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Original Article

Short-eared Owl (*Asio flammeus*)'s winter diets in northwestern Turkey (Thrace)

Kırbaykuşu (*Asio flammeus*)'nun Trakya'daki kış besin tercihi

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ABSTRACT

The short-eared owl (*Asio flammeus*) is essantially a migrant species that overwinters in Turkey in small numbers. A limited number of studies exist investigating the short-eared owls' diet, because it is difficult to determine their roosting areas and locate their pellets within the field. The pellet analysis of owls is one of the most prominently employed methods used to determine owl feeding strategies, and pellet analysis is important in the conservation studies of the short-eared owl. The present study is the first research investigating the diet of short-eared owl in Thrace. Our team gathered 153 pellets belonging to 308 prey items: 4 genus from Rodentia (Mammalia - *Microtus* sp, *Mus* sp, *Crecitulus* sp, *Apodemus* sp), 1 genus from Eulipotyphla (Mammalia - *Crocidura* sp) and 1 bird species from Passeriformes (Aves, *Alauda arvensis*) were identified within the pellets. Short-eared owls preferred in the majority of cases investigated small mammals (95%) in their diets, in particular *Microtus* sp (50%) and *Mus* sp (34%). Our team concluded that the *Microtus* and *Mus* genera occurred most commonly as the species in the study area. Various other small mammals identified in the pellets were comprised of *Apodemus* sp, *Mus* sp and *Crocidura* sp (11%), and a marginal number of birds (5%) were in addition found within the short-eared owl's diet. Short-eared owls, which display the characteristic behavior of an opportunistic predator, can shift their food habits with ease. However, our team found that a limited number of mammalian taxa comprised the short-eared owls' diet, and because the owl's diet consists mainly of rodents, the short-eared owl remains an important predator for agricultural fields and grasslands.

Keywords: Diets, diet preference, rodentia, short-eared owl

ÖZ

Kır Baykuşu (*Asio flammeus*) Türkiye'de esasen göçmen bir türdür ve kışlayan birey sayısı da azdır. Kır baykuşunun tüneme alanlarının tespitinin güç olması ve peletlerinin zor bulunması gibi sebeplerle yapılan çalışmalar da çok sınırlı sayıdadır. Pelet analizi baykuşların besin tercihini belirlemede kullanılan en etkili yöntem olup, türün koruma çalışmalarında da önemlidir. Bu pelet çalışması Kır baykuşunun Trakya'da kış diyetinin tespiti için yapılan ilk çalışmadır. Çalışmada Trakya'da kışlayan kır baykuşu (*Asio flammeus*) populasyonuna ait 153 pelet içinde 308 av bireyi tespit edilmiştir. Peletler içinde Rodentia'dan 4 (Mammalia - *Microtus* sp, *Mus* sp, *Crecitulus* sp, *Apodemus* sp), Eulipotyphla'dan 1 (Mammalia - *Crocidura* sp) cins ve Passeriformes'ten (Aves - *Alauda arvensis*) 1 kuş türü tanımlanmıştır. Kır baykuşunun diyetinin %95'ini küçük memeliler özellikle *Microtus* sp (%50) ve *Mus* sp (%34)'ye ait bireyler oluşturmaktadır. Bu da çalışma alanında en yaygın türlerin bu iki cinse ait olduğunu düşündürmektedir. Bununla birlikte, kır baykuşu zaman zaman diğer küçük memeli (%11) ve kuşlarla (% 5) beslenerek besin tercihini değiştirmekte ve fırsatçı bir predatör davranışı sergileyebilmektedir. Çalışmamızda kır baykuşunun beslendiği takson sayısının sınırlı olması ve esas besin kaynağının Rodentleri kapsaması kır baykuşunu tarımsal alan ve çayırlıklar için önemli bir predatör olduğunu göstermektedir.

Anahtar Kelimeler: Diyet, besin tercihi, rodentia, kır baykuşu

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INTRODUCTION

The short-eared owl (*Asio flammeus*) possesses a worldwide distribution. Though several populations of short-eared owls exist as resident, the majority of the Northern Hemisphere populations are migratory. Short-eared owl populations breeding in North Eurasia overwinter in the Mediterranean Region, North Africa, and South Asia (Holt and Leasure, 1993; Mebs and Scherzinger, 2000). The short-eared owl is capable of hunting during both the day and night over the course of the

breeding season, however, overwintering birds are typically crepuscular (Clark, 1975). Small mammals form an important part of the short-eared owls' diet (Canário et al., 2012). Additionally, short-eared owls may prey upon birds, bats, reptiles, amphibians, and even invertebrates (Djilali et al., 2016; Speakman, 1991). The short-eared owl is considered an opportunistic species (Canário et al., 2012).

It was recently estimated that up to 20 pairs of short-eared owls breed within Turkey (Birdlife International, 2017). The short-eared owl can be identified as a migrant species, essentially, for Turkey, and the owls overwinter especially within the western portion of Anatolia (Kirwan et al., 2008). Pellet analysis is one of the most widespread and accessible methods used in order to determine the feeding strategies of owls (Terry, 2008). Within Turkery, many studies already exist in the literature on the diet preferences of long-eared owls (*Asio otus*) and barn owls (*Tyto alba*). Only one study investigating the diet preferences of short-eared owls (*Asio flammeus*) has been previously carried out by Selçuk et al., (2017). Further comprehensive and long-term studies are necessary in order to understand the diet of the populations of short-eared owls overwintering in Turkey. The present study is the second scientific investigation examining the diet preference of short-eared owls within Turkey, and additionally the first study for the Thrace region. In the present study, our team aimed to determine the short-eared owl's diet and the ratios of different species in its diet, to gather data on the small mammal community present within the region, and to form a basis for further conservation studies to be carried out in the future within Turkey.

MATERIALS AND METHODS

Study Area

The inspected study area is situated on the border of the Kırklareli and Tekirdağ provinces (41°28'0.97"N, 27°44'25.63"E), located within Thrace, Turkey. Agricultural lands dominate the landscape of the area. Within the agricultural lands, relatively limited uncultivated agricultural lands are present, alongside sparse woodlands, shrubs, and rural settlements. The average annual temperature of Kırklareli comprises 13.3°C, and the area's average precipitation registers at 577.5 mm. Short-eared owl pellets were harvested from within the agricultural area, which has been uncultivated or left fallow for a long period of time, but has still been used for grazing (Figure 1).

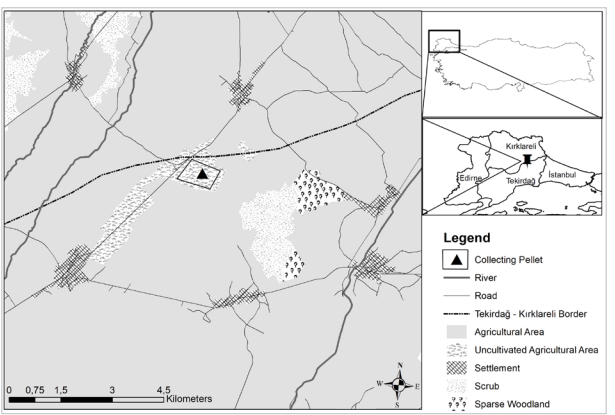


Figure 1. Study area

Method

The field studies our team conducted were carried out from January to March, 2019. The roosting areas of the owls were determined and subsequently inspected in detail. An area of approximately 1 km in diameter was scanned within proximity to the roosting areas, and all identified pellets were harvested. Each individual pellet was processed separately utilizing warm water to soften pellets and to ease the separation of food items within the pellets. Hair, bones, and other biological matter were removed via forceps and needles. Our team separated the remains into general groups. The identification of small mammals (Krystufek and Vohralik, 2001, 2005, 2009) and birds (Brown et al., 1993) was conducted via examination of the skull and jaw remnants. In addition, prey items were counted and sorted into Recognizable Taxonomic Units, based upon easily recognized features, since severalspecimens could not be defined upon the basis of their species (Keten et al., 2015). Descriptive statistics were then applied to the obtained data. According to Birrer (2009), due to the variations within body weight, sex, or individual variation geographically, biomass calculations within pellet studies may not produce accurate information. Hence, while analyzing the biomass of small mammal species, Krystufek and Vohralik (2001, 2005, 2009) was employed as reference. The average weight data of birds were taken from (http://genomics.senescence.info/). Thus, the biomass was calculated by taking the average weight of the species in Thrace.

RESULTS AND DISCUSSION

In the present study, a total of 153 pellets were harvested, and in total, 308 prey items were removed from the pellets. Our team has been able to identify six taxa as prey of the short-eared owl. While *Microtus* sp., *Mus* sp., *Apodemus* sp. (Mammalia, Rodentia), and *Crocidura* sp. (Mammalia, Eulipotyphla) were identified at the genus level, *Cricetulus migratorius* (Mammalia, Rodentia) and *Alauda arvensis* (Aves, Passeriformes) were identified at the species level. The amount of prey items detected ranged from up to 4 individual animals within each pellet, and the average item per pellet is 2.01±0.8 individuals. The average length of the pellets is 4.07 cm±0.9 (min 2.1 cm–max 7.4 cm), and the average weight of the pellet is 5.1 gr±2.3 (min 1.7 gr–max 12.8 gr).

The diet of the short-eared owls examined in the present study mainly consisted of small mammals (Rodentia and Eulipotyphla) at a rate of 95%, followed by birds (Passeriformes) at only 5% of their diet. In terms of biomass, 94% of the species were mammals, and 6% were birds. The most abundant species within the pellet remains was *Microtus* sp. (N; Prey number=153, F; Frequency=49.68%, B; Biomass=58.21%) and *Mus* sp. (N=106, F=34.42%, B=23.15%). Following those main species, other species present within the pellets were *Crecitulus migratorius* (N=18, F=5.84%, B=6.71%), *Apodemus* sp. (N=16, F=5.19%, B=5.93%), *Alauda arvensis* (N=14, F=4.55%, B=5.91%), and *Crocidura* sp. (N=1, F=0.32%, B=0.10), respectively (Table 1).

Table 1. Prey of *Asio flammeus*

PREY	Approximately Mean Body Weight(g)	N	F%	B%
Mammals				
Microtus sp.	33.8	153	49.7	58.2
Mus sp.	19.4	106	34.4	23.2
Crecitulus migratorius	33.1	18	5.8	6.7
Apodemus sp.	32.9	16	5.2	5.9
Crocidura sp.	8.9	1	0.3<1	<1
Mammals Total		294	95.4	94.10
Birds				
Alauda arvensis	37.5	14	4.6	5.9
Birds Total		14	4.6	5.9
Total Prey Item		308	100,00	100
Mean number prey/pellet		2.013		

N: prey number; F%: frequency; B%: biomass frequency

European studies conducted on the winter food preference of the short-eared owl (*Asio flammeus*) examine the entirety of the owl's diet within Pomorze Zachodnie, Northwestern Poland (Szymański et al., 2010), and 99.4% of the owl's diet within Cotu Văii, Constanţa County, Southeast Romania (Ionescu et al., (2017)) consist of small mammals. In contrast, the winter diet of the short-eared owl is comprised of 55.9% birds and 42.4% small mammals within Ireland (Country Cork) (Cullen and Smiddy, 2012). Due to a small number of individuals overwintering in Turkey, and some difficulties present in locating their pellets in the present terrain, only one study investigating their diet preferences of short-eared owl had been conducted in Turkey. According to the previous study, the short-eared owls' diet consists entirely of small mammals in Amasya (northern Turkey) (Selçuk et al., 2017). However, in our study, the short-eared owls' winter diet is mainly comprised of small mammals (95.4%), and a small amount (4.6%) of birds (Passeriformes). Short-eared owls may shift their food preference, and exhibit an opportunistic predator behavior within the present study area.

Short-eared owls typically prefer hunting *Microtus* sp.- vole species among small mammals species in Thrace. The studies in particular conducted across North America and Europe investigating the short-eared owls' diet preferences demonstrate that the winter diets of the short-eared owls consist mainly of *Microtus* sp. (Holt and Leasure, 1993; Korpimaki and Norrdahl, 1991; Mikkola, 1983). According to Szymański et al., (2010) the ratio of *Microtus* sp was 88.8% within Pomorze Zachodnie, Northwestern Poland, 95.8% in Cotu Văii, Constanţa County, Southeast Romania (Ionescu et al., (2017), and 97% in Lower Silesia (Uttendörfer, 1939). Within Amasya, Turkey, Selcuk et al. (2017) discovered that the ratio of *Microtus* sp. was 64.5% within the winter diets of short-eared owls. In the present study, the ratio of *Microtus* sp. was 49.7%. Across both studies, the species belonging to the Muridae family registered in the pellets as second place in their diets. However, unlike Selçuk et al. (2017), our research revealed that short-eared owls fed on birds in Thrace. The food spectrum of the short-eared owl varies depending upon the abundance of small mammal species within the hunting area (Dupal and Chernyshov, 2013). However, because the owls are opportunistic species, the abundance of prey may be insufficient to explain their food preference. The diet of owls varies greatly with respect to habitat and fauna worldwide. The differences of prey behavior, body weight, and amount of energy provided are the factors that determine together the diet preference of owls (Mushtaq-ul-Hassan et al., 2007). According to Birrer (2009), weather and vegetation is also effective upon owls' food preference. *Microtus* sp. and *Mus* sp. are thought to be a common species present within our study area. Nevertheless, they may be preferred more frequently than other species on behalf of their widespread, easy availability for owl predation due to their weight, behavior, and environmental conditions.

The short-eared owl's diet nearly completely consists of small mammals. But, due to the owl's opportunistic characteristics, the diet includes other species such as birds, bats, amphibians, and reptiles and invertebrates when the owl's main food sources are reduced (Canário et al., 2012, Dijilali et al., 2016; Speakman, 1991). It is noted that the short-eared owl preys upon birds at significant levels, especially during the owl's non-breeding period (Martínez et al., 1998; Munro, 1918; Pirovano et al., 2000; Stone et al., 1994). According to Fuentes et al. (1993) the second preferred food of the short-eared owls within the Juan Fernandez archipelago was birds, particularly the adults and eggs of petrels (*Pterodroma* sp). It was discovered within the study that the majority of the diet of the short-eared owl consists of birds in the winter in India (Srinivasulu and Srinivasulu, 2007). According to another study in India that was carried out by Jathar et al. (2011), 14.29% of short-eared owl's diet is composed of birds. According to Holt and Leisure (1993) the short-eared owl, par-

ticularly on the coasts and islands, significantly feed upon birds. In Europe, Glue (1977) noted that birds are the main source of food for the short-eared owl during winter for the population of owls inhabiting Great Britain and Ireland. Cullen and Simiddy (2012)'s study based within Ireland from 2004 to 2011 supports Glue (1977); 55.9% of the short-eared owl's diet consists of birds. In the present study, the ratio of birds in pellets is 4.55%, and all of them were identified as skylark (*Alauda arvensis*). Skylark (*Alauda arvensis*) possesses a wide distribution across Europe, and was found almost everywhere present as large flocks within open areas (meadows, agricultural areas) during winter (Shirihai and Svensson, 2018). It was observed that the skylarks formed large flocks in the study area. And that short-eared owls hunted the skylarks with ease.

Diet studies of birds of prey possess ecological importance (Fulk, 1976; Marti, 1987; Torre et al., 2004). It is important to understand the population dynamics of preys and food preferences of owls for conservation studies examining owl species (Birrer, 2009). Though the short-eared owl is an opportunistic species, in our study, it has been revealed that the number of species that the owl preys upon is limited. In many diet preference of short-eared-owls' studies, it was demonstrated that the ratios of *Microtus* and *Mus* species possessed higher density within the short-eared owl pellets. Hence, it can be concluded that owls exert an important pressure on Rodentia species in agricultural areas and grasslands. To elucidate the relationship between the small mammal species within agricultural areas and the short-eared owls. and their positive effects on agricultural activities in Turkey, it is of high importance to research and monitor the wintering population of short-eared owls for long periods of time to understand what transpires, their effects on the ecosystem, and their habits, and to a basis for short-eared owl conversation efforts.

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