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New records of *Chrotopterus auritus* (Peters, 1856) and *Noctilio albiventris* Desmarest, 1818 for the Humid Chaco of Formosa, Argentina

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ABSTRACT
The records of the false vampire bat *Chrotopterus auritus* (Peters, 1856) and lesser bulldog bat *Noctilio albiventris* Desmarest, 1818 in the Humid Chaco of Argentina are scarce, with a few specimens collected in 1938 and 1976, respectively. In 2022, we captured specimens of both species using mist nets at Estancia Guaycolec, Formosa. Furthermore, through camera traps, we documented shelter sharing between *C. auritus* and *Desmodus rotundus* (É. Geoffroy Saint-Hilaire, 1810) in an ombu tree (*Phytolacca dioica*). Our findings increase the known localities for these species in Formosa, expanding knowledge about their biology in a sparse studied ecoregion of Argentina.
Key words: Chiroptera, conservation, distribution, Noctilionidae, Phyllostomidae

RESUMEN – Nuevos registros de *Chrotopterus auritus* (Peters, 1856) y *Noctilio albiventris* Desmarest, 1818 para el Chaco húmedo de Formosa, República Argentina
Los registros de los murciélagos falso vampiro orejón *Chrotopterus auritus* (Peters, 1856) y murciélago pescador chico *Noctilio albiventris* Desmarest, 1818 en el Chaco Húmedo de Argentina son escasos, con pocos ejemplares recolectados en 1938 y 1976, respectivamente. En 2022, capturamos especímenes de ambas especies utilizando redes de niebla en la Estancia Guaycolec, Formosa. Además, mediante cámaras trampa, documentamos el uso compartido de refugio entre *C. auritus* y *Desmodus rotundus* (É. Geoffroy Saint-Hilaire, 1810) en un árbol de ombú (*Phytolacca dioica*). Nuestros hallazgos aumentan las localidades conocidas para estas especies en Formosa, ampliando el conocimiento sobre su biología en una ecorregión escasamente estudiada de Argentina.

Palabras clave: Chiroptera, conservación, distribución, Noctilionidae, Phyllostomidae

The woolly false vampire bat, *Chrotopterus auritus* (Peters, 1856), is the only representative of this genus among Phyllostomidae bats (Solari & Martínez-Arias 2014). The distribution of *C. auritus* extends over a wide range from southern Mexico to

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northern Argentina, including countries in Central and South America (see Medellin 1989; Gardner 2007; Barquez et al. 2015a). In Argentina, it has been recorded in the provinces of Chaco, Corrientes, Formosa, Jujuy, Misiones, Salta, and Tucumán, and was registered in the ecoregions of Yungas forests, Dry Chaco, Humid Chaco, Paranaense forests, Delta and Islands of the Paraná River, and Fields and Wetlands (Barquez & Díaz 2020). This species typically inhabits and shelters in primary forest, but due to human pressure on natural environments it has also been recorded in disturbed forest, where it takes advantage of the abundant food resources these areas provide (Gamboa-Alurralde & Díaz 2021). Due to its large body size and short but wide wings, it can inhabit wooded areas, where it travels short distances and spends a substantial amount of time perched while listening for prey (Vleut et al. 2019). The species is known for its predominantly carnivorous diet where birds, bats, and small terrestrial mammals are their main prey; however, it can occasionally consume arthropods and fruits (Medellin 1988, 1989; Bernard 2002; Witt & Fabián 2010; Basílio et al. 2017).

Currently, the genus *Noctilio* Linnaeus, 1766, comprises two nominal species: *Noctilio leporinus* (Linnaeus, 1758) is the largest one (forearm 81.6–88.1 mm; Hood & Jones 1984), and *Noctilio albiventris* Desmarest, 1818, the smallest (forearm shorter than 70 mm; Hood & Pitocchelli 1983). The distribution of *N. albiventris* extends from southern Mexico to northern Argentina, encompassing several countries in Central and South America (Hood & Pitocchelli 1983; Gardner 2007; Barquez et al. 2015b). In Argentina, it has been recorded in the provinces of Chaco, Corrientes, Formosa, Misiones, Salta, and Santa Fe (Barquez et al. 2020) and was registered in the ecoregions of Dry Chaco, Humid Chaco, Delta and Islands of the Paraná River, Iberá Swamps, and Fields and Wetlands (Barquez & Díaz 2021). The lesser bulldog bat is commonly found in habitats adjacent to bodies of water, such as streams, rivers, lagoons, and wetlands (Gardner 2007). While this species can tolerate certain degrees of habitat modification, its presence in ecosystems indicates a good condition of water bodies (Dirzo et al. 2014). This bat primarily inhabits primary forests, where it seeks refuge in tree hollows and termite mounds (Aranguren et al. 2011). *Noctilio albiventris* is characterized by having mechanisms for the search and capture of prey on water surfaces (Brown et al. 1983; Kalko et al. 1998). Although its primary diet consists of insects, it supplements its diet with small fish and fruits (Aranguren et al. 2011).

Herein, we document new records of *C. auritus* and *N. albiventris* within the Humid Chaco region of Formosa, Argentina, thereby augmenting the existing database for the area and filling knowledge gaps in the distribution of the species. In addition, we present new information on the shared use of shelters by *C. auritus* and *D. rotundus* in Argentina, enriching our understanding of the ecology of these species.

The fieldwork was conducted in livestock areas of Estancia Guaycolec and in the protected area Reserva Privada Mirikiná within the ranch in Formosa, Argentina (latitude -25.9703; longitude -58.1817). This reserve encompasses approximately 1100 ha of gallery forest that has remained free of anthropogenic activity since 1996 (Fig. 1). The reserve is recognized as an effective refuge for the wildlife and flora of the Humid Chaco (Fernandez-Duque & van der Heide 2013), while Estancia Guaycolec is a 24000 ha livestock ranch situated in the east of the province. The landscape compris-

es a mosaic of naturally fragmented vegetation, including wetlands, savannas, islands of algarrobo (*Prosopis alba*) and urunday (*Astronium balansae*) forests, palm groves, and gallery forests along the rivers and streams, with the Riacho Pilagá serving as the main effluent (Placci & Holz 2004; Fig. 1).

We conducted bat sampling throughout June, July, September, and December of 2022 using six mist nets deployed for five consecutive nights each month. The mist nets of six, nine, twelve x 2.4 meters were strategically positioned 50 to 100 meters apart and relocated frequently each three nights, spanned various habitats, including native forest areas, livestock zones, and over the Riacho Pilagá (Fig. 1). Three mist nets were set at ground level and three were positioned at the subcanopy level in areas conducive to intercepting flight pathways or situated over water. Mist nets were operated for approximately 6 h from sunset and were monitored at 30-minute intervals. Following capture, each bat was carefully removed from the net and kept in an individual cloth bag for subsequent taxonomic identification and data collection. Additionally, from July to September, a camera trap was installed in the Reserva Privada Mirikiná at a height of 0.50 m directed towards an opening in an ombu tree (latitude -25.9713; longitude -58.1769), which was programmed to be active 24 hours a day and to take a sequence of 3 photos with a 3- second interval between each one.

For each specimen, we recorded forearm length using a digital caliper, while body mass was recorded to the nearest 0.5 g utilizing a 100 g PESOLA spring scale. Sex and age range were also noted. Taxonomic identification followed to the keys provided by Barquez & Díaz (2020). Voucher specimens were preserved as skins, skeletons, or in 70% alcohol and were deposited in the Mammal Collection of the Laboratorio de Genética Evolutiva (CM-LGE) of the Instituto de Biología Subtropical (IBS)-nodo Posadas, CONICET-UNaM, Misiones. The collection of specimens was conducted under a permit granted by the Dirección de Recursos Naturales of Formosa Province (Collection Permit N° Res. 40/15 MPyA), in accordance with the ethical guidelines endorsed by the American Society of Mammalogists (Sikes 2016).

The total sampling effort amounted to 10857 meters net per hour, resulting in a capture success rate of 0.07 individuals per meter net per hour. For the camera trap, an effort of 1440 hours/days resulted in 12 photographs of bats belonging to two species, yielding a sampling success of 20%.

We captured an adult male specimen of *Chrotopterus auritus* (CM-LGE 728) at 21:54 hs on the night of July 13, 2022 (Table 1; Fig. 2A) using a ground-level mist net positioned in the gallery forest. This forest is characterized by the presence of trees such as *Ficus* sp. and *Phytolacca dioica* with a well- developed understory. We also recorded *C. auritus* individuals resting inside a hollow ombu tree (*P. dioica*) approximately 300 meters from the captured *C. auritus* individual (Fig. 3A) in the Reserva Privada Mirikiná on August 21, 2022, using camera traps. Additionally, a *D. rotundus* individual was detected in other photographs taken on the same tree and date (Fig. 3B), indicating cohabitation of these bat species within same shelter. Individuals of *D. rotundus* were later captured in a mist net installed a few meters from the shelter. Our voucher specimen exhibits the diagnostic external characteristics for *C. auritus* as described by Medellin (1989) and Barquez & Díaz (2020) (see Table 1).

We captured and took morphometric measurements of eight *N. albiventris* individuals (Table 1): four adult females (CM-LGE 755; CM-LGE 760; CM-LGE 761; CM-LGE 762), three adult males (CM-LGE 740; CM-LGE 749; CM-LGE 778), and one juvenile male (CM-LGE 752). The net was set up only in the months of September and December, when the stream's water level was low. The eight individuals of *N. albiventris* were captured at the following times and dates: 19:50hs on September 26, 19:31hs and 20:12hs on September 27, 20:39hs on September 29; 19:58hs two individuals and at 20:45hs on September 30, and 21:40hs on December 20 (Fig. 2B). The capture site is characterized by the presence of tree species such as *Gleditsia amorphoides* (Griseb) and *Sebastiana ramosissima* (Spreng). The specimens of *N. albiventris* share the diagnostic external characters described by Hood & Pitocchelli (1983) and Díaz et al. (2021). Currently, the subspecies *Noctilio albiventris cabrerai* Davis, 1976 is recognized in northern Argentina, southwestern Brazil, and Paraguay (Gardner 2007; Barquez & Diaz 2021).

Despite the wide distribution of the *C. auritus* and *N. albiventris* in the Neotropics (Gardner 2007; Barquez et al. 2015a, b), there are few documented records of both species in the Humid Chaco ecoregion of Argentina (Sandoval & Barquez 2013; Díaz & Barquez 2019; Gamboa-Alurralde & Barquez 2019). In fact, the most recent documented records date back to 1938 for *C. auritus* and 1976 for *N. albiventris* (see Barquez et al. 1999 and references therein). For instance, for Formosa province, Barquez & Diaz (2020) reported two records of *C. auritus,* one in the Dry Chaco at an unspecified site and another in the Humid Chaco at Puerto Vélaz, and two records of *N. albiventris* in Parque Nacional Río Pilcomayo and Clorinda, all located between 58 and 108 km from our study site. Our review of the Global Biodiversity Information Facility (GBIF 2024) revealed three historical collection records for *N. albiventris* in Formosa dating back to 1967, but no records for *C. auritus.* This is likely due to the absence of references to voucher specimens in the literature (see Barquez et al. 1999). Thus, our findings provide new localities that fill information gaps and offer specimens that enable the advancement of future taxonomic and biogeographic investigations.

Moreover, the wide geographical and temporal gap between the last documented reports for Formosa and the new captures serves as evidence of the limited number of studies and the scant attention historically given to this region (see Chebez et al. 2005; Sandoval & Barquez 2013; Huck et al. 2017). This is particularly crucial in a region like the Humid Chaco, where anthropogenic activities such as livestock farming and agriculture are the primary drivers of landscape alteration and habitat fragmentation (Nanni et al. 2020; Baumann et al. 2022). The ramifications of this scenario may include heightened edge effects, resulting in diminished species richness, disruption of trophic networks, impacts on functional groups, and facilitation of exotic species invasion (Gamboa-Alurralde & Díaz 2021). In this context, understanding the diversity, ecology, and distribution of native bats is imperative for devising effective conservation strategies and preserving the ecological services provided by natural ecosystems (Zarbá et al. 2022).

It is also worth noting that *C. auritus* is regarded as an opportunistic predator that

utilizes native forests as roosting sites (Delpietro 1992; Gamboa-Alurralde & Barquez 2019). Thus, its presence in various environments within the reserve serves as an indicator of healthy forests (Medellin 1989; Vleut et al. 2019). This bat species is commonly encountered in caves, where it shares roosting sites with other bat species such as *D. rotundus* and *Myotis nigricans* (Schinz, 1821) (Witt & Fabián 2010; Basílio et al. 2017). Additionally, *C. auritus* may utilize termite mounds, hollow trees, abandoned buildings, and mines as daytime roosts (Gardner 2007). Roosting in caves represents an ancestral ecological trait in Phyllostomidae lineages such as Phyllostominae and Desmodontinae (see Garbino & Tavares 2018). In this regard, we observed *C. auritus* and *D. rotundus* sharing a shelter in a tree hollow (Fig. 3). This observation suggests that, due to the absence of caves as refuges and the high fragmentation and loss of vegetation cover associated with land use in the Humid Chaco of Formosa (Nanni et al. 2020), there is likely a limited availability of suitable refuges for these bat species. Furthermore, it underscores the importance of taking precautions in the implementation of rabies control of *D. rotundus* as these measures could partially *C. auritus*, a crucial predator species in small mammal assemblages (Medellín 1989).

In conclusion, our data constitute the first record of these species in the Humid Chaco and Formosa province following a 50-to-85-year hiatus in new data reporting. Furthermore, we successfully documented ecological behaviors such as the shared utilization of roosts between carnivorous and hematophagous bats. Our findings underscore the paucity of understanding regarding bat assemblages in the Humid Chaco of Formosa, including the geographic distribution of its species and their ecological interactions. These insights are pivotal for informing the development of wildlife management and conservation policies.

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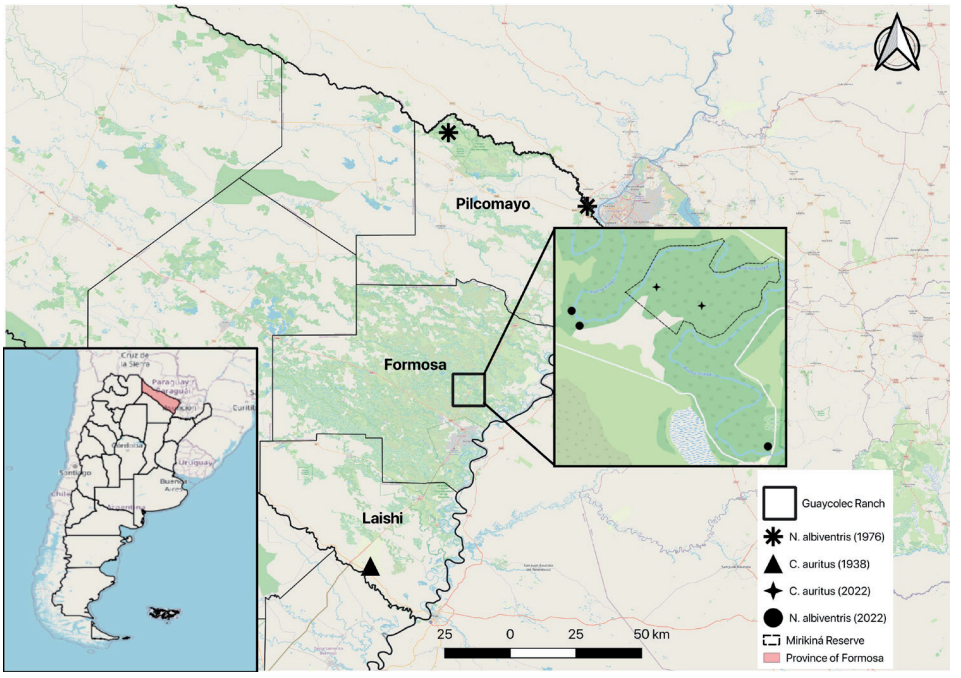

Figure 1. Geographic location of the new record of *C. auritus* and *N. albiventris* in Formosa. Previous record localities published by Barquez et al. (1999) are also depicted. **Figura 1.** Localización geográfica de los nuevos registros de *C. auritus* y *N. albiventris* en Formosa. También se representan las anteriores localidades de registros publicadas por Barquez et al. (1999).

Figure 2. Photos of the false vampire bat and the lesser bulldog bat. A) *Chrotopterus auritus* (CM-LGE 728); B) *Noctilio albiventris* (CM-LGE 740). Photo credits: Mariano S. Sánchez. **Figura 2.** Fotos del falso vampiro y el murciélago pescador chico. A) *Chrotopterus auritus* (CM-LGE 728); B) *Noctilio albiventris* (CM-LGE 740). Fotos: Mariano S. Sánchez.

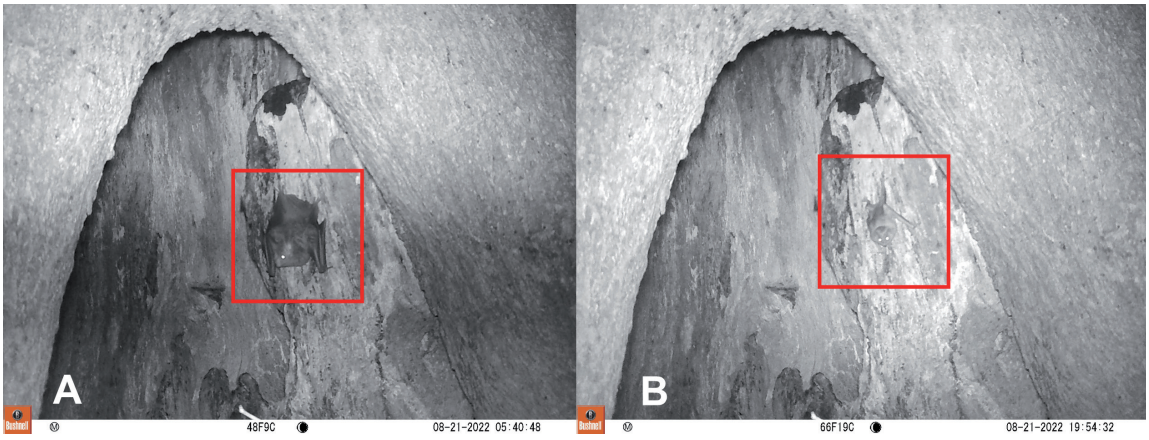

Figure 3. A) *Chrotopterus auritus* in a hollow ombú tree (*Phytolacca dioica*) recorded on August 21, 2022; B) *Desmodus rotundus* resting in the same tree on August 21, 2022. Photo credit: Owl Monkey Project, Formosa, Argentina. **Figura 3.** A) *Chrotopterus auritus* en un hueco de ombú (*Phytolacca dioica*) registrado el 21 de agosto 2022; B) *Desmodus rotundus* descansando en el mismo árbol el 21 de agosto 2022. Foto crédito Proyecto Mirikiná-Formosa, Argentina.

Table 1. External and cranial measurements (in mm) of the specimens of *Chrotopterus auritus* (CM-LGE 728) and *Noctilio albiventris* (CM-LGE 740; CM-LGE 749; CM-LGE 755; CM-LGE 760; CM-LGE 761; CM-LGE 762; CM-LGE 778). The institutional abbreviation is: CM-LGE, Mammal Collection of theLaboratorio de Genética Evolutiva (CM-LGE) of the Instituto de Biología Subtropical (IBS)-nodo Posadas, CONICET-UNaM. We express the measurements as the mean ± standard deviation for the *N. albiventris* specimens. To avoid bias in the values, we excluded the CM-LGE 752 specimen, as it was a juvenile. **Tabla 1.** Medidas externas y craneales (en mm) de los especímenes de *Chrotopterus auritus* (CM-LGE 728) y de *Noctilio albiventris* (CM-LGE 740; CM-LGE 749; CM-LGE 755; CM-LGE 760; CM-LGE 761; CM-LGE 762; CM-LGE 778). La abreviatura institucional: CM-LGE, Colección de Mamíferos del Laboratorio de Genética Evolutiva del Instituto de Biología Subtropical, Universidad Nacional de Misiones. Las medidas se expresan como la media ± desviación estándar para los especímenes de *N. albiventris*.

Measurements	***Chrotopterus auritus***	***Noctilio albiventris***	
Sex	Male	Female	Male
Weight (g)	75	28.4 (± 4.8)	32.5 (± 1)
Total length	100	65.5 (± 3.31)	68.4 (± 2.9)
Tail length	4.3	15.4 (± 2.9)	18.3 (± 1.5)
Hindfoot length	23.8	15.5 (± 2.13)	14.4 (± 0.4)
Ear length	45.2	23.2 (± 1)	23.6 (± 0.8)
Forearm length	78.9	63.6 (± 1.1)	63.8 (± 1)
Tibia length	32.6	22.2 (± 1)	22.7 (± 1.8)
Greatest lentgh of skull		20.43 (± 0.4)	21.8 (± 0.9)
Condyloinsicive length		19.1 (± 0.4)	19.6 (± 0.7)
Postorbital breadth		5.8 (± 0.11)	6.2 (± 0.4)
Zygomatic breadth		15.1 (± 0.9)	15.9 (± 0.4)
Braincase breadth		11.6 (± 0.04)	11.5 (± 0.1)
Mastoid breadth		11.6 (± 0.5)	12.1 (± 0.01)
Length of palatal		9 (± 0.4)	9.4 (± 0.3)
Breadth across molars		10 (± 0.6)	9.9 (± 0.3)
Length of mandible		14.2 (± 0.1)	15 (± 0.4)

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