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NOTES ON GEOGRAPHIC DISTRIBUTION

First confirmed record of *Teratohyla midas* (Lynch & Duellman, 1973) (Anura, Centrolenidae) from Bolivia

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Abstract. Different sources of information indicate the possible presence of *Teratohyla midas* (Lynch & Duellman, 1973) in Bolivia; however, none of them confirm this scenario. Here we confirm the presence of *T. midas* in the northern Bolivian Amazon (Pando Department) and extend the geographical distribution of the species to include Bolivia. Likewise, we contribute information on some aspects of this species' behavior and natural history.

Key words. Amazon, Amphibian, Glassfrog, Pando Department

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INTRODUCTION

The family Centrolenidae (glassfrogs) in Bolivia comprises 11 species (De la Riva and Reichle 2014; Frost 2024). The following genera and number of species have been recorded: *Cochranella* Taylor, 1951 (2 species), *Nymphargus* Cisneros-Heredia & McDiarmid, 2007 (2 species), *Rulyrana* Guayasamin, Castroviejo-Fisher, Trueb, Ayarzagüena, Rada & Vilà, 2009 (1 species), *Teratohyla* Taylor, 1951 (1 species), *Vitreorana* Guayasamin, Castroviejo-Fisher, Trueb, Ayarzagüena, Rada & Vilà, 2009 (1 species), and *Hyalinobatrachium* Ruiz-Carranza & Lynch, 1991 (4 species). Only one species, *Nymphargus bejaranoi* (Cannatella, 1980), is endemic to Bolivia (Frost 2024). The geographic range of glassfrogs in Bolivia includes the eastern Andean slopes (i.e. specifically the Yungas region), northern Amazon, and the Parque Nacional Noel Kempff Mercado (De la Riva and Reichle 2014; AmphibiaWeb 2024; Frost 2024).

The neighboring countries of Brazil and Peru have 18 and 37 species of centrolenids, respectively (Frost 2024). Some of these species have distributions near or surrounding Bolivia, and one notable example is *Teratohyla midas* (Lynch & Duellman, 1973) (see Morales and McDiarmid 1996; von May et al. 2009; França and Venâncio 2010; Melo-Sampaio and Oliveira 2013; Padial et al. 2016). *Teratohyla midas* (type locality: Santa Cecilia, Napo province, Ecuador, at 340 m elevation) has a wide distribution in South America (Guayasamin et al. 2009; Rojas-Padilla et al. 2019; Frost 2024), with its southern known distribution reaching south of the Peruvian Amazon (Rojas-Padilla et al. 2019) and near the border (Vista Alegre do Abuna) between Brazil and Bolivia (Melo-Sampaio and Oliveira 2013). This has resulted in postulations that the species likely also occurs in neighboring Bolivia (Rojas-Padilla et al. 2019; IUCN SSC Amphibian Specialist Group 2022; Frost 2024). Despite this, the presence of the species in Bolivia had not been yet confirmed.

Teratohyla midas is considered a common species that exhibits nocturnal and arboreal habits; it is usually found in the riparian vegetation of streams or creeks (Lynch and Duellman 1973; Malambo et al. 2013; Melo-Sampaio and Souza 2015; Rojas-Padilla et al. 2019).

There are many poorly studied areas in Bolivia (De la Riva and Reichle 2014), especially the Amazon region and Yungas due to their difficult access. The surge in research activities and the implementation of Rapid Assessment Programs (RAP) have facilitated the documentation of new records for the country and the discovery of new species, thus increasing the knowledge and richness of Bolivian amphibians (De la Riva and Reichle 2014). Here we report the first confirmed record of *T. midas* from the department of Pando, Bolivia, expanding the known geographical range to the northern Bolivian Amazon in South America.

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METHODS

During a RAP in the department of Pando, Bolivia, we found two adult individuals of *Teratohyla midas*. These were collected by hand, euthanized in 5% ethyl alcohol solution, processed (fixation and preservation) and deposited in the herpetological collection of the Centro de Investigación de Recursos Acuáticos (**CIRAH**) of the Universidad Autónoma del Beni José Ballivián, following methodology by Cacciali (2013) and Eversole et al. (2019).

More specifically, for each specimen photographed, we determined the snout–vent length using a flexible tape measure and weighed them using an Ohaus model HH 320 electronic balance. We georeferenced the collection location in decimal degrees using a Garmin eTrex GPS receiver and generated a point map using ArcGIS software (ArcMap v. 10.2).

The species identity is consistent with the original species description (Lynch and Duellman 1973) and other contributions (Guayasamin et al. 2009). Taxonomic nomenclature follows Frost (2024).

RESULTS

***Teratohyla midas* (Lynch & Duellman, 1973)**
Figures 1, 2

First records for Bolivia. BOLIVIA – PANDO • Manuripi province, Filadelfia municipality, surroundings of the Ucia community, riparian vegetation of the Amazonian forest in the Eléctrico stream, ca. 275 m elev. (Figure 1); –11.7827, –068.9861; 13.XI.2023; L.R. Rivas leg; 20:15h, 1♂, on bush leaf 1.85 m high, calling, CIRAH-1104 (Figure 2) • same locality and date; 20:22h, 1♂, on bush leaf 2.10 m high, calling, CIRAH-1105.

Identification: *Teratohyla midas* is a small-bodied species; both specimens measure 20 mm in snout–vent length and weigh 0.6 g. The dorsum of head, body, and limbs are green with a few small yellow flecks dorsolaterally on the body; humeral spines are absent; the hands and feet are greenish yellow; there is moderate webbing between fingers III and IV, and webbing between fingers of the foot I, II, III, IV, and V. The chest is white, and the heart is not visible. The liver is covered by transparent hepatic peritoneum. The digestive is tract white, and the ventral parietal peritoneum is white anteriorly and transparent posteriorly. The bones are dark green. The iris is silvery bronze with black reticulations (Figure 2).

The diagnostic characters and coloration pattern of both specimens are consistent with the description of the species by Lynch and Duellman (1973) and Guayasamin et al. (2009). However, they are slightly larger than those reported in the available literature.

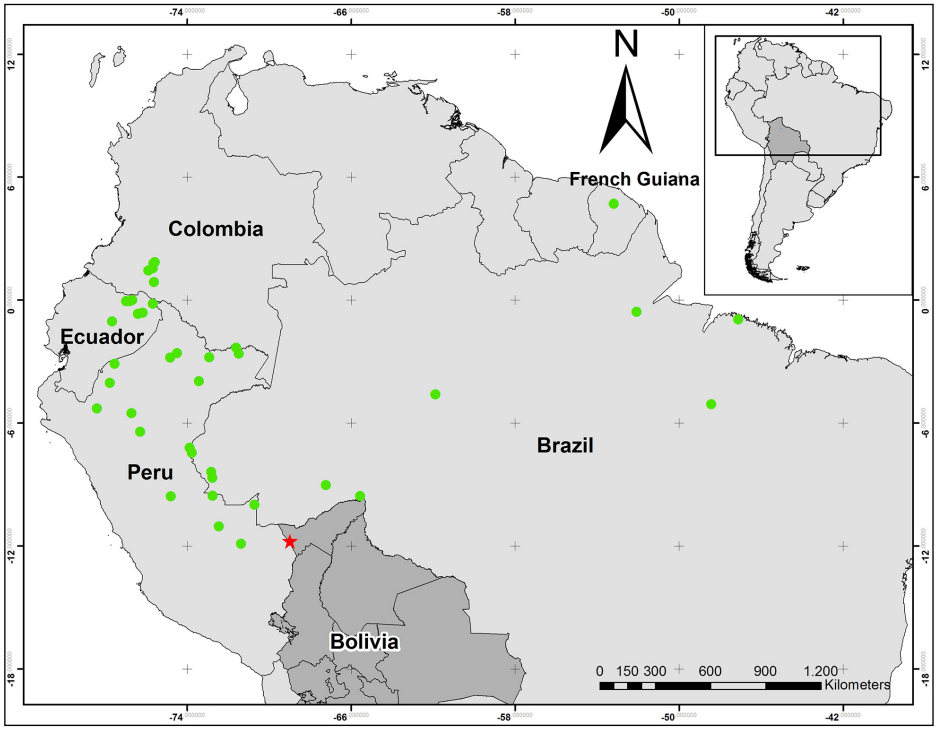

Figure 1. Range of geographic distribution of *Teratohyla midas* in South America (previous records, green points) and first confirmed record for the Pando Department, Bolivia (Ucia Community, red star).

Figure 2. Adult male of *Teratohyla midas* (CIRAH-1104) from Ucia Community, Pando Department, Bolivia.

DISCUSSION

During the last two decades, knowledge on the distribution of *Teratohyla midas* has increased the geographic range of the species into the Amazon region of Brazil and French Guiana (Kok and Castroviejo-Fisher 2008; Melo-Sampaio and Oliveira 2013; Pontes and Mattedi 2013; Araújo et al. 2018). The Peruvian (La Novia River, Ucayali region) and Brazilian (Vista Alegre do Abuna) localities reported by Padial et al. (2016) and Melo-Sampaio and Oliveira (2013), respectively, are among the localities closest to Bolivia, the former being 162 km (in a straight line) from the Bolivian border (Bolpebra, Pando), and the latter being located less than 20 km from the natural limit that separates Brazil from Bolivia (closest point to the Abuna River, Pando). Besides these distances, our record of *T. midas* from the department of Pando (Ucia community), Bolivia, is located ~360 km (in a straight line) from the other nearest point in Brazil (Boca do Acre; França and Venâncio (2010)) and ~259 km from the other closest point in Peru (Pakitza; Morales and McDiarmid 1996) (Figure 1). With the discovery of this species in the country, the number of Bolivian glassfrogs increases to 12.

Teratohyla midas occurs from 76 m above sea level in the French Guiana Amazon (Kok and Castroviejo-Fisher 2008) to 1,050 m above sea level on the eastern Andean slope (Malambo et al. 2013; AmphibiaWeb 2024). In Bolivia, *T. midas* was found at an altitude of 275 m in a secondary Amazonian forest managed particularly for the harvest of Brazilian nuts.

Teratohyla midas is known to be active throughout the year, but it is typically associated with wetland areas in the interior of the Amazonian forest (Lynch and Duellman 1973; Kok and Castroviejo-Fisher 2008; Malambo et al. 2013; Melo-Sampaio and Oliveira 2013; Pontes and Mattedi 2013; Melo-Sampaio and Souza 2015; Padial et al. 2016; Araújo et al. 2018; Rojas-Padilla et al. 2019). Males are usually found calling from the leaves of herbaceous plants, shrubs, or trees on the banks of the aforementioned bodies of water (Malambo et al. 2013; Melo-Sampaio and Oliveira 2013; Araújo et al. 2018; Rojas-Padilla et al. 2019). The two Bolivian individuals were found calling on leaves of bushes from the banks of a stream in the Amazonian forest, at a height between 1.85–2.10 m from the ground, similar behavior described by the previous authors. However, other individuals could be heard calling at a higher altitude over the same stream.

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ADDITIONAL INFORMATION

Conflict of interest
The authors declare that no competing interests exist.

Ethical statement
No ethical statement is reported.

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Authors contributions
Conceptualization: LRR, AM, CBE, RLP, FMA. Data curation: LRR. Formal analysis: LRR. Funding acquisition: LRR, FMA. Investigation: LRR. Methodology: LRR. Visualization LRR. Project administration: LRR. Writing – original draft: LRR. Writing – review and editing: LRR, AM, CBE, RLP, FMA.

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Data availability
All data that support the findings of this study are available in the main text.

REFERENCES

AmphibiaWeb (2024) https://amphibiaweb.org. University of California, Berkeley, California, USA. Accessed on: 2024-01-05.

Araújo KC, Pansonato A, Oliveira RH, Morais DH, Carvalho VT, Ávila RW (2018) Advertisement call and new distribution records from Brazil of *Teratohyla midas* (Lynch & Duellman, 1973) (Anura, Centrolenidae). Check List 14 (2): 303–308. http://doi.org/10.15560/14.2.303

Cacciali P (2013) Colecta y preparación de anfibios y reptiles: manual para colecta científica. Editorial Académica Española, London, UK, 177 pp.

De la Riva I, Reichle S (2014) Diversity and Conservation of the Amphibians of Bolivia. Herpetological Monographs 28: 46–65. http://doi.org/10.1655/herpmonographs-d-13-00009

Eversole CB, Powell RL, Lizarro D, Moreno F, Calderón G, Aparicio J, Crocker AV (2019) Introduction of a novel natural history collection: a model for global scientific collaboration and enhancement of biodiversity infrastructure with a focus on developing countries. Biodiversity and Conservation 28 (7): 1921–1931. http://doi.org/10.1007/s10531-019-01765-0

França FGR, Venâncio NM (2010) Reptiles and amphibians of a poorly known region in southwest Amazonia. Biotemas 23: 71–84. http://doi.org/10.5007/2175-7925.2010v23n3p71

Frost DR (2024) Amphibian species of the world: an online reference. Version 6.1. https://amphibiansoftheworld.amnh.org/index.php. Accessed on: 2024-01-05.

Guayasamin JM, Castroviejo-Fisher S, Trueb L, Ayarzagüena J, Rada M, Vila C (2009) Phylogenetic systematic of glassfrogs (Amphibia: Centrolenidae) and their sister taxon *Allophryne ruthveni*. Zootaxa 2100: 1–97. http://doi.org/10.11646/zootaxa.2100.1.1

IUCN SSC Amphibian Specialist Group (2022) *Teratohyla midas*. The IUCN Red List of Threatened Species 2022: e.T54971A54997093. https://doi.org/10.2305/iucn.uk.2022-2.rlts.t54971a54997093.en. Accessed on: 2024-01-05.

Kok PJR, Castroviejo-Fisher S (2008) Glassfrogs (Anura: Centrolenidae) of Kaieteur National Park, Guyana, with notes on the distribution and taxonomy of some species of the family in the Guiana Shield. Zootaxa 1680 (1): 25–53. http://doi.org/10.11646/zootaxa.1680.1.2

Lynch JD, Duellman WE (1973) A review of the Centrolenid frogs of Ecuador, with descriptions of new species. Occasional Papers of the Museum of Natural History, the University of Kansas 6 (16): 1–66.

Malambo C, González-Ibarra JF, Gomez-Polania YC (2013) Amphibia, Anura, Centrolenidae *Teratohyla midas* (Lynch & Duellman, 1973) and *Cochranella resplendens* (Lynch & Duellman, 1973) First and second record respectively for Colombia. Check List 9 (4): 894–896. https://doi.org/10.15560/9.4.894

Melo-Sampaio PR, Oliveira CMB (2013) *Teratohyla midas* Brazil: Rondonia: Porto Velho. Herpetological Review 44 (1): 104.

Melo-Sampaio PR, Souza MB (2015) New and noteworthy distributional records of treefrogs (Anura) from southwestern Amazonia. Check List 11 (4): 1–7. https://doi.org/10.15560/11.4.1681

Morales VR, McDiarmid RW (1996) Annotated checklist of the amphibians and reptiles of Pakitza, Manu National Park Reserve Zone, with comments on the herpetofauna of Madre de Dios, Peru. In: Wilson E, Sandoval A (Eds.) Manu: the biodiversity of southeastern Peru. Smithsonian Institution Press, Washington DC, USA, 503–522.

Padial JM, Gagliardi-Urrutia G, Chaparro JC, Gutérrez RC, Rojas-Padial O, Castroviejo-Fisher S (2016) Diversidad de anfibios y reptiles en el Parque Nacional Alto Purús, la Reserva Comunal Purús, y sus áreas de influencia. In: Germaná C, Mena Álvarez JK (Eds.) Diversidad biológica del sudeste de la Amazonia Peruana: avances en la investigación. World Wildlife Fund, Cooperative for Assistance and Relief Everywhere Perú, ProNaturaleza, ProPurús, Sociedad Zoológica de Fráncfort, Organización Regional AIDESEP Ucayali, Lima, Peru, 105–121.

Pontes RC, Mattedi C (2013) An unexpected record of *Teratohyla midas* (Lynch & Duellman, 1973) for Brazil reveals the presence of glass-frogs in the Brazilian northern lowlands (Anura: Centrolenidae). Check List 9 (6): 1590–1591. https://doi.org/10.15560/9.6.1590

Rojas-Padilla O, Ríos-Alva EJ, Gagliardi-Urrutia G (2019) First records of *Gastrotheca longipes* (Boulenger, 1882), *Cochranella resplendens* (Lynch & Duellman, 1973) and *Teratohyla midas* (Lynch & Duellman, 1973) for the Allpahuayo-Mishana National Reserve, Peru, with comments on their distribution in the Amazon Basin. Herpetology Notes 12: 461–472.

von May R, Siu-Ting K, Jacobs J, Medina-Müller M, Gagliardi-Urrutia G, Rodríguez L, Donnelly M (2009) Species diversity and conservation status of amphibians in Madre de Dios, southern Peru. Herpetological Conservation and Biology 4 (1): 14–29.