The Northern Cat-eyed Snake *Leptodeira septentrionalis* (Squamata; Colubridae): Hunting and Feeding Strategy on Red-eyed Tree Frog *Agalychnis callidryas* (Anura: Hylidae) in Belize

Tom W. Brown [1, 2, 3]

[1] Kanahau Utila Research and Conservation Facility, Isla de Utila, IB 34201, Honduras

[2] Mesoamerican and Caribbean Network for the Conservation of Amphibians and Reptiles (Red MesoHerp Network)

[3] University of Nottingham, School of Geography, England, UK, NG7 2RD

*Corresponding author e-mail: tom@kanahau.org

The Northern Cat-eyed Snake *Leptodeira septentrionalis* is a rear-fanged colubrid distributed widely across Meso-America (Kohler, 2003), including the country of Belize (Platt et al. 2016). Opistoglyphous species like *L. septentrionalis* will bite and hold their prey, or sometimes chew to increase venom delivery, until their venom takes affects (Savage, 2002; Solórzano, 2004). These snakes generally swallow prey headfirst but have previously been documented using alternative feeding strategies, such as internal organ ingestion (Arroyo-Trejos & Mora, 2016). Tree frogs and their eggs are common in the diet of *L. septentrionalis* (Platt et al. 2016), and individuals often gather to feed during breeding aggregations (Solórzano, 2004; Wells, 2007). Research suggests anurans are the dietary staple of *L. septentrionalis,* and at least eight different prey species have been documented to date (e.g. Duellman, 1963; Cabrera-Guzmán et al., 2009; Dehling, 2009; Arias et al., 2015; Engeman and Engeman, 2015); including *Agalychnis callidryas* eggs (Duellman, 1958; Pyburn, 1963; Wells, 2007) and adults (Platt et al. 2016). The following note supports prior literature by providing another example of *A. callidryas* predation by *L. septentrionalis*. This event is notable as the snake was observed and photographed locating its prey using olfactory senses, before capturing and ingesting it from behind.

The observation took place on 28 August 2018, 19:50h at Lower Dover Field Station, Unitedville, Belize (GPS: N 17.21540°, W 0.88.94758°, 58m asl). While exploring this area of privately protected lowland rainforest, a small breeding aggregation of Red-eyed Treefrog *A. callidryas* and Veined Treefrog *Trachycephalus venulosus* were located by their repeated calling. Upon approaching and observing c. <15 *A. callidryas* individuals call among each other (some already in amplexus), an adult *L. septentrionalis* was located actively foraging on a dried palm frond adjacent to one prior-calling male individual. When the snake was c. <30cm from the frog, it raised its head and proceeded to sense its prey using the tongue in a series of slow flicks (Fig. 1A). Upon orientating the position of its prey, the snake tentatively approached while slowly flicking its tongue, before striking at a near touching distance. The snake grasped the frog from behind and began chewing the prey to deliver its venom and establish a better grip (Fig. 1B). A struggle ensued for c. 5 minutes, where *A. callidryas* attempted to prise itself free from capture using its rear feet. The frog's last line of defence was clinging firmly to its perch in a desperate tussle to keep hold (Fig. 1C), but within a few minutes *A. callidryas* succumbed to the snakes venom and its grip began to fail. After forcedly levering its prey free, *L. septentrionalis* proceeded to ingest the

frog backwards without complication in little over 5 minutes (Fig. 1D).

Revisits to the site on the following two evenings located likely the same adult *L. septentrionalis* active again on the same palm leaf amid the group of breeding *A. callidryas*. No further predatory interactions were observed and no morphological data was collected.

Snakes are the main predators of anurans in habitats surrounding bodies of water (Wells, 2007; Santos-Silva et al., 2014). Given the accrual of frogs in the diet of *L.septentrionalis,* this snake could be a steadfast regulator of certain anuran populations in its range. The present observation indicates that *L.septentrionalis* not only locate their prey by movement but do also detect and stalk prey using olfactory senses. Following the suggestion of Arroyo-Trejos & Mora (2016), encounters of *L. septentrionalis* active on subsequent nights after feeding support the notion that this primitive colubrid predates prey 'little and often' as appose to 'large and infrequently' (Green, 1983). In summary, this note reaffirms the strong association of *L. septentrionalis* as predators at aggregation sites of breeding anurans like *A. callidryas*.

Figure 1. Photographs depicting the predation event from start to finish. **A: 19:52h** - *Leptodeira septentrionalis* approaching a Red-eyed Treefrog (*A. callidryas*) using its olfactory senses and tongue flicks. **B**: **19:55h** - *L. septentrionalis* strikes at the individual from behind and proceeds to chew and envenom its prey. **C**: **19:58h** - *L. septentrionalis* begins to ingest and prise the enervated *A. callidryas* from its perch. **D**: **20:04h** - Ingestion nears completion and only the front feet of *A. callidryas* remain protruding. © Tom W. Brown

Acknowledgements:

I would like to wholeheartedly thank the owners Madeline, Bill and Justin Reynolds of Lower Dover Field Station, for their continued hospitality and support during short visits to explore the incredible biodiversity of Belize.

References:

Arias, E., Chaves, G., García-Rodríguez, A., Ryan, M.J. (2015). Predation of *Rhaebo haematiticus* (Serpentes: Dipsadidae) in Costa Rica. *Mesoamerican Herpetology,* 2, 563–566.

Arroyo-Trejos, I. and Mora, J.M. (2016). Internal organ ingestion as an alternative feeding behavior for the Northern Cat-eyed Snake (*Leptodeira septentrionalis*). *Mesoamerican Herpetology,* 3 (1), 153-156.

Cabrera-Guzmán, E., Carmona-Torres, F.H., Reynoso, V.H. (2009). Natural History Notes. *Leptodeira septentrionalis* (Cat-eyed Snake). Diet. *Herpetological Review*, 40, 99.

Dehling, D. M. (2009). Natural History Notes. *Leptodeira septentrionalis* (Cat-eyed Snake). Prey. *Herpetological Review* 40, 356.

Duellman, W. E. (1958). A monographic study of the colubrid snake genus *Leptodeira*. *Bulletin of the American Museum of Natural History* 114, 1 – 152.

Duellman, W. E. (1963). Amphibians and reptiles of the rainforests of southern El Petén, Guatemala. *University of Kansas, Publication Museum of Natural History* 15, 205–249.

Engeman, R. and M., Engeman, C. (2015). Natural History Notes. *Leptodeira septentrionalis* (Northern Cat-eyed Snake). Diet and predation. *Herpetological Review* 46, 104–105.

Greene, H. W. (1983). Dietary correlates of the origin and radiation of snakes. *American Zoologist* 23, 431–441.

Platt, S.G., Rainwater, T.R., Meerman, J.C., Miller, S.M. (2016). Nature Notes. Notes on the diet, foraging behavior, and venom of some snakes in Belize. *Mesoamerican Herpetology* 3 (1), 162–170.

Pyburn, W.F. (1963). Observations on the life history of the Treefrog *Phyllomedusa callidryas* (Cope). *Texas Journal of Science* 15, 70 - 155.

Santos-Silva, C.R., Andrade, I.S., Araújo, M.L.N., Barros, L.C.S., Gomes, L., Ferrari, S.F. (2014). Predation of six anuran species by the Banded Cat-eyed Snake, *Leptodeira annulata* (Serpentes: Dipsadidae), in the Caatinga scrub of northeastern Bahia, Brazil. *Herpetology Notes* 7, 123–126.

Köhler G. (2003). Reptiles of Central America. – Offenbach (Herpeton).

Savage, J. M. (2002). The Amphibians and Reptiles of Costa Rica: A Herpetofauna between Two Continents, between Two Seas. The University of Chicago Press, Chicago, Illinois, United States.

Solórzano, A. (2004). Serpientes de Costa Rica: Distribución, Taxonomía e Historia Natural / Snakes of Costa Rica: Distribution, Taxonomy, and Natural History. Instituto Nacional de Biodiversidad (INBio), Santo Domingo de Heredia, Costa Rica.

Wells, K.D. (2007). The Ecology & Behaviour of Amphibians. The University of Chicago Press, Chicago & London, US.