Short Note

Fernando J. Novoa*, Álvaro Marín, Nicolás Gálvez and Rocío Almuna

Records and activity patterns of an undescribed *Lagidium* in Andean temperate ecosystems of southern Chile

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Abstract: *Lagidium wolffsohni* is one of the largest living chinchillids and among South America's least studied rodents, and it is endemic to the high-Andean rocky environments of Patagonia. We report new records of *L.* cf. *L. wolffsohni* in Chile's La Araucania Region, extending its northern range by 144 km. From 2023 to 2025, camera-trap surveys yielded 241 independent detections over 1,132 trap days between 1,620 and 1,800 m a.s.l. The species showed nocturnal, bimodal activity, with adults and juveniles indicating one annual reproductive event. These findings extend their ecological range into Andean temperate ecosystems and highlight the need for genetic and long-term monitoring to guide conservation efforts.

Keywords: viscacha; data deficient; Andes mountain range; *Araucaria araucana*; camera traps; mammals

Extant Chinchillids comprise three genera: *Chinchilla*, *Lagidium*, and *Lagostomus,* all endemic to South America. The genus *Lagidium* includes four widely recognized species: *L. peruanum* (Meyen 1833), *L. viscacia* (Molina 1782), *L. ahuacaense* (Ledesma et al. 2009), and *L. wolffsohni* (Thomas 1907), although taxonomic uncertainties persist regarding the validity of some species (Bellusci et al. 2024; Spotorno and Patton 2015; Teta and Lucero 2017). The group is broadly distributed along the Andes, from Ecuador to southern Argentina and Chile, occupying a variety of altitudinal environments with steep slopes and sparse vegetation (Chebez et al. 2014; Iriarte 2008; Spotorno and Patton 2015). Within this genus, *L. viscacia* and *L. wolffsohni* specifically inhabit the rocky outcrops of Patagonia in both Argentina and Chile (Osgood 1943; Spotorno and Patton 2015).

L. wolffsohni, occupies a unique taxonomic and ecological position among South American rodents. Despite its conspicuous morphology and marked ecological specialization, information on its biology and ecology remains limited, largely due to the inaccessibility and extreme environmental conditions of its high-Andean habitat. This knowledge gap is compounded by broader systematic uncertainty within *Lagidium*, as both morphological and molecular evidence have questioned the traditional delimitation of *L. viscacia* and suggested the existence of multiple subspecies (Ledesma et al. 2009; Spotorno et al. 2004; Teta and Lucero 2017).

Within this framework, *L. wolffsohni* is currently treated as a distinct species closely related to *L. moreni*, a taxon originally described on morphological grounds and still under discussion (Teta and Lucero 2017). *L. moreni*, distributed between Neuquén and Chubut in Argentina (Teta and Austrich 2019), at latitudes comparable to La Araucanía Region in Chile, differs morphologically from *L. wolffsohhni*, particularly in exhibiting relatively larger ears and a well-developed black dorsal stripe. Nevertheless, clarifying species boundaries within the genus will require targeted morphometric and genomic sampling. Consequently, key aspects of its natural history are poorly understood.

Although the species is regarded as considered rare in both Chile and Argentina, with a restricted geographic range and apparently small, localized populations (Iriarte et al. 2021; Novoa et al. 2023; Spotorno and Patton 2015), significant uncertainty persists regarding its actual distribution and

***Corresponding author: Fernando J. Novoa**, Programa de Doctorado en Ciencias Antárticas y Subantárticas & Cape Horn International Center for Global Change Studies and Biocultural Conservation (CHIC), Universidad de Magallanes, Punta Arenas 6210427, Chile; and ECOS (Ecosystem-Complexity-Society) Co-Laboratory, Pontificia Universidad Católica de Chile, Centre for Local Development (CEDEL UC), Villarrica 4930445, Chile, E-mail: frnovoa@uc.cl. https://orcid.org/0000-0002-8634-903X
Álvaro Marín, Corporación Nacional Forestal (CONAF), Santiago 8320000, Chile
Nicolás Gálvez, Wildlife Ecology and Coexistence Lab, Pontificia Universidad Católica de Chile, Centre for Local Development (CEDEL UC), Villarrica 4930445, Chile. https://orcid.org/0000-0002-5129-0090
Rocío Almuna, ECOS (Ecosystem-Complexity-Society) Co-Laboratory, Pontificia Universidad Católica de Chile, Centre for Local Development (CEDEL UC), Villarrica 4930445, Chile; and School of Agriculture and Environment, The University of Western Australia, Perth, WA 6009, Australia. https://orcid.org/0000-0002-6872-8562

conservation status. Reflecting this knowledge gap, it is listed as Vulnerable in Chile (Supreme Decree No. 5 of 1998), assessed as Endangered and later reclassified as Data Deficient in Argentina (Teta and Austrich 2019), and currently Data Deficient by the IUCN (Roach 2016).

L. wolffsohni is characterized by its large body size (>2 kg), distinguished by its stout, robust build and exceptionally long, dense fur strongly suffused with orange. Wool hairs exceed 35 mm and guard hairs may surpass 50 mm, conferring a notably bulky appearance. Dorsally, the pelage approaches clay-color, with brownish-slate hairs tipped creamy buff, while ventral areas become richer and more tawny. Distinct white patches are present in the axillary and inguinal regions. The ears are comparatively short, thickly haired, and dark-backed with creamy-tipped bases. The tail is remarkably bushy, with dorsal crest hairs exceeding 150 mm (Chebez et al. 2014; Mann 1978; Thomas 1907). The species inhabits rugged Andean terrains between ~800 and 4,000 m elevation, forming small colonies in rock crevices typically spaced 5–10 m apart. It exhibits gregarious behavior, primarily diurnal to crepuscular activity, and agile locomotion across rocky substrates, facilitated by its muscular limbs and tail-assisted balance. Reproduction occurs in spring, usually with a single offspring per female (Iriarte et al. 2021; Mann 1978).

In Chile, *L. wolffsohni* has been recorded in Aysén Region, near Cochrane (Figueroa et al. 2000) and in the Magallanes Region. In the latter, records include Torres del Paine National Park (NP) and adjacent areas such as Cerro Guido, Sierra de Los Baguales, and Sierra de Las Vizcachas (Johnson et al. 1990; Osgood 1943; Thomas 1907). Additionally, a fossil referred to *Lagidium sp.* has been reported from Mylodon Cave (Pardiñas et al. 2022). Iriarte et al. (2021) extended the species' known range ~722 km northward into Los Lagos Region, reporting occurrences in Pampa Frutilla and Cráter del Puma within Puyehue NP, and in Huinay, Hualaihué District (Palena Province). Novoa et al. (2023) added records in the same region from El Leon Valley near the Argentine border, further confirming this northward expansion. Here, we provide the first confirmed records of *L.* cf. *L. wolffsohni* for the La Araucanía Region, southern of Chile. We document its activity patterns and extend its known northern distribution by ~144 km. We discuss the implications of these findings for the species' ecology, taxonomy, and protection, and we outline priorities for future research and monitoring in Andean temperate ecosystems.

We surveyed populations of *L.* cf. *L. wolffsohni* in the La Araucanía Region, southern Chile, between 2023 and 2025 using systematic camera-trap monitoring, opportunistic observations, and historical records. Study sites were located near the forest line and in rocky mountainous zones close to the Argentine border, between 1,500 and 1,800 m a.s.l. The climate is cool-temperate, with summers below 30 °C, winters −5 to −10 °C, and annual rainfall of 2,000–4,500 mm. Higher forests (above 1,250 m) were dominated by *Araucaria araucana* and *Nothofagus pumilio*. Above 1,500 m, rocky areas were dominated by low shrubs of *Festuca pallescens*, *Gaultheria mucronata*, and *Pappostipa* spp (Donoso 1993). Camera traps were deployed at two sites within Villarrica NP: (1) Quinquilil (39°30′28.00″S, 71°35′34.46″W; 1,800 m) and (2) Sierra Millallipén (39°29′56.22″S, 71°30′48.67″W; 1,600 m). During the first sampling period (2 December 2023 to 7 March 2024), we deployed two unbaited camera traps at Sierra Millallipén: a Bushnell Trophy Cam HD Essential E3, active for 54 days, and a Browning Recon Force Elite HP5, active for 96 days. During the second sampling period, we deployed nine Bushnell CORE S–4K cameras – five at Sierra Millallipén (24 December 2024 to 2 May 2025, 130 days) and four at Quinquilil (31 January to 23 April 2025, 83 days). Cameras were placed along animal trails identified by footprints, feces, and other signs near cliff bases and ledges, to detect potential habitats used by the species. All cameras were set to normal sensitivity, configured to capture three pictures per trigger and 10–30 seg videos in rapid-fire mode, and a 30-min quiet interval between recording events. To complement camera-trap sampling and verify occurrence at a regional scale, we conducted opportunistic visual surveys, searched for indirect signs (e.g., feces), and reviewed historical observation records at two additional sites: (3) Conguillío NP (71°42′50.72″ W, 38°40′8.74″ S; 1,700 m), and (4) Tolhuaca NP (71°44′46.95″ W, 38° 12′6.43″ S; 1,600 m).

To evaluate the activity patterns of *L.* cf. *L. wolffsohni*, we analyzed time-stamped photographs obtained from camera traps (Chaudhary et al. 2020). Images were classified by species and processed using AddaxAI (van Lunteren 2023), integrating the MegaDetector machine learning model for wildlife image classification. This algorithm automatically detects animal presence in photographs. To maximize sensitivity, we implemented the most conservative detection confidence threshold (0.01) in AddaxAI, a parameter previously validated to achieve a 100 % detection success rate (i.e., all animals present in the images were correctly identified). Following automated classification, a manual review was performed by an observer to confirm the accuracy of detections. All detection events were sorted by time of occurrence, applying a 30-min independence threshold to avoid duplicate counts of the same event. Hourly detection frequencies were calculated to describe the species' activity over a 24-h cycle and activity patterns were estimated nonparametrically using kernel density estimations (Ridout and Linkie 2009).

We obtained new records of *L.* cf. *L. wolffsohni* at four sites in the La Araucanía Region via camera traps,

opportunistic observations, and historical data (Figure 1). Across both sampling periods, 241 independent detections were obtained over 1,132 camera-trap days, representing 21.3 % capture success (detections per camera-trap day). The species was detected by nine camera stations on rocky cliffs between 1,620 and ~1,800 m a.s.l., above the tree line of mixed forest of *A. araucana* and *N. pumilio*. Other species recorded included culpeo fox (*Lycalopex culpaeus*), several birds, small rodents, and reptiles.

We recorded *L.* cf. *L. wolffsohni* at both sites within Villarrica NP. (1) In Quinquilil, we obtained 33 detections over 83 days (332 camera-trap days; Figure 2A). (2) In Sierra Millallipén, we recorded 90 detections during the first sampling period (96 days; 150 camera-trap days; Figure 2B) and 118 detections during the second period (130 days; 650 camera-trap days). At the other two sites, species occurrence was confirmed as follows: (3) Conguillío NP, through visual observation without photographic confirmation; (4) Tolhuaca NP, through opportunistic photographic records obtained during direct encounters (Figure 2C).

Morphologically, individuals exhibited diagnostic traits of *L.* cf. *L. wolffsohni*, including large body size, rich brownish-slate dorsal coloration with a faint mid-dorsal dark stripe, short ears, a feathery tail, and grayish-orange dark tone (Figure 2A, B, C and D). Most detections involved solitary individuals; however, an adult with a juvenile was recorded at Sierra Millallipén in both sampling periods, starting in January (Figure 2E).

Pooling both sampling periods, *L.* cf. *L. wolffsohni* exhibited a bimodal activity (Figure 3). The first and most pronounced peak began to rise around 03:00 h, increasing steadily until reaching a maximum between 08:00 and 09:00 h. Activity then declined sharply toward midday, reaching its lowest levels between approximately 12:00 and 17:00 h. A second, smaller peak was recorded at dusk,

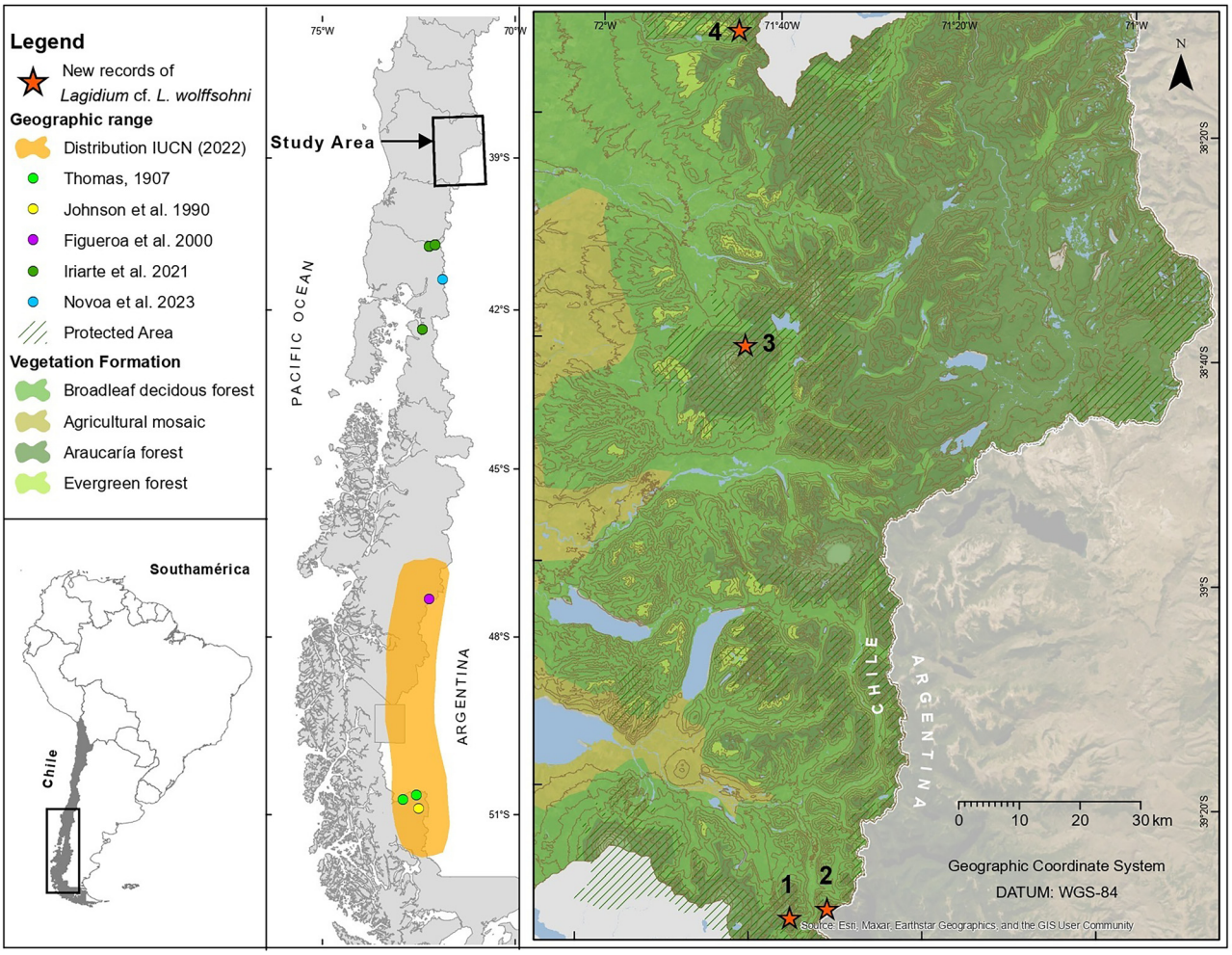

Figure 1: Study area of surveys conducted in the La Araucanía Region, southern Chile. Red stars indicate the new records of *Lagidium* cf. *L. wolffsohni*: (1) Quinquilil (Villarrica National Park), (2) Sierra Millalípén (Villarrica National Park), (3) Conguillío National Park, and (4) Tolhuaca National Park.

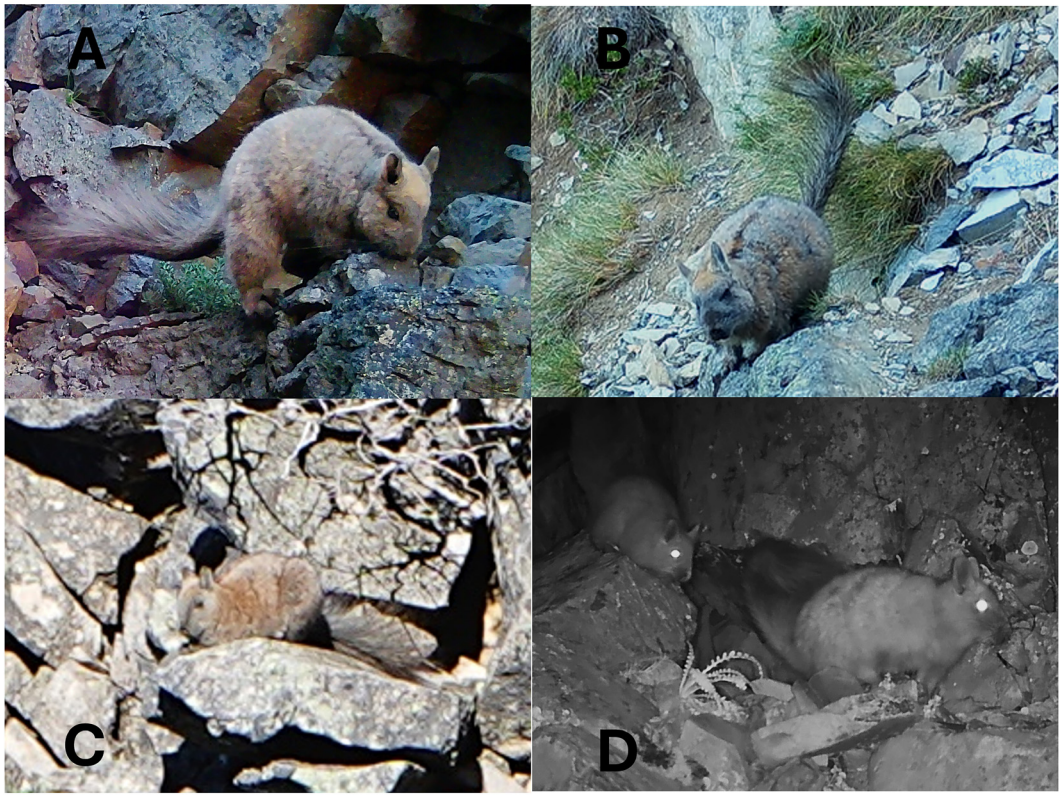

Figure 2: Different pictures of new records (A, B, C, D) of *Lagidium* cf. *L. wolffsohni* taken in La Araucanía region by camera trap. Villarrica National Park – Quinquilil site (A), Villarrica National Park – Sierra Millallipén site (B), Tolhuaca National Park (photo by Álvaro Marín) (C), and Record of an adult and a juvenile *Lagidium* cf. *L. wolffsohni* in Sierra Millallipén site (D).

between roughly 19:00 and 22:00 h. Activity was consistently low in afternoon and midnight hours.

We report the first confirmed record of viscachas from La Araucanía Region, and our records significantly expand the current knowledge of the distribution of *L.* cf. *L. wolffsohni* in Chile, extending its known northern distribution by approximately 144 km. This expansion builds on the recent records by Iriarte et al. (2021) and Novoa et al. (2023), which extended the species' range to the Los Lagos Region (~700 km northward) in northern Patagonia. Our findings confirm the species' presence in several protected areas within the southern Andes (Villarrica NP, Conguillío NP and, Tolhuaca NP). The pattern of records suggests *L.* cf. *L. wolffsohni* may be more widely distributed in Andean temperate ecosystems than previously recognized, albeit likely in a fragmented manner due to ecological discontinuities and human pressures, as also reported for other *Chinchilla* species (Stuhler et al. 2020).

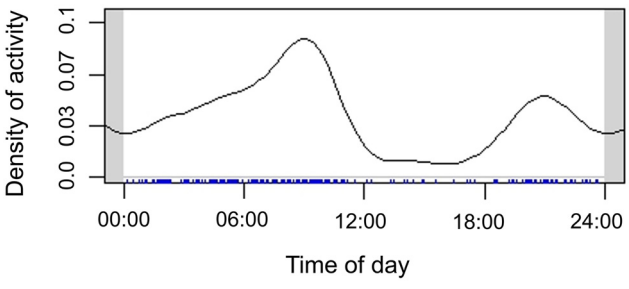

Figure 3: Estimated activity patterns of *Lagidium* cf. *L. wolffsohni*. Independent records are indicated by tick marks along the *x*-axis of the plot.

Field identifications were guided by established diagnostic criteria (Chebez et al. 2014; Iriarte 2008; Iriarte et al. 2021; Spotorno and Patton 2015). Individuals in La Araucanía exhibited grayer and darker-orange pelage than the canonical orange-tinged description, although not as dark as some individuals documented from northern Patagonia, yet consistent with the variation reported for that region (Iriarte et al. 2021). Marked pelage variability in viscachas is expected due to partial, year-round molting that produces patchy replacement of old hair and mixed pigment stages across age classes (Mann 1978), a process that likely underpins the colour variation observed by La Araucanía sites and that limits the taxonomic resolution of colour-based characters alone.

Nevertheless, we suggest caution in assigning these individuals to *L. wolffsohni*. First, the geographic gap between the southernmost confirmed records of *L. wolffsohni* (48°S) and our records in La Araucanía (39°S) spans approximately 900 km. Second, some individuals appear to exhibit a distinct dark forehead 'cap' not mentioned in the original description (Thomas 1907). Third, previous records from intermediate localities such as Puyehue (Iriarte et al. 2021) and El Leon Valley (Novoa et al. 2023) also lack molecular or morphometric confirmation. Together, these considerations leave open the possibility that the populations described here may represent an undescribed taxon requiring further investigation. In this regard, records from the eastern Andes of Argentina at comparable latitudes, particularly from Neuquén and Río Negro provinces, where *L. moreni* has been documented (Teta and Austrich 2019), provide relevant comparative context and should be incorporated in future morphometric and molecular analyses.

The absence of voucher specimens and genetic data precludes definitive taxonomic assignment. We therefore treat our records as *Lagidium* cf. *L. wolffsohni* provisionally, as resolving their taxonomic identity has direct implications for conservation status and management, regardless of whether these individuals represent a range extension of *L. wolffsohni* or an undescribed taxon.

Ecologically, we documented a bimodal activity pattern, predominantly nocturnal, with a strong pre-dawn to morning peak and a smaller dusk peak. This pattern is consistent with the bimodal activity previously reported for *L. wolffsohni* in Argentina (Pendaries 2020, 2021) and contrasts with earlier descriptions of diurnal–crepuscular behavior (Mann 1978), as well as with the mainly diurnal activity of *L. viscacia*. Nocturnality in *L.* cf. *L. wolffsohni* may reflect adaptive responses to predation risk and thermal constraints at high elevations, while also maximizing foraging opportunities in low-light conditions along rocky outcrops and cliff faces, as documented for other Andean rodents in Argentina (e.g. *L. viscacia;* Galende and Raffaele 2013). Reproductive observations (juveniles from January onward, often with adults) are consistent with a single annual breeding event and one offspring per female, with parturition in late spring (December; Mann 1978; Pendaries 2021). This low reproductive output, combined with a restricted and likely fragmented range, may increase vulnerability to local stressors. In contrast, Pearson (1948) documented similarly low fecundity in *L. peruanum*, typically a single, slowly developing embryo per gestation and interpreted this pattern as a characteristic low rate of reproduction in mountain vizcachas.

The restricted range of *L.* cf. *L. wolffsohni* makes it highly vulnerable to hunting, habitat loss, and environmental degradation (Iriarte 2008; Spotorno and Patton 2015). Although several records derive from protected areas, population connectivity and dynamics remain uncertain. Fragmentation from livestock grazing, deforestation, and extractive activities may further isolate subpopulations and increase the risk of local extinction in the La Araucanía Region (Beltrán-Véliz et al. 2023). Climate change likely affects the species' range and fitness, as reported for other Patagonian rodents (e.g., *Aconaemys fuscus*; Cuellar Soto et al. 2025). These patterns suggest that the species could be undergoing distributional contraction like that observed in other Andean caviomorphs. Conservation genetics and continuous, coordinated monitoring will be essential to understand population structure and to safeguard this poorly known Andean rodent endemic to southern South America.

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Research ethics: The camera-trap study is non-invasive and therefore did not require ethical approval from my institution. However, because the research was conducted within a protected area in Chile, we obtained authorization to carry out research activities using camera traps from the National Forestry Corporation of Chile (CONAF). Date approval: 05/08/2024, Permit document ID: No. 10/2024 IX.
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Data availability: Not applicable.

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