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A predator on the rocks: Another saxicolous *Bokermannohyla* species (Anura: Hylidae) as prey for *Chironius brazili* (Squamata: Colubridae) in Central Brazilian Cerrado

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Resumo

O gênero *Chironius* é composto por serpentes diurnas, escansoriais/arborícolas, distribuídas ao longo da América Central e do Sul. Essas serpentes se alimentam de uma grande variedade de presas, sendo os anuros de grande porte da família Hylidae os itens mais frequentemente reportados para a maioria das espécies. *Chironius brazili* está distribuída na América do Sul, no Cerrado e em áreas de transição com Mata Atlântica e Pampa. Há poucos estudos sobre a dieta dessa espécie, e neste trabalho adicionamos um novo registro de predação. Durante um trabalho de campo em uma área de Cerrado em Brasília, Distrito Federal, Brasil, encontramos um indivíduo de *C. brazili* predando um indivíduo adulto de *Bokermannohyla sapiranga*, um Hylidae endêmico do domínio. A serpente estava segurando o anuro pela cabeça, ingerindo-o vivo lentamente. *Chironius brazili* aparenta ter uma preferência por anuros da família Hylidae, assim como outras espécies do gênero. Entretanto, há uma diferença marcante no padrão de forrageamento e dieta entre *C. brazili*, que aparenta ser mais especializada em espécies saxícolas. Estudos futuros envolvendo a dieta de *C. brazili* ao longo da área de distribuição poderão revelar novas informações sobre a evolução do forrageamento e comportamento de predação nessa espécie.

Palavras-chave

Ambientes rupestres, Batracofagia, *Bokermannohyla sapiranga*, Comportamento de predação, Neotropical.

Abstract

The genus *Chironius* is composed of diurnal, scansorial/arboreal snakes, distributed across Central and South America. These snakes feed upon a wide variety of prey, with large Hylid frogs being the most frequently reported item for most species. *Chironius brazili* is a species distributed across the Cerrado and in transitional areas with Atlantic Forest and Pampa biomes in South America. There are only a few prey items published for the species, and herein we report a novel predation record. During a survey in a Cerrado area in Brasília, Distrito Federal, Brazil, we found an individual of *C. brazili* preying upon an adult individual of *Bokermannohyla sapiranga*, a Hylid frog endemic to the biome. The snake was holding the frog by the head, slowly ingesting it alive. The species seems to have a dietary preference for Hylid frogs, such as other species of the genus. However, there is a remarkable difference in the foraging behavior and diet between *C. brazili* which seems to be more specialized in saxicolous anurans. Further studies of the diet of *C. brazili* throughout its distribution may supply new information on the evolution of foraging and predation behavior in this species.

Keywords

Batracophagy, *Bokermannohyla sapiranga*, Neotropical, Predation behavior, Rocky environments.

Snakes prey upon a great variety of animals, with phylogenetic constraints determining most of the dietary variation (Bellini et al., 2015). The genus *Chironius Fitzinger*, 1826 is composed of 27 species of diurnal, scansorial/arboreal snakes, distributed across Central and South America (Bailey, 1955; Dixon et al., 1993; Nogueira et al., 2019; Entiauspe-Neto et al., 2020; Jadin et al., 2024; Quinteros-Muñoz et al., 2024; Sudré et al., 2024). *Chironius* prey upon several different taxa, such as amphibians, reptiles, birds and small mammals (Roberto & Souza, 2020; Banci et al., 2022). The genus also presents several morphological adaptations for arboreal habitats (e.g., slender body, long tails and higher vertebral density; Lillywhite & Henderson, 1993; Sheehy III et al., 2015) with large Hylid frogs being the most frequent prey item for most species (Roberto & Souza, 2020; Banci et al., 2022).

Chironius brazili Hamdan and Fernandes, 2015 is a medium-sized species distributed in the Cerrado and transitional areas with the Atlantic Forest and Pampa biomes (Hamdan & Fernandes, 2015; Nogueira et al., 2019; Ugalde et al., 2024), inhabiting mostly open areas and forest edges (Hamdan & Fernandes, 2015; Ugalde et al., 2024). The species is still poorly known in terms of diet and natural history, and available evidence indicates that *C. brazili*, as other congeners, is predominantly batrachophagous (Aximoff et al., 2017; Lucas et al., 2017; Passos et al., 2017; Assunção & Saturno, 2025; Oliveira et al., 2025). Recent observations have demonstrated that *Chironius brazili* actively forages on rocky substrates along lotic environments, preying primarily on saxicolous Hylids, which points to a recurrent foraging pattern shaped by both habitat use and prey phylogenetic affinity (Parreira et al., 2023). Herein, we document a new predation event involving *C. brazili* and *Bokermannohyla sapiranga* in the central Brazilian Cerrado, further reinforcing the emerging evidence that foraging on rocky environments and preying upon large stream-dwelling saxicolous Hylids represent an ecologically meaningful component of the species' feeding strategy.

On 12 May 2024, at 13h07, we observed an adult *Chironius brazili* preying upon an adult individual of *Bokermannohyla sapiranga* Brandão et al., 2012 (Fig. 1), while walking along a river in Chapada Imperial, Brasília, Distrito Federal, Brazil (15°32′23″ S, 48°06′19″ W; 1009 m a.s.l.). The snake was on a rock at the river margin, with approximately half of its body submerged, holding the frog by the head and slowly ingesting it alive. The interaction was observed for about 10 minutes, during which the *B. sapiranga* was unable to escape and showed little resistance. Possibly disturbed by our presence, the snake then retreated into rock crevices along the riverbank and disappeared from view, still holding the prey in its mouth.

Figure 1. Individual of *Chironius brazili* preying upon *Bokermannohyla sapiranga*, holding the anuran by the head while ingesting it alive. Photo by P.H.V.

Our record represents a new anuran species documented as prey of *C. brazili*. *Bokermannohyla sapiranga* is the only species of the genus occurring in Distrito Federal, and can be promptly identified by a robust body, hypertrophied forearms (in males), inconspicuous tarsal fold and brown finger discs (Brandão et al., 2012; Magalhães et al., 2016).

Before the description in 2015, *C. brazili* was part of the *C. flavolineatus* complex, so previous studies considered them as a single species. Since both species (*C. flavolineatus* and *C. brazili*) present some overlapping in distributions (see Nogueira et al., 2019),

the refinement of a diet composition list is a difficult task. Pinto et al. (2008) reported several prey items for *C. flavolineatus* but it is not possible to distinguish which and how many individuals correspond to *C. brazili* (Hamdan and Fernandes, 2015; Nogueira et al., 2019; Ugalde et al., 2024). After the reidentifications made by Oliveira et al. (2025), *B. sapiranga* becomes the sixth species officially reported as a prey for *C. brazili.* It is noteworthy that many prey items of *C. brazili* are species strongly associated with rocky substrates along fast-flowing streams (Caramaschi & Sazima, 1984; Brandão et al., 2012; Magalhães et al., 2016; Magalhães et al., 2018). Our record further supports the foraging pattern proposed by Parreira et al. (2023).

As in other congeners, *C. brazili* appears to prey mostly upon anurans, with a single record of fish reported to date (Assunção & Saturno, 2025; Oliveira et al., 2025). However, while species of *Chironius* are more frequently reported preying on arboreal Hylids and Leptodactylid frogs, *C. brazili* seems to focus on saxicolous frogs (Pinto et al., 2008; Lucas et al., 2017; Roberto & Souza, 2020; Banci et al., 2022; Parreira et al. 2023; Assunção & Saturno, 2025; Oliveira et al., 2025). No information of diet is yet available to *Chironius diamantina* Fernandes and Hamdan, 2014 (the closest species to *C. brazili*), however it is possible to present similar foraging strategy and diet to *C. brazili* (Pinto et al., 2008; Oliveira et al., 2025).

In this context, the suggestion that *Chironius* species, in open habitats, maintain a dietary preference for arboreal anurans (Assunção & Saturno, 2025), likely reflects a broad generalization, that we refute since most of the reported prey for *C. brazili* are saxicolous (Caramaschi & Sazima, 1984; Brandão et al., 2012; Magalhães et al., 2016, 2018).

Other species, such as *C. bicarinatus* (Wied, 1820) and *C. foveatus* Bailey, 1955 are associated with the Atlantic Forest, and also have records preying on *Bokermannohyla* (i.e.*Bokermannohyla circumdata* (Cope, 1871) and *B. hylax* (Heyer, 1985); see Roberto & Souza, 2020). Additionally, these *Bokermannohyla* species are arboreal and belong to lineages that are distinct from the saxicolous species that occur in open Cerrado formations (Faivovich et al., 2025). This pattern suggests that *Chironius* species inhabiting open formations are subject to distinct selective pressures (i.e. foraging in rocky environments and outcrops associated with fast-flowing water bodies) (Passos et al., 2017; Parreira et al., 2023; Assunção & Saturno, 2025; Oliveira et al., 2025; This work), which may allow a dietary preference for large saxicolous anurans.

Recent studies show a higher tendency to a saxicolous anurans-based diet (Lucas et al., 2017; Parreira et al. 2023; Assunção & Saturno, 2025; Oliveira et al., 2025), in areas in with a large availability of rocky environments. Consequently, the apparent preference for saxicolous anurans may reflect a sampling bias associated with availability of rocky environments in the biome. Additional dietary records of *C. flavolineatus*, *C. brazili* and, even, *C. diamantina*, with accurate prey identification and encompassing other domains (particularly the Pampa), are needed to better evaluate whether this foraging pattern represents a domain-specific response or a conserved trait in the evolutionary history of *C. brazili*.

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REFERENCES

Assunção V.O.F., Saturno G. 2025. New records of predation and feeding behavior of the vine snake *Chironius brazili* (Squamata: Colubridae) in the Espinhaço Mountain Range, Brazil. *Cuadernos de Herpetología* 39(2): 127–130. https://10.31017/CdH.2025.(2025-010)

Aximoff I., Cintra H., Pontes J. 2017. *Chironius flavolineatus* (Boettger's Sipo). Diet and habitat use. *Herpetological Review* 48(1): 205–206.

Bailey J.R. 1955. The snakes of the genus *Chironius* in Southeastern South America. *Occasional Papers of the Museum of Zoology, University of Michigan* 571: 1–21.

Banci K.R.S., Guimarães M., Siqueira L.H.C., Muscat E., Sazima I., Marques O.A.V. 2022. Body shape and diet reflect arboreality degree of five congeneric snakes sympatric in the Atlantic Forest. *Biotropica* 54: 839–851. https://10.1111/btp.13107

Bellini G.P., Giraudo A.R., Arzamendia V., Etchepare E.G. 2015. Temperate snake community in South America: Is diet determined by phylogeny or ecology? *PLOS ONE* 10(5): e0123237. https://10.1371/journal.pone.0123237

Brandão R.A., Magalhães R.F., Garda A., Campos L., Sebben A., Maciel N.M. 2012. A new species of *Bokermannohyla* (Anura: Hylidae) from highlands of Central Brazil. *Zootaxa* 3527: 28–42. https://10.11646/zootaxa.3527.1.2

Caramaschi U., Sazima I. 1984. Uma nova espécie de *Thoropa* da Serra do Cipó, Minas Gerais, Brasil (Amphibia, Leptodactylidae). *Revista Brasileira de Zoologia* 2: 139–146.

Cope, E.D. 1867. On the families of the raniform Anura. *Journal of the Academy of Natural Sciences of Philadelphia. Series 2*, 6: 189 – 206.

Dixon J.R., Wiest Jr J.A., Cei J.M. 1993. Revision of the Neotropical snake genus *Chironius Fitzinger* (Serpentes, Colubridae). *Museo Regionale di Scienze Naturali Monografie* 13: 1–280.

Entiauspe-Neto O.M., Lyra M.L., Koch C., Quintela F.M., Abegg A.D., Loebmann D. 2020. Taxonomic revision of *Chironius bicarinatus* (Wied 1820) (Serpentes: Colubridae), with description of a new species. *Herpetological Monographs* 34(1): 98–115. https://10.1655/HERPMONOGRAPHS-D-19-00013.1

Faivovich J., Lourenço C.C., Pinheiro P.D.P., Lyra M.L., Baêta D.P., Magalhães R.F., Grant T., Pezzuti T.L., Leite F.S.F., Araujo-Vieira K., Brandão R.A., Carvalho T.R., Marinho P., Orrico V.G.D., Sabbag A.F., Berneck B.V., Pereyra M.O., Giaretta A.A., Toledo L.F., Garcia P.C.A., Pombal Jr J.P., Wheeler W.C., Rodrigues M.T., Napoli M.F., Haddad C.F.B. 2025. The phylogenetic relationships of Bokermann's treefrogs: Species groups, reproductive biology, and biogeography (Anura: Hylidae: *Bokermannohyla*). Cladistics 41: 323–357. https://10.1111/cla.12619

Fitzinger L.J.F.J. 1826. Neue Classification der Reptilien nach ihren Natürlichen Verwandtschaften nebst einer Verwandtschafts-Tafel und einem Verzeichnisse der Reptilien-Sammlung des K. K. Zoologisch Museum's zu Wien. *Wien*: J. G. Heubner.

Fernandes D.S., Hamdan B. 2014. A new species of *Chironius Fitzinger*, 1826 from the state of Bahia, northeastern Brazil (Serpentes: Colubridae). *Zootaxa* 3881(61): 563–575. https://10.11646/zootaxa.3881.6.5

Hamdan B., Fernandes D. 2015. Taxonomic revision of *Chironius flavolineatus* (Jan, 1863) with description of a new species (Serpentes: Colubridae). *Zootaxa* 4012: 97–119. https://10.11646/zootaxa.4012.1.5

Heyer, W.R. 1985. New species of frogs from Boracéia, São Paulo, Brazil. *Proceedings of the Biological Society of Washington* 98: 657–671.

Jadin R.C., Jowers M.J., Blair C., Ludwig R.K., Salgado-Irazabal X., Murphy J.C. 2024. Rectifying a century of misidentifications: a taxonomic re-evaluation of sipo snakes (Colubridae: Chironius) on Trinidad. *Systematics and Biodiversity* 22(1): 2338064. https://10.1080/14772000.2024.2338064

Lillywhite, H.B., Henderson, R.W. 1993. Behavior and functional ecology of arboreal snakes. Pp. 1–48, in

Seigel, R.A., Collins, J.T. (Eds.), Snakes: Ecology and behavior. MacGraw-Hill Publishing, Ohio.

Lucas D.F., Silva D., Rocha P., Barbosa A., Feio R.N. 2017. Predação do Hilídeo *Bokermannohyla martinsi* (Bokermann, 1964) pela serpente *Chironius brazili* (Hamdan & Fernandes, 2015) na Reserva Particular do Patrimônio Natural Santuário do Caraça, Catas Altas, Minas Gerais, Brasil. *Anais do VIII Congresso Brasileiro de Herpetologia, Campo Grande, Brasil.*

Magalhães R.F., Garda A., Marques N.S., Brandão R. 2016. Sexual dimorphism and resource utilization by the Veadeiros waterfall frog *Bokermannohyla pseudopseudis* (Anura: Hylidae). *Salamandra* 52(2): 171–177.

Magalhães R.F., Lacerda J.V.A., Reis L.P., Garcia P.C.A., Pinheiro P.D.P. 2018. Sexual dimorphism in *Bokermannohyla martinsi* (Bokermann, 1964) (Anura, Hylidae) with a report of male-male combat. *South American Journal of Herpetology* 13: 202–209. https://10.2994/SAJH-D-17-00039.1

Nogueira C.C., Argôlo A.S.J., Arzamendia V., Azevedo J.A., Barbo F.E., Bérnils R.S., Bolochio B.E., Borges-Martins M., Brasil-Godinho M., Braz H., Buononato M.A., Cisneros-Heredia D.F., Colli G.R., Costa H.C., Franco F.L., Giraudo A., Gonzalez R.C., Guedes T., Hoogmoed M.S., Marques O.A.V., Montingelli G.G., Passos P., Prudente A.L.C., Rivas G.A., Sanchez P.M., Serrano F.C., Silva Jr N.J., Strussmann C., Vieira-Alencar J.P.S., Zaher H., Sawaya R.J., Martins M. 2019. Atlas of Brazilian snakes: Verified point-locality maps to mitigate the Wallacean shortfall in a megadiverse snake fauna. *South American Journal of Herpetology* 14 (Special Issue 1): 1–274. https://doi.org/10.2994/SAJH-D-19-00120.1

Oliveira E.B., Messias F., Souza M.D.A., Garani Y., Nali R.C., Costa H.C. 2025. A treefrog (*Bokermannohyla* cf. *luctuosa*) as prey of the sipo snake, *Chironius brazili* Hamdan & Fernandes, 2015. *Herpetology Notes* 18: 421–426.

Parreira I., Kimura P.C., Lima L.F.C., Freitas M.A., Brandão R.A. 2023. A new foraging habitat for *Chironius* vine snakes and a new prey for *Chironius* brazili in open rocky Cerrado habitats in Central Brazil. *Studies on Neotropical Fauna Environment* 2023: 1–5. https://10.1080/01650521.2023.2231328

Passos D.C., Glauss L.H.A., Galdino C.A.B. 2017. Predation of the Hylid frog *Bokermannohyla alvarengai* (Bokermann, 1956) by the Colubrid snake *Chironius flavolineatus* (Jan, 1863) in a montane rocky grassland. *Revista Brasileira de Zoociências* 18(1): 47–52.

Pinto R.R., Fernandes R., Marques O.A.V. 2008. Morphology and diet of two sympatric colubrid snakes, *Chironius flavolineatus* and *Chironius quadricarinatus* (Serpentes: Colubridae). *Amphibia-Reptilia* 29: 149–160.

Quinteros-Muñoz O., Gómez-Murillo P., Camacho-Badani T., Aguayo R., Carpio-Real R., Pérez E., Marca B., Gonzales L., Torres-Carvajal O. 2024. A new species of sipo snake, *Chironius* (Serpentes: Colubridae), from the Yungas of Bolivia. *Amphibian & Reptile Conservation* 18(1&2): 58–67 (e333).

Roberto I.J., Souza A.R. 2020. Review of prey items recorded for snakes of the genus *Chironius* (Squamata, Colubridae), including the first record of *Osteocephalus* as prey. *Herpetological Notes* 13: 1–5.

Sheehy III C.M., Albert J.S., Lillywhite H.B. 2015. The evolution of tail lenght in snakes associated with different gravitational environments. *Functional Ecology* 30(2): 244–254. https://10.1111/1365-2435.12472

Sudré V., Andrade-Junior A., Folly M., Azevedo J.A.R., Ávila R.W., Curcio F.F., Nunes P.M.S., Passos P. 2024. Revision of the *Chironius bicarinatus* complex (Serpentes: Colubridae): Redefined species boundaries and description of a new species. *Vertebrate Zoology* 74: 85–120. https://10.3897/vz.74.e106238

Ugalde M.R., Guimarães M.R.S., Luna I.V., Guedes T., Hamdan B. 2024. First record of *Chironius brazili*

Hamdan & Fernandes, 2015 (Squamata, Colubridae) for the state of Tocantins and the north region of Brazil. *Herpetologia Brasileira* 13(1): 140–146. https://10.5281/zenodo.1330816

Wied-Neuwied M. 1820. Reise nach Brasilien in den Jahren 1815 bis 1817. *Heinrich Ludwig Bronner, Frankfurt*, Vol. 1.

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