

## SMALL MAMMALS IN THE DIET OF LONG-EARED OWL (*ASIO OTUS*) IN THE SOUTHWEST OF BELARUS

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**Small mammals in the diet of long-eared owl (*Asio otus*) in the southwest of Belarus.** — **A. Savarin, D. Kitel.** — The article discusses the species and taxonomic composition of the long-eared owl (*Asio otus*) preys based on the analysis of pellets (n = 209) collected in the winter-spring period in 2016 in the Malarytsky district (Lozitsa village) and the Brest region district center. The distance between Malaryta town and Lozitsa village is about 10 km. Parts of the skull of 512 small mammals (2.45 individuals per pellet) and one bird were found. Feeding on birds for the long-eared owl is episodic. Representatives of 2 orders, 10 genera and 12 species of small mammals (5 species of shrews and 7 rodents) became preys of the owl. The proportion of rodents is 98.24 % of all preys. The absolute dominant among prey species is *Microtus arvalis* (85.16 % of all victims), which is consistent with numerous work carried out in other regions. Significant portions are of *Apodemus agrarius* (4.10 %), *Muscardinus avellanarius* (2.54 %), *Sylvaemus tauricus* (1.76 %), and *Alexandromys oeconomus* (1.56 %). The list of preys is presented by meadow-field, synanthropic and different species actively moving from adjacent forests in the Malaryta river floodplain and canal systems (*Sylvaemus tauricus*, *Sorex araneus*, *S. minutus*, *Neomys fodiens*). The occurrence of two shrew species *Crocidura leucodon* and *C. suaveolens* in the city of Malaryta has been proved, which corresponds to similar information for the city of Brest. This suggests that *C. suaveolens* inhabits the entire territory of the Belarusian Polesie at present. The occurrence of the non-abundant species *Sicista betulina* in vicinities of the town of Malaryta was confirmed. The results obtained confirm the significant trophic effect of the long-eared owl on the local population of the hazel dormouse and also indicate the relatively high abundance of this rodent in the study area. Seven species were identified in pellets of the long-eared owl living near the village of Lozitsa, and 12 species of small mammals were identified in the town of Malaryta. The diversity of the landscape of the town of Malaryta determines the large number of prey species.

Key words: small mammals, *Asio otus*, pellets, Malaryta, Brest region, Belarus.

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### Introduction

The long-eared owl (*Asio otus*) is the most numerous among the 13 species of owls (Strigiformes) inhabiting Belarus. The bird lives in various natural biotopes, as well as in settlements, including medium and large cities. The low demands on the nest design features (Kitel 2009), the relative tolerance to noise pollution and disturbance factors allow it to settle in city parks, cemeteries, and free-standing trees. It can occupy nests of various corvid birds located at a height of 2.0 to 8.5 m (Stoylovskiy & Malinoshevskiy 2017). There are many factors that influence the likelihood of colonisation of settlements by the (the main ones are the area of grasslands, parks, etc.), but noise pollution reduces the efficiency of night hunting (Fröhlich & Ciach 2018).

The food objects of the long-eared owl include the majority of terrestrial small mammal species, representatives of the orders Rodentia and Lipotyphla, as well as some bats (Chiroptera) (Sharikov & Makarova 2014). For example, parts of the skull of not only common and widely distributed species in Polesie (*Sylvaemus tauricus*, *Syl. sylvaticus*, *Apodemus agrarius*, *Microtus arvalis*, *Alexandromys oeconomus*, *Myodes glareolus*, *Talpa europaea*, *Sorex araneus*, and *S. minutus*), but also of less common (*Micromys minutus*, *Microtus subterraneus*) and rare species (*Muscardinus avellanarius*) (Balčiauskienė *et al.* 2006; Zaitseva & Hnatyna 2009, 2011; Stasiak *et al.* 2014; Lesiński *et al.* 2016, and others) were found in pellets *A. otus* near the borderlines of Belarus, Ukraine, Poland, and

Lithuania. However, the main feeding source of the long-eared owl in different regions are voles of the *Microtus* and *Alexandromys* genera (Kondratenko *et al.* 2006; Drebet 2011; Golova 2011; Tovpinets & Evstaf'ev 2013; Nistoreanu *et al.* 2020).

The number of long-eared owls in the Belarusian Polesie has been increasing in recent years. In this regard, its role as a myophage also increases. However, systematic studies on the long-eared owl's feeding have not been conducted in the region. There are known works on the nutrition of other owl species of the *Strix* and *Bubo* genera (Tishechkin 1997; Demianchuk 2009, and others).

Previously, the authors have published preliminary results of the analysis of long-eared owl pellets (Savarin & Kitel 2016). The point of view on synanthropisation of dormice (Zaytseva-Anciferova 2014) was also confirmed on a sample obtained in the south-west of Belarus: parts of the skull of *M. avellanarius* were found in more than 10 % of the pellets.

An analysis of the pellets on the transboundary territory of Ukraine, Poland, and Belarus is important from the point of view of zoogeography and faunogenesis; it will help to clarify the distribution boundaries of a number of insufficiently studied species, including those listed in the Red List of Belarus (2015). For instance, 3 of 4 living species of the dormouse family (Myoxidae) are listed in the Red List of Belarus (*M. avellanarius*, *Eliomys guercinus*, *Glis glis*). An endangered species, the common hamster (*Cricetus cricetus*), may also be the food object of the long-eared owl. It should be noted that there are many small mammals species in the territory of the Shatsky National Park that are of interest in a transboundary aspect: *C. cricetus*, *G. glis*, *Neomys anomalus*, *Crocidura leucodon*, *S. caecutiens*, etc. (Srebrodolska *et al.* 2004).

The purpose of the present work is to show the value of the analysis of the long-eared owl's pellets in clarifying the distribution of poorly studied and rare species of the Belarusian Polesie and Belarus in general.

## Material and Methods

Research material was collected in February, April, and May of 2016, in the Malarytsky district of the Brest region and in the regional centre (Fig. 1).

The area of forests make up 46.8 % of the district's total area followed by agricultural lands (40.8 %) and meadows (12.7 %). Pine dominates (55.3 %) among forest-forming species followed by birch (20.9 %), alder (14.1 %), and oak (4 %). About 70 % of agricultural lands are reclaimed, which improves the living conditions and migration of many species of small mammals.

The town of Malaryta is a district centre with a population of about 12,000 people. The area of the city is about 7 km<sup>2</sup>. Its main socio-economic and urban development features are the absence of large industrial enterprises and high-rise buildings, the predominance of manor buildings in the town's housing stock, and the proximity of agricultural and forest lands.

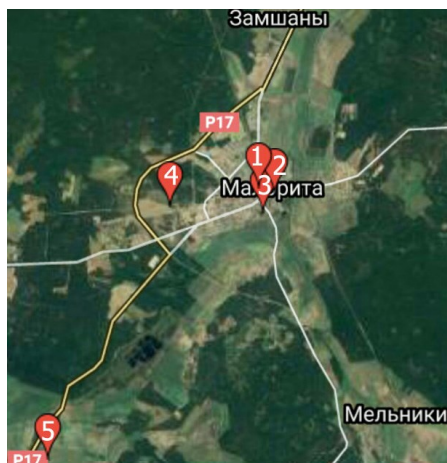


Fig. 1. Map of the study site (symbols are in the text).

Рис. 1. Карта місця досліджень (позначення в тексті).

The town is surrounded by a system of floodplain landscapes of the Malaryta River, a system of canals and ponds, and forested areas adjacent to the city border. Landscape diversity and the sufficient number of tree species create favourable conditions for the existence of the long-eared owl. Its food objects can be simultaneously synanthropic and meadow-field, forest and semi-aquatic species of small mammals.

Pellets were collected at five points. Points 1–4 are located in the town of Malaryta and point 5 is located in the Malarytsky district (Fig. 1 and 2): 1 — at the agricultural lyceum (N 51.791744° E 24.078101°), 2 — at the kindergarten "Solnyshko" (N 51.790512° E 24.084565°), 3 — in the old city cemetery (N 51.785991° E 24.079803°), 4 — on the outskirts of the city, by the water tower (N 51.783357° E 24.049449°), 5 — in the island coniferous forest near Lozitsa village (N 51.725889° E 23.995406°) located on a crop field.



Fig. 2. General view of the area where pellets were collected (symbols are in the text).

Рис. 2. Загальний вигляд місць збору пелеток (позначення в тексті).

The distance between Malaryta town and Lozitsa village is about 10 km. The long-eared owl finds food objects within a radius of about 1 km from the daytime resting place, so collections from the points 1-4 are combined into one sample. Respectively, 102 and 113 pellets were collected in the town of Malaryta and near the village of Lozitsa. In some pellets, there was only fur and small fragments of bones, which did not allow us to determine neither the species affiliation nor the number of eaten objects. Therefore, the number of pellets with food objects was 98 and 111, in which the total number of prey was 223 and 289, respectively. Photos of the pellets collection points 1–4 were taken using DJI Mavic Mini quadcopter.

For species diagnostics of small mammals, keys and analytical articles were used (Pucek 1984; Balčiauskienė *et al.* 2002; Baláž *et al.* 2013 and others).

## Results and Discussion

In 209 pellets, parts of the skull of 512 small mammals (2.45 individuals per pellet) and one bird (in point 3, a fragment of the beak about 3.5 cm and a feather more than 6 cm in length) were found. This fact indicates that in the study area, feeding on birds by the long-eared owl is episodic in nature. Similar results were obtained by Ukrainian experts in the bordering area of the Shatsk lakes (Zaitseva & Hnatyna 2009). In addition, this indicates the high abundance of its main feeding object, the common vole (*M. arvalis*). It is known that the long-eared owl refuses to nest in case of low abundance of *M. arvalis*.

Representatives of 2 orders (insectivores and rodents), 10 genera and 12 species of small mammals (5 species of shrews and 7 rodents) became preys of the long-eared owl (Table 1). The proportion of rodents is 98.24 % of all preys (503 of 512). Parts of the skull of the recorded species are shown in Fig. 3.

Table 1. The composition and ratio of prey species of the long-eared owl

Таблиця 1. Склад і кількісне співвідношення кормових об'єктів вухатої сови

No.	Species	Malaryta (n = 223)		Lozitsa (n = 289)		Total (n = 512)	
		ind.	%	ind.	%	ind.	%
1	<i>Sorex araneus</i>	3	1.35	1	0.35	4	0.78
2	<i>Sorex minutus</i>	1	0.45	–	–	1	0.20
3	<i>Neomys fodiens</i>	1	0.45	–	–	1	0.20
4	<i>Crocidura leucodon</i>	2	0.90	–	–	2	0.39
5	<i>Crocidura suaveolens</i>	1	0.45	–	–	1	0.20
6	<i>Muscardinus avellanarius</i>	2	0.90	11	3.81	13	2.54
7	<i>Sicista betulina</i>	1	0.45	–	–	1	0.20
8	<i>Apodemus agrarius</i>	17	7.62	4	1.38	21	4.10
9	<i>Sylvaemus tauricus</i>	6	2.69	3	1.04	9	1.76
10	<i>Rattus norvegicus</i>	1	0.45	1	0.35	2	0.39
11	<i>Microtus arvalis</i>	175	78.48	261	90.31	436	85.16
	<i>Microtus sp.</i>	8	3.59	5	1.73	13	2.54
12	<i>Alexandromys oeconomus</i>	5	2.24	3	1.04	8	1.56

The list of prey species is presented by meadow-field (*M. arvalis*, *Ap. agrarius*, *Al. oeconomus*), synanthropic (*C. leucodon*, *C. suaveolens*, *R. norvegicus*) and other species actively moving from adjacent forests in the Malaryta river floodplain and canal systems (including *Syl. tauricus*, *S. araneus*, *S. minutus*, *N. fodiens*). Forest species are represented by *Sicista betulina*. The northern birch mouse can even settle in the island forest cutting units, afforestation on which contribute to an increase in the number of animals (Ivanter & Kukhareva 2008). We caught individual specimens of this species in various regions of Belarus. The status of the species in the southwest of the country is assessed as non-abundant, possibly rare.

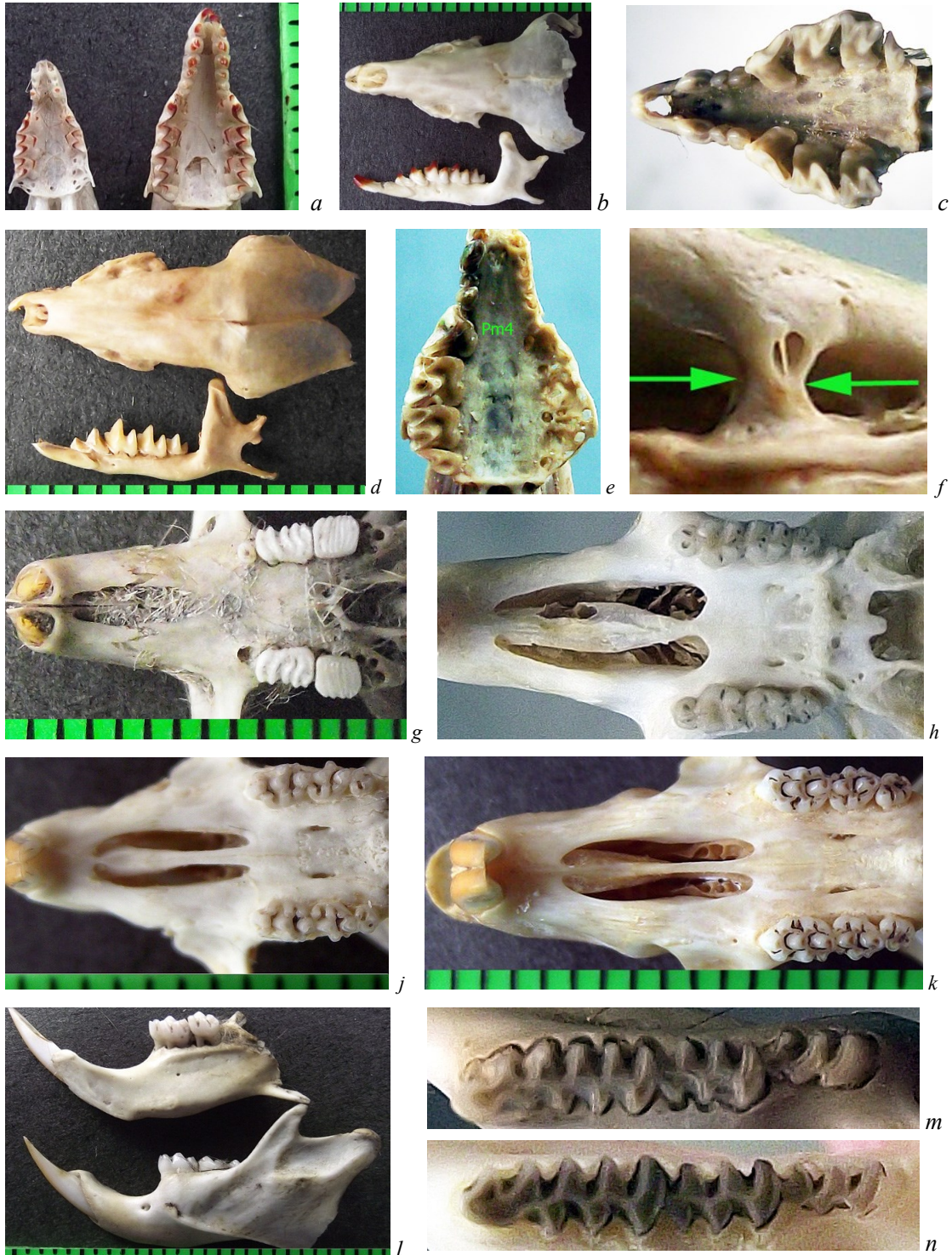


Fig. 3. Prey species of the long-eared owl: *a* — *S. minutus* and *S. araneus*, *b* — *N. fodiens*, *c* — *C. leucodon*, *d*, *e*, *f* — *C. suaveolens* (details in text), *g* — *M. avellanarius*, *h* — *Sicista betulina*, *j* — *Ap. agrarius*, *k* — *Syl. tauricus*, *l* — *R. norvegicus*, *m* — *M. arvalis* (lower molars), *n* — *Al. oecconomus* (lower molars).

Рис. 3. Кормові об'єкти сови вухатої: *a* — *S. minutus* та *S. araneus*, *b* — *N. fodiens*, *c* — *C. leucodon*, *d*, *e*, *f* — *C. suaveolens* (позначення в тексті), *g* — *M. avellanarius*, *h* — *Sicista betulina*, *j* — *Ap. agrarius*, *k* — *Syl. tauricus*, *l* — *R. norvegicus*, *m* — *M. arvalis* (нижній зубний ряд), *n* — *Al. oecconomus* (нижній зубний ряд).



Fig. 3. Remains of the hazel dormouse at an artificial nest, Maloryta town (point 4).

Рис. 3. Рештки *M. avellanarius* в штучному гнізді, м. Малорита (точка 4).

This point of view is consistent with the opinion of other researchers on the abundance of the species in the Prip'yatsky National Park (Dombrovski & Bolotina 2014). It is appropriate to add that this species is considered rare in the area of the Shatsky National Park (Srebrodolska *et al.* 2004).

Compared to other dormice species, *M. avellanarius* is less sensitive to disturbance of forest habitats (Dormice... 2001). However, the dormouse usually does not settle in artificial forest plantations, especially if the long-eared owl nests there. We suppose the owl finds the dormouse both in the immediate outskirts of the forest and in the settlements<sup>1</sup>. It should be noted that body parts of *M. avellanarius* (Fig. 3, indicated) were found in the artificial nest box for the long-eared owl located on a pine at the point 4 (Fig. 3) on 25.04.2015. Thus, the hazel dormouse is a constant food object of the long-eared owl in the research area. Considering the findings of *M. avellanarius* skulls in pellets from the two settlements having a significant portion among all prey species (Table 1, 0.90 % and 3.81 %, respectively), a relatively high local abundance of the species can be assumed.

The finding of two species of *Crociodura* in pellets from the regional centre is of particular interest, since these shrews are listed in the Appendix of the Red List of Belarus (2015) as “insufficient data”. It is important to indicate the following: dead individuals of *C. leucodon* were repeatedly found earlier both in the town itself (private sector; on the shore of Lake Voennoe) and in the Malarytsky region (e.g. near the village of Zamshany). In this regard, the discovery of the skull of *C. leucodon* in the pellets was “expected”. However, there is only one report about the finding of a *C. suaveolens* specimen in the 21st century in the Brest region: in pellets of the tawny owl (*Strix aluco*) in Brest near the Mukhovets river (Savarin & Kitel 2017). Considering the importance of finding the *C. suaveolens* specimen, we present a set of diagnostic characters of the species (height of the lower jaw is 4.02 mm; zygomatic width is 5.08 mm; lateral edges of Pm4 are rounded with a notch; height of the bony bridge in the infraorbital foramen is much larger than the width, etc.). There are technogenic objects in the town of Maloryta and its suburbs, where the finding of *C. suaveolens* is theoretically possible — these are urban treatment facilities and a solid waste landfill (e.g. *C. suaveolens* is a common species at the Gomel city landfill).

Given the findings of the lesser white-toothed shrew in the southwest (Brest and Maloryta) and in the south of Belarus (Zhitkovichi and Petrikovsky districts), as well as in a number of areas in the southeast (Zhlobinsky, Vetkovsky, Dobrushky, Gomelsky, etc.), we can suggest that, at present, *C. suaveolens* occurs in the entire territory of the Belarusian Polesie.

An interesting fact is that 7 species were identified in pellets of the long-eared owl from vicinities of Lozitsa, and 12 species of small mammals were identified and in pellets from Maloryta. This is due to the predominance of cereal monocultures contributing to the preservation of a high number of the common vole. Therefore, the portion of individuals of *M. arvalis* among all food objects of *A. otus* was 90.31 % and 78.48 %, respectively.

<sup>1</sup> On the other hand, the occurrence of the hazel dormouse near the agrocenosis and in the settlements increases the likelihood of survival due to the expansion of the food base, avoidance of exposure to the yellow-necked mouse, which can kill young dormice (Zaytseva 2009).

## Conclusions

Parts of the skull of 12 species of small mammals and of one bird were found in pellets of the long-eared owl (*Asio otus*) collected during the winter-spring period in 2016 in the Malarytsky district and in the district centre of the Brest region. Feeding on birds by the long-eared owl is episodic.

The portion of rodents is 98.24 % among all prey species (503 of 512). The dominant species among the long-eared owl's food objects, as in other regions, was the common vole *Microtus arvalis* (85.16 % of all prey species). A high portion of the rare hazel dormouse *Muscardinus avellanarius* was revealed (2.54 %) as well. This indicates not only the significant trophic effect of the long-eared owl on the local population of the hazel dormouse, but also the relatively high abundance of this rodent in the study area.

The occurrence of sibling species *Crocidura leucodon* and *C. suaveolens* in Malaryta town has been proven. To identify the lesser white-toothed shrew habitats, it is necessary to capture small mammals at the municipal solid waste landfill and wastewater treatment plant. Taking into account the capture of individuals of the lesser white-toothed shrew in a number of places in the Brest and Gomel regions, we suggest that *C. suaveolens* occurs in the entire territory of the Belarusian Polesie.

The occurrence of the non-abundant species *Sicista betulina* in the outskirts of the town of Malaryta was confirmed (a single finding).

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