REPTILES & AMPHIBIANS

When Running on Water isn't Enough, You Can Dive: Field Observation of Diving Behavior as an Antipredator Strategy in a Western Basilisk, *Basiliscus galeritus* Duméril 1851

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One strong pattern to emerge from field studies of behavioral interactions between predators and prey is a positive association between prey response and the intensity of the perceived threat (Stankowich and Blumstein 2005). The entire defensive repertoire of a population or a species may have evolved due to the strong and continuously selective pressure wielded by its natural predators (Greene 1988; Vamosi 2005). Moreover, predators might have coevolved to deal with these defensive strategies, generating a predator-prey arms race (e.g., Geffeney et al. 2002). Lizards are frequent prey of frogs, other lizards, snakes, birds, mammals, and even invertebrates (Vitt and Caldwell 2014), and are known to employ a variety of defensive strategies that include toxic and distasteful secretions, cryptic and aposematic coloration, and a variety of defensive postures and behaviors (Greene 1988; Lima 1998; Downes 2001), the most common of which are escape (flight), immobility, and tail-waving (Rand and Marx 1967; Telemeco et al. 2011).

Basilisks (*Basiliscus* spp.) are well known for using a remarkable antipredator behavior that consists of bipedaling across water as readily as on land (Rand and Marx 1967; Hsieh and Lauder 2004). However, diving behavior, another antipredator strategy used by basilisks, is rarely mentioned in the scientific literature (Rand and Marx 1967; Hernández-Córdoba et al. 2012). Herein we describe in detail the diving behavior of the Western Basilisk, *Basiliscus galeritus* Duméril 1851.

Western Basilisks range from the Pacific lowlands and eastern premontane elevations of Panama's Darien region southward through Colombia's Choco biogeographic region, the inter-Andean valleys of the Magdalena and Cauca Rivers, and throughout western Ecuador at elevations from sea level

Fig. 1. Habitat where a juvenile Western Basilisk (*Basiliscus galeritus*) exhibited diving behavior on the eastern flank of the Central Mountain Range, Samaná Municipality, Caldas Department, Colombia (the puddle into which the lizard dived in indicated by the red arrow) (A). The juvenile on a leaf at the bottom of the puddle (B). Photographs by Sergio Escobar-Lasso.

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to 980 m (Hernández et al. 2012; Ibáñez et al., 2019). These semi-aquatic, diurnally active lizards inhabit lowland and premontane wet forests but can tolerate high levels of habitat disturbance (Castro 1978; Vargas and Bolaños 1999; Ibáñez et al. 2019). They forage mainly in forest understory along rivers, streams, and even lakes (Castro 1978; Vargas and Bolaños 1999), sleeping at night on trees and shrubs near aquatic habitats (Ibáñez et al. 2019).

During a nocturnal survey at 2125 h on 8 August 2019, along a creek known locally as Bolloliso, Samaná Municipality, Caldas Department, Colombia (5.58938°N, 74.94606°W, WGS84; elev. 807 m asl), we encountered a juvenile *B. galeritus* (SVL 46.2 mm, tail length 108 mm, weight: 2.6 g) perched on a shrub 1.3 m above the ground next to the stream. When disturbed by our presence, it jumped from the shrub, ran quickly toward a small rocky puddle (30 cm deep), and dived into it. It remained submerged and motionless on a leaf at the bottom of the puddle for 9 min (Fig. 1). When it emerged from the puddle, it ran toward a ravine adjacent to the creek. It produced a cloacal discharge when captured.

Bradycardia and reduced metabolism during a dive appear to be a general response rather than a specialized adaptation in terrestrial lizards during submergence (Nielsen and Smith 1952; Wood and Johansen 1974). However, at least some lizards have the ability, when submerged, to resort to anaerobic metabolic pathways to obtain ATP (Nielsen 1962; Bennet et al. 1975; Randall et al. 2002). Mertens (1942) indicated that the Nile Monitor (*Varanus niloticus*) dives voluntarily for up to one hour. The Marine Iguana (*Amblyrhynchus cristatus*) can remain submerged for as long as 30 min (Hobson 1965, 1969). Moberly (1968) described Common Iguanas (*Iguana iguana*) diving for short periods, usually lasting less than 30 sec. Arrivillaga and Quinkert (2019) described a male gymnophthalmid (*Potamites erythrocularis*) submerged with its eyes closed, remaining motionless for as long as 1.5 min, and resurfacing for only a few seconds to breathe. Swierk (2019) described Water Anoles (*Anolis aquaticus*) breathing underwater for extended periods (16 min) to escape from predators, but these lizards use an underwater respiration system consisting of a recycled air bubble that clings to the anole's head. Boccia et al. (2021) found that some species of *Anolis* lizards (including *A. aquaticus*) can "rebreathe" exhaled air trapped between their skin and surrounding water but that other tested species (including *B. galeritus*) lose exhaled air to the surface as small bubbles and is thus unavailable for rebreathing.

Our observation of the juvenile Western Basilisk indicated that an enforced dive of nearly 10 min could be exceedingly stressful, suggesting that the diving ability of *B. galeritus* is inferior to those of at least some other aquatic or semi-aquatic lizards. Nonetheless, diving behavior in basilisks and other lizards associated with aquatic habitats could occur more frequently than previously thought.

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