Theriologia Ukrainica, **29**: 105–114 (2025)
p-ISSN 2616-7379 • e-ISSN 2617-1120
DOI: 10.53452/TU2908

CHARACTERISTICS OF THE DIET OF THE WESTERN BARN OWL AND THE LITTLE OWL IN ZAKARPATTIA OBLAST (UKRAINE)

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Key words

barn owl, little owl, food, trophic niche, Transcarpathia

doi

http://doi.org/10.53452/TU2908

Article info

submitted 31.03.2025
revised 03.06.2025
accepted 30.06.2025

Language

English, Ukrainian summary

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Abstract

The article presents the results of an analysis of nearly 150 pellets (containing 178 food items) of the little owl (*Athene noctua*) and about 300 pellets (containing 1268 food items) of the barn owl (*Tyto alba*) collected in Berehove Raion, Zakarpattia Oblast, in 2006–2008. The analysis of owl pellets is a highly effective method for studying the composition of faunal communities and the structure of prey species assemblages. Pellet analysis serves as a reliable tool for monitoring programmes and for identifying indicator species of small mammals. Among owl species common in Europe, the populations of the barn owl and, especially, the little owl are steadily declining, primarily due to ongoing urbanisation, which increases bird mortality. The barn owl, in particular, suffers from the modernisation and reconstruction of buildings, leading to the loss of traditional nesting sites. Small mammals constitute the primary prey of both owl species, comprising 99.8% of the barn owl's diet and 90.4% of the little owl's diet. The trophic niche of the barn owl, based on Simpson's index, is twice as wide as that of the little owl (5.2 vs. 2.0, respectively). The overlap of trophic niches between these predators, measured using Pianka's index, is 70.5%. The greatest similarity in prey usage is observed in the consumption of secondary and supplementary food components (91.7–99.3%), whereas similarity in the use of the primary prey species (*Microtus arvalis*) is lower, at 71.1%. During periods of environmental degradation and reduced abundance of the primary prey, the trophic niche overlap increases due to shared consumption of secondary and supplementary prey species. The little owl expands its trophic niche by including vertebrates from various taxonomic classes (birds, reptiles, amphibians, and fishes), while the barn owl broadens its niche by incorporating a greater diversity of small mammal species. This niche expansion reduces interspecific competition. Despite the overall similarity in diet composition, the trophic niches of the barn owl and little owl in Zakarpattia do not completely overlap. The similarity in the use of the primary prey is approximately 70%, which facilitates their coexistence.

Cite as

Drebet, M., L. Pokrytiuk. 2025. Characteristics of the diet of the western barn owl and the little owl in Zakarpattia Oblast (Ukraine). *Theriologia Ukrainica*, **29**: 105–114. [In English, with Ukrainian summary]

Живлення сипухи і сича хатнього в Закарпатській області (Україна)

Михайло Дребет, Леонід Покритюк

Резюме. У статті наведено результати аналізу близько 150 пелеток (178 компонентів їжі) сича хатнього та близько 300 пелеток (1268 компонентів) сипухи з території Берегівського району Закарпатської області в 2006–2008 рр. Аналіз сов'ячих пелеток є дієвим методом під час здійснення програм моніторингу біорізноманіття, який дозволяє відносно швидко накопичувати масовий остеологічний матеріал щодо фонових і рідкісних видів та контролювати динамічні зміни в природних угрупованнях без прямого втручання у перебіг природних процесів. Кількість виявлених видів здобичі в раціоні сов значною мірою залежить від розміру вибірки пелеток. У зв'язку з цим, природоохоронні території мають особливо високий потенціал для накопичення таких репрезентативних даних завдяки стабільним умовам середовища та сталому доступу до дослідницьких ділянок. Серед видів сов поширених в Європі чисельність популяцій сипухи і особливо сича хатнього постійно скорочується. Основна причина — це прогресуюча урбанізація середовища, яка спричинює загибель птахів. Сипуха потерпає від модернізації та реконструкції будівель, втрачаючи традиційні місця для гніздування. Основними об'єктами живлення сипухи і хатнього сича на Закарпатті є дрібні ссавці, їх частка у живленні сипухи становить 99,8 %, у сича хатнього — 90,4 %. Ширина трофічної ніші сипухи за індексом Сімпсона вдвічі більша ніж у сича — 5,2 та 2,0 відповідно. Перекриття трофічних ніш хижаків за Індексом Піанка становить 70,5 %. Найбільша схожість у використанні об'єктів живлення простежується для другорядних та додаткових компонентів живлення (91,7–99,3 %). Схожість у використанні основного об'єкту живлення (*Microtus arvalis*) становить лише 71,1 %. У період погіршення кліматичних умов та зниження чисельності основного компонента живлення трофічні ніші двох видів сов перекриваються за рахунок доступності одних і тих самих другорядних і додаткових видів-жертв. У хатнього сича розширення трофічної ніші відбувається за рахунок включення до раціону представників різних класів хребетних (птахи, плазуни, земноводні, риби), а в сипухи за рахунок включення до раціону більшої кількості видів основної групи компонентів живлення — дрібних ссавців. Розширення трофічних ніш послаблює конкуренцію між хижаками. Не зважаючи на загальну схожість раціонів живлення сипухи і сича хатнього в Закарпатській області, їх трофічні ніші повністю не перекриваються, а схожість використання основного компонента живлення становить близько 70 %, що забезпечує їм можливість спільного існування.

Ключові слова: сипуха, сич хатній, живлення, трофічна ніша, Закарпаття.

Introduction

The current state of research on owls in Ukraine, particularly in its western regions, is considered insufficient by many ornithologists and requires further systematic investigation [Bashta 2009; Godovanets 2009]. This is also supported by the recent dissertation research of Y. V. Kuzmenko (2021), which focuses on the Central and Eastern Polissia of Ukraine[1]. In the context of increasing anthropogenic transformation of natural habitats, the analysis of trophic structure and the identification of feeding features of birds of prey occupying the top of trophic chains are becoming increasingly relevant. This is especially true for synanthropic species such as the barn owl (*Tyto alba*) and the little owl (*Athene noctua*) [Zahorodnyi *et al.* 2021].

Trophic factors are considered key in describing the ecological niches of birds, as they determine all aspects of their life activities [Khlebosolov 2002]. At the same time, studies of the diet of such predators are also important for theriology, as they allow the species composition, abundance, and population structure of small mammals to be indirectly assessed, as well as to track ecological changes in prey communities across space and time.

The method of pellet analysis has been known in zoological practice since the first half of the 20th century [Pidoplichko 1935]. It is characterised by high effectiveness in analysing the faunal composition and the structure of prey species communities. The analysis of owl pellets is an efficient

[1] Unpublished work: Kuzmenko, Y. V. 2021. *Owls (Strigiformes) of Central and Eastern Polissia of Ukraine: species diversity, ecology, conservation.* PhD thesis in Zoology, Kyiv, 1–229. [Ukrainian] URL

method in the implementation of monitoring programs and in identifying indicator species of small mammals. The effectiveness of the pellet method is particularly emphasised for monitoring the theriofauna in protected areas, as it enables the relatively rapid accumulation of bulk osteological material of both common and rare species, and facilitates the tracking of dynamic changes in natural communities without direct interference with natural processes [Drebet 2022].

The method can be integrated into the State Environmental Monitoring System as a tool for assessing the status of biological and landscape diversity through the development of standardised protocols for the collection, analysis, and interpretation of pellet material. This would allow for the acquisition of representative data on small mammal population structure, the monitoring of faunal changes under the influence of natural and anthropogenic factors, and the identification of ecological indicators of environmental changes.

In Zakarpattia Oblast, the little owl (*Athene noctua*) is primarily distributed in lowland and foothill areas, avoiding forested regions [Potish 2009]. In villages, it is frequently observed on farms and within the grounds of schools, kindergartens, and machine-transport units. In urban areas, it has been recorded on premises of industrial facilities, in the outskirts of new residential developments, and in rarely visited buildings. For nesting, it readily chooses cavities in concrete slabs and various crevices in attics. The species predominantly breeds in agricultural landscapes and human settlements. In Berehove Raion, it is commonly found in transformed environments. Its diet includes small mammals, birds, and insects [Zahorodnyi *et al.* 2021]. In the territory of Berehove Raion, the estimated number of breeding territories ranges from 70 to 120, although there is a declining trend. During the winter period in the foothill zone, the species exhibits limited vertical movements from breeding territories [Godovanets 2009]. In the lowland areas of Berehove Raion, vocal activity near breeding sites is recorded throughout the year (with varying intensity), though it is assumed that individuals may relocate to areas with higher food availability (such as grain storage facilities, mills, and farms). Owing to its body structure, the little owl is a highly skilled predator, unmatched by other owls or diurnal raptors of similar size [Shtegman 1960], and thus it can compete for prey of similar size with the barn owl (*Tyto alba*).

Until the 1950s, the barn owl had been considered a widespread species in western Ukraine [Pidoplichko 1935; Strautman 1954]. Since the second half of the 20th century, its population in Ukraine has been declining rapidly [Tatarinov 1973], although in recent years some positive population trends have been observed [Vetrov *et al.* 2008]. The barn owl, listed in the Red Data Book of Ukraine as an endangered species, currently has a limited distribution in several regions of the country, including Zakarpattia, where its breeding population is estimated at approximately 30 pairs [Poluda 2021]. The primary cause of the species' decline is progressive urbanisation of the environment, which leads to mortality and the loss of traditional nesting sites [Hindmarch 2014].

The feeding spectra of the two studied owl species have been relatively well investigated in Europe [Contoli 1981; Gotta & Pigozzi 1997; Fattorini 1999; Sara 1999]. Moreover, additional studies have expanded this knowledge [Bon *et al.* 2001; Georgiev 2005; Wiacek *et al.* 2009]. In contrast, the diet of the barn owl in Ukraine has been addressed in only a few publications [Strautman 1954; Tatarinov 1960; Talposh 1963; Tatarinov 1973]. The trophic ecology of the little owl, however, has been somewhat better studied in Ukraine [Cherkashchenko 1970; Atamas & Tovpinets 2006; Skilskyi 2007] and recent studies have further contributed to the understanding of this topic [Bokotey 2010; Zahorodnyi *et al.* 2021].

A comparative analysis of the feeding spectra of the barn owl and the little owl is important for understanding the specifics of their trophic specialisation, determining the degree of interspecific competition, and clarifying the ecological role of each species within small-mammal communities. Diet analysis enables the assessment of trophic specialisation, the identification of potential interspecific competitive interactions, and the determination of the ecological role of each species in the structure of local small-mammal assemblages.

Furthermore, comparing feeding spectra across different regions of Ukraine allows the adaptability of each species to local conditions, prey availability, and environmental changes to be evaluated. Such comparisons are particularly relevant in the context of population declines in both species,

as they may help to identify critical factors influencing their status and serve as a scientific basis for the development of effective conservation measures under varying ecological conditions. An example of this approach is a recent study of the little owl's diet in Zakarpattia, which demonstrated that the species maintains its status as a trophic generalist, although its diet is significantly influenced by land use type and prey availability resulting from agricultural transformation of the environment [Zahorodnyi *et al.* 2021].

Materials and Methods

This article presents the results of an analysis of barn owl and little owl pellets collected in the territory of the Berehove Raion, Zakarpattia Oblast, in 2006–2008. The district covers an area of 802 km² and is located in the north-eastern part of the Central Danubian Lowland in terms of its physiographical characteristics [Geographical... 1990]. In total, approximately 150 little owl pellets (containing 178 food items) and around 300 barn owl pellets (containing 1268 food items) were analysed. The majority of the pellets were collected near the village of Dyida. A large dataset (approximately 1500 items) from this collection site was used earlier in a study dedicated to the diet of the little owl in Berehove Raion, Zakarpattia Oblast [Zahorodnyi *et al.* 2021]. Thus, these data may serve as a complement to the analysis of the little owl's diet.

Fresh food remains (e.g., lizard and snake remains) observed near nests were not included in the analysis; only osteological remains retrieved from pellets were examined.

The method of pellet analysis is widely used in Ukraine to study the quantitative and qualitative composition of the micromammal fauna, and, to a somewhat lesser extent, for investigating the diets of birds of prey and certain other avian groups. The value of this method has been noted by many researchers, but it received the most attention in studies of small mammal distribution in the Ukrainian SSR [Pidoplichko 1935]. Its relevance has grown significantly under modern research standards, as it is considered one of the most humane, non-invasive methods of study [Atamas 2004]. Owl pellets provide the best materials for further analysis, as the bones of prey animals are almost always intact and undamaged, which greatly facilitates species identification.

The identification of prey items was carried out based on the morphology of skull fragments, jaws, teeth, and dental structures [Pucek 1984].

Several statistical indices were used to analyse and compare the dietary samples (Table 1). Similarity between the samples was evaluated using Lennon's index, while the diversity of the feeding spectrum was calculated based on Simpson's index. The Morisita–Horn index (in a modified form) was applied to assess the similarity in the use of individual food components between the two owl species.

The concept of the trophic niche was interpreted as the system of trophic adaptations enabling species to exist in a particular environment. Pianka's index, adapted by MacArthur and Levinson, was used to estimate the degree of trophic niche overlap [Khlebosolov 2002].

Table 1. Statistical indices used for sample analysis and comparison

Таблиця 1. Статистичні індекси, використані для аналізу та порівняння вибірок

Indices	Formula	Components (description of parameters)
Lennon's formula, Q	$Q = 1 - N_I / I$ (ranging from 0 to 1)	N_I is the number of food components of one species, and I is the total number of food components
Simpson's formula and the diversity index, S	$S = 1 / \sum p_i^2$ (ranging from 0 to N)	p_i is the proportion of each component in the diet
Morisita–Horn index, C	$C = 2 \sum x_i y_i / (\sum x_i^2 + \sum y_i^2)$	x_i and y_i are the percentage values of food components in the diets of the two studied owl species
Pianka's index, adapted by MacArthur and Levinson's formula, O_{ik}	$O_{jk} = \sum_n p_{ij} p_{ik} / \sqrt{\sum p_{ij}^2 \sum p_{ik}^2}$	j and k are the species being compared

Results and Discussion

Results of the diet analysis of the barn owl and the little owl

The primary components of the diet of the barn owl and the little owl in Zakarpattia Oblast are small mammals, which comprise over 90% of the diet in both species. Additional prey items include birds, while amphibians and insects were detected only in the diet of the little owl (Fig. 1). Furthermore, the diet of the little owl also includes lizards and snakes (food remains observed near nests, which were not included in the analysis).

The barn owl's diet consists of 19 components, almost all of which are small mammals, with birds accounting for only 0.24% of the diet (Table 2).

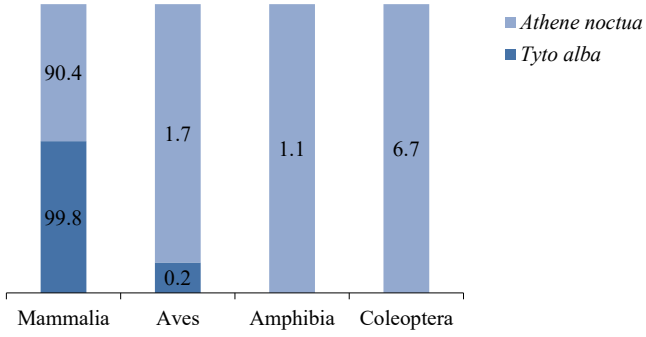

Fig. 1. Dietary components of the barn owl and the little owl in Zakarpattia Oblast, based on pellet analysis from 2006–2008.

Рис. 1. Компоненти живлення сипухи та сича хатнього в Закарпатській області. За результатом аналізу пелеток зібраних у 2006–2008 роках.

Table 2. Trophic relationships between *Tyto alba* and *Athene noctua* in Zakarpattia Oblast

Таблиця 2. Трофічні взаємини *Tyto alba* та *Athene noctua* в Закарпатській області

Prey component	*Tyto alba*		Morisita–Horn index, %	*Athene noctua*	
	N	%		N	%
Crocidura suaveolens	25	1.97	0	0	0
Crocidura leucodon	19	1.50	99.31	3	1.69
Neomys sp.	8	0.63	0	0	0
Sorex minutus	36	2.84	0	0	0
Sorex araneus	339	26.74	8.39	2	1.12
Sorex sp.	141	11.12	0	0	0
Micromys minutus	4	0.32	0	0	0
Apodemus agrarius	14	1.10	91.68	3	1.69
Sylvaemus tauricus	2	0.16	0	0	0
Sylvaemus sylvaticus	6	0.47	27.53	6	3.37
Sylvaemus sp.	7	0.55	0	0	0
Mus musculus	11	0.87	0	0	0
Rattus norvegicus	12	0.95	0	0	0
Muridae indet.	96	7.57	92.37	9	5.06
Myodes glareolus	4	0.32	0	0	0
Microtus arvalis	369	29.10	71.13	124	69.66
Microtus agrestis	4	0.32	52.05	2	1.12
Microtus sp.	168	13.25	80.84	12	6.74
Aves indet.	3	0.24	27.53	3	1.69
Amphibia indet.	0	0	0	2	1.12
Coleoptera indet.	0	0	0	12	6.74
Total	1268	100		178	100
Sample adequacy (Lennon's index)	0.1			0.5	
Diversity of feeding spectra (Simpson's index)	5.2			2.0	
Trophic niche overlap (Pianka's index)			70.5%		

The diet of the little owl consists of 11 components, with small mammals predominating; however, birds occur more frequently in its diet (1.69%), along with amphibians (1.12%) and insects (6.74%). An increased sample size (number of pellets) has a significant impact on the completeness of the prey species list in the little owl's diet. For example, analysis of 1446 little owl pellets collected from the same area in 2002–2020 identified 18 vertebrate species (including 16 species of small mammals) [Zahorodnyi *et al.* 2021]. The main prey of both the barn owl and little owl in Zakarpattia Oblast are small mammals, which comprise 99.8% of the barn owl's diet and 90.4% of the little owl's diet.

In terms of use of the main prey component (i.e. small mammals), the trophic niche of the barn owl is more than twice as broad, encompassing 14 species compared to 6 species in the little owl's diet. However, the little owl's diet is relatively more diverse in general, due to the presence of amphibians and insects. The common vole (*Microtus arvalis*) dominates the diets of both species, comprising 29.1% of the barn owl's diet and 69.7% of the little owl's diet.

Overall, the barn owl's diet analysis revealed no significant differences from previous studies [Pidoplichko 1935; Strautman 1954; Tatarinov 1960; Talposh 1963]. A similar proportion of main prey items has been reported for the little owl's diet within western Ukraine [Cherkashchenko 1970; Kiyko & Yakubenya 1995; Bashta 2009].

The predominance of micromammals in the diets of owls in Ukraine was demonstrated on a large dataset by I. H. Pidoplichko, who analysed 50 000 pellets (containing over 100 000 remains of small animals) and found that rodents accounted for approximately 80%, insectivorans for 15%, and birds for 1.5% [Pidoplichko 1935]. The high proportion of small mammals in the barn owl's diet is related to the absence of other characteristic diet components such as birds, amphibians, and insects.

The proportion of birds in the diet of the barn owl may increase in years of low micromammal abundance in the study area [Tatarinov 1960]. So, the low proportion of birds in the diets of both the barn owl and little owl in Zakarpattia Oblast in 2006–2008 is likely associated with the greater availability of the primary prey items—small mammals.

In the winter diet of the little owl in Lviv Oblast, small mammals also predominated, with birds completely absent. The author notes significant mid-winter warming, which may have influenced the absence of birds in the little owl's diet, but it is important to note the small sample size of the analysed pellets (18) in that publication [Bashta 2009].

In the diet of the little owl from Rivne Raion, birds accounted for approximately 7% [Cherkashchenko 1970]. Besides birds, the diet from this area also included small mammals, insects (7%), and amphibians (1%), closely resembling the diet of the little owl in Zakarpattia Oblast. The difference lies in the presence of insectivorans in the diet. The majority of little owl pellets from 2006–2008 reflect a winter–spring feeding aspect, with insectivorans present in pellets collected in April, while the seasonal aspect of the diet in the Rivne study was not specified.

Overall, the little owl, like the barn owl, is characterised by a broad spectrum of prey items influenced by range, season, and prey abundance and availability [Priklonsky 2001; Bashta 2009]. The proportion of insects in its summer diet may reach 50%, whereas the winter diet consists exclusively of small mammals and birds [Priklonsky 2001]. In the stomach contents of little owls from the Prut–Dniester interfluve in Ukraine during the summer, insects comprised 84.2% of the diet [Skilskyi 2007]. In eastern Ukraine, the winter diet of the little owl also consists solely of small mammals and is characterised by low diversity, only 5–7 species [Atamas & Tovpinets 2006].

Primary and secondary prey items

The primary prey item for both the barn owl and little owl in Berehove Raion of Zakarpattia Oblast is the common vole (*Microtus arvalis*). Its share in the barn owl's diet is 29.1%, and in the little owl's diet is 69.7%. Although previous publications on barn owl diet emphasise the variable proportions of prey components, the dominance of the common vole as the main prey item remains consistent. The proportions of other diet components also remain stable [Tatarinov 1960; Talposh 1963]. The common vole is similarly a primary prey item for the little owl in Ukraine [Cherkashchenko 1970; Atamas & Tovpinets 2006] and beyond [Priklonsky 1971].

An exception is the diet analysis of the little owl in Lviv Oblast, where the house mouse (*Mus musculus*) predominated (40%), and the common vole accounted for only 12% [Kiyko & Yakubenya 1995].

The secondary prey group of the barn owl consists of insectivorans, predominantly the common shrew (*Sorex araneus*), which accounts for 26.7%, and the genus *Sorex* in general, comprising 13.9%. A similar proportion of insectivorans in the barn owl's diet, ranging from 15% to 25%, was observed in the mid-20th century [Strautman 1954; Talposh 1963]. Analysis of barn owl pellets collected in the 1920s–1930s also indicates the secondary role of insectivorans in its diet [Pidoplichko 1935]. Representatives of the family Muridae may be considered secondary prey for the little owl, taking into account their overall proportion in the diet of little owls from Zakarpattia Oblast and other regions of Ukraine.

Additional prey items for the barn owl in Zakarpattia Oblast primarily include birds (Aves) and representatives of the family Muridae, whose proportions largely depend on the abundance of the barn owl's main prey component. Other supplementary prey species, which are present in low proportions but are characteristic of the owl's diet, include certain insectivorans, amphibians, and insects. In contrast to the barn owl, the additional prey of the little owl consists mainly of insectivorans, which collectively account for only about 3% of its diet. In other parts of western Ukraine, the proportion of shrews in the little owl's diet varies around 10% [Cherkashchenko 1970; Bashta 2009]. Besides, members of the family Soricidae and insects also constitute supplementary prey for the little owl, with their proportion varying seasonally.

In the diet of the barn owl, based on pellet analysis from samples collected in 2006–2008, no bats were detected. Bats can be considered incidental prey items that do not consistently enter the barn owl's diet and, even when present, often occur only as single individuals [Strautman 1954; Talposh 1963].

Diversity of feeding spectra and trophic niche overlap

Although the diets of the barn owl and the little owl in Berehove Raion of Zakarpattia Oblast are similar, both being primarily composed of micromammals, these species differ in their ecological requirements and so coexist without competition in many regions [Fattorini 1999]. A striking example of sympatry is the simultaneous nesting of both species in the attic of a tobacco-drying facility in the village of Dyida (with nests located 10–20 m apart), as well as in the attic of a farm in the Crimea [Vetrov *et al.* 2008].

The natural and climatic conditions of the study area favour the year-round availability of primary prey items, as reflected in the diets of the studied species.

Based on pellet analysis of the two owl species in Zakarpattia Oblast, the trophic niche breadth of the barn owl, measured by Simpson's index, is twice as large as that of the little owl (5.2 vs 2.0, respectively). This difference is associated with a greater number of small-mammal species in the barn owl's diet. It is evident that with an increased sample size (number of pellets), the feeding spectrum of the little owl will become significantly broader [Zahorodnyi *et al.* 2021]. So, this will lead to an expansion of the little owl's trophic niche and an increase in niche overlap with the barn owl. The trophic niche overlap, calculated by Pianka's index, is 70.5% (the index ranges from 0 [no overlap] to 100% [complete overlap]). The greatest similarity in the use of prey items is observed for secondary and supplementary food components (91.7–99.3%), whereas similarity in the use of the main prey item is only 71.1%. This indicates intensified interspecific competition during periods of adverse climatic conditions and decreased abundance of the primary prey component.

Under such conditions, the trophic niches of the two species narrow due to the availability of the same prey species. Conversely, the expansion of trophic niches reduces interspecific competition. In the little owl, trophic niche expansion occurs through the inclusion of representatives from various vertebrate classes (birds, reptiles, amphibians, and fish) in its diet, whereas in the barn owl, it is achieved by incorporating a greater number of species within the primary prey group, small mammals.

The results of our study show the predominance of small mammals in the diets of both owl species, which is consistent with findings from similar research. In Italy, the barn owl primarily consumes rodents (comprising 84% of its prey), whereas the little owl has a more diverse diet that includes a significant proportion of invertebrates. Thus, the little owl is a more opportunistic predator, capable of adjusting its diet based on prey availability [Gotta & Pigozzi 1997; Zahorodnyi *et al.* 2021]. Furthermore, studies in Central Europe show that the little owl prefers open landscapes with low vegetation, such as pastures and hayfields, which provide easier access to prey. This may explain the presence of insects in its diet, especially during periods when other food sources are less available [Salek & Lovy 2012]. A similar pattern was observed in the diet analysis of the little owl from Zakarpattia Oblast [Zahorodnyi *et al.* 2021].

The common vole (*Microtus arvalis*) is the dominant prey species for both owls, which is also supported by other studies where this species constitutes the primary prey for barn and little owls in various regions [Goutner & Alivizatos 2003]. The diet of the little owl includes amphibians and insects, particularly during the winter–spring period. This aligns with research from central Poland, which documented seasonal dietary shifts in the little owl: in warmer months, invertebrates predominate, whereas in winter the main preys are small mammals, indicating flexibility in prey selection depending on seasonal availability [Romanowski *et al.* 2013].

According to the analysed data, the trophic niche overlap between the barn owl and the little owl is 70.5%, indicating a significant but not complete similarity in prey selection. This is consistent with other studies that revealed a high degree of trophic niche overlap between these species, while also emphasising their ability to partition resources through differences in habitat use and behaviour. Specifically, research conducted in Italy showed that the barn owl primarily preys on larger rodents, whereas the little owl focuses on smaller species such as the wood mouse (*Apodemus sylvaticus*). This demonstrates a size-based trophic niche partitioning that facilitates their coexistence within the same environment [Gotta & Pigozzi 1997].

Thus, both species of synanthropic owls demonstrate flexibility in prey selection, allowing them to adapt to changes in their environment. This was confirmed for the little owl in Zakarpattia Oblast, where its diet included a wide range of prey depending on the season and landscape [Zahorodnyi *et al.* 2021]. The high degree of trophic niche overlap indicates potential competition; however, differences in behaviour and habitat preferences facilitate their coexistence.

A long-term study of the diet of the barn owl (*Tyto alba*) in Italy, involving large sample sizes, revealed temporal changes in prey diversity indices, including dominance and evenness indices [Conti *et al.* 2020]. Comparison of pellet samples from the tawny owl (*Strix aluco*) across different regions of Italy demonstrated that the number of detected prey species largely depends on sample size. Although there is high variability, a positive correlation between sample size and species richness was observed, emphasising the need to consider this factor when interpreting results [Crescia *et al.* 2024]. Based on this, protected areas possess particularly high potential for accumulating representative samples of this type due to stable protection regimes, sustainable habitats, and prolonged access to study sites.

Conclusions

The diets of the barn owl and little owl in Zakarpattia Oblast are characterised by a high overall similarity; however, their trophic niches do not completely overlap. The primary prey for both species is the common vole (*Microtus arvalis*), though the proportions of primary, secondary, and supplementary prey differ between them. The trophic niche overlap index (Pianka's index) is 70.5%, and the proportion of shared main prey is approximately 71.1%, indicating a moderate level of interspecific trophic segregation.

Intensification of trophic competition between the species is observed during periods of reduced abundance of their primary prey, particularly rodents. During such periods, both owl species shift to consuming secondary and supplementary prey items, which increases the overlap of their trophic niches. Under these conditions, the little owl expands its dietary niche by including vertebrates from

various taxonomic groups (birds, amphibians, reptiles, and fish), whereas the barn owl broadens its niche through the inclusion of a greater variety of micromammal species.

The difference in the feeding spectra is partly explained by the unequal sample sizes: approximately 300 pellets of the barn owl (containing 1268 food items) versus 150 pellets of the little owl (178 items). But this quantitative disproportion does not alter the overall pattern: both species remain microphagous, with a marked specialisation on small mammals.

The presence of a significant, yet incomplete, overlap in diets allows these species to coexist within the same landscapes. The shared use of hunting grounds and nesting sites is facilitated by partial spatial and trophic segregation, as well as flexibility in prey selection.

The large sample size and the extended duration of the study ensure high representativeness of the obtained results. Protected areas have especially high potential for accumulating such representative data due to stable environmental conditions and sustained access to study sites.

Acknowledgements

The authors express their gratitude to I. Zagorodniuk for editing the manuscript and for providing help during its preparation, and to Zoltan Barkaszi for proofreading the text.

Declarations

Funding. The research received no specific financial support.

Conflict of interests. The authors declare no conflicts of interest relevant to the content of this article.

Handling of materials. The study was conducted in compliance with the current legislation in regard to working in protected areas and with live animals.

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