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Food habits of Rufous-legged Owl in a protected area of south-central Chile affected by mixed wildfire

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Abstract The diet of Rufous-legged Owl, *Strix rufipes,* a small raptor present in an Andean protected area, is described here. During the fall of 2017, 44 pellets were collected in the study area, being subsequently analyzed. The occurrence of small mammal prey items in pellets was compared with capture frequencies with live-trapping through Sherman traps. Regarding occurrence frequencies in the diet, arthropods were the most frequent (49.34%), followed by mammals (39.31%), birds (7.86%) and reptiles (3.37%). However, in terms of biomass, mammals had the highest biomass contribution. The observed frequency of consumed preys showed a random pattern, according to the captures of small mammals obtained with Sherman traps. The role of wildfire in the composition of prey in the observed trophic spectrum of these forest owls is also discussed.

Keywords: biomass, disturbances, selectivity, trophic behavior, rodents

Összefoglalás A tanulmányban az Andok egyik védett területén élő kistermetű ragadozó madár, a vöröslábú bagoly *(Strix rufipes)* táplálékbázisát ismertetjük. 2017 őszén 44 köpetet gyűjtöttek a vizsgált területen. Az ezekben talált kisemlős zsákmányállatok előfordulását összehasonlítottuk a Sherman-csapdák általi élőcsapdás fogási gyakorisággal. A táplálék előfordulási gyakoriságát tekintve az ízeltlábúak voltak a leggyakoribbak (49,34%), őket követték az emlősök (39,31%), a madarak (7,86%) és a hüllők (3,37%). A biomassza vonatkozásában az emlősöknek volt a legnagyobb szerepe. Az elfogyasztott zsákmányállatok gyakorisága a Sherman-csapdákkal befogott kisemlősöknek megfelelően véletlenszerű mintázatot mutatott. Az erdőtüzek szerepe a zsákmány összetételében ezen erdei baglyok megfigyelt trofikus spektrumában szintén megvitatásra került.

Kulcsszavak: biomassza, zavarás, szelektivitás, táplálkozási viselkedés, rágcsálók

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Introduction

The Rufous-legged Owl (*Strix rufipes* King, 1828) is a nocturnal forest raptor of the Strigidae family, with a distribution in Chile that ranges between the Mediterranean climate zone and the Patagonian Tierra del Fuego, from 32° S to 53° S (Pavez 2004). This raptor is a habitat specialist inhabiting mainly mature native forests and secondary forest formations (Ibarra *et al.* 2012). This species consumes predominantly small mammals and birds, with variations according to the local distribution of their prey (Martínez 1993, Figueroa *et al.* 2006, Alvarado *et al.* 2007), which are associated mainly with native forests (Murúa 1996, Rozzi *et al.* 1996). However, the progressive change in land use in southern Chile is noteworthy, mainly due to production activities (Echeverría *et al.* 2008), which can compromise its occurrence on a local scale, a fact that has been reported for raptors from other latitudes (Rodríguez-Estrella *et al.* 1998).

Wildfires are the main type of disturbance worldwide (Whelan 1995), which are characterized by their high combustion of plant biomass (Bond & Keeley 2005). These disturbances have the potential to reconfigure the structure of ecosystems, and also affect the persistence of many animal taxa (Whelan 1995, DellaSalla & Hanson 2015). In southern-central Chile, there is a knowledge gap regarding responses of predators in environments disturbed by fire, which is becoming increasingly important due to the high frequency of fires that occur in Chilean territories (Úbeda & Sarricolea 2016). In this sense, reports showed that fire affects the structure of rodent and arthropod assemblages (Zúñiga *et al.* 2021, Zúñiga *et al*. 2022), affecting prey availability at the local scale. The objective of this study is to document the diet of Rufous-legged Owl in a protected area in Southern-central Chile affected by a wildfire.

Methods

The China Muerta National Reserve (38°42’00”S – 71° 26’00”W) is a governmental protected area in southern-central Chile. This reserve encompasses 11168 ha, and the vegetation is composed by araucaria *(Araucaria araucana)* trees in association with *Nothofagus* forests (CONAF 2014). In 2015, this reserve suffered a fire that affected 3700 ha and different degrees of severity (CONAF 2015).

During March-May 2017 (fall in the southern hemisphere), trails of this protected area were travelled in search of pellets. Pellets recognition was based on morphological criteria (Muñoz-Pedreros & Rau 2019), and this identification was reinforced through auditory records of the species in 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 (Chehébar & Martin 1989, Pearson 1995), as well as reference collections. The analysis of the diet was carried out based on the percentage frequency of occurrence of different prey in relation to the total number observed prey (Rau 2009). 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. The standard deviation of this index was calculated through the jackknife procedure (Jaksić & Medel 1987).

To determine the effect of prey biomass on the dietary spectrum of these owls, the geometric mean of the respective weights of different prey was calculated (Jaksić & Braker 1983). Simultaneously, the method of trophic isoclines was used (Kruuk & DeKock 1980), establishing a relationship between the biomass consumed and the occurrence frequency of prey, and thus their importance in the trophic spectrum (Rau 2000). Biomass of the registered prey were obtained from Muñoz-Pedreros and Gil (2009) for rodents, and Norambuena and Riquelme (2014) for birds.

To determine the trophic selectivity of *S. rufipes* in relation to the availability of prey in the environment, we used small mammal capture frequency values obtained as part of a previous study in the same study area (Zúñiga *et al*. 2021). In this way, the expected proportions of consumption of rodents were obtained through their capture rate in Sherman traps. Comparisons with the proportion of prey consumed by *S. rufipes* were made with a goodness-of-fit tests, and Bonferroni confidence intervals (Byers *et al.* 1984, Sokal & Rohlf 1995). These analyses were performed with HABUSE 4.0 program (Zúñiga *et al.* 2020).

Results

A total of 44 pellets were analyzed, in which a total of 99 prey items were identified, distributed in five trophic categories *(Table 1)*. Of these, arthropods showed the highest frequency, with a representation close to 50%. Next, cricetid rodents were the second most consumed group, with four species. Birds were group found with intermediate frequency, while reptiles were the least frequent. When comparing the frequencies of the consumption of rodents with respect to those obtained by trapping, it was found that *S. rufipes* consumed native rodents with a frequency different from that expected at random (χ^2=11.65, P<0.001). However, it was subsequently demostrated that all the consumption frequencies of all the species were within the Bonferroni confidence intervals *(Table 2)*, which denies any type of selectivity.

Table 1. Frequency and percentage of prey consumption by *Strix rufipes* in the study area

1. táblázat A vöröslábú bagoly *(Strix rufipes)* elfogyasztott zsákmányainak gyakoriságai és százalékos arányuk a vizsgálati területen

Prey item	Frequency (Percentage)
MAMMALS	
Rodentia	
Cricetidae	
Abrothrix longipilis	10 (11.23)
Abtothrix olivaceus	12 (13.48)
Irenomys tarsalis	4 (4.49)
Olygoryzomys longicaudatus	9 (10.11)
BIRDS	
Unidentified birds	7 (7.86)
REPTILES	
Liolaemus sp.	3 (3.37)
ARTHROPODS	
Unidentified insects	44 (49.34)

Table 2. Comparison of prey frequencies of *S. rufipes* in relation to observation by Sherman traps
2. táblázat A Sherman-csapdák által fogott zsákmányfajok és a vöröslábú bagoly által elfogyasztott zsákmány gyakoriságának összehasonlító táblázata

Species	Consumption frequency (observed/expected)	Bonferroni's confidence intervals
Abrothrix longipilis	(0.285/0.530)	(0.079–0.421)
Abrothrix olivaceus	(0.342/0.269)	(0.119–0.481)
Irenomys tarsalis	(0.114/0.040)	(0.060–0.390)
Olygoryzomys longicaudatus	(0.252/0.158)	(0.060–0.390)

The observed dietary diversity was β=3.39±5.78. In relation to biomass, a geometric mean of 5.59 grams was calculated. In the representation of the trophic isoclines, it was obtained that the three most abundant rodents and birds were found in the intermediate segments (between isoclines of 5% and 20%) *(Figure 1)*, while *Irenomys tarsalis* and arthropods were located in the lower isocline, between 1% and 5%. The remaining prey had a minimum representation, under the 1% isocline.

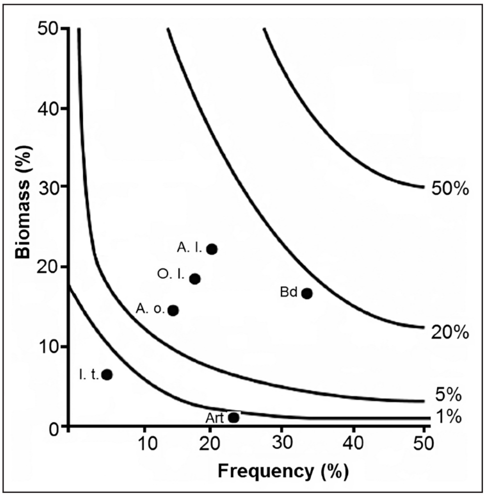

Figure 1. Trophic isoclines for Rufous-legged Owl in the study area. A. l.: *Abrothrix longipilis*; A. o.: *Abrothrix olivaceus*; I. t.: *Irenomys tarsalis*; O. l.: *Oligoryzomys longicaudatus*; Art: Arthropods; Bd.: Birds

1. ábra A vöröslábú bagoly táplálkozási izoklin vonalai a vizsgálati területen. A. l.: *Abrothrix longipilis*; A. o.: *Abrothrix olivaceus*; I. t.: *Irenomys tarsalis*; O. l.: *Oligoryzomys longicaudatus*; Art: Rovarok; Bd.: Madarak

Discussion

The observed dietary spectrum is partially in line with that reported in south-central Chile (Martínez 1993, Figueroa *et al.* 2006), where arthropods represent the majority of the trophic spectrum in terms of frequency, but rodents occupy the largest proportion in terms of biomass. The high value of the standard deviation in the dietary diversity index arises due to the proportion of arthropods consumed, which should be viewed with caution due to its low contribution in biomass. The low taxonomic resolution in this group is of special importance, due to the spatial differentiation that various species occupy (Peña 1987). This fact, added to the effect of fire on the composition of arthropods observed (Zúñiga *et al.* 2022), makes the observed picture to be viewed with caution. It is important to highlight that the low diversity of rodents would be a consequence of the burned condition of the study area, which restricted the possibility of detecting more species (Zúñiga *et al.* 2021). In the same sense, the absence of capture selectivity towards some rodent would be explained by their low abundances, although that season of sampling (fall) was in the period of highest abundance, according to their reproductive patterns (González & Murúa 1983). This fact suggests that this raptor would be in a suboptimal condition in terms of food availability, according to their energetic requirements (Graber 1962), forcing *S. rufipes* to migrate to patches with greater availability of small mammal prey species, which has been reported for species in other latitudes (Körpimaki & Hongell 1986). This situation is confirmed by the fact that this raptor was not sighted the following year of monitoring (Zúñiga, personal observation), as well as a decline in prey populations was reported (Zúñiga *et al.* 2021). However, this hypothesis has to be tested in the study area.

As conclusion, it was observed that the diet of *S. rufipes* was comprised mainly of arthropods, while vertebrates, and specifically rodents, had the highest representation in terms of biomass. It is especially important to monitor the diet of this raptor in the study area in the long term in order to assess how it evolves in a context of recovery from the fire, and therefore, if there is a correlation with the availability of prey.

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