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New additions to the anuran fauna of the Cancão Municipal Natural Park, Serra do Navio, state of Amapá, Brazil

Carlos Eduardo Costa-Campos[1], Patrick Ribeiro Sanches[2], Fillipe Pedroso-Santos[3], Vinicius A. M. B. de Figueiredo[1], Rodrigo Tavares-Pinheiro[1]

[1] Universidade Federal do Amapá, Departamento de Ciências Biológicas e da Saúde, Laboratório de Herpetologia, Macapá, AP, Brazil, CEP: 68.903-419.

[2] Instituto Nacional de Pesquisas da Amazônia, Programa de Pós-Graduação em Ecologia (Biologia), Manaus, Amazonas, Brasil.

[3] Universidade Federal do Amapá, Programa de Pós-Graduação em Biodiversidade Tropical, Macapá, Amapá, Brasil.

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ABSTRACT

Twelve species of anurans (*Amazophrynella teko*, *Rhinella castaneotica*, *Hyalinobatrachium mondolfii*, *H. tricolor*, *Pristimantis gutturalis*, *P. inguinalis*, *Ranitomeya variabilis*, *Osteocephalus leprieurii*, *Scinax proboscideus*, *Leptodactylus petersii*, *Chiasmocleis hudsoni*, *Synapturanus mirandaribeiroi*), into the seven families (Bufonidae, Centrolenidae, Craugastoridae, Dendrobatidae, Hylidae, Leptodactylidae, Microhylidae) are reported for the first time from Cancão Municipal Natural Park, state of Amapá, North Brazil. The total number of species of anurans known from the park now stands at 61 species. Our results contribute to an increase in the knowledge of the anuran fauna of Eastern Amazonia and Guiana Shield.

Key Words: Amphibians; Natural History; Protected Areas; Amazonia.

The state of Amapá is located in the extreme northeast of the Brazilian Amazon and belonging to the Guiana Shield region. Amapá plays an important role in Brazil's conservation with more than 95% of its original vegetation well-preserved and close to 70% of its extent lying within protected areas (Hilário *et al.,* 2017). The state has 14 protected areas (except private reserves) and five indigenous reserves (Drummond *et al.,* 2008). Despite this good conservation status, little is known about the diversity of anurans of this part of eastern Amazonia (Azevedo-Ramos and Galatti, 2002; Benício and Lima, 2017; Costa-Campos and Freire, 2019). Thus, inventories regarding the biodiversity are a conservation priority, especially because several studies based on deforestation have detected changes in the habitats potentially contributing to declines of some species (Becker *et al.,* 2016).

Cancão Municipal Natural Park is a Municipal Protection Conservation Unit that composes the Protected Areas Mosaic of the eastern Brazilian Amazonia, located in the municipality of Serra do Navio, in the northwest center portion of Amapá state, North Brazil. The Protected Areas that make up the Mosaic of the Eastern Amazon are: Tumucumaque Mountains National Park, Amapá National Forest, Iratapuru River Sustainable Development Reserve, Amapá State Forest, Cancão Municipal Natural Park, Extractive Reserve Beija-Flor Brilho de Fogo and Indigenous Land Wajãpi, Tumucumaque Mountains National Park e Rio Paru D'Este (Drummond *et al.,* 2008).

Of the Protected Areas that make up the Mosaic of the Eastern Amazon only four have amphibians' inventories: Tumucumaque Mountains National Park (Lima, 2008); Amapá National Forest (Benício and Lima, 2017), Cancão Municipal Natural Park (Silva-e-Silva and Costa-Campos, 2018), and Extractive Reserve Beija-Flor Brilho de Fogo (Pedroso *et al.,* 2019). For Iratapuru River

Author for correspondence: dududueducampos@gmail.com

Sustainable Development Reserve only records and new amphibian's species distributions have been registered (Costa-Campos *et al.,* 2020; Figueiredo *et al.,* 2020; Figueiredo *et al.,* 2021; Tavares-Pinheiro *et al.,* 2021).

Until recently the only literature report on anuran richness from municipality of Serra do Navio was a survey conducted by Silva-e-Silva and Costa-Campos (2018), and although the sampling effort was limited, they recorded significant richness (n = 49 species) for four areas in the Cancão Municipal Natural Park. Here, we provide new additions to the anurans of the municipality of Serra do Navio, in Amapá state, Brazil, and with some comments on the natural history and taxonomic notes.

The sampled area was conducted in the Cancão Municipal Natural Park (0°54'8.82"N; 52°0'19.62"W). The park has an area of 370,26 ha of *terra firme* forest, belonging to the Amazonian forest domain. The climate is classified as Am (Equatorial, Köpper-Geiger classification), with average temperature of 26.1 °C and rainfall annual of 2,450 mm (NHMET database, 2022).

The first fieldwork was conducted in the park during January to December 2013 (see Silva-e-Silva and Costa-Campos, 2018), whereas the second fieldwork occurs during March 2018 to February 2019 and July 2022. We using "visual encounter surveys" during the day (6:00 – 9:00 hs) and about the first three hours after dark on three nights. Surveys were made in two trails (Fig. 1): i) trail at Cancão forest (0°54'9.72"N, 52°0'17.64"W); and ii) right margin of the River Amapari trail (0°54'2.88"N, 52°0'48.44"W).

Specimens were anesthetized with 5% lidocaine, fixed with 10% formalin and preserved in 70% ethanol (Heyer *et al.,* 1994). Voucher specimens were deposited in the Herpetological Collection of Universidade Federal do Amapá (CECC). The taxonomic nomenclature applied herein follows Segalla et al. (2021) for amphibians with modifications made by Dubois (2017). The conservation status of species was obtained from the Red List of endangered species (IUCN, 2022).

We recorded 12 species of anurans (Fig. 2) belong to families Bufonidae (*Amazophrynella teko*, *Rhinella castaneotica*), Centrolenidae (*Hyalinobatrachium mondolfii*, *H. tricolor*), Craugastoridae (*Pristimantis gutturalis*, *P. inguinalis*), Dendrobatidae (*Ranitomeya variabilis*), Hylidae (*Osteocephalus leprieurii*, *Scinax proboscideus*), Leptodactylidae (*Leptodactylus petersii*), and Microhylidae (*Chiasmocleis hudsoni*, *Synapturanus mirandaribeiroi*), undetected in previous inventories at the Cancão Municipal Natural Park (*see* Silva-e-Silva and Costa-Campos, 2018).

Amazophrynella teko Rojas, Fouquet, Ron, Hernandez-Ruz, Melo-Sampaio, Chaparro, Vogt, Carvalho, Pinheiro, Avila, Farias, Gordo & Hrbek, 2018. Is a small toad of the family Bufonidae (SVL 12.9–15.8 mm in males and 17.9–21.5 mm in females; Rojas *et al.,* 2018). This species occurs in French Guiana, southern region of Suriname and Brazil (Amapá state), at elevations ranging from 70–350 m. The species is diurnal and crepuscular (Rojas *et al.,* 2018). The conservation status of this species is Not Evaluated under IUCN Red List of Threatened Species. Voucher number CECC 3168.

Rhinella castaneotica (Caldwell, 1991). A medium-sized species of the *Rhinella margaritifera* species group (SVL 18.4–23.6 mm in males and 18.9–26.3 mm in females; Caldwell, 1991). It is known from the Amazon Basin in Bolivia, Colombia, eastern Peru, Brazil (Amazonas, Amapá, Pará, and Rondônia), but likely occurs wider in the upper Amazon Basin. *Rhinella castaneotica* are nocturnal and terrestrial toads and natural habitats are tropical moist old-growth lowland forests. It is a forest floor species that breeds in Brazil nut capsules and temporary pools (Caldwell, 1993). There are no known significant threats to this species. *Rhinella castaneotica* is listed as Least Concern under IUCN Red List of Threatened Species. Voucher number CECC 2145.

Hyalinobatrachium mondolfii Castroviejo-Fisher, Vilà, Ayarzagüena, Blanc & Ernst, 2011. Is a small glassfrog (SVL 20.7–23.0 mm in adult males; unknown in females; Castroviejo-Fisher *et al.,* 2011). The species inhabits primary tropical floodplain forest of the eastern Guiana Shield (15–200 m) and the western Amazon. It has exclusively been found in vegetation associated with streams. This species has a broad distribution through the lowland Amazon rainforests, occurring in Bolivia, Brazil (Amapá state), Colombia, French Guiana, Guyana, Suriname and Venezuela (Castroviejo-Fisher *et al.,* 2011; Figueiredo *et al.,* 2020). Calling males were found perched on the underside of leaves at night, at a height of 3 m above ground. *Hyalinobatrachium mondolfii* is listed as Least Concern under IUCN

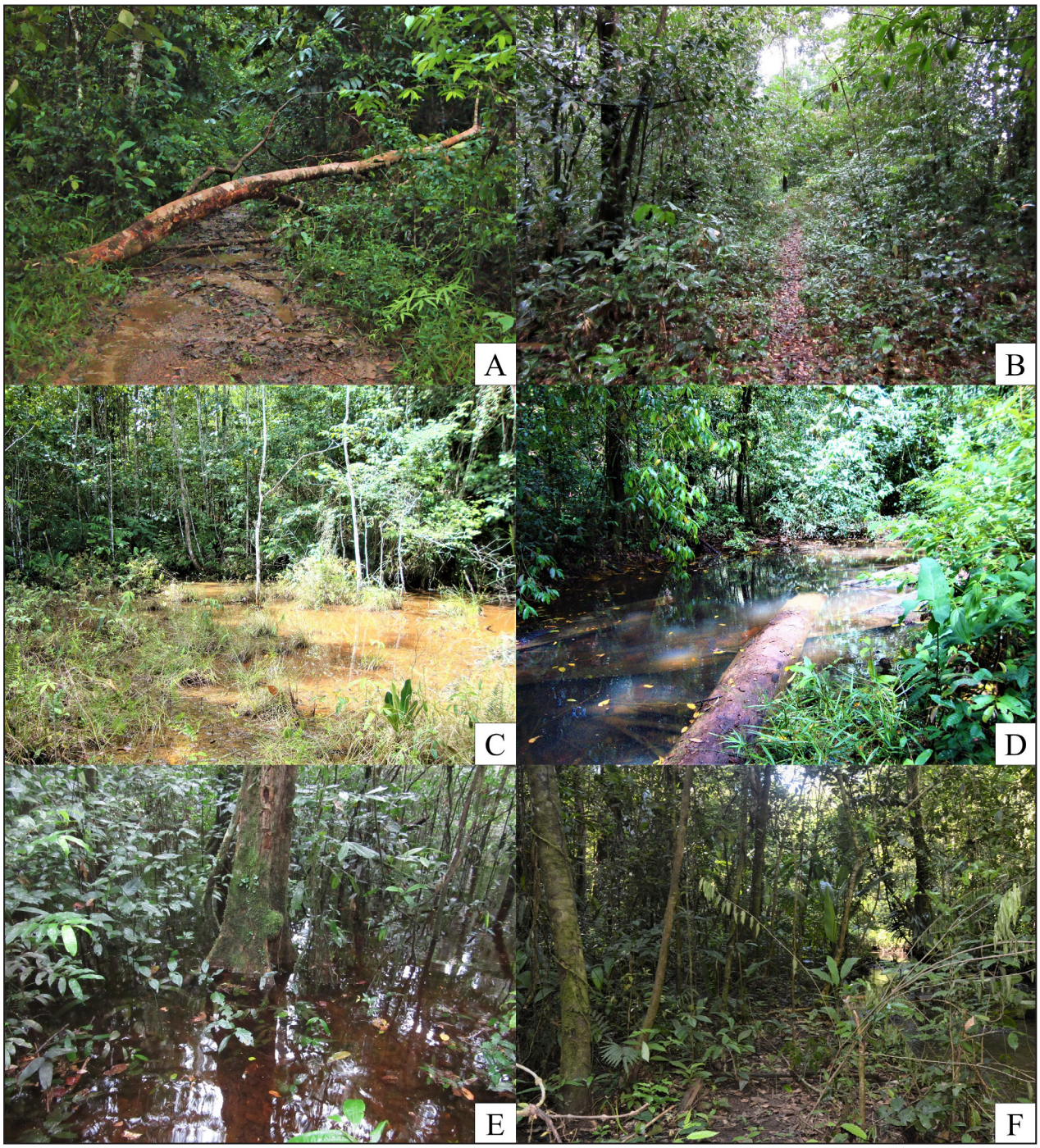

Figure 1. Trails and habitats sampled at the Cancão Municipal Natural Park, municipality of Serra do Navio, Amapá state: **A)** trail at Cancão forest; **B)** right margin of the River Amapari trail; **C)** Treefall gap at Cancão forest; **D)** temporary pond at river Amapari trail; **E)** igapó forest; **F)** *terra firme* forest.

Red List of Threatened Species. Voucher number CECC 1813.

Hyalinobatrachium tricolor Castroviejo-Fisher, Vilà, Ayarzagüena, Blanc & Ernst, 2011. Is a small glassfrog (SVL 20.3–21.0 mm in adult males; unknown in females; Castroviejo-Fisher *et al.,* 2011). Males call on vegetation 4–5 m above streams of 0.5–1.5 m deep. This species occurs in a riparian zone on the right bank of the Amapari River, which has some anthropic disturbance (Costa-Campos *et al.,* 2021) in the Amapá state, and in Crique Wapou, Kaw, French Guiana (type locality) at low elevations to 100 m (Castroviejo-Fisher *et al.,* 2011; Vacher *et al.,* 2020). Males call from the underside of leaves

Figure 2. Anurans recorded at the Cancão Municipal Natural Park, municipality of Serra do Navio, Amapá state: **A)** *Amazophrynella teko*; **B)** *Rhinella castaneotica*; **C)** *Hyalinobatrachium mondolfii*; **D)** *H. tricolor*; **E)** *Pristimantis gutturalis*; **F)** *P. inguinalis*); **G)** *Ranitomeya variabilis*); **H)** *Osteocephalus leprieurii*; **I)** *Scinax proboscideus*; **J)** *Leptodactylus petersii*; **K)** *Chiasmocleis hudsoni*; **L)** *Synapturanus mirandaribeiroi*.

during night and close to egg clutches. *Hyalinobatrachium tricolor* is listed as Least Concern under IUCN Red List of Threatened Species. Voucher number CECC 2783.

Pristimantis gutturalis (Hoogmoed, Lynch & Lescure, 1977). A medium-sized species belongs to Craugastoridae family (SVL 19.0–20.3 mm in males and 17.9–40.9 mm in females; Hoogmoed *et al.,* 1977). Is a diurnal and terrestrial frog found in leaf litter in tropical moist lowland forests and is known from Northern Brazil (Amapá), southern French Guiana, and eastern Surinam (Ouboter and Jairam, 2012; Frost, 2022). *Pristimantis gutturalis* is listed as Least Concern under IUCN Red List of Threatened Species. Voucher number CECC 3486.

Pristimantis inguinalis (Parker, 1940). Adult males measure on average 20.2 mm (Fouquet *et al.,* 2013). Is a arboreal frog of the family Craugastoridae. It is found in Guyana, Suriname, French Guiana, and northern Brazil (Amapá state). Occurs in primary forests at elevations of 50–700 m. Males call from trees 4–6 m above the ground (Cole *et al.,* 2013; Fouquet *et al.,* 2013). It is a common species, and no significant threats to it are known. Its range overlaps with several protected areas (IUCN SSC Amphibian Specialist Group, 2018). *Pristimantis inguinalis* is listed as Least Concern under IUCN Red List of Threatened Species. Voucher number CECC 3498.

Ranitomeya variabilis (Zimmermann & Zimmermann, 1988). Is a small (adult males has a mean SVL 17.4 mm and 18.0 in females; Brown *et al.,* 2008), diurnal and semi-arboreal dendrobatid, with inhabits in primary and secondary rainforests in the understory, canopy, and sometimes in leaf litter at elevations of up to 900-1200 m above sea level (Brown *et al.,* 2008). Its habitat is in the Amazon Rainforest. It most frequently uses bromeliads for breeding, approximately 2.5 m above the forest floor (Brown *et al.,* 2011; Simões *et al.,* 2019). Known distribution consists of widely separated populations, one in northeastern Amazonian Peru and extreme southeastern Colombia, and expected in the adjacent Brazil, Venezuela; extreme southern Guyana; eastern French Guiana; the mouth of the Amazon in Brazil (Frost, 2022; Muell *et al.,* 2022). *Ranitomeya variabilis* is listed as Data Deficient under IUCN Red List of Threatened Species. Voucher number CECC 2609.

Osteocephalus leprieurii (Duméril & Bibron, 1841). The species is a moderate-sized treefrog (SVL max size 63 mm, unknown sex; Lescure and Marty, 2000; Ouboter and Jairam, 2012) distributed throughout the Guiana Shield in French Guiana, Surinam, Guyana, Venezuela, Ecuador, Peru, Bolivia, and northern Brazil in Amazonas and Amapá (Santana *et al.,* 2008; Barrios-Amorós *et al.,* 2019; Figueiredo *et al.,* 2021). This species is an explosive breeder associated to lowland rainforest, where it occurs both in *terra firme* and in seasonally flooded forest (Jungfer and Hödl, 2002). *Osteocephalus leprieurii* is listed as Least Concern under IUCN Red List of Threatened Species. Voucher number CECC 3843.

Scinax proboscideus (Brongersma, 1933). The species is a moderate-sized (SVL max size 46 mm, unknown sex; Lescure and Marty, 2000; Ouboter and Jairam, 2012). Is a species of frog in the family Hylidae, currently known from French Guiana, Guyana, Suriname, and expected to be found in Brazil (Frost, 2022). Its natural habitats are subtropical or tropical moist lowland forests and intermittent freshwater marshes (Lescure and Marty, 2000). This species is categorized as Least Concern according to the IUCN Red List of Threatened Species. Voucher number CECC 2740.

Leptodactylus petersii (Steindachner, 1864). Is a small to moderate size (SVL 26.6–41.1 mm in males and 31.2–51.3 mm in female; De Sá *et al.,* 2014). Is a species of frog in the family Leptodactylidae found widely in the Guianas and the Amazon Basin. It has found in tropical rainforest, forest edge, open areas, savanna enclaves in the tropical rainforest, and open cerrado formations below 600 m (De Sá *et al.,* 2014). This nocturnal frog is usually found on the ground near water. Eggs are laid in a foam nest near water, to which the tadpoles will later move (Lima *et al.,* 2012). *Leptodactylus petersii* is listed as Least Concern under IUCN Red List of Threatened Species. Voucher number CECC 2398.

Chiasmocleis hudsoni Parker, 1940. Is a small-sized (SVL 14.9–16.4 mm in males and 19.9 mm in the single female; Costa-Campos *et al.,* 2019) common species living in tropical rainforests at elevations below 300 m, nocturnal, terrestrial and fossorial that inhabits streamside ponds (Rodrigues *et al.,* 2008). Is found in French Guiana, Suriname, Guyana, Guianan Venezuela, Colombia (Amazonas), and in Brazil at southern Amazonas, as well as at several localities in central and center-east Pará and from Serra do Navio municipality, Amapá state (Lima *et al.,* 2012; Peloso *et al.,* 2014; Costa-Campos *et al.,* 2019). *Chiasmocleis hudsoni* is listed as Least Concern under IUCN Red List of Threatened Species. Voucher number CECC 2262.

Synapturanus mirandaribeiroi (Nelson & Lescure, 1975). Is a medium-sized (SVL 26.2–30.8 in males and 28.6–34.4 in females; Fouquet *et al.,* 2021). The species is found in *terra firme* forests between 100–400 m above sea from the eastern Guiana Shield in Guyana, Suriname, south to Parque Estadual Rio Negro, Amazonas, Brazil; probably occurs in the northern part of the states of Amapá, Pará, and Roraima, in Brazil (Fouquet *et al.,* 2021).

Synapturanus mirandaribeiroi is listed as Least Concern under IUCN Red List of Threatened Species. Voucher number CECC 3847.

Previous research in the Cancão Municipal Natural Park represents the only officially published list of anurans present in the area (Silva-e-Silva and Costa-Campos, 2018). The authors recorded 49 anuran species of anurans belonging to 11 families: Allophrynidae (1); Aromobatidae (2), Bufonidae (5), Centrolenidae (1), Craugastoridae (5), Dendrobatidae (2), Eleutherodactylidae (1), Hylidae (18), Leptodactylidae (10), Phyllomedusidae (3) and Pipidae (1). In our study, we identify 12 species not registered in the previous study (i.e., Silva-e-Silva and Costa-Campos, 2018) increasing a known richness of 61 anurans species for the area.

Although the Cancão Municipal Natural Park is located on the edge of the urban expansion area of the municipality of Serra do Navio (Drummond *et al.,* 2008), the current number of 61 anuran species uncovered a representative sample of the anurofauna, when compared to other conservation units that are part of the Mosaic of the Eastern Amazon: 25 species listed for Extractive Reserve Beija-Flor Brilho de Fogo (Pedroso-Santos *et al.,* 2019); 53 species listed for Amapá National Forest (Benício and Lima, 2017), and 70 species listed for Tumucumaque Mountains National Park (Lima, 2008). The presence of new records in the study area (e.g., *Hyalinobatrachium mondolfii*, *H. tricolor* and *Chiasmocleis hudsoni*) according to previously studies (Costa-Campos *et al.,* 2019; Figueiredo *et al.,* 2020; Costa-Campos *et al.,* 2021) evidence the incipience of knowledge in the context of anuran fauna regional and revealing the importance of the anurans inventories in areas not samples.

Our results contribute to an increase in the knowledge of the anuran fauna of Eastern Amazonia and Guiana Shield, in which a lowland tropical forest in the municipality of Serra do Navio is inserted. With the increase in deforestation and logging in Brazilian Amazonia (Fearnside, 2005), the protection of these areas is importance for the conservation of the local anurofauna, considering the descriptions from new species (Taucce et al., 2020; Carvalho *et al.,* 2022) and the extension restricted and endemism of anurans in the region (Costa-Campos *et al.,* 2016; Pezzuti *et al.,* 2022). We recommended that future sampling designs include these areas to better characterize the amphibian diversity of Amazonian fauna.

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