



SHORT COMMUNICATION

First records of the seven-banded armadillo (*Dasypus septemcinctus*) and the six-banded armadillo (*Euphractus sexcinctus*) in northwestern Bolivia

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Abstract Armadillos are poorly studied in Bolivia and there is little information on their ecology, natural history, and distribution in the country. Here we increase the knowledge of the geographic distribution of two species of armadillos, *Dasypus septemcinctus* and *Euphractus sexcinctus*, with new camera trap-derived distribution records in northwestern Bolivia, in the department of La Paz. These new records are the westernmost records of the geographic distribution of both armadillos and are also new records for Madidi National Park and Natural Area of Integrated Management.

Keywords: armadillos, camera traps, Madidi National Park and Natural Area of Integrated Management, new records

Primeros registros del armadillo de siete bandas (*Dasypus septemcinctus*) y el armadillo de seis bandas (*Euphractus sexcinctus*) en el noroeste de Bolivia

Resumen Los armadillos están poco estudiados en Bolivia y hay escasa información sobre su ecología, historia natural y distribución en el país. Aquí aumentamos el conocimiento de la distribución geográfica de dos especies de armadillos, *Dasypus septemcinctus* y *Euphractus sexcinctus*, con nuevos registros de distribución obtenidos con cámaras trampa en el noroeste de Bolivia, en el departamento de La Paz. Estos nuevos datos son los registros más occidentales de la distribución geográfica de ambos armadillos y también son nuevos registros para el Parque Nacional y Área Natural de Manejo Integrado Madidi.

Palabras clave: armadillos, cámaras trampa, nuevos registros, Parque Nacional y Área Natural de Manejo Integrado Madidi

Armadillos belong to the order Cingulata and are characterized by having a dorsal carapace formed by juxtaposed plates arranged in transverse rows, with tails and short limbs. Armadillos are distributed from the central United States to the southern tip of Argentina (Wetzel, 1985; Eisenberg & Redford, 1999; Noss *et al.*, 2010). Many armadillo species are threatened by habitat loss and

degradation, as well as overhunting (Superina & Abba, 2020).

Bolivia is one of the countries with the greatest richness of armadillos, with at least 11 species distributed in different habitats (Aguirre *et al.*, 2019). In northern Bolivia, six species are present, three of the genus *Dasypus* and one species each of the

genera *Cabassous*, *Euphractus*, and *Priodontes* (Noss *et al.*, 2010). The seven-banded armadillo (*Dasypus septemcinctus* Linnaeus, 1758) and the six-banded armadillo (*Euphractus sexcinctus* Linnaeus, 1758) are species with few distributional records in northern Bolivia, as compared to *D. novemcinctus* and *D. beaniensis*. *Dasypus septemcinctus* is the smallest species of the genus (total head-body length: 380–525 mm), with six to seven mobile bands on its carapace and a very short tail (Noss *et al.*, 2010; Superina & Abba, 2018). It has the southernmost distribution of the genus, occurring in Brazil, Paraguay, Bolivia, Uruguay, and Argentina. It is present in savanna, grassland, forest, and disturbed habitats (Noss *et al.*, 2010; Feijó, 2020). Until 2010, in Bolivia there were only 22 confirmed records of this species in the Beni, Santa Cruz, and Tarija departments, at altitudes between 100 and 800 m asl (Noss *et al.*, 2010; Wallace *et al.*, 2013) (FIG. 1).

The six-banded armadillo (*E. sexcinctus*) has a chunkier appearance, with 6–7 mobile bands on the carapace, a total head-body length of 355–540 mm,

and a distinctive triangular-shaped head (Noss *et al.*, 2010; Superina & Abba 2018). It is distributed from southern Suriname to northern Argentina, in savanna, scrub, and dry and semi-deciduous forest habitats (Noss *et al.*, 2010). In Bolivia, until 2010, there were a total of 276 records in the departments of Beni, Santa Cruz, Chuquisaca, Tarija, and La Paz, in an altitudinal range from 100 to 894 m asl (Noss *et al.*, 2010; Wallace *et al.*, 2013). In 2016 two more records of the six-banded armadillo were added by camera traps in the Beni Department (Ayala *et al.*, 2017) (FIG. 1).

During 2017, as part of the scientific expedition Identidad Madidi (Identidad Madidi & SERNAP, 2020), a research campaign was conducted to record the biodiversity of the middle part of the Heath river, including efforts to sample the natural pampas grasslands in the Pampas del Heath. This work reports new records of two armadillos, *D. septemcinctus* and *E. sexcinctus*, in northwestern Bolivia and updates their national and global distribution.

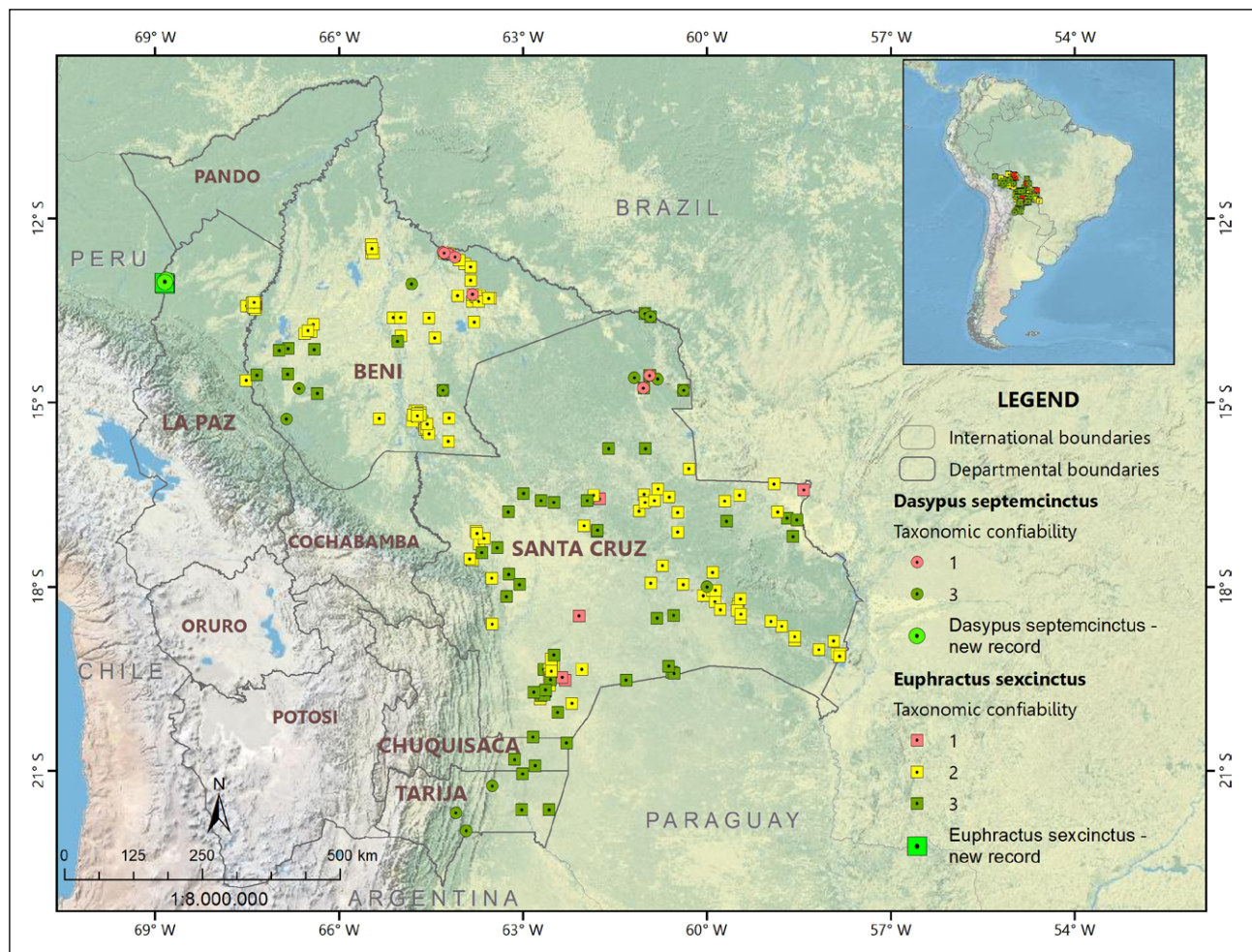


FIGURE 1. Updated geographic distribution of the six-banded armadillo (*Euphractus sexcinctus*) and the seven-banded armadillo (*Dasypus septemcinctus*) with new records in northwestern Bolivia and previously published records (Wallace *et al.*, 2013; Ayala *et al.*, 2017). **Confidence level 1 – Low:** Interviews; **Confidence level 2 – Medium:** Footprints – tracks, **Confidence level 3 – High:** Direct observation, specimen collected and photographs.



FIGURE 2. Camera trap record of the six-banded armadillo (*Euphractus sexcinctus*) in the Pampas del Heath, Madidi National Park and Natural Area of Integrated Management, Bolivia.

The study was conducted in the Heath basin in the Madidi National Park and Natural Area of Integrated Management (Madidi NP NAIM). The site has a slight altitudinal gradient of 194 to 222 m asl. The main camp was located in Puerto Moscoso (13°0'59.33"S, 68°51'7.14"W), a three-day boat ride from Puerto Chive. The survey was conducted from 20 June to 17 July 2017.

In general, the climate is warm, humid and tropical, with a marked dry season between May and October, and a total annual precipitation of approximately 2000 mm. The average temperature is between 24 and 26 °C (Montambault, 2002). The study area presents flooded forest, terra firme forest, pampas transition forest (chaparral or scrub), forest islands, gallery forest, and palm groves associated with savannas and swamps. The Pampas del Heath are a unique vegetation formation associated with fire dynamics, drainage and micro-relief (Montambault, 2002; Identidad Madidi & SERNAP, 2020). The Pampas del Heath are little explored, especially in the flooded parts.

Two methodologies were employed to record medium and large-sized mammals in the Pampas del Heath: camera trap surveys and line transects. A total of 71 camera trap stations were placed (savanna n = 15; forest n = 56), with a distance between stations of 0.7–2 km, collectively covering an effective area of 152.58 km² in forest and 31.58 km² in savanna habitats (savanna edge, forest island, and savanna scrub habitats). All cameras were programmed to operate 24 hours a day, taking 10 photos for each event at 1-minute intervals. All stations were active for 25 effective days.

A 4 km long path was enabled in the pampas to apply the line transect methodology. The routes were carried out during daylight hours starting at 06:30 h, at a rate of approximately 1 km/hour.

Camera trapping efforts in the Pampas del Heath yielded a sampling effort of 373.44 trap nights in savanna and 1,505.96 trap nights in forest habitats. Line transects amounted to a total distance of 48 km.

Euphractus sexcinctus was recorded with camera traps (**FIG. 2**) at two stations in savanna-scrub at distances of 51 and 140 m from the forest edge. *Dasypus septemcinctus* was recorded with camera traps (**FIG. 3**) in the natural savanna at 870 m distance from the forest edge and in line transects at 550 m from the edge (**TABLE 1**).

The records of both armadillos in the Pampas del Heath are the first for the Madidi national protected area, and the first of *D. septemcinctus* for the La Paz Department. These observations are also the westernmost records of the overall distribution of both species.

Both species of armadillos presented low occurrence of records, suggesting that they are species of relatively low abundance. Camera trapping with 25 days of effective sampling recorded *E. sexcinctus* twice and *D. septemcinctus* once, and in 23 days of line transect sampling *D. septemcinctus* was registered once. Three other armadillo species were also registered during fieldwork: *D. novemcinctus* (n = 231 photographs; n = 18 independent events), *D. beniensis* (n = 184 photographs; n = 11 independent events), and *Priodontes maximus* (n = 24 photographs; n = 3 independent events) (Ayala & Viscarra, 2018).

The closest records of *E. sexcinctus* with high taxonomic reliability (camera trap records) to the new records reported in this study are in General José Ballivian Province, Beni Department (Ayala *et al.*, 2017), at a distance of 235 km (**FIG. 1**). The closest record of *D. septemcinctus* with high taxonomic reliability (specimen) to those reported in this study is found in the San Borja municipality, General José Ballivian Province, Beni Department (Wallace *et al.*, 2013), at a distance of 307 km (**FIG. 1**). The records of both species of armadillos in the Pampas del Heath are the first for northwestern Bolivia, as well as the westernmost records of their distribution in South America. Therefore, this finding expands the known distribution of both species. It is also likely that their distribution extends throughout the Pampas del Heath (approximately 587 km²), including the small piece of Pampas on the Peruvian side of the Heath river. Given the proximity of these records to the Peruvian portion of the Pampas del Heath grasslands, surveys in Peru are urgently required as both would be new species for the country.

We recommend further studies focused on estimating the population status of both armadillos in this area. Globally, both species are currently classified as Least Concern (LC) according to the IUCN



FIGURE 3. Camera trap record of the seven-banded armadillo (*Dasypus septemcinctus*) in the Pampas del Heath, Madidi National Park and Natural Area of Integrated Management, Bolivia.

(Abba *et al.*, 2014; Anacleto *et al.*, 2014) and Data Deficient (DD) at the national scale (Tarifa & Aguirre, 2009).

Finally, this study is one of the fruits of the scientific expedition Identidad Madidi, which increased knowledge about the conservation importance of the Pampas del Heath. Representing the last remnants of natural savannas in the country, the Pampas del Heath are home to a great biological diversity, and as studies increase, more of their secrets and conservation values will be revealed.

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TABLE 1. Records of *Dasypus septemcinctus* and *Euphractus sexcinctus* with camera traps and line transects in the Pampas del Heath, Madidi National Park and Natural Area of Integrated Management, Bolivia. **CT:** camera traps, **T:** transects.

| Species | Date | Time | Coordinates | Altitude (m asl) | Habitat | Type of record |
|-------------------------|------------|-------|---------------|------------------|---------|-----------------------|
| <i>D. septemcinctus</i> | 27/07/2017 | 14:12 | 12°59'56.48"S | 68°48'51.34"W | 204 | Forest inland edge CT |
| | 09/07/2017 | 11:24 | 13°2'19.48"S | 68°50'19.42"W | 203 | Pampas T |
| <i>E. sexcinctus</i> | 02/07/2017 | 18:15 | 13°3'52.23"S, | 68°50'15.24"W | 205 | Pampas scrub CT |
| | 25/07/2017 | 14:38 | 13°2'39.87"S | 68°50'31.36"W | 206 | Pampas scrub CT |

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