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**SPECTRUL TROFIC AL CIUFULUI DE PĂDURE (*ASIO OTUS* L.)
ÎN PARTEA DE SUD A REPUBLICII MOLDOVA**

**TROPHIC SPECTRUM OF THE LONG-EARED OWL (*ASIO OTUS* L.)
IN THE SOUTHERN PART OF THE REPUBLIC OF MOLDOVA**

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Rezumat. Ciuful de pădure (*Asio otus*) este o pasăre sedentară în Moldova și formează colonii de iarnă de câteva zeci de indivizi în biotopuri favorabile din localități. Spectrul trofic al *A. otus* a fost studiat în perioada de iarnă în două situri din partea de sud a Republicii Moldova: Sadaclia și Slobozia Mare, unde au fost colectate 378 de inghuvii și identificați 678 de indivizi. Dieta ciufului de pădure a constat din mamifere mici (peste 95%) și păsări. În ambele locații dominant a fost *Microtus sp.*, constituind 67% în Sadaclia și 48% în Slobozia Mare, cu o frecvență de circa 70%. A doua specie ca abundență și frecvență a fost *Mus sp.*, urmat de *Apodemus sylvaticus*. Alte specii de rozătoare au avut o pondere și o frecvență reduse. Chițcanii din genul *Crocidura* au avut o pondere similară și foarte mică în Sadaclia și au lipsit în inghuviiile din Slobozia Mare. Păsările reprezentate de *Passeriformes* au constituit 4,1% în situl Sadaclia și 2,5% în Slobozia Mare cu frecvență redusă. Biomasa totală a prăzii consumate de *A. otus* a fost de 9,74 kg la Sadaclia și 5,12 kg la Slobozia mare, ceea ce demonstrează importanța acestui prădător în reglarea numărului de rozătoare în perioada de iarnă.

Cuvinte-cheie: *Asio otus*, spectru trofic, mamifere, păsări, nișă trofică, partea de sud a R. Moldova

Abstract. The long-eared owl (*Asio otus*) is a sedentary bird in Moldova and form winter colonies of several dozen individuals in suitable biotopes from localities. The trophic spectrum of *A. otus* was studied during the winter period in two sites from the southern part of the Republic of Moldova: Sadaclia and Slobozia Mare, where 378 pellets were collected and 678 individuals were identified. The diet of the long-eared owl consisted of small mammals (over 95%) and passerine birds. In both sites the *Microtus sp.* dominated in the pellets, constituting 67% in Sadaclia and 48% in Slobozia Mare, with a frequency of about 70%. The second most abundant and frequent species were *Mus sp.*, followed by *Apodemus sylvaticus*. Other rodent species had a low share and frequency. The *Crocidura* shrews had similar low share in Sadaclia pellets and were missing in Slobozia Mare pellets. The birds, represented by *Passeriformes*, constituted 4.1% in Sadaclia site and 2.5% in Slobozia Mare with low frequency. The total biomass of prey objects consumed by the long eared owl was of 9.74 kg in Sadaclia and 5.12 kg in Slobozia mare, which proves the importance of this predator in rodent number regulation during winter period.

Keywords: *Asio otus*, trophic spectrum, mammals, birds, trophic niche, southern part of R. Moldova

Introduction

The long-eared owl (*Asio otus otus* L.) is a sedentary bird and one of the most widespread and common nocturnal birds of prey (fig. 1). During the winter period, the density of the species increases due to the migrant individuals from the northern regions and they form colonies of several dozen

individuals. In most cases, the long-eared owls prefer to winter in the same places every year. The long-eared owl is well adapted to anthropic environment and its wintering colonies are frequently registered in localities all over Europe [1, 2, 3, 7, 11, 12, 21, 23] etc.



Fig. 1. Long-eared owl (*Asio otus*) and its pellets, Slobozia Mare

After the digestion process, the owls regurgitates the indigestible remains of the consumed animals (bones, hair, feathers, fur, chitin, etc.) in the form of pellets. The pellets study can provide important data regarding the food regime of the prey bird, small mammal fauna in a certain area, its density, seasonal and annual dynamics etc.

The studies of the long-eared owl trophic spectrum started in 1960's mostly in the central part of the republic [25, 27]. The studies continued in various natural and anthropized ecosystems of the central part of republic, where about 50 species of small mammals, birds and insects were revealed in *Asio otus* trophic spectrum [28, 29]. In the Republic of Moldova the long-eared owl inhabits the forest edge, forest shelter belts, forest strips along the roads, parks and orchards [26]. The hunting sectors of *Asio otus* are open type biotopes, especially near localities. For more than 20 years the study of owl's diet was practically abandoned and was resumed in the last years in various localities of the Republic of Moldova, including the southern part. Preliminary data on the diet of *Asio otus* in Sadaclia village revealed the high dominance of rodents [16]. There are no up to-date publications on owl diet in Moldova regarding the biomass of trophic objects and niche breadth, except for several papers concerning the long-eared owl diet in Chisinau city [17, 18].

The aim of the study was to reveal the diet of long-eared owl in two localities from the southern part of the Republic of Moldova, to determine the prey biomass and niche breadth, as well as to highlight the importance of *A. otus* in rodent species number regulation.

Material and methods

The trophic spectrum of *A. otus* was studied during winter period from two villages located in the southern part of the republic: Sadaclia (46.447, 28.879) and Slobozia Mare (45.573 N, 28.167 E).

In Sadaclia a colony of 19 *A. otus* wintering individuals was located in the townhouse square in coniferous trees, 174 pellets were collected in February 2022. In Slobozia Mare a wintering colony of 16 individuals was recorded in a patch of coniferous trees near the village museum, where 93 pellets were collected in November 2022.

Each pellet was measured, weighed and unfolded. The pellets were measured and weighed; the bones were cleaned and identified. Mammal species were identified after skull bones and teeth [19, 20]. The sibling species *Microtus arvalis* and *M. rossiaemeridionalis*, *Mus musculus* and *M.*

spicilegus that are very similar morphologically, were considered as *Microtus* sp. and *Mus* sp. The ecological analysis of identified mammals and birds was performed using several indexes: abundance, frequency and biomass. The trophic niche width was estimated using the *B* Levins' index: $B=1/\sum p^2$, [13], in its standardized version *B_s* (37): $B_s=(B-1)/(n-1)$, where *p* is the fraction of items in the diet, and *n* is the number of possible food categories [10]. *B_s* values ranges from 0 (100% utilization of a single food category) to 1 (equal use of all categories).

Results and discussions

The analysis of length and weight of intact pellets in the studied sites is presented below, as well as the number of individuals found in each pellet (tab. 1). The lowest values of pellet length were registered in Slobozia Mare locality, while the pellet weight had close values in both sites. The number of individuals per pellet varied from 1 to 4 with highest mean value in Slobozia Mare.

Table 1. Pellets measurements in the studied sites

Site, no of pellets	Pellet length, mm		Pellet weight, g		No of individuals per pellet	
	Min-max	mean	Min-max	mean	Min-max	mean
Sadaclia, n=132	21.2-59.7	36.9	1.1-3.4	2.13	1-4	2.26
Slobozia Mare, n=63	17.7-47.0	27.2	1.18-3.08	2.21	1-4	2.48

In winter period the trophic spectrum of long-eared owl in the studied localities consisted of mammals from 2 orders (Soricomorpha, Rodentia) and passerine birds. In Sadaclia –435 individuals from 8 mammal species and birds and in Slobozia Mare site – 243 individuals from 6 mammal species and birds have been identified (fig. 2, 3).

The diversity of prey objects proved to be higher in Sadaclia site on the account of shrew species, which is due to higher number of collected pellets, as well to a larger number of favorable ecosystems for *Crocidura* species, represented by pastures, forest shelter belts and agricultural lands in the surroundings of the locality. In Slobozia Mare, located in the Ramsar site „Lower Prut lakes” the surrounding ecosystems were represented mostly by wet habitats and meadow forests, which are favorable for shrews, but do not represent suitable hunting sectors for the long-eared owl.

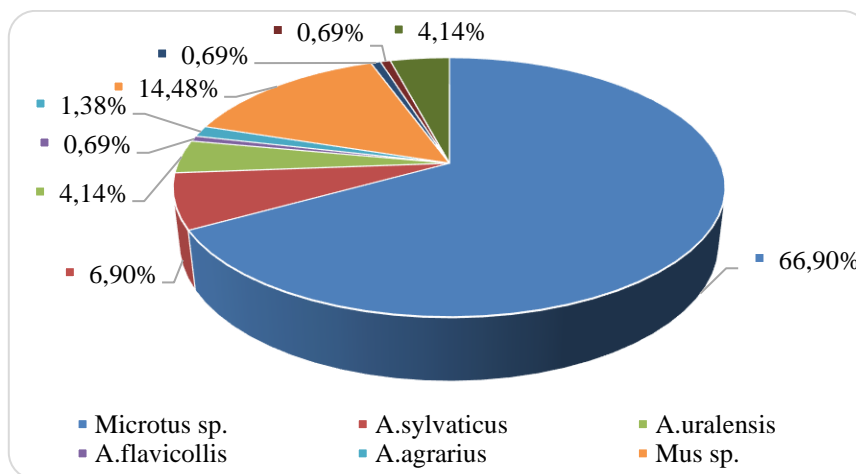


Fig. 2. Relative abundance of prey items in the diet of *A. otus* in Sadaclia

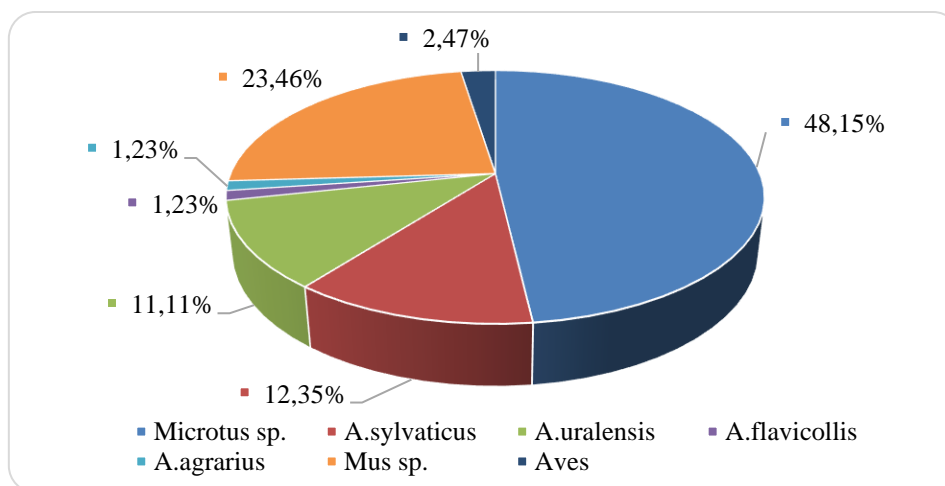


Fig. 3. Relative abundance of prey items in the diet of *A. otus* in Slobozia Mare

In both sites the *Microtus sp.* dominated in the pellets, constituting about 67% in Sadaclia and 48% in Slobozia Mare. The species frequency is also the highest, it being found in almost 70% of the pellets (tab. 2). The second most abundant and frequent species were *Mus sp.*, due to the location of the colonies in the village center. *A. sylvaticus* was the third species according to abundance and frequency (tab. 2). The species *A. uralensis* had a rather high share in Slobozia Mare pellets (11.11%) and a frequency above 30% in comparison to Sadaclia village, where it had low relative abundance and frequency. Other species had a share of less than 2% and much lower frequency (fig. 2, 3; tab. 2).

The shrews, represented by both *Crocidura* species, had similar low share in Sadaclia pellets and were missing in Slobozia Mare pellets. The birds, represented by Passeriformes, constituted 4.1% in Sadaclia site and 2.5% in Slobozia Mare with low frequency (tab. 2).

The highest biomass was registered in *Microtus sp.* and the total biomass consumed by the long eared owl was of 9.74 kg in Sadaclia and 5.12 kg in Slobozia Mare. The high biomass of field voles, which are considered pests of agricultural crops, and of the representatives of the genus *Mus* – pests of cereal warehouses and of inhabited houses shows the importance of *Asio otus* in biological control of rodent's number in winter season.

Table 1. Frequency and biomass of prey species in Sadaclia and Slobozia Mare

Species	Sadaclia		Slobozia Mare	
	Frequency, %	Biomass, g	Frequency, %	Biomass, g
Microtus sp.	70.69	6984	68.42	2808
A.sylvaticus	13.79	630	42.11	630
A.uralensis	10.34	324	31.58	486
A.flavicollis	1.72	75	5.26	75
A.agrarius	3.45	114	5.26	57
Mus sp.	29.31	945	57.89	855
C.leucodon	1.72	24	-	-
C.suaveolens	1.72	15	-	-
Passeriformes	8.62	630	10.53	210
Total biomass	9741		5121	
Trophic niche width	2.08		3.171	
Trophic niche width standardized	0.135		0.362	

The trophic niche width varied between 2.08 in Sadaclia and 3.17 in Slobozia Mare site; the standardized index varied between 0.135 and 0.362, respectively, which indicate that in Slobozia Mare site the prey categories had more even distribution in the diet, even if their diversity was lower (tab. 2). Also, the very low Bs indicate the preference for only 1-2 prey categories, fact confirmed by the high share of *Microtus* sp.

In previous studies on the territory of the republic, the preference of *A. otus* for the species of the *Microtus* genus in the winter period in localities was also mentioned, the field voles constituting more than half of prey objects [17, 18, 25, 27, 28, 29, 30] etc. The preference of the long-eared owl for *Microtus* species is influenced by their way of life: the field voles inhabit open type ecosystems that overlap with the hunting sectors of the long-eared owl, they reach high densities in a short time period, thus representing an easily accessible and abundant prey. In fact, the abundance of prey in a certain ecosystem is the main factor that influences its hunting by the predator [4, 8]. Therefore, the proportion of the field voles in the diet of *A. otus* varies according to their density in the field [7, 9].

In the studied localities the share of *Mus* species was rather high, most probably on the account of *M. musculus*, being the second prey item, fact mentioned in many other studies performed in urban and rural areas [6, 14, 15]. *Apodemus sylvaticus* is also an important prey for the long-eared owl during winter period. It has preponderant nocturnal activity and is a eurytopic species, preferring the habitats at the edge of the forest, especially those bordering with cultivated lands, fallow grounds, thus an accessible object for the predators. In some localities the species was even the most abundant prey during winter period [5, 12, 15]. The striped mouse and the pygmy field mouse are also field species, but they are much less often hunted by birds of prey, because of their much lower density compared to the field voles, and because of their preference for microhabitats with tall grasses. The yellow-necked mouse is a forest species and rarely enter open areas, thus avoiding falling prey to the long-eared owl.

The shrews are an alternative prey type for *A. otus* and are mostly hunted when the abundance of *Microtus* species is low. It was established that the share of shrews in the owl's diet depends on the abundance of *Microtus* species and doesn't depend on shrew abundance in certain area [9]. The passerine birds are important prey objects in winter, they constituted up to 4.2%, while in other studies their share in various localities in winter period constituted 0,5-10% [2, 5, 22, 24].

Conclusions

The analysis of 378 pellets of *Asio otus* in two localities from the southern part of the republic allowed the identification of 678 individuals. The length of the pellets varied between 17.7 mm and 59.7 mm with an average of 36.9 mm in Sadaclia and of 27.2 mm in Slobozia Mare. The pellets weight varied between 1.1 g and 3.4 g with an average of 2.13 and 2.21 g, respectively. The number of individuals per pellet varied between 1 and 4, the average being 2.26 in Sadaclia and 2.48 individuals in Slobozia Mare.

In winter period the trophic spectrum of long-eared owl in the studied localities consisted of 8 mammal species and birds in Sadaclia and 6 mammal species and birds in Slobozia Mare site. In both sites the *Microtus* sp. dominated in the pellets, constituting 67% in Sadaclia and 48% in Slobozia Mare, with a frequency of about 70%. The second most abundant and frequent species were *Mus* sp., followed by *Apodemus sylvaticus*. Other rodent species had a low share and frequency. The *Crocidura* shrews had similar low share in Sadaclia pellets and were missing in Slobozia Mare pellets.

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The total biomass of prey objects consumed by the long eared owl was of 9.74 kg in Sadaclia and 5.12 kg in Slobozia mare, which proves the importance of this predator in rodent number regulation during winter period.

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References

1. BANARU, V.; COROIU, I. Preliminary data on the micromammal fauna in the Someșul Mic basin (România) according to *Asio otus otus* L. pellets. *Studia Univ. "Babeș-Bolyai", Cluj-Napoca, Biol.* 1997; XLII (1-2), p. 103-108.
2. BENCOVĚ, V.; KAĽPAR, T.; BRYJA, J. Seasonal and interannual changes in diet composition of the Long-eared Owl (*Asio otus*) in Southern Moravia. *Tichodroma*. 2006; 18, p. 65-71.
3. BIRRER, S. Synthesis of 312 studies on the diet of the Long-eared Owl *Asio otus*. *Ardea*. 2009, 97 (4), p. 615-624.
4. CANOVA, L. Influence of snow cover on prey selection by Long-eared Owls *Asio otus*. *Ethology Ecology Evolution*. 1989, 1, p. 367-372.
5. DZEMIAN, S.; PILACINSKA, B.; PITUCHA, G. Winter diet composition of urban long-eared owls (*Asio otus*) in Rzeszow (SE Poland). *Biological let.*, 2012, 49 (2), p. 107-114.
6. ESCALA, C.; ALONSO, D; MAZUELAS, D. et al. Winter diet of Long-eared Owls *Asio otus* in the Ebro valley (NE Iberia). *Revista Catalana d'Ornitologia*. 2009, 25, p. 49-53.
7. GOSZCZYNSKI, J. Connection between predatory birds and mammals and their prey. *Acta Theriol.* 1977, 22(30), p. 399-430,
8. GUIDONI, R.; CAPIZZI, D.; CAROLI, L.; LUISELLI, L. Feeding habits of sympatric owls in an agricultural and forested landscape of central Italy. *Folia Zool.* 1999, 48 p. 199-202.
9. KORPIMAKI, E.; NORRDAHL, K. Avian and mammalian predators of shrews in Europe: regional differences, between year and seasonal variation and mortality due to predation. *Ann. Zool. Fenn.* 1989, 26(4), p. 389-400.
10. KREBS, C.J. Niche measures and resource preferences. In: *Ecological Methodology*, New York: Addison-Welsey Publishers. 1999, p. 455-496
11. LAIU, L.; MURARIU, D. The food of the long-eared owl (*Asio otus otus* L.) (Aves: Stringiformes) in wintering conditions of the urban environment in Romania. *Trav. Mus. Nat. His. Nat. Gr. Antipa*. 1998, 40, p. 413-430.
12. LAIU, L.; PASOL, P.; FENERU, F.; MURARIU, D. The analysis of the winter food structure in *Asio otus otus* L. (Aves: Strigiformes) from Bacau and Iasi towns – Moldova (Romania). *Trav. Mus. Nat. His. Nat. Gr. Antipa*. 2002, 44, p. 423-430.
13. LEVINS, R. *Evolution in Changing Environments: Some Theoretical Explorations*. Princeton: Princeton University Press. 1968. 121 p.
14. MARTELLI, C.; FASTELLI, P. Svernamento e dieta del gufo commune *Asio otus* nella città di Grosseto. *Gli Uccelli d'Italia*. 2013, 38, p. 85-91.
15. MURARIU, D.; ANDREESCU, I.; NESTEROV, V. Les composants de la nourriture d'hiver d'*Asio otus otus* (L., 1758) du nord-est de Bucarest (Roumanie). *Trav. Mus. Nat. His. Nat. Gr. Antipa*. 1991, 31, p. 415-420.
16. NISTREANU, V.; LARION, A.; POSTOLACHI, V. Small mammal diversity in steppe zone Sadaclia, Republic of Moldova. *DROBETA, Științele Naturii*. 2015, XXV, p. 135-141.
17. NISTREANU, V.; LARION, A. Importance of long-eared owl (*Asio otus* L.) in rodent regulation number in urban areas. *Scientific Papers. Agronomy*. 2020, LXIII (2), p. 294-299.

18. NISTREANU, V.; PARASCHIV, D.; LARION, A. Comparative analysis of long-eared owl (*Asio otus*) winter diet from two European cities – Chishinau (Republic of Moldova) and Bacau (Romania). *One Health & Risk Management*. 2020, 1(1), p. 51-58.
19. POPESCU, A.; MURARIU, D. *Fauna României. Mammalia, Rodentia*. Vol. XVI, Fasc. (2), Editura Academiei Române, 210 p, 2001.
20. PUCEK Z. (red.) *Keys to vertebrate of Poland. Mammals*. PWN – Polish Scientific Publishers – Warszawa. 1981. 370 p,
21. ROMANOWSKI, J.; ŻMIHORSKI, M. Effect of season, weather and habitat on diet variation of a feeding specialist: a case study of the long-eared owl, *Asio otus* in Central Poland. *Folia Zool.* 2008, 57(4), p. 411-419.
22. ROMANOWSKI, J. Trophic ecology of *Asio otus* (L.) and *Athene noctua* (Scop.) in the suburbs of Warsaw. *Pol. Ecol. Stud.* 1988, 14, p. 223-234.
23. SANDOR, A.; KISS, B. The diet of wintering Long-eared Owls (*Asio otus*) in Tulcea, Romania. *Scientific Annals of the Danube Delta Institute*. 2004, 10, p. 49-54.
24. TULIS, F.; VESELOVSKÝ, T.; BIRRER, S. Different alternative diets within two subgroups in a winter roost of long-eared owls. *Raptor Journal*. 2019; 13, p. 139-144. doi: 10.2478/srj20190002
25. АВЕРИН, Ю. В.; ГАНЯ, И. М. *Хищные птицы Молдавии и их роль в природе и сельском хозяйстве*. Изд-во «Картя Молдовеняскэ». 1966, 104 с.
26. АВЕРИН, Ю. В.; ГАНЯ, И. М.; ЗУБКОВ, Н. И.; МУНТЯНУ, А.И.; УСПЕНСКИЙ, Г.А. *Птицы. Животный мир Молдавии*. Кишинэу «Штиинца», 1981, 336 с.
27. АНИСИМОВ, Е. П. Факторы, определяющие добычу ушастой совы зимой. *Вопросы экологии и практического значения птиц и млекопитающих Молдавии*. 1969, 3, с. 36-40.
28. ЗУБКОВ, Н.И. Трофические связи и роль ушастой совы в биоценозах антропогенного ландшафта. *Млекопитающие и птицы антропогенного ландшафта Молдавии и их практическое значение*. Кишинэу «Штиинца», 1986. с. 41-59.
29. ЗУБКОВ, Н.И. Трофические связи сов в биоценозах Молдавии. *Экология птиц и млекопитающих Молдавии*. Кишинэу «Штиинца», 1981. с. 79-94.
30. ЗУБКОВ, Н.; НИСТРЯНУ, В. Биоценотические аспекты трофических связей некоторых видов хищных птиц и сов в бассейне Днестра. *Mat. Conf. Internaț. "Conservarea biodiversității bazinului Nistrului"*, 7-9 octombrie 1999, p. 73-75.