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AMMAC
Asociación Mexicana de Mastozoología A.C.

THERYA NOTES tiene como propósito difundir exclusivamente notas científicas con información original e inédita relacionada con el estudio de los mamíferos en todas las disciplinas que contribuyen a su conocimiento. Es un foro abierto para profesores, investigadores, profesionales y estudiantes de todo el mundo, en el que se publican notas académicas en español e inglés. THERYA NOTES es una revista digital de publicación continua que recibe propuestas para publicación durante todo el año. Tiene un sistema de evaluación por pares a doble ciego y es de acceso abierto.

En la Portada

Los armadillos son los únicos mamíferos que poseen regiones acorazadas que protegen su cabeza, cuerpo y cola. El conocimiento sobre cuidados parentales en armadillos es prácticamente nulo. En esta contribución se describe por primera vez, a través de registros fotográficos y de video, el acarreo de crías por parte de adultos de *Chaetophractus villosus* y *Zaedyus pichiy* en diferentes regiones de Argentina y Chile.
(Fotografía de A. Castro)

El logo de la AMMAC: "Ozomatli"

El nombre de "Ozomatli" proviene del náhuatl se refiere al símbolo astrológico del mono en el calendario azteca, así como al dios de la danza y del fuego. Se relaciona con la alegría, la danza, el canto, las habilidades. Al signo decimoprimero en la cosmogonía mexica. "Ozomatli" es una representación pictórica del mono araña (*Ateles geoffroyi*). La especie de primate de más amplia distribución en México. " Es habitante de los bosques, sobre todo de los que están por donde sale el sol en Anáhuac. Tiene el dorso pequeño, es barrigudo y su cola, que a veces se enrosca, es larga. Sus manos y sus pies parecen de hombre; también sus uñas. Los Ozomatin gritan y silban y hacen visajes a la gente. Arrojan piedras y palos. Su cara es casi como la de una persona, pero tienen mucho pelo."

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EQUIPO EDITORIAL

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New distribution record of the brown sac-wing bat *Balantiopteryx infusca* in Colombia

Nuevo registro de distribución del murciélago café de sacos alares *Balantiopteryx infusca* en Colombia

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The brown sac-wing bat *Balantiopteryx infusca* (Thomas, 1897) is among the least known of South American bats. Is categorized as Vulnerable by the IUCN, since their description in 1897 was known only to occur in four localities; two from the northwestern Ecuador and two localities from southwestern Colombia. We observed a colony (6 individuals) and collected three adult female specimens in a hollow at c.a. 5 m high at the steep wall of a gorge formed by the Río Gitocito in Corregimiento de Santa Cecilia, municipality of Pueblo Rico, Department of Risaralda, Colombia. The vegetation in this area is dominated by rain forests. The characters that distinguish our vouchers from other Emballonurids, and from other *Ballantiopteryx* are; glandular sac in the middle of the propatagium; rostrum bulbous anteriorly with lateral inflations extending forward over roots of canines; no sagittal crest; the inner margin of ear slightly concave; braincase elongate posteriorly; mesopterygoid fossa narrow. Our findings represent the northernmost distribution for *B. infusca* in the Chocó rain forest, extending 170 km north of the nearest record its distribution and filling gaps between known populations of the genus *Balantiopteryx*. This species endemic to the Chocó region of Colombia and Ecuador tends to be locally rare or hardly detected, more acoustic monitoring should be conducted in the Chocó rain forest to improve the knowledge about the distribution of this bat.

Key words: Choco/Darien; Emballonuridae; endemic bat; range extension; rain forest; rare bat; threatened bat.

El murciélago marrón de sacos alares *Balantiopteryx infusca* (Thomas, 1897) se encuentra entre los murciélagos sudamericanos menos conocidos. Está categorizada como Vulnerable por la UICN, desde su descripción en 1897 solo se conocía en cuatro localidades; dos del noroeste de Ecuador y dos localidades del suroeste de Colombia. Observamos una colonia (6 individuos) y colectamos tres hembras adultas en un hueco de aproximadamente 5 m de altura en la pared empinada del cañón formado por el Río Gitocito en el corregimiento de Santa Cecilia, municipio de Pueblo Rico, departamento de Risaralda, Colombia. La vegetación en esta área está dominada por los bosques lluviosos. Las características que distinguen nuestros ejemplares de otros Emballonuridos, y de otras especies en el género *Ballantiopteryx* son; saco glandular en el medio del propatagio; rostro abultado anteriormente con crecimientos laterales que se extienden hacia adelante sobre las raíces de los caninos; sin cresta sagital; margen interno de la oreja ligeramente cóncavo; caja craneana alargada posteriormente; fosa mesopterigoidea estrecha. Nuestros hallazgos representan la distribución más septentrional de *B. infusca* en la selva tropical del Chocó, extendiéndose 170 km al norte del registro más cercano y llenando vacíos entre las poblaciones del género *Balantiopteryx*. Esta especie endémica de la región chocoana de Colombia y Ecuador tiende a ser localmente rara o difícilmente detectada, se deben realizar más monitoreos acústicos en las selvas chocoanas para mejorar el conocimiento sobre la distribución de este murciélago.

Palabras clave: Chocó/Darién; Emballonuridae; especie amenazada; extensión de rango; murciélago endémico; murciélago raro; selva lluviosa.

The genus *Balantipoteryx* (Emballonuridae: Emballonurinae) contains three species (Simmons and Cirranello 2020), two of them (*B. io* and *B. plicata*), are fairly common cave-roosting bats found only in Middle America; the other species (*B. infusca*) is among the least known of South American bats (Arroyo-Cabrales and Jones 1987); it has an apparent rarity and restricted distribution (Lim *et al.* 2004).

The brown sac-wing bat (*B. infusca*) has been classified as Vulnerable by the IUCN (Tirira 2015). This status has been assigned because of the restricted range and limited knowledge of the species. Since their description in 1897 was known only to occur in four localities; two from the northwestern Ecuador, in the provinces of Esmeraldas and Imbabura (McCarthy *et al.* 2000), and two localities from southwestern Colombia (Alberico *et al.* 2000; Solari *et al.* 2013; Mantilla-Meluk *et al.* 2014) in the department of Valle del Cauca, on the western versant of the Colombian Andes. This region faces forest degradation in both small-scale selective logging and firewood harvesting and large-scale tree removals for gold mining, settlements, and illegal logging (Meyer *et al.* 2019).

We report a new record locality for *B. infusca*. This represents the northernmost distribution of the species in the Chocó rain forest in Colombia, extending the geographic distribution for the species and filling gaps between known populations of the genus *Balantiopteryx*.

On October 30, 2018, at 11:21h, we observed a colony (6 individuals) in a hollow at c.a. 5 m high at the steep wall of a gorge formed by the Río Gitocito (Figure 1a), near to the point where this river drains into the Río San Juan, Corregimiento de Santa Cecilia, municipality of Pueblo Rico, Department of Risaralda (5° 20' N, 76° 11' W, 393 m; Figure 1b), the vegetation in this area is dominated by rain forests. Also, an adult female was captured with a hand net and photographed (not collected).

On May 15, 2019, at 12:11h, we observed a colony (6 individuals) at the same place, then we set a mist net (12 m in length, mesh diameter of 36 mm and height of 4 m above the ground) and we captured three adult female specimens. Another male escaped from the net.

The specimens were collected following Sikes *et al.* (2011), euthanized and deposited in the Mammal Collection of the Laboratorio de Zoología Corporación Universitaria Santa Rosa de Cabal (CUS-M 469 nonparous female and CUS-M 470 pregnant female were preserved as skin and skeleton, and CUS-M 482 pregnant female was preserved in 70 % ethanol). Cranial and external measurements were taken in mm using a digital caliper (0.2 mm). The specimens were collected under permit CARDER (license number 2004 -September 2016).

Our vouchers of *B. infusca* have the set of characters that distinguish this genus from other in the family Emballonuridae, such as glandular sac in the middle of the propatagium that opens proximally (Figure 2b); rostrum bulbous anteriorly with lateral inflations extending forward over roots of canines, and no sagittal crest (Figure2c; Gardner 2007; Diaz *et al.* 2016). The characters that distinguish our vouchers from other *Balantiopteryx* are the inner margin of ear slightly concave (Figure 2a); braincase elongate posteriorly (Figure 2c), resembling the condition in *B. plicata* and less rounded than in *B. io*; moderate frontal depression; rostrum inflated both anteriorly and posteriorly; mesopterygoid fossa narrow as in *B. plicata* (Arroyo-Cabrales and Jones 1987). The measure ranges of two voucher specimens are (in mm): total length 55 to 62; tail length 12 to 15; foot 8 to 9; ear 9 to 12; length of forearm 39.5 to 40.5; greatest length of skull, 13.0 to 13.1; zygomatic breadth, 8.3 to 8.3; postorbital constriction, 3.1 to 3.5; breadth of braincase, 6.7 to 6.9; mastoid breadth 7.5 to 7.5; length of maxillary toothrow 4.7 to 5.0.

We report a new record locality representing the northernmost record for *B. infusca* confirming their geographic distribution in the Chocó rain forest, extending 560 km range distribution respect to the type locality in Río Cachaví, province of Esmeraldas, Ecuador, and 170 km respect to the northernmost Colombian distribution in Río Chanco, department of Valle del Cauca; also this are the first records of the species for the department of Risaralda (Castaño *et al.* 2018a) and for the Amurrupá Important Area For Bat Conservation (Castaño *et al.* 2018b).

These records reduce the considerable hiatus between known populations of the sister species *B. io* in Costa Rica and *B. infusca* in Colombia, supporting the hypothesis that; *B. infusca* and *B. io* speciated allopatrically in the Pacific ver-

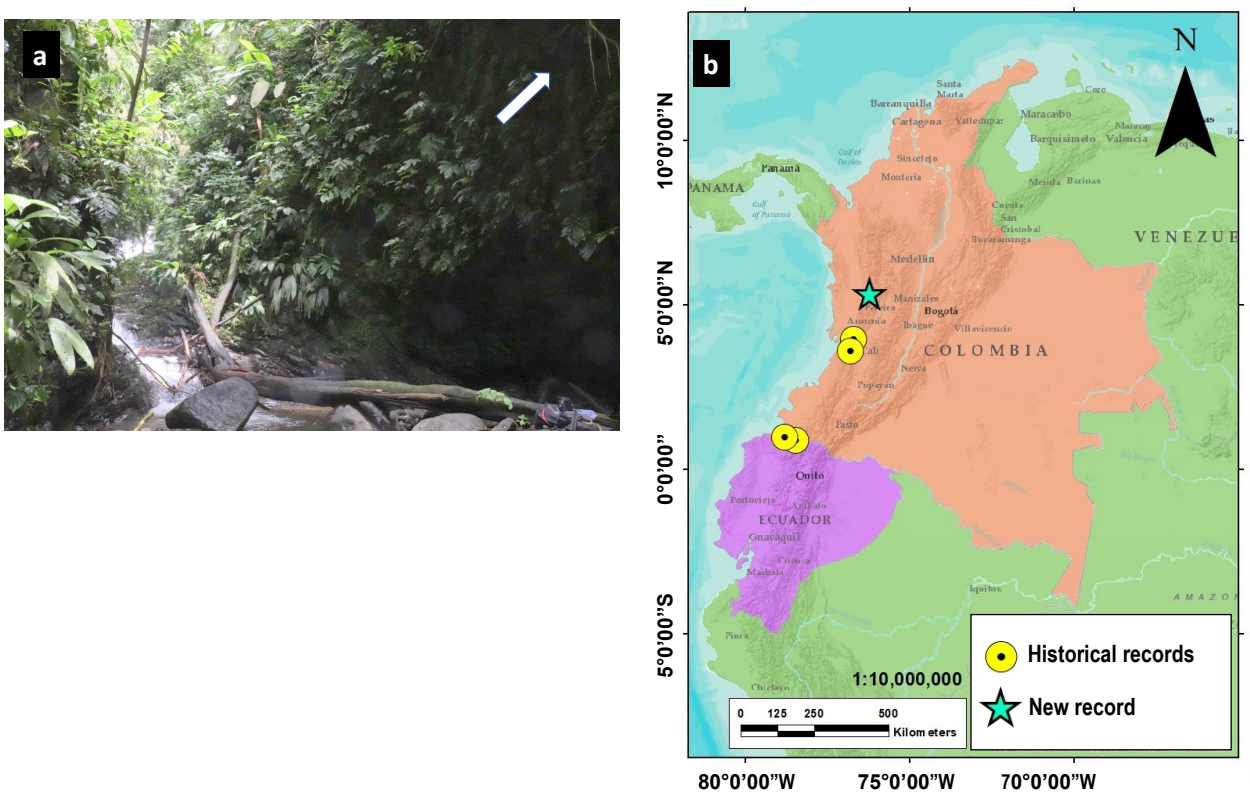

Figure 1. a) Habitat and hollow at the steep wall of a gorge formed by the Río Gitocito, the arrow indicates the place where the bats were resting. Photography by J. H. Castaño-Salazar. b) Records of the presence of *Balantiopteyx infusca*. Yellow circles indicate historical records. The blue star indicates the new record in department of Risaralda, Chocó rain forest, Colombia. Elaborated by V. Botero.

sant of Colombia and northwestern Ecuador, and in the wet Atlantic versant of southern México and northern Central America, respectively, prior to the present land connection between North and South America (Lim *et al.* 2004).

According to our observations, *B. infusca* tends to be locally rare or hardly detected by capture methods. Although in the Corregimiento de Santa Cecilia, there were several systematic bat studies using mist net and capture in caves, and there are more than 250 specimens (17 spp.) registered, this is the first report of *B. infusca* (Carranza-Quiceno *et al.* 2018). More acoustic monitoring should be conducted in the Chocó rain forest to improve the detectability and knowledge about the distribution of the brown sac-wing bat.

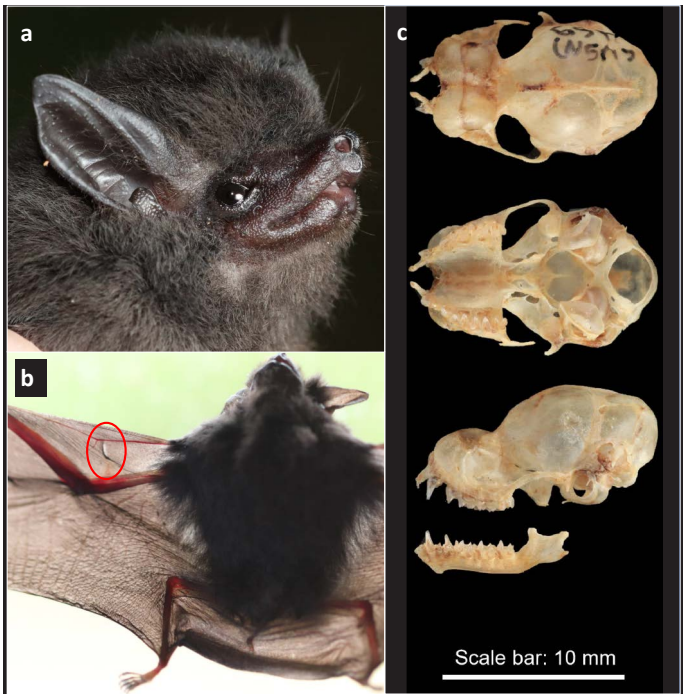

Figure 2. *Balantiopteryx infusca*. a) Face. b) Glandular sac in the middle of the propatagium. c) Dorsal, ventral, and lateral views of cranium, and lateral view of lower jaw (CUSM 469, ♀) from Corregimiento de Santa Cecilia, municipality of Pueblo Rico. Photographs by J. H. Castaño-Salazar.

Besides, the colony size (6 individuals) of *B. infusca* roosted inside this hollow suggests that the colony size of this species was shorter than colonies of *B. plicata* and *B. io* which can range from 100 to 1,000 individuals (McCarthy *et al.* 2000). Our small sample represented by 3 females and one male suggest that adult female *B. infusca* may outnumber, these results are in accordance with the findings in Ecuador (McCarthy *et al.* 2000). The cranial and external measure ranges of our vouchers are similar to those presented by Arroyo-Cabrales and Jones (1987).

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Recent confirmed records of *Galictis vittata* in the department of Sucre, Caribbean region of Colombia

Registros confirmados recientes de *Galictis vittata* en el departamento de Sucre, región Caribe de Colombia

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Galictis vittata is a small carnivore distributed in all the natural regions of Colombia, but it is considered as a "demographic rarity" due to its low density throughout its range in the national territory. This note documents new records with some ecological data and compiles the existing evidence about the local distribution of *G. vittata* in the department of Sucre, Colombian Caribbean. The new records are the product of fieldwork aiming at evaluating mammal diversity in the region, among other ecological aspects, by applying camera-trapping and interviews. In addition, other confirmed records of the species in the department were compiled based on the available information in three online data portals. The new records of *G. vittata* presented include a camera-trap record in a disturbed area of tropical dry forest and one related to an event of attack by domestic dogs. The local distribution of the species is extended to the sub-regions of Golfo de Morrosquillo and San Jorge, based on that three preserved specimens confirm its presence in the Montes de María sub-region. This is among the first data compilation of *G. vittata* focused specifically to the department of Sucre, also confirming its current presence in disturbed zones of tropical dry forest. The new records contribute evidence to previous statements about the potential ecological tolerance of the species to landscape modifications and provide novel information on possible threats and habitat use, specially about the potential importance of some elements in fragmented landscapes.

Key words: Distribution; Greater Grison; habitat use; northern Colombia; threats.

Galictis vittata es un pequeño carnívoro distribuido en todas las regiones naturales de Colombia, pero es considerado como una "rareza demográfica" debido a su baja densidad en toda su área de distribución en el territorio nacional. Esta nota documenta nuevos registros con algunos datos ecológicos y recopila la evidencia existente sobre la distribución local de *G. vittata* en el departamento de Sucre, Caribe colombiano. Los nuevos registros son producto de un trabajo de campo con el objetivo de evaluar la diversidad de mamíferos en la región, entre otros aspectos ecológicos, mediante la aplicación de fototrampeo y entrevistas. Además, se recopilaron otros registros confirmados de la especie en el departamento con base en la información disponible en tres portales de datos en línea. Los nuevos registros de *G. vittata* presentados incluyen un registro de cámara trampa en un área perturbada de bosque seco tropical y uno relacionado con un evento de ataque por perros domésticos. La distribución local de la especie se extiende a las subregiones de Golfo de Morrosquillo y San Jorge, con base en que tres ejemplares preservados confirman su presencia en la subregión de Montes de María. Esta es la primera compilación de datos de *G. vittata* enfocada específicamente al departamento de Sucre, confirmando también su presencia actual en zonas perturbadas de bosque seco tropical. Los nuevos registros aportan evidencia a declaraciones anteriores sobre la potencial tolerancia ecológica de la especie a las modificaciones del paisaje y brindan información novedosa sobre posibles amenazas y uso del hábitat, especialmente sobre la importancia potencial de algunos elementos en paisajes fragmentados.

Palabras clave: Amenazas; distribución; hurón mayor; norte de Colombia; uso de hábitat.

The Greater Grison, *Galictis vittata* (Schreber, 1776), is a small carnivore of the Mustelidae family with a widespread distribution from northeastern México to northern Argentina (Cuarón *et al.* 2016; Contreras-Díaz *et al.* 2020). This species has shown a low density throughout its known distribution range, with low detection in previous studies (Escobar-Lasso and Guzmán-Hernández 2014). It is considered one of the least known mustelids in America, with many knowledge gaps regarding its biology (González-Maya *et al.* 2011; Bornholdt *et al.* 2013). The species faces serious threats derived from deforestation and habitat destruction, illegal hunting for trade (pet) and persecution as retaliation for poultry predation (González-Maya *et al.* 2019). However, it is categorized as Least Concern according to the IUCN Red List of Threatened Species (Cuarón *et al.* 2016).

In Colombia, *G. vittata* presents a wide distribution and it is confirmed for all the natural regions of the country, including the departments of Antioquia, Arauca, Atlántico, Bolívar, Caldas, Caquetá, Casanare, Cauca, Cesar, Chocó, Córdoba, Cundinamarca, La Guajira, Magdalena, Meta, Nariño, Santander, Sucre, Tolima and Vichada (Ferrer-Pérez *et al.* 2009; Muñoz-S. and Hoyos-R. 2012; González-Maya *et al.* 2013a; Solari *et al.* 2013; Cañón and Trujillo 2014; Díaz-Pulido *et al.* 2014; Escobar-Lasso and Gil-Fernández 2014; Escobar-Lasso and Guzmán-Hernández 2014; Racero-Casarrubia and González-Maya 2014; Chacón-Pacheco *et al.* 2015; González-Maya *et al.* 2015; Racero-Casarrubia *et al.* 2015; Castaño-Uribe *et al.* 2016; Jiménez-Alvarado *et al.* 2016; Muñoz-S. *et al.* 2016; Meza-Joya *et al.* 2018; Echavarría-Rentería *et al.* 2018; Stevenson 2018; González-Maya *et al.* 2019). Nevertheless, most aspects of its ecology and population status remain unknown or with scarce and imprecise information mainly due to the lack of research (Jiménez-Alvarado *et al.* 2016; González-Maya *et al.* 2019). This hampers a proper conservation status assessment at local, regional and even national levels, so it is recognized among the top priorities for small carnivore research in the country (González-Maya *et al.* 2011).

Due to the large distribution range, it is assumed that *G. vittata* is potentially present in all the continental territory of the Colombian Caribbean (Jiménez-Alvarado *et al.* 2016), but previous studies have indicated it is one of the species with the lowest detection frequencies in the region (Díaz-Pulido *et al.* 2014). In addition, it is considered as a prioritized species given the scarce available information about its distribution, biology, uses and threats at regional level (Jiménez-Alvarado *et al.* 2016; Mesa-S. *et al.* 2016; González-Maya *et al.* 2019).

Considering that the Caribbean region of Colombia is one of the least studied regions for all small carnivores, and that most natural ecosystems were heavily transformed for the establishment of agricultural systems and livestock production (González-Maya *et al.* 2011; González-Maya *et al.* 2013b), here we present new records with some ecological data and compile the existing evidence about the local distribution of *G. vittata* in the department of Sucre.

Study area. The department of Sucre is located in the coastal plains of the Caribbean region of Colombia, north to the Central and Western Andean ranges (Durán and Pérez 2015), and it is circumscribed within the Alternohygric Tropical Zonobiome (Hernández-Camacho and Sánchez 1992). This department is politically divided in 26 municipalities distributed in five natural sub-regions (Golfo de Morrosquillo, Montes de María, Sabanas, San Jorge, and La Mojana), including a wide range of ecosystems, from tropical dry forests and natural savannas to wetlands and mangroves (De La Ossa-Lacayo 2017).

The new records of *G. vittata* were obtained in localities belonging to the sub-regions of Golfo de Morrosquillo and San Jorge. The first locality corresponds to the Buenos Aires extensive livestock system (8°52′ N, 75°15′ W; 77 m), located in the La Unión municipality, San Jorge sub-region. The other locality corresponds to El Tormento farm (9°25′ N, 75°27′ W; 46.5 m), located in the La Floresta village, Toluviejo municipality, Golfo de Morrosquillo sub-region. Both localities are characterized by the presence of small and dispersed fragments of secondary tropical dry forest. Anthropogenic transformation is very conspicuous in these areas, where the original forest cover has been extensively transformed mostly into pastures, particularly for agricultural and livestock production.

Methodology. One of the new records were obtained using an array of six camera-traps (Bushnell Trophy Cam®) installed in the Buenos Aires extensive livestock system, as part of an exploratory sampling for the "Evaluación de la diversidad de mamíferos silvestres en la región del Caribe colombiano" project. The cameras were configured to capture videos with 30 seconds intervals. These were active throughout 72 consecutive hours during three days on April, 2018. The other new record was obtained by the report of an attack on a wild animal by dogs kept at the El Tormento farm on February, 2019. Complete information of the case was documented because the informant initially presented a photograph of the dead animal which generated interest on the species in question.

Additionally, we complemented the database based on a systematic search and compilation of other confirmed records in the department (*i.e.,* preserved specimens and machine or human observations with photographic support), obtained from online data portals such as the Global Biodiversity Information Facility (GBIF, https://www.gbif.org/), the Sistema de Información sobre Biodiversidad de Colombia (SiB Colombia, https://sibcolombia.net/) and iNaturalist (https://www.inaturalist.org/).

Two new records for *G. vittata* are presented for the department of Sucre (Figure 1). The first of them was obtained on April 19, 2018 at 10:00 h and is based on a video of a solitary adult foraging in the Buenos Aires extensive livestock system (Figure 2a). The second was obtained on February 24, 2019 at 10:30 h and corresponds to a solitary individual that stayed overnight in the El Tormento farm inside a plant of Corozo (*Bactris guineensis*, Arecaceae). This individual was killed by dogs due to blunt injuries, according to the comments from the farm keepers. The specimen was not collected because the carcass was disposed in an area of the farm where it was apparently consumed by scavengers and could not be found after conducting an exhaustive search in the area. Therefore, the record was only documented through the photograph presented to the authors (Figure 2b).

One recent record (November 1, 2017) was obtained from citizen science available through the iNaturalist portal, which came from human observation with photographic evidence of three individuals observed in a tropical dry forest fragment on the Reserva Natural de la Sociedad Civil (RNSC) Sanguaré, located in the San Onofre municipality, Golfo de Morrosquillo sub-region. Additionally,

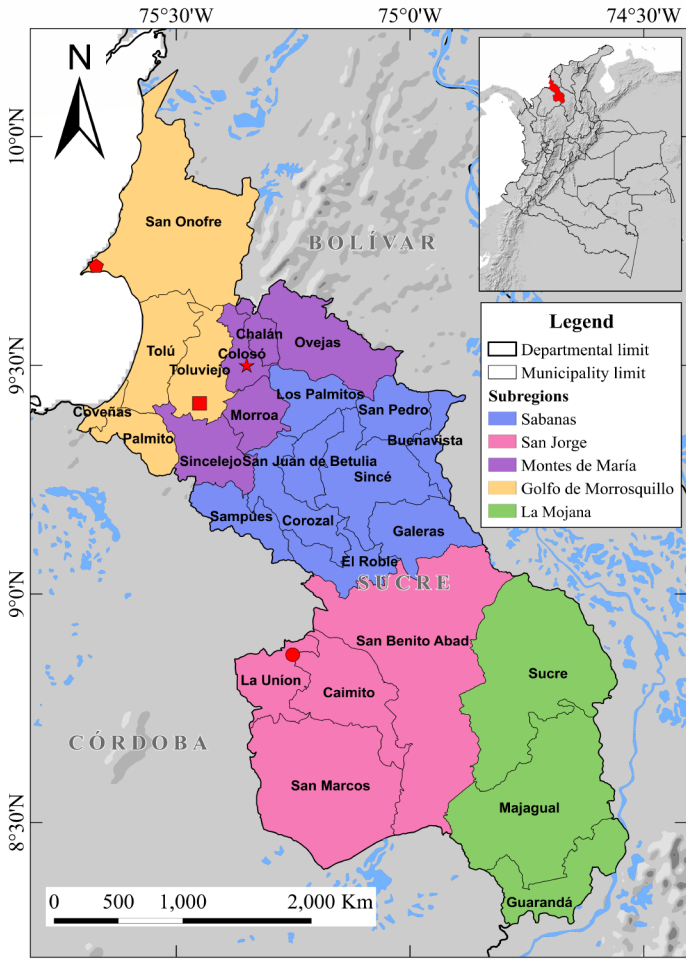

Figure 1. Confirmed records until mid-2020 of *Galictis vittata* in the department of Sucre, Colombian Caribbean region. Star: preserved specimens (historical records) from the Colosó municipality, Montes de María sub-region. Pentagon: photographic record in the Reserva Natural de la Sociedad Civil (RNSC) Sanguaré, San Onofre municipality, Golfo de Morrosquillo sub-region. Circle: camera-trap record in the Buenos Aires extensive livestock system, La Unión municipality, San Jorge sub-region. Square: record of an individual killed by domestic dogs in the El Tormento farm, La Floresta village, Toluviejo municipality, Golfo de Morrosquillo sub-region.

there are three historical records in GBIF and SiB Colombia, which correspond to specimen collections made by Philip Hershkovitz and Jorge 'El Mono' Hernández-Camacho during the previous century (only one specific date is provided in 1949) in the Colosó municipality, Montes de María sub-region (Table 1).

This note constitutes the first specific data compilations for *G. vittata* in the department of Sucre, indicating that there are only six confirmed records of the species until mid-2020 in this portion of the Colombian Caribbean region. The three recent records extend its local occurrence towards the sub-regions of Golfo de Morrosquillo and San Jorge, because the other three historical records already indicated its presence for the Montes de María sub-region. Thus, its distribution is extended 42.11 km towards the northwest and 71.63 km towards the southwest of the department. Large local data gaps on this small carnivore can be attributed in part to the problems related with field research in the department, especially given the long history of social conflict in many areas, and particularly for the Montes de María sub-region (Aguilera-Díaz 2013).

Our records provide evidence about the presence of *G. vittata* in disturbed areas and its potential ecological tolerance to landscape modifications (González-Maya *et al.* 2019), as supported by previous records in urban areas also in northern Colombia (Chacón-Pacheco *et al.* 2015) and in secondary vegetation adjacent to livestock grasslands in México (De La Torre *et al.* 2009). Also, our records provide novel observations on the species' habitat use by recording it on extensive livestock systems with a high degree of transformation (Figure 2c), probably exploring all elements of the landscape. In fact, the species had been found strongly associated with natural water bodies and forests with dense vegetation cover in the Colombian Caribbean region (Jiménez-Alvarado *et al.* 2016).

The presence of *G. vittata* on *B. guineensis* represents new information, highlighting the potential importance of this element as refuge for the species in fragmented landscapes (Figure 2d). Indeed, *B. guineensis* is a very common and valued plant species for consumption by most Caribbean Colombian communities (Bernal and Galeano 2013), which makes it widely common and widespread across both natural and disturbed areas in the region, especially in the department of Sucre. On the other hand, attacks by domestic dogs have been previously considered as a possible threat for this mustelid, but its impact requires further study due to the frequent number of documented cases (De La Torre *et al.* 2009; Chacón-Pacheco *et al.* 2015; Meza-Joya *et al.* 2018).

Table 1. Confirmed records until mid-2020 of *Galictis vittata* in the department of Sucre, Colombian Caribbean region. Recent records are presented with asterisk (*). FMNH-M = Mammal Collection of the Field Museum of Natural History; IAvH-M = Mammal Collection of the Instituto de Investigación de Recursos Biológicos Alexander von Humboldt.

Type of record	Date	Locality	Latitude	Longitude	Elevation (m)	Voucher specimen
Preserved specimen	01/06/1949	Las Campanas, Colosó, Montes de María	9.5	-75.35	175	FMNH-M 68906
Preserved specimen	n/a	?, Colosó, Montes de María		n/a	n/a	IAvH-M 5459
Preserved specimen	n/a	?, Colosó, Montes de María		n/a	n/a	IAvH-M 5547
Human observation (photographic evidence)*	01/11/2017	RNSC Sanguaré, San Onofre, Golfo de Morrosquillo	9.71	-75.67	n/a	iNaturalist 8876784
Machine observation (camera-trap)*	19/04/2018 (this note)	Buenos Aires extensive livestock system, La Unión, San Jorge	8.86	-75.25	77	n/a
Human observation (photographic evidence)*	24/02/2019 (this note)	El Tormento farm, La Floresta village, Toluviejo, Golfo de Morrosquillo	9.41	-75.45	46,5	n/a

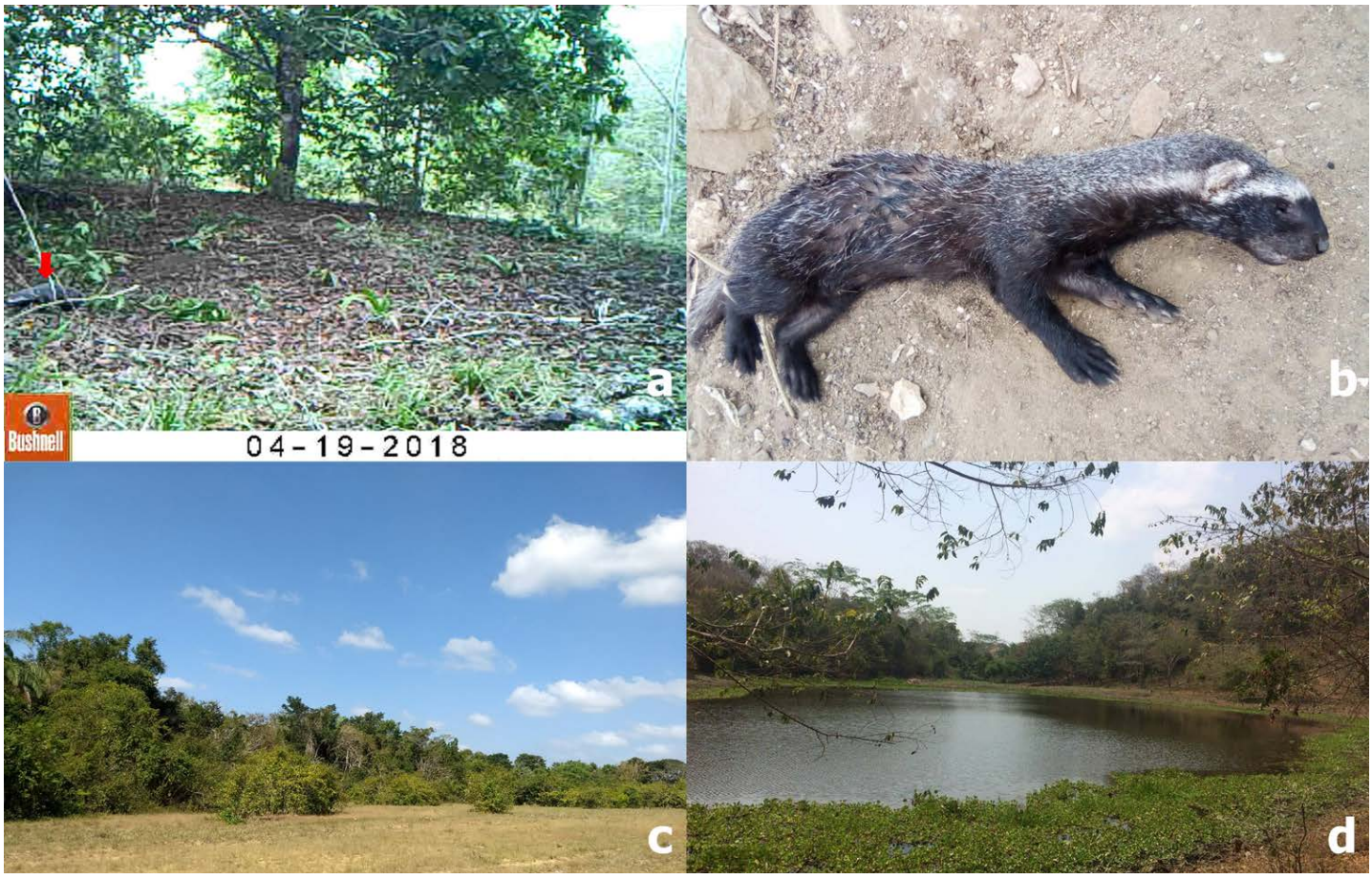

Figure 2. New confirmed records and habitat of *Galictis vittata* in the department of Sucre, Colombian Caribbean region. a) Individual recorded using camera-trap in the Buenos Aires extensive livestock system. b) Individual killed by domestic dogs in the El Tormento farm. c) Forest fragment in the La Unión municipality, San Jorge sub-region. d) Lagoon and surrounding forest fragment at the La Floresta village, Toluviejo municipality, Golfo de Morrosquillo sub-region.

The evidence presented herein is a good reflection on how research and data systematization efforts can provide valuable information for poorly known species, also increasing the general knowledge of the biodiversity in areas where social conditions have prevented proper assessment, management and conservation. Systematic efforts seem warranted to further understand many aspects for many species in a region urgently needing adequate landscape and conservation planning. Specifically, the study of the response of *G. vittata* to habitat transformation and other associated threats in new environments would not only increase the knowledge of the species but would provide the necessary information for a proper assessment of its conservation status at multiple spatial scales.

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Noteworthy record of *Neotamias solivagus* in Nuevo León, México

Registro notable de *Neotamias solivagus* en Nuevo León, México

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Six species of chipmunk *Neotamias spp.* are known in México. For the Sierra Madre Oriental mountain range, the only known species is *Neotamias solivagus* with two known locations, in south east Coahuila state. No other record has been published since 1956 and no known specimen of chipmunks is recorded in the state Nuevo León. The 4th of July 2020, during a wildlife photo hike in Cerro El Escorpión mountain, in the municipality of Santa Catarina, Nuevo León a small rodent with dorsal stripes, resembling a chipmunk, was photographed within the branches of a fallen tree. A week later, to obtain a better identification of the rodent, a camera trap was placed for two weeks at the site. The rodent photographed with the camera trap presents the same coloration pattern as the one initially photographed in the hike, alternating blackish and whitish back stripes. Due to its coloration typically like a chipmunk and potential distribution, it is identified as *Neotamias solivagus*; the presence of the tree squirrel *Sciurus alleni* was also recorded. Species of trees were identified in the area. This evidence would be the first documented record of the species in Nuevo León, within Parque Nacional Cumbres de Monterrey in a mixed conifers forest, as well as the lowest altitude record for the species. The coexistence of *N. solivagus* with tree squirrel *S. alleni* is documented and the conservation category of this chipmunk is commented.

Keys words: Camera trap; Cumbres de Monterrey; chipmunk; distribution; forest; squirrel.

Se conocen seis especies de chichimocos *Neotamias spp.* en México y para la Sierra Madre Oriental únicamente a *Neotamias solivagus* por ejemplares de dos localidades en las montañas del sureste del estado de Coahuila. Ningún registro de este sciúrido se ha publicado desde 1956. No se tiene registro de chichimocos del estado de Nuevo León. El 4 de Julio de 2020, en una caminata fotográfica de vida silvestre en la montaña Cerro El Escorpión, municipio de Santa Catarina, Nuevo León, se fotografió un pequeño roedor con bandas en la espalda típicas de un chichimoco en las ramas de un árbol caído. Una semana después, para mejor identificación de este roedor, se colocó una cámara trampa por dos semanas en el sitio. El roedor fotografiado con la cámara trampa presenta el mismo patrón de coloración al fotografiado durante la caminata, líneas dorsales blancas y negras intercaladas. Debido a su coloración típica como un chichimoco y a su distribución potencial es identificado como *Neotamias solivagus*; se registró también la presencia de la ardilla arbórea *Sciurus alleni*. Se identificaron a las especies arbóreas de la zona. Esta evidencia es el primer registro de un chichimoco en el estado de Nuevo León, dentro del Parque Nacional Cumbres de Monterrey en un bosque mixto de coníferas, así como el registro de menor altitud para la especie. Se documenta la coexistencia de *N. solivagus* con la ardilla arbórea *S. alleni* y se comenta la categoría de conservación de este chichimoco.

Palabras clave: Ardilla; bosque; cámara trampa; Cumbres de Monterrey; chichimoco; distribución.

In México Thorington *et al.* (2012) and Ceballos (2014) report five species of chipmunks *Neotamias spp.*, *N. bulleri* south of Sierra Madre Occidental (SMOc), *N. dorsalis* with 4 subspecies in the SMOc, west of Sonora and in the mountains north of Coahuila, *N. merriami* in the north border of Baja California, *N. obscurus* with two subspecies in the mountains of Baja California and *N. durangae* with two subspecies, *N. d. durangae* in the SMOc and *N. d. solivagus* in the Sierra Madre Oriental (SMOr) in Coahuila. Nevertheless, Ramírez-Pulido *et al.* (2014) and Álvarez-Castañeda *et al.* (2017) acknowledge six species for México, considering *Neotamias solivagus* as a species, because of published papers reporting geographical isolation and differences in morphology, genetics, color pattern, and bacular morphology. Álvarez-Castañeda and González-Ruiz (2018), refer to *N. solivagus* (= *Tamias solivagus*) with the common name "chichimoco de Coahuila". This note considers *N. solivagus* as a species.

All the information published about this little sciurid, smaller than 90 gr (Baker 1956), refers only to specimens of two mountains locations of the Sierra Madre Oriental to south east Coahuila, the first in Sierra de la Concordia (= Sierra de Guadalupe) as the type locality (Figure 1a) with 15 specimens (Howell 1922; Howell 1929; Goldman 1951), in the municipality of Saltillo and the second locality 100 km west, 19 and 21 km east of San Antonio de las Alazanas (Baker 1956) municipality of Arteaga (Figure 1a), with 13 specimens. No other record has been published since 1956.

The 4th of July, 2020, during a wildlife photo hike in Nuevo León between 13:00 and 14:00 hrs., with a temperature of 23 °C, in Cerro El Escorpión mountain, Santa Catarina, Nuevo León (25° 32´ 20" N, 100° 31´39" W) at 2,380 m (Figure 1b), two similar rodents were observed, one was photographed (Figure 2a, 2b) within the branches of a fallen tree (*Pinus sp.*) next to an oak (*Quercus greggii*); this site is 1.4 km north east of the state border between Coahuila and Nuevo León that is the top of Cerro El Escorpión mountain (Figure 1b). Due to its coloration, with dorsal bands is identified as a chipmunk. The closest human populated area to the site is Llanitos 800 m north (2,200 m),

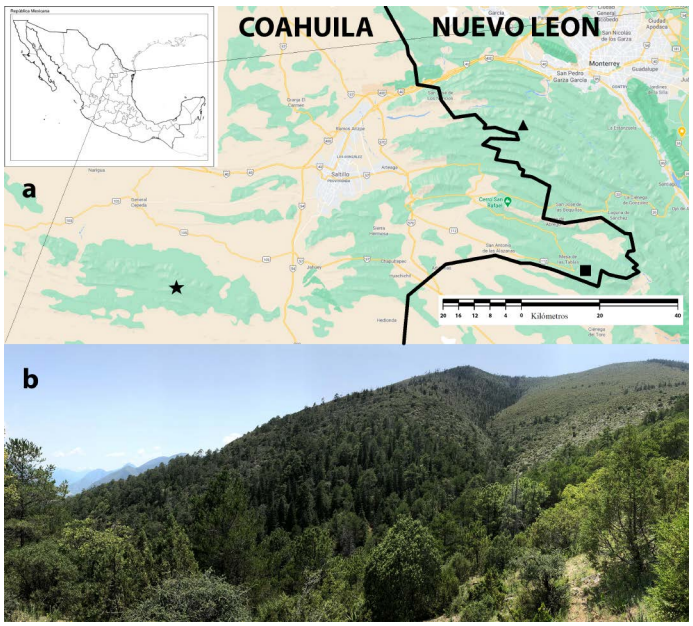

Figure 1. a) Map showing the border of the Mexican states Coahuila and Nuevo León, indicating the published records of *Neotamias solivagus*: this note in Nuevo León (dark triangle), type locality (dark star), and Baker (1956) (dark square). b) Panoramic view of the observation site of *Neotamias solivagus* in Cerro El Escorpión mountain, Santa Catarina, Nuevo León, México.

three families live in this area; the word "chichimoco" is unknown to them and the species is called by them as "huroncito" ("little ferret"). The residents of the area mention that "the huroncitos were seen every day, but after hurricane Gilberto in September 1988 none has been seen in the surroundings of the area, because creek was flooded, and water carried them away from the area".

For better identification, during July 11th, 2020 a camera trap was placed 40 m north of the first observation site (Moultrie Product, Model # CGC-12589-A-5) in a fallen pine tree, a day later presence of the chipmunk was confirmed at 9:01hrs.; the individual is identified as a *Neotamias solivagus* because of its distribution is within Sierra Madre Oriental (Figure 2c). Because *Neotamias dorsalis carminis* is located at 240 km northeast (Baker 1956), *N. bulleri* and *N. durangae* more than 400 km west, both in Sierra Madre Occidental (Ceballos 2014), misidentification as *N. solivagus* is unlikely. The coexistence of *N. solivagus* with *Sciurus alleni* (Figure 2f) is documented. Both species were recorded with this camera trap at different times of day during the next few days up to July 25th (Figure 2d and 2e) when the camera trap ran out of batteries. Considering this is an unusual species in the area, the area described is a protected area and scientific collector's permit is required, no individual was captured.

This photographic evidence is the first record of the species in Nuevo León (Best *et al.* 1993; Jiménez-Guzmán *et al.* 1999), as well as the northernmost location known at 39 km north of the closest published record (Baker 1956) and at 95 km northeast from the type locality (Figure 1a). This record is within the protected area Parque Nacional Cumbres de Monterrey.

The site of observation is a seasonal mountain stream, with north exposition, the creek side slopes have an inclination of 20 to 60 degrees, rocky areas and fallen trees, this allows sites for chipmunk's dens (Best *et al.* 1993). There is a Montane Mesic Forest or Mixed Conifers Forest (Figure 1b), arboreal stratum is composed of Douglas fir (*Pseudotsuga menziessi*), fir (*Abies vejarii*), pines (*Pinus teocote, P. greggii, P. montezumae, P. cembroides* and *P. johannis*), oaks (*Quercus greggii, Q. saltillensis, Q. grisea* and *Q. striatula*), madrone (*Arbutus xalapensis*), black cherry (*Prunus serotina*), junipers (*Juniperus flaccida* and *J. deppeana*), aspen (*Populus tremuloides*), walnut (*Juglans mollis*) and hawthorn (*Crataegus mexicana*), medium and herbaceous stratum is visually dense, which complicates spotting and tracking of this ground sciurid of secretive habits, making it difficult to detect (Best *et al.* 1993). In the area, the tree squirrel *Sciurus alleni* was present, this has arboreal and terrestrial habits, and it is possible that both species of sciurids compete for resources (Mercado-Morales 1985; Best *et al.* 1993). Baker (1956) does not comment on the coexistence of both squirrels.

Howell (1929) mentions that "Nelson and Goldman found this chipmunk common in the coniferous forest on top of the Sierra de Guadalupe" of the 8,500 to 9,500 feet of height (2,590 m to 2,900 m) and Baker (1956) indicates that "specimens were obtained in stands of pine, fir and aspen at elevations no lower than 9,000 feet (2,700 m)" thus this record in Nuevo León is the lowest altitude ever recorded for the species at 2,380 m in a conifer mixed forest habitat.

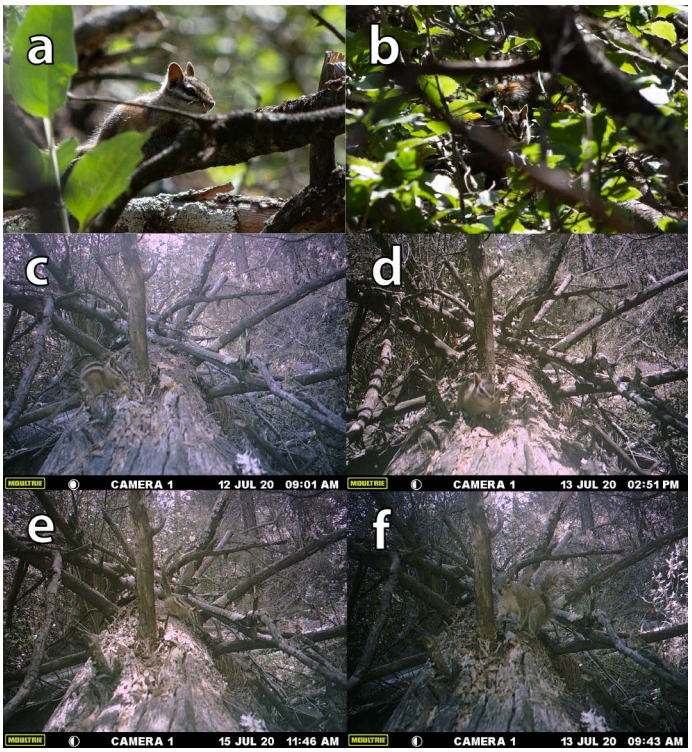

Figure 2. a) and b) *Neotamias solivagus* over fallen pine branches in Cerro El Escorpión mountain, Santa Catarina, Nuevo León, July 4th, 2020. c), d) and e) confirmation of *Neotamias solivagus* in Nuevo León with camera trap images, over fallen pine in Cerro El Escorpión, Santa Catarina, Nuevo León, México. d) Presence of *Sciurus alleni* coexisting with *Neotamias solivagus* in Cerro El Escorpión, Santa Catarina, Nuevo León, México.

In Naturalista-CONABIO (2020), 18 photographic records exist of this rodent, from 2015 to August 2020, three are from the author of this note, all in southeast of Coahuila; the three northernmost recorded, in the municipality of Ramos Arizpe, two are 9 km south and one 14 km southwest of the recorded in this note. All recorded between the months of March through November.

The chipmunk *Neotamias solivagus* is considered as least concern according to the International Union of Conservation of Nature (Álvarez-Castañeda *et al.* 2016) and in the Mexican Conservation Norm (SEMARNAT 2010, 2019) it is not considered in any category of conservation. Due to their small fragmented distribution limited by altitude and vegetation of mixed conifer forests, it is important to continue the study of this species to determine the current state of its population and understand their genetic diversity as well as its relation to other Mexican chipmunks.

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Diversity and conservation of bats in a private protected area of southern México

Diversidad y conservación de murciélagos de un área privada protegida del sur de México

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Species inventories represents the first step for the study of biological diversity. Achieving bat completeness inventories requires the use of several sampling methods. The species inventories are particularly important in zone with scarce or without biological information. This work updates the inventory of bat species of Private Protected Area known as the Jaguaroundi Ecological Park (hereafter PEJ, by its Spanish acronym), located in southern Veracruz. The sampling for this study was carried out between August and November 2015, using two methods (mist nets and ultrasonic detectors). We registered 33 species of bats, 23 species with mist nets (20 registered only with this method), and 13 species with ultrasonic detectors (10 registered only with this method). We recorded 23 species in ever green seasonal forest, 20 species were founded in secondary forest and 17 species in areas near water bodies. Overall, the PEJ harbor 34 bat species including previous and new records. Three of this species (*Lophostoma brasiliense*, *Myotis albescens* and *M. nigricans*) are included in the Official Mexican Norm (NOM-059-SEMARNAT-2010) and one species (*Peromyotis subflavus*) on the IUCN Red List. This updated bat inventory of the PEJ represents a significant contribution to the knowledge of bats diversity in southern Veracruz as well as the role in conservation of Private Protected Areas in México.

Key words: Jaguaroundi Ecological Park; mist nets; species inventory; tropical rain forest; ultrasonic detector; Veracruz.

Los inventarios de especies representan el primer paso para el estudio de la diversidad biológica. Alcanzar inventarios completos de murciélagos requiere el empleo de diversos métodos de muestreo. Los inventarios de especies son particularmente importantes en zonas con escasa o nula información biológica. En este trabajo se actualiza el inventario de especies de murciélagos del Área Privada Protegida conocida como Parque Ecológico Jaguaroundi (de aquí en adelante PEJ, por su acrónimo) localizada en el sur de Veracruz. El muestreo para este estudio se realizó entre agosto y noviembre de 2015, empleando dos métodos (redes de niebla y detectores ultrasónicos). Se registraron 33 especies de murciélagos, 23 especies con redes de niebla (20 registradas solo con este método) y 13 especies con detectores ultrasónicos (10 registradas solo con este método). Se registraron 23 especies en selva, 20 especies fueron encontradas en bosques secundarios y 17 especies en áreas cercanas a cuerpos de agua. En total, el PEJ alberga 34 especies de murciélagos incluyendo registros previos y nuevos. Tres de estas especies (*Lophostoma brasiliense*, *Myotis albescens* and *M. nigricans*) están incluidas en la Norma Oficial Mexicana (NOM-059-SEMARNAT-2010) y una especie (*Peromyotis subflavus*) en la Lista Roja de la IUCN. Este inventario actualizado de los murciélagos del PEJ representa un aporte significativo al conocimiento de la diversidad de murciélagos en el sur de Veracruz, así como del papel de conservación de las Áreas Protegidas Privadas en México.

Palabras clave: Bosque lluvioso tropical; detector ultrasónico; inventario de especies; Parque Ecológico Jaguaroundi; redes de niebla; Veracruz.

Bats are considered key components of the ecosystems where they inhabit, since they fulfill various ecological functions (Kunz *et al.* 2011), particularly in the tropics, where they reach a high diversity and abundance (Coates *et al.* 2017). For instance, the state of Veracruz harbors 89 bat species (González-Christen and Delfín-Alonso 2016), but the diversity knowledge about this group is not homogeneous across the territory. Therefore, there are areas were the information of chiropterofauna composition is limited or non-existent. Having complete species inventories in areas with scarce or without biological information represents the first step in the study of biological diversity (Dirzo and Raven 1994) and for the design and implementation of conservation strategies. In the case of bats, reaching satisfactory level of species inventory completeness is complicated given their high diversity and the sampling difficulty due to their nocturnal and flying habits (Furey *et al.* 2009). Therefore, it is necessary to implement different sampling methods (MacSwiney *et al.* 2008; Pech-Canche *et al.* 2011).

Bat diversity in natural protected areas of México has been studied mainly in governmental natural protected areas such as the biosphere reserves Los Tuxtlas, Veracruz (Coates *et al.* 2017) or Montes Azules, Chiapas (Medellín 1994), while knowledge of bat diversity in private protected areas is scarce (Ortiz-Lozada *et al.* 2017). Jaguaroundi Ecological Park (Parque Ecológico Jaguaroundi; hereafter PEJ, by its spanish acronym) is a Private Protected Area (PPA) that was the first voluntarily areas for

conservation (Área Destinada Voluntariamente a la Conservación; hereafter ADVC, by its Spanish acronym) in México. The PEJ is located in the south of the state of Veracruz, in an area severely modified by different human activities (*e.g.*, industrial activities and livestock; Nava and Rosas 2008). Little is known about species diversity, and the role of forest remnants in the maintenance of bats communities in this area. The PEJ has an extension of 960 hectares of diverse vegetation types and modified environments in different successional stages of passive restoration; however, there are hardly any preliminary inventories of the terrestrial vertebrates groups (mammals, birds, amphibians and reptiles; Herrera *et al.* 2008) which makes difficult to assess the role of PEJ on the conservation of biodiversity.

In the PEJ, in a preliminary study of the chiropterological fauna, 15 species were recorded using the mist net method (Herrera *et al.* 2008). In this study, we show the results of field work carried out in 2015, using two sampling methods (mist net trap and ultrasonic detector), we analyzed the complementarity between both methods, an updated inventory of bats of PEJ. Further we discuss the implications in terms of bat conservation. We expect that the information generated highlight the relevance of PEJ in the maintenance of bat diversity in a zone with continuous loss of original vegetation cover and help in the planning conservation strategies.

The PEJ is located in the Coatzacoalcos Municipality, in the south of the state of Veracruz, in southern México (Figure 1). The vegetation types present in the PEJ are evergreen forest, primary and secondary evergreen seasonal forest, oak forest, palm grove, swamp vegetation, savanna, as well as extensions of grasslands induced for livestock and small areas of bare ground (Ramos-Álvarez *et al.* 2008).

For the capture of bats in the PEJ, 9 sites were sampled between August and November 2015; one night per site placing 8 mist nets in each. Three sites were located in evergreen seasonal forest, three in secondary vegetation of ever green seasonal forest and three in areas near water bodies, located within the reserve. Each mist net was placed 30 minutes before dusk and remained active 4.5 hours on average (between 18:30 and 22:00 h) and was reviewed every 20 minutes.

Mist nets with a length of 12 m and a width of 2.5 m were used, starting from a few centimeters above the ground, with a mesh opening of 33 mm, installed with the help of posts secured with ropes. The sampling effort in each site was of 210 m^2 / net and the total sampling in all sites was of 1,890 m^2 / net. For each captured individual, the time of capture, as well as the measurements of weight and length of the forearm were recorded. We recorded the sex, age and reproductive status (males: scrotum or abdominal testicles; female: inactive, pregnant and lactating). The species iden-

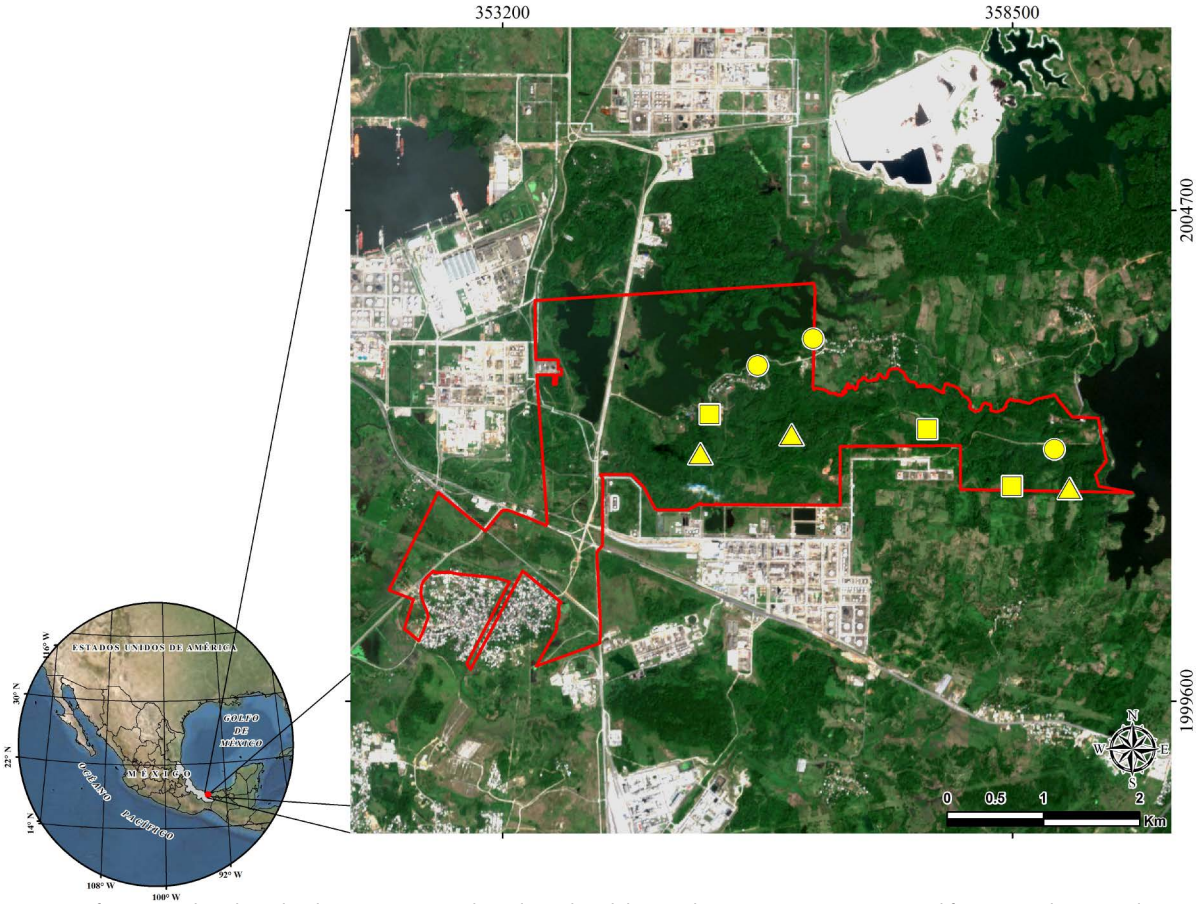

Figure 1. Location of Jaguaroundi Ecological Park (PEJ, perimeter indicated in red) and the sampling sites in ever-green seasonal forest (triangles), secondary vegetation of ever-green seasonal forest (squares) and areas near water bodies (circles).

tity of captured individuals was determined based on identification keys such as Medellín *et al.* (2008) and Álvarez-Castañeda *et al.* (2015) and later the specimens were released.

For the acoustic recording of bats, simultaneous samplings were carried out with the net method, in the months of August, September, and November of the same year at nine sites in the same environments, close to the sites where the samplings were carried out by the mist nets method. For this sampling, a SongMeter 2M + (Wildlife Acoustics) was used, which was installed on a tripod at a height of approximately 1.5 meters. The recordings were made continuously for a period of 2.5 hours, from the first 20 minutes before dusk, since it is the time interval considered the first peak of activity of insectivorous bats (Hayes 1997; Estrada-Villegas *et al.* 2010). The total sampling effort using this method was of 1,500 minutes. The recordings obtained were analyzed with the BatSound Pro 3.31 program (Petterson Elektronik AB), where the characteristics of the pulses were measured (*e.g.*, initial frequency, final frequency, interval between calls and duration of the call); later they were compared with the information in specialized literature and reference recordings previously obtained for the identification of species. The general taxonomic classification was based on the publication of Ramírez-Pulido *et al.* (2014), and on later taxonomic studies. In the case of *Pteronotus* genus taxonomy we based on the studies with molecular evidence of López-Wilchis *et al.* (2016) whose recognize to *P. mexicanus* as the species with distribution in southern Veracruz, and on the study of Pavan and Marroig (2016) whose recognize the subspecies *P. davyi fulvus* as a valid species.

To determine the degree of completeness of the bat species inventory for the PEJ, the expected richness was estimated, calculated with the first and second order Jacknife and Chao 2, non-parametric estimators (Moreno 2001), based on presence-absence data grouped in samples (sampling days), using the EstimateS version 9.0 program (Colwell 2013).

The conservation status of registered species was determined based on the list of Species at Risk (Official Mexican Norm; NOM-059-SEMARNAT-2010), published by the Ministry of the Environment and Natural Resources updated in 2018 (SEMARNAT 2010, 2019) and the Red List of the International Union for Conservation of Nature (IUCN 2020). The trophic guild of each species was defined based on the classification proposed by Kalko (1996).

As result of the fieldwork carried out in this study, 33 bat species were registered, belonging to 20 genera and 5 families. Of the 33 bat species, 23 species were registered in the mist nets, 20 recorded only using this sampling method. On the other hand, 13 species were registered with the ultrasonic detector, 10 of which were registered only using this method, and three species were registered by both methods. We recorded 23 species in ever-green seasonal forest areas, 20 species in secondary vegetation and 17 species in areas near water bodies. We found 10 species distributed in the three environments, 7 species were found in two environments and 16 species were recorded in one environment (Table 1). According to the number of species calculated with non-parametric estimators (Chao 2 = 37.5, Jacknife of first order = 42, Jacknife of second order = 44.6), the level of completeness varied between 74 %, and 88 %, respectively. Based on the recorded species on 2015, sampling effort altogether with the previously known species list for the reserve (Herrera *et al*. 2008), the inventory of chiropterofauna of the PEJ includes a total of 34 species. The best represented genus was *Myotis* with four species, followed by *Molossus*, and *Glossophaga* with three species each, while other genera such as *Saccopteryx*, *Mormoops*, *Centurio*, *Chiroderma*, *Desmodus*, *Lophostoma*, *Micronycteris*, *Platyrrhinus*, *Uroderma*, *Eptesicus,* and *Perimyotis* are represented by a single species. The best represented family was the Phyllostomidae with 19 species, followed by Vespertilionidae with eight species, while Emballonuridae is only represented by one species (Table 1). Of the recorded species, 15 are considered aerial insectivore, 13 frugivore, 3 nectarivore, 2 foliage insectivore and 1 species sanguivore (Table 1).

Three species are included in the NOM-059-SEMARNAT-2010: *Lophostoma brasiliense* in the Threatened category (Amenazada; A), *Myotis albescens* and *M. nigricans* in the Subject to Special Protection category (Sujeta a Protección Especial; Pr); while *Perimyotis subflavus* is in the Vulnerable category (VU), and *Pteronotus fulvus* has not been evaluated (NE) according to the IUCN red list (Table 1).

Updating the species inventory of the PEJ represents a significant contribution to the knowledge of bats at the extreme south of Veracruz, where there is no recent information. Most of the studies that explore species richness, and different aspects of diversity and bat ecology are mostly concentrated in Los Tuxtlas region in Veracruz (Estrada and Coates-Estrada 2002; Coates *et al.* 2017; Ramírez-Lucho *et al.* 2017). The species richness recorded in PEJ is equivalent to 51 % of the 65 bat species recorded for Los Tuxtlas region (Coates *et al.* 2017), 37 % of the 89 bat species recorded for Veracruz (González-Christen and Delfín-Alonso 2016), and 24 % of the 137 bat species recorded for México (Ceballos *et al.* 2014; Ramírez-Pulido *et al.* 2014; Álvarez-Castañeda *et al.* 2015). The diversity of bats recorded in PEJ highlight their relevance for the conservation of bats from local to national scale. Additionally, this study represents a contribution to the knowledge of the role of Private Protected Areas in the conservation of bats, which has been scarcely explored (Durán *et al.* 2012; Cruz-Bazán *et al.* 2017).

The effectiveness of each type of sampling (acoustic, mist nets) for the recording of bats can be explained by species characteristics, such as the type of feeding and echolocation system. For example, insectivorous bats of Molossidae and Vespertilionidae families can fly higher, faster, and have a more developed echolocation system that allows them to avoid nets (Silva and Bernard 2017), than species of the family Phyllostomidae, which was the most abundant family in this study (Table 1), and in others (MacSwiney *et al.* 2008;

Table 1. Bat species registered in the Jaguaroundi Ecological Park, Veracruz, México. Environment of records: Evergreen Seasonal Forest (FST); Secondary Vegetation of Evergreen Seasonal Forest (SF); Areas near Water Bodies (AWB). Guild: InsAe: Aerial Insectivore; InsFol: Foliage Insectivore; Nec: Nectarivore; Fru: Frugivore; San: Sanguivore. Source of the record: 1 = Herrera *et al.* 2008, 2 = this study. Sampling methods (Method): Ac = acoustic, Ne = nets. Species risk category according to the Mexican Ministry of the Environment (NOM): A = Threatened (amenazada), Pr = Subject to Special Protection (sujeta a protección especial) and according to the Red List of the International Union for Conservation of Nature (IUCN), LC = Least Concern, VU = Vulnerable, NE = Not evaluated.

Family	Species	FST	SF	AWB	Guild	Source	Method	NOM	IUCN
Emballonuridae	*Saccopteryx bilineata* (Temminck, 1838)	X			InsAe	2	Ac		LC
Molossidae	*Molossus molossus* (Pallas, 1766)	X	X	X	InsAe	2	Ac		LC
	Molossus rufus Geoffroy, 1805	X	X	X	InsAe	2	Ac		LC
	Molossus sinaloae Allen, 1906			X	InsAe	2	Ac		LC
Mormoopidae	*Mormoops megalophylla* (Peters, 1864)		X		InsAe	2	Ac		LC
	Pteronotus fulvus (Thomas, 1892)	X	X		InsAe	2	Ac		NE
	Pteronotus mexicanus (Miller, 1902)	X	X	X	InsAe	1, 2	Ac, Ne		LC
Phyllostomidae	*Artibeus jamaicensis* Leach, 1821	X	X	X	Fru	2	Ne		LC
	Artibeus lituratus (Olfers, 1818)	X	X	X	Fru	1, 2	Ne		LC
	Carollia perspicillata (Linnaeus, 1758)	X			Fru	1, 2	Ne		LC
	Carollia sowelli Baker, Solari and Hoffmann, 2002	X	X	X	Fru	1, 2	Ne		LC
	Centurio senex Gray, 1842	X	X	X	Fru	1, 2	Ne		LC
	Chiroderma salvini Dobson, 1878				Fru	1			LC
	Dermanura phaeotis Miller,1902	X	X	X	Fru	1, 2	Ne		LC
	Dermanura tolteca (Saussure, 1860)	X			Fru	2	Ne		LC
	Dermanura watsoni (Thomas, 1901)	X	X	X	Fru	1, 2	Ne		LC
	Desmodus rotundus (Geoffroy, 1810)		X		San	2	Ne		LC
	Glossophaga commissarisi Gardner, 1962	X		X	Nec	1, 2	Ne		LC
	Glossophaga leachii (Gray, 1844)		X	X	Nec	2	Ne		LC
	Glossophaga soricina (Pallas, 1766)		X	X	Nec	1, 2	Ne		LC
	Lophostoma brasiliense Peters, 1867	X			InsFol	2	Ne	A	LC
	Micronycteris microtis Miller, 1898	X			InsFol	2	Ne		LC
	Platyrrhinus helleri (Peters, 1866)	X		X	Fru	1, 2	Ne		LC
	Sturnira hondurensis Goodwin, 1940	X	X		Fru	2	Ne		LC
	Sturnira parvidens Goldman, 1917		X		Fru	2	Ne		LC
	Uroderma bilobatum Peters, 1866		X		Fru	2	Ne		LC
Vespertilionidae	*Eptesicus furinalis* (d´Orbigny, 1847)	X	X	X	InsAe	2	Ac		LC
	Lasiurus cinereus (Beauvois, 1796)			X	InsAe	2	Ac		LC
	Lasiurus ega (Gervais, 1856)	X			InsAe	2	Ac		LC
	Myotis albescens (Geoffroy, 1806)	X	X		InsAe	2	Ac, Ne	Pr	LC
	Myotis keaysi Allen, 1914	X			InsAe	1, 2	Ne		LC
	Myotis nigricans (Schinz, 1821)			X	InsAe	2	Ac	Pr	LC
	Myotis velifer (Allen, 1890)		X		InsAe	2	Ne		LC
	Perimyotis subflavus (Cuvier, 1832)	X			InsAe	2	Ac, Ne		VU

Ramírez-Lucho *et al.* 2017). Phyllostomid probably are easier to capture in mist nets due to their feeding habits based mostly on fruits and nectar produced by plants of the lower strata of vegetation (Simmons and Voss 1998; Giannini and Kalko 2004). Our results indicate the importance of using complementary sampling methods to obtain complete inventories of bat species (O´Farrell and Gannon 1999; Furey *et al.* 2009), including ultrasonic sampling method (MacSwiney *et al.* 2008; Pech-Canche *et al.* 2010).

Since species accumulation curves, generated based on the sampling effort made in 2015, indicated that there are still between 3 and 11 species to registered, it would be desirable to make a greater sampling effort in all environments of PEJ including as many months of the year as possible, in order to record a more complete species inventory. There are some species that may elude detection in our sampling effort, and it is possible than they occur in PEJ. For instance, *Chiroderma salvini* was previously reported by Herrera *et al.* (2008) in the PEJ. Similarly, Ortiz-Lozada *et al.* (2017) reported *Pteronotus personatus*, *Choeroniscus godmani* and *Rhogeesa tumida* in the Ceratozamia Protection and Development Area (Área

de Protección y Desarrollo de Ceratozamia; APDC by its spanish acronym), and APP located 5 km south to PEJ.

Among the species registered in the PEJ, *Centurio senex*, *Dermanura phaeotis*, *Eptesicus furinalis*, *Lophostoma brasiliense*, *Micronycteris microtis*, *Platyrrhinus helleri* and *Saccopteryx bilineata*, are considered vulnerable species, since they inhabit forest fragments, but avoid the open fields (Galindo-González 2007). In our study only *L. brasiliense*, *M. microtis* and *S. bilineata* were recorded exclusively in evergreen seasonal forest sites, while the other species were recorded in the entire landscape, except *P. helleri* which was recorded in forest and in areas near water bodies (Table 1). Other species as *Artibeus jamaicensis*, *A. lituratus*, *Carollia sowelli*, *C. perspicillata*, *Dermanura tolteca*, *Desmodus rotundus*, *Glossophaga soricina*, *Molossus rufus*, *Mormoops megalophylla*, *Myotis keaysi*, *Pteronotus fulvus*, *P. mesoamericanus* and *Uroderma bilobatum* are considered adaptable, generalist species, with greater tolerance to the environment transformation (Galindo-González 2007). However, in our study *C. perspicillata*, *D. tolteca* and *M. keaysi* were only recorded in forest sites (Table 1). The patterns of species distribution observed in the PEJ could be explained by the composition and heterogeneous configuration of the landscape matrix, and maybe due to the home range amplitude and the feeding habits of bat species, but future studies are necessary to determine the way the species move across the landscape.

From a conservation perspective, the species richness and the number of species included in categories of risk of extinction in national or international protection initiatives recorded so far in PEJ (Table 1), highlight the role of PEJ in the conservation of bats in a landscape severely modified by human activities (Nava and Rosas 2008; Sommer and Oropeza-Orozco 2010). Additionally, this study lays the base line for the development of conservation programs within the park at the local level and their possible inclusion in regional conservation programs as the Mesoamerican Biological Corridor (Miller *et al.* 2001).

A desirable future task is to evaluate the role of PEJ in conjunction with PPAs, the Tuzandepetl Ecological Park (Parque Ecológico Tuzandepetl; PET by its spanish acronym) and the APDC (5 km away between the three reserves; Figure 1), in the bat conservation of extreme south of Veracruz. These three reserves are the only Natural Protected Areas in the region, where the closest natural protected area is Los Tuxtlas Biosphere Reserve, located 50 km to the west, and La Chontalpa Ecological Park, located 85 km to the southeast. For this purpose, it is necessary to do sampling effort in several consecutive years considering all seasons, in the three PPAs, particularly in the PET where bat inventory species are lacking. For Ceratozamia Protection and Development Area, we recommend using the method of ultrasonic detectors, in order to have a more complete inventory of chiropterological fauna, because only 15 species were recorded using the mist nets sampling method (Ortiz-Lozada *et al.* 2017). But also, is desirable to carry out sampling effort in unprotected land in PPAs surrounding areas, considering all environments as forest patches, live fences, livestock grasslands and even urban areas to determine the landscape spatiotemporal use pattern that bats make.

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Carrying offspring: An unknown behavior of armadillos

Acarreo de crías: un comportamiento desconocido en los armadillos

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Armadillos are the only extant mammals characterized by bony shielded regions that protect their head, body, and tail. They have been found exclusively in the Americas. Reproduction is seasonal (from late winter and throughout the entire austral spring and summer, *i.e.*, September to March). During mating season two to four males attempt to mate with a single female, after mating the female raises the offspring alone. Parental care are practically unknown among armadillos. This contribution describes and document for the first time (both by photos and video) the carrying of young offspring by *Chaetophractus villosus* and *Zaedyus pichiy* at different locations of Argentina and Chile, most of them were obtained by citizen science. In all cases the adult catch their pup with its mouth, from its right or left forelimb (one case from the border of the pup scapular shield). Due to all cases are temporally and geographically disconnected, and was observed in different species, this behavior could be part of the usual parental care of armadillos. This results shows the importance of the citizen science for data collection, especially to gain new information about criptic species or uncommon behavior.

Key words: *Chaetophractus*; Chlamyphoridae; citizen science; mammal; postnatal care; South America, *Zaedyus*.

Los armadillos son los únicos mamíferos que poseen regiones acorazadas que protegen su cabeza, cuerpo y cola. Se distribuyen exclusivamente en América. La reproducción es estacional y ocurre entre el fin del invierno y durante toda la primavera y verano del hemisferio sur (septiembre a marzo). Durante la época reproductiva es común que dos a cuatro machos persigan una hembra e intenten copular con ella, luego de esto la hembra es la que se encarga de cuidar a las crías. El conocimiento sobre cuidados parentales en armadillos es prácticamente nulo. En esta contribución se describe por primera vez, a través de registros fotográficos y de video, el acarreo de crías por parte de adultos de *Chaetophractus villosus* y *Zaedyus pichiy* en diferentes regiones de Argentina y Chile, obtenidas mayormente a través de ciencia ciudadana. En todos los casos las crías fueron tomadas con la boca del adulto y del brazo derecho o izquierdo (húmero) o del borde del escudo pectoral. El hecho de que estos casos se encuentran separados temporal y geográficamente, sumado a que ha sido observado en diferentes especies, permite suponer que se trata de un comportamiento reproductivo usual en armadillos. Finalmente, es importante realzar la importancia de la ciencia ciudadana como base para la obtención de información biológica, especialmente sobre especies raras o sobre comportamientos desconocidos.

Palabras clave: *Chaetophractus*; Chlamyphoridae; ciencia ciudadana; cuidado posnatal; mamíferos; Sudamérica; *Zaedyus*.

Armadillos have been found exclusively in the Americas, from tropical forest to cold-open grasslands, and comprise approximately 20 extant species (56 % of living xenarthrans, Kennerley *et al.* 2018). They are the only extant Cingulata clade (Xenarthra) and are characterized by bony shielded regions that protect their head, body and tail, named cephalic shield, dorsal carapace and caudal sheath, respectively. The body region comprises the scapular and pelvic shield separated by a region of movable bands (see Soibelzon and León 2017). All extant armadillos have traditionally been included in the family Dasypodidae, but recent studies aim to divide them into two (Dasypodidae and Chlamyphoridae; Gibb *et al.* 2016; Mitchell *et al.* 2016) or four families (Dasypodidae, Chlamyphoridae, Euphractidae, and Tolypeutidae; Gaudin and Lyon 2017). Following the first proposal, the species included in this study (*Chaetophractus villosus* and *Zaedyus pichiy*) are Euphractinae, Chlamyphoridae. Their physiological characteristics (*e.g.*, low basal rates of metabolism and body temperature, high thermal conductance, and the possibility of entering torpor in *Zaedyus*; McNab 1980) determine their distribution, so they are more diverse in tropical regions than temperate ones (Soibelzon 2019). Among Euphractinae (commonly known as "hairy armadillos"), *C. villosus* has one of the widest distributions in Argentina (excluding only Mesopotamia and the Puna ecoregions) and southern Chile; it was recently introduced by humans in the southernmost province of Argentina (Tierra del Fuego; Poljak *et al.* 2007; Gallo *et al.* 2019). Due to its large distribution Rossi *et al.* (2016) proposed this species as a sentinel organism for environmental biomonitoring. *Zaedyus pichiy*, for other hand, are widely distributed from central to southern Argentina and some regions of Chile (Superina *et al.* 2019). Although different types of studies were carried out in armadillos (which includes evolutionary history, anatomy, histology, parasitology, ecology and fisiology) and the fact that they are easily maintained in zoos, little is known about their reproductive strategies (Superina and Abba 2018). *Chaetophractus villosus* reaches sexual maturity at one year of age (Superina and Abba 2018). The breeding season

occurs from late winter and throughout the entire austral spring (Luaces *et al.* 2011) with only one seasonal reproductive behavior which includes two hormonal peaks of females and males testis function only interrupted during May (Ciuccio *et al.* 2011; Luaces *et al.* 2011, 2012). Since the end of April (and continues during the spring) mounting attemps starts to be frequent and two to four males attempt to mate with a single female (E. Soibelzon pers. obs., from monitoring studies with camera traps). After 60 to 75 days of pregnancy, females have one to three pups per litter into their burrow, although juvenile females can have two breeding periods per year (Superina and Abba 2018). The pupping peak occurs during late spring (October to November), and the pups weigh around 80 to 110 gr (Sassaroli 1996). *Zaedyus pichiy* reaches sexual maturity at the age of 9–10 months, the breeding season occurs from spring to early summer, but could vary latitudinally. Births occur into the burrows between October and January and has one offspring per litter, which body mass is 50 gr (Superina and Abba 2018).

Behavioral aspects linked to parental care are little-known among armadillos. Superina and Abba (2018) suggest that the female raises the offspring alone in Euphractinae, without the collaboration of a male. Poma-Urey and Miserendino-Salazar (2014) observed a female of *Euphractus sexcinctus* carrying a young offspring in Bolivia, but this behavior has never before been more thoroughly documented in the literature. This contribution describes and documents for the first time the carrying of young offspring by *C. villosus* and *Z. pichiy* in Argentina and Chile.

This study was performed by differents methods wich includes field work and citizen science. Field works were performed in Buenos Aires and La Pampa Provinces (Argentina) as part of vertebrate monitoring studies. During field works, the area was covered by vehicle and on foot looking for armadillos activity. Informal interviews to local farmers were performed in order to gather information about ecological and ethological aspects of armadillos. Regarding to parental care in armadillos, an exhaustive bibliographic research was performed. Due to the scarcity of records and or published information, a survey in social networks were performed (Instagram: @armadillos_argentina), following the guidelines of citizen science (Tweddle *et al.* 2012). People reporting sightings were further requested to provide photographic evidence of the observed specimens and date of the observation and the exact location.

In order to improve the knowledge of breeding pattern of *Chaetophractus villosus*, three Bushnell camera traps were located in an abandoned field stall in Buenos Aires Province. This old stall has remained inhabited by humans almost for the last 70 years and is currently used by several mammals as refuge (during strong storms, hottest summer days), as wildlife and/or livestock passage (it has no doors or windows) and by *C. villosus* which has some burrows.

During field trips, only one photographic record of an adult carrying offspring was obtained (Figure 1 A-B). Interviews to local farmers contributed to increase the knowledge of general aspects of armadillos (Soibelzon *et al*. in press) and concerning to parental care, they state that this activity is unusual. Nine of them confirmed that they have seen armadillos carrying offspring with its mouth (eight for *C. villosus* and only one reported from *Z. pichiy* in La Pampa Province).

Ten records were obtained by social networks (Instagram: @armadillos_argentina), five of them including photographs (which were share to use from scientific purposes) and corresponds to *C. villosus* (Figure 1 C-F) and *Z. pichiy* (Figure 2). These photographic records correspond to three different ecoregions of Argentina (Pampa, Monte de llanuras y mesetas and Espinal) and the sub-Antarctic ecoregion of Magallanes of Chile (Table 1). In all cases, the adult was running while carrying one offspring by grabbing its right or left forelimb (or the border of its scapular shield) with its mouth (see Figure 1, 2 and supplementary video in the Appendix). Cases identified in Table 1 as A-C and E (also Figures 1 A-D and F) could not be more than a month old, evidenced by the color of the skin and the consistence of the carapace (following Superina and Abba 2018), while case D shows a large offspring, probably three months old (see also Figure 1 E). Case B from Table 1 (Figure 1 C) could take place relatively late or out of the breeding season, because it was recorded in March. Preliminar analyses of the camera traps records shows different kinds of behaviors of *C. villosus* (such as activity and reproduction patterns) but, until now, do not provide new information about the parental care.

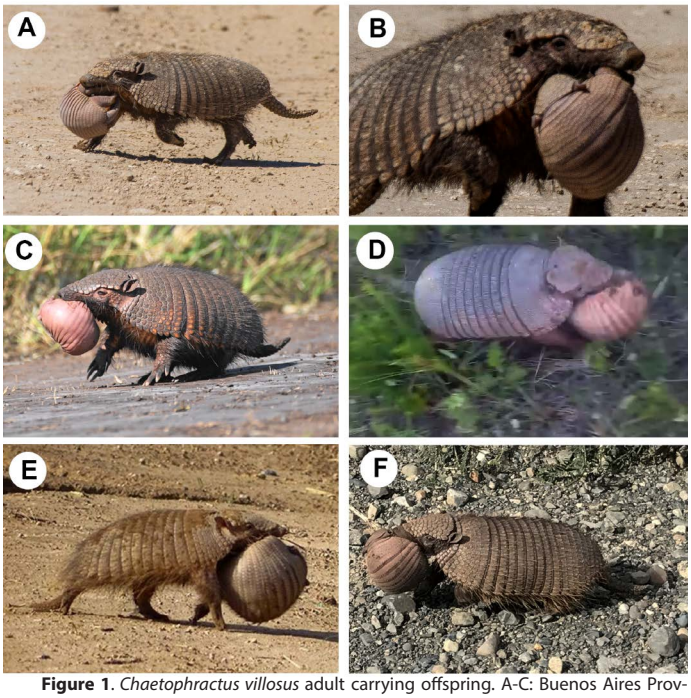

Figure 1. *Chaetophractus villosus* adult carrying offspring. A-C: Buenos Aires Province. A-B, Near Mechongué city (by the author); C, Near Necochea city (by G. Whitney); D: El Durazno, La Pampa Province (video capture by V. Fernández and F. Bruno); E: Monte Buey city, Córdoba Province (by W. J. Solsona); F: Torres del Paine National Park, Chile (by N. Vargas).

Table 1. Geographic location and dates of the records of carrying offspring mentioned in the text. CV: *Chaetophractus villosus*; ZP: *Zaedyus pichiy*. Coordinates in decimal degrees.

Case	Sp.	Location and Figures	Province	Country	Date month/year	Ecorregion	Coordinates	
A	CV	Mechongué (1A-B)	Buenos Aires	Argentina	11/2018	Pampa	-38.166766°	-58.256203°
B	CV	Necochea (1C)	Buenos Aires	Argentina	3/2015	Pampa	-38.554302°	-58.739739°
C	CV	El Durazno (1D)	La Pampa	Argentina	11/2018	Espinal	-36.703018°	-65.287811°
D	CV	Monte Buey (1E)	Córdoba	Argentina	1/2020	Pampa	-32.914764°	-62.452915°
E	CV	Torres del Paine NP (1F)	Magallanes	Chile	11/2017	Magellan	-51.278694°	-72.281654°
F	ZP	La Payunia (2)	Mendoza	Argentina	10/2019	Monte	-35.980271°	-68.749342°

Even though the observations presented here do not permit establish the sex of the adult, it probably corresponds to a female, taking into account that parental care of the offspring in *C. villosus* is carried out only by the females without the participation of the male (Superina and Abba 2018). In agreement, Poma-Urey and Miserendino-Salazar (2014) corroborated that the female carries the young in the yellow armadillo (*Euphractus sexcinctus*). These authors suggest that this behavior could be related to the nearby predator (and this could be the Case mentioned in Tabla 1 as E and C, because *Puma concolor* is abundant in those regions and is known to feed on armadillos, see Soibelzon *et al*. in press). An alternative explanation for this behavior is related to climatic factors that affect the places of refuge and upbringing of the offspring, given that four cases recorded in Argentina were immediately after a few days of heavy rains that could have flooded the den and forced females to switch between burrows.

Due to all cases are temporally and geographically disconnected and were observed in different ecoregions and species, this behavior could be widespread and part of the usual repertoire of behaviors of the species rather than rare occurrences. The carrying behavior reported here, along with reports for the yellow armadillo (Poma-Urey and Miserendino-Salazar 2014) and *Tolypeutes matacus* (in captivity at Zooborns, Edinburgh; see Zooborns 2016) constitute strong evidence that parental care in armadillos may be more complex than previously thought and probably extends to at least 3 months of age.

Figure 2. *Zaedyus pichiy* adult carrying offspring in La Payunia reserve (Mendoza, Argentina). Photo by A. Castro.

Finally, this results shows the importance of the teamwork between researchers and citizens to gain new information about mammals, especially those concerning to criptic species, distribution and/or particular or uncommon behavior. This new relationship proves to be positive in different parts of the world (*e.g.*, MammalNet, Mammal Mapper) and deeply enriches scientific knowledge and democratizes its access to the entire population.

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Appendix

Video record of an adult armadillos *Chaetophractus villosus* carrying young offspring in its mouth in El Durazno, La Pampa, Argentina (video by V. Fernandez and F. Bruno). https://drive.google.com/file/d/1xeL58Urp_GnX7lVZqr-BuyiuXMmuZbh02/view?usp=sharing

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Observations of lesions in *Sturnira parvidens* from Central México

Observaciones de lesiones en *Sturnira parvidens* en el centro de México

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Observations on health condition of organisms are useful to understanding the species biology, particularly because aspects as diseases and lesions are little known in phyllostomid bats, despite their high diversity in the Neotropical region. We reported two anomalies found in the northern yellow-shouldered bat (*Sturnira parvidens*) at a northwest locality of the state of Hidalgo, México. Bat sampling was carried out on February 2020 using three mist nets (46.8 m^2 net / night) at a locality of the municipality of Nicolás Flores. The individuals were measured and identified to species level, and conventional somatic measures, in addition sex and reproductive condition were determined. From a sample of 29 individuals of *Sturnira parvidens*, two of them showed physical anomalies; one male had a lesion on the metacarpal bone of the second finger of the right wing, and other male presents alopecic syndrome in their back. Bone fractures apparently are less frequent compared to other wing damages in bats, but it is difficult to establish their causes, and alopecic syndrome may be a rare condition in *S. parvidens*, but more studies to identify the etiologic agents that produce this disease are needed.

Key words: Alopecic syndrome; anomalies; Chiroptera; fracture; lesions; metacarpal; phyllostomid bats.

Las observaciones sobre las condiciones de salud de los organismos son útiles para comprender la biología de las especies, particularmente porque las enfermedades y lesiones son poco conocidas en los murciélagos filostómidos, a pesar de la alta diversidad de este grupo en el neotrópico. Reportamos dos anomalías físicas encontradas en el murciélago norteño de charreteras (*Sturnira parvidens*) en una localidad del noroeste del estado de Hidalgo, México. El muestreo de murciélagos se realizó en febrero de 2020 utilizando tres redes de niebla (46.8 m^2 red / noche) en una localidad del municipio de Nicolás Flores. Los individuos capturados fueron medidos e identificados a nivel de especie y se determinaron las medidas somáticas convencionales, además del sexo y su condición reproductiva. De una muestra de 29 individuos capturados de *Sturnira parvidens*, dos de ellos mostraron anomalías físicas; un macho presentó una lesión en el hueso metacarpiano del segundo dedo del ala derecha y otro macho exhibió síndrome alopécico en la espalda. En murciélagos, las fracturas óseas son menos comunes en comparación con otros tipos de daños en sus alas, pero es difícil establecer las causas de estas lesiones. El síndrome alopécico puede ser una condición rara en *S. parvidens*, pero aún es necesario identificar los agentes etiológicos que producen esta enfermedad.

Palabras clave: Anomalías; Chiroptera; fractura; lesiones; metacarpo; murciélagos filostómidos; síndrome alopécico.

Bats are a highly diverse group that occurs in all continents except Antarctica (Fenton and Simmons 2014). They play vital functions in the ecosystems, but unfortunately face many threats (*e.g.*, habitat loss, bushmeat hunting, and climate change) that increase the risk of local or global extinctions (Frick *et al.* 2020). Globally, the most frequent mortality events in bats are viral infections and bacterial diseases, as well as lesions due to accidents (O'Shea *et al.* 2016). However, information about diseases and lesions in phyllostomid bats has been poorly documented, and the available reports include only few species without detailed statistical summaries (Cichocki *et al.* 2019). In this context, possibly one of the least known aspects of Chiroptera are the causes and types of damage in their wings and other flight–enabling body parts.

Cichocki *et al.* (2019) classified the damage to southern and western Poland bat wings into five groups: tears in the wing, holes in wings, losses in the wing and tail membrane, loss of a finger membrane, and bone fractures. Apparently, some ecological determinants such as types of habitats and foraging mode determine the frequency of wing damages among bat species (Cichocki *et al.* 2019). Cat predation is responsible for traumatic injuries and wing lacerations in bat species roosting in buildings (Mühldorfer *et al.* 2011). Other injuries in bat wings are caused by fungal diseases, such as white nose syndrome, due to necrosis in the wing membrane (Fuller *et al.* 2011) and for individuals trapped in confined spaces (Mühldorfer *et al.* 2011). Additionally, it has been documented traumas, including bones fractured, elbow laceration, and compound wing fracture, sustained by migratory bats due to impact against wind turbines (Klug and Baerwald 2010). Some malformations in bat wings are congenital anomalies that include polydactyly and underdeveloped in radius and ulna, but apparently these types of anomalies are rarer (Kunz and Chase 1983).

Some isolated cases of wing damage due to different types of affectations have been reported in the following bat taxa: *Eptesicus fuscus* (Kunz and Chase 1983), *Barbastella barbastellus*, *Myotis daubentonii*, *M. myotis*, *M. nattereri*, *Plecotus auritus, Rhinolophus hipposideros* (Cichocki *et al.* 2019), *M. albescens*, *M. nigricans* (Voigt 2013), *M. lucifugus* (Fuller *et al.* 201i), *Lasiurus cinereus, Lasionycteris noctivagans* (Klug and Baerwald 2010), *Pipistrellus pipistrellus* (Garcês *et al.* 2017), *M. mystacinus*, *Vespertilio murinus,* and *Nyctalus noctula* (Mühldorfer *et al.* 2011).

On the other hand, hair loss or alopecic syndrome is a condition multifactorial in mammals that has been associated with allergens, ectoparasites, fungal dermatitis, bacterial, nutritional deficiencies or toxicities, hormonal imbalances and stress (Noxon 1995; Novak and Meyer 2009; Tang *et al.* 2012; Novak *et al.* 2014; Pugliares-Bonner *et al.* 2018). In bats, this condition it has been reported after disturbance events (Pedersen *et al.* 2012), poor condition habitat, anthropogenic activities, and physiologic stress (Tang *et al.* 2012).

The northern yellow-shouldered bat (*Sturnira parvidens*) is a medium-sized species that inhabits in a wide range of habitats (Gannon *et al.* 1989). It is found in both humid and semi-arid forests and usually it selects moist parts of forests and open areas (Handley 1976). It is widely distributed, occurring probably from Sonora in the Mexican Pacific Slope, and Tamaulipas in the Mexican Gulf Slope, including the Yucatán Peninsula in México, southward to north Costa Rica (Sánchez-Hernández *et al.* 2016; Solari 2019; Hernández-Canchola and León-Paniagua 2020). This bat species has a predominantly frugivorous-omnivorous diet (Sánchez-Hernández *et al.* 2016; Solari 2019), and consumes flowers and fruits from Piperaceae, Solanaceae, Melastomataceae, and Moraceae (Sánchez-Hernández *et al.* 2016).

In this work, we report two anomalies found in two individuals of *S. parvidens*, an individual with a lesion in one metacarpal bone, and other ones with alopecic syndrome on the back at a northwest locality of the state of Hidalgo, México, and we discuss the possible causes.

Bat sampling was carried out on 15 and 16 February 2020 at Pijay locality (20.7749 N, -99.1769 W) from the municipality of Nicolás Flores in the state of Hidalgo, México (Figure 1). This municipality is part of the north of the Valle del Mezquital and is located in the Sierra Madre Oriental mountain range (Sánchez-González *et al.* 2008). The main climate is sub-warm temperate, with an annual average temperature of 16 °C and an annual rainfall of 470 mm; the rainy period is from March to September (Sánchez-González *et al.* 2008). The main types of vegetation present in the municipality are thorny scrub at lowest altitude, and juniper forest, oak forest, and pine-oak forest at highest altitude. The habitat at Pijay locality corresponds to a gallery forest with the presence of thorny scrub on the nearby slopes.

We used three mist nets (two mist nets of 12 m long and one of 6 m long by 2.6 m high; 46.8 m^2 net / night) that were set at ground level and were opened at dusk for five consecutive hours. Mist nets were checked approximately every 20 min and bats were temporarily stored in cloth bags for data processing. All bats were measured and identified to species level using dichotomous keys (Medellín *et al.* 2008; Álvarez-Castañeda *et al.* 2017). *Sturnira parvidens* can be distinguished from the highland yellow-shouldered bat (*S. hondurensis*) by their lower incisor bi-lobbed and the forearm length between 41 to 45 mm (Álvarez-Castañeda *et al.* 2017). In order to avoid recapturing the same individuals during our sampling, the bats were marked in their wing membrane assigning them a consecutive number using a non-toxic permanent marker. Conventional somatic measures were taken for all captured individuals: ear length, forearm length (FAL), metacarpal length of third digit, foot length (± 1 mm precision), and body mass (BM; ± 1 gr precision). The sex and reproductive condition also were determined.

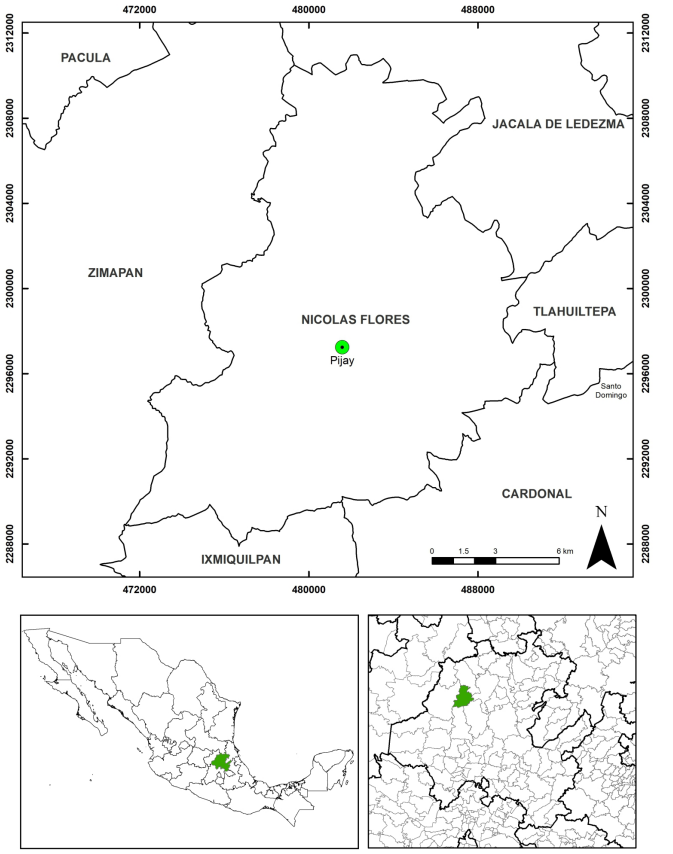

Figure 1. Location of the study area at Pijay from the municipality of Nicolás Flores in the state of Hidalgo, México.

We captured 30 bats from two species belonging to family Phyllostomidae, the northern yellow-shouldered bat, *Sturnira parvidens* (n = 29), and the Aztec fruit-eating bat, *Dermanura azteca* (n = 1; active male). All individuals of *S. parvidens* were adults. From all males (n = 24), three had scrotum testicles. The rest of individuals, including the females (n = 5), were inactive. Two individuals showed physical anomalies; the first one was an adult male with inguinal testicles (FAL = 45 mm, BM = 21 gr) that was caught on 15 February 2020. This male had a lesion on the metacarpal bone of the second finger of the right wing (Figure 2), which visually gives the

appearance that the bone fractured did not heal properly. The second individual was caught on 16 February 2020, it was an adult male with inguinal testicles (FAL = 45 mm, BM = 16 gr) with alopecic syndrome in their back (Figure 2). The affected area by hair loss in back covered 18 x 30 mm.

Bats have the ability to fly actively and possibly due to their maneuverability, high vagility, flight speed, foraging habits, and interaction with predator, the damage to wings is not rare. Wing injures in bats includes a wide variety of damages, both in wing membranes and metacarpal and phalanges bones. It is difficult to determine the real cause of the metacarpal bone injury in the northern yellow-shouldered bat. This type of lesions seems to be result from predator attacks, like cats (Mühldorfer *et al.* 2011), aggressive behavior of other bats, or mechanical damage due to consequence of some bumps against vegetation (Cichocki *et al.* 2019). *Sturnira parvidens* can be classified as a species that forages in highly cluttered spaces and collect fruits close to vegetation (Kalko 1997). In this scenario, it is possible that certain physical obstructions created by trunks, branches, leaves or other elements in the habitats, can affect the performance of the flight of bats and on certain occasions some parts of their wings can be injured. However, because there is not enough information on this topic, to test this preliminary hypothesis more empirical studies to determine the probability of injury occurrence and its possible association with structural characteristics of habitats are needed. On the other hand, bone fractures in bat wings are less frequent compared to other wing damages, such as: tear in wings, losses of finger membrane, or holes in wings (Cichocki *et al.* 2019). According to our observations in the field, apparently this injury does not affect the mobility of this individual, but we do not know if other aspects of their individual fitness may be affected or not, so the future implementation of comparative studies between healthy individuals and with wing lesions could yield answers.

Regarding alopecic syndrome, in bats this condition can arise due to various causes. For example, bats on Montserrat island from the British Crown Colony, this syndrome has been reported due to a zinc deficiency and ingestion of plant toxins (Pedersen *et al.* 2009). Other factors include physiological stress, high ectoparasite loads, or possible mineral deficiencies associated with the ingestion of ash as a consequence of severe alterations in the environment (Pedersen *et al.* 2012).

In southeastern México, alopecic syndrome has been documented in four species of frugivorous bats, including to *S. parvidens* (Bello-Gutiérrez *et al.* 2010). However, the highest prevalence of alopecic syndrome was found in *A. lituratus* (5.6 %), followed by the Jamaican fruit-eating bat (*A. jamaicensis*; 5 %; Bello-Gutiérrez *et al.* 2010). By contrast, for *S. parvidens* and the *S. hondurensis* only one individual (0.4 and 0.6 % of prevalence, respectively) was identified with alopecic syndrome (Bello-Gutiérrez *et al.* 2010). Therefore, we can infer that alopecic syndrome is possibly a rare condition in *S. parvidens*. However, more detailed studies to identify the etiologic agents that produce the alopecic syndrome in the genus *Sturnira* bats are needed.

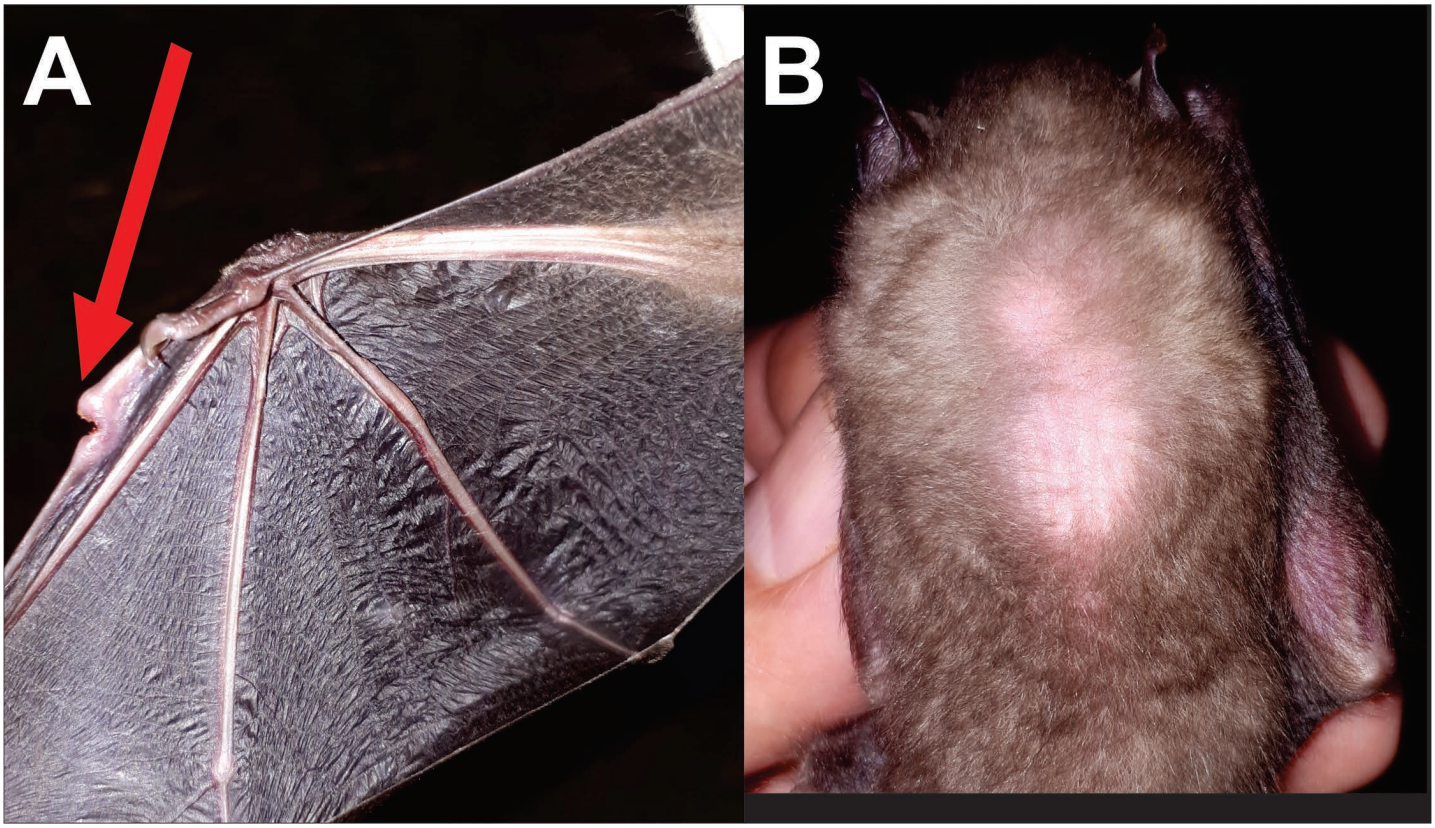

Figure 2. Abnormalities found in the northern yellow-shouldered bat, *Sturnira parvidens* at a northwest locality of the state of Hidalgo, México. A) An adult male with a lesion on the metacarpal bone; the injury is indicated by a red arrow. B) An adult male with alopecic syndrome in their back.

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Consumption event of the Pallas's mastiff bat (*Molossus molossus*) by the Central America bark scorpion (*Centruroides exilimanus*) in Honduras

Evento de consumo del murciélago mastín de Pallas (*Molossus molossus*) por el escorpión de corteza de Centroamérica (*Centruroides exilimanus*) en Honduras

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Many arthropods including scorpions are carnivores, but the feeding habits of many species are unknown. However, it is known they feed primarily on other arthropods and also include annelids and small vertebrates. As such several scorpions are potential mammal predators, but there is not any report on scorpions feeding on bats. Our objective is to report a feeding event on a Pallas's mastiff bat (*Molossus molossus*) by the Central America bark scorpion (*Centruroides exilimanus*) in southern Honduras. In order to document this event, we took photographs of the specimens, and the time the event occurred. There are several buildings and offices at the Clavo Rico mine in El Corpus, Choluteca, Honduras where we have observed three bat colonies. The habitat in this area corresponds to subtropical moist forest. On 20 October 2015 at 11:42 h we found a Central America bark scorpion pulling a female *M. molossus* from the ceiling of a building. The scorpion probably found or captured the bat inside the ceiling, and it already had eaten parts of the bat's head when we found it. Once on the floor the scorpion dragged the bat underneath of the building´s floor. Scorpions are able to predate on vertebrates, although we did not observe the predation event, there are neither reports on bat necrophagy by scorpions and there are no known cases of bat predation by these arthropods. Molossid bats perch in big groups even in sites where scorpions can easily access. A mastiff bat predated in Honduras was much heavier than the bark scorpion that captured it, so if it is a predation event it shows the extraordinary predatory capabilities of an arthropod with a potent venom.

Key words: Arachnids; arthropods; Buthidae; diet; moist forest; tropical habitats.

Muchos artrópodos, incluidos los escorpiones, son carnívoros, pero se desconocen los hábitos alimentarios de muchas especies. Se sabe que se alimentan principalmente de artrópodos e incluyen también anélidos y pequeños vertebrados. Potencialmente varias especies de escorpiones son depredadores de mamíferos, pero no hay ningún informe de consumo de murciélagos por escorpiones. Nuestro objetivo es reportar un evento de alimentación de un murciélago mastín de Pallas (*Molossus molossus*) por el escorpión de corteza de Centroamérica (*Centruroides exilimanus*) en el sur de Honduras. Para documentar este evento, tomamos fotografías de los especímenes y la hora en que ocurrió el evento. Hay varios edificios y oficinas en la mina Clavo Rico en El Corpus, Choluteca, Honduras donde hemos observado tres colonias de murciélagos. Esta mina está ubicada en el bosque húmedo tropical. El 20 de octubre de 2015 a las 11:42 h, encontramos un escorpión que arrastraba un *M. molossus* desde el techo de un edificio. El escorpión probablemente encontró o capturó al murciélago dentro del techo, y ya se había comido partes de la cabeza cuando lo encontramos. Una vez en el suelo, el escorpión arrastró al murciélago debajo del piso del edificio. Los escorpiones pueden depredar vertebrados, aunque no se observó el proceso de depredación tampoco han sido reportados casos de consumo de murciélagos muertos por escorpiones y no se conocen casos de depredación de murciélagos por estos artrópodos. Los murciélagos molósidos descansan en grandes grupos incluso en sitios donde los escorpiones pueden acceder fácilmente. El murciélago era mucho más pesado que el escorpión, por lo que, si este es un evento de depredación, demuestra las extraordinarias capacidades de un artrópodo con un potente veneno.

Palabras clave: Arácnidos; artrópodos; bosque húmedo; Buthidae; dieta; hábitats tropicales.

Neotropical region is characterized by a high species diversity and a wide variety of ecological interactions (Brown 2014). This large diversity of species represents various trophic levels both as predators and prey (Freestone *et al.* 2011). Predation is recognized as the most important cause of mortality in natural populations impacting all life stages (Zug *et al.* 2001). Predator-prey interactions are one of the main drivers of natural selection, ecological structuring of communities, and the functioning of ecosystems (Portalier *et al.* 2019; Valdez 2020).

Arthropods are the most diverse group in tropical habitats, and they are fundamentals to functioning of ecosystem and maintenance of biodiversity (Kremen *et al.* 1993). Many vertebrates (*e. g.*, lizards, birds, and bats) depend on arthropods for their survival (Mooney *et al.* 2010), and *viceversa*, many arthropods are carnivores, especially arachnids and scorpions (Wise 1993; Valdez 2020). Scorpions are both predators and prey of other organisms that form trophic webs (Valdez 2020). Information about food habits of scorpions are scarce and scattered throughout the literature (Barro and Cherva 2013). They feed primarily on other arthropods but include annelids and small vertebrates (McCormick and Polis 1990). Species of the family Buthidae have especially potent venom and include other scorpions, spiders, centipedes, chilopods, and insects in their diet (Koch 1977; McCormick and Polis 1990), and are also a human health concern (Borges *et al.* 2012).

A majority of terrestrial arthropods are primarily carnivorous, and those that are venomous tend to feed on larger prey than the non-venomous species (Molinari *et al.* 2005). Examples of predatory arthropods are praying mantises, wasps, mygalomorph spiders, scorpions, solpugids, decapod crustaceans, and scolopendrid centipedes (McCormick and Polis 1990; Molinari *et al.* 2005). While although all of these are potential bat predators (Molinari *et al.* 2005), there have been no previous reports of bat predation and consumption by scorpions. The Central America bark scorpion (*Centruroides exilimanus* Teruel and Stockwell, 2002, Scorpiones: Buthidae) is one of nine scorpion species known for Honduras (Teruel and Stockwell 2002).

Pallas's mastiff bat (*Molossus molossus* Pallas 1766 - Molossidae) roosts in hollow trees, coconut palms, mines and buildings (Mora *et al.* 2018). It is a common "house bat" that roosts in building ceilings and roofs in large colonies (Barros 2014). Specific predators of this species are unknown in Honduras (Mora *et al.* 2018). However, several bird species are known predators of *M. molossus* through its distribution range: black-and-white owl (*Ciccaba nigrolineata*), merlin (*Falco columbaris*), peregrine falcon (*Falco peregrinus*), and great kiskadee (*Pitangus sulphuratis*; Loureiro and Lim 2019). Here, we report a case of *C. exilimanus* feeding on *M. molossus* in southern Honduras.

We observed what appears to have been predation of *M. molossus* by *C. exilimanus*. We photographed the event as it occurred. The identification of the scorpion was determined based on Teruel and Stockwell (2002), and subsequently confirmed by R. Teruel (pers. comm.). The bat identification was based on Mora (2016). Our observations were at the Clavo Rico mine in the Municipality El Corpus, Department of Choluteca in southern Honduras (13° 17′ 19″ N, 87° 01′ 47″ W; Figure 1). There are several buildings and administration offices at this mine. There are known molossid colonies in three of the buildings, as well as abandoned tunnels in the mine used as bat roosts (M. Espinal, pers. obs.). El Corpus is at an elevation range between the lowland coastal plain of tropical dry forest life zone and the pine-covered highlands (Zerbock 2005). It is located 17 km east of the city of Choluteca at an elevation of 390 m (Zerbock 2005). The whole municipality is very mountainous with elevations ranging from 80 m where the foothills meet the Choluteca valley, to over 1,000 m at the eastern section at the limit with the municipality of San Marcos de Colón (Zerbock 2005). The vegetation is tropical moist forest influenced by the tropical dry forest with several deciduous tree species (Mayorga 1989; COHDEFOR 1994). The area is somewhat cooler than the lowlands reflecting the topography with an average annual temperature of 25.5 °C, that reaches 28 °C in March (Mayorga 1989).

On 20 October 2015 at 11:42 h, we observed a scorpion *C. exilimanus* pulling a female bat *M. molossus* from the ceiling of a building at the Clavo Rico mine. The scorpion was observed as it was emerging from the ceiling of an office and moving down the wall (Figure 2). We assume that the scorpion found or captured the bat inside the ceiling space where there is a colony of *M. molossus*. When we approached the scorpion, it moved down the wall until it reached the floor, but never released the bat holding it with the chelicerae. Neither our presence nor the camera light or sounds disturbed the scorpion. When we attempted to grab the bat, the scorpion did not release it and continued moving. When discovered, the scorpion had already eaten parts of the bat's head. After emerging from ceiling, the bat was on the scorpion's back as it carried it down the wall to the floor then proceeded to drag the bat in the floor, where we captured it for identification.

As we did not witness the initial encounter between the scorpion and the bat, we were unable to verify if this was predation or scavenging. However, the dead bat was fresh and soft and we surmised it had been recently killed (Figure 2). It did was not dry or stiff nor have any odor of decay. When we attempted to grab the bat, the scorpion did not release it suggesting that it perceived the movement as the struggling of its prey. This suggested that the scorpion had recently killed the bat and did not want to lose its prey.

This is the first record a scorpion eating a bat. Although scorpions are predators, their relationship with vertebrates is generally as prey despite being venomous (Polis et al. 1981; Valdez 2020). Two bat species, *Otonycteris hemprichii* and *Antrozous pallidus*, are known to prey on scorpions. Up to 70 % of the feces of *O. hemprichii* contained scorpion fragments (Holderied *et al.* 2011) and *A. pallidus* includes scorpions in its diet and is resistant to the venom of *C. sculpturatus* (Hopp *et al.* 2017). However, there are many records of terrestrial arthropods that prey on vertebrates (Valdez 2020). These include insects, spiders and scorpions that feed on small lizards (Blondheim and Werner 1989; Jehle *et al.* 1996; Pérez *et al.* 2010; Pérez and Minoli 2014). Scalloped centipedes prey on anurans, small lizards, small birds, mice and bats (Molinari *et al.* 2005; Martínez-Coronel *et al.* 2019; Valdez 2020).

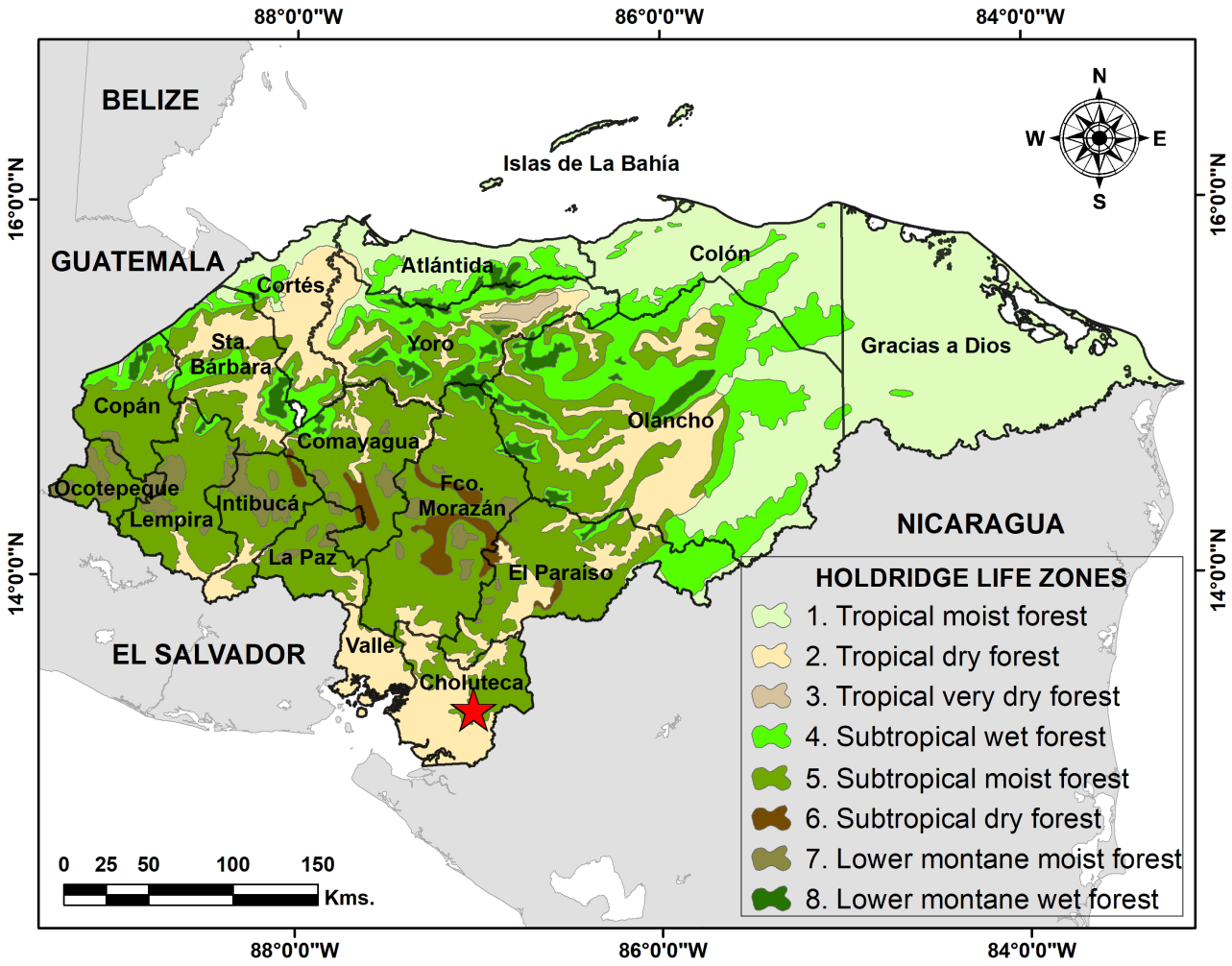

Figure 1. Distribution of life zones in Honduras according to the Holdridge classification system. The red star indicates the location of the Clavo Rico mine, El Corpus, Choluteca, southern Honduras.

The most common mammals predated by arthropods are bats and rodents, mainly spiders and centipedes (Valdez 2020). The most prominent predators of bats in general are owls, hawks, and snakes (Nyffeler and Knörnschild 2013). Predators of Pallas's mastiff bat include owls, falcons and the great kiskadee (Loureiro and Lim 2019). However, few large arthropods are also occasional bat predators (Molinari *et al.* 2005; Altringham 2011; Nyffeler and Knörnschild 2013) or take advantage of carcasses (Prous *et al.* 2017). The centipede *Scolopendra gigantean* was observed killing and eating individuals of three species of bats: *Mormoops megalophylla*, *Pteronotus davyi* (Mormoopidae) and *Leptonycteris curasoae* (Phyllostomidae) in a cave in Venezuela (Molinari *et al.* 2005). *Scolopendra viridicornis* predated to *Eptesicus furinalis* (Vespertilionidae) in a cave in Reserva Natural Vale, Espirito Santo, Brazil (Srbek-Araujo *et al.* 2012), and *M. molossus* in Cristalino State Park, Mato Grosso, Brazil (Noronha *et al.* 2015). *Scolopendra sumichrasti* was observed predating on *Natalus mexicanus* (Natalidae; Martínez-Coronel *et al.* 2019).

The most common arthropods that prey on bats are spiders with reports from almost every continent, especially from the Neotropics (Nyffeler and Knörnschild 2013). Spiders use sticky webs that opportunistically capture bats (Nyffeler and Vetter 2018). There is little information on other predators, particularly in the tropics where bats and their predators are most diverse. Scorpions have venomous stingers and a foraging strategy that enables them to be predators of small mammals that are encountered in their forest environments (Valdez 2020). Up to 10 % of scorpion diets are snakes (Greene 1997) which they are able to subdue with neurotoxins (Valdez 2020).

Prior to this report there have been no previous reports of scorpions preying on bats. It is possible that bat predation by scorpions may be more frequent than thought, especially on molossid bats which roost in large colonies that include building roofs where scorpions would have ready access (Mora *et al.* 2018; Loureiro and Lim 2019). Venomous arthropods capture larger prey than non-venomous ones (McCormick and Polis 1982). Therefore, the more venomous the arthropod the larger the prey it should be able to catch. In this case the mastiff bat was considerably larger than the bark scorpion that apparently captured it. This suggests that venomous arthropods have greater range of potential prey. Predation on vertebrates by arthropods is uncommon in ecological studies, as it is not frequently

Figure 2. A Central America bark scorpion (*Centruroides exilimanus*) going out from the ceiling of an office with a female Pallas's mastiff bat (*Molossus molossus*) at the Clavo Rico mine, El Corpus, Choluteca, Honduras.

observed and considered as rare events (Valdez 2020). Recognizing and quantifying such predator-prey interactions will further identify patterns and potential impacts of such relationships and how it may shape vertebrate populations and communities (Valdez 2020).

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New records of *Castor canadensis* from the Conchos River, Chihuahua, México

Nuevos registros de *Castor canadensis* en el Río Conchos, Chihuahua, México

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The North American beaver (*Castor canadensis*), has not been recorded in Chihuahua since 1972. We surveyed several sections of the Conchos River and its affluents in different areas of Chihuahua by walking along the rivers or canoeing looking for signs of their presence (tracks, gnawed tree trunks, felled trees and dens), in areas were beavers have been recorded in the past. We found no beavers in the surveyed areas of the Conchos River and its tributaries. The only place at Conchos River that we found them was at Pegüis Canyon. The area is the only well-preserved habitat where beavers were found. This beaver population is probably derived from the beavers found at Río Grande near Ojinaga or from the Natural Protected Area of Cañón de Santa Elena further south. Our findings suggest that the area is fairly well-preserved and important for the distribution of beavers in northern México. There is a clear need to conserve this section of the Conchos River as an important corridor for beavers, which are listed as endangered by NOM-059-SEMARNAT-2010.

Key words: Aquatic mammal; beaver; biodiversity; conservation; Pegüis Canyon; riparian habitat.

El castor (*Castor canadensis*), no ha sido registrado en el Estado de Chihuahua desde 1972. Monitoreamos varias secciones del Río Conchos y sus afluentes en diferentes localidades de Chihuahua, caminando por las orillas del río o usando canoas, buscando indicios de su presencia (huellas, troncos roídos o derribados y madrigueras), en donde los castores habían sido registrados con anterioridad. No se encontraron castores en las áreas monitoreadas del Río Conchos y sus tributarios. El único sitio en este río en donde los encontramos fue en el Cañón del Pegüis. Esta localidad es el único hábitat bien preservado para los castores. Esta población de castores probablemente se deriva de los castores del Río Grande cerca de Ojinaga o de los castores del Área Natural Protegida Cañón de Santa Elena más al sur. Nuestros hallazgos sugieren que el área se encuentra bien conservada y que es importante para la distribución de los castores en el norte de México. Existe una clara necesidad de conservar esta sección del Río Conchos como un importante corredor para los castores, cuya especie se encuentra protegida, listada como en peligro de extinción por la NOM-059-SEMARNAT-2010.

Palabras clave: Biodiversidad; castor; conservación; Cañón del Pegüis; hábitat ripario; mamífero acuático.

Beavers have a northern distribution in México, they mainly inhabit the basins of rivers flowing northwestward, northward, or northeastward in the Río Bravo (Río Grande), or southward in the Colorado River (Leopold 1959). In the State of Sonora, beavers inhabit the Bavispe River basin, which flows westward from the Sierra Madre Occidental in western Chihuahua (Gallo-Reynoso *et al.* 2002; Caire 2019) and its tributary, the Cajón Bonito River, which flows southward from the Sierra San Luis mountain range (Gallo-Reynoso pers. obs.; Pelz-Serrano *et al.* 2005). On the other hand, beavers also live in the San Pedro River (a tributary of the Gila River, Arizona), which flows in a northwest-north direction and joins the Colorado River in western Arizona (Olivares-Rivera 2018). Beavers were extirpated from the Sonora River in the early twentieth century when copper mines started operations in the Cananea region, and the river waters were heavily used along with extensive logging to feed water vapor for the machinery used in mills and for smelting copper ore (Mearns 1907; Villa-Ramírez 1954; Caire 2019).

Beavers extended the southern end of their range into México during the Miocene and Pliocene (Rybczynski *et al.* 2010). The current extensive vicariant distribution range of beavers in México probably dates back to the last glacial period (20,000 to 12,000 years before present) that reached the northern border of México (states of Tamaulipas, Nuevo León, Coahuila, Chihuahua, Durango, Sonora, and Baja California), driving the distribution of beavers southward. Then, the range of beavers retracted northward following the melting and redistribution of ice during the Pleistocene glaciation events (Rybczynski *et al.* 2010). Whole riparian ecosystems that had dominated the landscape during the glacial period also moved north. This riparian ecosystem gave rise to extensive biogeographic barriers such as the Chihuahuan and Sonoran deserts, and the subtropical temperate areas found in Texas and Tamaulipas plains. The basins of the rivers mentioned above remained after the glaciations due to high-elevation mountain ranges such as the Sierra Madre Oriental, the Rocky Mountains, and the Sierra Madre Occidental, leading to the vicariant distribution of beavers (López-Wilchis 1998).

Beavers in the Río Bravo basin are found on both sides of the U. S. A.-México border in the states of Chihuahua and Tamaulipas, in the protected areas Área de Protección de Flora y Fauna Cañón de Santa Elena (Santa Elena Canyon Protected Area for Flora and Fauna) and Big Bend National Park (Carreón-Hernández 2014). Beavers have also been recorded occasionally in other areas of Baja California, Chihuahua, Coahuila, Nuevo León, and Tamaulipas since 1965 (Leopold 1959; Vásquez-Farías 1996; López-Wilchis 1998; Mellink and Luévano 1998; Espinoza-Martínez *et al.* 2016). A specimen collected by Goldman in 1902 is the last known record of a beaver from the Conchos River in central Chihuahua (Bailey 1905; Anderson 1972). Evidence of beavers in gnawed tree trunks, tracks, and dens at Mezquite, a locality near the Pegüis Canyon, on the Conchos River closer to Ojinaga was observed by Anderson (1972). No new records of beavers beyond those mentioned by Anderson (1972), or the ones found by López-Wilchis (1998) near Ojinaga on the Río Grande (Río Bravo), and of those mentioned by López-González and García-Méndoza (2012). Years later, beaver tracks were mentioned by interviewed people in the Pegüis Canyon by Jiménez-González *et al.* (2004). Here we report on new records that confirm the presence of beavers in the Conchos River, specifically in the Pegüis Canyon, and discuss the current distribution and conservation status of beavers in the state of Chihuahua, México.

A field expedition to survey the Conchos River for river otters and beavers was conducted on October 24-27, 2019. We were searching for tracks, footprints, gnawed bark, felled trees and dens to confirm beaver presence; observations of tracks, footprints, gnawed bark and dens were identified according to Murie and Elbroch (2005) and identification of trees were done based on photographs and interviewed local people and their confirmed presence mentioned on Jiménez-González *et al.* (2004). We used canoes to survey both banks of the Conchos River in the Pegüis Canyon area. We canoed for four kilometers to a point located one km beyond the Mirador resting area on the MX 16 (Chihuahua - Ojinaga) highway. Beaver locations were registered with a GPS, readings taken at each location were corrected *a posteriori* to account for the poor reception inside the canyon (Figure 1). Other reaches of the Conchos and its affluents were surveyed for the presence of beavers in 2018 and 2019 by walking 5 km along both riverbanks searching for signs of beaver presence. Surveyed rivers in Central Chihuahua were: four sites at Conchos River, two sites at San Pedro River, two sites at Balleza River, two sites at Santa Isabel River and one site at Satevó River. In Durango, one site at Florido River (Table 1).

We found signs of beaver presence (*e. g.*, footprints, tracks and gnawed bark and tree trunks) in several muddy or sandy beaches along the riverbanks. We also surveyed a small section of the northern end of the Pegüis Canyon, where we found the gnawed bark of a pirul tree (*Schinus molle*) on the western bank of the river (Figure 2). Pirul trees were introduced to this part of Ojinaga many years ago and were planted on the site to provide shade for an eco-tour-

Table 1. Locations surveyed for the presence of North American Beaver (*Castor canadensis mexicanus*) in Central Chihuahua with no indications of their presence. *Near Ciudad Camargo (locality from Anderson 1972). ** In the state of Durango.

ID Number	River	Locality	Latitude (N)	Longitude (W)	Elevation (m)
1	Conchos	Valle de Zaragoza	27° 24.549′	105° 50.830′	1,343
2	Conchos	N of Valle de Zaragoza	27° 27.610′	105° 49.237′	1,333
3	Conchos	Below La Boquilla reservoir*	27° 32.911′	105° 24.697′	1,260
4	Conchos	El Granero reservoir	27° 58.403′	105°17.902′	1,042
5	San Pedro	Near Santa María de Cuevas	27° 51.578′	106° 20.419′	1,463
6	San Pedro	Below Las Vírgenes reservoir	28° 09.760′	105° 37.274′	1,199
7	Balleza	La Cruz	26° 54.660′	106° 19.841′	1,584
8	Balleza	Balleza	26° 58.485′	106° 20.773′	1,556
9	Florido	Near Villa de Ocampo**	26° 26.635′	105° 33.107′	1,738
10	Santa Isabel	Charco Largo	28° 17.918′	106° 16.637′	1,538
11	Santa Isabel	Near Ejido San Miguel	28° 11.142′	106°13.754′	1,478
12	Satevó	Near bridge of MX 24	27° 57.958′	106° 08.521′	1,391

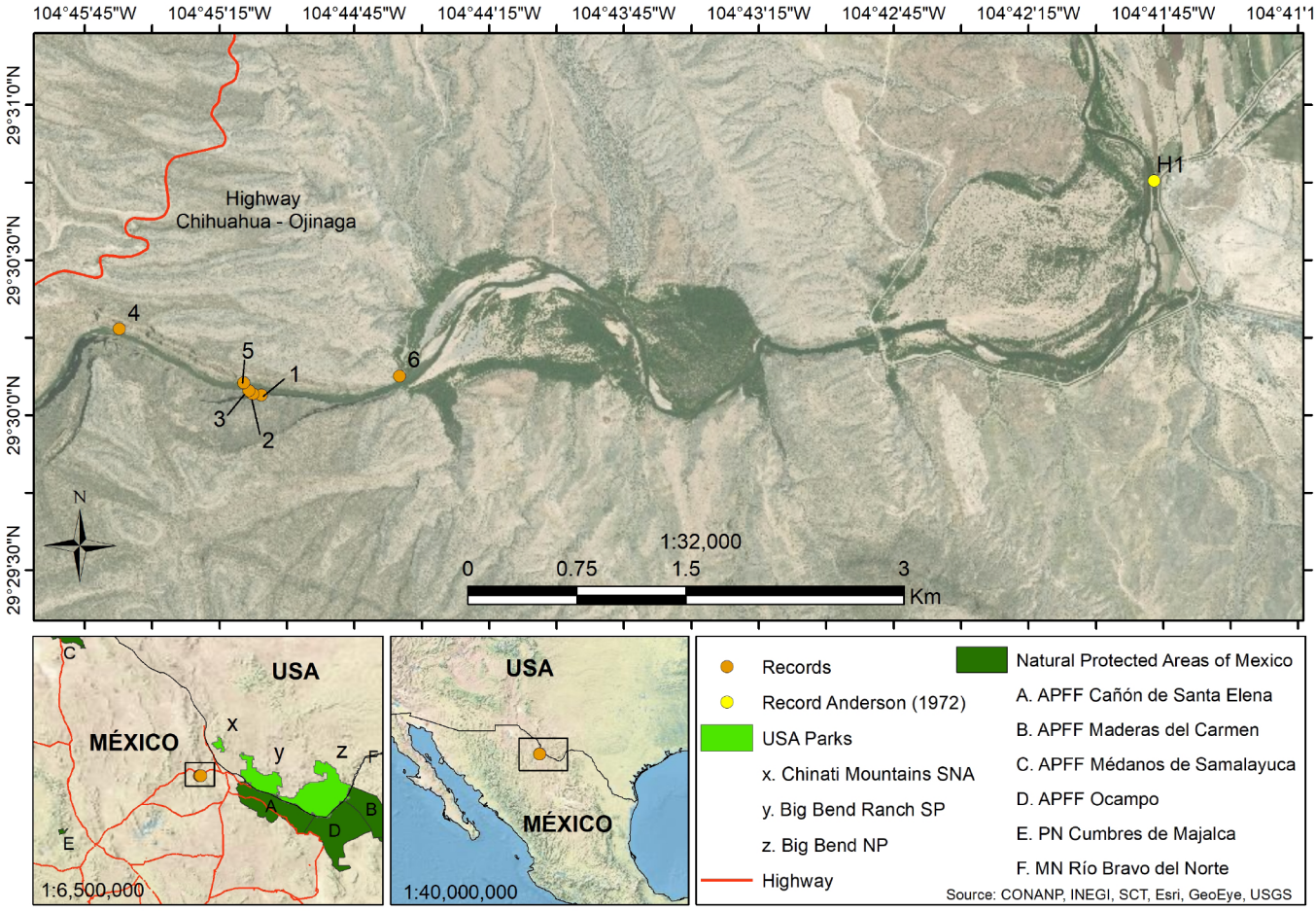

Figure 1. Orange dots are the new records of beaver (*Castor canadensis mexicanus*) in the Pegüis Canyon, Conchos River, Chihuahua. The numbers on the figure correspond to the localities in Table 2. H1 with a yellow dot, marks the Mezquite locality outside the Pegüis Canyon where Anderson (1972) recorded beavers. The inset maps show the current protected areas in México and the United States of America, showing the lack of protection for this species (left), and the general area in México where these new records were noted (right).

ism spot. Beaver activity was evident in this zone where the bark and small branches of other five pirul trees had been gnawed and taken away, causing the death of some of them. In addition, small branches of mesquite trees (*Prosopis glandulosa*) had also been cut down and carried to the river by beavers (Table 2).

The beaver habitat in the area was found to be well-preserved. The river banks were covered by dense tree vegetation dominated by mesquite (*Prosopis glandulosa*), palo verde (*Parkinsonia microphylla*), huizache (*Acacia* sp.), willows (*Salix* sp.), cottonwood (*Populus* sp.), saltcedar (*Tamarix ramosissima*), and giant reed (*Arundo donax*), together with tall shrubs such as jarilla (*Baccharis neglecta*), and a lower layer including thorny shrubs such as gatuño (*Acacia greggii*) and several grass and herb species. Inside the Pegüis Canyon, the vegetation of sandy banks consisted mostly of thickets of giant reed and jarilla; in contrast, mesquite, willow, and cottonwood were common on more rocky substrates. Vegetation beyond the riverbanks consisted mainly of lechuguilla (*Agave lechugilla*), creosote bush (*Larrea tridentata*), ocotillo (*Fouqueira splendens*), sotol (*Dasilyrion* sp.), prickly pear (*Opuntia* spp.), and other cacti and yucca (*Yucca* spp.).

The beaver habitat at the Pegüis Canyon is a long stretch of almost vertical, high rocky walls reaching 350–400 m (Figure 2); it is the boundary between the Sierra del Pegüis and Sierra de Matasaguas mountain ranges, the canyon is formed of Upper Cretaceous limestone (Flotte *et al.* 2008). The Conchos River meanders inside the canyon along 17 kilometers from its source at El Álamo to its mouth near the Mezquite locality. The river shows broad shallow reaches with sandy gravel bottom at the lower parts of the canyon, and narrow reaches with deep pools at the uppermost parts. A rocky barrier formed of large boulders that have fallen from the sheer walls occurs in the middle segment of the canyon; this section of the river is difficult to navigate due to the numerous rapids and flooding events in the rainy season (Jiménez-González *et al.* 2004). Faulting is evident in the extensive longitudinal cuts at various angles that form terraces at different inclination angles and heights. Riverbanks are made up of boulders, fallen rock debris, and sand/gravel or mud/sand beaches covered by vegetation.

Regarding biodiversity in the beaver's riparian habitat, that add importance to the canyon, we observed other fauna, such as a gray fox (*Urocyon cinereoargenteus*) in a crevice in the canyon wall on the western riverbank; several tracks of Nearctic otter (*Lontra canadensis*) on both sides of the river on sandy areas with patches of grass, giant reed, and jarilla; and tracks of raccoon (*Procyon lotor*) on muddy

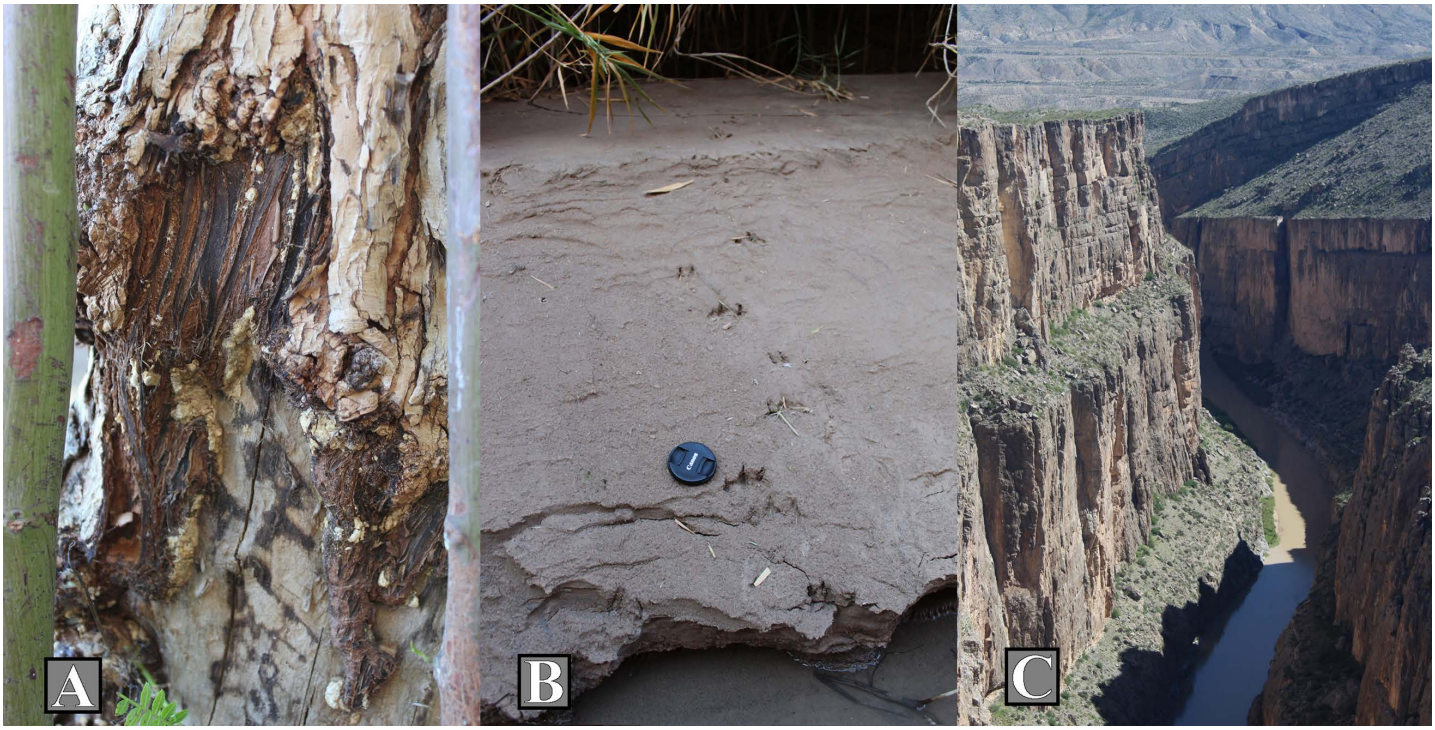

Figure 2. A) Trunk of a pirul tree (*Schinus molle*) gnawed by North American beavers (*Castor canadensis*) at the mouth of the Pegüis Canyon (Photo: I. Barba-Acuña). B) Beaver tracks on a sandy riverbank in the beaver's habitat. C). View of the Pegüis Canyon, the habitat of beavers at this portion of Conchos River (Photos: J. P. Gallo-Reynoso).

and sandy substrates. We also identified nests of cliff swallow (*Petrochelidon pyrrhonota*) on some cliffs, and several individuals of Gray heron (*Ardea herodias*), killdeer (*Charadrius vociferus*), and black phoebe (*Sayornis nigricans*), as well as individuals and nests of Comanche paper wasps (*Polistes comanchus*). Some fishes were observed but were unidentifiable because of the turbid water.

The middle portion of the Conchos River at Ciudad Camargo has not been thoroughly surveyed for the presence of beavers to confirm or dismiss previous records. We surveyed the banks of the Conchos River at Valle de Zaragoza, below the La Boquilla reservoir near Ciudad Camargo (at the locality referred to by Anderson 1972) or at El Granero reservoir. Surveys were also made at several affluents of the Conchos River; below Las Vírgenes reservoir on the San Pedro River, at Balleza River, at Río Florido, at Santa Isabel River and at Satevó River. We found no signs of gnawed or downed tree trunks, dens, or beaver tracks in any of these sites, although the local inhabitants (fishermen, ranchers, and farmworkers) of Conchos River know of their presence of or did observe beavers several decades ago before the reservoirs were built.

Our observations confirm the presence of the North American beaver in the Pegüis Canyon and add new records to the list of the fauna of this area, whose biodiversity, historic, and scenic values should be preserved (Jiménez-González *et al.* 2004). The beaver population in this area is probably derived from the beavers found at Río Grande near Ojinaga or from the Natural Protected Area of Cañón de Santa Elena further south. Our findings are significant and suggest that the area is fairly well-preserved and important for the distribution of beavers in northern México, which enhances the need for conservation of this section of the Conchos River as an important corridor for the species. However, this area on the Conchos River is currently not protected to safeguard either beaver populations or the biodiversity of the Pegüis Canyon (Figure 1).

Table 2. Location of new records of North American beaver (*Castor canadensis mexicanus*) from the Pegüis Canyon, Conchos River, Chihuahua. *Record near tracks of the Nearctic otter (*Lontra canadensis*). H1: record at the Conchos River from Anderson (1972). Numbers in the table correspond to the map on Figure 1.

ID Number	Record type	Latitude (N)	Longitude (W)	Elevation (m)
1	Tracks on a sandy riverbank	29° 30.041′	104° 45.116′	938
2	Tracks on a sandy riverbank	29° 30.068′	104° 45.127′	943
3	Tracks on a sandy riverbank, den, on an area dominated by giant reed (*Arundo donax*)	29° 30.078′	104° 45.142′	944
4	Tracks on a muddy riverbank	29° 30.338′	104° 45.596′	985
5	Tracks on a sandy riverbank*	29° 30.104′	104° 45.160′	930
6	Gnawed trunk of a pirul tree (*Schinus molle*)	29° 30.126′	104° 44.583′	836
H1	Approximate location of the "Mezquite" record from Anderson (1972)	29° 30.756′	104° 41.784′	819

It is worth noting that, before entering the Pegüis Canyon, the waters of the Conchos River flow through vast agricultural and urban areas in the central part of Chihuahua State, where numerous dams divert water to irrigation channels and the river receives urban and agricultural wastewater. Such conditions warrant the close monitoring of water quality and beaver occupation in the area to ensure the long-term survival of beavers which are listed as endangered by Mexican Official Norm NOM-059-SEMARNAT-2010 (SEMARNAT 2010), and to preserve the biodiversity and scenic values of the Pegüis Canyon.

This note is dedicated to the memory of Dr. Sydney Anderson (1927-2018) that conducted extensive fieldwork in Chihuahua in 1952, and from 1956-1960. He collected and prepared over 1,000 mammals from Chihuahua and produced an extensive reference of the mammals found in the state (Gardner *et al.* 2020).

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