Catalogue of American Amphibians and Reptiles.


**Rana blairi**
Mecham, Littlejohn, Oldham, Brown, and Brown

**Plains Leopard Frog**

*Rana blairi* Mecham, Littlejohn, Oldham, Brown, and Brown, 1973;
3. Type-locality, "1.6 km. W New Deal, Lubbock Co., Texas."


- **Content.** No subspecies are recognized.
- **Definition.** *Rana blairi* is a species of the *Rana pipiens* complex with one or both dorsolateral folds interrupted posteriorly and displaced medially, no vestigial male oviducts, and usually a complete, pale, supralabial stripe. Vocal sacs are external and of moderate size. The dorsum is patterned with dark brown, round spots, often surrounded by light, narrow borders. A dark snout spot is usually present, and the tympanum almost always has a white spot in the center. The posterior surface of the thigh is mottled or reticulated with dark brown markings. The area between spots on the dorsum is buff, pale brown, sometimes reddish-brown (in Oklahoma), or sometimes dull green (olive-green in Arizona). The abdomen is pale cream, except frequently with some yellow posteriorly, as well as in the groin and on the proximal part of the thigh.

- **Diagnosis.** *Rana blairi* can be distinguished from other members of the *R. pipiens* complex by the following combination of morphological characteristics: one or both dorsolateral folds interrupted posteriorly and displaced medially; no vestigial oviducts in males; and usually a complete, pale, supralabial stripe. The distinctive mating call has a low pulse number (average less than six pulses per call) and a slow pulse rate (average less than six pulses per sec below 24°C).

- **Descriptions.** The first extensive descriptive data for *R. blairi* were provided by McAlister (1962) before the species was formally described as new. Littlejohn and Oldham (1968) were the first to document the correspondence of a distinctive mating call with

**Figure 1.** Female *Rana blairi* from Spring Lake, Tazewell County, Illinois. Photograph by D.W. Whitman.

**Map.** The large open circle marks the type-locality; the solid triangle indicates a population that may have been introduced; solid symbols represent other locality records (localities that are close together geographically are sometimes combined under one symbol).

Detailed descriptions of tadpoles were given by Korky (1978) and Scott and Jennings (1985); brief descriptions were provided by Frost and Bagnara (1977) and Sebbins (1985); Hillis (1982) gave comparative commentary. Korky (1978) characterized tadpoles near transformation. The egg was described by Frost and Bagnara (1977); the egg mass was described by Hammerson (1982a), Lynch (1985), and Sebbins (1985). Developing embryos, newly metamorphosed stages, and juveniles have not been described.

The mating calls are typically groups of 2-4 well-spaced notes which may be described as "tuck tuck tuck tuck, tuck tuck tuck, tuck tuck tuck," etc. The first group of notes is usually longer than subsequent groups. Mating call data were presented by Brown and Morris (1990; Frost and Platz, 1983; Kruse, 1977; Mecham et al., [paratype], 1973; Platz, 1972); a black and white photograph of a frontal view of a live adult (Brown and Morris, 1990); and a black and white photograph of a dorsal view of a preserved adult (Cree, 1963) with a partly ingested bat, an Eastern Pipistrelle (Pipistrellus subflavus); other black and white photographs of dorsal views of preserved adults (Pace, 1974; Smith, 1956); and black and white drawings of adults (Ballinger and Lynch, 1983; Clarke, 1984; Johnson, 1987); a close-up, black and white photograph of a displaced dorsolateral fold (Post and Pettus, 1966); a close-up, black and white photograph of a lateral view of a collapsed vocal sac of a preserved male (Pace, 1974); a black and white photograph of a lateral view of a live tadpole, Gosner stage 39 (Scott and Jennings, 1985); black and white photographs of dorsal and lateral views of preserved tadpoles, Gosner stage 40 (Korky, 1978); black and white drawings of lateral (Gosner stage 38) and dorsal views, mouthparts, and iris of tadpoles (Scott and Jennings, 1985); photographs of chromosomes (Ward, 1977); photographs of isozyme phenotypes (Dunlap, 1979, 1982; Frost and Bagnara, 1977; Kruse and Dunlap, 1976; Platz, 1972); audiospectrograms of mating calls (Brown and Morris, 1990; Frost and Platz, 1983; Kruse, 1981; Mecham, 1971; Mecham et al., 1973); oscillograms of mating calls (Littlejohn and Oldham, 1968; Mecham, 1971); and audiospectrograms and oscillogram of chickle calls, e.g., grunt, grind, low trill (Mecham, 1971).

**Illustrations.** A black and white photograph of a dorsolateral view of the live, adult holotype was presented by Mecham et al. (1973) and Dubois (1977). Other illustrations include: color photographs of dorsolateral views of live adults (Behler and King, 1979; Black and Sievert, 1989; Brown, 1985; Collins, 1977; Collins and Collins, 1991; Hammerson, 1982a; Johnson, 1982, 1987); a color photograph of a dorsolateral view of a live subadult (Garrett and Barker, 1987); color illustrations of dorsolateral views of adults (Conant and Collins, 1991; Sebbins, 1985); black and white photographs of dorsolateral views of live adults (Bozeman et al., 1987; Brown and Morris, 1990; Brown et al., in press; Collins, 1974, 1982; Dunlap and Kruse, 1976; Johnson, 1977, 1978; Mecham et al., [paratype], 1973; Platz, 1972); a black and white photograph of a frontal view of a live adult (Brown and Morris, 1990); a black and white photograph of a dorsal view of a preserved adult (Cree, 1963) with a partly ingested bat, an Eastern Pipistrelle (Pipistrellus subflavus); other black and white photographs of dorsal views of preserved adults (Pace, 1974; Smith, 1956); and black and white drawings of adults (Ballinger and Lynch, 1983; Clarke, 1984; Johnson, 1987); a close-up, black and white photograph of a displaced dorsolateral fold (Post and Pettus, 1966); a close-up, black and white photograph of a lateral view of a collapsed vocal sac of a preserved male (Pace, 1974); a black and white photograph of a lateral view of a live tadpole, Gosner stage 39 (Scott and Jennings, 1985); black and white photographs of dorsal and lateral views of preserved tadpoles, Gosner stage 40 (Korky, 1978); black and white drawings of lateral (Gosner stage 38) and dorsal views, mouthparts, and iris of tadpoles (Scott and Jennings, 1985); photographs of chromosomes (Ward, 1977); photographs of isozyme phenotypes (Dunlap, 1979, 1982; Frost and Bagnara, 1977; Kruse and Dunlap, 1976; Platz, 1972); audiospectrograms of mating calls (Brown and Morris, 1990; Frost and Platz, 1983; Kruse, 1981; Mecham, 1971; Mecham et al., 1973); oscillograms of mating calls (Littlejohn and Oldham, 1968; Mecham, 1971); and audiospectrograms and oscillogram of chuckle calls, e.g., grunt, grind, low trill (Mecham, 1971).

**Distribution.** *Rana blairi* occurs primarily in the Great Plains and Prairie Peninsula, with a few populations in Arizona. The species ranges from southeastern and south-central South Dakota in the north, to central Texas in the south, and from southeastern Arizona in the west, to central Indiana in the east. In the west the range extends into eastern Colorado, eastern and southwestern New Mexico, southeastern Arizona, and western Texas. Eastwardly, these frogs range throughout the southeastern half of Nebraska, all of Kansas, much of Oklahoma (except the southeastern quarter), and much of northern Texas (except in the northeast). In the Prairie Peninsula, *R. blairi* is found in the southwestern half of Iowa, the northern half of Missouri, and in a wide band across central Illinois to central Indiana. An extension of the range follows the Mississippi River south into southeastern Missouri. Fifteen isolated populations have been found in Cochise County, southeastern Arizona. A population in north-central Arizona (Ashurst Lake, Coconino County;
Platz (1976) may be introduced (J.E. Platz in Clarkson and Rorabaugh, 1989). Many populations in a number of areas appear to be isolated. Major distributional studies by region include: Arizona (Frost and Bagnara, 1977); Colorado (Hammerson, 1982a; Post and Oldham, 1966); Illinois (Brown and Morris, 1990); Iowa (Christiansen and Bailey, 1991); Kansas (Collins, 1982); Missouri (Johnson, 1987); Nebraska (Brooks, 1976; Lynch, 1978, 1985); New Mexico (Fritts et al., 1984); Oklahoma (Black, 1976; Lardie, 1982); Texas (Dixon, 1976); northern and central Great Plains (Dunlap and Kruse, 1976); southern Great Plains (Hillis, 1981); and general (Littlejohn and Oldham, 1968; Pace, 1974). Most of these publications include range maps.

- **Fossil Record.** None has been positively identified. However, many Pleistocene fossils (Kansas - Estelman (1975), Holman (1971, 1972, 1984, 1987); Rogers (1982), Thien (1954), Texas - Holman (1969); Kaaper and Parmley (1990), Parmley (1988) have been assigned to *R. pipiens*, *R. pipiens* complex, or *Rana sp.* indiv. from within the present range of *R. blairi*, but allopatric to *R. pipiens*, *sensu stricto* (Brown and Morris, 1990) and other leopard frog taxa. *Rana pipiens*, *sensu lato*, has been the most consistently reported frog from the Pleistocene of the U.S.A. (Holman, 1972). However, Rogers (1984) could not separate the bones of *R. blairi*, *R. pipiens*, and *Rana sphenocephala*. Likewise, Holman (1977) could not find any consistent differences in the Pleistocene of these three species and *R. berlandieri*, and he concluded that the bones of species of leopard frogs are so similar that a fossil record will not clarify their relationships. Consequently, distinction of fossilized specimens of different sibling species of leopard frogs may not readily be possible at present. Thus, Rogers et al. (1985) reported "*R. blairi or R. pipiens* from the Middle Pleistocene of Colorado (within the present range of *R. pipiens*, just outside the present range of *R. blairi*.

- **Pertinent Literature.** Before the advent of settlement by Europeans, much of the habitat of *R. blairi* probably was prairie and adjacent areas (Brown and Morris, 1990; Brown et al., in press). With the subsequent extensive alteration of these environments by humans and climatic changes, *R. blairi* now occurs in a wide variety of habitats. Much of the land throughout the range of *R. blairi* is devoted to agriculture, but Brown and Morris (1990) never found the species in "cultivated fields" in Illinois. This is probably due to a number of types of severe modifications for agriculture. Outside the breeding season Brown and Morris (1990) found the species near breeding sites, in old fields, along creeks, on bottomlands, and in variable habitats that often showed past disturbance (nonagricultural) by humans, but not in mature upland forests. Former prairie regions and associated river floodplains, flatslands, rolling hills, and areas near aquatic habitats are inhabited in Missouri (Johnson, 1977, 1987). In Nebraska, Lynch (1978) found that *R. blairi* occurred on loess soils and "in areas extensively used for agriculture." Rowcrop cultivation increases levels of turbidity in streams, which the species often seems to prefer. Other workers (Black and Sievert, 1989; Hills, 1981; Scott and Jennings, 1985) mentioned the association of *R. blairi* with turbid ponds of a coal-fired power plant (Black and Sievert, 1989; Brown and Morris, 1990; Caldwell and Glass, 1976; Clarkson and Rorabaugh, 1989; Frost and Bagnara, 1977; Hammerson, 1982a; Hills, 1981; Johnson, 1977, 1987; Kruse and Francis, 1975; Scott and Jennings, 1985). Although both lentic and lotic sites are utilized, the former seem to be preferred or more frequently used.

Male *R. blairi* frequently call in a floating position at the water surface (Black and Sievert, 1989; Hills, 1981). Frost and Bagnara (1977) played tape recordings of mating calls of *R. blairi* to sexually active male *R. blairi* in the evening before calling began. Males responded vocally to these recordings, and they also often turned to face the speaker (fossil record approached) the source of the recording. However, playbacks of mating calls of *Rana chriscaubusia* failed to evoke any response from male *R. blairi* under similar circumstances.


Tadpoles can metamorphose at any time during the summer dependent upon when eggs were laid (Hammerson, 1982a). However, when eggs are laid in late summer or fall, tadpoles overwinter and transform the next spring (Axtell and Haskell, 1977). Tadpoles can metamorphose at any time during the summer dependent upon when eggs were laid (Hammerson, 1982a). However, when eggs are laid in late summer or fall, tadpoles overwinter and transform the next spring (Axtell and Haskell, 1977). Tadpoles can metamorphose at any time during the summer dependent upon when eggs were laid (Hammerson, 1982a). However, when eggs are laid in late summer or fall, tadpoles overwinter and transform the next spring (Axtell and Haskell, 1977).
PACE (1974), found natural hybrid R. blairi x R. pipiens at 13 of 39 sympatric localities in Nebraska. The pooled frequency of hybrids in most localities in Iowa, South Dakota, and Nebraska ranged from 1.0-6.2% except in two areas where it was considerably higher (11.8%, 11.8%). Dunlap (1976) found that natural hybrids R. blairi x R. pipiens could be identified by albumin phenotype; likewise, AXTELL (1977) identified natural hybrid R. blairi x R. sphenocopehalabalty LD phenotype. Habitat alteration by humans and unstable ecological conditions have been suggested as causes of the natural hybridization (Collins, 1982; Hammerson, 1982a; hillis, 1981; johnson, 1987; Lynch, 1978).

Artificial laboratory hybridizations have been carried out between R. blairi and eight other ranid species: R. arenicola, R. berlandieri, R. chiriacaubensis, R. megopoda, R. montezumae, R. palustris, R. pipiens, and R. sphenocopehalabalty. The objectives of these hybridizations were: to aid in the identification of natural hybrids (AXTELL, 1977; Dunlap and Kruse, 1976; Kruse and Dunlap, 1976; PLatz, 1972); to characterize isozyme phenotypes of hybrids and backcrosses (Dunlap, 1979, 1982); to determine degree of genetic divergence (cuellar, 1971; mechem, 1968, 1969; post and Pettus, 1966); to study post-mating reproductive isolation (frost and Bagnara, 1977; frost and PLatz, 1983; Post and Pettus, 1966); and to carry out linkage analyses (Dunlap, 1982; Wright et al., 1985).

The karyotype has 2n = 26, six metacentric and seven submetacentric chromosomal pairs, and dimorphic nucleolar organizer regions on chromosome pair no. 10 (WARD, 1977). Frost and PLatz (1978) reported normal meiotic activity in six laboratory reared female hybrids R. chiricaubensis x R. blairi, with formation of an average of six bivalents (chromosomal element numbers ranged from 18.7-22.0). Eight of nine hybrid females failed to show significant oocyte development; the ninth female contained only a few eggs, all of which were immature. Seven hybrid males had mean sperm counts of less than 6% of those of controls (frost and PLatz, 1983).

Major phylogenetic studies involved use of artificial laboratory hybridization (cuellar, 1971; mechem, 1969) and cladistic analyses of biochemical data (Hills, 1988; Hills and Davis, 1986; Hills et al., 1983). Zoogeography in the great plains, prairie peninsula, and along the Mississippi river in the central midwest was discussed by GREEN and Morris (1988). Bagnara (1977) identified natural hybrid R. blairi x R. pipiens. The objectives of these studies not heretofore mentioned include levY and salthe (1971, 1974) and salthe (1969).

The decline or extirpation of populations has been noted by Christiansen and Bailey (1991), clarkson and Roraugh (1989), Cousineau and Rogers (1991), frost (1983), frost and Bagnara (1977), Hammerson (1982a, 1982b), Hayes and Jennings (1986), and PLatz (1981).

Suggested causes included: water pollution; predation by introduced game fishes; groundwater pumping; introduction of exotic fishes and amphibians; agricultural development; increased aridity/drought; habitat loss or alteration; toxicants; competition with R. berlandieri, and predation by, competition with, and/or larval inhibition by Bullfrogs (R. craspeus).

Remarks. In publications during the seven years prior to the formal description of R. blairi as a new species, the following common names were used for the frog: DF complex, PF morphotype, DF frogs, western call type, western call race, western type, western form, western, southern plains type, southern plains form, southern plains, S. Plains, S. plains, plains type, southern plains ("western") type, "western" (southern plains) type, plains form, high plains frogs, central plains form, and western (plains) type.

Some information on R. blairi was published under the name "R. pipiens" before R. blairi was described as a new taxon (see Brown, 1973). Conversely, some information published under the name R. blairi apparently represents older data collected from R. pipiens and/or other leopard frog species.

Etymology. The specific name honors the late Dr. W. Frank Blair, Professor of Zoology, the University of Texas at Austin.

Literature Cited


