

New records of *Leopardus guigna tigrillo* and *Lycalopex culpaeus* in Placilla de Peñuelas, Chile and threats to their conservation

Nuevos registros de *Leopardus guigna tigrillo* y *Lycalopex culpaeus* en Placilla de Peñuelas, Chile y amenazas a su conservación

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The kodkod (*Leopardus guigna*) is considered vulnerable by the International Union for Conservation of Nature. On the other hand, although the Andean fox (*Lycalopex culpaeus*) is considered as least concern in Chile, the protected areas it inhabits are not enough to maintain viable populations. Here, we contribute to the knowledge of the Chilean fauna and identify threats to its conservation through camera traps. Three camera traps were placed in the study area, which remained active for 2 months. Whenever activated, cameras recorded time / temperature and 30 s videos. The presence of the kodkod, subspecies tigrillo (*L. g. tigrillo*) was recorded in the study area through photographs and videos. Additionally, the presence of Andean fox (*L. culpaeus*) and evidence of anthropogenic activities were recorded. We highlight the presence of *L. g. tigrillo*, an endemic species recorded for first time in the study area, and that of *L. culpaeus*. We detected anthropogenic activities (illegal logging, cattle grazing, motocross) that may represent a threat to the survival of these carnivores. We propose specific conservation actions to protect these species and their habitat.

Key words: Camera trap; carnivore; conservation; record.

El gato güiña (*Leopardus guigna*) es considerado vulnerable por la Unión Internacional para la Conservación de la Naturaleza. Por otro lado, aunque el zorro culpeo (*Lycalopex culpaeus*) se considera especie de menor preocupación en Chile, las áreas protegidas donde se encuentra no son suficientes para mantener poblaciones viables. En este estudio, contribuimos al conocimiento de la fauna de Chile e identificamos amenazas a su conservación mediante fototrampeo. Se colocaron 3 cámaras trampa en la zona de estudio, éstas permanecieron activas durante 2 meses. Las cámaras tomaron fotografías y videos de 30 s, registrando hora y temperatura. Se registró la presencia del gato güiña, subespecie tigrillo (*L. g. tigrillo*) en la zona de estudio mediante fotografías y videos. Adicionalmente, se registró la presencia de zorro culpeo (*L. culpaeus*) y evidencia de actividades antropogénicas. Se destaca la presencia de *L. g. tigrillo*, una especie endémica que se registra por primera vez en la zona de estudio y la de *L. culpaeus*. Se detectaron actividades antropogénicas (tala ilegal, pastoreo de ganado, motociclismo) que pueden representar una amenaza a la supervivencia de estos carnívoros por lo que proponemos acciones de conservación específicas para proteger a estas especies y su hábitat.

Palabras clave: Cámaras trampa; carnívoro; conservación; registro.

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The kodkod, *Leopardus guigna* Molina 1782, has an average weight of 1.4 to 2 kg ([Iriarte et al. 2013](#)) and is the smallest wild cat in the Americas ([Nowell and Jackson 1996](#)). It is one of the felids with the most restricted distribution in the world, it is distributed in south central Chile and Argentina ([Nowell and Jackson 1996](#)). There are two subspecies: *L. guigna tigrillo*, an endemic subspecies of Chile that is distributed between the Coquimbo and Biobío regions, and *L. guigna guigna* distributed from the Araucanía Region to Aysén and Argentina ([Napolitano et al. 2013](#)). In central Chile, the presence of this species has been confirmed by few records on the coastal edge of the Coquimbo and Valparaíso regions ([Acuña 2019](#); [Quiroz et al. 2019](#); [Napolitano](#)

[et al. 2014](#); [Napolitano et al. 2020](#)). This feline is found from sea level up to 2,500 m ([Nowell and Jackson 1996](#)), inhabiting sclerophyll forests, Mediterranean scrub, Valdivian and Patagonian temperate forest and near watercourses, where areas of dense vegetation act as a corridor for their dispersal ([Sanderson et al. 2002](#)).

Currently, *L. guigna* is listed as a vulnerable species internationally, due to its restricted distribution and ecological requirements that make it especially fragile in the face of growing habitat loss and fragmentation; this is attributed to causes such as the increase in the human population and deforestation in the humid temperate forest of Chile ([Napolitano et al. 2015](#)). The same category is

valid for Argentina (Monteverde *et al.* 2019) and part of Chile, from the Coquimbo region to the Los Ríos region. On the other hand, from the Los Lagos region to the Aysén region, it is cataloged as near threatened by the Chilean Ministry of Environment (Ministerio del Medio Ambiente; MMA 2011). Because of this, obtaining up to date information on the ecology and distribution of this species is important for a correct risk categorization of the species in its restricted distribution. Additionally, *L. guigna* may contribute to rodent control, due to its diet composed mainly of small mammals (Dunstone *et al.* 2002; Sanderson *et al.* 2002; Correa and Roa 2005; Figueroa *et al.* 2018), such as the long-tailed pygmy rice rat (*Oligoryzomys longicaudatus*), which is an important reservoir host of pathogens causing the deadly Hantavirus Pulmonary Syndrome (Gálvez and Hernández 2009).

On the other hand, the culpeo or Andean fox, *Lycalopex culpaeus* (Molina 1782), is the largest canid found in Chile (MMA 2011). The species is distributed throughout the Andes mountain range, from Colombia in the north to Tierra del Fuego in the south (Jiménez and Novaro 2004). Throughout its range, it makes use of diverse habitats such as mountainous terrain, deep valleys and open deserts, scrub-covered pampas, sclerophyll scrub, and beech forest. In the Andes of Perú, Chile, Bolivia and Argentina, it reaches elevations of up to 4,800 m. Currently, it is listed as a species of least concern by the International Union for Conservation of Nature (IUCN), since its populations are considered stable

throughout its distribution; nevertheless, in Chile, only 14 % of the protected areas where it is found are large enough to maintain viable populations of the species (Lucherini 2016). Despite of this, the Chilean Ministry of the Environment does not include the Andean fox in any risk category.

Given that both species coincide in certain habitats (*e.g.*, sclerophyll scrub) and conservation actions aimed at managing and protecting their distribution areas are recommended (Napolitano *et al.* 2015; Lucherini 2016), obtaining new records of these species can contribute to better planning and optimization of protected areas. In the present study, we aimed to contribute to the knowledge of the faunal richness of Chile, by carrying out a preliminary sampling of wild carnivores in the locality of Placilla de Peñuelas, commune of Valparaíso, Valparaíso Region, in central Chile.

The study area is located in the locality of Placilla de Peñuelas, 2 km west of the Lago Peñuelas National Reserve and south of the La Luz reservoir (33° 8' 56.92" S, 71° 34' 37.52" W; Figure 1). It is located in a ravine with coastal Mediterranean sclerophyllous vegetation and has an area of 11 ha, surrounded by plantations of introduced tree species (*Pinus radiata* and *Eucalyptus globulus*). In the area there are seeps of groundwater and evidence of illegal logging given the presence of tree stumps. It should be noted that the study area is classified by the Valparaíso communal regulatory plan (Ilustre Municipalidad de Valparaíso 2002) as a residential and habitat protection area.

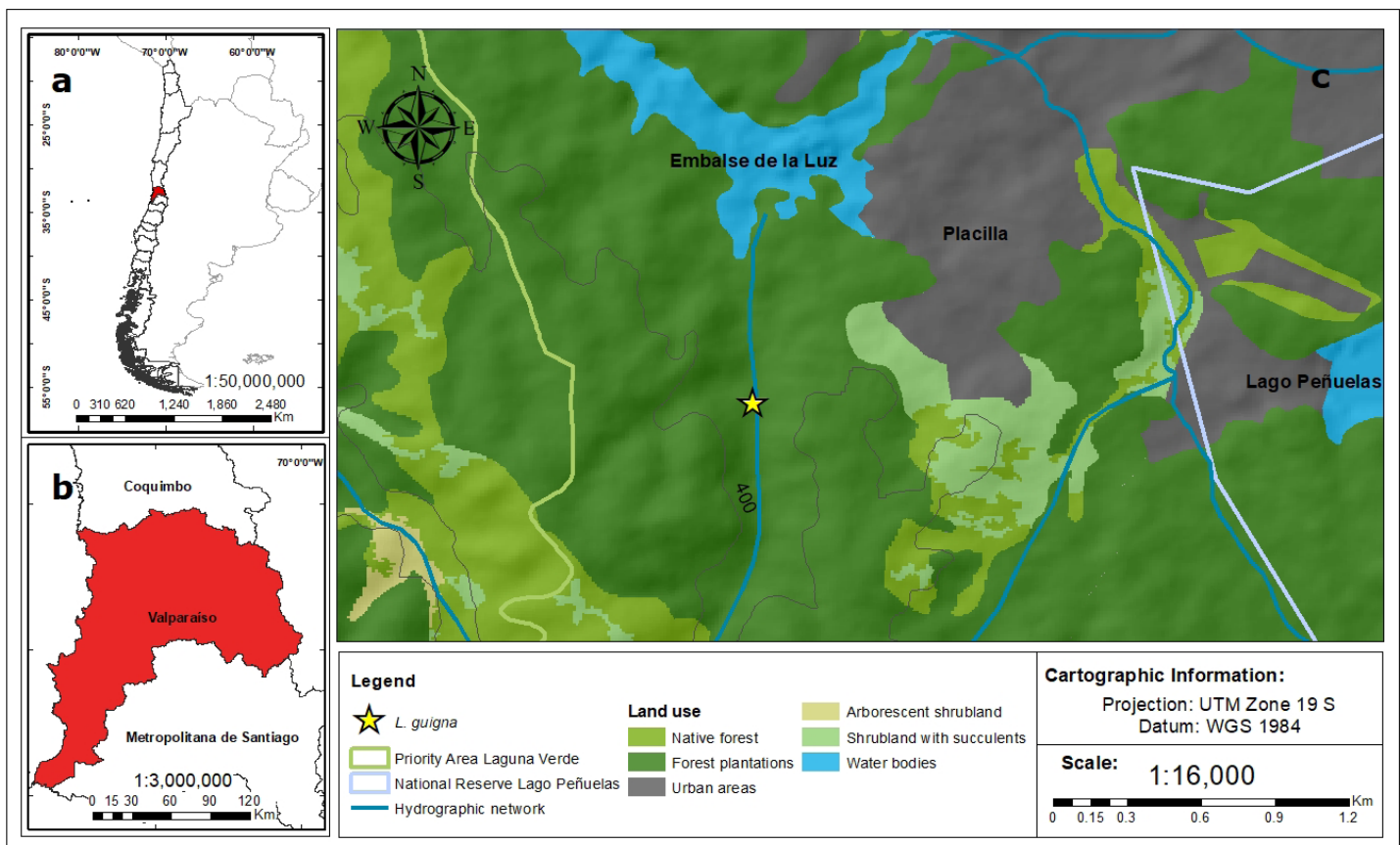


Figure 1. Location of the study area within the locality of Placilla de Peñuelas, Chile. a) Location at the national level indicated in red; b) record of *Leopardus guigna tigrillo* in the study area (Valparaíso); c) topographical characteristics around the study area.

We have monitored this area since 2016; however, it was at the end of July 2019 that we began using camera traps. Specifically, 3 camera traps were installed: a Bushnell (model Trophy Cam HD Aggressor) and 2 cameras HC801A model. To install the cameras, easily accessible sites were chosen where native vegetation did not interfere with visibility. The cameras were fixed on trees (50 cm from the ground), with a separation of 300 m between them, and were configured in hybrid mode to take 3 photos and 1 video of 30 s for each detection, with an interval of 1 s between detection events (with medium sensor sensitivity). Additionally, temperature logging was configured for detection events. The cameras remained active until the end of September 2019 (2 months in total), when the forest fire season began and they were removed from the field. During 2020 no cameras were set.

The first signs of the presence of the kodkod (*L. g. tigrillo*) were obtained on July 31, 2019 at 22:59 hr (33° 8' 56.90" S, 71° 34' 37.49" W). Subsequently, the camera traps recorded 15 photographs and 3 videos on August 4, 7 and 9, as well as on September 5 and 6 of the same year. Most of the records were at night (20:00 – 3:30 hr and there was only one at 13:37 hr), when relatively low temperatures were recorded (5 - 13 °C; Figure 2).

Another carnivore recorded by the camera traps was the Andean fox (*L. culpaeus*). Specifically, 4 photographs were obtained in 2019. In this case, we did not observe consistent patterns in terms of hours of greatest activity since both daytime and nighttime records were obtained and the recorded temperatures ranged between 10 - 32 °C. The records were made at elevations of up to 1,200 m, which confirms they were of Andean fox (*L. culpaeus*) and not of South American gray fox (*Lycalopex griseus*) since the South American gray foxes found mostly at altitudes below 500 m (Fuentes and Jaksic 1979). Finally, the camera traps also recorded the presence of cattle (*Bos taurus*) in the area.

Sampling with the photo-trapping method confirmed the presence of *L. g. tigrillo* in the town of Placilla de Peñuelas, commune of Valparaíso, this being the first record in the locality, corresponding to the endemic subspecies *L. g. tigrillo* given its distribution (Napolitano et al. 2013). Recently, Napolitano et al. (2020) extended the known distribution range of *L. g. tigrillo* to the Coquimbo Region and obtained new records for the Valparaíso Region, where the closest to our observations was obtained in the Puquén Biopark (100 km away in a straight line, eastbound). There have also been sightings in the commune of Olmue (~50 km east of Placilla de Peñuelas; Beltrami et al. 2015) and



Figure 2. a-b) Photographic records of the kodkod, *Leopardus guigna*; c-d) Andean fox, *Lycalopex culpaeus*, in Placilla de Peñuelas, Chile.

in the localities of San Antonio (~50 km to the south) and Viña del Mar (~15 km to the north; [Acuña 2019](#)). This last record would be the closest to those obtained in the present study. However, there is a highway (Route 68) that separates our study area from Viña del Mar and even from the Lago Peñuelas National Reserve, which could serve as a biological corridor between populations of kodkods in the communes of Valparaíso and Viña del Mar. In this regard, there is an urgent need to install wildlife crossings on Route 68 in order to maintain connectivity between kodkod habitat fragments and sympatric species.

Most of the kodkod records occurred at night, or when low temperatures were recorded, which coincides with previous observations ([Delibes-Mateos et al. 2014](#)). In the case of the Andean fox, the records were less restricted in terms of time and temperature and photographs were obtained up to 1,200 m. Although both species coincide (partially) in terms of hours of activity and were found in the same area, it is unlikely that competitive interactions will occur given that they have different habits. The Andean fox is strictly terrestrial, while the kodkod is partially arboreal. In a recent study, it was observed that coexistence between these carnivores was possible precisely due to ecological differences between both ([Zúñiga et al. 2017](#)).

We put forward forest fires as important threats to the habitat of these species, highlighting those of October and November 2019 that devastated more than 200 hectares in the Valparaíso Region ([El Observador 2019](#)), as well as the growing expansion of the real estate industry in the area, causing loss and fragmentation of the forest in Placilla de Peñuelas. In addition, during 2021 our cameras detected the presence of illegal logging and cross-country motorcycling in the study area. These activities, together with cattle grazing (detected by camera traps in 2019) could represent a threat to native fauna since they could modify the natural habitat and/or cause stress to wildlife. This could ultimately result in wildlife migrating to other areas.

It is suggested to establish a monitoring study in the locality and its surroundings in order to estimate the size of the local populations of kodkod and Andean fox, identify key sites for their conservation, and define the greatest threats to these species so we can start working on their mitigation. On the other hand, increasing photo-trapping effort could reveal the presence of other species in the area, thus strengthening the case for its protection. In addition to this, we propose to hold environmental education workshops in Placilla de Peñuelas, so that citizens value the biodiversity present in their environment and get involved in its conservation.

In conclusion, our study provides evidence of the presence of two carnivores with different conservation status, recorded for the first time in the locality of Placilla de Peñuelas. Given that we detected anthropogenic activities that could endanger the survival of these species, it will be necessary to continue monitoring the area and develop

new avenues of research that can support the conservation of native fauna.

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Literature cited

- ACUÑA, F. 2019. Descripción de endoparásitos gastrointestinales y cardiorrespiratorios en güiñas (*Leopardus guigna*) del centro y sur de Chile. Bachelor's thesis. Universidad de Chile. Santiago de Chile, Chile.
- BELTRAMI, E., C. OSORIO, AND C. BONACIC. 2015. Foxes and small wild felids co-occur spatially with domestic dogs in a highly disturbed landscape in the Mediterranean ecosystem of Central Chile. Conference UFAW. International Animal Welfare Science Symposium. Zagreb, Croacia. Available in majo.gonzalez@gmail.com.
- CORREA, P., AND A. ROA. 2005. Relaciones tróficas entre *Oncifelis guigna*, *Lycalopex culpaeus*, *Lycalopex griseus* y *Tyto alba* en un ambiente fragmentado de la zona central de Chile. *Mastozoología Neotropical* 12:57-60.
- DELIBES-MATEOS, M., ET AL. 2014. Activity patterns of the vulnerable güiña (*Leopardus guigna*) and its main prey in the Valdivian rainforest of southern Chile. *Mammalian Biology* 79:393-397.
- DUNSTONE, N., ET AL. 2002. Uso del hábitat, actividad y dieta de la güiña (*Oncifelis guigna*) en el Parque Nacional Laguna San Rafael, XI Región, Chile. *Boletín del Museo Nacional de Historia Natural de Chile* 51:147-158.
- EL OBSERVADOR. 2019. Alerta Roja: Incendio forestal consume más de 200 hectáreas en Placilla. <https://www.observador.cl/>. Accessed August 25, 2021.
- FIGUEROA, R. A., E. S. CORALES, AND J. R. RAU. 2018. Prey of the güiña (*Leopardus guigna*) in an Andean mixed southern beech forest, southern Chile. *Studies on Neotropical Fauna and Environment* 53:211-218.
- FUENTES, E. R., AND F. M. JAKSIC. 1979. Latitudinal size variation of chilean foxes: test of alternative hypotheses. *Ecology* 60:43-47.
- GÁLVEZ, N., AND F. HERNÁNDEZ. 2009. Connecting biological and socio-cultural dimensions of conservation: a strategy to engender positive attitudes towards the kodkod cat, within rural communities in Southern Chile. <https://www.darwin-initiative.org.uk/documents/DAR15006/18311/15-006%20FR%20Poster%20-%20IUCN%20Cat%20Project%20of%20the%20Month.pdf>. Accessed October 8, 2021.
- ILUSTRE MUNICIPALIDAD DE VALPARAÍSO. 2002. Modificación al plan regulador comunal de Valparaíso, sector Tranque La Luz, Ilustre Municipalidad de Valparaíso. Chile. <https://web.municipalidaddevalparaiso.cl/> Accessed September 3, 2002.
- IRIARTE, A., ET AL. 2013. Revisión actualizada sobre la biodiversidad y conservación de los felinos silvestres de Chile. *Boletín de Biodiversidad de Chile* 8:5-24.
- JIMÉNEZ, J. E., AND A. J. NOVARO. 2004. Culpeo (*Pseudalopex culpaeus*). Pp. 44-49 in *Canids: Foxes, wolves, jackals, and dogs. Status Survey and Conservation Action Plan* (Sillero-Zubiri,

- C., M. Hoffmann, and D. W. Macdonald, eds.). IUCN/SSC Canid Specialist Group. Gland, Switzerland.
- LUCHERINI, M. 2016. *Lycalopex culpaeus*. The IUCN Red List of Threatened Species 2016: e.T6929A85324366. Accessed August 22, 2021.
- MINISTERIO DEL MEDIO AMBIENTE (MMA). 2011. Ministerio del Medio Ambiente, Reglamento de Clasificación de Especies (RCE), DS 42 MMA 2011, 7mo proceso RCE. Santiago de Chile, Chile.
- MOLINA, G. I. 1782. La Guigna *Felis guigna*. Pp. 295 in: Saggio sulla storia naturale de Chili. Nella Stamperia di S. Tommaso d'Aquino. Bologna, Italy.
- MONTEVERDE, M., ET AL. 2019. *Leopardus guigna*. In: Categorización 2019 de los mamíferos de Argentina según su riesgo de extinción. Lista Roja de los mamíferos de Argentina. <http://cma.sarem.org.ar>. Accessed August 22, 2021.
- NAPOLITANO, C., ET AL. 2013. Population genetics of the felid *Leopardus guigna* in Southern South America: identifying intraspecific units for conservation. Pp. 159-186 in Molecular population genetics, evolutionary biology and biological conservation of Neotropical carnivores (Ruiz-García, M., and J. M. Shostell, eds.). Nova publishers. New York, U.S.A.
- NAPOLITANO, C., ET AL. 2014. Phylogeography and population history of *Leopardus guigna*, the smallest American felid. Conservation Genetics 15:631-653.
- NAPOLITANO, C., ET AL. 2015. *Leopardus guigna*. The IUCN Red List of Threatened Species 2015: e.T15311A50657245. Accessed August 22, 2021.
- NAPOLITANO, C., ET AL. 2020. New records of *Leopardus guigna* in its northern-most distribution in Chile: implications for conservation. Revista Chilena de Historia Natural 93:7.
- NOWELL, K., AND P. JACKSON. 1996. Wild Cats. Status Survey and Conservation Action Plan. IUCN/SSC Cat Specialist Group. Gland, Switzerland.
- QUIROZ, S., ET AL. 2019. Primer registro de *Leopardus guigna* (Molina, 1782) (Familia Felidae) en el Fundo El Pangue, comuna de Puchuncaví, Región de Valparaíso. Anales del Museo de Historia Natural de Valparaíso 32:50-54.
- SANDERSON, J., M. E. SUNQUIST, AND A. W. IRIARTE. 2002. Natural history and landscape-use of guignas (*Oncifelis guigna*) on Isla Grande de Chiloé, Chile. Journal of Mammalogy 83:608-613.
- ZÚNIGA, A. H., J. E. JIMÉNEZ, AND P. RAMÍREZ DE ARELLANO. 2017. Activity patterns in sympatric carnivores in the Nahuelbuta Mountain Range, southern-central Chile. Mammalia 81:445-453.

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