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Scientific Note

Biodiversity in an urban swamp forest fragment in Ubatuba, São Paulo, Brazil

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Abstract: Urbanization promotes changes in land use and the fragmentation of natural habitats giving rise to forest fragments within the urban matrix. We assessed the avifauna and herpetofauna of a 2.93 ha urban fragment of *Tabebuia cassinoides* (Lam.) DC. swamp forest in the center of Ubatuba, SP, located 2.2 km from the Serra do Mar State Park. Between August 2022 and August 2023, we conducted active searches totaling 192 man-hours. We recorded 72 bird species and 15 herpetofauna species. The fragment acts as a breeding site for amphibians and serves as a refuge and stepping stone for the species sampled, reinforcing its importance for the conservation of urban biodiversity.

Keywords: Urban matrix; stepping stone; herpetofauna; avifauna; *Tabebuia cassinoide*s.

Resumo: (Biodiversidade em um fragmento urbano de floresta paludosa em Ubatuba, São Paulo, Brasil.) A urbanização promove mudanças no uso do solo e a fragmentação de habitats naturais, originando fragmentos florestais inseridos na matriz urbana. Avaliamos a avifauna e a herpetofauna de um fragmento urbano de 2,93 ha de floresta paludosa de *Tabebuia cassinoides* (Lam.) DC. no centro de Ubatuba, SP, localizado a 2,2 km do Parque Estadual da Serra do Mar. Entre agosto de 2022 e agosto de 2023, realizamos buscas ativas totalizando 192 horas-homem. Registramos 72 espécies de aves e 15 espécies de herpetofauna. O fragmento atua como sítio reprodutivo para anfíbios e funciona como refúgio e "stepping stone" das espécies amostradas, reforçando sua importância para a conservação da biodiversidade urbana.

Palavras-chave: Matriz urbana; "stepping stone"; herpetofauna; avifauna; *Tabebuia cassinoide*s.

Urbanization comes with changes in the environmental use of soil, as well as natural habitat fragmentation (Haddad et al., 2015; Liu et al., 2016), giving rise to the concept of urban forests (Giacon et al., 2022). These forest fragments become green islands in a complex urban matrix. They are fundamental for biodiversity and provide critical habitat for a variety of species, as well as key ecosystem services for human populations (Canedoli et al., 2018; Long & Frank, 2020; Giacon et al., 2022; Mitchell & Devisscher, 2022; Ribeiro et al., 2022).

Although they are isolated, urban forest fragments can be important connectors with protected areas nearby, making genetic flow possible between them as observed in different studies around the world (Parris, 2006; Van Rossum & Triest, 2012). The animal, seed, and pollen dispersion through fragments and protected areas minimize the adverse effects of habitat fragmentation on biodiversity, such as diversity loss (Antonelli et al., 2022; Ribeiro et al., 2022). Moreover, those fragments are also an extension of species' home ranges, amplifying their demography.

In the center of Ubatuba - São Paulo there is a 2.93 hectare fragment of *Tabebuia cassinoides* (Lam.) DC. (Bignoniaceae) swamp forest. It belongs to the town administration and is adjacent to the local military police battalion, the fire department, and the municipal convention center. It is 2.2 kilometers in a straight line from the closest part of the Serra do Mar State Park, coordinates -23.444098 S, -45.071359 O, 3 m above sea level (Figures 1A and 1B). The fragment is surrounded by urban landscape, and part of it floods seasonally. Its vegetation and terrestrial fauna are isolated, but it functions as a refuge. *Tabebuia cassinoides* (Lam.) DC. is an endangered species, VU (vulnerable), according to the Brazilian Flora Red List (Martinelli & Moraes, 2013), and few regions still have swamp forests. Studying this urban forest could yield important information about the biodiversity of a threatened ecosystem inserted in a city.

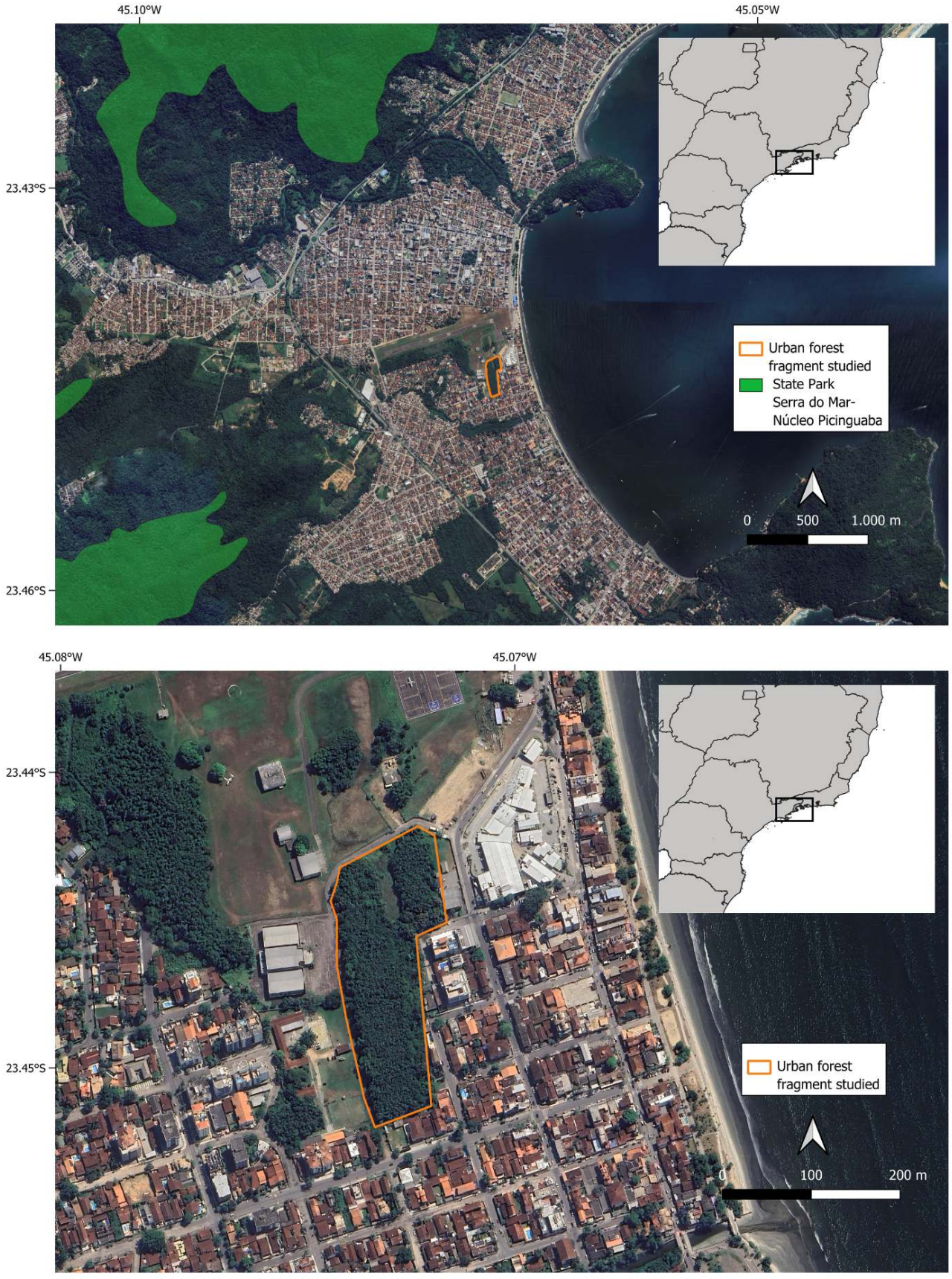

Figure 1: 1A. Urban fragment studied (orange) and the Serra do Mar State Park boundaries (bright green), which are 2.2 km away from the fragment in a straight line; **1B.** Close-up of the study area in the Ubatuba city center.

We monitored the swamp forest fragment from August 2022 to August 2023, concentrating on avifauna and herpetofauna. Two researchers conducted active searches twice a month: one nocturnal from 19:00 to 21:00, focusing more on amphibians and reptiles; and one diurnal between 06:00 and 08:00, looking for birds, adding up to 192

man-hours. The active search was conducted within the borders of the fragment, especially around three ponds in the area. There were no marked trails. All species of avifauna and herpetofauna recorded during the searches were entered into a database, including birds found at night and herpetofauna seen during the day.

We recorded 72 bird species from 15 different orders, 30 families and 68 genera (Table 1). The highlights of the list were the Little Nightjar *Hydropsalis parvula* (Gould, 1837) (Figure 2F) and the Rusty-backed Spinetail *Cranioleuca vulpina* (Pelzeln, 1856). Both species are rarely present in urban areas and were absent in previous large-scale bird surveys in Ubatuba (Dario & De-Vincenzo, 2011; Simpson et al., 2012). There are only a few records for the municipality in the digital citizen science platforms WikiAves and eBird (eBird, 2021; WikiAves, 2024b; WikiAves, 2024a).

Table 1. List of bird species recorded during the monitoring of the urban forest fragment in Ubatuba, SP, as well as the conservation status in the São Paulo state registries (1) and in the national (2) (São Paulo, 2018; ICMBio, 2025) (* = migratory species).

ORDER	Family	Scientific name	Popular name	1	2
ANSERIFORMES	Anatidae	*Amazonetta brasiliensis* (Gmelin, JF, 1789)	Brazilian Teal*	LC	LC
COLUMBIFORMES	Columbidae	*Patagioenas picazuro* (Temminck, 1813)	Picazuro, Pigeon	LC	LC
		Columbina talpacoti (Temminck, 1810)	Ruddy Ground, Dove	LC	LC
		Columba livia Gmelin, JF, 1789	Rock Dove	X*	NE
NYCTIBIIFORMES	Nyctibiidae	*Nyctibius griseus* (Gmelin, JF, 1789)	Common Potoo	LC	LC
CAPRIMULGIFORMES	Caprimulgidae	*Hydropsalis parvula* (Gould, 1837)	Little Nightjar	LC	LC
GRUIFORMES	Rallidae	*Aramides saracura* (Spix, 1825)	Slaty-breasted, Wood Rail	LC	LC
APODIFORMES	Apodidae	*Chaetura meridionalis* Hellmayr, 1907	Sick's Swift	LC	LC
		Progne chalybea (Gmelin, JF, 1789)	Grey-breasted Martin	LC	LC
		Pygochelidon cyanoleuca (Vieillot, 1817)	Blue-and-white Swallow	LC	LC
	Trochilidae	*Chionomesa fimbriata* (Gmelin, JF, 1788)	Glittering-throated Emerald*	LC	LC
		Florisuga fusca (Vieillot, 1817)	Black Jacobin*	LC	LC
		Eupetomena macroura (Gmelin, JF, 1788)	Swallow-tailed Hummingbird	LC	LC
		Thalurania glaucopis (Gmelin, JF, 1788)	Violet-capped Woodnymph	LC	LC
CHARADRIIFORMES	Charadriidae	*Vanellus chilensis* (Molina, 1782)	Southern Lapwing	LC	LC
PELECANIFORMES	Threskiornithidae	*Mesembrinibis cayennensis* (Gmelin, JF, 1789)	Green Ibis	LC	LC
		Phimosus infuscatus (Lichtenstein, MHC, 1823)	Bare-faced Ibis	LC	LC
	Ardeidae	*Syrigma sibilatrix* (Temminck, 1824)	Whistling Heron	LC	LC
		Butorides striata (Linnaeus, 1758)	Striated Heron	LC	LC
		Ardea alba Linnaeus, 1758	Great Egret	LC	LC
	Phalacrocoracidae	*Nannopterum brasilianum* (Gmelin, JF, 1789)	Neotropic Cormorant	LC	LC
CATHARTIFORMES	Cathartidae	*Coragyps atratus* (Bechstein, 1793)	Black Vulture	LC	LC
ACCIPITRIFORMES	Acciptridae	*Rupornis magnirostris* (Gmelin, JF, 1788)	Roadside Hawk	LC	LC
STRIGIFORMES	Strigidae	*Asio clamator* (Vieillot, 1808)	Striped Owl	LC	LC
PICIFORMES	Picidae	*Colaptes campestris* (Vieillot, 1818)	Campo Flicker	LC	LC
		Picumnus cirratus Temminck, 1825	White-barred Piculet	LC	LC
FALCONIFORMES	Falconidae	*Milvago chimachima* (Vieillot, 1816)	Yellow-headed, Caracara	LC	LC
		Caracara plancus (Miller, JF, 1777)	Crested Caracara	LC	LC
		Falco femoralis Temminck, 1822	Aplomado Falcon	LC	LC
PSITTACIFORMES	Psittacidae	*Brotogeris tirica* (Gmelin, JF, 1788)	Plain Parakeet	LC	LC
		Pyrrhura frontalis (Vieillot, 1818)	Maroon-bellied Parakeet	LC	LC
		Forpus xanthopterygius (Spix, 1824)	Cobalt-rumped Parrotlet	LC	LC
PASSERIFORMES	Thamnophilidae	*Herpsilochmus rufimarginatus* (Temminck, 1822)	Rufous-margined Antwren	LC	LC
		Dysithamnus mentalis (Temminck, 1823)	Plain Antvireo	LC	LC
	Dendrocolaptidae	*Lepidocolaptes angustirostris* (Vieillot, 1818)	Narrow-billed Woodcreeper	LC	LC
	Furnariidae	*Furnarius figulus* (Lichtenstein, MHC, 1823)	Band-tailed Hornero	LC	LC
		Synallaxis spixi Sclater, PL, 1856	Spix's Spinetail	LC	LC
		Cranioleuca vulpina (Pelzeln, 1856)	Rusty-backed Spinetail*	LC	LC
		Furnarius rufus (Gmelin, JF, 1788)	Rufous Hornero	LC	LC
	Rhynchocyclidae	*Todirostrum cinereum* (Linnaeus, 1766)	Common Tody-Flycatcher	LC	LC
	Tyrannidae	*Pitangus sulphuratus* (Linnaeus, 1766)	Great Kiskadee	LC	LC
		Myiozetetes similis (Spix, 1825)	Social Flycatcher	LC	LC
		Elaenia flavogaster (Thunberg, 1822)	Yellow-bellied Elaenia	LC	LC
		Cnemotriccus fuscatus (Wied-Neuwied, M, 1831)	Fuscous Flycatcher	LC	LC
		Pyrocephalus rubinus (Boddaert, 1783)	Scarlet Flycatcher*	LC	LC
		Camptostoma obsoletum (Temminck, 1824)	Southern Beardless Tyrannulet	LC	LC
		Megarynchus pitangua (Linnaeus, 1766)	Boat-billed Flycatcher	LC	LC
		Tyrannus melancholicus Vieillot, 1819	Tropical Kingbird*	LC	LC
		Lathrotriccus euleri (Cabanis, 1868)	Euler's Flycatcher*	LC	LC
		Fluvicola nengeta (Linnaeus, 1766)	Masked Water Tyrant	LC	LC
		Myiarchus ferox (Gmelin, JF, 1789)	Short-crested Flycatcher	LC	LC
		Tyrannus savana Daudin, 1802	Fork-tailed Flycatcher*	LC	LC

Cont.

ORDER	Family	Scientific name	Popular name	1	2
PASSERIFORMES	Troglodytidae	*Troglodytes musculus* Naumann, JF, 1823	Southern House Wren	LC	LC
		Cantorchilus longirostris (Vieillot, 1819)	Long-billed Wren	LC	LC
	Turdidae	*Turdus albicollis* Vieillot, 1818	White-necked Thrush	LC	LC
		Turdus leucomelas Vieillot, 1818	Pale-breasted Thrush	LC	LC
		Turdus rufiventris Vieillot, 1818	Rufous-bellied Thrush	LC	LC
		Turdus amaurochalinus Cabanis, 1851	Creamy-bellied Thrush	LC	LC
	Passeridae	*Passer domesticus* (Linnaeus, 1758)	House Sparrow	X*	NE
	Fringillidae	*Euphonia pectoralis* (Latham, 1801)	Chestnut-bellied Euphonia	LC	LC
	Passerellidae	*Zonotrichia capensis* (Müller, PLS, 1776)	Rufous-collared Sparrow	LC	LC
	Icteridae	*Gnorimopsar chopi* (Vieillot, 1819)	Chopi Blackbird	LC	LC
		Molothrus bonariensis (Gmelin, JF, 1789)	Shiny Cowbird	LC	LC
	Parulidae	*Geothlypis aequinoctialis* (Gmelin, JF, 1789)	Masked Yellowthroat	LC	LC
	Thraupidae	*Ramphocelus bresilia* (Linnaeus, 1766)	Brazilian Tanager	LC	LC
		Tangara seledon (Müller, PLS, 1776)	Green-headed Tanager	LC	LC
		Tachyphonus coronatus (Vieillot, 1822)	Ruby-crowned Tanager	LC	LC
		Coereba flaveola (Linnaeus, 1758)	Bananaquit	LC	LC
		Thraupis palmarum (Wied-Neuwied, M, 1821)	Palm Tanager	LC	LC
		Sicalis flaveola (Linnaeus, 1766)	Saffron Finch	LC	LC
		Thraupis sayaca (Linnaeus, 1766)	Sayaca Tanager	LC	LC
		Volatinia jacarina (Linnaeus, 1766)	Blue-black Grassquit	LC	LC

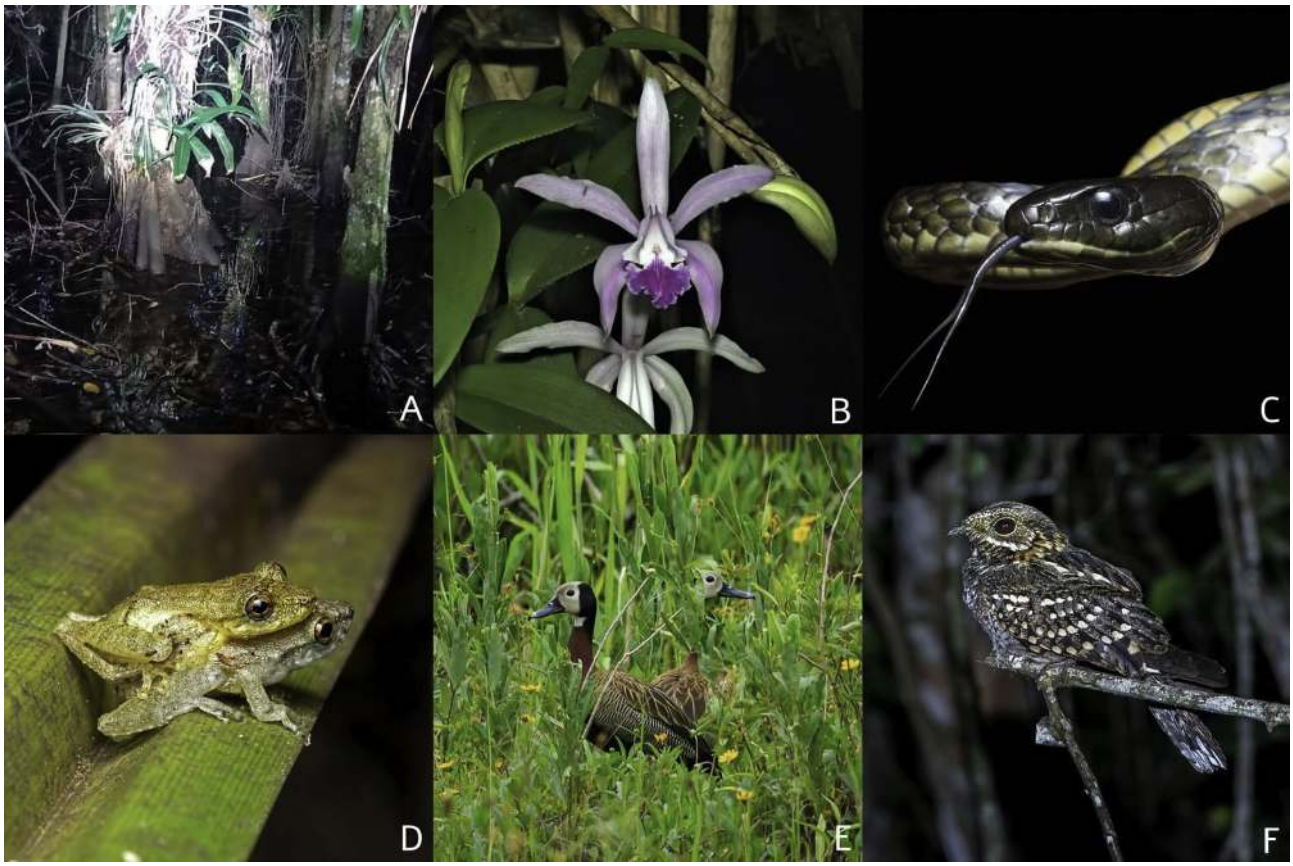

Figure 2: Pictures of biodiversity and environment in the monitored swamp forest. A. Flooded environment dominated by caixeta (*Tabebuia cassinoides*). B. Orchid *Cattleya intermedia*. C. Snake Brazilian Sipo (*Chironius laevicolis*). D. Amplexus of Rio Mutum Snouted Tree Frog (*Ololygon argyreonatus*). E. White-headed Whistling Duck (*Dendrocygna viduata*). F. Little Nightjar (*Hydropsalis parvula*), an uncommon bird in Ubatuba, SP, photographed in the study area. Author: Projeto Dacnis collection.

Regarding herpetofauna, we found 13 amphibians of three families and eight genera, and two snakes from different families (Table 2). We observed that the forest fragment functions as a reproductive site for the frog species encountered, as at times there was intense vocalization from most of the recorded species (Figure 2D; Figure 3). It shows that the fragment is a habitat for the metapopulation that occurs in the area. Moreover, although fragmentation and isolation of populations may result in genetic erosion and low variability, studies have shown that some species maintained high genetic diversity despite habitat fragmentation (Ralimanana et al., 2022).

Knowing the biodiversity of this urban fragment is fundamental to reinforce the need for its conservation. Since it lies less than 3 km away from protected forest in the Serra do Mar State Park, it may work as a stepping stone for local fauna populations, especially birds, becoming a part of their home range (Galina & Gimenes, 2006). Forest fragments can also hold a high genetic diversity as well as extend the range of animal species (Tee et al., 2018; Ribeiro et al., 2022; Ralimanana et al., 2022).

Table 2. List of amphibians and reptiles recorded during the monitoring of the urban forest fragment in Ubatuba, SP, as well as the conservation status in the São Paulo state registries (1) and in the national (2) (São Paulo, 2018; ICMBio, 2025 (* = migratory species).

ORDER	Family	Scientific name	Popular name	1	2
ANURA	Hylidae	*Boana albomarginata* (Spix, 1824)	White-banded Tree Frog	LC	LC
		Boana faber (Wied-Neuwied, 1821)	Smith Frog	LC	LC
		Dendropsophus elegans (Wied-Neuwied, 1824)	Elegant Forest Treefrog	LC	LC
		Dendropsophus minutus (Peters, 1872)	Lesser Treefrog	LC	LC
		Itapotihyla langsdorffii (Duméril and Bibron, 1841)	Ocellated Treefrog	LC	LC
		Ololygon argyreornata (Miranda-Ribeiro, 1926)	Rio Mutum Snouted Treefrog	LC	LC
		Ololygon littoralis (Pombal and Gordo, 1991)	Rio Verde Snouted Treefrog	LC	LC
		Ololygon faivovichi (Brasileiro, Oyamaguchi, and Haddad, 2007)	Bandeirantes Snouted Treefrog	LC	LC
		Scinax hayii (Barbour, 1909)	Hay's Snouted Treefrog	LC	LC
		Scinax imbegue Nunes, Kwet, and Pombal, 2012	Snouted Treefrog	LC	LC
		Trachycephalus mesophaeus (Hensel, 1867)	Porto Alegre Golden-eyed Treefrog	LC	LC
	Leptodactylidae	*Leptodactylus latrans* (Steffen, 1815)	Argus Frog	LC	LC
	Phyllomedusidae	*Pithecopus rohdei* (Mertens, 1926)	Rohde's Frog	LC	LC
SQUAMATA	Colubridae	*Chironius laevicollis* Wied-Neuwied, 1824	Brazilian sipo	LC	LC
	Dipsadidae	*Erythrolamprus miliaris* Linnaeus, 1758	Military Ground Snake	LC	LC



Figure 3: Rhode's Frog (*Pithecopus rhodei*) vocalizing upside down in the area. Author: Projeto Dacnis collection.

Impacts of the fragmentation of forests, such as patch isolation and increased edge effects, lead to loss of biodiversity, due to the decrease in landscape connectivity. We need to improve our knowledge about the role of fragments in maintaining biodiversity in the urban matrix and of fauna distribution between them (Tee et al., 2018).

On the conservation side, environmental education initiatives involving communities close to forest fragments should raise awareness about their importance and reinforce the need for the survival of native urban green areas. Besides providing shelter for wildlife in an otherwise hostile setting, these areas are crucial to the maintenance of local biodiversity, as has been proven by the wide variety of fauna found in this small forest fragment in the Ubatuba city center.

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