



New locality records for poorly known species of Andean sigmodontine rodents (Rodentia: Cricetidae) from Northwestern Argentina

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Abstract: The Sigmodontinae is a highly diverse subfamily of rodents that represents almost 30% of the mammalian species present in northwestern Argentina. However, the distribution of several species is delimited on the basis of scarce records. We add new localities for four poorly known species of rodents (*Abrothrix andina* Philippi 1858, *Abrothrix jelskii* Thomas 1824, *Neotomys ebriosus* Thomas 1894, *Auliscomys sublimis* Thomas 1900) in the High Andes of Jujuy and Salta provinces. We duplicate the number of known localities for *A. jelskii* in Salta, including the lowest known elevation record in Argentina and added the second known locality for Jujuy province. Furthermore, we add four new localities for *A. sublimis*, including the westernmost locality in Argentina, and reported for the first time this species at a departmental political division in NWA. Finally, we report the first departmental record for both *A. andina* and *N. ebriosus* in Valle Grande.

Key-Words: Biodiversity; Geographic distribution; High Andes; Small mammals.

Resumo: Novos registros de localidade para espécies incomuns de roedores sigmodontinae (Rodentia: Cricetidae) do noroeste da Argentina. Sigmodontinae é uma subfamília altamente diversa de roedores que representa quase 30% das espécies de mamíferos documentadas no noroeste da Argentina. Não obstante, a distribuição de várias espécies é delimitada com base em registros escassos. Neste estudo, adicionamos novas localidades para quatro espécies de roedores (*Abrothrix andina* Philippi 1858, *Abrothrix jelskii* Thomas 1824, *Neotomys ebriosus* Thomas 1894, *Auliscomys sublimis* Thomas 1900) nos Altos Andes das províncias de Jujuy e Salta. Duplicamos o número de localidades conhecidas para *A. jelskii* em Salta, incluindo o registro de menor altitude conhecido na Argentina, e também adicionamos a segunda localidade conhecida para Jujuy. Além disso, adicionamos quatro novas localidades para *A. sublimis*, incluindo a localidade mais ocidental da Argentina, e relatamos pela primeira vez esta espécie em uma divisão política departamental do NOA. Por fim, reportamos o primeiro registro de *A. andina* e *N. ebriosus* no departamento de Valle Grande.

Palavras-Chave: Altos Andes; Biodiversidade; Distribuição geográfica; Pequenos mamíferos.

INTRODUCTION

Mountainous regions are characterized by complex topography and steep environmental gradients that act as barriers to dispersal for populations of several species, leading to isolation and eventually, speciation. This is why mountain environments frequently host great species richness and endemism (Badgley, 2010; Grenyer *et al.*, 2006).

The North West of Argentina (NWA) is a region that comprises several physiographic and biogeographic unities. This area is a transition zone between both tropical and temperate biomes. Because of the latitudinal location and the abrupt altitudinal gradient, a succession of savannah, rain forests, deciduous forests, grassland and high altitude deserts take place in a relatively small area (Morrone, 2015; Morrone & Ezcurra, 2016). Therefore, there is a great diversity of both environmental and biotic changes with a unique species assembly promoted

by historic and ecological variations typical of a biogeographic transition zone (Ferro & Morrone, 2014). This region is also a hotspot of species richness and turnover for South American rodents, particularly for the sigmodontine, a highly diverse subfamily of rodents that represent almost 30% of the mammalian species present in NWA (Ferro & Barquez, 2008; 2014; Formoso & Teta, 2019; Jayat *et al.*, 2011a; Maestri & Patterson, 2016; Urquiza *et al.*, 2021; 2022).

However, there are still poorly studied regions in NWA, especially the High Andes area. Indeed, only few localities of the sigmodontine rodents' records are above 3,000 meters above sea level (m a.s.l.), and there are practically no records in the 4,750-5,500 m a.s.l. interval (Jayat *et al.*, 2011a; Storz *et al.*, 2020). In addition, most surveyed localities are located in close proximity to roads and in anthropogenically altered areas, with few studies in relatively pristine habitats (Jayat *et al.*, 2011a). Therefore, our knowledge of many highland



small mammals' taxa inhabiting NWA comes from very few locality records and affected by sampling bias. Furthermore, our understanding of the taxonomy and distribution of most species of sigmodontine in NWA is still incomplete (Jayat *et al.*, 2018).

In this paper, we report the results of fieldwork designed to fill this gap of distribution knowledge and add new localities for presumably rare High Andean sigmodontine rodent species in NWA.

MATERIAL AND METHODS

We conducted this study in highland localities placed in Jujuy and Salta provinces, Argentina, between 2016 and 2022. The study area belongs to the Puna, High Andes, and the mist grassland ecoregions (Brown & Pacheco, 2006). We surveyed 25 highland localities between 2,700 and 4,700 m a.s.l.

To sample rodent communities in each site, we used Sherman traps baited with a mixture of peanut butter, fat and oat. Generally, we set 40 traps in each site for three consecutive nights. We calculated trapping effort as trap-night, that is the number of traps multiplied by the number of nights they remained open. The trapping success is the number of captures divided by the number of trap-night (Wilson *et al.*, 1996).

We follow standardized protocols for mammal collection summarized in Barquez *et al.* (2021). We sexed, weighted and measured total length, tail length, hindfoot length (with claws), and ear length for each individual and preserved specimens as skin and skeleton or in alcohol 70%. We identified every species by comparison of morphological characters with specimens deposited in Colección Mamíferos Lillo and using specific bibliography (Patton *et al.*, 2015; Teta & Jayat, 2021). We recorded all captured specimens in the personal catalogue of two authors (AM and JHU). The voucher specimens were deposited at Colección Biológica de Vertebrados of Instituto de Biología de Altura (INBIAL-CV) Universidad Nacional de Jujuy and Colección Mamíferos Lillo (CML) Universidad Nacional de Tucumán. We followed the ethical guidelines of the American Society of Mammalogists (Sikes, 2016) during the capture and euthanization of the specimens.

All samples were authorized by the Secretary of Biodiversity, Ministry of Environment of the Jujuy province under file Nº 0257-393-V of permits granted to Dr. Marcos Vaira (Res. Nº 171/2015-DPB, extension request:

Res. Nº 040/2017-SB), and by Secretary of Environment, Ministry of Environment and Sustainable Production of the Salta province under file Nº 0090227-219363/2016-0 of permits granted to José Humberto Urquiza.

RESULTS

We captured 353 individuals with a trapping effort of 7044 trap-night, representing 13 genera and 19 species in the 20 localities where we have captured at least one individual. The total capture success was 4.98%. The morphometric measures for the specimens reported in this paper are detailed below in Table 1.

We recorded new localities for four sigmodontine species which are listed below with their known distribution and their diagnostic features. The localities added in this report are listed below and mapped in Figures 1 and 2.

Family Cricetidae Fischer, 1817 Subfamily Sigmodontinae Wagner, 1843 Tribe Abrotrichini D'Elia *et al.*, 2007

Abrothrix andina (Philippi, 1858)

Description. Small species (adults 15.5 g, total length 141.5 mm \pm 14.5 mm) with long, soft, grayish brown pelage. Black snout, distinctive whitish postauricular patches and long covered nails. The tail is shorter than the body (53.88 \pm 4.9) (Figure 3A).

Distribution. Mainly in highland grasslands of Puna and High Andes above 3,500 m a.s.l. in NW and central eastern Argentina (with records from 950 to 5,000 m a.s.l.), in the provinces of Jujuy, Salta, Catamarca, Tucumán, La Rioja, San Juan and Mendoza (Ferro & Barquez, 2008; d'Hiriart *et al.*, 2021; Jayat *et al.*, 2018; Patterson *et al.*, 2015; Teta *et al.*, 2006; Urquiza *et al.*, 2021).

New records. Jujuy: Depto. Humahuaca, Abra Azul, 35 km O de Santa Ana, 23°14'S; 65°02'53"O; 4496 msnm (INBIAL-CV 00330). Depto. Humahuaca, Abra Colorada, 23°13'52"S; 65°2'23"O; 4520 msnm (INBIAL-CV 00384 – INBIAL-CV 00387). Depto. Valle Grande, Laguna Verde, 23°17'43"S; 65°1'15"O; 4378 msnm (INBIAL-CV 00356) (Figure 1A).

Table 1: List of the four rodent species including data on number of individuals (n), mean weight (MW, g), mean total length (MTL, mm), mean tail length (MT, mm), mean hindfoot length (MF, mm), mean ear length (ME, mm) and sex ratio (sr, male:female) recorded during this study. For each measure we included the standard deviation.

Species	n	MW	MTL	MT	MF	ME	sr
<i>A. andina</i>	4	17.25 \pm 3.12	141.5 \pm 14.5	53.88 \pm 4.9	19.62 \pm 0.75	12.38 \pm 1.97	1:3
<i>A. jelskii</i>	4	32.5 \pm 7.4	183 \pm 6.37	81 \pm 4.11	24.5 \pm 2.08	18.12 \pm 0.25	2:2
<i>N. ebriosus</i>	2	47 \pm 4.24	197 \pm 11.3	82 \pm 4.6	24 \pm 0	18.5 \pm 2.12	2:0
<i>A. sublimis</i>	6	30.8 \pm 13.8	149 \pm 40.7	52 \pm 10.8	21 \pm 2.34	19.8 \pm 6.05	2:4

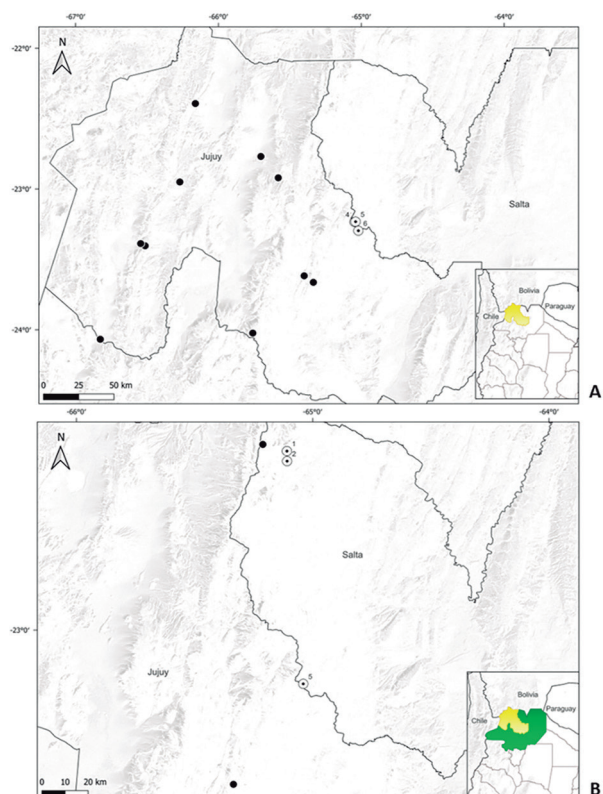


Figure 1: (A) Recorded localities for *Abrothrix andina* in Jujuy province. Black dots indicate previously published records and white dots the new localities (4 = Abra Azul, 5 = Abra Colorada, 6 = Laguna Verde). (B) Recorded localities for *Abrothrix jelskii* in Jujuy and Salta provinces. Black dots indicate previously published records and white dots the new localities (1 = Lagunas del Cerro Campanario, 2 = Curva dos, 5 = Abra Colorada).

Comments. The localities are placed in High Andes environments, characterized by cold, windy, and dry climatic conditions. The sparse vegetation, rock outcrops and sand dunes are represented by grasslands of *Poa*, *Festuca* and *Stipa* genera and woody plants such as *Azorella compacta* with compact and underground growth habitats. In Abra Azul we only captured one individual of *A. andina* and a male of *A. sublimis*, with a low trapping success (1.6%). In Abra Colorada we captured three females of *A. andina*, one of them lactating so it was released. In this locality we also captured two individuals of *A. jelskii*, with a trapping success of 4.16% in this locality. Finally, in Laguna Verde this species was captured together with *Akodon boliviensis*. The localities reported for *A. andina* in Jujuy province are placed in High Andes and Puna environments, all of them above 3300 m a.s.l.

Abrothrix jelskii (Thomas 1824)

Description. Medium size body (adults 32.5 g, total length 183 mm \pm 6.37 mm). Typical striking coloration, with a strong contrast between grey dorsal and white ventral parts and ferruginous tone in the nose, ears, feet and tail, and a white spot behind the ears. The tail is shorter than the body (81 \pm 4.11 mm) (Figure 3B).

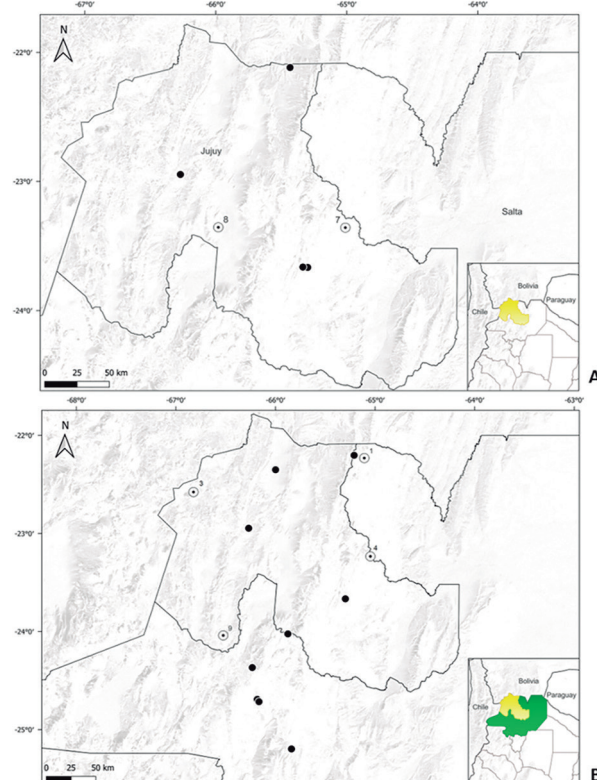


Figure 2: (A) Recorded localities for *Neotomys ebriosus* in Jujuy province. Black dots indicate previously published records and white dots the new localities (7 = Doblonzo, 8 = Abra del Valle). (B) Recorded localities for *Auliscomys sublimis* in Jujuy and Salta provinces. Black dots indicate previously published records and white dots the new localities (1 = Lagunas del Cerro Campanario, 3 = Laguna de Vilama, 4 = Abra Azul, 9 = Juguetería).

Distribution. It inhabits highland environments of the Central Andes above 3,500 m a.s.l. In Argentina was previously recorded in only two localities of Salta and Jujuy provinces (Jayat *et al.*, 2013; Sanborn, 1947).

New records. Jujuy: Depto. Humahuaca, Abra Colorada, 23°13'52"S; 65°2'23"O; 4520 msnm (INBIAL-CV 00385 – INBIAL-CV 00386). Salta: Depto. Santa Victoria, curva dos, R.P. 7 km 43, 28.3 km de Santa Victoria Oeste, 22°16'26"S; 65°6'31"O; 3936 msnm (INBIAL-CV 00329). Depto. Santa Victoria, Lagunas del Cerro Campanario, a 43 km SO de Santa Victoria Oeste, 22°13'51"S; 65°06'33"O; 4443 msnm (INBIAL-CV 00327) (Figure 1B).

Comments. In Lagunas del Cerro Campanario we recorded three individuals of *A. jelskii* and collected as a voucher specimen only one of them. We caught this species together with two species of sigmodontine rodents, two individuals of *A. sublimis* and one of *Phyllotis cf. rupestris*. In Curva dos locality, we captured one individual of *A. jelskii* with 4 individuals of *Akodon boliviensis*. The trapping success was also low: 0.33% and 0.42% for the two places respectively. The only previous record for Salta province was approximately 13 km W of the new localities, also placed in High Andes ecoregion and in similar rocky



Figure 3: Photograph of the captured specimens. (A) *Abrothrix andina* (male, INBIAL-CV 00330); (B) *Abrothrix jelskii* (male, INBIAL-CV 00329); (C) *Neotomys ebriosus* (male, INBIAL-CV 00355); (D) *Auliscomys sublimis* (male, INBIAL-CV 00320). Pictures taken by AM (A, D) and Miguel Cura (B, C).

outcrops environments and captured together with the following species: *Akodon albiventer*, *A. boliviensis*, *A. sublimis*, *Calomys musculus*, *C. lepidus*, *Phyllotis* cf. *rupestris*, *Andinomys edax*, *Octodontomys gliroides* and *Galea leucoblephara* (Jayat *et al.*, 2013). During one of the sampling sessions, a female was released and recaptured approximately 300 m from where it had been captured the previous day. In Abra Colorada (Jujuy) we captured a male and a female. The female was pregnant with four embryos. The only previous reproductive data was published in 1999 (Eisenberg & Redford), reporting two females captured in Perú with three embryos each one.

Tribe Euneomyini Pardiñas *et al.*, 2015

Neotomys ebriosus Thomas, 1894

Description. Medium size body (47 g, total length 197 ± 11.3 mm) with an overall greyish color with a strongly rufous muzzle, the base of the ears, the rump (Figure 3C). The tail is shorter than the body (82 ± 4.6 mm) and the hindfeet present its plantar surface entirely naked.

Distribution. This species is endemic of Central Andean highlands, associated with the presence of peatlands

(locally known as “vegas”) and dense grasses vegetation cover. Although this species has been mentioned as a mammal typical from the Altiplano, inhabiting elevations above 3,000 m a.s.l. (e.g., Pearson 1951), in the southern part of its range it occurs at lower elevations (as low as 2,700 m a.s.l.), well outside the limits of Puna and related cloud grassland on the eastern Andean slopes (Ferro & Barquez, 2017; Jayat *et al.*, 2008; Ortiz & Jayat, 2015). This species was previously recorded in Jujuy, Salta, Catamarca, San Juan, La Rioja and Tucumán provinces (Argentina) (Ferro & Barquez, 2017; d’Hiriart *et al.*, 2021; Jayat *et al.*, 2008, 2011b; Ortiz & Jayat, 2015; Pardiñas & Ortiz, 2001).

New records. Jujuy: Depto. Valle Grande, Doblonzo (Pueblo Viejo), 7 km O de Santa Ana, $23^{\circ}21'25''\text{S}$; $65^{\circ}0'40''\text{O}$; 3617 msnm (INBIAL-CV 00331). Depto. Valle Grande, Abra del Valle, Santa Ana, $23^{\circ}21'15''\text{S}$; $65^{\circ}58'51''\text{O}$; 3383 msnm (INBIAL-CV 00355) (Figure 2A).

Comments. The previous reported localities for Jujuy province were all placed in High Andes and Puna environments. We captured two males in cloud highland grasslands environments at 3300-3600 m a.s.l. We recorded three species in Doblonzo locality (*N. ebriosus*, *A. boliviensis*, *P. tucumanus*) and five in Abra del Valle (*N. ebriosus*, *A. boliviensis*, *P. tucumanus*, *Necromys*



lactens and *Oxymycterus paramensis*), with a trapping success of 1.83% and 2.5% respectively.

Tribe Phyllotini Vorontsov, 1959

Auliscomys sublimis (Thomas, 1900)

Description. Medium size body (adults 30.8 g, total length 149 mm \pm 40.7 mm). Long, soft, fine and bicolored pelage, grayish dorsally with yellowish tips and some black hairs. The hairs of the venter are whitish. An evident suede-colored line from the cheeks to the haunches is noticeable. Feet covered with abundant white hair. Tail is short and thick (52.5 mm), covered with fine white hair both dorsal as ventrally, and lacking tuft at tip. Short ears covered with fine yellowish hair and postauricular patches often present (Figure 3D).

Distribution. Present in High Andes and Puna environments, between 3,200 to above 5,000 m a.s.l. (Salar-Bravo, 2015). It was previously registered in eight localities in Jujuy and Salta provinces (Díaz *et al.*, 2006; Jayat *et al.*, 2013; d'Hiriart *et al.*, 2021; Urquiza *et al.*, 2021).

New records. Salta: Depto. Santa Victoria, Lagunas del Cerro Campanario, a 43 km SO de Santa Victoria Oeste, 22°13'51"S; 65°06'33"O; 4443 msnm (INBIAL-CV 00320, INBIAL-CV 00328). Jujuy: Depto. Humahuaca, Abra Azul, 35 km O de Santa Ana, 23°14'S; 65°02'53"O; 4496 msnm (INBIAL-CV 00341). Depto. de Rinconada, Laguna de Vilama, refugio de Guardaparque, 22°34'41"S; 66°49'27"O; 4562 msnm (CML 14170). Depto. Susques, Juguetería, 1 km S de las piletas de Agua Termal, 24°02'21"S; 66°31'33"O; 4369 msnm (INBIAL-CV 00357, INBIAL-CV 00358) (Figure 2B).

Comments. All captures for this species in this study were near stream and peatlands, in coincidence with Diaz and Barquez (2007), these data suggest that this species lives in open places, below rocks, and along the banks of streams. In Juguetería (Susques department) two females with breeding conditions were captured during November, in the southern hemisphere summer.

DISCUSSION

In the present paper we explored high mountain rodent fauna of Jujuy and Salta provinces, one of the least known mammal communities in the NWA. Our results show a community composition characteristic of High Andean and cloud highland grasslands environments with capture rates consistent with previous results (Jayat *et al.*, 2008; Urquiza *et al.*, 2022). However, despite a relative low level of trapping effort we recorded new

localities for four species which are considered rare or uncommon in the study area.

Perhaps the least remarkable is *Abrothrix andina* that was recorded several times in NWA (*e.g.*, Díaz & Barquez, 2007; Ferro & Barquez 2008, 2014; Jayat *et al.*, 2011b, 2018; d'Hiriart *et al.*, 2021; Urquiza *et al.*, 2021). In Jujuy province seven localities were reported, all of them above 3,500 m a.s.l. The new localities are placed above 4300 m a.s.l. In addition, this is the first record of this species in Valle Grande department (Laguna Verde).

On the contrary, *A. jelskii* is one of the least known species in this genus (Jayat *et al.*, 2013; Patterson *et al.*, 2015). In Argentina, it was recorded only in two localities, one in Salta province and one in Jujuy province. In Salta, *A. jelskii* was recorded for the first time by Jayat *et al.* (2013) in Lizoite. Here we added two new localities from Salta province, including the lowest elevation record for this species in Argentina at 3,936 m a.s.l. and the second known locality for Jujuy province. In Laguna del Cerro Campanario (Salta) this species was captured with an individual of *Phyllotis cf. rupestris*. Recent research (Ojeda *et al.*, 2021; Teta *et al.*, 2022) recognized the "*P. posticalis* – *P. rupestris*" clade corresponding to highland environments of northern Jujuy and Salta provinces. Besides, the taxonomy of the species belonging to the *P. xantopygus* group needs further multidisciplinary analysis in this region.

A. jelskii is categorized as "Data Deficient" by the Red List of Mammals in Argentina (Jayat *et al.*, 2019) due to the lack of basic information about its populations. Despite the fact that the distribution of *A. jelskii* is drawn as a continuum polygon, our results suggest that the real distribution might be patched, associated with accumulation of glacial till rocks on mountain slopes. In correspondence with previous records (Ferro & Barquez, 2014; Jayat *et al.*, 2018; Teta *et al.*, 2006), this species seems to be related with rock glacier environments as those described by Martini (2016) for NWA.

Neotomys ebriosus is a monotypic genus that was considered "incertae sedis" until it was included in a new tribe, Euneomyini (Pardiñas *et al.*, 2015). This species is known by few specimens and localities, so there is much about distribution patterns and natural history still poorly understood (Ferro & Barquez, 2017; Ortiz & Jayat, 2015). It was previously recorded in two localities in Salta and three in Jujuy (Jayat *et al.*, 2008, 2011b; Pardiñas & Ortiz, 2001). Here we add two new localities for the species in Jujuy province and the first record of *N. ebriosus* from Valle Grande department. In Abra del Valle this species was captured with an individual of *Oxymycterus paramensis*, which distribution corresponds mostly with Yungas ecoregion. *N. ebriosus* was reported for Puna and High Andes environments in Argentina. However, we captured this species in cloud grassland environments, while it was not caught in the High Andes environments surveyed localities for this study.



Until this report, *Auliscomys sublimis* was recorded for eight localities in NWA. In Salta province, there were four registered localities for this species (Jayat *et al.*, 2013; Ortiz *et al.*, 2010). Here we added Lagunas del Cerro Campanario as a new locality, placed in High Andes at 4,443 m a.s.l. In Jujuy this species was previously recorded in four localities (Díaz & Barquez, 2007; Jayat *et al.*, 2011a; Ortiz *et al.*, 2010; Urquiza *et al.*, 2021). Here we added three new localities for the species in this province. Abra Azul represents the first record for Humahuaca department at 4,496 m a.s.l. Finally, we added the first record for Rinconada department and the westernmost register from Argentina in Laguna de Vilama. This locality is within approximately 80 km of other places where the species was previously recorded.

Despite the fact that the knowledge about composition and diversity of sigmodontine rodents in NWA has increased in the last years, it is still incomplete (Ferro & Barquez, 2014; Jayat *et al.*, 2011a, 2018). Our work certainly witnesses this asseveration, and our results agree that the High Andes and Puna ecoregions are among less surveyed environments in NWA (see Jayat *et al.*, 2011a, 2018). In fact, with a rather small sampling effort we add valuable new information for four largely unknown species of the region which can be used for further studies, providing better interpretations of the biogeography of these poorly known region and species. In the current context of climate change, it is necessary to resolve these information gaps, especially considering the vulnerability if these environments and species.

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