Catalogue of American Amphibians and Reptiles.

Brown, L.E. 1992. *Rana blairi.*

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." Holotype, Univ. Michigan Mus. Zool. (UMMZ) 131690, an adult male (in alcohol) collected on 6 August 1971 by Charles Everett (examined by author).
Ranablairi (sic): Brooks, 1976:89.
R. Blairi (sic): Dunlap, 1982:247.

• **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.

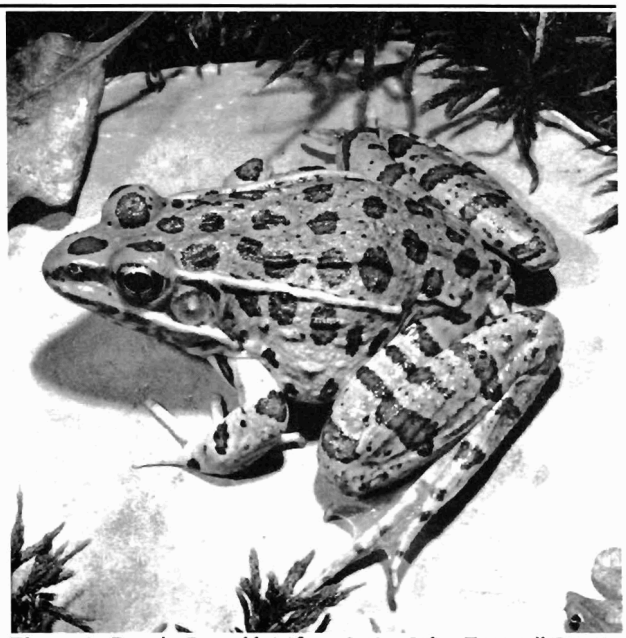
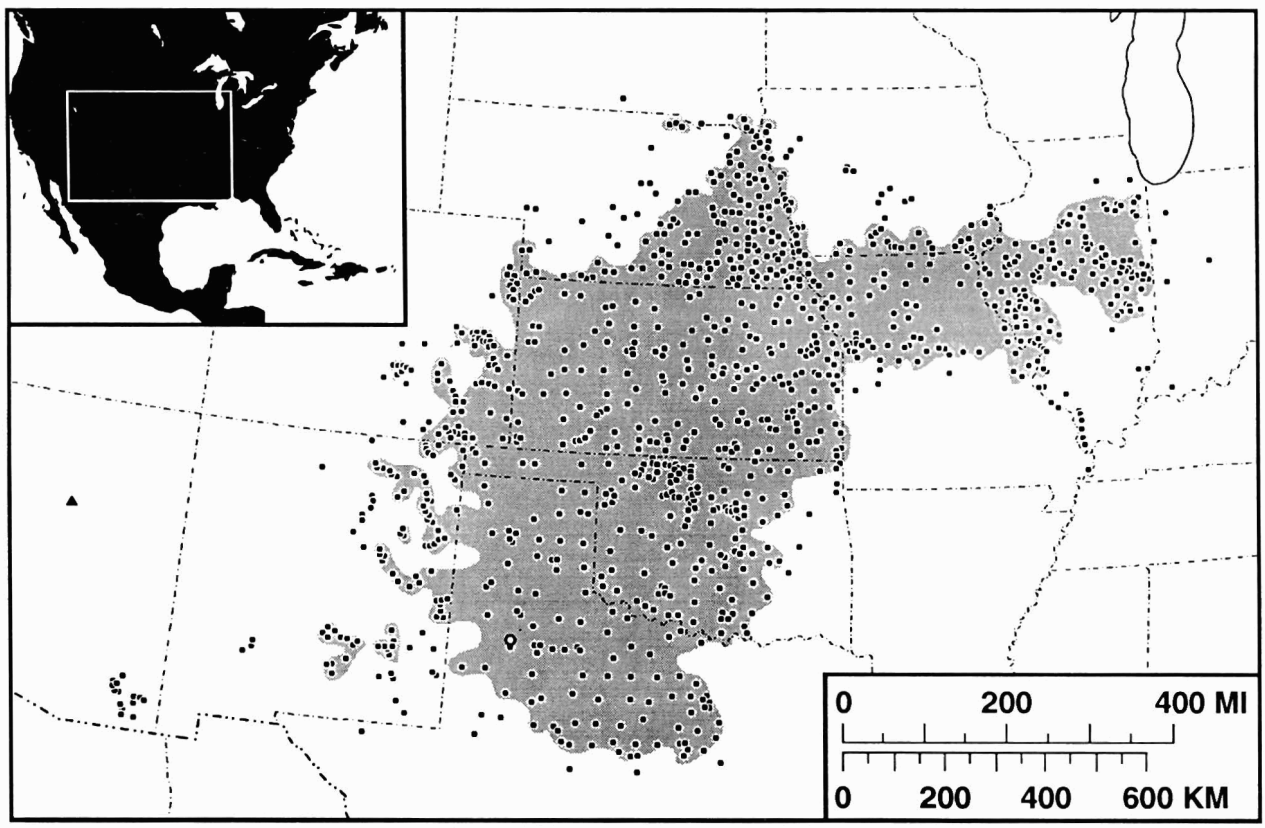


Figure 1. Female *Rana blairi* from Spring Lake, Tazewell County, Illinois. Photograph by D.W. Whitman.

• **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



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).

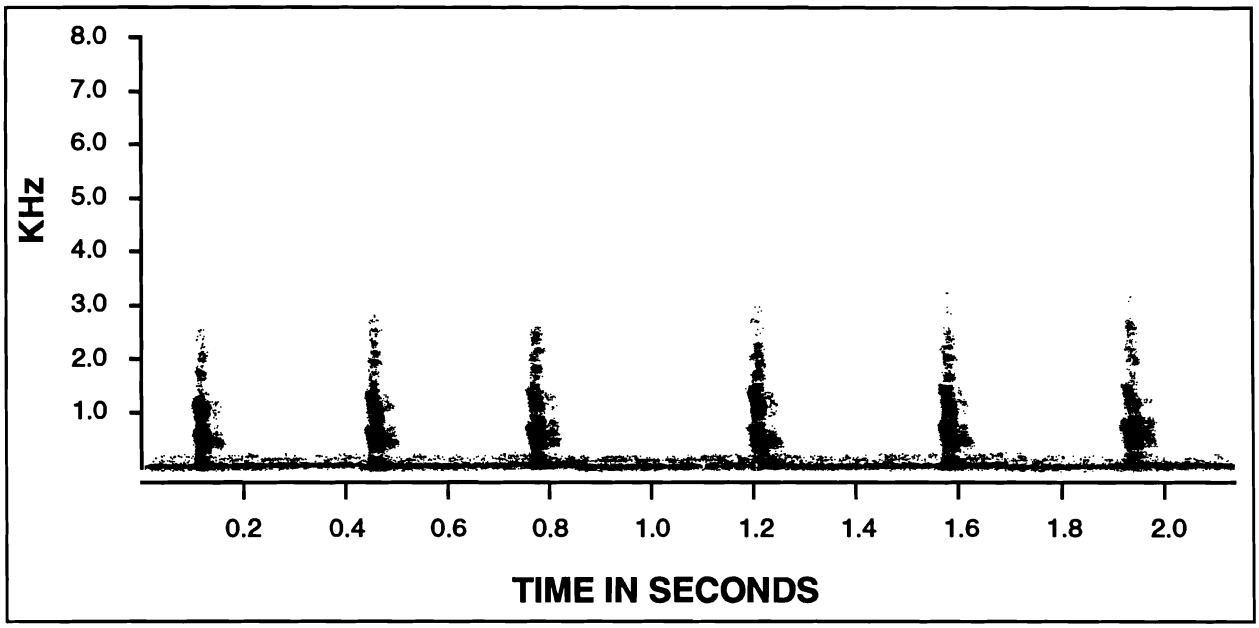


Figure 2. Audiospectrogram (narrow band) of mating calls of *Rana blairi* from north of Hudson, McLean County, Illinois, 24 April 1970; cloacal temperature 16.1°C, water temperature 16.0°C, air temperature 9.4°C, SVL = 68 mm measured alive (L.E. Brown recording).

different morphology for the species. The type series (four males, four females, all adults) was described in depth by Mecham et al. (1973). Dunlap and Kruse (1976) and Post and Pettus (1966) included good, reliable descriptions. The different "inner-spot" (sic) coloration (olive-green) of specimens from Arizona was identified by Frost and Bagnara (1977). In Oklahoma, Black and Sievert (1989) reported interspot coloration of tan to reddish brown; red coloration has also occasionally been encountered in that state (R.L. Lardie, pers. comm.). A statistical comparison of *R. blairi* and *Rana berlandieri* for certain morphological traits was made by Platz (1972). Accounts in field guides, regional handbooks, etc., that give fair to good descriptions for identification of adults include Ballinger and Lynch (1983), Behler and King (1979), Black and Sievert (1989), Brown (1985), Christiansen and Bailey (1991), Clarke (1984), Collins (1982), Collins and Colhns (1991), Conant and Collins (1991), Garrett and Barker (1987), Hammerson (1982a), Johnson (1977, 1987), Lynch (1985), Pace (1974), Smith (1978), and Stebbins (1985).

Detailed descriptions of tadpoles were given by Korky (1978) and Scott and Jennings (1985); brief descriptions were provided by Frost and Bagnara (1977) and Stebbins (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 Stebbins (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 Brown (1972), Dunlap and Kruse (1976), Frost and Bagnara (1976), Littlejohn and Oldham (1968), Mecham et al. (1973), Axtell (1977), and Frost and Platz (1983). Characteristics of mating calls of 10 males recorded at the type locality in a temperature range of 22.0-24.0°C were summarized by Mecham et al. (1973) as follows: mean call duration = 0.70 sec (range = 0.36-1.00 sec); mean pulse rate = 5.3 pulses/sec (range = 4.8-6.1 pulses/sec); mean pulse duration = 28.6 msec (range = 24-34 msec); mean pulse rise time = 9.7 msec (range = 7-16 msec). Ranges for mating call characteristics of all 39 males (temperature range = 15.5-25.0°C) reported by researchers are: call duration = 0.35-1.00 sec; pulse rate = 3.4-6.8 pulses/sec; pulse duration = 19.8-38.3 msec; pulse rise time = 7-16 msec. Mecham (1971) described different types of chuckle calls (grunt, grind, low trill).

• **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; Stebbins, 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; 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 (Creel, 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); 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 Pettus, 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, 1987); 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 - Eshelman [1975], Holman [1971, 1972, 1984, 1987], Rogers [1982], Tihen [1954]; Texas - Holman [1969], Kasper and Parmley [1990], Parmley [1988]) have been assigned to *R. pipiens*, *R. pipiens* complex, or *Rana* sp. indet. 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 ilia of these three species and *R. berlandieri*, and he concluded that the bones of species of leopard frogs are so similar that the 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, flatlands, 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; Hillis, 1981; Scott and Jennings, 1985) mentioned the association of *R. blairi* with turbid pools, and muddy tanks and rivers. Parasitological evidence from Nebraska (Brooks, 1976) indicated that *R. blairi* is quite aquatic. Lynch (1985) also found that both young and adult *R. blairi* were easily encountered in the fall along streams and rivers in Nebraska. In southwestern Kansas, Collins and Collins (1991) found *R. blairi* abundant in grasslands. At Cheyenne Bottoms in central Kansas, *R. blairi* prefers prairie streams and marshes (Irwin and Collins, 1987). In Colorado the species inhabits the eastern foothills, shortgrass prairie now utilized for pasture and grain farming, sandy soils, the margins of aquatic habitats, plains grassland, sandhills, rocky canyon bottoms, and semi-arid plains (Cousineau and Rogers, 1991; Gillis, 1979; Hammerson, 1982a). The species occurs at elevations below 1828 m in Colorado (Hammerson 1982a). Lardie and Black (1981) characterized the habitat of *R. blairi* in the xeric Cimarron Gypsum Hills region of northwestern Oklahoma as Mixed-grass Plains Biotic District, Grassland Faunal Region, Short-grass Plains Biotic District, and gramma-buffalo grassland. The area also contains escarpments, badlands, sandstone outcrops, sand dunes, caverns, and sinkholes. *Rana blairi* has been found in a number of caves in Oklahoma (Black, 1969, 1973; Bozeman et al., 1987; Collins and Collins, 1988). In Texas the species is adapted to dry prairies and plains, in which it seeks out aquatic habitats (Garrett and Barker, 1987). J.E. Platz (pers. comm.) found that *R. blairi* was typically found in Texas at shallow playa lakes, roadside ditches, and more recently at cattle stock tanks. In New Mexico, Scott and Jennings (1985) reported that *R. blairi* is found in an area that has numerous playa lakes of variable duration. Specimens were taken at rivers and ponds (human-made or natural) in temporary streambeds. In Arizona, extreme aridity limits available habitat and the species is mostly restricted to nonpermanent or semipermanent livestock tanks and irrigation sloughs, as well as an occasional permanent pool in an intermittent stream (Frost and Bagnara, 1977). Populations of *R. blairi* were found at elevations from 1200-1800 m in Arizona by Frost and Platz (1983). In addition to some of the preceding, Stebbins (1985) mentioned oak and oak-pine woodland as habitat, and he indicated that elevations from 110-2590 m are inhabited.

Breeding sites are quite variable and have included the following: roadside and drainage ditches, marshes, rain or temporary pools, flooded areas, farm ponds, lakes, livestock tanks, streams, rivers, pools in intermittent streams, irrigation sloughs, and ash-settling 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; Hillis, 1981; Johnson, 1977, 1987; Kruse and Francis, 1977; 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; Hillis, 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 (and sometimes approached) the source of the recording. However, playbacks of mating calls of *Rana chiricahuensis* failed to evoke any response from male *R. blairi* under similar circumstances.

Breeding can occur anytime from February through October, depending on local environmental conditions (Axtell, 1977; Axtell and Haskell, 1977; Black and Sievert, 1989; Caldwell and Glass, 1976; Collins, 1982; Collins and Collins, 1991; Dunlap and Kruse, 1976; Ehrlich, 1979; Frost and Bagnara, 1977; Frost and Platz, 1983; Gray and Stegall, 1986; Hammerson, 1982a; Hillis, 1981; Johnson, 1977, 1987; Lynch, 1978, 1985; Post and Pettus, 1967; Rundquist et al., 1978; Scott and Jennings, 1985; Stebbins, 1985). Hammerson (1982a) sometimes found newly laid eggs and large tadpoles together, and he suggested that breeding might occur more than once a year at a given site.

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; Collins, 1982; Collins and Collins, 1991; Hammerson, 1982a; Johnson, 1987; Lynch, 1985; Scott and Jennings, 1985). Newly metamorphosed juveniles averaged 27 mm in length in Missouri (Johnson, 1987), and the supralabial stripe is often well defined in the young (Stebbins, 1985).

The usual annual activity period was found by Collins (1982), Collins and Collins (1991), Hammerson (1982a), and Johnson (1987) to extend from early spring (Feb.-Apr.) into fall (Oct.). Hammerson (1982a) noted that in the fall, large numbers of *R. blairi* gathered at some ponds used as over-wintering sites. Sometimes the species is active in winter (Collins, 1982; Collins and Collins, 1991). Winter activity under ice in Oklahoma was reported by Black et al. (1976). Smith et al. (1983) noted four frozen *R. blairi* in December that had apparently died after leaving a Missouri pond through holes in the ice.

Frost and Bagnara (1977) found that after being disturbed, *R. blairi* often sought refuge in vegetation surrounding bodies of water, whereas *R. chiricahuensis* almost always jumped into the water. Gillis (1979) observed that when *R. blairi* were subjected to dehydration stress, they assumed a water-conservation posture (legs tucked near body, ventral surface pressed on substrate). *Rana pipiens* only adopted this posture when much more body moisture was lost (Gillis, 1979).

Reports of natural hybrids between *R. blairi* and three other species of leopard frogs include: *R. blairi* x *R. berlandieri*, (Littlejohn and Oldham, 1968; Platz, 1972, 1981); *R. blairi* x *R. pipiens*, (Black, 1976; Cousineau and Rogers, 1991; Dunlap, 1979; Dunlap and Kruse, 1976; Hammerson, 1982a; Kruse, 1981; Kruse and Dunlap, 1976; Lynch, 1978, 1985; Pace, 1974); *R. blairi* x *R. sphenocephala*, (Axtell, 1977; Black, 1976; Collins, 1982; Johnson, 1977, 1987). Notable among these were the studies of Platz (1972, 1981) on natural hybrid *R. blairi* x *R. berlandieri* in Texas. In 1969, twelve of 138 individuals were hybrids (eight F1, four inferred backcrosses), while in 1975, six of 94 frogs were inferred backcrosses. These animals were primarily identified on the basis of isozyme phenotypes which conflicted with identification based on morphology and color pattern. Lynch (1978), using his own data pooled with that of Dunlap and Kruse (1976) and

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%, 15.8%). Kruse and Dunlap (1976) found that natural hybrid *R. blairi* x *R. pipiens* could be identified by albumin phenotype; likewise, Axtell (1977) identified natural hybrid *R. blairi* x *R. sphenocephala* by LDH 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. areolata, R. berlandieri, R. chiricahuensis, R. megapoda, R. montezumae, R. palustris, R. pipiens,* and *R. sphenocephala.* 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; Mecham, 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., 1983).

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 (1983) found abnormal meiotic activity in six laboratory-produced male hybrid *R. chiricahuensis* 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 hybridizations (Cuellar, 1971; Mecham, 1969) and cladistic analyses of biochemical data (Hillis, 1988; Hillis and Davis, 1986; Hillis et al., 1983). Zoogeography in the Great Plains, Prairie Peninsula, and along the Mississippi River in the central Midwest was discussed by Brown and Morris (1990) and Brown et al. (in press). Frost and Bagnara (1977) commented on zoogeography in the Chihuahuan Desert.

Reviews of historical views and newer evidence pertaining to the taxonomy, speciation, and evolution of *R. blairi* and other leopard frog species were presented by Brown (1973), Dubois (1977), Hillis (1988), and Pace (1974). The discovery of *R. blairi* in the middle of Moore's (1946) proposed "north-south gradient of hybrid inviability" through the United States in *R. pipiens, sensu lato,* provided important evidence that Moore's (1944, 1946, 1949) single-species hypothesis was incorrect (Brown, 1973, Brown and Brown, 1972). On a lesser scale, Smith (1961) concluded that there was a wide, north-south zone of intergradation across central Illinois between two forms he recognized ("*Rana pipiens pipiens*" in the north and "*Rana pipiens sphenocephala*" in the south). Later, Brown and Morris (1990) and Morris et al. (1983) showed that the suspected intergrades were actually *R. blairi.*

Comprehensive studies of reproductive isolating mechanisms involving *R. blairi* include Frost and Platz (1983) in Arizona and New Mexico with three other species, and Hillis (1981) in Texas and Oklahoma with two other species. Both studies concluded that premating isolation was well developed. Hillis (1988) summarized isolating mechanisms among *R. blairi* and other sympatric, related, ranid species. Many other papers provided additional data or gave pertinent commentary.

Several papers have addressed predation on *R. blairi.* Kruse and Francis (1977) found that three predatory fish species consumed tadpoles of *R. blairi* and three other anuran species much more readily than the fish consumed Bullfrog tadpoles (*Rana catesbeiana*). Ehrlich (1979) observed that Bullfrog tadpoles unhesitatingly consumed the eggs and newly hatched larvae of *R. blairi.* Large Bullfrogs were found by Smith (1977) to readily orient to distress calls of recently metamorphosed *R. blairi* for purpose of consumption, and Hammerson (1982a, 1982b) implicated Bullfrogs as extirpating populations of *R. blairi* through predation or competition. However, Hayes and Jennings (1986) questioned the importance of Bullfrog predation in the decline of western North American ranids. At the University of Kansas Natural History Reservation, Fitch (1982) found that *R. blairi* made up an important part of the diet of several species of snakes. Hammerson (1982a) noted the distress calls produced by *R. blairi* when being preyed upon by Western Terrestrial Garter Snakes (*Thamnophis elegans*). *Rana blairi* were a significant food item found in a nest of the Mississippi Kite (*Ictinia misisippiensis*) by Robinson (1957). The remains of the carcasses of six small *R. blairi* were found by Parmley and Tyler (1978) around the entrance of a burrow of a Blacktail Prairie Dog (*Cynomys ludovicianus*) occupied by a Burrowing Owl (*Athene cunicularia*).

Specific information on the food habits of *R. blairi* is scanty. Black (1973) examined the alimentary canals of several *R. blairi* collected in total darkness in gypsum caves in northwestern Oklahoma. He found the remains of crickets (Family Gryllacrididae), beetles (Carabidae and Catopidae), and flies (Heleomyzidae). The frogs and invertebrates occurred near guano mounds. Hammerson (1982a) found a *R. blairi* in Colorado that had its stomach full of grasshoppers, and Creel (1963) captured a large *R. blairi* (SVL = 114 mm) in Texas consuming a bat (*Pipistrellus subflavus*) with only one of its wings protruding from the frog's mouth.

In contrast to the unspotted dorsums found at low frequencies in populations of *R. pipiens* (termed Burnsi mutants) and *R. sphenocephala,* no dorsally unspotted frogs were found by Brown and Funk (1977) among 219 preserved *R. blairi* from Illinois. Details of time-efficient, low cost procedures for laboratory rearing of tadpole and post-metamorphic *R. blairi* were presented by Frost (1982). Platyhelminth parasites of *R. blairi* in Nebraska were extensively surveyed by Brooks (1976) and Brooks and Welch (1976). Physiological effects of experimental anaerobiosis were studied by Rose and Drotman (1967). Gillis (1979) demonstrated the higher tolerance to water loss by adult *R. blairi,* when compared to adult *R. pipiens.* Isozyme studies not heretofore mentioned include Levy and Salthe (1971, 1974) and Salthe (1969).

The decline or extinction of populations has been noted by Christiansen and Bailey (1991), Clarkson and Rorabaugh (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. catesbeiana*).

• **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, DF 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.

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