

**LITHOBATES BERLANDIERI (Rio Grande Leopard Frog). VOLUNTARY THERMAL MAXIMUM.** Data are scarce on the ecology and natural history of *Lithobates berlandieri* (Dodd 2013. Frogs of the United States and Canada. 2 volumes. The John Hopkins University Press, Baltimore, Maryland. 982 pp.). I report four observations (10 individuals) of *L. berlandieri* voluntarily sitting in direct sunlight at air temperatures  $> 37^{\circ}\text{C}$ .

At 1527 h on 14 July 2007, two adult *L. berlandieri* were observed on a half-submerged rock in a cattle tank near La Gavia (ca. 13 km SW of San Carlos), Municipality of San Carlos, Tamaulipas, Mexico (24.48638°N, 99.03250°W; WGS 84; 449 m elev.). The pond was ca. 10 × 15 m, with a gently sloping perimeter of mostly exposed dry dirt and very minimal low grass and vegetation. No shade was available within 6–8 m of the waterline. The air temperature, recorded at ca. 1.3 m above the ground in the shade of my body at the bank of the pond, was record at 37.78°C, with a barometric pressure (bp) of 30.18. The two frogs were observed basking in direct sunlight, oriented facing west into the sun. Both frogs were fully out of the water, one sitting on dry rock, the other on the threshold of dry and damp rock. The forelimbs were held erect in a posture that kept much of the ventral surface of their bodies exposed to air, a typical posture of frogs facilitating heat loss through emitted radiation and evaporative water loss associated cooling the body temperature,  $T_b$  (Lillywhite 1970. Copeia 1970:158–168). The frogs were observed intermittently for a duration of ca. 10 min., during which time they did not move. Just before leaving the area, the frogs were approached to test their response in the extreme heat and additional photographs. The frogs showed no apparent signs of distress from the heat, appeared healthy, alert, and jumped into the pond, exhibiting typical predator escape behavior. Additional and similar observations of voluntary exposure and tolerance of temperatures  $> 37^{\circ}\text{C}$  in *L. berlandieri* were recorded. At 1411 h on 6 September 2005, one was seen basking in a roadside ditch with an air of 38.33°C, 30.68 bp, 3 km SE of Carrizo (36 km N of Jaumave), Municipality of Jaumave, Tamaulipas, Mexico (23.73138°N, 99.42250°W; WGS 84; 821 m elev.). At 1604 h on 16 August 2007, two *L. berlandieri* were photographed *in situ* basking on rock at 37.78°C, 30.15 bp, in San Pedro Canyon, west of La Boca de San Pedro, (24 km NW of Cd. Victoria) Municipality of Hidalgo, Tamaulipas, Mexico (23.90833°N, 99.35416°W; WGS 84; 477 m elev.). At 1345 h on 17 October 2007, h, five *L. berlandieri* were seen at a cattle tank at 37.22°C, 29.56 bp, near San Antonio Rayon (43.5 km S of Gonzalez), Municipality of González, Tamaulipas, Mexico (22.43083°N, 98.41194°W; WGS 84; 18 m elev.). All of these observations involved frogs voluntarily exposed to full afternoon sun, shallow lentic bodies of water with sparse vegetation, in semiarid environments. An exception being the observation in the Municipality of Hidalgo, which involved lotic water descending from higher elevations in the Sierra Madre Oriental with relatively lush aquatic and terrestrial vegetation at the microenvironment.

All locality coordinates, elevations, times, temperatures, and barometric pressures were determined using a handheld Magellan GPS. Unfortunately, the temperatures recorded in Tamaulipas reflect the macroclimatic air temperature, not the  $T_b$  frequently reported in the literature, so comparisons may not be equivalent. Nonetheless, with a maximum voluntary  $T_b$  of 34.7°C reported for *L. "picipiens,"* likely *L. berlandieri* (Brattstrom 1963. Ecology 44:238–255), and a critical thermal maximum of 38.2°C reported for *L. catesbeianus* (Lillywhite

1970, *op. cit.*), voluntary exposure and tolerance of 37.22–38.33°C temperatures are notable.

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**LITHOBATES CATESBEIANUS (American Bullfrog). DIET.** Here we present the first observation of a *Lithobates catesbeianus*, or any frog, eating *Rallus elegans* (King Rail). The frog was found on 13 July 2012 at B. K. Leach Memorial Conservation Area, Lincoln County, Missouri, USA (39.12706°N, 90.72597°W; WGS 84). Upon closer inspection, we discovered a juvenile *R. elegans* within the frog's stomach. *Rallus elegans* is known to nest at this site and is one of the few places in Missouri where they currently breed. Gary Calvert (Wildlife Management Biologist, B.K. Leach Memorial Conservation Area) examined the bird in more detail, confirming by its large size that it is a juvenile *R. elegans*.

*Rallus elegans* is a large-bodied, elusive wetland bird that is often difficult to observe. They inhabit freshwater and brackish marshes across eastern North America (Pickens and Meanley 2018. Birds of North America. <https://birdsna.org/Species-Account/bna/species/kinrai4/introduction>; 23 Mar 2019). *Rallus elegans* has declined sharply in the past 50 years with the species listed as endangered or threatened in 12 Eastern and Midwestern states in the United States, as well as Canada (Environment Canada 2012. Recovery Strategy for the King Rail (*Rallus elegans*) in Canada. Species at Risk Act Recovery Strategy Series. Environment Canada, Ottawa. 22 pp.; Pickens and Meanley 2018, *op. cit.*). Although *R. elegans* has not been previously observed being eaten by frogs, a downy juvenile *Rallus limicola* (Virginia Rail) was recovered from a *Lithobates clamitans* (Green Frog) stomach by Cramer (1932. Auk 49:80). Whether bullfrog predation is significantly contributing to juvenile *R. elegans* mortality is unknown, but causes of juvenile *R. elegans* mortality, and the impact of their survival on *R. elegans* populations warrant further study.

Other predators of *R. elegans* include raptors (Errington 1932. Condor 34:178–186; Errington 1933. Condor 35:19–29; Errington and Breckenridge 1936. Am. Midl. Nat. 17:831–848), mammals (Pickens and King 2013. Waterbirds 36:319–329; Pickens and Meanley 2018, *op. cit.*), including *Lynx rufus* (Bobcat), *Vulpes vulpes* (Red Fox) and *Lontra canadensis* (River Otter). *Procyon lotor* (Raccoon) and *Pantherophis alleghaniensis* (Eastern Rat Snake) have been recorded eating *R. elegans* eggs (Rogers 2013. J. Field Ornithol. 84:355–366.). Other reptilian predators include *Alligator mississippiensis* (American Alligator; Kellogg 1929. U.S. Dept. Agric., Tech. Bull. 147), and an *Agkistrodon piscivorus* (Cottonmouth) observed attempting but failing to eat *R. elegans* eggs (Rogers 2011. M.S. Thesis. North Carolina State University, Raleigh, North Carolina. 111 pp.). Although other birds have been noted in the diet of *L. catesbeianus*, to our knowledge this is the first report of frog predation on *R. elegans* (Dodd 2013. Frogs of the United States and Canada. John Hopkins University Press. Baltimore, Maryland. 1032 pp.).

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