New record and geographic distribution of *Physalaemus nattereri* (Steindachner, 1863) in the state of Piauí, northeastern Brazil

Claylton de Abreu Costa[1,5], João Lucas Pereira Ferreira[2,5], Nayla Letícia Assunção Rodrigues[3,5], Sâmia Caroline Melo Araújo[2,5], Kássio Castro Araújo[5], Ronildo Alves Benício[4], Etielle Barroso de Andrade[5,*]

1 Programa de Pós-graduação em Zoologia, Instituto de Ciências Biológicas, Universidade de Brasília, Asa Norte, 70910-900 Brasília, DF, Brasil.
2 Programa de Pós-graduação em Zoologia, Departamento de Ciências Biológicas, Universidade Estadual de Santa Cruz, Rodovia Jorge Amado km 16, 45662-900 Ilhéus, BA, Brasil.
3 Programa de Pós-graduação em Ecologia e Conservação da Biodiversidade, Departamento de Ciências Biológicas, Universidade Estadual de Santa Cruz, Rodovia Jorge Amado km 16, 45662-900 Ilhéus, BA, Brasil.
4 Laboratório de Herpetologia e Parasitologia de Animais Silvestres, Universidade Federal do Piauí, 64607-670 Picos, PI, Brasil.
5 Grupo de Pesquisa em Biodiversidade e Biotecnologia do Centro-Norte Piauiense, Instituto Federal de Educação, Ciência e Tecnologia do Piauí, Campus Pedro II, 64255-000 PI, Brasil.

** Corresponding author: etlandrade@hotmail.com*
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Leptodactylidae, with 235 described species, is one of the most diverse and widely distributed families in the world (Frost, 2023). In Brazil, there are 186 recognized species in 13 genera (Carvalho et al., 2020; Leal et al., 2021; Segalla et al., 2021; Carvalho et al., 2022; Frost, 2023). Among these, the genus *Physalaemus* Fitzinger, 1826 comprises a monophyletic group with 50 species in two large clades: *P. signifer* and *P. cuvieri* clades (Lourenço et al., 2015). Species of this genus are distributed throughout South America, from southeastern Colombia to central Argentina (Nascimento et al., 2005; Frost, 2023). They are characterized by the absence of dorsal tubercles, absence of vomerine teeth, absence of hypertro-

phied antebrachial tubercles, absence of parotoid glands, absence of flank glands, and egg deposition in foam nests (Lynch, 1971; Nascimento et al., 2005). Among these species, *Physalaemus nattereri* (Steindachner, 1863) is the largest species of *Physalaemus* (SVL 30-50 mm) with a variable dorsal pattern, dorsal coloration slightly reddish, prominent inguinal glands associated with large eye spots (Vaz-Silva et al., 2020) and deimatic behavior (Sazima & Caramaschi, 1986; Lenzi-Mattos et al., 2005). Reproductive behavior is explosive reproduction and eggs are deposited in foam nests on the margins of temporary ponds (Giaretta & Facure, 2006; Vaz-Silva et al., 2020).

Physalaemus nattereri is distributed across the eastern South American dry diagonal (*sensu* Luebert, 2021), occurring in Brazil, eastern Paraguay and Bolivia (Frost, 2023). In Brazil, it has a wide distribution, usually associated with patches of Cerrado, mainly in the Midwest and Southeast regions, but also in the Northeast region (Brasileiro et al., 2008; Lima et al., 2018, 2019; Frost, 2023). In the state of Piauí, northeastern Brazil, only three populations of *P. nattereri* are known in the municipalities of Floriano, Palmeirais, and Parnaguá (Lima et al., 2018, 2019; CRIA, 2023), all located in the south-central region of the state. Herein we present the first record of *P. nattereri* for the north-central region of Piauí, northeastern Brazil, increasing its known distribution and updating the distribution map for this species.

During fieldwork carried out in the north-central region of Piauí, four individuals of *P. nattereri* (Fig. 1) were found in two different localities. One specimen was vocalizing on a temporary pond, on the side of the access road to the municipality of Boa Hora (4.408° S; 42.124° W) on January 11, 2023, at approximately 22:00 h. Another three individuals were collected in the Floresta Nacional (Flona) de Palmares (5.056° S; 42.593° W), municipality of Altos, on March 12, 2023, also at 22:00 h. Both localities are in the Cerrado biome (IBGE, 2019). The municipality of Boa Hora has a dry sub-humid, megathermal climate, with an average annual rainfall of 1,329 mm, with rain occurring between January and April, and a dry climate for the rest of the year (Andrade Júnior et al., 2005; Veloso et al., 2018). The vegetation is transitional from Cerrado to Caatinga, with phytophysiognomies of riparian forest of carnaúba (wax palm) and lowland caatinga, on sandy soils formed by quartz (Ibiapina & Carvalho Júnior, 2012). The Flona de Palmares is a small Sustainable Use Conservation Unit (about 170 ha) with a tropical, megathermal climate, and two well-defined seasons, dry (June to November) and rainy (December to May), with annual precipitation average of 1,339 mm. The region

is in the Poti river sub-basin, although there are no watercourses in the interior of the conservation unit. It is characterized as semi-deciduous seasonal forest, in a transition area between Cerrado and Caatinga (ICMBio, 2019; Ivanov, 2020; Brandão et al., 2022).

The individuals were collected under collection permit SISBIO #86665-1 and 61838-6, euthanised with 5% lidocaine, fixed in 10% formalin and later preserved in 70% ethanol. The specimens were identified by reference to literature (Nascimento; Caramaschi & Cruz, 2005). Vouchers were deposited in the biological collections of the Instituto Federal de Educação, Ciência e Tecnologia do Piauí, IFPI Campus Pedro II, Piauí, Brazil (CBPII 317, 320) and Universidade Federal do Piauí, Campus Picos, Piauí, Brazil (CHUFPI 710-711). The distribution map (Fig 2) includes data available from *species*Link system (CRIA, 2023).

The new record of *P. nattereri* in the municipality of Boa Hora increases its known distribution by 200 km straight line from the municipality of Palmeirais, the former most northerly location of the species in the state of Piauí (Lima et al., 2018). The record of *P. nattereri* in the Flona de Palmares is between these two locations, about 115 km from Palmeirais and about 90 km from Boa Hora. We also heard vocalization of *P. nattereri* in the municipality of Campo Maior (4.830° S; 42.205° W), but they were not collected. These new records are the most northerly records of *P. nattereri* in Cerrado of Brazil (Fig. 2).

Despite the recent list of anurans from Piauí (Roberto et al., 2013), and the growing number of herpetofaunistic studies in the state, including areas close to those of the present study (e.g., Lima et al., 2019; Araújo et al., 2020 a, b), it is surprising that this species had not yet been recorded for the northern region. Because this anuran is an explosive breeder, with activity restricted to few days during the rainy season (Giaretta & Facure, 2006; Vaz-Silva et al., 2020) it may not have been detected in previous inventories. This study indicates that this species may be restricted to patches of Cerrado and transition areas in Piauí. In addition, this report and data from the literature suggest that *P. nattereri* may also occur in the northernmost region of the state of Maranhão (see Fig. 2), but further studies are needed.

Amphibians are one of the most endangered groups in the world (IUCN, 2023). Although *P. nattereri* is classified as a species of little concern in terms of extinction risks (Aquino et al., 2004), we still do not have any information about population estimates of this species for the state of Piauí. Recent studies have demonstrated the

negative impact of changes in landscape configuration and agrochemicals on amphibian populations, including *P. nattereri* (e.g., Sanchez-Domene et al., 2022; Fiorillo et al., 2023). The state of Piauí, especially in the Cerrado areas, has suffered from significant changes in vegetation cover and land use due to increasing agricultural activity (França et al., 2017). Therefore, the recent records of a common species, adapted to anthropized environments (Vaz-Silva et al., 2020) and endemic to the Cerrado, indicates the need for more efforts in inventories and studies for the conservation of herpetofauna in the state, both within and outside protected areas. Understanding of the fauna, including amphibians, is fundamental for the implementation of environmental measures for the preservation and conservation of natural ecosystems.

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Figure 1. Adult male *Physalaemus nattereri* (CBPII 320) recorded in Flona de Palmares, municipality of Altos, state of Piauí, northeastern Brazil. Photo by KCA.

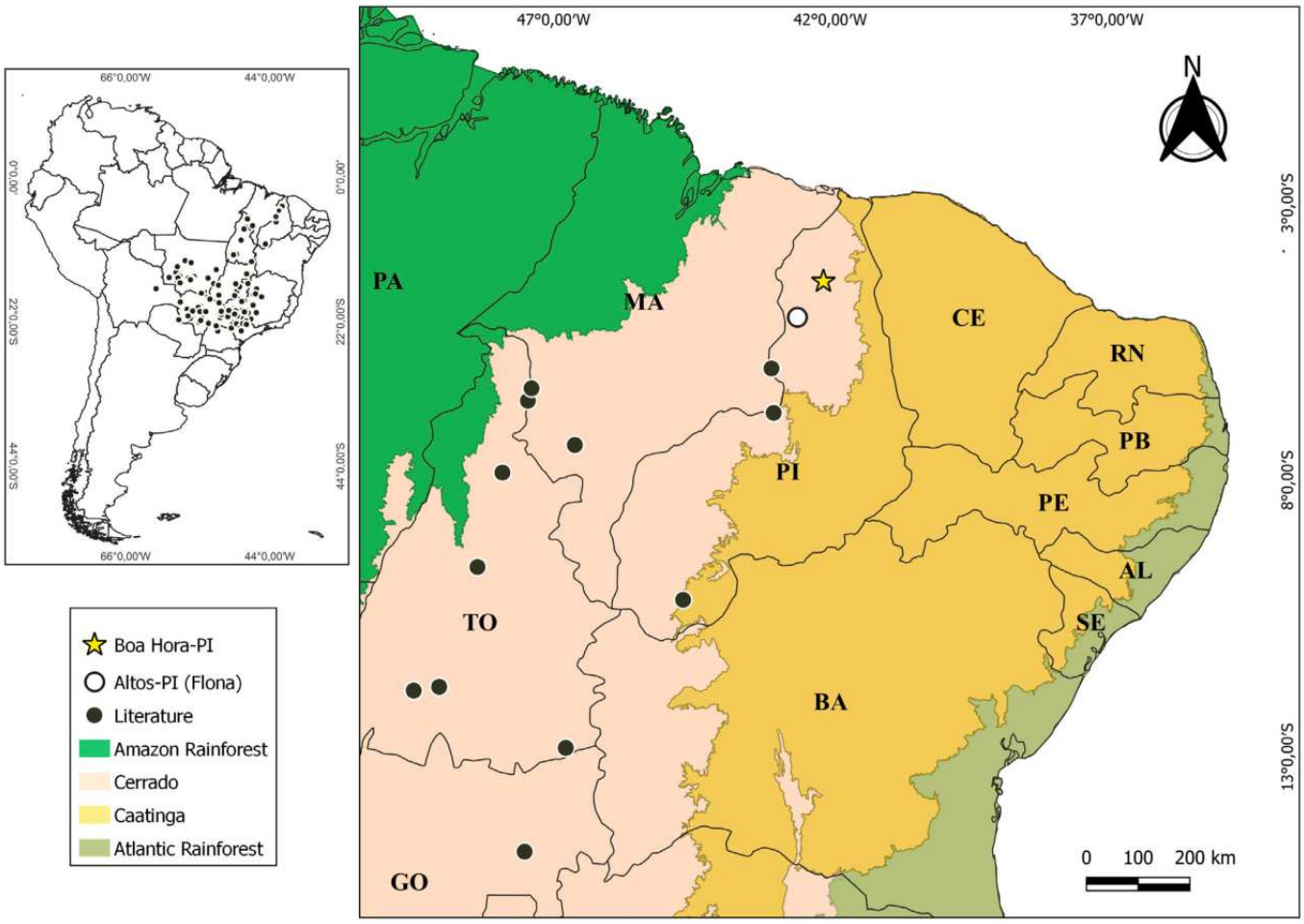


Figure 2. Geographical distribution map of *Physalaemus nattereri* in the Brazilian Cerrado biome, showing the new records of the species in the state of Piauí (white circle and yellow star). Abbreviations of the Brazilian states in the Cerrado biome shown on the map: PI = Piauí; MA = Maranhão; TO = Tocantins; GO = Goiás. Distribution data were extracted from the *species*Link system (*https://specieslink.net/*)