



A Predation Attempt by a Samar Cobra, *Naja samarensis* Peters 1861, on a Banded Bullfrog, *Kaloula pulchra* Gray 1831, on the Island of Mindanao, Philippines

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The Samar Cobra (*Naja samarensis*) is endemic to the Mindanao Faunal Region of the Philippines, comprised of mainland Mindanao, Basilan, Bohol, Leyte, Samar, and the adjacent smaller islands (Sanguila et al. 2016; Leviton et al. 2018; Sy and Mangkabong 2018; Sy and Bucol 2020). It occurs at elevations to 800 m asl and inhabits a variety of habitats ranging in quality from pristine to disturbed (e.g., from modified ecosystems, like rural villages and agricultural plantations, to tropical moist and/or karst forests) (Maglangit et al. 2022). This species is known to prey on small mammals, small reptiles (including other snakes), and frogs (Leviton 1965; Smith 1993; Ravalo et al. 2019; Pauwels and Brecko 2020; Verocai et al. 2023). As such, it plays an important role as a top-down population control in human-modified landscapes (see de Miranda 2017), particularly for introduced species.

Anurans are common targets of predators (Toledo et al. 2011; Fadel et al. 2019; Lira et al. 2020; Shahrudin 2021), particularly snakes, which account for an estimated 45% of reported instances of predation (Toledo et al. 2007). Due to the number and diversity of predators, strong selective pressures have led to the development of defensive and antipredation mechanisms specific for deterrence — and anurans employ at least 30 known antipredation mechanisms (Toledo et al. 2011; Ferreira et al. 2019). These include various behavioral defenses like the production of secretions, postural changes, and camouflage (Shahrudin 2021; Cuta et al. 2022). However, documentation of such mechanisms in nature are scarce in the literature on Philippine anurans (Cuta et al. 2022). The Banded Bullfrog (*Kaloula pulchra*), an introduced species, has been observed displaying antipredator mechanisms (Diesmos et al. 2006). However, information

about the ecology of *K. pulchra* in the Philippines, particularly its predators, is limited. Herein we describe a predatory attempt by a Samar Cobra on a Banded Bullfrog in Davao City, and chronicle the antipredator responses of *K. pulchra* against the snake.

The attempted predation occurred at 1235 h on 24 September 2023, in a residential area in Mintal, Davao City (7.08736 N, 125.49014 E), characterized by diverse patches of vegetation comprised of Rambutan (*Nephelium lappaceum*), Papaya (*Carica papaya*), Binunga (*Macaranga tanarius*), and various sedges interspersed with tree stumps and fallen branches. When initially encountered, the snake was grasping the right hindlimb of the immobile frog (SVL: 79 mm) (Figs. 1A–B), which had inflated its body while secreting a discernible whitish fluid, particularly on the posterior dorsum. About two minutes later, the snake redirected its bite to the frog’s loose dorsal skin and, in the process, altered its position (Fig. 1C). The snake then coiled around the body of the frog and attempted to ingest it headfirst. Bubbles were visible around the mouth of the snake, which then released the frog after several attempts to disengage. The snake lingered in proximity to the frog for a few minutes before leaving the area (Fig. 1D). Eight minutes after the snake left, we took photographs of the frog to confirm identification and placed it in a container to prevent another predation attempt by the snake. During this time, the frog remained immobile with its eyes closed and was not responsive to touch, but a very slow heartbeat was discernible. Surprisingly, the frog, albeit weak, was still alive the next morning (Fig. 1E).

Kaloula pulchra, like many amphibians, has developed various antipredation behaviors and defense mechanisms that can be executed simultaneously (Toledo et al. 2011;

Shahrudin 2021). For example, *K. pulchra* can inflate its lungs with air, causing its body to appear larger to deter ingestion by a potential predator (Bringsøe et al. 2021). This can be employed by these frogs while on the ground, float-

ing on water, or being seized by a predator (Toledo et al. 2011). In addition to ballooning, the frog also secretes fluids that serve as a chemical defense (Evans and Brodie 1994). Toledo et al. (2011) categorized anuran skin secretions into

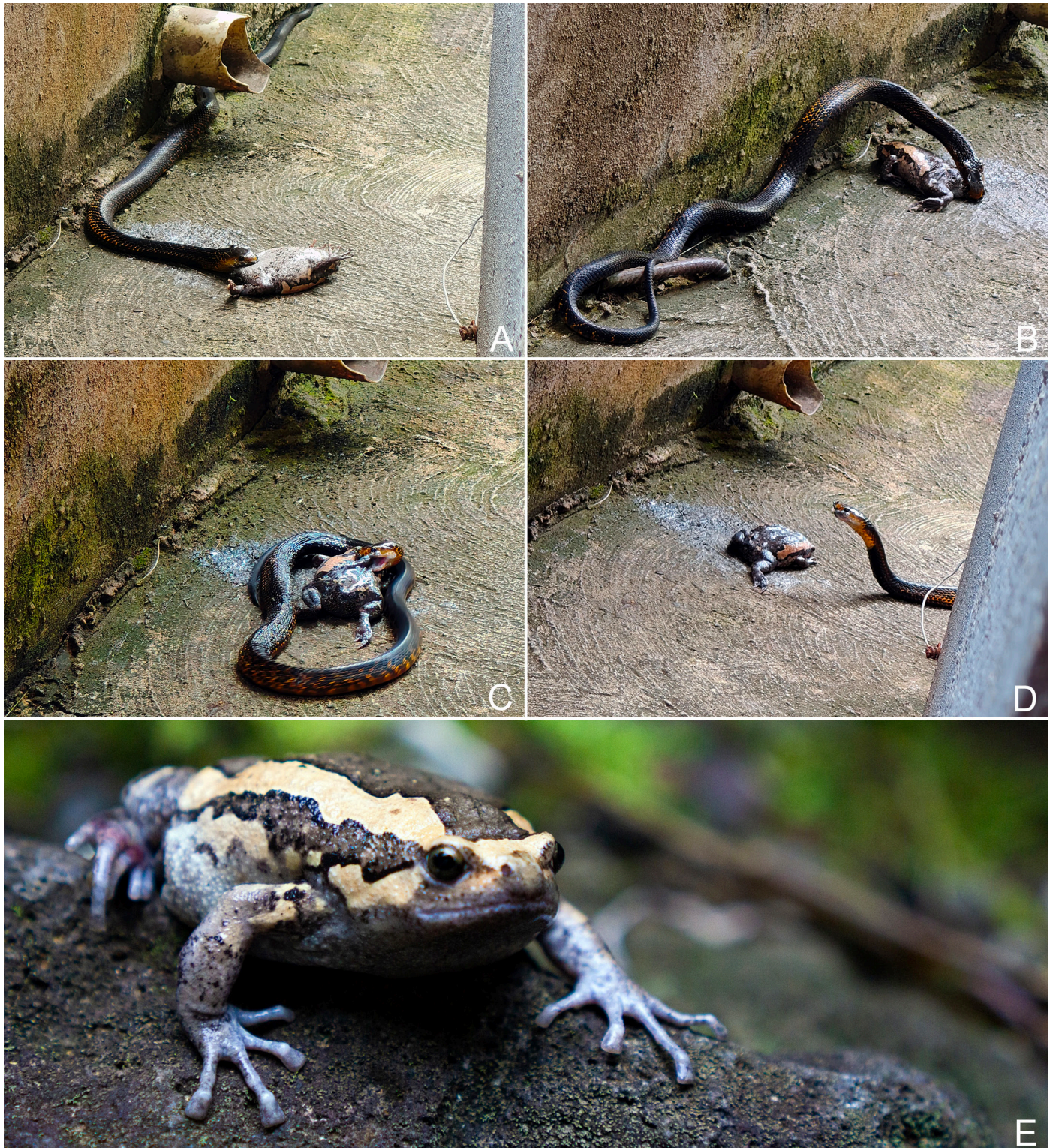


Figure 1. A predatory attempt by a Samar Cobra (*Naja samarensis*) on a Banded Bullfrog (*Kaloula pulchra*) in Davao City, Philippines. The snake initially grasped the frog by the leg (A & B) and worked its way to the frog's dorsum (C) before releasing it (D); surprisingly, although weak, the frog survived to at least the next day (E). Photographs by Anne Krizzia Caasi (A–D) and Lief Erikson Gamalo (E).

four types: adhesive, noxious, odoriferous, and slippery. The skin secretions of *K. pulchra* are generally considered to be adhesive (Evans and Brodie 1994) and have been shown to be unpleasant and distasteful to predators (Daly et al. 2004). The viscosity of these adhesive secretions can also reduce the mobility of the predator's jaws and mouth (Toledo et al. 2011; Cuta et al. 2022), which can slow down the predation process. These two defensive mechanisms may have contributed to the unsuccessful attempt by the cobra on the bullfrog. Although this predation attempt was unsuccessful, *N. samarensis* must now be considered a predator of the introduced frog. Samar Cobras also have been reported to prey on Cane Toads (*Rhinella marina*), another invasive anuran species on Mindanao Island (Smith 1993; Ravalo et al. 2019). These reports, together with the recent observation, highlight the possible role of *N. samarensis* in controlling introduced anuran species in the Philippines.

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