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New report of parental care and reproductive behavior in *Furipterus horrens* (Chiroptera: Furipteridae) in Pará, Brazil

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ABSTRACT
Furipterus horrens (F. Cuvier, 1828) is a species of widespread occurrence in South America, threatened with extinction in Brazil mainly due to the loss of feeding and sheltering habitats. There is still little information on ecological aspects of these bats. Here, we present new data on the parental and reproductive behavior of female *F. horrens* towards their offspring, observed in a cave in northern Brazil.
Keywords: Amazon Rainforest, Bats, Lactation, Neotropical, Thumbless bat

RESUMO - Novo relato de cuidado parental e comportamento reprodutivo em *Furipterus horrens* (Chiroptera: Furipteridae) no Pará, Brasil
Furipterus horrens (F. Cuvier, 1828) é uma espécie de ampla ocorrência na América do Sul, ameaçada de extinção no Brasil, principalmente devido à perda de habitats de alimentação e abrigo. Ainda há pouca informação sobre aspectos ecológicos desses morcegos. Aqui, apresentamos novos dados sobre o comportamento parental e reprodutivo de fêmeas de *F. horrens* em relação à sua prole, observados em uma caverna no norte do Brasil.
Palavras chave: Floresta Amazônica, Lactação, Morcegos, Neotropical, Thumbless bat

Bats reproduce annually according to different patterns that may vary depending on the timing of pregnancies, the spacing between them, or their relationship to climatic seasonality (Jerrett 1979; Tuttle & Stevenson 1982; Hernández-Aguilar & Santos-Moreno 2020). Intraspecifically, reproductive patterns can vary across a species' geographic range (Racey & Entwistle 2000), but births typically occur during periods of abundant trophic resources (Fleming et al. 1972; Tuttle & Stevenson 1982). For some species, behaviors such as parental care and reproductive habits can only be observed in their shelters, as is the case for species of the genus *Pteronotus* (Pimentel & Bernard

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2024) and other cave-dwelling bats such as *Lonchorhina aurita* Tomes, 1863 (Vargas-Mena et al. 2024).

Thumbless bat *Furipterus horrens* (F. Cuvier, 1828), a small, slow-flying, strictly insectivorous bat, is one such species. It is one of the smallest bats in the Neotropical region, weighing approximately 3g, with a wingspan of 15cm, and characterized by long, dense grayish fur (Uieda et al. 1980; Nowak 1994). This species is widely distributed across South America and is found in nearly all Brazilian biomes, typically roosting in large congregations in caves, although it has also been observed in tree holes (Uieda et al. 1980; Simmons & Voss 1998; Reis et al. 2013; Guimarães & Ferreira 2014; Bredt et al. 2018). Despite its broad distribution, *F. horrens* is classified as Vulnerable in Brazil due to habitat loss and a projected population decline of at least 30% over the next decade (ICMBio/MMA 2022).

Previous studies have provided some insights into the ecology and reproductive behavior of *F. horrens* (Uieda et al. 1980; Vargas-Mena et al. 2024; Bobrowiec et al. 2025). Uieda et al. (1980) documented its behavior in caves in Ubajara, Ceará, Brazil, reporting colonies of up to 250 individuals often clinging to cave walls and occasionally sharing roosts with other bat species. The authors described the positioning of pups clinging to the mother's ventral region during roosting and flight, as well as the presence of lactating females in January and February. More recently, Vargas-Mena et al. (2024) observed eight lactating females carrying pups and five juveniles in Serrote Preto and Casa de Homens caves during the rainy season (February–April). Complementing these findings, Bobrowiec et al. (2025) conducted a long-term study across 10 years and 100 iron caves in the Carajás region, Eastern Amazon, and reported a unimodal reproductive pattern for *F. horrens*, with pregnancy peaking during the dry season and lactation extending from the dry into the early rainy season. However, most studies on *F. horrens* in Brazil have focused on distribution records (Pol et al. 2003; Sato et al. 2011; Duda et al. 2012; Novaes et al. 2012; Leal et al. 2014; Portella et al. 2017; Monteiro et al. 2024), leaving significant gaps in our understanding of its ecological and reproductive behavior. Here, we present new observations on the parental care and reproductive behavior of *F. horrens* in a cave in the Amazonian biome, providing valuable data for the conservation of this vulnerable species.

Field observations were conducted in cave N4WS_0015, located in the Floresta Nacional de Carajás (FLONA Carajás), Pará, Brazil (latitude -6.066468; longitude -50.189433; SIRGAS 2000), as part of a broader space movement and use studieson cave-dwelling bats (Tavares et al. 2025). The observations took place over two consecutive nights in September 2018, coinciding with the early rainy season when insect abundance increases and reproductive activity peaks in tropical insectivorous bats (Racey & Entwistle 2000; Vargas-Mena et al. 2024). On both nights, observations began around 17:00 h inside the cave, and from 18:00 h onward, we moved to the cave entrance, where we remained until 19:30 h to monitor the bat emergence period. After this, we conducted brief incursions into the cave to search for unattended pups in other areas, but we were unable to locate any. Behavioral observations were conducted using red-light headlamps to minimize disturbance, and data were recorded through photographic documentation. The cave is situated within the Amazon Rainforest, characterized by

an ombrophilous forest with local vegetation variations associated with changes in topography (Mota et al. 2018).

A colony of approximately 100 individuals was observed roosting in an isolated section of the cave, separate from other bat species. The presence of *L. aurita* in this cave has been previously reported (Tavares et al. 2025). Additionally, other species such as *Peropteryx kappleri* Peters, 1867, *Carollia perspicillata* (Linnaeus, 1758), and *Glossophaga soricina* (Pallas, 1766) were also observed by the authors during fieldwork. Among the observed individuals, 20 lactating females were identified based on their slow flight patterns and the presence of pups clinging to their ventral region (Fig. 1). Over two consecutive nights, we observed four females leaving their offspring perched near the entrance area, on the cave ceiling, while going out to forage at around 18:00 h. These pups remained alone for approximately 1.5 hours until their mothers returned, picked them up, and moved back inside the cave (Fig. 2). This behavior was repeated on both nights. For the other 16 lactating females, we did not observe them leaving their pups at the entrance. It is possible that this behavior occurred in other internal sections of the cave, but during our observations inside, we did not detect any unattended pups.

The behavior of leaving pups at the roost while foraging is common among small insectivorous bats that do not carry their young, such as *Tadarida brasiliensis* (I. Geoffroy Saint-Hilaire, 1824) (Davis et al. 1962), *Hipposideros caffer* (Sundevall, 1846) (Brosset 1969), *Myotis velifer* (J.A. Allen, 1890) (Kunz 1974), *Myotis lucifugus* (Le Conte, 1831) (Kunz & Anthony 1996), and *Nycticeius humeralis* (Rafinesque, 1818) (Watkins & Shump 1981; Racey & Entwistle 2000). Carrying pups while foraging increases energetic costs, reduces maneuverability, and affects foraging efficiency (Norberg 1987; Hayssen & Kunz 1996), while also elevating energy expenditure (Anthony & Kunz 1977; Kunz et al. 1995). By leaving their pups in the cave, *F. horrens* females may mitigate these costs, although this strategy necessitates precise spatial and sensory mechanisms for pup retrieval (Gustin & McCracken 1987; Chaverri et al. 2018). The fact that only four females in our study exhibited this behavior, while the majority of lactating females were not seen leaving their young at the entrance, suggests variation in maternal strategies within the same colony. Some females may carry their pups while foraging, while others might leave them in less accessible areas of the cave, beyond our observation range. Further studies are needed to clarify the factors influencing this behavioral variation.

Our observations of lactating females in September contrast with earlier reports of lactation restricted to January and February (Uieda et al. 1980; Vargas-Mena et al. 2024), but align with recent findings by Bobrowiec et al. (2025), who documented high pregnancy and early lactation rates during the dry season, peaking in August and September. This reproductive timing suggests that *F. horrens* may exhibit flexibility in response to seasonal insect abundance. In tropical regions, insectivorous bat reproduction frequently aligns with the rainy season, which enhances prey availability (Willig 1985; Cumming & Bernard 1997; Racey & Entwistle 2000). The lactation period in such species often extends throughout the rainy season, from September to March (Janzen & Schoener 1968; Vaughan & Vaughan 1987; Racey & Entwistle 2000), a pattern consistent with our findings.

This study provides observations of parental care in *F. horrens* within the Amazoni-

an biome. We confirmed a behavior in which some females leave their pups perched near the cave entrance while foraging, rather than carrying them. However, this was observed in only four of the 20 lactating females, while the majority (16 individuals) were not seen leaving their young at the entrance. It is possible that these females carried their pups while foraging or left them in deeper, unobserved sections of the cave. This variation in maternal strategies within the same colony suggests individual or environmental factors influencing pup-separation behavior. Additionally, our observation of lactation in September expands the known reproductive timeline of this species, suggesting a potential link between reproductive timing and insect abundance. Our findings contribute baseline data on the reproductive ecology of this vulnerable species in an environment undergoing rapid change. However, further research is necessary to determine whether *F. horrens* adjusts its reproductive period based on prey availability, how females recognize their offspring upon returning, and whether alloparental care occurs. Understanding these aspects is critical for assessing the species' adaptive strategies and the potential impacts of environmental disturbances on its reproductive success.

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Figure 1. A female of *Furipterus horrens* nursing a pup.

Figure 2. Photograph of four *Furipterus horrens* pups that were left pearching on different parts of the cave ceiling by bats that went out to forage.

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