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Diet Composition and Prey Selection in the Long-eared Owl, *Asio otus* in Jordan: the Importance of Urban Avifauna

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Abstract

The diet composition of a resident pair of the Long-eared Owl (*Asio otus*) was investigated from a pine stand in southern Jordan. 111 intact and 40 fragmented pellets yielded a total of 181 individual prey items representing at least 3 rodents and 4 urban birds. Prey items were dominated by house sparrows (43.65%), greenfinches (18.78%) and rodents (15.5%) which were found in 40, 16 and 26 pellets, respectively. The results suggest that the Long-eared Owl is an opportunistic feeder preying on a wide spectrum of small vertebrates. Contrary to several reports elsewhere -including the Mediterranean region- where small mammals dominated the diet of the Long-eared Owl, birds were the most frequent prey item found in this study. The fact that the Long-eared Owl roosting in a pine plantation in Jordan depends so heavily on House Sparrows indicates the importance of forest fragments and urban avifauna for survival of this raptor at the southern edge of its distribution range.

Keywords: Diet, *Asio otus*, Jordan, birds.

1. Introduction

The analysis of owl pellets for prey remains provides a useful tool for augmenting biodiversity inventories and gaining insights into the abundance and distribution of small vertebrates (Askew, 2007; Avenant, 2005; Heisler *et al*., 2015; Torre *et al*., 2004). Additionally, owls (order Strigiformes) make an ideal group for studying prey selection due to the relative ease of collecting pellets and identifying prey remains. Prey selection and intake in owls are influenced by several factors including: predator and prey size, prey availability, the environment (i.e. vegetation), and intensity of competition (e.g. Herrera and Hiraldo, 1976; Comay and Dayan, 2018).

The Long-eared Owl (*Asio otus*) is a medium-sized nocturnal species with distinct erect, blackish ear-tufts. It has a broad distribution across the northern latitudes of North America, Europe, Eurasia, and the Levant (Cramp and Simmons, 1985). It prefers forests close to open country, edges of semi-open woodland and urban areas (Cramp and Simmons, 1985). It is known as an opportunist feeder and takes a high diversity of small-sized prey (Birrer, 2009). This owl is considered as an uncommon winter visitor in Jordan (Andrews, 1995). Along with global distribution, diet has been extensively studied in North America and Europe, yet reports on its ecology and diet within the most southern limits of its distribution are under-represented and far from satisfactory (Birrer, 2009). Only recently, Obuch (2018) reported on the diet of this owl in Jordan.

Jordan sits at the most southern edge of distribution of the Long-eared Owl, yet no studies have been conducted on its distribution and ecology. The present study reports on the diet of a Long-eared Owl from southern Jordan over a period of four months.

2. Methods

Regurgitated pellets (111 in total in addition to 40 broken pellets) from a Long-eared Owl roost site on the edge of Mutah University campus (31° 5.792' N, 35° 43.091' E) in southern Jordan were collected during July - October of 2018. The owls were seen within a plantation of pine trees overlooking open steppe vegetation (Fig. 1). The area sits within the non-forest, dry Mediterranean vegetation. The area is highly degraded by overgrazing and accommodates a suite of urban areas, agricultural farms, and open areas. The majority of the open area is barren and rarely covered by vegetation with a few water run-off-systems (wadis) vegetated by bushes and shrubby microsystems.

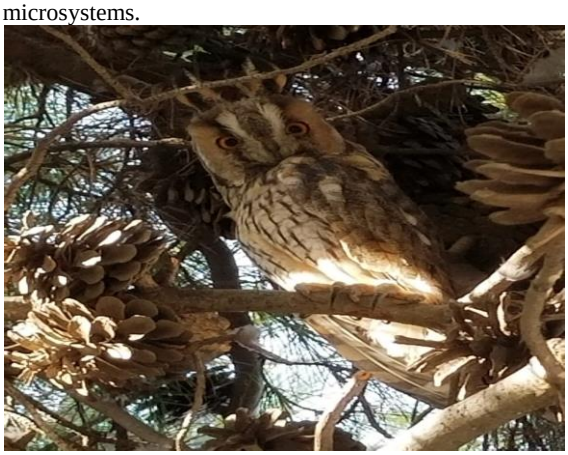

Figure 1. A Long-eared Owl seen in the study near Mutah University in southern Jordan.

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Each pellet was soaked in warm water and teased using a pair of forceps and a needle to separate prey remains for identification. For each species, lower and upper jaws were cleaned and preserved. Prey remains were identified using distinctive morphological characteristics of body and/or skull parts (e.g. mouthparts, mandibles, dentaries) described based on previous collections from the region (Harrison and Bates, 1991; Ujhelyi, 2016; www.skullsite.com).

Diet composition was expressed by frequency of occurrence of each prey item in the pellets (number of pellets with in which a prey item occurred), the total number of individuals (minimum number of individuals, MNI), percentage (number of individuals divided by the total number of prey individuals), and the percentage of mass taken using estimates of prey body weight. The total number of prey individuals in a pellet was determined using the total number of mandibles and/or skulls that were found (Yalden and Morris, 1990).

3. Results

Pellets were dark and cylindrical in shape with an average length of 35.78±0.9 mm (mean ± standard error) and 21.1±0.3 mm in width. The sample of 111 pellets and fragments contained an average of 1.26±0.05 prey items per pellet that were estimated to belong to a total of 181 prey individuals including, at least three species of small mammals, four species of birds, and additional unidentified species of passerine birds (Table 1). 84 pellets contained one prey item (69 only birds and 15 only rodents), the rest contained two (22 with two birds and three with a bird and a rodent) or three (one with birds only and one with two birds and a rodent) prey items. The 153 individual remains of birds were comprised of House Sparrows (*Passer domesticus*) 43.65% (N=79), Greenfinches (*Chloris chloris*) 17.78% (N=34), Warblers (*Sylvia* sp.) 5.52% (N=10), Common Blackbird (*Turdus merula*) 1.1% (N=2), and unidentified bird limbs (15.47%, N=28). The pellets also contained 28 remains of three rodent species including remains of one mole rat. Although the total frequency of prey items contained 84.5% birds and 15.5% rodents, the total mass intake was 73.7% birds and 26.3% rodents.

Table 1. Food composition of the long-eared owl in Jordan in terms of frequencies and percentages of prey items.

	Occurrence in pellets	MNI	percentage	prey weight	Percent weight
Birds, Aves					
House Sparrow (*Passer domesticus*)	40	79	43.65	27	34.65
Greenfinch (*Chloris chloris*)	16	34	18.78	25	13.81
Warbler (*Sylvia* sp.)	10	10	5.52	17	2.76
Common Blackbird (*Turdus merula*)	2	2	1.10	100	3.25
Unidentified birds (feathers and limb bones)	26	28	15.47	42.25	19.22
Mammals, Rodentia					
Mole Rat (*Nannospalax ehrenbergi*)	1	1	0.55	150	2.44
House Mouse (*Mus musculus*)	4	4	2.21	14	0.91
Tristram's Jird (*Meriones tristrami*)	14	16	8.84	70	18.19
Unidentified rodents (fur and limb bones)	7	7	3.87	42	4.78
		181	100		

4. Discussion

This is the first report on the diet composition of the Long-eared Owl (*Asio otus*) in its southern most limit of distribution. The diet composition of the Long-eared Owl contained a wide variety of small vertebrate prey items. Bird remains occurred the most in the pellets and comprised the highest frequency at about 84.5% (of which House Sparrows made 43.65%), whereas rodents made up the remaining 15.5% of the diet remains. However, rodents made up 26.3% of the total prey intake compared to birds (73.7%). The remains of nocturnal rodents suggest that hunting for food was mostly done during the night, while birds were hunted at their roost sites within the trees and bushes (Cramp and Simmons, 1985, Leader *et al.*, 2010).

Contrary to several reports elsewhere -including the Mediterranean region and the Levant- where small mammals dominated the diet of the Long-eared Owl (Yosef, 1997; Seçkin and Coşkun, 2005, Seçkin and Coşkun, 2006; Leader *et al.*, 2008; Birrer, 2009), birds were the most frequent prey item in this study. In other parts in the Middle East, Field Voles (*Microtus guentheri*) were the main prey item (Yosef, 1997; Charter *et al.*, 2012). Diet composition in other parts of the Long-eared Owl's distribution revealed a higher percentage of small mammals followed by birds (Birrer, 2009). Rodents accounted for the largest prey class among the biomass of mammalian prey taken (Birrer, 2009). In the Negev Desert, the diet of Long-eared Owl consisted mainly of small mammals (71.3%) and birds (26.5%) birds, of which migratory birds formed a significantly larger part of the total birds consumed during migration than during the non-migratory months (Leader *et al.*, 2008). The diet of wintering Long-eared Owls in Zabol, Iran, was predominantly larger rodents (c. 150 g) including the Indian Gerbil (*Tatera indica*), whereas birds made up 25.6% of prey items (Khaleghizadeh *et al.*, 2009). In Diyarbakir, Turkey, Long-eared Owl pellets were composed mostly of Rodentia (95.48% of the identified remains), with Field Voles (*M. guentheri*) representing 71.29% of the prey remains.

Our results are consistent with Obuch (2018), in which the diet of *A. otus* consisted mainly of birds in urban areas (78.3%). Obuch (2018) found that House Sparrow, *P. domesticus*, was most common prey item reaching 40.1%. Long-eared Owls in this study most probably consumed more birds because of the abundance of passerines and the

lack of small mammals. In a city park in Jerusalem, the diet of the Long-eared Owl was composed of 13 species of birds which accounted for the most common prey group (91% by number) (Kiat *et al.*, 2008). House Sparrows (*Passer domesticus*) and Blackcaps (*Sylvia atricapilla*) were the most frequent prey species (22% and 17% by number). Göçer (2016) also found that all prey items from an urban park were Passeriformes and consisted of two species belonging to Passeridae and Hirundinidae. 78 of the 86 prey items (90.7%) were House Sparrow (*Passer domesticus*) and the other eight (9.3%) were House Martin (*Delichon urbicum*).

The fact that the Long-eared Owl roosting in a pine plantation in Jordan depends so heavily on House Sparrows indicates the importance of forest fragments and urban birds for the survival of this raptor at the southernmost edge of its distribution range (Kiat *et al*., 2008; Göçer, 2016). Our results and those of others strongly suggest that *A. otus* has opportunistic feeding habits. While most energy-yielding prey were nocturnal small mammals (e.g. *M. tristrami*), smaller to avian prey (e.g. *P. domesticus*) were also hunted. Feeding and prey selection by *A. otus* within the urban areas of Jordan is likely influenced by the abundance and availability of prey species (Village, 1981; Yosef, 1997; Pirovano *et al*., 2000). The results suggest that owls in general are able to adjust their diet to urban environments (see also Amr *et al*. 2016).

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