

Short Note

Federico L. Agnolin*, Sergio O. Lucero and Julio Torres

Historical record of *Holochilus vulpinus* (Rodentia, Sigmodontinae) from northern Patagonia, Argentina

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Abstract: Marsh rats of the species *Holochilus vulpinus* inhabit mesic and humid environments. For this reason, it is frequently used in paleoenvironmental studies to infer past humid conditions. Holocene archeological record indicates that *H. vulpinus* had a wider geographical distribution than today. Its regional extinction in north Patagonia at the XIX century was attributed to the dry and cold Little Ice Age (LIA). Here we present the finding of a specimen of *H. vulpinus* from northeastern Patagonia (Valcheta stream, Río Negro province, Argentina), just at the end of LIA. Implications of this novel historical record are discussed.

Keywords: *Holochilus vulpinus*; Little Ice Age; Patagonia; Río Negro; Valcheta.

Marsh rats of the genus *Holochilus* Brandt, 1835 are large rodents of the tribe Oryzomyini which are widely distributed through tropical and subtropical lowlands of South America from Venezuela and the Guyanas to southern Buenos Aires province, Argentina (Hershkovitz 1955). As currently understood, *Holochilus* is composed of six living species (Pardiñas et al. 2013, Gonçalves et al. 2015).

*Corresponding author: Federico L. Agnolin, Laboratorio de Anatomía Comparada y Evolución de los Vertebrados, Museo Argentino de Ciencias Naturales “Bernardino Rivadavia”, Av. Angel Gallardo 470, (C1405BDB), Buenos Aires, Argentina; and Fundación de Historia Natural “Félix de Azara”, Departamento de Ciencias Naturales y Antropología, CEBBAD – Universidad Maimónides, Hidalgo 775, Buenos Aires, Argentina, e-mail: fedeagnolin@yahoo.com.ar

Sergio O. Lucero: División Mastozoología, Museo Argentino de Ciencias Naturales “Bernardino Rivadavia”, Av. Angel Gallardo 470, (C1405BDB), Buenos Aires, Argentina

Julio Torres: Instituto de Diversidad y Evolución Austral (IDEAUS-CONICET), Bv. Brown 2915, (U9120ACD), Puerto Madryn, Chubut, Argentina

However, the alpha taxonomy of this genus is still pending of a comprehensive revision (D’Elía et al. 2015).

These rodents have morphological specializations to semi-aquatic life that enable them to inhabit marsh environments (Hershkovitz 1955, Massoia 1971, 1976). Due to their current ecological requirements, the presence of *Holochilus* in archeological or paleontological sites was regarded as indicative of relatively humid and temperate climatic conditions (Teta et al. 2005, Stoessel et al. 2008, Fernández et al. 2011, Pardiñas and Teta 2011).

The southernmost geographical limit of the genus corresponds to the species *Holochilus vulpinus* (Brants, 1827) at southern Buenos Aires province (referred as *Holochilus brasiliensis* by Formoso et al. 2010; Figure 1). Yepes (1935) and Cabrera (1957) mentioned this genus for northeastern Río Negro province, but without voucher specimens sustaining this assertion.

Some records of *Holochilus vulpinus* in Holocene archeological sites in Córdoba (Teta et al. 2005), Río Negro and Neuquén provinces (Formoso et al. 2010, Fernández et al. 2011, Pardiñas and Teta 2011, Teta et al. 2014) indicate that the species had a much wider distributional range in the past (Figure 1). These findings extended the past distribution of *H. vulpinus* more than 250 km to the southwest and west from its current distributional range (Pardiñas and Teta 2011). On the basis of this record, the authors propose that *H. vulpinus* modified its distributional range during the Late Holocene.

In this work, we present a historical record for *Holochilus vulpinus* in northeastern Río Negro province, Patagonia, Argentina. Because this record is 300 km from the current distribution of this taxon we explore its paleoclimatic significances.

The specimen, housed at the Museo Argentino de Ciencias Naturales “Bernardino Rivadavia” under the number MACN-Ma 41.485 (Figure 2), consists of a damaged skin of an adult individual recovered from the public exhibition. The external measurements of this animal are: head and body length = 247.11 mm; tail length = 188.13 mm; ear length = 15.9 mm; hindfoot length with and without

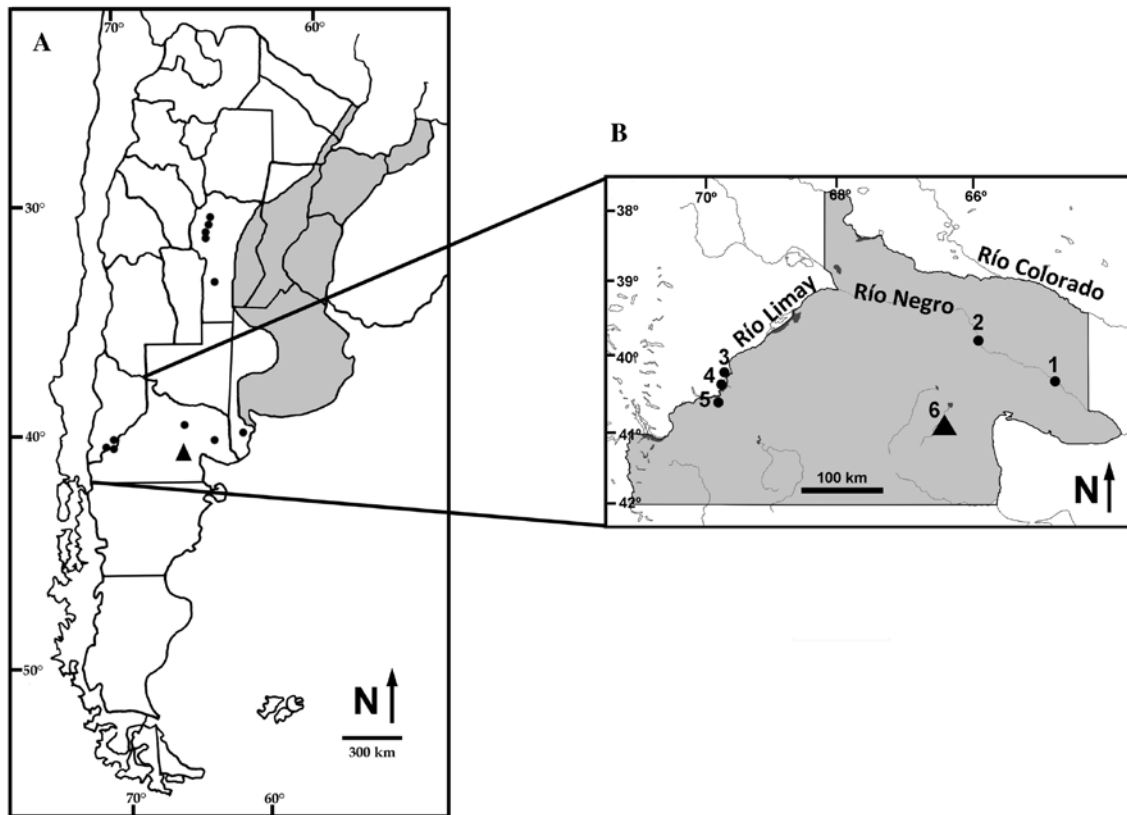


Figure 1: (A) Map showing current geographical distribution of *Holochilus vulpinus* shaded in gray, dots outside the shaded area correspond to archeological records. (B) Map detailing archeological records of *Holochilus vulpinus* in Río Negro province, Argentina. References: 1, Angostura 1 archeological site; 2, Negro Muerto archeological site; 3, Alero Arias archeological site; 4, Rincón Chico 2 archeological site; 5, La Marcelina 1 archeological site; 6, Valcheta stream valley. Black circles indicate Holocene archeological findings; black triangle indicates present finding.



Figure 2: *Holochilus vulpinus* specimen MACN-Ma 41.485, in side view. Scale bar: 3 cm.

claw = 46.6–40.79 mm). The skin has a long, dense and hispid fur. Dorsal coloration is reddish brown intermixed with black hairs, darker in the midline. Dorsal individual hairs are gray in the base and orangish toward the middle and tip; in some cases, tips are blackish. The belly is covered by soft orange fur, with the throat and inguinal region almost completely white. Tail is slightly bicolor, darker in the dorsum and proportionally longer than in *Holochilus lagigliai* (Pardiñas et al. 2013). Feet are covered with short

orangish hairs. Overall, these characteristics allow recognition of this specimen as belonging to *Holochilus vulpinus* (cf. Hershkovitz 1955, Massoia 1976; specimens referred to *Holochilus brasiliensis darwini* Thomas, 1897).

The specimen MACN-Ma 41.485 was collected by C. Burmeister on 1887. Burmeister wrote in February 8 in 1887, that when he was crossing the Río Negro valley at Fortín Castre locality (Lat -39.8667 ; Long -65.2833), one settler gave him a specimen of *Hesperomys vulpinus* (= *H. vulpinus*) that was captured in the Valcheta stream valley. This settler informed Burmeister that this rat was very common and ate his crops, mainly pumpkins (Burmeister 1888: 194). This specimen then was prepared for exhibition at the Museo Público de Buenos Aires (currently Museo Argentino de Ciencias Naturales “Bernardino Rivadavia”).

Phytogeographically, the Valcheta stream is emplaced within the Monte-Patagonian Ecotone, near the Rionegrino Ecotone (Cabrera and Willink 1980, Leon et al. 1998). The Valcheta stream conforms a wide valley that

occasionally floods due to increase of the watercourse. It is an important and well-known area of endemisms that is strongly modified for agricultural activities (Ceï 1969, 1980, Ortubay and Cussac 2000, Rumi et al. 2008), its native vegetation representing steppes of xerophytic, psammophytic and halophytic plants (Cabrera 1976).

By the Late Holocene Patagonia suffered important climatic fluctuations, with alternating pulses of warm and cool climates (Mayewski et al. 2004). In Central Argentina some pulses of the last millennium have been associated mainly with two climate events: the Medieval Warm Period (MWP) and a Little Ice Age (LIA) (Cioccale 1999, Teta et al. 2005). At northern Patagonia successive pulses of warm and cool conditions were reported (900–1070, 1270–1380 and 1520–1660) (Villalba 1994a,b). Warm periods were characterized by a general increase of temperature and humidity, with increases of water body levels (Iriondo 1999, Schäbitz 2003, Stoessel et al. 2008). On the other side, cool periods were associated with aridification characterized by general decreases of temperature and humidity (Carignano 1999, Cioccale 1999), although some records indicate a moisture increment (Villalba 1994a,b).

The extralimital occurrence of *Holochilus vulpinus* have been attributed to warm and humid periods that probably enhance optimal environment conditions that allowed the expansion of populations of this species (Teta et al. 2005, Stoessel et al. 2008, Pardiñas and Teta 2011, Pardiñas et al. 2013). The same appears to occur with the horned frog *Ceratophrys* (Wied-Neuwied, 1824) that has similar environmental requirements to those of *Holochilus*. This frog has been reported on archeological sites, approximately 400 km to the south of its current geographical distribution (Stoessel et al. 2008). The recent retraction of distribution of both taxa was attributed to the LIA, that probably produced an aridification of this region by the end of XIX century (Stoessel et al. 2008, Pardiñas and Teta 2011).

The fact that a specimen of *Holochilus vulpinus* was captured in 1887 in Valcheta stream, has relevance in that it has occurred just at the end of the LIA, contradicting the idea of geographical retraction related with this phenomenon (see Stoessel et al. 2008, Pardiñas and Teta 2011). Further, as informed by Burmeister (1888) the species was abundant at the Valcheta valley, at least. On the basis of this record, it is possible to sketch out two hypotheses explaining the distribution of *H. vulpinus* in the area. The first one may hypothesize that the distribution of *Holochilus* was not severely affected by the LIA along the Late Holocene.

Another possibility is that the species was severely affected by the LIA, but some populations of this rodent

(i.e. Valcheta valley) were able to survive to the rough climate of Patagonia on natural oasis. The recent finding in the Valcheta valley of *Didelphis albiventris* Lund, 1840 (Carrera and Udrizar Sauthier 2014) would also add evidence that this area of Patagonia could have acted alternatively as a refuge or corridor for northern fauna, as evidenced by some of its endemisms (e.g. *Gymnocharacinus bergii* Steindachner, 1903; Ortubay and Cussac 2000).

In addition, because current mammalogical information for the Valcheta area is incomplete we cannot securely reject the survival of relictual populations of *Holochilus vulpinus* in recent times.

The rejection or acceptance of any of these hypotheses will depend on future findings of this species in old museum collections, or in new archeological sites.

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References

- Burmeister, C.V. 1888. Últimas exploraciones en Patagonia, incluyendo los datos recogido en sus viajes por el ingeniero Asahel P. Bell y seguido de un mapa descriptivo. *Revista de la Sociedad Geográfica Argentina* 4: 193–272.
- Cabrera, A. 1957. Catálogo de los mamíferos de América del Sur. *Revista del Museo Argentino de Ciencias Naturales “Bernardino Rivadavia”* 4: 1–308.
- Cabrera, A.L. 1976. Regiones Fitogeográficas Argentinas. *Enciclopedia Argentina de Agricultura y Jardinería* 2: 1–85.
- Cabrera, A.L. and A. Willink. 1980. *Biogeografía de América Latina*. 2a edición corregida. Secretaría General de la Organización de los Estados Americanos. Washington DC. EEUU. Monografía 13, Serie de Biología. 120 pp.
- Carignano, C.A. 1999. Late Pleistocene to recent climate change in Córdoba Province, Argentina: geomorphological evidence. *Quat. Int.* 58: 117–134.
- Carrera, M. and D.E. Udrizar Sauthier. 2014. Enlarging the knowledge on *Didelphis albiventris* (Didelphimorphia, Didelphidae) in Northern Patagonia: new records and distribution extension. *Historia Natural* 4: 111–115.
- Ceï, J.M. 1969. La meseta basáltica de Somuncurá, Río Negro. Herpetofauna endémica y sus peculiares equilibrios biocenóticos. *Physis* 28: 257–271.

- Cei, J.M. 1980. Amphibians of Argentina. *Monitore Zoologico Italiano (NS) Monografia 2*: 1–609.
- Cioccale, M.A. 1999. Climatic fluctuations in the central region of Argentina in the last 1000 years. *Quat. Int.* 62: 35–47.
- D'Elía, G., J.D. Hanson, M.R. Mauldin, P. Teta, and U.F.J. Pardiñas. 2015. Molecular systematics of South American marsh rats of the genus *Holochilus* (Muroidea, Cricetidae, Sigmodontinae). *J. Mammal.* 96: 1081–1094.
- Fernández, F.J., L. Del Papa, G.J. Moreira, L. Prates, and L.J.M. De Santis. 2011. Small mammal remains recovered from two archaeological sites in the middle and lower Negro River valley (Late Holocene, Argentina): taphonomic issues and paleoenvironmental implications. *Quat. Int.* 245: 136–147.
- Formoso, A.E., D.E. Udrizar Sauthier, and U.F.J. Pardiñas. 2010. Mammalia, Rodentia, Sigmodontinae, *Holochilus brasiliensis* (Desmarest, 1819): distribution extention. *Checklist 6*: 195–197.
- Gonçalves, P.R., P. Teta, and C. Bonvicino. 2015. Genus *Holochilus* Brandt, 1835. In: (J. Patton, U.F.J. Pardiñas and G. D'Elía, eds.) *Mammals of South America. 2. Rodents*. University of Chicago Press, Chicago, Illinois. pp. 325–335.
- Hershkovitz, P. 1955. South American marsh rats, genus *Holochilus*, with a summary of sigmodont rodents. *Fieldiana 37*: 639–674.
- Iriondo, M. 1999. Climatic changes in the South American plains: Records of a continent–scale oscillation. *Quat. Int.* 58: 93–112.
- Leon, R.J.C., D. Bran, M. Collantes, J.M. Paruelo, and A. Soriano. 1998. Grandes unidades de vegetación de la Patagonia extra andina. *Ecología Austral 8*: 125–144.
- Massoia, E. 1971. Caracteres y rasgos bioecológicos de *Holochilus brasiliensis chacarius* Thomas (“rata nutria”) de la provincia de Formosa y comparaciones con *Holochilus brasiliensis vulpinus* (Brants) (Mammalia, Rodentia, Cricetidae). *Revista de Investigaciones Agropecuarias, Biología y Producción Animal 8*: 13–40.
- Massoia, E. 1976. Mammalia. In: (R. Ringuelet, dir.). *Fauna de Agua Dulce de la República Argentina*. Fundación editorial Ciencia y Cultura 44: 1–128.
- Mayewski, P.A., E.E. Rohling, J. Curt Stager, W. Karlén, K.A. Maasch, L. David Meeker, E.A. Meyerson, F. Gasse, S. van Kreveld, K. Holmgren, J. Lee-Thorp, G. Rosqvist, F. Rack, M. Staubwasser, R.R. Schneider, and E.J. Steig. 2004. Holocene climate variability. *Quat. Res.* 62: 243–255.
- Ortubay, S.G. and V.E. Cussac. 2000. Threatened fishes of the world: *Gymnocharacinus bergi* Steindachner, 1903 (Characidae). *Environ. Biol. Fish.* 58: 144.
- Pardiñas, U.F.J. and P. Teta. 2011. Historia fósil de las ratas palustres de los géneros *Holochilus* y *Lundomys* (Cricetidae, Sigmodontinae) en el Cono Sur de América del Sur. *Estudios Geológicos 67*: 111–129.
- Pardiñas, U.F.J., P. Teta, D. Voglino, and F.J. Fernández. 2013. Enlarging rodent diversity in west–central Argentina: a new species of the genus *Holochilus* (Cricetidae, Sigmodontinae). *J. Mammal.* 94: 231–240.
- Rumi, A., D.E. Gutierrez Gregoric, V. Núñez, and G.A. Darrigran. 2008. Malacología Latinoamericana. Moluscos de agua dulce de Argentina. *Revista de Biología Tropical 56*: 77–111.
- Schäbitz, F. 2003. Estudios polínicos del Cuaternario en las regiones áridas del sur de Argentina. *Revista del Museo Argentino de Ciencias Naturales 5*: 291–299.
- Stoessel, L., S. Bogan, G. Martínez, and F.L. Agnolin. 2008. Implicaciones paleoambientales de la presencia del género *Ceratophrys* (Anura, Ceratophryinae) en contextos arqueológicos de la transición pampeano–patagónica en el Holoceno tardío (curso inferior del río Colorado, Argentina). *Magallania 36*: 195–203.
- Teta, P., A. Andrade, and U.F.J. Pardiñas. 2005. Micromamíferos (Didelphimorphia y Rodentia) y paleoambientes del Holoceno tardío en la Patagonia noroccidental extra–andina (Argentina). *Archaeofauna 14*: 183–197.
- Teta, P., A. Formoso, M., Tammone, D. De Tomasso, F. Fernández, J. Torres, and U.F.J. Pardiñas. 2014. Micromamíferos, cambio climático e impacto antrópico: ¿Cuánto han cambiado las comunidades del sur de América del Sur en los últimos 500 años? *Therya 5*: 7–27.
- Villalba, R. 1994a. Fluctuaciones climáticas en latitudes medias de América del sur durante los últimos 1000 años: sus relaciones con la oscilación del sur. *Revista Chilena de Historia Natural 67*: 453–461.
- Villalba, R. 1994b. Tree-ring and glacial evidence for the Medieval Warm Epoch and the Little Ice Age in Southern South America. *Climatic Change 26*: 183–197.
- Yepes, J. 1935. Epítome de la sistemática de los roedores argentinos. *Revista del Instituto de Bacteriología 7*: 213–269.