*) the most abundant emergent plant.

Vertebrates other than *H. gratiosa* observed at breeding sites included *Acris crepitans*, *Ambystoma tigrinum*, *Bufo woodhousei fowleri*, *Chelydra serpentina*, *Gastrophryne carolinensis*, *H.*

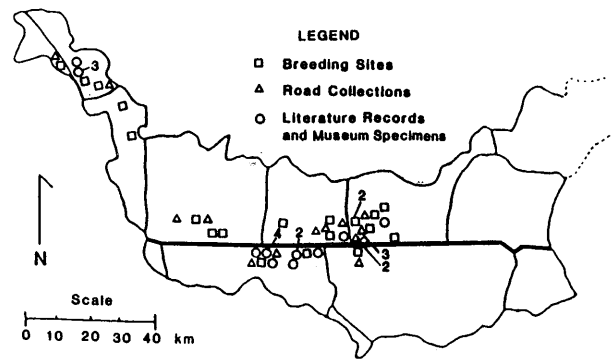


Figure 2. Distribution of known records of *Hyla gratiosa* in the Pennyroyal Plain of Kentucky and Tennessee. Numerals indicate multiple records in localities too close together to be resolved at this scale.

crucifer, *H. versicolor* complex, *Ictalurus melas*, *Notophthalmus viridescens*, *Pseudacris triseriata*, *Pseudemys scripta elegans*, *Rana catesbeiana*, *R. clamitans*, and *R. sphenoccephala*. Of course, all of these were not seen at every site.

Averages for air temperature, water temperature, dissolved oxygen, and pH recorded at all breeding sites are given in Table 1.

During 1983, *H. gratiosa* was first observed on 20 May and last seen on 26 July; during 1984, 18 May and 28 August were the earliest and latest dates on which activity was recorded. Calling was first heard on 8 June in 1983 and on 18 May in 1984 and was last recorded on 26 July in 1983 and 15 July in 1984. Juveniles (27 mm to 41 mm SVL) were encountered on roads near breeding sites from 25 June to 28 August in 1984. With few exceptions, calling was limited to the period between 2100 and 2400 CDT.

An average of 3.3 (+ or - 2.0 SD, range 1-8) males were heard calling at each site. All were observed in an inflated condition at the surface of the water with a mean depth of 28.0 cm (+ or - 23.4 SD, range 2-120 cm), usually among grain stubble at an average distance from shore of 5.2 m (+ or - 5.9 SD, range 0-20.0 m).

Only one female was encountered at a breeding site. This occurred on 19 June 1983 in Christian County, Kentucky. She and an adult male were in axillary amplexus floating at the surface of

Table 1. Means, standard deviations (SD), and ranges of air temperatures, water temperatures, dissolved oxygen, and pH values recorded at *Hyla gratiosa* breeding sites in the Pennyroyal Plain between 8 June and 26 July of 1983 and 18 May and 15 July of 1984.

	N*	Mean	Standard deviation	Range
Air temperature	26	24.2°C	3.3	17-32°C
Water temperature	23	27.0°C	1.5	24-29°C
Dissolved oxygen	15	8 ppm	2.5	2.5-12.0 ppm
pH	11	7.3	1.3	5.0-9.2

*Number of readings

Table 2. Snout-vent and tibia lengths (in mm) of the *Hyla gratiosa* collected in the Pennyroyal Plain during 1983 and 1984.

	N*	Snout-vent lengths			Tibia length		
		mean	SD	range	mean	SD	range
Males	20	56.2	6.38	45.0-61.0	24.3	2.10	20.0-27.0
Females	2	57.5	0.71	57.0-58.0	25.3	0.35	25.0-25.5
Juveniles	12	31.7	4.35	27.0-41.0	15.3	2.20	13.0-19.0
All Individuals Combined	34	47.6	13.15	27.0-75.0	21.2	4.80	13.0-27.0

*Number of specimens examined

shallow water (20 cm deep) among floating wheat stubble, 5 m from the water's edge. Three additional females were encountered on roads. These were found on 24 May 1983, 17 June 1983, and 19 August 1984.

Averages of the snout-vent lengths and tibia lengths of the *H. gratiosa* captured during this study are given in Table 2.

DISCUSSION

Breeding sites tended to be clustered in the central Pennyroyal Plain of southeastern Todd and southwestern Logan counties, Kentucky and in northeastern Montgomery and northwestern Robertson counties, Tennessee. From there they were scattered along a line running through the western Pennyroyal of Kentucky from south-central Christian County to southeastern Lyon County. Extensive searching eastward through Simpson County, Kentucky and Robertson County, Tennessee failed to reveal any breeding colonies, despite the presence of what appeared to be favorable habitat. Additional work in these areas may yet reveal the species' presence.

Outside the Pennyroyal Plain, *H. gratiosa* has been observed breeding in a wide variety of habitats. Wright (1932), and Wright and Wright (1949) found them breeding in temporary, semi-permanent, or permanent, open ponds located within pine barrens, cypress woods, and flooded cornfields. They were also found in cypress woods by Allen (1932), Neill (1952), and Oldham and Gerhardt (1975) and in flooded cornfields by Jobson (1940). Black and Gosner (1958) found breeding activity in a permanent pond encircled by deciduous woods. Other breeding individuals have been found in a swamp, a small grassy pond, a flooded sand pit (Funderburg 1953, 1955), a semi-permanent pond with dense undergrowth (Cahn 1939), a small permanent woodland pond (Goin 1938), a natural pond in a live-oak hammock (Neill 1958), and other types of ponds, swamps and streams (Blem and Miller 1980, Brandt 1933, Martof 1954, McKeever 1977).

In the Pennyroyal Plain, however, breeding sites seem to be more uniform in character. Monroe and Giannini (1977) described the Caldwell County, Kentucky sites as a flooded slough containing several permanent wet areas with considerable submergent grass and weedy growth. Henderson's (1978) Montgomery County, Tennessee sites were generally permanently flooded sinkholes and man-made ponds surrounded by pasture. The breeding sites in this study were generally open ponds with little, if any, woody vegetation. The majority of them were temporarily flooded sinks found in grain fields, with the rest being permanent sink ponds, most of which were used by cattle.

Scant information exists describing the vertebrate community associated with the breeding habitat of *H. gratiosa*. However,

Wright (1932) reported many vertebrates, predominately anurans, utilizing *H. gratiosa* breeding sites in the Okefenokee Swamp, Georgia. Cahn (1939) reported observing *Acris crepitans*, *A. gryllus*, *Bufo woodhousei fowleri*, *H. crucifer*, *H. versicolor*, *Rana catesbeiana*, and *R. sphenoccephala* at a breeding site in northern Alabama, and Black and Gosner (1958) reported observing *A. crepitans*, *H. versicolor*, and *R. clamitans* at a site in New Jersey. Except for *A. gryllus*, these same species were encountered sharing breeding sites with *H. gratiosa* in the Pennyroyal Plain. The fact that frog species outnumbered other vertebrates was probably due to the temporary nature of the breeding sites (thus excluding most fish) and to the fact that site visits usually occurred at night during early to mid-summer when many frogs are breeding.

In Wright's (1932) study, the average minimum air temperature at which *H. gratiosa* began calling was 70°F (21°C), provided adequate rainfall had occurred, and the average maximum temperature at which they were heard calling was 91°F (32°C). Giannini (1983) found that rainfall and temperature were critical for breeding activity. He noted that if air temperature dropped below 18.9°C, calling activity ceased, but if it was above 18.9°C calling resumed, with most activity occurring when the temperature was at least 21.1°C. During this study calling activity was observed at an average temperature of 24.2°C (range 17-32°C), always following periods of rainfall.

Nothing has been published previously concerning the dissolved oxygen content, pH, or temperature of the water at *H. gratiosa* breeding sites. Therefore, no comparisons of our data with that from other localities can be made. Further studies of water quality at breeding sites is needed.

In the Pennyroyal Plain, *H. gratiosa* seems to emerge from winter dormancy in early May and to remain active until late August. Giannini's (1983) record of 7 May represents the earliest known appearance, whereas our record of 28 August represents the latest. Juvenile individuals appear most active in July and August. Yearly variations in beginning and end of the annual activity period in this study are unexplained. However, it seems reasonable to suspect temperature and precipitation as important controlling factors since they have been shown to play a role in limiting breeding activity (Giannini 1983).

Breeding activity of *H. gratiosa* in the Coastal Plain portion of its range has been recorded from early spring to late summer (Brandt 1936, Oldham and Gerhardt 1975, Blem and Miller, 1980). In the Pennyroyal Plain, however, breeding seems confined to a shorter period lasting from late spring to mid-summer. Our data on mating were obtained from mid-May to late July as were Giannini's (1983). Henderson's (1978) observations of breeding were restricted to July.

Henderson (1978) reported that the duration of the average nightly calling period for *H. gratiosa* choruses during 1976 was 106.6 minutes and that for 1977 it was 31 minutes. He also reported calling beginning as early as 1930 CDT and quitting as late as 2330 CDT. Although this study did not record call durations for any one site, calling was generally heard during the period of 2100 to 2400 CDT.

Wright and Wright (1949) stated that breeding choruses including more than 20 to 25 males are not often seen. However, anywhere from one to 130 males have been reported at a single breeding site (Black and Gosner 1958, Blem and Miller 1980, Cahn 1939, Funderburg 1953, Goin 1938, Henderson 1978, Monroe and Giannini 1977, Oldham and Gerhardt 1975). The results of this study suggest that in the Pennyroyal Plain breeding aggregations are rather small averaging only 3.3 calling males per site.

Male *H. gratiosa* have been repeatedly observed calling in an inflated condition at the surface of shallow water, usually among aquatic vegetation (Bartlett 1981, Deckert 1915, Gerhardt 1974, Henderson 1978, Oldham and Gerhardt 1975). Goin (1938) found most of the breeding individuals near the water's edge, with few in open water. Neill (1952) reported finding them in ponds, and a few on bushes and tree trunks near the water, but never more than five feet off the ground. Black and Gosner (1958) observed calling males sitting on the leaves of the white water lily. Monroe and Giannini (1977) found calling males sitting on floating vegetation in water less than one meter deep, and Henderson (1978) reported that calling males were floating on the water (15.2 to 55.8 cm deep) among aquatic vegetation, anywhere from 0.45 to 2.1 m from the water's edge. Likewise, the Pennyroyal Plain males call while inflated at the surface of shallow water usually among floating grain stubble and that they may be anywhere from 0 to 20 m out from shore.

Henderson (1978) in determining population size of *H. gratiosa* at a breeding site assumed equal sex ratio. Goin (1938) collected 170 individuals from one breeding site; 40 were females and 130 were males. We found only one female at a breeding site. This biased sex ratio likely resulted from the greater difficulty of locating nonvocal females.

Henderson (1978) reported that the average SVL of the *H. gratiosa* he studied was 57.7 mm (+ or - 7.59 SD, range 49.2-74.6 mm). We observed a somewhat lower average SVL of 47.6 mm (+ or - 13.15 SD, range 27.0-75.0 mm). We included several juveniles (27.0-41.0 mm SVL), thus lowering the overall average SVL of the sample. When these individuals are not included, the mean SVL for the males calculates to 56.2 mm and for the females, 57.5 mm, values that agree with Henderson's (1978).

CONCLUSIONS

The information gathered in this study suggests the following about the distribution and breeding habitat of *Hyla gratiosa* in south-central Kentucky and north-central Tennessee:

1. The distribution seems limited to the central and western portions of the Pennyroyal Plain.
2. The typical breeding habitat is a temporary or semi-permanent flooded sink in a grain field, usually with grain stubble being the only vegetation.
3. Other species of anurans are the primary vertebrate cohabitants of breeding sites.
4. Depending on local weather, activity of adults begins in early May and continues until the end of July. Terrestrial activity of juveniles begins in late June and continues until the end of August.
5. Given adequate rainfall, males call at air temperatures ranging from 17°C to 32°C (mean of 24.2°C) during late evening between 2100-2400 EDT.
6. The number of calling males at any one site is low, usually less than 10.

7. Calling males assume an inflated posture at the surface of shallow water amid vegetative cover.

8. Females appear to be considerably less numerous than males, but may simply be harder to detect because they do not call.

SPECIMENS EXAMINED

Kentucky

Caldwell County: 12.0 km (7.5 mi) SW Princeton, 2 specimens, ULM 6780-6781, 5 July 1976; 1.8 km (1.1 mi) w. of junction with KY 139 on KY 514 (Schoolhouse Road), 1 juvenile specimen in basement of house, John MacGregor's personal collection, 2 August 1983; 2.4 km (1.5 mi) W of junction with KY 139 along W side of KY 514, 1 specimen from mowed wheat field, John MacGregor's personal collection, 3 August 1983; 3.2 km (2.0 mi) NW of junction with Hopson Road along SW side of KY 139, 1 adult male from flooded portion of corn field, APSU 3611, 12 July 1984; junction KY 514 and KY 126-128, 1 juvenile alive on road (AOR), APSU 3619, 21 August 1984. **Christian County:** 2.3 km (1.4 mi) N of junction with KY 117 on KY 345, 1 adult female dead on road (DOR), APSU 3596, 17 June 1983; 1.0 km (0.6 mi) W of junction with KY 345 along S side of Featrace Lane, 2 adults (male and female) from temporary pond in wheat field, APSU 3597, 19 June 1983; 1.0 km (0.6 mi) W of junction with US 41A along S side of KY 117, 1 adult male from flooded portion of corn field, APSU 3602, 29 June 1983; 0.3 km (0.2 mi) W of junction with US 41A along S side of KY 117, 1 adult male from flooded portion of corn field, APSU 3603, 19 July 1983; 5.0 km (3.1 mi) W of junction with KY 107 on Zion Hope-Herdon Road, 1 juvenile AOR, APSU 3615, 6 August 1984. **Logan County:** junction of Prentiss-Lawrence and Prentiss-Keysburg Roads, 2.6 km (1.6 mi) No of Keysburg, 2 specimens AOR, APSU 2919, 20 May 1979; 1.0 km (0.6 mi) E of Todd-Logan County line on KY 848, 17.7 km (11 air mi) W of Adairville, 1 specimen AOR, APSU 2920, 20 May 1979; S side of Smith Road at its junction with Dot-Tennessee State Line Road, 0.8 air km (0.5 air mi) N of TN-KY state line, 1 adult male from cattle pond, APSU 3599, 22 June 1983; 0.2 km (0.1 mi) E of junction with KY 102 on James Rose Road, 1 adult male AOR, APSU 3604, 15 June 1984; 0.5 km (0.3 mi) E of Todd-Logan County line on KY 848, 1 adult male AOR, APSU 3605, 15 June 1984; 1.6 km (1.0 mi) E of junction with KY 102 along S side of James Rose Road, 1 adult male from flooded portion of wheat field, APSU 3606, 17 June 1984; 0.2 km (0.1 mi) S junction of James Rose Road along W side of KY 102, 1 adult male from permanent pond, APSU 3607, 18 June 1984, 0.9 air km (0.6 mi) S of junction with James Rose Road along SE side of KY 102, 1 adult male from flooded portion of wheat field, APSU 3608, 25 June 1984; 3.2 km (2.0 mi) E of junction with KY 102 off N side of James Rose road, 1 adult male from flooded sink in barley field, APSU 3609, 25 June 1984; 1.1 km (0.7 mi) S of junction with James Rose Road on KY 102, 3 juveniles AOR, APSU 3610, 25 June 1984; 2.3 km (1.4 mi) S of junction with James Rose Road on KY 102, 2 juveniles AOR, APSU 3613 and 3616, 31 July 1984 and 14 August 1984; 4.2 km (2.6 mi) S of junction with James Rose Road on KY 102, 1 juvenile AOR, APSU 3617, 14 August 1984. **Lyon County:** 0.8 km (0.5 mi) W of junction with KY 903 on KY 730, 2 juveniles AOR, APSU 3612, 12 July 1984. **Todd County:** 8.0 km (5.0 mi) S of Allensville, 5 specimens, ULM 4346-4348, 3 June 1971, and 4798, 18 May 1972, APSU 3177, 12 June 1971; 0.8 km (0.5 mi) E of junction with US 79 on KY 848, 1 specimen AOR, John MacGregor's personal collection, 20 May 1983; 1.0 km (0.6 mi) E of junction with Allison Road on KY 848, 1 adult male AOR, APSU 3592, 20 May 1983; 2.4 km (1.5 mi) E of junction with L and N RR (Hadensville) on KY 848, 1 specimen DOR, APSU 3593, 20 May 1983; junction Snaden Mill Road and US 79, 1 adult male from flooded portion of wheat field, APSU 3598, 21 June 1983; 0.2 km (0.1 mi) N junction with Jack Gray Road along E side of County Road 1802, 4.0 air km S of Trenton, 1 adult male

from flooded portion of cornfield, APSU 3601, 28 June 1983; 2.4 km (1.5 mi) S of junction with KY 102 (Allensville) on Allensville-Tennessee State Line Road, 1 juvenile AOR, APSU 3614, 26 July 1984. **Trigg County:** 0.2 km (0.1 mi) N of junction with Kentucky 958 along W side of County Road 1507, 6.4 air km (4.0 mi) S of Cerulean, 1 adult male from pond at edge of wheat field, APSU 3595, 15 June 1983.

Tennessee

Montgomery County: 6.7 km (4.2 mi) W of junction with Port Royal Road on Rossvie Road, 1 specimen AOR, APSU 2922, 30 May 1979; Dunbar Cave Road near spillway of Swan Lake, St. Bethlehem community, 2 specimens AOR, APSU 1390 and 1392, 16 May 1966 and 26 May 1967; 1.9 km (1.2 mi) N of junction with Rossvie Road on Port Royal Road, 1 specimen AOR, APSU 1391, 17 May 1966; 1.1 air km (0.7 air mi) S Rossvie on L.C. Connell farm, 9 specimens from sink pond in open pasture, APSU 3175, 3176, and 3178, 8 June 1971, 7 June 1971, 11 June 1971; 1.6 km (1.0 mi) W of junction with TN 48 on Hazel Wood Road, 1 adult female DOR, APSU 3594, 24 May 1983; 1.8 km (1.1 mi) SW of TN-KY state line on Guthrie Lane (County Road 6317), 1 adult female AOR, APSU 3618, 19 August 1984. **Robertson County:** 3.5 km (2.2 mi) SW of TN-KY state line along W side of Keysburg Road, 6.0 air km (3.7 mi) NNE of Adams P.O., 1 adult male from flooded portion of barley field, APSU 3600, 26 June 1983; 4.8 km (3.0 mi) S of TN-KY state line on Keysburg Road, 1 juvenile AOR, APSU 3620, 28 August 1984.

CALLING RECORDS

Tennessee

Montgomery County: large cattle pond on S side of Rossvie Road, 5.3 km W of junction with Port Royal Road, 8 and 9 June 1983; flooded portion of corn field on S side of Hazel Wood Road, 1.6 km E of Needmore Road, 23 and 24 June 1984.

Kentucky

Caldwell County: large cattle pond on NW side of KY 514, 1.3 km SW of KY 126-128, 10 June 1984.

LITERATURE RECORDS

Kentucky

Caldwell County: 12 km (7.5 mi) S of Princeton (Giannini 1983, Monroe and Giannini 1977); along Dry Creek approx. 50 m E of Highway 139S (Giannini 1983). **Lyon County:** 1-3 km (0.6-1.9 mi) from first Caldwell County site (Giannini 1983). **Todd County:** 5.0 mi (8.0 km) S of Allensville (Monroe and Taylor 1972). **Trigg County:** 1-3 km (0.6-1.9 mi) from first Caldwell County site (Giannini 1983).

Tennessee

Montgomery County: northeastern Montgomery County about 6 mi (9.7 km) S of KY border (Scott and Harker 1968); 0.5 mi (0.8 km) S of intersection with Needmore Road on Peacher's Mill Road (Scott, Chester and Snyder 1980), TN Hwy. 48 near junction with Hazelwood [Hazel Wood] Road (Scott, Chester and Snyder 1980); 4.2 road mi (6.8 km) W of junction with Port Royal Road on Rossvie Road (Scott, Chester and Snyder 1980), northern portion of county 3.1, 2.1 and 0.8 km (1.9, 1.3 and 0.5 mi) S of Christian-Todd County border in Kentucky, Clarksville and Hammackville quadrangles (Henderson 1978).

WORKS CITED

- Allen, M.J. 1932. A survey of the amphibians and reptiles of Harrison County, Mississippi. American Museum Novitates 1932(542):1-20.
- Bartlett, R.D. 1981. The quest for a "strange" treefrog. Northern Ohio Association of Herpetologists Notes 8(8):7-9.
- Black, I.H. and K.L. Gosner. 1958. The barking tree frog, *Hyla gratiosa* in New Jersey. Herpetologica 13(4):254-255.
- Blem, C.R. and M.A. Miller. 1980. The barking treefrog. Virginia Wildlife 41:16-17.
- Brandt, B.B. 1933. An extension of the range of *Hyla gratiosa* LeConte. Copeia 1933(1):39.
- . 1936. The frogs and toads of eastern North Carolina. Copeia 1936(4):215-223.
- Branson, B.A., D.F. Harker, Jr., J.M. Baskin, M.E. Medley, D.L. Batch, M.L. Warren, Jr., W.H. Davis, W.C. Houtcooper, B. Monroe, Jr., L.R. Phillippe, and P. Cupp. 1981. Endangered, threatened, and rare animals and plants of Kentucky. Transactions of the Kentucky Academy of Science 42(3-4):77-89.
- Cahn, A.R. 1939. The barking frog, *Hyla gratiosa*, in northern Alabama. Copeia 1939(1):52-53.
- Caldwell, J.P. 1982. *Hyla gratiosa*. Catalogue of American Amphibians and Reptiles 298.1-298.2
- Conant, R. 1975. A field guide to the reptiles and amphibians of eastern and central North America. 2nd ed. Houghton Mifflin Co., Boston, MA. 429 p.
- Deckert, R.F. 1915. Further notes on the Salientia of Jacksonville, Fla. Copeia 1915(18):3-5.
- Eagar, D.C., and R.M. Hatcher, editors. 1980. Tennessee's rare wildlife: Volume I: The vertebrates. Tennessee Wildlife Resources Agency and Tennessee Conservation Department, Nashville.
- Funderburg, J.B. 1953. The Georgia tree frog, *Hyla gratiosa* LeConte, in North Carolina. Herpetologica 9(4):176.
- Funderburg, J.B., Jr. 1955. The amphibians of New Hanover County, North Carolina. Journal of the Elisha Mitchell Scientific Society 71(1):19-28.
- Gerhardt, H.C. 1974. The vocalizations of some hybrid treefrogs: acoustic and behavioral analyses. Behaviour 49(1-2):130-151.
- Giannini, R.W. 1983. The occurrence of *Hyla gratiosa* in Caldwell County Kentucky, and their breeding patterns. M.S. Thesis. University of Louisville, Louisville, KY. 19 p.
- Goin, C.J. 1938. A large chorus of *Hyla gratiosa*. Copeia 1938(1):48.
- Henderson, C.R. 1978. An ecological and vocalization study of the barking treefrog, *Hyla gratiosa* LeConte, in Montgomery County, Tennessee. M.S. Thesis. Tennessee Technological University, Cookeville, TN. 57 p.
- Jobson, H.G.M. 1940. Reptiles and amphibians from Georgetown County, South Carolina. Herpetologica 2(1):39-43.
- Kendall, J.L. 1933. Climatic summary of the United States: Section 74-Western Kentucky. United States Department of Agriculture, Weather Bureau.
- Martof, B. 1954. The barking frog, *Hyla gratiosa*, in the Cumberland Plateau of Georgia. Copeia 1954(2):157.
- McKeever, S. 1977. Observations of *Cophthrella* feeding on tree frogs (*Hyla*). Mosquito News 37(3):522-523.
- Monroe, B.L., Jr. and R.W. Giannini. 1977. Distribution of the barking treefrog in Kentucky. Transactions of the Kentucky Academy of Science. 38(3-4):143-144.
- , and R.W. Taylor. 1972. Occurrence of the barking treefrog, *Hyla gratiosa*, in Kentucky. Journal of Herpetology. 6(1):78.
- Neill, W.T. 1952. Burrowing habits of *Hyla gratiosa*. Copeia 1952(3):196.
- . 1958. The varied calls of the barking treefrog, *Hyla gratiosa* LeConte. Copeia 1958(1):44-46.
- Oldham, R.S. and H.C. Gerhardt. 1975. Behavioral isolating mechanisms of the treefrogs *Hyla cinerea* and *H. gratiosa*. Copeia 1975(2):223-231.
- Quarterman, E. and R.L. Powell. 1978. Potential ecological/geological natural landmarks on the Interior Low Plateaus. United States Department of Interior, National Park Service. 739 p.
- Saur, C.O. 1927. Geography of the Pennyroyal. The Kentucky Geological Survey, Frankfort. Series 6, Bulletin 25, 303 p.
- Scott, A.F., E.W. Chester, and D.H. Snyder. 1980. A study of selected potential natural areas in the lower Cumberland River basin of Tennessee. Tennessee Department of Conservation, Heritage Program, Nashville, 151 p.
- , and D.F. Harker. 1968. First records of the barking treefrog, *Hyla gratiosa* LeConte, from Tennessee. Herpetologica 24(1):82.
- Springer, M.E. and J.A. Elder. 1980. Soils of Tennessee. The University of Tennessee Agricultural Experiment Station, Knoxville and the United States Department of Agriculture Soil Conservation Service. Bulletin 596, 66 p.
- Thornthwaite, C.W. 1948. An approach toward a rational classification of climate. Geographical Review 38:55-94.
- University of Kentucky. 1970. Soils handbook. University of Kentucky, Cooperative Extension Service, Agriculture and Home Economics. Miscellaneous. Publication No. 383, Lexington, Kentucky. 41 p.
- Wright, A.H. 1932. Life-histories of the frogs of Okefenokee Swamp, Georgia. North American Salientia (Anura) No. 2. The Macmillan Co., New York. 497 p.
- , and A.A. Wright. 1949. Handbook of frogs and toads of the United States and Canada. 3rd ed. Comstock Publishing Co., Inc., Ithaca, New York. 640 p.

ACKNOWLEDGEMENTS

The authors wish to express sincere appreciation to Drs. Edward W. Chester and Charles N. Boehms for their assistance in preparation of the manuscript. Special thanks are extended to Mr. and Mrs. Mike Silvey for the information they provided. Gratitude is expressed to Kevin Souza, Gary Hale, and John Koons for their assistance in the field. Finally, we would like to thank Marilyn Griffy for typing the manuscript.