



## NATURAL HISTORY NOTE

Güiña (*Leopardus guigna*) preys on cavity-nesting nestlingsGüiña (*Leopardus guigna*) depreda polluelos de aves que nidifican en cavidadesTOMÁS A. ALTAMIRANO<sup>1,2\*</sup>, FELIPE HERNÁNDEZ<sup>3</sup>, MARIANO DE LA MAZA<sup>1,4</sup> & CRISTIAN BONACIC<sup>1</sup><sup>1</sup>Fauna Australis Wildlife Laboratory, Department of Ecosystem and Environment, School of Agricultural and Forests Sciences, Pontificia Universidad Católica de Chile. CP 7820436, Chile<sup>2</sup>The Peregrine Fund, 5668 W Flying Hawk Lane, ID 83709, Boise, Idaho, USA<sup>3</sup>Department of Wildlife Ecology and Conservation, University of Florida, 110 Newins-Ziegler Hall, Gainesville, FL 32611-0430, USA<sup>4</sup>National Forestry Service (CONAF), Protected Areas Management, Department of Biodiversity Conservation. CP 8330407, Chile

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Predation has been a leading cause of nesting failure among diverse species of birds, accounting for up to 90 % of nest failure in some endangered populations (e.g., Cain et al. 2003). Different types of predators, such as small/medium-sized mammals and birds, are able to impact the reproductive success of birds by preying on their nest contents (Rogers & Caro 1998, Söderström et al. 1998, Purcell & Verner 1999). Nevertheless, direct evidences of predation events has been poorly documented, highlighting the relevance to obtain original and reliable data about an ecological interaction that may strongly impact bird populations and community structure, particularly in highly perturbed ecosystems.

The vulnerable güiña (*Leopardus guigna* Molina 1782), or kodkod cat, is one of the smallest (1.2-2.2 kg) felids in the world (Nowell & Jackson 1996). It has a limited distribution, restricted to a narrow strip within the temperate forests in south-central Chile and Argentina (30-50 °S, 70-75 °W) (Redford & Eisenberg 1992), inhabiting continuous and fragmented forests (Gálvez et al. 2013). The güiña has been described as a nocturnal carnivore (Hernández et al. Unpublished data), suggesting daily activity synchronization with small rodents, its primary prey item (up to 82 %; Dunstone et al. 2002, Correa & Roa 2005). Flightless (e.g., Chucao tapaculo *Scelorchilus rubecola* Kittlitz 1830, Huet-huet *Pteroptochos tarnii* King 1831) and occasionally flying birds (e.g., Austral thrush *Turdus falklandii* Quoy & Gaimard 1824,

Thorn-tailed rayadito *Aphrastura spinicauda* Gmelin 1789) have been documented as secondary prey items within güiña's diet (24 %, Sanderson et al. 2002, Freer 2004). Even though güiña has been suggested as primarily terrestrial, its ability to prey on birds inhabiting the overstory or large-trees coincides with the well-developed tree climbing abilities displayed by the species (Sanderson et al. 2002). Previous güiña diet studies have been focused mainly on the identification of bird remains to species level (Sanderson et al. 2002, Freer 2004), not differentiating between age classes (e.g., adults/nestlings birds). The latter could shed light into the effects of predation on the reproductive biology of temperate forest bird assemblages.

In this article, we report the first records of güiña attempting to prey upon cavity-nesting bird nestlings in the temperate forest of South America. The study was conducted in an Andean landscape in the Araucanía district, South-Central Chile (39°16' S, 71°48' W). We identified study sites in six independent forests across an elevation gradient, from 271 meters above sea level (masl) to 1063 masl. Sites were separated by a minimum linear distance of 1.6 km. Four sites represent early successional stages of forests at lowlands dominated by broadleaf species such as Roble beech *Nothofagus obliqua* (Mirb.) Oerst., Coigüe *Nothofagus dombeyi* (Mirb.) Oerst., and Chilean laurel *Laurelia sempervirens* (Ruiz & Pav.) Tul. The remaining two sites are old-

growth, conifer-broadleaf mixed forests at higher altitudes dominated by Prince Albert's yew *Saxegothaea conspicua* Lindl., Chilean Tepa *Laureliopsis philippiana* (Looser) Schodde, and Coigüe.

In winter 2010, 240 nest boxes (40 per site) were installed in order to assess nest box use by small cavity-nesting birds and mammals (i.e., depth 17.1 cm; entrance hole diameter 3.1 cm). The nest boxes were systematically placed in a grid, by hanging them from a tree branch 1.5 meters above ground and 25 meters apart. During two breeding seasons (2010-2011 and 2011-2012), nest boxes were monitored by direct observation and through the use of camera traps to monitor the activity of cavity users and identify potential nest predators. Passive digital camera traps (i.e., Reconyx®) were used to monitor activity at the 49 nest boxes. Cameras were set at each box for 22 days resulting in 1,078 camera-trap days. Cameras were placed in front or beside each box, programmed to operate 24 hours a day, and visited for maintenance every 10 days. An independent predation attempt at a site was defined as a photo capturing the presence of a predator with at least one hour interval between sequences (Di Bitetti et al. 2006).

Two secondary cavity nesting bird species used the nest boxes, mainly Thorn-tailed Rayadito and occasionally Southern House Wren (*Troglodytes aedon* Vieillot 1809). Additionally, three small mammal species were recorded as nest box users: Monito del monte (*Dromiciops gliroides* Thomas 1894), Chilean Arboreal-rat (*Irenomys tarsalis* Philippi 1900), and Long-tailed Rice Mice (*Oligoryzomys longicaudatus* Bennett 1832). Monito del monte also was registered as a cavity-nesting bird predator, along with *Milvago chimango* Vieillot 1816, *Glaucidium nana* King 1828, *Rattus rattus* Linnaeus 1758 among others<sup>1</sup>. We registered güiña activity in three of the study sites, with predation attempts only on Thorn-tailed Rayadito nestlings. We detected at least three different individuals of güiña

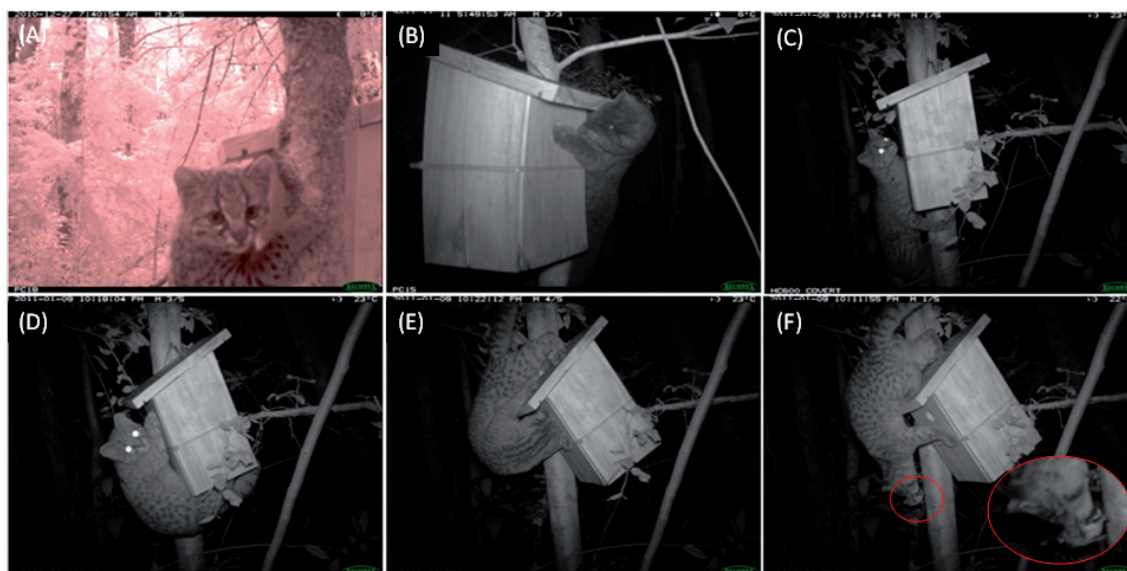
within seven independent photo sequences, two of them involving spotted güiñas (black-spots over buff or gray-brown coat) and a single melanistic individual (black coat) (Fig. 1). Seventy one percent of the predation attempts were concentrated at night (i.e., 2100 to 0600 h), whereas only 29 % were registered at dawn and dusk periods. This behaviour parallels the species' activity pattern described in other studies (Hernández et al. Unpublished data), which may correspond with the heightened activity of small mammals.

Previous studies investigating güiña diet suggest the species' preference to depredate flightless avian species that predominantly nest and forage close to the ground (e.g., *S. rubecula*) (Sanderson et al. 2002, Freer 2004). However, we show evidence for güiña preying on nestlings of a "large-tree user" birds (as Thorn-tailed Rayadito, Díaz et al. 2005), supporting an opportunistic felid behaviour. Trees climbed by individual güiñas within this study had a diameter at breast height (dbh) ranging from 5.4 to 7.5 cm. This differs from previous observations that report güiñas easily climbing trees with dbh > 8 cm (Sanderson et al. 2002).

Most predation attempts lasted less than two minutes (86 %, mean  $\pm$  SD = 00:47  $\pm$  0:41 minutes, n = 6), except one (36:11 minutes). These attempts mainly affected nests in nestling stages, and only one occurred in the post fledging stage (empty nest box), possibly attracted by the fecal odor. Only the longest güiña predation attempt was successful (14 %), resulting in the capture of a single nestling from the box (Fig. 1). The individual güiña then attempted to capture another Rayadito nestling from the same nest box but was unsuccessful.

The limited predation success and time allocated to güiña predation attempts could be explained by the depth dimension of nest boxes and their restricted entrance holes, which likely hampered the nestling captures. In fact, the entrances of natural cavities used for nesting -excluding fissures- in temperate forest are normally larger and/or less deep than nest boxes (TA Altamirano & JT Ibarra unpublished data), suggesting that real güiña predation success may be underestimated as a result of the restricted artificial cavity/nest box dimensions. To estimate the real cavity-nesting predation success, it would be

1 ALTAMIRANO TA, M DE LA MAZA & C BONACIC (2011) Depredación de nidos de rayadito (*Aphrastura spinicauda*) en el bosque templado andino de Chile. X Congreso Chileno de Ornitología, Santiago, Chile. Boletín Chileno de Ornitología 17: 26.



*Fig. 1:* Images of güiña predation attempts on nest boxes occupied by cavity-nesting birds. Spotted güiña trying to prey on a nest box (A); melanistic güiña attempting to capture a nestling (B); spotted güiña climbing a tree to approach a nest box; trying to catch a nestling; and capturing it (C-F).

Imágenes de intentos de depredación de güiña sobre aves que utilizan cajas-nido. Güiña moteada tratando de depredar una caja-nido (A); güiña melánica intentando capturar un polluelo (B); güiña moteada escalando el árbol de la caja-nido; tratando de capturar un polluelo; y capturándolo (C-F).

necessary to conduct experimental nest box designs comparing different entrance size and box depth, or even better, assessing directly the predation success of natural cavities showing different dimensions. Finally, as güiña predation events do not leave any distinct sign on the nest box, at least with these dimension and entrance diameter, studies using this technique in temperate forest of South America should be cautious as not to overestimate breeding success when counting missing nestlings without predation evidence.

Our data provide the first evidences of güiña predation behaviour on cavity-nesting birds of the temperate forest of South-Central Chile, contributing to improve the natural history knowledge of this vulnerable felid. However, many interesting questions remain regarding the güiña diet and the influence of its predatory behaviour on different temperate forest bird populations. How does the predation success compare between open vs. cavity-nesting birds? Are nestlings more common prey than adult birds? How much does the güiña contribute to predation pressure on bird species? How are güiña impacting breeding site selection? What

are the implications for avian reproductive biology and conservation?

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