Journal of Threatened Taxa

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ISSN 0974-7907 (Online) | ISSN 0974-7893 (Print)

SMALL WILD CATS SPECIAL ISSUE

Short Communication

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14 December 2020 | Vol. 12 | No. 16 | Pages: 17252–17257
DOI: 10.11609/jott.6208.12.16.17252-17257

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Journal of Threatened Taxa | www.threatenedtaxa.org | 14 December 2020 | 12(16): 17252–17257
ISSN 0974-7907 (Online) | ISSN 0974-7893 (Print)
DOI: https://doi.org/10.11609/jott.6208.12.16.17252-17257
#6208 | Received 22 May 2020 | Final received 15 July 2020 | Finally accepted 21 July 2020
PLATINUM OPEN ACCESS

SHORT COMMUNICATION

Updating records of a threatened felid species of the Argentinian Patagonia: the Guigna *Leopardus guigna* (Molina, 1782) (Mammalia: Carnivora: Felidae) in Los Alerces National Park

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Abstract: The Guigna *Leopardus guigna* is an endemic felid of the Valdivian Temperate Forests in Argentina and Chile, and of the Chilean Matorral ecoregion. It is a small-sized felid (1.6–2.5 kg), one of the least known wild felids, and categorized as Vulnerable to extinction. Here, we present two new reliable records in Los Alerces National Park, Chubut Province, Argentina, the southernmost protected area, in which the species is present. The first record is an individual found dead on 6 June 2019 on the bank of Frey River near Amutui Quimei Lake. The second record was an individual casually captured in an American Mink *Neovison vison* cage on 7 December 2019 near Menéndez Lake. Both records were in forested *Nothofagus* sites very nearby to watercourses. In order to maintain viable long-term Guigna populations, corridors between protected areas should be established, particularly in habitat dominated by human presence and activities. We strongly recommend further fieldwork in protected areas and between them to increase the knowledge about the distribution, habitat use, and ecology of the Guigna.

Keywords: *Abrothrix*, American Mink, Argentinian protected area, cage trap, Kodkod, Valdivian Temperate Forests.

Resumen: El Guigna *Leopardus guigna* es un félido endémico de los Bosques Templados Valdivianos, en Argentina y Chile, y de la ecoregión Matorral Chileno en Chile. Este felino de pequeño tamaño (1.6-2.5 kg) es uno de los miembros menos conocidos de la Familia, y categorizado como Vulnerable a la extinción. En este trabajo, presentamos nuevos registros indudables en el Parque Nacional Los Alerces, provincia del Chubut, Argentina, el área Protegida más austral con registros fehacientes de la especie. El primero corresponde a un individuo encontrado muerto el 6 de junio de 2019 en la costa del río Frey, cerca del embalse Amutui Quimei. El segundo fue un individuo capturado casualmente en una trampa para visón *Neovison vison* el 7 de diciembre de 2019 en el lago Menéndez. Ambos registros ocurrieron en bosques de *Nothofagus* muy cerca de cursos de agua. Para mantener una población viable de Guigna a largo plazo, se deben establecer corredores entre las áreas protegidas, particularmente en hábitats dominados por la presencia y actividades humanas. Creemos que es necesario un mayor trabajo de campo en las áreas protegidas y entre ellas, para contribuir al conocimiento ecológico de esta especie.

Palabras clave: *Abrothrix,* Áreas protegida de Argentina, Bosques Templados Valdivianos, Kodkod, Trampa para visones.

Editor: Angie Appel, Wild Cat Network, Bad Marienberg, Germany. **Date of publication:** 14 December 2020 (online & print)

Citation: Guerisoli, M.de.las.M., M.I. Schiaffini & G. Bauer (2020). Updating records of a threatened felid species of the Argentinian Patagonia: the Guigna *Leopardus guigna* (Molina, 1782) (Mammalia: Carnivora: Felidae) in Los Alerces National Park. *Journal of Threatened Taxa* 12(16): 17252–17257. https://doi.org/10.11609/jott.6208.12.16.17252-17257

Funding: None.

Competing interests: The authors declare no competing interests.

Acknowledgements: We thank Roberto Sauval for the picture of the Guigna specimen. We are grateful to Administración de Parques Nacionales for granting the permit no. DI-2018-255-APN-DRPN#APNAC for American Mink control and to all the park rangers involved in this fieldwork. Three anonymous reviewers made valuable comments that improved this article.

The Guigna *Leopardus guigna*, also called Kodkod or "Gato Huiña", is an elusive and cryptic species endemic to Chilean and Argentinian Valdivian Temperate Forests and Chilean Matorral (Nowell & Jackson 1996; Sunquist & Sunquist 2002, 2009; Tecklin et al. 2011; Fig. 1). Apart from being very small and rare, the Guigna is a wild felid with a restricted geographical distribution in approximately 300,000km^2 (Napolitano et al. 2015; Fig. 1). Categorized on the IUCN Red List as Vulnerable, its area of occupancy is fragmented due to loss and degradation of native forests (Napolitano et al. 2015). Due to changes in human use of land, the Guigna has lost 5.5% of its range since 1923 (Cuyckens et al. 2015). Moreover, Cuyckens et al. (2015) estimated that climate change together with human land use will negatively affect 40% of the Guigna's present potential distribution by the year 2050. Additionally, retaliatory killing for poultry depredation, road kills and attacks by dogs are also threats to this species, particularly in fragmented landscapes (Napolitano et al. 2015). In this scenario, contact with Domestic Cat *Felis catus* can be common, thus increasing transmission of common domestic species' pathogens such as Feline Immunodeficiency Virus and Feline Leukemia Virus (Mora et al. 2015). Still, in human-dominated landscapes, the Guigna can tolerate habitat fragmentation as long as an appropriate network of forest patches exists (Gálvez et al. 2018).

Protected areas are pivotal for the preservation of the Guigna, given that a great portion of the species' present range is contained in 19 protected areas of Chile and Argentina, covering a total of 133,882km^2 (Napolitano et al. 2014; Cuyckens et al. 2015). In Argentina, the Guigna is also categorized as Vulnerable (Monteverde et al. 2019), and its geographic distribution covers the Andean Mountains of Neuquén, Rio Negro and Chubut provinces with an area of less than 20,000km^2 (Monteverde et al. 2019; Figure 1). In this portion of its global range, the Guigna occurs only in four national parks of the Argentinian Patagonia, namely in Lanín, Nahuel Huapi, Lago Puelo, and Los Alerces national parks (Fig. 1), which together cover a total area of 13,837km^2 (SIB 2020a). In these protected areas, the Guigna is a "species with special value", a protection category that includes all species that: i) are highly threatened, ii) are distributed in at least 10% of the Argentinian national parks, and iii) represent a societal and spiritual value for local people (Monteverde et al. 2019).

In Argentina, the southernmost protected area where the Guigna is known to occur is Los Alerces National Park. In this protected area, only eight sighting records of Guigna exist during the last four decades 1978–2018 (SIB 2020a). These sightings consisted of nine individuals: four adults, three sub-adults, and two of uncertain age. Most of the individuals were sighted in summer (n = 6, SIB 2020a). Considering that this national park receives approximately 130,000 visitors per year (SIB 2020b) with about 15 active rangers in the field (GB, pers. obs.), the sighting frequency of this felid is quite low. New records for this rare and threatened species are of high value. Here, we report two additional records of the Guigna in Los Alerces National Park in 2019.

Study area

Los Alerces National Park covers 2,595.7km^2 in the Andean region of northwestern Chubut Province, Argentina (Fig. 1) and includes two main management categories: national reserve and national park (Martin & Chehébar 2001). The first is a buffer zone of 722.9km^2 where human activities are permitted, but regulated for livestock raising and tourism, while the second preserves the core area of this conservation unit extending over 1,872.8km^2 (Martin & Chehébar 2001). This protected area is part of the Valdivian Temperate Forests (Dinerstein et al. 2017), an ecoregion that spans across 346,000km^2 between 36 and 47°S latitude and is dominated by complex and open forests with endemic broadleaf evergreen tree species (Tecklin et al. 2011).

The climate is temperate cold, with a mean annual temperature of 8°C (APN 1997). The mean maximum temperature in summer is 14.7°C, and mean minimum in winter is 1.8°C. Mean annual precipitation decreases abruptly from west to east, from more than 3,000mm/year on the western side of the national park, including Valdivian evergreen rainforest, to 800mm/year at the eastern forest-steppe ecotone (APN 2019). Variable conditions of elevation and sun exposure affect the water balance and creates warm microclimates (APN 2019). Precipitation occurs mainly from April to October, with snowfall concentrated during autumn to spring, i.e. June to September (APN 2019).

Material and Methods

We recorded two Guignas opportunistically while conducting wildlife studies inside Los Alerces National Park in 2019. For controlling American Mink *Neovison vison*, we installed cage traps of 46cm in length with an entrance of 10 cm x 10 cm. Capture was authorized through a permit no. DI-2018-255-APN-DRPN#APNAC. Traps were installed at 2–3 m from the water edge and baited with Rainbow Trout *Oncorhynchus mykiss*. Guigna's faeces was analysed macroscopically by eye and microscopically using a microscope with 10x and

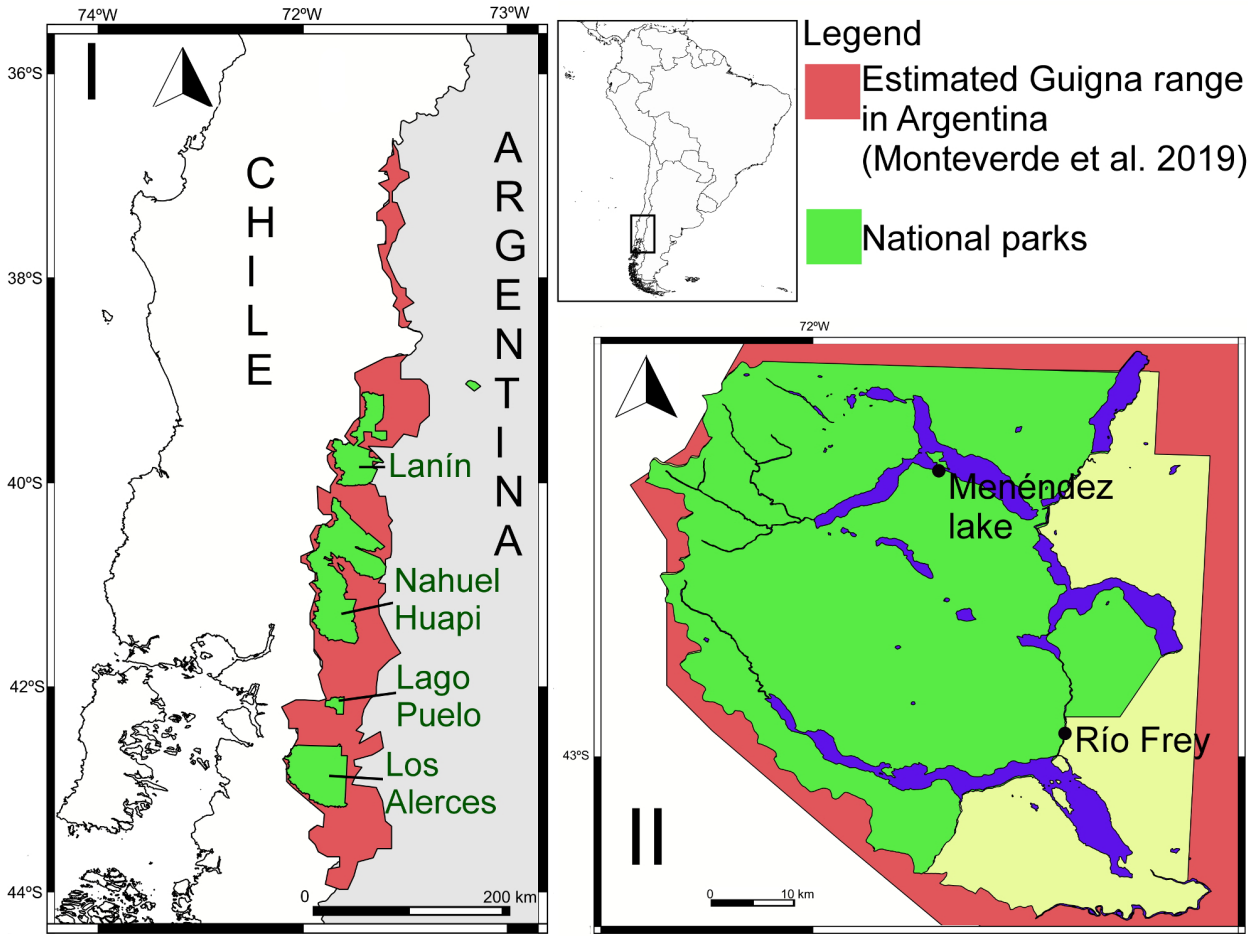

Figure 1. Map showing study area and distribution of the Guigna in Argentina.

40x lenses. Coordinates were determined using a GPS Garmin Etrex Legend-H.

Results

On 6 June 2019 at 11.00h, a subadult female was found dead on the bank of Frey River (Image 1) near Amutui Quimei Lake (-42.9741°S & -71.7241°W; Fig. 1). The cause of death was unknown. It was severely malnourished and estimated to have died a maximum of 48 hours ago. Its mass and total length were 940g and 65cm, respectively. It was not possible to remove the stomach and intestinal contents due to the decomposition status. The habitat of the finding location is characterized by typical Andean Forest, mainly composed of Coihue *Nothofagus dombeyi* (Fagaceae), Ciprés de la Cordillera *Austrocedrus chilensis* (Cupressaceae), Maitén *Maytenus boaria* (Celastraceae) and Radal *Lomatia hirsuta* (Proteaceae) trees, interspersed with Chilean Bamboo *Chusquea culeou*.

This Guigna specimen is now housed at the mammal's collection of Laboratorio de Investigaciones en Evolución y Biodiversidad (LIEB-M-1630), Esquel, Argentina.

On 7 December 2019 at 10:00h, one of us (MIS) found a live adult Guigna in a cage trap (Image 2) at Menéndez Lake (-42.6869°S & -71.8622°W; Fig. 1). This location was 35km in straight line from the first record location. We were unable to determine the sex of this individual because of its body position and scared condition. We estimated that the Guigna was captured between approximately 19.00h of 6 December 2019 and the next morning at approximately 09.00h. When found, the Guigna exhibited a nervous behaviour and was released shortly afterwards. Inside the cage, we found faeces composed entirely of dark grey hairs with a cuticular and medullary pattern that were identified as belonging to *Abrothrix* species. The capture site in the Andean Forest was characterized by a dense understorey with several fallen trunks that had a diameter ranging from approximately 5 to 50 cm. The nearby forest was dominated by adult more than 5m high trees of Coihue, Ciprés, Tepa *Laureliopsis philippiana* (Monimiaceae), Tineo *Weinmannia trichosperma* (Cunoniaceae) and

Image 1. Guigna found dead on 6 June 2019 in Río Frey near Amutui Quimei Lake, Los Alerces National Park, Argentina. © R. Sauval

Image 2. Guigna captured in a cage trap on 7 December 2019 near Menéndez Lake, Los Alerces National Park, Argentina. © M. Schiaffini

shrubs of Maqui *Aristotelia chilensis* (Elaeocarpaceae), and Espino Azul *Rhaphithamnus spinosus* (Verbenaceae).

Discussion

Los Alerces National Park is one of four national parks in Argentina where Guignas were sighted apart from Nahuel Huapi, Lago Puelo and Lanín National Parks (SIB 2020a). The last known sighting of a Guigna in Los Alerces National Park was in January 2018, but without photographic evidence. This Guigna was close to a stream and a water intake of the park where the habitat is characterized by the presence of low Ñire *Nothofagus antarctica* (Fagaceae) and Ciprés forests (SIB 2020a). According to Napolitano et al. (2015), the distribution of the Guigna extends to Santa Cruz province in Argentina near Perito Moreno National Park. In the latest published map for the species by Monteverde et al. (2019), however, Los Alerces National Park is the southernmost protected area in Argentina with confirmed presence of the species. We think that it is probably present in more southerly regions of Argentina, but lack of records and research efforts make it difficult to confirm this. Napolitano et al. (2014) affirmed that the Andes mountain range was neither a historical nor a current effective barrier to gene flow for the Guigna, but the southern Guigna group identified in Chile, the San Rafael Lake group between -46.5^{0}S and -47.5^{0}S, is geographically isolated. The potential Guigna population in the Argentinian side between -46.5^{0}S and -48^{0}S is demographically isolated or received dispersing individuals from the "Argentinian group", a population approximately 160km to the north (Napolitano et al. 2014). The closest cluster in Chile is the Lake District group (Napolitano et al. 2014) at a distance of about 600km. Still, dispersal of Guignas between regions in Argentina may not be easy, since they are likely exposed to competition from its more abundant and larger-sized sister species, the Geoffroy's Cat *Leopardus geoffroyi* (Lucherini et al. 2008; Napolitano et al. 2014).

At present, two Guigna subspecies are recognized: *L. g. tigrillo* inhabiting the Chilean Matorral, woodlands and forests in northern and central Chile; and *L. g. guigna* inhabiting the denser Valdivian temperate rainforest and Andean Patagonian forest in southern Chile and southwestern Argentina (Napolitano et al. 2014). The two records in Los Alerces National Park can possibly be referred to *L. g. guigna*, but based only on geographic distribution. These new records were found near closed vegetation habitat, with dense understorey and near waterbodies. Vegetation cover is an important ecological requirement for this species (Napolitano et al. 2015). The main vegetation around the two records were *Nothofagus* and Ciprés trees, with dense understorey. The presence of many carnivore species is associated with dense understorey, since the abundance of prey such as small mammals and birds is correlated with the presence of understorey shrub cover (Saavedra & Simonetti 2005; Estades et al. 2012). Dense understorey has been an important characteristic to enhance Guigna presence in forest plantations in Chile (Simonetti et al. 2013) and in other areas of Chile where Guignas were recorded (Sanderson et al. 2002; Acosta-Jamett & Simonetti 2004; Delibes-Mateos et al. 2014). Gálvez et al. (2013) found that in a fragmented Andean piedmont landscape, Guignas inhabited sites preferentially with forest cover such as old and secondary forest and scrubland. Although this species is thought to be strongly dependent on forests and sensitive to degradation and fragmentation (Sunquist & Sunquist 2002; Acosta-Jamett & Simonetti 2004; Acosta & Lucherini 2008), Gálvez et al. (2018) emphasized that it can tolerate habitat loss if networks of forest patches are present in agricultural areas.

In the faecal sample of the Guigna captured we found remains of *Abrothrix* species. This rodent was identified as a common prey of the Guigna in southern Chile, where faecal samples contained mainly *A. olivacea* and *A. hirta*, representing between 5.8% and 33.3% of the Guigna's diet (Dunstone et al. 2002; Freer 2004; Correa & Roa 2005; Moreira-Arce et al. 2015; Figueroa et al. 2018).

According to Cuyckens et al. (2015), the border between Argentina and Los Lagos Region in Chile is highly suitable for Guigna conservation. Two groups of Guigna haplotypes, i.e. Lake District and Argentinian, occur in this region with low migration rates between them (Napolitano et al. 2014). This area was proposed as a "Management Unit for Guigna Conservation" that facilitates various degrees of gene flow between Guigna populations (Napolitano et al. 2014). In order to maintain viable long-term populations, corridors between protected areas need to be established, particularly in habitat dominated by human presence and activities. We strongly recommend further fieldwork in protected areas and between them to increase the knowledge about the ecology and conservation needs of the Guigna, especially in Argentina.

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PLATINUM OPEN ACCESS

ISSN 0974-7907 (Online) | ISSN 0974-7893 (Print)

December 2020 | Vol. 12 | No. 16 | Pages: 17171–17262
Date of Publication: 14 December 2020 (Online & Print)
DOI: 10.11609/jott.2020.12.16.17171-17262

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