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DIET COMPOSITION OF THE AUSTRAL PYGMY OWL IN A PERI-URBAN PROTECTED AREA IN SOUTH-CENTRAL CHILE

A. H. Zúñiga[1,2*], J. R. Rau[2], V. Fuenzalida[3], R. Sandoval[4]

[1]*Departamento de Ciencias Agronómicas y Recursos Naturales, Universidad de La Frontera, Temuco, Chile*
[2]*Laboratorio de Ecología, Departamento de Ciencias Biológicas, Universidad de Los Lagos, Osorno, Chile*
[3]*Consultoro Ambientes del Sur, Temuco, Chile*
[4]*Red de la Conservación de Nahuelbuta, Contulmo, Chile*
[*]*Corresponding author*
E-mail: alfredo.zuniga@ufrontera.cl

Diet Composition of the Austral Pygmy Owl in a Peri-Urban Protected Area in South-Central Chile. Zúñiga, A. H., Rau, J. R., Fuenzalida, V., Sandoval, R. — The diet of the Austral Pygmy Owl, *Glaucidium nana,* a small raptor, was studied by pellet analysis. During fall of 2020, 52 pellets were collected in a peri-urban protected area. Amongst 122 prey items, Muridae, represented exclusively by the alien species *Rattus rattus* and *Rattus norvegicus*, made up 35.24 % by number and 67.1 % of the biomass, followed by native Cricetidae, at a 37.69 % by number and 17.9 % by biomass. In the last place in relative frequency were birds and arthropods. The biomass contribution was unequal among the different prey, being the alien prey the group with the highest profit. The role of the landscape in the composition of prey in the observed trophic spectrum is discussed.
Key words: Austral Pygmy Owl, biomass, diet composition, landscape transformation, trophic behavior, rodents.

Introduction

The Austral Pygmy Owl (*Glaucidium nana* King, 1828) is a raptor of the Strigidae family, with a wide distribution throughout the Chilean territory, that is from 27° S to 53° S (Pavez, 2004). It is a generalist raptor in spatial terms, being able to use diverse habitats through this distribution (Pavez, 2004; Ibarra et al., 2015). Regarding to its diet, there are reports based on a general consumption regarding the diversity of prey, highlighting small mammals, birds and invertebrates mainly in North-central Chile (Jiménez & Jaksic, 1989; Jiménez & Jaksic, 1993; Jaksic et al., 1993). However, there are information gaps about their feeding habits in other latitudes (Jaksic, 1997), which is of special interest about changes in prey selectivity associated with their abundance (Jaksic, 1989).

In Southern-central Chile, where this raptor is largely associated with native forest (Rozzi et al., 1996), exists with an important diversity of potential prey (Peña, 1992; Murúa, 1996; Rozzi et al., 1996). However, the progressive reduction and conversion of the native forest in recent decades has put considerable pressure on ecological communities, homogenizing the diversity of species (Echeverría et al., 2008). In the same way, there are information gaps regarding their dietary habits in urban and peri-urban environments, which is of interest in relation to their knowledge due to both the structural modification of their natural environment, as well as the alteration in the availability of resources (Solaro, 2018), with changes in the feeding spectra (McPherson et al., 2021). The objective of this study is to document the diet of the Austral Pygmy Owl in a peri-urban protected area in Southern-central Chile.

Study area

Cerro Ñielol National Monument is a protected area in Southern-central Chile (38º43' S 72º35' W). It has an area of 88 ha, is adjacent to the city of Temuco and belongs to the Huimpil-Ñielol mountain range. Its climate is Mediterranean of the per humid type (Di Castri & Hajek, 1976), and it is represented in terms of vegetation by a deciduous forest, which includes the roble-laurel-lingue formation (Oberdorfer, 1960). 43 % of the plant species in the Natural Monument are of introduced origin, which accounts for the anthropogenic effect on a local scale (Hauenstein et al., 1988). Around it, there are both extensions of the original forest of the protected area, as well as fragments of forest plantations (*Pinus radiata* and *Eucalyptus globulus*), and thickets dominated by the common gorse *Ulex europeaus*.

Material and methods

During May and June 2020 (fall in the southern hemisphere), trails of this protected area were travelled in search of pellets. Pellets were recognized through their morphology (Muñoz-Pedreros & Rau, 2004), and this identification was reinforced through auditory records of the species at the collection site (Egli, 2006). Subsequently, pellets were collected in paper bags and stored for further processing. In laboratory, pellets were manually shredded to obtain undigested prey remains, which were visualized using an electronic magnifying glass. These were identified through keys associated with hair, feathers and skulls (Day, 1966; Chehébar & Martin, 1989; Pearson, 1995), as well as reference collections. The analysis of the diet was carried out based on the frequency of occurrence of the different prey in relation to the total observed (Rau, 2000). Dietary diversity was calculated through the Levins index β (Levins, 1968). This index fluctuates between 0 and n, where n is the number of prey categories obtained, which allows us to observe the degree of uniformity in their consumption. The standard deviation of this index was calculated through the jackknife procedure (Jaksic & Medel, 1987).

To determine the effect of prey biomass on the dietary spectrum, the geometric mean of their respective weights was calculated (Jaksic & Barker, 1983). In parallel, the method of trophic isoclines was used (Kruuk & DeKock, 1980), those that allow establishing a relationship between the biomass consumed and the frequency of preys (Rau, 2000). The weights of the registered dams were obtained from Muñoz-Pedreros & Gil (2009) for rodents, Parera (2018) for marsupials, and Norambuena & Riquelme (2014) for birds.

Results and discussion

A total of 52 pellets were obtained, in which a total of 122 preys were obtained, distributed in three trophic categories: mammals, birds, and arthropods. In mammals, rodents showed the highest frequency, with a representation above 70 %. In this Order, family Cricetidae, predominated with three species (table 1). Next, murids, an alien family, were the second most consumed group, with two species. Arthropods and birds were found in an intermediate group, while marsupials were the group with the least representation.

Table 1. Frequency and percentage of prey consumption by Austral Pygmy Owl in the study area

Prey item	Frequency (Percentage)
Mammals	
Rodentia	
Cricetidae	
Abrothrix longipilis	24 (19.67)
Abtothrix olivaceus	13 (10.65)
Olygoryzomys longicaudatus	9 (7.37)
Muridae	
Rattus norvegicus	25 (20.49)
Rattus rattus	18 (14.75)
Marsupialia	
Dromiciops gliroides	4 (3.27)
Birds	
Unidentified birds	12 (9.83)
Arthropods	
Unidentified insects	9 (7.37)
Cratomelus armatus	8 (6.55)

The dietary diversity observed was $\beta = 6.38 \pm 1.09$. In relation to the effect of biomass, a geometric mean of 55.33 grams was obtained, while in the representation of the trophic isoclines, it was obtained that both the two murine species and the cricetid *Abrothrix longipilis* were found in the intermediate segments (between isoclines of 5 % and 20 %; fig. 1), while birds and *Abrothrix olivaceus* were located in the lower isocline, between 1 % and 5 %. The remaining prey obtained a minimum representation, under the 1 % isocline.

The numbers of pellets collected is similar to reported in other raptors in the same biogeographic area (Zúñiga et al., 2018), which allows establishing its representativeness in terms of sample size. The observed dietary spectrum contrasts greatly with that reported in North-central Chile (Jiménez & Jaksic, 1993; Jaksic et al., 1993), due to the different representation of prey, which accounts for their variation at the latitudinal level. In this sense, this record showed more consistency with reports in southern Chile (Figueroa & Corales, 2015), which is related with the consumption potential to forest-living species. The dietary pattern observed in this raptor in the study area could be explained primarily by the transformation of the environment at a local scale, where the conversion of native forest to forest plantations and urbanized sites would result in a change in the rodent assemblage, with a decrease in the diversity of native species, with the Muridae fauna being one of the dominant groups in this environment (Fernández & Simonetti, 2013), which would explain its great ecological plasticity to occupy diverse habitats (Jaksic et al., 2002). Previous reports have found a low contribution of alien rodents in the diet of raptors (Rau et al., 1985), when a recent change in trophic behavior is plausible. Added to this finding is the high frequency of records of murids in the study area by means of camera trapping (Zúñiga, unpublished data). This fact suggests that the presence of these species could be used by *G. nana* as alternative prey, with the alteration of its trophic spectrum (Speziale & Lambertucci, 2013). In the case of native rodents, the composition was similar to that reported in patches of native forest at the same latitude (Zúñiga et al., 2021 a), what would be attributed to the spatial flexibility of this raptor (Ibarra et al., 2012; Zúñiga et al., 2021 b).

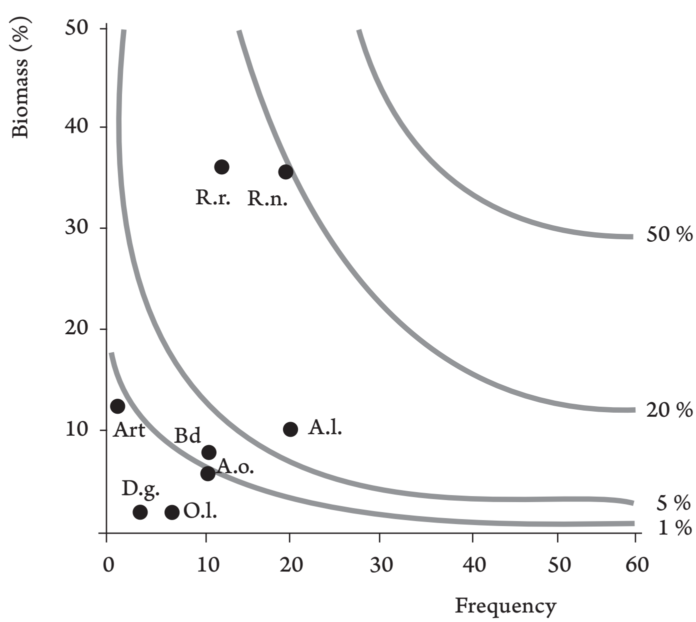

Fig. 1. Trophic isoclines for Austral Pygmy Owl, *Glaucidium nana,* in the study area: A. l. — *Abrothrix longipilis*; A. o. — *Abrothrix olivaceus*; Art — Arthropods; Bd. — Birds; D. g. — *Dromiciops gliroides*; R. n. — *Rattus norvegicus*; R. r. — *Rattus rattus*.

In relation to native rodents, the high rate of predation on *Abrothrix longipilis* and *Abrothix olivaceus* is notable, which are characterized by their general condition in the use of space (Murúa, 1982; Glanz, 1984), which supposes a wide distribution in the study area. In contrast, the low frequency of consumption of *O. longicaudatus* by *G. nana* would be explained by a decrease in its abundance, a consequence of interannual fluctuations in its population size (Murúa et al., 1986). This fact, however, needs to be tested to determine the degree to which variations in the abundance of this rodent can affect the consumption of other species. On the other hand, the presence of the marsupial *Dromiciops gliroides* in the diet of this bird of prey, whose spatial habits are mainly associated with the native forest (Fontúrbel et al., 2010), suggests that *G. nana* uses this habitat to a significant extent for hunting activities, considering the differentiated use of space by prey.

The seasonal effect of the present study would affect the pattern of prey diversity, due to the variations in the abundance of species at this temporal level. In this sense, the season on where the present study was carried out coincides with the one with the highest abundance for native rodents (González & Murúa, 1983). However, this pattern differs in the case of alien rodents whose reproductive dynamics seem to be more continuous (King et al., 1996), situation for which predators would use this group frequently in the study area (Zuñiga, unpublished data), thus allowing to compensate for the low abundance of native prey. In the case of birds and arthropods, although an intermediate frequency of prey was obtained, the lack of taxonomic resolution for both groups to determine species should be viewed with caution (Greene & Jaksic, 1983), due to the richness of species in both groups in the study area (Rozzi et al., 1996; Peña, 1992). This fact, considering the spatial heterogeneity that allow to infer spatial patterns of *G. nana* with greater precision associated with their hunting habits.

The observed geometric mean is within the range of rodents, which accounts for the minimum requirement of this group for raptors (Hamilton & Neil, 1981). However, it is suggested the greater importance of murids to be arranged in the trophic isoclines, where they are located in a higher position than to the rest, which if both species are considered together. In this way, it is obtained that the other types of prey, due to their low contribution in biomass, were found in the lowest isocline, thus suggesting that their importance is of a lower order, for which their consumption would be opportunistic.

As conclusion, it was observed that the Austral Pigmy Owl mainly consumed alien rodents, considering their greater abundance in the study area, while the native ones exhibited the second place in this spectrum, despite being in the season of greater abundance. The anthropized condition of the landscape played a determining role in modifying the supply of local prey, with which this raptor was able to adapt its feeding behavior. Long-term monitoring of rodents is especially important to determine changes in the trophic responses of the species as a function of changes in the abundance of these preys at a specific level.

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