



Acta Biológica Colombiana

ISSN: 0120-548X

ISSN: 1900-1649

Universidad Nacional de Colombia, Facultad de Ciencias,
Departamento de Biología

LANDGREF FILHO, Paulo; AOKI, Camila; SOUSA, Daiene Louveira
Hokama de; SOUZA, Edivaldo Oliveira de; BRANDÃO, Reuber
Albuquerque; ÁVILA, Robson Waldemar; ODA, Fabrício Hiroiuki
ESCAPE OR BE PREYED: NEW RECORDS AND CURRENT KNOWLEDGE ON
PREDATORS OF PSEUDINAE FROGS (ANURA: HYLIDAE) IN SOUTH AMERICA
Acta Biológica Colombiana, vol. 24, no. 2, 2019, May-August, pp. 397-402
Universidad Nacional de Colombia, Facultad de Ciencias, Departamento de Biología

DOI: <https://doi.org/10.15446/abc.v24n2.74650>

Available in: <https://www.redalyc.org/articulo.oa?id=319060771020>

- How to cite
- Complete issue
- More information about this article
- Journal's webpage in redalyc.org

UNEN
redalyc.org

Scientific Information System Redalyc

Network of Scientific Journals from Latin America and the Caribbean, Spain and
Portugal

Project academic non-profit, developed under the open access initiative



Acta Biológica Colombiana
ISSN: 0120-548X
ISSN: 1900-1649
Universidad Nacional de Colombia, Facultad de
Ciencias, Departamento de Biología

ESCAPE OR BE PREYED: NEW RECORDS AND CURRENT KNOWLEDGE ON PREDATORS OF PSEUDINAE FROGS (ANURA: HYLIDAE) IN SOUTH AMERICA

LANDGREF FILHO, Paulo; AOKI, Camila; SOUSA, Daiene Louveira Hokama de; SOUZA, Edivaldo Oliveira de; BRANDÃO, Reuber Albuquerque; ÁVILA, Robson Waldemar; ODA, Fabrício Hiroiuki
ESCAPE OR BE PREYED: NEW RECORDS AND CURRENT KNOWLEDGE ON PREDATORS OF PSEUDINAE FROGS (ANURA: HYLIDAE) IN SOUTH AMERICA

Acta Biológica Colombiana, vol. 24, no. 2, 2019

Universidad Nacional de Colombia, Facultad de Ciencias, Departamento de Biología

Available in: <http://www.redalyc.org/articulo.oa?id=319060771020>

DOI: 10.15446/abc.v24n2.74650

ESCAPE OR BE PREYED: NEW RECORDS AND CURRENT KNOWLEDGE ON PREDATORS OF PSEUDINAE FROGS (ANURA: HYLIDAE) IN SOUTH AMERICA

Escape o sea presa: nuevos registros y conocimiento actual sobre depredadores de ranas Pseudinae (Anura: Hylidae) en América del sur

Paulo LANDGREF FILHO¹

Universidade Federal de Mato Grosso do Sul, Brazil

Camila AOKI¹²

Universidade Federal de Mato Grosso do Sul, Brazil

Daiene Louveira Hokama de SOUSA³

Instituto Federal de Mato Grosso do Sul, Brazil

Edivaldo Oliveira de SOUZA²

Universidade Federal de Mato Grosso do Sul, Brazil

Reuber Albuquerque BRANDÃO⁴

Universidade de Brasília, Brazil

Robson Waldemar ÁVILA⁵

Universidade Regional do Cariri, Brazil

Fabício Hiroiuki ODA^{5*}

Universidade Regional do Cariri, Brazil

Acta Biológica Colombiana, vol. 24, no. 2, 2019

Universidad Nacional de Colombia,
Facultad de Ciencias, Departamento de
Biología

Received: 03 September 2018

Revised document received: 10 October
2018

Accepted: 11 January 2019

DOI: 10.15446/abc.v24n2.74650

CC BY-NC-SA

ABSTRACT: Neotropical amphibians play important roles as preys and predators in freshwater and terrestrial ecosystems. The subfamily Pseudinae includes small and medium-sized frogs within three genera representing 13 valid species. Most published records of predation on Pseudinae frogs are anecdotic and scarce. Herein, we provide five new reports of predation and presenting a detailed literature review on Pseudinae predation, with 15 studies published between 1983-2017. Pseudinae species were preyed at both day and night by a wide variety of predators, principally birds. Adults were preyed upon more frequently than juveniles and tadpoles. In the present study, most predators were diurnal, with birds accounting for most records. A variety of invertebrates prey on anurans, but water bugs and spiders are the most common ones. In the present study, water bugs comprised 75 % of the Pseudinae predation records by invertebrates. However, anuran predation by invertebrates remains poorly documented. Thus, the description of new cases of predation accompanied by a review of the data available in the literature is crucial to understanding Neotropical food webs.

Keywords: Anura, aquatic birds, aquatic insects, predator-prey interactions.

RESUMEN: Los anfibios neotropicales desempeñan papeles importantes como depredadores y presas en los ecosistemas dulce acuícolas y terrestres. La subfamilia Pseudinae incluye ranas pequeñas y medianas, distribuidas en tres géneros y representando 13 especies válidas. Los registros de depredación de Pseudinae son escasos y anecdóticos. Por lo tanto, el conocimiento de nuevos casos puede mejorar nuestra

comprensión de las relaciones depredador-presa entre estas ranas y su papel en la cadena trófica. Presentamos cinco nuevos registros de depredación y revisamos los casos de depredación de la literatura, que incluyen 15 estudios publicados entre 1983 y 2017. Las especies de Pseudinae son depredadas, tanto durante el día como en la noche, por una gran variedad de depredadores, principalmente aves. Los adultos son más frecuentemente depredados que los juveniles y los renacuajos. En el presente estudio, las chinches de agua representan 75 % de los registros de depredación de Pseudinae por invertebrados. Sin embargo, depredación de anuros por invertebrados permanece poco documentada. Por lo tanto, la descripción de nuevos casos de depredación, junto a una revisión de los datos disponibles en la literatura es crucial para entender redes tróficas neotropicales.

Palabras clave: Anura, aves acuáticas, insectos acuáticos, interacción depredador-presa.

Neotropical amphibians play important roles in freshwater and terrestrial ecosystems, contributing to different ecological functions (Cortés-Gomez *et al.*, 2015), one of the most important of which is their dual role in the food web, acting as prey and predator for a wide variety of invertebrates and vertebrates (Toledo, 2005; Toledo *et al.*, 2007). Anuran species are abundant and conspicuous during the breeding season when adult and newly-metamorphosed individuals are more susceptible to becoming prey items for aquatic and terrestrial predators (Toledo, 2005; Toledo *et al.*, 2007). Thus, predation is an important biotic process that affects the distribution and structure of amphibian communities (Morin, 1983, 1986; Hamer and Parris, 2013).

The subfamily Pseudinae (Fitzinger, 1843) includes small and medium-sized frogs within three genera and representing 13 valid species distributed in tropical and subtropical South America east of the Andes, including Trinidad southward to Uruguay, Paraguay, and northern Argentina (Duellman *et al.*, 2016; Frost *et al.*, 2018). Most published records of predation on Pseudinae frogs are anecdotic and scarce (see Toledo, 2005; Toledo *et al.*, 2007). Therefore, knowledge of new cases may improve our understanding of predator-prey relationships among these frogs and their role in the food web. Moreover, there is no compilation of recent predation records of Pseudinae frogs in South America. Herein, we reported five cases of predation on two Pseudinae frog species by a crocodilian and four aquatic bird species. We also present a list with invertebrate and vertebrate predators of six Pseudinae species, reviewed from available literature on predation of amphibians in South America.

New predation records for Pseudinae species were obtained from field observations performed during anuran surveys at a locality in Tocantins state (municipality of Palmas), a location in Goiás state (municipality of Britânia), and two localities in Mato Grosso do Sul state (municipalities of Aquidauana and Corumbá), northern and central Brazil, respectively. Voucher specimens were anesthetized with 5 % lidocaine, fixed in 10 % formalin, preserved in 70 % ethanol, and housed at the Zoological Reference Collection of the Universidade Federal de Mato Grosso do Sul - Amphibia (ZUFMS - AMP).

Unpublished data (i.e., new predation records) as well as articles and natural history notes published in Herpetozoa (from 1988 to the 31th volume of 2018), Herpetological Review (from 1967 to the fourth

volume of 2018), Herpetological Bulletin (from 2008 to the 145th issue of 2018), and Herpetology Notes (from 2008 to the 11th issue of 2018) were considered in the present review. These journals were selected due to their specialized sections on natural history notes. We also carried out a bibliographic search in Web of Science on December 13th, 2018, considering all years and not applying any filters. The search terms were ("predation" OR "prey") AND ("*Lysapsus*" OR "*Pseudis*" OR "*Scarthyla*"). As we were interested in predation events in the field, predation events in laboratory experiments and captivity were not considered. We also did not include records of predation attempts, since such occurrences would not necessarily result in a predation event (Toledo *et al.*, 2007).

In the municipality of Palmas, we observed a juvenile *Caiman crocodilus* preying on an adult *Pseudis tocantins* on 11 November 2000 at 22:10 h in a flooded lagoon of the Tocantins River. In the municipality of Britânia, we observed an adult *Ardea cocoi* preying on an adult *P. tocantins* on 08 February 2003 at 10:00 h in a swampy area. Brandão and Peres Jr., (2001) observed several times individuals of *Pseudis tocantins* on large and vegetated permanent ponds during a long-term herpetofaunal inventory in the Tocantins river valley, between the cities of Porto Nacional and Palmas, Tocantins state. Nevertheless, predation events were not observed in the study site (RA Brandão, personal communication). Furthermore, there are no reported cases of predation on *Pseudis tocantins* in the available literature. The predation of *C. crocodilus* and *A. cocoi* on *P. tocantins* are the first records of predation for this Pseudinae species.

During fieldworks in two farms in southern Pantanal wetland, Mato Grosso do Sul state, Brazil; we recorded three cases of predation on *Pseudis platensis*. On 2nd November 2011 in a swampy area at "Fazenda Retirinho" in the municipality of Aquidauana (19°54' S, 56°01' W), we observed an adult *Megaceryle torquata* preying on an adult *P. platensis*. The bird was on a barbed wire fence and saw the frog in a temporary puddle. At that time, the bird flew toward the water body, where captured the frog, and returned to barbed fence post holding it in its beak. The frog was killed by being beaten against the fence post. When disturbed by our presence the bird flew away. On 29th May 2013 in a swampy area at "Fazenda Tupã" in the municipality of Corumbá (18°20' S, 55°20' W), we observed an adult *Theristicus caudatus* and an adult *Phaetusa simplex* preying on two individuals of *P. platensis* (Fig. 1a - 1b). Records on predation of *P. platensis* by birds are scarce. Among these, only three species - *Tigrisoma lineatum*, *Guira guira*, and *Butorides striatus* - have been reported as predators of adults and tadpoles of *Pseudis platensis* (Prado, 2003; Landgraf Filho *et al.*, 2011; Smith and Atkinson, 2017). Therefore, *Megaceryle torquata*, *Theristicus caudatus*, and *Phaetusa simplex* are new predators of *P. platensis*.

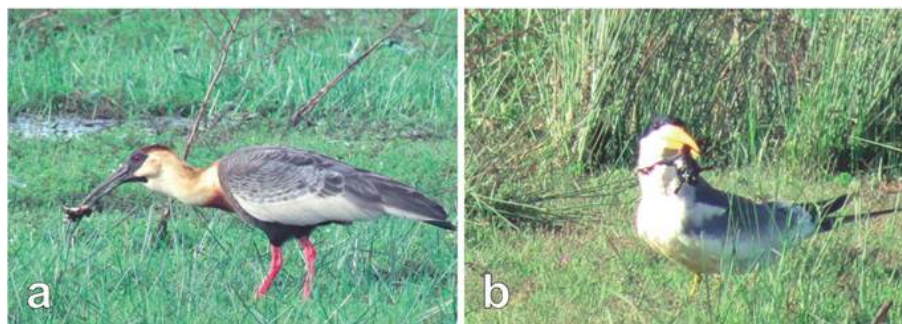


Figure 1

Theristicus caudatus (a) and *Phaetusa simplex* (b) holding specimens of *Pseudis platensis* in swampy areas in southern Pantanal wetland, state of Mato Grosso do Sul, central Brazil. Photos: Edivaldo Oliveira de Souza.

We recovered 22 predation events from the literature reviewed, which were reported in 15 studies published between 1983 and 2017 (Table 1). Considering all events, six Pseudinae species - *Lysapsus limellum*, *Pseudis boliviiana*, *P. minuta*, *P. paradoxa*, *P. platensis*, and *P. tocantins* - have been reported as prey of 21 predator taxa, including nine birds, four reptiles, three amphibians, three insects, one fish, and one spider (Table 1, Fig. 2). *Pseudis platensis* had the highest number of predation events, with 11 reported cases. Of these, 72 % (n = 8) were recorded in Brazil (Table 1). In a literature review on invertebrate predators of anurans, Toledo, (2005) found no records of predation on Pseudinae frogs. Toledo *et al.*, (2007) conducted a detailed review on post-metamorphic anurans as preys of vertebrates and considered unpublished data as well as only articles and natural history notes published in Herpetological Review. The authors found only two predation event records for Pseudinae frogs, both for *P. platensis* (Santos *et al.* , 1996; Prado, 2003). In the present study, we considered articles and natural history notes published in four herpetological journals, unpublished data, and additional references searched in the Web of Science. This diversified data source increased the information in this review, improving the knowledge available on predators of Pseudinae frogs. However, we found that only 46 % of the Pseudinae species known in South America have been reported as prey items of invertebrate and vertebrate predators. Among these species, five belong to the genus *Pseudis*, demonstrating that much is yet to be understood regarding predator-prey interactions for most Pseudinae species, especially species of *Lysapsus* and *Scarthyla*.

Table 1

Invertebrates and vertebrates identified as predators of Pseudinae frogs in South America. Prey stage: A - adult, J - juvenile, T - tadpole. Period of day: D - day, N - night, ? - data not available.

Pseudinae prey	Prey stage	Predator	Taxon	Period of day	Geographic coordinates (Country*)	Source
<i>Lysapsus limellum</i>	A	Belostomatidae gen. sp.	Insect	?	7°32' S, 63°04' W (BRA)	Garda <i>et al.</i> , (2007)
	A	Lycosidae gen sp.	Spider	?	2°00' S, 54°04' W (BRA)	
<i>Pseudis boliviana</i>	A	<i>Pseudis paradoxa</i>	Anuran	N	0°08' N, 51°03' W (BRA)	Baía <i>et al.</i> , (2016)
<i>Pseudis minuta</i>	A	<i>Lethocerus annulipes</i>	Insect	D	31°54' S, 54°07' W (URU)	Gobel <i>et al.</i> , (2013)
	A	<i>Pseudis minuta</i>	Anuran	N	32°24' S, 55°32' W (URU)	Lombardo <i>et al.</i> , (2010)
	J	<i>Erythrolamprus poecilogyrus</i>	Snake	?	30°05' S, 50°58' W (BRA)	Lema <i>et al.</i> , (1983)
<i>Pseudis paradoxa</i>	T, A	<i>Mycteria americana</i>	Bird	D	7°45' N, 68°55' W (VEN)	González, (1997)
	T	Heron (Undetermined)	Bird	D	10°06' N, 61°51' W (TTO)	Downie <i>et al.</i> , (2009)
	A	<i>Helicops angulatus</i>	Snake	N	Specimen from museum collection (BRA)	Teixeira <i>et al.</i> , (2017)
<i>Pseudis platensis</i>	T	<i>Belostoma</i> sp.	Insect	?	8°59' S, 56°37' W (BRA)	Ceron <i>et al.</i> , (2017)
	A	<i>Hoplias</i> cf. <i>malabaricus</i>	Fish	N	18°13' S, 55°44' W (BRA)	Frey-Dargas <i>et al.</i> , (2014)
	A	<i>Leptodactylus chaquensis</i>	Anuran	N	22°37' S, 52°53' W (BRA)	Oda <i>et al.</i> , (2016)
	T, A	<i>Caiman yacare</i>	Crocodylian	N	18°59' S, 56°40' W (BRA)	Santos <i>et al.</i> , (1996); Campos, (2003)
	A	<i>Hidrodynastes gigas</i>	Snake	?	Specimens from field sampling and museum collections (ARG)	López and Giraudo, (2004)
	A	<i>Tigrisoma lineatum</i>	Bird	D	19°34' S, 57°00' W (BRA)	Prado, (2003)
	A	<i>Guira guira</i>	Bird	D	22°30' S, 53°17' W (BRA)	Landgraf Filho <i>et al.</i> , (2011)
	T	<i>Butorides striatus</i>	Bird	D	22°31' S, 59°40' W (PAR)	Smith and Atkinson, (2017)
	A	<i>Megascyle torquata</i>	Bird	D	19°54' S, 56°01' W (BRA)	Present study
	A	<i>Theristicus caudatus</i>	Bird	D	18°20' S, 55°20' W (BRA)	Present study
	A	<i>Phaetusa simplex</i>	Bird	D		Present study
<i>Pseudis tocantins</i>	A	<i>Caiman crocodilus</i>	Crocodylian	N	10°14' S, 48°19' W (BRA)	Present study
	A	<i>Ardea cocoi</i>	Bird	D	15°14' S, 51°09' W (BRA)	Present study

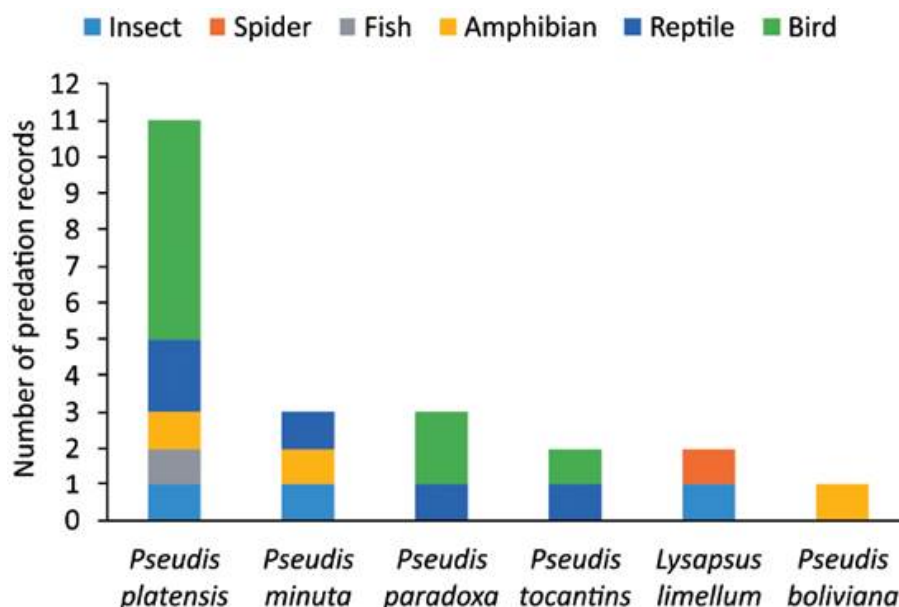


Figure 2
Number of predation records per Pseudinae species.

The higher number of predation events reported for *Pseudis platensis* may be due to its wider geographic distribution in Bolivia, Paraguay, Argentina and Brazil (Frost *et al.*, 2018). Likewise, Brazil is the largest country in South America and thus have greater research efforts (in the absolute number of researchers) than other countries in the region (Van Noorden, 2014).

Pseudinae species have both diurnal and nocturnal activity (see Brandão *et al.*, 2003; Ávila and Ferreira, 2004). They are exposed to a different set of predators in each period, such as visually oriented predators during daytime and movement-sensitive predators at night, which influence its activity patterns and behaviors, especially in the breeding season (Lima and Dill, 1990; Garda *et al.*, 2007; Buxton and Sperry, 2016). Among the most important vertebrate predators of amphibians are the birds (Polin *et al.*, 2001). In the present study, adult frogs were preyed upon more frequently than juveniles and tadpoles. Diurnal and visually oriented predators were the majority, with birds accounting for most records (90 % of the predation events recorded with diurnal predators alone). Except for *Guiraguira*, all avian predators in this study are wading birds. They are considered as convenience predators, but foraging in environments inhabited by *Pseudis* and *Lysapsus* and feed on them with regularity in nature (González, 1997; Toledo *et al.*, 2007).

The higher abundance of Pseudinae species can make these common preys for amphibians and reptiles, mainly crocodilians and aquatic snakes (López and Giraudo, 2004; Toledo *et al.*, 2007; Oda *et al.*, 2016), with even the occurrence of cannibalistic events (Lombardo *et al.*, 2010).

Although few predation events of Pseudinae species by other amphibians and reptiles have been published; we believe that the interaction between them also occur with frequency as reported for birds. A variety of invertebrates prey on anurans, but water bugs and spiders are

the most common predators (Toledo, 2005). In the present study, water bugs accounting for most records (75 % of the predation events recorded with invertebrate predators alone). However, events of anuran predation by invertebrates remain poorly documented, and it is probable that such events are more difficult to record since it is necessary to observe the moment of predation. In contrast, predation events can be determined for vertebrates through the analysis of the digestive tract (Pombal Jr., 2007).

Predation is a key factor in community structure, directly affecting trophic relationships among species and, consequently, species coexistence (Chase *et al.*, 2002; Morlon *et al.*, 2014). As important prey items for invertebrates and vertebrates, amphibians contribute to ecosystem structures, energy pathways and food webs (Hocking and Babbitt, 2014). However, trophic relationships are rarely observed in the field and poorly documented, especially in tropical ecosystems (Poulin *et al.*, 2001). Understanding trophic links require recording a significant subset of a predator-prey assemblage and are essential to understanding food webs.

This study presents important data on the predation of Pseudinae frogs by invertebrates and vertebrates in South America. For most Pseudinae species there are no reports of predation, especially species of *Lysapsus* and *Scarthyla*. The Pseudinae species with a higher number of predation events reported was *Pseudis platensis*. Birds and water bugs accounting for most predation records among the vertebrates and invertebrates, respectively. However, events of anuran predation by invertebrates remain poorly documented because are more difficult to record. Thus, the description of new cases of predation accompanied by a review of the data available in the literature is crucial to understanding Neotropical food webs.

ACKNOWLEDGMENTS

We would like to thank Juan Antonio Balbuena, Jean Carlo Gonçalves Ortega, Martha Ramírez Pinilla, Carlos Andrés Caho Rodríguez, and two anonymous reviewers for their helpful comments and improvements of the manuscript. FH Oda receives a postdoctoral fellowship from Fundação Cearense de Apoio ao Desenvolvimento Científico e Tecnológico/Coordenação de Aperfeiçoamento Pessoal de Nível Superior (Grant n. 88887.162751/2018-00). RW Ávila would like to thank Conselho Nacional de Desenvolvimento Científico e Tecnológico for having provided a research fellowship (Process n. 305988/2018-2). This study was financed in part by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior - Brasil (CAPES) - Finance Code 001.

REFERENCES

Ávila RW, Ferreira VL. Riqueza e densidade de vocalizações de anuros (Amphibia) em uma área urbana de Corumbá, Mato Grosso do Sul, Brasil.

- Rev Bras Zool. 2004;21(4):887-892. Doi: <https://doi.org/10.1590/S0101-81752004000400024>
- Baía RRJ, Costa-Campos CE, Furtado MFM, Silva e Silva YB. *Pseudis boliviana* (Harlequin Frog). Predation. Herpetol Rev. 2016;47(1):118.
- Brandão RA, Peres Jr AK. Levantamento da Herpetofauna na área de influência do Aproveitamento Hidroelétrico da UHE Luís Eduardo Magalhães, Palmas, TO. Humanitas. 2001;3(1):35-50.
- Brandão RA, Garda A, Braz V, Fonseca B. Observations on the ecology of *Pseudis bolbodactyla* (Anura, Pseudidae) in central Brazil. Phyllomedusa. 2003;2(1):3-8. Doi: <https://doi.org/10.11606/issn.2316-9079.v2i1p03-08>
- Buxton VL, Sperry JH. Reproductive decisions in anurans: A review of how predation and competition affects the deposition of eggs and tadpoles. BioScience. 2016;67(1):26-38. Doi: <https://doi.org/10.1093/biosci/biw149>
- Campos Z. *Caiman crocodilus yacare* (Pantanal Caiman). Food-Related Movement. Herpetol Rev. 2003;34(2):140-141.
- Ceron K, Ferreira VL, Tomas WM, Santana DJ. Battle of giants: Predation on giant tadpole of *Pseudis platensis* (Anura: Hylidae) by a giant water bug (Hemiptera: Belostomatidae). Herpetol Notes. 2017;10:263-265.
- Chase JM, Abrams PA, Grover JP, Diehl S, Chesson P, Holt RD, Richards SA, Nisbet RM, Case TJ. The interaction between predation and competition: a review and synthesis. Ecol Lett. 2002;5(2):302-315. Doi: <http://www.doi.org/10.1046/j.1461-0248.2002.00315.x>
- Cortés-Gomez AM, Ruiz-Agudelo CA, Valencia-Aguilar A, Ladle RJ. Ecological functions of neotropical amphibians and reptiles: a review. Univ Sci. 2015;20(2):229-245. Doi: <http://www.doi.org/10.11144/Javeriana.SC20-2.efna>
- Downie JR, Ramnarine I, Sams K, Walsh PT. The paradoxical frog *Pseudis paradoxa*: larval habitat, growth and metamorphosis. Herpetol J. 2009;19(1):11-19.
- Duellman WE, Marion AB, Hedges SB. Phylogenetics, classification, and biogeography of tree frogs (Amphibia: Anura: Arboranae). Zootaxa. 2016;4104(1):1-109. Doi: <http://www.doi.org/10.11646/zootaxa.4104.1.1>.
- Frey-Dargas JH, Landgref-Filho P, Aoki C, Sousa DLH, Souza EO. *Pseudis platensis* (Paradox frog) predation. Herpetol Rev. 2014;45(2):306-307.
- Frost DR. Amphibian species of the world: an online reference [Version 6.0]. Available at: <http://research.amnh.org/vz/herpetology/amphibia/> . Cited 1 Aug 2018.
- Garda AA, Costa GC, França FGR, Mesquita DO. Ecology of *Lysapsus limellum* in the Brazilian Amazon river basin. Herpetol J. 2007;17(3):141-148.
- Gobel N, Cortizas S, Mautone JM, Borteiro C, Laufer G. Predation of *Pseudis minuta* Günther 1858, by *Lethocerus annulipes* (Heteroptera: Belostomatidae). Cuad Herpetol. 2013;27(1):63.
- González JA. Seasonal variation in the foraging ecology of the Wood Stork in the southern Llanos of Venezuela. The Condor. 1997;99(3):671-680.

- Hamer AJ, Parris KM. Predation modifies larval amphibian communities in urban wetlands. *Wetlands*. 2013;33(4):641-652. Doi: <https://doi.org/10.1007/s13157-013-0420-2>
- Hocking DJ, Babbitt KJ. Amphibian contributions to ecosystem services. *Herpetol Conserv Biol*. 2014;9(1):1-17.
- Landgraf Filho P, Aoki C, Godoi MN. *Pseudis platensis* (Paradox Frog). Predation. *Herpetol Rev*. 2011;42(1):90.
- Lema T, Araujo ML, Azevedo ACP. Contribuição ao conhecimento da alimentação e do modo alimentar de serpentes do Brasil. *Comum Mus Ciênc Tecnol PUCRS, Sér Zool*. 1983;26:41-121.
- Lima SL, Dill LM. Behavioral decisions made under the risk of predation - a review and prospectus. *Can J Zool*. 1990;68(4):619-640. Doi: <https://doi.org/10.1139/z90-092>.
- Lombardo I, Maneyro R, Carreira S. *Pseudis minuta* (Lesser Swimming Frog). Cannibalism. *Herpetol Rev*. 2010;41(3):341.
- López MS, Giraudo AR. Diet of the large water snake *Hydrodynastes gigas* (Colubridae) from northeast Argentina. *Amphib-reptil*. 2004;25(2):178-184. Doi: <https://doi.org/10.1163/1568538041231148>.
- Morin PJ. Predation, competition, and the composition of larval anuran guilds. *Ecol Monograph*. 1983;53(2):119-138. Doi: <https://doi.org/10.2307/1942491>.
- Morin PJ. Interactions between intraspecific competition and predation in an amphibian predator-prey system. *Ecology*. 1986;67(3):713-720. Doi: <https://doi.org/10.2307/1937694>.
- Morlon H, Kefi S, Martinez ND. Effects of trophic similarity on community composition. *Ecol Lett*. 2014;17(12):1495-1506. Doi: <https://doi.org/10.1111/ele.1235>.
- Oda FH, Gambale PG, Batista VG. *Leptodactylus chaquensis* (Anura, Leptodactylidae) as a predator of *Pseudis platensis* (Anura, Hylidae) in southern Brazil. *Lundiana*. 2016;12(1):45-48.
- Pombal Jr JP. Notas sobre predação em uma taxocenose de anfíbios anuros no sudeste do Brasil. *Rev Bras Zool*. 2007;24:841-843. Doi: <https://doi.org/10.1590/S0101-81752007000300034>.
- Poulin B, Lefebvre G, Ibáñez R, Jaramillo C, Hernández C, Rand AS. Avian predation upon lizards and frogs in a neotropical forest understorey. *J Trop Ecol*. 2001;17(1):21-40. Doi: <https://doi.org/10.1017/S026646740100102X>.
- Prado CPA. *Leptodactylus chaquensis* (NCN), *Pseudis paradoxa* (Paradox Frog), and *Phrynobryas venulosa* (Veined Treefrog). Predation. *Herpetol Rev*. 2003;34(3):231-232.
- Santos SA, Stoll MN, Pinheiro MS, Campos Z, Magnusson WE, Mourão G. Diets of *Caiman crocodilus yacare* from different habitats in the Brazilian Pantanal. *Herpetol J*. 1996;6(4):111-117.
- Smith P, Atkinson K. Observations of two predation events involving herps and birds. *Herpetol Notes*. 2017;10:635-637.
- Teixeira CC, Montag LFA, Santos-Costa MC. Diet composition and foraging habitat use by three species of water snakes, *Helicops* Wagler, 1830,

(Serpentes: Dipsadidae) in eastern Brazilian Amazonia. J Herpetol. 2017;51(2):215-222. Doi: <https://doi.org/10.1670/15-161>.

Toledo LF. Predation of juvenile and adult anurans by invertebrates: current knowledge and perspectives. Herpetol Rev. 2005;36(4):395-400.

Toledo LF, Ribeiro RS, Haddad CFB. Anurans as prey: an exploratory analysis and size relationships between predators and their prey. J Zool. 2007;271(2):170-177. Doi: <https://doi.org/10.1111/j.1469-7998.2006.00195.x>.

Van Noorden R. The impact gap: South America by the numbers. Nature. 2014;510(7504):202-203. Doi: <https://doi.org/10.1038/510202a>.

Notes

Associate Editor: Martha Ramírez Pinilla.

Citation/Citar este artículo como: Landgref Filho P, Aoki A, Sousa DLH, Souza EO, Brandão RA, Ávila RW, Oda FH. Escape or be Preyed: New Records and Current Knowledge on Predators of Pseudinae Frogs (Anura: Hylidae) in South America. Acta biol. Colomb. 2019;24(2):397-402. DOI: <http://dx.doi.org/10.15446/abc.v24n2.74650>

CONFLICT OF INTEREST No potential conflict of interest was reported by the authors.

Author notes

Todo el contenido de esta revista, excepto dónde está identificado, está bajo una Licencia Creative Commons

*

Forcorrespondence: fabricio_oda@hotmail.com