

PREDATION OF THE CLOUDY SNAIL-EATER, *SIBON NEBULATUS*, BY THE GREAT KISKADEE, *PITANGUS SULPHURATUS*, IN THE NORTHERN LOWLANDS OF COSTA RICA

DEPREDACIÓN DE LA CARACOLERA COMÚN, *SIBON NEBULATUS*, POR EL CRISTOFUÉ, *PITANGUS SULPHURATUS*, EN LAS TIERRAS BAJAS DEL NORTE DE COSTA RICA

José Manuel Mora^{1,2*} & Elián Villalobos Alvarado³

¹Carrera de Gestión Ecoturística, Sede Central, Universidad Técnica Nacional, Alajuela, Costa Rica.

²Department of Biology and Museum of Vertebrate Biology, Portland State University, Portland, Oregon, USA.

³Carrera de Gestión Ecoturística, Sede Central, Universidad Técnica Nacional, Alajuela, Costa Rica.

*Correspondence: josemora07@gmail.com

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Resumen. – Varias serpientes están adaptadas a un estilo de vida arbóreo, incluidas algunas que consumen moluscos, como las pertenecientes al género *Sibon*. En Costa Rica hay siete especies de *Sibon* y una de las más comunes es la caracolera común (*Sibon nebulatus*), la cual es una serpiente nocturna de hábitos principalmente arborícolas, aunque a veces se encuentra en el suelo. Con base en una observación registrada por fotografía en las tierras bajas del norte de Costa Rica, reportamos la depredación de la caracolera común por parte del cristofué (*Pitangus sulfuratus*). Este registro contribuye al conocimiento de las interacciones tróficas de ambas especies.

Palabras clave. – Dieta, Dipsadidae, interacciones inespecíficas, serpiente arborícola.

Abstract. – Several snakes are adapted to an arboreal lifestyle, including some that consume mollusks, such as those belonging to the genus *Sibon*. In Costa Rica, there are seven species of *Sibon*, and one of the most common is the Cloudy Snail-eater (*Sibon nebulatus*), a nocturnal snake with primarily arboreal habits but also sometimes found on the ground. Based on a photographically documented observation in the northern lowlands of Costa Rica, we report the predation of the Cloudy Snail-eater by the Great Kiskadee (*Pitangus sulfuratus*). This record contributes to the knowledge of the trophic interactions of both species.

Key words. – Arboreal snake, diet, Dipsadidae, interspecific interactions.

The Neotropical region boasts abundant species diversity (Brown, 2014), this diversity spans various trophic levels, encompassing both predators and preys (Freestone et al., 2011). Predator-prey dynamics serve as pivotal forces driving natural selection, shaping ecological community structures, and influencing ecosystem functioning (Portalier et al., 2019; Valdez, 2020).

Costa Rica has a high diversity of predators, including snakes belonging to the Dipsadidae family with 65 species (Solórzano, 2022). Within this family there are several groups of species with specific characteristics adapted to particular habits. Of note

is the high number of arboreal snakes that consume mollusks and, although they represent only 12% of arboreal snakes, specialization for pareids and mollusks is included in the diet of many dipsadines, such as species of the genus *Sibon* (Harrington et al., 2018).

Sibon snakes are part of a group informally called “goo-eaters” because their diets consist entirely of soft-bodied invertebrates, exclusively invertebrates such as gastropod mollusks and annelids representing a highly diversified, ecologically specialized clade (Mora et al., 2023a). As specialized

“goo-eating” dipsadine snakes display a set of morphological and histochemical adaptations linked to the capture of their soft-bodied, viscous invertebrate prey (dos Santos et al., 2017). Some of the adaptations for this feeding habit is the presence of a complex protein-secreting delivery system in dipsadini (Zaher et al., 2014; dos Santos et al., 2017).

There are currently 22 species of *Sibon* found from Mexico through Central America to Colombia (Uetz et al., 2023). Among them, one of the most widely distributed species is the Cloudy Snail-eater, *Sibon nebulatus* (Linnaeus, 1758), which inhabits both the Pacific and Atlantic slopes, from southeastern Mexico through Central America to Ecuador, Colombia and Brazil, as well as some Caribbean islands (Uetz et al., 2023). In Costa Rica, it is most commonly found on the Atlantic slope, including the northern lowlands, and in the southwestern Pacific region, although it is occasionally found elsewhere on the Pacific slope and in the Central Valley (Leenders, 2019). Its altitudinal range extends from near sea level to 1,200 m in Costa Rica (Solórzano, 2022).

The Cloudy Snail-eater is abundant and widely distributed, thriving in various habitat types, from untouched primary rainforests to urban parks, gardens, and developed areas (Solórzano, 2022). It exhibits nocturnal and arboreal behavior, although it is occasionally observed on the ground while traversing open spaces between trees (Leenders, 2019).

Due to its highly specialized diet consisting on slugs and snails, the Cloudy Snail-eater exhibits specific anatomical adaptations (Harrington et al., 2018). These adaptations include modified jaws, teeth, and skull structures, which enable the snake to extract snails from their shells and swallow them whole (Leenders, 2019). Despite its appearance, characterized by spreading its jaws to resemble a triangular, viper-like head on occasion, the Cloudy Snail-eater is entirely non-aggressive and does not attempt to bite (Leenders, 2019).

The Cloudy Snail-eater typically measures an average total length of 85 cm and possesses a somewhat robust physique with a strongly compressed body. It features a prehensile tail,

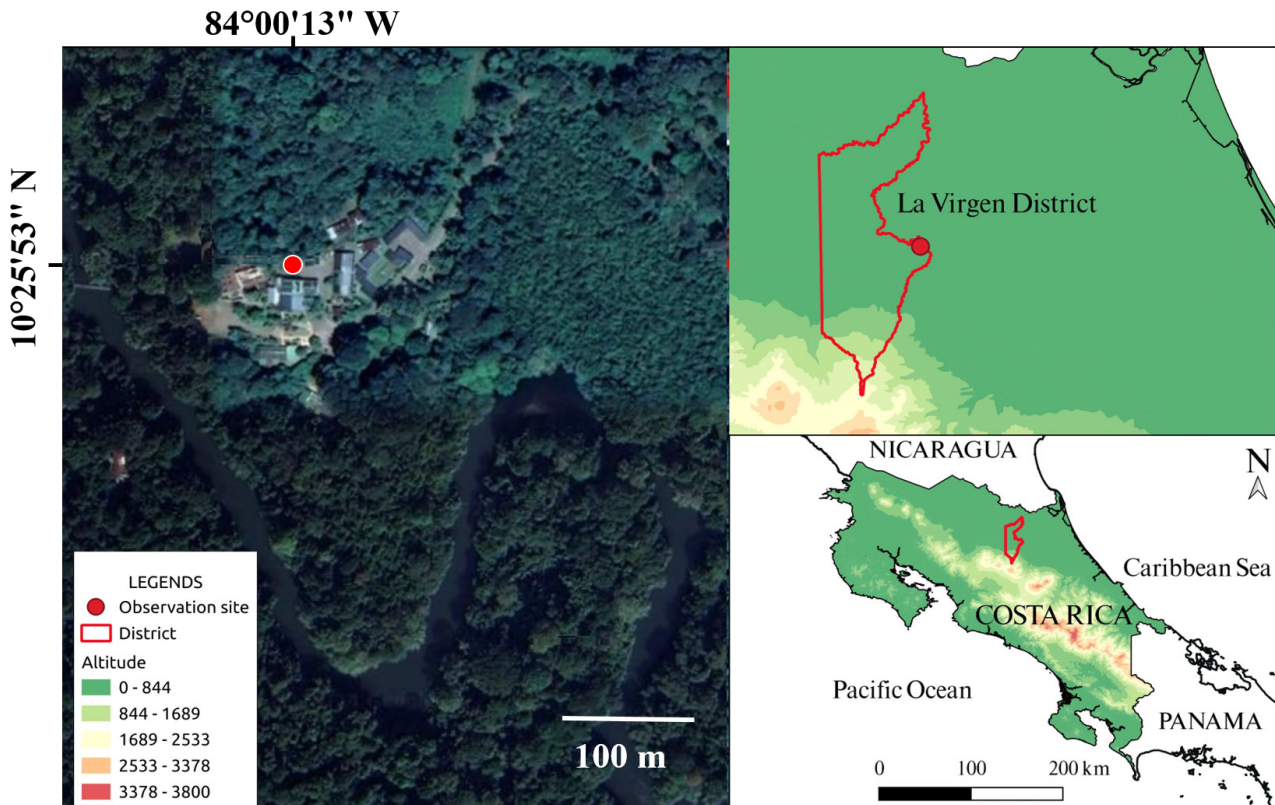


Figura 1. Sitio de depredación de *Sibon nebulatus*, en La Selva, Sarapiquí, Heredia, Costa Rica.

Figure 1. Predation site of *Sibon nebulatus* in La Selva, Sarapiquí, Heredia, Costa Rica.

a large head with a bluntly-rounded snout, and large eyes with vertically elliptical pupils (Leenders, 2019). Its dorsal coloration is predominantly gray, adorned with black bands along the body and tail. These bands are bordered on both sides by a linear series of cream or pale salmon-pink spots (Leenders, 2019).

On 24th January 2024, at 10:04 h, as a result of an incidental observation during a bird-watching tour, we observe a predation event in which a Cloudy Snail-eater was attacked by a Great Kiskadee, *Pitangus sulphuratus*, near the dining room of La Selva Biological Station (10°25'53" N, 84°00'13" W, 48 m a.s.l.; Fig. 1). The snake was hanging from the bird's beak, and after approximately 2 min of being beaten, it no longer showed signs of life (Fig. 2). After a few seconds, the Great Kiskadee flew out of our range of view, carrying the snake with it.

As a generalist omnivore, the Great Kiskadee consumes a varied diet that includes a wide range of animal prey, such as arthropods and vertebrates (including fish, lizards, snakes, and frogs), as well as fruits and human-provided food items like dog food and bird seed when available (Mathys, 2020). Its diet primarily consists of large insects, small lizards, snakes, and frogs, and it is known to drop from low perches to catch prey or hop about on the ground (Stiles & Skutch, 1989). Additionally, it may occasionally raid nests of smaller birds and dive into shallow waters to catch small fish, tadpoles, and insects (Stiles & Skutch, 1989). Likewise, the Great Kiskadee also feeds on fruits while perched or in-flight fruits while perched or in flight (Stiles & Skutch, 1989).

In a study carried out in the Pantanal of Brazil, bats and other vertebrates were identified in the diet of the Great Kiskadee;



Figura 2. *Pitangus sulphuratus* depredando a una caracolera común, *Sibon nebulatus*, en la Estación Biológica La Selva, Sarapiquí, Heredia, Costa Rica.

Figure 2. *Pitangus sulphuratus* predating a Cloudy Snail-eater, *Sibon nebulatus*, at La Selva Biological Station, Sarapiquí, Heredia, Costa Rica.

however, no snakes were observed (Fischer et al., 2010; Munin et al., 2012). Among the amphibians and reptiles documented as prey of the Great Kiskadee are frogs (*Pleurodema borelli*), turtles (*Phrynops hilarii*), lizards (*Hemidactylus mabouia*; *Sceloporus melanorhinus*) and small snakes, although the scientific literature does not specify the species (Peñas Queralt et al., 2023). These researchers reported predation of *Drymobius margaritiferus* by the Greater Kiskadee (Peñas-Queralt et al., 2023).

Gathering data on specific instances, such as the one described here, including the taxa involved in these interactions (Mora et al., 2023b), is an important initial step in understanding the level of selective pressure exerted by specific predators on the herpetofauna (Mora et al., 2023c). This case of a Great Kiskadee preying on the Clouded Snail-eater is just one example of the vast amount of information on snake ecology that remains unknown. Even anecdotal information deserves publication to contribute to a better understanding of the trophic relationships of Neotropical reptiles (Quirós Rosales et al., 2023).

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CITED LITERATURE

- Brown, J.H. 2014. Why are there so many species in the tropics? *Journal of Biogeography* 41:8-22.
- Dos Santos Meireles, M., F. Magalhães da Silva, E. Hingst-Zaher, F. Andrade Machado, H. El Dine Zaher & A.L. da Costa Prudente. 2017. Cranial adaptations for feeding on snails in species of *Sibynomorphus* (Dipsadidae: Dipsadinae). *Zoology* 120:24-30.
- Fischer, E., R.L. Munin, J.M. Longo, W. Fischer & P.R. De Souza. 2010. Predation on bats by Great Kiskadees. *Journal of Field Ornithology* 81:17-20.
- Freestone, A.L., R.W. Osman, G.M. Ruiz & M.E. Torchin. 2011. Stronger predation in the tropics shapes species richness patterns in marine communities. *Ecology* 92:983-993.
- Harrington, S.M., J.M. de Haan, L. Shapiro & S. Ruane. 2018. Habits and characteristics of arboreal snakes worldwide: arboreality constrains body size but does not affect lineage diversification. *Biological Journal of the Linnean Society* 125:61-71.
- Leenders, T. 2019. Reptiles of Costa Rica: a field guide. Zona Tropical Publications, Ithaca, New York, USA.
- Mathys, B. 2020. Great Kiskadee (*Pitangus sulphuratus* Linnaeus, 1766). Pp. 60-62. In C.T. Downs & L.A. Hart (Eds.). *Invasive Birds Global Trends and Impacts*. CABI, Boston, Massachusetts, USA.
- Mora, J.M., R. Vargas, R. Alvarado & L.I. López. 2023a. Two Neotropical Snakes Attacked as Prey by Army Ants in Costa Rica. *Caribbean Journal of Science* 53:374-383.
- Mora, J.M., R. Alvarado & H. Alfaro Lara. 2023b. Predation of a Yellow-Headed Gecko (*Gonatodes albogularis*) by a Bromeliad Spider *Cupiennius coccineus*. *Revista Latinoamericana de Herpetología* 6:6-12.
- Mora, J.M., K.M. Gutiérrez & L.I. López. 2023c. Predation of a La Loma Robber Frog, *Pristimantis caryophyllaceus* (Barbour, 1928), by a Rhinoceros spear Bearer, *Copiphora rhinoceros* Pictet, 1888. *Caribbean Journal of Science* 53:222-228.
- Munin, R.L., E. Fischer & J.M. Longo. 2012. Foraging of Great Kiskadees (*Pitangus sulphuratus*) and food items offered to nestlings in the Pantanal. *Brazilian Journal of Biology* 72:459-462.
- Peñas-Queralt, A., C. Mora Rueda & P.E. Nahuat-Cervera. 2023. Depredación de culebra corredora de petatillos (*Drymobius margaritiferus*) por un Luis Bienteveo (*Pitangus sulphuratus*) en Campeche, México. *Revista Latinoamericana de Herpetología* 6:116-119.
- Portalier, S.M.J., G.F. Fussmann, M. Loreau & M. Cherif. 2019. The mechanics of predator-prey interactions: First principles of physics predict predator-prey size ratios. *Functional Ecology* 33:323-334.
- Quirós Rosales, M., J.M. Mora & R. Alvarado. 2023. Predation of *Lepidophyma flavimaculatum* (Squamata: Xantusiidae) by *Basiliscus plumifrons* (Squamata: Corytophanidae). *Phyllomedusa: Journal of Herpetology* 22:69-74.
- Solórzano, A. 2022. Serpientes de Costa Rica: Distribución, Taxonomía e Historia Natural. 2nd. ed. Topografía e imprenta LIL S.A., San José, Costa Rica.



- Stiles, F.G. & A.F. Skutch. 1989. Guide to the Birds of Costa Rica. Comstock Publishing Associates. Ithaca, New York, USA.
- Uetz, P., P. Freed, R. Aguilar, F. Reyes, J. Kudera & J. Hošek (eds.). 2023. The Reptile Database. <http://www.reptile-database.org>. [Consulted in March 2024].
- Valdez, J.W. 2020. Arthropods as vertebrate predators: a review of global patterns. *Global Ecology and Biogeography* 29:1691-1703.
- Zaher, H., L. Oliveira, F.G. Grazziotin, M. Campagner, C. Jared, M.M. Antoniazzi & A.L. Prudente. 2014. Consuming viscous prey: a novel protein-secreting delivery system in neotropical snail-eating snakes. *BMC Evolutionary Biology* 14:58.

