

FEEDING OF THE LITTLE OWL DURING NESTING SEASON IN THE DANUBE DELTA (ROMANIA)

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Abstract. The feeding of Little Owl was studied based on 103 pellets collected near Letea village, in the Danube Delta. Pellets were collected near the nest, each month from April until June 2009 and in the owl's diet, several species of insects, mammals and birds were identified. The highest percentage is represented by insects, with species belonging to orders Coleoptera (71.92%), Orthoptera (15.45%) and Dermaptera (5.31%). Among the Coleoptera, the most frequent group is represented by species of family Carabidae - 22.34% and 20.16% other unidentified species. Among the Orthoptera, *Gryllotalpa* sp. is the most abundant (15.21%). Regarding the Mammals, rodents represent their favorite prey. Over 65% of the micro mammals identified as prey belong to *Micromys minutus* (42%) and *Microtus arvalis* (26%) species. In the pellets, the remains of one specimen of *Pipistrellus* sp. have also been identified. Birds hold a small percentage of Little Owl's diet, only two species being identified: *Motacilla alba* and *Passer montanus*.

Keywords: *Athene noctua*, diet, pellets, Danube Delta.

Rezumat. Hrana cucuvelei în perioada cuibăritului în Delta Dunării (România). Hrana cucuvelei a fost studiată pe baza a 103 ingluvii colectate în vecinătatea localității Letea (Delta Dunării). Ingluviile au fost colectate în apropierea cuibului, în fiecare lună din aprilie până în iunie 2009. În resturile de hrană, a cucuvelei, au fost identificate mai multe specii de insecte, mamifere și păsări. Ponderea cea mai mare este reprezentată de insecte, cu specii ce aparțin ordinului Coleoptera (71,92%), Orthoptera (15,45%) și Dermaptera cu 5,31%. Dintre Coleoptera, speciile din familia Carabidae reprezintă 22,34%, iar alte specii de Coleoptera cu 20,16%. Din ordinul Orthoptera, specia *Gryllotalpa* sp. este cea mai abundentă (15,21%). Dintre mamifere, rozătoarele reprezintă prada favorită. Peste 65% din totalitatea micromamiferelor identificate ca prăzi aparțin speciilor *Micromys minutus* (42%) și *Microtus arvalis* (26%). În resturile de hrană a fost identificat un exemplar aparținând genului *Pipistrellus* sp. Păsările dețin un procent mic în dieta cucuvelei, au fost identificate 2 specii: *Motacilla alba* și *Passer montanus*.

Cuvinte cheie: *Athene noctua*, hrană, ingluvii, Delta Dunării.

Introduction

Little Owls (*Athene noctua* Scopoli, 1769) are small owls mainly found in open cultivated habitats and forests, where they nest in tree holes, rock cavities, farm buildings or even holes in the ground. Their main diet consists of small mammals and invertebrates, which are usually caught at dusk or during the night (Schönn, 1986; Genot & Van Nieuwenhuyse, 2002).

In Europe, the Little Owl populations have been considerably reduced, especially as a result of large scale habitat alteration associated with the agriculture intensification and mechanization, which caused a reduction of food availability of and nesting sites (Schönn, 1986; Tucker & Heath, 1994).

Choosing an appropriate habitat might be the result of the integration in different types of habitats, which meet certain needs for different individuals (Orians & Wittenberger, 1991).

The nesting site selection is a key element of the habitat selection for birds (Hilden, 1965), with important consequences for both their survival and reproduction (Cody, 1985).

The appropriate habitats for the Little Owl are usually open cultivated areas, pastures and countryside zones. However, the studies conducted in these areas show a decline in the number of individuals and the existence of apparently adequate areas, but which have still remained unoccupied (Ferrus *et al.*, 2002; Zuberogioitia, 2002).

Material and Methods

The nest was located on the Southern edge of Letea village (Danube Delta) under the roof of a water pumping building.

Home range scale: the size of the home range was conservatively assumed for Little Owl to be a 30ha circular plot around nests (309 m radius) (Génot & Wilhem, 1993; Martínez & Zuberogioitia, 2004, Van Nieuwenhuysse *et al.* 2008). We analysed an area of 1000m around the nest, as the extended feeding habitat, in order to have a better representation of the local landscape (Zabala *et al.*, 2006). The identified habitats fell into seven categories: farming area (extended cultivated parcels, orchards and vineyards), ditch (water-covered surfaces, which can be crossed with small-sized boats), natural levees (elevated deposits, non-flooded areas, bordered by areas with bulrush and reed), locality, pasture (land covered with grass or herbage and grazed by or suitable for grazing by livestock), reed (surfaces covered with reed and bulrush), salty soils (salty floodable lands, with plants specific to salty soils) (Fig. 1).

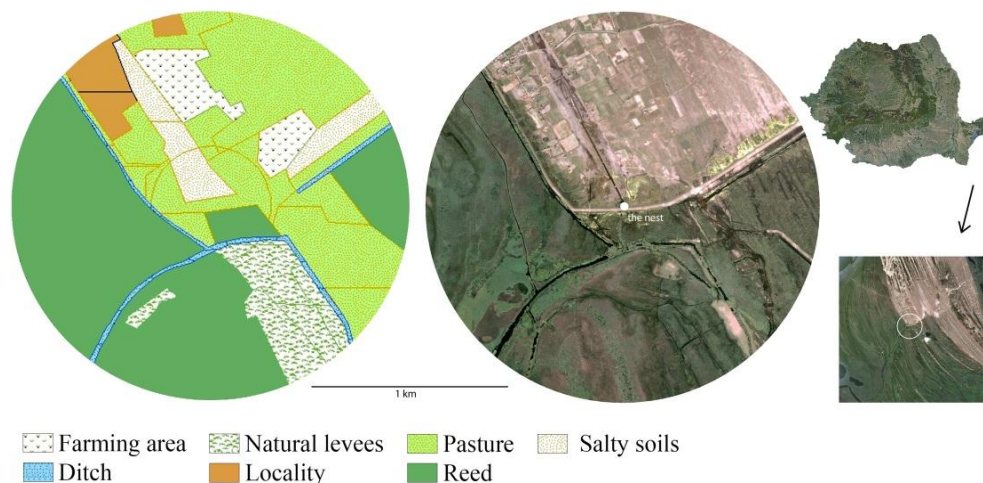


Figure 1. Map of the study area with the location of Little Owl nest.

The composition of the Little Owl's diet has been analysed using the pellets collected at the nesting site for three subsequent months (April, May and June). We

collected 103 pellets: 34 in April, 45 in May and 24 in June. All the pellets were collected in separate bags and analysed as separate samples.

For the identification of the prey species, we used skulls and mandibles for mammals, humeri and tarsometatarsi for birds and mandibles, part of legs and elytra for insects. The mammal preys were identified according to keys proposed by Pucek (1981). Mammal and bird remains were compared to the reference collection of the authors. For additional help in the species identification of birds, Moreno (1985, 1986, 1987) was also used.

For identification of insects the remaining chitinous rest were all separated and identified at order, family or species level where possible. In general small parts were found (heads, mandibles, tibiae, part of elytra or cerci) in the pellets. These were identified with the specific literature (Lindroth, 1985; Baraud, 1992; Hurka, 2005; Iorgu 2009).

We have used the proportion of prey items (%N) which represents hunting acts and proportion of prey biomass (%B) which could be an index of energy intake by owls. The latter is relevant in an energetic context, especially during the winter, an energetically stressful period for raptors Rubolini (2003). Biomass was calculated by multiplying the number of prey specimens by the average body mass of a given species. Estimates of prey biomass were derived from the literature Murariu (2000), Popescu and Murariu (2001), Pucek (1981), Stănescu (1999).

Paired elements of each taxon were separated and the largest number of elements was considered the minimum number of individuals (MNI) recovered from each sample.

The following indexes were used for the data analysis: Simpson ($D = \sum (n / N)^2$; n = the total number of organisms of a particular species; N = the total number of organisms of all species).

Results and Discussion

As a result of the analysis of the home range (scale 300 m) five types of habitats have been identified. The pastures are dominant (46.55%), followed by reed (26.587%), salty soil (18.03%), ditch (5.00%) and natural levees (3.81%). We analysed an area of 1000 m around the next, as the extended feeding habitat, in order to have a better representation of the local landscape (Zabala *et al.*, 2006). The identified habitats have been divided into seven categories: reed beds (42.25%), pastures (32.05%), natural levees (8.39%), salty soil (6.01%), farming areas (5.31%), locality (3.77%), ditch (2.18%) (Fig. 1).

The nesting of the specimen identified by us was similar to the common pattern preferred by the species: barns, stables, attics, deserted houses and buildings surrounded by plains, pastures, meadows and large orchards which are used for grazing livestock (Kitowski & Kisiel, 2003; Martínez & Zuberogoitia, 2004).

According to this study, the diet of the Little Owl consists mainly of insects and small mammals and also birds in a low percentage.

Our study has shown that most of the Little Owls captured invertebrates, mainly insects. Their food majorly consisted of beetles (Coleoptera), mole-crickets (Orthoptera) and earwigs (Dermaptera). This outcome has been achieved by other authors as well (Georgiev, 2005; Haralambos *et al.*, 2006; Tomé *et al.*, 2008).

On the whole we have identified 828 prey specimens, the specific diversity being high (Simpson's Index of Diversity) in the three collecting dates (Table 1). We have identified 768 invertebrates (92.75%) and 60 vertebrates (7.24%). Most of the preys were

identified in May (446 preys), the rest were identified in April (222 preys) and in June (160 preys).

Table 1. Summary of Simpson index test describing the insignificant differences in Little Owl' diet size during three months.

	April	May	June	Total
No. of pellets	34	45	24	103
Total number of preys	222	446	160	828
% Vertebrate preys	5.85	7.17	9.37	7.24
% Invertebrate preys	94.14	92.82	90.62	92.75
Simpson index (1-D)	0.8546	0.8368	0.8777	-

Most of the preys belong to the order Coleoptera (71.92%). The remaining belong to orders Orthoptera (16.68%) and Dermaptera (5.73%). Over 60% of the identified invertebrate preys belong to the families Carabidae (24.25%), Coleoptera (21.77%) and Gryllotalpidae (16.42%). The rest of the identified preys belong to families Melolonthidae, Scarabaeidae, Geotrupidae (Coleoptera), Labiduridae (Dermaptera) etc. (Table 2).

The owl's summer food is predominantly formed by insects and less by mammals and birds (Table 2). The preference of insects in the summer food of the owl was also noticed by other authors (Petrescu, 1994; Popescu *et al.*, 1986; Barbu & Sorescu, 1972; Tomé *et al.*, 2008). In the contrary of the summer period, during winter months the base food is formed mostly by micromammals and birds (Popescu & Savu, 1981; Savu, 1982).

Very few vertebrates were identified in the Little Owl's diet. Rodents occur in the highest number, while the insectivores, chiropterans and birds are less numerous (Petrescu, 1994; Tomé *et al.*, 2008).

The highest number of vertebrates have been identified in the pellets collected in June (9.37%), followed by those collected in May (7.17%) and in April (5.85%). Most of the preys are mammals, 85%, while the rest of 15% are birds. In the case of mammals, 76.66% were rodents, 6.66% were insectivores and 1.66% was chiropterans (Table 2).

Other authors have also identified chiropterans in the Little Owl's diet, in small proportions, such as *Plecotus* sp. (Barbu & Sorescu, 1970), *Rhinolophus ferrumequinum*. (Laiu & Murariu, 1997), *Nyctalus noctula* (Laiu & Murariu, 2000) and *Pipistrellus pipistrellus* (Vassilis & Haralambos, 2003). Other researchers have found unidentified chiropterans: Popescu & Blidărescu, 1983; Petrescu 1994.

Most of the vertebrate preys were identified in the pellets collected in May (53.33%) and in lower percentages in June (25%) and April (21.66%). Over 65% of all the identified micro mammals belong to the *Micromys minutus* (42%) and *Microtus arvalis* (26%) species. We have noticed that the largest number of micromammals was identified in May, 8 species (*Mus musculus*, *Mus spicilegus*, *Micromys minutus*, *Microtus arvalis*, *Apodemus agrestis*, *Apodemus uralensis*, *Neomy anomalus* and *Sorex araneus*), and 4 species for each other month (April and June). One can also remark that only 2 species (*Micromys minutus*, *Microtus arvalis*) were identified in the pellets collected in each of the 3 months.

In the analysed pellets, remains of two bird species *Motacilla alba* (6 specimens) and *Passer domesticus* (3 specimens) have been identified (Table 2). The small consumption of birds is in concordance with the observations of other authors (Popescu & Savu, 1981; Popescu & Blidărescu, 1983; Petrescu, 1994).

Table 2. Abundance (A%) and frequency (F%) of occurrence of the consumed preys remains in Little Owls pellets, Letea, Romania.

			April		May		June		Total	
			A%	F%	A%	F%	A%	F%	A%	F%
Vegetal fragments			-	-	-	4.44	-	12.5	-	4.85
Mineral parts			-	5.88	-	2.22	-	0	-	2.91
Orthoptera	Gryllotalpidae	<i>Gryllotalpa</i> sp.	15.76	52.9	12.10	86.66	23.12	95.83	15.21	67.9
	Tettigoniidae	<i>Platycleis</i> sp.	-	5.88	0.22	6.66	0.62	20.8	0.24	9.70
	Carabidae	<i>Carabida</i> sp.	22.97	44.11	28.69	48.8	3.75	16.6	22.34	39.8
	Carabidae	<i>Scarites</i> sp.	0.45	8.82	0.22	11.1	-	-	0.24	7.76
	Melolonthidae	<i>Anoxia orientalis</i>	10.36	17.64	3.36	26.6	11.87	75	6.88	34.9
	Scarabaeidae	<i>Copris lunaris</i>	3.60	23.52	5.38	26.6	10	62.5	5.79	33.9
	Scarabaeidae	<i>Scarabeus</i> sp.	-	-	-	-	5.62	20.8	1.08	4.85
Coleoptera	Tenebrionidae	-	4.05	26.47	2.46	8.88	-	-	2.41	12.6
	Elateridae	-	-	-	0.22	6.66	-	-	0.12	2.91
	Curculionidae	-	1.35	17.64	2.24	24.4	-	-	1.57	16.5
	Geotrupidae	-	8.10	14.70	4.48	37.7	-	-	4.58	21.3
	Dytiscidae	<i>Dytiscus</i> sp.	0.90	38.23	6.05	11.1	2.5	33.3	3.98	25.2
	Hydrophilidae	<i>Hydrophilus piceus</i>	3.15	55.88	0.44	11.1	8.75	87.5	2.77	43.6
	Coleoptera undet.	-	21.17	79.41	22.86	93.3	11.25	66.6	20.16	82.5
Dermaptera	Labiduridae	<i>Labidura riparia</i>	2.25	20.58	4.03	37.7	13.12	95.8	5.31	35.9
Passeriforme	Motacillide	<i>Motacilla alba</i>	-	-	0.44	4.44	2.5	4.16	0.72	2.91
	Passeride	<i>Passer domesticus</i>	0.45	2.94	-	-	1.25	8.33	0.36	2.91
Rodentia		<i>Mus musculus</i>	-	-	0.22	2.22	-	-	0.12	0.97
		<i>Mus spicilegus</i>	-	-	0.22	2.22	-	-	0.12	0.97
	Muridae	<i>Micromys minutus</i>	2.25	11.76	3.36	24.4	0.62	4.16	2.53	14.5
		<i>Apodemus agrestis</i>	-	-	0.44	4.44	-	-	0.24	1.94
		<i>Apodemus uralensis</i>	1.35	8.82	0.44	4.44	-	-	0.60	4.85
	Microtidae	<i>Microtus arvalis</i>	1.35	8.82	1.12	11.1	3.12	20.8	1.57	12.6
		<i>Arvicola terrestris</i>	0.45	2.94	-	-	1.25	8.33	0.36	2.91
Insectivora	Soricidae	<i>Neomys anomalus</i>	-	-	-	4.44	-	-	0.24	1.94
		<i>Sorex araneus</i>	-	-	0.22	2.22	0.62	4.16	0.24	1.94
Chiroptera	Vespertilionidae	<i>Pipistrellus</i> sp.	-	-	0.22	2.22	-	-	0.12	0.97

Even if the insects are numerically represented better in the summer food of the owl, in the investigated region, the mammals have a higher biomass weight (Table 3). As far as the biomass is concerned, rodents occur in the largest proportion - 81.74%, followed by the other groups with lower percentages (birds 11.87%, insectivores 5.24% and chiropterans 1.70%). In April the rodents' biomass represented 92.93% of the captured vertebrates. Among the rodents two species have the total biomass of over 60% (*Arvicola terrestris* 39.15% and *Microtus arvalis* 27.46%). In the pellets collected in May, the rodents' biomass lowered (83.32%) while the insectivores' biomass increased up to 8.10%. Among the vertebrates, the species with the largest biomass are two rodent species *Microtus arvalis* (34.68%) and *Microtus minutus* (22.41%).

Table 3. Identified prey remains (vertebrates) in Little Owls pellets, Letea, Romania.

Prey species	Vernacular Name	April			May			June		
		No	PO	PB	No	PO	PB	No	PO	PB
<i>Motacilla alba</i>	White Wagtail	-	-	-	2	6.25	7.68	4	26.66	12.33
<i>Passer domesticus</i>	House Sparrow	1	7.69	7.04	-	-	-	2	13.33	8.56
Total Birds		1	7.69	7.04	2	6.26	7.68	6	39.99	20.89
<i>Mus musculus</i>	House Mouse	-	-	-	1	3.12	3.20	-	-	-
<i>Mus spicilegus</i>	Steppe Mouse	-	-	-	1	3.12	2.98	-	-	-
<i>Micromys minutus</i>	Harvest Mouse	5	38.46	9.85	15	46.87	22.41	1	6.66	1.19
<i>Microtus arvalis</i>	Common Vole	3	23.07	27.46	5	15.62	34.68	5	33.33	27.84
<i>Apodemus agrestis</i>	Striped Field Mouse	-	-	-	2	6.25	11.73	-	-	-
<i>Apodemus uralensis</i>	Pygmy Field Mouse	3	23.07	16.47	2	6.25	8.32	-	-	-
<i>Arvicola terrestris</i>	Water Vole	1	7.69	39.15	-	-	-	2	13.33	49.95
Total Rodents		12	92.29	92.93	26	81.23	83.32	8	52.99	68.98
<i>Neomys anomalus</i>	Miller's Water Shrew	-	-	-	2	6.25	5.12	-	-	-
<i>Sorex araneus</i>	Common Shrew	-	-	-	1	3.12	2.98	1	6.66	2.39
Total Insectivores		-	-	-	3	9.37	8.10	1	6.66	2.39
<i>Pipistrellus</i> sp.	Pipistrelle bat	-	-	-	1	3.12	1.70	-	-	-
Total Chiroptera		-	-	-	1	3.12	1.70	-	-	-
Total vertebrates					13			15		

Of all the captured vertebrates captured in May, the highest biomass percentage is represented by rodents (68.98%) followed by birds (20.89%). In terms of species, *Arvicola terrestris* represents 49.95% and *Microtus arvalis* 27.84%.

Regarding the vertebrates, the most frequent species found in the bony remains are *Mycromys minutus* (14.5%) and *Microtus arvalis* (12.6%).

In Romania, the rodent species present in the Owl's diet varies with the region, period investigated and their abundance. Of all the rodents, *Microtus arvalis* represents an important component in the Little Owl's diet, being found in high percentage regardless of the monitoring region and period (Popescu & Savu, 1981; Popescu & Blidărescu, 1983; Savu, 1983; Petrescu, 1994; Laiu & Murariu, 1997, 2000).

Conclusions

In the investigated region, the owl's summer food is predominantly composed from insects and small mammals, 92.68% and respectively 6.14% from the total number of preys identified in the pellets.

From the insects, Coleoptera had the highest weight representing 71.92% from the rests of food that was analysed. From the mammals, the rodents had an important role in the food of this strigiform. *Micromys minutus* and *Microtus arvalis* species, that dominated numerically, were major feeding components. The birds were components of small importance in the food of the owl, their percentage being of 1.8%. The chiropters appear accidentally in the food of the owl (0.12%), observation also mentioned by other authors.

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