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SHORT COMMUNICATION

The currently known distribution of the Austral Patagonian and Fuegian bats

La distribución actualmente conocida de los murciélagos de la Patagonia austral y Tierra del Fuego

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ABSTRACT

We report the currently existing 31 records for Austral Patagonian and Fuegian bats spanning from 1866 to 2022. The Vespertilionidae were: *Myotis chiloensis*, *Histiotus magellanicus*, and *Lasiurus varius*, and the Molossidae was *Tadarida brasiliensis*. The former two species were recorded at forested sites along a swath that runs NW-SE for about 670 km from Torres del Paine in continental Magallanes to Tierra del Fuego and Navarino islands. Those forests were Coihue-Canelo *(Nothofagus betuloides-Drymis winteri)*, Coihue-Lenga (*N. betuloides-N. pumilio*), Lenga (*N. pumilio-Maytenus disticha*), or Ñirre shrubland (*N. antarctica-Chiliotrichum difussum*). Only one record for each of *Lasiurus varius*, *Histiotus magellanicus*, and *Tadarida brasiliensis* were located in steppe environments of *Festuca gracillima-Chiliotrichum difussum* but were centered at human habitations and surrounding orchards or plantations, and their presence therein may be deemed accidental.

Keywords: *Histiotus*, *Lasiurus*, Magallanes, *Myotis*, *Tadarida*.

RESUMEN

Reportamos los 31 registros actualmente existentes de murciélagos patagónicos australes y fueguinos que abarcan desde 1866 hasta 2022. Los Vespertilionidae fueron: *Myotis chiloensis*, *Histiotus magellanicus* y *Lasiurus varius*, y el Molossidae fue *Tadarida brasiliensis*. Las dos primeras especies fueron registradas en sitios boscosos a lo largo de una franja que corre de Noroeste a Sureste por aproximadamente 670 km desde Torres del Paine en Magallanes continental hasta las islas de Tierra del Fuego y Navarino. Dichos bosques eran de Coihue-Canelo (*Nothofagus betuloides-Drymis winteri*), Coihue-Lenga (*N. betuloides-N. pumilio*), Lenga (*N. pumilio-Maytenus disticha*), o matorral de Ñirre (*N. antárctica-Chiliotrichum difussum*). Los pocos registros de los murciélagos *Lasiurus varius* y *Tadarida brasiliensis* fueron de estepas con *Festuca gracillima-Chiliotrichum difussum* pero se centraron en viviendas humanas y huertos o plantaciones circundantes, y pueden ser considerados accidentales.

Palabras clave: *Histiotus*, *Lasiurus*, Magallanes, *Myotis*, *Tadarida*.

The thrust to decarbonize Chile's energy matrix has led to consider the Magallanes Region as a major player in the development of "green energy" based on aerogenerators or wind turbines in wind farms. Indeed, the Servicio Agrícola y Ganadero [Agriculture and Livestock Service] (2015) issued a guideline to ponder the potential impacts of such developments and associated high-tension powerlines as early as 2015. Norambuena *et al*. (2022) addressed a letter to the Editor of the journal Science calling attention to the likely mortality of birds in the Magallanes Region. They extrapolated mortality results from an existing wind farm informing "a rate of 0.6 to 1.8 bird collisions per wind turbine per year (3). Scaling this to the magnitude of the planned Magallanes project could lead to between 1740 and 5220 bird collisions per year." [3] Refers to an official document (República de Chile 2021). They did not refer specifically to bats, but Norambuena *et al*. (2023) highlighted the potentially high mortality that regional bats could face from such wind farms.

Because there is little knowledge on the Austral Patagonian bats, Jaksic & Martínez (2023) reviewed the existing literature and reported a depauperate Chiropterofauna consisting of essentially three species (the year-round residents *Histiotus magellanicus* and *Myotis chiloensis*, and the apparently migratory *Lasiurus varius*), both in continental and insular settings. They called attention to the paucity of information on the fine-scale geographic distribution, local abundance, and migration patterns of those bats. We take on this task, and here report all the known records to these bats in Austral Patagonia (including Tierra del Fuego archipelago), with georeferencing, and with the aim of informing the state of the art before any wind farms become operational.

For the definition of the Austral Patagonian and Fuegian geographic-political concept we followed Martinic (1957), who considers that region to encompass administrative territories in Argentina (Provinces of Santa Cruz and of Tierra del Fuego) and Chile (Regions of Aysén and Magallanes), both continental and insular. Nevertheless, we concentrated only in the southern portion of that area, i.e., Magallanes Region and Tierra del Fuego Provinces (both Argentinian and Chilean). The Fuegian archipelago contains the large island itself (ca. 48,000 km^2), seven medium-sized islands (Hoste, Santa Inés, Navarino, Dawson, Aracena, Clarence, and Staten, ranging from 4,100 to 500 km^2 in the same sequence), and ca. 3,000 smaller islands and islets. We use Fuegia as a shorthand for Tierra del Fuego archipelago.

Our review protocol follows Jaksic & Martinez (2023). In short, most bat locations were traced back from current to older sources, using mainstream journals, monographs, and books. New sources emerged when engine-searching the internet without time or language constraints for vernacular key words such as bat, fledermaus or murciélago, both in singular and plural forms; or scientific names such as *Histiotus*, *Lasiurus*, *Myotis*, or *Vespertilio*. These records were complemented with one personal communication (A. Kusch) and one of the authors' own observations (D. Martínez). Additionally, we used the data provided by a free access international network and data infrastructure called Global Biodiversity Information Facility (GBIF). This network draws diverse data sources together using data standards, including Darwin Core, which forms the basis for the bulk of GBIF index of hundreds of millions of species occurrence records. From this data base only georeferenced records of the three bat species inhabiting both continental Magallanes and Tierra del Fuego archipelago were considered, together with the single record for *Tadarida brasiliensis* at Cabo Vírgenes lighthouse in southernmost Santa Cruz Province of Argentina. For plotting the georeferenced bat records, we used QGIS 3.28 Firenze, a free and open-source geographic information system, which is an official project of the Open-Source Geospatial Foundation (OSGeo). Then, to assess factually the vegetation at each site recorded, the georeferenced record layer was superimposed on vegetational cover shapes for the Magallanes Region, downloaded from the Chilean vegetation resources cadastre by CONAF, stored at their territorial information system site (https://sit.conaf.cl/).

All records, sources, and relevant vegetational cover information is provided in Table 1 and mapped into Fig. 1. Over a century and a half, only 31 records for Austral Patagonian and Fuegian bats have surfaced. Three Vespertilionidae species were recorded: *Myotis chiloensis* (Chiloé's little brown bat), *Histiotus magellanicus* (southern big-eared brown bat), and *Lasiurus varius* (cinnamon red bat). Also, one Molossidae bat, *Tadarida brasiliensis* (Brazilian free-tailed bat). Most bat specimens were recorded at forested sites along an arched swath that roughly runs NW-SE for about 670 km although somewhat interrupted by fjords, sounds, and channels, roughly from Torres de Paine National Park to Tierra del Fuego's tip (Ushuaia city and Navarino Island). Most bat records were from Coihue-Canelo (*Nothofagus betuloides-Drymis winteri*), Coihue-Lenga (*N. betuloides-N. pumilio*), and Lenga forests (*N. pumilio-Maytenus disticha*), or from Ñirre shrubland (*N. antarctica-Chiliotrichum difussum*). The few records of bats from steppes (*Festuca gracillima-Chiliotrichum difussum*) were from human habitations and surrounding orchards or exotic tree windbreakers, and they may be deemed accidentals (Jaksic & Martínez 2023). These bats corresponded to *Lasiurus varius* and *Tadarida brasiliensis*. It

thus appears that the true resident bats in Austral Patagonia and Fuegian archipelago are *Histiotus magellanicus* and *Myotis chiloensis*, associated to forest and not to steppe environments (Jaksic & Martínez 2023). Both species are also found in forested areas toward their mostly northerly-centered distribution in Argentina and Chile.

It should be noted that the fast pace of climate change may be bringing new opportunities for colonization by northerly bats, but the steppe environment does not seem to afford much shelter or food for newcomers. Because wind farms are planned to be placed on such wind-swept places rather than on nearby forests, it appears that the current Austral Patagonian and Fuegian bats may not suffer unduly from such new energy developments. It should also be considered that the present land use of the Magallanes-Fuegian steppes is twofold: Large pastures devoted to extensive sheep raising –since the end of the nineteenth century–, and the more recent developments of oil and gas fields and their associated infrastructure and road network. None of these seem conducive to bat impact, at least directly.

But none of the above should be an excuse for not monitoring bat mortality in wind farms; much could be learned. For instance, a recent review by Agudelo *et al.* (2021) on bat mortality in wind farms all over Latin America revealed data from only one source in Chile and none from Argentina. In the former case, 57 wind turbines operating during a whole year caused 27 bat fatalities involving two species in Los Cururos wind farm (coordinates not specified) in the Coquimbo Region of north-central Chile. A paper by Escobar *et al.* (2015) escaped the screening of Agudelo *et al.* (2021), and it reports that three female *Tadarida brasiliensis* were found dead at the foot of wind towers of two wind-powered turbines from two wind farms at a coastal area (31.336° S, 71.616° W and 31.066° S, 71.616° W) of Coquimbo Region, with a capacity of production of 46 and 48 megawatts, respectively. An anonymous referee called our attention to the fact that the SNIFA web page stores data from 101 wind farms in Chile, with ca. 500 records of bats. An analysis of such data is necessary to forecast the probable impact of wind farms in Austral Patagonia and Fuegia, before crying wolf (or threatened bat...)

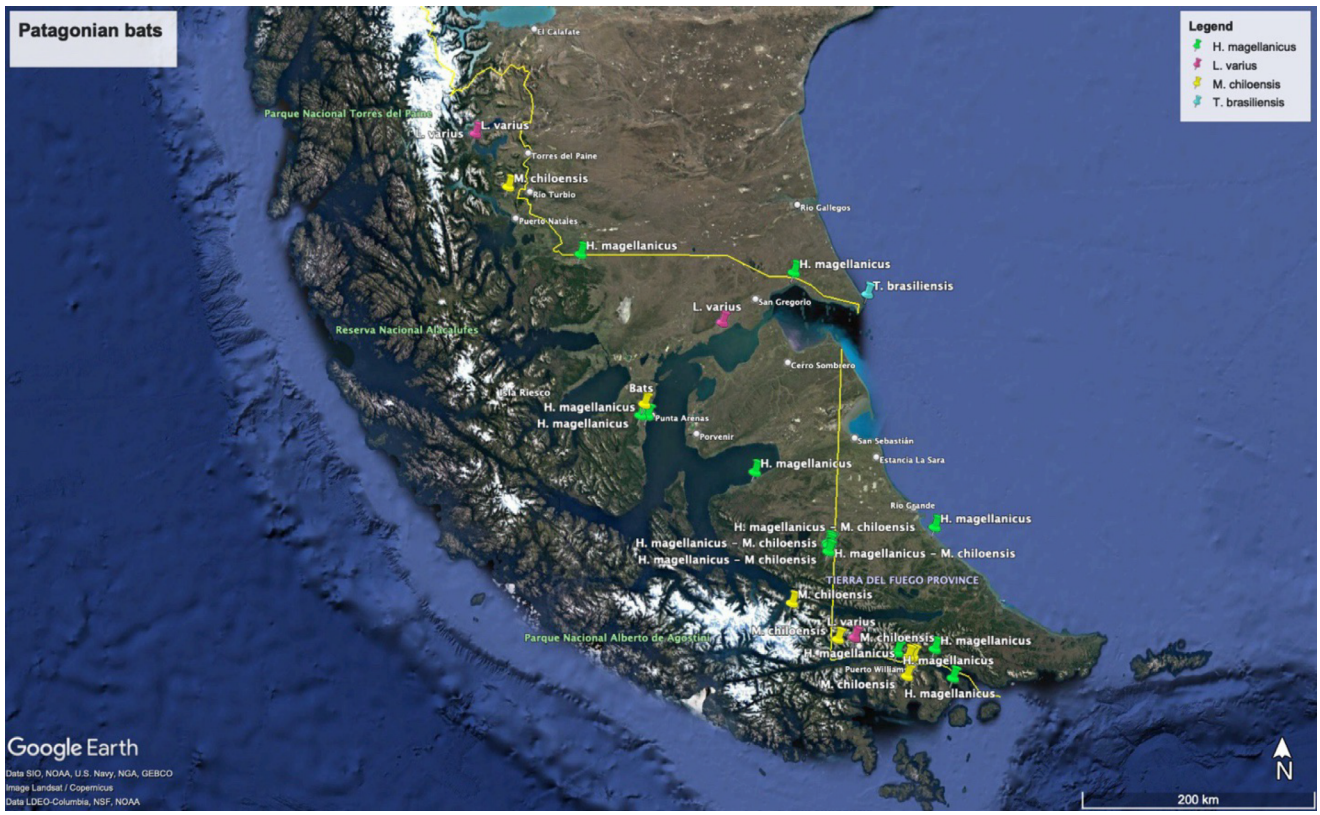

Figure 1. Mapping of georeferenced records of Austral Patagonian and Fuegian bats from 1866 to 2022. Not all records from Table 1 can be seen here because of scale. Green pins/pinchos verdes = *Histiotus magellanicus*; yellow pins/pinchos amarillos = *Myotis chiloensis*; pink pins/pinchos rosados = *Lasiurus varius*; light-blue pin/pincho celeste = *Tadarida brasiliensis*. / Registros georreferenciados de los murciélagos de la Patagonia austral y Tierra del Fuego entre 1866 y 2022. No todos los registros de la Tabla 1 pueden verse aquí debido a la escala.

Table 1. Georeferenced records of Austral Patagonian and Fuegian bats from 1866 to 2022. / Registros georreferenciados de los murciélagos de la Patagonia austral y Tierra del Fuego entre 1866 y 2022. Bats: *H. = Histiotus*, *M. = Myotis*, *L. = Lasiurus*, *T. = Tadarida*. Code: Used for building map in Fig. 1. Date: Year and first letters of month. Latitude and Longitude: Decimal coordinates. No.: Number of individuals observed, nd = No data. Locality: AR = Argentina, CL = Chile. Vegetation classification: *C. = Chiliotrichum*, *D = Drymis*, *F. = Festuca*, *M. = Maytenus*, *N. = Nothofagus*.

Bat species	Code	Date	Latitude	Longitude	No.	Locality	Reference	Habitat type	Vegetation classification
H. magellanicus	1H	1866	53.2418	70.9589	1	Coastal forest at SW Magellan Strait, Punta Arenas city, CL	Philippi 1866	Ñirre shrubland	Deciduous shrubland of *N. antactica-C. difussum*
Bats (generic)	1B	1866	53.1589	70.9932	nd	Forested slope W of Punta Arenas city, CL	Ohlin 1896	Lenga forest	Deciduous forest of *N. pumilio-M. disticha*
M. chiloensis	2M	1902	54.8186	68.3550	1	Ushuaia city, Tierra del Fuego, AR	Dabbene 1902	Coihue-lenga forest	Mixed forest of *N. betuloides-N. pumilio*
H. magellanicus	12H	1902	54.8186	68.3550	nd	Ushuaia city, Tierra del Fuego, AR	Dabbene 1902	Coihue-lenga forest	Mixed forest of *N. betuloides-N. pumilio*
L. varius	28L	1902	54.8186	68.3550	nd	Ushuaia city, Tierra del Fuego, AR	Dabbene 1902	Coihue-lenga forest	Mixed forest of *N. betuloides-N. pumilio*
H. magellanicus	13H	1907	53.6403	69.6498	nd	Cameron sheep station, Tierra del Fuego, CL	Crawshay 1907	Ñirre shrubland	Deciduous shrubland of *N. antactica-C. difussum*
M. chiloensis	3M	1933 Feb	54.9424	67.6634	2	Port Róbalo, N shore of Navarino Island, CL	GBIF: Junius Bird	Coihue-lenga forest	Mixed forest of *N. betuloides-N. pumilio*
M. chiloensis	4M	1957 Feb	55.0833	67.6666	1	Navarino Island, CL	Peña & Barría 1972	Lenga forest	Deciduous forest of *N. pumilio-M. disticha*
M. chiloensis	5M	1957 Feb	54.9383	67.6019	6	Port Williams outskirts, Navarino Island, CL	Peña & Barría 1972	Coihue-lenga forest	Mixed forest of *N. betuloides-N. pumilio*
H. magellanicus	14H	1966 Dec	52.0733	71.7482	1	El Monte, forested area SE Rubens River, CL	Peña & Barría 1972	Lenga forest	Deciduous forest of *N. pumilio-M. disticha*
H. magellanicus	15H	1972 Apr	55.0828	67.0770	1	Port Toro, Navarino Island, CL	Peña & Barría 1972	Coihue-canelo forest	Coastal evergreen forest of *N. betuloides-D. winteri*
L. varius	29L	1973 Jan	52.5669	70.0711	3	San Gregorio sheep station, Magallanes, CL	Tamayo & Pérez 1979	Steppe, in an exotic tree windbreaker	Eastern steppe of *F. gracillima-C. difussum*
L. varius	30L	1977 Jan	51.1785	72.9590	2	Torres del Paine National Park, Magallanes, CL, Administrative HQ	Rau & Yáñez 1979	Ñirre shrubland, perched on a cherry tree	Deciduous shrubland of *N. antactica-C. difussum*
L. varius	30L	1978 Jan	51.1785	72.9590	2	Torres del Paine National Park, Magallanes, CL, Administrative HQ	Rau & Yáñez 1979	Ñirre shrubland, perched on a cherry tree	Deciduous shrubland of *N. antactica-C. difussum*
M. chiloensis	6M	1982 Mar	54.8341	68.5621	1	Forested area in Lapataia River, Ushuaia, Tierra del Fuego Island, AR	Chebez *et al.* 2014	Coihue-lenga forest	Mixed forest of *N. betuloides-N. pumilio*
H. magellanicus	16H	1982 Mar	53.9953	67.4158	1	Viamonte sheep station, Tierra del Fuego, AR	Chebez *et al.* 2014	Ñirre shrubland	Deciduous shrubland of *N. antactica-C. difussum*

Continuation Table 1.

Bat species	Code	Date	Latitude	Longitude	No.	Locality	Reference	Habitat type	Vegetation classification
H. magellanicus	17H	1982 Mar	54.8780	67.3315	1	Harberton sheep station, 65 km E Ushuaia, Tierra del Fuego, AR	Chebez *et al.* 2014	Coihue-canelo forest	Coastal evergreen forest of *N. betuloides-D. winteri*
T. brasiliensis	27T	2011 Apr	52.3332	68.3558	1	Cape Vírgenes lighthouse, Santa Cruz Province, AR	Barquez *et al.* 2013	Steppe, inside AR Navy's lighthouse	Eastern steppe of *F. gracillima-C. difussum*
M. chiloensis	7M	2015 Apr	54.5801	69.1527	4	Fjord Parry, A. Agostini National Park, Tierra del Fuego, CL	Ossa 2016	Coihue-lenga forest	Mixed forest of *N. betuloides-N. pumilio*
M. chiloensis	8M	2017 Sep	51.5741	72.5856	1	Outskirts of Port Natales, Magallanes, CL	GBIF: Ignacio Fernández	Steppe, in an orchard	Eastern steppe of *F. gracillima-C. difussum*
M. chiloensis	9M	2017 Nov	54.1389	68.7056	11	Karukinka Park, Tierra del Fuego, CL, near Pampa Guanaco	Ossa *et al.* 2020	Lenga forest	Deciduous forest of *N. pumilio-M. disticha*
H. magellanicus	18H	2017 Nov	54.1389	68.7056	30	Karukinka Park, near Pampa Guanaco	Ossa *et al.* 2020	Lenga forest	Deciduous forest of *N. pumilio-M. disticha*
H. magellanicus & *M. chiloensis*	21HM	2017 Nov	54.2005	68.7204	nd	Karukinka Park, southernmost roosting site	Ossa *et al.* 2020	Lenga forest	Deciduous forest of *N. pumilio-M. disticha*
Both species	22HM	2017 Nov	54.1556	68.7205	nd	Karukinka Park, roosting site HM1	Ossa *et al.* 2020	Lenga forest	Deciduous forest of N. pumilio-M. disticha
Both species	23HM	2017 Dec	54.1403	68.7039	nd	Karukinka Park, roosting site HM2	Ossa *et al.* 2020	Lenga forest	Deciduous forest of *N. pumilio-M. disticha*
Both species	24HM	2017 Dec	54.1391	68.7102	nd	Karukinka Park, roosting site HM3	Ossa *et al.* 2020	Lenga forest	Deciduous forest of *N. pumilio-M. disticha*
Both species	25HM	2017 Dec	54.1397	68.7188	nd	Karukinka Park, roosting site HM4	Ossa *et al.* 2020	Lenga forest	Deciduous forest of *N. pumilio-M. disticha*
Both species	26HM	2017 Dec	54.1388	68.7326	nd	Karukinka Park, roosting site HM5	Ossa *et al.* 2020	Lenga forest	Deciduous forest of *N. pumilio-M. disticha*
H. magellanicus	10H	2021 Mar	54.9131	67.8068	1	Outskirts W of Port Williams, Navarino Island, CL	GBIF: Tamara Contador	Coihue-canelo forest	Coastal evergreen forest of *N. betuloides-D. winteri*
H. magellanicus	19H	2021 Dec	53.2403	71.0403	2	Leñadura, 8 km S of Punta Arenas city, Magallanes, CL	Alejandro Kusch, pers. comm.	Lenga forest	Deciduous forest of *N. pumilio-M. disticha*
H. magellanicus	20H	2022	52.1936	69.2327	1	Cañadón Grande sheep station, Magallanes, CL	David Martínez, pers. obs.	Steppe, inside administr. building	Eastern steppe of *F. gracillima-C. difussum*

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